GEOTECHNICAL EXPLORATION REPORT
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
A-TOWN PARCEL B
CITY OF ANAHEIM, ORANGE COUNTY CALIFORNIA

Prepared for:

P.T. METRO, LLC

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Project No. 12882.001

October 28, 2020

Leighton and Associates, Inc.

A LEIGHTON GROUP COMPANY

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P.T. Metro, LLC
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Attention: Mr. Paul Ogier

Subject: Geotechnical Exploration Report
Proposed Multi-Family Residential Development
A-Town Parcel B
Southwest Corner of East Katella Avenue and Market Street
City of Anaheim, Orange County, California

In accordance with our August 14, 2020 proposal, authorized on September 11, 2020, Leighton and Associates, Inc. (Leighton) has completed geotechnical exploration for the subject project. We understand from review of KTGY's *Concept Site Design Plan* that Parcel B is proposed to consist of multi-family Type III and Type V podium residential development over two levels of retail and one level of subterranean parking. In addition, we understand that drywells are being considered for the project for stormwater BMPs in the northwestern and southeastern portions of the site. Ancillary improvements are anticipated to consist of utility infrastructure, flatwork, and landscaping.

The purpose of our geotechnical exploration was to evaluate the subsurface conditions at the site, identify potential geologic and seismic hazards that may impact the project, and provide geotechnical recommendations for design and construction of the proposed project as currently planned.

The project is considered feasible from a geotechnical standpoint. The results of our exploration, conclusions and recommendations are presented in this report.

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We appreciate the opportunity to be of service to you on this project. If you have any questions or if we can be of further service, please contact us at ***(866) LEIGHTON***; or specifically at the phone extensions or e-mail addresses listed below.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Site Description and Proposed Development

The project site is located at the southeast corner of East Katella Avenue and Westside Drive in the city of Anaheim, California. The site location (latitude 33.802501°, longitude -117.894236°) and immediate vicinity are shown on Figure 1, *Site Location Map.*

Site Description: The project site is a roughly rectangular parcel of land approximately 3.4 acres in size and bounded by East Katella Avenue to the north, Westside Drive to the west, Meridian Street to the south and Market Street to the east. It is our understanding Parcel B was mass graded in 2013 per the *City of Anaheim Mass Grading and Erosion Control Plan for Tr. 17703* (12 sheets), prepared by Hunsaker and Associates Irvine, Inc., dated October 22, 2018. Parcel B is currently vacant with top of slope elevation (El.) +151 feet to El. +147 feet descending north to East Katella Avenue. Descending perimeter slopes are inclined roughly at 2.5:1 (horizontal:vertical) or flatter to toe El. +137 feet to El. +135 feet. Overall pad grade is approximately 12-14 feet below adjacent grade with drainage to the north. Topographic information from the mass grading plans (Hunsaker, 2018) was utilized as the base map for Figure 2a, *Exploration Location Map*, included with this report.

Aerial Imagery Review: Based on review of historical aerial photographs (NETR, 2020), the site was vacant undeveloped land that appears to have been used for agricultural purposes until at least 1963. Between approximately 1972 and 1980, four (4) commercial buildings were constructed at the site with paved surface parking; and by approximately 2009, the buildings and site improvements, roadways and utility infrastructure were removed and the site was graded as a part of then proposed A Town Development concept. We understand per review of the compaction report prepared by Group Delta Consultants, Inc. (GDC, 2014), additional grading was performed at the site in 2013 that included placement of engineered fill in the central and southern portions of the overall A-Town development site of which Parcel B is included. Between approximately 2014 and 2016, additional grading was performed to bring the site to roughly its current configuration by removing previously constructed streets associated with the former development concept.

Proposed Development of Parcel B: Review of the *A-Town: Parcel B Site Design* plan set (4 sheets) for the project prepared by KTGY (undated); we understand the proposed development consists of a multi-family Type III and Type V podium residential development over two levels of retail and one level of subterranean parking, see Figure 2b, *Development Concept Map* . We understand drywells are being considered for the project for stormwater Best Management Practices (BMPs) in the northwestern and southeastern portion of the site. The lowest finished floor of the basement parking level is assumed to be approximately 10 to 12 feet below current site adjacent grade. Preliminary structural loading information was not yet available at the time this report was prepared.

1.2 Purpose and Scope

Purpose of our geotechnical exploration was to evaluate the subsurface conditions at the site relative to the proposed Parcel B development concept and provide geotechnical recommendations to aid in the design and construction for the project as currently described above. In accordance with our August 14, 2020 proposal authorized on September 11, 2020, our Scope of Work included the following:

- *Research* – We reviewed readily available and provided literature including in-house geotechnical reports, literature, aerial photographs, and maps relevant to the site. We evaluated geological hazards and potential geotechnical issues that may significantly impact the site. The documents reviewed are listed in Section 5.0 *References*.

- *Pre-Field Exploration Activities* – Reconnaissance of the site was performed by a certified engineering geologist to mark the proposed exploration locations. Underground Service Alert (USA) was notified to locate and mark existing underground utilities prior to our subsurface exploration.

- *Field Exploration* – Our subsurface exploration (soil borings) was performed on September 25, 2020, and included drilling, logging, and sampling of two (2) hollow-stem auger borings (designated LB-3 and LB-4) to depths of approximately 41½ and 26½ feet below the existing ground surface (bgs), respectively. Two (2) additional borings (designated P-4 and P-5) were drilled to approximate depths of 31½ and 30 feet bgs, respectively, for subsequent percolation testing. Approximate location of these explorations are shown on Figure 2a, *Exploration Location Map* and corresponding boring logs are presented in Appendix A, *Exploration Logs.*

During drilling of the hollow-stem auger borings both bulk and drive samples were obtained from the borings for geotechnical laboratory testing. Driven ring samples were collected from the borings using a Modified California ring-lined sampler conducted in accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were also performed within the borings in accordance with ASTM Test Method D 1586. Samples were collected at 2½ and 5-foot intervals throughout the depth of exploration. In both test methods, the sampler is driven below the bottom of the borehole by a 140-pound weight (hammer) free-falling 30 inches. The drilling rig was equipped with an automatic hammer to provide greater consistency in the drop height and striking frequency. The number of blows to drive the sampler the final 12-inches of the 18-inch drive interval is termed the “blowcount” or SPT N-value. N-values provide a measure of relative density in granular (non-cohesive) soils and comparative consistency in cohesive soils. Number of blows per 6 inches of penetration was recorded on the boring logs included in Appendix A.

The borings were logged in the field by an engineering geologist from our firm. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System (USCS). The samples were sealed and packaged for transportation to our laboratory for testing. After completion of drilling, the borings were backfilled to the ground surface with hydrated bentonite chips. Excess soil cuttings from the borings were spread onsite.

Cone Penetrometer Test (CPT) Exploration - In addition to the soil borings, one (1) Cone Penetrometer Test (CPT) sounding was advanced along the eastern margin of the site (designated CPT-1) to an approximate depth of 70 feet bgs (Figure 2a). Shear wave velocity measurements were taken to develop seismic design parameters. CPT soundings were performed in accordance with ASTM D5778 advanced by a 30-ton CPT rig in which a standard Cone equipped with a 15 cm^2 tip advanced at a constant rate of approximately 1 inch per second.

The CPT provides a continuous record of the subsurface stratigraphy via data regarding tip and sleeve resistance which is continuously recorded electronically as the probe is advanced through the subsurface stratigraphy. The recorded data is processed yielding interpretations of soil type based upon the anticipated engineering behavior of the various soil strata though which the probe penetrates. A graphical log of the interpreted soil conditions at the CPT sounding location is included in Appendix A.

- *Percolation Testing* – Borings P-4 and P-5 (Figure 2a) were converted to temporary percolation test wells upon completion of drilling and sampling. The test wells consisted of 2-inch slotted (0.020-inch slots) PVC well casing surrounded by No. 3 Monterey Sand placed in the annulus of the well within the test zone. In-situ percolation testing was performed on October 15, 2020 in general accordance with the *Orange County Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Programs (WQMPs)* (OCPW, 2013). The results of the percolation testing are presented in Appendix B, *Percolation Test Data*. Refer to the discussion of infiltration rate presented in Section 2.4.1, *Infiltration*.

- *Laboratory Testing* – Selected relatively undisturbed and bulk soil samples obtained from our current hollow-stem-auger borings were tested at our in-house Irvine (DSA LEA 063) geotechnical laboratory. This laboratory testing program was designed to evaluate physical geotechnical characteristics of site soils including corrosion potential. A description of geotechnical test procedures and results are presented in Appendix C, *Geotechnical Laboratory Testing*. Tests performed during this investigation include:

  - In-situ Moisture Content and Dry Density (ASTM D 2216 and ASTM D 2937);
  - Expansion Index (ASTM D 4829);
  - Maximum Dry Density (ASTM D 1557);
  - Direct Shear (ASTM D 3080);
  - Particle Size Analysis (ASTM D 422);
  - Consolidation (ASTM D 2435);
  - R-value; and
  - Corrosivity Suite – pH, Sulfate, Chloride, and Resistivity (California Test Methods 417, 422, and 532/643).

  Results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A.

- *Engineering Analysis* – Data obtained from these borings and geotechnical laboratory testing was evaluated and analyzed to develop geotechnical conclusions and recommendations for proposed Parcel B improvements described in Section 1.1 of this report.

- *Report Preparation* – This report presents our findings, conclusions, and recommendations for the proposed development.

1.3 Site Background and Previous Studies

Parcel B was originally planned to be developed as a part of the overall A-Town Metro Platinum Triangle development project consisting of a total area over 44 acres in size. The initial development plan for the overall project site in 2004 included the construction of high-rise buildings up to 29 stories in height, podium type structures over 2 levels of subterranean parking, various 4- to 5-story mixed use and residential buildings with 1 to 2 levels of subterranean parking and associated streets and utility infrastructure for the project site. Preliminary geotechnical explorations were performed by Leighton and Group Delta Consultants, Inc. to support preliminary design of the proposed development at that time (Leighton, 2004, 2005a and 2005b; GDC, 2006). Copies of the relevant prior exploration logs performed at the site and immediate vicinity by Leighton and others, as available, are included in Appendix D, *Exploration Logs (previous studies)*. Not all prior consultant logs were available for our review, those exploration locations are known only from prior reports.

Since the original A-Town development scheme included high-rise buildings and podium type structures with 1 to 2 subterranean levels, excavations for the subterranean levels were performed in some of the parcels, including Parcel B (El. +127 feet), Parcel C (El. +132 feet) and Parcel D (El. +137 feet). The excavations, roadway, and utility construction were completed in 2006-2007 and a report documenting the geotechnical observation and testing was prepared by GDC (2007). Testing of imported material derived from many sources, according to GDC (2014) generally contained less than 35 percent fines in the upper 7 feet of fill and between 20 to 50 percent below 7 feet. Prior footprints when compared to current dimensions and layout of Parcel B indicate variable thickness of fill material should be expected.

After completion of the utilities and roadways in 2006-2007, the project was put on hold until approximately 2013. Imported fill was required to backfill the excavations performed in 2006-2007. GDC performed observation and testing of the grading operations in support of fill placement at the site between June and October of 2013 as documented in their 2014 report (GDC, 2014). The approximate limits of grading and fill placement is shown on Figure 2a.

2.0 GEOTECHNICAL FINDINGS

2.1 Regional Geologic Setting

The project site is located on the lowest reach of the Santa Ana River basin within the Peninsular Ranges geomorphic province. The Peninsular Ranges geomorphic province extends southward from the Los Angeles Basin to the tip of Baja California (Yerkes et al., 1965) and is characterized by elongated northwest-trending mountain ranges separated by sediment-floored valleys. The most dominant structural features of the province are the northwest trending fault zones, most of which die out, merge with, or are terminated by the steep reverse faults at the southern margin of the Transverse Ranges geomorphic province. East of the site are the northwest-trending Santa Ana Mountains, a large range which has been uplifted on its eastern side along the Whittier-Elsinore Fault Zone, producing a tilted, irregular highland that slopes westward toward the sea.

The area south and west of the Santa Ana Mountains is generally characterized as a broad, complex, alluvial fan which receives sediments from the Santa Ana River and its tributaries draining the Santa Ana and San Bernardino Mountains. These sediments are comprised of relatively flat-lying, unconsolidated to loosely consolidated clastic deposits that are approximately 3,000 feet thick beneath the site (Sprotte et al., 1980, and Real, 1985).

2.2 Surficial Geology

The surficial deposits at the site and in the vicinity consist of Quaternary age, youthful alluvial fan and floodplain deposits (alluvium) deposited by the Santa Ana River and tributaries (Bedrossian and Roffers, 2010; Morton and Miller, 2006). Mapped geologic units in the vicinity of the project site is presented as Figure 3, *Regional Geology Map*. These unconsolidated alluvial sediments are comprised of generally flat-lying, non-marine deposits of sand and minor amount of silt (Sprotte et al., 1980; and Morton and Miller, 2006). These sandy deposits are geologically youthful (Holocene age or less than 11,000 years old) and are reported to be approximately 80 to 100 feet thick beneath the site (Sprotte et al., 1980; and Real, 1985). Beneath the Holocene-aged sediments are the older semi-consolidated deposits of Pleistocene-age (11,000 to 1.6 million years) generally marked by an eroded surface displaying well oxidized soils and an increase in relative density.

2.3 Subsurface Conditions

Based on interpretation of subsurface explorations, the site is underlain by certified engineered fill (GDC, 2014) of variable thickness overlying Quaternary-age young alluvial fan deposits. A general description of the earth materials as encountered are described below:

Certified Engineered Fill (Afc): The existing near-surface artificial fill soils encountered in our exploratory borings range in thickness from nominal less than a foot to 16½ feet below existing grade across the project site. These soils are characterized as olive brown to dark brown, moist to very moist, sandy silt, silty sand, clayey sand and sand with varying rock and manmade fragments. The existing fill materials encountered at the site are understood to have been placed under the observation and testing of GDC as documented in their compaction report (GDC, 2014).

Quaternary Age Young Alluvial Fan Deposits (Qyf): The Quaternary age young alluvial fan deposits encountered beneath the fill materials in our exploratory borings generally consist of yellow brown to gray brown, poorly to well graded moist, sand and silty sand with thin beds or laminations of silt and clay.

The stratigraphy of the subsurface soils encountered in each soil boring is presented on the boring logs (Appendix A). The interpreted subsurface conditions across the site are depicted on Figure 4, *Geologic Cross-Sections A-A' and B-B'.*

2.3.1 Expansive Soil Characteristics

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and which shrink when dried. Foundations constructed on these soils are subject to uplifting forces caused by the swelling. Without proper mitigation measures, heaving and cracking of both building foundations and slabs-on-grade could result.

One (1) near-surface bulk soil sample obtained during our subsurface exploration was tested for expansion potential. The test results indicate an Expansion Index (EI) value of 3 ("very low" potential for expansion). The Expansion Index laboratory test result is included in Appendix C of this report.

Expansive soils will likely not impact the proposed construction. Variance in expansion potential of onsite soil is possible but not anticipated. Therefore, additional testing may be performed upon completion of site grading and excavation to confirm the expansion potential presented in this report. For purposes of this report, and based upon visual characterization of alluvial materials at approximate foundation depth, very low expansion potential of site materials may be considered to support design.

2.3.2 Soil Corrosivity

One (1) near-surface bulk soil sample obtained during our subsurface exploration were tested for corrosivity to assess corrosion potential to buried concrete. The chemical analysis test results for the onsite soil from our geotechnical exploration are included in Appendix C of this report.

The test results indicate *Soluble Sulfate* concentration of 164 parts per million (ppm), *Chloride* content of 42 ppm, *pH* value of 8.1, and *Minimum Resistivity* value of 1,800 ohm-cm.

The results of the resistivity tests indicate the underlying soil is severely corrosive to buried ferrous metals per ASTM STP 1013. Based on the measured water-soluble sulfate contents from the soil samples, concrete in contact with the soil is expected to have moderate exposure to sulfate attack (S1) per ACI 318 (ACI, 2014). The samples tested for water-soluble chloride content indicate a low potential for corrosion of steel in concrete (C1) due to the chloride content of the soil.

2.3.3 Soil Compressibility

Three (3) samples of the onsite soils recovered from the borings were subjected to consolidation testing to evaluate the compressibility of these materials under assumed loads representative of anticipated structural bearing stresses. The results of testing indicate these soils exhibit a low compressibility potential. The results of testing are presented in Appendix C.

2.3.4 Shear Strength

Evaluation of the shear strength characteristics of the soils included laboratory direct shear testing. The results of testing are included in Appendix C as well as summary graphs that provide values of angle of internal friction (ø) and cohesion (c) for use in geotechnical analysis.

2.3.5 Shear Wave Velocity Profile

Shear wave velocities were measured in CPT-1 and results are presented in Appendix A. Based on the average shear wave velocity of about 850 feet per second recorded at CPT-1, from the ground surface down to about 70 feet bgs, the site was classified as Site Class D.

2.3.6 Excavation Characteristics

Based on our subsurface explorations performed at the site and our experience from grading jobs in the vicinity of the site, we anticipate the onsite artificial fill and native earth materials can generally be excavated using conventional excavation equipment in good operating condition.

2.4 Groundwater Conditions

Groundwater was not encountered in our subsurface investigation to the maximum depth explored of 51½ feet bgs. According to groundwater information obtained through the California Geological Survey (CGS) and presented in the Seismic Hazard Zone Report for the Anaheim Quadrangle (CGS, 1997), the historically shallowest groundwater depth in the vicinity of the project site is greater than 50 feet bgs. Based on prior explorations performed at the overall A-Town site by Leighton in 2005, groundwater was encountered at a depth of approximately 80 feet bgs just east of Parcel B, corresponding to El. +62 feet msl.

Based on these findings, groundwater is not expected to pose a constraint during or after construction. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture, should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff, or from stormwater infiltration.

2.4.1 Infiltration

Percolation testing was performed within temporary percolation wells installed within borings P-4 and P-5 to evaluate the infiltration characteristics of subsurface soils. The percolation tests were conducted in general accordance with the *Orange County Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Programs (WQMPs)* (OCPW, 2013). Results of the percolation testing are presented in Appendix B, *Percolation Test Data*. The test locations and zones tested are shown on Figure 2a, *Exploration Location Map*.

A boring percolation test is useful for field measurements of the infiltration rate of soils, and is suited for testing when the design depth of the infiltration device is deeper than current existing grades, especially in areas where it is difficult to dig test pits, or where the depths of these test pits would be considerably deep. At the subject site, testing consisted of advancing the borings to general depths anticipated for the invert of typical infiltration devices below the planned basement level, approximately 10 to 30 feet below Parcel B subgrade corresponding to El. +125 feet to El. +105 feet.

The tests were performed using a constant-head method which records the approximate volume of water delivered to the test zone while maintaining a relatively constant height of water in the well over the testing period. Since the subsurface materials were generally favorable for percolation (sandy soils), a water source was used to deliver water to each well at a relatively constant rate while recording the water height in the well. The measured infiltration rate for each percolation test was calculated by dividing the total volume of water infiltrated by the total duration of the test and dividing by the percolation surface area. Detailed results of the field testing data and measured infiltration rate for the test wells are presented in Appendix B. The test results are summarized below:

Table 1 – Measured (Unfactored) Infiltration Rate

Test Well Designation	Approximate Depth of Test Zone (feet bgs)	Approximate Elevation of Test Zone (feet msl)	Measured Infiltration Rate (inches per hour)
P-4	10 to 30	125 to 105	30
P-5	10 to 30	125 to 105	38
GDC 2015-P1	4-30	132-106	43

The results of the percolation tests indicate favorable rates of infiltration at the specific locations and depths tested. The measured infiltration rates are the result of small-scale test performed at specific locations and depths. The actual infiltration rate over the area of the proposed infiltration device could vary significantly from the test locations. Therefore, care must be used in the selection of infiltration rate for use in design and the potential for variances in soil conditions that could significantly affect field performance. The infiltration rate will decline over time between maintenance cycles as the BMP surface becomes occluded and particulates accumulate in the infiltrative layer.

2.5 Surface Fault Rupture

Our review of available literature indicates that no known active faults have been mapped across the site, and the site is **not** located within a currently established *Alquist-Priolo Earthquake Fault Zone* (Bryant and Hart, 2007). Therefore, the potential for surface fault rupture at the site is expected to be low and a surface fault rupture hazard evaluation is not mandated for this site.

The location of the closest active faults to the site was evaluated using the United States Geological Survey (USGS) Earthquake Hazards Program National Seismic Hazard Maps (USGS, 2008). The closest active faults to the site with the potential for surface fault rupture are the Whittier-Elsinore fault and the Newport-Inglewood Fault Zone (NIFZ), located approximately 8.9 and10.3 miles from the site, respectively. The San Andreas fault, which is the largest active fault in California, is approximately 40 miles northeast of the site on the north side of the San Gabriel Mountains. Major regional faults with surface expression in proximity to the site are shown on Figure 5, *Regional Fault and Historic Seismicity Map*.

2.6 Strong Ground Shaking

The principal seismic hazard to the site is ground shaking resulting from an earthquake occurring along any of several major active and potentially active faults in southern California (Figure 5). The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the source, and the site response characteristics.

Accordingly, design of the project should be performed in accordance with all applicable current codes and standards utilizing the appropriate seismic design parameters to reduce seismic risk as defined by California Geological Survey (CGS) Chapter 2 of Special Publication 117A (CGS, 2008). The 2019 edition of the California Building Code (CBC) is the current edition of the code. Through compliance with these regulatory requirements and the utilization of appropriate seismic design parameters selected by the design professionals, potential effects relating to seismic shaking can be reduced.

The following code-based seismic parameters should be considered for design under the 2019 CBC:

Table 2 – 2019 CBC Based Ground Motion Parameters (Mapped Values)

Categorization Coefficient	Code-Based
Site Latitude	33.802501°
Site Longitude	-117.894236°
Site Class	D
Mapped Spectral Response Acceleration at Short Period (0.2 sec), S_S	1.401 g
Mapped Spectral Response Acceleration at Long Period (1 sec), S_1	0.497 g
Short Period (0.2 sec) Site Coefficient, F_a	1.0
Long Period (1 sec) Site Coefficient, F_v	null[1]
Adjusted Spectral Response Acceleration at Short Period (0.2 sec), S_{MS}	1.401 g
Adjusted Spectral Response Acceleration at Long Period (1 sec), S_{M1}	null[1]
Design Spectral Response Acceleration at Short Period (0.2 sec), S_{DS}	0.934 g
Design Spectral Response Acceleration at Long Period (1 sec), S_{D1}	null[1]
Site-adjusted geometric mean Peak Ground Acceleration, PGA_M	0.651 g

[1]Per Exception 2 in Section 11.4.8 of ASCE 7-16, seismic response coefficient C_S to be determined by Eq. 12.8-2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for $T > T_L$

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2.7 Liquefaction Potential

The term liquefaction is generally referenced to loss of strength and stiffness in soils due to build-up of pore water pressure when subject to cyclic or monotonic loading. Both sandy and clayey soils are susceptible to loss of strength and stiffness. Because of the difference in strength characteristic and methods for evaluating strength loss potential for granular and clayey soils, the term liquefaction is used for granular soils while cyclic softening is used for fine-grained soils (i.e. clays and plastic silts).

In general, adverse effects of liquefaction or cyclic softening include excessive ground settlement, loss of bearing support for structural foundations, and seismically-induced lateral ground deformations such as lateral spreading. Depending upon the relative thickness of the liquefied strata with respect to overlying non-liquefiable soils, other potentially adverse effects such as ground oscillation and ground fissuring may occur.

As shown on the *Seismic Hazard Zones* map for the Anaheim Quadrangle (CGS, 1998), the project site is **not** located within an area that has been identified by the State of California as being potentially susceptible to liquefaction (Figure 6, *Seismic Hazard Map*). In addition, the current and historic depth to groundwater are both greater than 50 feet bgs. Based on these findings, liquefaction is not considered a hazard at the site.

2.8 Seismically-Induced Settlement

Seismically-induced settlement consists of dynamic settlement of unsaturated soil (above groundwater) and liquefaction-induced settlement (below groundwater). These settlements occur primarily within low density sandy soil due to reduction in volume during and shortly after an earthquake event.

Based on our evaluation of the site soils, the total seismically-induced settlement is estimated to be less than ½ inch. The differential settlement can be taken as half the total settlement over a horizontal distance of 30 feet.

2.9 Lateral Spreading

Liquefaction may also cause lateral spreading. For lateral spreading to occur, the liquefiable zone must be continuous, unconstrained laterally, and free to move along gently sloping ground toward an unconfined area. Since the site is relatively flat and constrained laterally, earthquake-induced lateral spreading is not considered a hazard at the site.

2.10 Earthquake-Induced Landsliding

As shown on Figure 6, the site is **not** mapped within a seismically-induced landslide hazard zone identified by the State of California (CGS, 1998). In addition, due to project site being relatively flat, it is our opinion that the potential for seismically-induced landslide hazard at the site is negligible.

2.11 Storm Induced Flooding

According to a Federal Emergency Management Agency (FEMA) flood insurance rate map (FEMA, 2009), the project site is located within a flood hazard area identified as “Zone X”, which is defined as an area with a 0.2 percent annual chance flood hazard. As shown on Figure 7, *Flood Hazard Zone Map*, the site **is** located within a 500-year flood hazard zone. Regionally, storm runoff flow is generally directed to the south.

2.12 Earthquake-Induced Flooding

This can be caused by failure of dams or other water-retaining structures as a result of earthquakes. The project site **is** located within a flood impact zone from Prado Dam as indicated on Figure 8, *Dam Inundation Map*. However, due to the location and distance of the site from Prado Dam, the potential for earthquake-induced flooding to occur due to a failure of this dam is considered low. Catastrophic failure of this dam is expected to be a very unlikely event in that dam safety regulations exist and are enforced by the Division of Safety of Dams, Army Corp of Engineers and Department of Water Resources. Inspectors may require dam owners to perform work, maintenance or implement controls if issues are found with the safety of the dam.

3.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

Based on this study, we conclude that the proposed development for the Parcel B is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in design and construction.

If encountered, all existing undocumented fill is recommended to be removed from the proposed building/structure footprint areas to expose suitable native soils prior to placement of engineered fill. Due to extensive rodent burrowing and desiccation of fill, at a minimum the upper two (2) feet of existing certified engineered fill should be reprocessed (i.e. scarified, moisture conditioned and recompacted) prior to placement of additional engineered fill.

The recommendations below are based upon the exhibited geotechnical engineering properties of the soils and their anticipated response both during and after construction. The recommendations are also based upon proper field observation and testing during construction. The project geotechnical engineer should be notified of suspected variances in field conditions to determine the effect upon the recommendations subsequently presented. These recommendations are considered minimal and may be superseded by more restrictive requirements of the civil and structural engineers, the City of Anaheim and other governing agencies.

Leighton should review the grading plans, foundation plans and project specifications as they become available to verify that the recommendations presented in this report have been incorporated into the plans for this project.

3.1 Site Grading

Earthwork guide specifications are presented in Appendix E, *Earthwork and Grading Guide Specifications*. Earthwork for Parcel B is expected to include overexcavation and recompaction, shoring and slope cutting operations, basement wall backfill and utility installation/paving. Project earthwork is expected to include overexcavation and recompaction of any fill soils below new improvement footprints.

3.1.1 Site Preparation

Prior to construction, the site should be cleared of any vegetation, trash, and/or debris within the area of proposed grading. These materials should be removed from the site. After the site is cleared, the soils should be carefully observed for the removal of all unsuitable deposits. All undocumented fill or man-made debris, including certified fill soils to a depth of at least two feet should be removed, reworked and replaced as engineered fill.

3.1.2 Removals and Overexcavations

Disturbed and desiccated fill and extensive rodent burrowing was observed across the bottom of Parcel B. Accordingly, over excavation should extend to a minimum depth of 2 feet below current grade to allow removal, reworking of unsuitable site soils and replacement as engineered fill.

The lateral extent of removals and overexcavations beyond foundations should be equal to the depth of removals and overexcavations below the proposed foundations. Localized areas in the unexplored portions of the site should be anticipated to require deeper removals depending on observed subsurface conditions evaluated during grading of the site.

Any underground obstructions encountered should be removed. Efforts should be made to locate any existing utility lines. Those lines should be removed or rerouted where interfering with proposed new foundations.

3.1.3 Excavation Bottom Preparation

Resulting removal excavation bottom-surfaces should be observed by Leighton prior to placement of any backfill or new construction. After these over-excavations are completed, and prior to fill placement, exposed surfaces should be scarified to a minimum depth of 6 inches, moisture-conditioned to or slightly above optimum moisture content, and recompacted to a minimum 95 percent relative compaction as determined by ASTM D1557 standard test method (modified Proctor compaction curve).

3.1.4 Fill Materials

On-site soil that is free of construction debris, organics, or rock larger than 4 inches in largest dimension is suitable to be used as fill for support of structures. Onsite clayey soils, if encountered during site grading, should not be used within 2 feet of concrete slabs-on-grade. Any imported fill soil should be approved by the geotechnical engineer prior to import or use onsite. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less than 2 percent), have a very low expansion potential (with an Expansion Index less than 21) and have a low corrosion impact to the proposed improvements.

3.1.5 Fill Placement and Compaction

Fill soils should be placed in loose lifts not exceeding 8 inches, moisture-conditioned to at least 2 percent above optimum moisture content, and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM Test Method D 1557 (modified Proctor compaction curve). Aggregate base should also be compacted to a minimum of 95 percent relative compaction.

Fills placed on slopes steeper than 5:1 (horizontal:vertical) should be benched into dense soils. Benching should be of sufficient depth to remove all loose material. A minimum bench height of 3 feet into approved material should be maintained at all times

3.1.6 Shrinkage

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Field and laboratory data used in our calculations included laboratory-measured maximum dry density for the general soil type encountered at the subject site, the measured in-place densities of near surface soils encountered and our experience.

Based upon the results of the in-place density of native alluvial soils and engineered fill and the moisture-density relationship exhibited by representative bulk samples of the near surface soils, recompaction of the soils is anticipated to result in volume shrinkage in the range of 5 to 10 percent. The estimated shrinkage does not include material losses due to removal of organic material or other unsuitable bearing materials (debris, rubble, oversize material greater than 6-inches) and the actual shrinkage that occurs during grading may vary throughout the site.

3.2 Shoring

If necessary, the planned shoring system for the site may consist of soldier piles and lagging. Soldier piles may consist of steel H-beams set in pre-drilled holes and backfilled with lean-mix concrete to the ground surface. The pre-drilling auger diameter should be smaller than the diagonal dimension of the H-beam. Since the depth of the excavation is anticipated to be on the order of approximately 12 feet below existing grade, tieback anchors and internal bracing are not expected to be required. The potential for raveling and caving of sand layers may pose difficulties in the installation of the soldier piles. Accordingly, the shoring contractor should be prepared to use special techniques and measures, if necessary, to permit the proper installation of the soldier piles.

3.2.1 Lateral Earth Pressures

For design of cantilevered shoring, where the surface of the backfill is level, it can be assumed that drained soils will exert a lateral pressure equal to that developed by a fluid with a density of 35 pounds per cubic foot (pcf). In addition to the recommended earth pressure, the shoring should be designed to resist any applicable surcharge loads due to foundation, storage, traffic, or other anticipated loads.

In addition to the recommended earth pressure, the upper 10 feet of shoring adjacent to streets should be designed to resist a uniform lateral pressure 100 psf, acting as a result of an assumed 100 psf surcharge behind the shoring due to normal street traffic. The recommended lateral surcharge due to traffic also applies to permanent basement walls. If the traffic is kept back at least 10 feet from the shoring, the traffic surcharge may be neglected. We can determine lateral surcharge pressures for specific cases, such as construction crane, concrete trucks, and other heavy construction equipment adjacent to shoring, if requested.

3.2.2 Design of Soldier Piles

For the design of soldier piles spaced at least two diameters on centers (OC), the allowable lateral bearing value (passive value) of the soils below the level of excavation may be assumed to be 600 psf at the excavated surface, up to a maximum of 6,000 psf. To develop the full lateral value, provisions should be taken to assure firm contact between the soldier piles and soils.

Concrete placed in the soldier pile excavations may be a lean-mix concrete. However, the concrete used in that portion of the soldier pile which is below the planned excavated level should be of sufficient strength to adequately transfer the imposed loads from the soldier pile to the surrounding soils.

The frictional resistance between the soldier piles and the retained earth may be used in resisting the downward component of the design load. For piles encased in concrete, the coefficient of friction between the soldier piles and the retained earth may be taken as 0.4. This value is based on the assumption that uniform full bearing will be developed between the steel soldier beam and the lean-mix concrete and between the lean-mix concrete and the retained earth. In addition, provided that the portion of the soldier piles below the excavated level is backfilled with structural concrete, the soldier piles below the excavated level may be used to resist downward loads. The frictional resistance between the concrete soldier piles and the soils below the excavated level may be taken as equal to 500 psf.

3.2.3 Lagging

Continuous lagging will be required between the soldier piles. Careful installation of the lagging will be necessary to achieve bearing against the retained earth.

The soldier piles should be designed for the full anticipated lateral pressure. However, the pressure on the lagging will be less due to arching in the soils. For clear spans up to 8 feet, we recommend that the lagging be designed for a semi-circular distribution of earth pressure where the maximum pressure is 400 psf at the midline between soldier piles, and 0 psf at the soldier piles.

3.2.4 Deflection

It is difficult to accurately predict the amount of deflection of a shored embankment. It should be realized, however, that some deflection will occur. The maximum allowable horizontal shoring deflection adjacent to existing buildings, as measured at the top of the excavation, is ½ inch. The maximum allowable horizontal shoring deflection, as measured at the top of the excavation, should be limited to 1 inch in other areas.

If greater deflection occurs during construction, additional bracing may be necessary to minimize settlement of adjacent structures and of any utilities in the adjacent streets. To reduce the deflection of the shoring, if desired, a greater active pressure could be used in the shoring design.

3.2.5 Monitoring

Some means of monitoring the performance of the shoring system is recommended. The monitoring should consist of periodic surveying of the lateral and vertical locations of the tops of all the soldier piles or though installation of inclinometers. We will be pleased to discuss this further with the design consultants and the contractor when the design of the shoring system is finalized.

We recommend that the adjacent existing streets be surveyed for horizontal and vertical locations. Also, a careful pre-construction survey of existing cracks and offsets in the streets should be performed and recorded along with photographic records. A pre-construction benchmark survey establishing horizontal locations and vertical elevations for the adjacent buildings combined with documentation of existing cracks and offsets may be useful in responding to claims of distress and damage (if any).

3.3 Foundation Design

Conventional spread footings established in undisturbed natural soils or engineered fill may be used to support the proposed building. Footings should be embedded a minimum 18 inches below the lowest adjacent grade. An allowable soil bearing pressure of 4,000 pounds per square foot (psf) may be used for footings with a minimum width of 12 inches for continuous footings and 18 inches for isolated footings.

The ultimate bearing capacity can be taken as 12,000 psf, which does not incorporate a factor of safety. A resistance factor of 0.5 should be used for initial bearing capacity evaluation with factored loads.

The allowable bearing capacity for shallow footings is based on a total static settlement of ½ inch. Differential settlement can be taken as half the total settlement over a horizontal distance of 30 feet.

For static loading, 50 pounds per cubic inch (pci) may be assumed as the modulus of subgrade reaction (*k*). For seismic loading, a *k* value of 150 pci may be assumed.

Since settlement is a function of footing size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. Once developed by the structural engineer, we should review total dead and sustained live loads for each column including plan location and span distance, to evaluate if differential settlements between dissimilarly loaded columns will be tolerable. Excessive differential settlement can be mitigated with the use of reduced bearing pressures, deeper footing embedment, possibly changing overexcavation schemes and using imported base material under spread footings, or possibly other methods.

Resistance to lateral loads will be provided by a combination of friction between the soil and structure interface and passive pressure acting against the vertical portion of the footings structures. For calculating lateral resistance, a passive pressure of 300 psf per foot of depth to a maximum of 3,000 psf and a frictional coefficient of 0.3 may be used. Note that the passive and frictional coefficients do not include a factor of safety. The frictional resistance and the passive resistance of the soils can be combined without reduction in determining the total lateral resistance.

3.4 Slabs-on-Grade

Concrete slabs may be designed using a modulus of subgrade reaction of 100 pci provided the subgrade is prepared as described in Section 3.1. From a geotechnical standpoint, we recommend slab-on-grade be a minimum 5 inches thick with No. 3 rebar placed at the center of the slab at 24 inches on center in each direction. The structural engineer should design the actual thickness and reinforcement based on anticipated loading conditions. Where moisture-sensitive floor coverings or equipment is planned, the slabs should be protected by a minimum 10-mil-thick vapor barrier between the slab and subgrade. A coefficient of friction of 0.35 can be used between the floor slab and the vapor barrier.

Minor cracking of concrete after curing due to drying and shrinkage is normal and should be expected; however, concrete is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low-slump concrete or low water/cement ratios can reduce the potential for shrinkage cracking. Additionally, our experience indicates that the use of reinforcement in slabs and foundations can generally reduce the potential but not eliminate for concrete cracking.

To reduce the potential for excessive cracking, concrete slabs-on-grade should be provided with construction or weakened plane joints at frequent intervals. Joints should be laid out to form approximately square panels.

3.5 Sulfate Attack and Ferrous Corrosion Protection

3.5.1 Sulfate Exposure

Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. A potentially high sulfate content could also cause corrosion of reinforcing steel in concrete. Section 1904A of the 2019 California Building Code (CBC) defers to the American Concrete Institute's (ACI's) ACI 318-14 for concrete durability requirements. Table 19.3.1.1 of ACI 318-14 lists "*Exposure categories and classes*," including sulfate exposure as follows:

Table 3 - Sulfate Concentration and Exposure

Soluble Sulfate in Water (parts-per-million)	Water-Soluble Sulfate (SO_4) in soil (percentage by weight)	ACI 318-14 Sulfate Class
0-150	0.00 - 0.10	S0 (negligible)
150-1,500	0.10 - 0.20	S1 (moderate*)
1,500-10,000	0.20 - 2.00	S2 (severe)
>10,000	>2.00	S3 (very severe)

*or seawater

3.5.2 Ferrous Corrosivity

Many factors can modify corrosion potential of soil including soil moisture content, resistivity, permeability and pH, as well as chloride and sulfate concentration. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Based on the findings of studies presented in ASTM STP 1013 titled "*Effects of Soil Characteristics on Corrosion*" (February 1989), the approximate relationship between soil resistivity and soil corrosiveness was developed as follows:

Table 4 - Soil Resistivity and Soil Corrosivity

Soil Resistivity (ohm-cm)	Classification of Soil Corrosiveness
0 to 900	Very Severely Corrosive
900 to 2,300	Severely Corrosive
2,300 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
10,000 to >100,000	Very Mildly Corrosive

Acidity is an important factor of soil corrosivity. The lower the pH (the more acidic the environment), the higher the soil corrosivity will be with respect to buried metallic structures and utilities. As soil pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures, due to protective surface films, which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint. Chloride and sulfate ion concentrations, and pH appear to play secondary roles in modifying corrosion potential. High chloride levels tend to reduce soil resistivity and break down otherwise protective surface deposits, which can result in corrosion of buried steel or reinforced concrete structures.

3.5.3 Corrosivity Test Results

To evaluate corrosion potential of soils sampled from this site, we tested a bulk soil sample for soluble sulfate content, soluble chloride content, pH and resistivity. Results of these tests are summarized below:

Table 5 - Results of Corrosivity Testing

Boring Number	Sample Depth (feet)	Sulfate (mg/kg)	Chloride (mg/kg)	pH	Minimum Resistivity (ohm-cm)
2020- LB4	0-5	164	42	8.1	1,800

Note: mg/kg = milligrams per kilogram, or parts-per-million (ppm)

These results are discussed as follows:

- **Sulfate Exposure**: Based on test results and Table 19.3.1.1 of ACI 318-14, in our opinion, sulfate exposure should be considered “**moderate**” with an **Exposure Class S1**.

- **Ferrous Corrosivity**: As shown above, minimum soil resistivity of **1,800 ohm-centimeters or less** was measured in our laboratory test. In our opinion, based on resistivity correlation presented in Table 4 Section 3.4.2, it appears for site soils that corrosion potential to buried steel may be characterized as “**severely corrosive**” at the site.

As standard design concepts, ferrous pipe buried in moist to wet site earth materials should be avoided by using high-density polyethylene (HDPE) or other non-ferrous pipe when possible. Or ferrous pipe can be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from on-site earth materials.

3.6 Retaining Walls

Recommended lateral earth pressures are provided as equivalent fluid unit weights, in psf/ft. or pcf. These values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

On-site soils are likely suitable to be used as retaining wall backfill due to its very low expansion potential, field and laboratory verification are recommended before use. Should site soil be considered or available for reuse behind basement retaining walls, it should be tested to ensure Expansion potential is less than 20 (EI<20). Recommended lateral earth pressures for retaining walls backfilled with sandy soils with drained conditions as shown on Figure 9, *Retaining Wall Backfill and Subdrain Detail* are as follows:

Table 6 – Retaining Wall Design Earth Pressures

Retaining Wall Condition (Level Backfill)	Equivalent Fluid Pressure (pounds-per-cubic-foot)*
Active (cantilever)	35
At-Rest (braced)	60
Passive Resistance (compacted fill)	300
Seismic Increment (add to active pressure)	20

Walls that are free to rotate or deflect may be designed using active earth pressure. For basement walls or walls that are fixed against rotation, the at-rest pressure should be used. For the seismic condition, the pressure should be distributed as an equivalent fluid pressure with the dynamic thrust should be applied at a height of 1/3 H above the base of the wall.

3.6.1 Sliding and Overturning

Total depth of retained earth for design of walls and for uplift resistance, should be measured as the vertical height of the stem below the ground surface at the wall face for stem design, or measured at the heel of the footing for overturning and sliding. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing, if drained, or 60 pcf if submerged, for properly compacted backfill.

3.6.2 Drainage

Adequate drainage may be provided by a subdrain system positioned behind earth retaining walls. Typically, this system consists of a 4-inch minimum diameter perforated pipe placed near the base of the wall (perforations placed downward). The pipe should be bedded and backfilled with pervious backfill material described in Section 300-3.5.2 of the *Standard Specifications for Public Works Construction* (Green Book), 2018 Edition. This pervious backfill should extend at least 2 feet out from the wall and to within 2 feet of the outside finished grade. This pervious backfill and pipe should be wrapped in filter fabric, such as Mirafi 140N or equivalent, placed as described in Section 300-8.1 of the *Standard Specifications for Public Works Construction*

(Green Book), 2018 Edition. The subdrain outlet should be connected to a free-draining outlet or sump.

Miradrain, Geotech Drainage Panels, or Enkadrain drainage geocomposites, or similar, may be used for wall drainage as an alternative to the Class 2 Permeable Material or drain rock backfill, particularly where horizontal space is limited adjacent to shoring (where walls are cast against shoring). These drainage panels should be connected to the perforated drainpipe at the base of the wall.

3.7 Pavements

To provide support for paving, the subgrade soils should be prepared as recommended in the Section 3.1. Compaction of the subgrade, including trench backfills, to at least 95 percent of the maximum dry density as determined by ASTM Test Method D 1557, and achieving a firm, hard, and unyielding surface will be important for paving support. The preparation of the paving area subgrade should be performed immediately prior to placement of the base course.

Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet. Landscape areas must be separated from pavements with concrete curbs and/or edge drains. Excessive over-irrigation will have an adverse impact on adjacent pavements. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from paving, will result in premature pavement failure.

3.7.1 Asphalt Concrete

The required paving and base thicknesses will depend on the expected wheel loads and volume of traffic (Traffic Index or TI). Assuming that the paving subgrade will consist of engineered fill with an R-value greater than 40, compacted to at least 95 percent as recommended, the minimum recommended paving thicknesses are presented in the following table. Results of R-value testing on a near surface sample of existing onsite soils indicates a value of 72.

Table 7 – Asphalt Concrete Pavement Sections

Design Traffic Index (TI)	Asphalt Concrete (inches)	Base Course (inches)
5	3	4
6	3	8
7	4	8

A minimum of 3-inches of asphalt is recommended due to hot weather oxidation and degradation common in southern California. Traffic Indexes (TIs) used in our pavement design are considered reasonable values for proposed auto parking lots, and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Higher TIs should be used in heavy truck traffic areas or high-volume lanes.

