Preliminary Geotechnical Engineering Report

MACE RANCH INNOVATION CENTER

WKA No. 10344.02

January 20, 2015

Prepared For:

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Davis, California

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Preliminary Geotechnical Engineering Report
MACE RANCH INNOVATION CENTER
Mace Boulevard & County Road 32A
Davis, California
WKA No. 10344.02
January 20, 2015

INTRODUCTION

We have completed a preliminary geotechnical engineering study for the approximate 212-acre Mace Ranch Innovation Center property, located easterly of Mace Boulevard, north of County Road 32A, in Davis, California. Our work has been performed in accordance with authorization from Buzz Oates Group of Companies, and the scope of work outlined in our proposal letter dated July 31, 2014 (Revised November 24, 2014).

Purpose and Scope of Work

The purposes of this study are to describe the nature and general engineering properties of the soil and groundwater conditions at the site, and to provide findings and conclusions regarding the feasibility of developing the site with an innovation and technology center from a geotechnical engineering perspective. This report is preliminary in nature and describes the impacts of both soil and groundwater conditions on site development, but is not intended for use in specific design and construction of the project.

Our scope of work has included a site reconnaissance, review of our files for previous studies completed in the project vicinity, available aerial photographs, topographic maps and geologic maps covering the site, and a review of the Department of Agricultural Natural Resources Conservation Service (NRCS) Soil Survey for Yolo County. We also performed a subsurface exploration, including the drilling and sampling of 17 borings (D1 through D17) to depths ranging from 15 to 26½ feet below existing site grades and completed two seismic cone penetrometer test soundings (SCPT1 and SCPT2) advanced to a depth of about 100 feet below existing site grades. Undisturbed and bulk samples of surface and near-surface soils were obtained from the boring locations and were taken to our laboratory to determine the engineering characteristics of the on-site soils. The results of our field and laboratory work were then analyzed to develop preliminary geotechnical engineering conclusions regarding site preparation and fill placement, foundation design and interior floor slab support for building structures, and preliminary street pavement sections.

Related Experience

Supplemental information used in the preparation of this report included review of the following reports prepared for properties in the vicinity of the project site:

- Wallace-Kuhl & Associates, Inc., *Geotechnical Engineering Report* (WKA Inc. No. 4984.01, dated November 28, 2001) prepared for a Texaco gas station (currently an Arco am/pm gas station), located adjacent to, and westerly, of the southwest corner of the site;
- Wallace-Kuhl & Associates, Inc., *Geotechnical Engineering Report* (WKA Inc. No. 7779.01, dated September 21, 2007) prepared for the 2nd Street Plaza retail development, located about 1,300 feet southwest of the southwest corner of the site; and,
- Wallace-Kuhl & Associates, Inc., *Geotechnical Engineering Report* (WKA Inc. No. 8231.01, dated December 31, 2008) prepared for the Davis East Area water tank and pump station, located about 800 feet south of the southwest corner of the site.

Our office also prepared separate environmental consulting reports for this project, including: *Phase I Environmental Site Assessment* (WKA No. 10344.01, dated January 6, 2015) and *Surface Soil Investigation* (WKA No. 10344.03, dated December 31, 2014).

Figures

A Vicinity Map showing the location of the site is included as Figure 1. Figure 2 shows the site boundaries and features, approximate locations of our subsurface explorations, and the approximate distribution of the NRCS Soil Survey types. The Logs of Soil Borings are shown on Figures 3 through 19. An explanation of the Unified Soil Classification System symbols used on the boring logs is included as Figure 20. Appendix A contains general information regarding our field investigation and information regarding the laboratory testing program. Appendix B contains copies of the SCPT reports provided by Gregg Drilling & Testing, Inc. Appendix C contains copies of the output files for the liquefaction analysis and associated data.

Project Description

Based on conversations with Ms. Peggy Grillo of Buzz Oates Group of Companies, we understand the site is being considered for development of an innovation and technology center. Development of the site will likely include one- to three-story buildings constructed of

concrete tilt-up panels, with interior concrete slab-on-grade lower floors. Structural loads for the buildings are anticipated to be relatively moderate to heavy based on this type of construction. Associated development would include construction of underground utilities, access roads, exterior flatwork, and landscaping.

FINDINGS

Site Description

The approximate 212-acre Mace Ranch Innovation Center property is located easterly of Mace Boulevard, north of County Road 32A in Davis, California (see Figure 1). The property is comprised of three adjacent parcels identified by Yolo County Assessor's Parcel Number's (APN's) 033-630-009, 033-650-009, and 033-650-026.

The site is bounded to the north and east by fallow, agricultural land; to the south by County Road 32A, beyond which is Interstate 80 (I-80); and, to the west by Mace Boulevard, beyond which are a gas station, church, and vacant land.

In general, the ground surface elevations across the site generally decrease in the east direction with surface elevations ranging between about +25 and +30 feet mean sea level (msl), based on review of the United States Geological Survey *7.5 Minute Topographic Map of the Davis Quadrangle, California*, dated 1992.

At the time of our site investigation, performed on November 26, 2014 and January 5 and 6, 2015, remnants of a row crop were observed throughout a major potion of the site. An active row crop was observed in the northwestern portion of the site during our November site visit; however, during our January site visits this row crop appeared recently harvested. A drainage canal measuring about 30 feet wide and 10 feet deep was observed bisecting the central portion of the site, extending in west-east orientation. A rectangular-shaped detention basin measuring about 350 feet wide, 1,200 feet long and up to about 10 feet deep was observed in the central-eastern potion of the site. The basin did not contain water at the time of our site investigation; however, a significant amount of water was observed within the canal. Three mature trees and dried vegetation were observed within the basin. An area supporting what appeared to be a control station was observed adjacent to the northeast of the basin; this area was enclosed with a chain-link fence. Several concrete structures were observed within the possible control station. Three irrigation wells were observed along the western boundary of the site, adjacent to Mace Boulevard. Diesel-powered engines were observed by the two most

southern wells which indicate the wells are likely active. The most northern well was covered with a steel plate which indicates the well has likely been inactive for sometime. Several unpaved access routes were observed throughout the site. Overhead power lines were observed along the eastern and southern boundaries of the site. The approximate location of site features observed during our site investigation is shown on the Site Plan, Figure 2.

Historical Arial Photograph Review

We reviewed historical aerial photographs of the site available from our files and the Google Earth website. Available photographs were taken in the years 1957, 1968, 1974, 1984, 1993, 1998 and 2003 through 2014.

Review of the photograph taken in 1957 shows the site as agricultural land. This photograph also shows a meandering canal in the southwestern-southern potion of the site. The approximate location of the former canal is shown on the Site Plan, Figure 2. Review of photographs taken in 1968, 1974 and 1984 show the site has generally remained unchanged since 1957.

Review of the photograph taken in 1993 shows the canal observed in previous photographs has been backfilled. This photograph also shows a drainage canal bisecting the central potion of the site in east-west orientation and a detention basin in the central-eastern portion of the site. The canal and basin appear to be those observed during our site investigation. The remaining potions of the site generally remain unchanged. We understand the former canal was backfilled with soil excavated during the construction of the detention basin; however, we are not aware of documentation regarding the backfill observation/compaction operations. Review of the photographs taken in 1998, 2003 and 2004 show the site has generally remained unchanged since 1993.

Review of the photograph taken in 2005 shows what appears to be the control station area observed during our site investigation adjacent to the northeast of the detention basin. Review of the remaining photographs shows the site has generally remained unchanged since 2005.

General Site Geology

The Mace Ranch Innovation Center site is located in the western portion of the Great Valley geomorphic province of California. The Great Valley of California is generally considered to be an elongated sedimentary trough, approximately 450 miles long and 50 miles wide. Rock units within the Great Valley geomorphic province consist of Mesozoic to Cenozoic marine and non-

marine sedimentary rocks. These sediments have been folded into an asymmetric syncline, the axis of which lies immediately east of the interior Coast Ranges. The sedimentary units on the east side of the Great Valley are minimally deformed and are deposited on basement rocks of the Sierra Nevada geomorphic province. The sedimentary rocks on the west side of the Great Valley are deformed and dip at moderate angles to the east.

Surface elevations within the Great Valley generally range from several feet below mean sea level to more than 1000 feet above sea level. The major topographical feature in the Great Valley is the Sutter Buttes (a volcanic remnant) that rise approximately 1980 feet above the surrounding valley floor. The Sutter Buttes are located approximately 45 miles north to northwest of the site.

Based on review of the *Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California*, published by the USGS (Helley and Harwood), dated 1985, the site is mapped as underlain by the Quaternary basin deposits (Qb). The basin deposits consist of Holocene-aged (less than 11,700 years old) fine-grained silts and clays derived from the same sources as modern alluvium. The geologic deposits mapped on the site are consistent with the soils data obtained from the subsurface investigation at the site.

Soil Conditions

Two seismic cone penetration test soundings (SCPT1 and SCPT2) and 17 exploratory borings (D1 through D16) were performed at the site on November 26, 2014 and January 5 and 6, 2015, respectively. The approximate locations of the explorations are shown on the Site Plan, Figure 2. Due to an active row crop during the time our boring explorations were marked, explorations were not performed in the northwestern corner of the site.

Generally, the surface and near-surface soils at our borings consisted of medium stiff to very stiff, high plasticity, silty clays to depths ranging from about two to 18 feet below existing site grades. The surface and near-surface clayey soils were observed to be disturbed/soft to depths ranging from about 1½ to two feet below existing sit grades. Beneath the surface and near-surface, high plasticity clay soils, we generally encountered alternating layers of medium stiff to very stiff, sandy clays and silty clays, and loose to medium dense clayey sands to the maximum explored boring depth of 26½ feet below existing site grades. Boring D3 was drilled at the central portion of the existing basin. Undocumented fill soils consisting of stiff, sandy clays interbedded with layers of silty sand and a trace of gravel were encountered at D3 to a depth of about six feet below existing site grades. The undocumented fill soils were underlain by stiff, silty and sandy clay to the explored depth of 16½ feet below existing site grades.

Review of the SCPTs revealed soils at the site beyond the depth of 26½ feet likely consist of interbedded layers of silty clay, clayey silt, sandy silt and silty sand to the maximum explored depth of about 100 feet below site grades.

The soil conditions encountered in our explorations are consistent with those encountered in previous studies performed near the site, and also with the mapped geology.

For specific information regarding the soil conditions at a specific exploration location, please refer to the Logs of Soil Borings, Figures 3 through 19, and/or the SCPT reports included in Appendix B.

Soil Conservation Survey Soil Conditions

Review of the Department of Agricultural NRCS Soil Survey for Yolo County, California indicates the near-surface soils at the subject property consist of six different soils types, including the "Capay silty clay (Ca)"; "Sycamore silt loam, drained (Sp)"; "Sycamore complex, drained (Sv)"; "Tyndall very fine sandy loam, drained (Tc)", "Willows clay (Wb)" and, the "Willows clay, alkali, drained (Wd)". A brief description of the different soil types is presented below. The approximate distribution of these soils; as mapped by the NRCS, is shown on Figure 2.

- Ca – Capay silty clay: typically consists of silty clay extending from the ground surface to a depth of more than 64 inches.
- Sp – Sycamore silt loam: typically consists of silt loam extending from the ground surface to a depth of more than 60 inches.
- Sv – Sycamore complex, drained: typically consists of silt loam extending from the ground surface to a depth of 44 inches. The silt loam is underlain by silty clay extending to a depth of more than 60 inches.
- Tc – Tyndall very fine sandy loam, drained: typically consists of sandy loam extending from the ground surface to a depth of more than 60 inches.
- Wb – Willows clay: typically consists of clay extending from the ground surface to a depth of more than 72 inches.
- Wd – Willows clay, alkali, drained: typically consists of clay extending from the ground surface to a depth of more than 72 inches.

The NRCS soil descriptions are generally consistent with our site observations and the soils observed in our explorations.

Groundwater

Groundwater was not encountered in our borings performed on January 5 and 6, 2015 to the maximum explored boring depth of 26½ feet below existing site grades; however, groundwater was encountered in our SCPT explorations performed on November 26, 2014, at a depth of about 34 feet below existing site grades.

To supplement our groundwater data, we reviewed available groundwater information at the California Department of Water Resources (DWR) website. The DWR periodically monitors groundwater levels in wells across the state. Their website shows a well located adjacent to the east of the central portion of the site. The well is identified as Well No. 08N03E07B001M with a ground surface elevation of +27.5 feet msl, similar to the subject site. Groundwater data for this well was recorded from November 7, 1948 to at least November 1967. Data shows the highest recorded groundwater elevation was about +16 feet msl at the well (about 11.5 feet below the ground surface at the well) on April 1, 1952. The lowest recorded groundwater elevation was about -45 feet msl at the well (about 72.5 feet below the ground surface at the well) on July 20, 1964.

We also reviewed the Yolo County Flood Control Water Conservation District, Annual Engineer's Report for 2003 and 2004, prepared by Wood Rodgers, Inc. Based on review of these reports, the groundwater elevation beneath the site was about +15 feet msl from Spring 2003 to Spring 2004.

Based on the available groundwater data, groundwater depths at the site have likely ranged from approximately nine to 75 feet below site grades since 1948. These groundwater conditions are consistent with the groundwater level encountered in our SCPT explorations and explorations for previous studies performed in the general vicinity of the site. Groundwater levels at the site should be expected to fluctuate throughout the year based on variations in seasonal precipitation, local pumping, and other factors.

CONCLUSIONS

Bearing Capacity and Building Support

Based on our field observations and laboratory testing, the upper 1½ to two feet of near-surface soils appear to be disturbed/soft within the major portions of the site. The existing condition of the near-surface soils is likely due to previous agricultural activities and seasonal moisture fluctuations of the soils. In our opinion, the upper 1½ to two feet of the near-surface soils across the site should not be relied upon for direct support of anticipated structures and pavements associated with the innovation and technology center. The 1½ to two feet of the near-surface soils across the site will require excavation, processing, moisture conditioning and uniform recompaction to achieve adequate support conditions for the proposed improvements associated with the office/research park.

Adequate clearing of the existing surface and sub-surface structures, irrigation wells, former canal, existing drainage canal, detention basin, and proper backfilling of the resulting depressions will also be essential for support of anticipated structures and pavements associated with the innovation and technology center.

