GEOTECHNICAL EXPLORATION AND GEOLOGIC HAZARD ASSESSMENT

SAN RAMON VALLEY CENTER

CONTRA COSTA COUNTY, CALIFORNIA

SUBMITTED

TO

CONTRA COSTA COUNTY COMMUNITY COLLEGE DISTRICT

MARTINEZ, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 2581.1.120.01

AUGUST 21, 2003

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Mr. Tom Beckett
Contra Costa County Community College District
500 Court Street
Martinez, CA 94553

Subject: San Ramon Valley Center
Contra Costa County, California

GEOTECHNICAL EXPLORATION AND GEOLOGIC HAZARD ASSESSMENT

Dear Mr. Beckett:

At your request and with your authorization, we conducted a geotechnical exploration and geologic hazard evaluation for the proposed San Ramon Valley Center Site, located within the Windemere project in Contra Costa County, California.

The accompanying report contains our exploration data, conclusions, and recommendations for construction on the subject area. Based on our study, it is our opinion that the proposed development is feasible from a geotechnical standpoint provided the recommendations included in this report are followed.

We are pleased to be of service to you on this project and look forward to consulting further with you and your design team.

Very truly yours,

ENGEO INCORPORATED

Stefanos A. Papadopulos

Josef J. Tootle, PE

REGISTERED PROFESSIONAL ENGINEER
JOSEF J. TOOTLE
No. 58282
Exp. 6-30-06
CIVIL
STATE OF CALIFORNIA

rc/jt/jd:gex

Reviewed by:

Phil Stuecheli, CEG

REGISTERED GEOLOGIST
PHILIP J. STUECHELI
No. 1640
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Shawn Munger

cc: 1 – Mr. Joseph R. Sutton, DASSE Design, Inc.

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INTRODUCTION

Purpose and Scope

The purpose of this geotechnical and geologic hazard report is to provide recommendations regarding grading, foundation design, and site drainage for construction of the proposed San Ramon Valley Center facilities within the Windemere project site. ENGEO Incorporated previously performed several geotechnical explorations and observed and tested the mass grading performed to date within the Windemere project site. Our conclusions and recommendations were presented in the reports titled "Geotechnical Exploration, Windemere, Contra Costa County, California" (1995), "Supplemental Geotechnical Exploration, Windemere Phase I, Contra Costa County, California" (2000), and "Testing and Observation Services, Windemere Phase 1, Subdivision 7976, Contra Costa County, California" (2003).

The scope of our work for this project included the following:

1. Review of previously published maps and reports regarding geological and geotechnical characteristics of the subject site.
2. Review of previously performed mass grading records for the subject site.
3. Exploratory drilling of 29 test borings and 14 cone penetration test soundings within and adjacent to the proposed building footprints, sampling, and laboratory testing of subsurface materials.
4. Analysis of geological and geotechnical data.
5. Preparation of this report summarizing our conclusions and geotechnical recommendations.

This report was prepared for the exclusive use of Contra Costa County Community College District and its design team consultants. In the event that any changes are made in the character, design, or layout of the development, the conclusions and recommendations contained in this report should be reviewed by ENGEO to determine whether modifications to the report are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO Incorporated.

Site Location and Description

The proposed San Ramon Valley Center site will be constructed within the Windemere development site. The Windemere property consists of roughly 2,300 acres located east of Dougherty Road and south of Camino Tassajara in unincorporated Contra Costa County (Figure 1). The Windemere property is generally characterized by open, rolling, grass-covered hills with scattered trees and a flat-lying flood plain terrace east of Alamo Creek.

According to the schematic site plans prepared by tBP Architecture, the proposed San Ramon Valley Center site will be located west of Bollinger Canyon Road and south of Watermill Road in the southwestern portion of the Windemere property (Figure 2). The subject area consists of a nearly level terrace created by placing engineered fill on the existing flood plane adjacent to the Main Branch of Alamo Creek. Current elevations range from a high of about 493 feet above mean sea level (msl) in the northeast portion of the site to a low of about 486 feet above (msl) in the northwest portion of the site.

Proposed Development

According to the preliminary Site Plan by tBP Architecture shown on Figure 2, the proposed facilities include eight one- to two-story buildings, associated ground-level parking, and open-space landscaping. The proposed structures include administration, laboratory, classroom, library, and community center buildings.

GEOLOGY AND SEISMICITY

Geology

The site geology was previously mapped on a regional scale by the California Division of Mines and Geology (CDMG), U.S. Geological Survey (USGS), and others (Figures 4, 5, and 6). In general, bedrock mapped at the Windemere site consists of late Miocene to Pliocene age (8.5 to 2.5 million years old) non-marine claystone and siltstone, interbedded with sandstone, pebble conglomerate, and volcanic tuff (Figures 4, 5 and 6). The geology of the Windemere Site was depicted in the ENGEO report of November 1995. In this report we have followed the nomenclature of Davenport (1986) and Dibblee (1980) and refer to the bedrock underlying the San Ramon Valley Center site as Tassajara Formation (Pta).

Faulting and Seismicity

Uplift and resulting deformation and erosion of the sedimentary rocks reportedly began sometime after 2.5 million years ago and resulted in the formation of numerous folds and inactive faults in the general site region (Isaacson, 1990). However, no active faults are known to pass through the proposed San Ramon Valley Center site (Wagner, 1978; Dibblee, 1980; Crane, 1995; Graymer, et al., 1996). The closest known active faults to the site are the Calaveras fault located about 2.4 miles (3.9 kilometers) to the southwest and Greenville fault located about 8.3 miles (13.3 kilometers to the northeast. These faults have estimated maximum moment magnitudes (Mw) of 6.8 and 6.9, respectively (CDMG, 1996). Many earthquakes of low magnitude occur every year throughout the region; most are concentrated along the San Andreas, Hayward, and Calaveras faults. The San Andreas and Hayward faults are located about 28.9 miles (47 kilometers) and 10.4 miles (16.1 kilometers) southwest of the property, respectively. These and other active faults within 100 kilometers of the site are presented in the following table

Fault Name	Approximate Distance (mi)	Approximate Distance (km)	Max. Earthquake Magnitude (M_w)	1997 UBC Designation
Calaveras	2.4	3.9	6.8	B
Greenville	8.3	13.3	6.9	B
Concord – Green Valley	10.0	16.1	6.9	B
Hayward	10.4	16.8	7.1	A
Great Valley	12.4	19.9	6.7	B
Monte Vista – Shannon	28.5	45.8	6.8	B
San Andreas	28.9	46.5	7.9	A
Rodgers Creek	32.9	53	7.0	A
West Napa	33.8	54.5	6.5	B
San Gregorio	35.6	57.3	7.3	A
Sargent	42.4	68.3	6.8	B
Zanyante – Vergeles	45.9	73.9	6.8	B
Ortigalita	47.7	76.7	6.9	B
Hunting Creek – Berryessa	51.0	82.1	6.9	B
Point Reyes	52	83.7	6.8	B
Monterey Bay – Tularcitos	58.5	94.2	7.1	B

The bedrock formations in the project area south of Mount Diablo and north of the Livermore Valley have been folded and cut by thrust faults that typically dip toward the north, according to recent geologic mapping by Crane (1995) and Graymer, et al., (1996). Inactive bedrock thrust faults are mapped by Crane (1995) across the Windemere site (Figure 6). These faults were produced by regional tectonic forces that have compressed bedding in the general site area into a series of northwesterly-trending folds and intervening minor folds. When rock is compressed in this manner, flexural slip shears (intraformational faults) develop along the bedding planes as well as across the beds to accommodate the compression. These shears or bedrock faults are considered nonseismogenic, or not capable of producing an earthquake.

Geologic studies by Unruh and Sawyer (1997) suggest that the core of Mount Diablo may be underlain at depth (several thousand feet) by an active "blind" thrust fault system (a "blind" thrust fault does not extend to the surface). According to Unruh and Sawyer (1997), movement on the blind thrust fault system has been responsible for the uplift of Mount Diablo and the folding of the

rocks in the site vicinity. Unruh and Sawyer believe that surface effects of the deeply buried blind thrust fault system have typically been relatively slow, diffuse, and distributed vertical movements associated with the growth of folds.

Figure 7 shows the approximate location of Quaternary faults and significant historic earthquakes mapped within the San Francisco Bay Region. According to Unruh and Sawyer (1997), the blind thrust fault system associated with Mount Diablo is thought to exist north of the site, at depths of approximately 3 to 4½ miles. There is no known historic seismicity that can be directly associated with the postulated blind thrust fault, but Unruh and Sawyer estimate a maximum moment magnitude (Mw) of 6.25 to 6.75. The location of a possible earthquake on a buried blind thrust cannot be easily predicted, but could presumably occur relatively close to the proposed project.

The regional seismicity of the Bay Area was recently evaluated by the Working Group on Northern California Earthquake Probabilities (WGEP 1999). The Working Group periodically attempts to summarize seismic risk in the Bay Area by presenting probabilities of 6.7Mw or greater earthquakes on active Bay Area faults for a 30-year return interval; the most recent summary gives a 70 percent aggregate probability for the entire Bay Area. The Working Group has assigned contributing probabilities to the above aggregate, of 4, 6, and 18 percent for the Mount Diablo Thrust, Greenville, and Calaveras faults, respectively.

GEOTECHNICAL EXPLORATION

Soil Borings

One hundred thirty-nine exploratory borings were drilled within the Windemere property prior to this geotechnical exploration. An additional 29 exploratory borings were drilled between December 2 and 23, 2002, and 14 exploratory cone penetration testing (CPT) soundings were performed on December 3, 2002, specifically for the exploration of the San Ramon Valley Center site. Boring and CPT locations are shown on Figure 2.

The 29 borings were drilled using a truck-mounted drill rig; 26 of the borings were drilled with continuous flight, 4-inch-diameter solid-stem augers, and 3 borings, (B-19, B-26, B-27) were drilled using a combination of continuous flight auger and rotary wash drilling methods. Soil samples recovered during drilling were collected with either of two types of split-spoon samplers. Cohesive soils and deeply weathered rocks were typically collected with a 3-inch O.D. California-type split-spoon sampler fitted with 6-inch-long brass liners. Cohesionless soils and dense less-weathered rock samples were typically collected with a 2-inch O.D. split-spoon sampler (without liners) also known as a Standard Penetration Test (SPT) sampler. The samplers were driven using a 140-pound hammer, dropped 30 inches, employing a rope and cathead system in Borings B-1 thru B-17 and automatic hammer in Borings B-18 thru B-29.

The penetration of the sampler into the native materials was field recorded as the number of blows needed to drive the sampler eighteen inches in 6-inch increments. The blow count results on the boring logs were recorded as the number of blows required for the last one foot of penetration. When driving refusal was encountered, penetration was recorded as the number of blows per measured distance of penetration.

The CPT rig has a 20-ton compression-type cone with a 15-square-centimeter (cm^2) base area, an apex angle of 60 degrees, and a friction sleeve with a surface area of 225 cm^2. The cone, connected with a series of rods, is pushed into the ground at a constant rate. Cone readings are taken at approximately 5-cm intervals with a penetration rate of 2 centimeters per second in accordance with ASTM D-3441. Measurements include the tip resistance to penetration of the cone (Q_c), the subsurface conditions resistance of the surface sleeve (F_s), and pore pressure (u) (Robertson and Campanella, 1989).

ENGEO Engineers/Geologists logged the borings in the field. The field boring logs were then used to develop the report boring logs (Figures A-1 through A-29, Appendix A). The CPT logs are provided in Appendix A. The boring and CPT locations were located by pacing from existing features; the locations should be considered accurate only to the degree implied by the method used.

The logs depict subsurface conditions within the borings and CPT soundings on the date of exploration; however, subsurface conditions may vary with time.

Laboratory Testing

Following drilling, samples were reexamined in the ENGEO laboratory to confirm field classifications. Representative driven samples were tested for the following physical characteristics:

Characteristic	Test Method	Location of Results Within this Report
Natural Unit Weight	ASTM D-2216	Appendix A
Natural Moisture Content	ASTM D-2216	Appendix A
Atterberg Limits	ASTM D-4318	Appendix B
Gradation	ASTM D-422-63	Appendix B
Unconfined Compressive Strength	ASTM D-2166	Appendix B
Sulfate testing	EPA 300.0M	Appendix B

Laboratory test results from samples recovered are included on the boring logs in Appendix A and on the laboratory figures in Appendix B as noted above.

Subsurface Soil Conditions

As previously discussed, rough grading of the site was completed prior to our exploration during the mass grading operations of the Windemere project. As presented in Appendix C, Table I includes laboratory compaction tests performed on typical fill materials placed during the grading operations of the site. Table II includes in-place density tests performed to determine the relative compaction and in-place moisture content of the compacted material.

The largest portion of the proposed San Ramon Valley Center site is located on engineered fill. The eastern portion of the proposed site is located in a cut area that was subexcavated approximately 5 to 6 feet and recompacted with engineered fill. The western portion of the proposed site is located in an area that has up to approximately 15 feet of fill.

The findings of our exploration indicate that the engineered fill ranges from silty and clayey sand to sandy and silty clay and has a thickness of approximately 5 to 15 feet. The fill material has a low to high plasticity and a low to high expansion potential with Plasticity Indexes ranging from 12 to 46. A layer of alluvium (Qal) up to 50 feet in thickness underlies the fill. The top 15 feet of the alluvium generally consists of very stiff to hard silty clay with high plasticity, and the rest of the alluvium consists of very stiff silty clays. Isolated lenses of medium dense silty sands were encountered in the southwestern corner of the site as indicated on Borings B-26 and B-19.

The bedrock underlying the alluvium consists mainly of interbedded friable silty sandstone, weak siltstone, and claystone. Based on interpretation of aerial photographs and mapping of nearby cutslope exposures along Bollinger Canyon Road, it appears that bedrock layers in the vicinity of

the San Ramon Valley Center site strike northwest and dip at inclinations of between near-vertical to approximately 35 to 40 degrees south.

Groundwater Conditions

Groundwater was encountered in Boring B-30 at a depth of approximately 30 feet during drilling. The presence of groundwater was masked in Borings B-19, B-26, and B-27 using rotary wash drilling method. It should be noted that the borings may not have been left open for a sufficient period of time to establish equilibrium groundwater conditions. In addition, fluctuations in groundwater elevations may occur due to factors such as weather conditions, time of year, and irrigation practices.

CONCLUSIONS

Based on our explorations and laboratory test results, we conclude that the proposed San Ramon Valley Center project is feasible from a geotechnical standpoint provided the recommendations included in this report, along with other sound engineering practices, are incorporated in the design and construction of the project. The primary geotechnical design considerations are earthquake-induced strong ground shaking and the on-site expansive soil and bedrock.

Seismic Hazards

Potential seismic hazards resulting from a nearby moderate to major earthquake may include primary ground rupture, ground shaking, liquefaction, dynamic densification, lateral spreading, inundation due to embankment failure, and earthquake-induced landsliding. These hazards are discussed below. Risks from seiches, tsunamis, and volcanic eruption are currently considered negligible at the San Ramon Valley Center site.

Ground Rupture. No known active faults have been mapped passing through the proposed school site; therefore, the potential for ground rupture is considered low.

Ground Shaking. An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site. The degree of shaking is dependent on the magnitude of the event, the distance to its zone of rupture, and local geologic conditions.

To evaluate the potential impacts to the project by earthquake-induced ground shaking, we performed a probabilistic seismic hazard analysis for San Ramon Valley Center site. In this analysis, a computer program (EZ-FRISK) was used to model the seismic setting of the region and is able to explicitly account for uncertainty relating to the following:

- Earthquake magnitude.
- Rupture length.
- Location of rupture.
- Maximum possible earthquake magnitude.
- Recurrence interval of earthquake events.

The program calculates, by summation from earthquake sources, the total average annual expected number of occurrences of acceleration greater than each of several specified values. Once the annual probability is obtained, the probability of the level of ground acceleration being exceeded over a specified time period is calculated. Using this method, a horizontal ground surface acceleration of 0.66g is predicted to have a 10 percent probability of being exceeded in a 100-year design life, and a horizontal ground surface acceleration of 0.52g is predicted to have a 10 percent probability of being exceeded in a 50-year design life. The probabilistic ground surface acceleration was derived using an attenuation relationship developed by Abrahamson and Silva (1997). Figure 8 shows the normalized spectral acceleration.

To mitigate the ground shaking effects, all structures should be designed using sound engineering judgment and the latest Uniform Building Code (UBC) requirements as a minimum, taking into consideration that the proposed San Ramon Valley buildings are considered special occupancy structures. In accordance with the 1997 UBC, the site is located within Seismic Zone 4, with a seismic zone factor Z of 0.4, as given in Figure 16-2 and Table 16-I in the UBC. Based on site conditions, the soil profile at the San Ramon Valley Center site can be classified as S_D, a stiff soil profile as defined in Table 16-J. According to Tables 16-S and 16-T, near source factors, N_a of 1.0 and N_v of 1.2, are based on the Calaveras fault being a seismic source type B, approximately 2.4 miles (3.9 km) away. The UBC parameters for the San Ramon Valley Center site are presented in the following table:

1997 UNIFORM BUILDING CODE - Chapter 16

ITEM	DESIGN VALUE	SOURCE
Seismic Zone	4	Figure 16-2
Seismic Zone Factor	0.40	Table 16-I
Soil Profile Type	S_D	Table 16-J
Seismic Source Type	B	Table 16-U
Near Source Factor, N_a	1.00	Table 16-S
Near Source Factor, N_v	1.20	Table 16-T
Seismic Coefficient, C_a	0.44	Table 16-Q
Seismic Coefficient, C_v	0.77	Table 16-R

Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The prescribed lateral forces are generally considered to be substantially smaller than the actual peak forces that would be associated with a major earthquake. Consequently, structures should be able to (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

Liquefaction. Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength because of pore pressure build-up under the reversing cyclic shear stresses associated with earthquakes.

As discussed previously, the site soils primarily consist of stiff to hard silty and sandy clay underlain by bedrock. At boring location B-19, lenses of medium-dense silty sand were encountered from approximately 55 to 65 feet below the ground surface. At boring location B-26, lenses of

medium-dense silty sands were found from approximately 45 to 50 feet and 60 to 65 feet below the ground surface. According to the criteria of liquefaction assessment after Seed (1985) and Marcuson (1990), the medium dense silty sand lenses can be considered non-liquefiable based on several characteristics including density, Liquid Limit, and percentage of fine-grained soils passing the number 200 Sieve and/or finer than 0.005 millimeters. Therefore, it is our opinion that the potential for liquefaction of the on-site soils can be considered low.

Earthquake-Induced Densification. Densification of loose to medium-dense sand above and below the groundwater level during earthquake shaking could cause settlement. As previously stated, loose to medium-dense sands were not encountered during the subsurface exploration above the groundwater table; therefore, densification induced by earthquake shaking is expected to be insignificant.

Lateral Spreading. Lateral spreading is a failure within a nearly horizontal soil zone (possibly due to liquefaction), which causes the overlying soil mass to move toward a free face or down a gentle slope. It is our opinion that lateral spreading at the site is unlikely since the site soils are not considered susceptible to liquefaction. In addition, a keyway was previously constructed between the site and the adjacent creek (ENGEO 2003). The keyway depth extended below the flow line of the creek and was backfilled with engineered fill compacted in accordance with the Windemere Phase I specifications (ENGEO 2000).

Earthquake-Induced Landsliding. No landslides have been mapped within or immediately adjacent to the site; therefore, the potential for earthquake-induced landsliding to occur is considered low.

Expansive Soils

A significant geotechnical concern is the expansive nature of the native soil and bedrock across the proposed project location. The clayey soil and bedrock in this region have a high plasticity and high expansion potential.

Expansive soils bedrock materials shrink and swell as a result of the seasonal fluctuation in moisture content. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Structural damage due to volume changes associated with expansive subgrade materials can be reduced through proper site grading and foundation design.

Corrosive Soils

Based on our previous experience on immediately adjacent sites, the corrosion potential of the site soils and bedrock materials is highly variable and significantly dependent on grading procedures. The impact of corrosive soils on proposed building foundations due to sulfate attack is dependent on the characteristics of the soils located within the building pads. To evaluate the corrosion potential of these soils we collected ten soil samples representative of the location areas of the proposed building foundations. The soil samples were submitted to Entech Analytical Labs, Inc., under a documented chain of custody for sulfate testing. The purpose of the testing was to determine the sulfate concentrations of soils on pads to determine appropriate cement and concrete design parameters for the subject lots in accordance with the requirement of the Uniform Building Code (1997).

The 1997 UBC (Table 19-A4) provides the following guidelines to mitigate sulfate attack on buried concrete structures.

Sulfate Exposure	Sulfate In Soil		Cement Type	Maximum Water-Cement Ratio	Minimum F'_c (Psi)
	mg/kg	(%)			
Negligible	0 – 1,000	0.00 – 0.10	---	---	---
Moderate	1,000 – 2,000	0.10 – 0.20	II, IP(MS), IS(MS)	0.50	4,000
Severe	2,000 – 20,000	0.20 – 2.00	V	0.45	4,500
Very Severe	Over 20,000	over 2.00	V plus pozzolan	0.45	4,500

According to the test results, eight samples yielded sulfate concentrations from 86 to 600 mg/kg and two samples yielded non-detectible concentrations. In accordance with the criteria presented in Table 19-A-4 of the 1997 Uniform Building Code (UBC), these soils are classified in the negligible sulfate exposure range. Cement type, water-cement ratio and concrete strength are not specified by the UCB for this range.

RECOMMENDATIONS

Grading

The mass grading of the San Ramon Valley Center site was part of the Windemere Phase I development and was performed between June 2000 and September 2001 (ENGEO 2003).

Subgrade Preparation

All areas to receive fill, slabs-on-grade, or pavements should be scarified to a depth of at least 8 inches, moisture conditioned, and compacted to the requirements for engineered fill presented in the "Placement of Fill" section of this report. The finished subgrade should be firm and non-yielding under the weight of compaction equipment.

Fill Materials

Site soils and bedrock containing less than 3 percent organics are suitable for use as engineered fill except in areas were non-expansive import is required. Import materials, if any are needed, must meet the requirements contained in Section 2.02B, Part I of the Guide Contract Specifications. The Geotechnical Engineer should be informed if any importation of soil is contemplated. A sample of the proposed import material should be submitted to the Geotechnical Engineer for evaluation prior to delivery at the site.

Placement of Fill

Overcompaction of expansive materials (PI>12) may produce an undesirable environment for expansion in the zone of significant seasonal moisture variation; therefore, the following compaction control requirements should be generally applied to engineered fills:

Description	Materials	Minimum Relative Compaction (%)	Minimum Moisture Content (percentage points over optimum moisture)
Within the upper 5 feet	Expansive	87 to 92	+5
	Non-expansive	90	+2
Below 5 feet	Expansive	90	+4
	Non-expansive	95	+2

Maximum dry densities and moisture contents should be determined in accordance with ASTM D-1557. Plasticity Index determinations should be made as a part of grading control for materials in the upper 3 to 5 feet from rough design pad grades in building areas. All fills should be placed in lifts not exceeding 8 inches or the depth of penetration of the compaction equipment used, whichever is less.

Foundation Recommendations

Conventional Footing System. According to the site plan provided, eight buildings will be located at the site. It is our opinion that the proposed buildings and associated facilities can be constructed on continuous spread footings bearing on compacted fill. The Structural Engineer should determine all foundation reinforcement based on the anticipated structural loads. The foundation plans should be submitted to the Geotechnical Engineer for review when they become available.

In order to reduce the effects of the potentially expansive soils, the foundations should extend below much of the zone of seasonal moisture variation. This section provides recommendations for a conventional footing system. The strip footing foundations constructed on a properly prepared subgrade can be expected to reduce the cracking and distress that is common to construction on expansive soils. However, minor cracking and distress should be anticipated in the structures and the slabs-on-grade. The geotechnical design criteria to be used in footing sizing are as follows:

Minimum depth of footing embedment:	30 inches below lowest adjacent grade.
Minimum width of footing:	12 inches.
Maximum allowable footing pressure:	4,500 pounds per square foot (psf) for dead-plus-live loads. This value may be increased by one-third for total loads.

Foundation plans should be reviewed by the Geotechnical Engineer when they become available. Footing trenches should be cleared of all loose materials, and soils exposed in footing excavations should not be allowed to desiccate prior to placing concrete. The Geotechnical Engineer or his/her field representative should observe the footing trenches prior to concrete placement.

Slab-on-Grade Construction. Interior slabs-on-grade should be underlain by a layer of non-expansive fill at least 24 inches thick. The slab reinforcing should be designed by the Structural Engineer.

To reduce moisture rise through the slabs-on-grade, we recommend that a water vapor retarder be constructed beneath the slabs. The vapor retarder should consist of a minimum 20-mil-thick vapor membrane over at least 4 inches of free-draining crushed rock or gravel. The vapor retarder can be considered the upper 4 inches of required non-expansive fill. The Structural Engineer should be consulted on the placement of a sand cushion over the vapor membrane.

Some cracking of the slabs-on-grade should be anticipated at the site as a result of concrete shrinkage and the expansive nature of the on-site soils and bedrock. Frequent control joints should be provided to control the cracking.

Lateral Loads

Lateral load resistance may be provided by frictional resistance between the foundation concrete and the subgrade soils and by passive earth pressure acting against the side of the foundation. A passive pressure of 300 pcf may be used to evaluate the passive resistance that can be developed on the foundation elements. The upper one foot of soil should be excluded from passive pressure computations unless pavement or concrete slab confines it. A coefficient of friction of 0.30 can be used between concrete and the subgrade. A combination of both friction and passive pressure may be used if one of the values is reduced by 75 percent.

Preliminary Pavement Design

Based on our field explorations and laboratory testing, we estimate that site soils will have a resistance ("R") value of 5. The following preliminary pavement sections have been determined for Traffic Indices of 4.5, 5, and 6 based on an assumed R-value of 5 according to the method contained in Topic 608 of Highway Design Manual by CALTRANS.

Traffic Index	Alternative I		Alternative II		
	AC in.	AB in.	AC in.	AB in.	ASB* in.
4.5	3.0	8.0	---	---	---
5.0	3.0	10.0	3.0	6.0	5.0
6.0	3.5	13.0	3.5	6.0	8.0

Notes: AC is asphalt concrete
AB is aggregate base Class 2 Material with minimum R-value = 78
ASB is aggregate subbase with minimum R-value = 50
* Lime treated subgrade can be substituted for ASB provided equivalent R-values can be obtained

The Traffic Index should be determined by the Civil Engineer or appropriate public agency. These sections are for estimating purposes only. In our opinion, the performance of R-value testing prior to site grading would not be adequate to determine pavement support characteristics of the subgrade materials placed at proposed finished grades during grading. Therefore, we recommend R-value

testing be performed following site grading to determine the as-built pavement subgrade characteristics for final pavement section evaluation. Pavement construction and all materials should comply with the requirements of the Standard Specifications of the State of California Division of Highways, County requirements, and the following minimum requirements:

- All pavement subgrades should be scarified to a depth of 12 inches below finished subgrade elevation, moisture conditioned to 3 percentage points above optimum, and compacted to at least 92 percent relative compaction and in accordance with County requirements.
- Subgrade soils should be in a stable, non-pumping condition at the time aggregate baserock materials are placed and compacted.
- Adequate provisions must be made such that the subgrade soils and aggregate baserock materials are not allowed to become saturated.
- Aggregate baserock materials should meet current Caltrans specifications for Class 2 aggregate baserock and should be compacted to at least 95 percent of maximum dry density at a minimum moisture content of optimum.
- Asphalt paving materials should meet current Caltrans specifications for asphalt concrete.
- All concrete curbs separating pavement and irrigated landscaped areas should extend into the subgrade and below the bottom of adjacent aggregate baserock materials.

Utilities

It is recommended that all utility trench backfill be done under the observation of a Geotechnical Engineer. Pipe zone backfill (i.e., material beneath and immediately surrounding the pipe) may consist of a well-graded import or native material less than ¾ inch in maximum dimension. Trench zone backfill (i.e., material placed between the pipe zone backfill and the ground surface) may consist of native soil compacted in accordance with recommendations for engineered fill.

Where import material is used for pipe zone backfill, we recommend that it consist of fine- to medium-grained sand or a well-graded mixture of sand and gravel and that this material not be used

within 2 feet of finish grades. In general, uniformly graded gravel should not be used for pipe or trench zone backfill due to the potential for migration of (1) soil into the relatively large void spaces present in this type of material; and (2) water along trenches backfilled with this type of material. All utility trenches entering buildings and paved areas must be provided with an impervious seal consisting of native materials or concrete where the trenches pass under structure perimeters or curb lines. The impervious plug should extend at least 3 feet to either side of the crossing. This is to prevent surface water percolation into the sands under foundations and pavements where such water would remain trapped in a perched condition, allowing clays to develop their full expansion potential.

Utility trenches should not be located upslope of any foundation area unless the placement, depth and backfill material to be used are reviewed by the Geotechnical Engineer. Care should be exercised where utility trenches are located beside foundation areas. Utility trenches constructed parallel to foundations should be located entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. Utility companies and Landscape Architects should be made aware of this information.

Utility trenches in areas to be paved should be backfilled to the specifications provided in this report for engineered fill and in accordance with Contra Costa County requirements; however, compaction of trench backfill by jetting shall not be allowed at this site.

Plan Review and Construction Observation Service

It is important to the success of this project that the recommendations contained in this report be carefully implemented in the field. ENGEO should be retained to review the project plans and specifications to confirm that they meet the intent of the recommendations contained in this report.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions.

The professional staff of ENGEO Incorporated strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our work.