3.7.2 Portland Cement Concrete Paving

For light axle loads and average daily truck traffic (ADT) less than (<) 500, fire lanes subject to outrigger loads, trash corral aprons, or other areas where point loads are possible, should be paved with Portland Cement Concrete (PCC) with a minimum thickness of 7-inches over properly compacted fill. However, for medium/heavy axle loads and an ADT of (≥) 500 or more over properly compacted fill subgrades, a minimum PCC thickness of 8-inches should be used, such as for loading docks, etc. All PCC pavements should have a minimum 28-day concrete compressive strength of 3,250 pounds-per-square-inch (psi), and have appropriate joints and saw cuts in accordance with either Portland Cement Association (PCA) or American Concrete Institute (ACI) guidelines. PCC subgrades supporting axle loads are recommended to be compacted to 95 percent relative compaction in the upper 12 inches.

Table 8 – PCC Pavement Sections

Traffic Index	PCC (inches)	Base Course (inches)
5	6	4
6	6.5	4
7	7	4

This 4-inch layer of Class 2 aggregate may be used beneath other areas of PCC pavement to improve performance. Additional details should be added to plans indicating pavement thickness transitions, pavement joint dowels, expansion joints and saw cut joints. Use of concrete cutoff or edge barriers should be considered at the perimeter of common parking or driveway areas when abutting either open (unfinished) or landscaped areas.

3.7.3 Paving Materials

Asphalt concrete, aggregate base and Portland Cement Concrete (PCC) should conform to *Caltrans Standard Specifications* (2018 Edition):

https://dot.ca.gov/-/media/dot-media/programs/design/documents/f00203402018stdspecsa11y.pdf

Recommended structural pavement materials should conform to the specified provisions in the Caltrans *Standard Specifications* (2018) including grading and quality requirements, shown below:

- **Asphalt Concrete (Hot Mixed Asphalt)** for pavement should be Type A and should conform to Section 39 of the *Standard Specifications*. Asphalt concrete specimens should be tested for surface abrasion in accordance with CT-360.

- **Class 2 Aggregate Base (AB)** should conform to Section 26 of the *Standard Specifications*.

- **Portland Cement Concrete (PCC)** pavement should conform to Section 40 of the *Standard Specifications*. PCC pavement materials (pavement, structures, minor concrete) should conform to Section 90 of the *Standard Specifications*.

As an alternative, asphalt concrete can conform to Section 203-6 of the *Standard Specifications for Public Works Construction* (Green Book), 2018 Edition. Crushed aggregate base or crushed miscellaneous base can conform to Sections 200-2.2 and 200-2.4 of the *Standard Specifications for Public Works Construction* (Green Book), 2018 Edition, respectively.

3.8 Infiltration BMP Design Considerations

The small-scale infiltration rates presented in Section 2.4.1 should be converted to a large-scale rate using a reduction factor. In addition, infiltration rates will degrade over time due to complete saturation of underlying soils, and fines build-up and plugging if pretreatment of the storm water is not performed. As such, a reduction of the measured small-scale infiltration rate using a minimum factor of safety of 3 or more should be used to establish a more realistic infiltration rate for the service life of the system(s).

In general, a vast majority of geotechnical distress issues are related to improper drainage. Distress in the form of foundation movement could occur. Direct infiltration to the subsurface is not recommended adjacent to curb and gutter and public pavements as soil saturation could lead to a loss of soil support, settlement or collapse, and internal erosion (piping). Additionally, infiltration water will migrate along pipe backfill (typically sand or gravel bedding) affecting improvements far from the point of infiltration. Proposed direct open bottom infiltration systems, although not anticipated at this time, should be located as far away from existing or proposed foundations, rigid improvements and utilities as is practical in order to reduce the geotechnical distress issues related to water. Where sufficient distance from improvements cannot be achieved, additional recommendations may be warranted and can be provided during plan review.

Prior to construction of any infiltration device intended for the site, the plans should be reviewed by the geotechnical consultant to verify that our geotechnical recommendations have been appropriately incorporated into the plans and not compromised by the addition of an infiltration system to the site. The designer of any infiltration system should contact the geotechnical consultant for geotechnical input during the design process as they feel necessary.

3.9 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations, and foundation excavations should be performed in accordance with project plans, specifications, and all OSHA requirements. Excavations 4 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel are allowed to enter.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the cut, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structure.

Temporary excavations should be treated in accordance with the State of California version of OSHA excavation regulations, Construction Safety Orders for Excavation General Requirements, Article 6, Section 1541, effective October 1, 1995. The sides of excavations should be shored or sloped in accordance with OSHA regulations. OSHA allows the sides of unbraced excavations, up to a maximum height of 20 feet, to be cut to a ¾H:1V (horizontal:vertical) slope for Type A soils, 1H:1V for Type B soils, and 1½H:1V for Type C soils. Near-surface onsite soils are to be considered Type B soils.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor shall be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

3.10 Trench Backfill

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1 and 306-6 of the Standard Specifications for Public Works Construction, ("Greenbook"), 2018 Edition. Utility trenches can be backfilled with onsite sandy material free of rubble, debris, organic and oversized material up to (≤) 3-inches in largest dimension. Prior to backfilling trenches, pipes should be bedded in and covered with either:

(1) **Sand:** A uniform, sand material that has a Sand Equivalent (SE) greater-than-or-equal-to (≥) 30, passing the No. 4 U.S. Standard Sieve (or as specified by the pipe manufacturer), water densified in place, or

(2) **CLSM:** Controlled Low Strength Material (CLSM) conforming to Section 201-6 of the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2018 Edition. CLSM should not be jetted.

Pipe bedding should extend at least 4 inches below the pipeline invert and at least 12 inches over the top of the pipeline. Native and clean fill soils can be used as backfill over the pipe bedding zone, and should be placed in thin lifts, moisture conditioned above optimum, and mechanically compacted to at least 95 percent relative compaction, relative to the ASTM D 1557 laboratory maximum density.

3.11 Drainage and Landscaping

Building walls below grade should be waterproofed or at least damp proofed, depending upon the degree of moisture protection desired. Surface drainage should be designed to direct water away from foundations and toward approved drainage devices. Irrigation of landscaping should be controlled to maintain, as much as possible, consistent moisture content sufficient to provide healthy plant growth without overwatering.

3.12 Additional Geotechnical Services

Leighton should review the grading plans, foundation plans, and specifications when they are available to verify that the recommendations presented in this report have been properly interpreted and incorporated.

Geotechnical observation and testing should be provided during the following activities:

- Grading and excavation of the site;
- Subgrade Preparation;
- Compaction of all fill materials;
- Utility trench backfilling and compaction;
- Footing excavation and slab-on-grade preparation;
- Pavement subgrade and base preparation;
- Placement of asphalt concrete and/or concrete; and
- When any unusual conditions are encountered.

4.0 LIMITATIONS

This geotechnical exploration does not address the potential for encountering hazardous soil at this site. In addition, this report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is, by necessity, incomplete. Please also refer GBA's *Important Information About Your Geotechnical Report* (included at the rear of the text), presenting additional information and limitations regarding geotechnical engineering studies and reports. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report are only valid if Leighton Consulting, Inc. has the opportunity to observe subsurface conditions during grading and construction, to confirm that our data are representative for the site. Leighton Consulting, Inc. should also review the construction plans and project specifications, when available, to comment on the geotechnical aspects.

This report was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing at this time in Orange County. We do not make any warranty, either expressed or implied.

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Important Information about This

Geotechnical-Engineering Report

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

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

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

Understand the Geotechnical-Engineering Services Provided for this Report

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

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

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

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

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

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

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

Read this Report in Full

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

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

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

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

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

This Report's Recommendations Are Confirmation-Dependent

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

This Report Could Be Misinterpreted

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

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

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

Give Constructors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

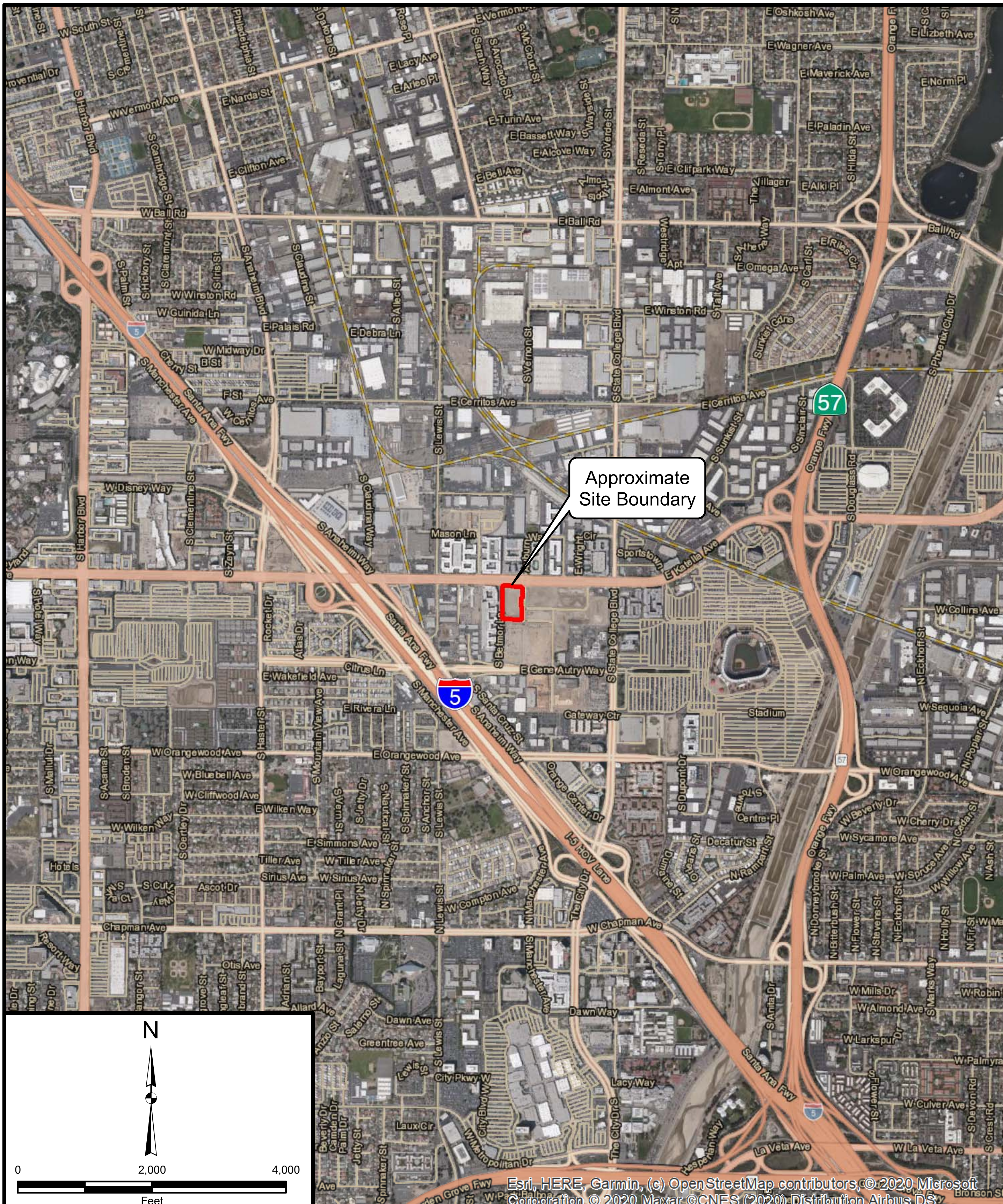
The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide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

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

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

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org



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Scale:1 " = 2,000 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

SITE LOCATION MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 1

Leighton

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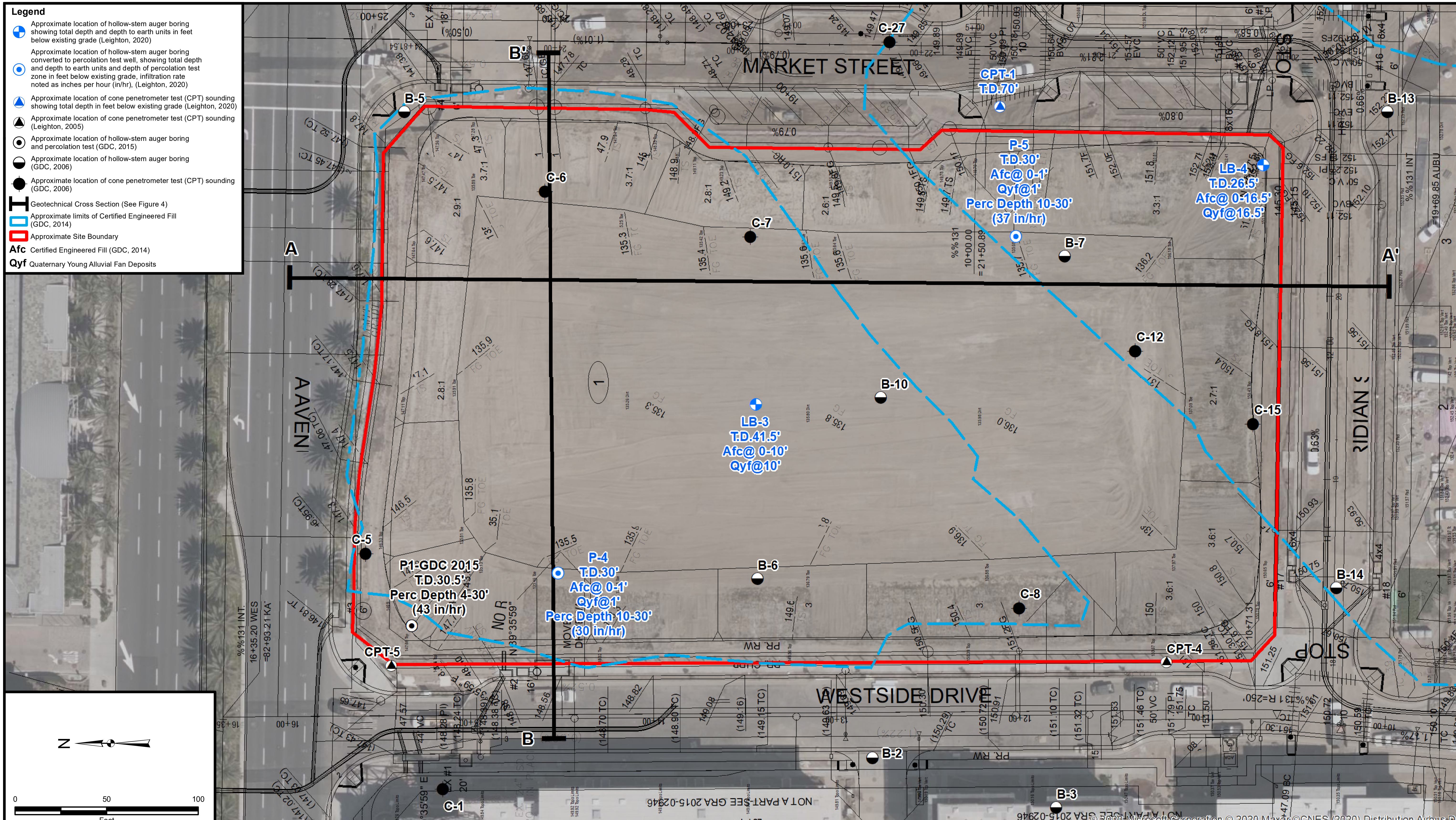

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Scale:1 " = 50 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

EXPLORATION LOCATION MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 2a

Leighton

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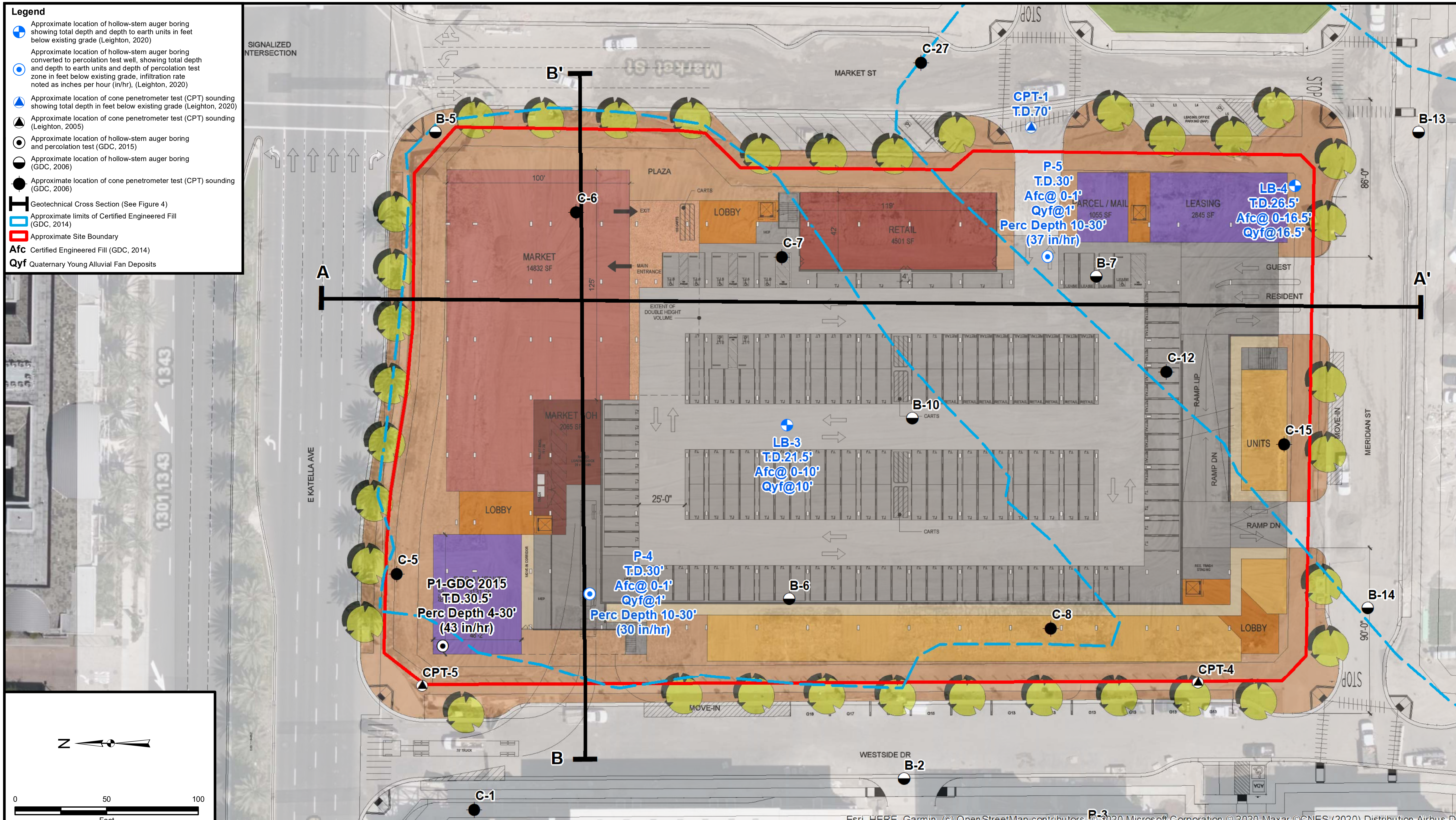

Project: 12882.001	Eng/Geol: CCK/JAR
Scale: 1 " = 50 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

DEVELOPMENT CONCEPT MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 2b

Leighton

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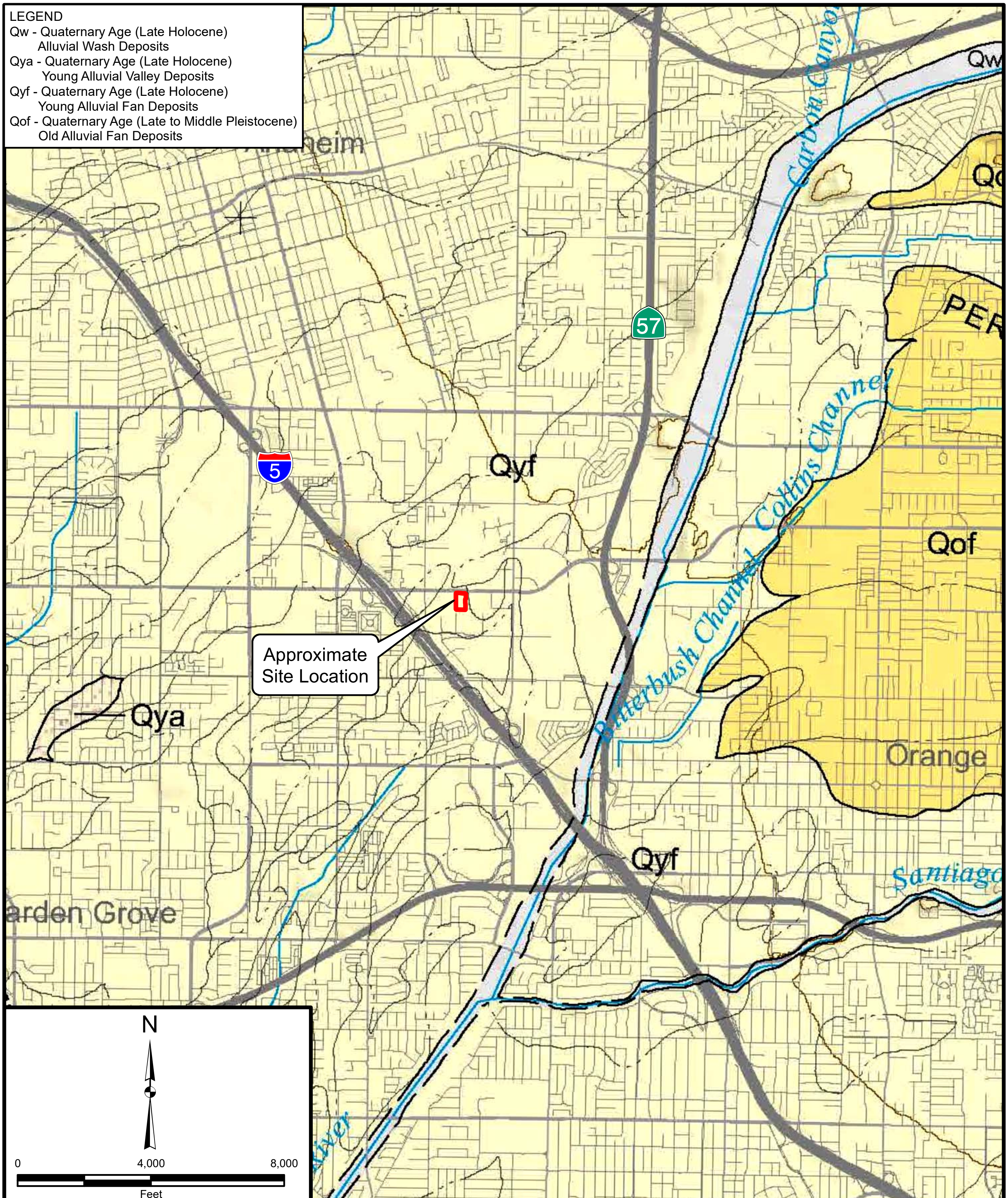

Project: 12882.001	Eng/Geol: CCK/JAR
Scale:1 " = 4,000 '	Date: October 2020

Base Map: Geologic Compilation of Quaternary Surficial Deposits in Southern California, Orange County, July 2020
Thematic Information: Leighton, USGS
Author: Leighton Geomatics (btran)

REGIONAL GEOLOGY MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 3

Leighton

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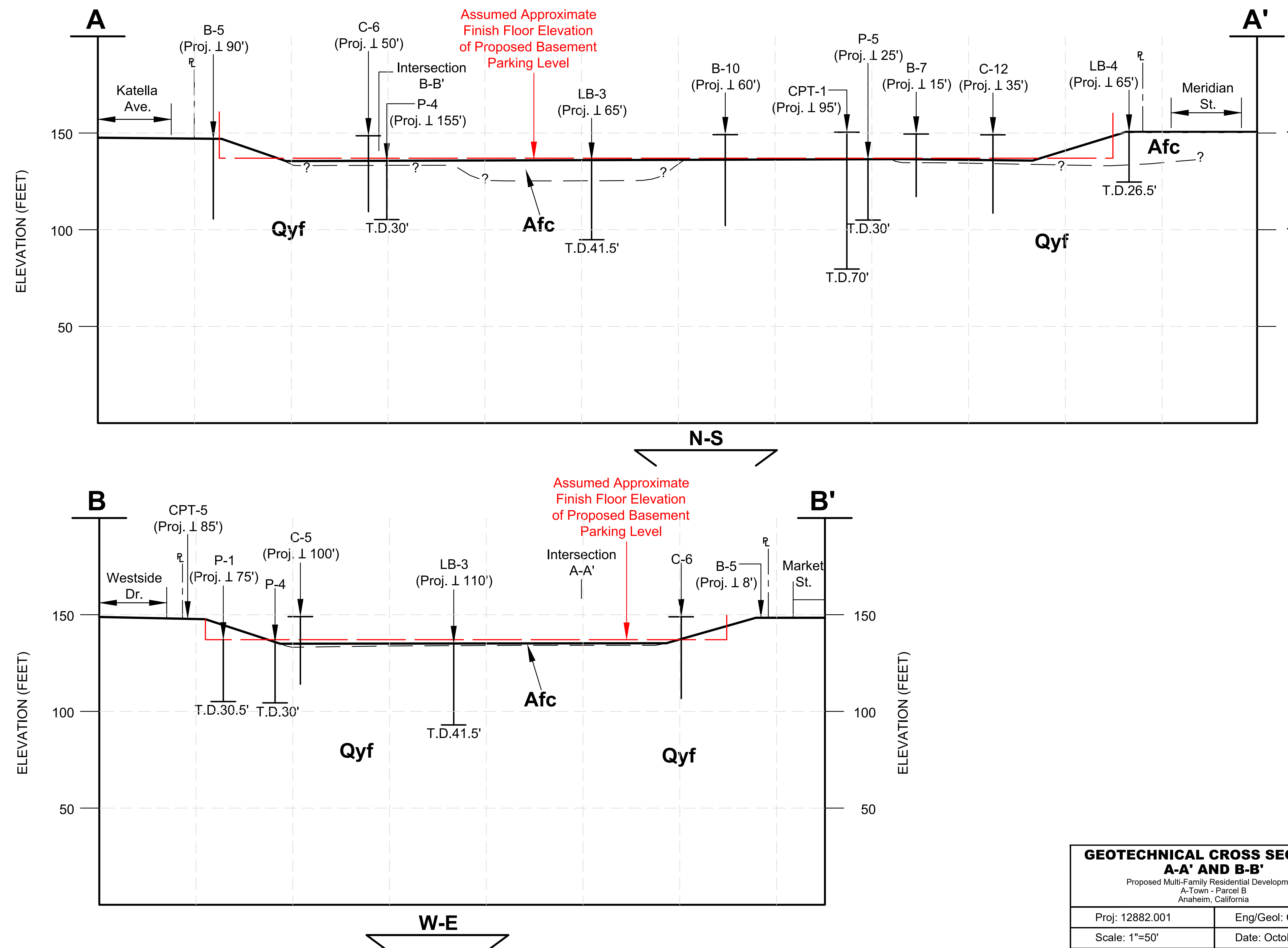


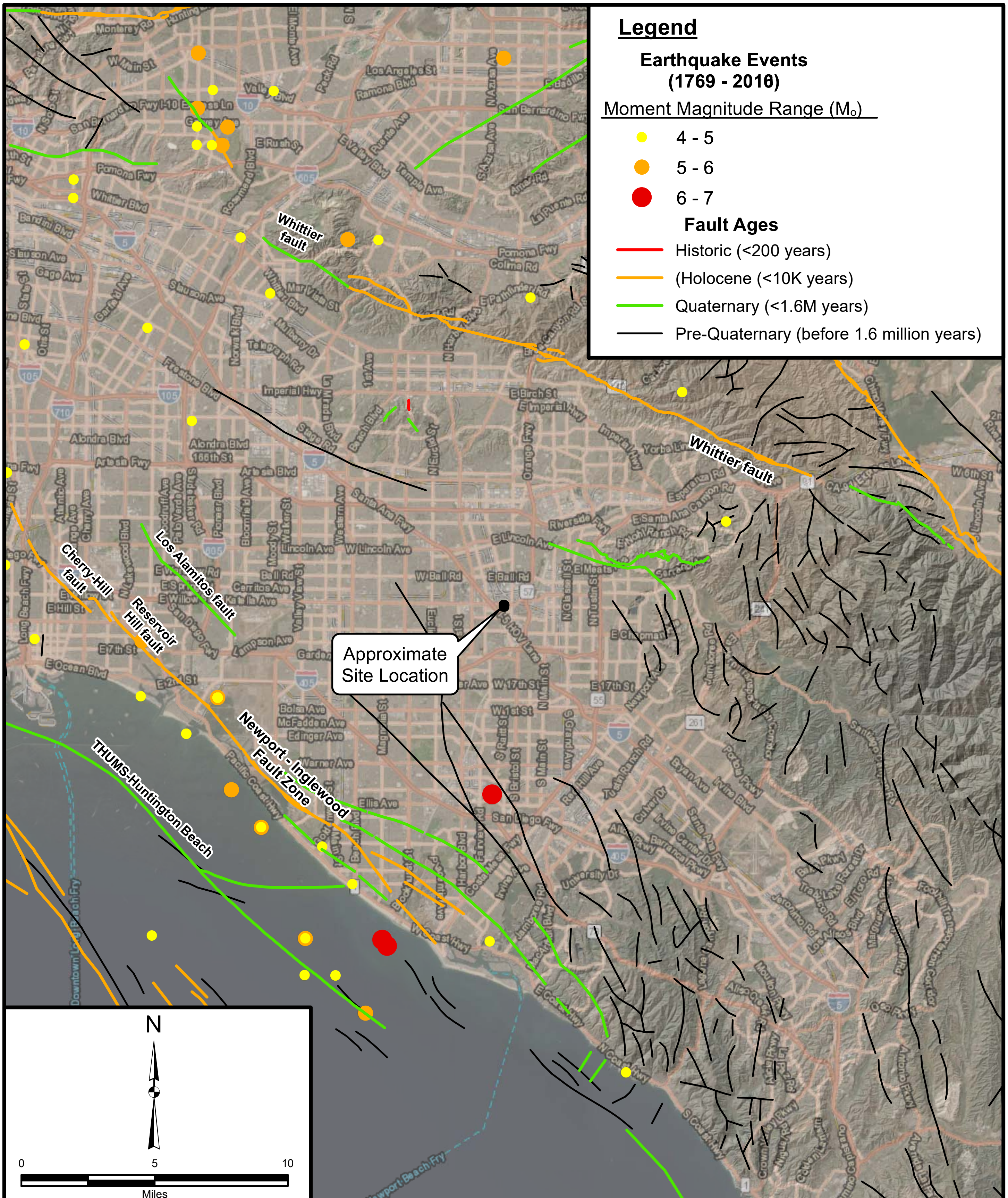
GEOTECHNICAL CROSS SECTIONS A-A' AND B-B'

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Proj: 12882.001	Eng/Geol: CCK/JAR
Scale: 1"=50'	Date: October 2020

Figure 4

Leighton



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Scale:1 " = 5 miles	Date: October 2020

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton, Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: CGS, USGS, SCEC.
Author: Leighton Geomatics (btran)

REGIONAL FAULT AND HISTORICAL SEISMICITY MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 5

Leighton

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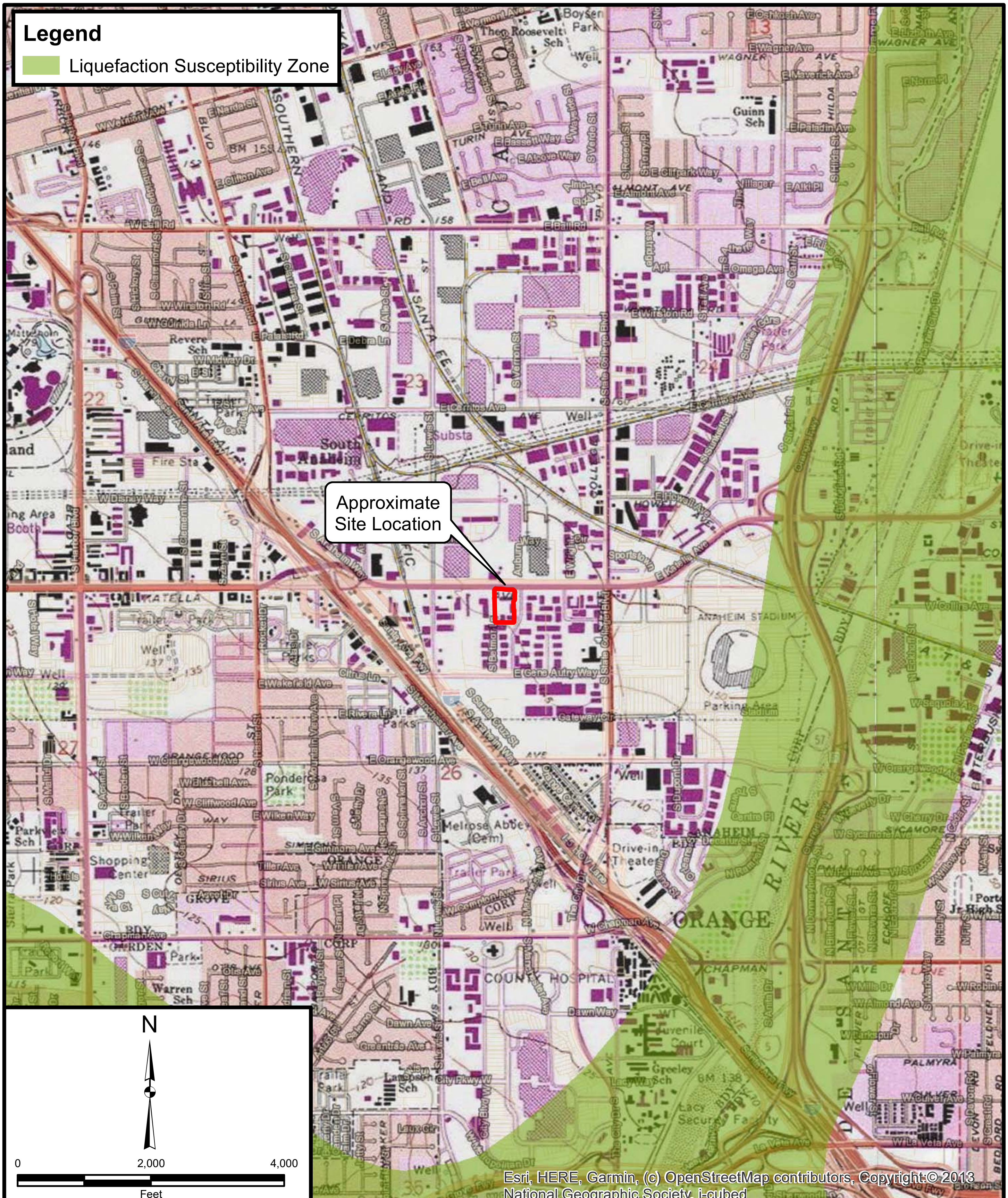

Project: 12882.001	Eng/Geol: CCK/JAR	
Scale:1 " = 2,000 '	Date: October 2020	

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton, CGS
Author: Leighton Geomatics (btran)

SEISMIC HAZARD MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 6

Leighton

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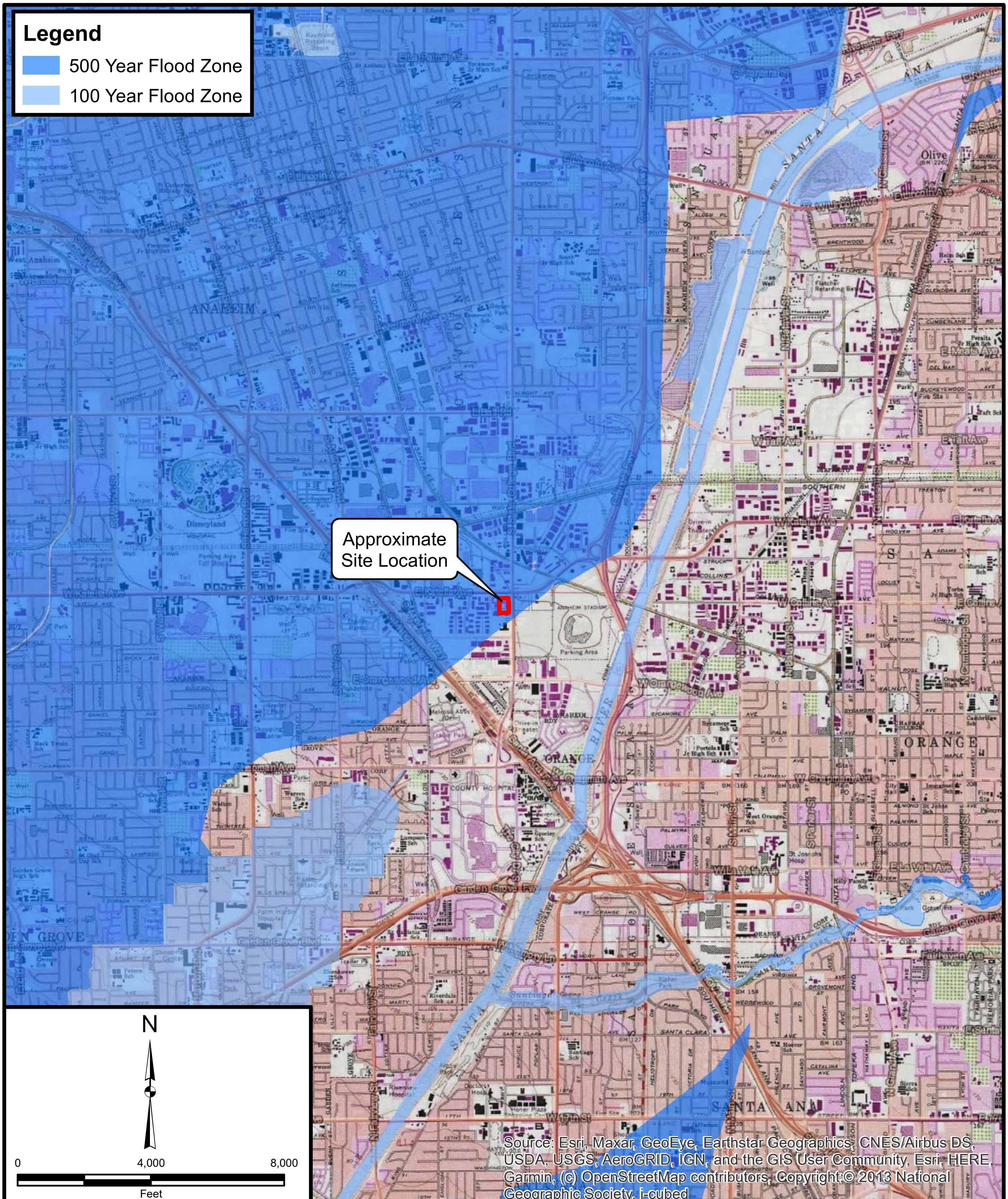

Project: 12882.001	Eng/Geol: CCK/JAR
Scale:1 " = 4,000 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020
Thematic Information: Leighton, CA DWR, FEMA
Author: Leighton Geomatics (btran)

FLOOD HAZARD ZONE MAP

Proposed Multi-Family Residential Development
A-Town - Parcel B
Anaheim, California

Figure 7

Leighton

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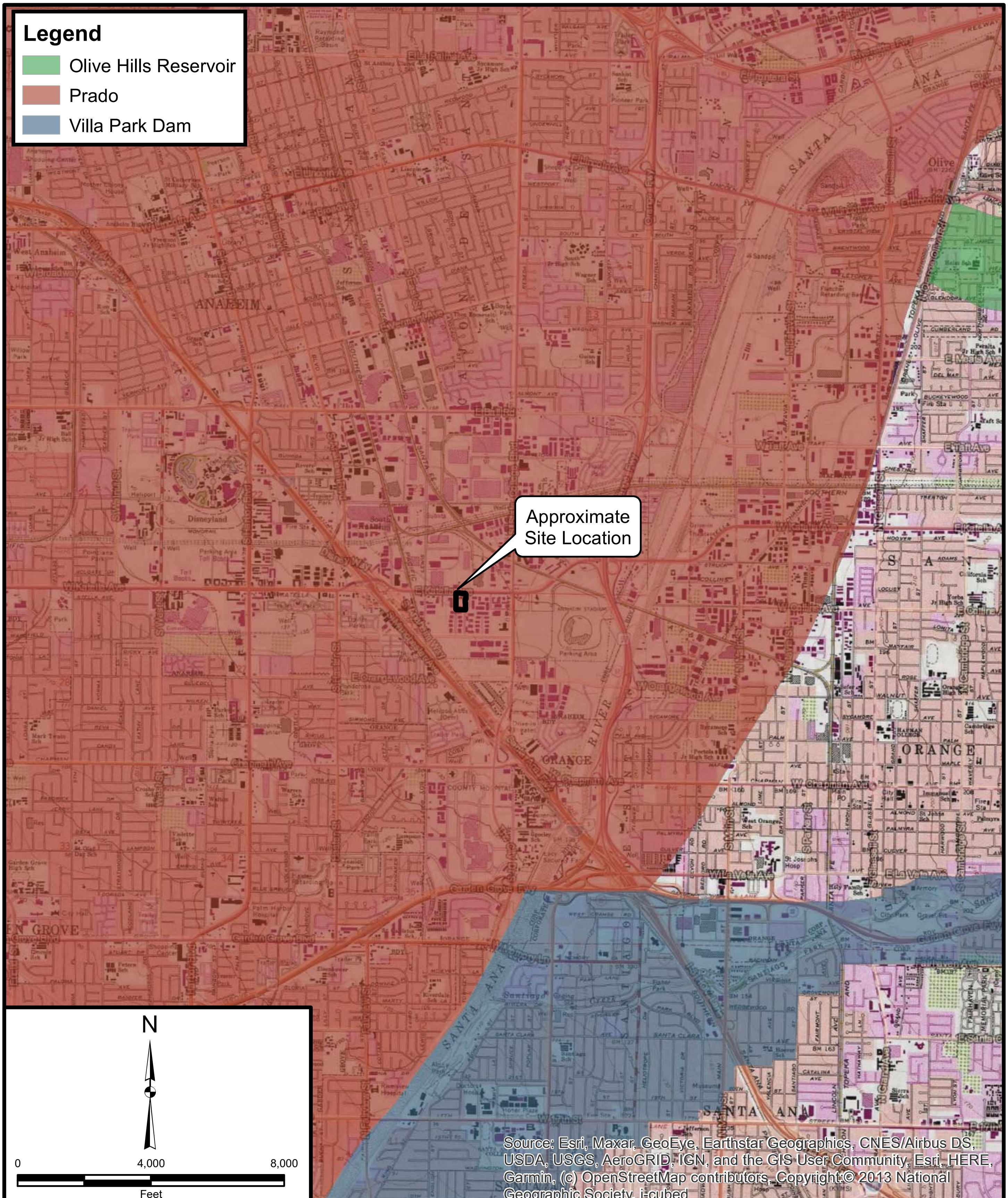

Project: 12882.001	Eng/Geol: CCK/JAR	DAM INUNDATION MAP	Figure 8
Scale:1 " = 4,000 '	Date: October 2020	Proposed Multi-Family Residential Development	Leighton
Base Map: ESRI ArcGIS Online 2020 Thematic Information: Leighton, CA DWR, FEMA Author: Leighton Geomatics (btran)		A-Town - Parcel B Anaheim, California	

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APPENDIX A

EXPLORATION LOGS

Leighton

GEOTECHNICAL BORING LOG LB-3

Project No.	12882.001	**Date Drilled**	9-26-20
Project	A-Town - Parcel B	**Logged By**	JAR
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	135'
Location	See Figure 2a - *Exploration Location Map*	**Sampled By**	JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
135	0							(SP-SM)g	**Artificial fill, certified (Afc):** @0': SAND to Silty SAND (SP-SM), loose, dry, fine to coarse grained SAND, fine to coarse GRAVEL, some angular COBBLE-sized rock and concrete debris, abundant rodent burrows	
				R1	6 9 8	107	4	SP	@2': SAND (SP), medium dense, moist, yellow brown, fine to coarse grained SAND, fine GRAVEL, well graded	
130	5			R2	7 14 17	102	3	SP	@5': SAND (SP), medium dense, fine to coarse grained SAND, with fine pebbly GRAVEL, well graded	
				R3	5 6 10	107	12		@7': With silty rip-up clasts	
125	10			R4	6 8 10			SM	**Quaternary Young Alluvium: (Qyf)** @10': Silty SAND (SM), medium dense, olive grey brown, moist, fine grained SAND, poorly graded	CN, DS
120	15			S1	5 9 12		16	SP	@15': SAND (SP), medium dense, moist, grey brown, fine to medium grained SAND, Moderately-Graded, fining upward sequences with basal coarse grained SAND	
115	20			R5	15 26 30	104	6	SP	@20':SAND (SP), dense, coarse grained SAND, fine GRAVEL, well graded	
110	25			S2	4 5 5		16	SM-ML	@25': Silty SAND (SM), loose, olive brown, moist, fine grained SAND @26': SILT (ML), medium stiff, moist, with thin beds of SAND and CLAY	
105	30									