Field and laboratory test results indicate the undisturbed native soils underlying the upper 1½ to two feet across the site, as well as new engineered fills composed of on-site or imported granular material are capable of supporting the anticipated structures and pavements associated with the office/research park.

2013 CBC/ASCE 7-10 Seismic Design Criteria

Seismic *Site Class*

Site-specific shear wave velocity data was collected at SCPT1 and SCPT2, which were advanced to a depth of about 100 feet below existing site grades. Shear wave velocities obtained at the locations of SCPT1 and SCPT 2 varied from about 588 to 1146 feet per second (fps) within the upper 100 feet of the soil profile. The average shear wave velocities within the upper 100 feet was determined at each SCPT in accordance with Section 20.4.2 of the American Society of Civil Engineers, Minimum Design Loads for Building and Other Structures (ASCE 7-10), as referenced by the 2013 California Building Code (CBC), and was found to be about 900 fps at SCPT1 and 859 fps at SCPT2. Based on Table 20.3-1 of ASCE 7-10, a seismic Site Class D applies to sites with average shear wave velocities between 600 and 1,200 fps. According to the information obtained from the shear wave velocity measurements, the

soils at this site can be designated as site Class D in determining seismic design forces for this project in accordance with Table Section 1613A.3 of the 2013 CBC. A summary of the calculated shear wave velocities is presented in Table 1.

TABLE 1
SUMMARY OF SHEAR WAVE VELOCITIES

Approximate Test Depth (feet)	Interval Velocities (feet per second)	
	SCPT1	SCPT2
10	632.5	587.6
20	879.5	764.9
30	975.1	843.4
40	896.8	809.7
50	844.0	844.0
60	738.2	957.2
70	867.4	826.8
80	1146.1	1026.1
90	1117.1	1070.4
Average Velocity	899.6	858.9

Seismic Design Parameters

Section 1613A of the 2013 edition of the CBC references ASCE Standard 7-10 for seismic design. The seismic design parameters provided below are based on the site latitude and longitude using the United States Seismic Design Maps public domain computer program developed by the USGS (Version 3.1.0, July 11, 2013). The 2013 CBC parameters provided below in Table 2 should be used for seismic design of anticipated structures associated with the innovation and technology center.

TABLE 2
2013 CBC/ASCE 7-10 SEISMIC DESIGN PARAMETERS

Latitude: 38.5600° N Longitude: 121.6890° W	ASCE 7-10 Table/Figure	2013 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2-seconds	Figure 22-1	Figure 1613.3.1(1)	S_S	0.889g
1.0-second Period MCE	Figure 22-2	Figure 1613.3.1(2)	S_1	0.348g
Soil Class	Table 20.3-1	Section 1613.3.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.3.3(1)	F_a	1.144
Site Coefficient	Table 11.4-2	Table 1613.3.3(2)	F_v	1.705
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-37	S_{MS}	1.017g
	Equation 11.4-2	Equation 16-38	S_{M1}	0.593g
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-39	S_{DS}	0.678g
	Equation 11.4-4	Equation 16-40	S_{D1}	0.395g
Seismic Design Category	Table 11.6-1	Section 1613.3.5(1)	Risk Category I to IV	D
	Table 11.6-2	Section 1613.3.5(2)	Risk Category I to IV	D

Notes:
MCE = Maximum Considered Earthquake
g = Gravity

Liquefaction Potential

Liquefaction is a soil strength and stiffness loss phenomenon that typically occurs in loose, saturated cohesionless soils as a result of strong ground shaking during earthquakes. The potential for liquefaction at a site is usually determined based on the results of a subsurface geotechnical investigation and the groundwater conditions beneath the site. Hazards to buildings associated with liquefaction include bearing capacity failure, lateral spreading, and differential settlement of soils below foundations, which can contribute to structural damage or collapse.

The results of the seismic cone penetration test soundings (SCPT1 and SCPT2) performed at the site revealed the underlying soils generally consist of silty clays with interbedded silt layers extending to the maximum explored depth of 100 feet below existing site grades. Based upon the relatively thick layers of cohesive soils, and the lack of historic occurrence of liquefaction, it is our opinion that the potential for liquefaction of the soils beneath most of the site is relatively low. However, alluvial fan deposits underlying the site are of a relatively young geologic age, and relatively thin interbedded granular soil deposits were encountered at the SCPT soundings. In addition, based on available groundwater data, the historical high groundwater is indicated to be about nine feet below the existing ground surface. These site conditions require than an evaluation of the liquefaction potential be performed at the site in accordance with the 2013 CBC.

A liquefaction analysis to determine factors of safety against liquefaction was performed for the soil and groundwater conditions encountered at SCPT1 and SCPT2. The liquefaction analysis was performed on the soils located within 50 feet of the ground surface, as theoretical liquefaction at depths greater than 50 feet below the ground surface is generally not considered capable of affecting improvements to the site at those depths.

Liquefaction Analysis and Results

In performing our liquefaction analysis we used the soil liquefaction assessment software LiqIT (Version 4.7) developed by GeoLogismiki that utilizes data collected from SCPT soundings to determine factors of safety against liquefaction for varying earthquake input energies. The program uses the results of the National Center for Earthquake Engineering Research (NCEER) liquefaction evaluation methods summarized by Youd, et al (2001). Input values were obtained using the results of SCPT1 and SCPT2. A design static groundwater level of nine feet below the existing ground surface (approximate historical high groundwater elevation) was used in our analysis based on our review of historic groundwater levels at the site. A peak ground acceleration (PGA_M) of 0.37 g was used in the liquefaction analysis based on Equation 11.8-1 of ASCE Standard 7-10. A mode magnitude earthquake of 6.56 was used for this analysis using the 2008 USGS National Seismic Hazard Mapping Project (NSHMP) Probabilistic Seismic Hazard Analysis (PSHA) Interactive Deaggregation web site.

Our analysis of the SCPT data indicates that most of the soils encountered in the SCPTs are clays with interbedded silts with safety factors of 5.0 or greater against liquefaction. However, the analysis reveals that relatively thin discrete soil layers within SCPT1 possess safety factors between about 0.52 and 1.28. A factor of safety of 1.3 or greater against liquefaction potential is generally considered acceptable (liquefaction-induced settlement unlikely).

Copies of the output files for the liquefaction analysis, including the results of the 2008 USGS NSHMP PSHA Interactive Deaggregation, are provided in Appendix C.

Seismically Induced Settlement

Post-liquefaction settlement calculations within LiqIT are performed using the methodology of Ishihara and Yoshimine (1992). Given the results of our analysis performed for this investigation, the worst-case estimate of total post-liquefaction settlement is calculated to be about 0.6 inches of total and differential settlement across 50 feet, or the least dimension of the structure, whichever is less. These estimates of post-liquefaction seismic settlements represent free-field ground settlement, not settlement of the proposed structures.

Liquefaction potential at the site was also evaluated based on the Liquefaction Potential Index (LPI). The LPI is a measure of the liquefaction potential based on an analysis of the entire vertical soil profile not just discrete layers (Iwasaki, 1986; Toprak and Holzer, 2003). Factors taken into consideration for the LPI calculations include: thickness of the liquefied layer; proximity of the liquefied layer to the surface; and, the factor of safety. The LPI ranges from 0 to 100 with the value zero representing no liquefaction potential. Surface manifestations of liquefaction occur at LPI ≥ 5. The LPI for the SCPT soundings are presented below in Table 3:

TABLE 3
SUMMARY OF LIQUEFACTION POTENTIAL INDEX (LPI)

SCPT Sounding	LPI
SCPT1	1
SCPT2	0

Based on the soil conditions encountered at the site and our liquefaction analysis, including LPI evaluations, it is our professional opinion that the potential for liquefaction of the soils beneath the site is very low.

In our opinion, based on the calculated settlements, structures designed to withstand complete collapse from “worst-case scenario” total and differential seismic settlements of 0.6 inches across 50 feet, or the shortest dimension of the structure, whichever is less, would be capable of achieving life safety requirements as established by the 2013 CBC.

Excavation Conditions

The soils at the site are anticipated to be excavatable with conventional earthwork and trenching equipment. Standard size backhoes and excavators should be capable of excavating soils at the site associated with foundations, pavements and utility trenches.

Based on our borings, foundation excavations and shallow trenches for utilities, less than five feet deep, should stand at near vertical inclinations, unless saturated soil conditions are encountered. Utility trench excavations deeper than five feet should be sloped or braced in accordance with current California Occupational Safety and Health Administration (Cal/OSHA).

Soil Expansion Potential

Laboratory testing of clay soils collected from the upper four feet at different areas of the site revealed the near-surface soils are of high to very high plasticity when tested in accordance with the American Society of Testing and Materials (ASTM) D4318 (see Figure A1). Clay soils with high to very high plasticity typically also possess a significant degree of expansion potential. Laboratory test results of near-surface soils collected from the upper four feet at Borings D7 and D17 revealed the near-surface clay soils possess a “medium” to “very high” expansion potential when tested in accordance with ASTM D 4829 test method (see Figures A3 and A4). Review of the Department of Agricultural NRCS Soil Survey for Yolo County, California indicates the near-surface soils at project site consist of six different soils types, as described in the Soil Conservation Survey Soil Conditions section of this report. Therefore, the degree of expansion potential possessed by the surface and near-surface soils at the site will likely vary across the site.

Based on the laboratory test results and our experience on nearby projects, the near-surface clays are capable of exerting significant expansion pressures on structural foundations, interior slabs, exterior flatwork and pavements. Therefore, it is our opinion that expansive soils must be considered in the design and construction of the anticipated improvements associated with the innovation and technology center. Preliminary recommendations to mitigate the effect of expansive clay on the anticipated foundations, interiors slabs and flatwork have been provided in this report.

Material Suitability

The native soils are considered suitable for use as engineered fill, provided they do not contain significant vegetation or debris, and are at appropriate moisture contents to allow for proper

compaction. The clay soils present beneath the site are not suitable for direct support of interior or exterior slab-on-grade concrete. Preliminary recommendations for subgrade preparation have been presented in this report to mitigate the effect of expansive clay on the anticipated structures and slabs.

Pavement Subgrade Quality

Laboratory test results performed on near-surface clay soils from the upper four feet at Borings D2 and D13 revealed the near-surface clays are poor quality materials for support of asphalt concrete pavements, and will require thicker pavement sections to compensate for the poor quality pavement support characteristics. Laboratory test results revealed the clays possess a Resistance ("R") value of five when tested in accordance with California Test 301 (see Figure A5). For preliminary design purposes we have used an R-value of five for the calculation of alternate pavement sections supported on untreated near-surface clay soils.

Our experience in the vicinity of the site suggests that lime treatment of the clay soils can result in a substantial improvement to the support characteristics of the clays, and reduce the thickness of the required aggregate base materials. The performance of chemically stabilized soils is dependent on uniform mixing of the quicklime into the subgrade soils, and providing a proper curing period following compaction. An experienced soil stabilization contractor, combined with a comprehensive quality control program, is essential to achieve the best results with lime stabilized soils. Near-surface clay soils from the upper four feet at Boring D2 were mixed with four percent dolomitic quicklime and subjected to an R-value test. Laboratory test results indicate the treated clays possess an R-value of 80 when tested in accordance with California Test 301 (see Figure A6). Based on Chapter 610 of the *Caltrans Highway Design Manual*, dated May 7, 2012, a maximum R-value of 40 should be used for design of pavements to be supported on a treated subgrade. Therefore, for preliminary design purposes we have used an R-value of 40 for the calculation of alternate pavement sections supported on treated near-surface clay soils.

Preliminary Soil Corrosion Potential

Six samples of near-surface clay soils from the upper four feet were submitted to Sunland Analytical Lab for testing to determine pH, chloride and sulfate concentrations, and minimum resistivity to help evaluate the potential for corrosive attack upon buried concrete. The results of the corrosivity testing are summarized in Table 4; copies of the corrosion test reports are presented in Figures A7 through A12.

TABLE 4
SUMMARY OF SOIL CORROSIVITY TESTING RESULTS

Analyte	Units	Test Method	Sample Identification					
			D2 (0 to 4 ft.)	D5 (0 to 4 ft.)	D7 (0 to 4 ft.)	D11 (0 to 4 ft.)	D13 (0 to 4 ft.)	D17 (0 to 4 ft.)
pH	---	CA DOT 643 Modified*	7.78	7.77	7.52	7.42	7.53	7.6
Minimum Resistivity	Ω-cm	CA DOT 643 Modified*	940	830	750	860	830	720
Chloride	ppm	CA DOT 417	35.0	48.0	61.5	39.8	41.5	40.7
Sulfate	ppm	CA DOT 422	63.4	88.5	112.1	79.6	79.9	73.2

Notes:
* = Small cell method
Ω-cm = Ohm-centimeters
ppm = Parts per million
CA DOT = California Department of Transportation
ft. = feet

The California Department of Transportation Corrosion and Structural Concrete Field Investigation Branch, Corrosion Guidelines, considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 2000 ppm, or the pH is 5.5 or less. Based on this criterion, the on-site soils tested are not considered usually corrosive to steel reinforcement properly embedded within Portland cement concrete (PCC). However, the relatively low resistivity test results of the samples tested indicates the on-site soils may be moderately to highly corrosive to unprotected metal in contact with surface and near-surface soils at the site.

Table 4.2.1 – *Exposure Categories and Classes*, American Concrete Institute (ACI) 318, Section 4.2, as referenced in Section 1904.1 of the 2013 CBC, indicates the severity of sulfate exposure for the sample tested is *Not Applicable*. Ordinary Type I-II Portland cement is considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, if it is desired to further define the soil corrosion potential at the site, a corrosion engineer should be consulted.

Groundwater and Seasonal Moisture

Groundwater was observed in our SCPT explorations at a depth of about 34 feet below existing site on November 26, 2014; however, review of available groundwater data revealed the historical high groundwater elevation at the site is likely about nine feet below the existing ground surface.

Based on historical groundwater data, we anticipate excavations greater than nine feet below existing site grades may encounter groundwater and require dewatering (depending on the time of year). For preliminary design purposes, groundwater should be anticipated at an elevation of +16 feet msl. Where groundwater is encountered, the use of sumps, submersible pumps, deep wells or a well point system could be used as methods to lower the groundwater level. The dewatering method used will depend on the soil conditions, depth of the excavation and amount of groundwater present within the excavation.