This report is based upon field and other conditions discovered at the time of preparation of ENGEO's work. This document must not be subject to unauthorized reuse, that is, reuse without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time. If actual field or other conditions necessitate clarifications, adjustments, modifications or other changes to ENGEO's work, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

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LIST OF FIGURES

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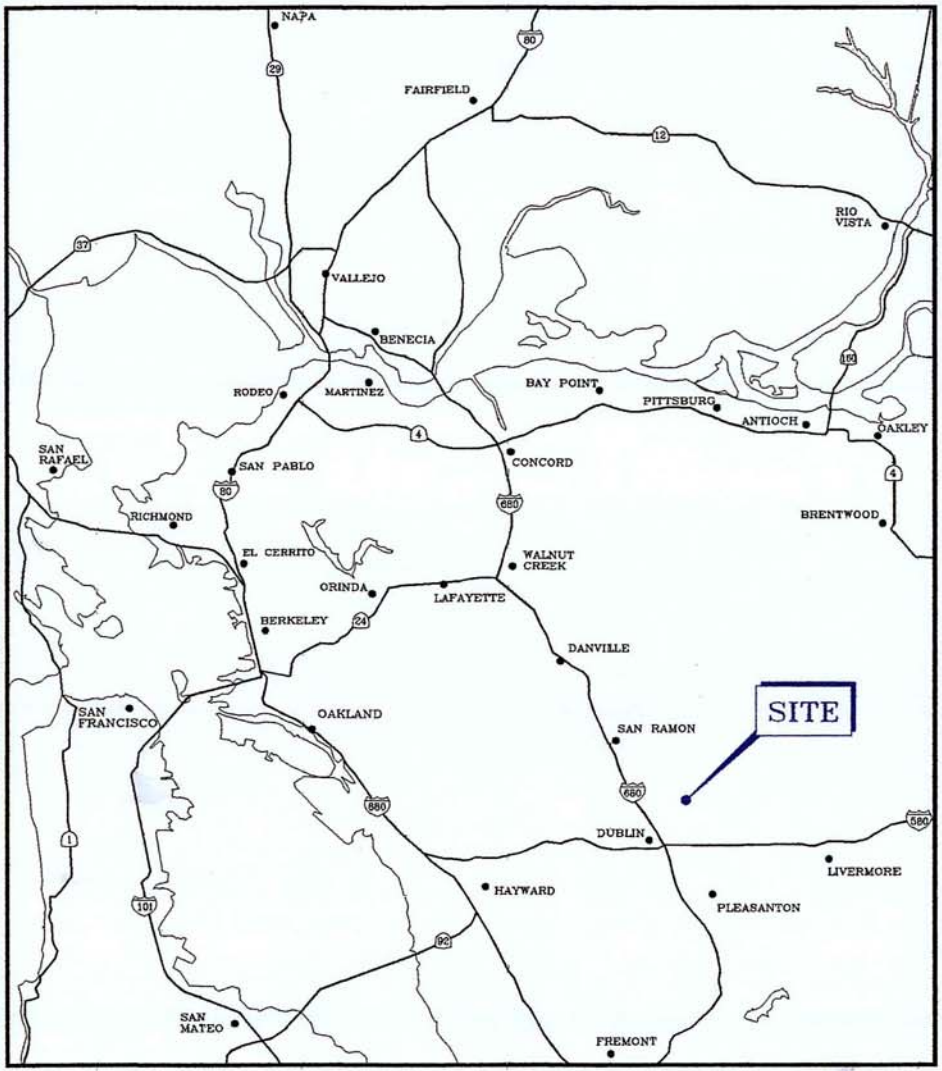

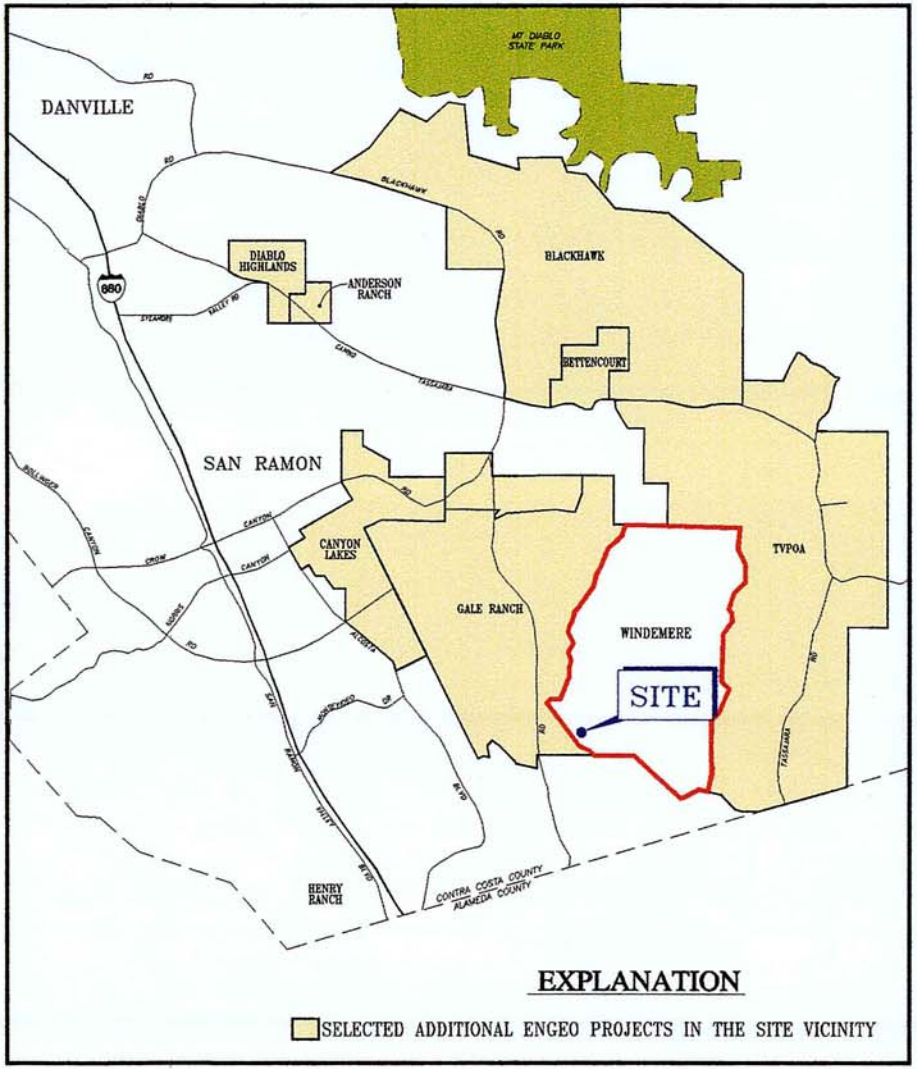

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NO SCALE

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE LOCATION MAP
SAN RAMON VALLEY CENTER
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01		FIGURE NO. 1
DATE: AUGUST 2003		
DRAWN BY: SRP	CHECKED BY: JT	

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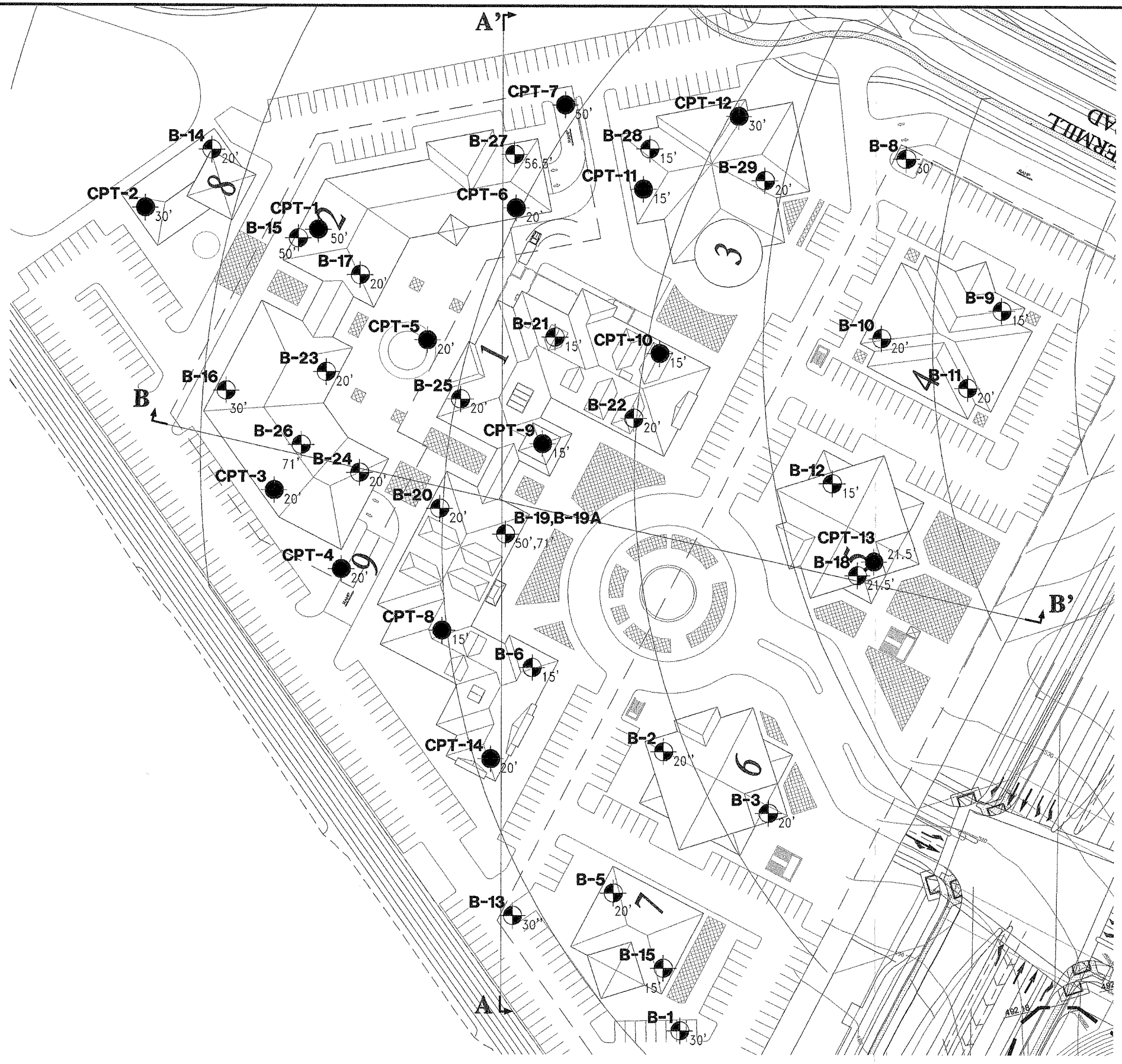

EXPLANATION

- B-29 20' — APPROXIMATE LOCATION OF EXPLORATORY BORING (2002)
- B-13 21.5' — APPROXIMATE LOCATION OF EXPLORATORY BORING (2001)
- A' — A — APPROXIMATE LOCATION OF CROSS SECTION

N

0 FEET 100

0 METERS 50

BASE MAP SOURCE: CBG, IPB

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

BORING AND TEST PIT LOCATION MAP

SAN RAMON VALLEY CENTER

CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01

DATE: AUGUST 2003

DRAWN BY: SRP CHECKED BY: JT

FIGURE NO. 2

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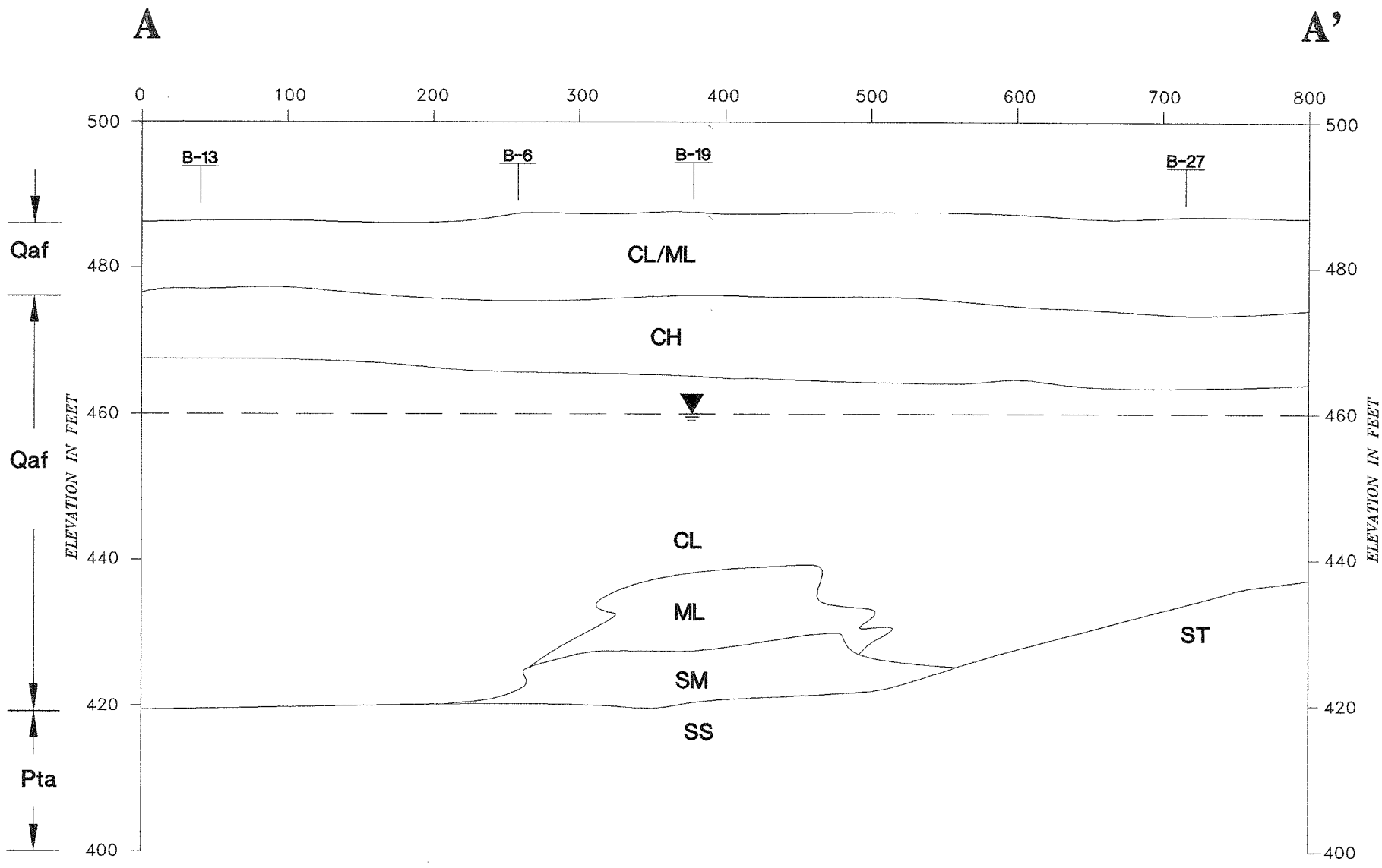
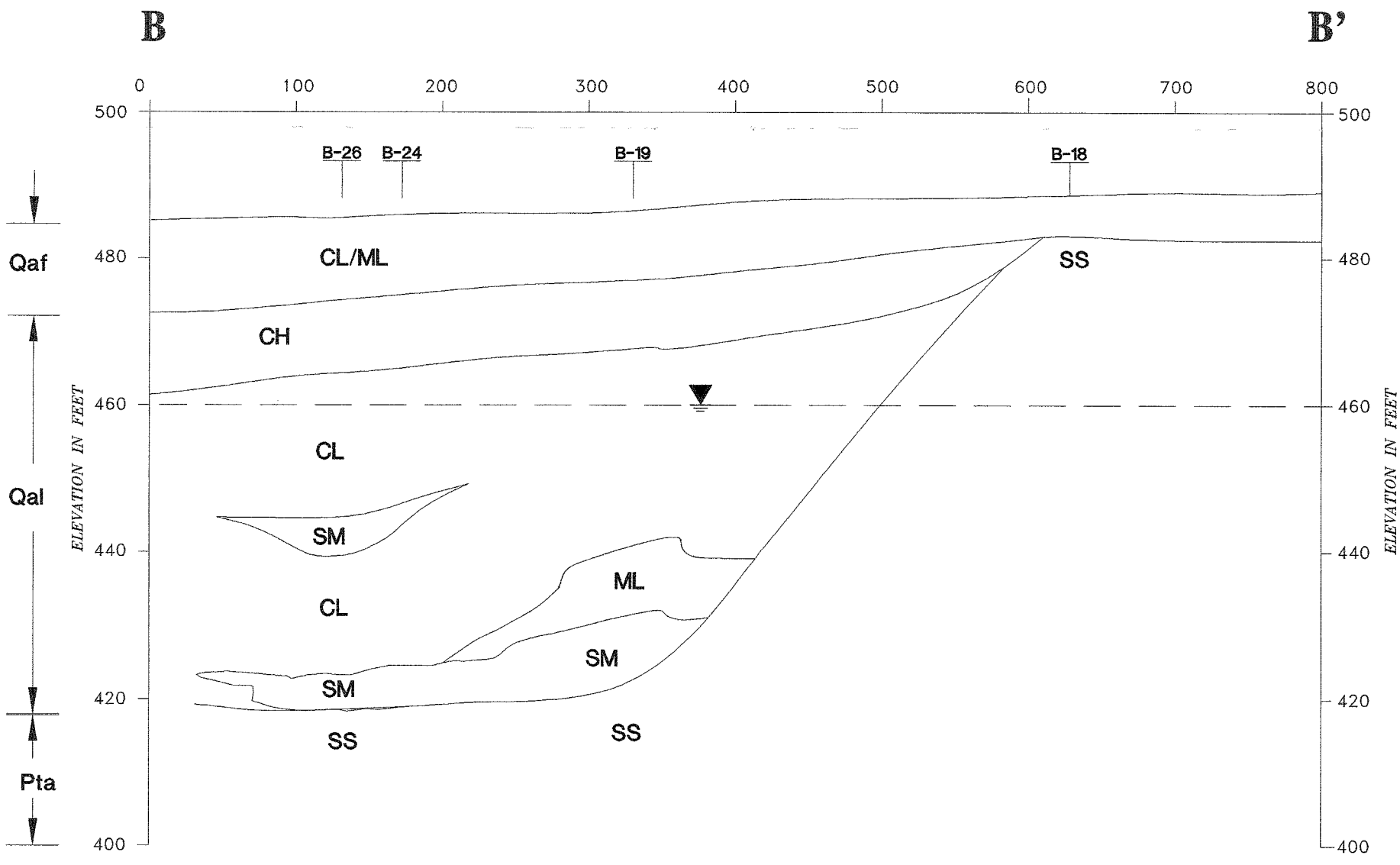
SECTION A-A'



SECTION B-B'



EXPLANATION

CL/ML	CLAY/SILT	Qaf	ENGINERED FILL
CH	FAT CLAY	Qal	ALLUVIUM
SP/SM	SAND/SILTY SAND	Pta	TASSAJARA FORMATION
SS	SANDSTONE	B-13	APPROXIMATE LOCATION OF BORING
ST	SILTSTONE		
	GROUNDWATER TABLE		

V:1"=20', H:1"=100'

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CROSS SECTIONS A-A', B-B'
SAN RAMON VALLEY CENTER
SAN RAMON, CALIFORNIA

PROJECT NO.: 2581.1.120.01		FIGURE NO. 3
DATE: AUGUST 2003		
DRAWN BY: SRP	CHECKED BY: JT	

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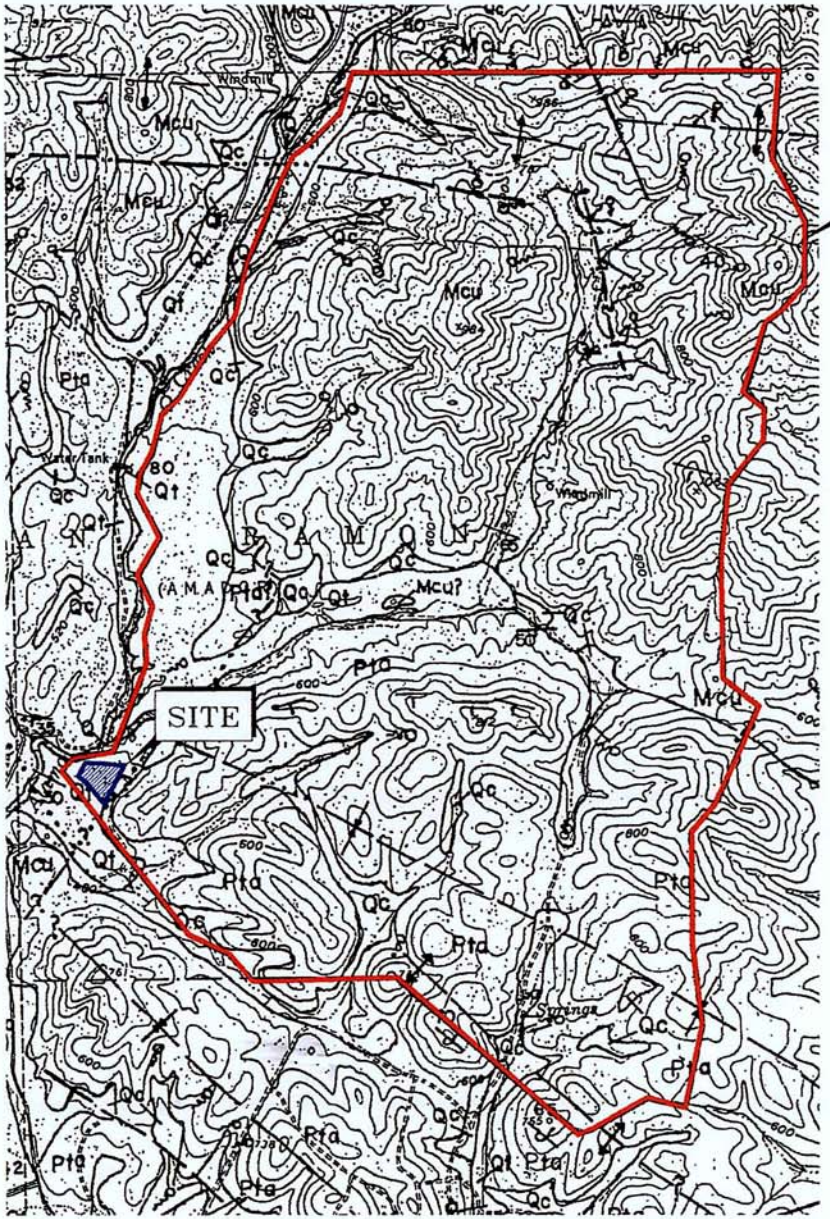

EXPLANATION

Q	ALLUVIUM
Qc	COLLUVIUM/ALLUVIUM FAN DEPOSITS
Qt	ALLUVIAL TERRACE DEPOSITS
Pta	TASSAJARA FORMATION
Mcu	UNDIVIDED CONTINENTAL ROCKS
	LAPILLI TUFF & ASH LAYERS
	APPROXIMATE LOCATION OF GEOLOGIC CONTACT
	APPROXIMATE LOCATION OF MAJOR FAULTS
50/80	STRIKE AND DIP OF BEDDING, OVERTURNED BEDS, AND VERTICAL BEDDING
	APPARENT STRIKE AND DIP OF BEDDING
	ANTICLINE
	SYNCLINE
	SPRINGS AND SEEPS

N

0 MILE .5
0 KILOMETER 1

BASE MAP SOURCE: DAVENPORT, 1986

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

REGIONAL GEOLOGIC MAP
SAN RAMON VALLEY CENTER
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01		FIGURE NO. 4
DATE: AUGUST 2003		
DRAWN BY: RAC	CHECKED BY: JT	

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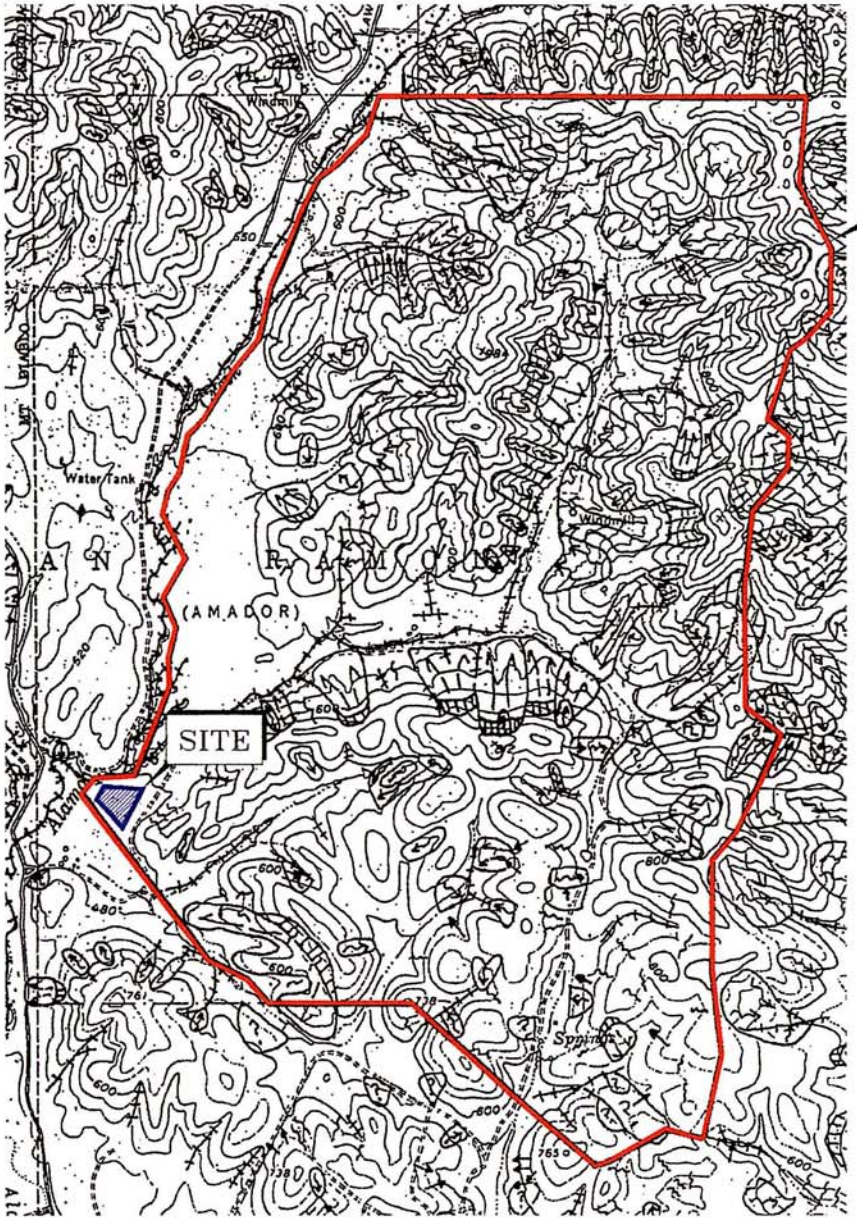


EXPLANATION

- DEFINITE LANDSLIDE
- PROBABLE LANDSLIDE
- QUESTIONABLE LANDSLIDE
- SMALL LANDSLIDE
- EARTHFLOW
- SMALL EARTHFLOW
- EARTHFLOW COMPLEX
- CREEP
- INCISED CHANNEL OR GULLY

N

0 MILE .5
0 KILOMETER 1

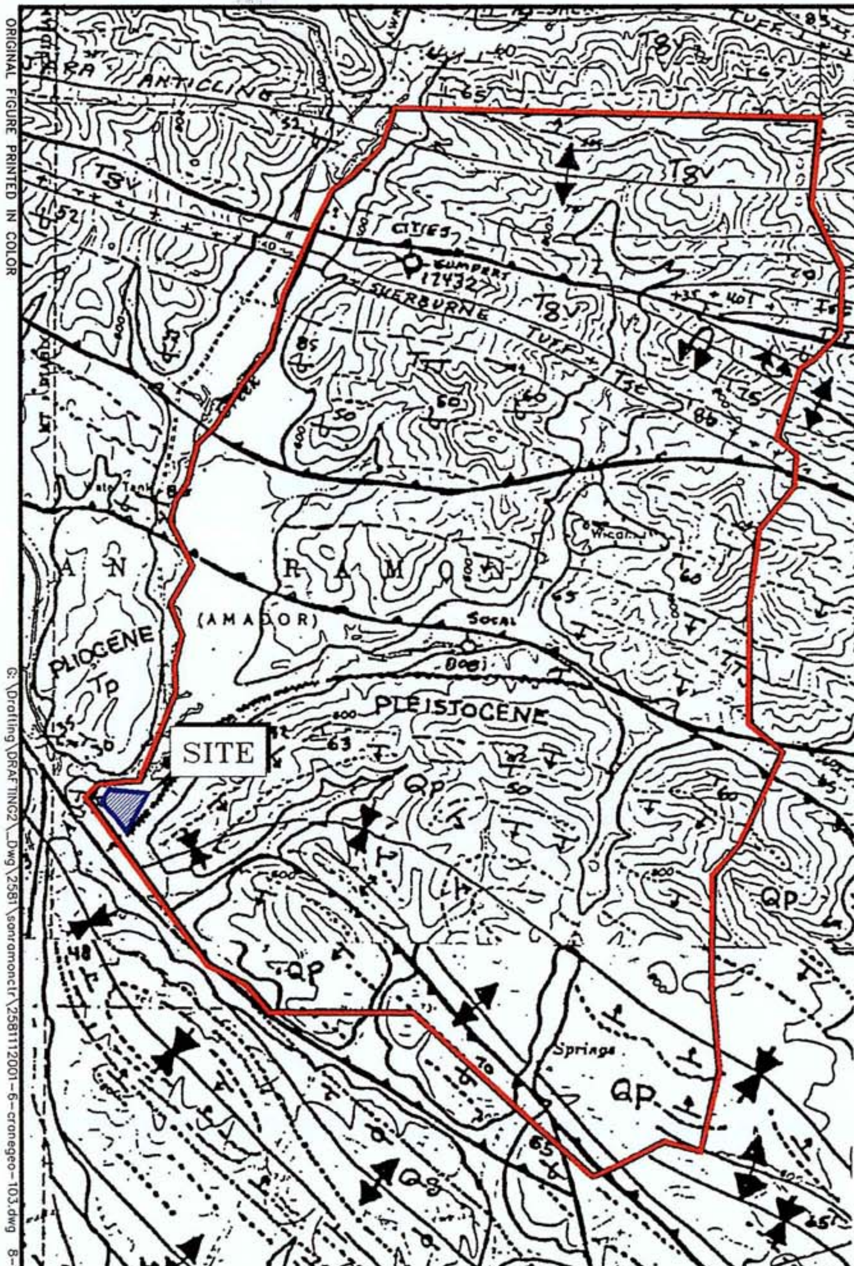
BASE MAP SOURCE: DAVENPORT, 1986

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

REGIONAL LANDSLIDE MAP
SAN RAMON VALLEY CENTER
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01	FIGURE NO. 5
DATE: AUGUST 2003	
DRAWN BY: RC	CHECKED BY: JT

ORIGINAL FIGURE PRINTED IN COLOR



WINDEMERE BOUNDARY

BASE MAP SOURCE: CRANE, 1980

EXPLANATION

PLEISTOCENE (UNDIFFERENTIATED)
PLIOCENE (UNDIFFERENTIATED)
TASSAJARA FORMATION
SHERBURNE TUFF
GREEN VALLEY FORMATION
GEOLOGIC CONTACT (APPROXIMATE)
RESISTANT BEDDING
FAULT
THRUST FAULT, SAW TEETH ON UPPER PLATE
ANTICLINE
OVERTURNED ANTICLINE
SYNCLINE
OVERTURNED SYNCLINE
STRIKE AND DIP OF BEDDING
STRIKE AND DIRECTION OF DIP BEDDING
STRIKE AND DIP OF OVERTURNED BEDDING
HORIZONTAL BEDDING SHOWING TREND OF LINEATIONS
LANDSLIDE
DRY HOLE OR ABANDONED WELL

N

0 MILE .5
0 KILOMETER 1

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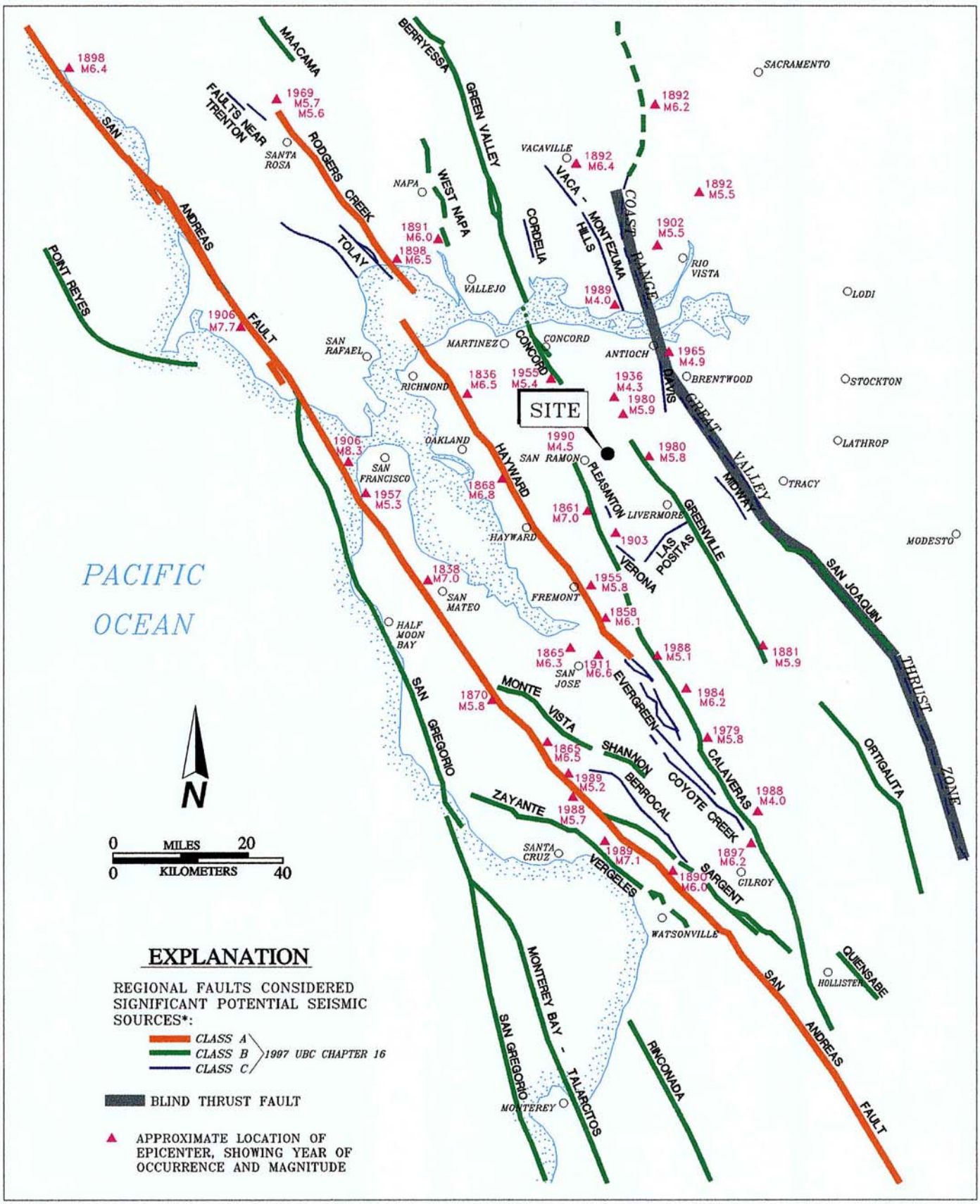
CRANE GEOLOGIC MAP
SAN RAMON VALLEY CENTER
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01		FIGURE NO. 6
DATE: AUGUST 2003		
DRAWN BY: RC	CHECKED BY: JT	



*BASED ON USGS OPEN REPORT 96-706

ENGEO INCORPORATED
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REGIONAL FAULTING AND SEISMICITY

SAN RAMON VALLEY CENTER

CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01

DATE: AUGUST 2003

DRAWN BY: DLB CHECKED BY: JT

FIGURE NO. 7

ORIGINAL FIGURE PRINTED IN COLOR

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NORMILIZED ACCELERATION RESPONSE SPECTRUM

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

NORMALIZED SPECTRAL ACCELERATION
SAN RAMON VALLEY CENTER
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 2581.1.120.01	FIGURE NO. 8
DATE: AUGUST 2003	
DRAWN BY: SRP	CHECKED BY: JT

APPENDIX A

ENGEO INCORPORATED

Boring Logs

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MATL LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW - Well graded gravels or gravel-sand mixtures GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW - Well graded sands, or gravelly sand mixtures SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MATL SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity CL - Inorganic clay with low to medium plasticity OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Inorganic silt with high plasticity CH - Inorganic clay with high plasticity OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4 "	3"	12"	
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*	BLOWS/FOOT (S.P.T.)
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-15
VERY STIFF	2-4	15-30
HARD	OVER 4	OVER 30

MOISTURE CONDITION

DRY	Absence of moisture, dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater
SATURATED	Below the water table

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

TRACE	Particles are present, but estimated to the less than 5%
SOME	5 to 15%
WITH	15 to 30%
.....Y	30 to 50%

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Continuous Core
- Bag Samples
- NR No Recovery

LINE TYPES

- _____ Solid - Layer Break
- - - - - - Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

- Ground-water level during drilling
- Stabilized ground-water level

ENGEO INCORPORATED
1971-2001 * 30 YEARS OF EXCELLENCE

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
		1-1-1 1-1-2		SILTY CLAY (CL), yellow brown, damp, hard, with fine-grained sand, trace gravel. (FILL)	38	+4.5*	105	20.1
	1							
5								
	2	1-2-1			30	+4.5*		
10	3							
		1-3-1 1-3-2		SILTY CLAY (CH), dark brown, damp, very stiff, trace medium-coarse sand.	48	3.75*		
	4							
15								
	5	1-4-1			32	4.0*	99	24.5
20	6							
		1-5-1 1-5-2		SILTY CLAY (CL), dark yellow brown, damp, very stiff, with trace carbonates.	35	3.0*		
	7							
25				Grades, dark brown				
	8	1-6-1 1-6-2		▽	26	2.75*		
				SANDY CLAY (CL), yellow brown with gray nodules, stiff.				
	9							
30								
		1-7-1			18			
	10			Bottom of boring at approximately 31 $^{1}/_{2}$ feet. Groundwater encountered at 27 feet during drilling.				
35								
	11							
40	12							