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

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

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

GEOTECHNICAL BORING LOG LB-3

Project No.	12882.001	**Date Drilled**	9-26-20
Project	A-Town - Parcel B	**Logged By**	JAR
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	135'
Location	See Figure 2a - *Exploration Location Map*	**Sampled By**	JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
105	30			R6	4 21 30	94	13	SP	@30':SAND (SP), dense, yellow brown, moist, fine grained SAND, poorly graded	
100	35			S3	6 7 7		4		@35': SAND (SP) medium dense, contact with Sandy Lean CLAY (Paleosol) @36 feet	
								CL	@36': Sandy Lean CLAY (CL), stiff, olive brown, moist, very fine grained SAND, few SILT, oxidation stringers	
95	40			R7	15 20 25	92	32	ML-CL	@40': Sandy SILT to Silty CLAY (CL-ML), hard, olive brown, moist, very fine grained SAND peds, oxidized along laminae, poor blocky structure (Paleosol)	
									Total Depth of Boring: 41.5 Feet No groundwater encountered during drilling. Boring backfilled with bentonite chips (hydrated) upon completion of drilling and logging. Excess cuttings spread on site.	
90	45									
85	50									
80	55									
75	60									

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

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

GEOTECHNICAL BORING LOG LB-4

Project No.	12882.001	**Date Drilled**	9-26-20
Project	A-Town - Parcel B	**Logged By**	JAR
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	152'
Location	See Figure 2a - *Exploration Location Map*	**Sampled By**	JAR

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

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0		BB-1				SMg	**Artificial fill, certified (Afc):** @0': Silty SAND (SMg) with GRAVEL, weeds, and concrete debris, abundant rodent burrows	EI, CN, CR, DS RV
150			R2	16 25 30	112	7		@2': Silty SAND (SMg) with GRAVEL, dense, dark brown, moist, fine to coarse grained SAND, fine to coarse subrounded to angular GRAVEL	
	5		R1	10 15 28	114	9	SM	@5': Silty SAND (SM), dense, olive brown, moist, fine to medium grained SAND	
145			R3	14 18 22	118	11	SC	@7': Silty CLAY (CL) with GRAVEL, hard, blackish brown, fine to coarse grained SAND, fine to coarse angular GRAVEL	CN, DS
	10		R4	9 12 19	118	11	SM-SC	@10': Silty Clayey SAND (SM-SCg) with GRAVEL, medium dense, blackish brown, moist	
140									
	15		S1	3 4 6		15		@15': Abundant rock fragments, blackish brown, very moist near transition to SAND @16.5 feet	
135							SP	**Quaternary Young Alluvium: (Qyf)** @16.5': SAND (SP), medium dense, yellow brown, moist, fine to coarse grained SAND, well-graded	
	20		S2	7 11 20		5		@20': SAND (SP), medium dense, poorly graded	
130									
	25		S3	5 7 4		3		@25': SAND (SP) loose, slightly moist, poorly graded	
							CL	@26.3': to 26.4': CLAY (CL) thin bed, olive brown, moist, grades down to fine grained SAND in shoe	
125								Total Depth of Boring: 26.5 Feet No groundwater encountered during drilling. Boring backfilled with bentonite chips (hydrated) upon completion of drilling and logging. Excess cuttings spread on site.	
	30								

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

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

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

GEOTECHNICAL BORING LOG P-4

Project No.	12882.001	**Date Drilled**	9-26-20
Project	A-Town - Parcel B	**Logged By**	JAR
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	135'
Location	See Figure 2a - *Exploration Location Map*	**Sampled By**	JAR

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
135	0			BB-1				SP-SM	**Artificial fill, certified: (Afc)** @0': Poorly-Graded SAND to Silty SAND (SP-SM), loose, weeds, some coarse GRAVEL and angular COBBLE sized rock, 12 to 14-inches, concrete rubble at surface, abundant rodent burrows **Quaternary Young Alluvium: (Qyf)**	
130	5			R1	8 15 18	113	2	SP	@5': SAND (SP), medium dense, yellow brown, fine to coarse grained SAND, well-graded, some bedded fine GRAVEL, poorly graded	
125	10			R2	5 14 11	96	6	SP-SM	@10': SAND with SILT (SP-SM), medium dense, very moist, fine grained SAND, silty clay rip-up clasts, poorly graded **0%GR: 92%SA: 8%FI**	SA
				S1	4 6 8		4		@12': Medium dense, grayish black, fine grained SAND, micaceous	
120	15			R3	14 20 25	100	5	SP	@15': SAND (SP), dense, moist, fine to coarse grained SAND, fine GRAVEL, poorly graded	
				S2	3 4 3		15			
								ML	@18': Sandy SILT (ML), stiff, very moist, very fine grained	
115	20			R4	4 8 15	106	9	SM	@20': Silty SAND (SM), soft, very fine grained SAND, trace clay **0%GR: 65%SA: 35%FI**	SA
				S3	4 4 8		13	SP	@22': SAND (SP), loose, with thin (1-inch) CLAY bed, poorly graded @23': Sandy SILT, fine grained	
110	25			R5	10 12 18	113	14	SM	@25': Silty SAND(SM), medium dense, fine grained SAND	
				S4	4 8 10		10	SM	@27': Silty SAND (SM), medium dense, very fine grained SAND **0%GR: 67%SA: 33%FI**	SA
								CL	@28.5': Laminated CLAY (CL) in shoe, very moist, oxidized, moderately plastic, with charcoal layers (laminations)	
105	30			R6	10 18 30	92	24	ML	@30': Sandy SILT, very stiff	
								SP	@31': SAND (SP), medium dense, fine grained, poorly graded	
									Total Depth of Boring: 31.5 Feet No groundwater encountered during drilling. Boring converted into Percolation Test Boring upon completion of drilling and logging. 2-inch slotted 0.020-inch PVC screen installed from 10 feet to 30 feet; solid 2-inch PVC Riser pipe from 0 to 10 feet. Annulus filled with No. 3 Monterey SAND. Excess cuttings spread on site.	
100	35									
95	40									

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

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

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

GEOTECHNICAL BORING LOG P-5

Project No.	12882.001	**Date Drilled**	9-26-20
Project	A-Town - Parcel B	**Logged By**	JAR
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	135'
Location	See Figure 2a - *Exploration Location Map*	**Sampled By**	JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
135	0			BB-1				SP-SM	**Artificial fill, certified(Afc)** @0': Poorly-Graded SAND to Silty SAND (SP-SM), loose, dry, fine to coarse grained SAND, fine GRAVEL and SILTSTONE rock fragments, some concrete debris, abundant rodent burrows	
									Quaternary Young Alluvium: (Qyf)	
130	5			R1	7 14 20	103	3	SP	@5': SAND (SP), medium dense, yellow brown, moist, fine to coarse grained SAND, fine pebbly GRAVEL, poorly graded	
125	10			S1	5 3 6		13		@10': Poorly-Graded SAND (SP), loose, fine to medium grained	
								CL	@11' to 11.3': Silty CLAY (CL) bed, becomes fine grained oxidized SAND (SP) below, olive brown to orange brown	
				R2	9 12 19	100	4	SP	@12': SAND (SP), medium dense, yellow brown, fine to coarse grained SAND, fine pebbly GRAVEL, poorly graded **0%GR: 97%SA: 3%FI**	SA
120	15			S2	4 7 10		4	SP-SM	@15':SAND with SILT (SP-SM), medium dense, yellow brown, fine grained, few coarse grained SAND, poorly-graded, black mineral laminations	
				R3	8 10 15	114	10	SM	@17': Silty SAND (SM), medium dense, olive brown, moist, fine grained SAND, poorly-graded	
115	20			S3	5 6 8		13	ML	@20': Silty SAND (SM), medium dense, olive brown, moist, fine grained SAND **0%GR: 60%SA: 40%FI**	SA
								CL	@21.5': CLAY (CL) laminations in shoe	
				R4	7 11 17	108	8	ML	@22': Sandy SILT (ML), hard, with charcoal flakes	
110	25			S4	3 4 6		16		@25': Sandy SILT (ML), stiff, with some fine grained SAND pods and CLAY-lined soil peds, olive brown, moist **0%GR: 41%SA: 59%FI**	SA
				R5	6 9 14	86	28		@27': Clayey SILT (ML), very stiff, olive brown, very moist, some fine grained SAND pods, oxidized, micaceous, poor blocky structure, trace gravel **1%GR: 14%SA: 85%FI**	SA
				S5	6 9 16		11	SP-SM	29': Contact, SAND with SILT (SP-SM), medium dense, fine grained SAND, poorly-graded	
105	30								Total Depth of Boring: 30 Feet No groundwater encountered during drilling. Boring converted into Percolation Test Boring upon completion of drilling and logging. 2-inch slotted 0.020-inch PVC screen installed from 10 feet to 30 feet; solid 2-inch PVC Riser pipe from 0 to 10 feet. Annulus filled with No. 3 Monterey SAND. Excess cuttings spread on site.	
100	35									
95	40									

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

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

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

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

APPENDIX B

PERCOLATION TEST DATA

Leighton

Boring Percolation Test Data Sheet

Project Number:	12882.001	**Test Hole Number:**	2020-P4
Project Name:	A-Town Parcel B	**Date Excavated:**	9/26/2020
Earth Description:	Alluvium	**Date Tested:**	10/15/2020
Liquid Description:	Tap water	**Depth of boring (ft):**	30
Tested By:	JMP	**Radius of boring, r (in):**	4
		Radius of casing (in):	1
		Length of slotted of casing (ft):	20
		Depth to Initial Water Depth (ft):	12
		Porosity of Annulus Material, *n* :	0.35
		Bentonite Plug at Bottom:	No

Field Percolation Data

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	9:11	-	-	-	0.0
2	9:14	3	12.50	210.0	36.0
3	9:17	3	12.20	213.6	72.0
4	9:21	4	12.08	215.0	120.0
5	9:31	10	11.89	217.3	240.0
6	9:41	10	11.84	217.9	360.0
7	9:51	10	11.76	218.9	480.0
8	10:01	10	11.71	219.5	600.0
9	10:11	10	11.65	220.2	720.0
10	10:21	10	11.72	219.4	840.0
11	10:31	10	11.63	220.4	960.0
12	10:41	10	11.60	220.8	1080.0
13	10:51	10	11.55	221.4	1200.0
14	11:01	10	11.53	221.6	1320.0
15	11:11	10	11.52	221.8	1440.0

High Flowrate Percolation Test Calculation

Total Volume of Water Delivered (gallons)	1440.0
Total Volume of Water Delivered (cubic inches)	332640
Average Water Height (inches)	218.4
Average Percolation Surface Area (cubic Inches)	5539.7
Duration of Test (minutes)	120
Duration of Test (hours)	2.00

Rate of Water Delivery:
5 gallons per 25 seconds

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate (inches per hour) = 30.0

Boring Percolation Test Data Sheet

Project Number:	12882.001	**Test Hole Number:**	2020-P5
Project Name:	A-Town Parcel B	**Date Excavated:**	9/26/2020
Earth Description:	Alluvium	**Date Tested:**	10/15/2020
Liquid Description:	Tap water	**Depth of boring (ft):**	30
Tested By:	JMP	**Radius of boring, r (in):**	4
		Radius of casing (in):	1
		Length of slotted of casing (ft):	20
		Depth to Initial Water Depth (ft):	16
		Porosity of Annulus Material, *n* :	0.35
		Bentonite Plug at Bottom:	No

Field Percolation Data

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	11:34	-	-	-	0.0
2	11:37	3	16.34	163.9	36.0
3	11:40	3	16.12	166.6	72.0
4	11:44	4	15.95	168.6	120.0
5	11:54	10	15.78	170.6	240.0
6	12:04	10	15.62	172.6	360.0
7	12:14	10	15.51	173.9	480.0
8	12:24	10	15.48	174.2	600.0
9	12:34	10	15.45	174.6	720.0
10	12:44	10	15.41	175.1	840.0
11	12:54	10	15.35	175.8	960.0
12	13:04	10	15.31	176.3	1080.0
13	13:14	10	15.27	176.8	1200.0
14	13:24	10	15.22	177.4	1320.0
15	13:34	10	15.20	177.6	1440.0

High Flowrate Percolation Test Calculation

Total Volume of Water Delivered (gallons)	1440.0
Total Volume of Water Delivered (cubic inches)	332640
Average Water Height (inches)	173.1
Average Percolation Surface Area (cubic Inches)	4401.6
Duration of Test (minutes)	120
Duration of Test (hours)	2.00

Rate of Water Delivery:
5 gallons per 25 seconds

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate (inches per hour) = 37.8

APPENDIX C

LABORATORY TEST RESULTS

Leighton

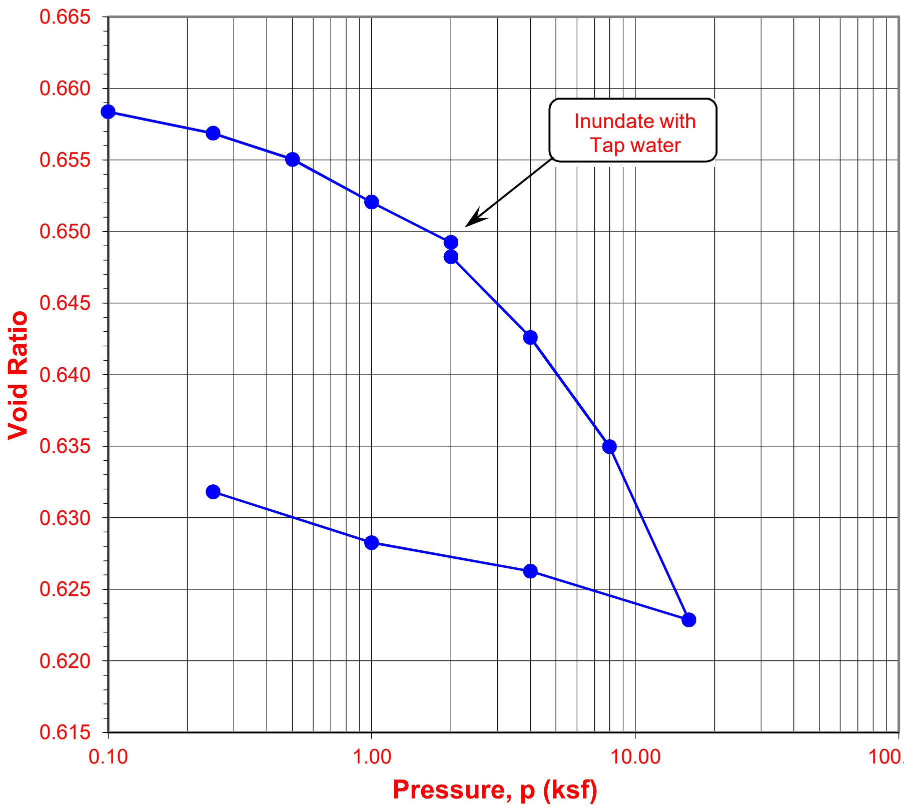
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	A-Town, Parcel B	Tested By: GB/YN	Date: 09/30/20
Project No.:	12882.001	Checked By: J. Ward	Date: 10/27/20
Boring No.:	2020 LB-3	Depth (ft.): 10.0	
Sample No.:	R4	Sample Type: Ring	
Soil Identification:	Olive gray silty sand (SM)		

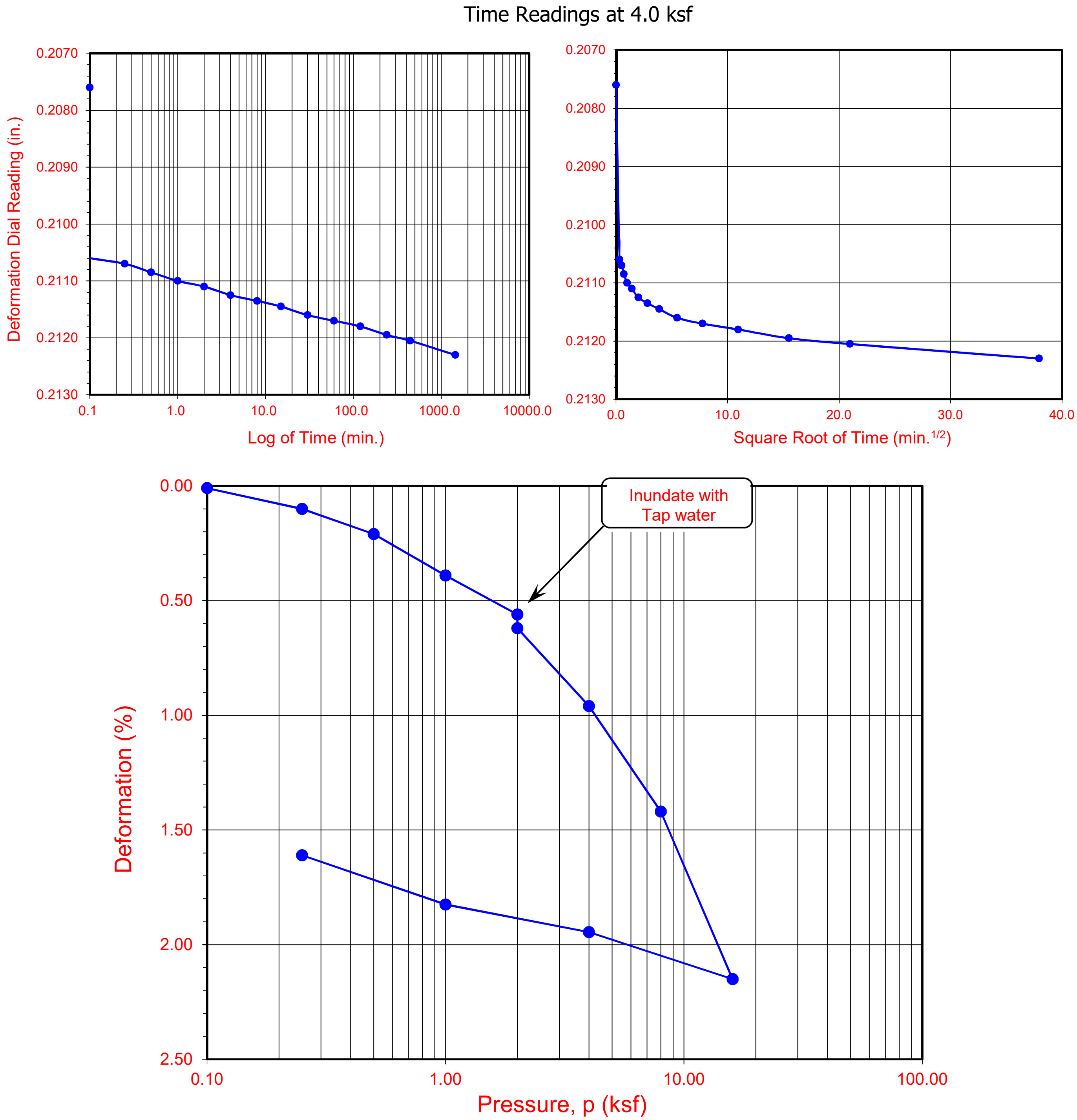
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	170.06
Weight of Ring (g):	41.34
Height after consol. (in.):	0.9839
Before Test	
Wt. of Wet Sample+Cont. (g):	105.08
Wt. of Dry Sample+Cont. (g):	101.66
Weight of Container (g):	37.51
Initial Moisture Content (%)	5.3
Initial Dry Density (pcf)	101.6
Initial Saturation (%):	22
Initial Vertical Reading (in.)	0.1979
After Test	
Wt. of Wet Sample+Cont. (g):	240.76
Wt. of Dry Sample+Cont. (g):	218.39
Weight of Container (g):	59.82
Final Moisture Content (%)	19.08
Final Dry Density (pcf):	99.1
Final Saturation (%):	73
Final Vertical Reading (in.)	0.2173
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43



Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.1980	0.9999	0.00	0.01	0.658	0.01
0.25	0.1995	0.9984	0.06	0.16	0.657	0.10
0.50	0.2013	0.9966	0.13	0.34	0.655	0.21
1.00	0.2041	0.9938	0.23	0.62	0.652	0.39
2.00	0.2070	0.9909	0.35	0.91	0.649	0.56
2.00	0.2076	0.9903	0.35	0.97	0.648	0.62
4.00	0.2123	0.9856	0.48	1.44	0.643	0.96
8.00	0.2183	0.9796	0.62	2.04	0.635	1.42
16.00	0.2270	0.9709	0.76	2.91	0.623	2.15
4.00	0.2235	0.9745	0.61	2.56	0.626	1.95
1.00	0.2207	0.9773	0.45	2.28	0.628	1.83
0.25	0.2173	0.9806	0.33	1.94	0.632	1.61

Time Readings at 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/3/20	7:15:00	0.0	0.0	0.2076
10/3/20	7:15:06	0.1	0.3	0.2106
10/3/20	7:15:15	0.2	0.5	0.2107
10/3/20	7:15:30	0.5	0.7	0.2109
10/3/20	7:16:00	1.0	1.0	0.2110
10/3/20	7:17:00	2.0	1.4	0.2111
10/3/20	7:19:00	4.0	2.0	0.2113
10/3/20	7:23:00	8.0	2.8	0.2114
10/3/20	7:30:00	15.0	3.9	0.2115
10/3/20	7:45:00	30.0	5.5	0.2116
10/3/20	8:15:00	60.0	7.7	0.2117
10/3/20	9:15:00	120.0	11.0	0.2118
10/3/20	11:15:00	240.0	15.5	0.2120
10/3/20	14:35:00	440.0	21.0	0.2121
10/4/20	7:15:00	1440.0	37.9	0.2123



Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
2020 LB-3	**R4**	**10**	**5.3**	**19.1**	**101.6**	**99.1**	**0.659**	**0.632**	**22**	**73**

Soil Identification: Olive gray silty sand (SM)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 12882.001

A-Town, Parcel B

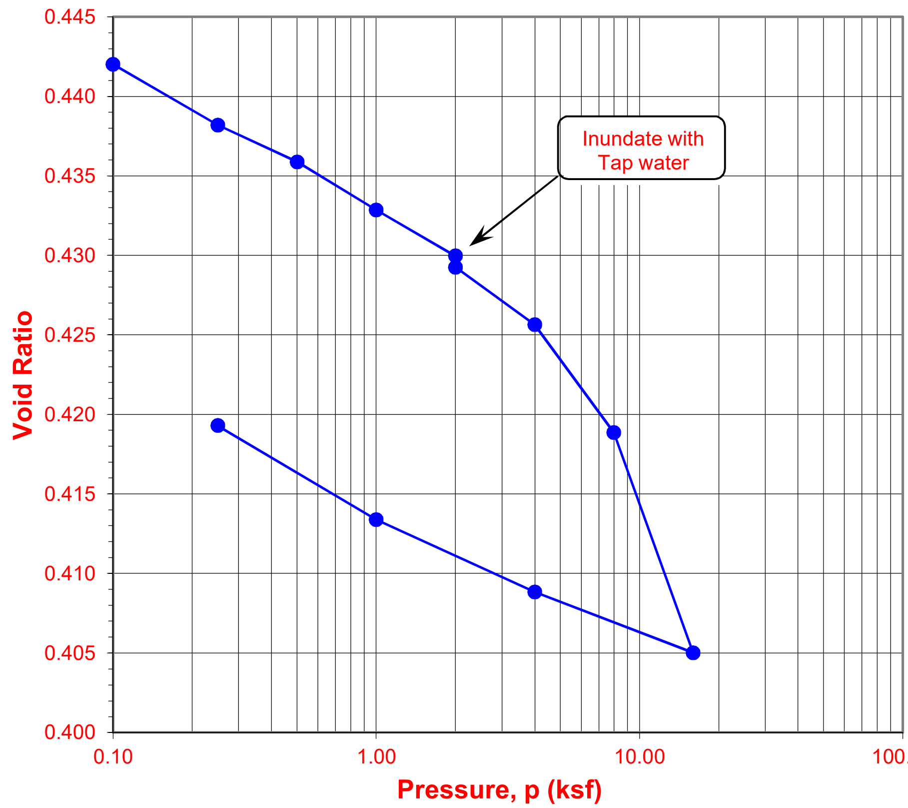
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	A-Town, Parcel B	Tested By: GB/YN	Date: 10/01/20
Project No.:	12882.001	Checked By: J. Ward	Date: 10/27/20
Boring No.:	2020 LB-4	Depth (ft.): 0-5	
Sample No.:	BB1	Sample Type:	90% Remold
Soil Identification:	Olive brown silty sand (SM)		

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	191.31
Weight of Ring (g):	40.69
Height after consol. (in.):	0.9841
Before Test	
Wt. of Wet Sample+Cont. (g):	169.34
Wt. of Dry Sample+Cont. (g):	162.14
Weight of Container (g):	61.83
Initial Moisture Content (%)	7.2
Initial Dry Density (pcf)	116.9
Initial Saturation (%):	44
Initial Vertical Reading (in.)	0.1287
After Test	
Wt. of Wet Sample+Cont. (g):	238.02
Wt. of Dry Sample+Cont. (g):	220.34
Weight of Container (g):	39.16
Final Moisture Content (%)	12.58
Final Dry Density (pcf):	118.7
Final Saturation (%):	81
Final Vertical Reading (in.)	0.1464
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

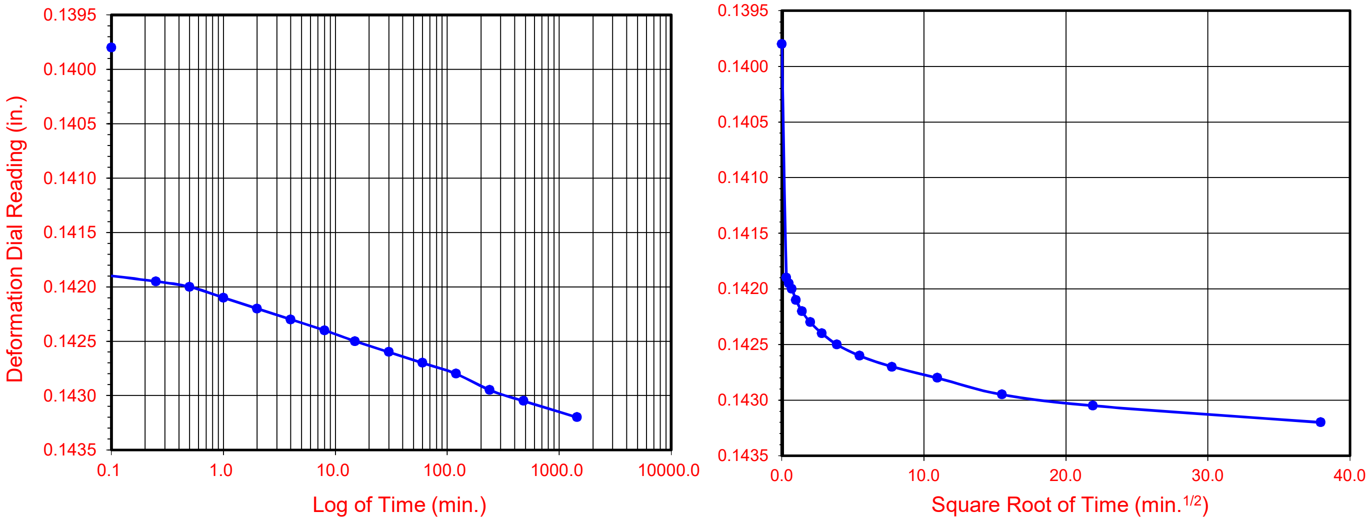


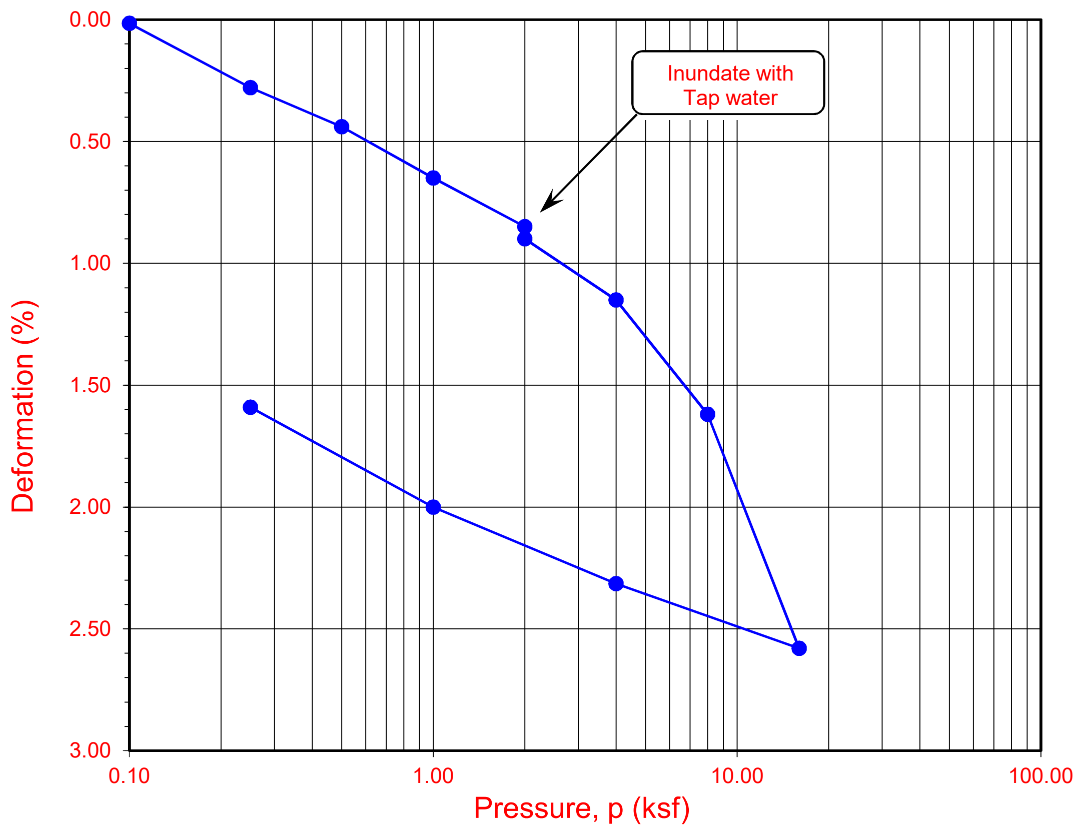
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.1289	0.9999	0.00	0.01	0.442	0.01
0.25	0.1318	0.9969	0.03	0.31	0.438	0.28
0.50	0.1339	0.9948	0.08	0.52	0.436	0.44
1.00	0.1367	0.9920	0.15	0.80	0.433	0.65
2.00	0.1393	0.9894	0.21	1.06	0.430	0.85
2.00	0.1398	0.9889	0.21	1.11	0.429	0.90
4.00	0.1432	0.9855	0.30	1.45	0.426	1.15
8.00	0.1489	0.9798	0.40	2.02	0.419	1.62
16.00	0.1598	0.9689	0.53	3.11	0.405	2.58
4.00	0.1558	0.9730	0.39	2.71	0.409	2.32
1.00	0.1515	0.9772	0.28	2.28	0.413	2.00
0.25	0.1464	0.9823	0.18	1.77	0.419	1.59

Time Readings at 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/5/20	9:00:00	0.0	0.0	0.1398
10/5/20	9:00:06	0.1	0.3	0.1419
10/5/20	9:00:15	0.2	0.5	0.1420
10/5/20	9:00:30	0.5	0.7	0.1420
10/5/20	9:01:00	1.0	1.0	0.1421
10/5/20	9:02:00	2.0	1.4	0.1422
10/5/20	9:04:00	4.0	2.0	0.1423
10/5/20	9:08:00	8.0	2.8	0.1424
10/5/20	9:15:00	15.0	3.9	0.1425
10/5/20	9:30:00	30.0	5.5	0.1426
10/5/20	10:00:00	60.0	7.7	0.1427
10/5/20	11:00:00	120.0	11.0	0.1428
10/5/20	13:00:00	240.0	15.5	0.1430
10/5/20	17:00:00	480.0	21.9	0.1431
10/6/20	9:00:00	1440.0	37.9	0.1432

Time Readings at 4.0 ksf





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
2020 LB-4	**BB1**	**0-5**	**7.2**	**12.6**	**116.9**	**118.7**	**0.442**	**0.419**	**44**	**81**

Soil Identification: Olive brown silty sand (SM)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 12882.001

A-Town, Parcel B

10-20

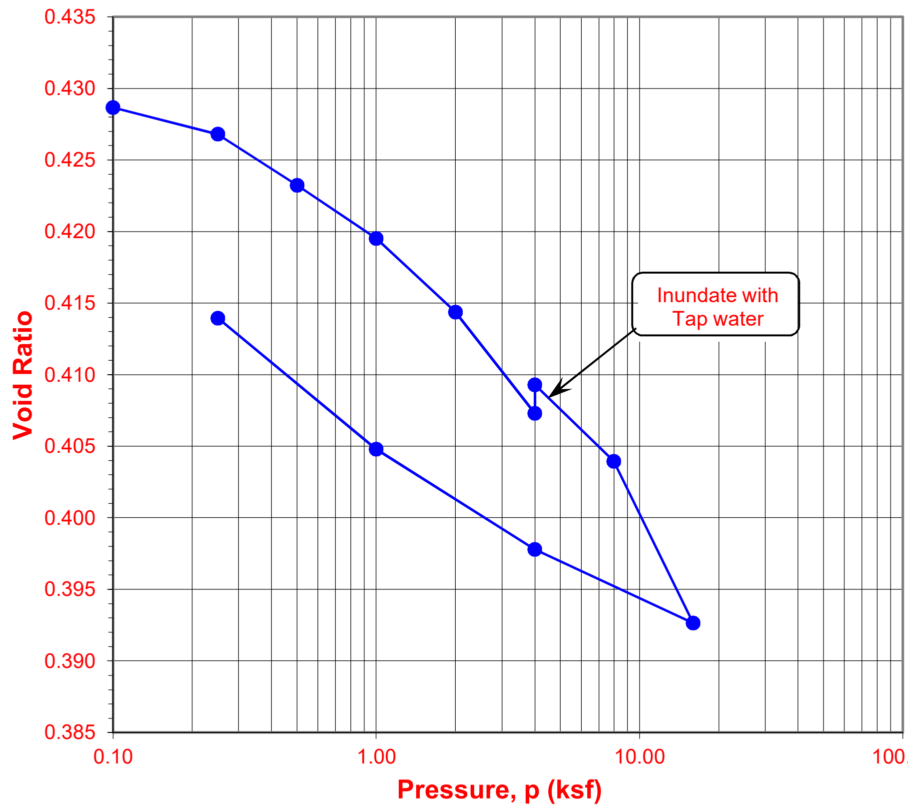
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	A-Town, Parcel B	Tested By: GB/YN	Date: 09/30/20
Project No.:	12882.001	Checked By: J. Ward	Date: 10/27/20
Boring No.:	2020 LB-4	Depth (ft.): 7.0	
Sample No.:	R3	Sample Type:	Ring
Soil Identification:	Dark olive brown silty clay (CL-ML)		

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	203.51
Weight of Ring (g):	45.05
Height after consol. (in.):	0.9895
Before Test	
Wt. of Wet Sample+Cont. (g):	161.71
Wt. of Dry Sample+Cont. (g):	148.69
Weight of Container (g):	37.58
Initial Moisture Content (%)	11.7
Initial Dry Density (pcf)	118.0
Initial Saturation (%):	74
Initial Vertical Reading (in.)	0.2031
After Test	
Wt. of Wet Sample+Cont. (g):	267.29
Wt. of Dry Sample+Cont. (g):	247.76
Weight of Container (g):	62.10
Final Moisture Content (%)	13.89
Final Dry Density (pcf):	118.2
Final Saturation (%):	88
Final Vertical Reading (in.)	0.2169
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

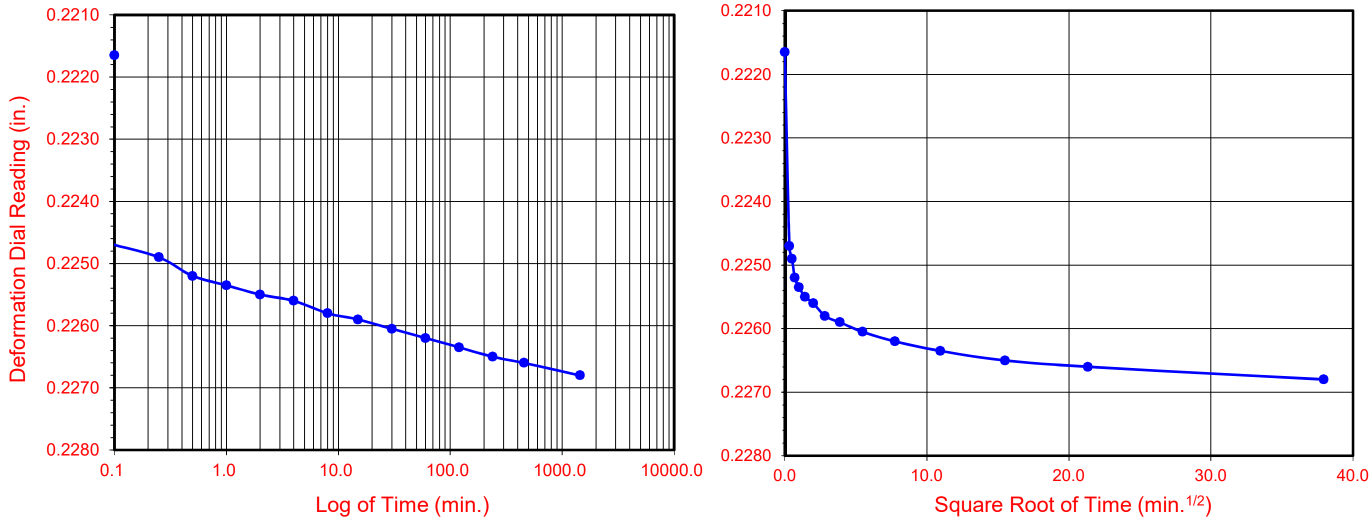


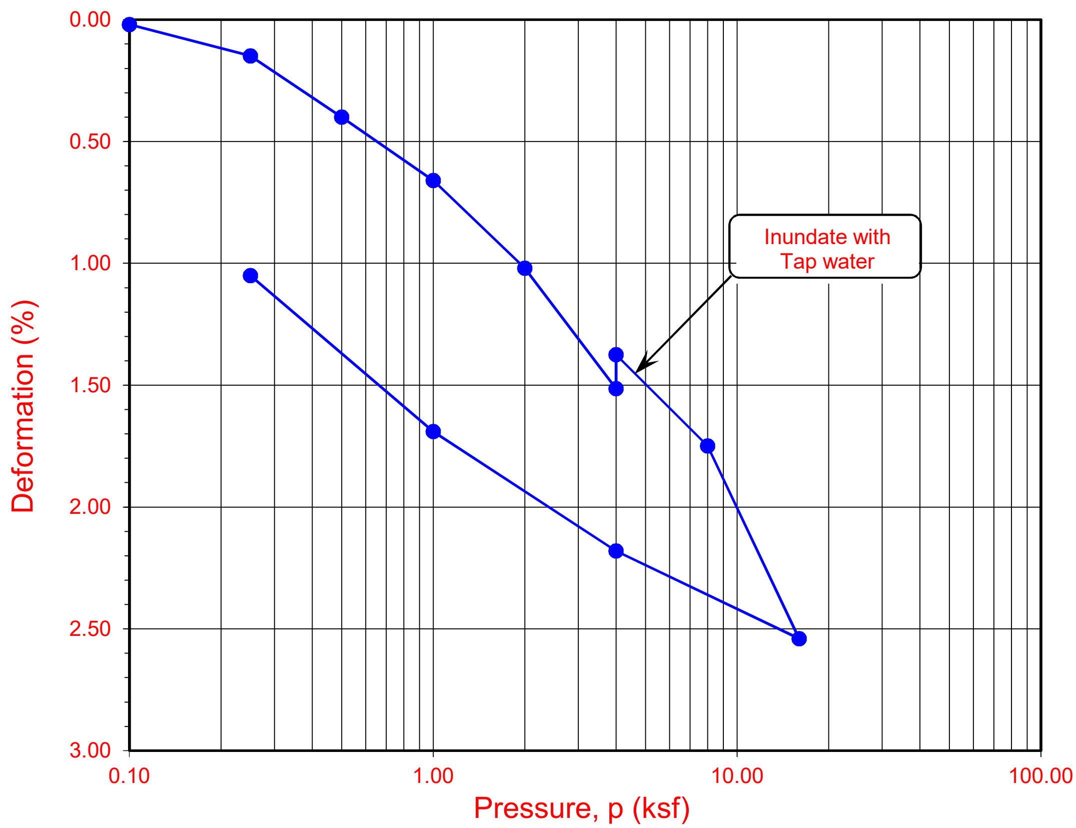
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.2033	0.9998	0.00	0.02	0.429	0.02
0.25	0.2052	0.9979	0.06	0.21	0.427	0.15
0.50	0.2084	0.9947	0.13	0.53	0.423	0.40
1.00	0.2120	0.9911	0.23	0.89	0.420	0.66
2.00	0.2168	0.9863	0.35	1.37	0.414	1.02
4.00	0.2218	0.9814	0.35	1.87	0.407	1.52
4.00	0.2217	0.9815	0.48	1.86	0.409	1.38
8.00	0.2268	0.9763	0.62	2.37	0.404	1.75
16.00	0.2361	0.9670	0.76	3.30	0.393	2.54
4.00	0.2310	0.9721	0.61	2.79	0.398	2.18
1.00	0.2245	0.9786	0.45	2.14	0.405	1.69
0.25	0.2169	0.9862	0.33	1.38	0.414	1.05

Time Readings at 8.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/3/20	7:00:00	0.0	0.0	0.2217
10/3/20	7:00:06	0.1	0.3	0.2247
10/3/20	7:00:15	0.2	0.5	0.2249
10/3/20	7:00:30	0.5	0.7	0.2252
10/3/20	7:01:00	1.0	1.0	0.2254
10/3/20	7:02:00	2.0	1.4	0.2255
10/3/20	7:04:00	4.0	2.0	0.2256
10/3/20	7:08:00	8.0	2.8	0.2258
10/3/20	7:15:00	15.0	3.9	0.2259
10/3/20	7:30:00	30.0	5.5	0.2261
10/3/20	8:00:00	60.0	7.7	0.2262
10/3/20	9:00:00	120.0	11.0	0.2264
10/3/20	11:00:00	240.0	15.5	0.2265
10/3/20	14:35:00	455.0	21.3	0.2266
10/4/20	7:00:00	1440.0	37.9	0.2268

Time Readings at 8.0 ksf





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
2020 LB-4	**R3**	**7**	**11.7**	**13.9**	**118.0**	**118.2**	**0.429**	**0.414**	**74**	**88**

Soil Identification: Dark olive brown silty clay (CL-ML)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 12882.001

A-Town, Parcel B

10-20

Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: A-Town, Parcel B   Tested By : G. Berdy   Date: 09/29/20

