Fault Activity Investigation

6044 Carlos Avenue

Hollywood District, City of Los Angeles, California

GDC Project No. LA-1230

April 28, 2015

GDC Project No. LA-1230

GROUP DELTA

Boulevard Capitol
215 S. La Cienega, Suite 203
Beverly Hills, CA 90211

April 28, 2015

Attention: Mr. Robert Budman, Principal

Subject: Fault Activity Investigation
Proposed Apartment Development
6044 Carlos Avenue
Hollywood Area, City of Los Angeles, California
GDC Project No. LA-1230

Dear Mr. Budman:

Group Delta Consultants (GDC) is pleased to submit this Fault Activity Investigation report for the proposed 6044 Carlos Avenue development in the Hollywood District of the City of Los Angeles. Under the Alquist-Priolo Earthquake Fault Zoning Act (APEFZ) of 1972, the California Geological Survey (CGS), in January and November 2014, issued a preliminary and supplemental APEFZ Map showing several inferred "active faults" that are part of a new Hollywood Fault Zone. The newly enacted zone encompasses the Carlos site, and thus requires a geologic standard-of-practice investigation. The City of Los Angeles, required that all sites within the zone be investigated in conformance with the APEFZ Act as documented in the City of Los Angeles Fault Rupture Study Area (PRFSA) code per city document number P\BC 2014-113, Item I, E, 7. GDC has completed a standard-of-practice geological investigation based on the Final APEFZ map for the Hollywood 7.5 Minute Quadrangle. The geological investigation yielded information permitting assessment of the newly mapped fault strands in accordance with the PRFSA. In summary, the GDC investigation illustrates that faults either do not exist onsite or are demonstrably "not active" according to current State of California definitions.

GDC appreciates the opportunity to provide geotechnical and geological services for this project. Should you have any questions, please call at 310-320-5100.

Yours Sincerely,
GROUP DELTA CONSULTANTS, INC.

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1.0 INTRODUCTION

This report presents the Group Delta Consultants, Inc. (GDC) Fault Activity Investigation of the "6044 Carlos Avenue" site. The site is located about 200 feet east of Grower Street on the south side of Carlos Avenue in the Hollywood District of the City of Los Angeles (Plate 1). This report provides maps, a cross-section, relative pedological dating assessments, and interpretations consistent with current geologic standards of practice applicable to an Alquist-Priolo (APEFZ) Earthquake Fault Zoning Investigation.

The APEFZ Act was initiated in early 1972. It requires geologic investigations for faults identified by the California Geologic Survey (CGS) as "***sufficiently active and well-defined.***" There are currently 559 APEFZ maps affecting development in the state of California. Based on ongoing compilation of documented or suspected fault activity since 1972, the California Geological Survey (CGS) has continued to add additional faults, now including the Hollywood Fault Zone, in such zones. The inferred fault zones are then reviewed by local geological and other knowledgeable parties. When warranted, the zone is officially approved by the controlling agency, the State Mining and Geology Board.

From literature compilation and independent interpretation the CGS, in November 2014, finalized a supplemental report for the Hollywood Fault Zone within an Earthquake Fault Zone (Figure 1). The map designates this as a "**fault that has had surface or near surface ground rupture within the last 11,700 years (Holocene Epoch)**". The CGS also postulated individual "earthquake fault" strands within the Hollywood Fault Zone. Of particular interest is one strand, herein deemed the "Yucca Street Strand," inferred to be trending west to east along Carlos Avenue (Figure 1). The CGS interpretation stems mainly from their observations of fault exploratory studies, groundwater level differentials in the near vicinity recorded in two geotechnical borings (GDC, 2006) and on topographic expression, namely, a south-facing slope east of Argyle Avenue, west of Grower Street and north of Carlos Avenue (Plate 1). However, recent fault investigations conducted in the area of the intersection of Yucca Street and Argyle Avenue documented that, if present, this strand is not active

The recent APEFZ and City of Los Angeles Fault Rupture Study Area (PRFSA) code zonation requires site specific geologic investigations. The investigations must inherently confirm or deny the age and/or existence of any APEFZ-defined faults on or within 50 feet of the property and should follow current geologic "standards-of-practice." Procedurally, since the City of Los Angeles is the lead agency with the authority to approve the Carlos site investigation. This study was performed under the PRSFA regulations.

1.1 PROPERTY DESCRIPTION

The 6044 Carlos site consists of an existing apartment complex with resident parking along the southern property line. The property is bound on the north by Carlos Avenue and the First Presbyterian Church of Hollywood, to the south and west by a new apartment complex and to the east by a large parking lot.

1.2 PURPOSE

This study specifically evaluates whether CGS inferred Yucca Street Strand of the Hollywood Fault Zone and determines if the presence or absence of active faulting might constrain redevelopment of the 6044 Carlos site. Accordingly, this investigation follows current State, City, and professional geological standards required to assess the possible APEFZ-defined active faults.

1.3 SCOPE

The Carlos site does not have sufficient room to excavate a fault trench in the adjacent parking lot. Therefore, the inviestgation consisted of advancing six (6) continuous and undisturbed soil core borings and 14 Cone Penetrometer Tests (CPT) soundings along a north-south line extending across Carlos Avenue and extending 50 feet south of the property line. (Plate 1; Appendix A). GDC also reviewed pertinent aerial photographs, geologic and topographic maps, peer-reviewed published articles, and proprietary geotechnical reports. Additionally, GDC reconnoitered the site and its environs for geomorphic evidence of possible surface fault ruptures.

In summary, the GDC investigation included:

- Review and analysis of relevant geotechnical and geologic investigations, published geologic and geotechnical maps and reports. Specific references are documented in Section 7. This includes careful review, interpretation, and extrapolation of geologic information from adjacent sites that GDC performed earlier (Plate 1).
- Geomorphological and geologic reconnaissance.
- Coordination with the owner, with Underground Service Alert (USA), and with the City of Los Angeles Department of Public Works to locate utilities and to coordinate the logistics of the field investigation,
- Initial site observation to assess existing conditions relative to the planned development. Prior to drilling the cores or pushing the CPT's, initial advancement of a hand auger to 5 feet was performed to satisfy USA requirements.
- Advancing 14 in-line CPT-soundings up to 80 feet deep along a north-south transect along Argyle Avenue north of Yucca Street by Gregg In Situ/Drilling, Inc. Logs and interpretations of the CPT data are given in Appendix A. Locations are given on Plate 1.
- Drilling 6 in-line core holes to ~70 feet deep between the CPT soundings along the aforementioned north-south transect, and a short east-west transect (Borings B-8 and B-9) across Argyle Avenue (Plate 1). This was carried out by Gregg Drilling, Inc., using an 8.75 inch diameter hollow stem auger with a 3 inch diameter and 5 foot long split coring barrel down the auger annulus. The recovered cores were placed in 2.5 foot long cardboard core boxes and transported to the GDC laboratory for further examination. Core logs are provided in Appendix A. Locations are indicated on Plate 1.
- Illustration of the subsurface structure and stratigraphy with CPT and soil core logs on geologic cross-sections A-A'.
- Retention of Dr. Roy J. Shlemon to assist GDC with analysis of the local Quaternary geology, soil stratigraphy and paleoseismology assessment of the investigation (Appendix B). In this report GDC uses the term "soil" as a pedogenic (weathering) feature and as a tool for dating sediments. It is not used in reference to engineering material.

- Preparation and summary of GDC findings and conclusions with attachments and appendices.

2.0 PREVIOUS AND CURRENT INVESTIGATIONS

2.1 PREVIOUS INVESTIGATIONS

Previous geologic mapping and investigations of the Hollywood Fault in this area were based mainly on a few local outcrops in the area, on geomorphic expression, and groundwater differential recorded among water wells. Based on the limited, site-specific data (Hoots, 1930; Hoots and Kew, 1931; Dolan, 1997, 2000; Dibblee, 1988), the California Geological Survey recently published and submitted a Draft Fault Evaluation Report (FER 253, 2014b) to complement the preliminary AP map for the Hollywood 7.5 Quadrangle. Then on November 6, 2014, the CGS (2014b) issued an 'official' APFEZ map showing a revised location of the Yucca Street Strand (Figure 1). The Preliminary FER 253 depicts an inferred active (Holocene) trace of a Hollywood Fault ("Yucca Street Strand", Figure 1) as trending across the study site (Figure 1).

As documented in the readily available literature, site-specific fault activity and geotechnical investigations in the area similarly addressed the potential impact of the Hollywood Fault (Law, 2000; GeoPentech, 2001, 2005; Group Delta 2014a- c; Group Delta 2015a-b; Leighton, 2011; City of Los Angeles, 2009; Langan, 2011, 2012).

2.2 PRESENT INVESTIGATION

Thus far, a few nearby site-specific investigations have been performed to evaluate the presence and activity-level of a postulated Hollywood Fault which the Yucca Street Strand trends though the Carlos site. Most assessments were based solely on interpretation of CPT core transects, downhole logging of large diameter borings, and tectonic-geomorphic modeling. This investigation was based on the CGS supplemental fault locations. However, the breadth of the approved fault investigations (GDC 2015a-b; 2014a-d) permits GDC to assess the new strand (CGS, 2014a) in a manner appropriate for an APEFZ investigation. The investigation included the following tasks.

2.2.1 CONE PENETRATION TESTS

The -exploration was conducted with CPT soundings and core borings. CPT's were centered every 10 to 15 feet and pushed up to a depth of ~80 feet or to refusal. The tip and side resistance of the CPT cone was recorded and plotted on applicable cross-sections (see Plate 1); the field data is contained in Appendix A.

2.2.2 CONTINUOUS CORE BORINGS

The core borings (6) were placed between CPT's to calibrate the subsurface geology. Cores were drilled using an 8.75 inch hollow stem auger with a 3 inch diameter core barrel. The barrel was placed down the annulus of the auger and pushed about 3 to 4 inches in front of the bit as the auger was advanced. The barrel was connected and held stationary with respect to the rig rotary head system by a series of rods that pushed the barrel ahead of the bit to prevent the barrel from spinning. This resulted in collection of relatively undisturbed continuous core samples. The cores provide a physical view of the subsurface soil conditions used to calibrate the CPT data.

The cores were obtained in 2.5 foot runs to optimize recovery. The cores were placed in boxes, field logged, and returned to the GDC laboratory for detailed logging. After analysis, the core information was combined with the CPT data to calibrate the CPT's to the sediments recovered (Plate 1; Appendix A).

3.0 GEOLOGIC FRAMEWORK

3.1 REGIONAL GEOLOGIC SETTING

3.1.1 STRUCTURE

The Santa Monica Mountains began uplift in the Jurassic, and intermittent tectonic movement continues to the present (Hoots, 1930; Hoots and Kew, 1931; Dibblee, 1991). By the middle Miocene, transrotational deformation affected the Topanga sediments, resulting in simple, west-plunging folds. About 5 ma, in response to changes in relative movements of the North American and Pacific Plates and the resultant onset of transpressional stress along the San Andreas and related boundary faults, high-angle normal faults inverted to compression-driven reverse and thrust faults (for example, Wright, 1991). One such fault/fault zone is the Hollywood Fault, which has traditionally been judged to be a left-lateral-reverse feature near the base of the Hollywood Hills.

Transpressional deformation since inversion complicated the regional structural pattern. In the immediate study area, the southeastern limbs of local folds were "down-dropped" along the Hollywood Fault Zone (Dibblee, 1991). By the onset of the Quaternary, many folds were buried by episodic, climatically controlled alluvial deposits that covered most of the study area. Starting at least by mid-Quaternary time, the surface expression of local left-lateral and thrust faults were generally buried by continuing region-wide alluviation. Great relief was generally expressed along major south-trending canyons that incised the alluvial cap(s), only to be filled and again partially filled in response to regional change in climate.

Today, the Los Angeles Basin is continuing to be influenced by convergence tectonics that started ~2-3ma giving rise to the seismically active folding and thrust belt along a 7 -10 mile deep seated detachment that is documented from earthquakes recorded during the last 40 years (Davis, 1994, 1989; Namson, 1988; Figure 4). With this in mind, strike-slip and surface faulting may have ceased during the Middle to Late Pleistocene in the western Transverse Range.

3.1.2 HOLLYWOOD FAULT

The Hollywood Fault Zone forms the general boundary separating the LA Basin (Hollywood Sub-basin) from the Transverse Ranges on the north and the Peninsular Ranges on the south (CGS, 2014). From west to east, the Hollywood Fault is generally divided into five segments all characterized by left-lateral oblique slip (Figure 1).

3.2 TECTONIC-GEOMORPHIC SETTING

3.2.1 REGIONAL ANALYSIS

Hoots and Kew (1931; Figure 3) initially identified a "bedrock fault" about 2,000 feet north of Yucca Street and west of Argyle Avenue, (Figure 3) inferred to be a strand of the Hollywood Fault

Zone and trends north of the Carlos site. The fault characteristically superposed Miocene Topanga Formation rocks over the younger upper Miocene Modelo Formation (Hoots and Kew, 1931; Dibblee 1991).

Recently, fault locations have been based on tectonic geomorphic expression (for example, CGS, 2014 (summary FER); Crook and others, 1983; Dolan and others, 2000, 2000a; Dolan and Pratt, 1997; Dolan and others, 1997; Tsutsumi and others, 2001; United States Geological Survey, 2005). Trench exposures and CPT/Core Samples at other sites provided locations as well as relative activity information useful for dating faulting and folding in this area.

GDC also analyzed the geomorphic and topographic expression of the northern Hollywood area of the Los Angeles Basin that encompasses this site and its environs. For example, the USGS Burbank 7.5' Quadrangle (1926 edition; reprinted in 1941) depicts west-to-east topographic breaks and truncated ridges that mark the traditional trend of the Hollywood Fault to the north (Figures 5). Presumably, the topography stemmed from surface fault rupture. However, GDC investigations (GDC, 2015a-b; 2014a-c) illustrated that the truncated ridge immediately west of this site is likely formed from one of or a combination of erosional factors and pre-Holocene faulting.

From the geomorphic expression, as well as from trench exposures, CPT and borings from other projects, GDC reconstructed the general landscape evolution in the area over the past ~300ka. In brief, throughout the Quaternary, regional changes in climate and vegetation resulted in deep channel cutting, partial alluvial filling, and locally later re-incision.

3.2.2 SOIL-STRATIGRAPHIC AGE ESTIMATES

As documented in Appendix B, continuous core B-1 and B-3 were evaluated for soil-stratigraphic age estimates. Soil-stratigraphic measurements and descriptions show that the Beechwood Fan sediments are capped by a remnant, very slightly developed surface soil, replete with three, intercalated interval buried paleosols in B-1 and five in B-3, ranging in relative development from slight to moderate. Based on calibration with numerically dated soils elsewhere in Mediterranean climates, the cumulative time of soil weathering for formation of the alluvial fan sediments is an estimated ~15-20ka with the Pleistocene-Holocene boundary occurring within ~ 10-12 feet from the surface (see Appendix B for the complete paleosol analysis).

3.3 STRATIGRAPHY

GDC described and otherwise analyzed site-specific core sediments according to their physical properties and relative soil profile development (Appendix B). GDC recognizes three useful mappable unit deposits, as described in B-1 and B-3 from the continuous cores and projected across the site from other cores and CPT data (Plate 1 and2; Appendix A): the upper clays, silts and sands of the "Beechwood Sand" deposits (Qs), and immediately underlying, the sandy unit of the upper older alluvium unit (Qoal2), and a lower complex of interbedded older alluvium (Qoal1). GDC describes the sequences starting from the youngest (Artificial Fill) to the Lower Older Alluvium deposit as documented on cross-section A-A'.

3.3.1 ARTIFICIAL FILL (Qaf)

Surficial artificial fill blankets the areas explored at this area where the explorations were conducted. The artificial fill consisted of gravelly sand and silts with some clay and high in organics. In general, where encountered, the fill was penetrated with little difficulty and proved little hindrance to core sampling.

3.3.2 HOLOCENE SAND (Qs) (BEECHWOOD SAND DEPOSITS)

The Beechwood Sand is derived from Santa Monica Mountains terrain and was transported south down infill canyons and were deposited as mudflow and debris flow sediments across the lower plains as broad alluvial fan (Figure 6). The Beechwood Sands, in general, are silty to clayey and poorly sorted and slope down slightly to the south.

The Beechwood Sand deposits were dated using soil-stratigraphic methods and was estimated to be Holocene in age. These deposits consist of loose to moderately dense and in, gradational to abrupt contact with other debris flow beds within this unit. The sands matrix is generally a silty to clayey matrix (Appendix B). The sand ranged from fine- to coarse-grained with occasional fine-grained gravel and weathered silty soil horizons. Gravels were concentrated along unconformities and bottoms of cut and fill channels and on top of eroded beds, identifying a grossly fining-upward sedimentation sequences. This unit was found to be unconformable laying on top of a buried paleosol. The paleosol surface was estimated to be ~15ka to ~20ka (Appendix B). Since this surface is Pleistocene and the Beechwood Sand deposits are Holocene, the contact along the paleosol defines the Holocene-Pleistocene boundary (Appendix B).

In the area of the Carlos site, the ~12ka-15ka inset fan canyon alignment is trending south along Vista Del Mar Avenue ~ 500 feet to the west. This canyon aggraded with modern Beechwood Fan sediments. As the inset canyon filled with modern alluvial deposits, the overflow of sediments fanned out mantling the older remnant alluvial fan surface during the Holocene as seen in cross-section A-A'. At the study site, the sands unconformable overlie Pleistocene Upper Older Alluvium (Qoal2) Deposits (Appendix B; Plate 2). This unit occurs at a depth below the artificial fill to around 12 feet below the surface bgs.

3.3.3 PLEISTOCENE UPPER OLDER ALLUVIUM DEPOSITS (Qoal2)

The Beechwood Sands are immediately underlain by Pleistocene Upper Older Alluvium deposits (Qoal2) (GDC, 2014a). Unlike the studies to the west, (GDC 2015a-b; 2014a-d) the upper Pleistocene mudflow deposits are absent or are minor constituents to the complex system of mudflow and debris flow deposits making up the Upper Older Alluvium deposits. This deposit is generally horizontal and dipping slightly to the south.

Upper older alluvium deposits occur in the area of this study and to the west but the aerial extent to the east most likely is in unconformable contact with the upper Beechwood Sand though this is unknown at this time. Paleosols at the Carlos site were estimated to be ~60ka. The upper contact with the Beechwood Sand deposit truncates at an angular unconformity at the Holocene-Pleistocene boundary. Though buried, the deposits are in angular unconformity with the Upper Older Alluvium deposits.

3.3.4 LOWER OLDER ALLUVIUM DEPOSITS (Qoal1)

Typically, the upper older alluvium deposits are beds of sand and some fine-grained gravel, silts and clays. This deposit is a vestige of a once extensive alluvial plain later incised by local south-trending canyons. The older alluvial deposits are judged to be ~300ka or older, from other studies to the west, based on paleosols from cores at the Carlos site, the soil stratigraphic estimate of the Lower Older Alluvium deposit is judged to be ~200ka. (Appendix B). In the Carlos site area, the Lower Older Alluvium beds have an apparent dip of ~20-30 degrees to the south (Plate 2).

In sum, based to a great degree on extrapolation of stratigraphy exposed in the study trenches west of the site, as well as abundant CPT-soundings and core holes, GDC (2015a-b; 2014a-c) reconstructed a regional model for landscape evolution and age for the Carlos site. The Lower and Upper Older Alluvium Deposits and the Holocene Sands were deposited during geologic times of landscape instability which is summarized in Section 3.3.6.

3.3.5 YUCCA STREET ANTICLINE

The Yucca Street Anticline, was interpreted from the geology of studies to the west of this study (GDC 2015a-b; 2014a-d). This anticline trends to the north of this site. Beds in the Lower Older Alluvium deposits are dipping to the south. Since the beds are on the south side of the anticline, their kinematics are due to folding and not as much, or any from surface faulting.

3.3.6 PALEOGEOGRAPHY

The Lower Older Alluvium deposits formed ~200ka or during MIS 7 (marine isotope stage 7) or during a time of relative landscape stability (Appendix B). This unit consisted of multiple mudflow and debris flows that originated out of the Santa Monica Mountain and were deposited to the south as alluviual fans. These sediments underwent erosion and structural tilt between ~160ka and ~120ka or during MIS 6. The tilted beds dipped to the south which puts the Lower Older Alluvium beds, at the Carlos site, to be on the south limb of the Yucca Street Anticline as defined by previous studies in the area (GDC 2015a-b; GDC 2014a-c; Appendix B).

From ~80ka-120ka (MIS 5), the Upper Older Alluvium sediments was unconformably deposited on top of the tilted and highly eroded surface of the Lower Older Alluvial deposits. The Upper Older Alluvium deposits consists of multiple mudflow and debris flow sediments similar to the Lower Older Alluvium sediments but did not have a paleosol development as do the older sediments and did not undergo the folding and tilting that the Lower Older Alluvial deposits underwent.

During MIS 3 (~35ka-40ka), the Upper Older Alluvium surface underwent a period of stability where a slight to moderated paleosol formed which was buried by a mantle of sediments that have moderately paleosol development that suggests a minimum of ~20ka or during MIS 2. During MSI 3 and the end of MIS 2, deep channels formed in the Upper Older Alluvium deposits giving rise to inset canyons that are filled with Holocene sediments today.

This ~20ka paleosol is buried with Holocene Beechwood Sands indicating that their unconformable contact defines the Holocene-Pleistocene boundary. This sand unit filled in the deep channels and mantled the surrounding Upper Older Alluvium deposits.

4.0 EVALUATION OF FAULT ACTIVITY

4.1 CPT/CORES – CARLOS SITE

Geologic observations of the CPT soundings and cores document the subsurface geology across the eastern adjacent parking lot next to the Carlos site from north to south (Appendix A). The upper 5 feet was not sampled due to the excavation with a hand auger to satisfy USA requirements. Below the surface, from approximately 3 to 5 feet, the hand-auger encountered silty sands and silts with scattered sand, gravels, and fill consisting of debris from its demolition of the previous building. This sub-unit was weak to moderately dense.

The Beechwood Sand deposits (Qs) predominate the upper 10-12 feet as illustrated above marker horizon A along cross-section A-A'. This sand, part of the Beechwood Fan, unconformably overlies Upper and Lower Older Alluvium (Qoal1 and 2). The Beechwood Sands are typically poorly graded with a silty to clayey matrix. Gravels and sands grading upward from coarse- to fine-grained as demonstrated in the fault trenching to the west of this site (GDC 2015, a-b; 2014a-d) though not evident with continuous cores, this gradation usually indicates cut and fill channels in the cores.

After plotting the sub-surface data across the inferred strand, the stratigraphy was found that the beds in the Upper Older Alluvium, in the area of CPT 9, had a slight downward warp. This anomaly was tested to see if the beds are continuous from CPT 8 to CPT 10. The beds projected across CPT 9 from CPT 8 to CPT 10 did not show any likely offset (Plate 3). This anomaly can be explained as a paleo channel that is trending downward from east to west to the main channel along Vista Del Mar Avenue.

On cross-section A-A', contacts A and B illustrate a continuous unbroken contact. Contact A separates the upper Holocene Berachwood Sands from the Upper Older Alluvium deposits while contact B separates the upper and lower Older Alluvium deposits. In other words, the beds show old erosional surfaces along the projection of line A and B on cross-section A-A' that are continuous and not broken by fault activity in the Holocene Beechwood Sands or the Late Pleistocene Upper Older Alluvium unit (Plate 2, cross-section A-A').

5.0 CONCLUSIONS AND RECOMMENDATIONS

This report summarizes the results of the geological investigation for the Carlos site. The geologic investigation summarized in this report was based upon 6 continuous-cored borings and 14 Cone Penetrometer probes. In summary, no Holocene-age faults were found breaking the Holocene or the Later Pleistocene sediments. The details of the findings and conclusions are:

1. Sediments encountered during the exploration phase at the Carlos site range downward from the uppermost Holocene (Beechwood) Sands to a Late Pleistocene Upper Older Alluvium deposits.

2. The three units, below the artificial fill, are separated by an angular unconformity (Plate 2, contacts A and B) which are not broken by active faulting.

3. An anticlinal structure was defined from other GDC projects to the west, with the crest trending north of the Carlos site. The ~200ka or Lower Older Alluvium deposit are tilted to the south with an apparent dip of ~20-30 degrees. Tilting of the Lower Older Alluvium deposits are perhaps due to the beds being on the south limb of the anticline and not faulting.

4. The ~60ka or older Upper Older Alluvium unconformably overlies the dipping older alluvial beds. These beds are slightly dipping to the south demonstrating the folding predates the channel incision that contains the < 12ka Holocene Sand deposits.

5. One north-south boring and CPT transects show continuity of the top and bottom of the Upper Older Alluvium unit extending across the entire Carlos site, including 50+ feet to the north and south of the Carlos site. At around CPT-9, cross-section A-A', the bedding in the Upper Older Alluvium is cut by a channel or a fault. This feature does not break the upper Holocene, Contact A (cross-section A-A') indicating that if a fault, it is not active.

6. No surface rupture hazard per APEFZ or the City of Los Angeles PRFSA zone was found crossing the Carlos site.

6.0 LIMITATIONS

The overall assessment of the geologic and fault hazard conditions, in this report, reflects GDC's professional opinions and is intended for the use by Boulevard Capitol, and its design consultants. This report has been prepared solely for assessing seismic impact on the proposed development and may not contain sufficient information for environmental (hazardous waste) and geotechnical (foundation) purposes. The recommendations shall not be extrapolated to areas not covered by this report, or used for other facilities, without the review and approval of GDC and from Boulevard Capitol. This report or any portion of this report may be provided to state, county or city agents for informational purposes only.

The GDC investigation and evaluations were performed in accordance with generally accepted local standards using that degree of care and skill ordinarily exercised under similar circumstances by reputable engineering geology and geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report.