During the wet season, infiltrating surface runoff water will create a saturated surface condition due to the relatively low permeability of the near-surface soils. It is probable that grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soil, intended for use as engineered fill, will require a prolonged period of dry weather and/or considerable aeration to reach a moisture content that allows achieving the required compaction. This should be considered in the construction schedule for the project.

PRELIMINARY RECOMMENDATIONS

Site Grading

Of special importance for earthwork operations for this site will be the clearing of existing surface and subsurface structures associated with current and previous site activities, including all vegetation and organically laden soil, irrigation wells and distribution systems (including the existing and former canals and the detention basin), irrigation piping, any other underground utilities designated to be removed or abandoned, trench backfill associated with underground utilities, foundations, and existing concrete structures/slabs. On-site irrigation wells designated to be removed should be properly abandoned in accordance with Yolo County Environmental Health Department requirements. If documentation of the backfill observation/compaction operations for the former canal is not available, the area of the former canal should be properly identified and investigated to evaluate the conditions of the backfill material. Based on review

of historical aerial photographs, the approximate location of the former canal is shown on the Site Plan, Figure 2. Our subsurface exploration included three borings in the near vicinity of the former canal; however, evidence of the presence of fill soils was not observed. Excavations and depressions resulting from the removal of these items must be backfilled with engineered fill.

Removal of trees and other vegetation at the site should include the entire rootball and all roots larger than ½-inch in diameter. Removal of surface organics would depend on the condition and quantity of the organics at the time grading is to begin. Discing of the organics may be suitable for construction, if the organic concentrations are not too heavy at the time of grading. Stripping of the organics likely would be required if organic concentrations are high, with strippings being completely removed from the site or used only in landscape areas.

The removal of trees and root systems likely will disturb the soils to depths of at least 24 inches. This condition may require over-excavation of surface soils to moisture condition and recompact to the full depth of the soils disturbance. Excavation depths in the range of 12 to 18 inches may be required in areas where trees will be removed, although the actual depth of over-excavation can only be determined at the time the work is performed.

Due the presence of disturbed/soft surface and near-surface soils within the upper 1½ to 2 feet of major portions of the site, a combination of over-excavation, processing, moisture conditioning and uniform recompaction of the surface and near-surface soils will likely be required to achieve stable support conditions for the proposed improvements associated with the office/research park. A contingency should be provided to include a unit cost (per cubic yard) for over-excavation and recompaction as engineered fill.

The expansive clay soils present beneath the site are not suitable for direct support of interior or exterior slab-on-grade concrete; therefore, expansive soil pressures must be considered in the design and construction of the anticipated improvements associated with the office/research park. Preliminary recommendations for subgrade preparation to mitigate the effect of expansive clay on the anticipated structures and slabs may include replacing expansive clay soils with imported, compactable, non-expansive, granular material, or chemically treating the on-site, expansive clay soils.

Standard fill construction and compaction procedures, including uniform moisture conditioning of the on-site or imported soils to an over optimum moisture content at the time of compaction, will be important for proper support of the planned improvements associated with the office/research park.

Foundation Design and Floor Slab Support

Relatively shallow reinforced concrete conventional continuous perimeter foundations with isolated interior footings are anticipated to be capable of supporting structures with loads typical of one- to three-story buildings constructed of concrete, tilt-up panels. Our preliminary evaluation of the geotechnical aspects of the project reveals the near-surface soils at the site consist of medium to very highly expansive clays; therefore, minimum foundation depths of 18 inches are recommended for the planned buildings. Minimum foundation widths of 12 inches for continuous foundation and 24 inches wide for isolated spread foundations would be applicable for shallow foundations. We recommend that all foundations be reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. We anticipate a bearing capacity on the order of 2000 to 2500 pounds per square foot (psf) for dead plus live load will be applicable to undisturbed native materials and engineered fill.

Interior slab-on-grade concrete floors can be supported on a properly prepared subgrade and should be designed and constructed for their intended use with appropriate thickness, reinforcement, jointing and consideration of potential moisture vapor penetration. Uniform moisture conditioning and compaction of the subgrade soils prior to concrete placement, design of the slabs with appropriate reinforcement and jointing, and providing adequate curing of the slab concrete are considered crucial to the performance of the slabs.

Preliminary Pavement Sections

Laboratory test results from near-surface clay soils collected from the upper four feet at Borings D2 and D13 exhibit poor support qualities for support of asphalt concrete pavements. Relatively thick pavement sections would be required for pavements unless the clays are lime-treated. Based on laboratory test results, we used a Resistance ("R") value of 5 for untreated native clay subgrades and an R-value of 40 for clay subgrades amended with at least four percent high calcium or dolomitic quicklime, for the design of pavements. Preliminary pavement sections for varying traffic conditions (i.e. Traffic Indices) are presented as Table 5. The procedures used for flexible pavement design are in general conformance with Chapters 600 to 670 of the *California Highway Design Manual*, dated May of 2012.

TABLE 5
PRELIMINARY PAVEMENT DESIGN ALTERNATIVES
FOR ASPHALT CONCRETE PAVEMENTS

Traffic Index (TI)	Pavement Use	Untreated Subgrades R-value = 5		Lime-Treated Subgrades Soils (a) R-value = 40	
		Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
4.5	Automobile Parking Only	2½*	10	2½*	4
5.5	Automobile and Light to Moderate Truck Traffic	2½	13	2½*	7
		3*	12	3½*	5
6.5	Moderate Truck Traffic and Fire Lanes	3	16	3	8
		4*	14	4*	6

** = Asphalt concrete thickness contains the Caltrans safety factor.*
(a) = Lime-treated subgrade should be at least 12 inches thick and possess a minimum R-value of 40 when testing in accordance with California Test 301.

We emphasize that the performance of a pavement is critically dependent upon uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill within the limits of the pavements.

If pavement subgrade soils will be lime-treated, for estimating purposes only, we recommend a minimum spread rate of at least 4½ pounds of quicklime per square foot of mixing depth (at least 12 inches).

Materials used for pavement construction should conform to the appropriate sections of the most recent editions of the Caltrans Standard Specifications and applicable municipality standards, latest editions.

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to the performance of pavements. Where drop

inlets or other surface drainage features are to be constructed, we strongly recommend that weep holes be provided at the base/subgrade level to allow free drainage of collected water.

Future Geotechnical Engineering Study

Prior to final design and the commencement of site grading, a design level geotechnical investigation of the property should be conducted. The design level geotechnical investigation should include additional test borings or test pits with soil sampling, laboratory testing and additional engineering evaluation. The final report should present geotechnical engineering conclusions and specific recommendations regarding site preparation, foundation design, floor support, site drainage and pavement design.

LIMITATIONS

The findings, conclusions and preliminary recommendations contained in this report are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by our field exploration and laboratory testing program. We have used prudent engineering judgment based upon the information provided and the data generated.

This report has been prepared in substantial conformance with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

We emphasize that this report is general in nature and intended for use in planning and budgeting for the project and is applicable only to the investigated site.

Wallace - Kuhl & Associates

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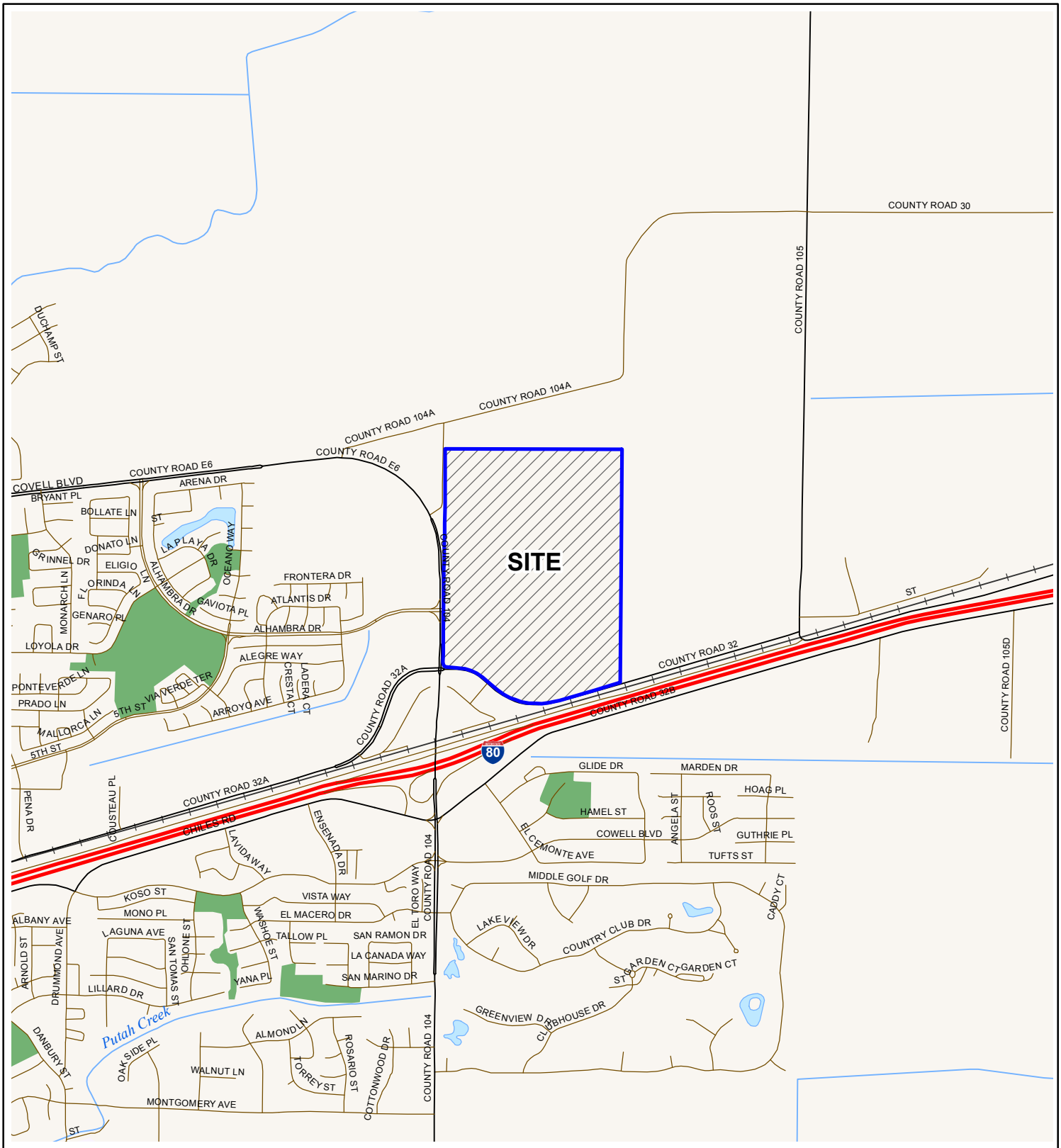

Street data courtesy of ESRI, 2010.
Hydrography courtesy of the U.S. Geological Survey acquired from the GIS Data Depot, December, 2007.
Projection: NAD 83, California State Plane, Zone II

N

0 1,000 2,000
Feet

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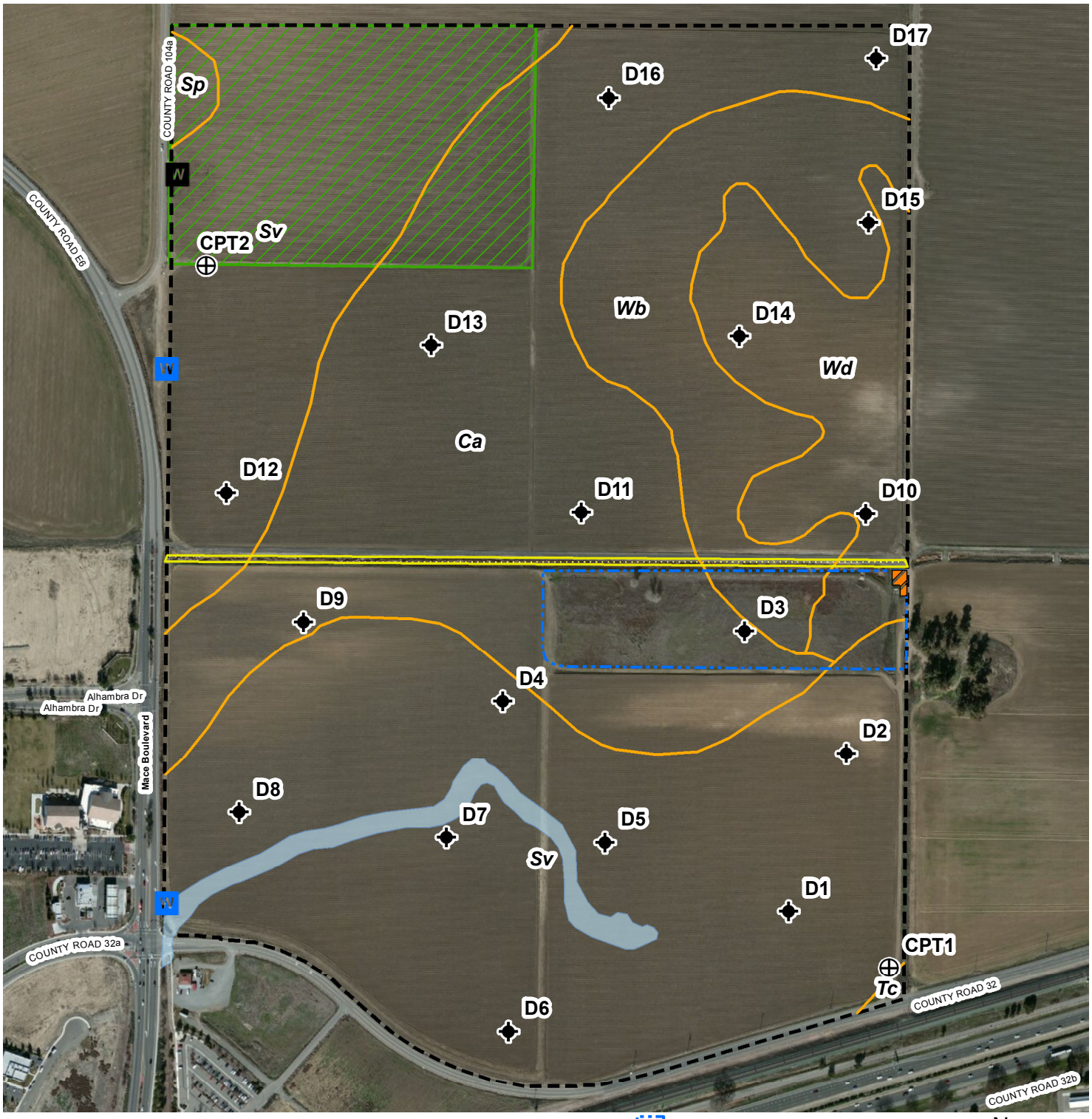
VICINITY MAP

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	1
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15

WKA NO. 10344.02



Aerial imagery courtesy of ESRI.
Projection: NAD 83, California State Plane, Zone II

Legend

- Former Canal
- Approximate CPT Location
- Approximate Boring Location
- Site Boundary
- Recently harvested row crop
- Detention Basin
- Drainage Canal
- Fenced Area
- *Ca* - Capay silty clay
- *Sp* - Sycamore silt loam, drained
- *Sv* - Sycamore complex, drained
- *Tc* - Tyndall very fine sandy loam, drained
- *Wb* - Willows clay
- *Wd* - Willows clay, alkali, drained
- W Active Well
- W Inactive Well

N

0 250 500
Feet

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SOIL SURVEY MAP

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	2
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO. 10344.02	

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D1

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**20.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, slightly sandy, silty CLAY (CL).		D1-1I	17	16.3	102	
			Brown, moist, stiff, silty CLAY (CL).		D1-2I	18	23.6	102	
	5								
					D1-3I	12	28.2	86	
	10								
			brown with orange-brown mottling, very stiff		D1-4I	23			
	15								
			stiff		D1-5I	19			
	20		Boring terminated at 20' below existing site grade. Groundwater was not observed.						