Project No. : 12882.001   Checked By: J. Ward   Date: 10/26/20

Boring No.	2020 LB-4			
Sample No.	BB1			
Sample Depth (ft)	0-5			
Soil Identification:	Olive brown SM			
Wet Weight of Soil + Container (g)	180.32			
Dry Weight of Soil + Container (g)	175.15			
Weight of Container (g)	69.47			
Moisture Content (%)	4.89			
Weight of Soaked Soil (g)	100.47			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	309			
Crucible No.	9			
Furnace Temperature (°C)	860			
Time In / Time Out	9:00/9:45			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	21.2087			
Wt. of Crucible (g)	21.2049			
Wt. of Residue (g) (A)	0.0038			
PPM of Sulfate (A) x 41150	156.37			
PPM of Sulfate, Dry Weight Basis	**164**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.6			
PPM of Chloride (C -0.2) * 100 * 30 / B	40			
PPM of Chloride, Dry Wt. Basis	**42**			

pH TEST, DOT California Test 643

pH Value	**8.10**			
Temperature °C	20.5			

SOIL RESISTIVITY TEST

DOT CA TEST 643

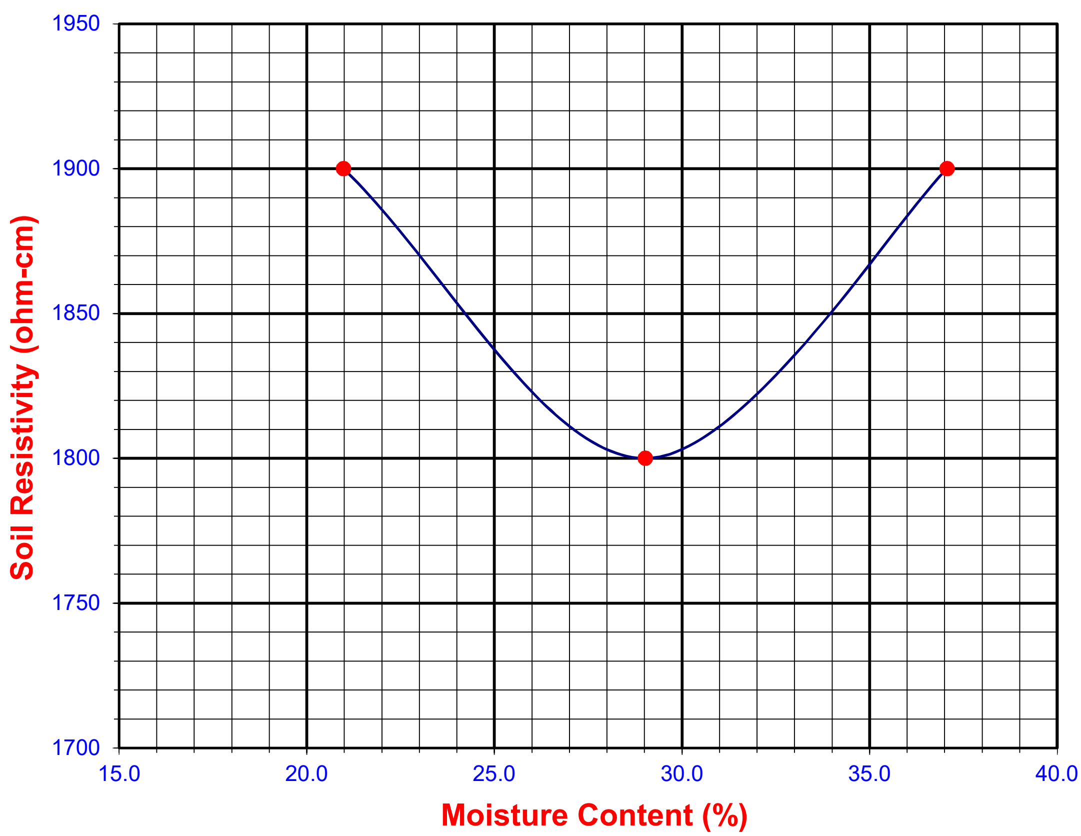
Project Name:	A-Town, Parcel B	Tested By :	J. Gonzalez Date: 10/05/20
Project No. :	12882.001	Checked By:	J. Ward Date: 10/26/20
Boring No.:	2020 LB-4	Depth (ft.) :	0-5
Sample No. :	BB1		
Soil Identification:*	Olive brown SM		

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

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	20.98	1900	1900
2	30	29.02	1800	1800
3	40	37.07	1900	1900
4				
5				

Moisture Content (%) (MCi)	4.89
Wet Wt. of Soil + Cont. (g)	180.32
Dry Wt. of Soil + Cont. (g)	175.15
Wt. of Container (g)	69.47
Container No.	
Initial Soil Wt. (g) (Wt)	130.40
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
1800	**29.0**	**164**	**42**	**8.10**	**20.5**



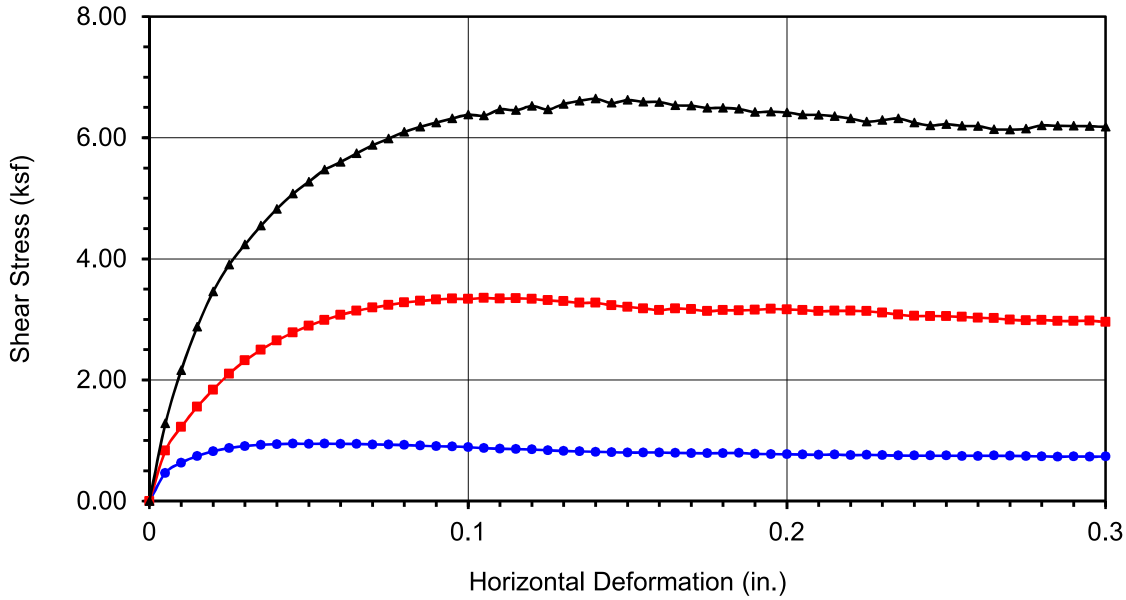
DIRECT SHEAR TEST

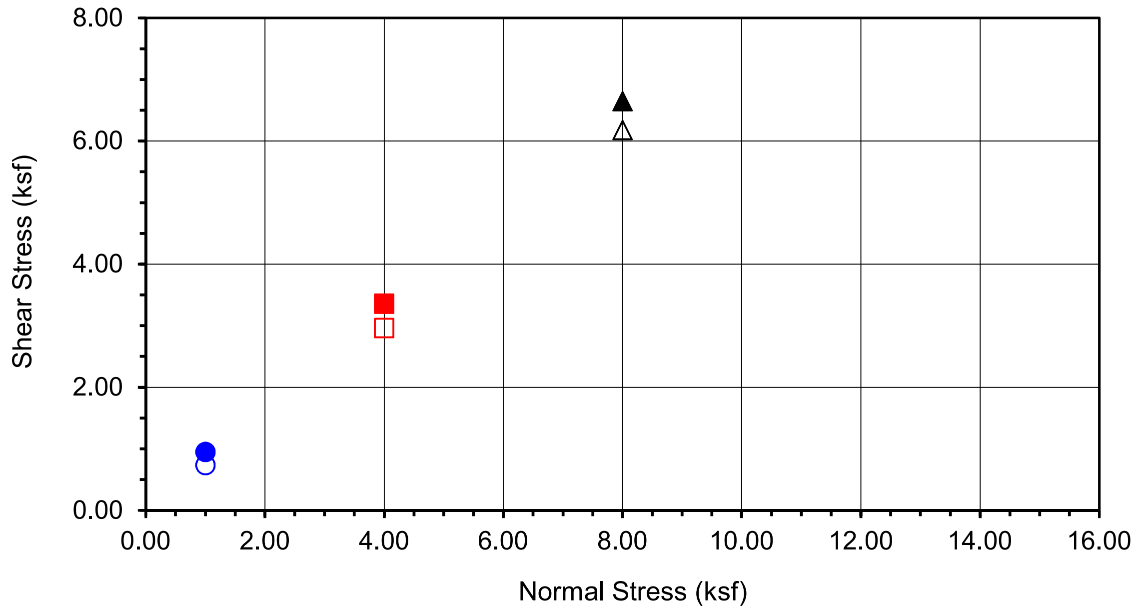
Consolidated Drained - ASTM D 3080

Leighton

Project Name:	A-Town, Parcel B	Tested By:	G. Bathala	Date:	09/30/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/26/20
Boring No.:	LB-3	Sample Type:	Ring		
Sample No.:	R4	Depth (ft.):	10.0		
Soil Identification:	Olive gray silty sand (SM)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	177.04	178.51	189.63
Weight of Ring(gm):	44.69	45.27	43.36
Before Shearing			
Weight of Wet Sample+Cont.(gm):	105.08	105.08	105.08
Weight of Dry Sample+Cont.(gm):	101.66	101.66	101.66
Weight of Container(gm):	37.51	37.51	37.51
Vertical Rdg.(in): Initial	0.2514	0.2714	0.0000
Vertical Rdg.(in): Final	0.2585	0.2938	-0.0312
After Shearing			
Weight of Wet Sample+Cont.(gm):	195.57	197.61	198.06
Weight of Dry Sample+Cont.(gm):	173.42	176.81	179.20
Weight of Container(gm):	57.96	59.57	52.66
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-3**
Sample No.	**R4**
Depth (ft)	**10**
Sample Type: Ring	
Soil Identification: Olive gray silty sand (SM)	

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.949	■ 3.354	▲ 6.643
Shear Stress @ End of Test (ksf)	○ 0.736	□ 2.958	△ 6.178
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	5.33	5.33	5.33
Dry Density (pcf)	104.5	105.2	115.5
Saturation (%)	23.5	23.9	31.3
Soil Height Before Shearing (in.)	0.9929	0.9776	0.9688
Final Moisture Content (%)	19.2	17.7	14.9

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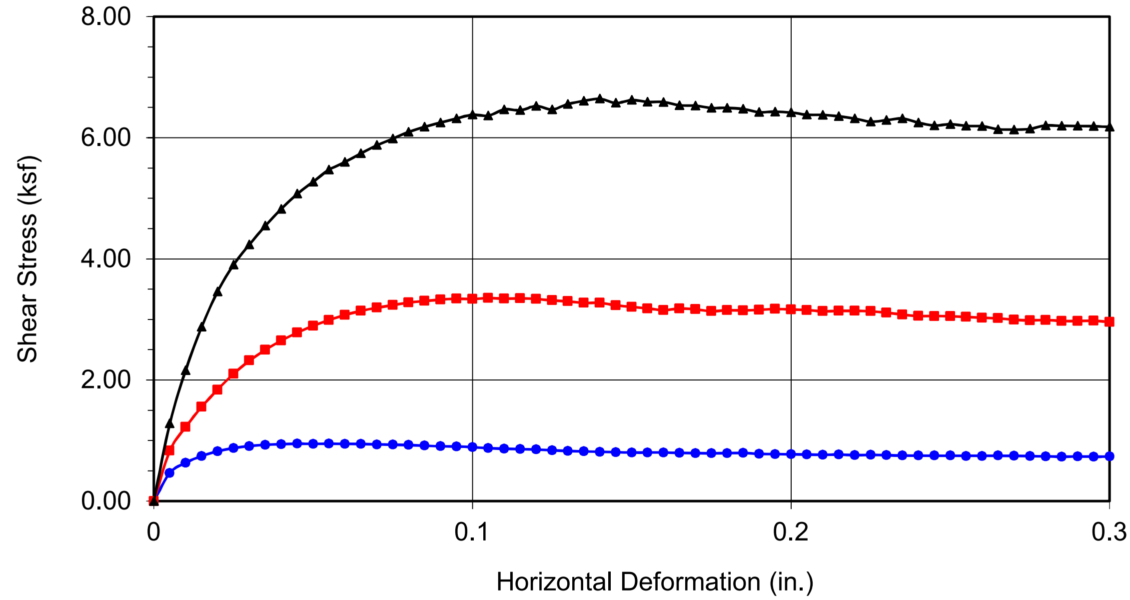
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

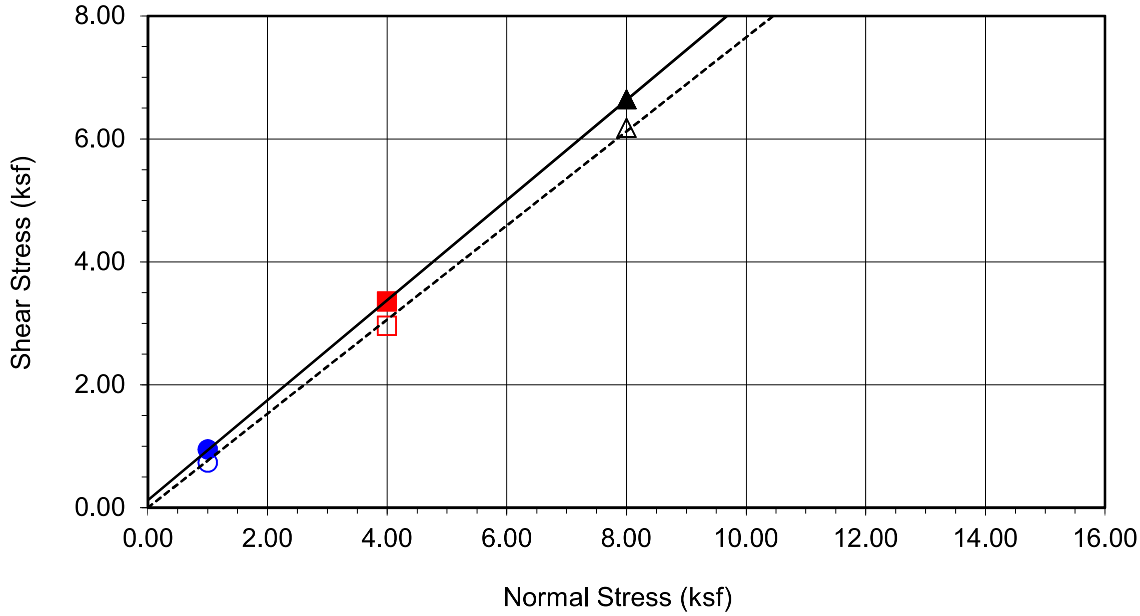
Project No.: 12882.001

A-Town, Parcel B

09-20

DS 2020 LB-3, R4 @ 10





Boring No.	**LB-3**
Sample No.	**R4**
Depth (ft)	**10**
Sample Type:	Ring

Soil Identification:
Olive gray silty sand (SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	122	39
Ultimate	0	37

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.949	■ 3.354	▲ 6.643
Shear Stress @ End of Test (ksf)	○ 0.736	□ 2.958	△ 6.178
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	5.33	5.33	5.33
Dry Density (pcf)	104.5	105.2	115.5
Saturation (%)	23.5	23.9	31.3
Soil Height Before Shearing (in.)	0.9929	0.9776	0.9688
Final Moisture Content (%)	19.2	17.7	14.9

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DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 12882.001

A-Town, Parcel B

09-20

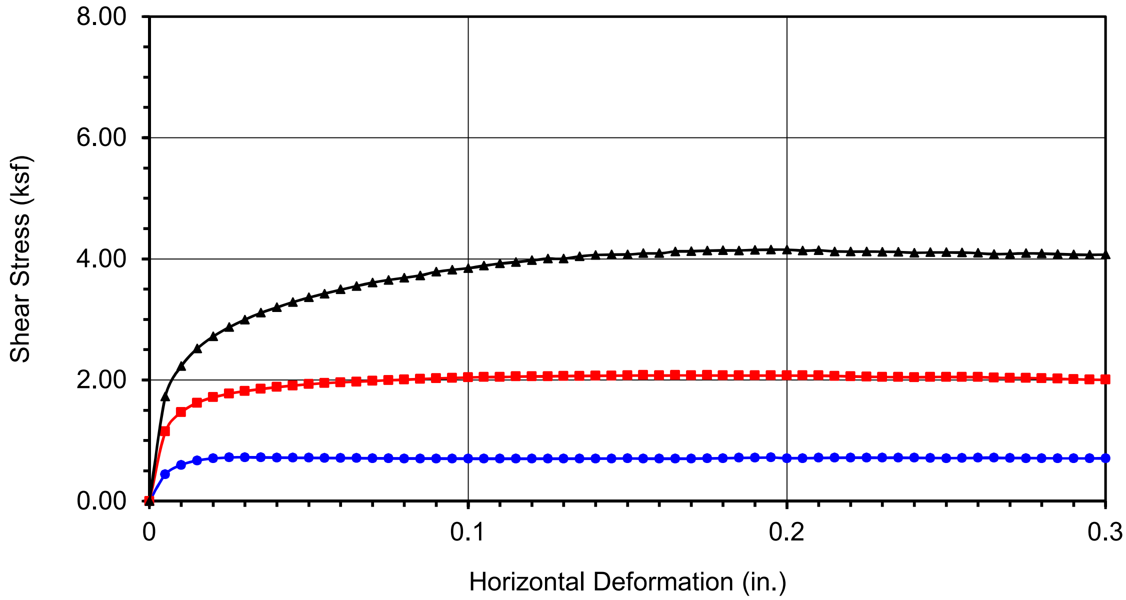
DIRECT SHEAR TEST

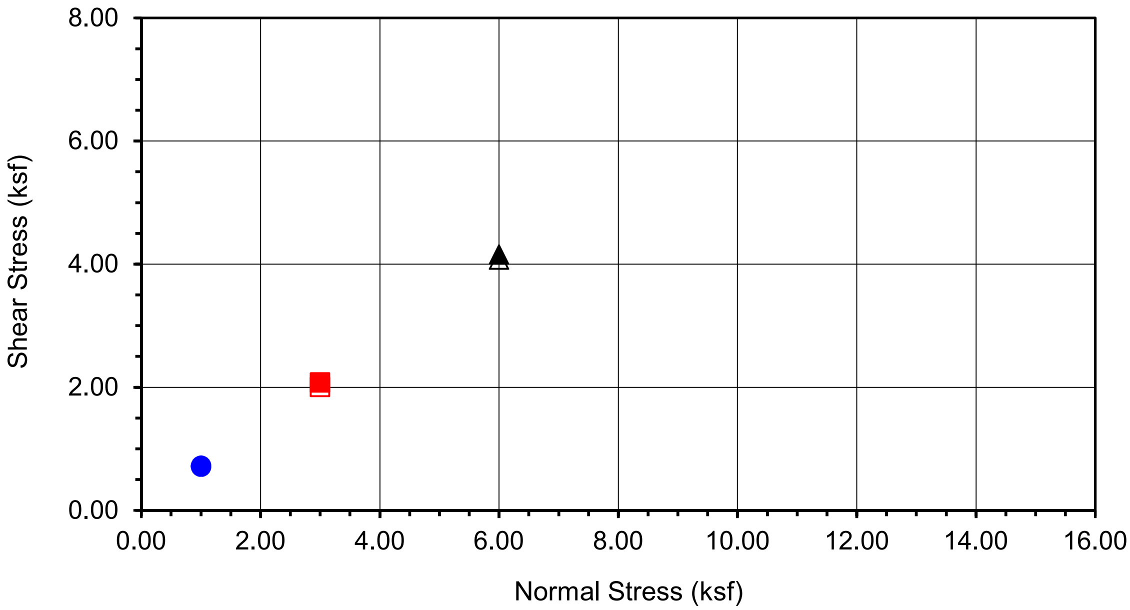
Consolidated Drained - ASTM D 3080

Leighton

Project Name:	A-Town, Parcel B	Tested By:	G. Bathala	Date:	10/02/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/26/20
Boring No.:	LB-4	Sample Type:	90% Remold		
Sample No.:	BB1	Depth (ft.):	0-5		
Soil Identification:	Olive brown silty sand (SM)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.01	196.35	197.27
Weight of Ring(gm):	45.83	45.72	45.78
Before Shearing			
Weight of Wet Sample+Cont.(gm):	172.00	172.00	172.00
Weight of Dry Sample+Cont.(gm):	164.83	164.83	164.83
Weight of Container(gm):	64.77	64.77	64.77
Vertical Rdg.(in): Initial	0.0000	0.2555	0.0000
Vertical Rdg.(in): Final	-0.0076	0.2699	-0.0205
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.06	214.57	223.25
Weight of Dry Sample+Cont.(gm):	177.95	196.66	206.11
Weight of Container(gm):	39.56	57.26	66.08
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-4**
Sample No.	**BB1**
Depth (ft)	**0-5**

Sample Type:

90% Remold

Soil Identification:
Olive brown silty sand (SM)

Normal Stress (kip/ft²)	1.000	3.000	6.000
Peak Shear Stress (kip/ft²)	● 0.723	■ 2.078	▲ 4.153
Shear Stress @ End of Test (ksf)	○ 0.707	□ 2.003	△ 4.071
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.17	7.17	7.17
Dry Density (pcf)	116.5	116.9	117.6
Saturation (%)	43.4	43.8	44.6
Soil Height Before Shearing (in.)	0.9924	0.9856	0.9795
Final Moisture Content (%)	13.8	12.8	12.2

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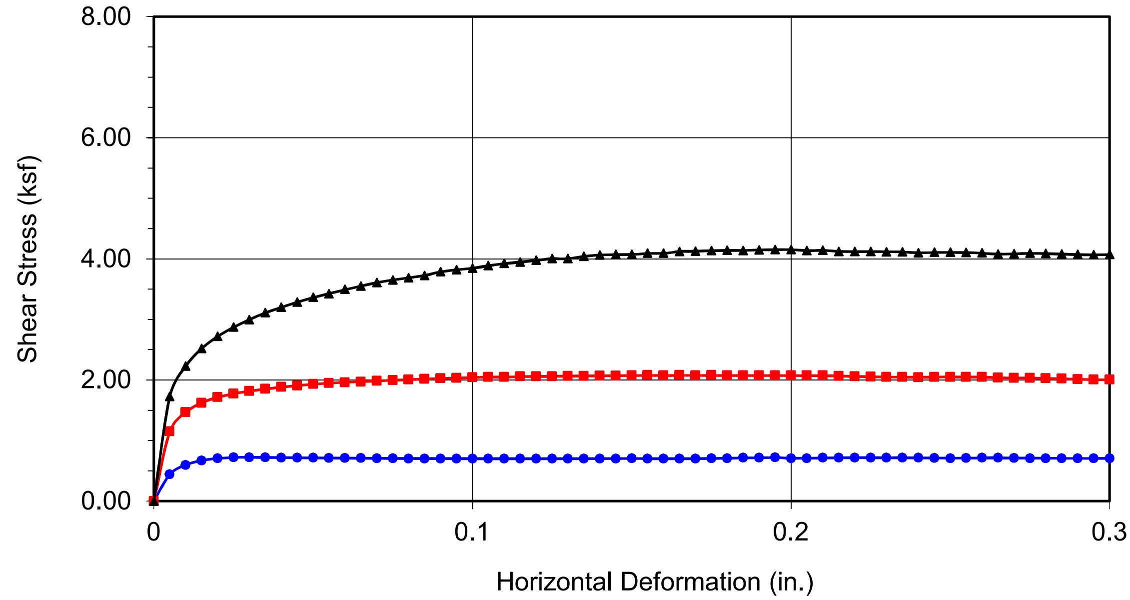
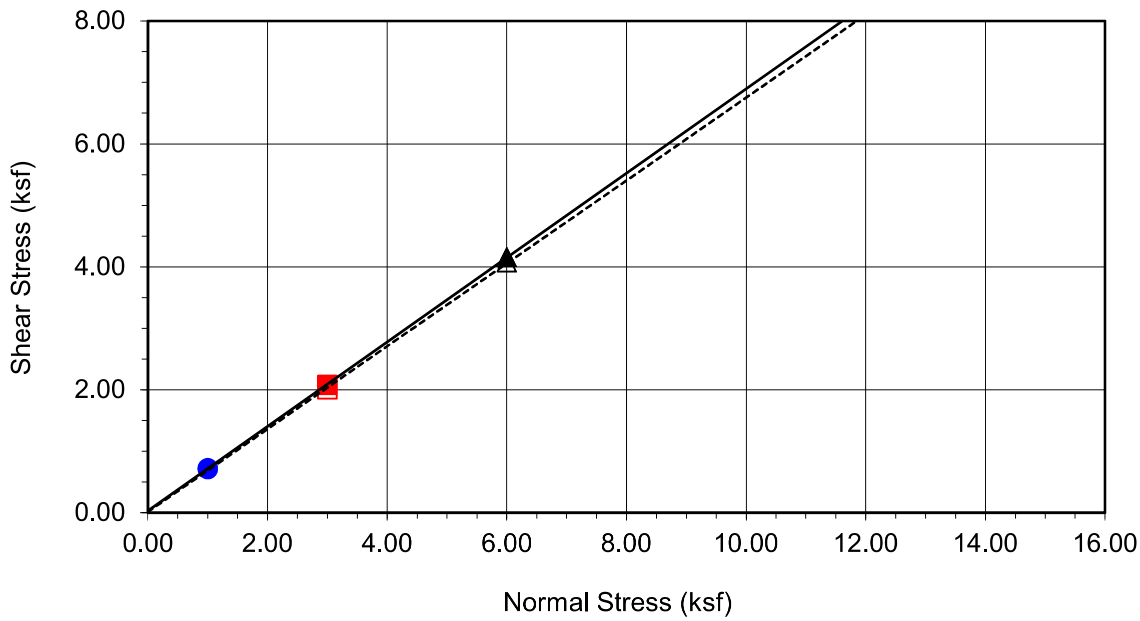
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 12882.001

A-Town, Parcel B

10-20





Boring No.	**LB-4**
Sample No.	**BB1**
Depth (ft)	**0-5**
Sample Type:	90% Remold

Soil Identification:
Olive brown silty sand (SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	30	34
Ultimate	13	34

Normal Stress (kip/ft²)	1.000	3.000	6.000
Peak Shear Stress (kip/ft²)	● 0.723	■ 2.078	▲ 4.153
Shear Stress @ End of Test (ksf)	○ 0.707	□ 2.003	△ 4.071
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.17	7.17	7.17
Dry Density (pcf)	116.5	116.9	117.6
Saturation (%)	43.4	43.8	44.6
Soil Height Before Shearing (in.)	0.9924	0.9856	0.9795
Final Moisture Content (%)	13.8	12.8	12.2

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 12882.001

A-Town, Parcel B

10-20

DS 2020 LB-4, BB1 @ 0-5

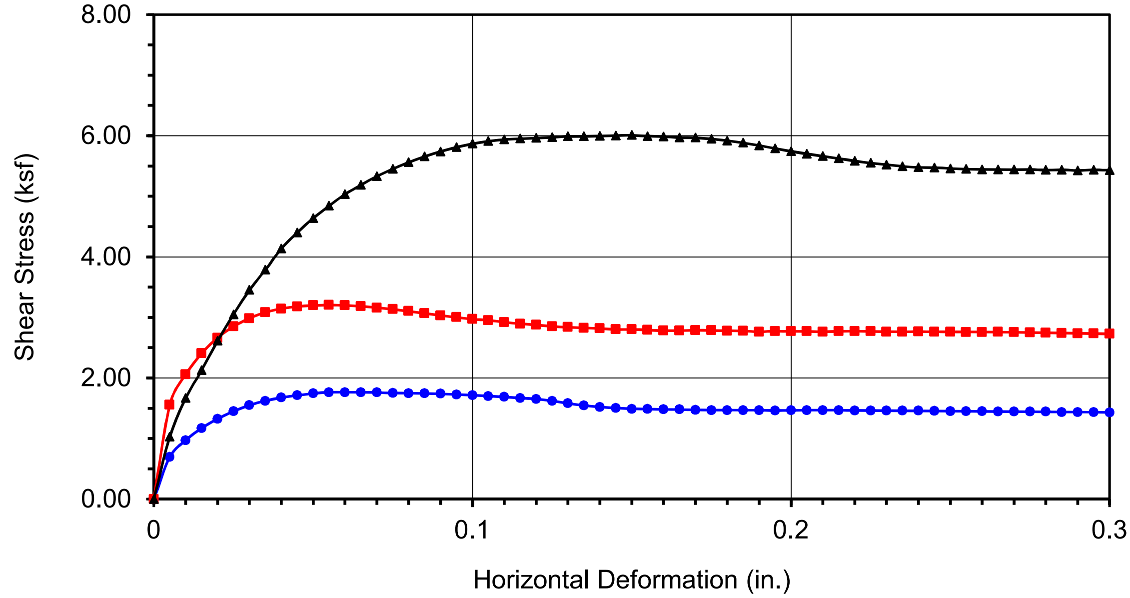
DIRECT SHEAR TEST

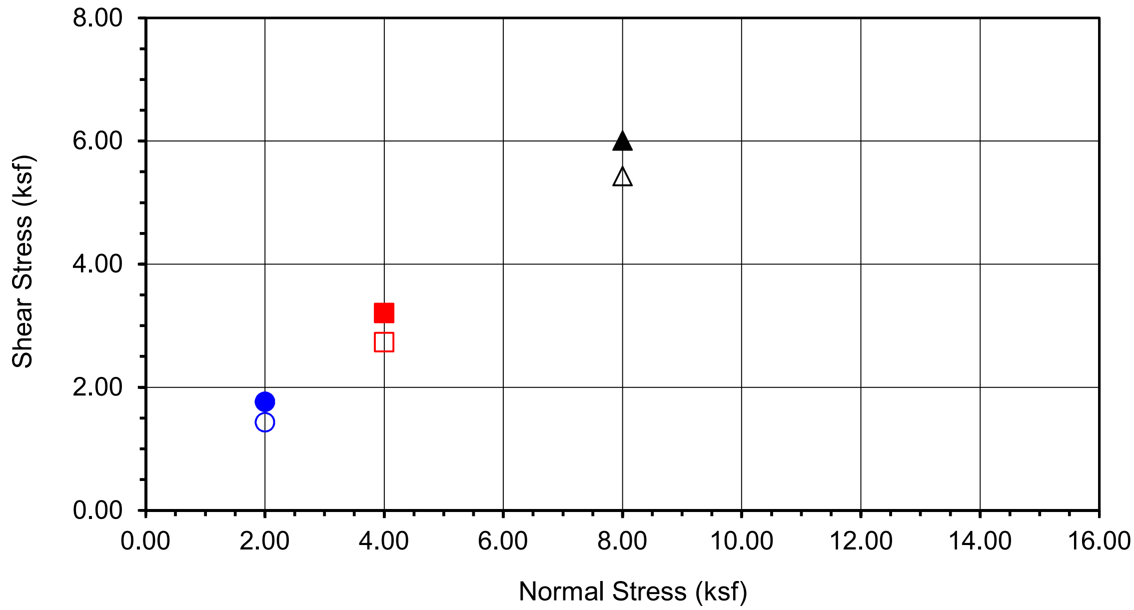
Consolidated Drained - ASTM D 3080

Leighton

Project Name:	A-Town, Parcel B	Tested By:	G. Bathala	Date:	10/01/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/26/20
Boring No.:	LB-4	Sample Type:	Ring		
Sample No.:	R3	Depth (ft.):	7.0		
Soil Identification:	Dark olive brown silty clay (CL-ML)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	203.24	203.81	207.29
Weight of Ring(gm):	44.81	42.41	45.53
Before Shearing			
Weight of Wet Sample+Cont.(gm):	161.71	161.71	161.71
Weight of Dry Sample+Cont.(gm):	148.69	148.69	148.69
Weight of Container(gm):	37.58	37.58	37.58
Vertical Rdg.(in): Initial	0.0000	0.2676	0.0000
Vertical Rdg.(in): Final	-0.0105	0.2858	-0.0278
After Shearing			
Weight of Wet Sample+Cont.(gm):	220.61	223.90	228.63
Weight of Dry Sample+Cont.(gm):	199.45	203.48	209.46
Weight of Container(gm):	59.83	61.04	66.78
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-4**
Sample No.	**R3**
Depth (ft)	**7**

Sample Type:

Ring

Soil Identification:
Dark olive brown silty clay (CL-ML)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.764	■ 3.204	▲ 6.008
Shear Stress @ End of Test (ksf)	○ 1.430	□ 2.729	△ 5.429
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.72	11.72	11.72
Dry Density (pcf)	117.9	120.2	120.4
Saturation (%)	73.7	78.5	79.1
Soil Height Before Shearing (in.)	0.9895	0.9818	0.9722
Final Moisture Content (%)	15.2	14.3	13.4

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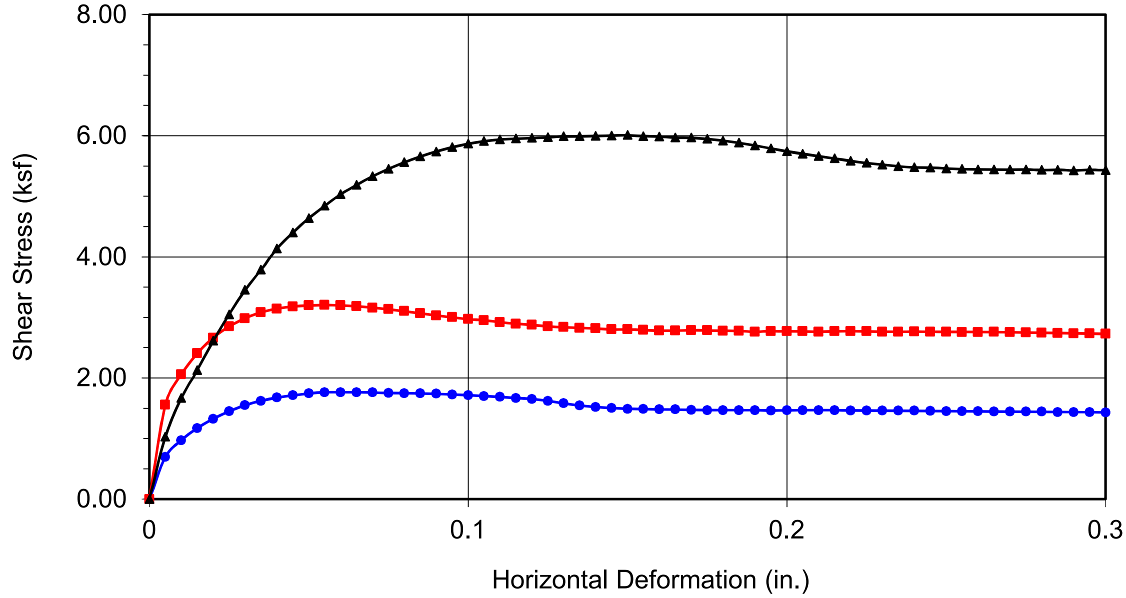
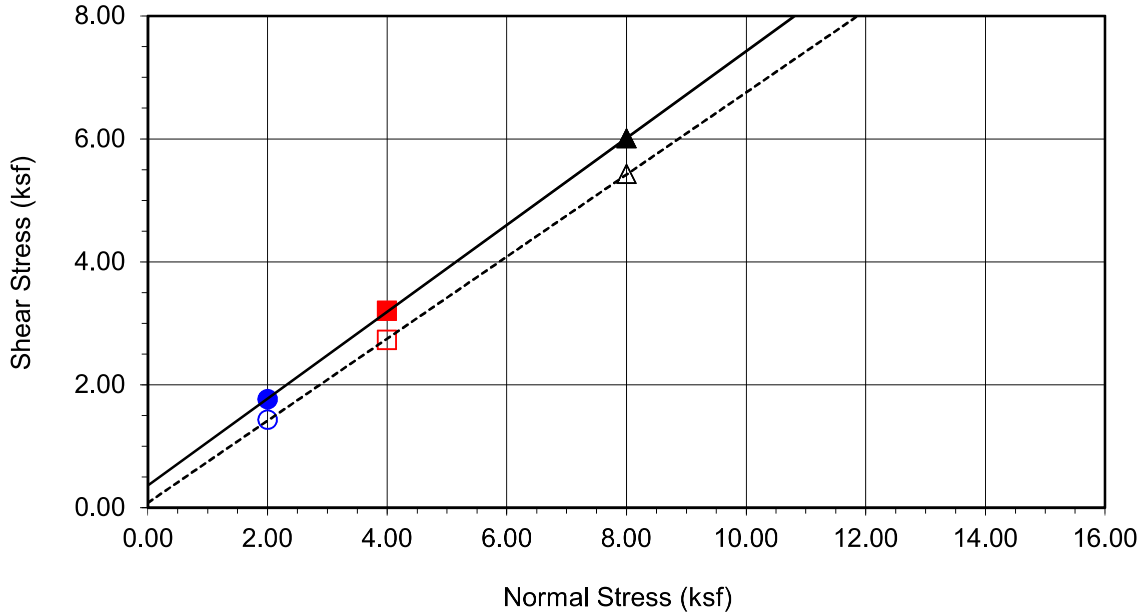
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 12882.001

A-Town, Parcel B

10-20





Boring No.	**LB-4**
Sample No.	**R3**
Depth (ft)	**7**
Sample Type:	Ring

Soil Identification:
Dark olive brown silty clay (CL-ML)

Strength Parameters

	C (psf)	ϕ (°)
Peak	362	35
Ultimate	80	34

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.764	■ 3.204	▲ 6.008
Shear Stress @ End of Test (ksf)	○ 1.430	□ 2.729	△ 5.429
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.72	11.72	11.72
Dry Density (pcf)	117.9	120.2	120.4
Saturation (%)	73.7	78.5	79.1
Soil Height Before Shearing (in.)	0.9895	0.9818	0.9722
Final Moisture Content (%)	15.2	14.3	13.4

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 12882.001

A-Town, Parcel B

10-20

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	A-Town, Parcel B	Tested By:	S. Felter	Date:	10/06/20
Project No.:	12882.001	Checked By:	A. Santos	Date:	10/26/20
Boring No.:	2020 LB-4	Depth (ft.):	0-5		
Sample No.:	BB1				
Soil Identification:	Olive brown silty sand (SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0030
Wt. Comp. Soil + Mold	(g)	616.30	441.80
Wt. of Mold	(g)	190.00	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	850.00	631.80
Dry Wt. of Soil + Cont.	(g)	789.20	585.82
Wt. of Container	(g)	0.00	190.00
Moisture Content	(%)	7.70	11.62
Wet Density	(pcf)	128.6	132.9
Dry Density	(pcf)	119.4	119.0
Void Ratio		0.412	0.416
Total Porosity		0.292	0.294
Pore Volume	(cc)	60.4	61.0
Degree of Saturation (%) [S_{meas}]		**50.5**	75.4

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

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
10/06/20	8:17	1.0	0	0.6160
10/06/20	8:27	1.0	10	0.6155
Add Distilled Water to the Specimen				
10/06/20	10:48	1.0	141	0.6185
10/07/20	6:50	1.0	1343	0.6190
10/07/20	7:50	1.0	1403	0.6190

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**3**

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	A-Town, Parcel B	Tested By:	J. Gonzalez	Date:	09/30/20
Project No.:	12882.001	Checked By:	A. Santos	Date:	10/01/20
Boring No.:	2020 LB-4	Depth (ft.):	0-5		
Sample No.:	BB1				
Soil Identification:	Olive brown silty sand (SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

Preparation Method:	X	Moist		
		Dry		
Compaction Method	X	Mechanical Ram		
		Manual Ram		

Scalp Fraction (%)	
#3/4	
#3/8	
#4	8.9

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.03330

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3831	3947	3973			
Weight of Mold (g)	1868	1868	1868			
Net Weight of Soil (g)	1963	2079	2105			
Wet Weight of Soil + Cont. (g)	350.8	290.4	323.2			
Dry Weight of Soil + Cont. (g)	338.9	274.6	299.2			
Weight of Container (g)	39.2	39.5	39.6			
Moisture Content (%)	3.97	6.72	9.24			
Wet Density (pcf)	130.0	137.6	139.4			
Dry Density (pcf)	125.0	129.0	127.6			

Maximum Dry Density (pcf)	**129.0**	**Optimum Moisture Content (%)**	**7.3**
Corrected Dry Density (pcf)	**131.7**	**Corrected Moisture Content (%)**	**6.7**

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

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

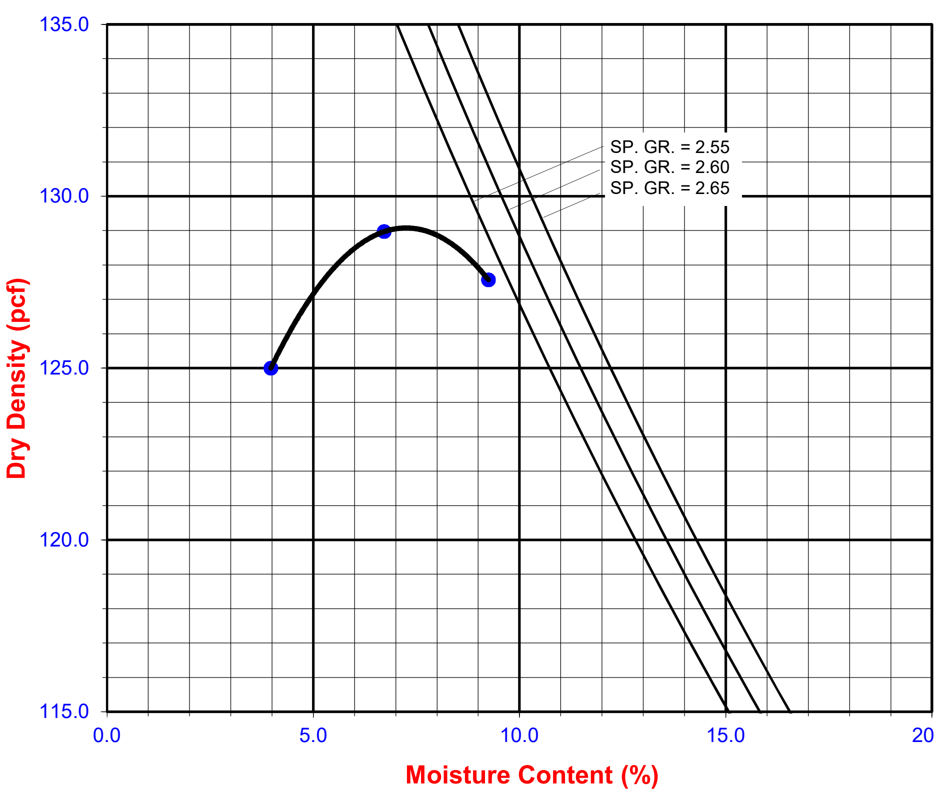
☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



R-VALUE TEST RESULTS

DOT CA Test 301

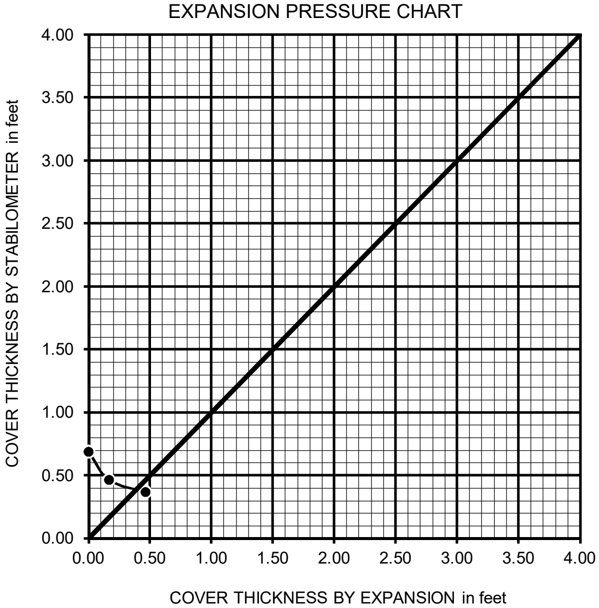
Leighton

PROJECT NAME:	A-Town, Parcel B	PROJECT NUMBER:	12882.001
BORING NUMBER:	LB-4	DEPTH (FT.):	0-5
SAMPLE NUMBER:	BB1	TECHNICIAN:	O. Figueroa
SAMPLE DESCRIPTION:	Olive brown silty sand (SM)	DATE COMPLETED:	10/3/2020