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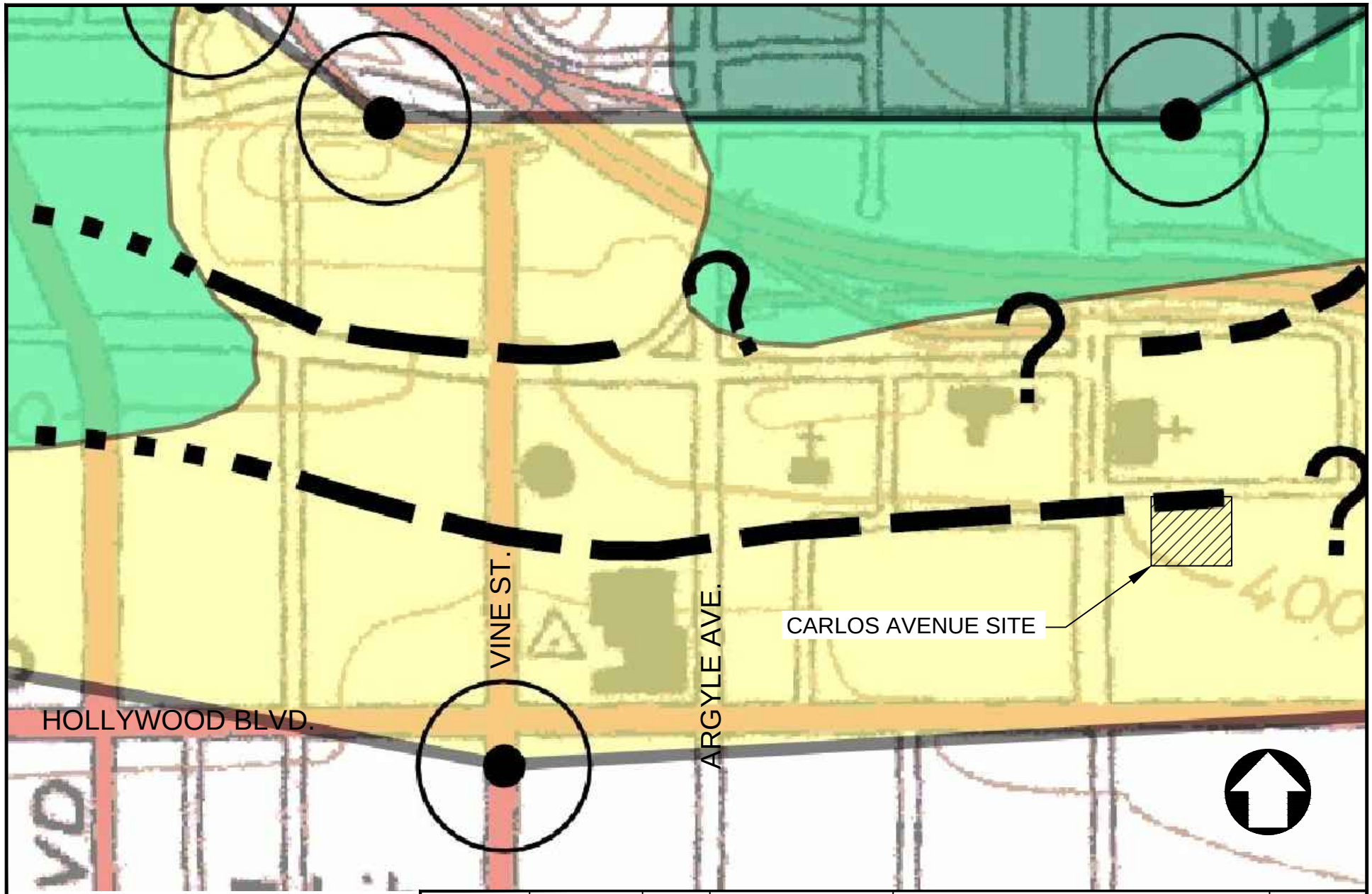
FIGURES



Reference: Fault Strands From Supplemental CGS, 2014a

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	SITE MAP WITH AP ZONE, ARGYLE AND YUCCA STRANDS
REVISION:	APPROVED BY: SK		6044 CARLOS AVENUE
REVISION:			PROJECT NUMBER: LA1230 SCALE: NO SCALE FIGURE NUMBER: 1

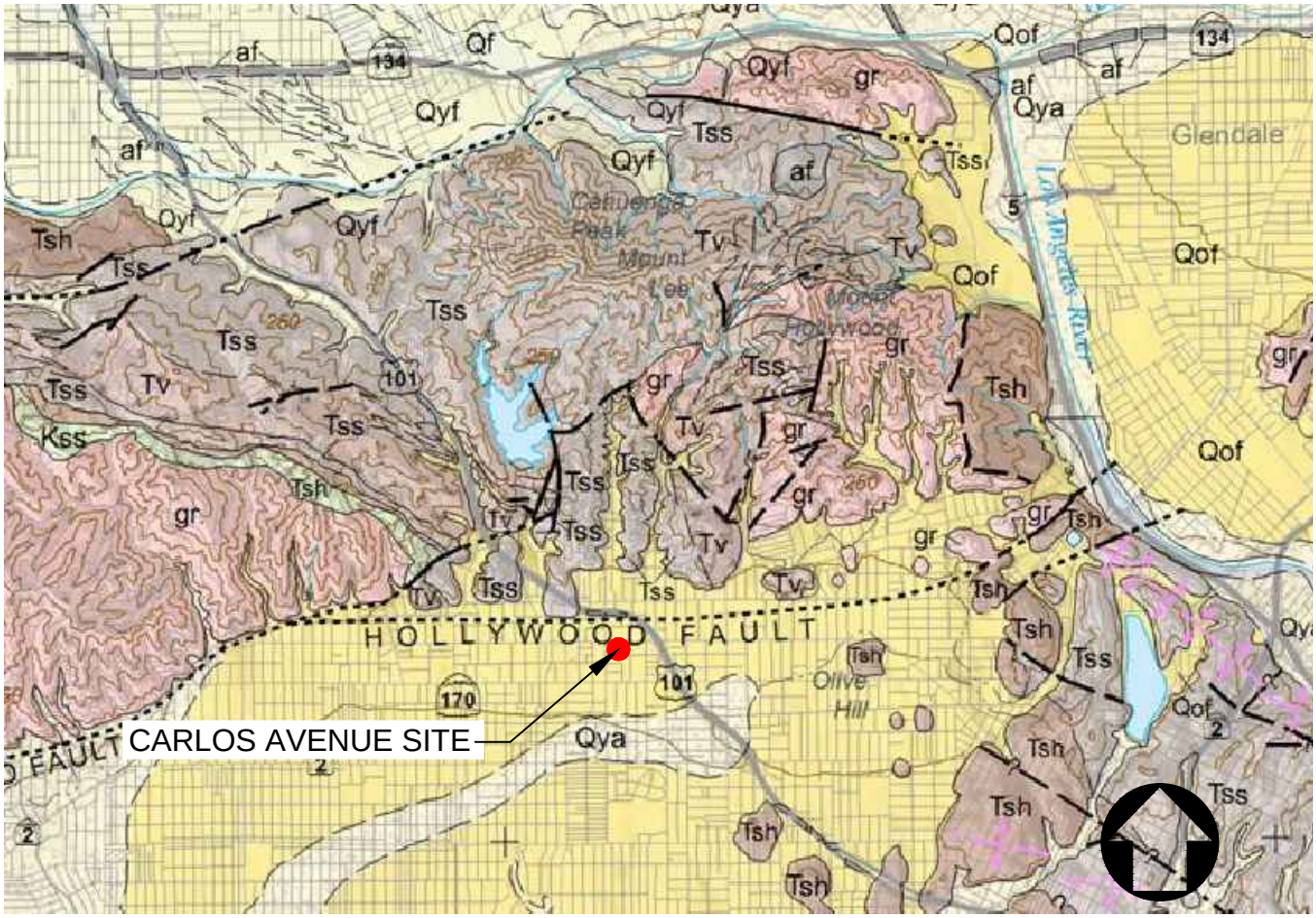


Figure 2: Regional geologic map of the area. Scale ~1:100,000. (California Geological Survey., 2003, "Quaternary Geology Map of the Los Angeles 30x60 Quadrangle").

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CGS QUATERNARY GEOLOGIC MAP	PROJECT NUMBER: LA1230
REVISION:	APPROVED BY: SK				SCALE: NO SCALE
REVISION:				6044 CARLOS AVENUE	FIGURE NUMBER: 2

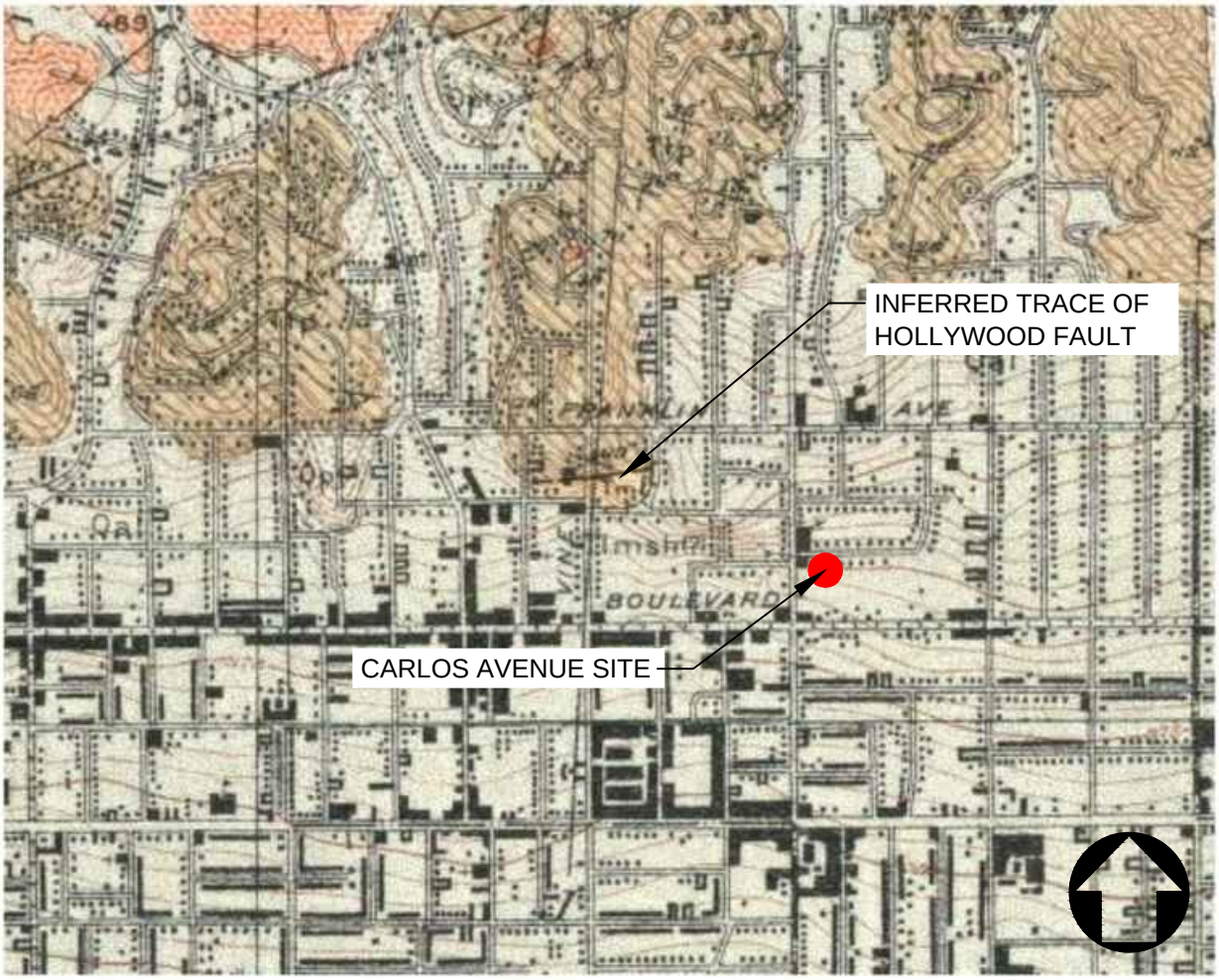
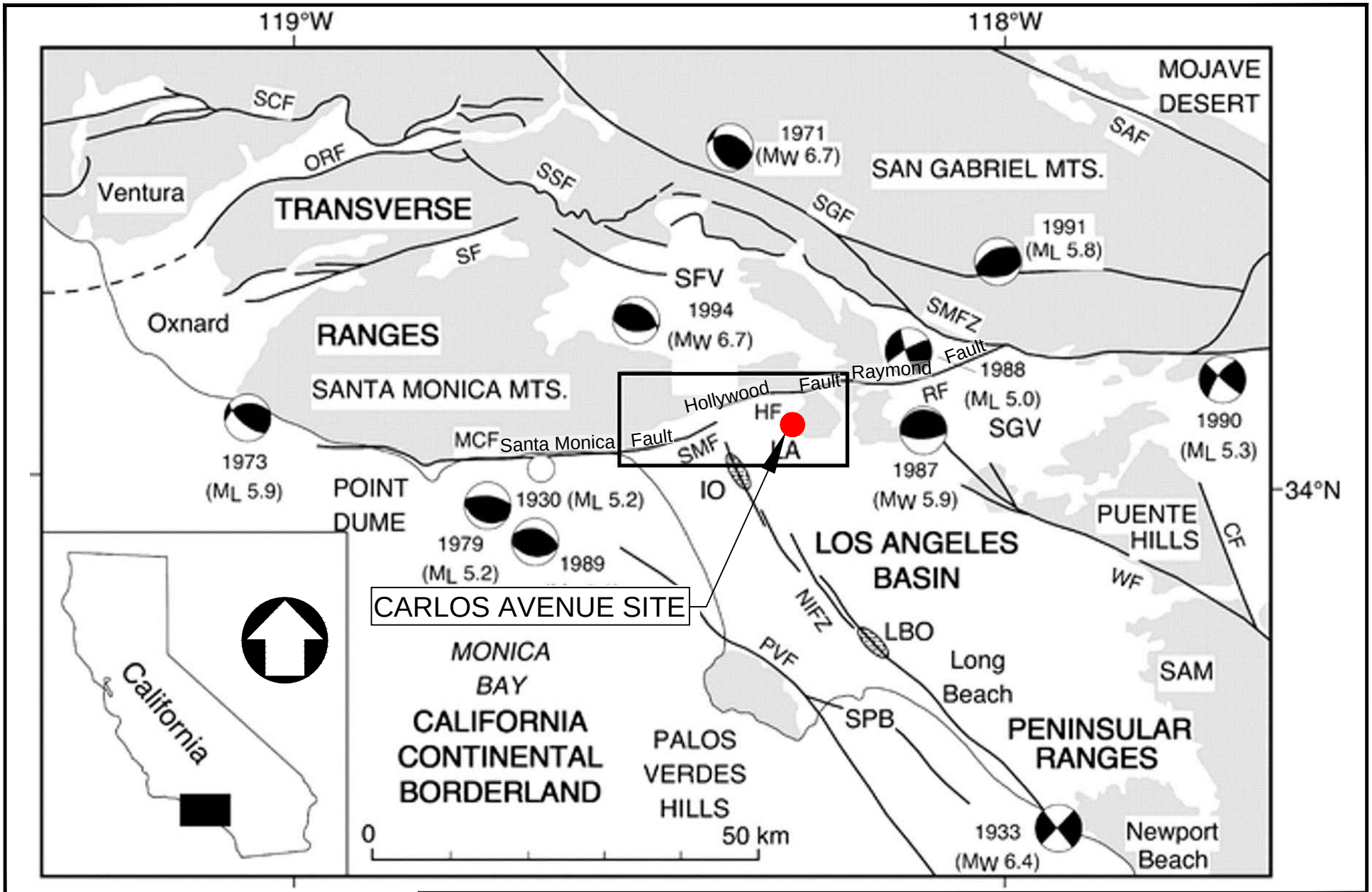


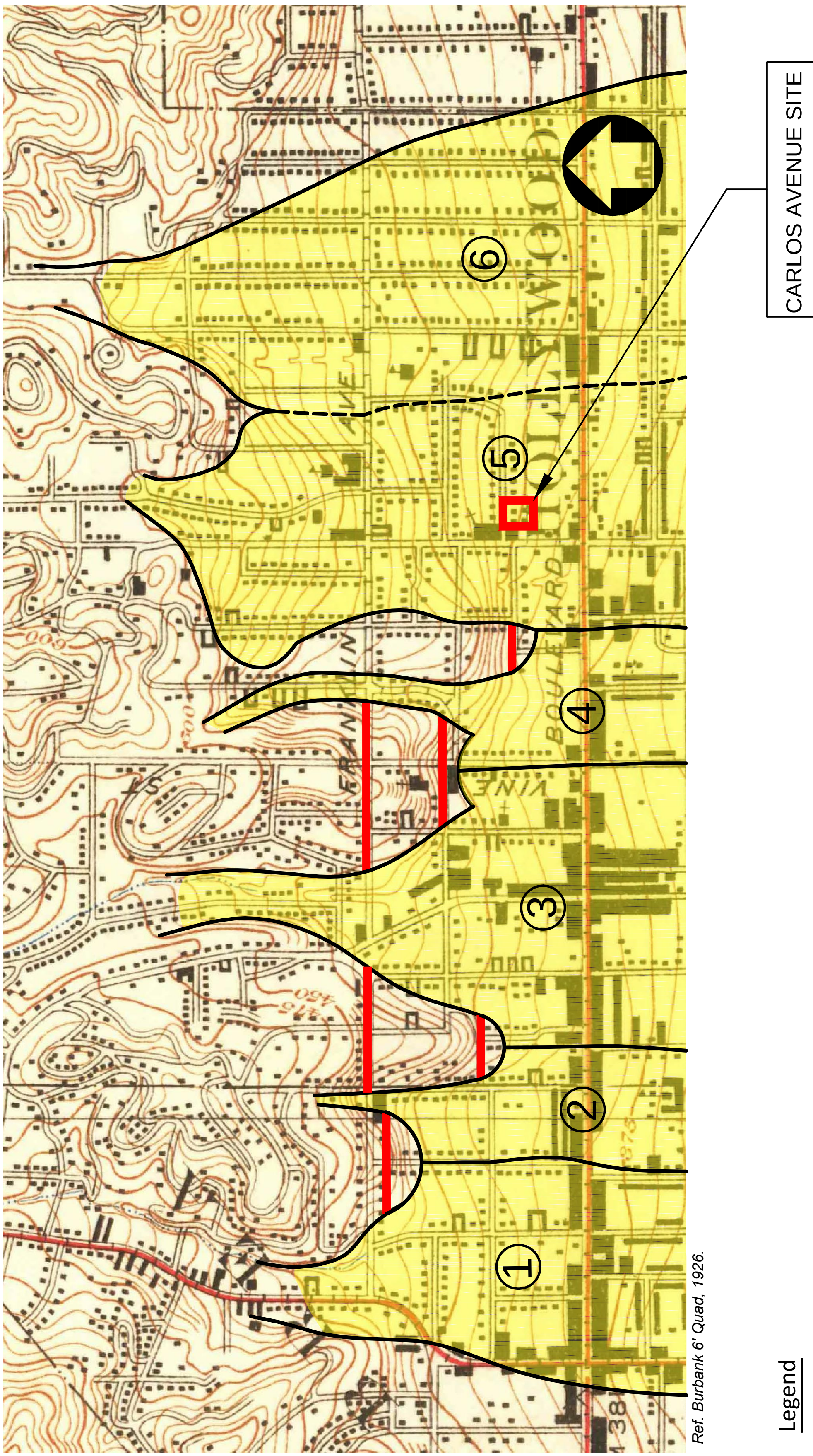
Figure 3: Geologic map of Carlos site and vicinity (after Hoots and Kew, 1931) showing inferred trace of a Hollywood Fault separating Modelo (T_m), and Topanga (T_t) Formations, granite rocks (gr), and alluvium (Q_{al}).

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	LOCAL GEOLOGIC MAP	PROJECT NUMBER: LA1230
REVISION:	APPROVED BY: SK				SCALE: NO SCALE
REVISION:				6044 CARLOS AVENUE	FIGURE NUMBER: 3



Regional fault map of Los Angeles area (after Tsutsumi, Yeats, Huftile, 2001)

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	MAJOR FAULTS AND HISTORIC SEISMICITY OF THE GREATER LOS ANGELES AREA
REVISION:	APPROVED BY: SK		6044 CARLOS AVENUE
REVISION:			PROJECT NUMBER: LA1230 SCALE: NO SCALE FIGURE NUMBER: 4



Legend
① Highland Fan
② Whitley Fan
③ Cahuenga Fan
④ Argyle Fan
⑤ Beechwood Fan
⑥ Brush Fan
Geomorphic Breaks in Slope

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC	MAP ILLUSTRATING GEOMORPHIC FEATURES NEAR THE CHAMPION SITE	PROJECT NUMBER: LA1230
REVISION:	APPROVED BY: SK	370 Amapola Ave. Suite 212 Torrance, CA. 90501	6044 CARLOS AVENUE	SCALE: NO SCALE
REVISION:				FIGURE NUMBER: 5

GEOLOGIC STUDIES BY
(GDC 2015 a-b; 2014 a-d),
SEE SECTION 7

CARLOS AVENUE
SITE

CHAMPION EAST
TRENCH

CHAMPION WEST
TRENCH

ESTIMATED TREND OF ANTICLINE

Yucca St

Carlos Ave

Argyle Ave

101

Hollyw

LEGEND

- GEOLOGIC CONTACT APPROXIMATELY LOCATED QUERIED WHERE SURMISED, DOTTED WHERE BURIED
- STRIKE AND DIP OF BEDDING
- STRIKE AND DIP OF FAULT
- STRIKE AND DIP OF BURIED FAULT
- DEPTH OF WATER BELOW GROUND SURFACE ENCOUNTERED IN EXCAVATION, AND DATE
- Q_s SAND "ARGYLE CHANNEL" DEPOSITS (8-11ka)
- Q_m MUDFLOW (35ka)
- Q_{oal} OLDER ALLUVIUM (300ka)
- APPROXIMATE LOCATION OF ANTICLINE. BARB INDICATES DIRECTION OF PLUNGE.
- PROPERTY LINE

B-6 Boring Location and Number, GDC 2014
BA-2 Bucket Auger Location and Number, GDC 2014
C-20 CPT (Cone Penetration Test) Location and Number, GDC 2014
B-2 Boring Location and Number, GDC 2006
LB4 Boring Location and Number, Langan 2011
Trench Location Outlines
Approximate Location of Concealed Fault
B-1 Geotechnical Boring by approximate location of Geotechnologies, 2006

0 40' 80'

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	GEOLOGIC MAP 6044 CARLOS AVENUE
REVISION:	APPROVED BY: SK		PROJECT NUMBER: LA1230 SCALE: AS SHOWN FIGURE NUMBER: 6
REVISION:			

STRATIGRAPHIC SECTION

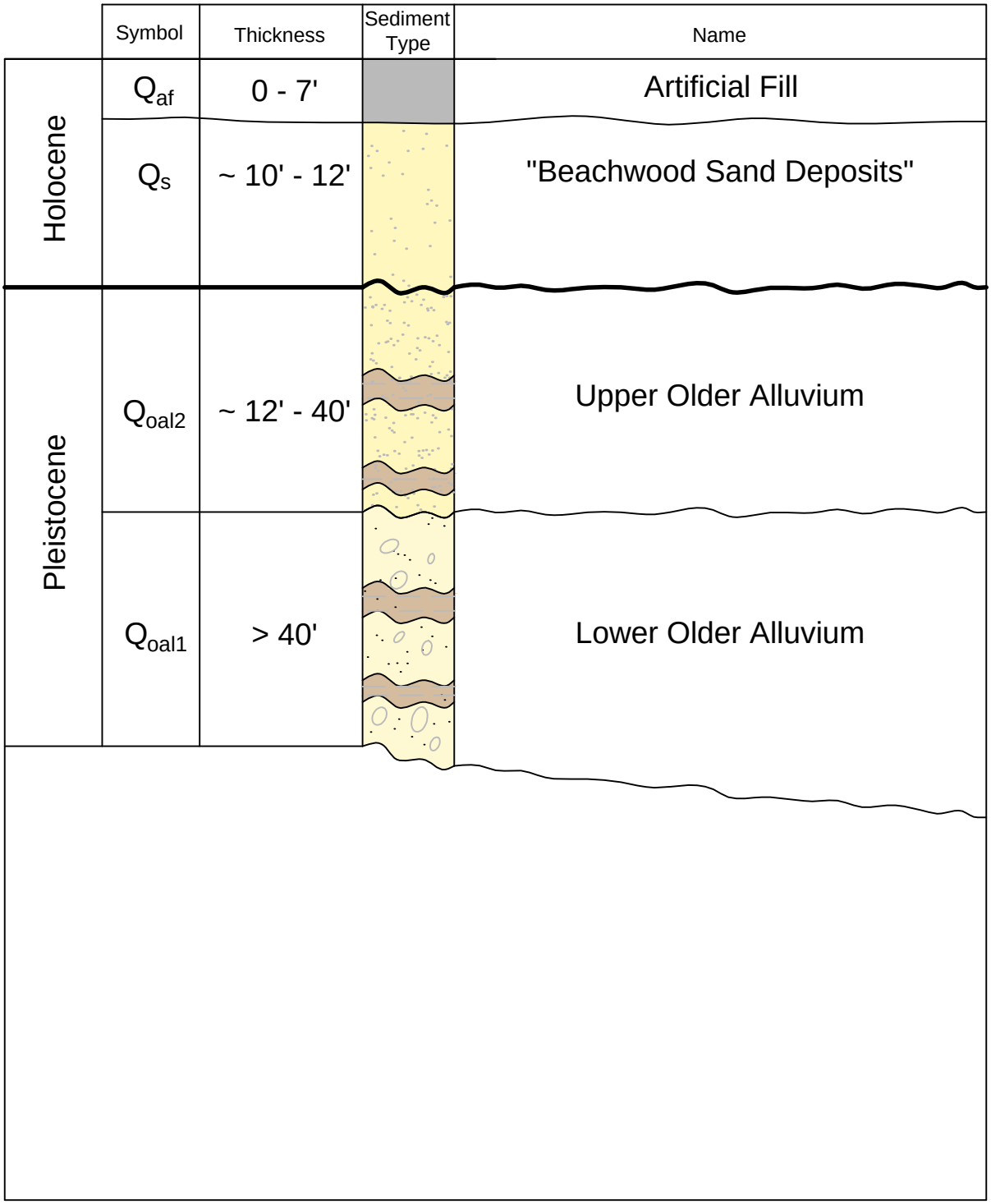
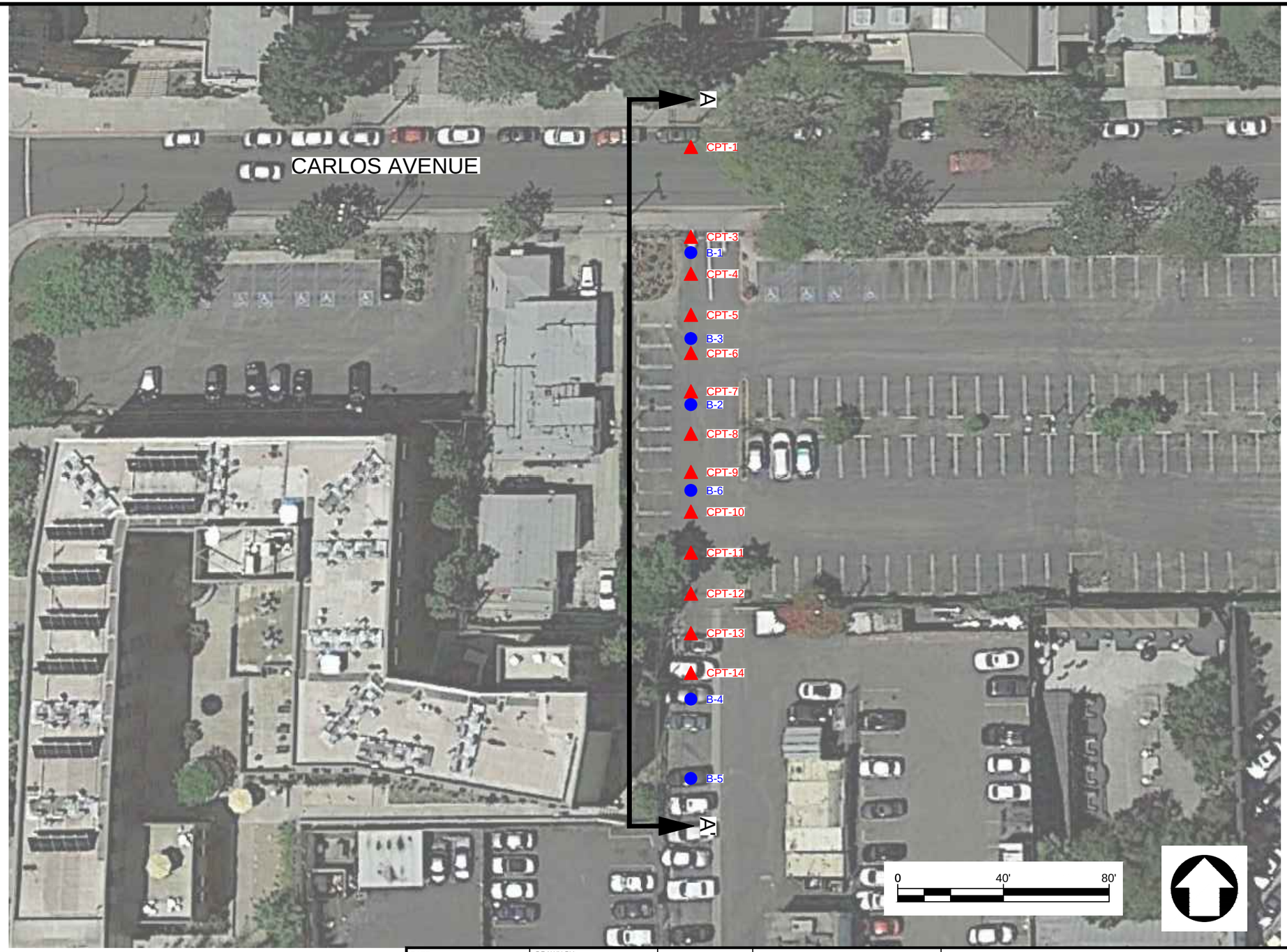