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ENGEO INCORPORATED
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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-1

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-1

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 489 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), yellow brown, damp to moist, with silt. (FILL)				
	1	2-1-1 2-1-2		SAND (SM), yellow brown, moist, very dense, with silt, trace gravel. (FILL)	84/9"			
5								
	2	2-2-1			37			
10	3			SILTY SAND (SM), yellow brown, moist, dense, trace gravel. (FILL)				
		2-3-1			40			
	4							
15				SILTY CLAY (CH), dark brown to black, stiff, moist, with carbonates.				
	5	2-4-1			23			
	6							
20		2.5-1 2-5-2		SILTY CLAY (CL), dark yellow brown, moist, hard, with carbonates, trace of sand.	58		111	18.2
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-2

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-2

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 489 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
	1	3-1-1		SILTY SAND (SM), yellow brown, moist, very dense, some clay. (FILL) Percent Passing No. 200 Sieve = 43	63			16.2
5		3-2-1			55/6"			
	2			(Grades with gravel)				
10	3			SAND (SP-SM), light yellow brown, moist, hard, with some silt. (FILL)				
		3-3-1		(Drilling rate decreased drastically)	53/6"			
	4	3-4-1		SANDSTONE, yellow brown, hard, friable, deeply weathered.	55/6"			
15	5			Bottom of boring at approximately 14 feet. Groundwater not encountered during drilling.				
20	6							
	7							
25	8							
	9							
30	10							
35	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-3

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-3

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SAND (SM), yellow brown, moist, medium dense, some silt. (FILL)				
		4-1-1		SILTY CLAY (CL), dark yellow brown, very stiff, moist, with fine-grained				
		4-1-2			37			
	1			sand. (FILL) Becoming olive brown.				
5				(grades dark brown with occasional white speckles, moist, hard, with				
		4-2-1		trace fine to coarse gravel.				
	2	4-2-2			40	+4.5*		
10	3			SANDY CLAY (CL), dark yellow brown, moist, hard, fine- to				
		4-3-1		coarse-grained sand. (FILL)	50/5"			
	4							
15				SILTY CLAY (CH), dark brown, moist, hard, some fine-grained sand.				
	5	4-4-1			36			
				Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-4

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-4

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				CLAYEY SAND (SC), yellow brown, moist, with some gravel. (FILL)				
	1	5-1-1 5-1-2		SANDY CLAY (CL), olive brown with yellow brown nodules, very stiff, moist. (FILL)	35			
5				(Grades hard, with some gravel)				
	2	5-2-1 5-2-2			55			
10	3	5-3-1 5-3-2		SILTY CLAY (CH), dark brown, moist, hard.	50/5 1/2"	+4.5*		
	4							
15				SANDY SILT (ML), dark brown, moist, hard, with clay, trace carbonates.				
	5	5-4-1			33			
	6							
20		5-5-1		SILTY CLAY (CL), dark brown, very stiff, moist, trace fine-grained sand and carbonates.	36	2.75*		
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25	8							
	9							
30								
	10							
35	11							
	12							
40								

ENGEO INCORPORATED
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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-5

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-5

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
				DATE OF BORING: December 2, 2002 SURFACE ELEVATION: Approx. 488 feet (149 meters)				
0				SILTY SAND (SM), yellow brown, moist, medium dense, with gravel. (FILL)				
	1	6-1-1			38			
5				(Grading yellow brown)				
	2	6-2-1			49			
10	3							
		6-3-1			45			
	4			SILTY CLAY (CH), dark brown, very stiff to hard, moist, some fine-grained sand.				
15								
	5	6-4-1			57			
				Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25								
	8							
30	9							
	10							
35								
	11							
	12							
40								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-6

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-6

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 494 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light grayish brown, moist, hard, fine-grained sand, with silt. (FILL)				
	1	7-1			48			
5								
	2							
		7-2		SAND (SC), light brown, moist, dense, some clay, fine- to coarse-grained sand. (FILL)	40			
10	3							
	4							
		7-3		SILTY CLAY (CH), dark brown, moist, hard, trace fine-grained sand.	61			
15	5							
				(Trace carbonates at 14 feet)				
		7-4			51			
20	6							
	7							
		7-5		SILTY CLAY (CL), olive brown, wet, hard, with fine-grained sand.	42			
25	8							
		7-6			38	3.0	96	27.2
30	9			Bottom of boring at approximately 29 $^1/_2$ feet. Groundwater not encountered during drilling.				
	10							
35	11							
	12							
40								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-7

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01

CHECKED BY: SI

FIGURE NO. A-7

DATE OF BORING: December 2, 2002

SURFACE ELEVATION: Approx. 491 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light grayish brown, damp, very stiff, with silt. (FILL)				
		8-1		SAND (SC), light grayish brown, moist, very dense, fine to coarse sand, some clay and fine to coarse angular gravel, . (FILL)	63/6"			
5	1							
	2							
10	3							
		8-2		SILTY CLAY (CL), olive brown, moist, hard, with fine-grained sand. (FILL)	55			
	4							
15		8-3		SAND (SC), olive brown, moist, very dense, fine to coarse-grained sand, with clay, trace fine gravel. (FILL)	83		+4.5*	112.6
	5							
20	6							
		8-4		SILTY CLAY with fine sand (CH), dark brown, moist, hard.	77			
	7							
25								
	8	8-5		SANDY CLAY (CL), dark brown, moist, hard, fine-grained sand, trace carbonates.	43			
	9							
30								
		8-6		SILTY CLAY (CL), dark olive brown, moist to wet, very stiff, some fine-grained sand.	25			
	10			Bottom of boring at approximately 31 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
35	11							
	12							
40								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

ENGEO INCORPORATED
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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-8

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-8

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 492 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light grayish brown, damp to moist, hard, fine-grained sand, some silt. (FILL)				
	1	9-1		(Rock fragments, some gravel at 3 feet) (FILL)	50/6"			
5	2							
	3	9-2			37			
10	4							
		9-3		SAND (SC), mottled light and dark brown, dense, fine- to coarse-grained sand, some clay and gravel. (FILL)	47		107	15.3
15	5			Bottom of boring at approximately 14 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25	8							
30	9							
	10							
35	11							
40	12							

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-9

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY RAC

FIGURE NO. A-9

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 491 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light grayish brown, very stiff to hard, damp to moist, fine-grained sand, some silt. (FILL)				
	1	10-1		SAND (SC), light brown, moist, very dense, fine- to coarse-grained sand, with clay, trace fine gravel. (FILL)	80		105	16.5
5	2							
		10-2		SILTY CLAY (CL), light brown, moist, hard, with fine-grained sand. (FILL)	59			
10	3							
	4	10-3		SAND (SC), brown, moist, dense, fine- to coarse-grained sand, with clay, some fine gravel, . (FILL)	45			
15	5							
		10-4		SILTY CLAY (CH), dark brown, very stiff, moist, some fine-grained sand.	27			
20	6			Bottom of boring at approximately 19 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
	7							
25								
	8							
30	9							
	10							
35	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-10

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SL

FIGURE NO. A-10

0541 2581112001_SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 491 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light grayish brown, damp to moist, very stiff to hard, fine-grained sand, some silt. (FILL)				
5	1	11-1		SAND (SC), light brown, moist, very dense, fine- to coarse-grained sand, some clay, trace fine gravel. (FILL)	83			
10	2	11-2		SILTY CLAY (CH), dark brown, moist, hard, trace fine-grained sand.	37			
15	3	11-3		SILTY CLAY (CL), dark brown, moist, hard, with fine-grained sand, trace carbonates.	54		110	15.4
20	4	11-4		SILTY SAND (SM), light grayish brown, moist, very dense, fine-grained sand.	54			
25	5			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
30	6							
35	7							
40	8							
	9							
	10							
	11							
	12							

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-11

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SL

FIGURE NO. A-11

0541 258111200l SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 491 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), grayish brown, damp to moist, hard, fine-grained sand, some silt. (FILL)				
	1	12-1		(grades mottled dark brown and olive brown, moist, some fine gravel) (FILL)	50		108	15.7
5	2							
		12-2		SILTY CLAY (CH), dark brown, moist, hard, some fine-grained sand.	41			
10	3							
	4	12-3			46			
15	5			Bottom of boring at approximately 14 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25	8							
	9							
30	10							
35	11							
40	12							

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-12

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-12

0541 2581112001_SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				AGREGGATE BASE. (FILL)				
	1	13-1		SILTY CLAY (CL), dark brown, moist, very stiff, with fine-grained sand, trace carbonates. (FILL)	19		94	9.1
5	2							
	3	13-2		SILTY CLAY (CH), dark brown, hard, trace fine-grained sand, fine gravel, and carbonates.	52			
10	4							
	5	13-3			36			
15	6			SILTY CLAY (CL), dark olive brown, moist, very stiff, some fine-grained sand.				
	7	13-4			22			
20	8			(grades dark brown, moist to wet, hard)				
	9	13-5			36			
25	10			(grades with fine-grained sand)				
	11	13-6			28		104	22.5
30	12			Bottom of boring at approximately 29 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
35								
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-13

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SL

FIGURE NO. A-13

DATE OF BORING: December 3, 2002

SURFACE ELEVATION: Approx. 485 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), light greyish brown, moist, hard, fine-grained sand, some silt. (FILL)				
	1	14-1		SILTY CLAY (CL), dark brown, very stiff, moist, trace fine-grained sand. (FILL)	24	2.5*	106	20.7
5								
	2	14-2		(grades with fine-grained sand, some fine gravel)	26	3.5*		
10	3							
	4	14-3		SILT CLAY (CH), dark brown, moist, hard, trace fine-grained sand.	43	+4.5*		
15	5							
		14-4		CLAYEY SAND (SC), yellow brown, moist, dense, medium grained.	47	+4.5*		
	6	14-5		SILTY CLAY (CL), dark brown, moist, hard, trace fine-grained sand.	25			
20				Bottom of boring at approximately 20 feet. Groundwater not encountered during drilling.				
	7							
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-14

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-14

0541 2581112001_SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 4, 2002

SURFACE ELEVATION: Approx. 486 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, moist, hard, trace fine-grained sand, trace fine gravel. (FILL)				
	1	15-1			20	3.0*		
5								
	2	15-2		SILTY CLAY (CL), dark brown, moist, hard, trace fine-grained sand, and fine gravel. (FILL)	27	+4.5*		
10	3							
	4	15-3			45	+4.5*		
15								
	5	15-4		SANDY SILT (ML), yellow brown, moist, hard, fine-grained sand.	43	+4.5*		
20	6							
	7	15-5		SILTY CLAY (CL), dark brown, very stiff to saturated, moist, hard, trace fine-grained sand. ▽	26	2.5*		
25								
	8			SANDY CLAY (CL), olive brown, stiff.				
		15-6			17	0.25		
30	9							
	10	15-7			14			
35								
	11							
		15-8		SILTY CLAY (CL), blue gray, stiff, with medium-grained sand.	14			
40	12							

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-15

LOGGED BY: R. Calvert

PROJ. NO.: 2581.1.120.01 CHECKED BY SI

FIGURE NO. A-15

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
				DATE OF BORING: December 4, 2002				
				SURFACE ELEVATION: Approx. 486 feet (148 meters)				
40				SILTY CLAY (CL), continued.				
	13							
		15-9		SANDY CLAYSTONE: blue grey, friable, deeply weathered.	25	2.5*		
45	14							
		15-10		CLAYEY SANDSTONE: blue grey, friable, deeply weathered.	45	+4.5*		
	15							
50		15-11			28			
				Bottom of boring at approximately 50 feet. Groundwater encountered at 26 feet during drilling.				
	16							
55	17							
	18							
60	19							
65	20							
	21							
70	22							
	23							
75	24							
80								

0541 2581112001_SANRAMONVALLEYCENTER.GPJ 1/30/03

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-15

LOGGED BY: R. Calvert

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-15

DATE OF BORING: December 4, 2002

SURFACE ELEVATION: Approx. 486 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
	1	16-1		SANDY CLAY (CL), olive brown, hard, moist, fine-grained sand, some silt and coarse gravel. (FILL)	28	+4.5*		
5								
	2	16-2			28			
10	3							
	4	16-3		SILTY CLAY (CH), dark brown, moist, hard, some fine-grained sand.	41	+4.5*		
15								
	5	16-4						
		16-5		CLAYEY SAND (SC), olive, moist, dense, coarse grained.	38			
				SILTY CLAY (CL) olive brown, very stiff, moist.				
20	6	16-6			25			
	7	16-7			38			
25				▽				
	8	16-8		SANDY CLAY (CL), olive, very stiff, moist, fine to medium-grained sand.	33			
	9	16-9			17			
30				Bottom of boring at approximately 30 feet. Groundwater encountered at 26 1/2 feet during drilling.				
	10							
35								
	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-16

LOGGED BY: R. Calvert

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-16

DATE OF BORING: December 4, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0		17-1		SILTY CLAY (CL), brown and olive brown mottling, very stiff, moist, with fine-grained sand, fine gravel. (FILL)	26	3.0*	109	18.6
	1							
5		17-2			25			
	2							
10	3	17-3			40			
	4							
15		17-4		SILTY CLAY (CH), dark brown, very stiff, moist, trace fine-grained sand.	46			
	5							
20	6	17-5			48			
				Bottom of boring at approximately 20 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25	7							
	8							
30	9							
	10							
35	11							
40	12							

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-17

LOGGED BY: R. Calvert

PROJ. NO.: 2581.1.120.01 CHECKED BY SL

FIGURE NO. A-17

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 17, 2002

SURFACE ELEVATION: Approx. 491 feet (150 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), with sand. (FILL)				
	1							
5		18-1-1		SAND (SP), yellow brown, very dense, moist. (FILL)	59		98	8.0
	2							
		18-2-1		SILTSTONE, light brown, friable, deeply weathered.	50/5"			
10	3							
	4							
15		18-3-2						
	5	18-3-1			77			
	6							
20		18-4-2		SANDSTONE, light brown, friable, poorly cemented, deeply weathered.				
		18-4-1			74		99	23.9
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-18

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-18

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), medium brown, very stiff, fine to coarse-grained sand. (FILL)				
	1	19-1-1		SILTY CLAY (CL), dark brown, very stiff, damp, trace fine-grained sand. (FILL)	17	2.25*	95	24.0
5								
	2	19-2-1		SANDY CLAY (CL), reddish yellow brown, hard, damp, trace fine gravel. (FILL)	17	4.5*		
10	3							
		19-3-1		SILTY CLAY (CH)), dark brown to black, damp, very stiff.	19			
	4							
15				(sandy lenses at 16 feet)				
	5	19-4-1			30			
	6							
20		19-5-2		SANDY CLAY (CL), dark to medium brown, very stiff, moist, fine-grained sand, some silt.				
		19-5-1			17	3.0*		
	7							
25		19-6-2		SILTY CLAY (CL), dark brown to black, stiff, moist, some fine-grained sand.				
	8	19-6-1			11	1.75*		
	9			▽				
30		19-7-2		(grades greenish gray, with light red and black nodules, very stiff.				
		19-7-2			17	2.5*		
	10							
35								
	11	19-8-2						
		19-8-1			15	2.0	101	24.6
40	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-19

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-19

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40		19-9-2 19-9-1		(grades olive brown)	14	2.5*		
	13							
45								
	14	19A-1		SILT (ML), light olive brown, very stiff, some fine-grained sand and clay. Percent Passing No. 200 Sieve = 69 LL = 35	18			
	15							
50		19A-2			5			
	16							
55								
	17	19A-3		SILTY SAND (SM), light olive brown, medium dense, some clay. Percent Passing No. 200 Sieve = 57 LL = 31	8			
	18							
60								
	19	19A-4		SILTY SAND (SM), light olive brown, medium dense, fine- to medium-grained, with clay, some silt. Percent Passing No. 200 Sieve = 41 LL = 24	16			
65								
	20			SILTY SANDSTONE: olive brown, weak to friable, poorly cemented, deeply weathered.				
	21							
70					50/5"			
	22			Bottom of boring at approximately 71 feet. Groundwater encountered at 30 feet during drilling.				
75	23							
	24							
80								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-19

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-19

DATE OF BORING: December 17, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0		20-1-1		SAND (SM), yellow brown, moist, medium dense, fine to coarse-grained, with silt and gravel. (FILL)	15			
	1	20-2-1		SILTY SAND (SM), yellow brown to dark brown, moist, medium dense, fine to coarse-grained, with clay, trace gravel. (FILL)	11			
5	2							
		20-3-1		SILTY CLAY (CH), dark brown to black, damp, moist, hard.	20	+4.5*	108	17.2
10	3							
	4	20-4-1		(occasional sandy interbeds)	25	2.75*		
15	5							
		20-5-1		SILTY CLAY (CL), dark to yellow brown with white nodules, very stiff, moist, with fine-grained sand.	22			
20	6			Bottom of boring at approximately 19 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
	7							
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-20

LOGGED BY: S. Papadopulos

PROJ. NO.: 2581.1.120.01

CHECKED BY

FIGURE NO. A-20

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
				DATE OF BORING: December 18, 2002				
				SURFACE ELEVATION: Approx. 488 feet (149 meters)				
0				SILTY CLAY (CL), dark brown with olive brown mottling, moist, hard, with fine-grained sand. (FILL)				
	1							
5				(Sandy pockets at 6 feet) (FILL)				
	2	21-1			38			
10	3							
		21-2			44			
	4			SILTY CLAY (CH), dark brown, very stiff, moist, some fine-grained sand.				
15								
	5	21-3			25			
				Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25								
	8							
30	9							
	10							
35								
	11							
	12							
40								

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-21

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-21

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 489 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SANDY CLAY (CL), mottled dark brown and olive brown, very stiff to hard, moist, fine- to medium-grained and some silt. (FILL)				
5	1							
	2							
10	3	22-1		(grades with some fine to coarse-gravel)	37			
	4			SILTY CLAY (CH), dark brown, moist, hard, some fine-grained sand.				
15	5	22-2			38			
	6			SILTY CLAY (CL), dark olive brown, moist to wet, very stiff, some fine-grained sand.				
20		22-3			18			
	7			Bottom of boring at approximately 20 feet. Groundwater not encountered during drilling.				
25	8							
30	9							
	10							
35	11							
40	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-22

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SL

FIGURE NO. A-22

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), dark grayish brown, moist, very stiff, with fine-grained sand. (FILL)				
	1							
5				(grades with some fine to coarse-gravel)				
	2	23-1			19			
10	3							
		23-2			25			
	4							
15				SILTY CLAY (CH), dark brown, very stiff, moist, some fine-grained sand.				
	5	23-3			21			
	6							
20		23-4		SILTY CLAY (CL), dark olive brown, very stiff, moist, fine- to medium-grained sand.	20			
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

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ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-23

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY

FIGURE NO. A-23

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), dark brown, very stiff, moist, with fine-grained sand. (FILL)				
	1							
5				(trace fine- to coarse gravel at 5 feet)				
	2	24-1			19			
10	3							
		24-2		SILTY CLAY (CH), dark brown, stiff, moist, some fine-grained sand.	10			
	4							
15				(grades very stiff)				
	5	24-3			26			
20	6			SILTY CLAY (CL), dark olive brown, very stiff, moist, some fine-grained sand.				
		24-4			16			
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-24

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01

CHECKED BY: SI

FIGURE NO. A-24

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 18, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), dark brown, very stiff, moist, with fine-grained sand. (FILL)				
5	1							
	2							
		25-1		SILTY CLAY (CH), dark brown, stiff, moist, some fine-grained sand.	12		99	25.1
10	3							
	4			(grades hard)				
		25-2			33			
15	5							
	6	25-3		SILTY CLAY (CL), dark olive brown, very stiff, moist, some fine-grained sand.	21			
20				Bottom of boring at approximately 20 feet. Groundwater not encountered during drilling.				
	7							
25								
	8							
	9							
30								
	10							
35	11							
	12							
40								

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ENGEO INCORPORATED
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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-25

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01

CHECKED BY: SF

FIGURE NO. A-25

DATE OF BORING: December 19, 2002

SURFACE ELEVATION: Approx. 486 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), dark brown, with fine-grained sand. (FILL)				
	1							
5								
	2							
10	3							
				SILTY CLAY (CH), dark brown, with some fine sand, organic odor.				
	4							
15								
	5							
	6							
20				SILTY CLAY (CL), grayish brown, stiff, with fine-grained sand.				
	7							
25								
	8	26-1			7			
	9							
30								
		26-2			7			
	10							
35								
	11	26-3		SILTY CLAY (CL), grayish brown, saturated, medium stiff, fine to medium sand.	7			
	12							
40								

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1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-26

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-26

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 19, 2002

SURFACE ELEVATION: Approx. 486 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40								
		26-4		SILTY SAND (SM), brown, saturated, medium dense, fine to medium sand.	17			
	13			Percent Passing No. 200 Sieve = 24				
45								
	14	26-5		SILTY CLAY (CL), olive gray with rust mottling, stiff, with fine-grained sand.	6			
	15							
50								
		26-6		(grades very stiff)	11			
	16							
55								
	17							
	18							
60								
		26-7		SAND (SM), olive brown, fine to medium-grained sand, with clay, some silt.	20			
	19							
65								
	20							
				SANDSTONE: brown, friable, deeply weathered.				
	21							
70								
		26-8			75			
	22			Bottom of boring at approximately 71 feet. Groundwater not encountered during drilling.				
75								
	23							
	24							
80								

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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-26

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SI

FIGURE NO. A-26

0541 2581112001 SANRAMONVALLEYCENTER.GPJ 1/30/03

DATE OF BORING: December 19, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, moist, with fine-grained sand. (FILL)				
5	1							
10	2							
15	3							
	4			SILTY CLAY (CH), dark brown, very stiff to hard, some fine-grained sand.				
	5							
20	6			SILTY CLAY (CL), dark olive brown, stiff, moist, with fine-grained sand.				
		27-1			14			
	7							
25				SANDY CLAY (CL), brown, stiff, moist, fine- to medium-grained sand, some silt.				
	8	27-2			10			
	9							
30		27-3			9			
	10							
35								
	11	27-4			9			
40	12							

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ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-27

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-27

DATE OF BORING: December 19, 2002

SURFACE ELEVATION: Approx. 487 feet (148 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40								
		27-5		SILTY CLAY (CL), olive gray with rust inclusions, very stiff, moist, some fine-grained sand.	11			
	13							
45								
	14	27-6			13			
	15							
50								
	16							
55								
	17			SILTSTONE, olive, friable, deeply weathered.				
		27-7			78			
				Bottom of boring at approximately 56 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
	18							
60								
	19							
65								
	20							
	21							
70								
	22							
75	23							
	24							
80								

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ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-27

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-27

DATE OF BORING: December 23, 2002

SURFACE ELEVATION: Approx. 488 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				CLAYEY SAND (SC), grayish brown to yellow brown with mottling, very stiff, moist. (FILL)				
	1	28-1-2 28-1-1			27	1.25*		
5				SILTY SAND (SM), light yellow, medium dense, fine to medium grained. (FILL) (2 inch-thick clay layer at 6 feet)				
	2	28-2-2 28-2-1			26			
10	3							
		28-3-1			20			16.6
	4			SILTY CLAY (CH), dark brown, hard, moist, some fine-grained sand.				
15		28-4-2						
	5	28-4-1			33	+4.5*		
				Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
	7							
25								
	8							
30	9							
	10							
35								
	11							
	12							
40								

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ENGEO INCORPORATED
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SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-28

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SI

FIGURE NO. A-28

DATE OF BORING: December 23, 2002

SURFACE ELEVATION: Approx. 489 feet (149 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0		29-1-2		SILTY CLAY (CL), dark brown, stiff, moist. (FILL)				
		29-1-1			22	1.75*		
	1			SILTY SAND (SM), yellow brown, moist, medium dense, trace fine gravel. (FILL)				
5		29-2-1			32			
	2							
		29-3-1			39			
10	3							
	4							
		29-4-1			45			
15				SILTY CLAY (CH), dark brown, stiff, moist.				
	5							
	6							
20		29-5-1			25	3.75		
	7			Bottom of boring at approximately 21 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
25								
	8							
	9							
30								
	10							
35								
	11							
	12							
40								

0541 2581112001_SANRAMONVALLEYCENTER.GPJ 1/30/03

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

SAN RAMON VALLEY CENTER

SAN RAMON, CALIFORNIA

BORING NO.: B-29

LOGGED BY: E. Forcier

PROJ. NO.: 2581.1.120.01 CHECKED BY SF

FIGURE NO. A-29

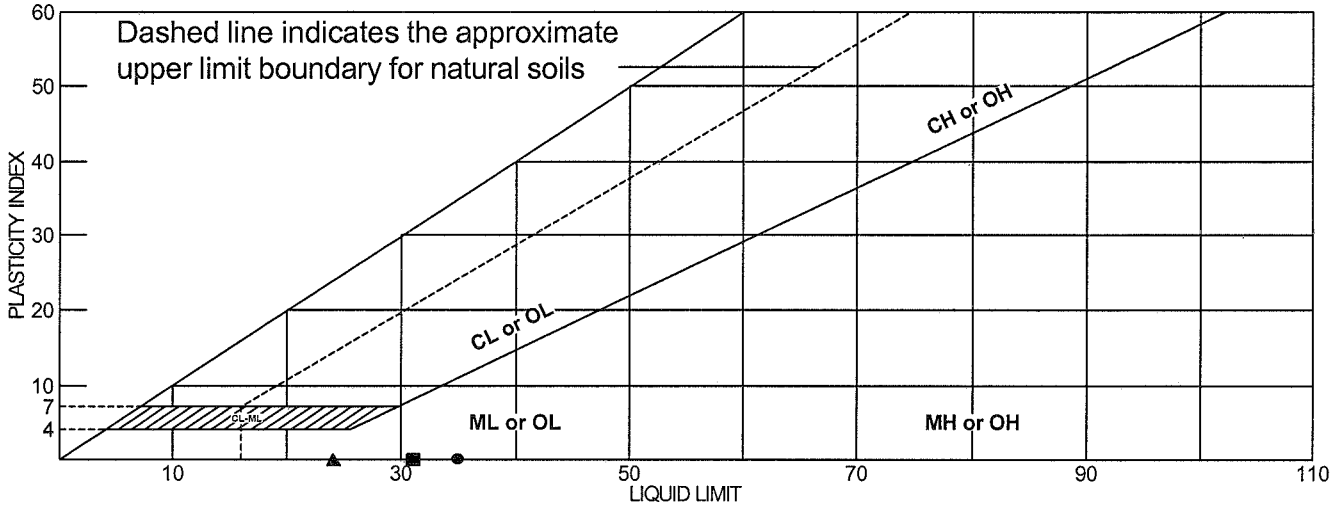
APPENDIX B

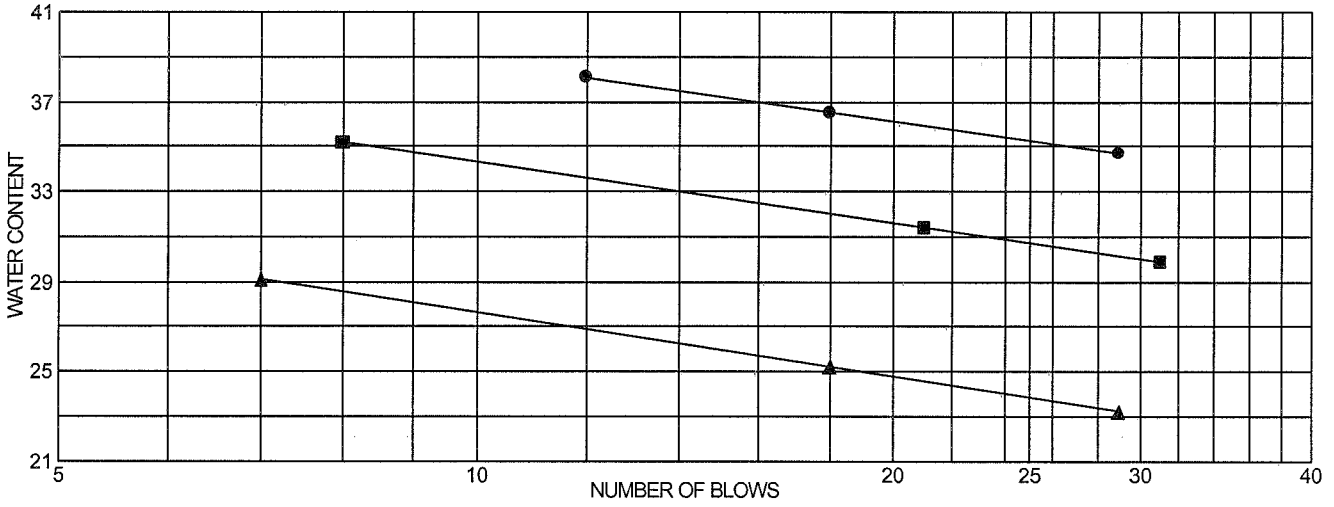
ENGEO INCORPORATED
ENTECH ANALYTICAL LABS, INC
GREGG

Laboratory Test Results

2581.1.120.01
August 21, 2003

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light olive brown silty Clay with very fine sand	35		NP			
■	Light olive brown silty Clay with very fine sand	31		NP			
▲	Light olive brown sandy silty Clay	24		NP			

Project No. 2581.1.120.01 **Client:** 2581

Project: San Ramon Valley Center

● **Source:** PI **Sample No.:** 19A-1 **Elev./Depth:** 45.5-46.5 ft.

■ **Source:** PI **Sample No.:** 19A-3 **Elev./Depth:** 55.5-56.5 ft.

▲ **Source:** PI **Sample No.:** 19A-4 **Elev./Depth:** 60.5-61.5 ft.

Remarks:

●

■

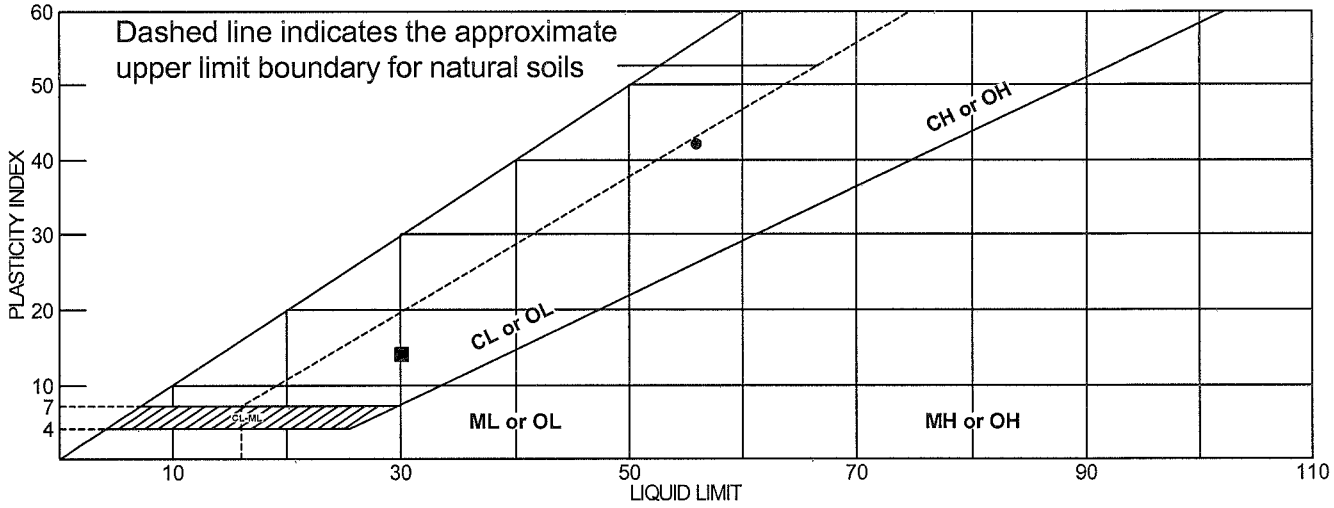
▲

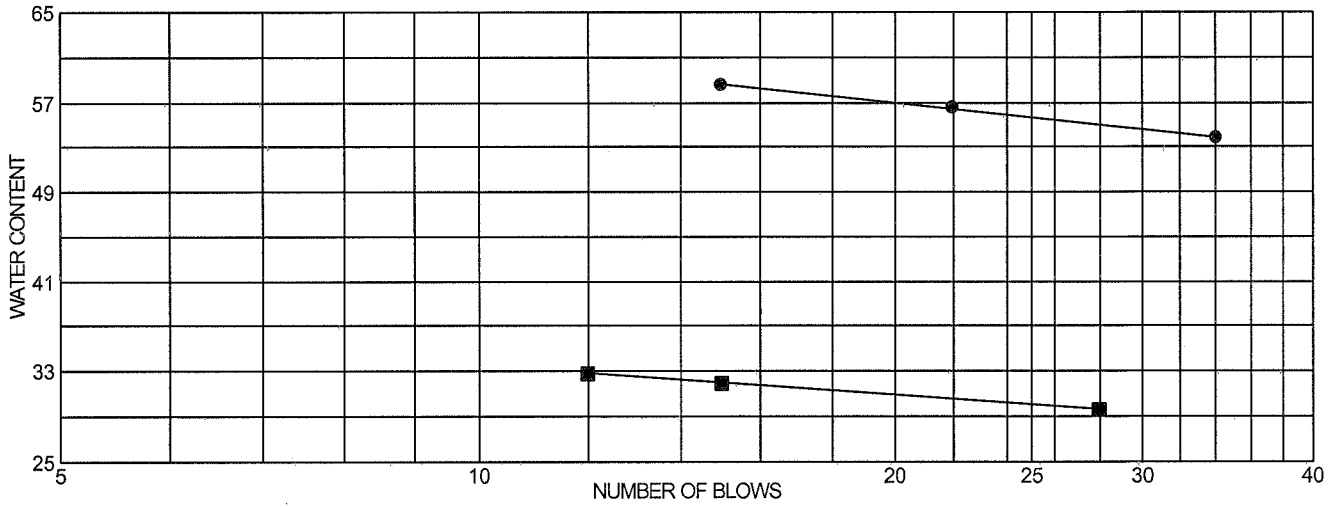
ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark grayish brown Clay with very fine sand	56	14	42			CH
■	Dark grayish brown silty Clay with very fine sand	30	16	14			CL

Project No. 2581.1.120.01 **Client:** 2581

Project: San Ramon Valley Center

● **Source:** PI **Sample No.:** 4-2-2

■ **Source:** PI **Sample No.:** 12-1Z **Elev./Depth:** 4.5 ft.