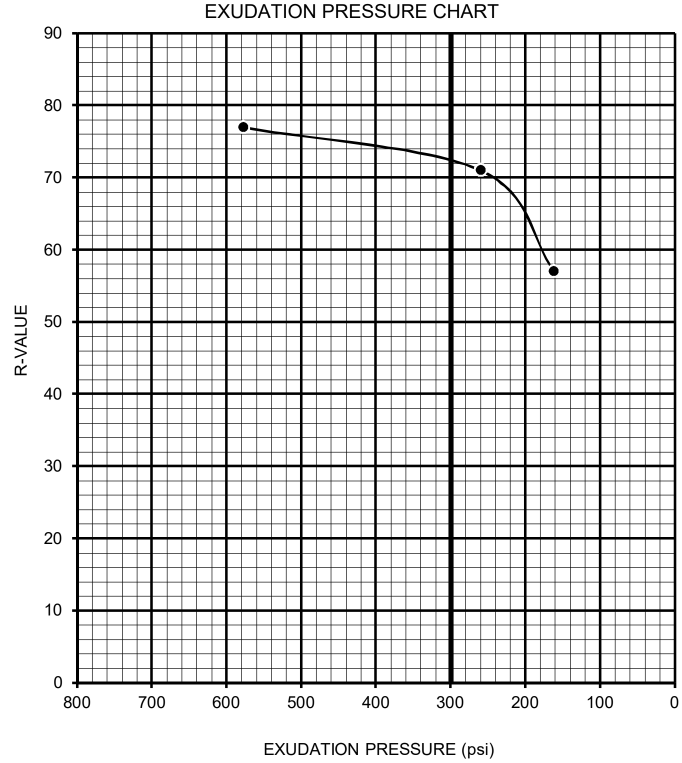
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	8.7	9.5	10.4
HEIGHT OF SAMPLE, Inches	2.43	2.51	2.47
DRY DENSITY, pcf	131.2	129.2	128.3
COMPACTOR PRESSURE, psi	350	350	250
EXUDATION PRESSURE, psi	578	260	161
EXPANSION, Inches x 10exp-4	14	5	0
STABILITY Ph 2,000 lbs (160 psi)	22	28	44
TURNS DISPLACEMENT	4.50	4.80	5.00
R-VALUE UNCORRECTED	78	71	57
R-VALUE CORRECTED	77	71	57

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.37	0.46	0.69
EXPANSION PRESSURE THICKNESS, ft.	0.47	0.17	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	75
R-VALUE BY EXUDATION:	72
EQUILIBRIUM R-VALUE:	72

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name:	A-Town, Parcel B	Tested By:	YN/GEB	Date:	10/01/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/26/20
Boring No.:	2020 P-4				
Sample No.:	R4	Depth (feet):	20.0		
Soil Identification:	Olive silty sand (SM)				

% Gravel	**0**	**Soil Type**
% Sand	**65**	**SM**
% Fines	**35**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	70.05	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	69.97	145.28
Wt.of Air-Dry Soil + Cont. (g)	694.84	Wt. of Container No.___ (g)	1.00	56.93	74.91
Wt. of Container	140.32	Moisture Content (%)	0.00	0.61	
Dry Wt. of Soil (g)	554.52	Wt. of Dry Soil (g)			70.37

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.11	100.0
Pan		

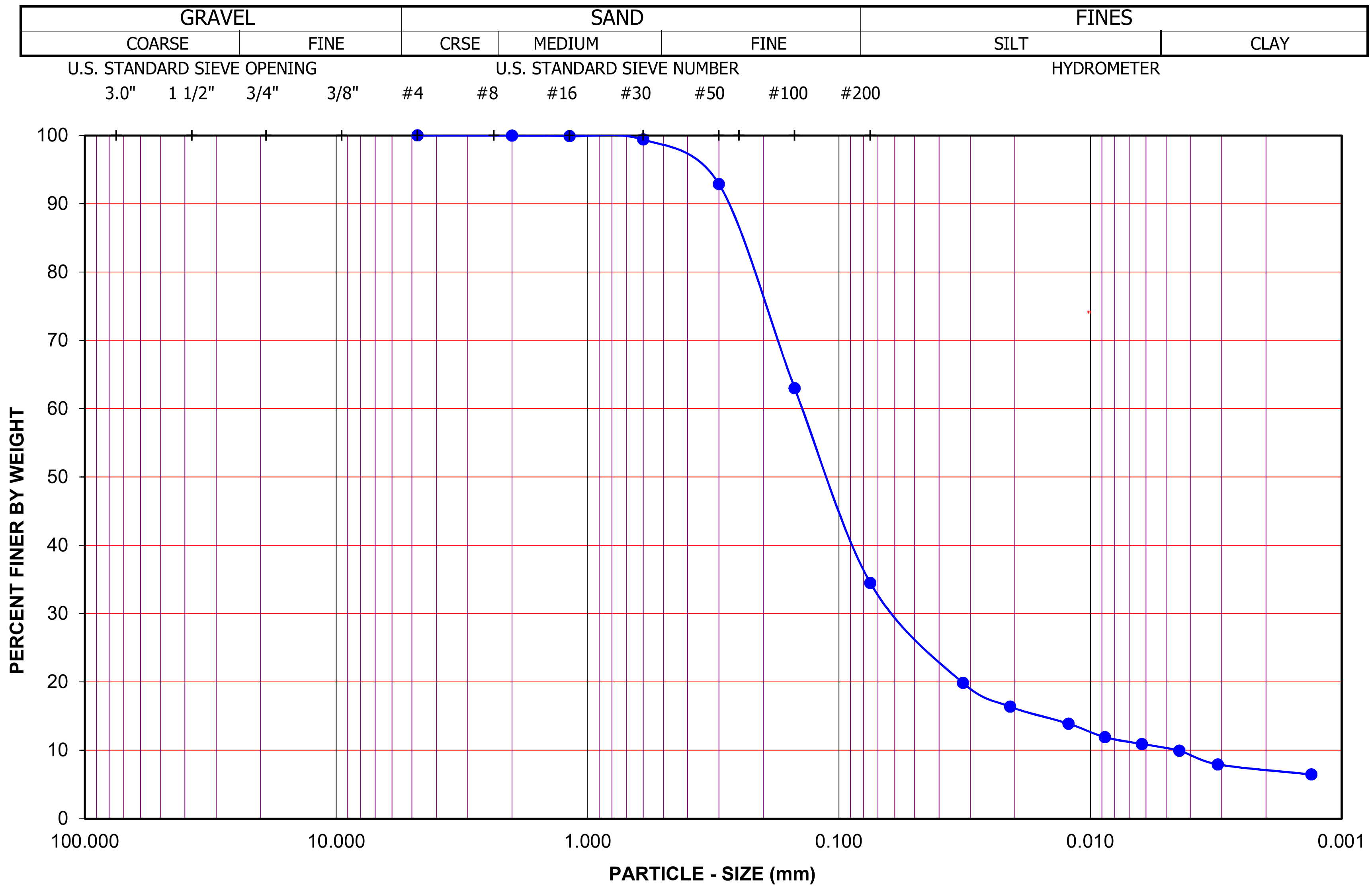
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.08	99.9	99.9
No. 30	0.58	99.4	99.4
No. 50	7.10	92.9	92.9
No. 100	36.94	63.0	63.0
No. 200	65.40	34.5	34.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 100.48 Wt. of Dry Soil (g) 99.87

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
02-Oct-20	8:32	0		8.0			
	8:34	2	21.6	8.0	28.0	19.9	0.0321
	8:37	5	21.5	8.0	24.5	16.4	0.0208
	8:47	15	21.5	8.0	22.0	13.9	0.0122
	9:02	30	21.5	8.0	20.0	11.9	0.0087
	9:32	60	21.4	8.0	19.0	10.9	0.0062
	10:32	120	21.6	8.0	18.0	9.9	0.0044
	12:42	250	21.9	8.0	16.0	7.9	0.0031
03-Oct-20	8:32	1440	20.7	8.0	14.5	6.5	0.0013



Project Name: A-Town, Parcel B

Project No.: 12882.001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Boring No.: 2020 P-4 Sample No.: R4

Depth (feet): 20.0 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 65 : 35

Oct-20

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name:	A-Town, Parcel B	Tested By:	YN/GEB	Date:	10/01/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/26/20
Boring No.:	2020 P-5				
Sample No.:	R5	Depth (feet):	27.0		
Soil Identification:	Olive silt with sand (ML)s				

		Soil Type
% Gravel	**1**	**(ML)s**
% Sand	**14**	
% Fines	**85**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	81.17	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	81.05	109.69
Wt.of Air-Dry Soil + Cont. (g)	577.38	Wt. of Container No.___ (g)	1.00	66.88	87.58
Wt. of Container	154.29	Moisture Content (%)	0.00	0.85	
Dry Wt. of Soil (g)	423.09	Wt. of Dry Soil (g)			22.11

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	1.96	99.5
No. 4	4.90	98.8
No. 10	6.30	98.5
Pan		

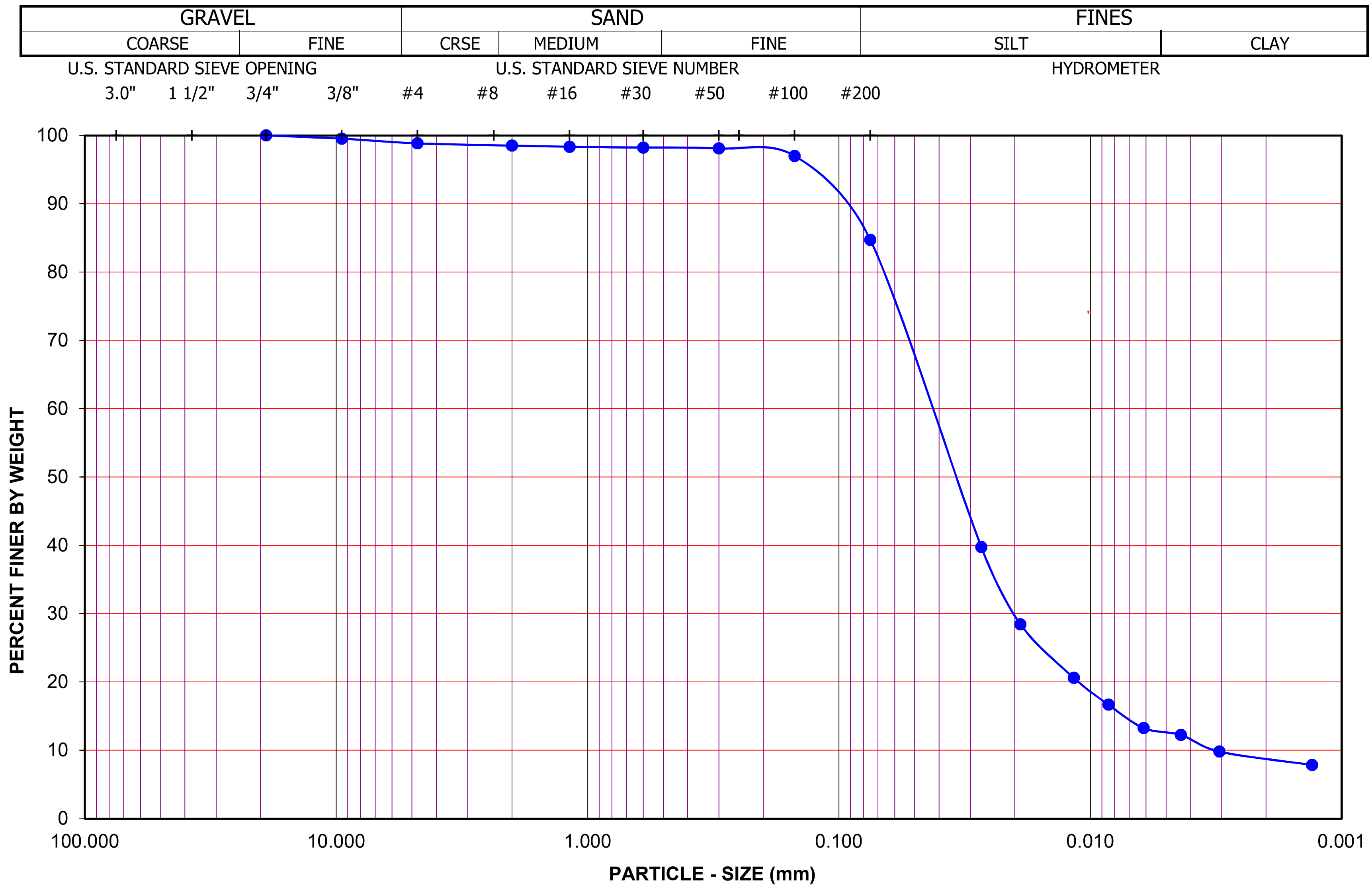
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	98.5
No. 16	0.16	99.8	98.4
No. 30	0.28	99.7	98.2
No. 50	0.42	99.6	98.1
No. 100	1.54	98.5	97.0
No. 200	13.96	86.0	84.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 100.44 Wt. of Dry Soil (g) 99.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
02-Oct-20	8:20	0		8.0			
	8:22	2	21.3	8.0	48.5	39.7	0.0271
	8:25	5	21.4	8.0	37.0	28.5	0.0190
	8:35	15	21.4	8.0	29.0	20.6	0.0116
	8:50	30	21.4	8.0	25.0	16.7	0.0085
	9:20	60	21.3	8.0	21.5	13.2	0.0061
	10:20	120	21.4	8.0	20.5	12.3	0.0044
	12:30	250	21.8	8.0	18.0	9.8	0.0031
03-Oct-20	8:20	1440	20.7	8.0	16.0	7.8	0.0013



Project Name: A-Town, Parcel B

Project No.: 12882.001

Boring No.: 2020 P-5 Sample No.: R5

Depth (feet): 27.0 Soil Type : (ML)s

Soil Identification: Olive silt with sand (ML)s

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 1 : 14 : 85

Oct-20

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name: A-Town, Parcel B
Tested By: YN/GEB
Date: 10/01/20
Project No.: 12882.001
Checked By: J. Ward
Date: 10/26/20
Boring No.: 2020 P-5
Sample No.: S3
Depth (feet): 20.0
Soil Identification: Olive silty sand (SM)

		Soil Type
% Gravel	**0**	
% Sand	**60**	**SM**
% Fines	**40**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	73.34	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	73.26	134.80
Wt.of Air-Dry Soil + Cont. (g)	680.00	Wt. of Container No.___ (g)	1.00	59.22	75.75
Wt. of Container	132.82	Moisture Content (%)	0.00	0.57	
Dry Wt. of Soil (g)	547.18	Wt. of Dry Soil (g)			59.05

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	1.46	99.7
Pan		

Sieve after Hydrometer & Wet Sieve

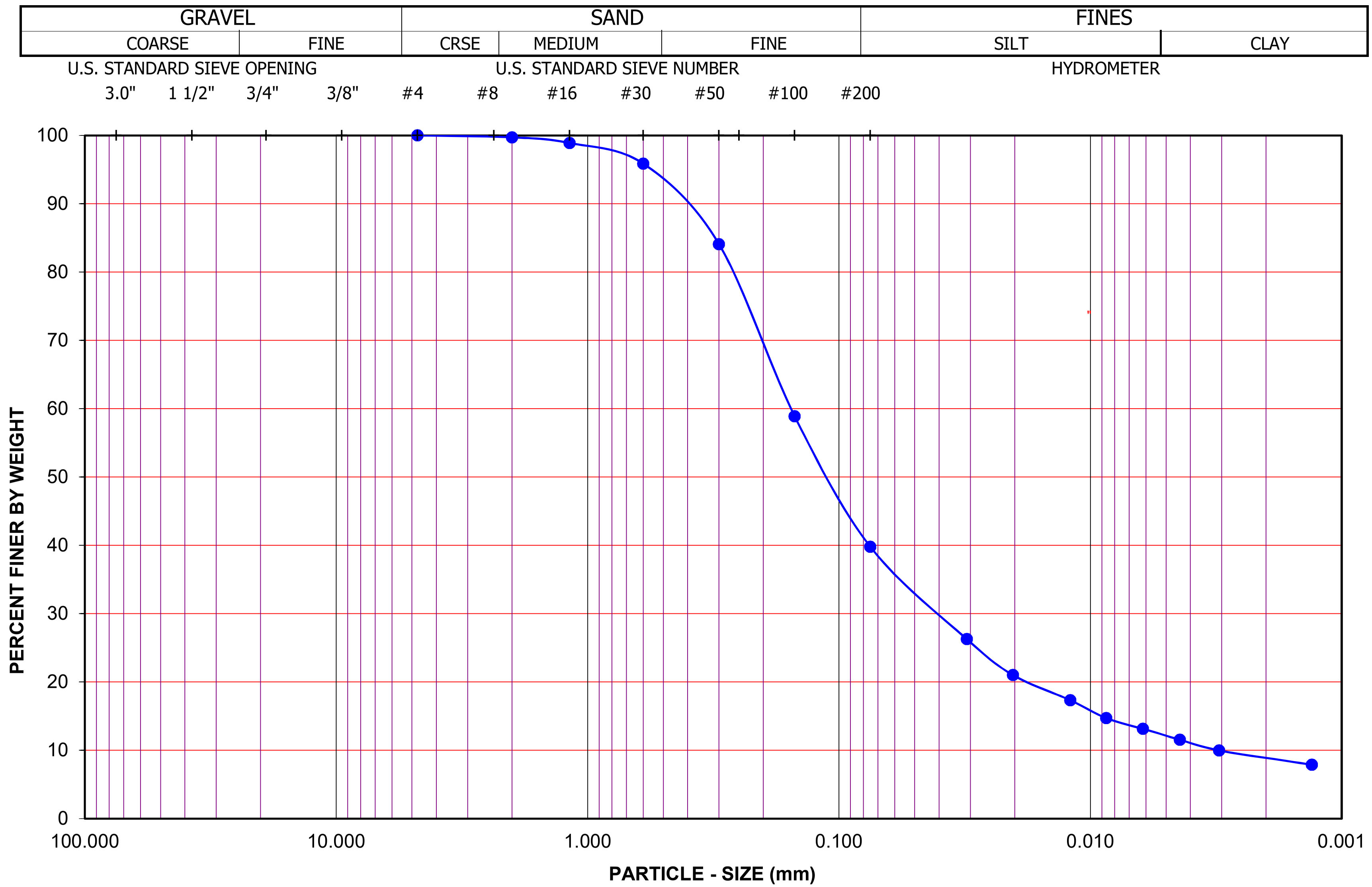
U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.7
No. 16	0.79	99.2	98.9
No. 30	3.65	96.1	95.9
No. 50	14.77	84.3	84.1
No. 100	38.53	59.1	58.9
No. 200	56.58	39.9	39.8
Pan			

Hydrometer

Wt. of Air-Dry Soil (g) 94.67 Wt. of Dry Soil (g) 94.13

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
02-Oct-20	8:28	0		8.0			
	8:30	2	21.6	8.0	33.0	26.3	0.0310
	8:33	5	21.5	8.0	28.0	21.0	0.0203
	8:43	15	21.5	8.0	24.5	17.3	0.0120
	8:58	30	21.5	8.0	22.0	14.7	0.0086
	9:28	60	21.4	8.0	20.5	13.1	0.0062
	10:28	120	21.5	8.0	19.0	11.6	0.0044
	12:38	250	21.9	8.0	17.5	10.0	0.0031
03-Oct-20	8:28	1440	20.7	8.0	15.5	7.9	0.0013



Project Name: A-Town, Parcel B

Project No.: 12882.001

Boring No.: 2020 P-5   Sample No.: S3

Depth (feet): 20.0   Soil Type : SM

Soil Identification: Olive silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%)   0 : 60 : 40

Oct-20

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: A-Town, Parcel B — Tested By: YN/GEB — Date: 10/01/20

Project No.: 12882.001 — Checked By: J. Ward — Date: 10/26/20

Boring No.: 2020 P-5

Sample No.: S4 — Depth (feet): 25.0

Soil Identification: Olive sandy silt s(ML)

		Soil Type
% Gravel	**0**	**s(ML)**
% Sand	**41**	
% Fines	**59**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	68.90	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	68.80	136.32
Wt.of Air-Dry Soil + Cont. (g)	624.60	Wt. of Container No.___ (g)	1.00	51.50	87.89
Wt. of Container	126.18	Moisture Content (%)	0.00	0.58	
Dry Wt. of Soil (g)	498.42	Wt. of Dry Soil (g)			48.43

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.65	99.9
No. 10	1.73	99.7
Pan		

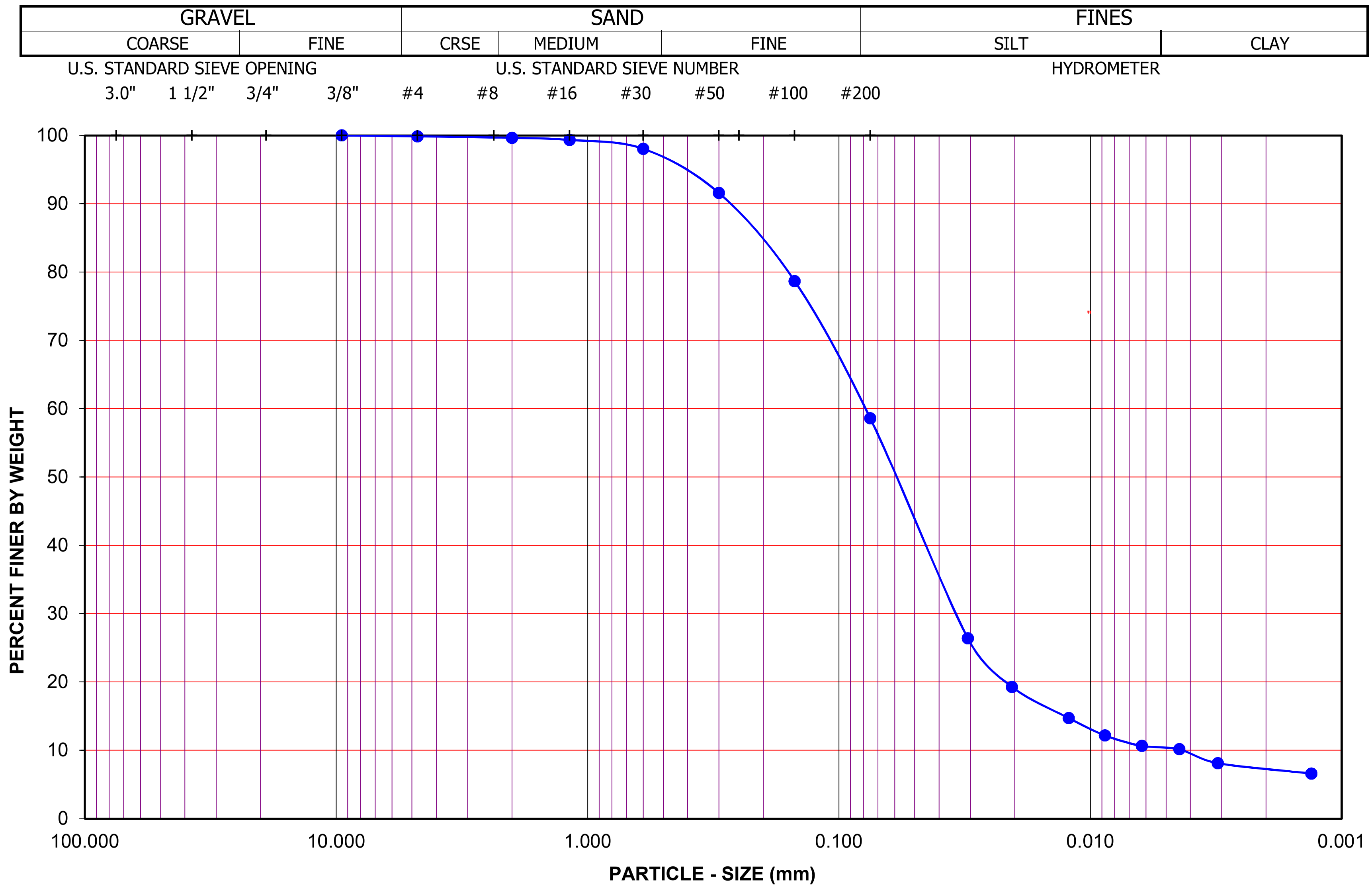
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.7
No. 16	0.30	99.7	99.3
No. 30	1.58	98.4	98.0
No. 50	7.90	91.9	91.6
No. 100	20.50	79.0	78.7
No. 200	40.14	58.8	58.6
Pan			

Hydrometer — Wt. of Air-Dry Soil (g): 97.96 — Wt. of Dry Soil (g): 97.40

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
02-Oct-20	8:24	0		8.0			
	8:26	2	21.5	8.0	34.0	26.4	0.0307
	8:29	5	21.4	8.0	27.0	19.3	0.0205
	8:39	15	21.4	8.0	22.5	14.7	0.0122
	8:54	30	21.4	8.0	20.0	12.2	0.0087
	9:24	60	21.4	8.0	18.5	10.7	0.0062
	10:24	120	21.4	8.0	18.0	10.1	0.0044
	12:34	250	21.9	8.0	16.0	8.1	0.0031
03-Oct-20	8:24	1440	20.7	8.0	14.5	6.6	0.0013



Project Name: A-Town, Parcel B

Project No.: 12882.001

Boring No.: 2020 P-5 Sample No.: S4

Depth (feet): 25.0 Soil Type : s(ML)

Soil Identification: Olive sandy silt s(ML)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 0 : 41 : 59

Oct-20

SA & Hyd 2020 P-5, S4 @ 25

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

Leighton

Project Name:	A-Town, Parcel B	Tested By:	S. Felter	Date: 10/02/20
Project No.:	12882.001	Checked By:	J. Ward	Date: 10/23/20
Boring No.:	2020 P-4	Depth (feet):	10.0	
Sample No.:	R2			
Soil Identification:	Grayish brown poorly-graded sand with silt (SP-SM)			

		Moisture Content of Total Air - Dry Soil	
Container No.:	ZK	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	950.9	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	248.8	Wt. of Container No.______ (g)	1.0
Dry Wt. of Soil (g)	702.1	Moisture Content (%)	0.0

After Wet Sieve	Container No.	ZK
	Wt. of Dry Soil + Container (g)	912.5
	Wt. of Container (g)	248.8
	Dry Wt. of Soil Retained on # 200 Sieve (g)	663.7

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
1 1/2"	37.5		
1"	25.0		
3/4"	19.0		
1/2"	12.5		
3/8"	9.5		
#4	4.75		
#8	2.36	0.0	100.0
#16	1.18	1.9	99.7
#30	0.600	35.4	95.0
#50	0.300	344.9	50.9
#100	0.150	601.5	14.3
#200	0.075	647.8	7.7
PAN			

GRAVEL: **0 %**

SAND: **92 %**

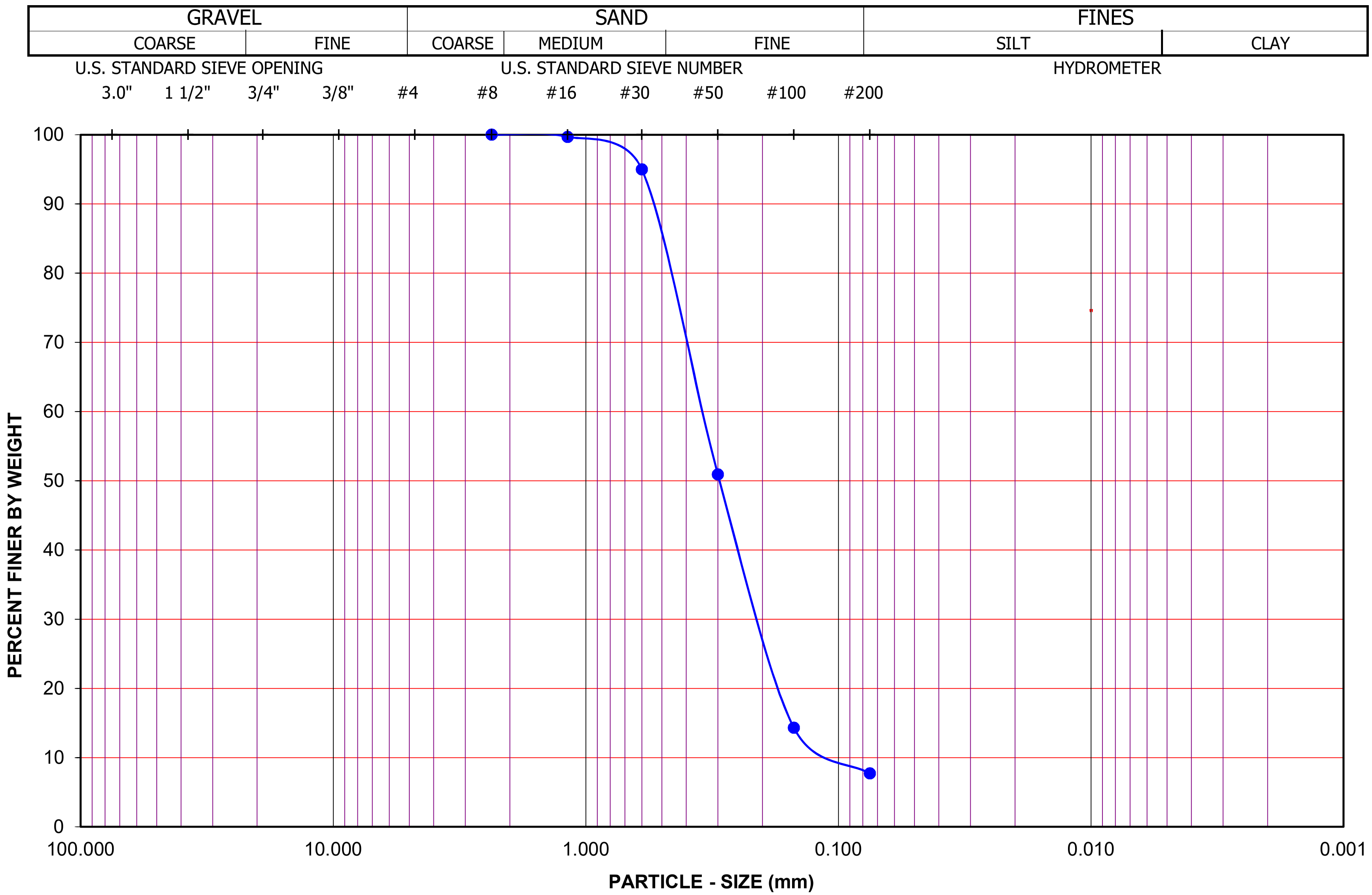
FINES: **8 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 2.83

Cc = $(D30)^2/(D60*D10)$ = 1.19

Remarks:



Project Name: A-Town, Parcel B

Project No.: 12882.001

Boring No.: 2020 P-4 | Sample No.: R2

Depth (feet): 10.0 | Soil Type : SP-SM

Soil Identification: Grayish brown poorly-graded sand with silt (SP-SM)

GR:SA:FI : (%) 0 : 92 : 8

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Oct-20

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

ASTM D 6913

Leighton

Project Name:	A-Town, Parcel B	Tested By:	S. Felter	Date:	10/02/20
Project No.:	12882.001	Checked By:	J. Ward	Date:	10/23/20
Boring No.:	2020 P-4	Depth (feet):	27.0		
Sample No.:	S4				
Soil Identification:	Grayish brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	YK	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	973.2	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	251.3	Wt. of Container No.______ (g)	1.0
Dry Wt. of Soil (g)	721.9	Moisture Content (%)	0.0

After Wet Sieve	Container No.	YK
	Wt. of Dry Soil + Container (g)	767.6
	Wt. of Container (g)	251.3
	Dry Wt. of Soil Retained on # 200 Sieve (g)	516.3

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
1 1/2"	37.5		
1"	25.0		
3/4"	19.0		
1/2"	12.5		
3/8"	9.5		
#4	4.75		
#8	2.36	0.0	100.0
#16	1.18	2.8	99.6
#30	0.600	8.0	98.9
#50	0.300	31.8	95.6
#100	0.150	243.0	66.3
#200	0.075	486.2	32.6
PAN			

GRAVEL: **0 %**

SAND: **67 %**

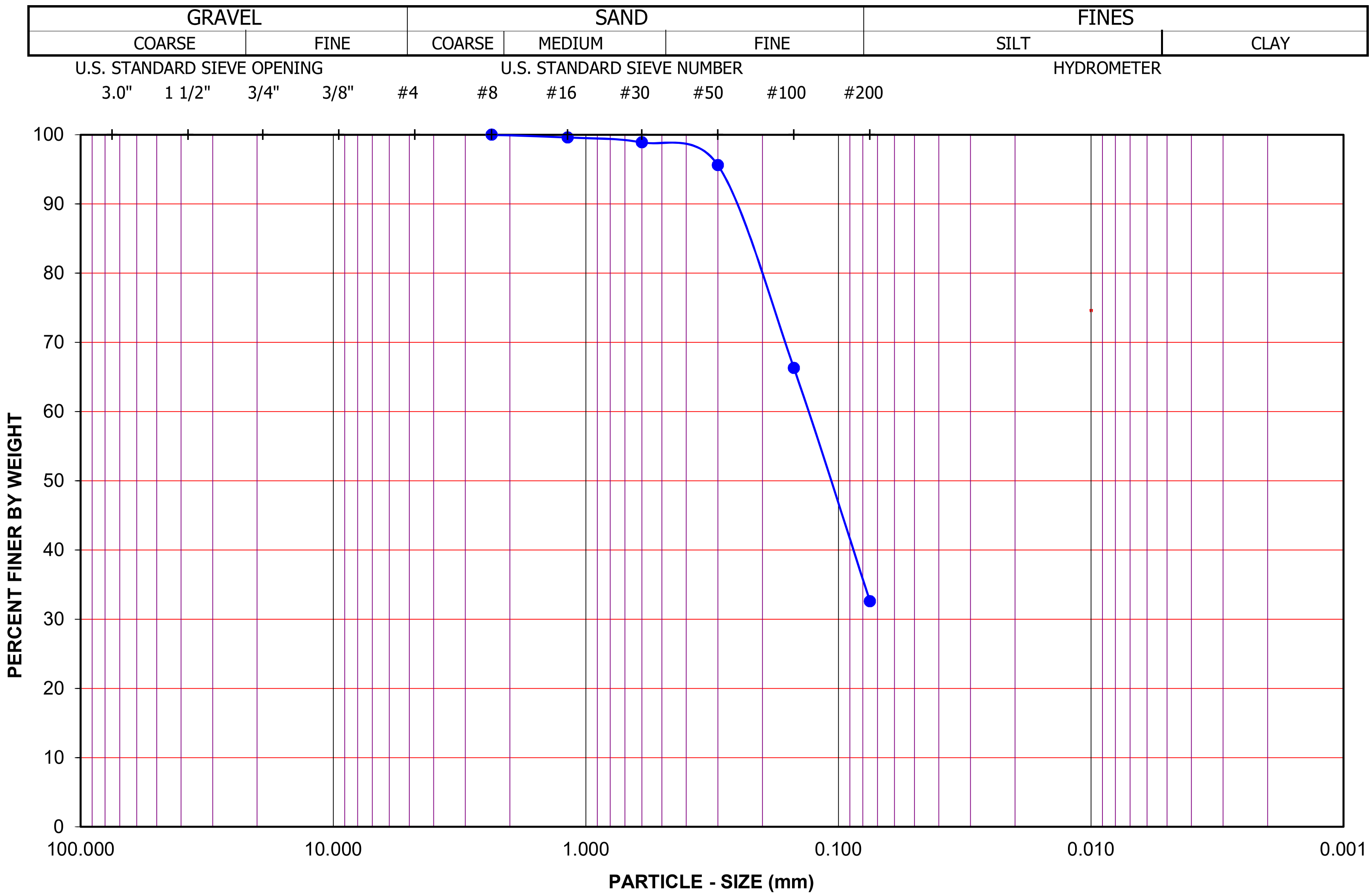
FINES: **33 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks: ______



Project Name: A-Town, Parcel B

Project No.: 12882.001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Boring No.: 2020 P-4 Sample No.: S4

Depth (feet): 27.0 Soil Type : SM

Soil Identification: Grayish brown silty sand (SM)

GR:SA:FI : (%) 0 : 67 : 33

Oct-20

Sieve 2020 P-4, S4 @ 27

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

Leighton

Project Name:	A-Town, Parcel B	Tested By:	S. Felter Date: 10/02/20
Project No.:	12882.001	Checked By:	J. Ward Date: 10/23/20
Boring No.:	2020 P-5	Depth (feet):	12.0
Sample No.:	R2		
Soil Identification:	Grayish brown poorly-graded sand (SP)		

		Moisture Content of Total Air - Dry Soil	
Container No.:	GE	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	982.7	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	249.9	Wt. of Container No.______ (g)	1.0
Dry Wt. of Soil (g)	732.8	Moisture Content (%)	0.0

After Wet Sieve	Container No.	GE
	Wt. of Dry Soil + Container (g)	960.6
	Wt. of Container (g)	249.9
	Dry Wt. of Soil Retained on # 200 Sieve (g)	710.7

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
1 1/2"	37.5		
1"	25.0		
3/4"	19.0		
1/2"	12.5	0.0	100.0
3/8"	9.5	1.4	99.8
#4	4.75	3.1	99.6
#8	2.36	11.7	98.4
#16	1.18	62.4	91.5
#30	0.600	246.9	66.3
#50	0.300	529.7	27.7
#100	0.150	676.4	7.7
#200	0.075	708.1	3.4
PAN			

GRAVEL: **0 %**

SAND: **97 %**

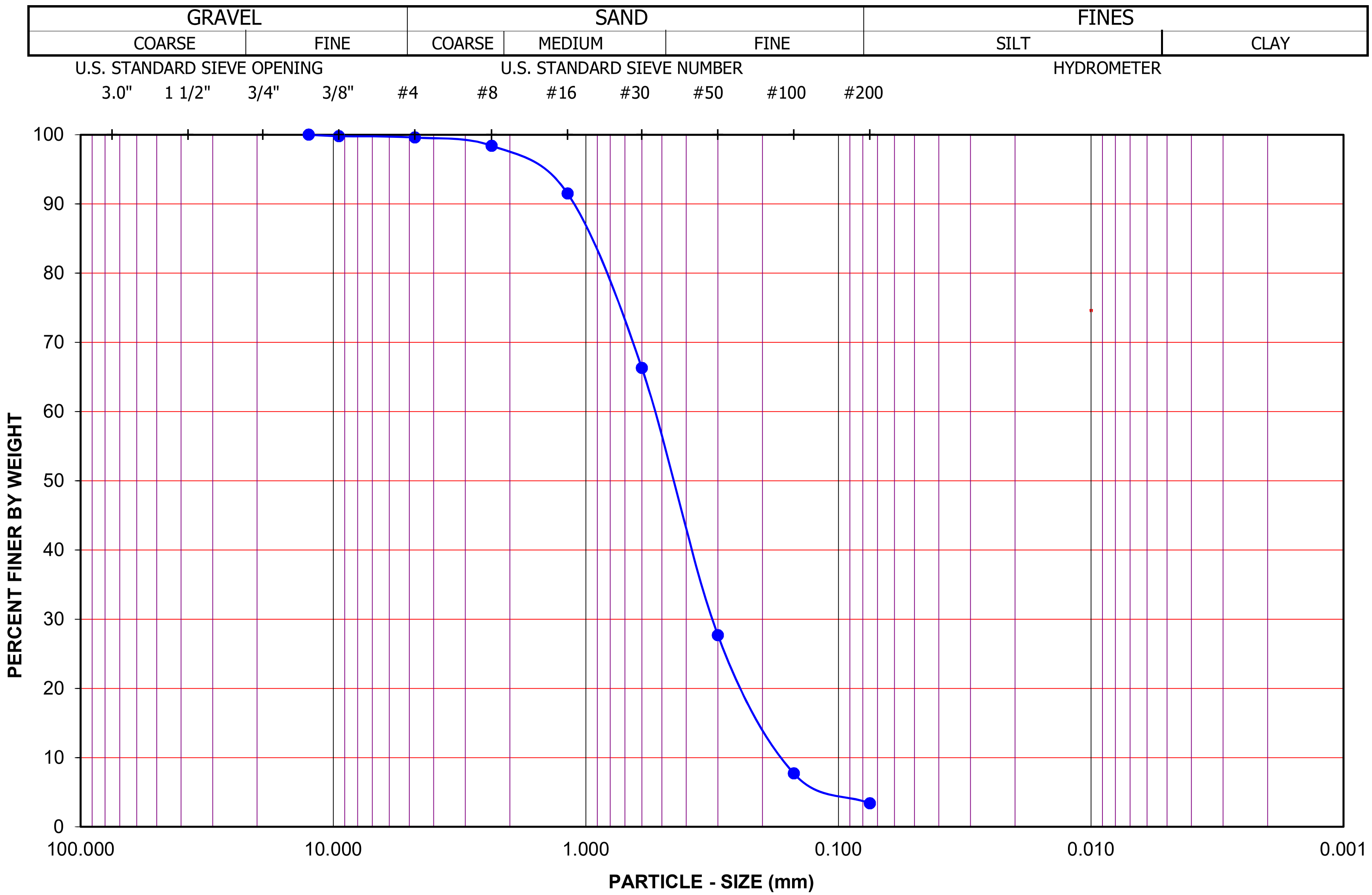
FINES: **3 %**

GROUP SYMBOL: **SP**

$Cu = D60/D10 =$ 3.12

$Cc = (D30)^2/(D60*D10) =$ 1.07

Remarks:



Project Name: A-Town, Parcel B

Project No.: 12882.001

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 6913

Boring No.: 2020 P-5 Sample No.: R2

Depth (feet): 12.0 Soil Type : SP

Soil Identification: Grayish brown poorly-graded sand (SP)

GR:SA:FI : (%) 0 : 97 : 3

Oct-20

Sieve 2020 P-5, R2 @ 12

APPENDIX D

EXPLORATION LOGS (PREVIOUS STUDIES)

Leighton

GEOTECHNICAL BORING LOG BH-1

Date 2-28-05
Project Platinum Triangle
Project No. 011331-011-
Drilling Co. West HazMat
Type of Rig CME-75
Hole Diameter 8"
Drive Weight 140
Drop 30"
Elevation Top of Hole 144'
Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@0': 3" Asphalt over 3" aggregate base Fill	
									@1': Sand (SP/SM), fine to coarse grained sand,some silt, fine gravel, moist, brown, dark brown to brownish black	MD,CR
				1			3.5	SP		
140									Alluvium (Qal)	
	5			2	5 7 8	105.3	2.4	SP	@4': Sand (SP), fine to coarse grained sand, fine rounded gravel, moist, medium dense, light yellowish brown	
135										
	10			3	3 4 8			SP	@18-20": Encountered layer of gravel	
130										
	15			4	8 8 12	101.3	4.3	SP		
125									@20': Sand (SP), medium to coarse grained sand, fine rounded gravel, some silt, micaceous, dry, medium dense, light yellow brown	
	20			5	7 10 12			SP	@26.5': Silt (ML), very fine grained sand, trace clay, moist, dark brown	
120										
	25			6	3 10 13	93.3	2.8	ML		
									@30': Sand (SP), fine to coarse grained sand, thin inter-beds of wet silt, sand is moist, medium dense, micaceous, sand is light yellow brown, silt is olive brown	
115										
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-1

Date 2-28-05 | Sheet 2 of 3
Project Platinum Triangle | Project No. 011331-011-
Drilling Co. West HazMat | Type of Rig CME-75
Hole Diameter 8" | Drive Weight 140 | Drop 30"
Elevation Top of Hole 144' | Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			7	4 10 12			SP	@35': Sand (SP), medium to coarse grained sand, thinly inter-bedded silt, moist, medium dense, light yellow brown	
110	35			8	8 12 19	101.7	4.3	SP	@40': Silt to Sandy Silt (ML), very fine grained sand, moist, medium stiff, micaceous, light olive brown	
105	40			9	4 7 8			ML	@43': Becomes fine grained Silty Sand (SM), trace clay	
								SM	@46': Sandy Silt (ML), fine to medium grained sand, trace clay, moist, medium stiff, micaceous, light olive brown to reddish brown	
100	45			10	3 5 8	114.4	15.5	SM ML	@50': Clayey Silt (ML), some medium sand, thin inter-beds of alternating clay and silt, very moist, light olive brown to orange brown	
95	50			11	5 5 9			ML	@55': Sand (SP), fine grained sand, trace silt, moist, medium dense, light whitish gray	
90	55			12	3 13 15	99.2	3.7	SP	@60': Sand (SP), fine to coarse grained sand, slightly moist, medium dense, micaceous, light whitish gray	
85	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG BH-1

Date 2-28-05 **Sheet** 3 **of** 3

Project Platinum Triangle **Project No.** 011331-011-

Drilling Co. West HazMat **Type of Rig** CME-75

Hole Diameter 8" **Drive Weight** 140 **Drop** 30"

Elevation Top of Hole 144' **Location** Anaheim, California

Logged By JAR

Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			13	9 18 23			SP	@65': Gravelly Sand to Sandy Gravel (SP/GP), medium to coarse grained sand, fine to coarse well rounded siliceous gravel, very dense, light whitish gray to light yellowish brown	
80										
	65			14	6 21 50/5	110.0	2.4	GP		
75										
	70				13 23 29			SP	@70': Gravelly Sand (SP), predominately coarse sand, some silt, fine to coarse gravel, moist, dense, reddish brown	
70									Total depth: 71.5' No groundwater encountered Boring backfilled with soil cuttings and patched with asphalt upon completion	
	75									
65										
	80									
60										
	85									
55										
	90									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-2

Date	3-1-05	**Sheet**	1 of 4
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	West HazMat	**Type of Rig**	CME-75
Hole Diameter	8"	**Drive Weight**	140
Drop	30"	**Elevation Top of Hole**	147'
Location	Anaheim, California		

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
147	0						@0': 3" of Asphalt over 4" of Sandy Gravel Base Fill @7": Silty Sand to Sand (SM/SP), fine to medium grained sand, some fine rounded gravel and asphalt pieces to 1/4", micaceous, brown to dark brownish black	MD,CR
	~2.5	1			4.2	SP/SM		
							Alluvium (Qal)	
	~6	2	2 2 4			SP	@4': Sand (SP), fine to coarse grained sand, fine well rounded gravel, moist, light yellowish brown	
137	10	3	2 7 8	100.1	5.8	SP	@10': Sand (SP), fine to medium grained sand, moist, medium dense, light yellowish brown	DS
132	15	4	4 5 6			SP	@15': Sand (SP), fine to coarse grained sand, moist, medium dense	MD,SA
	~17.5	5			6.1	SP		
127	20	6	3 10 10	100.2	3.7	SP	@20': Sand (SP), fine to medium grained sand, moist, medium dense, light yellowish brown	DS
122	25	7	4 7 8			SP	@25': Sand (SP), fine to coarse grained sand, some silt, trace of fine gravel, moist, medium dense	

Elevation scale: 145, 140, 135, 130, 125, 120. Depth scale: 0, 5, 10, 15, 20, 25, 30. Graphic Log: N S.