Figure 7

PLATES

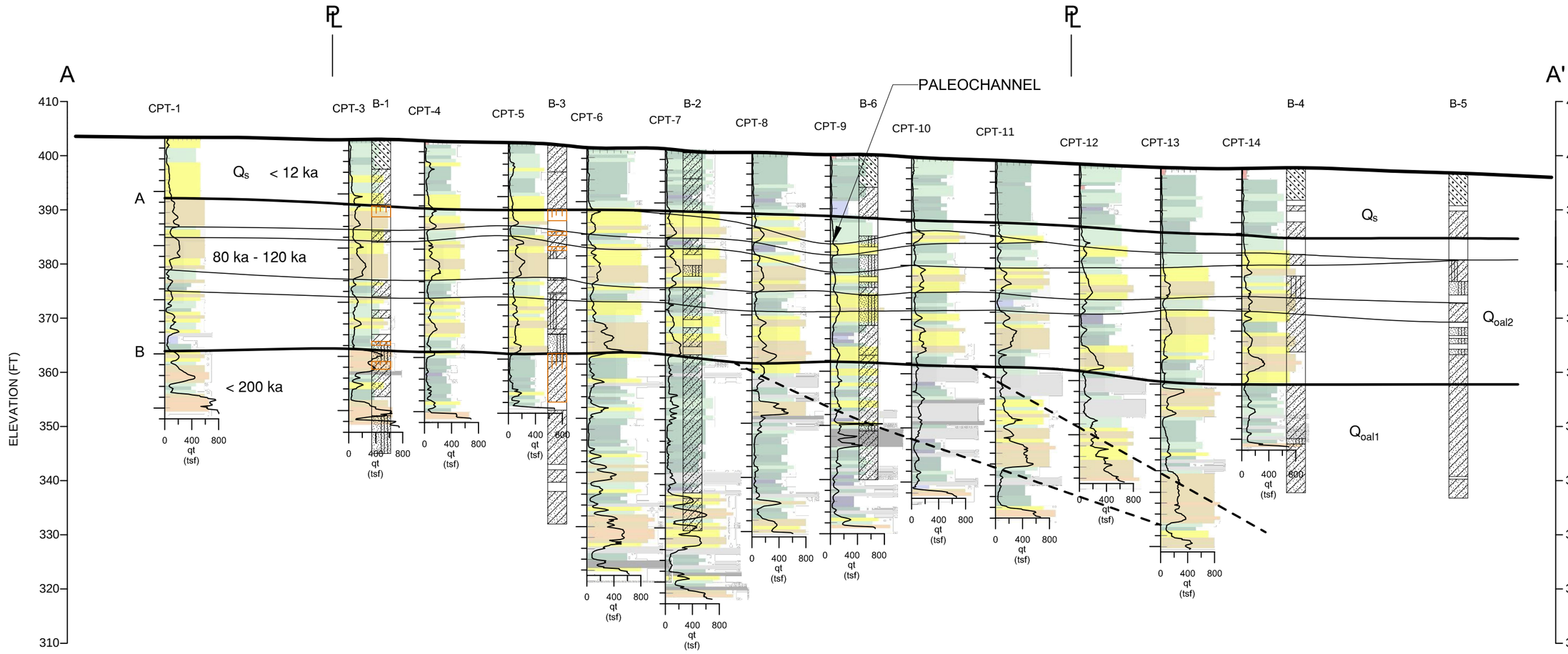


LEGEND

- B-1 — BORING LOCATION AND NUMBER
- CPT-14 — CPT (CONE PENETRATION TEST) LOCATION AND NUMBER

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CPT AND BORING LOCATION MAP
REVISION: -	APPROVED BY: SK		CARLOS AVENUE FAULT INVESTIGATION
REVISION: -			

PROJECT NUMBER: LA1230
SCALE: AS SHOWN
PLATE NUMBER: 1



LEGEND

HOLOCENE	Artificial Fill	Q_{af}	
HOLOCENE	"Beachwood Sand Deposits"	Q_s	< 12 ka
PLEISTOCENE	Upper Older Alluvium	Q_{oal2}	80 ka - 120 ka
PLEISTOCENE	Lower Older Alluvium	Q_{oal1}	< 200 ka

PALEOSOL

ka KILO ANNUM (1,000 YEARS)

V
20'
10'
SCALE (FT):
H
0' 10' 20'

DATE: 4/28/2015	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION A-A'	PROJECT NUMBER: LA1230
REVISION:	APPROVED BY: SK				SCALE: AS SHOWN
REVISION:				CARLOS AVENUE FAULT INVESTIGATION	PLATE NUMBER: 2

APPENDIX A: FIELD EXPLORATION – CPT DATA AND SOIL CORE LOGS

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-1**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 58
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 403	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt approximately 3 inches thick				
									Artificial Fill (Qaf)				
	400												
5		1	1	29/30					**Holocene Sand (Qs)** **Clayey SAND** 7.5YR 3/4 (dark brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	395	2	1	29/30									
10		3	2	24/30									
	390	4	2	26/30					**Upper Older Alluvium (Qoal2)** **Silty SAND** 7.5YR 5/6 (strong brown); moist; mostly fine to medium SAND; trace coarse SAND; trace fine to coarse GRAVEL. 3" diameter cobble at upper contact with clayey SAND. @ 12': trace fine GRAVEL @ 14': sharp contact with mostly fine SAND, few medium SAND and trace coarse SAND and fine GRAVEL. @ 16': Grades to fine to medium SAND; trace coarse SAND and fine GRAVEL.				
15		5	3	22/30									
	385	6	3	34/30					**Clayey SAND** 7.5YR 5/6 (strong brown); moist; mostly fine SAND; trace medium and coarse SAND; trace fine GRAVEL. Granitic gravels moderate to highly grusified.				
									Silty SAND 7.5YR 5/6 (strong brown); moist; mostly fine to medium SAND; trace coarse SAND.				

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Torrance, CA 90501

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

FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230		**BORING** **B-1**
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 58
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 403	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		7	4	25/30					@ 20': Cobble clast; broken from drilling; few coarse SAND @ 21': No gravels or cobbles; mostly fine sand; few medium SAND; trace coarse SAND.				
	380	8	4	29/30									
25		9	5	26/30									
									Clayey SAND 7.5YR 5/6 (strong brown); moist; mostly fine SAND; trace medium and coarse SAND; trace fine GRAVEL. Granitic gravels moderate to highly grusified.				
	375	10	5	31/30									
30									**Silty SAND** 7.5YR 5/6 (strong brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND.				
		11	6	25/30									
									Clayey SAND 7.5YR 5/6 (strong brown); moist; mostly fine SAND; trace medium SAND and coarse GRAVEL. Granitic gravels moderate to highly grusified; basalt gravels are highly weathered.				
	370	12	6	26/30					**Silty SAND** 7.5YR 5/6 (strong brown); moist; mostly fine to medium SAND; trace coarse GRAVEL.				
35		13	7	26/30									
									Sandy CLAY 7.5YR 5/6 (strong brown); wet; fine SAND.				
	365	14	7	25/30					**Clayey SAND** 7.5YR 4/4 (brown); wet; mostly fine SAND.				
									Lower Older Alluvium (Qoal1) **SAND with Silt** 10YR 4/4 (dark yellowish brown); wet; mostly fine to medium SAND; few coarse GRAVEL.				

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

FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-1**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 58
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 403	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		15	8	32/30					**Clayey SAND** 7.5YR 4/4 (brown); wet; mostly fine SAND.				
	360	16	8	29/30					@ 42.3': few medium SAND				
45		17	9	29/30					@ 47': trace cobbles broken by drilling.				
	355	18	9	25/30					**Silty SAND** 10YR 4/6 (dark yellowish brown); wet; mostly fine SAND; few medium SAND; trace coarse SAND. Gravel layer at top of contact with Silty SAND.				
50		19	10	7/30					**SAND with Silt** 10YR 4/4 (dark yellowish brown); wet; mostly medium to coarse SAND; few fine SAND; few fine to coarse GRAVEL; trace COBBLES.				
	350	20	10	0/30									
55		21	11	0/30					@ 58': drilling refusal.				
	345								Total depth = 58 feet below ground surface Groundwater encountered during drilling at 35 feet				

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

FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-1**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 58
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 403	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Backfilled with soil cuttings and patched with cold patch				
	340												
65													
	335												
70													
	330												
75													
	325												

GDC_ROCK_CORE_ENG_LA LA-1230 SOIL CORES B-1 - B-6.GPJ ROCK2.GDT 4/28/15

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Torrance, CA 90501

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

FIGURE d

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-2**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 399	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt, approximately 3 inches thick.				
									Artificial Fill (Qaf)				
	395												
5		1	1	27/30					**Holocene Sand (Qs)** **Clayey SAND** 10YR 3/2 (very dark grayish brown); moist; mostly fine to medium SAND; few coarse SAND and fine GRAVEL; trace coarse GRAVEL.				
		2	1	28/30									
	390												
10		3	2	23/30					**Upper Older Alluvium (Qoal2)** **Silty SAND** 10YR 5/6 (yellowish brown); moist; mostly fine to medium SAND; trace coarse SAND and fine GRAVEL. Granite gravels are highly grusified.				
		4	2	17/30									
	385												
15		5	3	21/30					**Clayey SAND to Sandy CLAY** 10YR 5/6 (yellowish brown); moist; fine SAND; trace medium SAND.				
		6	3	23/30					**Clayey SAND** 10YR 4/4 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	380								**Silty SAND** 10YR 6/6 (yellowish brown); moist; fine to				

GDC_ROCK_CORE_ENG_LA LA-1230 SOIL CORES B-1 - B-6.GPJ ROCK2.GDT 4/28/15

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

FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-2**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 399	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		7	4	23/30					medium SAND; few coarse SAND; trace fine GRAVEL.				
									SAND with Silt 10YR 5/6 (yellowish brown); moist; fine to medium SAND; few coarse SAND; trace fine GRAVEL.				
		8	4	27/30					**Silty SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND.				
	375												
25		9	5	30/30					**Clayey SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium and coarse SAND.				
		10	5	30/30									
	370												
30		11	6	23/30					**Silty SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; few medium to coarse SAND; trace fine GRAVEL.				
		12	6	30/30					**Clayey SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	365												
35		13	7	47/60					**Silty SAND** 10YR 5/4 (yellowish brown); moist; mostly fine to medium SAND; trace coarse SAND and fine GRAVEL.				
									Lower Older Alluvium (Qoal1) **Clayey SAND** 5YR 4/3 (reddish brown); wet; mostly fine SAND; trace fine GRAVEL. Basalt gravels are highly weathered. @ 37.5': groundwater encountered during drilling.				
	360												

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FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-2**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 399	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		14	8	56/60					@ 40': 10YR 4/4 (brown); mostly fine to medium SAND; trace coarse SAND and fine GRAVEL. Basalt gravels are highly weathered.				
	355												
45		15	9	37/60					@ 43': 10YR 4/6 (strong brown); mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	350												
50		16	10	45/60									
	345												
55		17	11	48/60									
	340												

GDC_ROCK_CORE_ENG_LA LA-1230 SOIL CORES B-1 - B-6.GPJ ROCK2.GDT 4/28/15

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FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-2**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/4/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 399	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		18	12	45/60									
	335								**Silty SAND** 7.5YR 4/4 (brown); moist; mostly fine to medium SAND; few coarse SAND; trace fine GRAVEL.				
65		19	13	42/60					**Clayey SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	330												
70									Total depth = 70 feet below ground surface Groundwater encountered during drilling at 37.5 feet Backfilled with soil cuttings and patched with cold patch				
	325												
75													
	320												

GDC_ROCK_CORE_ENG_LA LA-1230 SOIL CORES B-1 - B-6.GPJ ROCK2.GDT 4/28/15

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FIGURE d

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-3**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 402	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt, approximately 6-inches thick **Artificial Fill (Qaf)**				
	400												
5		1	1	29/30					**Holocene Sand (Qs)** **Clayey SAND** 10YR 3/2 (very dark grayish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL. @ 6': 10YR 4/4 (dark yellowish brown)				
	395	2	1	30/30									
10		3	2	23/30					@ 10': 10YR 4/6 (dark yellowish brown)				
	390	4	2	28/30					**Upper Older Alluvium (Qoal2)** **Silty SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium and coarse SAND; trace fine GRAVEL.				
15		5	3	26/30									
	385	6	3	27/30					**Clayey SAND** 10YR 4/4 to 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL. @ 19': trace granite cobble. **Silty SAND with Clay** 10YR 6/6 (yellowish brown);				

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FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-3**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 402	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		7	4	29/30					moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL; iron oxide staining observed along granitic clasts.				
	380								**Silty SAND** 10YR 5/6 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
		8	4	28/30									
25		9	5	28/30					**Silty SAND with Clay** 10YR 6/6 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL; iron oxide staining observed along granitic clasts. @ 25': few fine gravel; red oxidation observed on many of the gravel surfaces.				
	375								**Clayey SAND** 10YR 5/6 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
		10	5	32/30					**Silty SAND** 10YR 5/6 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
30		11	6	27/30					**Silty SAND with Clay** 10YR 6/6 (yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL; iron oxide staining observed along granitic clasts.				
	370	12	6	30/30									
									Clayey SAND 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL.				
35		13	7	33/60					**Silty SAND** 10YR 6/6 (brownish yellow); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	365								**SAND with Silt** 10YR 5/6 (yellowish brown); moist; mostly fine to medium SAND; few coarse SAND; trace fine GRAVEL.				
									@ 38.5': mostly fine SAND; few medium SAND; trace coarse SAND				
									@ 39': mostly fine to medium SAND; few coarse				

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FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-3**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 402	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		14	8	30/30					SAND; wet; groundwater encountered during drilling. **Lower Older Alluvium (Qoal1)**				
	360	15	8	31/30					**Clayey SAND** 5YR 4/4 (reddish brown); wet; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL; red and yellow oxide staining on granitic clasts; basalt clast at 42.5' highly weathered (dark red in color). @ 42.5': 7.5YR 4/4 (brown) higher sand content.				
45		16	9	32/30					@ 45': mottled 7.5YR 5/6 (strong brown) and 7.5YR 5/1 (gray).				
	355	17	9	31/30					**Silty SAND** 7.5YR 5/6 (strong brown); wet; mostly fine to medium SAND; trace coarse SAND and fine GRAVEL.				
50		18	10	29/30					**Clayey SAND** 7.5YR 4/6 (strong brown); wet; mostly fine SAND; trace medium to coarse SAND.				
	350	19	10	32/30									
55		20	11	27/30									
	345	21	11	29/30					**Silty SAND** 7.5YR 5/6 (strong brown); moist; mostly fine SAND; trace medium SAND.				

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FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-3**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 70
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 402	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		22	12	45/60					**Clayey SAND** 7.5YR 5/6 (strong brown); moist to wet; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
	340								**Silty SAND** 7.5YR 5/6 (strong brown); moist; mostly fine SAND; trace medium SAND.				
65		23	13	49/60					**Clayey SAND** 7.5YR 4/4 (brown); moist; mostly fine SAND; few medium SAND; trace fine GRAVEL.				
	335								@ 68': cobble with red and yellow oxide staining on the surface.				
70									Total depth = 70 feet below ground surface Groundwater encountered during drilling at 39 feet Backfilled with cuttings and patched with cold patch				
	330												
75													
	325												

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FIGURE d

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-4**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 397	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt approximately 3 inches thick				
	395								**Artificial Fill (Qaf)**				
5		1	1	30/30									
	390								**Holocene Sand (Qs)**				
		1	1	30/30					**Silty SAND** 10YR 5/6 (yellowish brown); moist; mostly fine to medium SAND; trace coarse SAND and fine GRAVEL.				
									Clayey SAND 10YR 4/4 (dark yellowish brown); moist; mostly fine SAND.				
									Silty SAND 10YR 6/4 (light yellowish brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND.				
10		2	2	24/30					**Clayey SAND** 10YR 6/4 (light yellowish brown); moist; mostly fine to medium SAND; trace coarse SAND and fine GRAVEL.				
	385												
		2	2	25/30					**Upper Older Alluvium (Qoal2)**				
									Silty SAND 10YR 5/6 (yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL and COBBLES.				
15		3	3	21/30									
	380								**Clayey SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium and coarse SAND and fine GRAVEL.				
		3	3	24/30									
									Silty SAND 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL and COBBLES.				

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FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-4**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 397	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
	375	4	4	26/30					**Silty SAND with Clay** 7.5YR 5/6 (strong brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL.				
		4	4	31/30					@ 23': Silty SAND				
25		5	5	27/30					**Clayey SAND** 7.5YR 4/4 (brown); moist; mostly fine SAND; trace medium and coarse SAND.				
	370	5	5	26/30					@ 27': trace fine GRAVEL; red oxidation on gravel surfaces.				
30		6	6	29/60									
	365								**Lower Older Alluvium (Qoal1)**				
35		7	7	0/60					**Silty SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL and COBBLES. @ 35': large cobble in shoe; no recovery in sampler.				
	360												

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FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-4**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 397	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
	355	8	8	32/30					**Clayey SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; few medium SAND; trace coarse SAND and fine GRAVEL; red oxidation on gravel surfaces.				
		8	8	28/30					@ 42': higher clay content; 7.5YR 4/4 (brown); moist to wet.				
45		9	9	26/30									
	350	9	9	31/30									
50		10	10	30/30					**Sand with Silt** 7.5YR 4/6 (strong brown); moist to wet; fine to medium SAND; few coarse SAND; trace fine GRAVEL.				
	345	10	10	38/30					**Clayey SAND** mottled 7.5YR 4/6 (strong brown) 7.5/YR 5/8 (strong brown) 7.5/YR 5/2 (brown); wet, mostly fine SAND; trace medium to coarse SAND; groundwater encountered during drilling. @ 52.2': 5YR 4/4 (reddish brown) trace fine GRAVEL.				
55		11	11	58/60									
	340												

GDC_ROCK_CORE_ENG_LA LA-1230 SOIL CORES B-1 - B-6.GPJ ROCK2.GDT 4/28/15

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FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-4**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/5/2015	**LOGGED BY** Terry Otis	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE CME 95	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)** 397	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
	335								Total depth = 60 feet below ground surface Groundwater encountered during drilling at 50 feet Backfilled with soil cuttings and patched with cold patch				
65													
	330												
70													
	325												
75													
	320												

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FIGURE d

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-5**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt approximately 3 inches thick **Artificial Fill (Qaf)**				
5		1	1	28/30					**Holocene Sand (Qs)** **Silty SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND.				
		2	1	29/30					**Clayey SAND** 7.5YR 4/4 (brown); moist; mostly fine SAND; trace medium to coarse SAND, fine GRAVEL, and rootlets; pinhole porosity.				
10		3	2	32/30					@ 10': 7.5YR 4/6 (strong brown)				
		4	2	26/30					**Upper Older Alluvium (Qoal2)** **Silty SAND** 10YR 5/8 (yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL.				
15		5	3	29/30					**Silty to Clayey SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL.				
		6	3	29/30									

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FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-5**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		7	4	26/30					**SAND with Silt** 10YR 5/6 (yellowish brown); moist; mostly fine SAND; trace medium SAND.				
									@ 21': few medium SAND; trace coarse SAND and fine GRAVEL.				
		8	4	28/30					**Silty SAND** 10YR 5/8 (yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND and fine GRAVEL.				
25		9	5	29/30					**Clayey SAND** 10YR 5/6 (yellowish brown); moist; mostly fine SAND; trace medium SAND.				
									@ 25': trace coarse SAND and fine GRAVEL. Increased clay content				
		10	5	26/30					**Silty SAND** 10YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND.				
									SAND with Silt 10YR 5/6 (yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND.				
30		11	6	27.5/30					**Silty SAND** 10YR 5/6 (yellowish brown); moist; mostly fine SAND.				
									SAND with Silt 10YR 6/8 (brownish yellow); moist; mostly fine to medium SAND; trace fine GRAVEL.				
									Silty SAND 10YR 5/6 (yellowish brown); moist; mostly fine SAND.				
		12	6	19/30					**SAND with Silt** 10YR 6/8 (brownish yellow); moist; mostly fine to medium SAND; trace fine GRAVEL.				
									Lower Older Alluvium (Qoal1)				
35		13	7	31/30					**Clayey SAND** 7.5YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND. @ 35': 5YR 4/4 (reddish brown); trace fine GRAVEL.				
		14	7	31/30					@37.5': 7.5YR 4/6 (strong brown)				

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FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-5**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		15	8	60/60					@ 40': trace weathered basalt (deep red in color)				
45		16	9	51/60					@ 45' to 47': 5YR 4/6 (yellowish red); trace GRAVEL. @ 47' to 50': 7.5YR 4/6 (strong brown); mostly fine SAND.				
50		17	10	58/60									
55		18	11	51/60					@ 54.5': large cobble fragment **Silty SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; some medium to coarse SAND. **Clayey SAND** 7.5YR 4/6 (dark yellowish brown); moist; mostly fine SAND; trace medium to coarse SAND. @ 59.5': trace fine GRAVEL.				

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FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-5**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Total depth = 60 feet below ground surface No groundwater encountered during drilling Backfilled with soil cuttings and patched with cold patch				
65													
70													
75													

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FIGURE d

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-6**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 1 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Asphalt approximately 3 inches thick **Artificial Fill (Qaf)**				
5		1	1	32/30					**Holocene Sand (Qs)** **Clayey SAND** 7.5YR 3/3 (dark brown); moist; mostly fine SAND; trace medium to coarse SAND.				
		2	1	24/30									
10		3	2	30/30					**Upper Older Alluvium (Qoal2)** **Silty SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND. @ 13.5': trace fine GRAVEL.				
		4	2	28/30									
15		5	3	25/30					**SAND with Silt** 7.5YR 5/4 (brown); moist; mostly fine SAND; some medium to coarse SAND.				
		6	3	27/30					**Silty SAND** 7.5YR 5/4 (brown); moist; mostly fine SAND; trace medium to coarse SAND.				
									SAND with Silt 7.5YR 4/6 (strong brown); moist; mostly fine SAND; some medium to coarse SAND.				