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FIGURE 3

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D2

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**26.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D2 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, medium stiff to stiff, silty CLAY (CH).						
					D2-1I	10	22.9	102	
			Brown, moist, soft to medium stiff, silty CLAY (CL).						
			Brown, moist, stiff, slightly sandy, silty CLAY (CL).						
	5				D2-2I	16	23.1	96	
	10				D2-3I	13	27.5	97	
			Brown mottled with orange-brown, moist, very stiff, sandy CLAY (CL); fine sand.						
	15				D2-4I	21	30.8	86	
	20				D2-5I	27			
			Brown to orange-brown, moist, medium dense, clayey SAND (SC); fine to medium sand.						
			Brown to orange-brown, moist, very stiff, sandy CLAY (CL); fine sand.						
	25				D2-6I	21			
			Boring terminated at 26.5' below existing site grade. Groundwater was not observed.						

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FIGURE 4

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D3

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**16.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Brown, moist, stiff, sandy CLAY (CL-Fill); fine to medium sand.						
					D3-1I	15	23.9	100	
	5		Interbedded with layers of silty sand; fine to coarse sand; trace of fine gravel.		D3-2I	11	18.1	100	
			Brown, moist, stiff, silty CLAY (CL/CH).						
	10				D3-3I	19	31.2	90	
			Brown to red-brown, moist, stiff, slightly sandy, silty CLAY (CL).						
	15				D3-4I	18			
			Boring terminated at 16.5' below existing site grade. Groundwater was not observed.						

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FIGURE 5

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D4

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**25.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, medium stiff, silty CLAY (CH).		D4-1I	9	22.2	92	PI
					D4-2I	34	19.8	106	
	5		Brown, moist, very stiff, sandy CLAY (CL); fine to medium sand.						
			Brown, moist, stiff, slightly sandy, silty CLAY (CL).						
					D4-3I	12	26.7	99	
	10		Brown, moist, very stiff, silty CLAY (CL/CH)						
					D4-4I	30			
	15								
			brown with red-brown mottling		D4-5I	25			
	20								
			Brown, moist, very stiff, sandy CLAY (CL); fine to medium sand.						
					D4-6I	21			
	25		Boring terminated at 25' below existing site grade. Groundwater was not observed.						

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FIGURE 6

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D5

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**16.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D5 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D5-1I	13	24.5	97	
	5		Brown, moist, stiff, sandy CLAY (CL); fine sand.		D5-2I	15	23.3	100	
	10		Brown, moist, medium stiff, slightly sandy, silty CLAY (CL).		D5-3I	8	31.8	91	
	15		Brown, moist, very stiff, silty CLAY (CL).		D5-4I	22			
			Boring terminated at 16.5' below existing site grade. Groundwater was not observed.						

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FIGURE 7

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D6

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**20.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, medium stiff to stiff, silty CLAY (CH).		D6-1I	10	25.8	96	
					D6-2I	16	24.1	96	
	5		Brown, moist, stiff, sandy CLAY (CL); fine sand.						
			Brown mottled with orange-brown, moist, stiff, slightly sandy, silty CLAY (CL).		D6-3I	11	25.2	101	
	10								
					D6-4I	16			
	15								
			Brown, moist, medium dense, clayey SAND (SC); fine sand.						
					D6-5I	15			
	20		Boring terminated at 20' below existing site grade. Groundwater was not observed.						

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FIGURE 8

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D7

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**16.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D7 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D7-1I	19			PI
	5		Brown, moist, very stiff, slightly sandy, silty CLAY (CL).		D7-2I	33	21.0	105	
	10		Brown mottled with orange-brown, moist, very stiff, silty CLAY (CL/CH).		D7-3I	25	20.2	108	
	15		Brown, moist, stiff, sandy CLAY (CL).		D7-4I	18	21.1	103	
			Boring terminated at 16.5' below existing site grade. Groundwater was not observed.						

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FIGURE 9

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D8

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**25.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D8-1I	12	21.6	113	
					D8-2I	15	27.4	91	
	5		Brown, moist, stiff, slightly sandy, silty CLAY (CL).						
					D8-3I	11	24.5	98	
	10								
			light brown		D8-4I	18	26.1	96	
	15								
					D8-5I	15			
	20		Brown, moist, very stiff, silty CLAY (CL).						
					D8-6I	21			
	25		Boring terminated at 25' below existing site grade. Groundwater was not observed.						

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FIGURE 10

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D9

Sheet 1 of 1

Date(s) Drilled	**1/5/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**21.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty CLAY (CH).		D9-1I	21	27.7	93	
	5		brown with red-brown mottling		D9-2I	35	27.1	84	
			Brown, moist, stiff to very stiff, slightly sandy, silty CLAY (CL).						
	10				D9-3I	20	27.1	88	
			Brown, moist, very stiff, silty CLAY (CL).						
	15				D9-4I	24			
	20				D9-5I	32			
			lens of silty sand						
			Boring terminated at 21.5' below existing site grade. Groundwater was not observed.						

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FIGURE 11

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D10

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**21.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D10-1I	17			PI
	5		Brown, moist, stiff, slightly sandy, silty CLAY (CL).		D10-2I	16	27.3	95	
	10		Brown, moist, very stiff, silty CLAY (CL).		D10-3I	22	23.4	101	
	15		stiff		D10-4I	19	30.6	91	
	20		very stiff		D10-5I	22			
			Boring terminated at 21.5' below existing site grade. Groundwater was not observed.						

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FIGURE 12

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D11

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**15.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D11 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, medium stiff, silty CLAY (CH).		D11-1I	7			
			very stiff		D11-2I	27			
	5		Brown, moist, very stiff, slightly sandy, silty CLAY (CL).						
			stiff		D11-3I	15			
	10		Brown, moist, stiff, silty CLAY (CL).		D11-4I	19			
	15		Boring terminated at 15' below existing site grade. Groundwater was not observed.						

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FIGURE 13

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D12

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**26.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).						
					D12-1I	16	28.4	93	
	5		very stiff		D12-2I	22	25.9	92	
	10		brown		D12-3I	26	22.2	103	
	15				D12-4I	25	26.5	94	
			Brown, moist, very stiff, slightly sandy, silty CLAY (CL).						
	20				D12-5I	23			
	25				D12-6I	21			
			Boring terminated at 26.5' below existing site grade. Groundwater was not observed.						

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FIGURE 14

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D13

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**20.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D13 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, medium stiff, silty CLAY (CH).		D13-1I	6	28.8	91	
			very stiff		D13-2I	22	24.4	97	
	5		Brown, moist, stiff, slightly sandy, silty CLAY (CL).		D13-3I	16	27.6	99	
	10		Brown, moist, very stiff, silty CLAY (CL).		D13-4I	23	23.3	97	
	15				D13-5I	31			
	20		Boring terminated at 20' below existing site grade. Groundwater was not observed.						

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FIGURE 15

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D14

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**16.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, slightly sandy, silty CLAY (CH).		D14-1I	22	20.7	99	
	5		Brown, moist, loose to medium dense, silty SAND (SM); fine to medium sand.		D14-2I	13	15.7	91	
			Brown, moist, stiff, slightly sandy, silty CLAY (CL).						
	10				D14-3I	13	28.9	87	
	15				D14-4I	18			
			Boring terminated at 16.5' below existing site grade. Groundwater was not observed.						

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FIGURE 16

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D15

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**26.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D15-1I	13	27.6	95	
	5		Brown, moist, stiff, slightly sandy, silty CLAY (CL).		D15-2I	14		93	
			Brown, moist, stiff to very stiff, silty CLAY (CL/CH).						
	10				D15-3I	20	21.5	103	
	15		light brown		D15-4I	21	20.9	102	
			Brown, moist, medium dense, silty SAND (SM); fine to medium sand.						
	20				D15-5I	27			
			Brown, moist, very stiff, slightly sandy, silty CLAY (CL).						
	25				D15-6I	23			
			Boring terminated at 26.5' below existing site grade. Groundwater was not observed.						

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FIGURE 17

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D16

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**20.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks				Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D16-1I	13			PI
			very stiff		D16-2I	26	20.9	98	
	5								
			Brown, moist, stiff, slightly sandy, silty CLAY (CL).		D16-3I	14	28.0	90	
	10								
					D16-4I	15	25.1	101	
	15								
			very stiff		D16-5I	32			
	20		Boring terminated at 20' below existing site grade. Groundwater was not observed.						

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FIGURE 18

Project: Mace Ranch Innovation Center
Project Location: Davis, California
WKA Number: 10344.02

LOG OF SOIL BORING D17

Sheet 1 of 1

Date(s) Drilled	**1/6/15**	Logged By	**ML**	Checked By	**DRG**
Drilling Method	**Solid Stem Auger**	Drilling Contractor	**V & W Drilling, Inc.**	Total Depth of Drill Hole	**15.0 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Neat Cement**
Remarks	**Bulk Sample D17 (0' to 4')**			Driving Method and Drop	**140 lb hammer, 30 inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty CLAY (CH).		D17-1I	11	29.9	86	GR 97% fines
	5		brown, very stiff		D17-2I	25	22.9	98	
	10		light brown, stiff		D17-3I	17	23.8	98	
			Brown, moist, very stiff, slightly sandy, silty CLAY (CL).		D17-4I	34			
	15		Boring terminated at 15' below existing site grade. Groundwater was not observed.						

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FIGURE 19

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sampler: no recovery

= SPT Sampler

= Initial Water Level

= Final Water Level

— — — = Estimated or gradational material change line

——— = Observed material change line

Laboratory Tests

PI = Plasticity Index
EI = Expansion Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradational Analysis (Sieve)
K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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UNIFIED SOIL CLASSIFICATION SYSTEM

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	20
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO. 10344.02	

APPENDICES

APPENDIX A
General Project Information and Laboratory Test Results

APPENDIX A

A. GENERAL INFORMATION

The performance of a preliminary geotechnical engineering investigation for the approximate 212-acre Mace Ranch Innovation Center property, located easterly of Mace Boulevard, north of County Road 32A, in Davis, California, was authorized by Troy Estacio of Buzz Oates Group of Companies on December 1, 2014. Authorization was for an investigation as described in our proposal letter dated July 31, 2014 (Revised November 24, 2014), sent to our client Buzz Oates Group of Companies whose address is 8615 Elder Creek Road, Sacramento, California; telephone (916) 379-3834; facsimile (916) 379-8834.

B. FIELD EXPLORATION

As part of our investigation of the Mace Ranch Innovation Center property, our field exploration included the advancement of two seismic cone penetrometer test soundings (SCPT1 and SCPT2) and the drilling and sampling of 17borings (D1 through D17) at the approximate locations shown on Figure 2.

Seismic cone penetrometer test soundings SCPT1 and SCPT 2 were advanced at the site on November 26, 2014, utilizing a 25-ton, truck-mounted rig provided by Gregg Drilling & Testing, Inc. of Martinez, California. The SCPT's consisted of advancing a 10-square centimeter cone penetrometer at a rate of about one inch per second to a depth of about 100 feet below existing site grades. Data was collected from the cone penetrometer at an approximate depth interval of 10 centimeters (or 3.9 inches). Shear wave velocity data was collected from SCPT's at an approximate depth interval of 10 feet. Pore pressure dissipation tests were performed at SCTP1 and SCPT2 at a depth of about 98 and 67 feet below existing grades, respectively.

Borings D1 through D17 were drilled across the site on January 5 and 6, 2015, utilizing a CME-55 truck-mounted drill rig equipped with six-inch diameter, solid helical flight auger, to depths ranging from 15 to 26½ feet below existing site grades. At various intervals relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., modified California split-spoon sampler driven by a 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each six-inch (6") interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, is designated as the penetration resistance or "blow count" for that particular drive. The samples were retained in two-inch (2") diameter by six-inch (6") long thin-walled brass tubes contained within the sampler. After recovery, the soils in the tubes were visually classified by the field engineer and the ends of the tubes were sealed to preserve the natural moisture contents.

In addition to the driven sample from the borings, representative bulk samples of near-surface soils were also collected and retained in plastic bags. Driven and bulk samples were taken to our laboratory for additional soil classification and selection of samples for testing.

Copies of the reports for SCPT1 and SCPT2, provided by Gregg Drilling & Testing, Inc. are included in Appendix B.

The Logs of Soil Borings, Figures 3 through 19, contain descriptions of the soils encountered at each boring location. A boring legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 20.

C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D2216), and unconfined compressive strength (ASTM D2166). The results of these tests are included in the Logs of Borings at the depth each sample was obtained.

Five representative samples of near-surface cohesive soil were subjected to Atterberg Limits tests (ASTM D4318). The results of these tests are presented in Figure A1.