Remarks:

●

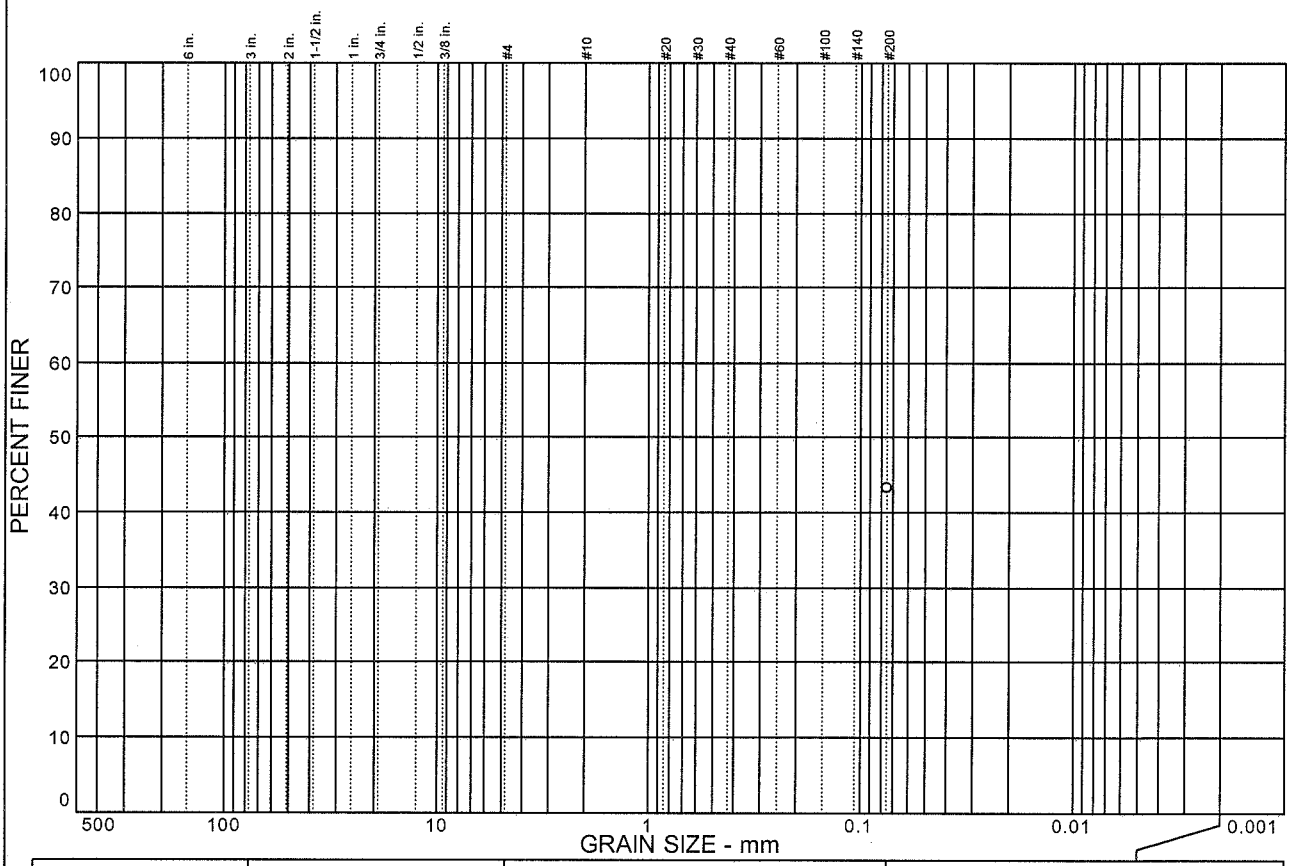
■

ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Plate

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						43.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	43.3		

* (no specification provided)

Soil Description

Light olive brown sandy silty Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

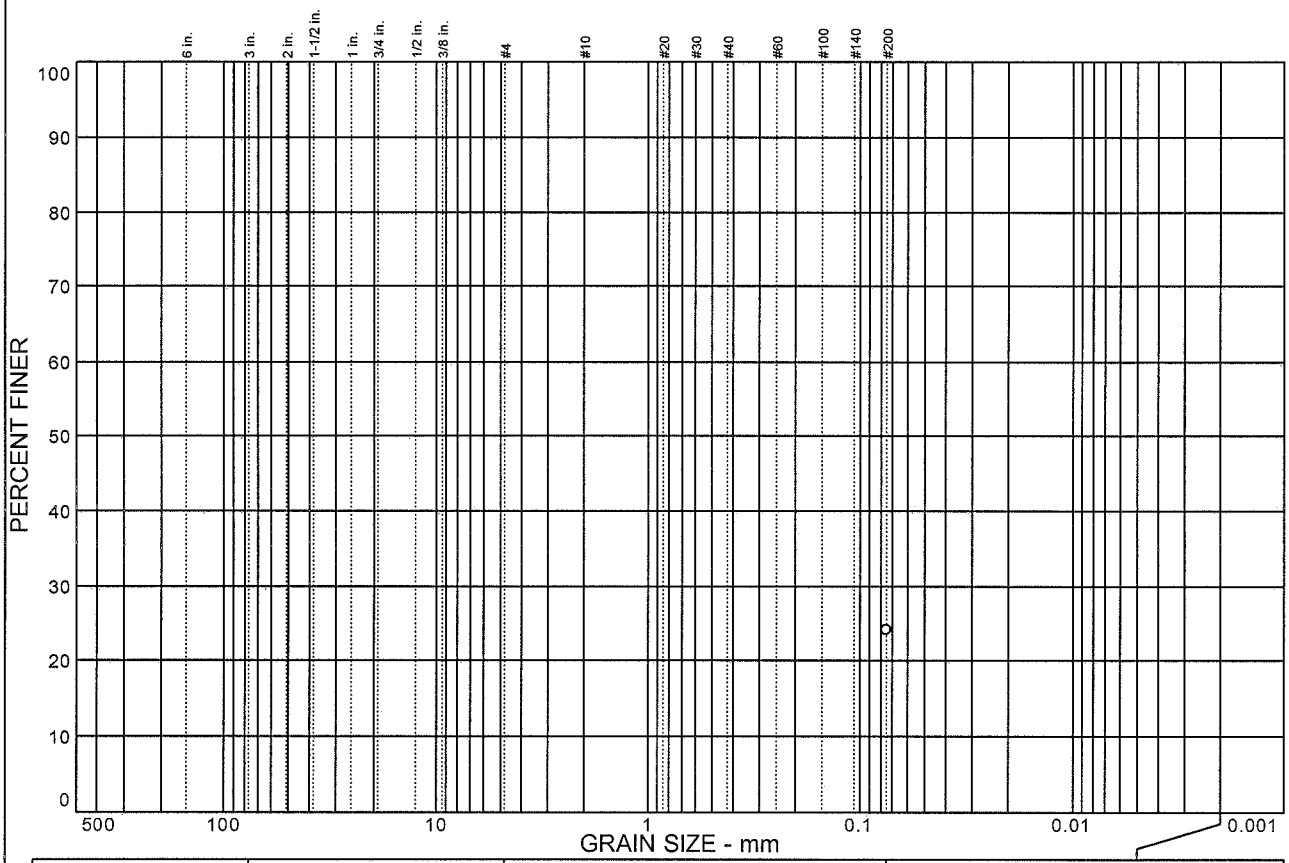
Remarks

Sample No.: 3-1-1 **Source of Sample:** %200 **Date:** 01/21/03
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						24.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	24.1		

* (no specification provided)

Soil Description

Olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

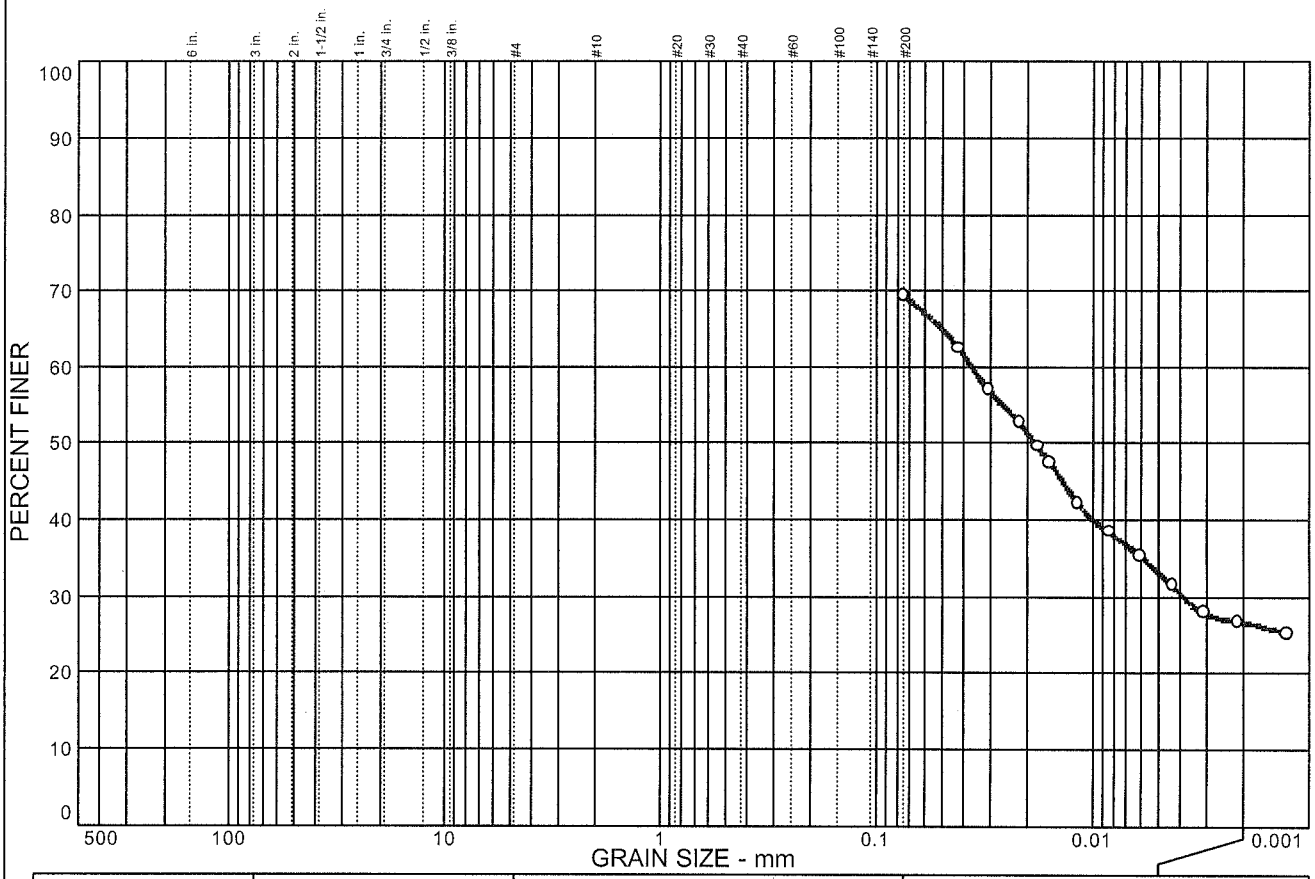
Remarks

Sample No.: 26-4 **Source of Sample:** %200 **Date:** 01/20/03
Location: **Elev./Depth:** 40.5-41.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						42.7	26.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	69.4		

* (no specification provided)

Soil Description

Light olive brown silt with fine sand and clay

Atterberg Limits

PL= N/A LL= 35 PI= N/A

Coefficients

D_{85}= D_{60}= 0.0363 D_{50}= 0.0185
D_{30}= 0.0038 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

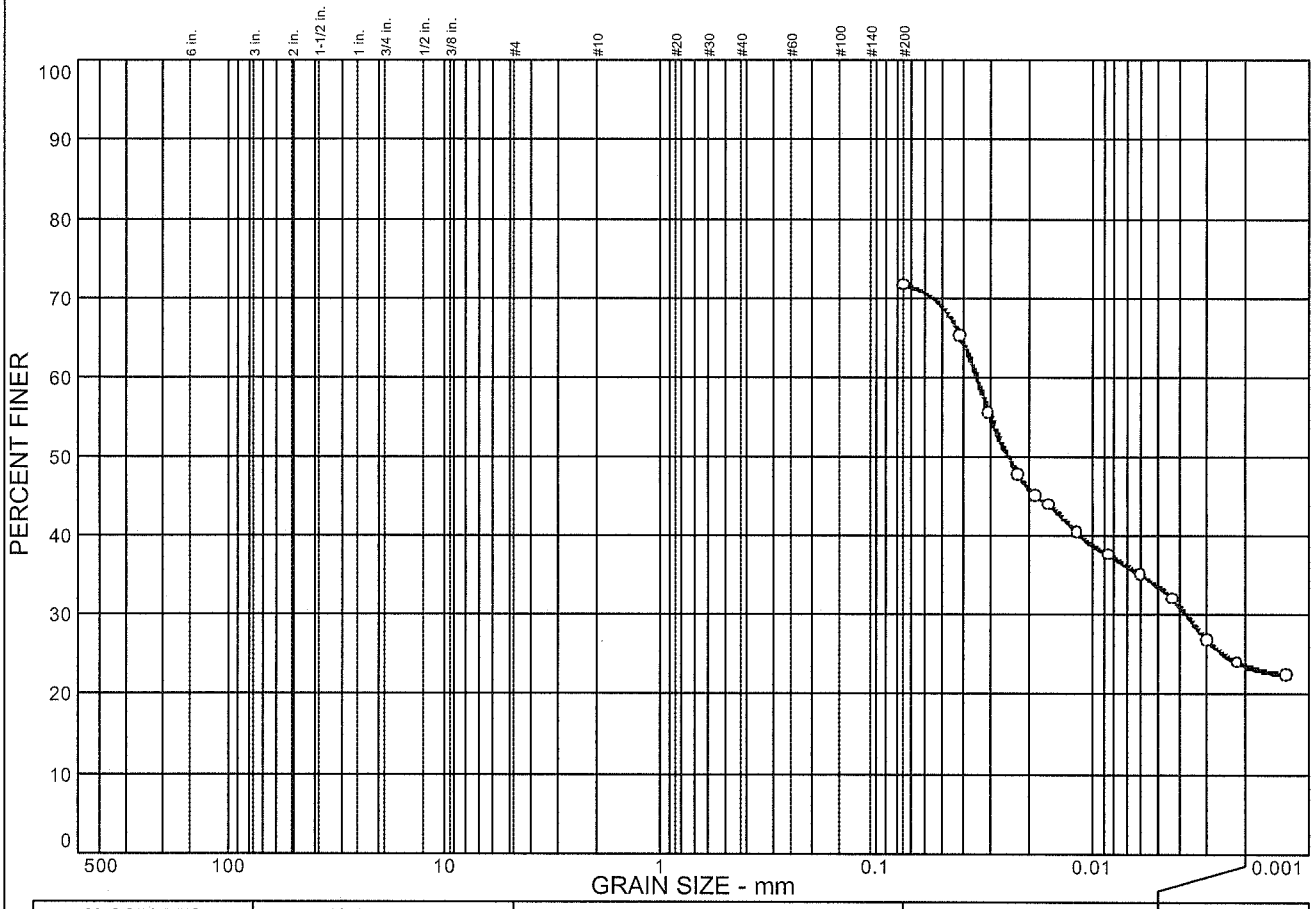
Remarks

Sample No.: 19A-1 **Source of Sample:** Hydro **Date:** 01/21/03
Location: **Elev./Depth:** 45.5-46.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			48.0	23.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	71.6		

* (no specification provided)

Soil Description

Light olive brown silty with very fine sand and clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= 0.0350 D_{50}= 0.0249
D_{30}= 0.0037 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

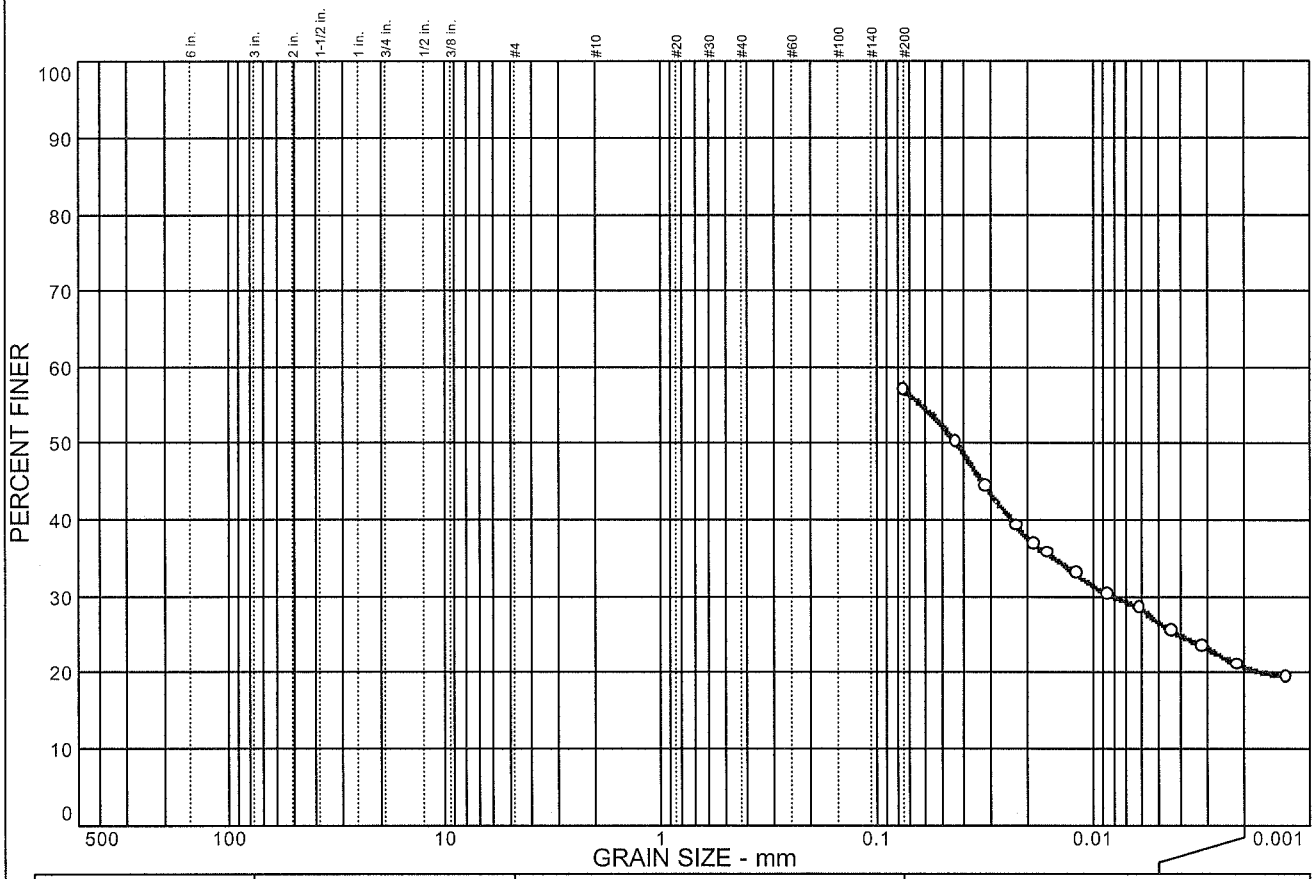
Remarks

Sample No.: 19A-2 **Source of Sample:** Hydro **Date:** 01/21/03
Location: **Elev./Depth:** 50.5-51.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						36.3	20.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	57.0		

* (no specification provided)

Soil Description

Light olive brown silty sand

Atterberg Limits

PL= N/A LL= 31 PI= N/A

Coefficients

D_{85}= D_{60}= D_{50}= 0.0426
D_{30}= 0.0081 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

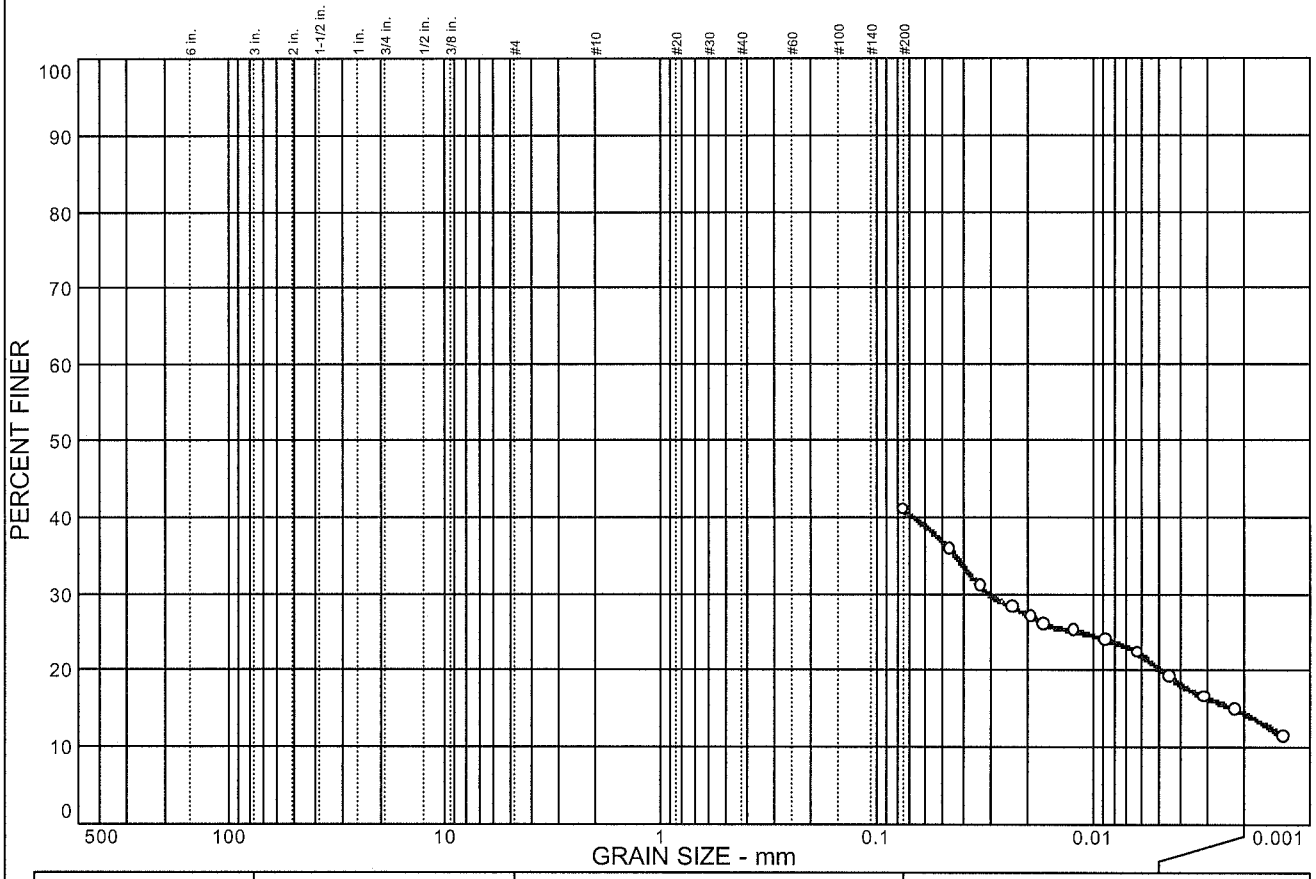
Remarks

Sample No.: 19A-3 **Source of Sample:** Hydro **Date:** 01/21/03
Location: **Elev./Depth:** 55.5-56.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						26.6	14.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	41.0		

* (no specification provided)

Soil Description

Light olive brown silty Sand.

Atterberg Limits

PL= N/A LL= 24 PI= N/A

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= 0.0301 D_{15}= 0.0022 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

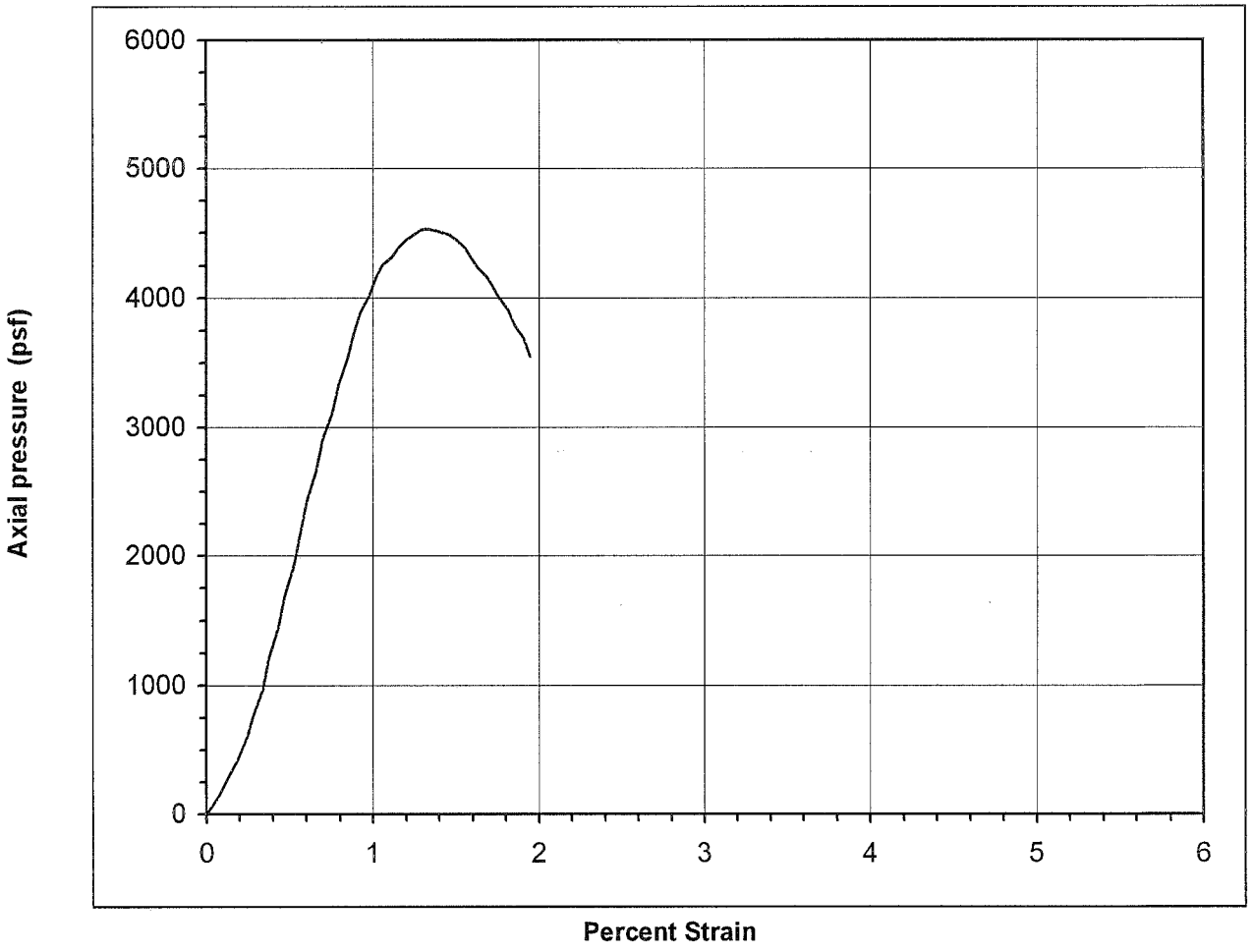
Remarks

Sample No.: 19A-4 **Source of Sample:** Hydro **Date:** 01/21/03
Location: **Elev./Depth:** 60.5-61.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client: 2581
Project: San Ramon Valley Center
Project No: 2581.1.120.01

Unconfined Compression Test
ASTM Test Method D2166



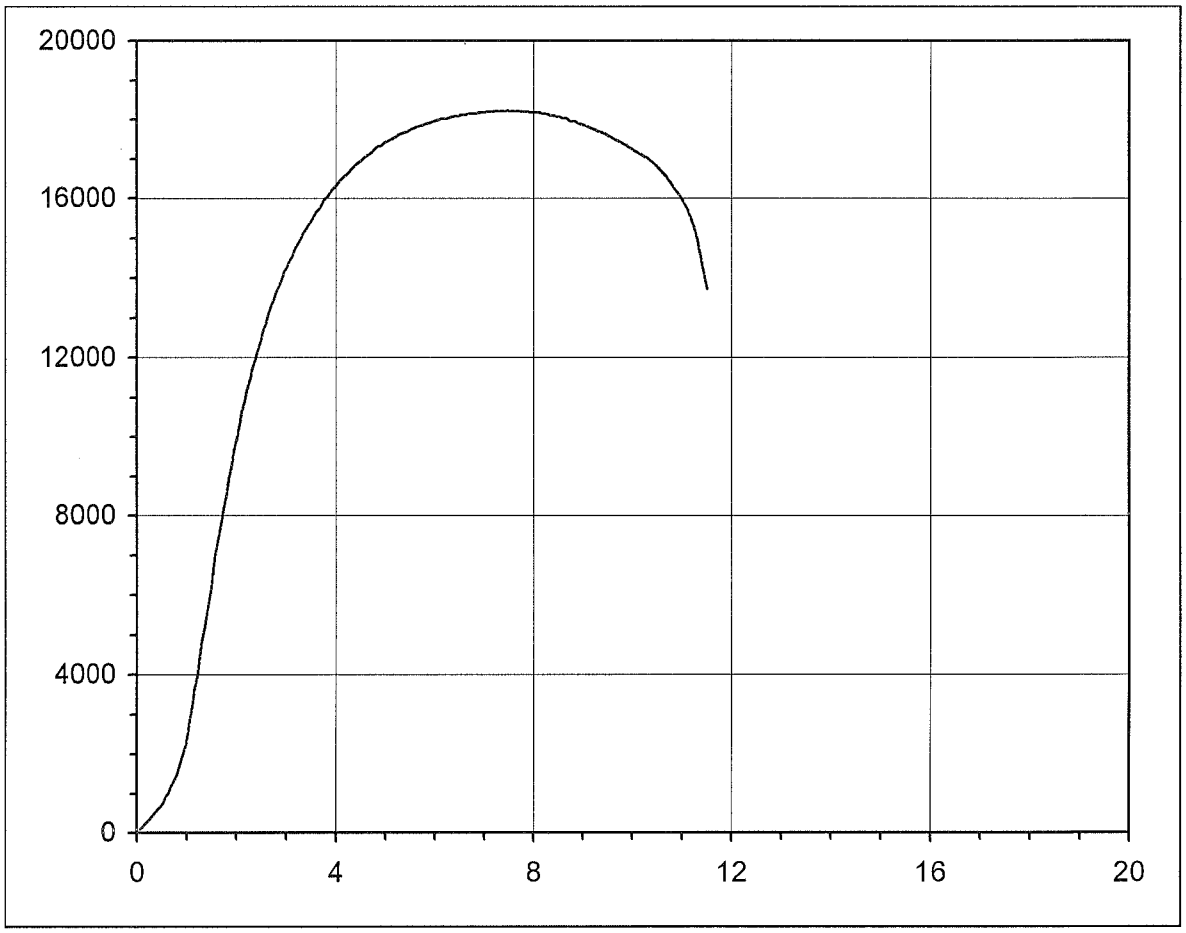
Unconfined Compressive Strength: 4520 psf 2.3 tsf

Sample Description: Light olive brown silty Clay with fine sand

Initial Diameter:	2.420	in.	Sample Number:	1-1-1	
Initial Height:	5.49	in.	Dry Unit Weight:	104.5	pcf
Strain Rate:	1.418	%/min	Moisture Content:	20.1	%
Total Strain:	1.95	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 1-1-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