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FIGURE a

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-6**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 2 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		7	4	27.5/30					@ 20' to 22.5': trace fine GRAVEL.				
		8	4	27/30					**Silty SAND** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; trace medium to coarse SAND.				
									SAND with Silt 7.5YR 4/6 (strong brown); moist; mostly fine SAND; some medium to coarse SAND.				
25		9	5	31/30					**Clayey SAND** 7.5YR 4/4 (brown); moist; mostly fine SAND; trace medium to coarse SAND.				
									SAND with Silt 7.5YR 4/6 (strong brown); moist; mostly fine SAND; some medium to coarse SAND; trace fine GRAVEL.				
		10	5	26/30									
30		11	6	29.5/30					@ 30.4': large cobble fragment				
									Clayey SAND 7.5YR 4/4 (brown); moist; mostly fine SAND; trace medium to coarse SAND.				
		12	6	30/30					@ 32.5': 5YR 3/3 (dark reddish brown)				
35		13	7	32/30					@ 35.5': 5YR 4/4 (reddish brown)				
									@ 36.5': trace fine GRAVEL				
		14	7	26.5/30					**Lower Older Alluvium (Qoal1)**				
									@ 38': large cobble fragment				
									@ 39.5': 7.5YR 4/6 (strong brown)				

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FIGURE b

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-6**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 3 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
		15	8	35.5/30					@ 40': 5YR 3/3 (dark reddish brown)				
		16	8	33/30					@ 42.5': 5YR 4/6 (yellowish red)				
45		17	9	50.5/60					@ 45' to 48.5': some medium to coarse SAND. @ 45.5': 1 to 2 inch thick layer of weathered granite				
50		18	10	46/60					**SAND with Silt** 7.5YR 4/6 (strong brown); moist; mostly fine SAND; some medium to coarse SAND. **Clayey SAND** 5YR 4/6 (yellowish red); moist; mostly fine SAND; some medium to coarse SAND.				
55		19	11	60/60					@ 56.5': approximately 1 inch thick lense of CLAY				

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FIGURE c

LOG OF CORE BORING

PROJECT NAME 6044 Carlos Avenue	**PROJECT NUMBER** LA-1230	**BORING** **B-6**	
SITE LOCATION 6044 Carlos Ave.	**DATE(S) DRILLED** 3/27/2015	**LOGGED BY** Terry Otis and Chelsea Woods	**SHEET NO.** 4 of 4
DRILLING METHOD Hollow Stem Auger	**DRILL BIT SIZE/TYPE** 8 in	**CHECKED BY** Steve Kolthoff	**TOTAL DEPTH DRILLED (feet)** 60
DRILL RIG TYPE MARL M12	**DRILLED BY** Gregg In-Situ Drilling	**INCLINATION FROM VERTICAL/BEARING** 0	
APPARENT GROUNDWATER DEPTH None encountered		**APPROXIMATE PILE TOP ELEVATION (feet)**	
COMMENTS		**BOREHOLE BACKFILL**	

DEPTH (ft)	ELEVATION (ft)	ROCK CORE: RUN NO.	BOX NO.	RECOVERY, %	FRAC. FREQ.	R.Q.D., %	FRACTURE DRAWING/ NUMBER	LITHOLOGY	MATERIAL DESCRIPTION	PACKER TESTS	LABORATORY TESTS	DRILL RATE, FEET/HOUR	FIELD NOTES
									Total depth = 60 feet below ground surface No groundwater encountered during drilling Backfilled with soil cuttings and patched with cold patch				
65													
70													
75													

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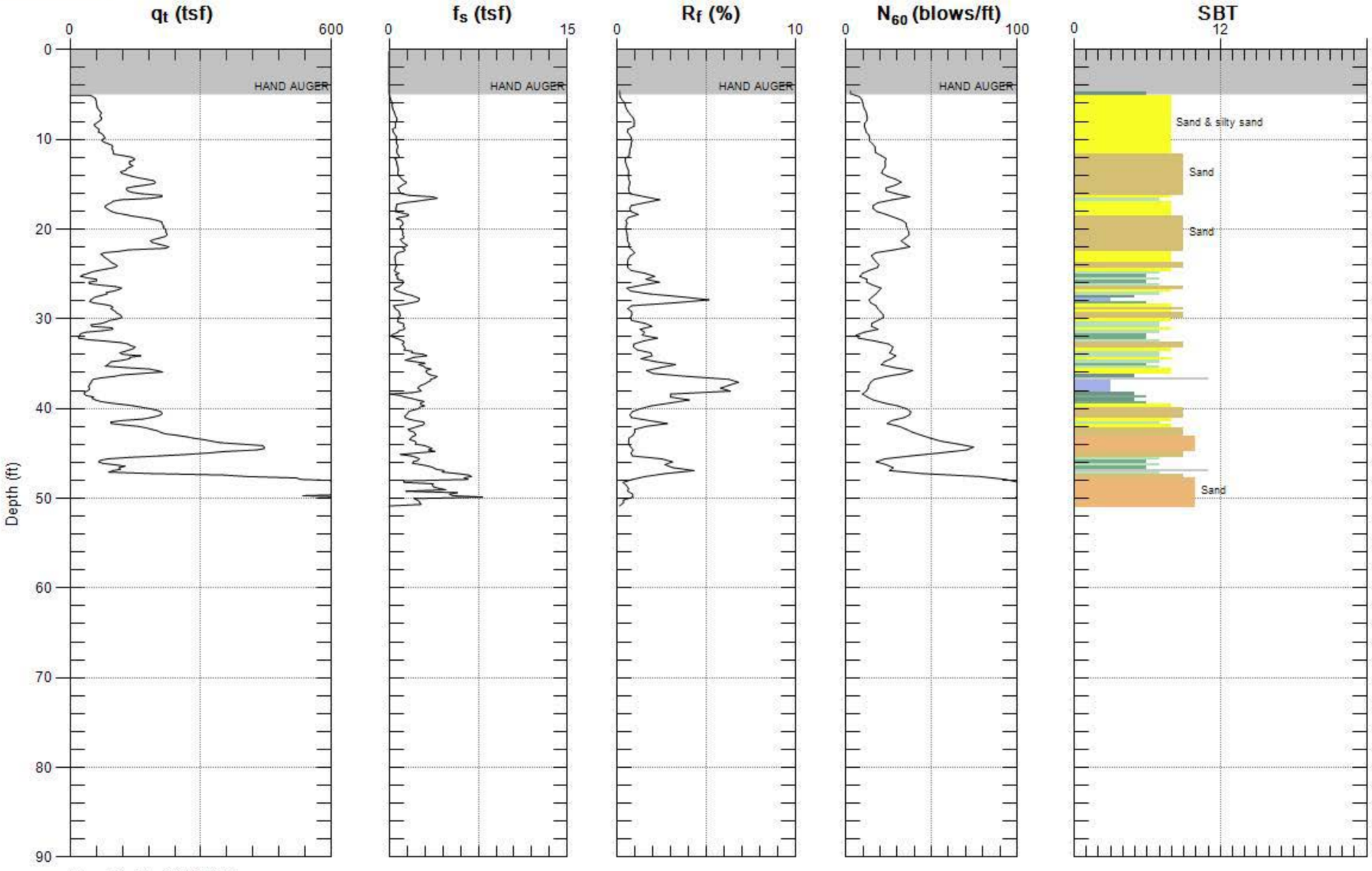
FIGURE d

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-1
Engineer: T.OTIS
Date: 3/2/2015 09:28



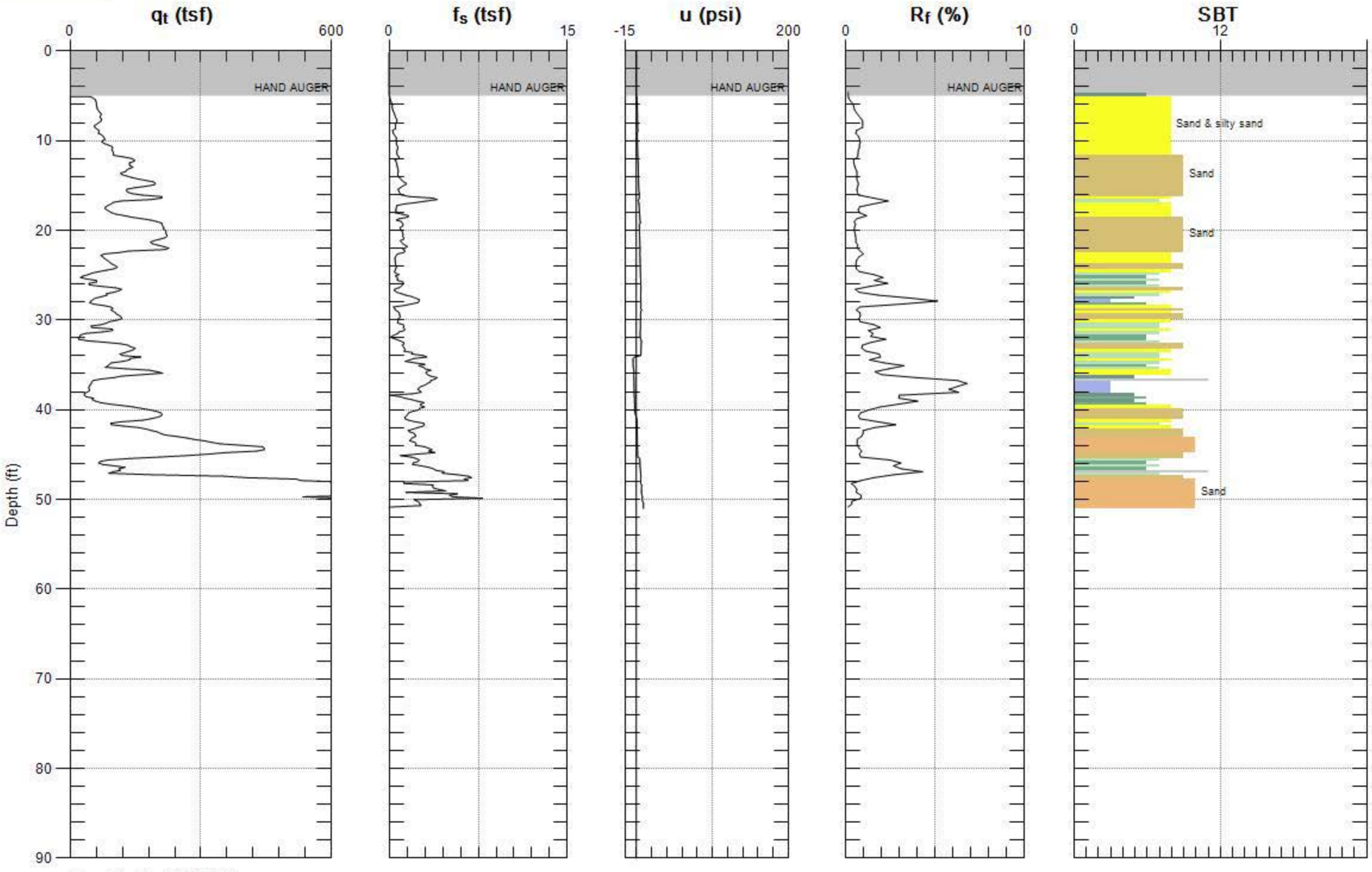
Max. Depth: 51.017 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-1

Engineer: T.OTIS
Date: 3/2/2015 09:28

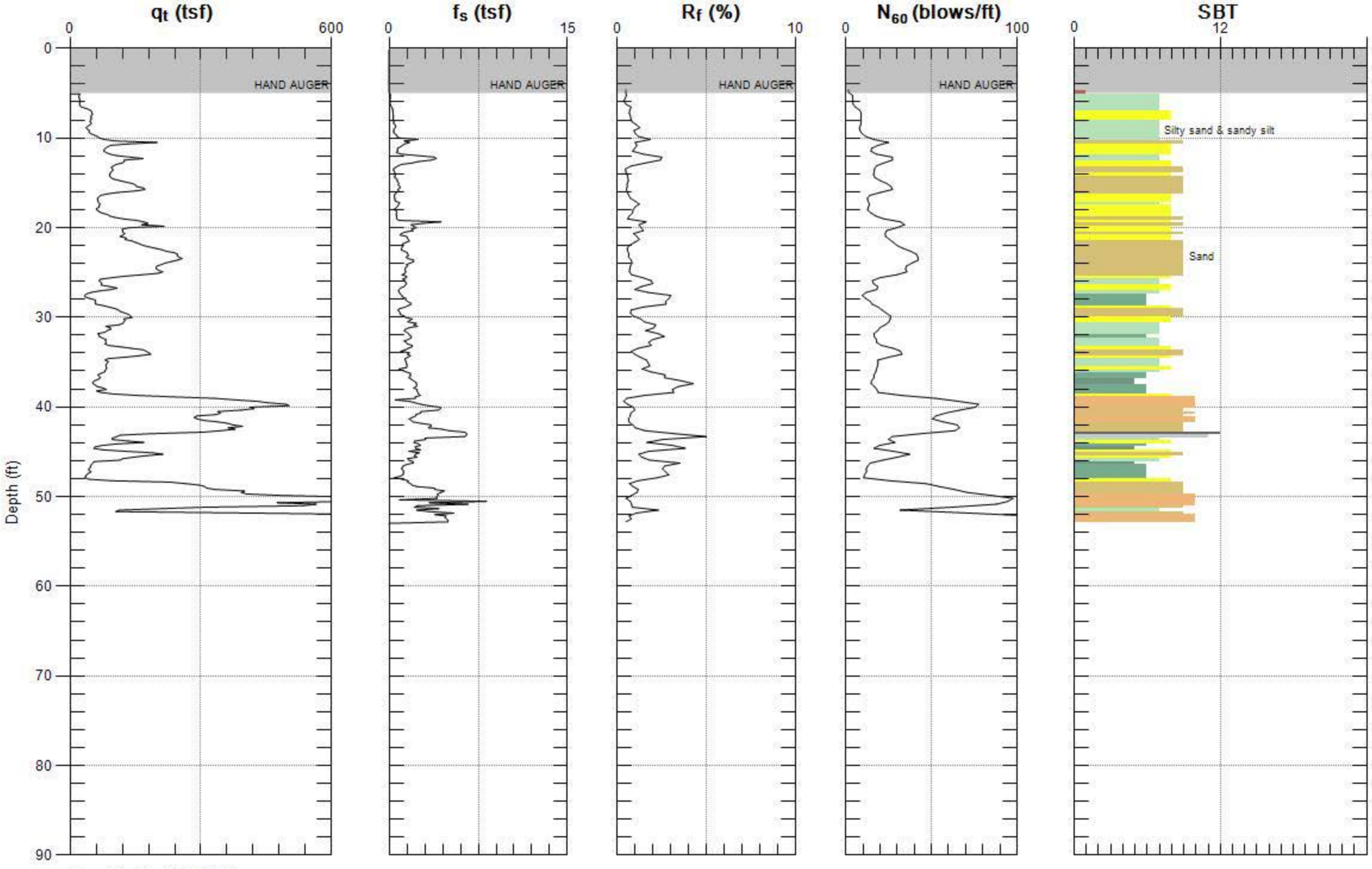


Max. Depth: 51.017 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-3
Engineer: T.OTIS
Date: 3/2/2015 12:03

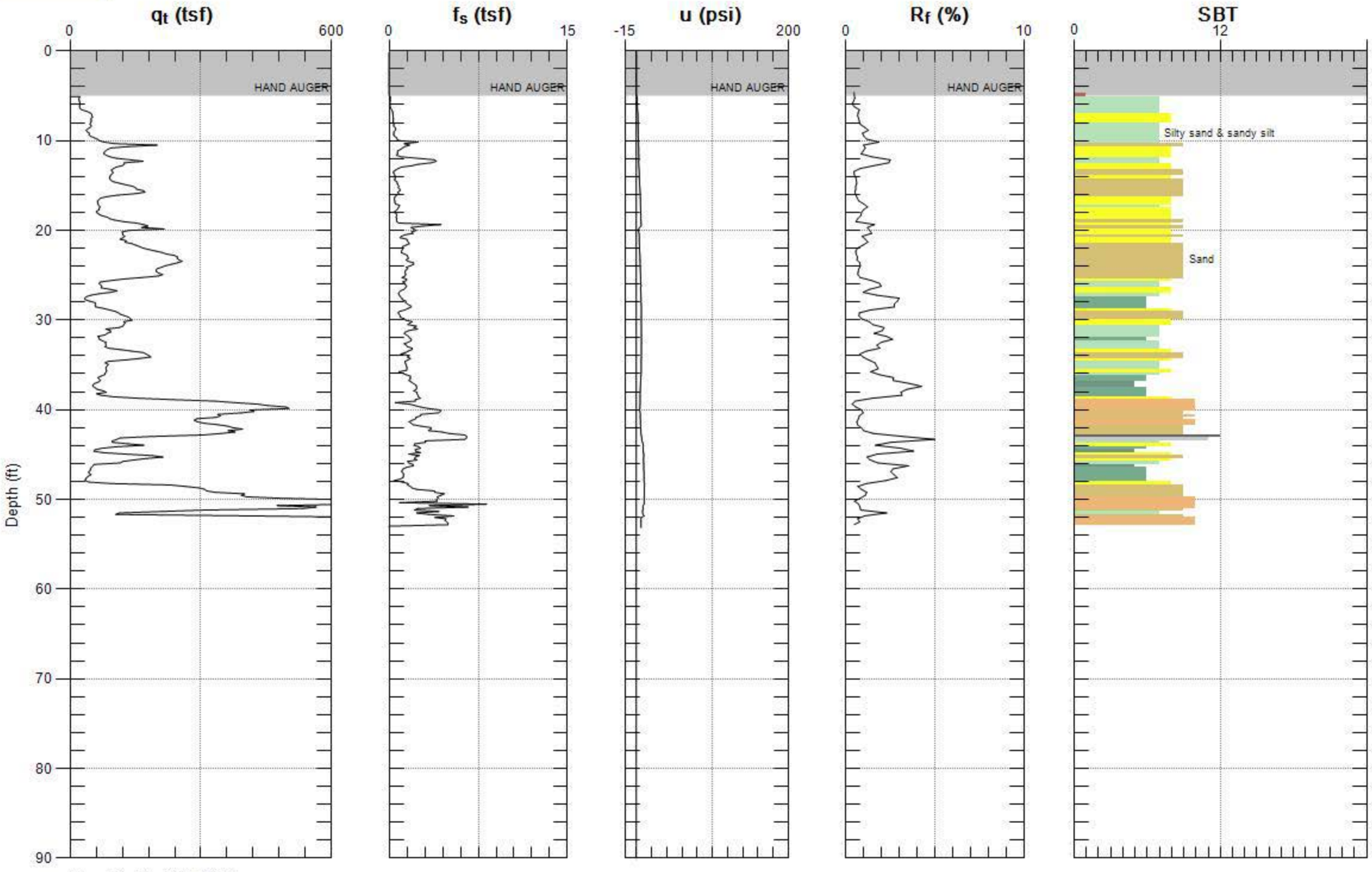


Max. Depth: 53.150 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-3
Engineer: T.OTIS
Date: 3/2/2015 12:03



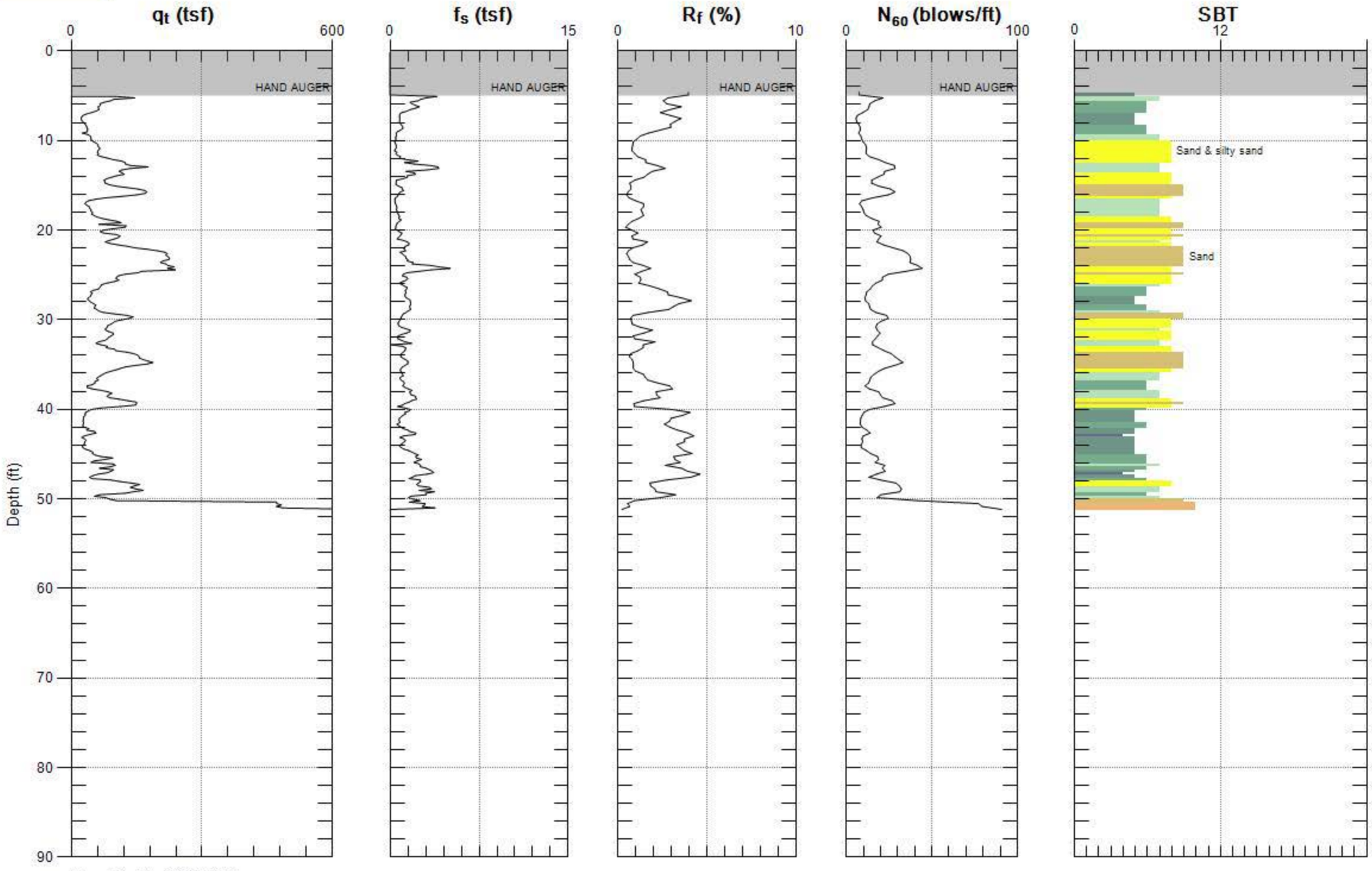
Max. Depth: 53.150 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-4

Engineer: T.OTIS
Date: 3/2/2015 01:00



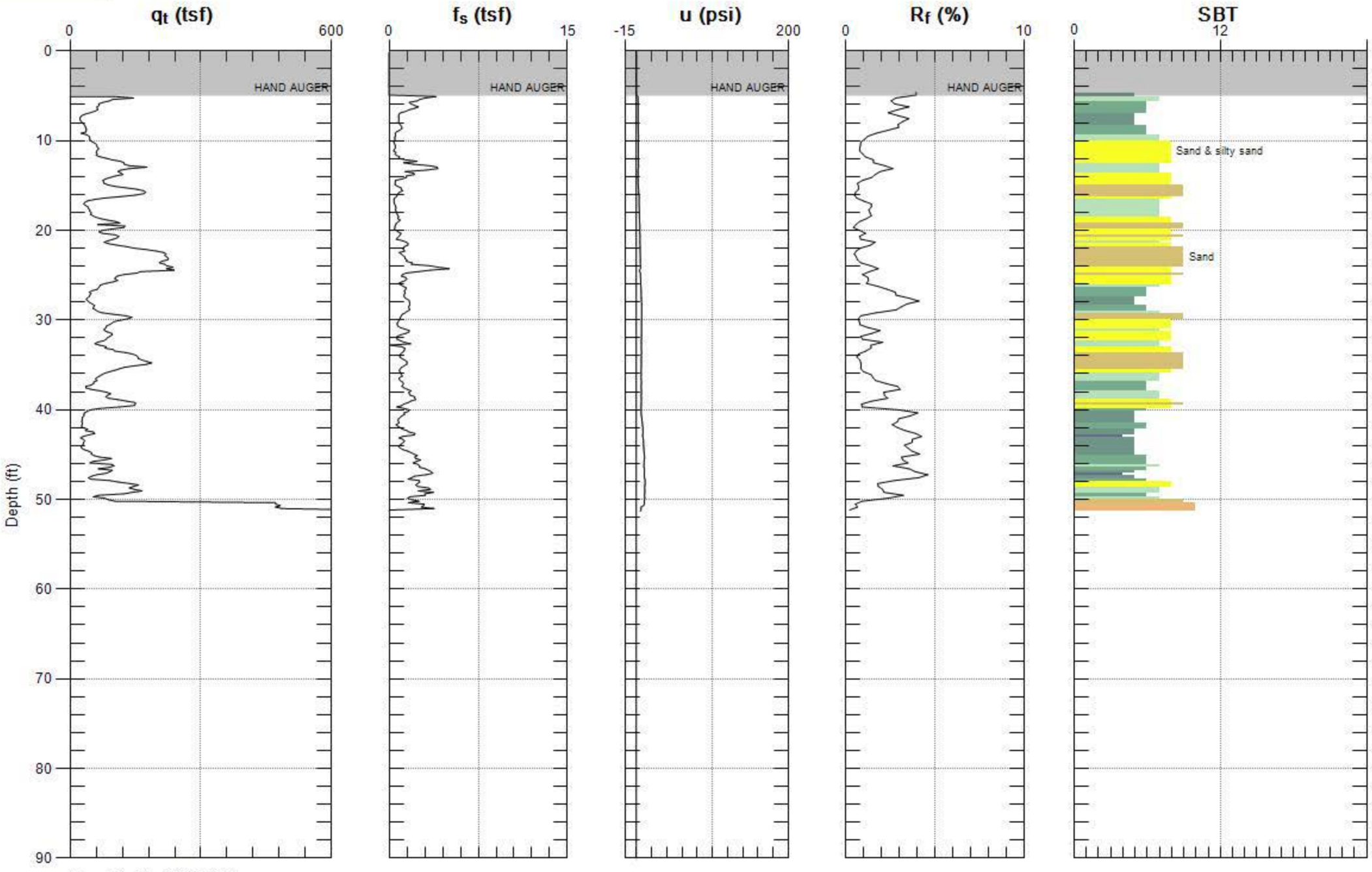
Max. Depth: 51.345 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-4

Engineer: T.OTIS
Date: 3/2/2015 01:00

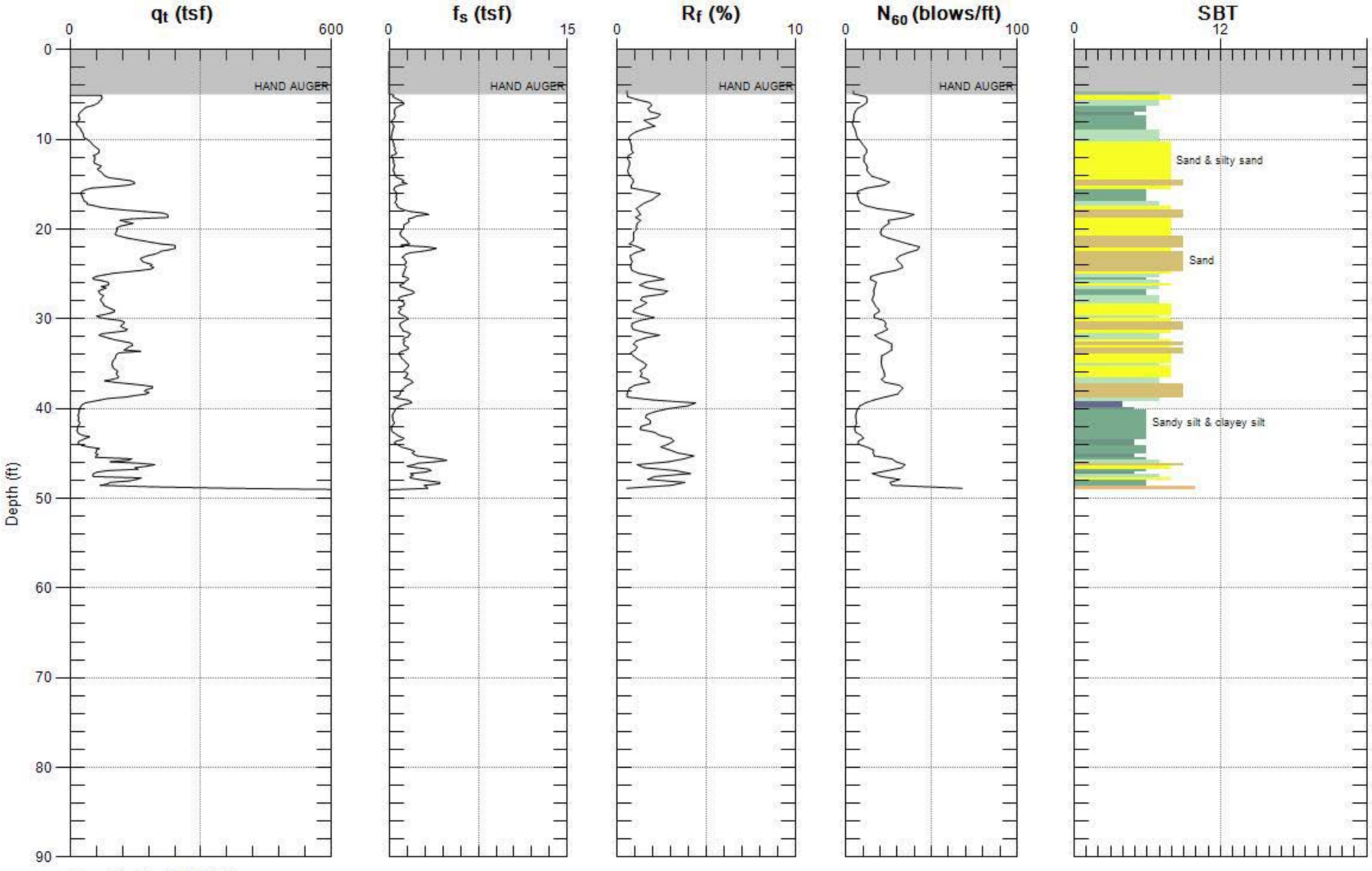


Max. Depth: 51.345 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-5
Engineer: T.OTIS
Date: 3/2/2015 01:30