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-2

Date	3-1-05	**Sheet**	2 **of** 4
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	West HazMat	**Type of Rig**	CME-75
Hole Diameter	8"	**Drive Weight**	140 **Drop** 30"
Elevation Top of Hole	147'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			8	3 7 12	107.7	15.6	SM	@30': Silty Sand (SM), fine to medium grained sand, moist, loose to medium dense, light yellowish brown	DS
115										
	35			9	3 6 10			SP	@35': Sand (SP), fine to coarse grained sand, moist, loose to medium dense, light yellowish brown	
110										
	40			10	8 9 17	94.1	27.2	ML	@40': Sandy Silt (ML), very fine grained sand, trace thin inter-beds of silty clay, moist, stiff, olive brown	DS
105										
	45			11	3 4 10			ML	@45': Sandy Silt (ML), very fine to medium grained sand, moist, loose to medium dense, olive brown	
100										
	50			12	4 8 27	115.8	12.6	SP	@50': Sand (SP), very fine to coarse grained sand, moist, medium dense, yellowish brown	DS
95										
	55			13	4 5 9			SP	@55': Sand (SP), fine to medium grained sand, trace silt, moist, medium dense, yellowish brown	
90										
	60									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-2

Date 3-1-05 **Sheet** 3 **of** 4
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. West HazMat **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 147' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			14	3 7 18	94.7	2.4	SP	@60': Sand (SP), medium to coarse grained sand, trace silt and fine rounded gravel, moist, medium dense, light grayish white	DS
85										
	65			15	3 6 12			CL	@65': Silty Clay (CL), fine to coarse grained sand, very moist, interbedded clayey silt to silty clay, light tannish brown	
80								GP	@66.5': grades to Sandy Gravel to Gravelly Sand (SP/GP), wet in head of sampler, gravel subrounded to rounded, some slaty gravel, cobbles to >3"	
	70			16	9 30 40	120.7	5.5	GP	@70': Sandy Gravel (GP), fine to coarse sand, fine to coarse gravel, sub-angular to rounded gravel, some gravel > 2.5"	
75										
	75			17	10 9 6			ML	@76': Clayey Silt (ML), very fine sand, trace coarse sand, medium stiff, micaceous, very moist, head of sampler is wet, medium brown	
70										
	80			18	3 30 35	115.7	6.3	GP-GC	@80.5': Clayey to Silty Gravel (GM), medium to coarse grained sand, fine to coarse gravel and cobble in clayey sand matrix, moderately consolidated, moist, dark reddish brown	
65										
	85 ▽			19	33 30 29			SM	@85': Silty Sand (SM), fine grained sand, wet, encounter groundwater @86': Gravel (GP), fine to coarse gravel, wet dense	
60										
	90									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG BH-2

Date	3-1-05	**Sheet**	4 **of** 4
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	West HazMat	**Type of Rig**	CME-75
Hole Diameter	8"	**Drive Weight**	140
Drop	30"		
Elevation Top of Hole	147'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			20	11 18 21			GP	@90': Sandy Gravel (GP), medium to coarse inter-bedded sand to fine to coarse gravel within sand matrix, wet, dense, medium brown	
55										
	95			21					@95': Heaving sands, pulled out sampler, added water, advance to 101'- no recovery	
50										
	100			22	7 16 38			CL	@101': Clayey Sand to Sandy Clayey (SC/CL), fine grained sand, abundant fine gravel, some silt, wet, light reddish brown @102': Heaving sands, refusal of sampler, terminated boring	
45										
									Total depth: 102' Groundwater encountered at 85' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
	105									
40										
	110									
35										
	115									
30										
	120									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-3

Date: 3-1-05 | Sheet 1 of 3
Project: Platinum Triangle | Project No. 011331-011-
Drilling Co.: West HazMat | Type of Rig: CME-75
Hole Diameter: 8" | Drive Weight: 140 | Drop: 30"
Elevation Top of Hole: 148' | Location: Anaheim, California

Logged By: JAR
Sampled By: JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0': 3" Asphalt over 4" Sandy Gravel base Fill	
									@ 7": Silty Sand (SM), fine to medium grained sand, trace fine gravel, asphalt debris, dark brown to dark blackish brown Alluvium (Qal)	
145									@ 3': Sand (SP), fine to coarse grained sand, trace fine gravel, moist, light yellowish brown	
	5			1	1 5 7	98.8	2.6	SP		MD,CR
									@ 7': Becoming light orange brown	
140				2			7.4	SP		
	10			3	3 7 8			SP	@ 10': Sand (SP), medium to coarse grained sand, fine gravel, moist, light yellowish brown	
135										
	15			4	5 6 11	103.9	3.7	SP	@ 15': Sand (SP), fine to coarse grained sand, moist, micaceous, some silt, light yellow brown	DS
130										
	20			5	7 8 11			SP	@ 21': Sand (SP), fine grained sand, moist, medium dense, light greyish white	
125										
	25			6	5 8 14	103.7	5.0	SP	@ 25': Silty Sand (SM), fine to medium grained sand, moist, medium dense, light brown to medium brown	DS
120										
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-3

Date 3-1-05 **Sheet** 2 **of** 3
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. West HazMat **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 148' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			7	4 6 7			ML	@ 30': Sandy Silt (ML), very fine grained sand, moist, medium stiff, micaceous, brown	
115										
	35			8	2 7 13	100.6	7.5	SP	@ 35': Sand (SP), fine to medium grained sand, some silt, moist, medium dense, light yellowish brown	DS
110										
	40			9	6 11 11			SM	@ 40': Silty Sand (SM), fine grained sand, moist, medium dense, micaceous, light brown	
105										
	45			10	4 7 11	82.6	37.5	CL	@ 45': Silty Clay (CL), thinly interbedded fine to medium grained micaceous sand, wet, medium stiff, mottled olive brown to orange brown	DS,CN
100										
	50			11	8 12 15			SM	@ 50': Silty Sand (SM), fine to medium grained sand, interbedded silt and clayey silt, moist, medium dense, light olive brown	
95										
	55			12	3 12 23	101.5	2.6	SP	@ 55': Sand (SP), fine to coarse grained sand, fine gravel, moist, medium dense, light whitish grey	
90										
	60									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-3

Date	3-1-05	**Project No.**	011331-011-
Project	Platinum Triangle	**Type of Rig**	CME-75
Drilling Co.	West HazMat	**Drop**	30"
Hole Diameter	8"	**Drive Weight**	140
Elevation Top of Hole	148'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N – S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			13	8 16 21			SP	@ 60': Sand (SP), fine to medium grained sand, some silt, moist, dense, micaceous, light greyish white	
85										
	65			14	5 20 28	105.8	5.2	SP	@ 65': Sand (SP), fine to medium grained sand, very moist, encountered perched groundwater, dense, micaceous, light whitish gray	
80										
	70			15	4 7 10			CL	@ 70': Clay (CL), some silt and very fine sand, very moist, medium stiff, medium plasticity, light orange brown	
75									Total depth: 71.5' Perched groundwater encountered at 65' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
	75									
70										
	80									
65										
	85									
60										
	90									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-4

Date 4-19-05 **Sheet** 1 **of** 4
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. Martini Drilling **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 148' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@0': 3" Asphalt concrete over 4" Sandy Gravel base	
									@.7': Fill Sand (SP), fine to coarse grained sand, some silt and coarse gravel and asphlt debris to 3" in size, micaceous, moist, medium brown	
145				1				SP	3': Alluvium (Qal) Sand (SP), fine to medium grained sand, some silt, micaceous, moist, medium dense, brown	
	5			2	7 5 6			SP		
140									@10': Sand (SP), fine to coarse grained sand, moist, medium dense, light yellow brown	
	10			3	2 4 8			SP		
135										
	15			4	4 9 13			SP-SM	@15'; Sand with Silt (SP/SM), fine to coarse grained sand, moist, medium dense, light yellow brown	
130										
	20			5	6 11 13			SP	@20': Sand (SP), fine to coarse grained sand, some silt, trace of fine gravel, moist, medium dense, brown	
125										
	25			6	7 14 22			SP	@25': Sand (SP), fine to coarse grained sand, some silt, micaceous, dense, light yellow brown	
120										
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-4

Date 4-19-05 **Sheet** 2 **of** 4
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. Martini Drilling **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 148' **Location** Anaheim, California

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JAR Sampled By JAR	Type of Tests
	30			7	4 5 3			ML	@30': Silt (ML), some fine sand, some clay, micaceous, moist, brown	
115										
	35			8	4 11 18			SM	@35': Silty Sand (SM), fine grained sand, medium dense, micaceous, moist, brown	
110										
	40			9	4 5 7			ML	@40': Sandy Silt (ML), fine grained sand, micaceous, moist, medium stiff, medium brown	
105										
	45			10	8 23 30			SP	@45': Sand (SP), fine to medium grained sand, micaceous, some silt, moist, dense, light yellow brown	
100										
	50			11	1 2 2			ML	@50': Clayey Silt (ML), micaceous, wet, loose, medium brown	
95										
	55			12	4 18 30			SM	@55': Silty Sand (SM), fine to medium grained sand, micaceous, moist, dense, medium brown	
90										
	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-4

Date: 4-19-05 | Sheet 3 of 4

Project: Platinum Triangle | Project No.: 011331-011-

Drilling Co.: Martini Drilling | Type of Rig: CME-75

Hole Diameter: 8" | Drive Weight: 140 | Drop: 30"

Elevation Top of Hole: 148' | Location: Anaheim, California

Logged By: JAR

Sampled By: JAR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			13	5 4 6			ML	@60': Sandy Silt (ML), trace of fine grained sand, micaeous, moist, medium stiff, light brown	
85										
	65			14	6 18 50			ML	@65': Sandy Silt (ML), very fine grained sand, micaeous, dry, very stiff, light yellow brown	
80										
	70			15	11 12 12			SM	@70': Silty Sand (SM), fine grained sand, trace of coarse sand, moist, medium dense, medium brown	
75										
	75			16	7 13 16			CL	@75': Silty Clay (CL), trace of coarse sand, porous, stiff, moist, dark reddish brown to orange brown	
70										
	80			17	2 6 10			CL	@80': Silty Clay (CL), trace of fine sand with interbedded medium to coarse grained sand, micaeous, medium stiff, light orange brown @81.5': encountered groundwater, coarse sand to fine gravel	
65										
	85			18	20 27 46			SP	@85': Gravelley Sand (SP), coarse grained sand, fine gravel, wet, dense, orange brown added bentonite mud to auger	
60										
	90									

Graphic Log: N S

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-4

Date	4-19-05	Sheet	4 of 4
Project	Platinum Triangle	Project No.	011331-011-
Drilling Co.	Martini Drilling	Type of Rig	CME-75
Hole Diameter	8"	Drive Weight	140	Drop 30"
Elevation Top of Hole	148'	Location	Anaheim, California

Logged By: JAR
Sampled By: JAR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			19	10 8 12			SP	@90': Gravelley Sand (SP), coarse grained sand, fine gravel, wet, medium dense, orange brown	
									@91': interbedded Sandy Clay (CL), loose, fine gravel	
55										
	95			20	17 23 36			SP	@95': Gravelley Sand (SP), coarse grained sand, fine gravel, wet, very dense, orange brown	
50										
	100			21	13 15 28			GP	@100': Sandy Gravel (GP), coarse grained sand, fine to coarse gravel, wet, dense, orange brown	
45									Total depth: 101.5' Encountered groundwater @ 81.5' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
	105									
40										
	110									
35										
	115									
30										
	120									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG BH-5

Date 4-19-05 **Sheet** 1 **of** 5
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. Martini Drilling **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 145' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
145	0								@0': 3" Asphalt concrete over Gravelley Sand (SP) base @.7': Fill Sand (SP), fine to coarse grained sand and gravel, some silt and asphalt debris, moist, orange brown	
				1				SP		
140	5			2	3 4 5			SP	@5': Alluvium (Qal) Sand (SP), fine to coarse grained sand, trace silt, moist, loose, micaceous, orange grey	
135	10			3	3 9 15			SP	@10': Sand (SP), fine to coarse grained sand, moist, micaceous, medium dense, orange grey	
130	15			4	2 6 9			SP	@15': Sand (SP), fine to coarse grained sand, some silt, micaceous, moist, medium dense, light orange brown	
125	20			5	12 20 22			SP	@20': Sand (SP), fine to coarse grained sand, some silt, fine to coarse gravel, wet, dense, orange brown	
120	25			6	5 8 8			SP-SM	@25': Sand with Silt (SP/SM), fine to coarse sand, moist, medium dense, orange brown	
115	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-5

Date	4-19-05	**Sheet**	2 of 5
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	Martini Drilling	**Type of Rig**	CME-75
Hole Diameter	8"	**Drive Weight**	140
Drop	30"		
Elevation Top of Hole	145'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
115	30			7	4 8 12			SM	@30': Silty Sand (SM), fine grained sand, very moist, medium dense, micaceous, orange brown	
110	35			8	4 6 8			SM	@35': Silty Sand (SM), fine grained sand, very moist, orange brown	
105	40			9	8 19 37			ML	@40': Sandy Silt (ML), fine grained sand, micaceous, very stiff, moist, orange brown	
100	45			10	3 5 8			ML	@45': Clayey Silt (ML), interbedded fine grained sand, micaceous, medium stiff, moist, orange brown	
95	50			11	9 16 15			SM	@50': Silty Sand (SM), fine grained sand, moist, micaceous, dense	
90	55			12	6 13 15			SP	@55': Sand (SP), fine grained sand, some silt, moist, dense, orange brown	
85	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
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RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-5

Date	4-19-05	**Project No.**	011331-011-
Project	Platinum Triangle	**Type of Rig**	CME-75
Drilling Co.	Martini Drilling		
Hole Diameter	8"	**Drive Weight**	140
Drop	30"		
Elevation Top of Hole	145'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
85	60		13	7 25 47			SM	@60': Silty Sand (SM), fine to coarse grained sand, trace of fine gravel, moist, very dense, orange brown	
80	65		14	12 25 20			SP	@65': Gravelley Sand (SP), fine to coarse grained sand, fine to coarse gravel, very dense, orange brown	
75	70		15	8 15 17			CL	@70': Silty Clay (CL), trace of fine slaty gravel, porous, stiff, moist, dark reddish brown to orange brown	
70	75		16	3 5 7			CL	@75': Silty Clay (CL), same as above @77': encountered gravel	
65	80		17	20 50/6"			SP	@80': Gravelley Sand (SP), fine to coarse grained sand, some silt, fine to coarse slaty gravel, very dense, wet, reddish brown @81.5': encountered groundwater added bentonite mud to augers	
60	85		18	35 23 29			SP	@85': Gravelley Sand (SP), fine to coarse grained sand, fine to coarse gravel, wet, very dense, orange brown	
55	90								

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG BH-5

Date: 4-19-05
Project: Platinum Triangle
Project No.: 011331-011-
Drilling Co.: Martini Drilling
Type of Rig: CME-75
Hole Diameter: 8"
Drive Weight: 140
Drop: 30"
Elevation Top of Hole: 145'
Location: Anaheim, California

Logged By: JAR
Sampled By: JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
55	90			19	18 16 13			SP	@90': Gravelley Sand (SP), coarse grained sand, fine gravel, wet, dense, orange brown	
50	95			20	3 3 5			CL	@95': Silty Clay (CL), wet, loose, mottled orange brown	
45	100			21	9 23 25			CL	@100': Silty Clay (CL), some very fine grained sand, very stiff, wet, orange brown	
40	105			22	3 5 5			CL	@105': Silty Clay (CL), loose, moist, mottled orange brown	
35	110			23	3 6 14			CL	@110':" Silty Clay (CL), trace of fine grained sand, medium stiff, moist, light greyish brown	
30	115			24	6 23 29			SM	@116" Silty Sand (SM), fine to coarse grained sand, moist, dense, brown	
					18				@120': Silty Sand (SM), fine grained sand, wet, dense, light yellow brown	
25	120									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-5

Date 4-19-05 | Sheet 5 of 5
Project Platinum Triangle | Project No. 011331-011-
Drilling Co. Martini Drilling | Type of Rig CME-75
Hole Diameter 8" | Drive Weight 140 | Drop 30"
Elevation Top of Hole 145' | Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
25	120			25	40 33			SM	Total depth: 121.5' Encountered groundwater @ 81.5' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
20	125									
15	130									
10	135									
5	140									
0	145									
-5	150									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-6

Date 4-20-05
Sheet 1 of 4
Project Platinum Triangle
Project No. 011331-011-
Drilling Co. Martini Drilling
Type of Rig CME-75
Hole Diameter 6"
Drive Weight 140
Drop 30"
Elevation Top of Hole 147'
Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@0': 3" Asphalt concrete over Gravelley Sand (SP) base @.7': Fill Sand (SP), fine to coarse grained sand and gravel, some silt and asphalt debris, cobbles to >4", moist, orange brown @1.5': Alluvium (Qal) Sand (SP), fine to coarse grained sand, fine rounded gravel, trace silt, moist, medium dense, micaceous, orange grey	
145										
	5			1	8 9 13			SP	@5': Sand (SP), fine to coarse grained sand, moist, micaceous, medium dense, orange grey	
140										
	10			2	3 5 10			SP	@10': Sand (SP), medium to coarse grained sand, dry, medium dense, light yellow brown	
135										
	15			3	4 6 14			SP-SM	@15': Sand with Silt (SP/SM), fine to coarse grained sand, micaceous, dry, light yellow brown	
130										
	20			4	6 10 12			SP	@20': Sand (SP), fine to coarse grained sand, moist, micaceous, medium dense, orange grey	
125										
	25			5	8 19 21			SP-SM	@25': Sand with Silt (SP/SM), fine to coarse grained sand, micaceous, moist, dense, medium brown	
120				6				SP-SM		
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-6

Date 4-20-05
Project Platinum Triangle
Project No. 011331-011-
Drilling Co. Martini Drilling
Type of Rig CME-75
Hole Diameter 6"
Drive Weight 140
Drop 30"
Elevation Top of Hole 147'
Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			7	6 7 10			SP	@30': Sand (SP), fine to coarse grained sand, some silt, moist, medium dense, light brown	
115										
	35			8	9 27 45			SM	@35': Silty Sand (SM), fine grained sand, micaceous, moist, medium stiff, brown	
110										
	40			9	4 6 7			ML	@40': Sandy Silt (ML), very fine grained sand, micaceous, moist, medium stiff, brown	
105										
	45			10	5 9 11			ML	@45': Sandy Silt (ML), very fine grained sand and thinly interbedded clay (CL), moist, medium stiff, light brown to olive brown	
100										
	50			11	2 3 5			ML	@50': Sandy Silt (ML) to Silty Sand (SM), very fine grained sand, micaceous, moist, loose; grades to Silty Sand (SM), fine grained sand and fine gravel, moist, brown to dark olive brown	
95										
	55			12	14 34 44			ML/SM	@55': Silt (ML), trace of fine grained sand, trace clay, well indurated, very stiff, moist, dark olive black grades to Sand (SP), medium to coarse grained sand, some silt, very dense, light yellow brown	
90										
	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-6

Date	4-20-05	**Sheet**	3 of 4
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	Martini Drilling	**Type of Rig**	CME-75
Hole Diameter	6"	**Drive Weight**	140
Drop	30"		
Elevation Top of Hole	147'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			13	2 5 15			ML	@60': Sandy Silt (ML), very fine grained sand, trace of clay, moist, medium stiff, dark brown grades to Silty Sand (SM), fine to medium grained sand, dry, light yellow brown	
85										
	65			14	20 46 50			SM	@65': Sand (SP), fine to coarse grained sand, fine gravel, micaceous, moist, very dense, light yellow brown	
80										
	70			15	12 25 35			SP	@70': Sand (SP), same as above	
75										
	75			16	13 29 47			SP	@75': Sand (SP), medium to coarse grained sand, dry, very dense, light yellow brown	
70										
	80			17	11 50			CL	@80': Silty Clay (CL), trace of fine grained sand, fine gravel, very moist, stiff, dark reddish brown grades to Gravelley Sand (SP), medium to coarse grained sand, fine slaty gravel, moist, well indurated, very dense @81': Hard drilling, added bentonite mud to augers @82.5': encountered groundwater	
65										
	85			18	41 50			GP	@85': Gravelley Sand (SP), coarse grained sand, some silt, fine to coarse gravel to 3" in size, very dense, wet	
60										
	90									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
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- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG BH-6

Date 4-20-05

Project Platinum Triangle

Project No. 011331-011-

Drilling Co. Martini Drilling

Type of Rig CME-75

Hole Diameter 6"

Drive Weight 140

Drop 30"

Elevation Top of Hole 147'

Location Anaheim, California

Logged By JAR

Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			19	42 29 25			SP	@90': Sand (SP), coarse grained sand and coarse gravel, wet, some silt, very dense, very hard, reddish brown @91.5': grades to fine Sand with Clay (SC)	
55										
	95			20	8 20 25			SC	@95': Silty Sand (SM) to Clayey Sand (SC), fine grained sand, some coarse grained sand and gravel, wet, dense grades to Sandy Silt (ML), fine grained sand, wet	
50										
	100			21	3 4 6			CL	@100': Silty Clay (CL), fine grained sand, wet, loose, dark reddish brown	
45				22	17 33 30			SM	@102': Silty Sand to Clayey Sand (SM/SC), fine grained sand, trace of fine gravel,wet, very dense, dark reddish brown	
	105								Total depth: 103.5' Encountered groundwater @ 82.5' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
40										
	110									
35										
	115									
30										
	120									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-7

Date 4-20-05 **Sheet** 1 **of** 5
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. Martini Drilling **Type of Rig** CME-75
Hole Diameter 6" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 146' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
146	0							@0': 3" Asphalt concrete over Gravelley Sand (SP) base @.7'-2': Fill Sand (SP), fine to coarse grained sand and gravel, some silt and asphalt debris, moist, orange brown @2': Alluvium (Qal) Clayey Silt (ML) to Silty Clay (CL), trace of fine grained sand, micaceous, thinly interbedded, olice brown grades to Silty Sand (SM), fine grained sand, moist, medium dense, brown	
145			1				ML-CL		
140	5		2	2 8 7			CL		
								@10': Sand (SP), fine to coarse grined sand, some silt, moist, light yellow brown	
135	10		3	5 7 12			SP		
			4				SP		
130	15		5	3 6 9			SP	@15': Sand (SP), same as above	
125	20		6	7 16 23			SP	@20': Sand (SP), medium to ocarse grained sand, micaceous, moist, medium dense, light yellow brown	
120	25		7	5 9 10			SP-SM	@25': Sand with Silt (SP/SM), fine to coarse grained sand, slightly moist, medium dense, yellow brown	
	30								

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
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RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-7

Date 4-20-05 | Sheet 2 of 5
Project Platinum Triangle | Project No. 011331-011-
Drilling Co. Martini Drilling | Type of Rig CME-75
Hole Diameter 6" | Drive Weight 140 | Drop 30"
Elevation Top of Hole 146' | Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
115	30			8	5 11 16			SM	@30': Silty Sand (SM), fine to coarse grained sand, micaceous, trace clay, wet, medium dense, brown	
110	35			9	6 7 12			SP-SM	@35': Sand with Silt (SP/SM), fine grained sand, micaceous, medium dense, moist, light yellow brown	
105	40			10	14 25 36			SP	@40': Sand (SP), fine to coarse grained sand, micaceous, trace of silt, moist, dense, light yellow brown	
100	45			11	9 11 12			SM	@45': SIlty Sand (SM), fine to medium grained sand, micaeous, moist, medium dense, light brown to moderately oxidized orange brown	
95	50			12	7 9 9			CL	@50': Silty Clay (CL), trace of fine grained sand, micaceous, moist, medium stiff, olive brown t orange brown to dark reddish orange	
90	55			13	3 2 4			ML	@55': Clayey Silt (ML), trace of fine grained sand, micaeous, wet, loose, dark olive brown	
	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-7

Date	4-20-05	**Sheet**	3 **of** 5
Project	Platinum Triangle	**Project No.**	011331-011-
Drilling Co.	Martini Drilling	**Type of Rig**	CME-75
Hole Diameter	6"	**Drive Weight**	140 — **Drop** 30"
Elevation Top of Hole	146'	**Location**	Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
85	60	14	13 25 50			SP	@60': Sand (SP), fine to medium grained sand, some silt, moist, dense, light yellow brown	
80	65	15	5 8 8			ML	@65': Sandy Silt (ML), fine to coarse grained sand, fine gravel, trace clay, wet, reddish brown grades to Gravelley Sand (SP), fine to coarse grained sand and gravel, some silt	
75	70	16	34 50			SC	@70-71': Clayey Gravel (SC), coarse gravel @71': Sandy Gravel (GP/SP), fine to coarese grained sand, some silt, fine to coarse gravel, moist, dark reddish brown to orange brown	
70	75	17	5 8 9			CL	@75': Sandy Clay (CL), fine grained sand, fine to coarse gravel, very moist, medium stiff, light reddish brown	
65	80	18	34 50/4"			SP	@80': Gravelley Sand (SP), coarse grained sand, some silt, fine to coarse gravel, very dense, orange brown	
60	85	19	6 34 29			SP	same as above, wet	
	90							

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-7

Date 4-20-05
Project Platinum Triangle
Project No. 011331-011-
Drilling Co. Martini Drilling
Type of Rig CME-75
Hole Diameter 6"
Drive Weight 140
Drop 30"
Elevation Top of Hole 146'
Location Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90								@90': no recovery	
55				20	23 50/5"			GP		
	95								@95': Silty Sand (SM), fine grained sand, medium dense, wet grades to Gravelley Clay (CL), coarse gravel, wet, stiff	
50				21	1 8 11			SP-SC		
	100								@100': Silty Sand (SM), fine to ocarse grained sand, fine gravel, wet, very dense, dark brown	
45				22	8 29 26			SM		
	105								@106': Silty Clay (CL), trace of fine snad, wet, medium stiff, reddish brown	
40				23	5 8 7			CL		
	110								@110': Gravelley Sand (SP), fine to coarse grained sand, fine to coarse grained gravel, wet, dense, dark reddish brown	
35				24	9 17 16			SP		
	115								@115': Silty Clay (CL), some fine grained sand and gravel, very moist, stiff, dark reddish brown	
30				25	4 4 6			CL		
	120									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG BH-7

Date 4-20-05 **Sheet** 5 **of** 5
Project Platinum Triangle **Project No.** 011331-011-
Drilling Co. Martini Drilling **Type of Rig** CME-75
Hole Diameter 6" **Drive Weight** 140 **Drop** 30"
Elevation Top of Hole 146' **Location** Anaheim, California

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
25	120			26	8 31 39			SP	@120': Sand (Sp), fine to medium grained sand, some fine gravel, wet, very dense grades to Silty Clay (CL), very thinly interbedded, wet, stiff	
20	125			27	21 15 23			CL	@125': Clay (CL), trace of fine sand, very moist, very stiff, medium plasticity, olive brown to orange brown	
15	130			28	5 10 13			CL	@130': Sandy Clay 9CL), fine grained sand, stiff, moist, light grey to orange grey	
10	135								Total depth: 131.5' Encountered groundwater @ 82' below ground surface Boring backfilled with soil cuttings and patched with asphalt upon completion	
5	140									
0	145									
	150									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

011331-011

PRESENTATION

OF

CONE PENETRATION TEST DATA

Project:

Platinum Triangle
Anaheim, CA
February 28, 2005

Prepared for:

Mr. Chris Livesey
Leighton & Associates
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Office (800) 253-4567 / Fax (949) 250-1114

Prepared by:

KTE

KEHOE TESTING & ENGINEERING

15571 Industry Lane
Huntington Beach, CA 92649-1534
Office (714) 901-7270 / Fax (714) 901-7289

TABLE OF CONTENTS

PRESENTATION

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the Platinum Triangle project located at in Anaheim, California. The work was performed by Kehoe Testing & Engineering (KTE) on February 28, 2005. The scope of work was performed as directed by Leighton & Associates personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at five locations to determine the soil lithology. The groundwater measurements were taken in the open CPT hole approximately 10 minutes after completion of CPT. The following **TABLE 2.1** summarizes the CPT soundings performed:

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	69	Refusal, hole opened to 68.4 ft (dry)
CPT-2	70	Hole opened to 69.7 ft (dry)
CPT-3	72	Hole opened to 68.7 ft (dry)
CPT-4	70	Hole opened to 69.3 ft (dry)
CPT-5	72	Hole opened to 65.0 ft (dry)

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone and recorded the following parameters at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed
- Pore Pressure Dissipation (at selected depths)

The above parameters were recorded and viewed in real time using a portable computer and stored on a diskette for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. Penetration depths are referenced to ground surface. The soil classification on the CPT plots is derived from the CPT Classification Chart (Robertson, 1986) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

Output from the interpretation program CPTINT provides averaged CPT data over one-foot intervals. The CPTINT output includes Soil Classification Zones, SPT N Values and Undrained Shear Strength (Su). A summary of the equations used for the tabulated parameters is provided in the CPTINT Correlation Table in the Appendix.

The interpretation of soils encountered on this project was carried out using correlations developed by Robertson et al, 1986. It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgment and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

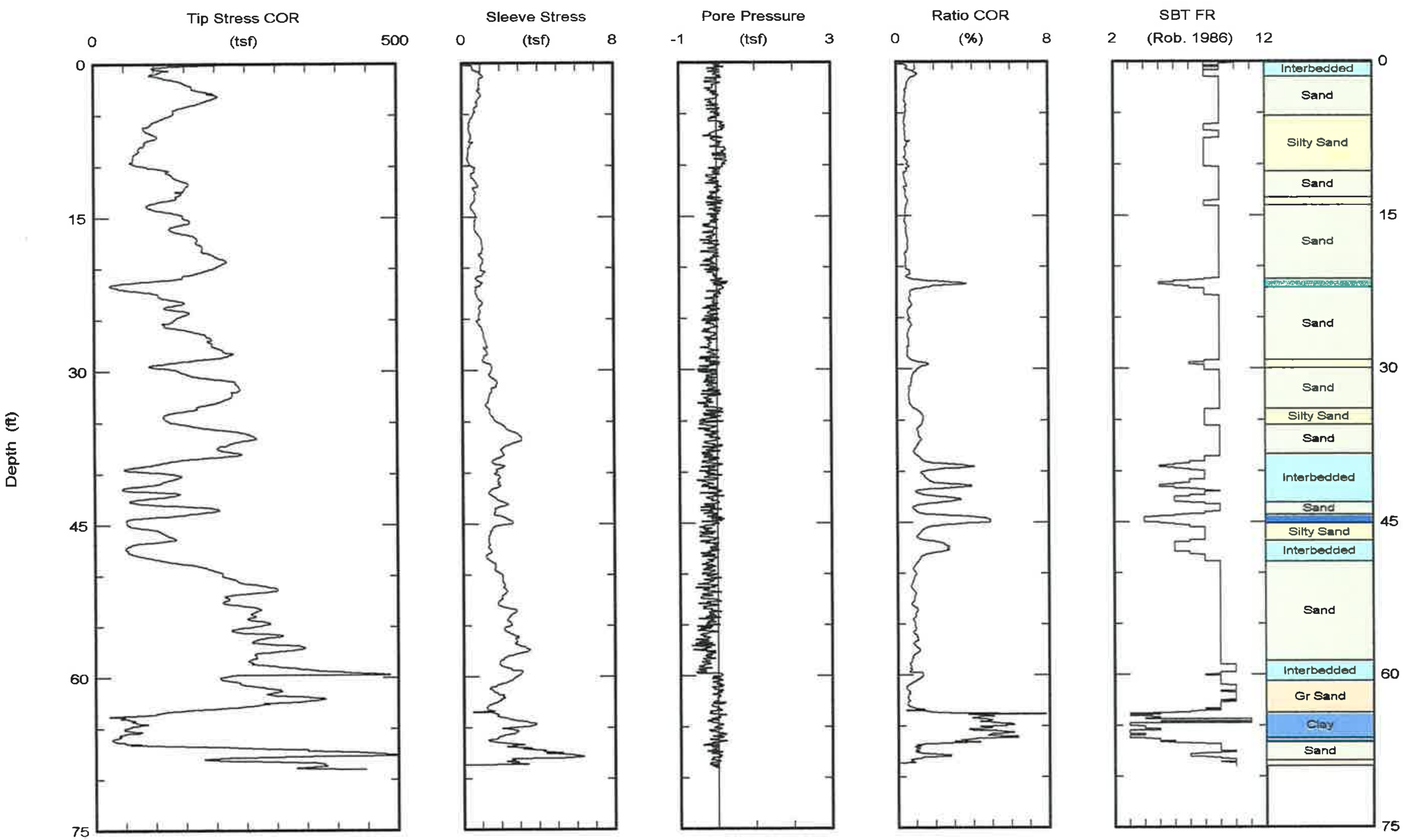
KEHOE TESTING & ENGINEERING

Steven P. Kehoe, P.E.
President

03/02/05-ls

APPENDIX

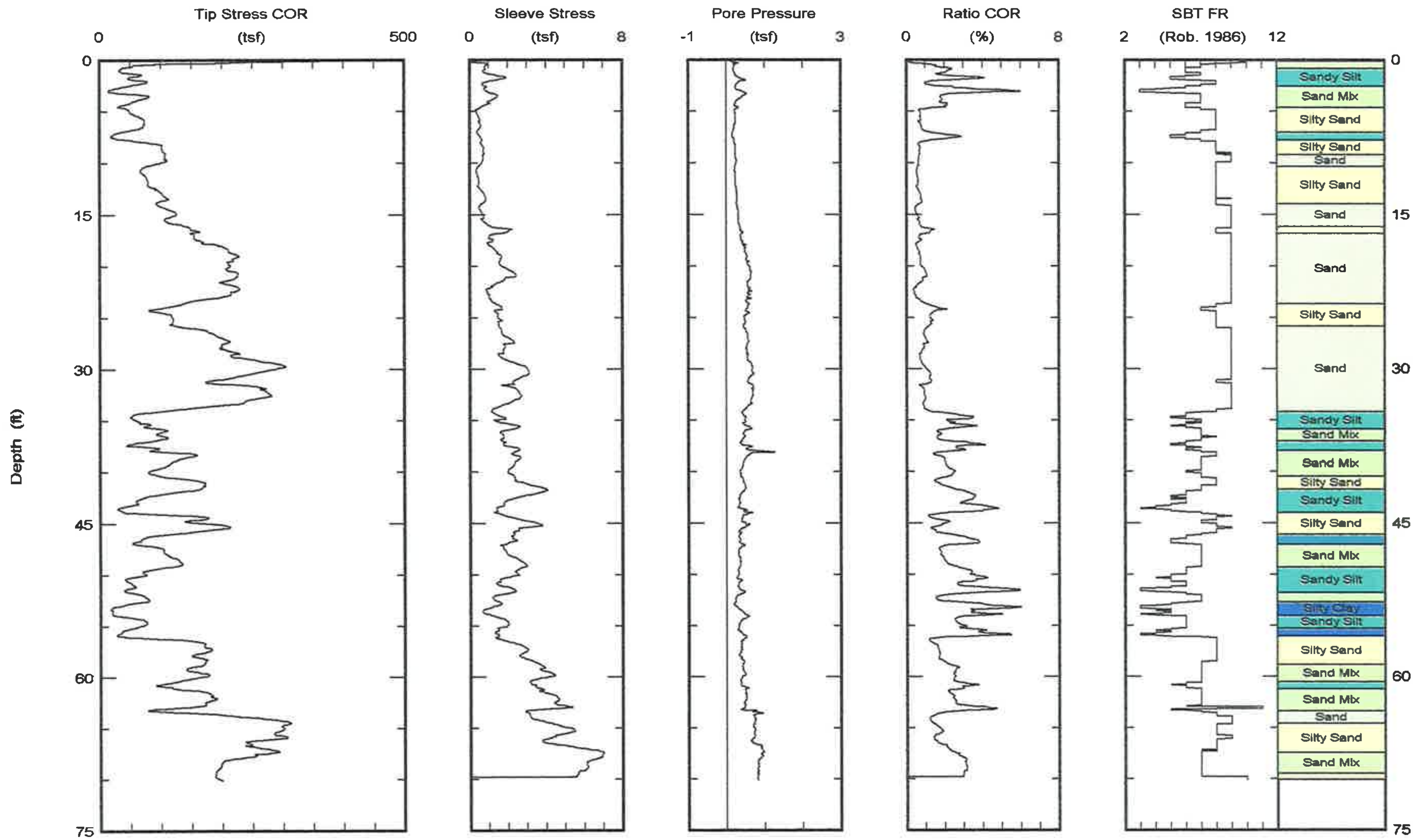
Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 skehoe@msn.com	CPT Data 30 ton rig	Date: 28/Feb/2005 Test ID: CPT-1 Project: Anaheim
	Client: Leighton Job Site: Platinum Triangle	



Maximum depth: 69.01 (ft)

Test ID: CPT-1
File: Z28F0501C.ECP

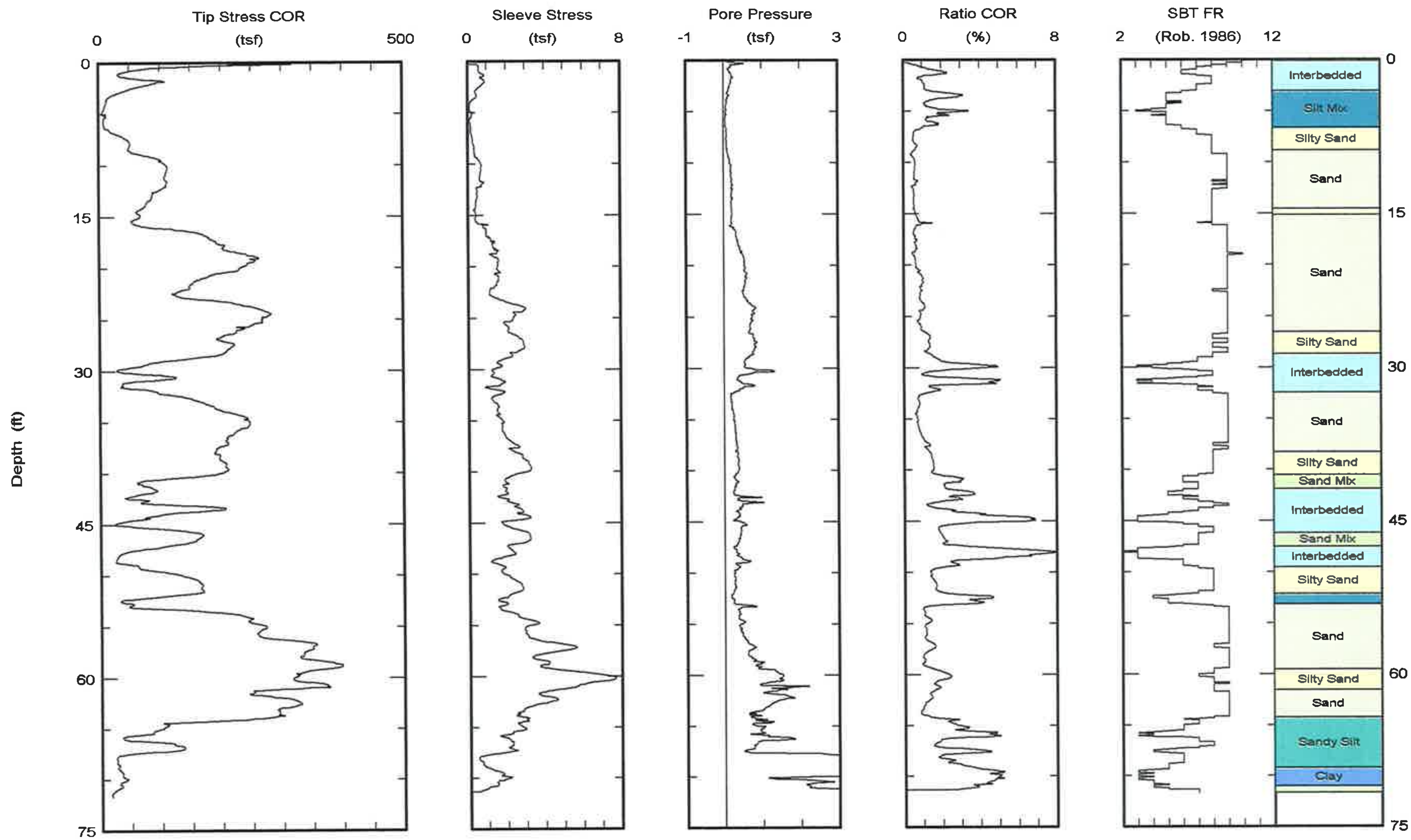
Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 skehoe@msn.com	CPT Data 30 ton rig	Date: 28/Feb/2005 Test ID: CPT-2 Project: Anaheim
	Client: Leighton Job Site: Platinum Triangle	



Maximum depth: 70.11 (ft)