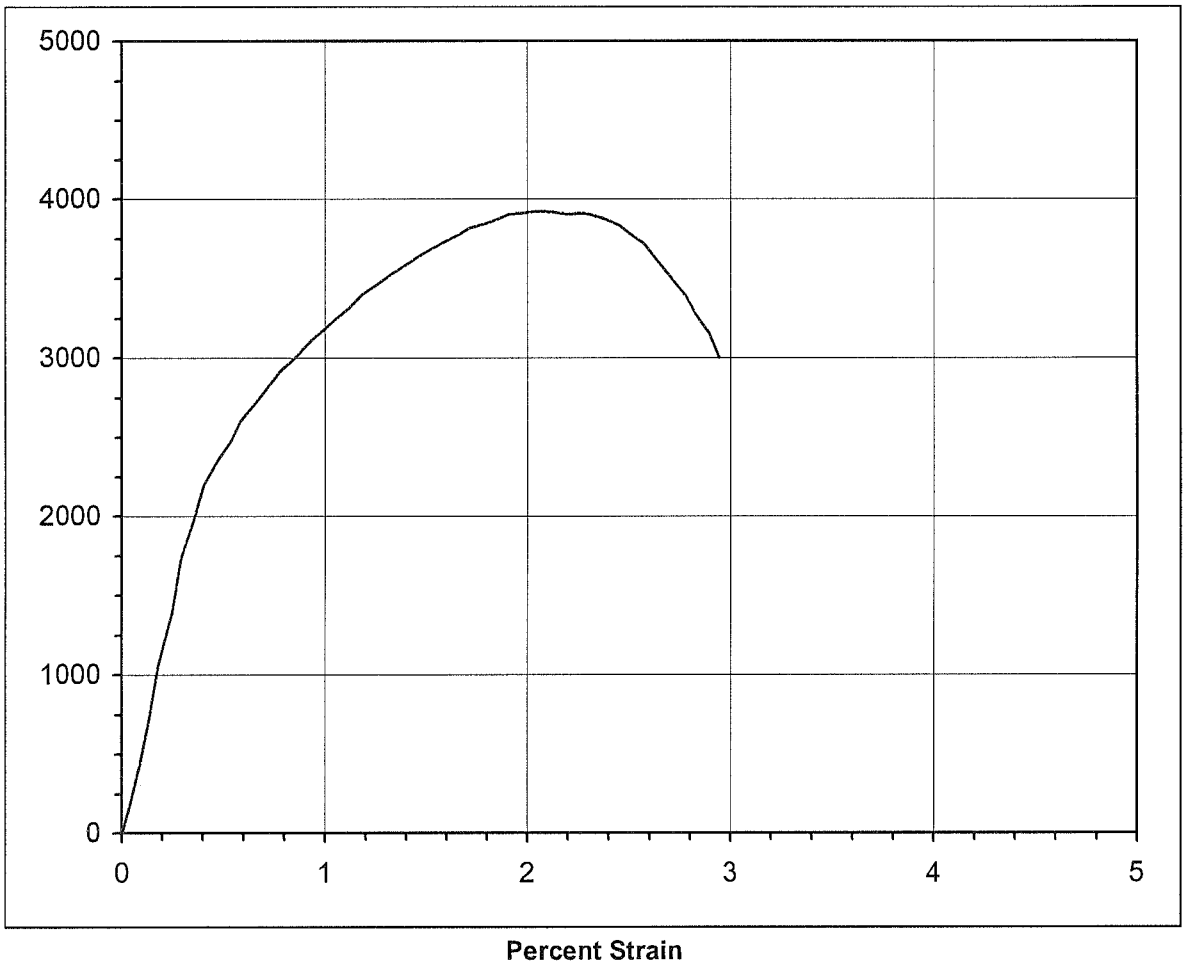
Unconfined Compressive Strength: 18180 psf 9.1 tsf

Sample Description: Very dark grayish brown Clay with fine sand

Initial Diameter:	2.420	in.	Sample Number:	11-3	
Initial Height:	4.84	in.	Dry Unit Weight:	109.7	pcf
Strain Rate:	1.571	%/min	Moisture Content:	15.4	%
Total Strain:	11.51	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 11-3 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



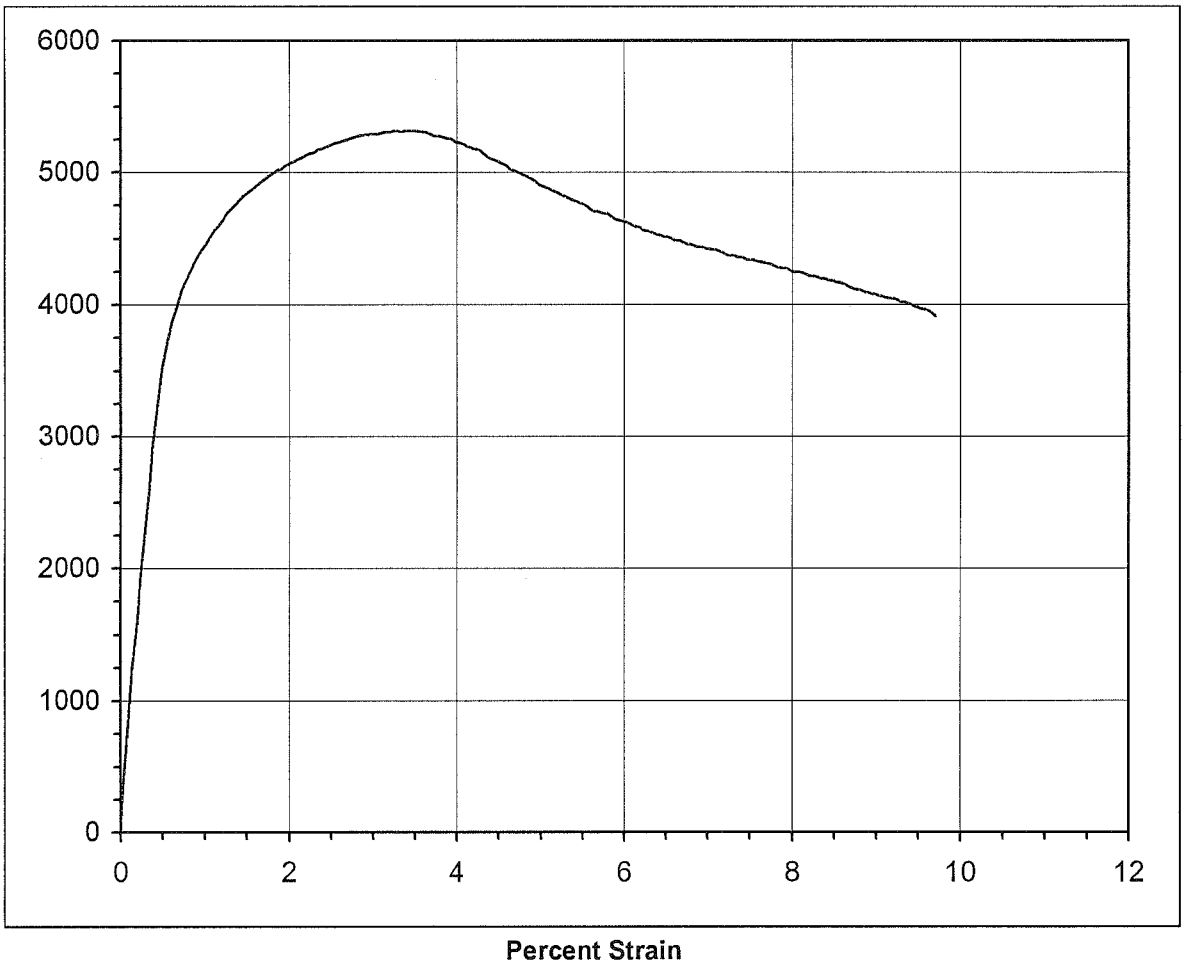
Unconfined Compressive Strength: 3910 psf 2.0 tsf

Sample Description: Light olive brown silty Clay with sand

Initial Diameter:	2.420	in.	Sample Number:	12-1	
Initial Height:	4.64	in.	Dry Unit Weight:	108.0	pcf
Strain Rate:	1.836	%/min	Moisture Content:	15.7	%
Total Strain:	2.95	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 12-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



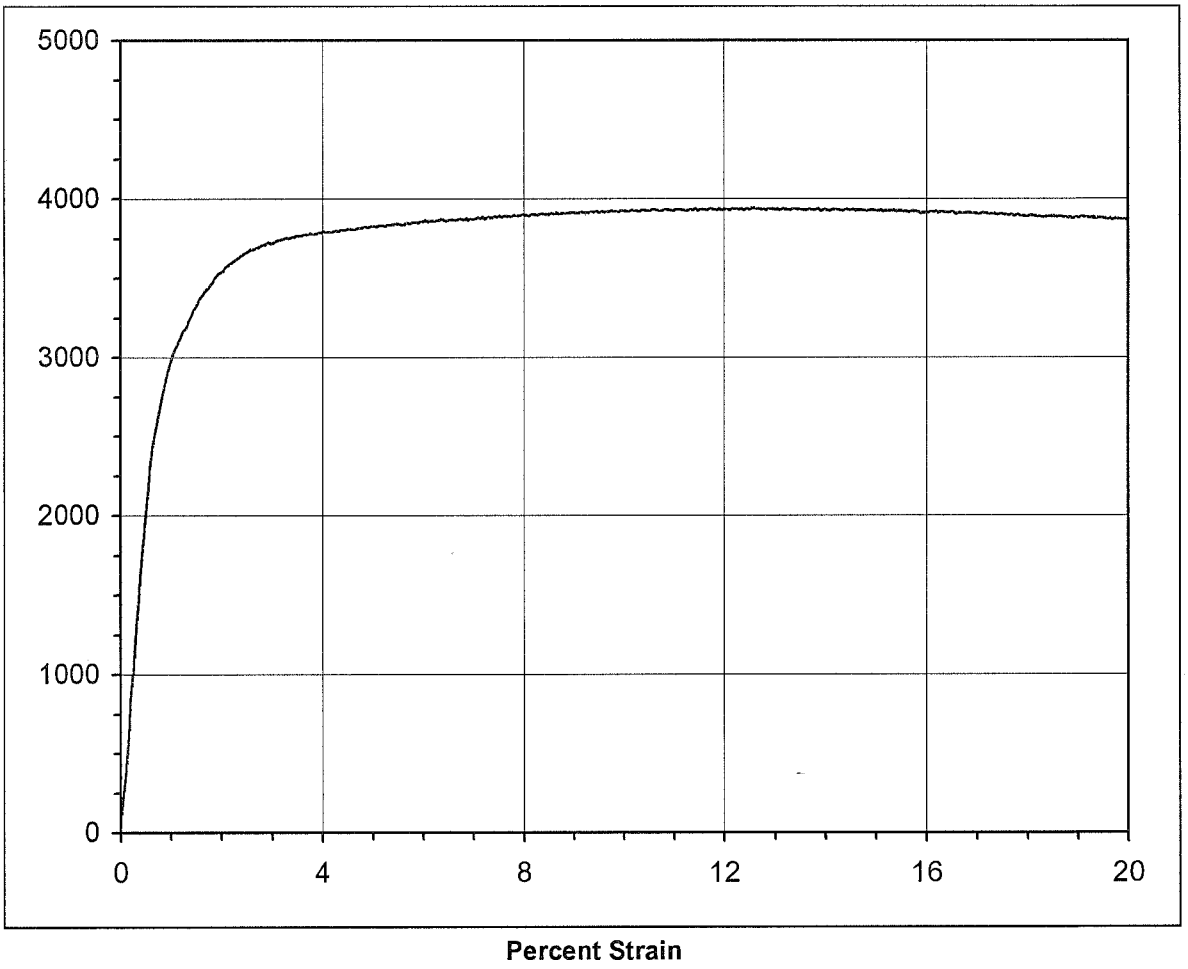
Unconfined Compressive Strength: 5310 psf 2.7 tsf

Sample Description: Very dark grayish brown Clay

Initial Diameter:	2.420	in.	Sample Number:	13-1	
Initial Height:	5.43	in.	Dry Unit Weight:	93.9	pcf
Strain Rate:	1.497	%/min	Moisture Content:	9.1	%
Total Strain:	9.70	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 13-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



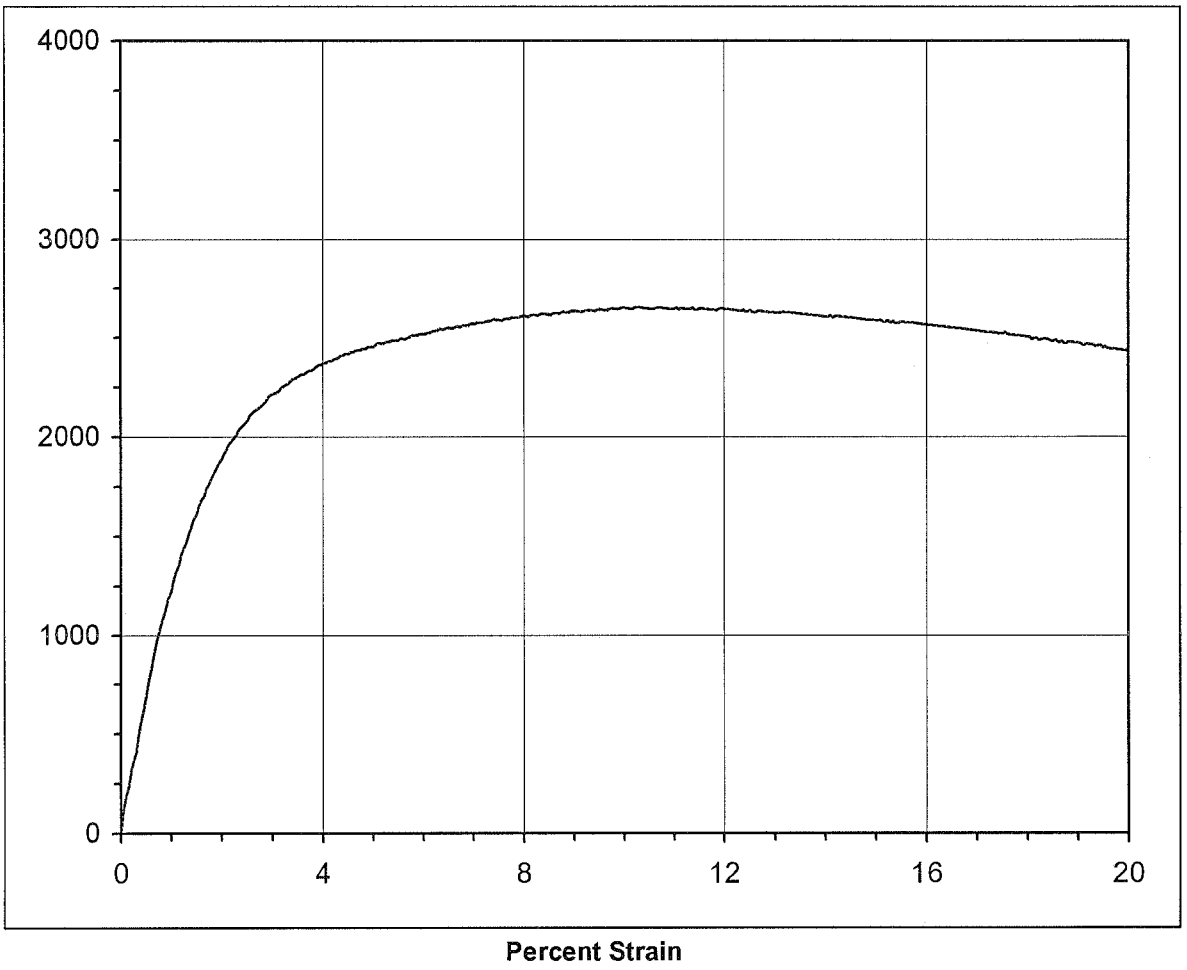
Unconfined Compressive Strength: 3930 psf 2.0 tsf

Sample Description: Very dark grayish brown Clay

Initial Diameter:	2.420	in.	Sample Number:	14-1	
Initial Height:	5.72	in.	Dry Unit Weight:	106.0	pcf
Strain Rate:	1.329	%/min	Moisture Content:	20.7	%
Total Strain:	20.04	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 14-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



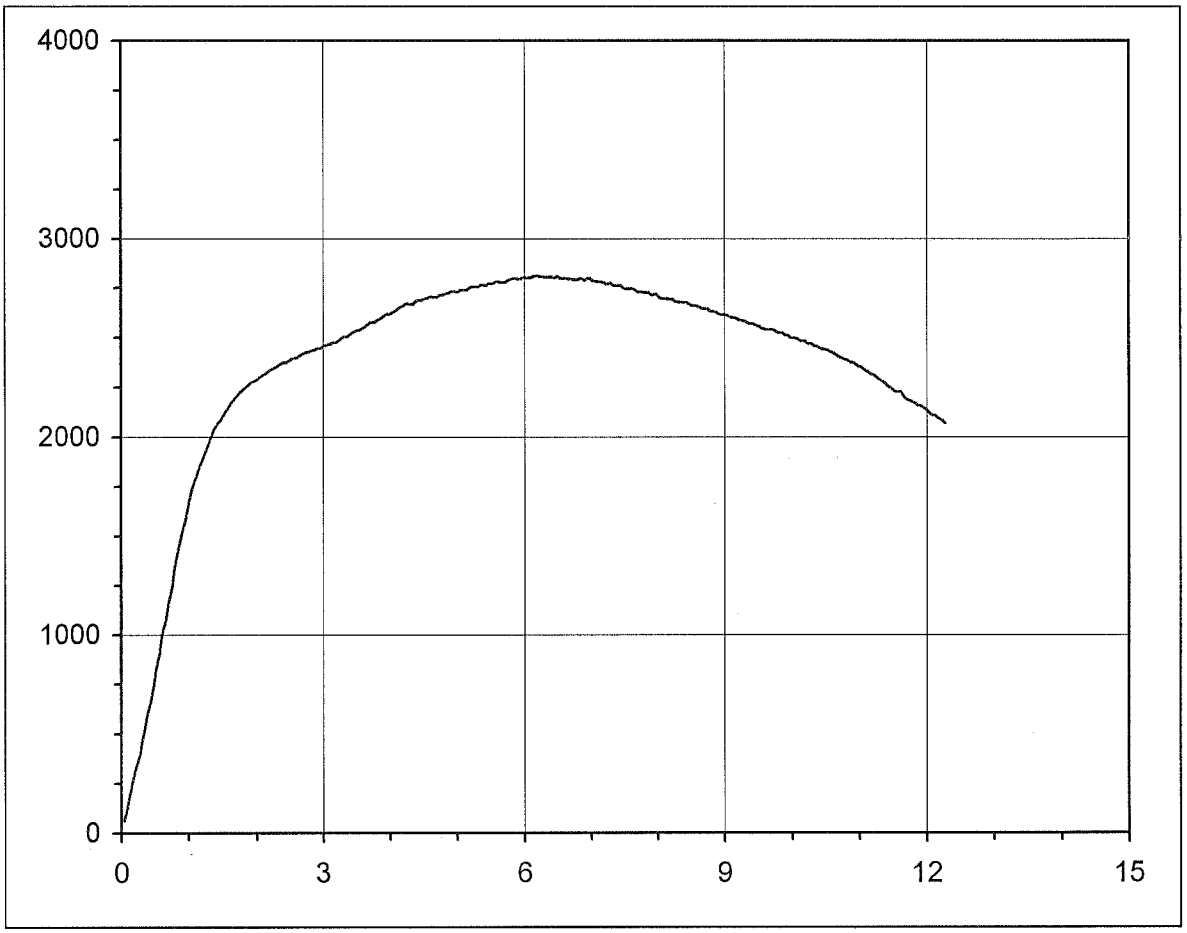
Unconfined Compressive Strength: 2650 psf 1.3 tsf

Sample Description: Grayish brown silty Clay to Clay with fine sand

Initial Diameter:	2.420	in.	Sample Number:	15-1	
Initial Height:	5.42	in.	Dry Unit Weight:	106.0	pcf
Strain Rate:	1.460	%/min	Moisture Content:	19.9	%
Total Strain:	20.00	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 15-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



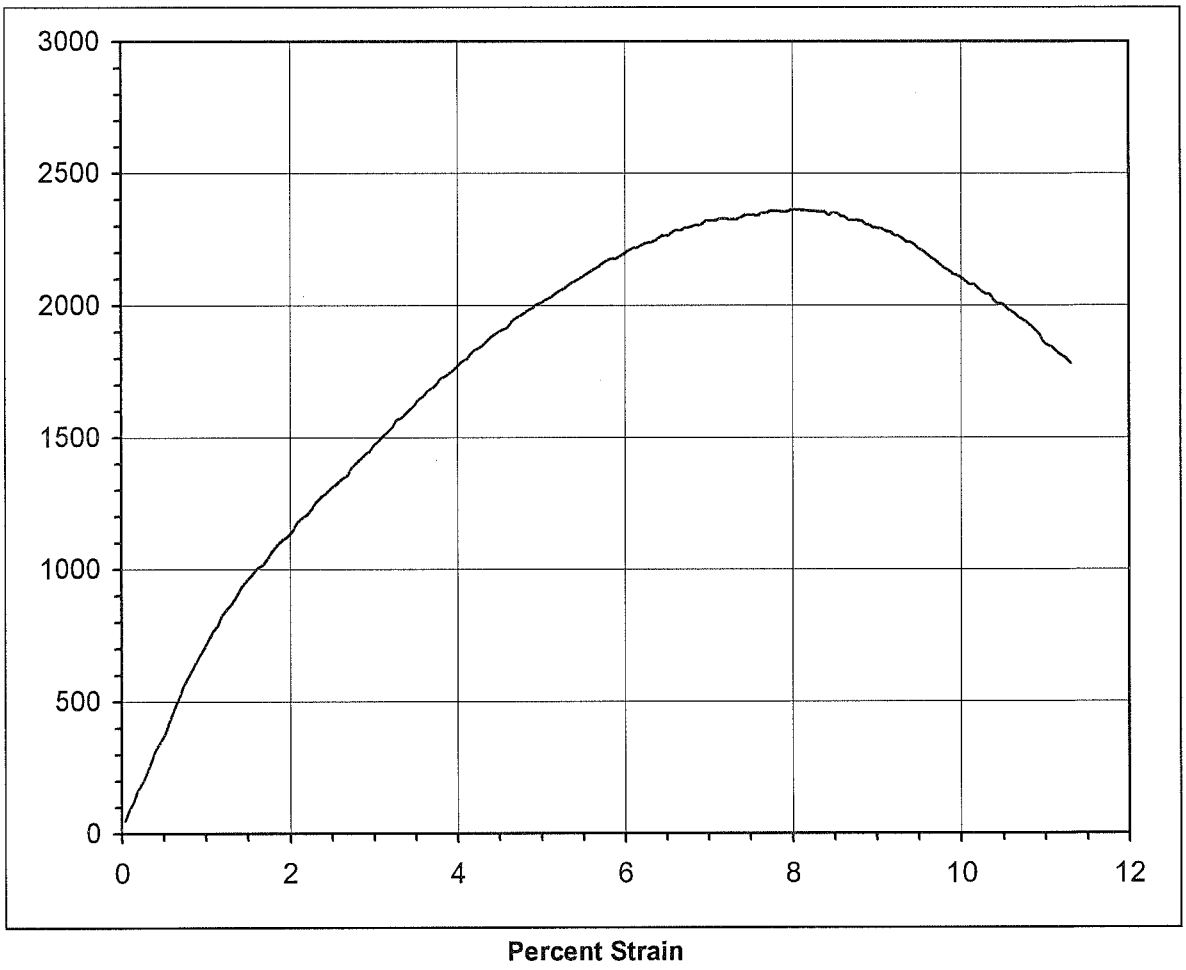
Unconfined Compressive Strength: 2800 psf 1.4 tsf

Sample Description: Light olive brown sandy silty Clay grading to very dark grayish brown Clay

Initial Diameter:	2.420	in.	Sample Number:	19-1-1	
Initial Height:	5.63	in.	Dry Unit Weight:	95.0	pcf
Strain Rate:	1.381	%/min	Moisture Content:	24.0	%
Total Strain:	12.26	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 19-1-1 Date: 1/15/2003	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



Unconfined Compressive Strength: 2360 psf 1.2 tsf

Sample Description: Light olive brown sandy silty Clay grading into Clay with sand

Initial Diameter:	2.420	in.	Sample Number:	19-8-1	
Initial Height:	4.95	in.	Dry Unit Weight:	101.0	pcf
Strain Rate:	1.608	%/min	Moisture Content:	24.6	%
Total Strain:	11.31	%	Depth of Sample:		ft.

ENGEO INCORPORATED	SAN RAMON VALLEY CENTER San Ramon , California	Job No.: 2581.1.120.01 Sample Number: 19-8-1 Date: 1/15/2003	Figure No.

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

January 24, 2003

Stefamos Papadopulos
Engeo, Inc.
2401 Crow Canyon Road, Suite 200
San Ramon, CA 94583

Order:	32940	**Date Collected:**	01/15/03
Project Name:	San Ramon Valley Central	**Date Received:**	01/17/03
Project Number:	2851112001	**P.O. Number:**	2851112001
Project Notes:			

On January 17, 2003, samples were received under documentented chain of custody. Results for the following analyses are attached:

Matrix	Test	Method
Solid	PDF	PDF
	Sulfate in Solids by IC	EPA 300.0M

Chemical analysis of these samples has been completed. Summaries of the data are contained on the following pages. USEPA protocols for sample storage and preservation were followed.

Entech Analytical Labs, Inc. is certified by the State of California (#2346). If you have any questions regarding procedures or results, please call me at 408-588-0200.

Sincerely,

Patti Sandrock
QA/QC Manager

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Engeo, Inc.
2401 Crow Canyon Road, Suite 200
San Ramon, CA 94583
Attn: Stefamos Papadopulos

Date: 1/24/03
Date Received: 01/17/03
Project Name: San Ramon Valley Central
Project Number: 2851112001
P.O. Number: 2851112001
Sampled By: Ramon Castillon

Certified Analytical Report

Order ID: 32940 **Lab Sample ID:** 32940-001 **Client Sample ID:** B-2
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	210	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-002 **Client Sample ID:** B-6
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	120	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-003 **Client Sample ID:** B-19
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	360	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-004 **Client Sample ID:** B-22
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	330	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-005 **Client Sample ID:** B-29
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	200	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

DF = Dilution Factor ND = Not Detected DLR = Detection Limit Reported PQL = Practical Quantitation Limit

Analysis performed by Entech Analytical Labs, Inc. (CA ELAP #2346)

Patti Sandrock, QA/QC Manager

Environmental Analysis Since 1983

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Engeo, Inc.
2401 Crow Canyon Road, Suite 200
San Ramon, CA 94583
Attn: Stefamos Papadopulos

Date: 1/24/03
Date Received: 01/17/03
Project Name: San Ramon Valley Central
Project Number: 2851112001
P.O. Number: 2851112001
Sampled By: Ramon Castillon

Certified Analytical Report

Order ID: 32940 **Lab Sample ID:** 32940-006 **Client Sample ID:** B-17
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	86	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-007 **Client Sample ID:** B-26
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	350	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-008 **Client Sample ID:** B-14
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	600	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-009 **Client Sample ID:** B-12
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	360	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

Order ID: 32940 **Lab Sample ID:** 32940-010 **Client Sample ID:** B-9
Sample Time: 10:00 AM **Sample Date:** 01/15/03 **Matrix:** Solid

Parameter	Result	DF	PQL	DLR	Units	Analysis Date	QC Batch ID	Method
Sulfate	250	1	5	5	mg/Kg	01/21/03	SIC030121	EPA 300.0M

DF = Dilution Factor ND = Not Detected DLR = Detection Limit Reported PQL = Practical Quantitation Limit

Analysis performed by Entech Analytical Labs, Inc. (CA ELAP #2346)

Patti Sandrock, QA/QC Manager

Environmental Analysis Since 1983

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Quality Control Results Summary

QC Batch #: SIC030121 **Units:** mg/Kg

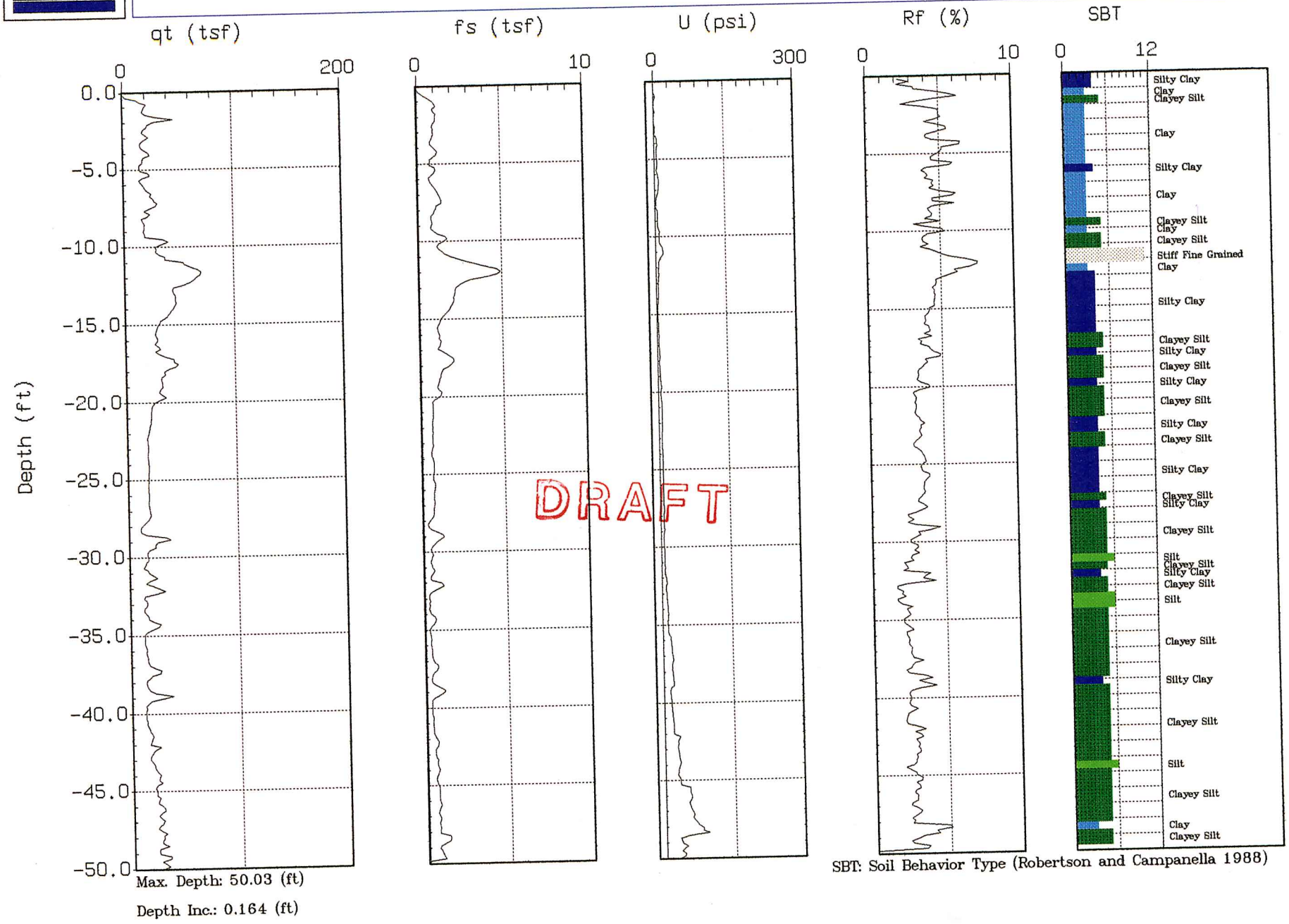
Matrix: Solid **Date Analyzed:** 01/21/03

Parameter	Method	Blank Result	Spike Sample ID	Spike Amount	Sample Result	Spike Result	QC Type	% Recovery	RPD	RPD Limits	Recovery Limits
Test: Sulfate											
Sulfate	EPA 300.0M	ND		15		14.393	LCS	96.0			80.0 - 120.0
Test: Sulfate											
Sulfate	EPA 300.0M	ND		15		14.266	LCSD	95.1	0.89	30.00	80.0 - 120.0

GREGG

ENGEO

Site : SAN RAMON SANRAMON Geologist : STEFANOS
Location : CPT-01 Date : 12:03:02 08:52



Max. Depth: 50.03 (ft)

Depth Inc.: 0.164 (ft)

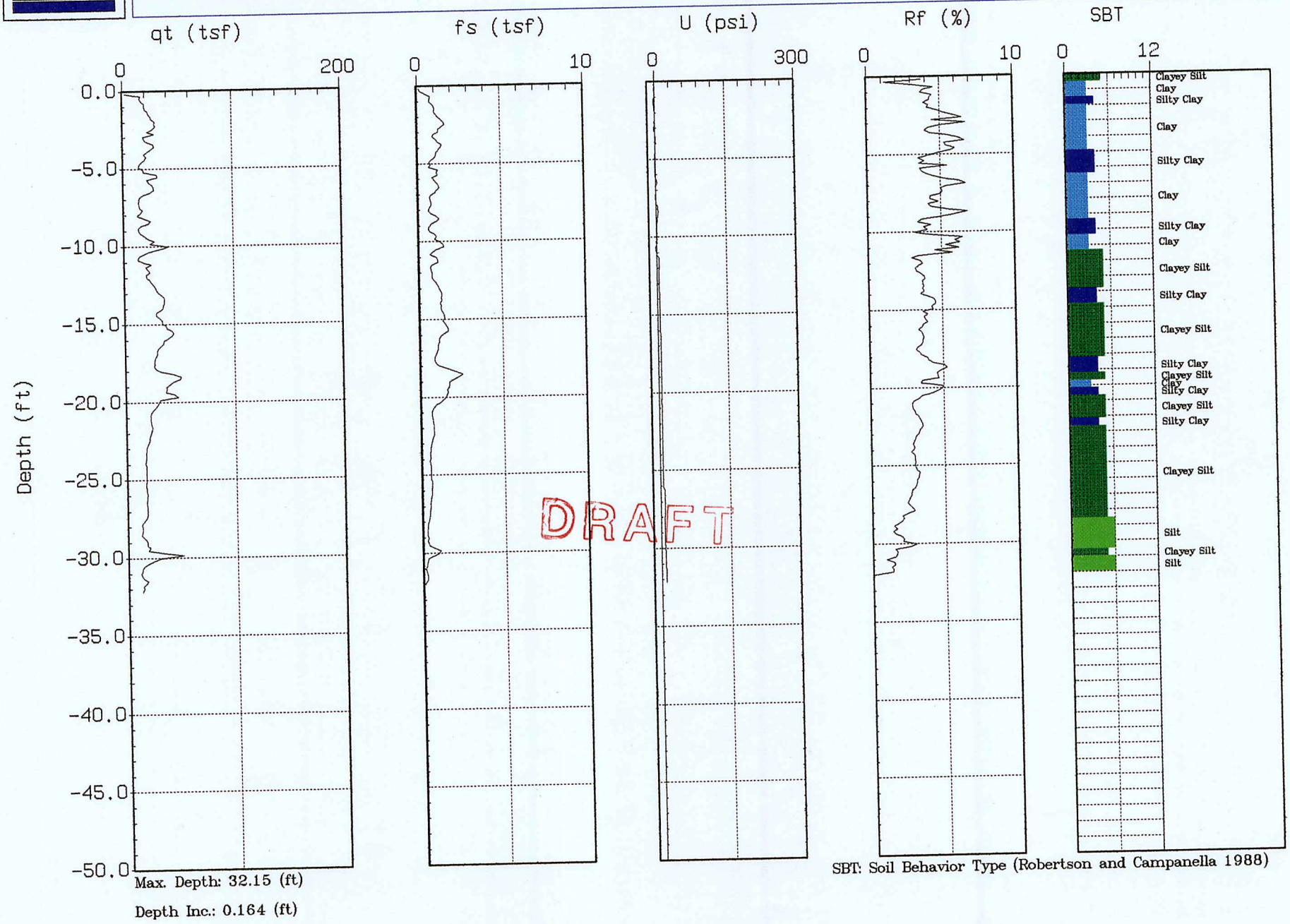
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-02