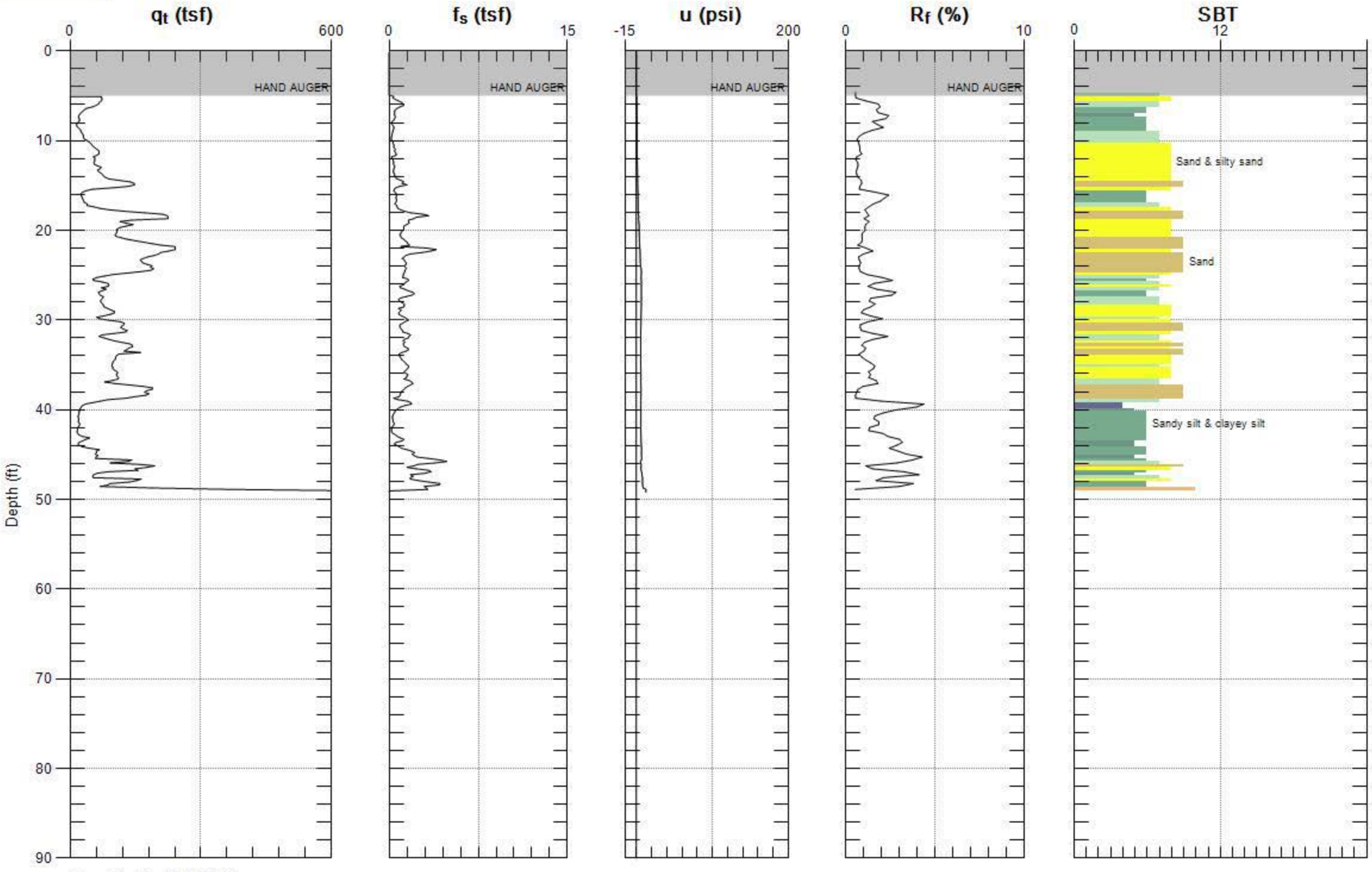
Max. Depth: 49.213 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-5

Engineer: T.OTIS
Date: 3/2/2015 01:30

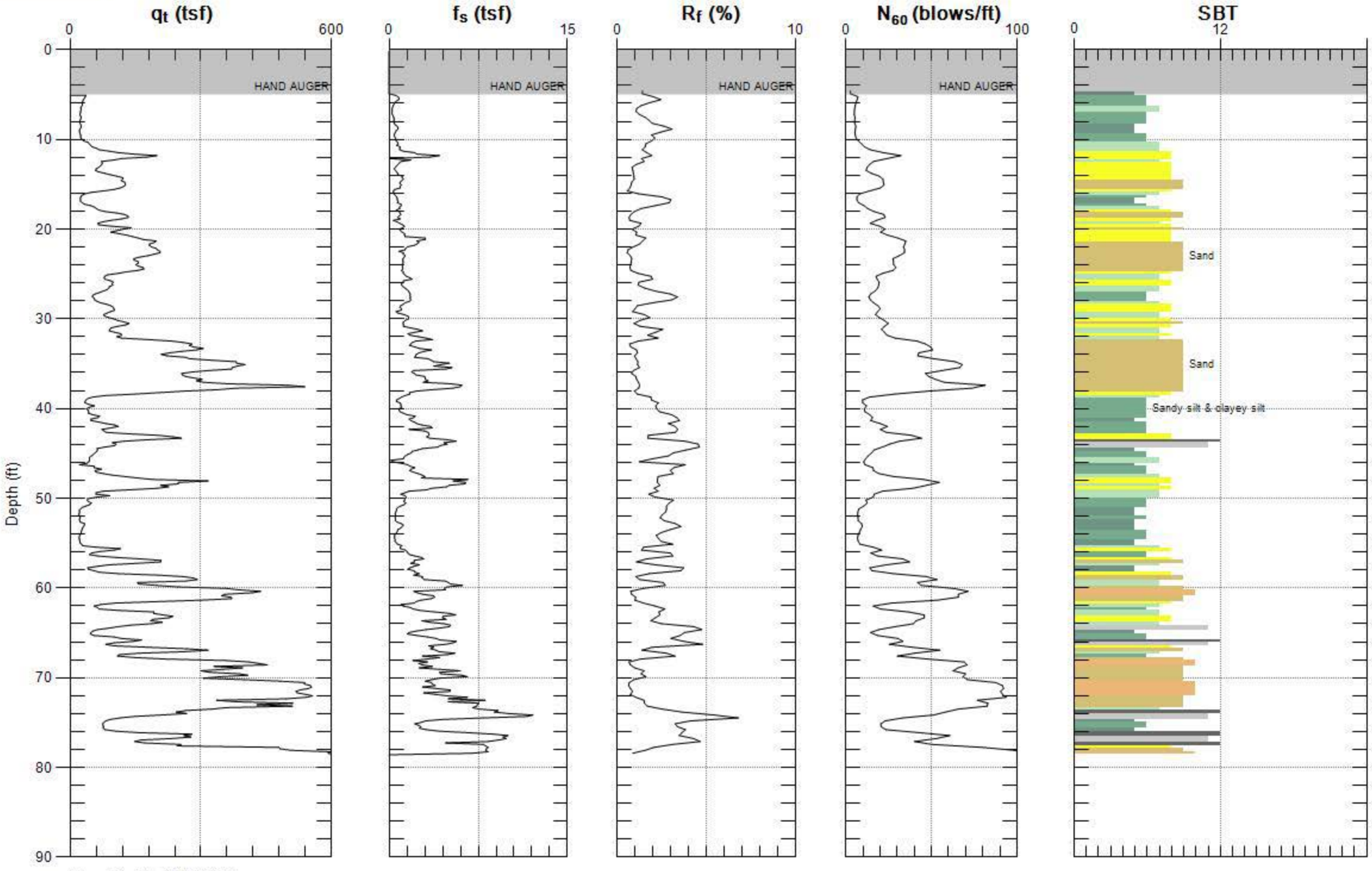


Max. Depth: 49.213 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-6
Engineer: T.OTIS
Date: 3/3/2015 07:34

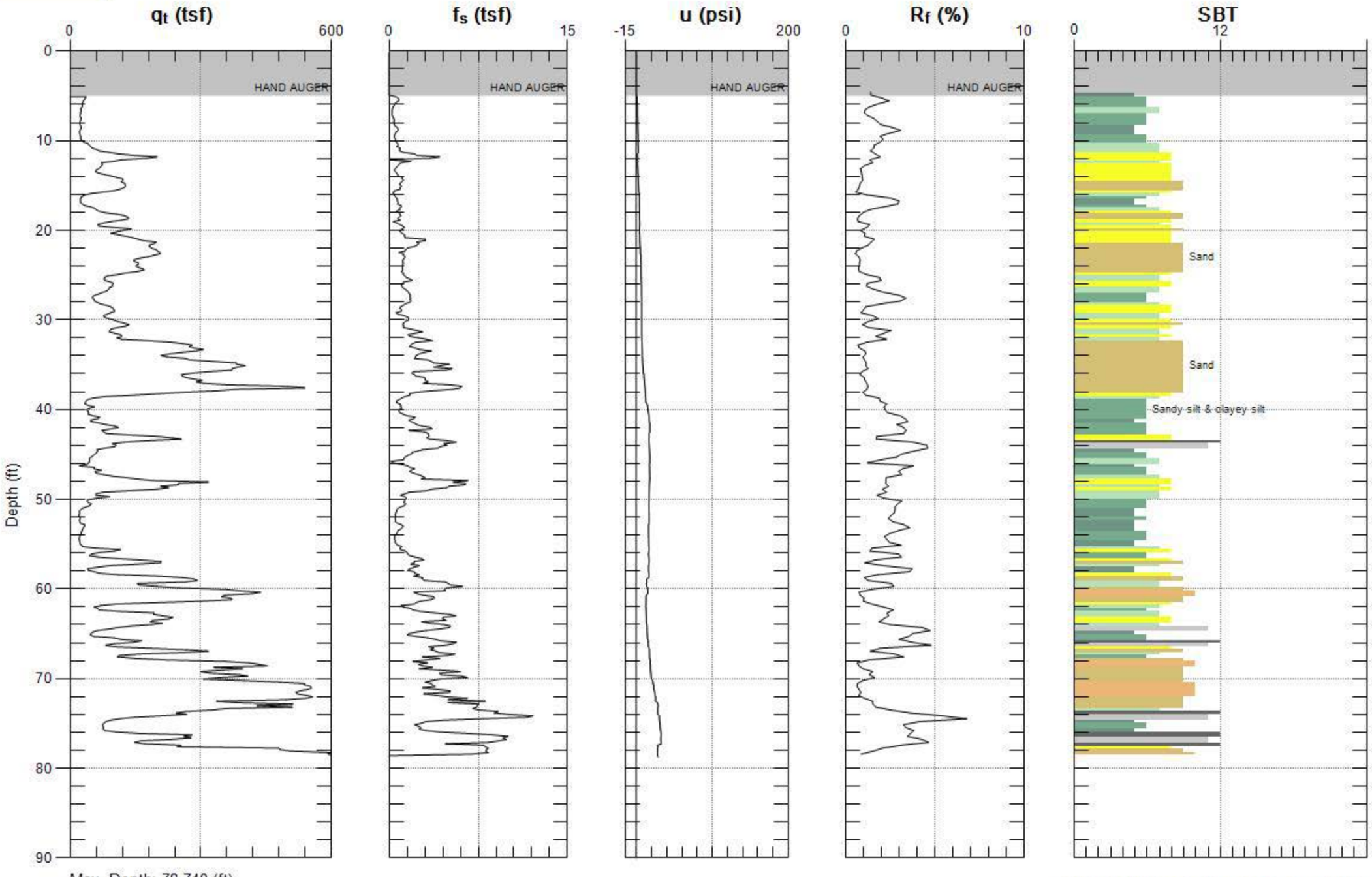


Max. Depth: 78.740 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-6
Engineer: T.OTIS
Date: 3/3/2015 07:34



Max. Depth: 78.740 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

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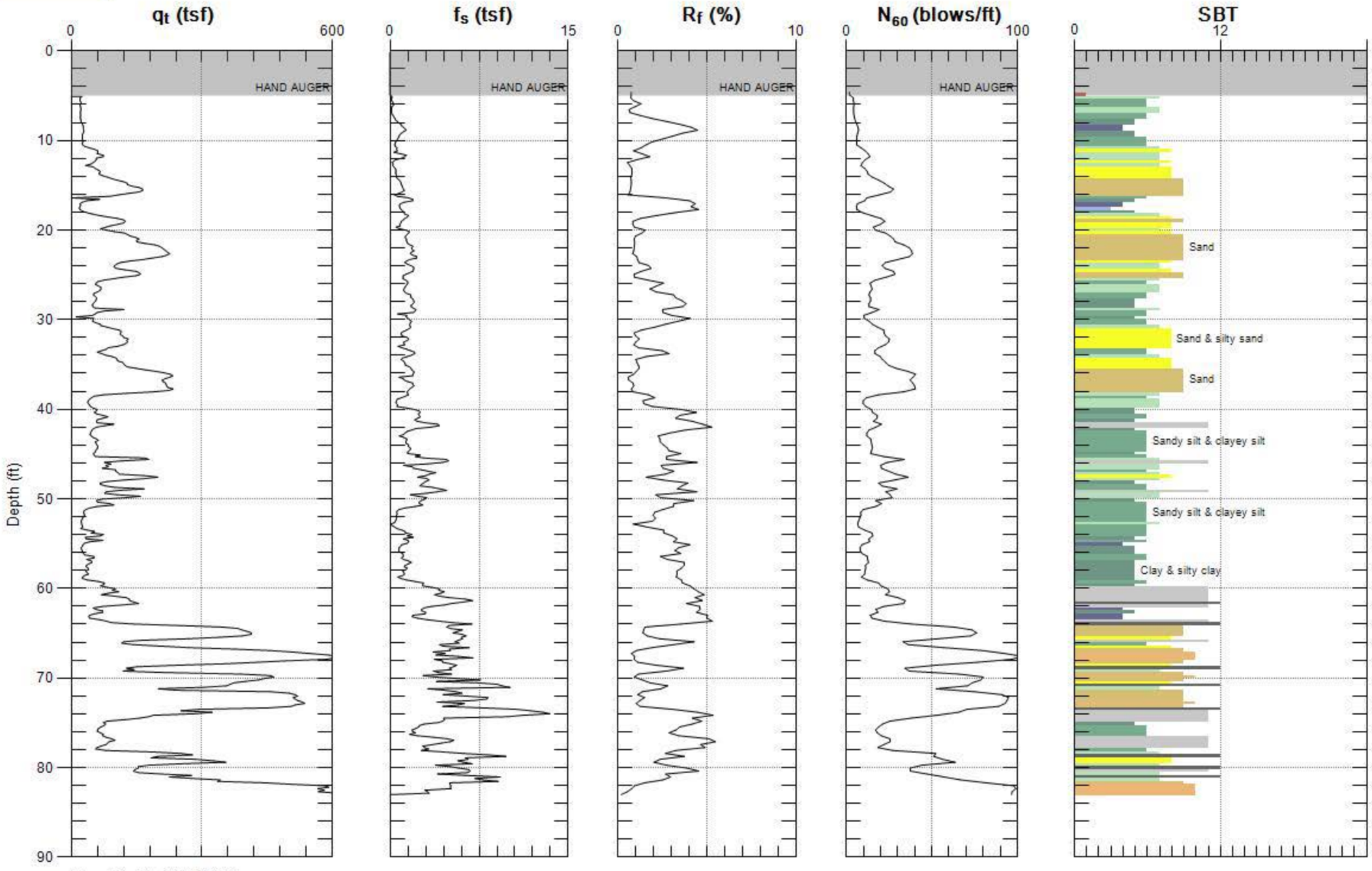
Sounding: CPT-7
Engineer: T.OTIS
Date: 3/3/2015 09:05



Max. Depth: 83.169 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

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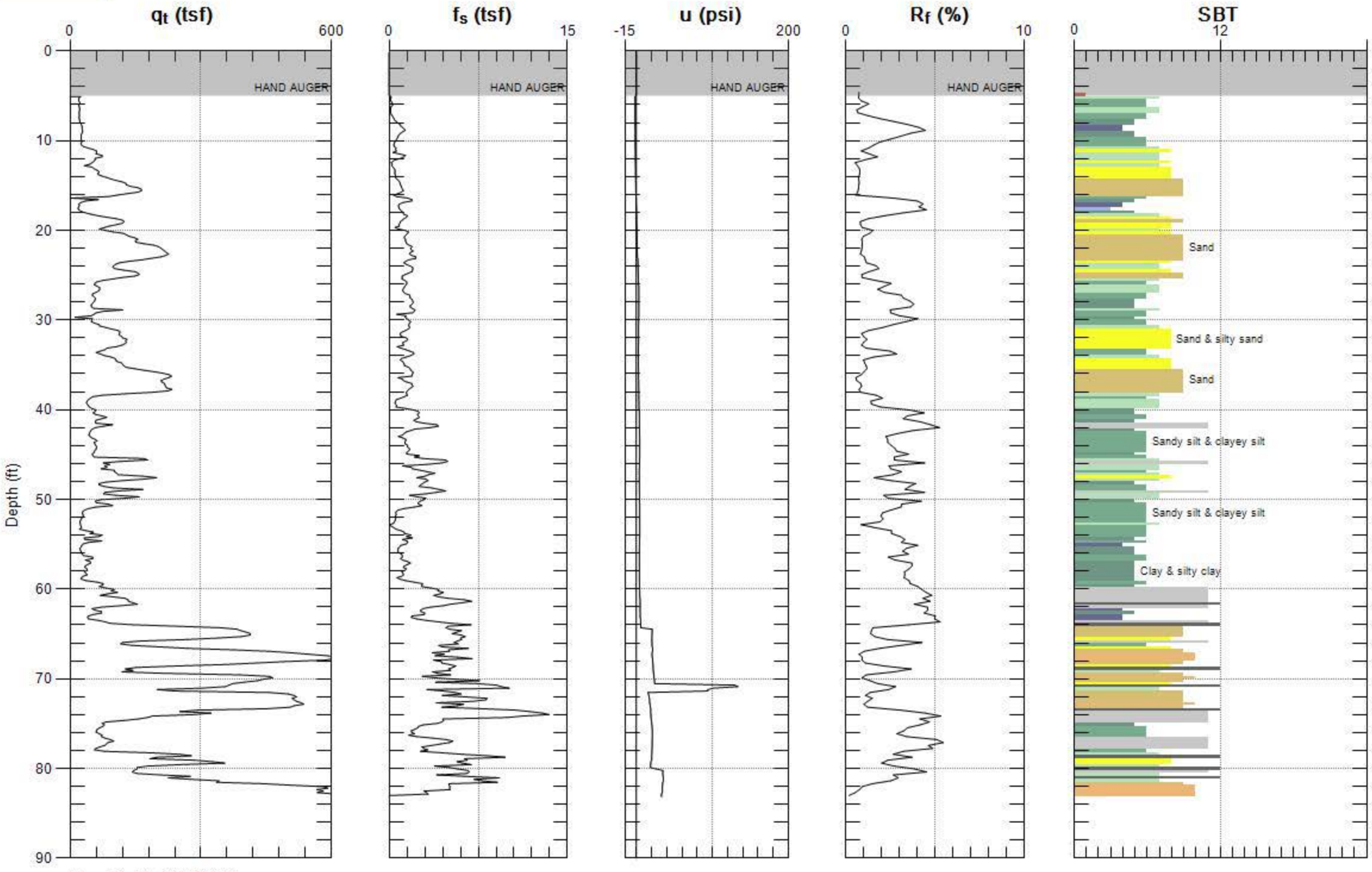
Sounding: CPT-7
Engineer: T.OTIS
Date: 3/3/2015 09:05



Max. Depth: 83.169 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

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Sounding: CPT-8
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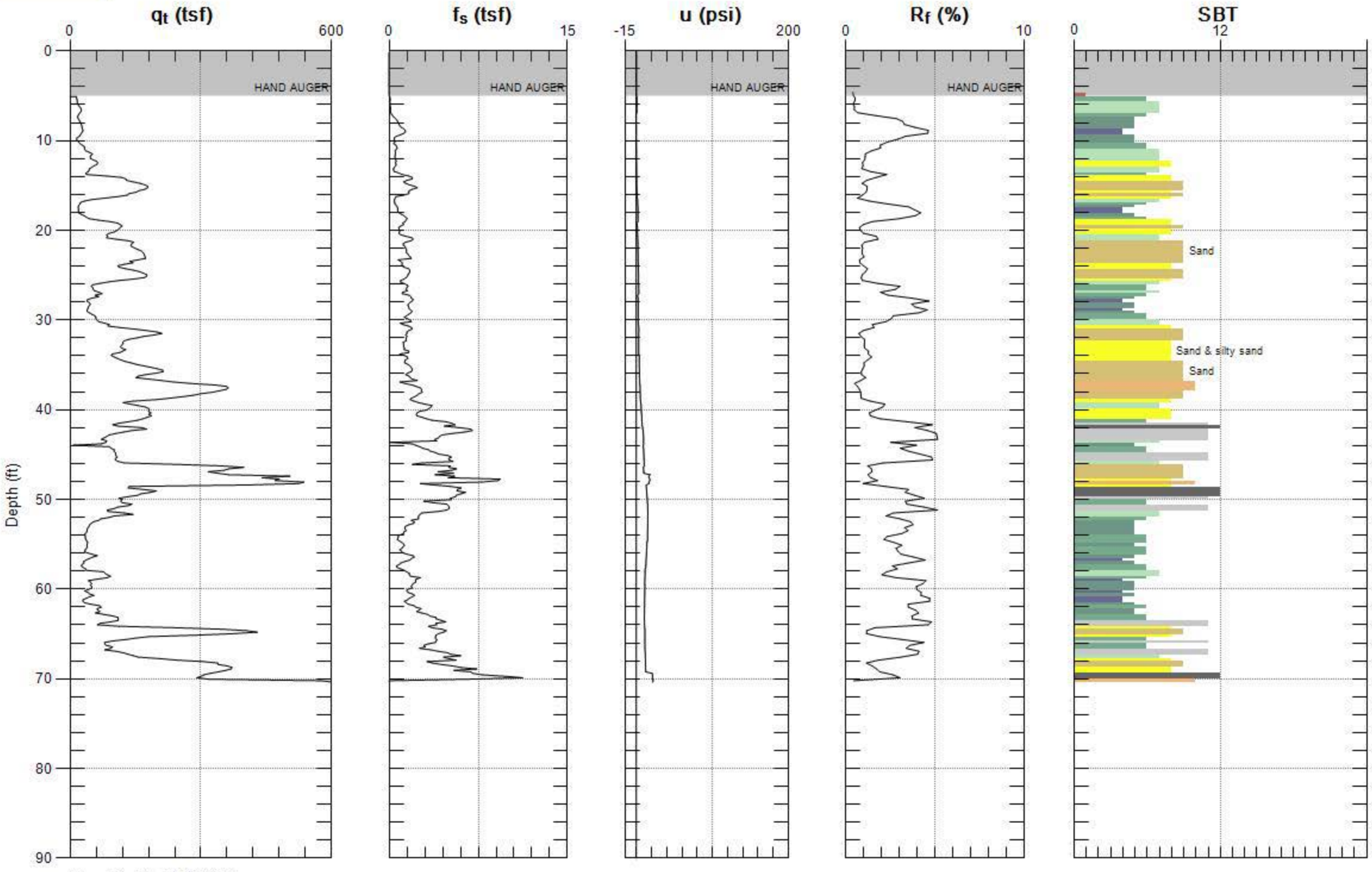
Date: 3/3/2015 10:01



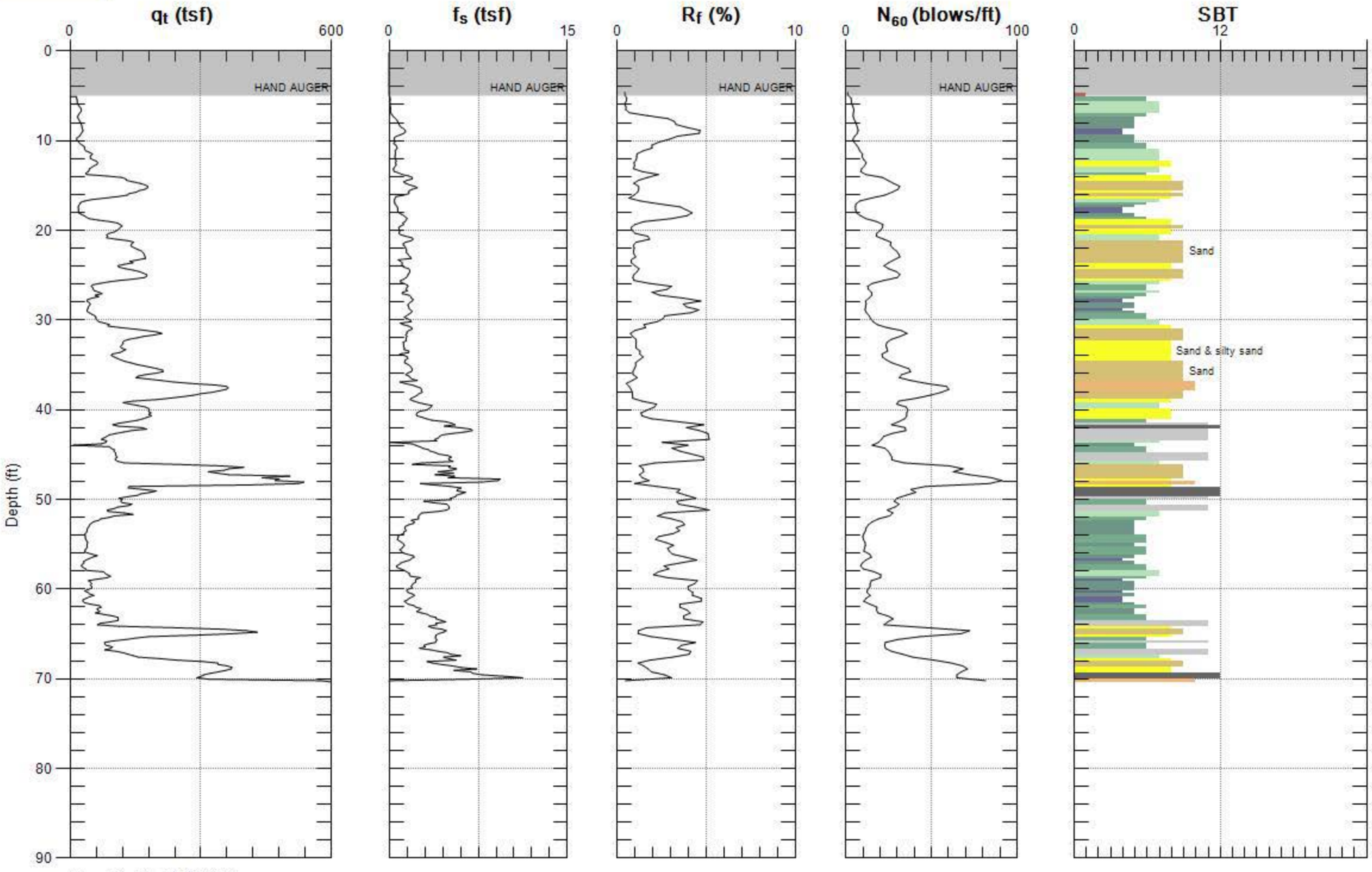
Max. Depth: 70.374 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-8