Test ID: CPT-2
File: Z28F0505C.ECP

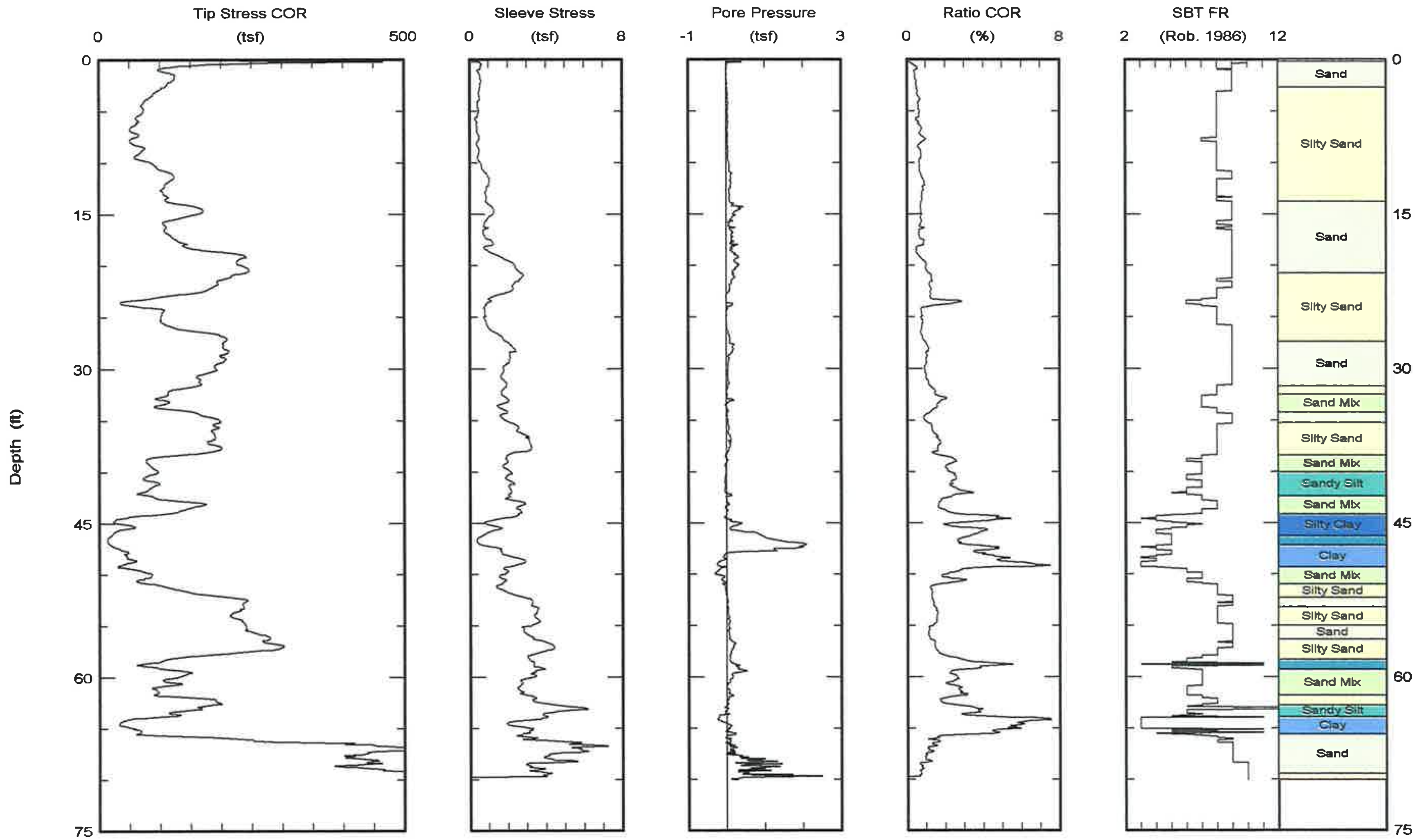
Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 skehoe@msn.com	CPT Data 30 ton rig	Date: 28/Feb/2005 Test ID: CPT-3 Project: Anaheim
	Client: Leighton Job Site: Platinum Triangle	



Maximum depth: 71.74 (ft)

Test ID: CPT-3
File: Z28F0504C ECP

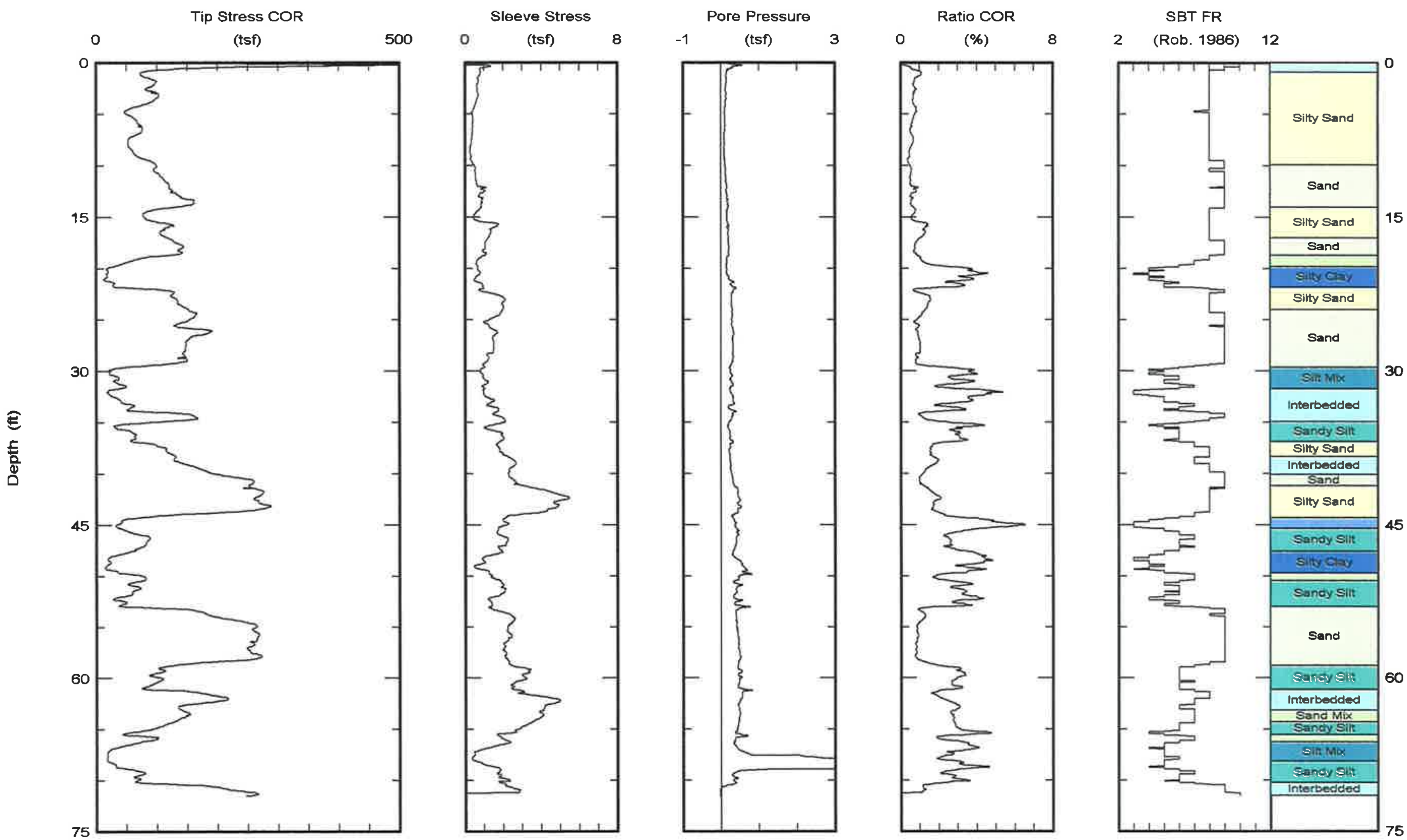
Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 skehoe@msn.com	CPT Data 30 ton rig	Date: 28/Feb/2005 Test ID: CPT-4 Project: Anaheim
	Client: Leighton Job Site: Platinum Triangle	



Maximum depth: 70.06 (ft)

Test ID: CPT-4
File: Z28F0503C ECP

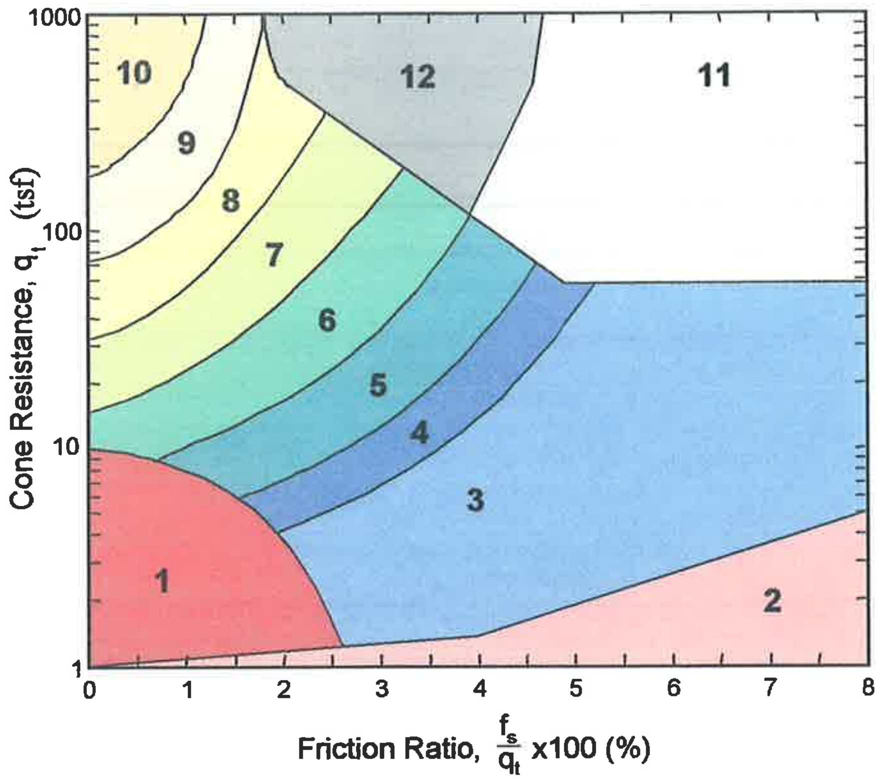
Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 skehoe@msn.com	CPT Data 30 ton rig	Date: 28/Feb/2005 Test ID: CPT-5 Project: Anaheim
	Client: Leighton Job Site: Platinum Triangle	



Maximum depth: 71.54 (ft)

Test ID: CPT-5
File: Z28F0506C ECP

CPT Soil Behavior Type Legend
(Robertson et al. 1986)



Zone	Soil Behavior Type
1	Sensitive, Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay (Silt Mix)
6	Sandy Silt to Clayey Silt
7	Silty Sand to Sandy Silt (Sand Mix)
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained*
12	Sand to Clayey Sand*

*Overconsolidated or cemented

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Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	110.008	0.522	0.475	9	21	32	UNDFD
1.500	121.864	0.997	0.818	8	29	44	UNDFD
2.500	170.129	0.910	0.535	9	33	50	UNDFD
3.500	189.750	0.893	0.471	9	36	54	UNDFD
4.500	139.550	0.708	0.507	9	27	41	UNDFD
5.500	109.467	0.498	0.455	9	21	32	UNDFD
6.500	89.075	0.412	0.462	8	21	32	UNDFD
7.500	93.091	0.478	0.514	8	22	33	UNDFD
8.500	73.217	0.370	0.505	8	18	27	UNDFD
9.500	66.150	0.349	0.528	8	16	24	UNDFD
10.500	115.558	0.613	0.530	9	22	30	UNDFD
11.500	147.483	0.703	0.476	9	28	36	UNDFD
12.500	143.983	0.682	0.474	9	28	34	UNDFD
13.500	107.775	0.617	0.572	9	21	24	UNDFD
14.500	123.354	0.618	0.501	9	24	26	UNDFD
15.500	148.677	0.704	0.473	9	28	29	UNDFD
16.500	143.662	0.776	0.540	9	28	27	UNDFD
17.500	173.046	1.049	0.606	9	33	31	UNDFD
18.500	188.908	1.023	0.542	9	36	32	UNDFD
19.500	211.231	1.062	0.503	9	40	34	UNDFD
20.500	166.507	1.019	0.612	9	32	26	UNDFD
21.500	57.500	0.885	1.538	7	18	14	UNDFD
22.500	93.769	0.762	0.813	8	22	17	UNDFD
23.500	132.614	0.969	0.730	9	25	19	UNDFD
24.500	146.169	0.913	0.625	9	28	20	UNDFD
25.500	127.207	0.911	0.716	9	24	17	UNDFD
26.500	180.138	1.126	0.625	9	35	24	UNDFD
27.500	197.329	1.246	0.632	9	38	25	UNDFD
28.500	212.323	1.240	0.584	9	41	26	UNDFD
29.500	120.071	1.397	1.164	8	29	18	UNDFD
30.500	174.557	1.546	0.886	9	33	20	UNDFD
31.500	237.246	1.737	0.732	9	45	27	UNDFD
32.500	223.271	1.453	0.651	9	43	25	UNDFD
33.500	174.057	1.339	0.769	9	33	19	UNDFD
34.500	119.462	1.583	1.325	8	29	16	UNDFD
35.500	184.808	2.232	1.207	8	44	24	UNDFD
36.500	254.854	3.020	1.185	9	49	26	UNDFD
37.500	215.900	2.272	1.052	9	41	21	UNDFD
38.500	177.400	1.906	1.074	9	34	17	UNDFD
39.500	80.414	1.887	2.347	7	26	13	UNDFD
40.500	127.071	1.881	1.481	8	30	15	UNDFD
41.499	80.877	1.678	2.075	7	26	13	UNDFD
42.499	90.179	1.799	1.995	7	29	15	UNDFD
43.499	177.077	1.906	1.076	9	34	17	UNDFD
44.499	77.643	2.259	2.910	6	30	15	UNDFD
45.499	91.379	1.677	1.835	7	29	15	UNDFD
46.499	108.007	1.397	1.294	8	26	13	UNDFD
47.499	55.715	1.428	2.564	6	21	11	UNDFD
48.499	111.593	1.402	1.256	8	27	14	UNDFD
49.499	194.586	1.789	0.919	9	37	19	UNDFD

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Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
50.499	237.043	2.122	0.895	9	45	23	UNDFD
51.499	274.743	2.234	0.813	9	53	27	UNDFD
52.499	220.579	1.968	0.892	9	42	21	UNDFD
53.499	264.529	2.531	0.957	9	51	26	UNDFD
54.499	270.220	2.463	0.912	9	52	26	UNDFD
55.499	257.471	2.354	0.914	9	49	25	UNDFD
56.499	287.843	2.836	0.985	9	55	28	UNDFD
57.499	298.313	3.107	1.041	9	57	29	UNDFD
58.499	268.514	2.040	0.760	9	51	26	UNDFD
59.499	356.057	2.774	0.779	10	57	29	UNDFD
60.499	233.521	2.313	0.990	9	45	23	UNDFD
61.499	305.436	1.715	0.561	10	49	25	UNDFD
62.499	305.980	1.730	0.565	10	49	25	UNDFD
63.499	106.979	1.514	1.415	8	26	13	UNDFD
64.499	62.873	3.127	4.973	4	40	20	3.923
65.499	49.629	2.391	4.817	4	32	16	3.036
66.499	101.029	2.160	2.138	7	32	16	UNDFD
67.499	373.829	4.836	1.294	9	72	36	UNDFD
68.499	320.414	1.827	0.570	10	51	26	UNDFD
69.499	447.000	0.000	0.000	10	UNDFD	UNDFD	UNDFD

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Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	102.500	0.638	0.623	8	25	38	UNDFD
1.500	50.540	1.282	2.537	6	19	29	UNDFD
2.500	49.187	0.828	1.683	7	16	24	UNDFD
3.500	59.836	1.274	2.130	7	19	29	UNDFD
4.500	44.547	0.705	1.582	7	14	21	UNDFD
5.500	63.027	0.467	0.740	8	15	23	UNDFD
6.500	63.600	0.520	0.818	8	15	23	UNDFD
7.500	35.760	0.561	1.570	7	11	17	UNDFD
8.500	100.921	0.707	0.701	8	24	36	UNDFD
9.500	107.414	0.721	0.672	8	26	39	UNDFD
10.500	75.320	0.451	0.598	8	18	25	UNDFD
11.500	77.586	0.473	0.609	8	19	25	UNDFD
12.500	90.957	0.579	0.636	8	22	27	UNDFD
13.500	103.047	0.799	0.776	8	25	29	UNDFD
14.500	113.479	0.586	0.516	9	22	24	UNDFD
15.500	115.379	0.758	0.657	9	22	23	UNDFD
16.500	150.480	1.589	1.056	9	29	29	UNDFD
17.500	166.973	1.077	0.645	9	32	30	UNDFD
18.500	211.873	1.358	0.641	9	41	37	UNDFD
19.500	216.900	1.621	0.747	9	42	36	UNDFD
20.500	218.164	2.171	0.995	9	42	35	UNDFD
21.500	213.173	1.634	0.766	9	41	33	UNDFD
22.500	218.409	0.991	0.454	9	42	32	UNDFD
23.500	146.191	1.301	0.890	9	28	21	UNDFD
24.500	102.373	1.506	1.471	8	25	18	UNDFD
25.500	123.425	1.558	1.262	8	30	21	UNDFD
26.500	182.191	1.755	0.963	9	35	24	UNDFD
27.500	204.455	2.074	1.014	9	39	26	UNDFD
28.500	218.992	1.693	0.773	9	42	27	UNDFD
29.500	285.600	2.527	0.885	9	55	34	UNDFD
30.500	240.800	2.934	1.218	9	46	28	UNDFD
31.500	221.927	2.245	1.012	9	43	26	UNDFD
32.500	269.208	2.603	0.967	9	52	30	UNDFD
33.500	188.009	1.743	0.927	9	36	20	UNDFD
34.500	63.455	1.476	2.327	6	24	13	UNDFD
35.500	83.100	2.073	2.495	6	32	17	UNDFD
36.500	99.745	1.709	1.713	7	32	17	UNDFD
37.500	71.573	2.132	2.979	6	27	14	UNDFD
38.500	135.933	2.464	1.813	7	43	22	UNDFD
39.500	101.209	2.217	2.191	7	32	16	UNDFD
40.500	118.845	2.297	1.933	7	38	19	UNDFD
41.499	161.773	3.531	2.183	7	52	26	UNDFD
42.499	77.100	2.625	3.405	6	30	15	UNDFD
43.499	42.664	1.565	3.667	5	20	10	2.664
44.499	144.225	2.351	1.630	8	35	18	UNDFD
45.499	182.536	2.903	1.590	8	44	22	UNDFD
46.499	73.373	2.270	3.094	6	28	14	UNDFD
47.499	96.317	1.823	1.893	7	31	16	UNDFD
48.499	126.164	2.531	2.006	7	40	20	UNDFD
49.499	89.455	2.627	2.937	6	34	17	UNDFD

--| INPUT FILE: C:\Temp\CPT-2.CSV |-----------------------------------

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
50.499	50.509	1.761	3.486	5	24	12	3.159
51.499	52.064	2.053	3.943	5	25	13	3.258
52.499	67.000	1.390	2.075	7	21	11	UNDFD
53.499	21.825	0.948	4.345	3	21	11	1.234
54.499	68.158	1.832	2.689	6	26	13	UNDFD
55.499	39.223	1.487	3.791	5	19	10	2.386
56.499	139.686	2.011	1.439	8	33	17	UNDFD
57.499	168.386	2.844	1.689	8	40	20	UNDFD
58.499	167.807	3.341	1.991	7	54	27	UNDFD
59.499	159.371	4.086	2.564	7	51	26	UNDFD
60.499	120.686	3.380	2.801	6	46	23	UNDFD
61.499	162.531	3.988	2.454	7	52	26	UNDFD
62.499	172.780	4.699	2.720	7	55	28	UNDFD
63.499	159.871	3.324	2.079	7	51	26	UNDFD
64.499	298.814	4.176	1.398	9	57	29	UNDFD
65.499	295.471	4.954	1.677	8	71	36	UNDFD
66.499	252.914	4.521	1.788	8	61	31	UNDFD
67.499	263.464	6.788	2.576	7	84	42	UNDFD
68.499	199.943	6.221	3.112	7	64	32	UNDFD
69.499	190.336	4.530	2.380	7	61	31	UNDFD
70.499	198.650	0.000	0.000	10	UNDFD	UNDFD	UNDFD

--| INPUT FILE: C:\Temp\CPT-3.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	107.175	0.435	0.406	9	21	32	UNDFD
1.500	63.757	0.785	1.231	7	20	30	UNDFD
2.500	56.300	0.626	1.111	7	18	27	UNDFD
3.500	16.800	0.385	2.294	5	8	12	1.106
4.500	9.329	0.136	1.455	5	4	6	0.604
5.500	9.592	0.175	1.828	5	5	8	0.617
6.500	16.677	0.177	1.061	6	6	9	UNDFD
7.500	45.862	0.252	0.548	8	11	17	UNDFD
8.500	53.542	0.344	0.643	8	13	20	UNDFD
9.500	97.231	0.521	0.536	8	23	35	UNDFD
10.500	111.631	0.702	0.628	9	21	30	UNDFD
11.500	109.931	0.692	0.630	9	21	28	UNDFD
12.500	97.146	0.548	0.564	8	23	28	UNDFD
13.500	81.550	0.471	0.577	8	20	23	UNDFD
14.500	66.654	0.404	0.606	8	16	17	UNDFD
15.500	61.550	0.514	0.836	8	15	16	UNDFD
16.500	148.307	0.920	0.620	9	28	28	UNDFD
17.500	192.964	1.228	0.636	9	37	35	UNDFD
18.500	228.267	1.390	0.609	9	44	40	UNDFD
19.500	246.929	1.564	0.633	9	47	41	UNDFD
20.500	202.493	1.551	0.766	9	39	33	UNDFD
21.500	154.243	1.544	1.001	9	30	24	UNDFD
22.500	133.057	1.204	0.905	9	25	19	UNDFD
23.500	222.813	2.154	0.967	9	43	32	UNDFD
24.500	273.800	2.631	0.961	9	52	38	UNDFD
25.500	251.593	2.104	0.836	9	48	34	UNDFD
26.500	210.073	2.338	1.113	9	40	27	UNDFD
27.500	213.960	2.905	1.358	8	51	34	UNDFD
28.500	179.350	2.359	1.315	8	43	28	UNDFD
29.500	63.053	1.600	2.538	6	24	15	UNDFD
30.500	87.393	1.357	1.553	7	28	17	UNDFD
31.500	50.786	1.521	2.994	6	19	11	UNDFD
32.500	131.200	1.515	1.154	8	31	18	UNDFD
33.500	186.427	1.484	0.796	9	36	21	UNDFD
34.500	234.193	1.606	0.686	9	45	25	UNDFD
35.500	236.977	1.789	0.755	9	45	25	UNDFD
36.500	212.107	1.960	0.924	9	41	22	UNDFD
37.500	197.887	2.388	1.207	9	38	20	UNDFD
38.500	197.725	2.804	1.418	8	47	24	UNDFD
39.500	207.253	3.208	1.548	8	50	25	UNDFD
40.500	123.208	2.248	1.825	7	39	20	UNDFD
41.499	80.714	1.929	2.390	6	31	16	UNDFD
42.499	62.862	1.885	2.999	6	24	12	UNDFD
43.499	159.586	2.629	1.648	8	38	19	UNDFD
44.499	60.769	2.615	4.304	5	29	15	3.867
45.499	104.915	2.302	2.194	7	33	17	UNDFD
46.499	152.862	3.130	2.048	7	49	25	UNDFD
47.499	66.109	2.190	3.313	6	25	13	UNDFD
48.499	33.642	1.598	4.749	3	32	16	2.042
49.499	91.950	1.756	1.910	7	29	15	UNDFD

--| INPUT FILE: C:\Temp\CPT-3.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
50.499	157.391	2.336	1.484	8	38	19	UNDFD
51.499	155.200	2.647	1.705	8	37	19	UNDFD
52.499	51.545	1.836	3.563	5	25	13	3.219
53.499	157.867	1.943	1.231	8	38	19	UNDFD
54.499	251.791	3.097	1.230	9	48	24	UNDFD
55.499	262.891	2.967	1.129	9	50	25	UNDFD
56.499	326.118	3.951	1.211	9	62	31	UNDFD
57.499	338.460	4.687	1.385	9	65	33	UNDFD
58.499	371.309	3.763	1.013	9	71	36	UNDFD
59.499	339.280	5.425	1.599	8	81	41	UNDFD
60.499	347.045	6.828	1.968	8	83	42	UNDFD
61.499	275.036	4.367	1.588	8	66	33	UNDFD
62.499	319.115	4.018	1.259	9	61	31	UNDFD
63.499	290.008	2.695	0.929	9	56	28	UNDFD
64.499	142.054	2.802	1.972	7	45	23	UNDFD
65.499	68.567	2.332	3.401	6	26	13	UNDFD
66.499	105.108	2.153	2.048	7	34	17	UNDFD
67.499	59.550	1.548	2.599	6	23	12	UNDFD
68.499	27.008	0.654	2.422	6	10	5	UNDFD
69.499	35.218	1.595	4.528	4	22	11	2.060
70.499	32.525	1.483	4.561	4	21	11	1.877
71.499	18.567	0.307	1.652	6	7	4	UNDFD

--| INPUT FILE: C:\Temp\CPT-4.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	184.375	0.490	0.266	9	35	53	UNDFD
1.500	117.279	0.511	0.436	9	22	33	UNDFD
2.500	109.292	0.568	0.520	9	21	32	UNDFD
3.500	85.715	0.519	0.606	8	21	32	UNDFD
4.500	72.377	0.452	0.624	8	17	26	UNDFD
5.500	66.283	0.407	0.614	8	16	24	UNDFD
6.500	56.360	0.393	0.697	8	13	20	UNDFD
7.500	57.892	0.468	0.808	8	14	21	UNDFD
8.500	67.809	0.455	0.670	8	16	24	UNDFD
9.500	68.627	0.484	0.705	8	16	24	UNDFD
10.500	99.250	0.678	0.683	8	24	33	UNDFD
11.500	119.100	0.998	0.838	8	29	37	UNDFD
12.500	105.590	0.909	0.861	8	25	30	UNDFD
13.500	113.909	0.892	0.783	8	27	31	UNDFD
14.500	164.190	1.221	0.744	9	31	33	UNDFD
15.500	124.445	0.941	0.756	9	24	25	UNDFD
16.500	110.180	0.770	0.699	8	26	25	UNDFD
17.500	128.809	1.025	0.796	9	25	23	UNDFD
18.500	180.909	1.012	0.559	9	35	31	UNDFD
19.500	231.873	2.004	0.864	9	44	38	UNDFD
20.500	237.900	2.592	1.090	9	46	38	UNDFD
21.500	200.009	2.526	1.263	8	48	38	UNDFD
22.500	157.545	1.966	1.248	8	38	29	UNDFD
23.500	56.800	0.996	1.754	7	18	13	UNDFD
24.500	99.882	0.806	0.807	8	24	17	UNDFD
25.500	106.591	0.858	0.805	8	26	18	UNDFD
26.500	170.591	1.334	0.782	9	33	22	UNDFD
27.500	205.682	2.008	0.976	9	39	26	UNDFD
28.500	206.373	2.225	1.078	9	40	26	UNDFD
29.500	197.318	1.961	0.994	9	38	24	UNDFD
30.500	173.218	1.717	0.991	9	33	20	UNDFD
31.500	153.855	1.865	1.212	8	37	22	UNDFD
32.500	107.618	1.796	1.669	7	34	20	UNDFD
33.500	107.030	1.719	1.606	7	34	19	UNDFD
34.500	171.818	1.790	1.042	9	33	18	UNDFD
35.500	192.727	2.348	1.218	9	37	20	UNDFD
36.500	187.517	2.901	1.547	8	45	24	UNDFD
37.500	191.609	3.196	1.668	8	46	24	UNDFD
38.500	108.927	2.025	1.859	7	35	18	UNDFD
39.500	88.036	1.904	2.162	7	28	14	UNDFD
40.500	82.264	2.037	2.477	6	32	16	UNDFD
41.499	85.464	2.166	2.535	6	33	17	UNDFD
42.499	103.382	2.188	2.117	7	33	17	UNDFD
43.499	148.273	2.674	1.803	7	47	24	UNDFD
44.499	47.182	1.765	3.740	5	23	12	2.961
45.499	41.200	1.225	2.972	6	16	8	UNDFD
46.499	16.655	0.515	3.095	5	8	4	0.918
47.499	33.200	1.320	3.976	4	21	11	2.017
48.499	49.582	2.528	5.099	3	47	24	3.105
49.499	58.945	1.998	3.390	5	28	14	3.725

--| INPUT FILE: C:\Temp\CPT-4.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
50.499	75.709	1.698	2.243	7	24	12	UNDFD
51.499	132.973	1.731	1.302	8	32	16	UNDFD
52.499	227.227	3.050	1.342	8	54	27	UNDFD
53.499	227.383	3.477	1.529	8	54	27	UNDFD
54.499	231.545	3.501	1.512	8	55	28	UNDFD
55.499	251.533	2.911	1.157	9	48	24	UNDFD
56.499	280.780	3.772	1.343	9	54	27	UNDFD
57.499	238.327	3.843	1.612	8	57	29	UNDFD
58.499	95.182	3.235	3.398	6	36	18	UNDFD
59.499	129.264	3.491	2.701	7	41	21	UNDFD
60.499	114.840	2.744	2.389	7	37	19	UNDFD
61.499	99.918	2.779	2.781	6	38	19	UNDFD
62.499	183.282	4.075	2.223	7	59	30	UNDFD
63.499	119.064	4.542	3.815	6	46	23	UNDFD
64.499	41.520	2.560	6.166	3	40	20	2.501
65.499	100.710	3.033	3.012	6	39	20	UNDFD
66.499	391.823	5.283	1.348	9	75	38	UNDFD
67.499	444.579	4.781	1.075	9	85	43	UNDFD
68.499	437.431	3.816	0.872	10	70	35	UNDFD
69.499	552.854	2.632	0.476	10	88	44	UNDFD
70.499	565.300	0.000	0.000	10	UNDFD	UNDFD	UNDFD

--| INPUT FILE: C:\Temp\CPT-5.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	191.367	0.795	0.415	9	37	56	UNDFD
1.500	86.975	0.726	0.835	8	21	32	UNDFD
2.500	90.533	0.664	0.734	8	22	33	UNDFD
3.500	98.050	0.658	0.671	8	23	35	UNDFD
4.500	60.675	0.474	0.781	8	15	23	UNDFD
5.500	64.092	0.419	0.654	8	15	23	UNDFD
6.500	74.223	0.408	0.549	8	18	27	UNDFD
7.500	56.171	0.367	0.654	8	13	20	UNDFD
8.500	59.392	0.300	0.505	8	14	21	UNDFD
9.500	84.585	0.368	0.436	8	20	30	UNDFD
10.500	99.621	0.554	0.556	8	24	33	UNDFD
11.500	114.736	0.606	0.529	9	22	28	UNDFD
12.500	127.993	0.897	0.701	9	25	30	UNDFD
13.500	152.629	0.891	0.584	9	29	33	UNDFD
14.500	88.400	0.639	0.723	8	21	23	UNDFD
15.500	102.486	1.090	1.064	8	25	26	UNDFD
16.500	110.057	1.349	1.226	8	26	25	UNDFD
17.500	133.777	1.108	0.829	9	26	24	UNDFD
18.500	121.750	0.993	0.815	8	29	26	UNDFD
19.500	44.169	0.662	1.498	7	14	12	UNDFD
20.500	18.762	0.710	3.784	4	12	10	1.166
21.500	29.557	0.776	2.627	6	11	9	UNDFD
22.500	123.508	1.443	1.168	8	30	23	UNDFD
23.500	139.536	2.025	1.451	8	33	25	UNDFD
24.500	160.071	1.741	1.088	9	31	22	UNDFD
25.500	143.569	1.222	0.851	9	28	20	UNDFD
26.500	170.893	1.571	0.919	9	33	22	UNDFD
27.500	148.150	1.523	1.028	9	28	18	UNDFD
28.500	145.185	1.302	0.897	9	28	18	UNDFD
29.500	83.314	0.995	1.194	8	20	13	UNDFD
30.500	30.050	0.952	3.169	5	14	9	1.877
31.500	36.150	1.043	2.885	6	14	8	UNDFD
32.500	30.031	1.195	3.981	4	19	11	1.867
33.500	57.886	1.489	2.573	6	22	12	UNDFD
34.500	144.957	1.849	1.276	8	35	19	UNDFD
35.500	45.507	1.442	3.169	5	22	12	2.886
36.500	64.586	1.942	3.007	6	25	13	UNDFD
37.500	109.631	1.778	1.622	7	35	18	UNDFD
38.500	130.550	2.348	1.798	7	42	21	UNDFD
39.500	169.621	2.446	1.442	8	41	21	UNDFD
40.500	238.729	2.481	1.039	9	46	23	UNDFD
41.499	263.114	3.804	1.446	8	63	32	UNDFD
42.499	267.093	5.068	1.897	8	64	32	UNDFD
43.499	243.700	4.336	1.779	8	58	29	UNDFD
44.499	59.664	2.192	3.674	5	29	15	3.793
45.499	48.850	1.801	3.688	5	23	12	3.068
46.499	84.750	2.144	2.530	6	32	16	UNDFD
47.499	59.529	1.809	3.038	6	23	12	UNDFD
48.499	21.936	0.929	4.236	4	14	7	1.261
49.499	35.943	1.021	2.840	6	14	7	UNDFD

--| INPUT FILE: C:\Temp\CPT-5.CSV |

Depth (feet)	Qt(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
50.499	69.250	1.759	2.540	6	27	14	UNDFD
51.499	62.929	1.980	3.146	6	24	12	UNDFD
52.499	40.379	1.356	3.359	5	19	10	2.474
53.499	160.879	1.876	1.166	8	39	20	UNDFD
54.499	241.407	2.452	1.016	9	46	23	UNDFD
55.499	263.529	2.314	0.878	9	50	25	UNDFD
56.499	260.750	2.179	0.836	9	50	25	UNDFD
57.499	259.247	2.098	0.809	9	50	25	UNDFD
58.499	176.593	2.362	1.338	8	42	21	UNDFD
59.499	101.764	3.219	3.163	6	39	20	UNDFD
60.499	95.593	2.708	2.833	6	37	19	UNDFD
61.499	164.900	3.272	1.984	7	53	27	UNDFD
62.499	169.293	4.565	2.697	7	54	27	UNDFD
63.499	146.107	4.025	2.755	7	47	24	UNDFD
64.499	116.714	3.324	2.848	6	45	23	UNDFD
65.499	75.473	2.177	2.884	6	29	15	UNDFD
66.499	54.271	1.796	3.309	5	26	13	3.342
67.499	19.186	0.484	2.524	5	9	5	0.999
68.499	32.864	1.144	3.482	5	16	8	1.907
69.499	71.207	1.883	2.645	6	27	14	UNDFD
70.499	156.543	2.266	1.448	8	37	19	UNDFD
71.499	256.225	1.070	0.418	10	41	21	UNDFD

-------------with NOTES & References at end-------------

Program: CPTINT - CPT Cone Interpretation Program
Version: 5.2
Table File by: Dr. R. G. (DICK) Campanella, P.Eng.
Rev. Dated: April 3, 2002

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
Depth average see NOTE #1	Depth averaged over specified range (see menu)		All	All
Parameter Averaging	Averaged over range specified for depth. If no values exist, your choice is zero's or no value		All	All
Qc, Tip Stress	measured tip force/area	#6,#8	All	All
Qt corrtd for U2 see NOTE #2	Qt = Qc + (1 - a) x U2 and a = tip area ratio Defaults to U2 if given or uses U1 or U3 times Const.	#6,#8	All	All
[Note: Input value from input file is used if defined, not calculated]				
Q (Qt Normalized)	$Q = \frac{Qt - sv}{sv'}$	#9 & 13	All	All
Fs	measured sleeve force/area	#6,#8	All	All
Rf Friction Ratio (if Rf>8, Rf=8)	$Rf = \frac{Fs}{Qt} \times 100\%$	#6,#8	All	All
F (Rf Normalized)	$F = \frac{Fs}{(Qt - sv)} \times 100\%$	#9 & 13	All	All
Gamma Total Unit Weight (Soil + Water) see NOTE #3	Based on Rf or Bq Classif. Zone Zone # — Gamma = kN/m^3 1 Qt<4bar 15.70 1 Qt=4bar 17.30 2 Rf<5% 13.36 2 Rf=5% 11.80 2 Bq Zone 12.58 3 Qt<10bar 18.86 3 Qt=10bar 19.65 4, 5 & 6 Qt<20bar 18.86 4, 5 & 6 Qt=20bar 19.65 7 18.86 8 & 9 19.65 10 20.44 11 & 12 21.22		All	All

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
U Penetration Pore Pressure see NOTE #4	U1,measured on Face of tip U2,measured Behind Tip at shoulder (std location) U3,measured Behind Friction Sleeve		All	All
Water Table	Depth below ground surface to where pore pressure = 0 Make negative if water level is above ground		All	All
Uo Hydrostatic Pore Pressure see NOTE #4	Uo = water depth,Hw x unit weight water, Gamma or Uo=Hw=depth-depth to water table if depth<water table,Uo = 0		All	All
dU Excess Pore Pressure	dU = U2 - Uo Defaults to U2 if given or uses U1 or U3 x const.		All	All
DPPR (Differential Pore Pressure Ratio)	$DPPR = \frac{dU}{Qt} = \frac{U - Uo}{Qt}$ Defaults to U2 if given or uses U1 or U3 x const.	#6,#8	All	All
Bq	$Bq = \frac{dU}{Qt - sv}$	# 4 # 8 # 13	All	All
OS (Overburden Stress)	OS = sv = S (Gamma x Depth)		All	All
EOS (Effective Overburden Stress)	EOS = sv' = OS - Uo = sv - Uo		All	All
Rf Zone Soil Behavior Type see NOTE #5	Classification chart for Qc and Rf Zone # = Soil Behavior Type 1=sensitive fine grained 2=organic material 3=clay 4=silty clay 5=clayey silt 6=sandy silt 7=silty sand 8=fine sand 9=sand 10=gravelly sand 11=very stiff fine grained ¥ 12=sand to clayey sand ¥ ¥ overconsolidated or cemented	#6 #8, Fig4.3	All	1<Qt<1000bar 0<Rf<8%

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
Bq Zone Soil Behavior Type	Classification chart for Qc and Bq (same zone #'s as Rf above)	#8 Fig 4.3	All	0<Qt<1000bar -0.1<Bq<1.4
Spt N(60) Standard Penetration Test (Blows/foot) at 60% Energy After R&C(1983) see NOTE #6	Qt/N ratio per zone Zone # Qt/N Zone # Qt/N 1 2 7 3 2 1 8 4 3 1 9 5 4 1.5 10 6 5 2 11 1 6 2.5 12 2	# 7 # 8 Fig 4.2	All	All
Spt N1(60) Normalized for Overburden str	Spt N1(60) = Cn x Spt N(60) where Cn = (sv')^(-0.77)	# 8	All	0.5<Cn<1.5
Dr Relative Density see NOTE #7	Specific Sands: $Dr = \frac{100}{C2} * \ln\left[\frac{Qc}{C0\ sv'^{C1}}\right]$ where: All are NC & UNAGED	# 8		
Compressibility	Sand | C0 | C1 | C2			
moderate	Ticino | 17.37 | .558 | 2.58	# 1	Sand	7 to 10 0<Qt<500bar 0<sv'<5bar
high	Schmertmann | 15.32 | .520 | 2.75	# 1		
all	ALL SANDS: NC, OC, ALL TESTS $Dr = C3 + C4 \log_{10}\left[\frac{Qc/C1}{(sv'/C0)^{C2}}\right]$ where: C0 | C1 | C2 | C3 | C4 0.100 | 0.0981 | 0.5 | -98 | 66	# 5	Sand	7 to 10 (6 possible)
Phi Friction Angle	Methods: 1) Robertson & Campanella 2) Durgunoglu & Mitchell 3) Janbu beta = +15 degree 4) Janbu beta = 0 degree 5) Janbu beta = -15 degree	 #6, #8 # 2 #6, #8 #6, #8 #6, #8	Sand	7 to 10 & 6 0<Qt<500bar 0<sv'<4bar 29<phi<49

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
Gmax Maximum Shear Modulus at very small strains	Clay: Gmax = alpha x Qt Sand: Digitized figure of Qc vs Gmax with interpolation between sv'curves,R&C method	# 8 Fig4.18 # 6 # 8 Fig4.13	Clay Sand	1 to 6 (6 possible) 7 to 10 .25<sv'<8bar
CSR(Qc), t/s LEVEL ground Liquefaction SAND Resistance see NOTE #8	Seed's CSR vs N1(60) graph for specified equake Magnitude.Can include silty sand corr. for Zone 7. N1(60) from CPT correlations.	# 11 # 12	Sand	7 to 10 (6 possible)
CSR(Eq), t/s Cyclic Stress Ratio applied by design quake	$CSR(Eq) = 0.65 \frac{Amax}{g} \frac{sv}{svo'} rd$ Amax=max surface acceleratn including Amplification	# 12 # 3	Sand	7 to 10 (6 possible)
[Note: Input value from input file is used if defined, & not calculated]				
rd Reduction Factor to find CSR(Eq)	Digitized graph to use for depth vs rd: 1) Seed's mean 2) Fraser Delta	# 12 # 3	Sand	(6 possible) 7 to 10 0<depth<30m
FL,Safety Factor against Liquefaction	FL = CSR(Qc)/CSR(Eq)	# 3	Sand	7 to 10 (6 possible)
Qcr Critical Bearng required to resist Liquefctn	Qcr backcalculated from CSR(Eq) for a specified FL. Qcr is only for the given GWT,EOS,OS,Amax/g & Eq.Mag	# 12	Sand	7 to 10 (6 possible)
Su, Undrained Shear Strength of CLAY METHODS:	Nk: $Su = \frac{Qc - st}{Nk}$	# 8	Clay	1 to 6
	Nke: $Su = \frac{Qt - U2}{Nke}$		Clay	1 to 6
	Nkt: $Su = \frac{Qt - sv}{Nkt}$		Clay	1 to 6
	Nc: $Su = \frac{Qt}{Nc}$		Clay	1 to 6
see NOTE #9	NdU: $Su = \frac{dU2}{NdU}$ (dU1 or dU3)		Clay	1 to 6

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
Su/EOS	$Su/EOS = \frac{Su}{sv'}$	# 8	Clay	1 to 6
Ko (NC) Normally Consolidated	(Ko)NC = 1 - Sin(f) see NOTE #10	# 8	Sand	7 to 10 (6 possible)
Ko (OC) Over Consolidated	$(Ko)OC = (Ko)NC \times OCR^{0.42}$	# 8	Sand	7 to 10 (6 possible)
E25 Youngs Modulus	E25 = alpha x Qt where user input alpha	# 8 4.11&12	Sand	(6) 7 to 10 0<Qt<500bar
M Constrained Modulus	CLAY: M = alpha x Qt where user input alpha SAND: Methods: Qt: M = alpha x Qt Baldi: $\frac{M}{Qt} = C0 \times pa \left(\frac{sv'}{pa}\right)^{C1} \times OCR^{C2} \times \exp(C3\ Dr)$	# 8 Tabl4.3 # 8 Fig4.10	Clay Sand Sand	1 to 6 7 to 10 (6 possible) 7 to 10
OCR (Clay) Over- Consolidation Ratio see NOTE #11	$OCR = \left[\frac{\frac{Su}{svo'}}{\left(\frac{Su}{svo'}\right)_{NC}}\right]^{1.25}$	# 6 # 8 Fig4.19	Clay	1 to 6
Ic Material Index After J&D(1993) see NOTE #18	$Ic = \left[\left(3-\log_{10}(Q(1-Bq))\right)^{2} + \left(1.5+1.3\log_{10} F\right)^{2} \right]^{0.5}$	# 13 # 17	All	All
Spt N(60) Standard Penetration Test (Blows/foot) at 60% Energy After J&D(1993) see NOTE #16	Qc/N = 8.5(1-(Ic/4.75)) where Qc in bars	# 13	All	All

Parameter	Methods	Refer. Number	Valid Soil Type	Valid Zone
State Parameter State, (e-units) Current Void Void Ratio minus Critical Void Ratio	$State = \frac{\ln\left[\frac{3M + 8.5M/F}{Q(1-Bq)}\right]}{11.9 - 1.33F}$ $M = \frac{6 \sin fcv}{3 - \sin fcv}$ fcv = const. vol. Phi angle	# 14	All	All
Fines Content FC(%) Percent less than #200 Sieve After Davies,99	FC(%) = 42.4179(Ic) - 54.8574 FC(%) = 0% if Ic < 1.2933 FC(%) = 100% if Ic > 3.6508	# 15	All	All
OCR (Clay) Overcons. Ratio by Pore Press. U1 & U2 or U1 & U3 see NOTE #17	OCR = 0.5 + 1.50(PPD) PPD = (U1 - U2)/Uo or PPD = (U1 - U3)/Uo and default 0.5 & 1.5 are settable	# 16	Clay	1 to 6

1. Depth averaging may be in 0.5, 1, 2.5 or 5 ft. intervals or 0.1, 0.25, 0.5 or 1.0 m intervals, or no depth averaging if zero is selected. The average is the mean value of the readings in the interval. The depth value is the mid-depth of the averaged interval. It is convenient to start at half the depth averaging interval. For example, if you want "even" depths and the depth averaging is set at 0.50 m then start at 0.25 to get values of depth of 0.5, 1.0, 1.5, etc.