Geologist : STEFANOS
Date : 12:03:02 09:50



Max. Depth: 32.15 (ft)

Depth Inc.: 0.164 (ft)

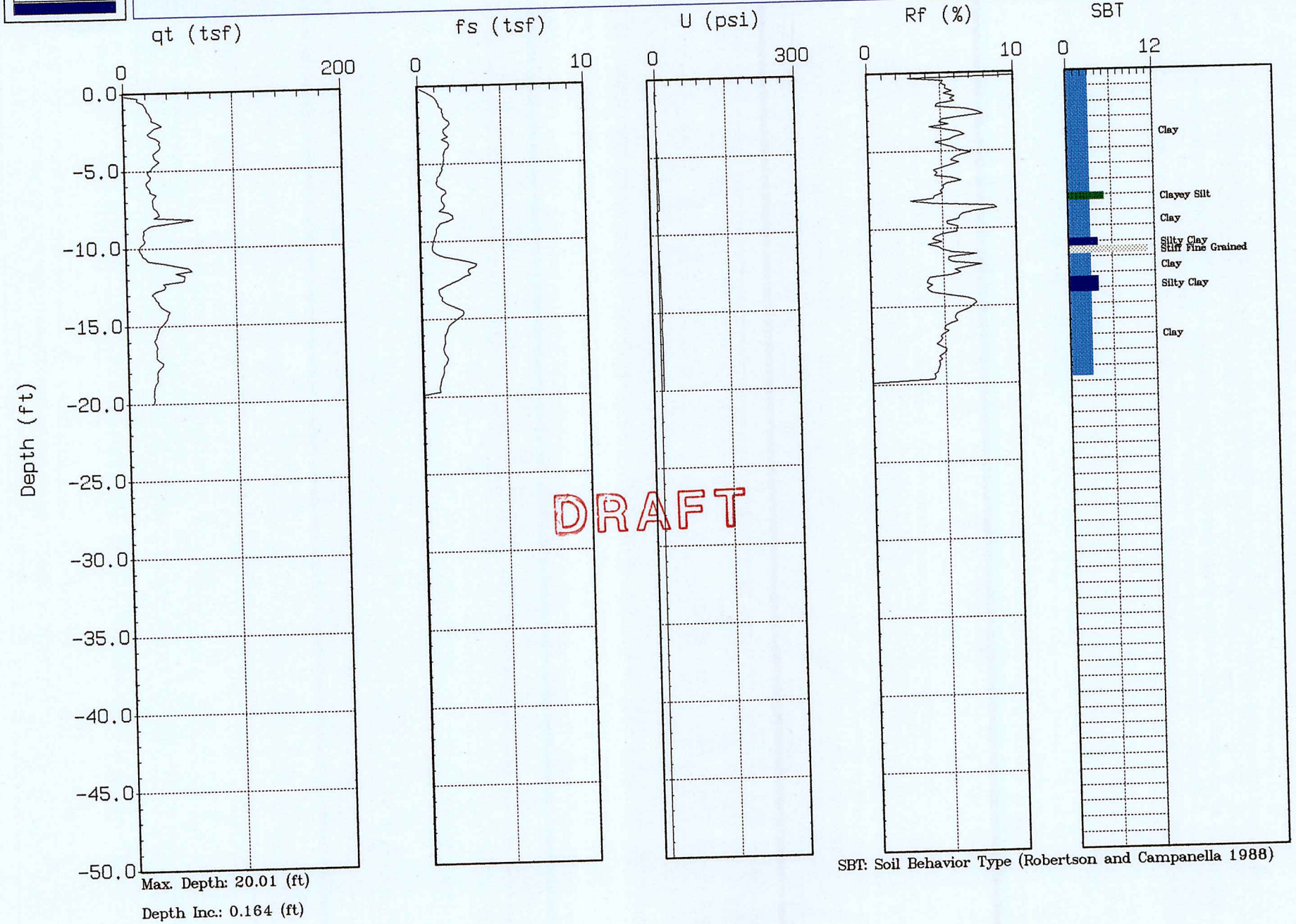
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-03

Geologist : STEFANOS
Date : 12:03:02 10:13



Max. Depth: 20.01 (ft)

Depth Inc.: 0.164 (ft)

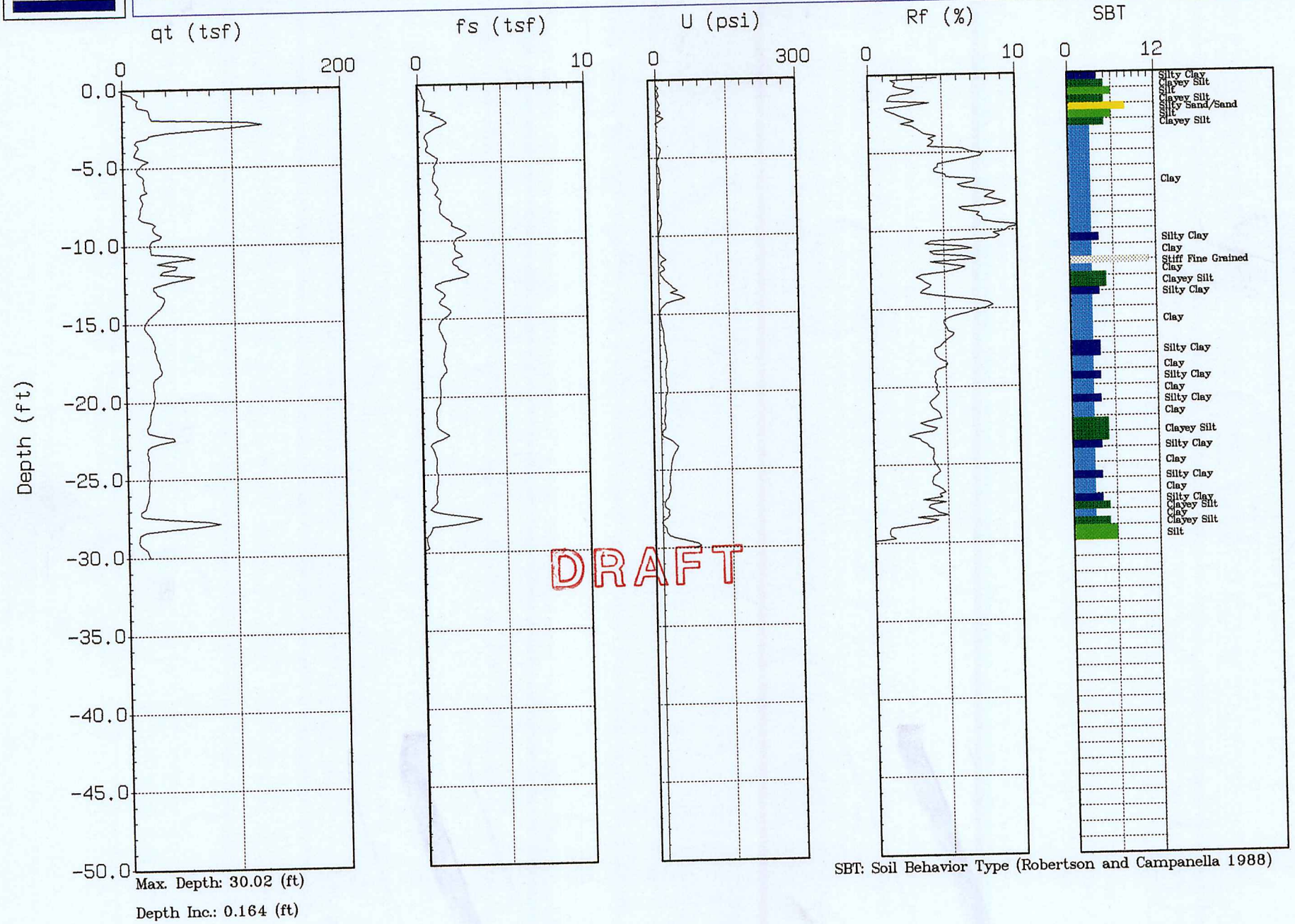
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-04

Geologist : 20 Ton St 046
Date : 12:03:02 10:49



Max. Depth: 30.02 (ft)

Depth Inc.: 0.164 (ft)

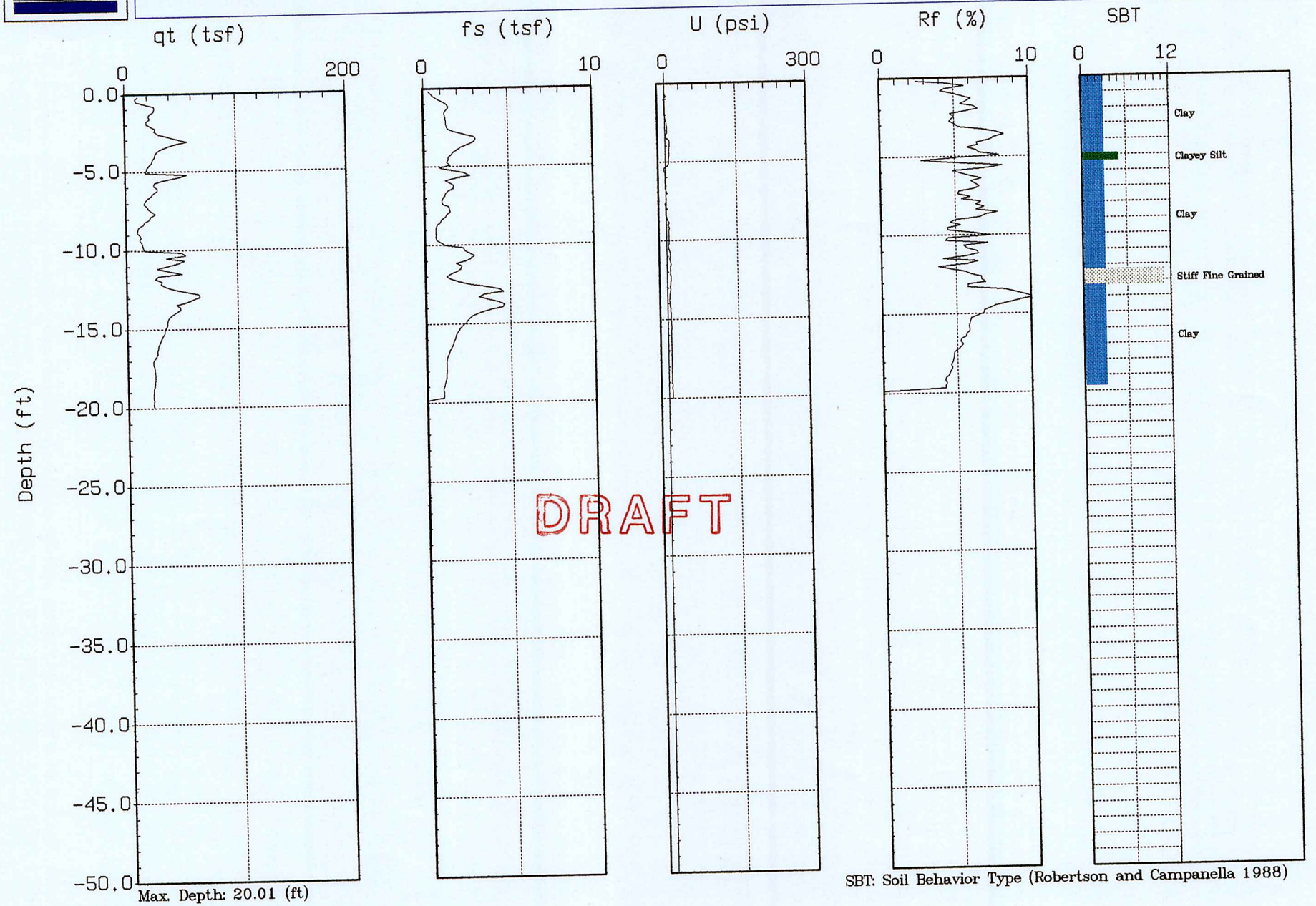
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-05

Geologist : STEFANOS
Date : 12:03:02 11:10



Max. Depth: 20.01 (ft)

Depth Inc.: 0.164 (ft)

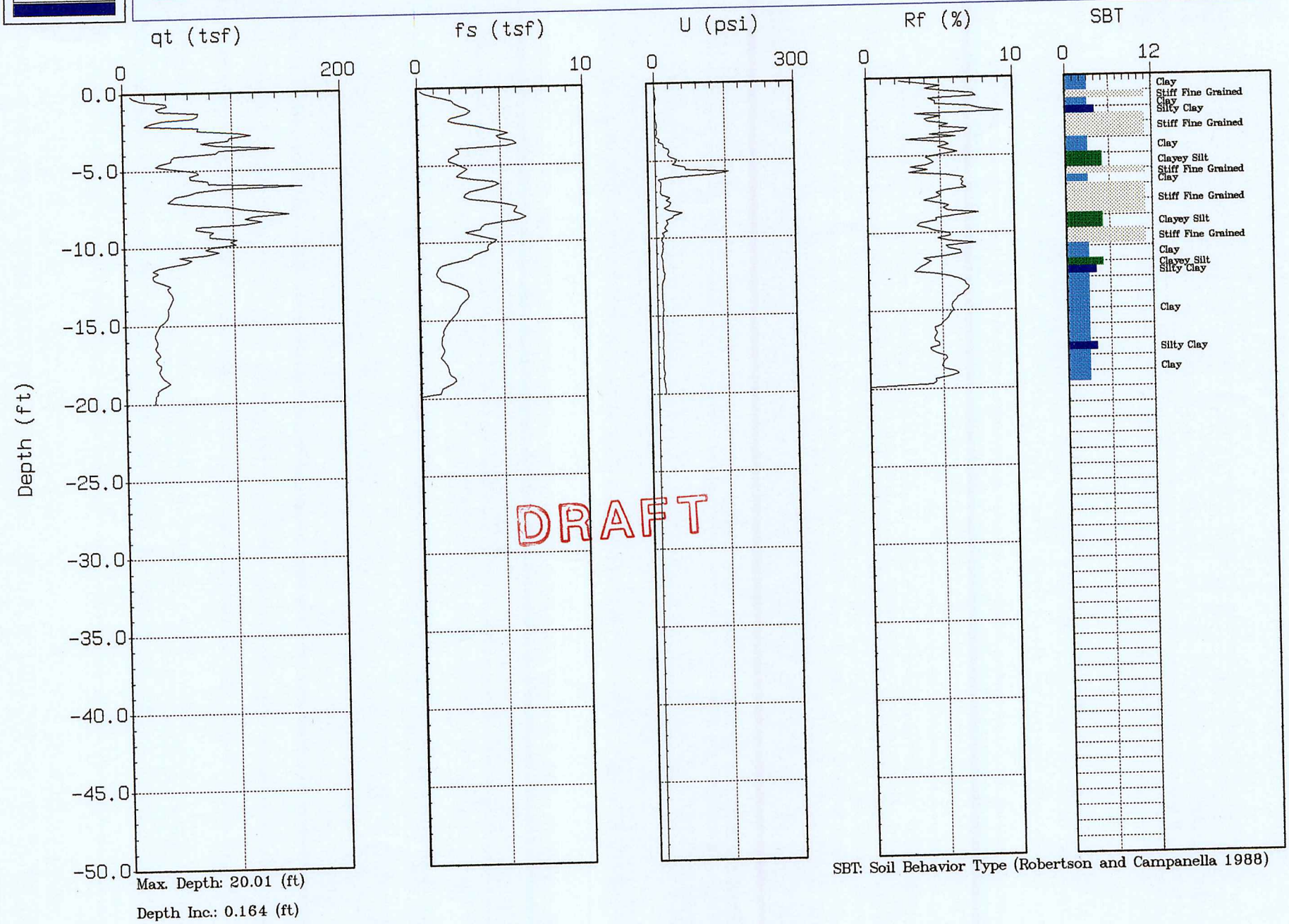
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-06

Geologist : STEFANO
Date : 12:03:02 11:40



Max. Depth: 20.01 (ft)

Depth Inc.: 0.164 (ft)

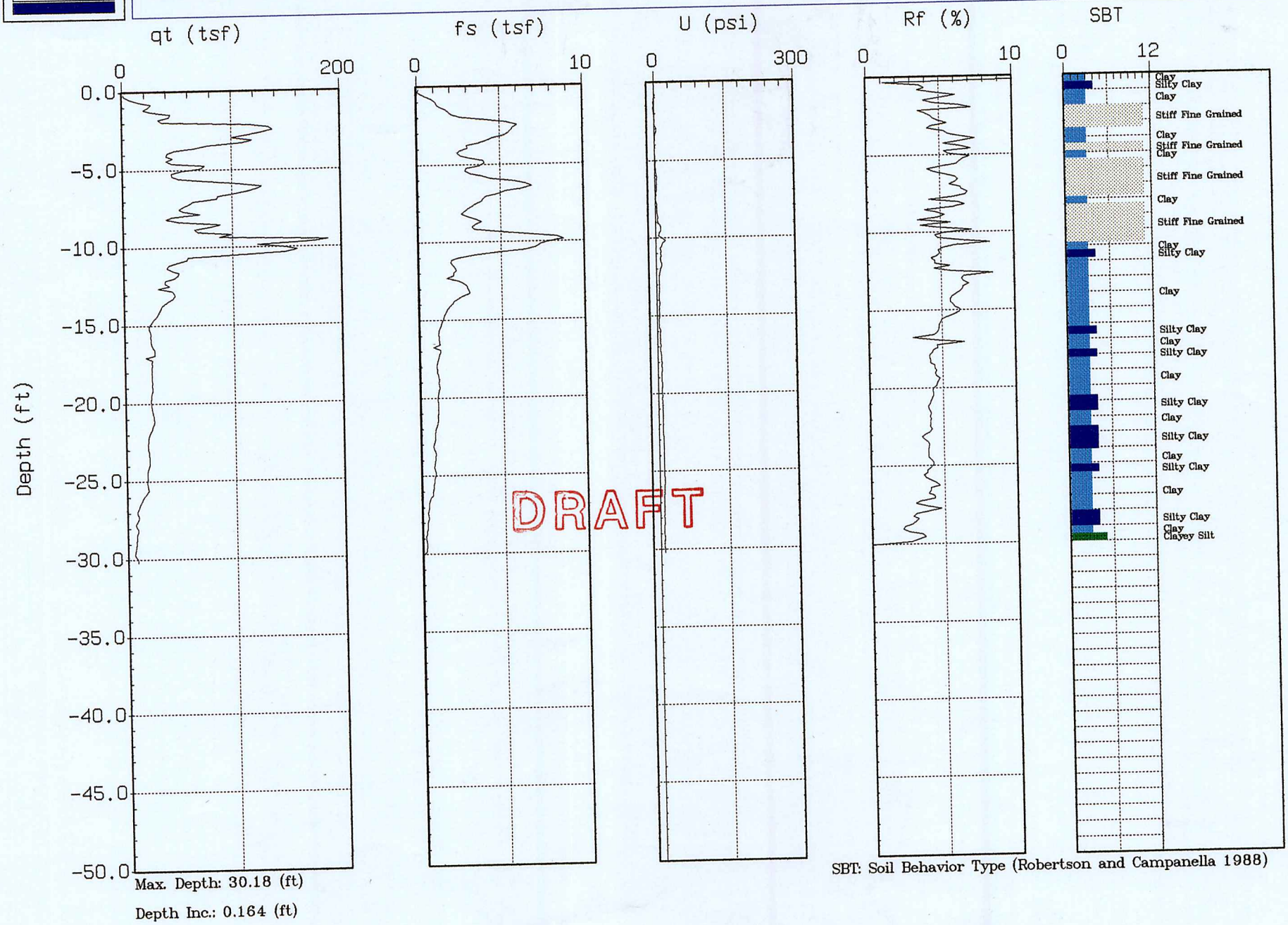
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-07

Geologist : STEFANOS
Date : 12:03:02 12:01



Max. Depth: 30.18 (ft)

Depth Inc.: 0.164 (ft)

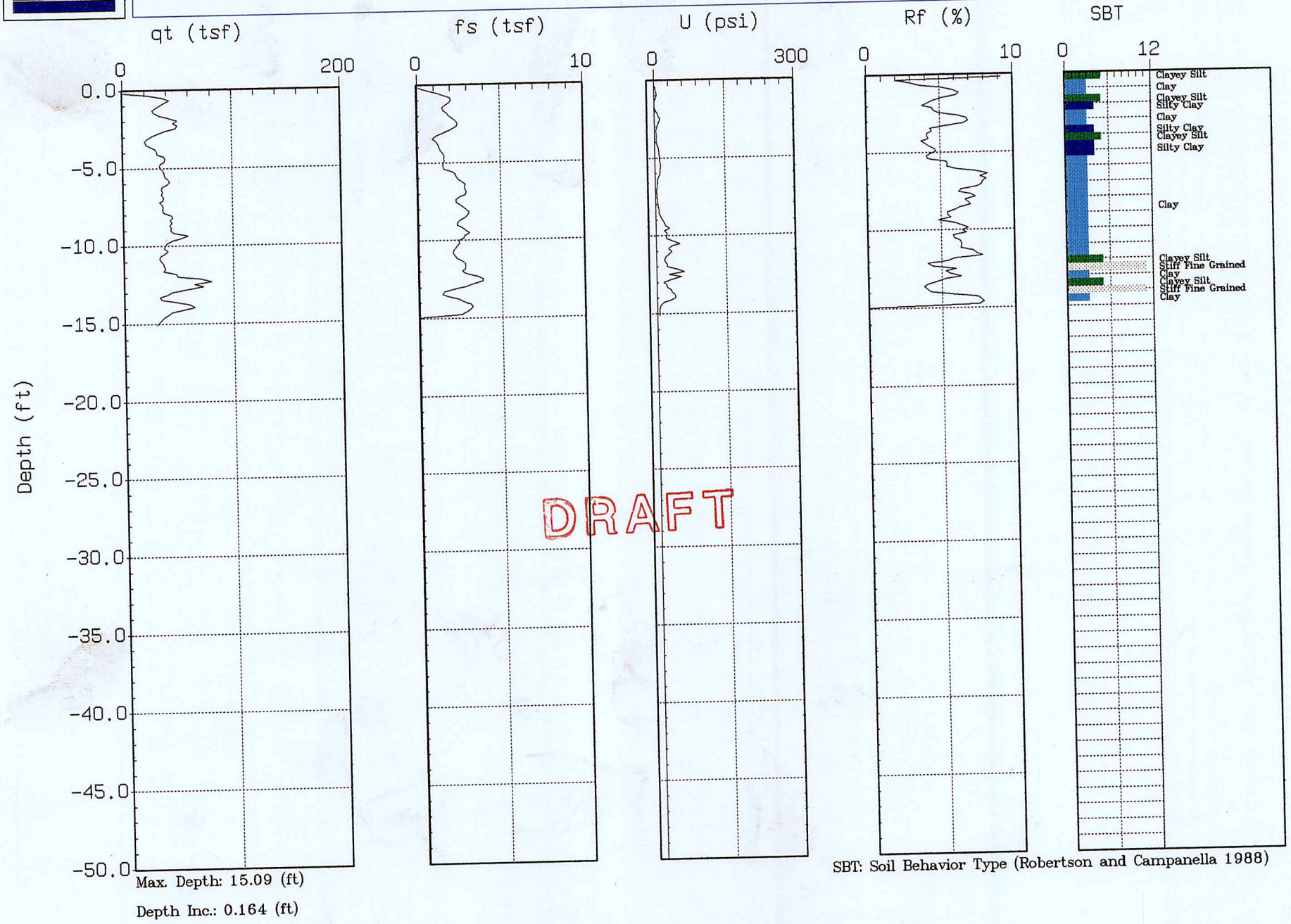
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-08

Geologist : STEFANOS
Date : 12:03:02 13:39



Max. Depth: 15.09 (ft)

Depth Inc.: 0.164 (ft)

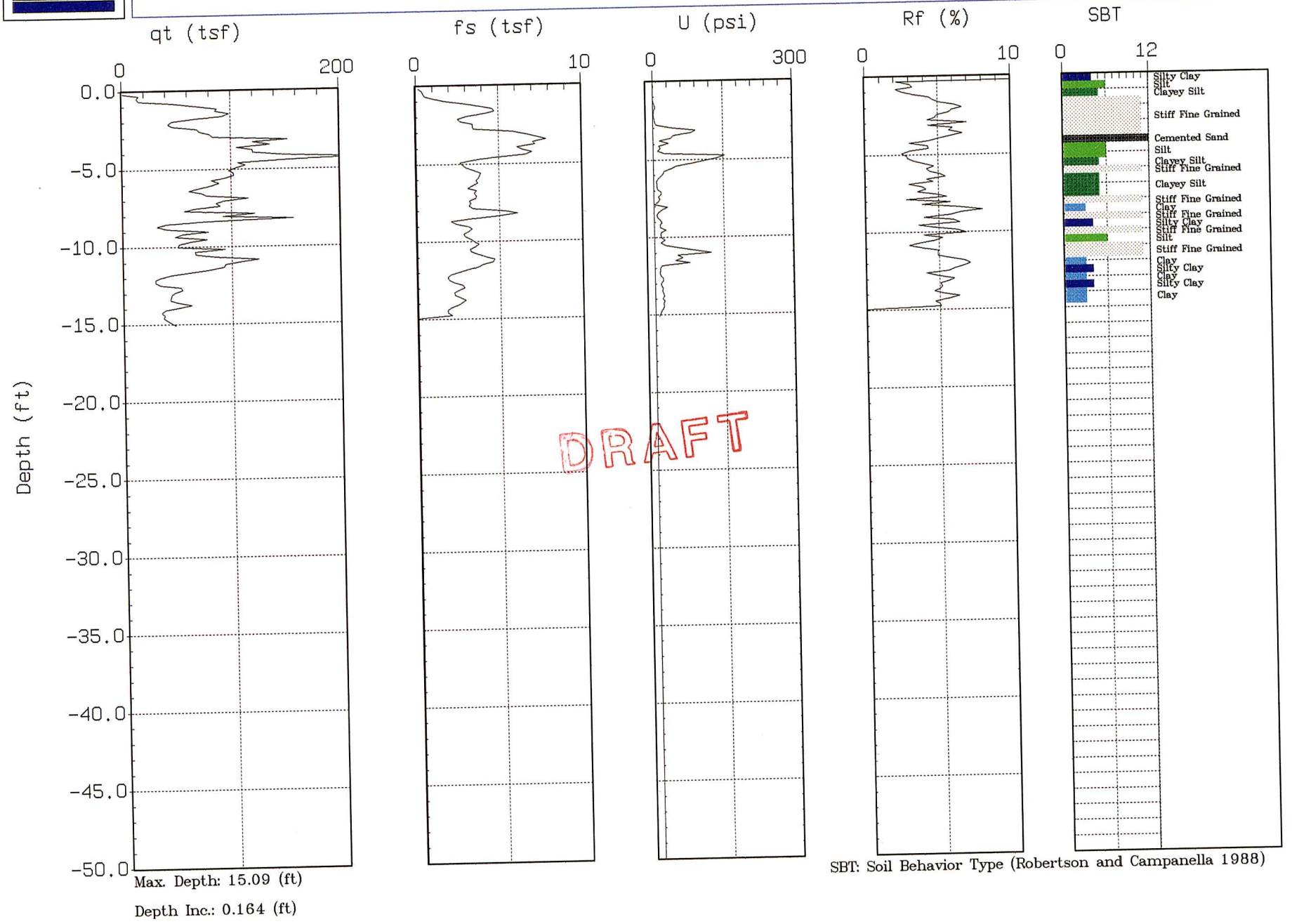
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-09

Geologist : STEFANOS
Date : 12:03:02 13:59



Max. Depth: 15.09 (ft)

Depth Inc.: 0.164 (ft)

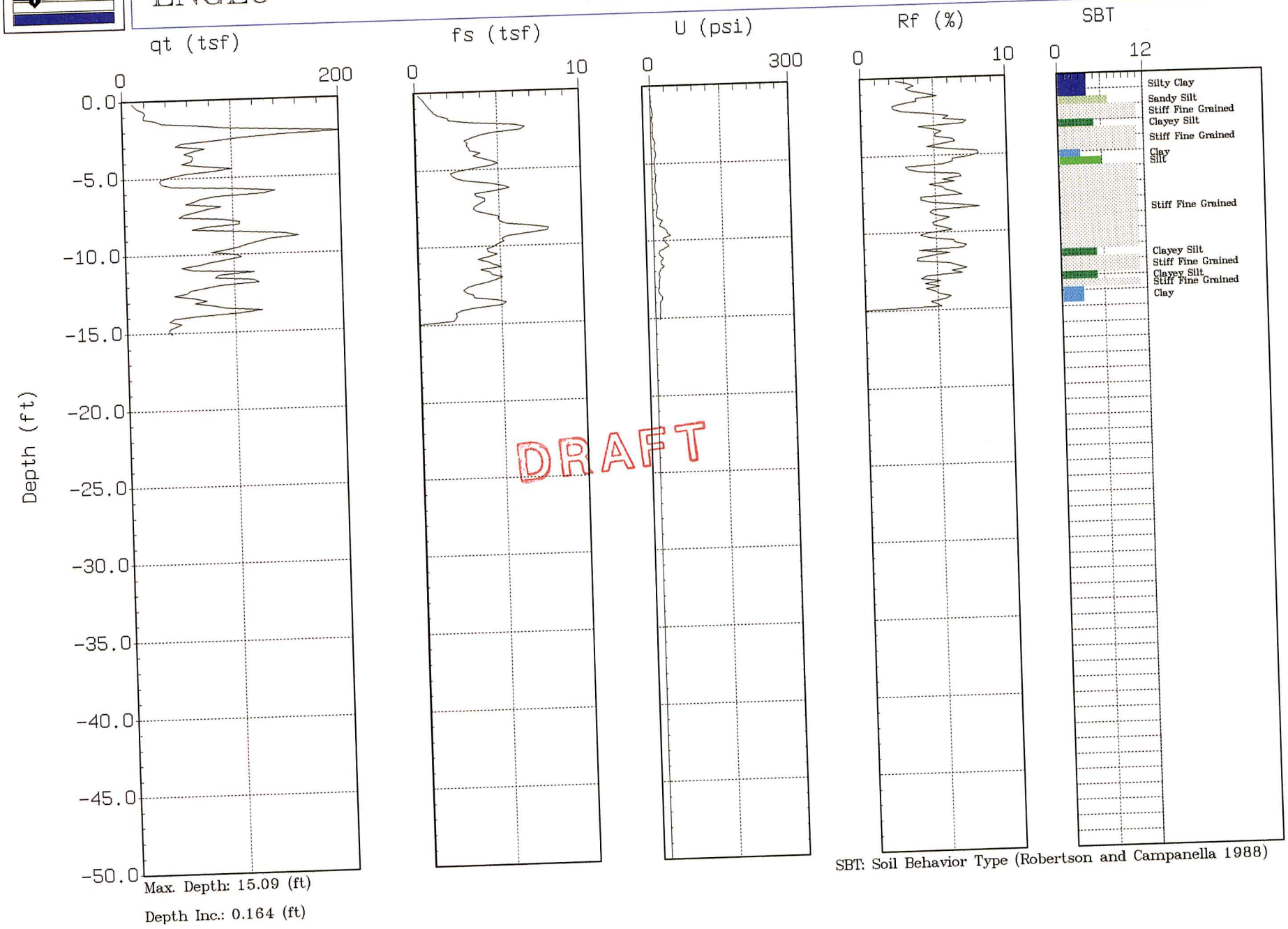
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-10

Geologist : STEFANOS
Date : 12:03:02 14:16



Max. Depth: 15.09 (ft)

Depth Inc.: 0.164 (ft)

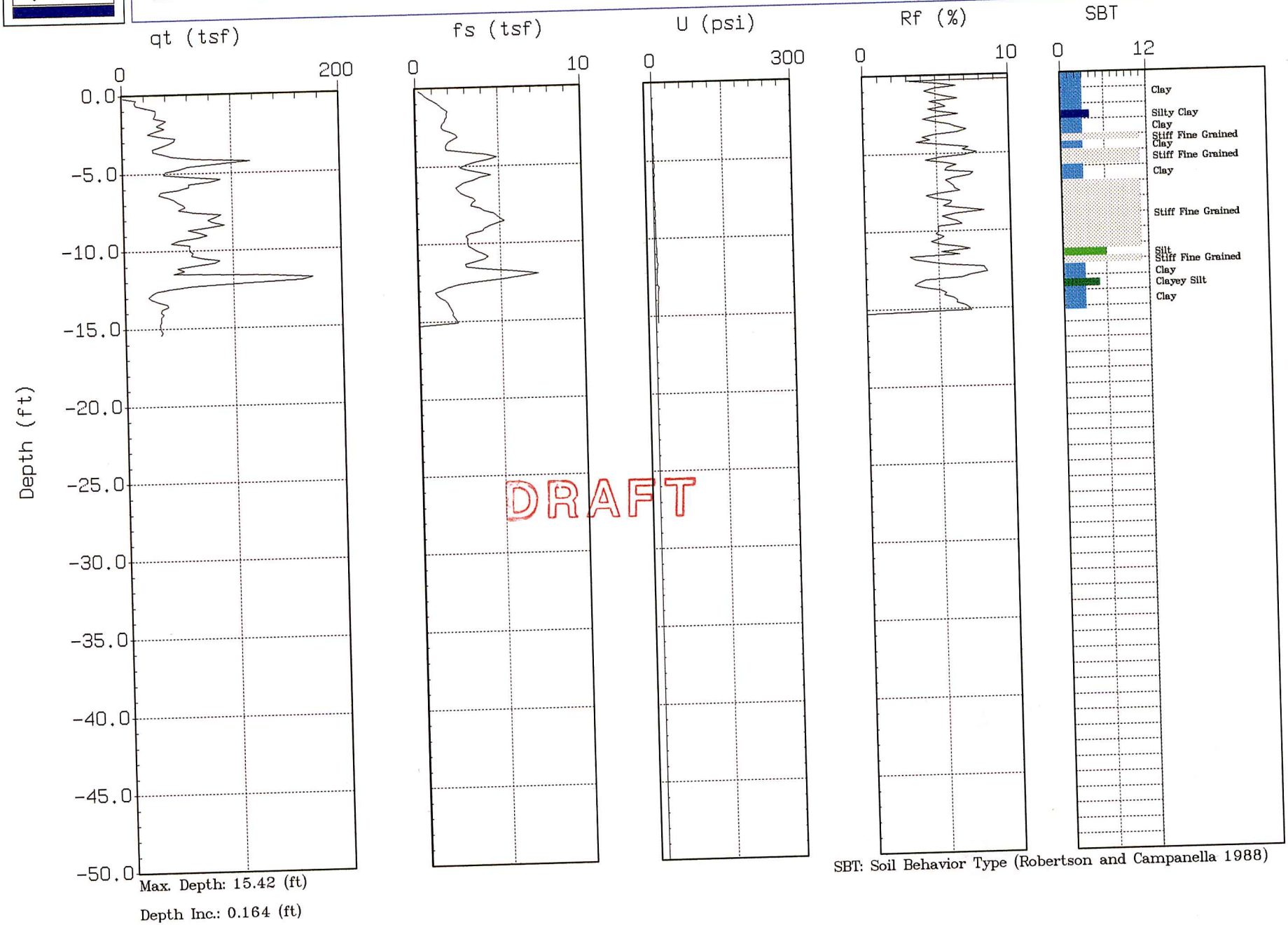
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-11