Engineer: T.OTIS
Date: 3/3/2015 10:01

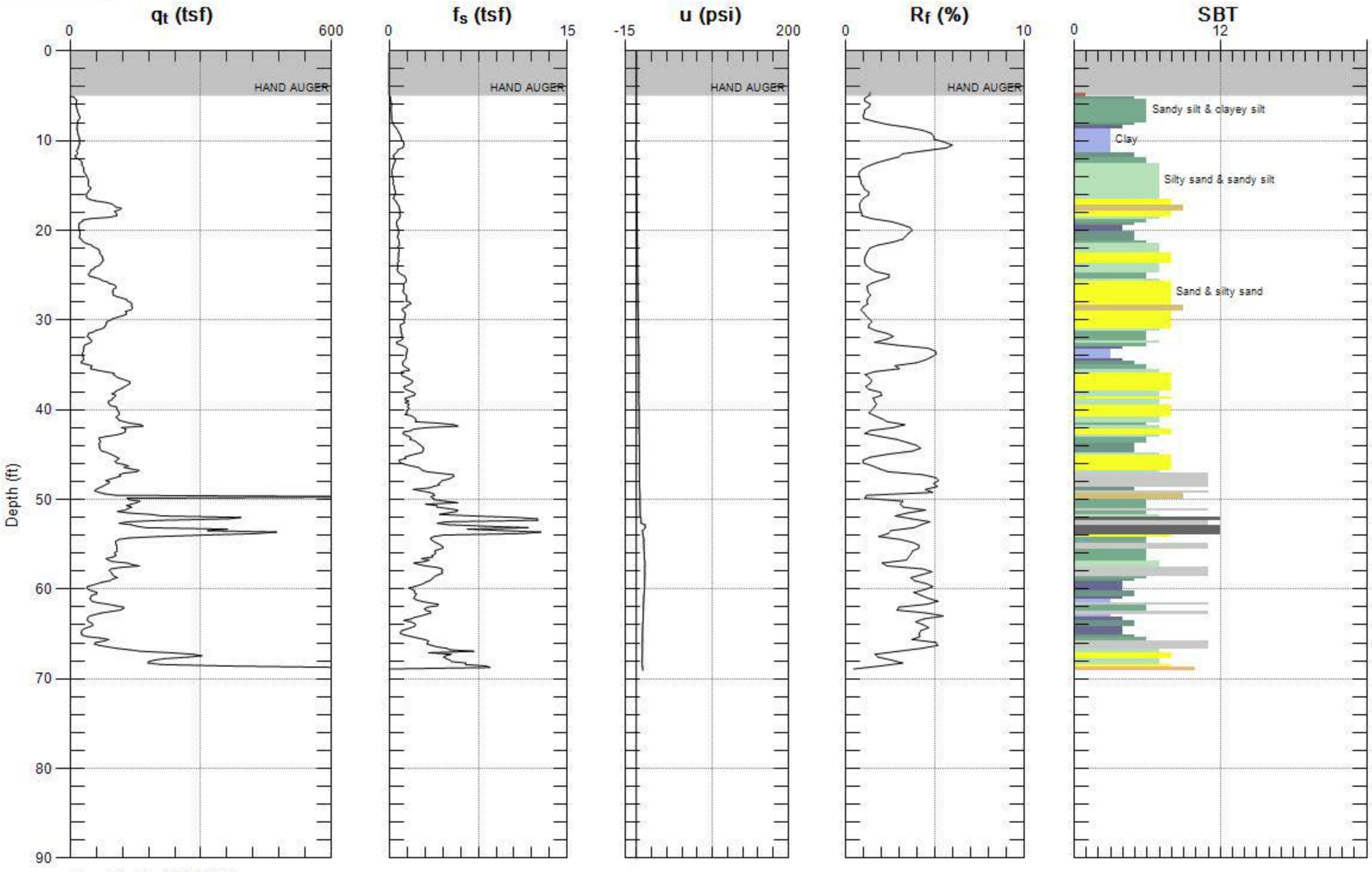


Max. Depth: 70.374 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-9
Engineer: T.OTIS
Date: 3/3/2015 11:53

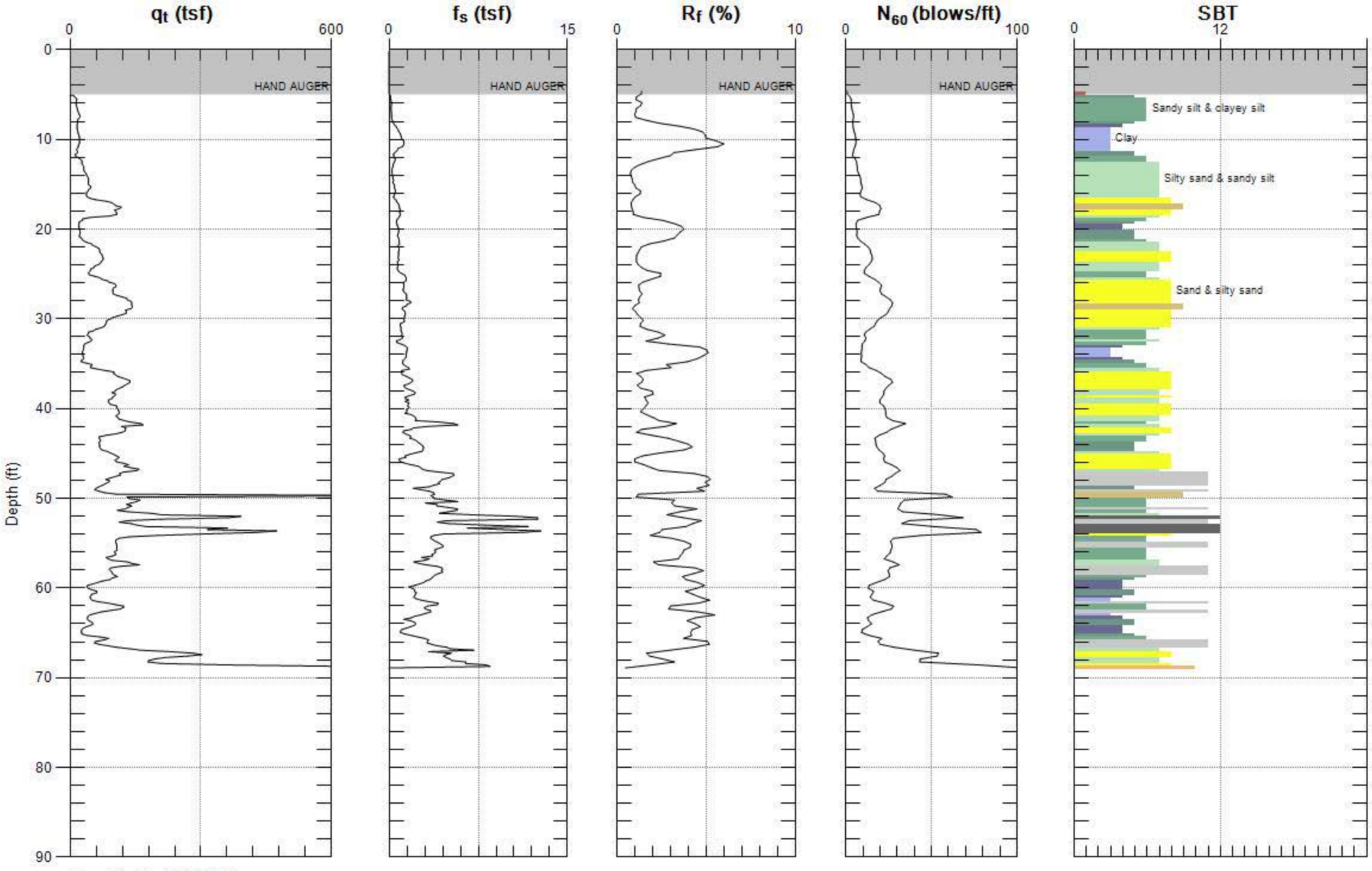


Max. Depth: 69.062 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-9
Engineer: T.OTIS
Date: 3/3/2015 11:53



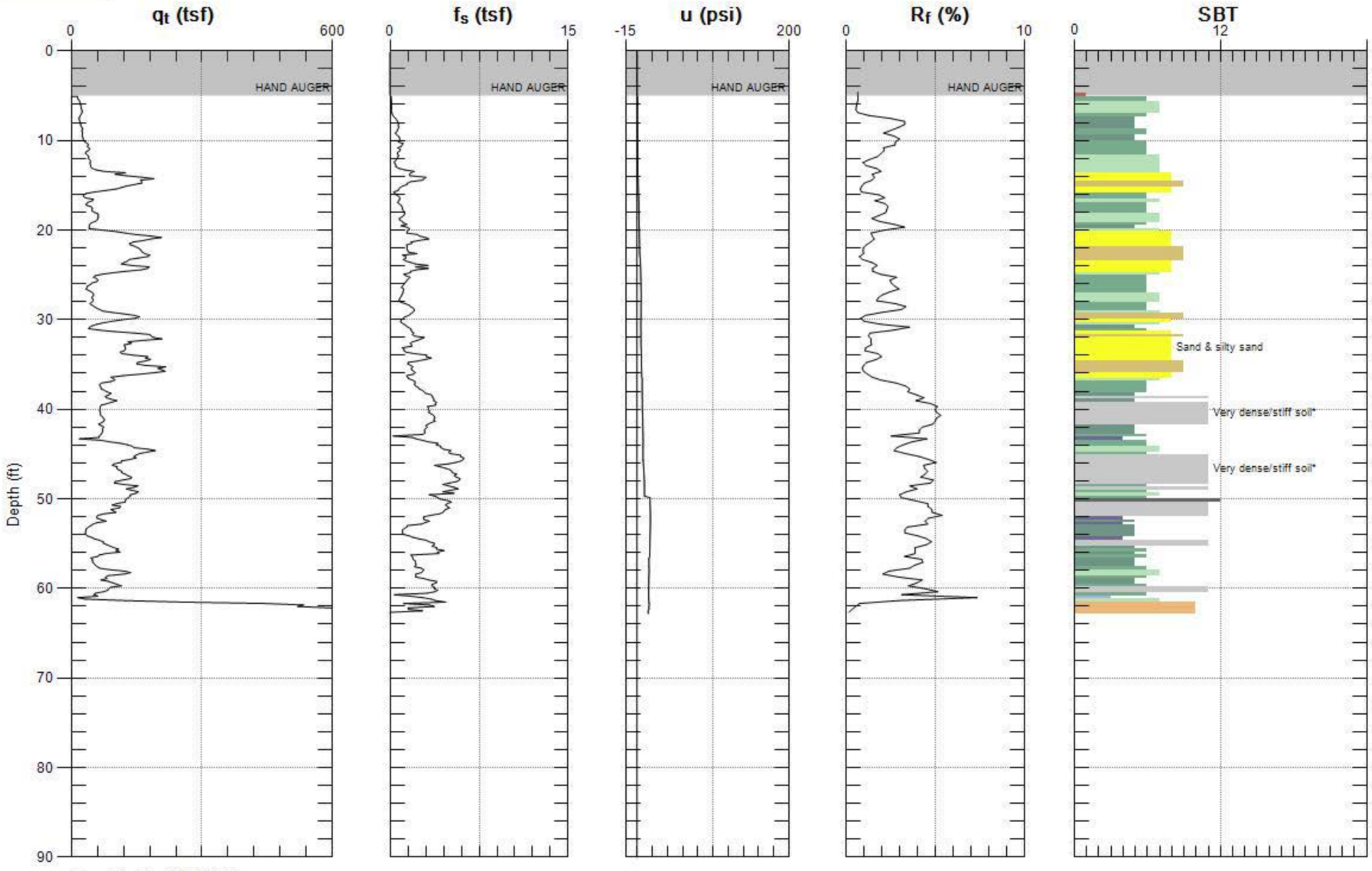
Max. Depth: 69.062 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-10

Engineer: T.OTIS
Date: 3/3/2015 12:36

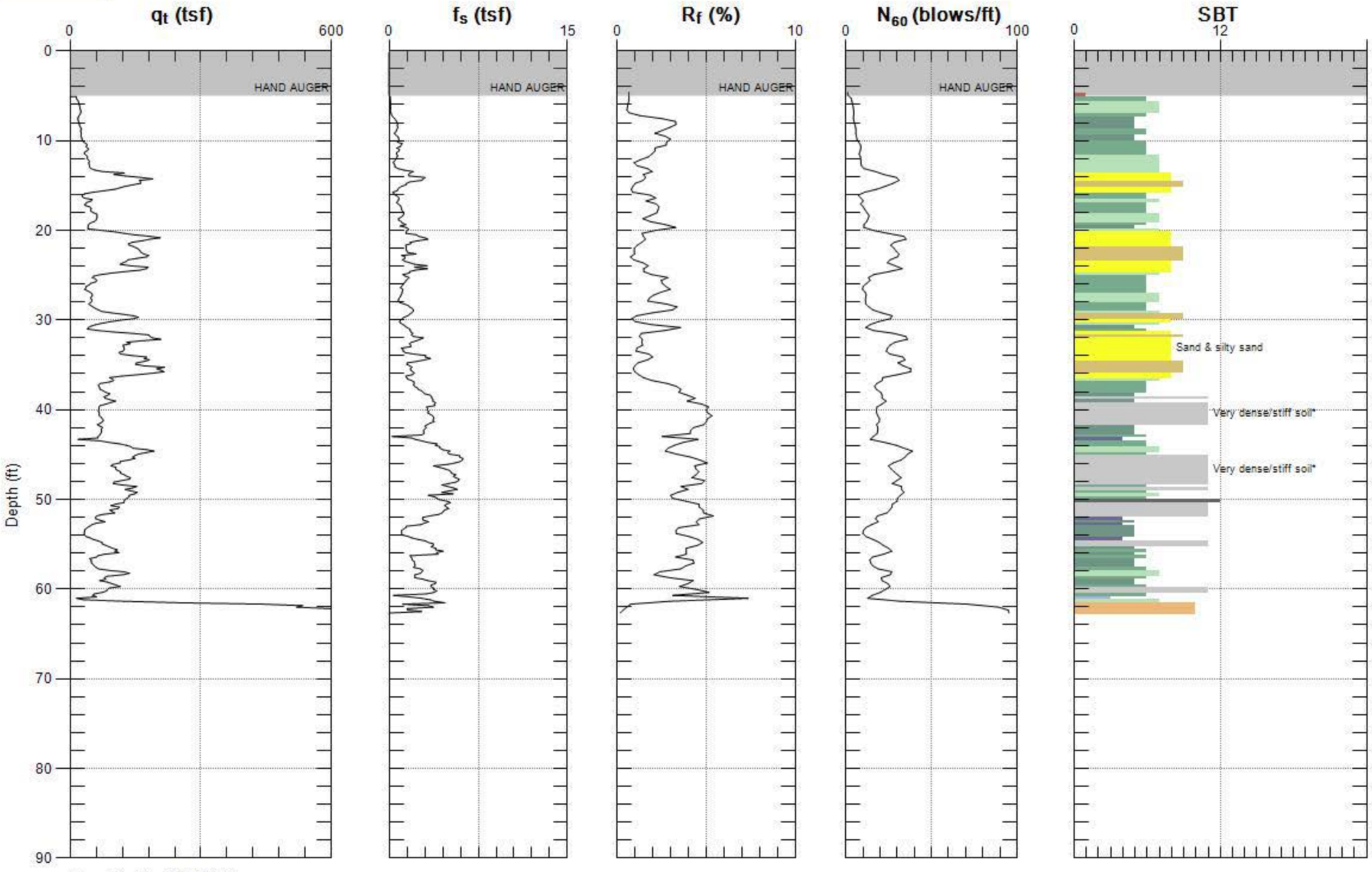


Max. Depth: 62.828 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-10
Engineer: T.OTIS
Date: 3/3/2015 12:36

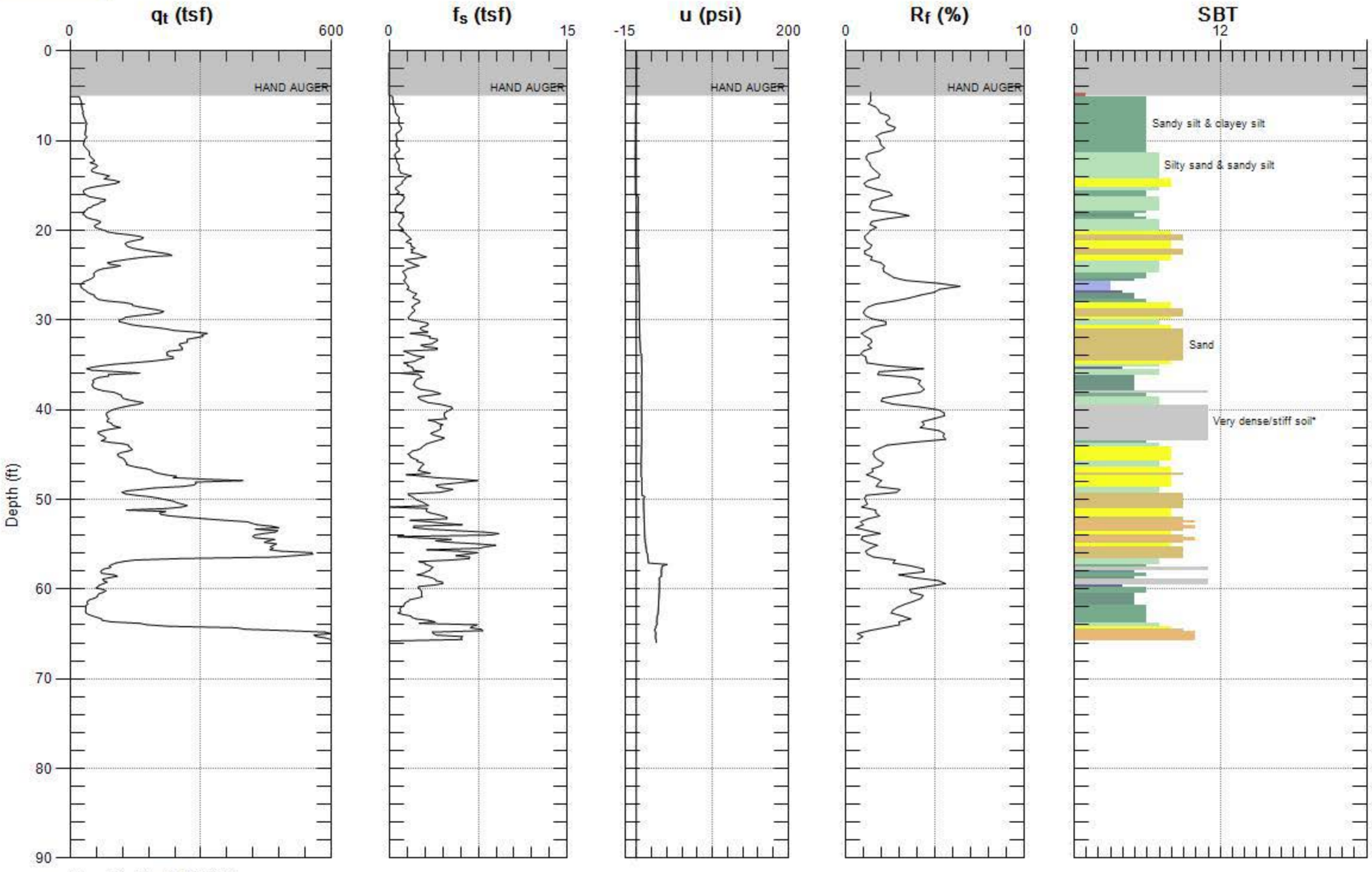


Max. Depth: 62.828 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-11
Engineer: T.OTIS
Date: 3/3/2015 01:08



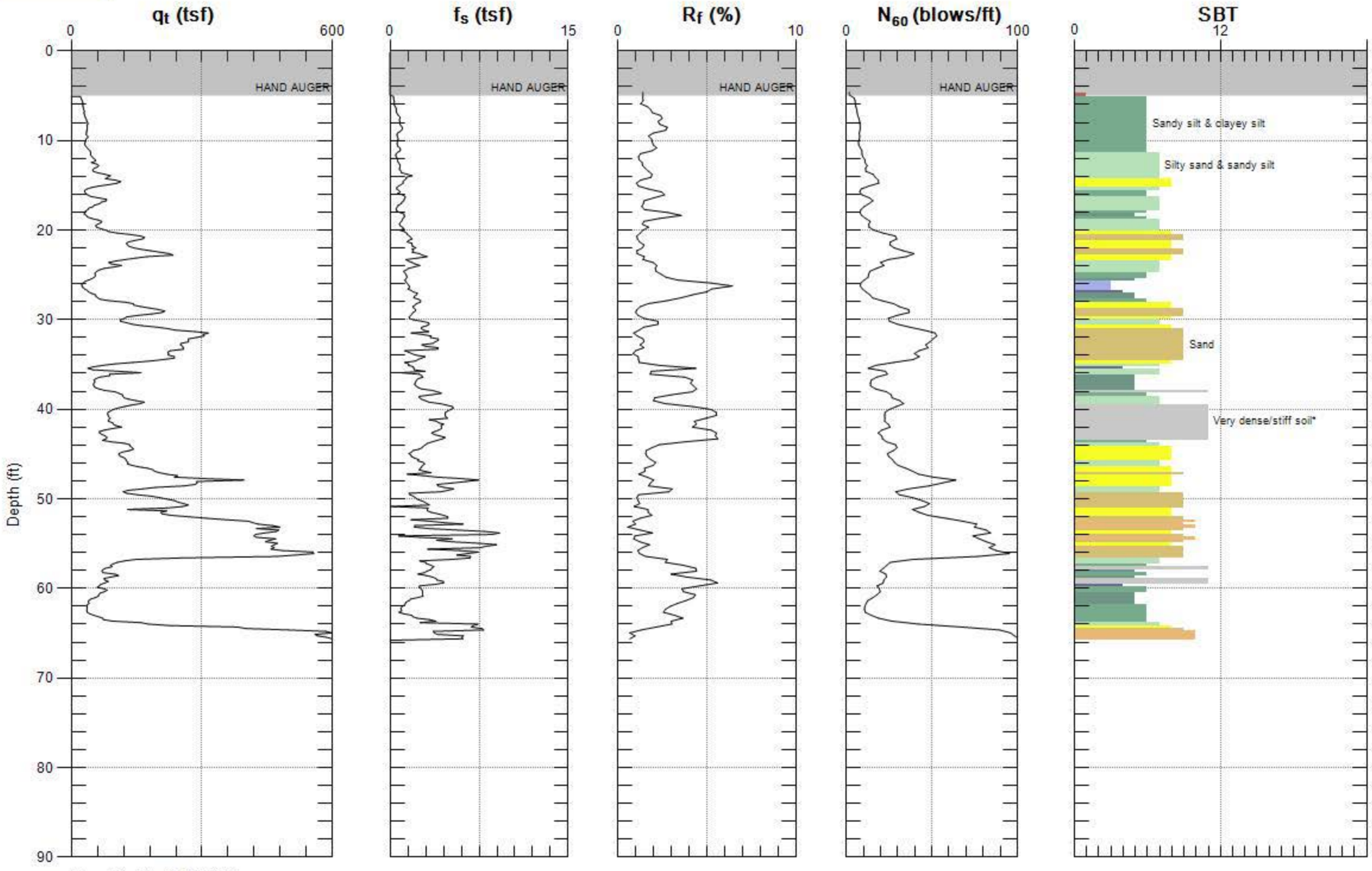
Max. Depth: 65.945 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-11

Engineer: T.OTIS
Date: 3/3/2015 01:08



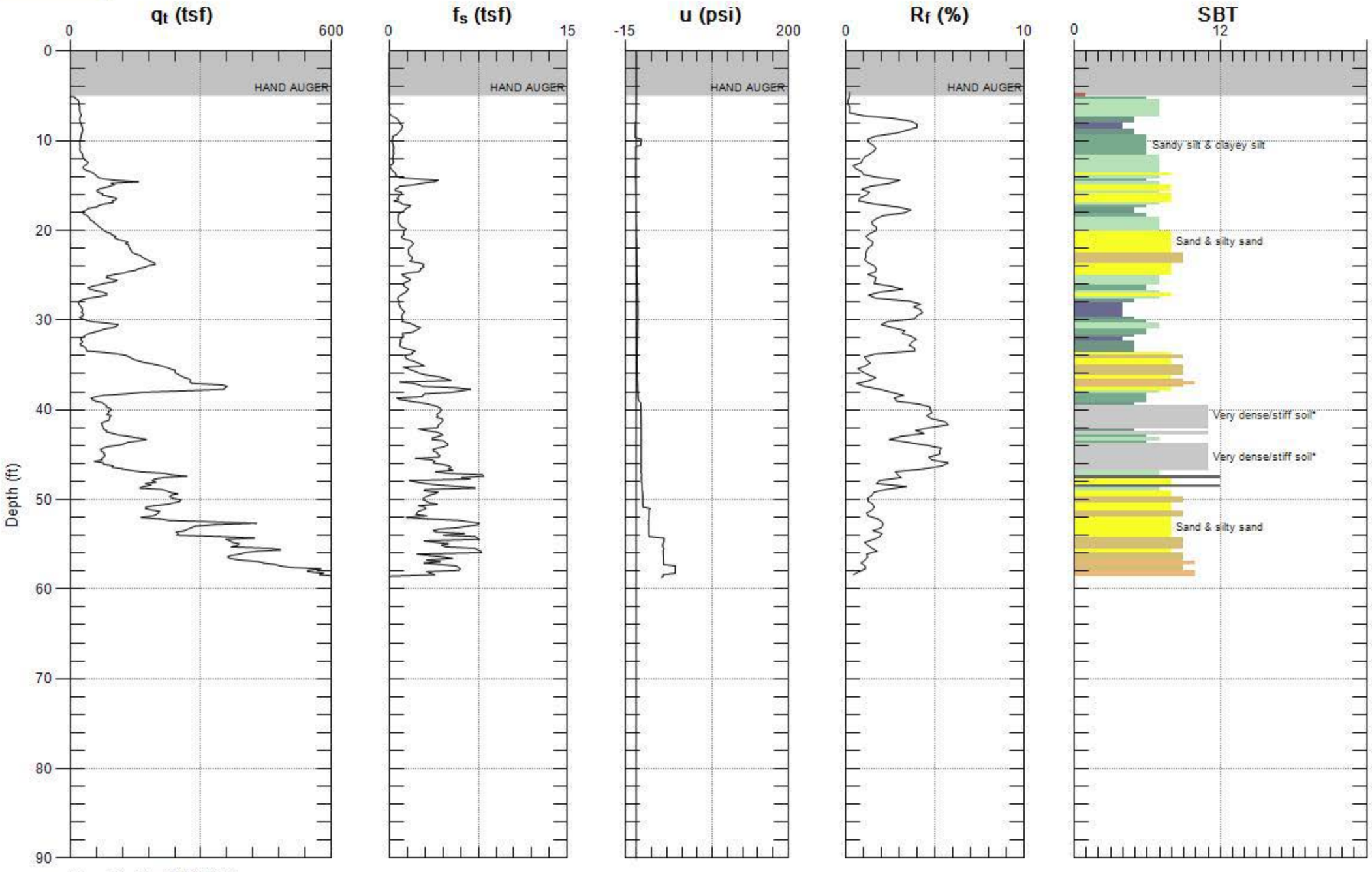
Max. Depth: 65.945 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-12