One soil sample was tested for particle-size distribution (ASTM C136/D422) and percent passing the No. 200 sieve (ASTM D1140). The results of the particle-size distribution tests are contained in Figure No. A2. The percent passing the No. 200 sieve are included on the boring logs at the depth the sample was obtained.

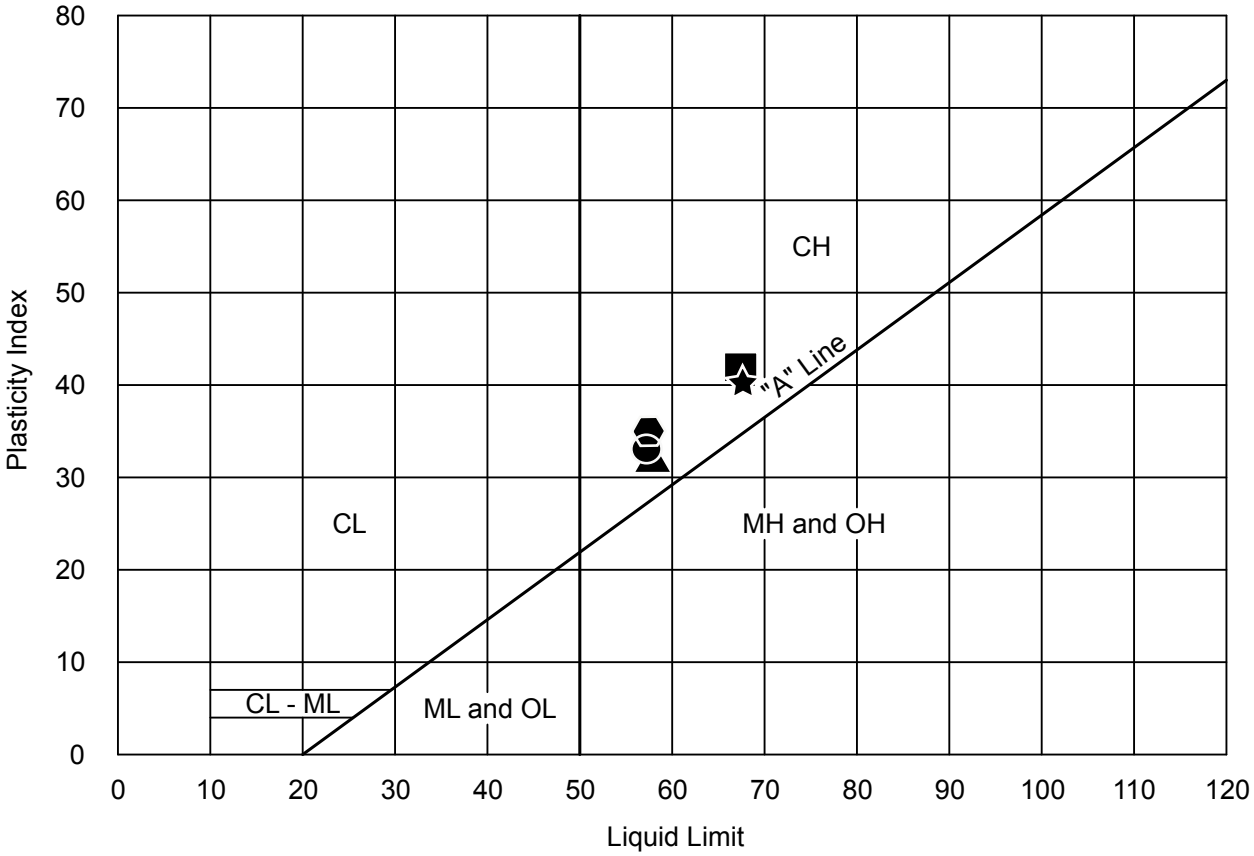
Two representative samples of near-surface soil from different areas of the site were subjected to Expansion Index testing (ASTM D4829); the results of the tests are presented in Figures A3 and A4.

Two bulk samples of anticipated pavement subgrade soil collected from different areas of the site were subjected to Resistance ("R") value testing in accordance with California Test 301. In addition, one sample was mixed with four percent dolomitic quicklime and subjected to an R-value test. The results of the R-value tests, which were used in the pavement design, are presented in Figures A5 and A6.

Six near-surface soil samples were submitted to Sunland Analytical to determine the soil pH and minimum resistivity (California Test 643), Sulfate concentration (California Test 417) and Chloride concentration (California Test 422). The results of these tests are presented in Figures A7 and A12.

ATTERBERG LIMITS

ASTM D4318



KEY SYMBOL	LOCATION	SAMPLE DEPTH	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		PASSING No. 200 SIEVE (%)	UNIFIED SOIL CLASSIFI-CATION SYMBOL
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		
●	D4-1I	1'-1.5'	22.2	58	33	---	CH
▲	D7- 1I	2'-2.5'	---	59	34	---	CH
⬢	D10-1I	2'-2.5'	---	57	35	---	CH
★	D16-1I	1'-1.5'	---	68	40	---	CH
■	D17	0'-4'	---	67	41	97	CH

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ATTERBERG LIMITS

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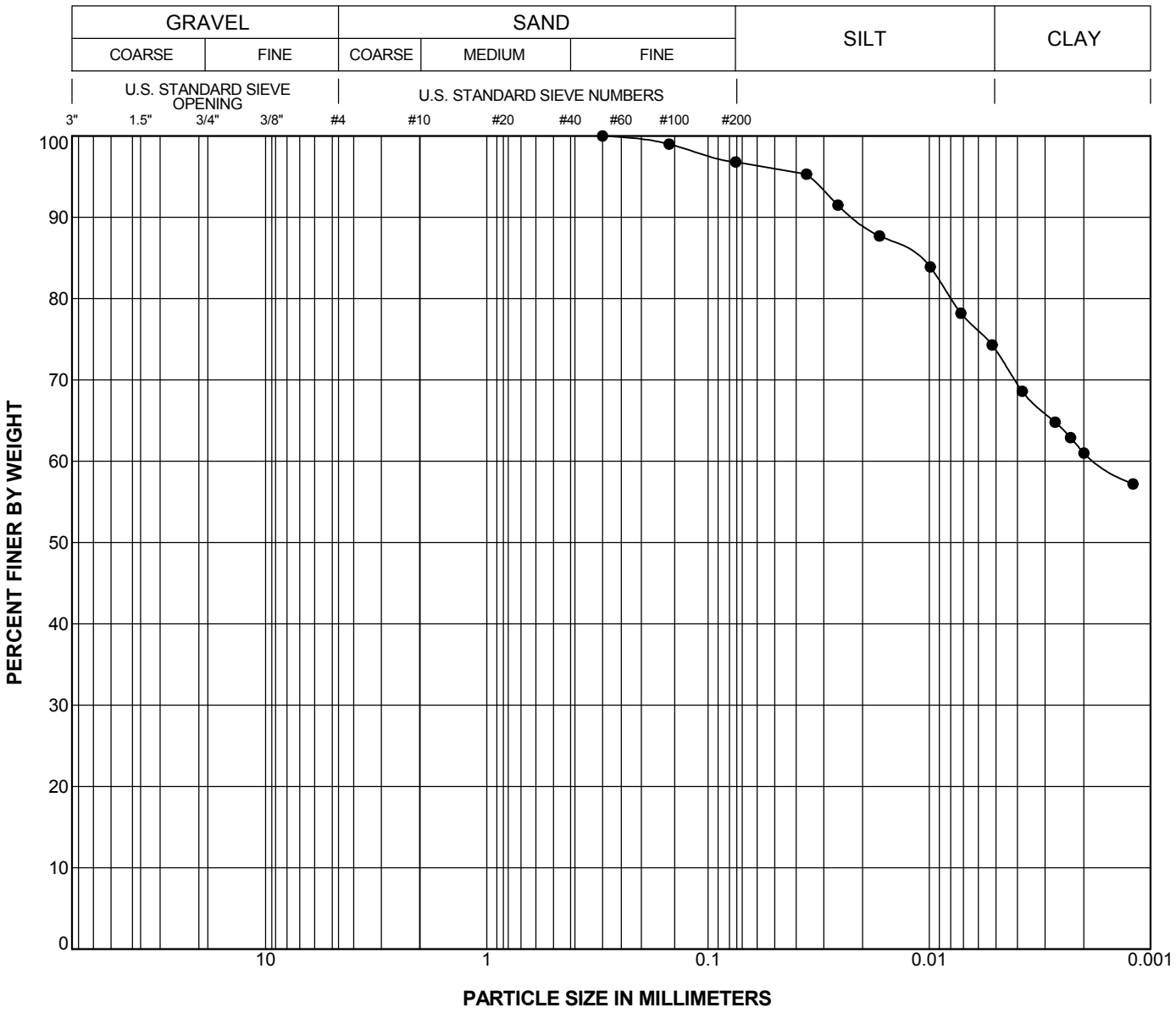
Davis, California

FIGURE	A1
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO. 10344.02	



Boring Number	Sample Number	USCS	Depth (feet)	Symbol	LL	PI	Classification
D17	D17	CH	0' to 4'	●	67	41	Dark brown, silty CLAY

PARTICLE SIZE DISTRIBUTION

Project: Mace Ranch Innovation Center
WKA No. 10344.02

FIGURE A2

GRAIN SIZE 10344.02 - MACE RANCH INNOVATION CENTER.GPJ WKA.GDT 1/16/15 11:02 AM

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EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Dark brown, silty clay

LOCATION: D7

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
0'-4'	14.8	34.6	93	**57**

CLASSIFICATION OF EXPANSIVE SOIL *

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	**Medium**
91 - 130	High
Above 130	Very High

* From ASTM D4829, Table 1

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EXPANSION INDEX

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Davis, California

FIGURE	A3
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15

WKA NO. 10344.02

EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Dark brown, silty clay

LOCATION: D17

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
0'-4'	16.6	37.7	89	**132**

CLASSIFICATION OF EXPANSIVE SOIL *

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	**Very High**

* From ASTM D4829, Table 1

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EXPANSION INDEX

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A4
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15

WKA NO. 10344.02

RESISTANCE VALUE TEST RESULTS

(California Test 301)

MATERIAL DESCRIPTION: Dark brown and brown, silty clay

LOCATION: D2 (0'-4')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial, inches x 1000)	Expansion Pressure (psf)	R Value
1	108	19.33	492	32	139	0.0

Sample extruded, therefore R-Value = 5

MATERIAL DESCRIPTION: Dark brown and brown, silty clay

LOCATION: D13 (0'-4')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial, inches x 1000)	Expansion Pressure (psf)	R Value
1	0.0	21.08	703	124	537	0.0

Sample extruded, therefore R-Value = 5

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RESISTANCE VALUE TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A5
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

RESISTANCE VALUE TEST RESULTS

(California Test 301)

MATERIAL DESCRIPTION: Dark brown and brown, silty clay with 4% lime

LOCATION: D2 (0'-4')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial, inches x 1000)	Expansion Pressure (psf)	R Value
1	108	19.38	223	0	0	76
2	111	18.56	344	0	0	83
3	111	17.71	454	5	22	89

R-Value at 300 psi exudation pressure = **80**

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RESISTANCE VALUE TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A6
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D2 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142407

EVALUATION FOR SOIL CORROSION

Soil pH	7.78			
Minimum Resistivity	0.94	ohm-cm (x1000)		
Chloride	35.0	ppm	0.0035	%
Sulfate-S	63.4	ppm	0.0063	%

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A7
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D5 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142408

EVALUATION FOR SOIL CORROSION

Soil pH	7.77		
Minimum Resistivity	0.83	ohm-cm (x1000)	
Chloride	48.0 ppm	0.0048	%
Sulfate-S	88.5 ppm	0.0089	%

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A8
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D7 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142409

EVALUATION FOR SOIL CORROSION

Soil pH	7.52			
Minimum Resistivity	0.75	ohm-cm (x1000)		
Chloride	61.5	ppm	0.0062	%
Sulfate-S	112.1	ppm	0.0112	%

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A9
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D11 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142410

EVALUATION FOR SOIL CORROSION

Soil pH	7.42	
Minimum Resistivity	0.86	ohm-cm (x1000)
Chloride	39.8 ppm	0.004 %
Sulfate-S	79.6 ppm	0.008 %

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A10
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D13 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142411

EVALUATION FOR SOIL CORROSION

Soil pH	7.53	
Minimum Resistivity	0.83	ohm-cm (x1000)
Chloride	41.5 ppm	0.0042 %
Sulfate-S	79.9 ppm	0.008 %

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

FIGURE	A11
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/14/15
Date Submitted 01/08/15

To: Mauricio Luna
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA, 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 10344.02-INNOVATION Site ID: D17 @ 0-4 FT
Your purchase order number is 1519.
Thank you for your business.