Geologist : STEFANOS
Date : 12:03:02 14:38



Max. Depth: 15.42 (ft)

Depth Inc.: 0.164 (ft)

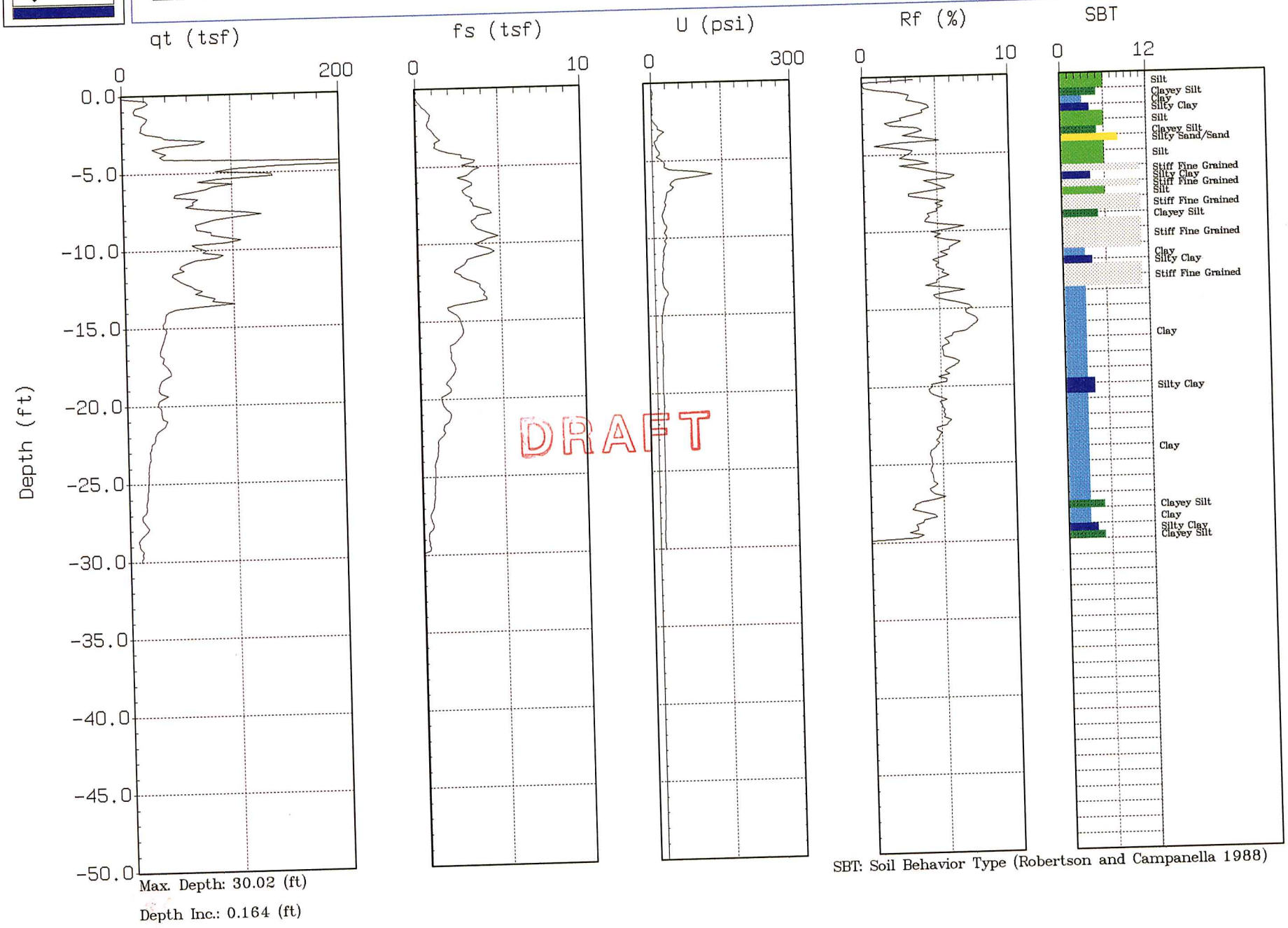
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-12

Geologist : STEFANOS
Date : 12:03:02 14:56



Max. Depth: 30.02 (ft)

Depth Inc.: 0.164 (ft)

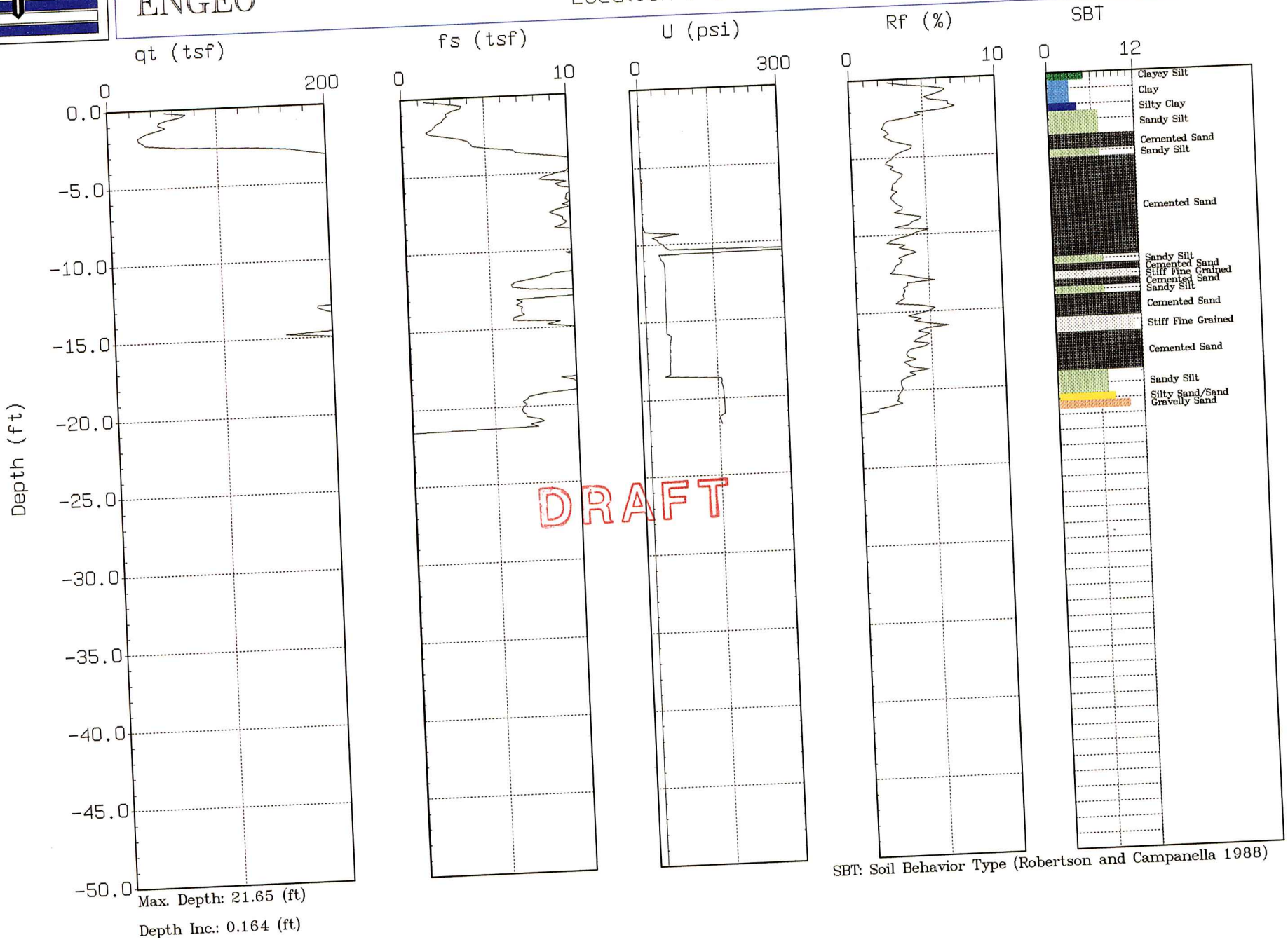
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-13

Geologist : STEFANOS
Date : 12:03:02 15:39



Max. Depth: 21.65 (ft)

Depth Inc.: 0.164 (ft)

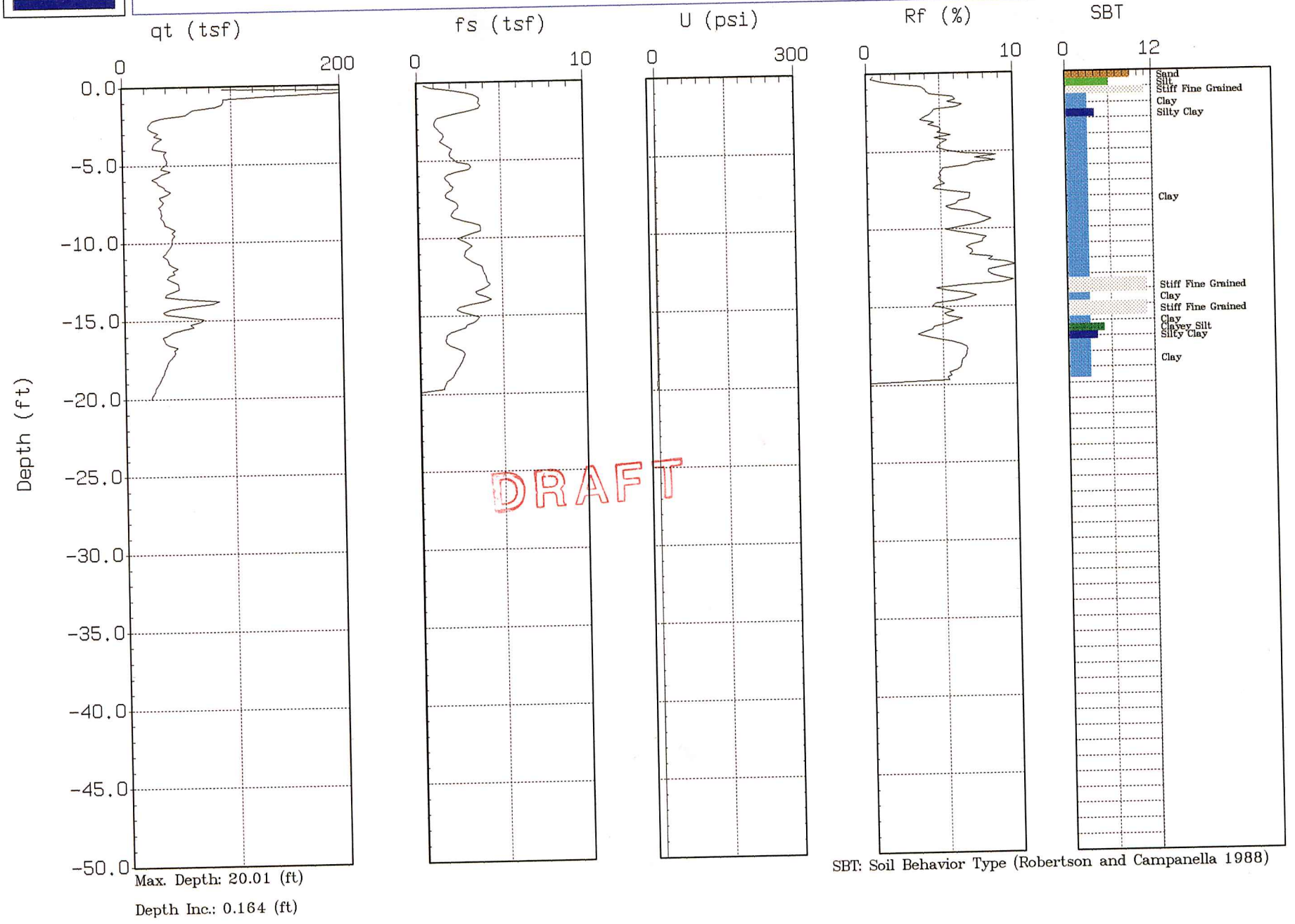
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

ENGEO

Site : SAN RAMON
Location : CPT-14

Geologist : STEFANOS
Date : 12:03:02 16:24



Max. Depth: 20.01 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

APPENDIX C

ENGEO Incorporated, Compaction Test Results

1 (STANDARD ASTM TEST PROCEDURE D-1557)

2 (CALIFORNIA IMPACT TEST METHOD 216)

JOB NO. 2581.1.120.01
DATE: AUGUST 2003

TABLE I
LABORATORY COMPACTION TEST RESULTS

TEST METHOD	TEST NO.	SOURCE AND DESCRIPTION	MAXIMUM DRY DENSITY PCF	MAXIMUM DRY DENSITY g/cc	OPTIMUM MOISTURE % DRY WT.	PLASTICITY INDEX
1	2	Site - Very dark gray CLAY	113.7	1.82	15.3	46
1	4	Site - Light olive brown silty clayey SAND with claystone fragments	112.5	1.80	14.1	16
1	7	Site - Grayish brown silty CLAY w/fine sand abundant dess. carbonates	115.6	1.85	14.0	23
1	8	Site - Dark gray sandy silty CLAY w/dess. carbonates	120.2	1.93	11.9	13
1	9	Site - Olive brown sandy silty CLAY	117.0	1.88	13.8	12
1	10	Site - Dark grayish brown sandy silty CLAY	116.0	1.86	12.5	31
1	11	Site - Light olive brown sandy silty CLAY w/trace dess. carbonates	113.6	1.82	14.6	23
1	12	Site - Olive sandy silty CLAY w/claystone fragments	116.0	1.86	13.8	17
1	20	Site - Dark grayish brown sandy CLAY w/dess. carbonates	113.5	1.82	14.1	
1	21	Site - Light olive brown sandy silty CLAY w/dess carbonates	115.6	1.85	14.4	
1	22	Site - Olive gray silty CLAY w/dess carbonates	116.2	1.86	13.4	

SG - SUBGRADE
F - DENOTES FAILING TEST
8F9 - SECOND NO. DENOTES RETEST NO.

FILE NO.: 2581.1.120.01
DATE: AUGUST 2003

TABLE II
SUMMARY OF FIELD DENSITY TESTING

Test No.		Date	Test Location Community College Windemere	Elev Ft.	Dry Density P.C.F.	Dry Density g/cc	Moisture Content %	Relative Compaction % of Max. Dry Density	Lab Curve Test No. (Table I)
1		6/13/00	F-6, N0225, E5360	473	101.9	1.63	19.6	90	2
2		6/14/00	F-6, N0275, E5355	472	102.4	1.64	22.1	90	2
3		6/14/00	F-6, N0215, E5365	474	102.1	1.64	20.2	90	2
4		6/14/00	F-6, N0260, E5425	473	102.7	1.65	19.9	90	2
5		6/14/00	F-6, N0205, E5470	475	102.3	1.64	19.8	90	2
6	F 7	6/14/00	F-6, N0165, E5480	478	99.1	1.59	20.2	87	2
7		6/14/00	F-6, N0165, E5480	478	103.6	1.66	20.6	91	2
8	F 11	6/15/00	F-6, N0220, E5345	465	98.2	1.57	24.3	86	2
9	F 12	6/15/00	F-6, N0190, E5370	467	100.8	1.62	18.7	89	2
10		6/15/00	F-6, N0165, E5395	468	104.2	1.67	20.4	92	2
11		6/15/00	F-6, N0220, E5345	465	102.5	1.64	20.9	90	2
12		6/15/00	F-6, N0190, E5370	467	102.3	1.64	21.1	90	2
13	F 14	6/16/00	F-6, N0155, E5445	477	93.2	1.49	15.9	81	7
14		6/16/00	F-6, N0155, E5445	477	106.5	1.71	18.1	92	7
15		6/16/00	F-6, N0170, E5365	476	103.8	1.66	19.7	90	7
16	F 18	6/16/00	F-6, N0205, E5385	475	98.4	1.58	18.5	85	7
17		6/16/00	F-6, N0240, E5410	475	107.8	1.73	17.4	90	8
18		6/16/00	F-6, N0205, E5385	475	104.4	1.67	20.1	90	7
19	F 25	6/16/00	F-6, N0210, E5330	474	100.3	1.61	23.3	87	7
20		6/16/00	F-6, N0205, E5385	475	105.4	1.69	18.4	91	7
21	F 23	6/16/00	F-6, N0225, E5470	475	101.7	1.63	18.2	88	7
22	F 24	6/16/00	F-6, N0175, E5445	475	99.1	1.59	23.7	86	7
23		6/16/00	F-6, N0225, E5470	475	103.6	1.66	19.2	90	7
24		6/16/00	F-6, N0175, E5445	475	105.4	1.69	18.2	91	7
25	F 28	6/16/00	F-6, N0210, E5330	474	104.0	1.67	21.0	87	8
26		6/16/00	F-6, N0240, E5425	476	103.9	1.67	18.4	90	7
27		6/16/00	F-6, N0150, E5350	473	101.9	1.63	22.5	90	2
28		6/16/00	F-6, N0210, E5330	474	108.3	1.74	19.6	90	8
29	F 31	6/16/00	F-6, N0180, E5375	476	99.8	1.60	18.8	89	4
30		6/16/00	F-6, N0165, E5360	477	100.8	1.62	20.1	90	4
31		6/16/00	F-6, N0180, E5375	476	104.0	1.67	21.7	92	4
32	F 33	6/17/00	F-6, N0170, E5400	473	99.8	1.60	20.4	86	7
33		6/17/00	F-6, N0170, E5400	473	106.2	1.70	20.8	92	7
34		6/17/00	F-6, N0190, E5500	473	103.7	1.66	20.2	90	7
35		6/17/00	F-6, N0165, E5350	473	103.9	1.67	20.1	90	7
36		6/17/00	F-6, N0150, E5300	474	105.9	1.70	20.0	92	7
37		6/17/00	F-6, N0170, E5350	474	104.3	1.67	19.0	90	7
38		6/17/00	F-6, N0190, E5400	474	103.9	1.67	20.2	90	7
39	F 45	6/19/00	F-6, N0217, E5381	477	98.3	1.57	19.1	87	4
40	F 46	6/19/00	F-6, N0245, E5390	475	99.8	1.60	18.9	89	4
41	F 47	6/19/00	F-6, N0170, E5360	474	95.8	1.54	23.1	85	4
42	F 48	6/19/00	F-6, N0250, E5430	474	97.8	1.57	16.8	84	10
43	F 49	6/19/00	F-6, N0220, E5405	475	94.8	1.52	21.4	84	4
44	F 50	6/19/00	F-6, N0175, E5365	476	93.9	1.50	23.3	83	4
45	F 51	6/19/00	F-6, N0217, E5381	477	98.8	1.58	18.4	88	4
46		6/19/00	F-6, N0245, E5390	475	102.0	1.63	19.2	91	4

SG - SUBGRADE
F - DENOTES FAILING TEST
8F9 - SECOND NO. DENOTES RETEST NO.

FILE NO.: 2581.1.120.01
DATE: AUGUST 2003

TABLE II
SUMMARY OF FIELD DENSITY TESTING

Test No.		Date	Test Location Community College Windemere	Elev Ft.	Dry Density P.C.F.	Dry Density g/cc	Moisture Content %	Relative Compaction % of Max. Dry Density	Lab Curve Test No. (Table I)
47	F 52	6/19/00	F-6, N0170, E5360	474	97.4	1.56	20.3	87	4
48	F 53	6/19/00	F-6, N0250, E5430	474	96.5	1.55	19.2	83	10
49	F 54	6/19/00	F-6, N0220, E5405	476	92.5	1.48	19.6	82	4
50	F 55	6/19/00	F-6, N0175, E5365	477	94.5	1.51	18.5	84	4
51	F 56	6/19/00	F-6, N0217, E5381	477	98.5	1.58	12.3	88	4
52	F 57	6/19/00	F-6, N0170, E5360	474	99.0	1.59	18.3	88	4
53		6/19/00	F-6, N0250, E5430	474	107.1	1.72	17.5	92	10
54	F 58	6/19/00	F-6, N0220, E5405	475	92.8	1.49	21.4	82	4
55		6/19/00	F-6, N0175, E5365	477	105.9	1.70	18.6	94	4
56		6/19/00	F-6, N0217, E5381	477	103.7	1.66	18.4	92	4
57		6/19/00	F-6, N0170, E5360	474	100.9	1.62	19.0	90	4
58		6/19/00	F-6, N0220, E5405	475	101.2	1.62	18.9	90	4
59		6/20/00	F-6, N0140, E5290	483	105.8	1.70	20.1	94	4
60		6/20/00	F-6, N0175, E5280	483	103.1	1.65	19.1	92	4
61		6/20/00	F-6, N0215, E5320	484	103.9	1.67	19.9	92	4
62	F 75	6/20/00	F-6, N0213, E5405	474	107.0	1.71	12.7	95	4
63	F 76	6/20/00	F-6, N0215, E5381	475	106.7	1.71	16.4	95	4
64		6/20/00	F-6, N0227, E5354	476	100.7	1.61	19.4	90	4
65		6/20/00	F-6, N0238, E5374	477	100.6	1.61	18.4	90	4
66		6/20/00	F-6, N0163, E5339	477	101.0	1.62	20.5	90	4
67		6/20/00	F-6, N0190, E5337	477	102.3	1.64	18.2	91	4
68	F 71	6/20/00	F-6, N0150, E5366	477	95.2	1.53	13.0	85	4
69		6/20/00	F-6, N0180, E5325	477	103.8	1.66	18.1	92	4
70	F 72	6/20/00	F-6, N0173, E5357	478	96.8	1.55	21.5	86	4
71	F 73	6/20/00	F-6, N0150, E5366	478	105.8	1.70	16.0	94	4
72	F 74	6/20/00	F-6, N0173, E5357	478	98.6	1.58	19.2	88	4
73		6/20/00	F-6, N0150, E5366	478	100.9	1.62	18.3	90	4
74		6/20/00	F-6, N0173, E5357	478	103.0	1.65	18.2	92	4
75		6/20/00	F-6, N0213, E5405	475	103.8	1.66	18.6	92	4
76		6/20/00	F-6, N0215, E5381	476	104.1	1.67	18.4	93	4
77		6/21/00	F-6, N0238, E5374	480	102.2	1.64	18.7	91	4
78	F 79	6/21/00	F-6, N0240, E5345	485	96.0	1.54	15.8	85	4
79		6/21/00	F-6, N0240, E5345	485	107.3	1.72	18.1	95	4
80		6/21/00	F-6, N0155, E5318	484	106.1	1.70	18.1	94	4
81	F 83	6/21/00	F-6, N0205, E5345	483	107.8	1.73	16.1	96	4
82		6/21/00	F-6, N0150, E5345	483	102.1	1.64	18.2	91	4
83		6/21/00	F-6, N0205, E5345	483	102.2	1.64	18.7	91	4
84	F 89	6/21/00	F-6, N0150, E5330	484	97.0	1.55	14.5	86	4
85		6/21/00	F-6, N0245, E5320	482	101.3	1.62	18.1	90	4
86	F 90	6/21/00	F-6, N0220, E5425	484	104.8	1.68	15.9	93	4
87	F 91	6/21/00	F-6, N0170, E5420	485	102.4	1.64	17.0	91	4
88		6/21/00	F-6, N0235, E5385	485	100.9	1.62	19.1	90	4
89		6/21/00	F-6, N0150, E5330	484	100.8	1.62	18.2	90	4
90	F 92	6/21/00	F-6, N0220, E5425	485	105.8	1.70	15.7	94	4
91		6/21/00	F-6, N0170, E5420	486	101.0	1.62	18.5	90	4
92	F 95	6/21/00	F-6, N0220, E5425	485	98.5	1.58	18.2	88	4

SG - SUBGRADE
F - DENOTES FAILING TEST
8F9 - SECOND NO. DENOTES RETEST NO.

FILE NO.: 2581.1.120.01
DATE: AUGUST 2003

TABLE II
SUMMARY OF FIELD DENSITY TESTING

Test No.		Date	Test Location Community College Windemere	Elev Ft.	Dry Density P.C.F.	Dry Density g/cc	Moisture Content %	Relative Compaction % of Max. Dry Density	Lab Curve Test No. (Table I)
93		6/21/00	F-6, N0280, E5420	485	103.5	1.66	18.2	92	4
94		6/21/00	F-6, N0175, E5415	486	105.5	1.69	18.1	94	4
95		6/21/00	F-6, N0220, E5425	485	106.0	1.70	19.5	94	4
96		6/22/00	F-6, N0890, E5470	482	104.7	1.68	19.3	91	7
97		6/22/00	F-6, N0930, E5490	483	102.1	1.64	21.3	90	11
98		6/22/00	F-6, N0945, E5465	484	101.9	1.63	21.7	90	11
99		6/22/00	F-6, N0905, E5445	482	107.3	1.72	20.1	92	9
100	F 104	6/22/00	F-6, N0255, E5535	494	97.0	1.55	16.9	86	4
101	F 105	6/22/00	F-6, N0240, E5580	494	96.6	1.55	23.4	86	4
102		6/22/00	F-6, N0275, E5540	494	103.5	1.66	18.7	92	4
103		6/22/00	F-6, N0270, E5580	494	104.2	1.67	18.9	93	4
104	F 106	6/22/00	F-6, N0255, E5535	494	100.2	1.61	20.0	89	4
105		6/22/00	F-6, N0240, E5580	494	102.2	1.64	20.1	91	4
106		6/22/00	F-6, N0255, E5535	490	101.1	1.62	18.6	90	4
107	F 111	6/22/00	F-6, N0220, E5425	489	99.5	1.59	20.0	88	4
108		6/22/00	F-6, N0210, E5410	490	107.0	1.71	18.4	95	4
109		6/22/00	F-6, N0170, E5410	490	105.3	1.69	18.2	94	4
110	F 112	6/22/00	F-6, N0210, E5390	490	94.5	1.51	17.0	84	4
111		6/22/00	F-6, N0220, E5425	489	104.6	1.68	18.3	93	4
112		6/22/00	F-6, N0210, E5390	490	105.0	1.68	18.4	93	4
113	F 121	6/23/00	F-6, N0110, E5420	496	93.7	1.50	17.9	82	11
114	F 122	6/23/00	F-6, N0150, E5440	496	98.6	1.58	20.5	87	11
115		6/23/00	F-6, N0180, E5450	495	102.9	1.65	21.8	91	11
116	F 123	6/23/00	F-6, N0230, E5420	495	96.1	1.54	20.1	85	11
117		6/23/00	F-6, N0090, E5440	496	102.6	1.64	19.2	90	11
118	F 131	6/23/00	F-6, N0125, E5450	496	98.5	1.58	19.2	87	11
119		6/23/00	F-6, N0155, E5465	495	105.0	1.68	21.4	92	11
120	F 132	6/23/00	F-6, N0175, E5470	495	97.1	1.56	20.6	85	11
121	F 129	6/23/00	F-6, N0110, E5420	496	100.1	1.60	18.7	88	11
122		6/23/00	F-6, N0150, E5440	496	103.2	1.65	20.4	91	11
123	F 130	6/23/00	F-6, N0230, E5420	495	99.3	1.59	18.1	87	11
124		6/23/00	F-6, N9920, E5455	486	104.2	1.67	19.1	92	11
125		6/23/00	F-6, N9930, E5455	490	102.9	1.65	20.6	91	11
126		6/23/00	F-6, N9980, E5470	493	102.6	1.64	18.9	90	11
127		6/23/00	F-6, N0115, E5480	497	105.0	1.68	20.3	92	11
128		6/23/00	F-6, N0155, E5500	496	104.6	1.68	18.9	92	11
129		6/23/00	F-6, N0110, E5420	496	103.7	1.66	21.2	91	11
130		6/23/00	F-6, N0230, E5420	495	102.7	1.65	19.7	90	11
131		6/23/00	F-6, N0125, E5450	496	105.7	1.69	18.6	93	11
132		6/23/00	F-6, N0175, E5470	495	101.9	1.63	19.3	90	11
133		6/23/00	F-6, N9945, E5485	496	101.9	1.63	19.7	90	11
134	F 135	6/23/00	F-6, N9970, E5445	497	97.3	1.56	19.8	86	11
135		6/23/00	F-6, N9970, E5445	497	103.2	1.65	20.1	91	11
136		6/23/00	F-6, N9980, E5450	499	102.5	1.64	20.0	90	11
137		6/23/00	F-6, N9955, E5440	498	103.6	1.66	19.1	91	11
138		6/23/00	F-6, N9960, E5480	499	102.9	1.65	20.7	91	11

SG - SUBGRADE
F - DENOTES FAILING TEST
8F9 - SECOND NO. DENOTES RETEST NO.

FILE NO.: 2581.1.120.01
DATE: AUGUST 2003

TABLE II
SUMMARY OF FIELD DENSITY TESTING

Test No.		Date	Test Location Community College Windemere	Elev Ft.	Dry Density P.C.F.	Dry Density g/cc	Moisture Content %	Relative Compaction % of Max. Dry Density	Lab Curve Test No. (Table I)
139		6/23/00	F-6, N9940, E5470	498	104.7	1.68	21.4	92	11
140		6/23/00	F-6, N0250, E5620	492	103.1	1.65	18.8	91	11
141	F 144	6/24/00	F-6, N9900, E5420	481	102.3	1.64	20.7	88	7
142	F 145	6/24/00	F-6, N9890, E5400	481	100.6	1.61	19.9	87	7
143	F 146	6/24/00	F-6, N9900, E5420	481	101.3	1.62	23.1	88	7
144	F 147	6/24/00	F-6, N9890, E5450	481	98.2	1.57	23.2	85	7
145		6/24/00	F-6, N9910, E5430	481	103.5	1.66	20.1	90	7
146		6/24/00	F-6, N9990, E5420	481	103.6	1.66	19.9	90	7
147		6/24/00	F-6, N9890, E5400	481	103.9	1.67	19.8	90	7
148		6/24/00	F-6, N9910, E5440	481	106.0	1.70	20.3	92	7
149		6/24/00	F-6, N9870, E5400	481	103.5	1.66	23.9	90	7
150		6/24/00	F-6, N9925, E5425	481	106.5	1.71	18.9	92	7
151		6/24/00	F-6, N9900, E5400	482	102.6	1.64	20.6	90	11
152		6/24/00	F-6, N9910, E5390	482	102.8	1.65	20.9	90	11
153	F 154	6/24/00	F-6, N9890, E5410	482	95.0	1.52	24.7	82	7
154		6/24/00	F-6, N9890, E5410	482	103.7	1.66	22.5	90	7
155		6/24/00	F-6, N9870, E5410	483	103.5	1.66	21.3	90	7
156		6/27/00	F-6, N9915, E5490	486	104.1	1.67	19.3	90	12
157	F 159	6/27/00	F-6, N9955, E5505	485	101.3	1.62	22.4	87	12
158		6/27/00	F-6, N9970, E5460	485	104.4	1.67	20.7	90	12
159		6/27/00	F-6, N9955, E5505	485	107.1	1.72	18.9	92	12
160		6/27/00	F-6, N9930, E5440	487	105.2	1.69	20.0	91	12
161		6/27/00	F-6, N9925, E5475	486	104.6	1.68	21.1	90	12
162		6/27/00	F-6, N9950, E5495	486	106.5	1.71	19.5	92	12
163		6/28/00	F-6, N9930, E5450	489	106.5	1.71	18.9	91	9
164		6/28/00	F-6, N9950, E5460	489	105.8	1.70	19.2	90	9
165		6/28/00	F-6, N9920, E5470	489	102.0	1.63	19.7	90	11
166		6/28/00	F-6, N9940, E5460	489	103.5	1.66	19.2	91	11
167		6/28/00	F-6, N9950, E5490	489	106.5	1.71	18.2	91	9
168	F 170	6/28/00	F-6, N9950, E5490	489	100.0	1.60	23.0	88	11
169		6/28/00	F-6, N9970, E5480	489	108.1	1.73	19.3	92	9
170		6/28/00	F-6, N9950, E5490	489	102.1	1.64	20.1	90	11
171		6/28/00	F-6, N9950, E5480	488	106.0	1.70	19.3	93	11
172		6/28/00	F-6, N9970, E5460	488	103.0	1.65	19.3	91	11
173		6/28/00	F-6, N9970, E5460	488	104.1	1.67	19.2	92	11
174		6/28/00	F-6, N9990, E5460	488	103.4	1.66	19.2	91	11
175		6/28/00	F-6, N9980, E5480	488	102.7	1.65	20.3	90	11
176		6/28/00	F-6, N9990, E5450	488	103.7	1.66	20.5	91	11
177		7/28/00	F-6, N0270, E5685	508	104.4	1.67	19.1	92	11
178		7/28/00	F-6, N0220, E5660	509	104.2	1.67	21.9	92	11
179		7/28/00	F-6, N0160, E5630	510	106.2	1.70	18.6	93	11
180		7/28/00	F-6, N0115, E5605	508	102.6	1.64	18.9	90	11
181		9/27/00	F-6, N0260, E5640	498	106.2	1.70	19.6	93	11
182		9/27/00	F-6, N0205, E5615	497	102.1	1.64	19.4	90	11
183		9/27/00	F-6, N0205, E5615	497	103.3	1.66	20.4	91	11
184		9/27/00	F-6, N9900, E5450	488	103.1	1.65	19.5	91	20

SG - SUBGRADE
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FILE NO.: 2581.1.120.01
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TABLE II
SUMMARY OF FIELD DENSITY TESTING

Test No.	Date	Test Location Community College Windemere	Elev Ft.	Dry Density P.C.F.	Dry Density g/cc	Moisture Content %	Relative Compaction % of Max. Dry Density	Lab Curve Test No. (Table I)
185	9/27/00	F-6, N9950, E5500	488	102.6	1.64	20.1	90	20
186	9/27/00	F-6, N0000, E5510	489	102.9	1.65	21.1	91	20
187	9/27/00	F-6, N0050, E5550	490	103.0	1.65	20.5	91	20
188	9/27/00	F-6, N0100, E5550	491	102.8	1.65	23.2	91	20
189	9/27/00	F-6, N0200, E5600	492	103.1	1.65	23.1	91	20
190	9/27/00	F-6, N0300, E5665	493	101.8	1.63	23.0	90	20
191	9/27/00	F-6, N0025, E5525	490	102.3	1.64	22.8	90	20
192	9/27/00	F-6, N0135, E5580	493	101.9	1.63	24.5	90	20
193	9/27/00	F-6, N0315, E5675	495	102.0	1.63	25.6	90	20
194	9/27/00	F-6, N0100, E5550	491	104.1	1.67	20.6	90	22
195	9/27/00	F-6, N0200, E5600	492	104.5	1.67	20.9	90	22
196	9/27/00	F-6, N0300, E5665	493	105.1	1.68	19.8	90	22
197	9/27/00	F-6, N0025, E5525	490	105.0	1.68	19.9	90	22
198	9/27/00	F-6, N0135, E5580	493	104.8	1.68	20.7	90	22
199	9/27/00	F-6, N0315, E5675	495	104.2	1.67	21.2	90	22
200	9/28/00	F-6, N0205, E5615	498	104.1	1.67	21.2	90	21
201	9/28/00	F-6, N0205, E5615	496	104.3	1.67	19.8	90	21
202	9/28/00	F-6, N0205, E5615	495	103.5	1.66	19.7	90	21
203	9/28/00	F-6, N0205, E5615	495	105.2	1.69	18.9	91	21

APPENDIX D

Guide Contract Specifications

GUIDE CONTRACT SPECIFICATIONS

PART I - EARTHWORK

PREFACE

These specifications are intended as a guide for the earthwork performed at the subject development project. If there is a conflict between these specifications (including the recommendations of the geotechnical report) and agency or code requirements, it should be brought to the attention of ENGEO and Owner prior to contract bidding.