Engineer: T.OTIS
Date: 3/3/2015 01:44



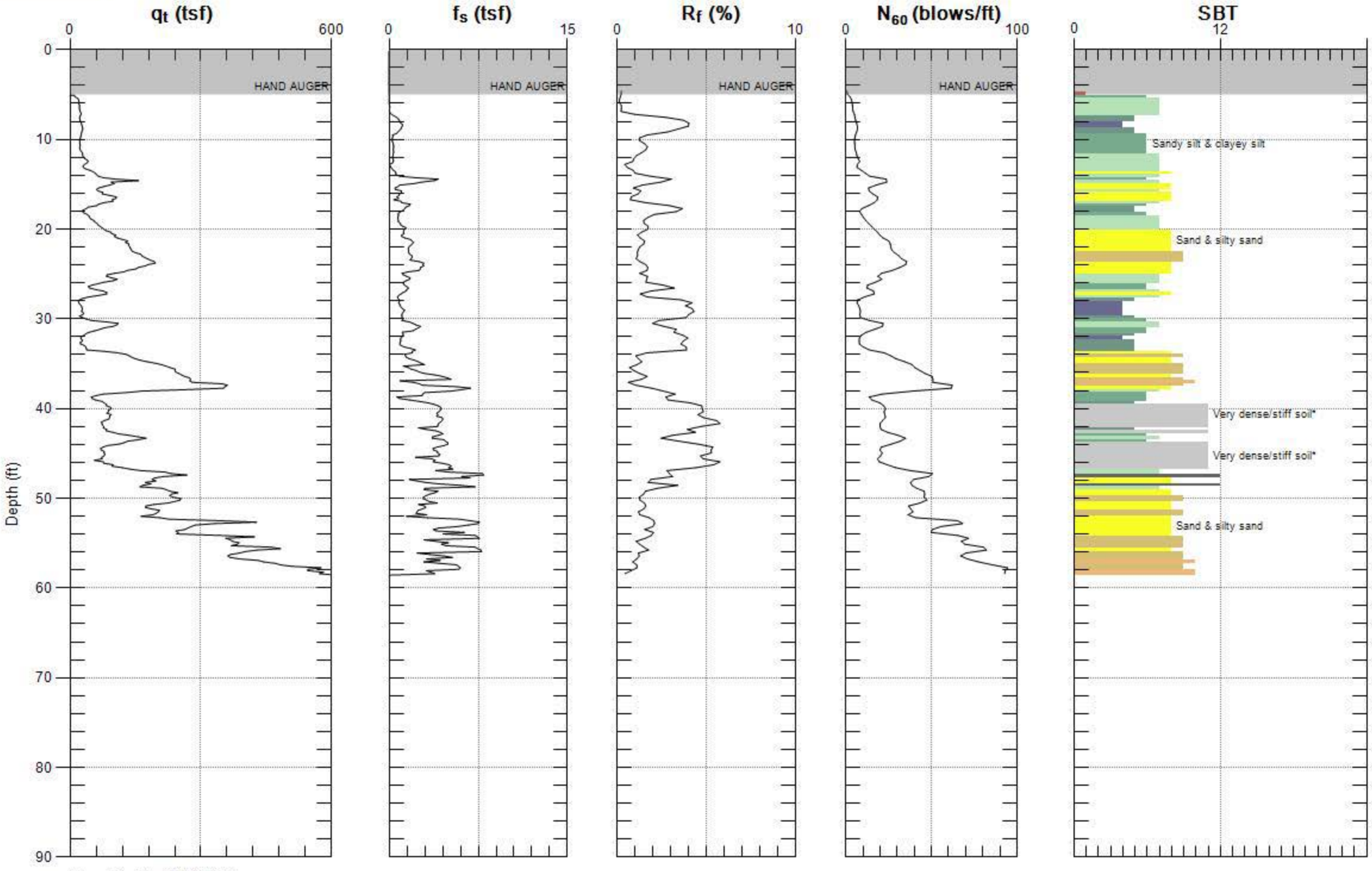
Max. Depth: 58.727 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-12

Engineer: T.OTIS
Date: 3/3/2015 01:44



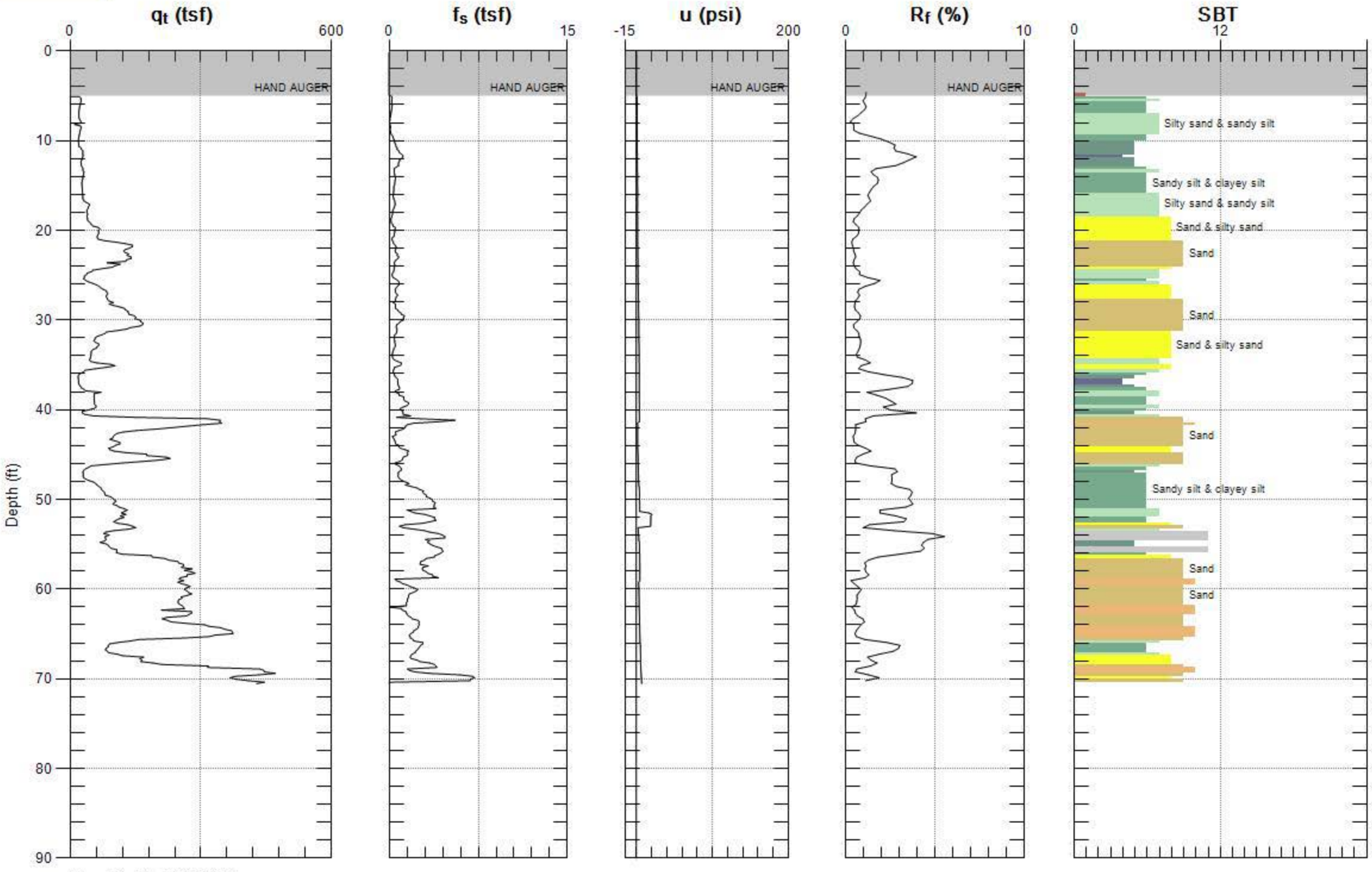
Max. Depth: 58.727 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-13

Engineer: T.OTIS
Date: 3/3/2015 03:01

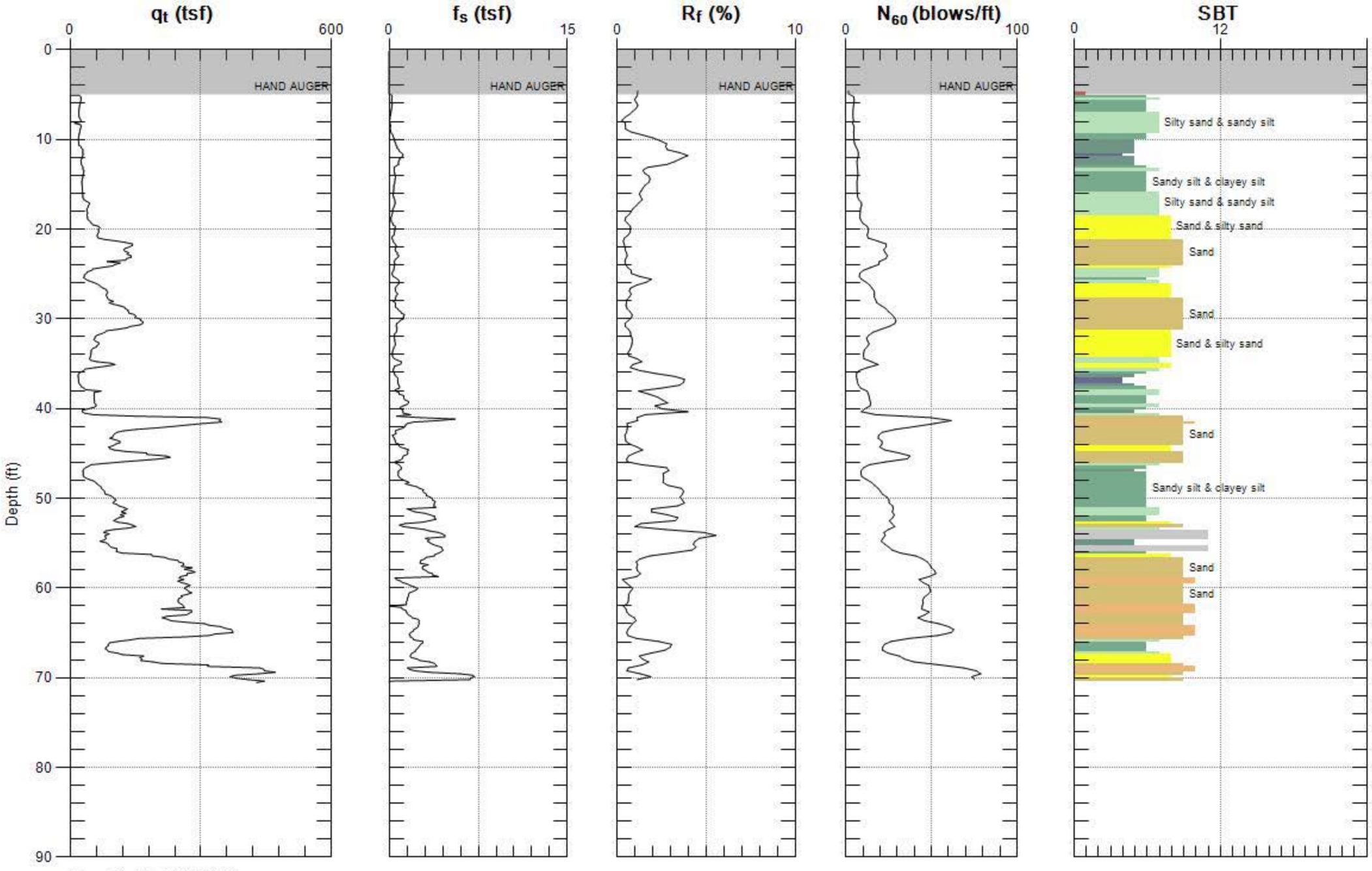


Max. Depth: 70.538 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-13
Engineer: T.OTIS
Date: 3/3/2015 03:01



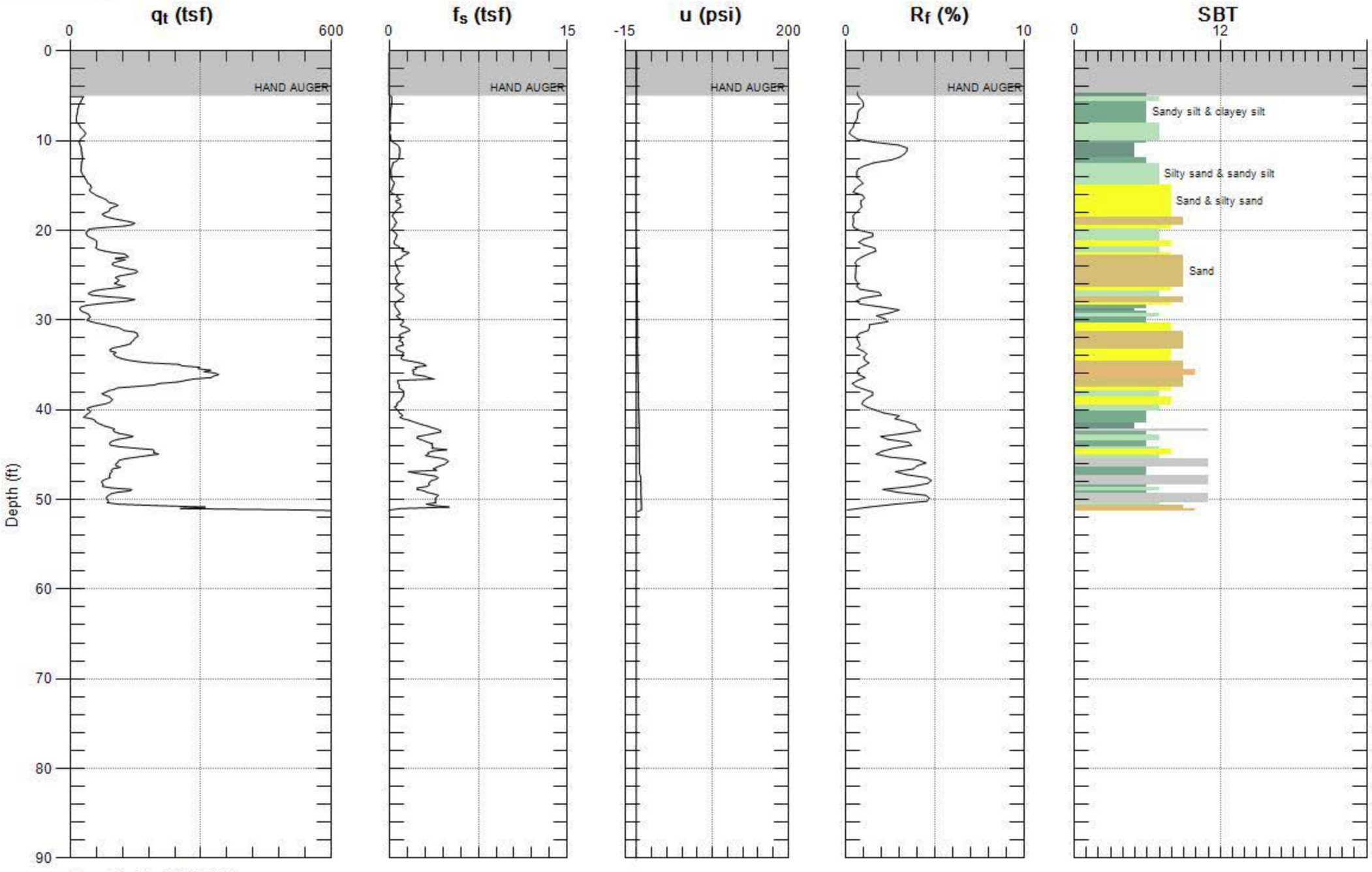
Max. Depth: 70.538 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-14

Engineer: T.OTIS
Date: 3/3/2015 03:32



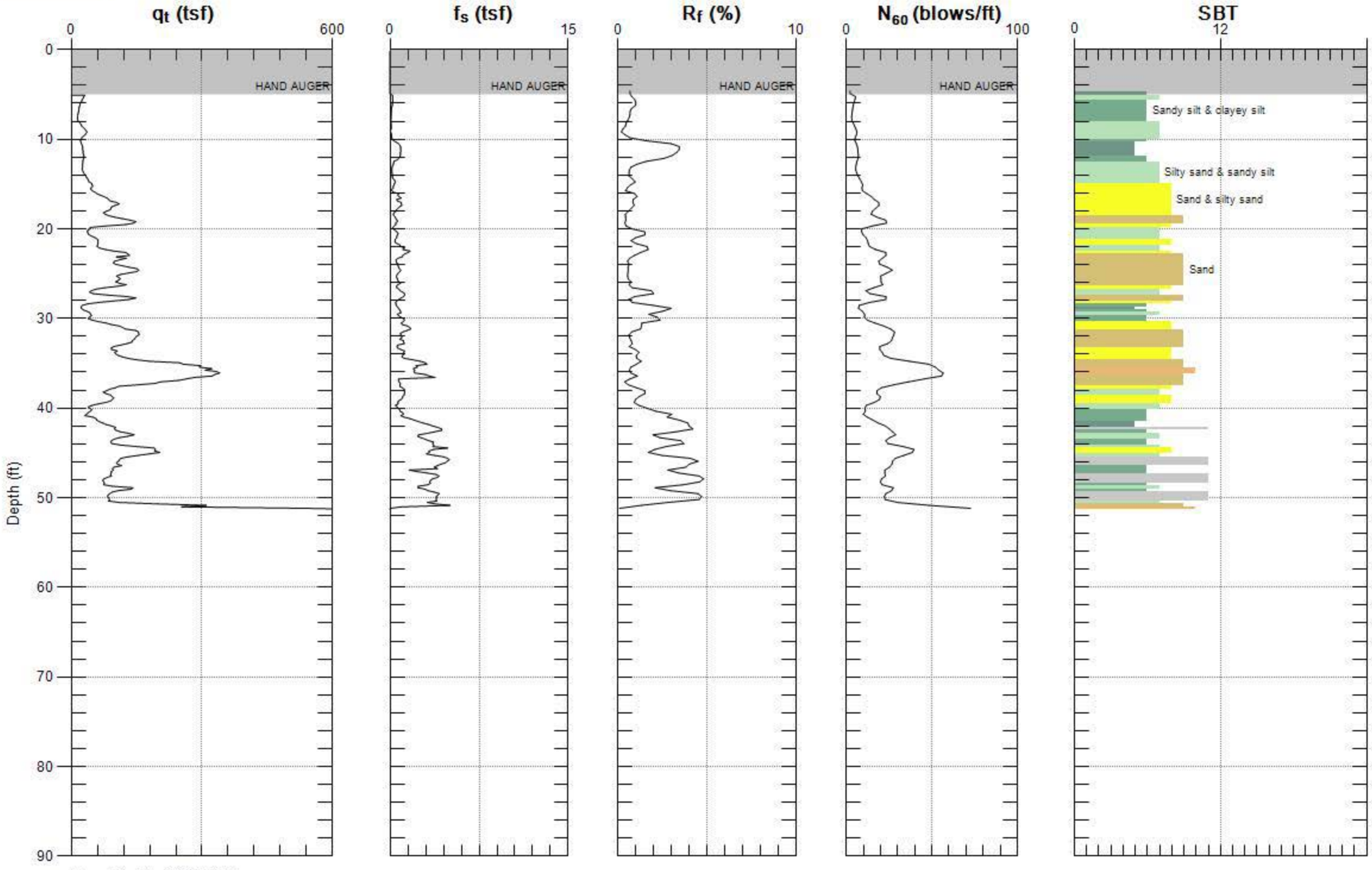
Max. Depth: 51.345 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GROUP DELTA

Site: CARLOS AVE.
Sounding: CPT-14

Engineer: T.OTIS
Date: 3/3/2015 03:32



Max. Depth: 51.345 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX B: SOIL STRATIGRAPHIC AGE ASSESSMENTS

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Quaternary Geology
Economic Geomorphology
Soil Stratigraphy
Geoarchaeology
PG 2867; CPG 1766; CPESC 2167

APPENDIX B

SOIL-STRATIGRAPHIC ASSESSMENT OF SEDIMENT AGE, GROUP DELTA CONSULTANTS CORES B-1 AND B-3, 6044 CARLOS AVENUE, HOLLYWOOD AREA, CITY OF LOS ANGELES, CALIFORNIA

INTRODUCTION

This Appendix summarizes soil-stratigraphic field measurements and descriptions for dating sediments and soils (pedologic profiles) exposed in two ~50-ft, continuous cores recovered by Group Delta Consultants (GDC) from borings at 6044 Carlos Avenue in the Hollywood area of the City of Los Angeles, California. Of the several ~70-ft-long GDC cores, two (B-1 and B-3) were specifically selected for analysis based on their location immediately north and south, respectively, of an apparent "subsurface anomaly" depicted on a N-S, cone penetrometer test (CPT) cross section (GDC Plate 1, cross-section A-A`). Pertinent location and geologic maps, and CPT and continuous core data are given in the GDC narrative and hence are referred to, but not replicated in this document.

This investigation was commissioned by GDC and particularly focused on cores B-1 and B-3 as available for analysis in the GDC laboratory. Preliminary geomorphic and likely subsurface geological settings are based on interpretation of site-specific aerial photographs and topographic maps, and on recently completed GDC geologic and geotechnical investigations in the immediate area now submitted to the City of Los Angeles, Department of Building and Safety.

Assistance was kindly provided by Steven Kolthoff, Consulting Senior Engineering Geologist.

The cores were examined and described on 3 April 2015 using traditional pedological (soil science) terminology and field methodology described in Soil Survey Division Staff (1993), in Soil Survey Staff (1999) and in Schaetzl and Anderson (2005). The applicability of soil-

stratigraphy for assessing fault-age (time of last displacement), particularly related to construction of residential and commercial properties, dams, landfills and other large engineered structures, is summarized in Shlemon (1985). Numeric dating and "calibration" with relative soil profile development is reviewed in Birkeland (1999), McFadden (1989), and Eppes and others (2002).

The presence of multiple buried paleosols, as identified in the cores, indicates that, as elsewhere in California, the Carlos Avenue area was subject to periodic regional sedimentation, ostensibly under "pluvial" climatic and vegetation environments, separated by epochs of relative landscape stability that gave rise to weathering and resulting soil formation.

Relative profile development of the several buried paleosols encountered in the B-1 and B-3 cores is based mainly on color changes (Munsell notation) and on presence, thickness and continuity of translocated clay films. In brief, as employed in this document, soils, whether surface or buried, are "undeveloped" if there is no discernible presence of either a cambic (Bw) or an argillic (Bt) horizon. Slightly developed profiles are typified by a cambic or an incipient argillic horizon, the later often informally designated "Btj." A moderately developed soil is readily identified by translocated clay films that line ped faces, bridge mineral grains and often line root pores. The clay films are commonly reddish-brown in color (Munsell 7.5YR). Strongly to very strongly developed soils typically have a 20 to 40 percent increase in translocated subsurface clay compared with that in the parent material. In chronosequences, subsurface colors are increasingly more red (rubification) than the parent material. Additionally, the subsoil thickness increases with relative development. Whether increasing relative profile development results stems solely from the time of surface exposure or from the influence of paleo-climates remains controversial. Nevertheless, relative profile development can be "calibrated" with radiocarbon, or locally with U-series and OSL dating methods, to extrapolate soil and sediment ages over wide areas. Accordingly, the Carlos Avenue soil ages are given in ranges and, where feasible, associated with the marine isotope stage chronology (Chappell and Shackleton, 1986; Martinson and others, 1987).

Almost all the core-identified buried paleosols are typified by truncated (eroded) argillic horizons, in some cases up to several inches thick. Locally, however, post-pedogenic erosion has entirely removed any remnant soil. Inherently, therefore, relative profile development provides only a minimum age for the underlying sediments (parent material).

In general, the Carlos Avenue soil parent materials are mixed-lithology, grossly fining-upward fluvial sediments, interspersed with locally derived mudflows grading downslope into debris flows. The remnant buried paleosols are typically internally stratified, and formed on various parent material grain sizes and lithologies. It is therefore unrealistic to compare the percentage of remnant illuvial clay with that in an assumed original parent material for quantifying soil age using a typical "soil development index" (Harden, 1982). Hence, soil (weathering) ages are estimated using "numeric calibration" applied in similar Mediterranean climates (McFadden, 1989; Eppes and others, 2002).

GEOMORPHIC SETTING

As shown on regional aerial photographs and topographic maps (GDC Plate 1; Figs. 3 and 5), the 6044 Carlos Avenue site lies on the now-buried, southeastern flank of a likely "high-level" alluvial fan. To the south, the site is covered by an increasing thickness of younger sediments primarily laid down by the "Beechwood fan" (GDC Fig 5). In contrast, recent GDC investigations in the nearby Argyle Avenue and Yucca Street areas (GDC Fig. 1) encountered up to ~30-ft of (Holocene) alluvial sediments, age assessments initially deduced from the lack of either surface or internal moderately or strongly developed buried paleosols, and later verified by several radiocarbon dates. In contrast, surface and near-surface soils capping the Carlos Avenue site are moderately developed, typified by up to ~3-ft thick cumulic argillic horizons. This unusually high subsoil thickness implies that the immediate site area was likely on an alluvial fan toe-slope and thus received periodic increments of sedimentation that did not bury the profiles, but rather slowly resulted in their accumulation (cumulic). Further, the former topography was also likely at least a few feet higher than any active drainage, and hence did not receive appreciable sedimentation for at least the last ~20 ka. A detailed description and age assessment of the Carlos Avenue pedogenic profiles and the likely depositional environment of their underlying parent materials (sediments) are provided in Tables 1 and 2, and discussed in the following section.

SOIL-STRATIGRAPHY, CORE B-1

As shown on GDC Plates 1 and 2, continuous core B-1 was obtained north of an inferred "subsurface anomaly" between cone penetrometer tests CPT-4 and CPT-5. The local surface elevations and site-condition information are provided in the GDC narrative and hence not replicated here. In brief, however, the B-1 core exposed a surface asphalt cap underlain by about ~5 ft of mixed artificial fill

and remnants of the original organic horizon and locally derived rubble informally designated as horizon “Af2-A” (Table 1).