* For future reference to this analysis please use SUN # 68551 - 142412

EVALUATION FOR SOIL CORROSION

Soil pH	7.6	
Minimum Resistivity	0.72	ohm-cm (x1000)
Chloride	40.7 ppm	0.0041 %
Sulfate-S	73.2 ppm	0.0073 %

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

CORROSION TEST RESULTS

MACE RANCH INNOVATION CENTER

Davis, California

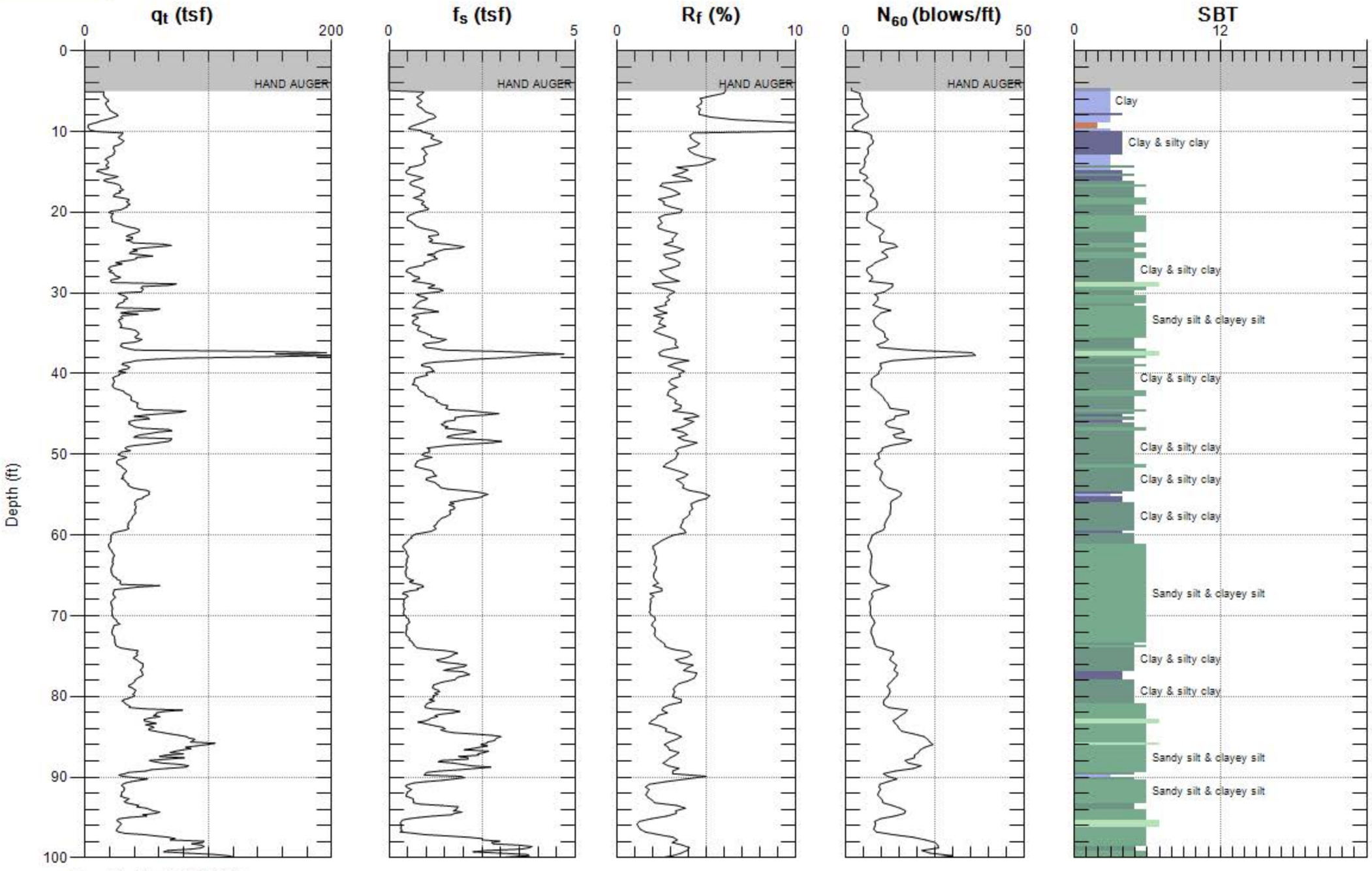
FIGURE	A12
DRAWN BY	KLP
CHECKED BY	ML
PROJECT MGR	DRG
DATE	01/15
WKA NO.	10344.02

APPENDIX B

Gregg Drilling & Testing, Inc. Cone Penetrometer Test Reports

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK
Sounding: SCPT-01
Engineer: M.LUNA
Date: 11/26/2014 09:04



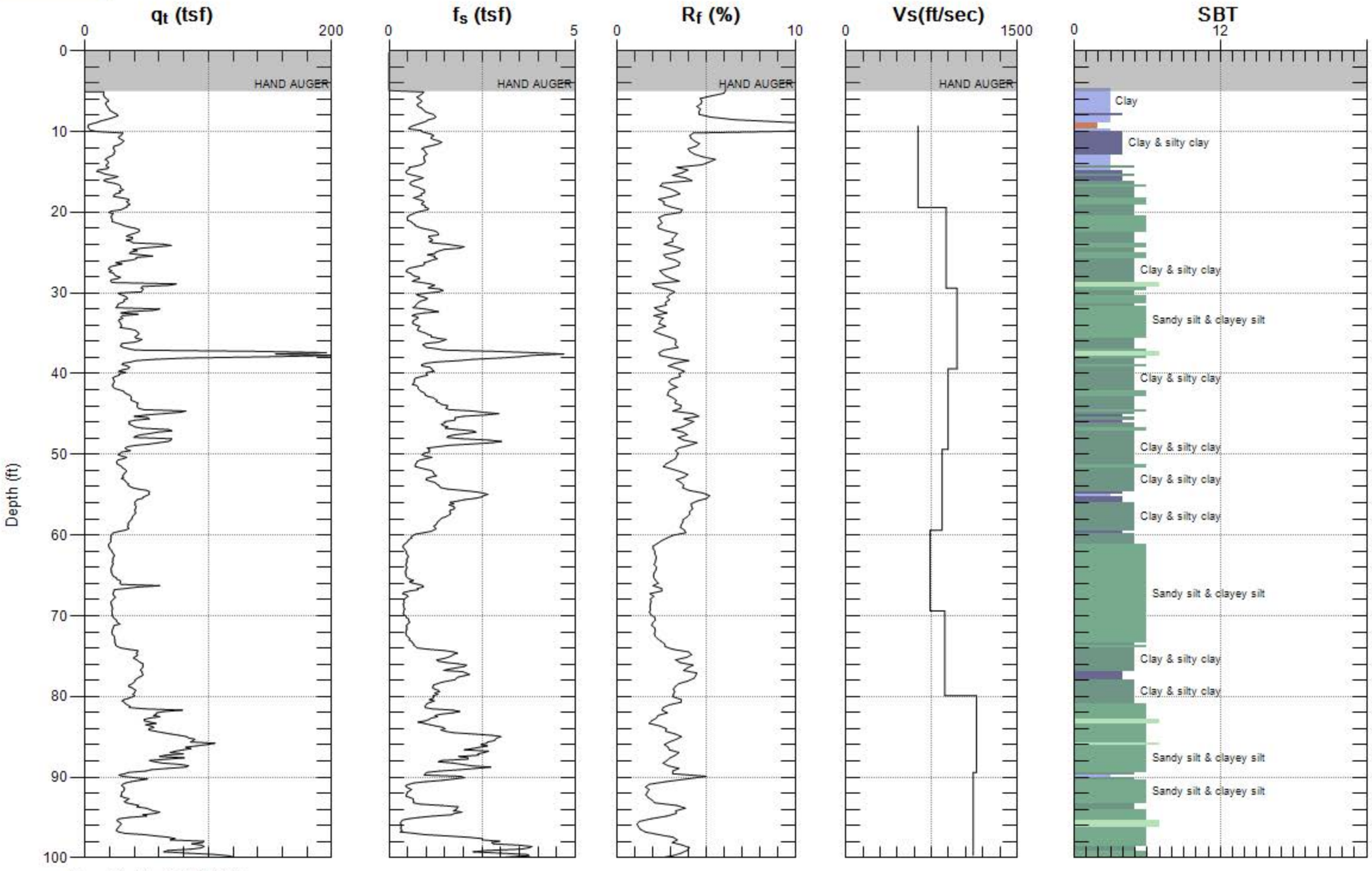
Max. Depth: 100.394 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK **Engineer: M.LUNA**

Sounding: SCPT-01 **Date: 11/26/2014 09:04**

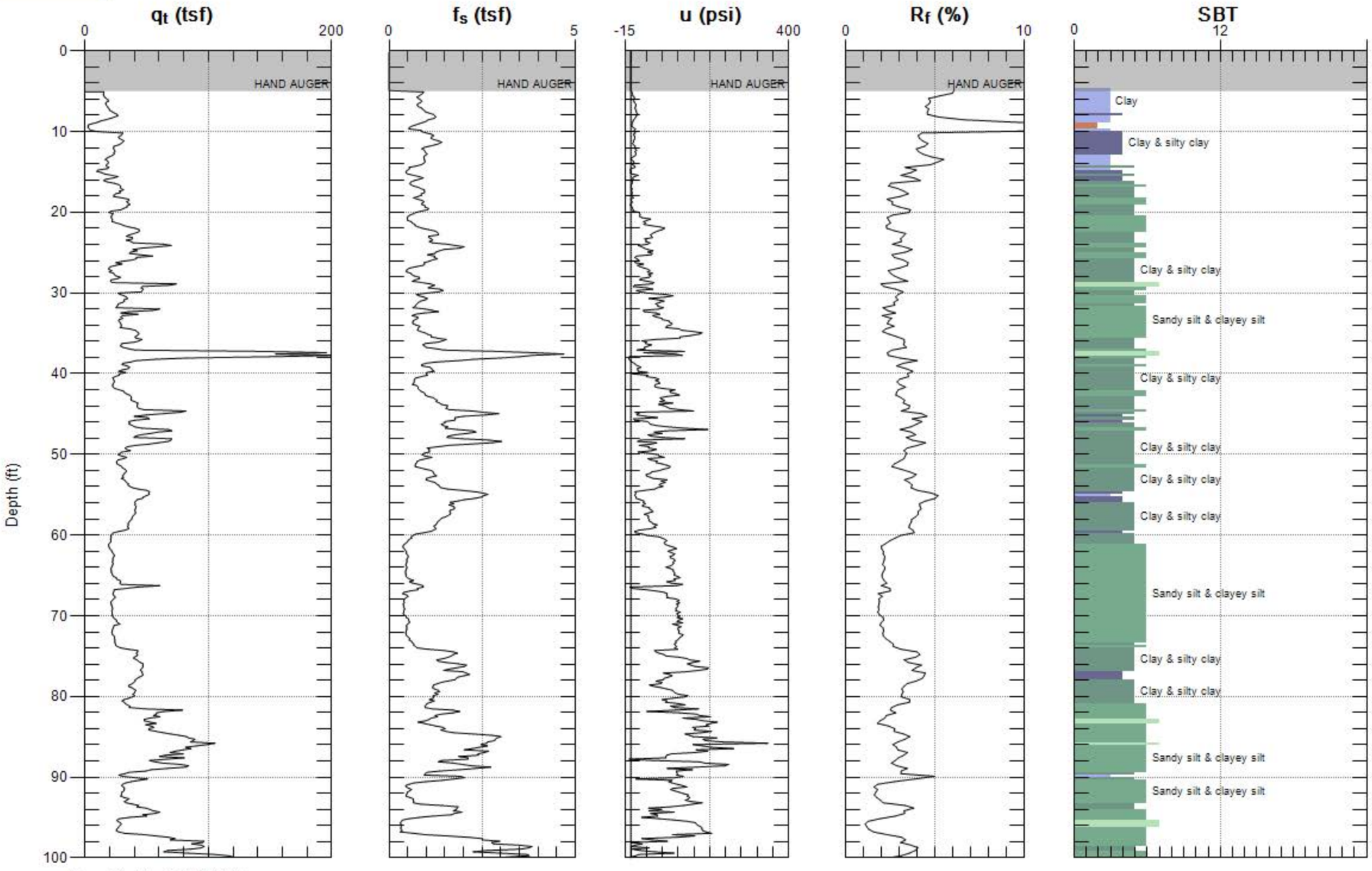


Max. Depth: 100.394 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK
Sounding: SCPT-01
Engineer: M.LUNA
Date: 11/26/2014 09:04

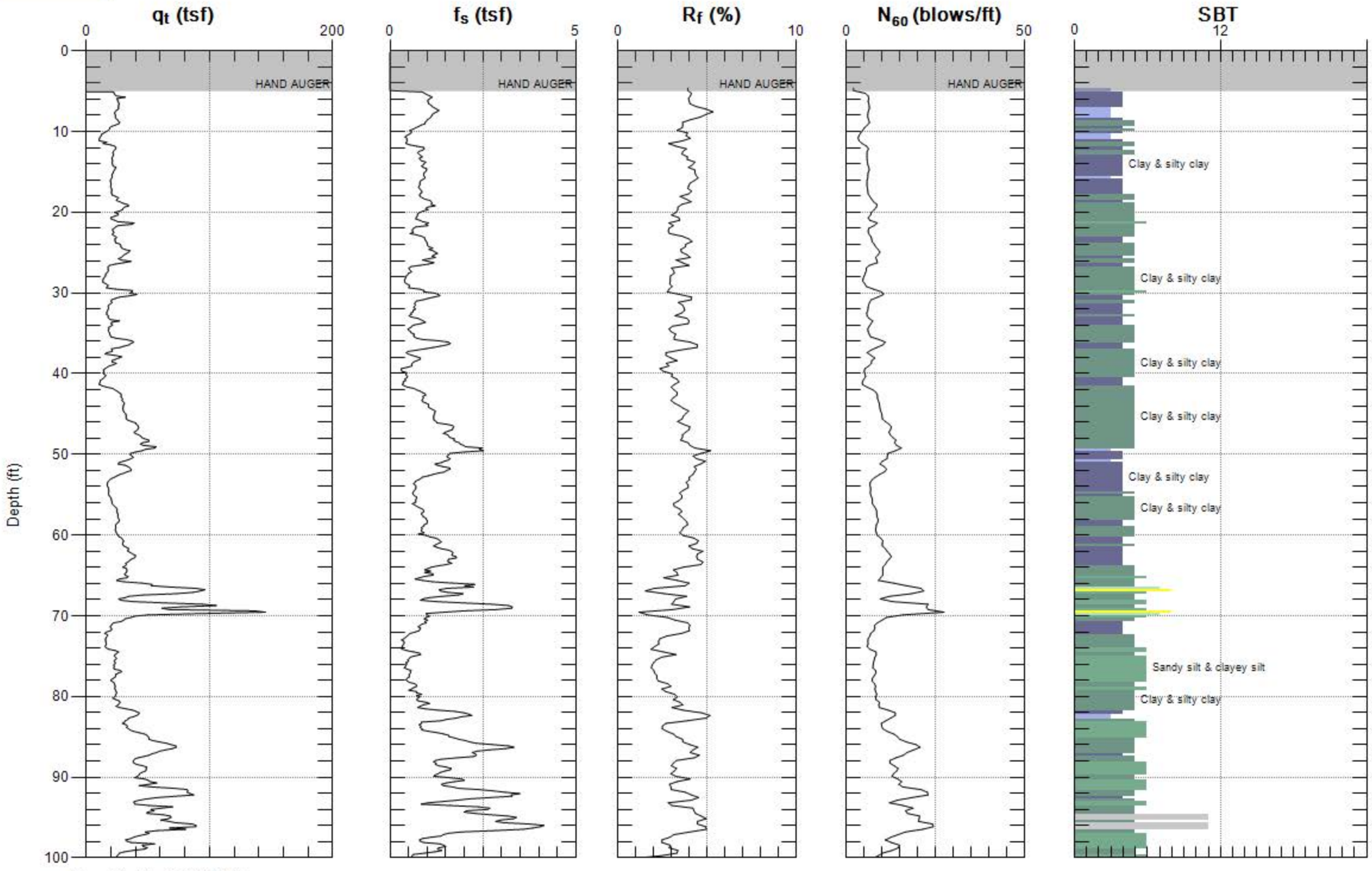


Max. Depth: 100.394 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK
Sounding: SCPT-02
Engineer: M.LUNA
Date: 11/26/2014 01:40