PART 1 - GENERAL

1.01 WORK COVERED

A. Grading, excavating, filling and backfilling, including trenching and backfilling for utilities as necessary to complete the Project as indicated on the Drawings.

B. Subsurface drainage as indicated on the Drawings.

1.02 CODES AND STANDARDS

A. Excavating, trenching, filling, backfilling, and grading work shall meet the applicable requirements of the Uniform Building Code and the standards and ordinances of state and local governing authorities.

1.03 SUBSURFACE SOIL CONDITIONS

A. The Owners' Geotechnical Exploration report is available for inspection by bidder or Contractor. The Contractor shall refer to the findings and recommendations of the Geotechnical Exploration report in planning and executing his work.

1.04 DEFINITIONS

A. Fill: All soil, rock, or soil-rock materials placed to raise the grades of the site or to backfill excavations.

B. Backfill: All soil, rock or soil-rock material used to fill excavations and trenches.

C. On-Site Material: Soil and/or rock material which is obtained from the site.

D. Imported Material: Soil and/or rock material which is brought to the site from off-site areas.

E. Select Material: On-site and/or imported material which is approved by ENGEO as a specific-purpose fill.

F. Engineered Fill: Fill upon which ENGEO has made sufficient observations and tests to confirm that the fill has been placed and compacted in accordance with specifications and requirements.

G. Degree of Compaction or Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of the fill and backfill material as compacted in the field to the maximum dry density of the same material as determined by ASTM D-1557 or California 216 compaction test method.

H. Optimum Moisture: Water content, percentage by dry weight, corresponding to the maximum dry density as determined by ASTM D-1557.

I. ENGEO: The project geotechnical engineering consulting firm, its employees or its designated representatives.

J. Drawings: All documents, approved for construction, which describe the Work.

1.05 OBSERVATION AND TESTING

A. All site preparation, cutting and shaping, excavating, filling, and backfilling shall be carried out under the observation of ENGEO, employed and paid for by the Owners. ENGEO will perform appropriate field and laboratory tests to evaluate the suitability of fill material, the proper moisture content for compaction, and the degree of compaction achieved. Any fill that does not meet the specification requirements shall be removed and/or reworked until the requirements are satisfied.

B. Cutting and shaping, excavating, conditioning, filling, and compacting procedures require approval of ENGEO as they are performed. Any work found unsatisfactory or any work disturbed by subsequent operations before approval is granted shall be corrected in an approved manner as recommended by ENGEO.

C. Tests for compaction will be made in accordance with test procedures outlined in ASTM D-1557, as applicable. Field testing of soils or compacted fill shall conform with the applicable requirements of ASTM D-2922.

D. All authorized observation and testing will be paid for by the Owners.

1.06 SITE CONDITIONS

A. Excavating, filling, backfilling, and grading work shall not be performed during unfavorable weather conditions. When the work is interrupted by rain, excavating, filling, backfilling, and grading work shall not be resumed until the site and soil conditions are suitable.

B. Contractor shall take the necessary measures to prevent erosion of freshly filled, backfilled, and graded areas until such time as permanent drainage and erosion control measures have been installed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing the required excavating, filling, backfilling, and grading work, and trenching and backfilling for utilities.

2.02 SOIL MATERIALS

A. Fill

1. Material to be used for engineered fill and backfill shall be free from organic matter and other deleterious substances, and of such quality that it will compact thoroughly without excessive voids when watered and rolled. Excavated on-site material will be considered suitable for engineered fill and backfill if it contains no more than 3 percent organic matter, is free of debris and other deleterious substances and conforms to the requirements specified above. Rocks of maximum dimension in excess of two-thirds of the lift thickness shall be removed from any fill material to the satisfaction of ENGEO.

2. Excavated earth material which is suitable for engineered fill or backfill, as determined by ENGEO, shall be conditioned for reuse and properly stockpiled as required for later filling and backfilling operations. Conditioning shall consist of spreading material in layers not to exceed 8 inches and raking free of debris and rubble. Rocks and aggregate exceeding the allowed largest dimension, and deleterious material shall be removed from the site and disposed off site in a legal manner.

3. ENGEO shall be notified at least 48 hours prior to the start of filling and backfilling operations so that it may evaluate samples of the material intended for use as fill and backfill. All materials to be used for filling and backfilling require the approval of ENGEO.

B. Import Material: Where conditions require the importation of fill material, the material shall be an inert, nonexpansive soil or soil-rock material free of organic matter and meeting the following requirements unless otherwise approved by ENGEO.

Gradation (ASTM D-421):	Sieve Size	Percent Passing
	2-inch	100
	#200	15 - 70
Plasticity (ASTM D-4318):	Liquid Limit	Plasticity Index
	< 30	< 12
Swell Potential (ASTM D-4546B): (at optimum moisture)	Percent Heave	Swell Pressure
	< 2 percent	< 300 psf
Resistance Value (ASTM D-2844):	Minimum 25	
Organic Content (ASTM D-2974):	Less than 2 percent	

A sample of the proposed import material should be submitted to ENGEO for evaluation prior to delivery at the site.

2.03 SAND

A. Sand for sand cushion under slabs and for bedding of pipe in utility trenches shall be a clean and graded, washed sand, free from clay or organic material, suitable for the intended purpose with 90 to 100 percent passing a No. 4 U.S. Standard Sieve, not more than 5 percent passing a No. 200 U.S. Standard Sieve, and generally conforming to ASTM C33 for fine aggregate.

2.04 AGGREGATE DRAINAGE FILL

A. Aggregate drainage fill under concrete slabs and paving shall consist of broken stone, crushed or uncrushed gravel, clean quarry waste, or a combination thereof. The aggregate shall be free from fines, vegetable matter, loam, volcanic tuff, and other deleterious

substances. It shall be of such quality that the absorption of water in a saturated surface dry condition does not exceed 3 percent of the oven dry weight of the samples.

B. Aggregate drainage fill shall be of such size that the percentage composition by dry weight as determined by laboratory sieves (U. S. Series) will conform to the following grading:

Sieve Size	Percentage Passing Sieve
1½-inches	100
1-inch	90 - 100
#4	0 - 5

2.05 SUBDRAINS

A. Perforated subdrain pipe of the required diameter shall be installed as shown on the drawings. The pipe(s) shall also conform to these specifications unless otherwise specified by ENGEO in the field.

Subdrain pipe shall be manufactured in accordance with one of the following requirements:

Design depths less than 30 feet

- Perforated ABS Solid Wall SDR 35 (ASTM D-2751)
- Perforated PVC Solid Wall SDR 35 (ASTM D-3034)
- Perforated PVC A-2000 (ASTM F949)
- Perforated Corrugated HDPE double-wall (AASHTO M-252 or M-294, Caltrans Type S, 50 psi minimum stiffness)

Design depths less than 50 feet

- Perforated PVC SDR 23.5 Solid Wall (ASTM D-3034)
- Perforated Sch. 40 PVC Solid Wall (ASTM-1785)
- Perforated ABS SDR 23.5 Solid Wall (ASTM D-2751)
- Perforated ABS DWV/Sch. 40 (ASTM D-2661 and D-1527)
- Perforated Corrugated HDPE double-wall (AASHTO M-252 or M-294, Caltrans Type S, 70 psi minimum stiffness)

Design depths less than 70 feet

- Perforated ABS Solid Wall SDR 15.3 (ASTM D-2751)
- Perforated Sch. 80 PVC (ASTM D-1785)
- Perforated Corrugated Aluminum (ASTM B-745)

B. Permeable Material (Class 2): Class 2 permeable material for filling trenches under, around, and over subdrains, behind building and retaining walls, and for pervious blankets shall consist of clean, coarse sand and gravel or crushed stone, conforming to the following grading requirements:

Sieve Size	Percentage Passing Sieve
1-inch	100
¾-inch	90 - 100
3/8-inch	40 - 100
#4	25 - 40
#8	18 - 33
#30	5 - 15
#50	0 - 7
#200	0 - 3

C. Filter Fabric: All filter fabric shall meet the following Minimum Average Roll Values unless otherwise specified by ENGEO.

Grab Strength (ASTM D-4632) .....180 lbs
Mass Per Unit Area (ASTM D-4751).....6 oz/yd^2
Apparent Opening Size (ASTM D-4751).....70-100 U.S. Std. Sieve
Flow Rate (ASTM D-4491) .....80 gal/min/ft^2
Puncture Strength (ASTM D-4833).....80 lbs

D. Vapor Retarder: Vapor Retarders shall consist of PVC, LDPE or HDPE impermeable sheeting at least 10 mils thick..

2.06 PERMEABLE MATERIAL (Class 1; Type A)

A. Class 1 permeable material to be used in conjunction with filter fabric for backfilling of subdrain excavations shall conform to the following grading requirements:

Sieve Size	Percentage Passing Sieve
¾-inch	100
½-inch	95 - 100
3/8-inch	70 - 100
#4	0 - 55
#8	0 - 10
#200	0 - 3

PART 3 - EXECUTION

3.01 STAKING AND GRADES

A. Contractor shall lay out all his work, establish all necessary markers, bench marks, grading stakes, and other stakes as required to achieve design grades.

3.02 EXISTING UTILITIES

A. Contractor shall verify the location and depth (elevation) of all existing utilities and services before performing any excavation work.

3.03 EXCAVATION

A. Contractor shall perform excavating as indicated and required for concrete footings, drilled piers, foundations, floor slabs, concrete walks, and site leveling and grading, and provide shoring, bracing, underpinning, cribbing, pumping, and planking as required. The bottoms of excavations shall be firm undisturbed earth, clean and free from loose material, debris, and foreign matter.

B. Excavations shall be kept free from water at all times. Adequate dewatering equipment shall be maintained at the site to handle emergency situations until concrete or backfill is placed.

C. Unauthorized excavations for footings shall be filled with concrete to required elevations, unless other methods of filling are authorized by ENGEO.

D. Excavated earth material which is suitable for engineered fill or backfill, as determined by ENGEO, shall be conditioned for reuse and properly stockpiled for later filling and backfilling operations as specified under Section 2.02, "Soil Materials."

E. Abandoned sewers, piping, and other utilities encountered during excavating shall be removed and the resulting excavations shall be backfilled with engineered fill as required by ENGEO.

F. Any active utility lines encountered shall be reported immediately to the Owner's Representative and authorities involved. The Owner and proper authorities shall be permitted free access to take the measures deemed necessary to repair, relocate, or remove the obstruction as determined by the responsible authority or Owner's Representative.

3.04 SUBGRADE PREPARATION

A. All brush and other rubbish, as well as trees and root systems not marked for saving, shall be removed from the site and legally disposed of.

B. Any existing structures, foundations, underground storage tanks, or debris must be removed from the site prior to any building, grading, or fill operations. Septic tanks, including all drain fields and other lines, if encountered, must be totally removed. The resulting depressions shall be properly prepared and filled to the satisfaction of ENGEO.

C. Vegetation and organic topsoil shall be removed from the surface upon which the fill is to be placed and either removed and legally disposed of or stockpiled for later use in approved landscape areas. The surface shall then be scarified to a depth of at least eight inches until the surface is free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

D. After the foundation for the fill has been cleared and scarified, it shall be made uniform and free from large clods. The proper moisture content must be obtained by adding water or aerating. The foundation for the fill shall be compacted at the proper moisture content to a relative compaction as specified herein.

3.05 ENGINEERED FILL

A. Select Material: Fill material shall be "Select" or "Imported Material" as previously specified.

B. Placing and Compacting: Engineered fill shall be constructed by approved and accepted methods. Fill material shall be spread in uniform lifts not exceeding 8 inches in uncompacted thickness. Each layer shall be spread evenly, and thoroughly blade-mixed to obtain uniformity of material. Fill material which does not contain sufficient moisture as specified by ENGEO shall be sprinkled with water; if it contains excess moisture it shall be aerated or blended with drier material to achieve the proper water content. Select material and water shall then be thoroughly mixed before being compacted.

C. Unless otherwise specified in the Geotechnical Exploration report, each layer of spread select material shall be compacted to at least 90 percent relative compaction at a moisture content of at least three percent above the optimum moisture content. Minimum compaction in all keyways shall be a minimum of 95 percent with a minimum moisture content of at least 1 percentage point above optimum.

D. Unless otherwise specified in the Geotechnical Exploration report or otherwise required by the local authorities, the upper 6 inches of engineered fill in areas to receive pavement shall be compacted to at least 95 percent relative compaction with a minimum moisture content of at least 3 percentage points above optimum.

E. Testing and Observation of Fill: The work shall consist of field observation and testing to determine that each layer has been compacted to the required density and that the required moisture is being obtained. Any layer or portion of a layer that does not attain the compaction required shall be reworked until the required density is obtained.

F. Compaction: Compaction shall be by sheepsfoot rollers, multiple-wheel steel or pneumatic-tired rollers or other types of acceptable compaction equipment. Rollers shall be of such design that they will be able to compact the fill to the specified compaction. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer must be continuous so that the required compaction may be obtained uniformly throughout each layer.

G. Fill slopes shall be constructed by overfilling the design slopes and later cutting back the slopes to the design grades. No loose soil will be permitted on the faces of the finished slopes.

H. Strippings and topsoil shall be stockpiled as approved by Owner, then placed in accordance with ENGEO's recommendations to a minimum thickness of 6 inches and a maximum thickness of 12 inches over exposed open space cut slopes which are 3:1 or flatter, and track walked to the satisfaction of ENGEO.

I. Final Prepared Subgrade: Finish blading and smoothing shall be performed as necessary to produce the required density, with a uniform surface, smooth and true to grade.

3.06 BACKFILLING

A. Backfill shall not be placed against footings, building walls, or other structures until approved by ENGEO.

B. Backfill material shall be Select Material as specified for engineered fill.

C. Backfill shall be placed in 6-inch layers, leveled, rammed, and tamped in place. Each layer shall be compacted with suitable compaction equipment to 90 percent relative compaction at a moisture content of at least 3 percent above optimum.

3.07 TRENCHING AND BACKFILLING FOR UTILITIES

A. Trenching:

1. Trenching shall include the removal of material and obstructions, the installation and removal of sheeting and bracing and the control of water as necessary to provide the required utilities and services.

2. Trenches shall be excavated to the lines, grades, and dimensions indicated on the Drawings. Maximum allowable trench width shall be the outside diameter of the pipe plus 24 inches, inclusive of any trench bracing.

3. When the trench bottom is a soft or unstable material as determined by ENGEO, it shall be made firm and solid by removing said unstable material to a sufficient depth and replacing it with on-site material compacted to 90 percent minimum relative compaction.

4. Where water is encountered in the trench, the contractor must provide materials necessary to drain the water and stabilize the bed.

B. Backfilling:

1. Trenches must be backfilled within 2 days of excavation to minimize desiccation.

2. Bedding material shall be sand and shall not extend more than 6 inches above any utility lines.

3. Backfill material shall be select material.

4. Trenches shall be backfilled as indicated or required and compacted with suitable equipment to 90 percent minimum relative compaction at the required moisture content.

3.08 SUBDRAINS

A. Trenches for subdrain pipe shall be excavated to a minimum width equal to the outside diameter of the pipe plus at least 12 inches and to a depth of approximately 2 inches below the grade established for the invert of the pipe, or as indicated on the Drawings.

B. The space below the pipe invert shall be filled with a layer of Class 2 permeable material, upon which the pipe shall be laid with perforations down. Sections shall be joined as recommended by the pipe manufacturer.

C. Rocks, bricks, broken concrete, or other hard material shall not be used to give intermediate support to pipes. Large stones or other hard objects shall not be left in contact with the pipes.

D. Excavations for subdrains shall be filled as required to fill voids and prevent settlement without damaging the subdrain pipe. Alternatively, excavations for subdrains may be filled with Class 1 permeable material (as defined in Section 2.06) wrapped in Filter Fabric (as defined in Section 2.05).

3.09 AGGREGATE DRAINAGE FILL

A. ENGEO shall approve finished subgrades before aggregate drainage fill is installed.

B. Pipes, drains, conduits, and any other mechanical or electrical installations shall be in place before any aggregate drainage fill is placed. Backfill at walls to elevation of drainage fill shall be in place and compacted.

C. Aggregate drainage fill under slabs and concrete paving shall be the minimum uniform thickness after compaction of dimensions indicated on Drawings. Where not indicated, minimum thickness after compaction shall be 4 inches.

D. Aggregate drainage fill shall be rolled to form a well-compacted bed.

E. The finished aggregate drainage fill must be observed and approved by ENGEO before proceeding with any subsequent construction over the compacted base or fill.

3.10 SAND CUSHION

A. A sand cushion shall be placed over the vapor retarder membrane under concrete slabs on grade. Sand cushion shall be placed in uniform thickness as indicated on the Drawings. Where not indicated, the thickness shall be 2 inches.

3.11 FINISH GRADING

A. All areas must be finish graded to elevations and grades indicated on the Drawings. In areas to receive topsoil and landscape planting, finish grading shall be performed to a uniform 6 inches below the grades and elevations indicated on the Drawings, and brought to final grade with topsoil.

3.12 DISPOSAL OF WASTE MATERIALS

A. Excess earth materials and debris shall be removed from the site and disposed of in a legal manner. Location of dump site and length of haul are the Contractor's responsibility.

PART II - GEOGRID SOIL REINFORCEMENT

1. DESCRIPTION:

   Work shall consist of furnishing geogrid soil reinforcement for use in construction of reinforced soil slopes and retention systems.

2. GEOGRID MATERIAL:

   2.1 The specific geogrid material shall be preapproved by ENGEO.

   2.2 The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under construction stresses and shall have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced.

   2.3 The geogrids shall have an Allowable Strength (T_a) and Pullout Resistance, for the soil type(s) indicated, as listed in Table I.

   2.4 Certifications: The Contractor shall submit a manufacturer's certification that the geogrids supplied meet the respective index criteria set when geogrid was approved by ENGEO, measured in full accordance with all test methods and standards specified. In case of dispute over validity of values, the Contractor will supply test data from an ENGEO-approved laboratory to support the certified values submitted.

3. CONSTRUCTION:

   3.1 Delivery, Storage, and Handling: Contractor shall check the geogrid upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geogrid shall be protected from temperatures greater than 140 °F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geogrid will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geogrid damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

3.2 On-Site Representative: Geogrid material suppliers shall provide a qualified and experienced representative on site at the initiation of the project, for a minimum of three days, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Geogrid reinforcement may be joined with mechanical connections or overlaps as recommended and approved by the Manufacturer. Joints shall not be placed within 6 feet of the slope face, within 4 feet below top of slope, nor horizontally or vertically adjacent to another joint.

3.4 Geogrid Placement: The geogrid reinforcement shall be installed in accordance with the manufacturer's recommendations. The geogrid reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed.

The geogrid reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. However, if the Contractor is unable to complete a required length with a single continuous length of geogrid, a joint may be made with the Manufacturer's approval. Only one joint per length of geogrid shall be allowed. This joint shall be made for the full width of the strip by using a similar material with similar strength. Joints in geogrid reinforcement shall be pulled and held taut during fill placement.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacings between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings.

Adjacent rolls of geogrid reinforcement shall be overlapped or mechanically connected where exposed in a wrap around face system, as applicable.

The Contractor may place only that amount of geogrid reinforcement required for immediately pending work to prevent undue damage. After a layer of geogrid reinforcement has been placed, the next succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geogrid reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geogrid reinforcement and soil.

Geogrid reinforcement shall be placed to lay flat and pulled tight prior to backfilling. After a layer of geogrid reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geogrid reinforcement in position until the subsequent soil layer can be placed.

Under no circumstances shall a track-type vehicle be allowed on the geogrid reinforcement before at least six inches of soil have been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geogrid reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

During construction, the surface of the fill should be kept approximately horizontal. Geogrid reinforcement shall be placed directly on the compacted horizontal fill surface. Geogrid reinforcements are to be placed within three inches of the design elevations and extend the length as shown on the elevation view unless otherwise directed by ENGEO. Correct orientation of the geogrid reinforcement shall be verified by ENGEO.

Table I
Allowable Geogrid Strength
With Various Soil Types
For Geosynthetic Reinforcement In
Mechanically Stabilized Earth Slopes

(Geogrid Pullout Resistance and Allowable Strengths vary with reinforced backfill used due to soil anchorage and site damage factors. Guidelines are provided below.)

SOIL TYPE	MINIMUM ALLOWABLE STRENGTH, T_a (lb/ft)*		
	GEOGRID Type I	GEOGRID Type II	GEOGRID Type III
A. Gravels, sandy gravels, and gravel-sand-silt mixtures (GW, GP, GC, GM & SP)**	2400	4800	7200
B. Well graded sands, gravelly sands, and sand-silt mixtures (SW & SM)**	2000	4000	6000
C. Silts, very fine sands, clayey sands and clayey silts (SC & ML)**	1000	2000	3000
D. Gravelly clays, sandy clays, silty clays, and lean clays (CL)**	1600	3200	4800

* All partial Factors of Safety for reduction of design strength are included in listed values. Additional factors of safety may be required to further reduce these design strengths based on site conditions.

** Unified Soil Classifications.

PART III - GEOTEXTILE SOIL REINFORCEMENT

1. DESCRIPTION:

   Work shall consist of furnishing geotextile soil reinforcement for use in construction of reinforced soil slopes.

2. GEOTEXTILE MATERIAL:

   2.1 The specific geotextile material and supplier shall be preapproved by ENGEO.

   2.2 The geotextile shall have a high tensile modulus and shall have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced.

   2.3 The geotextiles shall have an Allowable Strength (T_a) and Pullout Resistance, for the soil type(s) indicated as listed in Table II.

   2.4 Certification: The Contractor shall submit a manufacturer's certification that the geotextiles supplied meet the respective index criteria set when geotextile was approved by ENGEO, measured in full accordance with all test methods and standards specified. In case of dispute over validity of values, the Contractor will supply the data from an ENGEO-approved laboratory to support the certified values submitted.

3. CONSTRUCTION:

   3.1 Delivery, Storage and Handling: Contractor shall check the geotextile upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geotextile shall be protected from temperatures greater than 140 °F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geotextile will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geotextile damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

   3.2 On-Site Representative: Geotextile material suppliers shall provide a qualified and experienced representative on site at the initiation of the project, for a minimum of three days, to assist the Contractor and ENGEO personnel at the start of construction. If there is

more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Geotextile Placement: The geotextile reinforcement shall be installed in accordance with the manufacturer's recommendations. The geotextile reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed.

The geotextile reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. Joints shall not be used with geotextiles.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacings between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings.

Adjacent rolls of geotextile reinforcement shall be overlapped or mechanically connected where exposed in a wrap around face system, as applicable.

The Contractor may place only that amount of geotextile reinforcement required for immediately pending work to prevent undue damage. After a layer of geotextile reinforcement has been placed, the succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geotextile reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geotextile reinforcement and soil.

Geosynthetic reinforcement shall be placed to lay flat and be pulled tight prior to backfilling. After a layer of geotextile reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geotextile reinforcement in position until the subsequent soil layer can be placed.

Under no circumstances shall a track-type vehicle be allowed on the geotextile reinforcement before at least six inches of soil has been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geotextile reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geotextile reinforcement as slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

During construction, the surface of the fill should be kept approximately horizontal. Geotextile reinforcement shall be placed directly on the compacted horizontal fill surface. Geotextile reinforcements are to be placed within three inches of the design elevations and

extend the length as shown on the elevation view unless otherwise directed by ENGEO. Correct orientation of the geotextile reinforcement shall be verified by ENGEO.

Table II
Allowable Geotextile Strength
With Various Soil Types
For Geosynthetic Reinforcement In
Mechanically Stabilized Earth Slopes

(Geotextile Pullout Resistance and Allowable Strengths vary with reinforced backfill used due to soil anchorage and site damage factors. Guidelines are provided below.)

SOIL TYPE	MINIMUM ALLOWABLE STRENGTH, T_a (lb/ft)*		
	GEOTEXTILE Type I	GEOTEXTILE Type II	GEOTEXTILE Type III
A. Gravels, sandy gravels, and gravel-sand-silt mixtures (GW, GP, GC, GM & SP)**	2400	4800	7200
B. Well graded sands, gravelly sands, and sand-silt mixtures (SW & SM)**	2000	4000	6000
C. Silts, very fine sands, clayey sands and clayey silts (SC & ML)**	1000	2000	3000
D. Gravelly clays, sandy clays, silty clays, and lean clays (CL)**	1600	3200	4800

* All partial Factors of Safety for reduction of design strength are included in listed values. Additional factors of safety may be required to further reduce these design strengths based on site conditions.

** Unified Soil Classifications.

PART IV - EROSION CONTROL MAT OR BLANKET

1. DESCRIPTION:

   Work shall consist of furnishing and placing a synthetic erosion control mat and/or degradable erosion control blanket for slope face protection and lining of runoff channels.

2. EROSION CONTROL MATERIALS:

   2.1 The specific erosion control material and supplier shall be pre-approved by ENGEO.

   2.2 Certification: The Contractor shall submit a manufacturer's certification that the erosion mat/blanket supplied meets the criteria specified when the material was approved by ENGEO. The manufacturer's certification shall include a submittal package of documented test results that confirm the property values. In case of a dispute over validity of values, the Contractor will supply property test data from an ENGEO-approved laboratory, to support the certified values submitted. Minimum average roll values, per ASTM D 4759, shall be used for conformance determinations.

3. CONSTRUCTION:

   3.1 Delivery, Storage, and Handling: Contractor shall check the erosion control material upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the erosion mat shall be protected from temperatures greater than 140 °F, mud, dirt, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the erosion mat/blanket shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be removed by cutting OUT a section of the mat. The remaining ends should be overlapped and secured with ground anchors. Any erosion mat/blanket damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Owner.

   3.2 On-Site Representative: Erosion control material suppliers shall provide a qualified and experienced representative on site, for a minimum of one day, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criteria will apply to construction of the initial slope only. The representative shall be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Placement: The erosion control material shall be placed and anchored on a smooth graded, firm surface approved by the Engineer. Anchoring terminal ends of the erosion control material shall be accomplished through use of key trenches. The material in the trenches shall be anchored to the soil on maximum 1½ foot centers. Topsoil, if required by construction drawings, placed over final grade prior to installation of the erosion control material shall be limited to a depth not exceeding 3 inches.

3.4 Erosion control material shall be anchored, overlapped, and otherwise constructed to ensure performance until vegetation is well established. Anchors shall be as designated on the construction drawings, with a minimum of 12 inches length, and shall be spaced as designated on the construction drawings, with a maximum spacing of 4 feet.

3.5 Soil Filling: If noted on the construction drawings, the erosion control mat shall be filled with a fine grained topsoil, as recommended by the manufacturer. Soil shall be lightly raked or brushed on/into the mat to fill the mat voids or to a maximum depth of 1 inch.

PART V - GEOSYNTHETIC DRAINAGE COMPOSITE

1. DESCRIPTION:

Work shall consist of furnishing and placing a geosynthetic drainage system as a subsurface drainage medium for reinforced soil slopes.

2. DRAINAGE COMPOSITE MATERIALS:

2.1 The specific drainage composite material and supplier shall be preapproved by ENGEO.

2.2 The drain shall be of composite construction consisting of a supporting structure or drainage core material surrounded by a geotextile. The geotextile shall encapsulate the drainage core and prevent random soil intrusion into the drainage structure. The drainage core material shall consist of a three dimensional polymeric material with a structure that permits flow along the core laterally. The core structure shall also be constructed to permit flow regardless of the water inlet surface. The drainage core shall provide support to the geotextile. The fabric shall meet the minimum property requirements for filter fabric listed in Section 2.05C of the Guide Earthwork Specifications.

2.3 A geotextile flap shall be provided along all drainage core edges. This flap shall be of sufficient width for sealing the geotextile to the adjacent drainage structure edge to prevent soil intrusion into the structure during and after installation. The geotextile shall cover the full length of the core.

2.4 The geocomposite core shall be furnished with an approved method of constructing and connecting with outlet pipes or weepholes as shown on the plans. Any fittings shall allow entry of water from the core but prevent intrusion of backfill material into the core material.

2.5 Certification and Acceptance: The Contractor shall submit a manufacturer's certification that the geosynthetic drainage composite meets the design properties and respective index criteria measured in full accordance with all test methods and standards specified. The manufacturer's certification shall include a submittal package of documented test results that confirm the design values. In case of dispute over validity of design values, the Contractor will supply design property test data from an ENGEO-approved laboratory, to support the certified values submitted. Minimum average roll values, per ASTM D 4759, shall be used for determining conformance.

3. CONSTRUCTION:

3.1 Delivery, Storage, and Handling: Contractor shall check the geosynthetic drainage composite upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geosynthetic drainage composite shall be protected from temperatures greater than 140 °F, mud, dirt, and debris. Manufacturer's recommendations in regards to protection from direct sunlight must also be followed. At the time of installation, the geosynthetic drainage composite shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be removed or repaired. Any geosynthetic drainage composite damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Owner.

3.2 On-Site Representative: Geosynthetic drainage composite material suppliers shall provide a qualified and experienced representative on site, for a minimum of one half day, to assist the Contractor and ENGEO personnel at the start of construction with directions on the use of drainage composite. If there is more than one application on a project, this criterion will apply to construction of the initial application only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining applications.

3.3 Placement: The soil surface against which the geosynthetic drainage composite is to be placed shall be free of debris and inordinate irregularities that will prevent intimate contact between the soil surface and the drain.

3.4 Seams: Edge seams shall be formed by utilizing the flap of the geotextile extending from the geocomposite's edge and lapping over the top of the fabric of the adjacent course. The fabric flap shall be securely fastened to the adjacent fabric by means of plastic tape or non-water-soluble construction adhesive, as recommended by the supplier. Where vertical splices are necessary at the end of a geocomposite roll or panel, an 8-inch-wide continuous strip of geotextile may be placed, centering over the seam and continuously fastened on both sides with plastic tape or non-water-soluble construction adhesive. As an alternative, rolls of geocomposite drain material may be joined together by turning back the fabric at the roll edges and interlocking the cuspidations approximately 2 inches. For overlapping in this manner, the fabric shall be lapped and tightly taped beyond the seam with tape or adhesive. Interlocking of the core shall always be made with the upstream edge on top in the direction of water flow. To prevent soil intrusion, all exposed edges of the geocomposite drainage core edge must be covered. Alternatively, a 12-inch-wide strip of fabric may be utilized in the same manner, fastening it to the exposed fabric 8 inches in from the edge and folding the remaining flap over the core edge.

3.5 Soil Fill Placement: Structural backfill shall be placed immediately over the geocomposite drain. Care shall be taken during the backfill operation not to damage the geotextile surface of the drain. Care shall also be taken to avoid excessive settlement of the backfill material. The geocomposite drain, once installed, shall not be exposed for more than seven days prior to backfilling.