The 5-ft thick cumulic argillic horizon (Bt) is mainly a dark yellowish brown pebbly silty clay loam. The horizon is also typified by few dark yellowish brown (10YR 4/4) clay films that line ped faces, bridge mineral grains and fill fine root pores. Given the ~5-ft thickness and moderate relative development, this subsoil is certainly pre-Holocene in age. Compared with similar, well drained profiles in Mediterranean climates, the soil represents at least ~20 ka of weathering. By comparison with the marine isotope chronology, this weathering epoch may well have initiated during stage 3, ~30-35 ka ago (Chappell and Shackleton, 1986; Martinson and others, 1987). Accordingly, the underlying parent material (C horizon), local mud- and debris-flows to a depth of ~12.5-ft, unconformably overlies light yellowish brown pebbly coarse sand that was apparently laid down during a previous epoch of relative landscape instability (pluviality?). From a stratigraphic standpoint, this inferentially took place during isotope stage 4, ~50-60 ka ago.

An underlying, ~10-ft sequence of sand clay and pebbly coarse sand (horizons 3Bb through 3C2b), is capped by a slightly to moderately developed buried paleosol (3Bb). This argillic horizon is identified by its few very fine brown to dark brown (10YR 4/3) clay films that bridge mineral grains and fill root pores. It is less developed that the overlying near-surface Bt horizon at 5.5-11.7 ft. And it is obviously truncated. Nevertheless, the 3Bb (17.5-19.3 ft), still indicates a ~15-20-ka epoch of local landscape stability. When this weathering epoch occurred is unknown but, based on stratigraphic position, likely took place during a preceding stage of relative landscape stability, inferentially during isotope substage 5a, ~80 ka ago.

Several discrete alluvial units occur between ~27.5 and 38.0 ft (Table 1; horizons 4C1b, 4C2b, 5C1b, 5C2b, 5C3b). The sediments are mainly loamy coarse sand to sandy clay loams replete with basal unconformities (abrupt wavy to irregular broken lower boundaries). Accordingly, one or more cambic or incipient argillic horizons may have capped these units, but were eroded during deposition of overlying units. A relative age for these deposits is deduced from stratigraphic position as likely at least ~90 to ~110 ka (substages 5b through 5d).

Slightly to moderately developed argillic horizons (6Bb and 8Bt1b-8Bt2b) occur at ~38.0 and 41.1-ft, respectively (Table 1). These remnant buried paleosols – at a minimum – represent about 20 ka and ~30-35 ka of weathering, ostensibly occurring during or before substage 5e (~120 ka). The parent material, to the

base of the Core B-1 measured section (44.0 ft), is inherently older. It was laid down during previous epochs of relative landscape instability, inferentially at least ~150 ka ago (isotope stage 6).

Given the presence of the near-surface, >~20 ka, moderately developed cumulic soil, the Core B-1, Pleistocene-Holocene boundary is less than about 10 to 12 ft deep. GDC independently identifies this boundary on a north-south, CPT section across the Carlos Avenue site (GDC Plate 2). This section also shows that neither faults nor possible dipping beds (buried anticlinal structures) extend to above ~50-ft from the modern surface. Thus, any subsurface deformation here occurred well before Holocene time.

SOIL-STRATIGRAPHY, CORE B-3

Core B-3 was measured and described to a depth of ~50-ft (Table 2). GDC collected the core in the north part of the Carlos Avenue site, about 30-ft south of B-1 (GDC Plate 1).

As documented on Table 2, the upper ~five ft of B-3 is similar to B-1, a thin asphalt cap and an artificial fill (horizon Af2-A1). This is underlain by ~2.0 ft of a remnant organic horizon (A2). Below, to ~10.5 ft, is a moderately developed, ~3.5-ft thick (cumulic) argillic horizon (Bt). This horizon is akin to that at comparable depth in Core B-1; namely, a silty clay loam with few fine dark brown (7.5YR 4/3) clay films that line ped faces and bridge mineral grains. It grades downward to increasingly coarse-grained sediments with pebbles up to ~0.3-in diameter. These unconformably overlie the 2C horizon (abrupt wavy boundary). The thickness and relative development of the near-surface argillic horizon (Bt) represents at least ~20 ka of weathering and relative landscape development. Ostensibly, this initiated during isotope stage 3, ~30-35 ka ago.

Horizon 2C (Table 2) is a ~2.0 ft thick, yellowish brown (10YR 5/4) pebbly sandy clay loam with common (~20 percent) angular clasts increasing near the base of a grossly fining-upward sequence. With its abrupt wavy lower boundary, it unconformably overlies and truncates the top of an underlying buried paleosol (horizon 2Bt1b).

At a depth of ~ 12.5 ft, Core B-3 encountered ~2.5-ft thick buried argillic horizons (2Bt1b and 2Bt2b), components of a moderately developed soil. Typified by few very fine strong brown (7.5YR 4/6) clay films that line bed faces and bridge mineral grains, the soil represents an estimated ~30-35 ka of relative landscape

stability and weathering. From stratigraphic position, this most likely took place during or before isotope substage 5a, about 80 ka ago.

Buried paleosol at ~16.5, 20.0 and 24.5 ft (3Bt1b, 4Btb and 5Btb) are each slightly to moderately developed. Each argillic horizon is truncated by overlying, fining-upward fluvial gravels. Accordingly, the buried soils were probably thicker than observed in the core. Nevertheless, for conservatism, each soil is interpreted to represent no more than ~20 to 30-35 ka of weathering, and thus – from stratigraphic position – ostensibly formed during substages 5c and 5e about 100 and 120 ka ago. It is indeed plausible, however, that the buried paleosols represent weathering during one or more previous epochs of relative landscape stability.

Several discrete fluvial deposits are recorded in the B-3 interval between ~25 and 40 ft. These stratified deposits (parent material horizons 6C1b through 7C3b; Table 2) are replete with basal unconformities and locally very loose, many (>50 percent) angular quartzitic clasts, portions of which were not recovered in the GDC core. From stratigraphic position, these sediments were laid down during epochs(s) of regional landscape instability, ostensibly isotope stage 6 (~150 ka) or before.

An approximately 9-ft thick, cumulic argillic horizon (8Bt-b, 8Bt2b, 8Bt3b) was identified at ~40.5 to 49.8 ft, the base of the measured section. Forming on multiple mud-and debris-flows, these argillic horizons identify another moderately developed buried paleosol. The age of this soil is unknown except that, from stratigraphic position, it must be at least ~200 ka old (stage 7).

DISCUSSION AND CONCLUSIONS

Two ~45-50-ft deep continuous cores (B-1 and B-3) at 6044 Carlos Avenue (Hollywood) exposed surface and underlying buried paleosols useful for dating late Quaternary sediments. The cores, in the north part of the site, are about 30-ft apart, representative of site, subsurface stratigraphy and “straddle” inferred subsurface anomaly. Of particular interest were core-recognizable buried paleosols (argillic horizons) that identify epochs of past landscape stability and soil formation.

The paleosols are mainly dated by relative soil-profile development, and where possible, “calibrated” by radiocarbon or other numeric dating techniques, and by association with the marine oxygen-isotope stage chronology.

GDC north-south CPT and continuous core cross sections identify several marker beds as well as subsurface anomalies. The origin of the anomalies is unknown, but they may reflect possible faults, deeply incised paleo-topography (buried relief) or the limb of buried structures, as GDC (2006) documented in trenches at nearby projects (e.g., Yucca Street and Argyle Avenue).

Prior to regional mass-grading, the Carlos Avenue site was apparently located on the southeastern flank of "old alluvial deposits," which were topographically higher than adjacent Holocene alluvial deposits of the GDC-designated "Beechwood" fan. The ~3-ft thick near-surface, moderately developed, cumulic soil, identified in both B-1 and B-3, demonstrates that a thin veneer of side-slope sediments was almost continuously deposited at the site. Relative soil development indicates that the near-surface soils reflect at least ~20 ka of weathering, the onset of which reasonably began ~30-35 ka ago (isotope stage 3). Accordingly, based on relative profile development, the Pleistocene-Holocene boundary, in both cores, occurs within ~10-12 ft from the surface.

Both cores also display comparable sequences of interbedded sediments and moderately developed buried paleosols to a depth of ~30 ft. These sediments identify alternating epochs of relative landscape instability (deposition) and stability (soil formation) for at least the past ~100 ka. Below this depth, however, there is no obvious correlation of sediments or soils between the two cores. Based on CPT signatures, however, GDC does correlate deeper sediments. Nevertheless, the generally matching B-1 and B-3 soil stratigraphy shows no breaks (faults, incised topography) in this area since at least the last ~100 ka.

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Table 1

Soil-Stratigraphic Measurement and Description, Core B-1, 6044 Carlos Avenue, Hollywood Area, City of Los Angeles, California

Depth (ft)	Horizon	Description
0.0 – 0.3	Af1	Asphalt cap
0.3 – 5.5	Af2-A	Artificial Fill: Mixed original organic horizon, gravel and locally derived rubble fragments; poorly compacted.
5.5 – 11.7	Bt	Dark yellowish brown (10YR 4/4) to brown to dark brown (10YR 3/3) when moist pebbly silty clay loam; moderate to strong fine to medium platy structure to weak structure grading to fine to medium subangular structure near base; very hard to extremely hard, very firm, slightly sticky and plastic; common pebbles and subrounded clasts to 0.2-in dia., few very fine dark yellowish brown (10YR 4/4) clay films lining ped faces, bridging mineral grains (cumulic argillic horizon) and filling common to many fine pores and root traces; mixed mudflow and debris-flow deposits; abrupt wavy to locally broken boundary.
11.7 -12.5	C	Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) when moist coarse sandy loam; moderate medium angular blocky structure; very hard, very firm to friable structure; non-sticky and slightly plastic; common to many very angular granitic clasts to ~3-in dia. at base; local mud and debris flow deposits; abrupt wavy boundary (unconformity).
12.5 – 14.0	2C1b	Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) when moist pebbly very coarse sand; single grained; loose, very friable, non-sticky and non-plastic; gradual wavy boundary.
14.0 – 17.5	2C2b	Light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4) when moist sandy clay loam; weak to moderate fine subangular blocky structure; hard, loose to friable, non-sticky and slightly plastic; few subangular clasts to 0.5-in. dia., at ~14.4 ft., increasing clasts near base of horizon; base of fining upward section; abrupt wavy boundary (unconformity).
17.5 – 19.3	3Bb	**Buried Paleosol**: Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) when moist sandy clay loam; moderate fine platy to weak to moderate fine subangular blocky structure; very hard, very firm, slightly sticky and plastic; few very fine brown to dark brown (10YR 4/3) bridging mineral grains and filling root pores; sand lenses to 2-in thick throughout horizon, stratified; mixed mud-and debris-flows; gradual wavy boundary.

Table 1 (continued)

Depth (ft)	Horizon	Description
19.3 – 26.5	3C1b	Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) when moist pebbly loamy sand; single grained to weak fine subangular blocky structure; loose to slightly hard, friable, non-sticky and non-plastic; few to common gravel lenses to 1-in. thick through horizon; metamorphic and granitic subangular clasts to 0.5-in. dia., abrupt wavy boundary.
26.5 – 27.5	3C2b	Light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4) when moist coarse sandy loam; massive to weak medium subangular blocky structure; very hard, firm, non-sticky and slightly plastic; few to common subrounded clasts to 0.2-in. dia., increasing near base; abrupt wavy boundary (unconformity).
27.5 – 29.3	4C1b	Yellowish brown (10YR 5/4) to brown to dark brown (10YR 4/3) when moist silty clay loam moderate medium platy structure; hard, firm, slightly sticky and slightly plastic; gradual wavy boundary.
29.3 – 31.8	4C2b	Light yellowish brown (10YR 6/4) to yellowish brown (10YR 4/4) when moist loamy coarse sand; single-grained to weak fine subangular blocky structure; slightly hard, friable, non-sticky and non-plastic; few to common subangular clasts to 0.3-in., dia., abrupt wavy boundary (unconformity).
31.8 – 32.5	5C1b	Brown (10YR 5/3) to yellowish brown (10YR 5/4) when moist sandy clay loam; moderate fine subangular blocky structure; hard, firm, non-sticky and slightly sticky; gradual wavy boundary.
32.5 – 35.5	5C2b	Light yellowish brown (10YR 6/4) to brown (10YR 5/3) when moist pebbly loamy coarse sand; moderate fine to moderate medium subangular blocky structure; hard, firm, non-sticky and slightly plastic; gradual wavy boundary.
35.5 – 38.0	5C3b	Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) when moist sandy clay loam; moderate to strong medium angular blocky structure; very hard, very firm, slightly sticky and plastic; gradual wavy to abrupt wavy boundary (unconformity).
38.0 – 39.9	6Bb	**Buried Paleosol:** Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) when moist medium sandy loam; single grained to weak medium subangular blocky structure; loose, very friable, non-sticky and slightly plastic; few very fine, yellowish brown (10YR 5/4) clay films lining ped faces and bridging mineral grains (argillic); few pebbly stringers to 0.2-in. thick near base; abrupt wavy to broken boundary (unconformity).

Table 1 (continued)

Depth (ft)	Horizon	Description
39.9 – 41.1	7Cb	Very pale brown (10YR 8/4) to brown to dark brown (10YR 4/3) when moist pebbly coarse sand; single grained; loose, very friable, non-sticky and non-plastic; common to many subrounded clasts to 0.3-in., dia. within "clean fluvial sand;" abrupt wavy boundary (unconformity).
41.1 – 42.5	8B1b	**Buried Paleosol:** Yellowish brown (10YR 5/4) to brown to dark brown (10YR 4/3) silty clay loam; massive to weak medium subangular blocky structure; very hard, very firm sticky and plastic; few subrounded angular clasts to 0.2-in. dia.; horizontal mixed mud-and debris-flow deposits; slightly to moderately bioturbated; common fine dark yellowish brown (10YR 4/4) filled root and worm holes; gradual wavy boundary.
42.5 – 44.0	8B2b	Brownish yellow (10YR 6/6) to brown to dark brown (10YR 4/3) when moist silty clay; moderate to strong medium subangular blocky structure; very hard, extremely firm, sticky and plastic; few very fine dark yellowish brown (10YR 4/4) clay films bridging mineral grains, increasing near base; common stratified subangular pebbles to 0.1-in. dia. throughout horizon; base of measured section.

Notes:

1. Section measured and described by RJS and SK, 3 April 2015 from cores collected by Group Delta Consultants..

2. The ~5-ft thick uppermost cumulic argillic horizon (B) is "slightly to moderately developed;" typified by few to locally common, dark reddish brown clay films lining ped faces, bridging mineral grains and filling root holes and pores. Horizon thickness and relative profile development suggest a minimum ~20 ka age for the soil with pedogenic onset starting ~30-325 ka ago (isotope stage 3). The parent material (pebbly sandy clay) is inherently older, ostensibly laid down during the previous regional "pluvial epoch" ~ 60 ka ago (marine isotope stage 4). At this locality, the Pleistocene – Holocene boundary occurs <~10-12 ft from the modern surface.

3. The remnant buried paleosol at 17.5 – 19.3 ft (3Bb) is a truncated "slightly developed" profile with field observable argillic horizon. The parent material is primarily locally derived mudflows and debris flows. Based on relative profile development and stratigraphic position, this paleosol ostensibly formed ~80 ka ago (isotope substage 5). Based on stratigraphic position, the underlying parent material was presumably laid down during the previous epoch of regional pluviality ~about 100-ka ago (substage 5b).

4. Slightly to moderately developed buried paleosols (argillic horizons) ostensibly capped horizons 4C1b and 5C1b; but these have been eroded by the immediately overlying, high-energy fluvial deposits that give rise to the base of grossly fining-upward fluvial sequences observed throughout the entire measured section.

5. The buried paleosols at 38.0 to 39.5 and 41.1 to 42.5-ft (horizons 6Bb and 8B1b, respectively) are slightly to moderately developed. They, too, are remnant profiles generally formed on mixed mud- and debris-flows and now truncated by truncated by erosion and subsequent deposition of capping high-energy fluvial sediments. Based on relative profile development, these soils each represent a minimum of ~15 to 20 k of weathering. From stratigraphic position, the soils formed during one or more substages of isotope stage 5 (~100-120 ka). The underlying parent material is therefore at least ~150 ka old (stage 6) though likely older.

6. Base of measured section at ~44.0 ft; well below the Pleistocene-Holocene boundary.

Table 2

Soil-Stratigraphic Measurement and Description, Core B-3, 6044 Carlos Avenue, Hollywood Area, City of Los Angeles, California

Depth (ft)	Horizon	Description
0.0 – 0.3	Af1	Asphalt cap
0.3 – 5.0	Af2-A1	Artificial Fill: Mixed original organic horizon; gravel and locally derived rubble fragments; uncompacted.
5.0 – 7.0	A2	Olive brown (2.5Y 4/3) to dark olive brown (2.5Y 3/3) when moist silty clay loam; weak medium subangular blocky structure; very hard, very firm, sticky and slightly plastic; decreasing organic matter near base; few subangular clasts to 1-in. dia., gradual wavy boundary.
7.0 – 10.5	B	Dark yellowish brown (10YR 4/4) to dark brown (10YR 3/3) when moist silty clay loam; moderate medium platy structure; very hard, very friable, sticky and very plastic; few fine dark brown (7.5YR 4/3) lining ped faces and bridging mineral grains (cumulic argillic horizon); few subangular clasts to 0.3-in. dia., increasing near base; abrupt wavy boundary; base of fining-upward section (unconformity).
10.5 – 12.5	2C	Yellowish brown (10YR 5/4) to brown to dark brown (10YR 4/3) when moist pebbly sandy clay loam; moderate fine to medium platy to weak fine subangular blocky structure; hard to very hard, very firm, sticky and plastic; common subangular clasts increase near base; abrupt wavy boundary (unconformity).
12.5 – 14.0	2Bt1b	**Buried Paleosol:** Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) pebbly sandy loamy clay; weak fine subangular blocky structure; slightly hard, firm, sticky and plastic; few very fine strong brown (7.5YR 4/6) clay films bridging mineral grains; decreasing near base; few to locally common subrounded to subangular clasts to 0.5-in. dia. near top of horizon; gradual smooth to gradual wavy boundary.
14.0 – 15.1	2Bt2b	Very pale brown (10YR 7/4) to dark yellowish brown (10YR 4/4) when moist coarse loamy sand; massive to weak medium subangular blocky structure; hard, very firm, slightly sticky plastic; few subangular clasts to 0.5-in. dia.; very few yellowish brown (10YR 5/6) clay films bridging mineral grains; few very fine roots holes near base; abrupt wavy boundary.
15.1 – 16.2	2Cb	Yellow (10YR 7/6) to yellowish brown (10YR 5/6) when moist pebbly loamy sandy clay; massive to weak fine subangular

Table 2 (continued)

Depth (ft)	Horizon	Description
		blocky structure; single grained, friable, non-sticky and non-plastic; few angular clasts to 0.2-in. dia., abrupt wavy to abrupt smooth boundary; base of fining-upward section (unconformity).
16.2 – 17.0	3Bt1b	**Buried Paleosol:** Yellowish brown (10YR 5/6) to brown (10YR 5/3) when moist sandy silty clay; moderate to strong medium platy structure; very hard, very firm, sticky and plastic; few to common fine yellowish brown (10YR 5/6) clay films lining ped faces, bridging mineral grains and filling root pores (argillic horizon); abrupt wavy boundary.
17.0 – 17.9	3Bt2tb	Yellowish brown (10YR 5/6) to yellowish brown (10YR 5/4) when moist loamy sand; fine to medium, subangular blocky structure; hard, very firm, slightly sticky; slightly plastic few very fine dark yellowish brown (10YR 4/6) bridging mineral grains few very fine pores; abrupt to clear wavy boundary.
17.9 – 18.7	3C1b	Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) when moist coarse sandy loam; weak fine platy to weak fine subangular blocky structure; soft, friable, non-sticky and non-plastic; common subangular clasts to 1.0-in. dia. near top; gradual wavy boundary.
18.7 – 20.5	4Btb	**Buried Paleosol:** Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) when moist pebbly loamy coarse sand; weak to moderate medium subangular blocky structure, hard to very hard, very firm, non-sticky and non-plastic; few very fine dark yellowish brown (10YR 4/4) clay films bridging mineral grains (incipient argillic horizon – “Btj”); common to many subangular clasts to 0.5-in. dia., slightly effervescent (land snail fragments (?); abrupt smooth boundary.
20.5 – 21.5	4C1b	Yellowish brown (10YR 5/6) to yellowish brown (10YR 5/4) when moist sandy clay loam; moderate fine to medium platy structure; weak fine subangular blocky structure; hard, firm to very firm; non-sticky and slightly plastic; gradual wavy boundary.
21.5 – 24.0	4C2b	Light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4) when moist loamy coarse sand; single grained; soft, very friable, non-sticky and non-plastic; few subangular to subrounded clasts to 0.5-in. dia., horizontal, lenticular “beds;” few ~1.0-in-thick interbedded clay throughout horizon; gradual smooth boundary.

Table 2 (continued)

Depth (ft)	Horizon	Description
24.0 – 25.0	5Btb	**Buried Paleosol:** Light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4) when moist pebbly loamy sand; 1f subangular blocky structure; hard to very hard, very firm, non-sticky and slightly plastic; few very fine dark yellowish brown (10YR 5/6) clay films bridging mineral grains and filling few very fine root pores (argillic horizon); abrupt wavy boundary (unconformity).
25.0 – 27.0	6C1b	Yellowish brown (10YR 5/6) to yellowish brown (10YR 5/4) when moist sandy clay loam moderate medium platy to moderate fine subangular blocky structure; extremely hard, very firm, sticky and plastic, common subangular clasts to 0.2-in. dia., few subrounded quartzitic clasts to 1.0-in. dia. throughout horizon, few grussified granitic clasts; mixed mudflow and debris-flow deposits; abrupt wavy boundary.
27.0 – 28.0	6C2b	Brownish yellow (10YR 6/6) to dark yellowish brown (10YR 4/4) when moist sandy clay loam; weak medium subangular blocky structure; slightly hard, friable non-sticky and slightly plastic; abrupt wavy boundary.
28.0 – 29.5	6C3b	Yellowish brown (10YR 5/6) to dark yellowish brown (10YR4/4) when moist sandy clay; weak to moderate medium subangular blocky structure; hard, firm, non-sticky and non-plastic; hard, firm, non-sticky and non-plastic; few gravel beds to 2-in. thick throughout horizon; gradual smooth to gradual wavy boundary.
29.5 – 31.0	6C4b	Brownish yellow (10YR 6/6) to yellowish brown (10YR 5/4) when moist sandy clay loam; moderate fine to medium subangular blocky structure; soft, friable, non-sticky and slightly plastic; clear wavy boundary.
31.0 – 34.5	6C5b	Light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4) when moist sandy clay loam; weak to moderate fine platy to moderate fine subangular blocky structure; hard, firm to very firm, slightly sticky and slightly plastic; few to common medium to coarse sands lenses to ~2-in. thick mid-horizon; abrupt wavy to abrupt irregular (broken) boundary (unconformity).
34.5 – 38.0	7C1b	[no color], pebbly very coarse sand; single grain; very friable, loose; non-sticky and non-plastic; common to many subrounded quartzite clasts to 1-in. dia., ~85 percent core loss (no recovery); abrupt wavy to abrupt irregular (broken) boundary (unconformity).
38.0 – 39.2	7C2b	Very pale brown (10YR 7/4) to dark yellowish brown (10YR 4/6) when moist coarse sandy loam; single grained to weak very fine

Table 2 (continued)

Depth (ft)	Horizon	Description
		subangular blocky structure; soft, very friable, non-sticky and non-plastic; common subrounded to subangular clasts to 0.4-in. dia., increasing near base; abrupt wavy boundary.
39.2 – 40.5	7C3b	Very pale brown (10YR 7/3) to light yellowish brown (10YR 6/4) pebbly coarse sand; massive to single grained; soft, very friable, non-sticky and non-plastic; few subrounded clasts to 0.5-in. dia. increasing near base; abrupt wavy boundary (unconformity).
40.5 – 47.5	8Bt1b	**Buried Paleosol:** Yellowish brown (10YR 5/4) to brown to dark brown (10YR 4/3) when moist silty clay loam; moderate to strong fine platy to weak fine subangular blocky structure; extremely hard, very firm to extremely firm, slightly sticky and slightly plastic; few very fine yellowish brown (10YR 5/4) clay films bridging mineral and filling common very fine root pores throughout horizon (cumulic argillic); very few subangular pebbles to 0.1-in. dia., multiple, superimposed mud flows; abrupt wavy boundary.
47.5 – 49.0	8Bt2b	Yellowish brown (10YR 5/4) to brown to dark brown (10YR 4/3) when moist loamy coarse sand; moderate to strong medium subangular blocky structure; extremely hard, extremely firm, non-sticky and slightly plastic; common very fine dark yellowish brown (10YR 4/4) clay films lining ped faces and bridging mineral grains (cumulic argillic); multiple, thin mudflows with subrounded clasts to 1.5-in. dia., gradual wavy to abrupt wavy boundary.
49.0 – 49.8	8Bt3b	Yellowish brown (10YR 5/6) to dark yellowish brown (10YR 4/4) when moist silty clay loam; strong fine to medium angular blocky structure; extremely hard, extremely firm, sticky and plastic; few thin dark yellowish brown (10YR 4/4) bridging mineral grains; few subangular clasts to 0.1-in. dia. throughout horizon; abrupt wavy boundary; base of measured section.

Notes:

1. Section measured and described by RJS and SK, 3 April 2015 from cores collected by Group Delta Consultants, Torrance, CA.

2. The ~3.5-ft thick uppermost cumulic argillic horizon (B) is “moderately developed;” typified by few fine dark brown (7.5YR 4/3) lining ped faces, bridging mineral grains and filling root pores. Horizon thickness and relative profile development suggest a minimum 20 ka age for the soil with pedogenic onset presumably ~30-35 ka (stage 3). The underlying parent material is

inherently older, inferentially laid down ~60 ka (stage 4). The Pleistocene-Holocene boundary occurs within ~10- to 12 ft from the modern surface.

3. A ~2.6-ft-thick buried paleosol at 12.5-14.0 ft (2Bt1b) is "slightly to moderately developed," characterized by few very fine strong brown (7.5YR 4/6) clay films bridging mineral grains. This soil represents another ~15-20 ka of weathering, which, from stratigraphic position, took place ~80 ka ago (isotope substage 5a).

4. Buried paleosols at ~16.5, 20.0 and 24.5 ft (3Bt1b, 4Btb and 5Btb) are each "slightly to moderately developed." These soils are truncated by overlying high-energy fluvial gravels, and hence were likely substantially thicker than observed in the cores. For conservatism, each soil represents a minimum of ~15 ka of weathering, which, based on stratigraphic position, may have occurred ~80, 100 and 120 ka ago (substages 5a, 5c and possibly 5e, respectively). The parent material for paleosol 5Btb may thus have been laid down during a preceding epoch of regional deposition; here, based on stratigraphic position, is assumed to be ~150 ka ago, during stage 6.

5. The paleosol (cumulic argillic horizons) at ~40.5 ft (horizons 8Bt1b through 8Bt3b) is "moderately developed" and is superimposed on multiple mudflow and debris flows. Based on its "deep" stratigraphic position, the soil may have formed at least ~200 ka ago, a time of relative landscape stability (stage 7).

6. The base of the measured section is 49.8 ft.