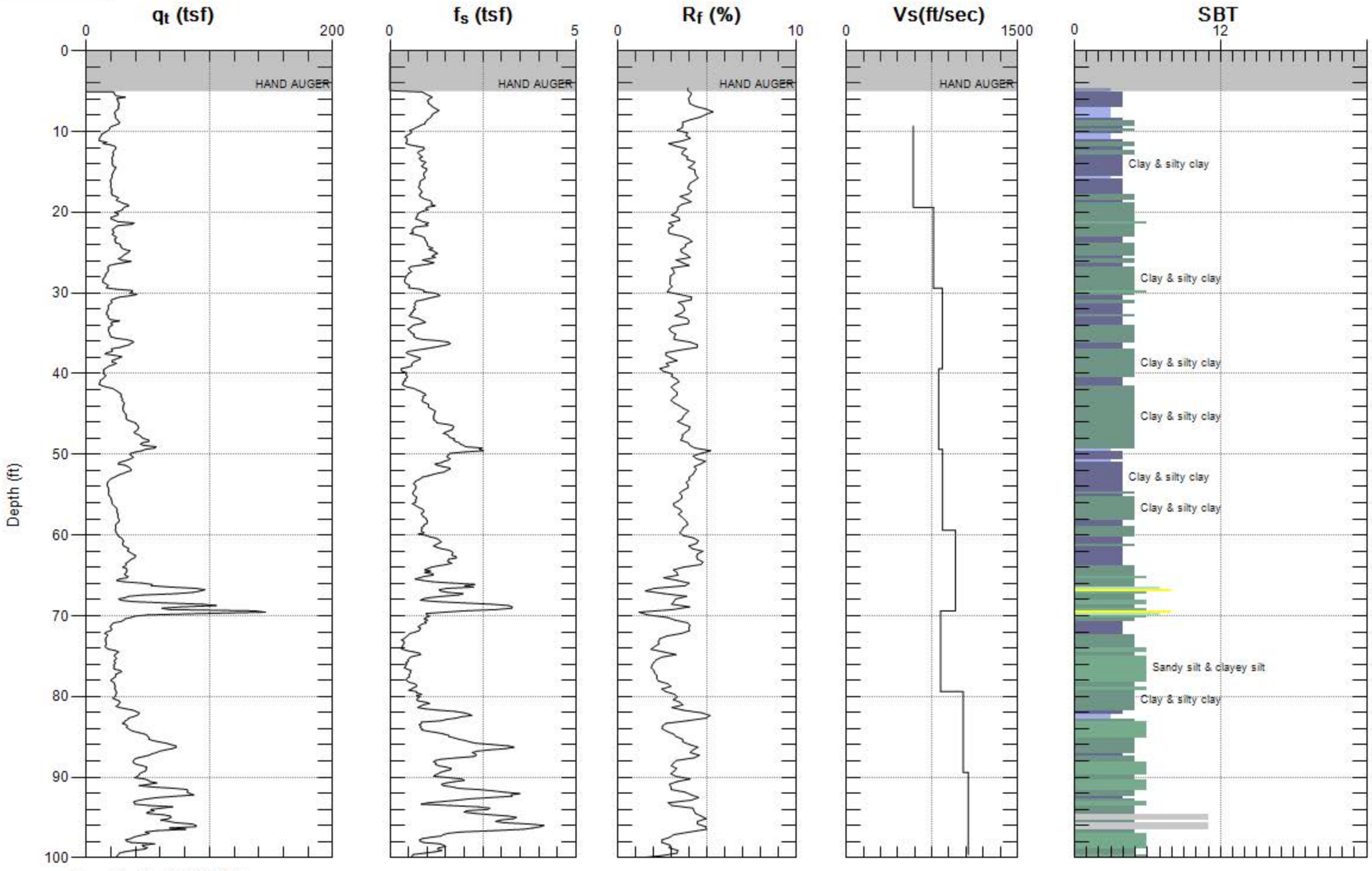
Max. Depth: 100.230 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK **Engineer: M.LUNA**

Sounding: SCPT-02 **Date: 11/26/2014 01:40**



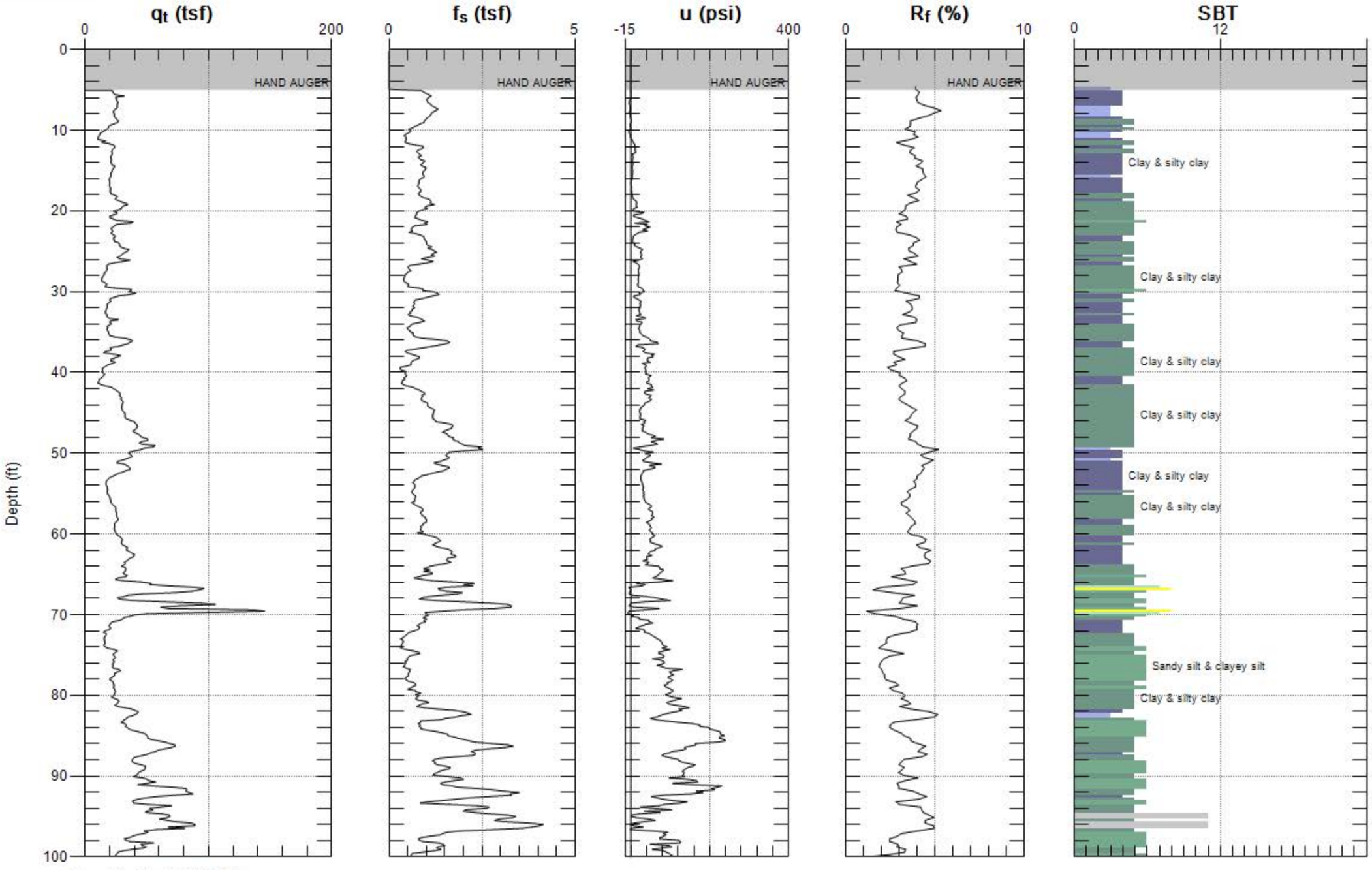
Max. Depth: 100.230 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

WALLACE-KUHL & ASSOC.

Site: DAVIS INNOVATION PK **Engineer: M.LUNA**

Sounding: SCPT-02 **Date: 11/26/2014 01:40**



Max. Depth: 100.230 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C
Liquefaction Analysis and Associated Data

GeoLogismiki
Geotechnical Engineering Software
Merarhias 56, 621 25 - Serrai, Greece
url: http://www.geologismiki.gr - email: info@geologismiki.gr

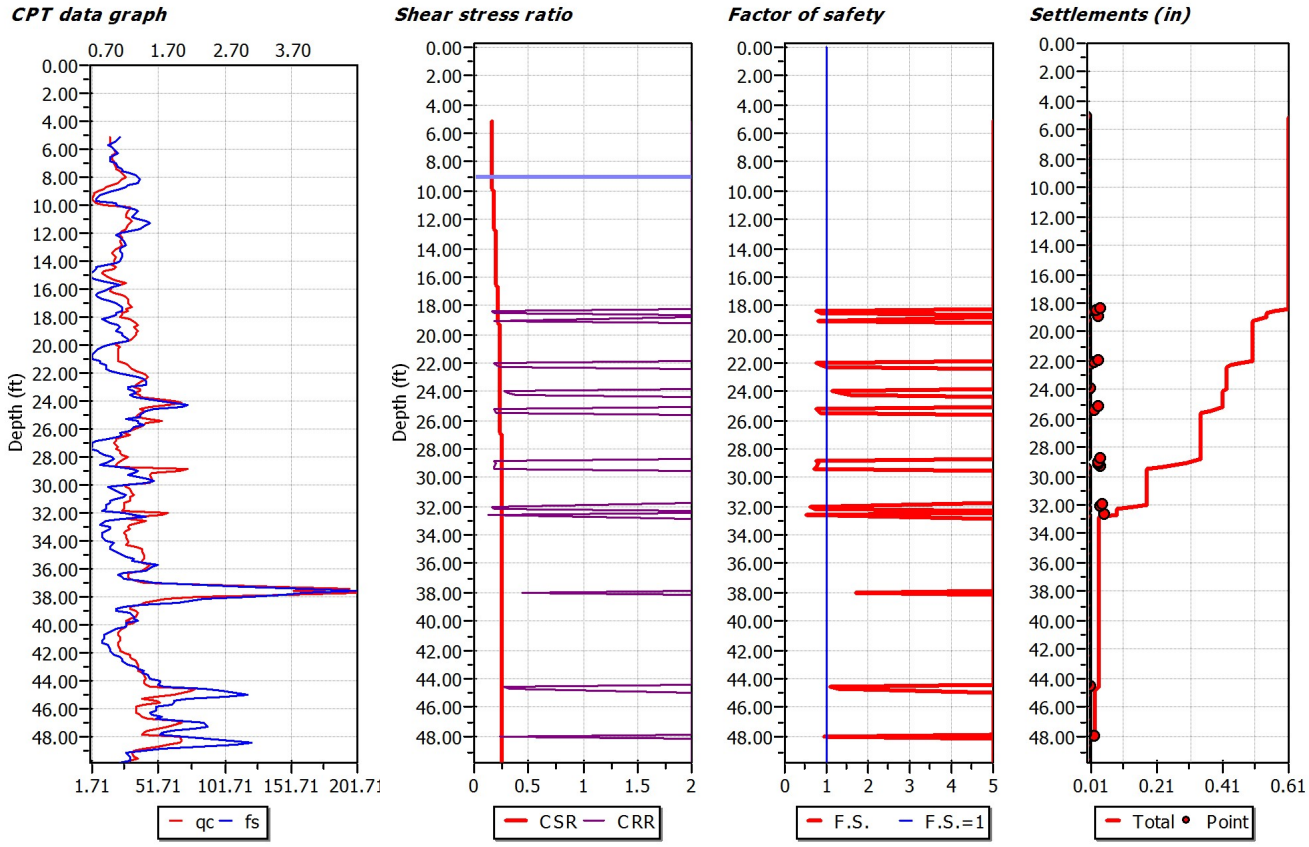
LIQUEFACTION ANALYSIS REPORT

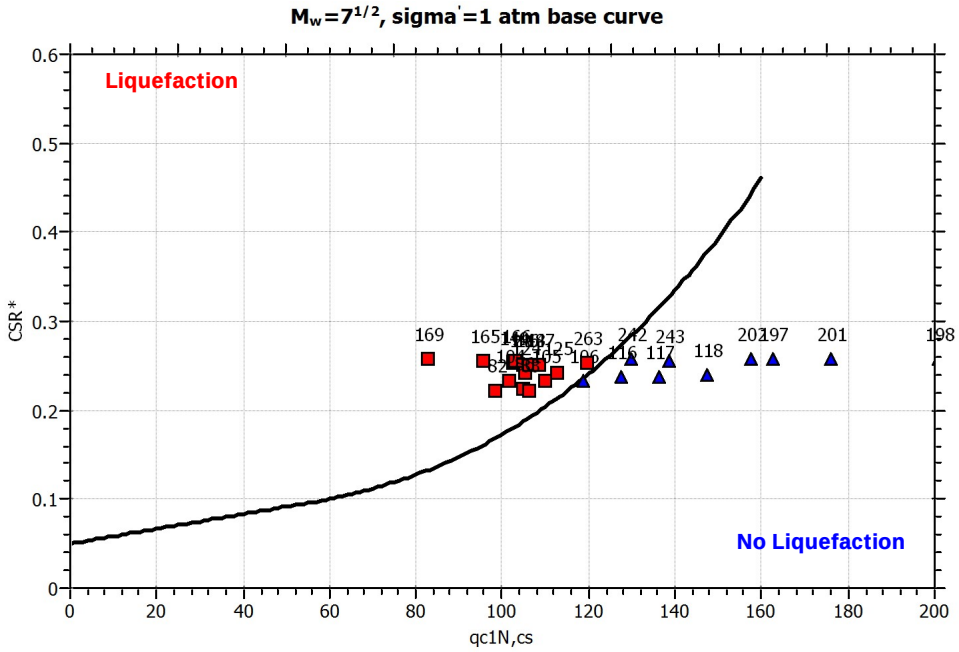
Project title : 10344.02 - Davis Innovation Park