2. Basic input CPTU data columns are for Depth, Qc, Fs, U1, U2, U3, INC and TEMP may be selected. In addition the following parameters may also be specified as an INPUT data column: Qt, Gamma, Uo, Spt N, Rf Zone, Bq Zone and CSR(EQ). These values will be used where required to obtain other interpreted parameters. If they are not specified the program will estimate them when they are required. For example, you can create an OUTPUT data file of any of the above parameters and then edit some or all of the values to suite your measurements or your desires to specify their values. You can do that with "Gamma" values to input your measurements of unit weight, or with "Uo" if you want to input values of pore water pressure other than hydrostatic, or with any of the other input parameters. You would use your edited file of adjusted data as your new INPUT data file. Thus, you can specify these parameters if you want to override the Program's values.

You can also use the designated value of "9E9" to denote an unknown value.

You can use the "OTHER" designation to input other data that exists on your input file and identify its units. This allows you to output it, without operating on it, if you choose.

It is best NOT to use depth averaging when using input data that is not continuous at regular depth intervals. Always use DEPTH AVERAGING with extreme caution since the program averages ALL INPUT parameters over the interval chosen irregardless of soil type. Careful use of start and end depth choises can make depth averaging very effective.

3. Since there is no data in the file within the initial depth interval, a default Gamma (unit weight) must be specified from the surface to the starting depth. This is done in the "Param" Menu in units of kN/m^3 (1kN/m^3=6.36pcf). Also, you can specify the values of Gamma to be used by the program as in NOTE #2 above.

4. If pore pressures are not measured by the cone then the program will take Qc as being equal to Qt for all interpretations requiring Qt. Also, Uo may be specified in the input file as a column of Uo vs depth values, if the water pressures are not hydrostatic. See NOTE #2 for more info on customizing input data.

5. You can choose to use either the Rf classif. Zone or the Bq classif. Zone to divide soil into Undrained Parameters (Zones 1 to 6) and Drained Parameters (Zones 7 to 10) in the "Param" Menu. (However, in order to use the Bq Zone you must have Pore Pressure, U2, data.) Also, you may choose to switch Zone 6 to a Drained Zone from its Undrained Zone status. This is done if you feel that the soil identified as Zone 6 (sandy silt) is really coaser (using other sources of information) and/or you want it analyzed as a Drained rather than Undrained soil. Finally, the soil behavior names in each zone were shortened in version 5.0 for simplicity. For example, Zone 6 was named "sandy silt to clayey silt" but was shortened to "sandy silt".

6. Spt N is the same as Spt N(60) for 60% transferred energy. This value is calculated from the Qt/N ratios given for each Soil Zone (you can specify either Rf or Bq Zone) and these values are used in the Level Ground Liquefaction analysis. Values of Spt N may be specified in the Input File, if indepedently measured values are to be used. We suggest that you not use depth averaging if you only have selected Spt N values at a few depths. You may use "9E9" for missing data.

7. If Dr values are negative then soil is very loose or likely more of an undrained soil like a silty sand rather than a drained soil for which the Dr correlations were developed. Use Dr interpretations very cautiously since they also assume the soil is free draining, uncemented, unaged and has the same compressibility of grains as the soil used for the correlations in chamber calibration tests.

8. The simplified sand liquefaction analysis for level ground according to Seed et al requires Spt N1(60) and earthquake magnitude to obtain the cyclic stress ratio to cause liquefaction, CSR(Qc). The design maximum ground acceleration, the depth-reduction factor, Rd, and overburden total and effective stresses are required to calculate the cyclic stress ratio applied by the design earthquake, CSR(EQ). The program estimates the N1(60) values from the cone stresses, the operator identifies the earthquake magnitude and Seed et al chart is used to get CSR(Qc). The program also calculates CSR(EQ) from the user specified maximum ground acceleration including any amplification factors, the calculated overburden stresses and either Seed's mean or the Fraser Delta Rd factor. The Fraser Delta is used only when amplification factors of the order of 2 or more are used. See Reference Nos. 3, 6, 11 and 12 for more information. The user can INPUT specific values for Spt N, CSR(EQ), Soil Zones, Gamma's, etc. in order to customize the analysis for the existing data base of information. It is recommended that you do not use depth averaging when using specific input data but make calculations at specific depths where external input data exists. The calculated value of Qcr is the minimum value of cone bearing stress required at a given depth such that the factor of safety against liquefaction, or the ratio FL = CSR(Qc)/CSR(EQ) have the specified value for a given earthquake magnitude, max. ground acceleration, depth reduction factor, and calculated overburden stresses. This value of Qcr is useful to identify the required minimum level of soil improvement for a given design condition.

9. The NdU method to calculate undrained shear strength has been extended to allow the user to choose either dU1, or dU2 or dU3 provided such pore pressure measurements exist.

10. The Overconsolidation Ratio, OCR, for the sand must be estimated by the user in the "Param" menu if you want to estimate Ko in the sand layers. For the typical normally consolidated sand, OCR = 1.0.

11. It is currently only possible to estimate the OCR for a clay, which makes use of the correlations obtained from extensive laboratory tests.

12. An improved calculation and print routine was added to version 5.0 which uses swap routines to reduce memory requirements, but slows down the calculations.

13. The classification charts for Rf has been extended at all boundaries such that values of Rf>8 and values of Qc<1.00 are possible. The Bq classification chart which requires dU2 and can now accept values of Bq>1.2 and Qt<1. Unfortunately, this feature does not work.

14. Version 5.1ppd added several enhancements to the program. You may input an average vertical flow gradient, which is applied over the entire profile depth to be analysed so adjust the depth of interest accordingly. Zero gives hydrostatic and no flow, a negative gradient is upward flow which increases pore pressure and reduces vertical effective stress. A positive gradient gives downward flow.

15. A State Parameter or current void ratio minus critical void ratio is calculated according to the paper by Ref. 14, Plewes, Davies and Jefferies, 1994.

16. An alternate method to estimate SPT from CPT is provided according to Ref. 13, Jefferies and Davies, 1993 in ASTM.

17. An alternate method to estimate OCR in clays is provided which uses the measured pore pressure difference, ppd, so both U1 and U2 or U1 and U3 must be measured at the same time. (see Ref. 16)

18. Version 5.2 added the value Ic (Material Index) according to Jefferies & Davies, 1993, 1991 (Ref. 13 & 17) which combines all Normalized parameters Q, F and Bq.
(Note: QtN was changed to Q and RfN to F.)

18A. In Version 5.2, if at any depth the value of Bq>1 (in very sensitive saturated soil)then Bq is made equal to 0.99. Also, if Rf>8 it is made 7.99. These changes have a negligable effect on the results.

19. FC(%) or percent of dry weight less than #200 sieve (.074mm) was also added according to Davies, 1999 Ref.#15)

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	P-1

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	30.5	136	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
												Poorly-graded SAND with SILT (SP-SM); brown; damp; mostly SAND; subangular, few fines; nonplastic.
	135	B-1										
												Medium dense; light gray.
5		R-2	7 5 15	20	19							
	130	S-3	7 9 8	17	24							
												SILTY SAND (SM); medium dense; brown; damp; mostly fine to medium SAND; few coarse SAND; some fines; trace GRAVEL; low plasticity. 71% SAND; 28% fines; 1% GRAVEL
10		R-4	5 5 8	13	12			10.5	104		PA	
	125											Poorly-graded SAND (SP); medium dense; brown; moist; mostly medium to coarse SAND; little fine SAND; trace fines; nonplastic.
		S-5	5 5 11	16	23							
												Dense.
15		R-6	13 20 28	48	45							
	120											Medium dense.
		S-7	6 6 9	15	21							
												Mostly medium SAND.
20		R-8	4 4 9	13	12							
	115											SILTY SAND (SM); dense; brown; damp; mostly fine SAND; few medium SAND; some fines; low plasticity. 66% SAND; 34% fines
		S-9	9 13 17	30	42			11.8			PA	
												SANDY SILT (ML); stiff; brown; damp; mostly fines, some fine SAND; low plasticity.
		R-10	4	12	11							

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	**P-1**

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	30.5	136	▽ NE / *NE* DURING DRILLING ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	110			5 7											*(SANDY SILT (ML), continued.)*
			S-11	4 5 7	12	17			19.4			PA			Very stiff; moist; trace medium SAND. 62% fines; 38% SAND
30			R-12	12 15 39	54	51									Poorly-graded SAND with SILT (SP-SM); very dense; brown; moist; mostly fine SAND; subrounded; few fines; nonplastic.
	105														Groundwater not encountered. Bottom of borehole at 30.5 ft. Boring was completed at the planned depth. Percolation test completed. Boring backfilled with cement grout tremmie. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
35	100														
40	95														
45	90														

GROUP DELTA

GROUP DELTA CONSULTANTS
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FIGURE
b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	**P-2**

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	28.5	135	⊻ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
															Poorly-graded SAND (SP); brown; damp; mostly fine to medium SAND; trace fines; nonplastic.
		Bulk	B-1												
		SPT	S-2	2 3 7	10	14									Medium dense.
5	130														
		MC	R-3	9 16 20	36	34									Dense; light gray.
		SPT	S-4	5 6 7	13	18									Medium dense; brown.
10	125														
		MC	R-5	11 18 25	43	40			4.9	104		PA			Dense; trace coarse SAND. 96% SAND; 4% fines
		SPT	S-6	7 11 12	23	32									
15	120														
		MC	R-7	9 10 9	19	18									Medium dense.
		SPT	S-8	3 5 8	13	18			10.3			#200			SILTY SAND (SM); medium dense; brown; damp; mostly fine SAND; little fines; trace GRAVEL; nonplastic. 78% SAND; 21% fines; 1% GRAVEL
20	115														Poorly graded SAND (SP); medium dense; brown; moist; mostly fine to medium SAND; trace fines; nonplastic.
		MC	R-9	11 17 24	41	39									Dense.
		SPT	S-10	6 9 11	20	28									Medium dense.

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	**P-2**

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	28.5	135	⊻ NE / *NE* DURING DRILLING ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
															(Poorly graded SAND (SP), continued.) Dense.
			R-11	16 21 26	47	44									
			S-12	8 9 9	18	25			11.5			PA			SILTY SAND (SM); medium dense; olive brown; moist; mostly fine SAND; few medium SAND; some fines; nonplastic. 63% SAND; 37% fines
30	105														
35	100														
40	95														
45	90														

Groundwater not encountered.
Bottom of borehole at 28.5 ft.
Boring was completed at the planned depth.
Percolation test completed.
Boring backfilled with cement grout tremmie.

This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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FIGURE

b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	P-3

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	39	145	∇ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc	AFTER DRILLING ▼ NE / *NE*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		Bulk	B-1												Poorly-graded SAND (SP); brown; moist; mostly medium SAND (subangular - subrounded); trace fines; nonplastic.
5	140	MC	R-2	7 13 12	25	24									Medium dense.
10	135	SPT	S-3	4 8 11	19	27									
		MC	R-4	16 28 33	61	57									Very dense; trace GRAVEL.
15	130	SPT	S-5	5 14 17	31	44									Dense.
		MC	R-6	7 11 21	32	30									Trace coarse SAND.
20	125	SPT	S-7	7 12 14	26	37									
		MC	R-8	12 15 19	34	32									

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FIGURE

a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	P-3

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/19/2015	10/19/2015	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	E. Smith	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	39	145	∇ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc	▼ NE / *NE* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-9	4 7 10	17	24									SILTY SAND (SM); medium dense; brown; moist; mostly medium SAND; little fines; nonplastic.
			R-10	4 9 14	23	22			5.9	107		PA			Mostly fine to medium SAND. 84% SAND; 16% fines
30	115		S-11	9 11 14	25	35									Poorly graded SAND with SILT (SP-SM); dense; brown; moist; mostly fine to medium SAND; few fines; nonplastic.
			R-12	6 15 23	38	36			3.2			#200			94% SAND; 6% fines
35	110		S-13	9 13 15	28	39									Mostly medium SAND.
			R-14	6 5 8	13	12			35.8	85		PA			SILT (ML); stiff; brown; moist; mostly fines; few fine SAND; low plasticity. 91% fines; 9% SAND
40	105														Groundwater not encountered. Bottom of borehole at 39.0 ft. Boring was completed at the planned depth. Percolation test completed. Boring backfilled with cement grout tremmie. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
45	100														

GDC_LOG_BORING_2013 IR-607A.GPJ GDC2013.GDT 11/3/15

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

FIGURE b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	P-4

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/21/2015	10/21/2015	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	C. Wood	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	40	145	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	145	Bulk	B-1												SILTY SAND (SM); brown; damp; mostly fine SAND; trace coarse SAND; some fines; trace fine GRAVEL; nonplastic.
5	140	MC	R-2	8 11 12	23	22									Poorly graded SAND (SP); medium dense; light brown; damp; mostly fine to medium SAND; few coarse SAND; subangular to subrounded; trace fines; nonplastic.
10	135	SPT	S-3	4 5 8	13	18									Mostly medium SAND; some coarse SAND; few fine SAND.
15	130	MC	R-4	12 16 22	38	36			3.0	101		PA			Dense; moist; mostly fine to medium SAND; trace coarse SAND; trace fine GRAVEL. 94% SAND; 4% fines; 2% GRAVEL
20	125	SPT	S-5	6 9 10	19	27									Medium dense; few coarse SAND.

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FIGURE a

BORING RECORD

PROJECT NAME: PT metro	PROJECT NUMBER: IR 607A	HOLE ID: **P-4**	
SITE LOCATION: 1404 East Katella Avenue, Anaheim, CA	START: 10/21/2015	FINISH: 10/21/2015	SHEET NO.: 2 of 2
DRILLING COMPANY: 2R Drilling	DRILL RIG: CME 75	DRILLING METHOD: Hollow Stem Auger	LOGGED BY: C. Wood; CHECKED BY: M. DiNicola
HAMMER TYPE (WEIGHT/DROP): Hammer: 140 lbs., Drop: 30 in.	HAMMER EFFICIENCY (ERi): 84.5%	BORING DIA. (in): 8; TOTAL DEPTH (ft): 40	GROUND ELEV (ft): 145
DRIVE SAMPLER TYPE(S) & SIZE (ID): Bulk, SPT (1.4"), MC (2.4")	NOTES: N_{60} = 1.41 Nspt = 0.94 Nmc	DEPTH/*ELEV.* GW (ft): ∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING	

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-6	8 22 33	55	52									*(Poorly graded SAND (SP), continued.)* Very dense; mostly medium to coarse SAND; some fine SAND.
30	115		S-7	8 13 12	25	35									Dense; mostly fine to medium SAND.
35	110		R-8	11 25 32	57	54			8.3			PA			SILTY SAND (SM); very dense; brown; moist; mostly fine SAND; trace medium SAND; some fines; nonplastic. 67% SAND; 33% fines
			S-9	8 7 12	19	27			12.6			#200			Medium dense. 58% SAND; 42% fines
40	105														Groundwater not encountered. Bottom of borehole at 40.0 ft. Boring was completed at the planned depth. Begin well construction at 9:00 am. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
45	100														

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FIGURE b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	P-5

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/21/2015	10/21/2015	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	C. Wood	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	40	147	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	147	Bulk													SILTY SAND (SM); brown; moist; mostly fine SAND; some fines; nonplastic.
	145		B-1												
5		SPT	S-2	15 22 30	52	73									Very dense; mostly fine to coarse SAND, subangular to subrounded.
	140														
10		MC	R-3	7 9 13	22	21			0.9			PA			Poorly graded SAND (SP); medium dense; light brown; damp; mostly medium SAND; little fine SAND; trace coarse SAND; subangular to subrounded; trace fines; trace GRAVEL; nonplastic. 97% SAND; 2% fines; 1% GRAVEL
	135														
15		SPT	S-4	2 4 5	9	13									Moist; mostly fine to medium SAND; few coarse SAND.
	130														
20		MC	R-5	15 24 32	56	53									Very dense; dry to moist; mostly medium SAND; some coarse SAND; few fine SAND.
	125														

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FIGURE a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
PT metro	IR 607A	**P-5**

SITE LOCATION	START	FINISH	SHEET NO.
1404 East Katella Avenue, Anaheim, CA	10/21/2015	10/21/2015	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R Drilling	CME 75	Hollow Stem Auger	C. Wood	M. DiNicola

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	84.5%	8	40	147	▽ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
Bulk, SPT (1.4"), MC (2.4")	N_{60} = 1.41 Nspt = 0.94 Nmc	▼ NE / *NE*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	120	SPT	S-6	7 11 13	24	34									*(Poorly graded SAND (SP), continued.)* Dense.
30	115	MC	R-7	10 16 20	36	34			4.5	104		PA			SILTY SAND (SM); dense; light brown; moist; mostly fine SAND; little medium SAND; little fines; nonplastic. 87% SAND; 13% fines
35		SPT	S-8	6 7 7	14	20									Poorly graded SAND (SP); medium dense; light brown; moist; mostly fine SAND; few medium SAND; trace fines; nonplastic.
	110	MC	R-9	16 24 31	55	52									Very dense; dry to moist; mostly medium SAND; some coarse SAND; few fine SAND.
		SPT	S-10	9 10 11	21	30			2.7			#200			Poorly-graded SAND with SILT (SP-SM); dense; light brown; moist; mostly fine to medium SAND; few fines; nonplastic.
40	105														Groundwater not encountered. Bottom of borehole at 40.0 ft. Boring was completed at the planned depth. Percolation test completed. Boring backfilled with cement grout tremmie. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
45	100														

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FIGURE

b

APPENDIX E

EARTHWORK AND GRADING GUIDE SPECIFICATIONS

Leighton

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

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Leighton

LEIGHTON AND ASSOCIATES, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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Standard Details

Leighton

1.0 GENERAL

1.1 Intent

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

1.2 The Geotechnical Consultant of Record

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

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

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

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction.

The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 <u>The Earthwork Contractor</u>

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 <u>Clearing and Grubbing</u>

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

3.3 Import

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

4.0 FILL PLACEMENT AND COMPACTION

4.1 Fill Layers

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

4.2 Fill Moisture Conditioning

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

4.3 Compaction of Fill

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

4.4 Compaction of Fill Slopes

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

4.5 Compaction Testing

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

4.6 Frequency of Compaction Testing

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

4.7 Compaction Test Locations

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

5.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, 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 Safety

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

7.2 Bedding and Backfill

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

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

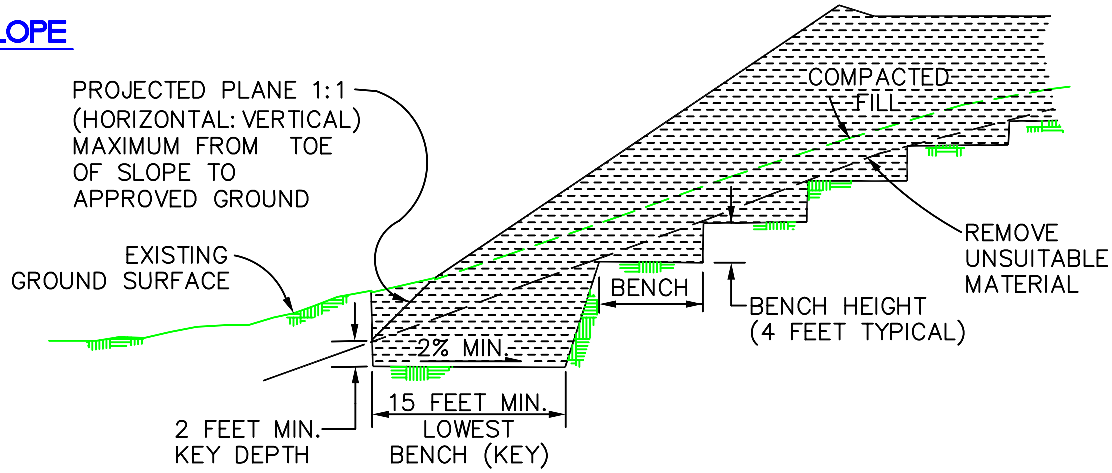
7.3 Lift Thickness

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

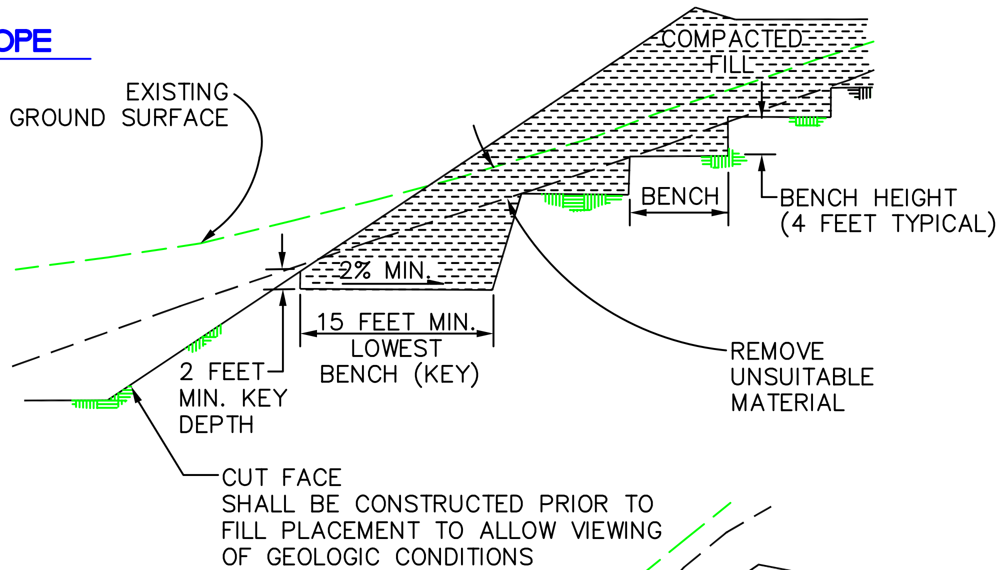
7.4 Observation and Testing

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

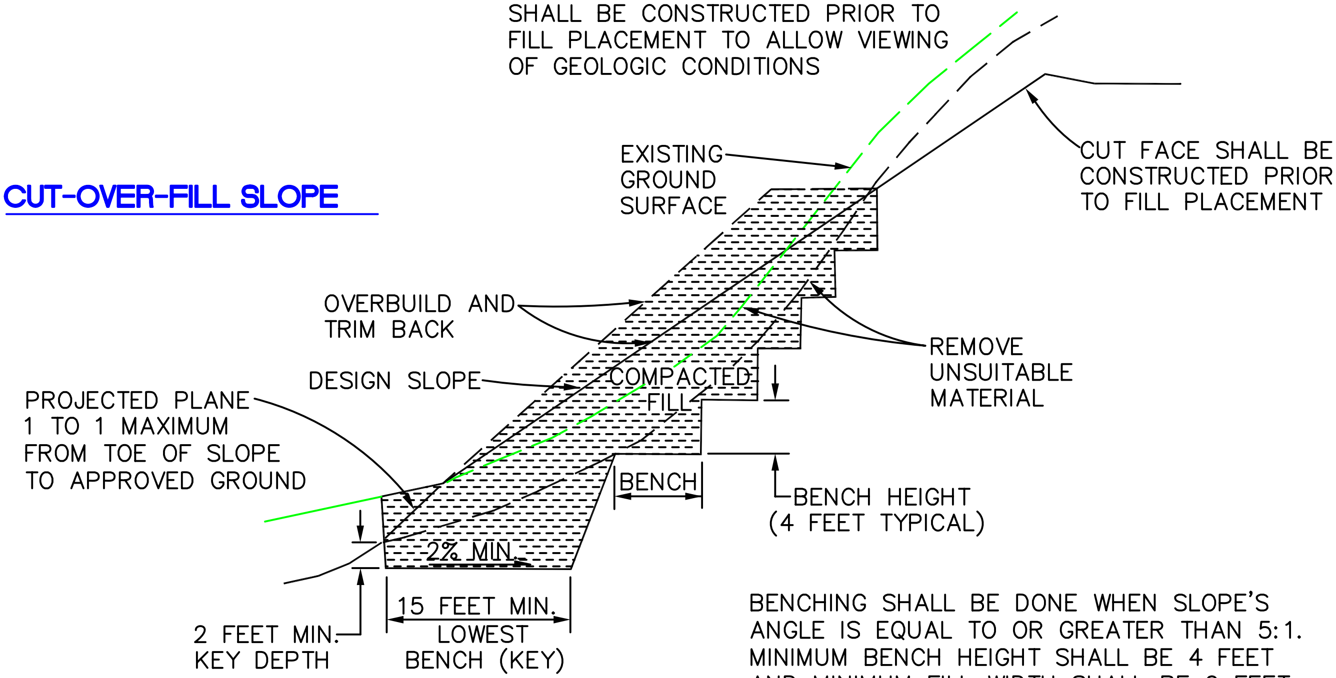
FILL SLOPE



FILL-OVER-CUT SLOPE

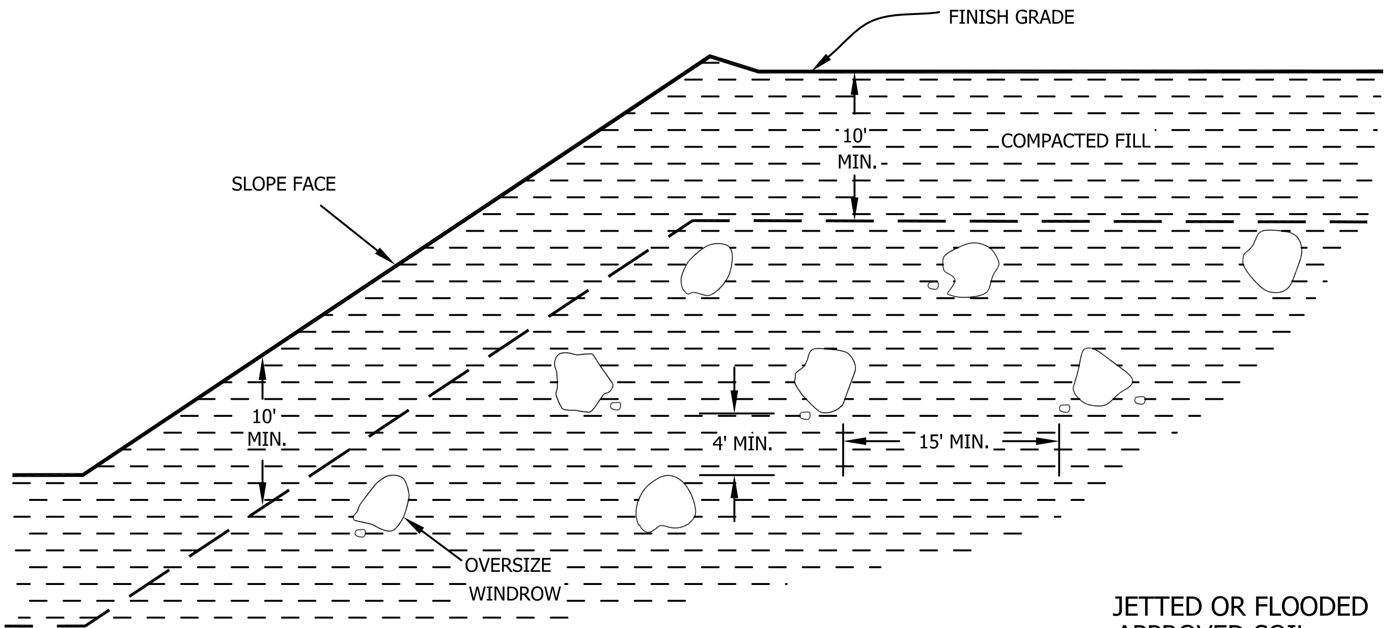


CUT-OVER-FILL SLOPE

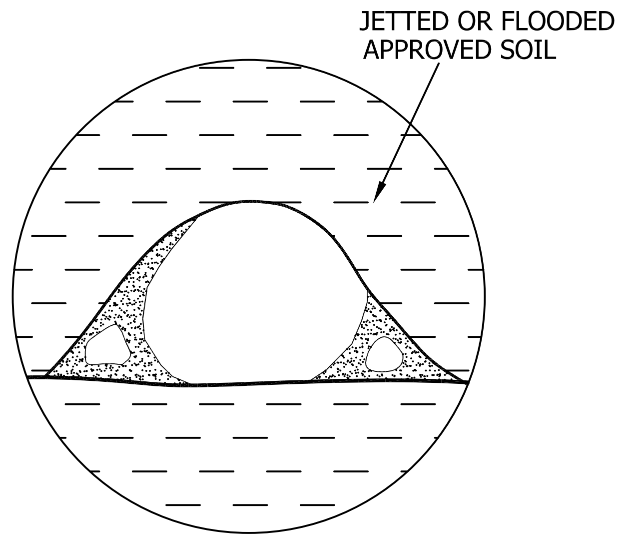


BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

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

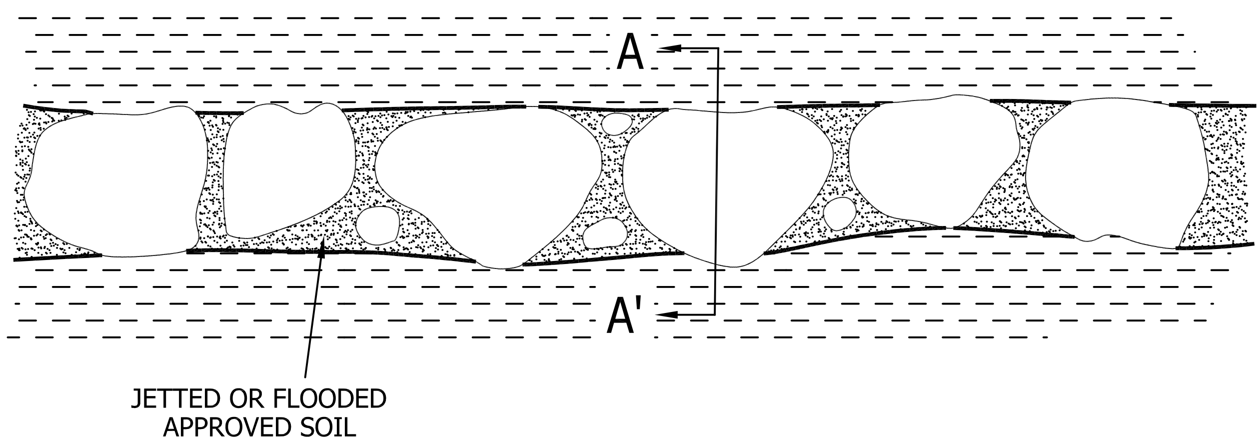


- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.



SECTION A-A'

PROFILE ALONG WINDROW



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

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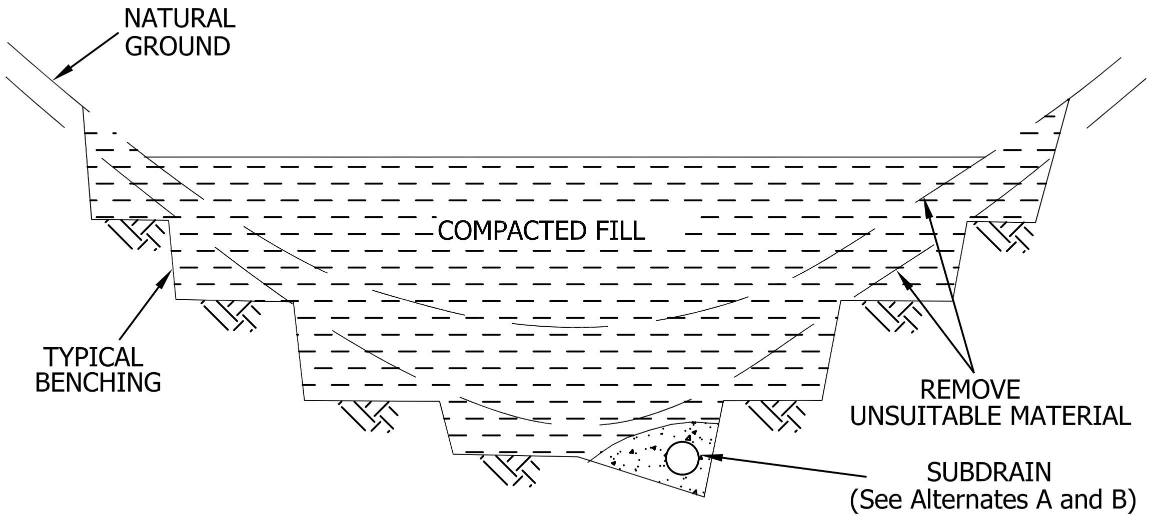
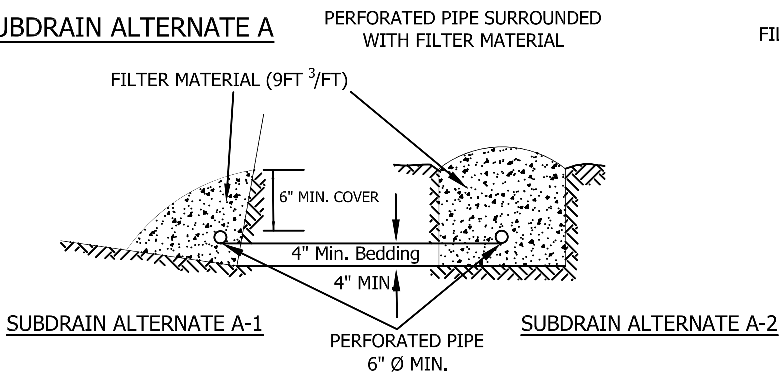


SUBDRAIN ALTERNATE A

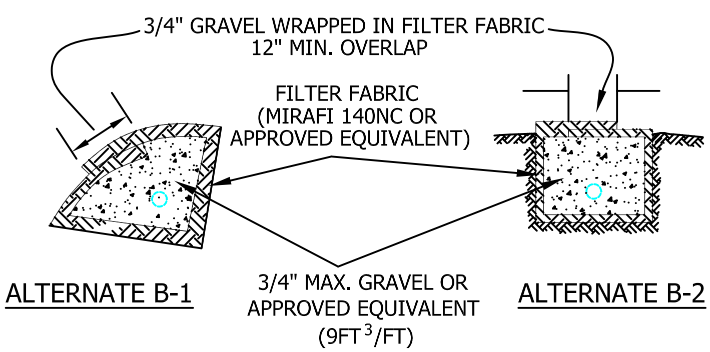


FILTER MATERIAL

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

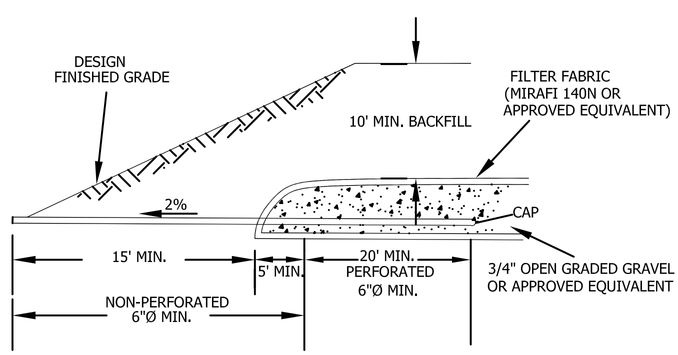
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



○ PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

DETAIL OF CANYON SUBDRAIN TERMINAL



CANYON SUBDRAIN	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C	Leighton

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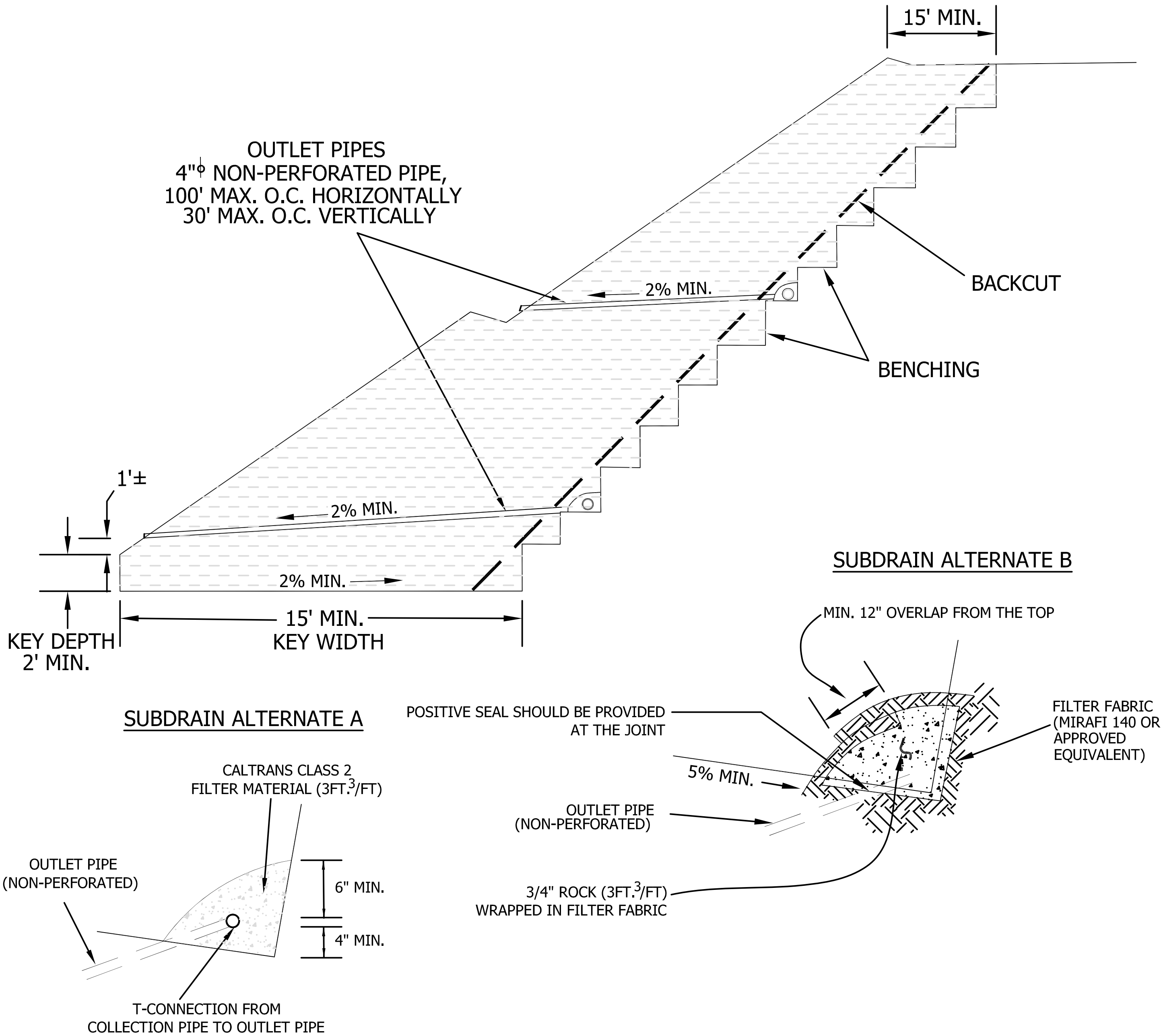

- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4"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

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

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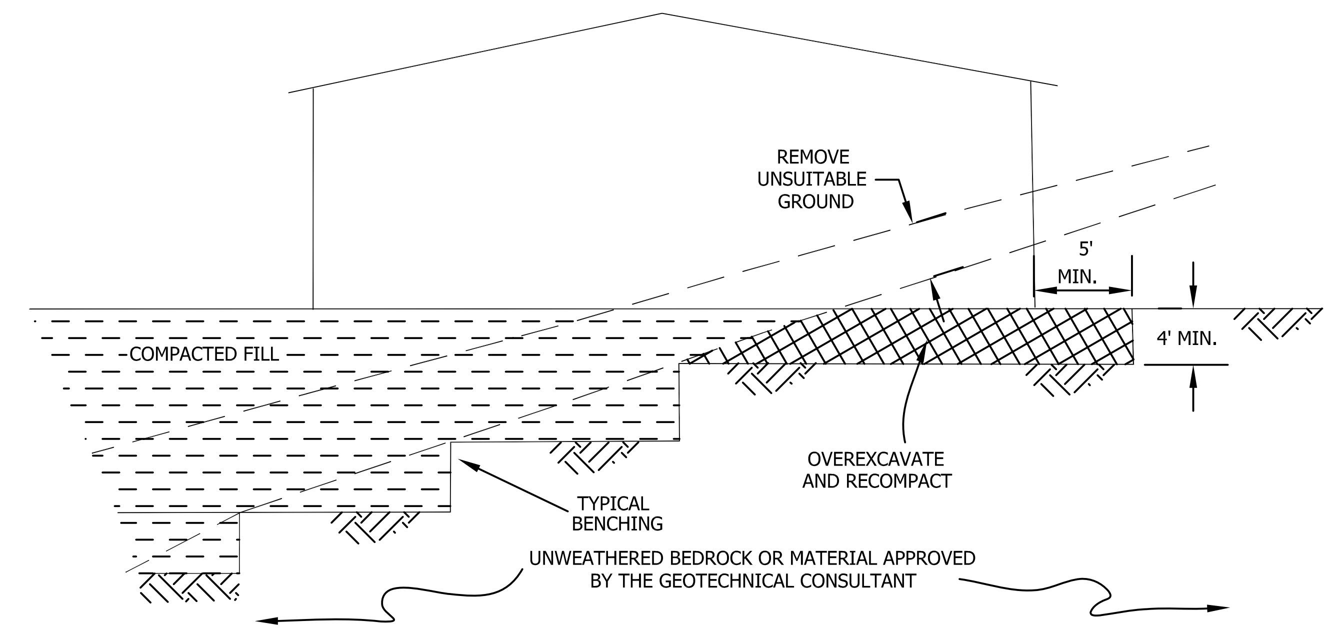
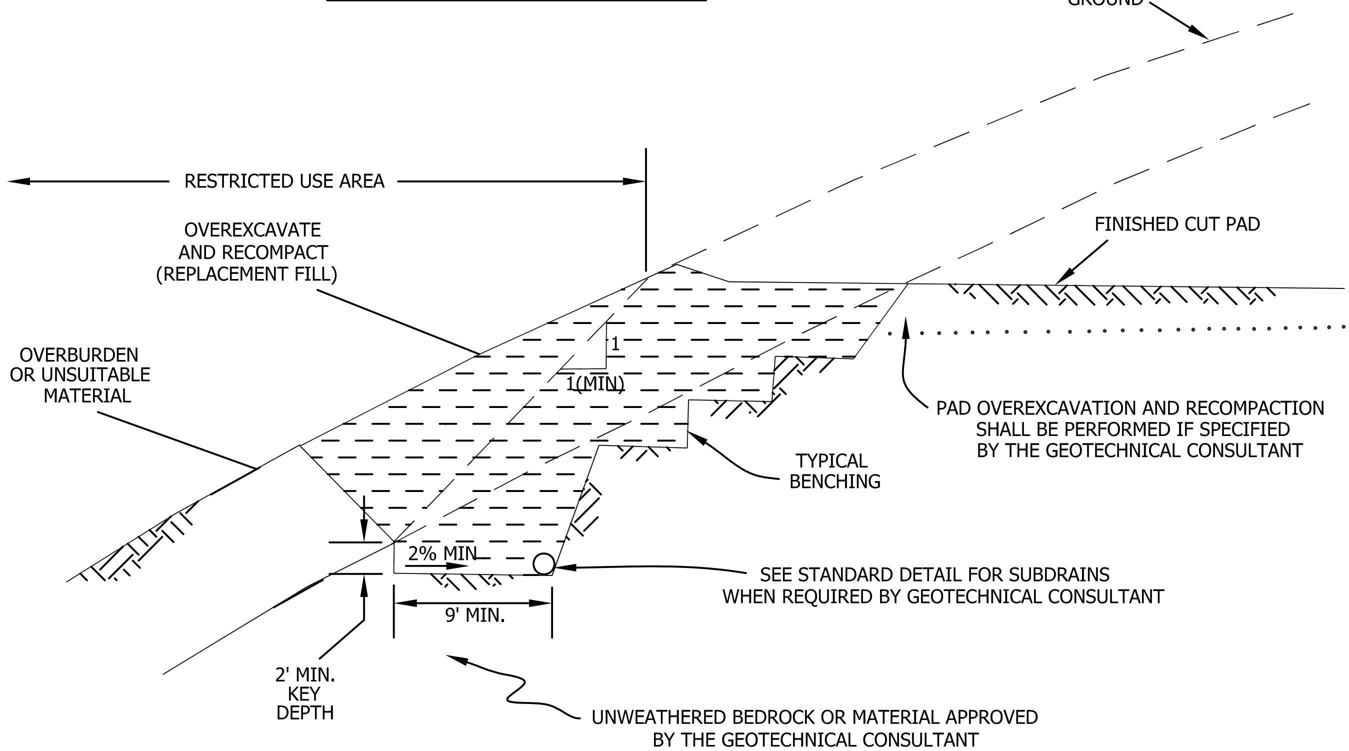
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



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

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