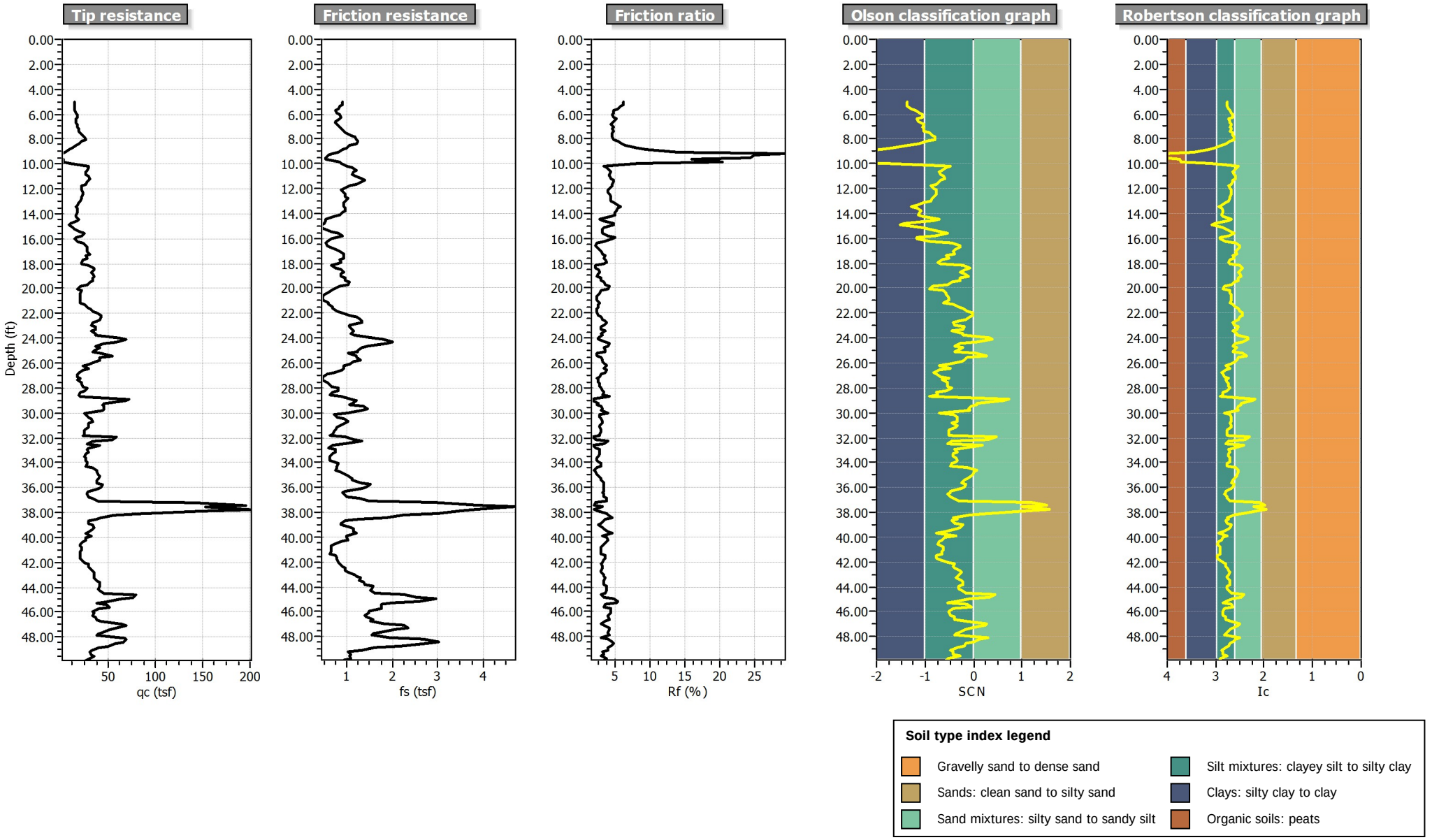
Project subtitle : SCPT-01

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	9.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.56
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.37 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olson classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

GeoLogismiki
Geotechnical Engineering Software
Merarhias 56, 621 25 - Serrai, Greece
url: http://www.geologismiki.gr - email: info@geologismiki.gr

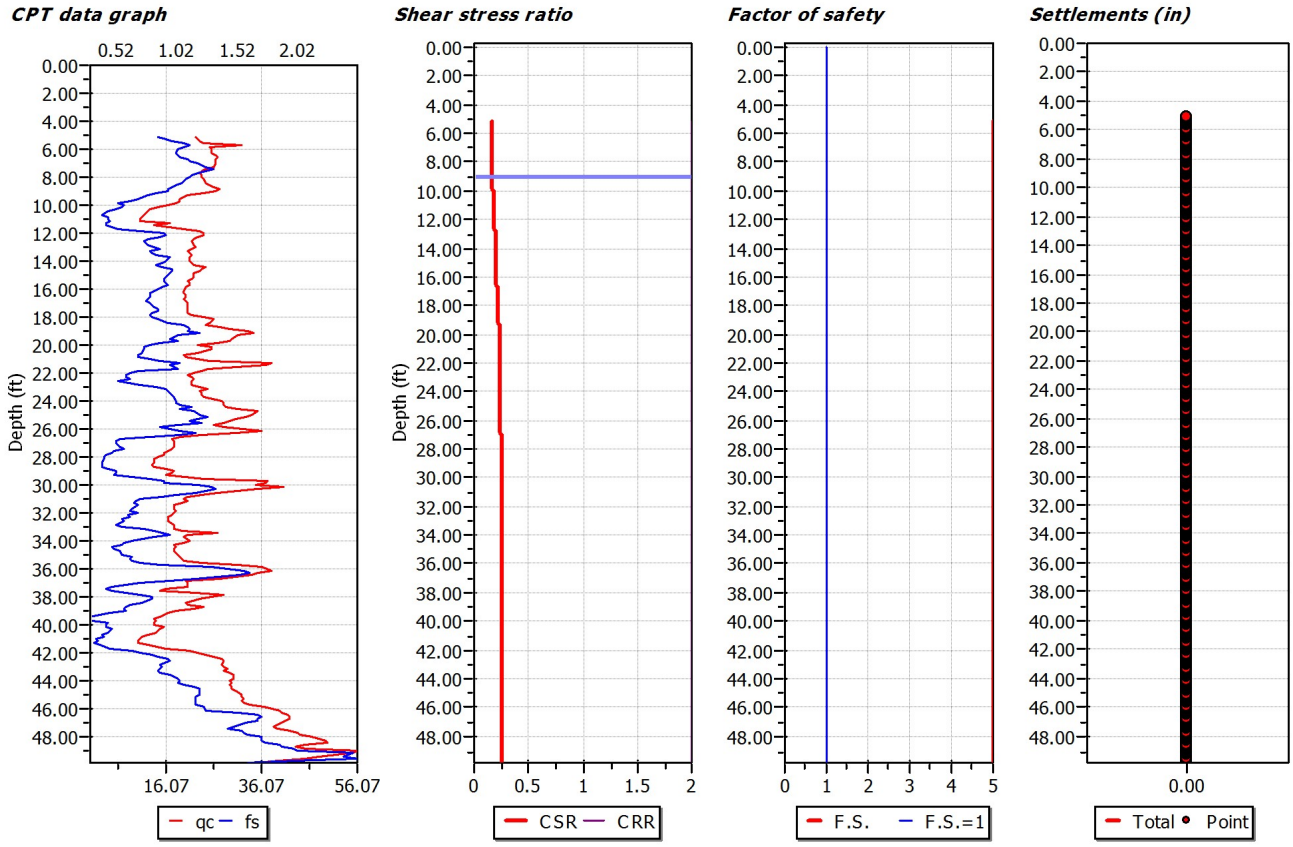
LIQUEFACTION ANALYSIS REPORT

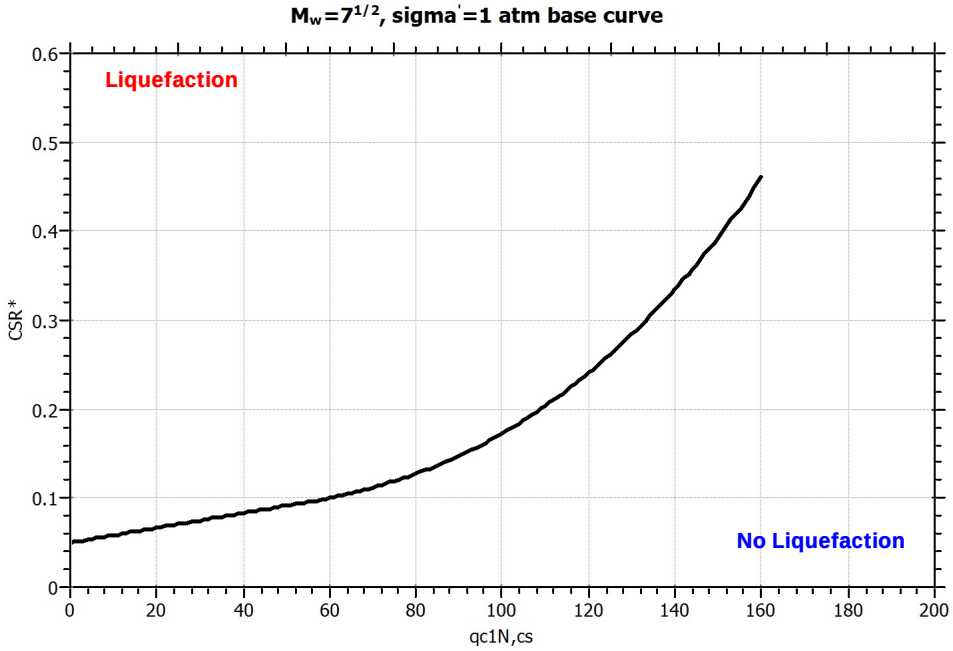
Project title : 10344.02 - Davis Innovation Park

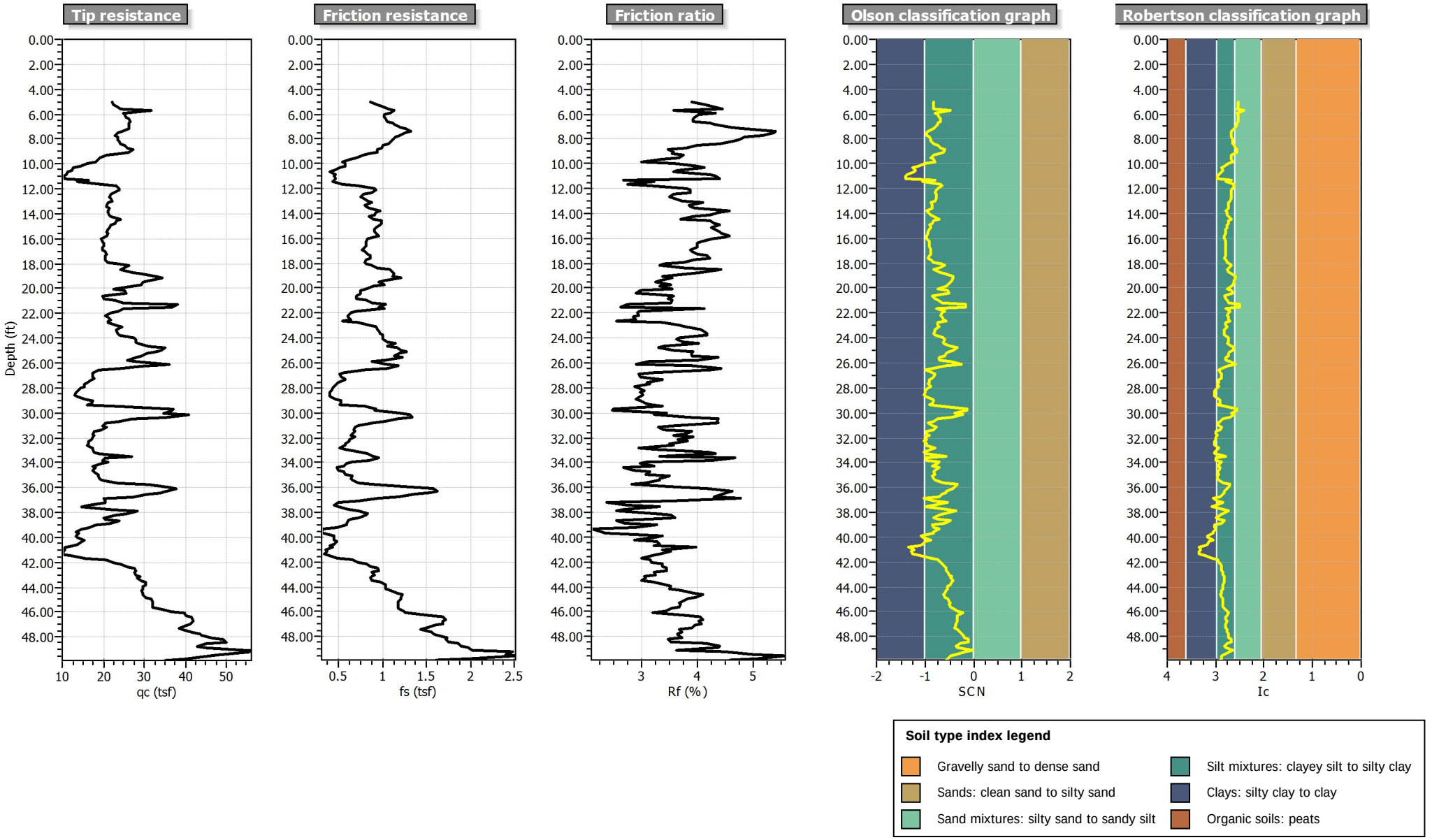
Project subtitle : SCPT-02

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	9.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.56
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.37 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olson classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

PSH Deaggregation on NEHRP D soil
10344.02_-_Davi 121.689º W, 38.560 N.

Peak Horiz. Ground Accel.>=0.3988 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 34.4 km, 6.43, 1.43
Modal (R,M,ε_0) = 28.4 km, 6.56, 1.56 (from peak R,M bin)
Modal (R,M,ε*) = 27.9 km, 6.40,> 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0