PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR THE EAST AREA 1 SPECIFIC PLAN SANTA PAULA AREA OF UNINCORPORATED VENTURA COUNTY, CALIFORNIA

Prepared for:

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c/o Parkstone Companies
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Project Number 031852-001

April 19, 2007

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

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To: Limoneira Company
c/o Parkstone Companies
860 Hampshire Road, Suite U
Westlake Village, California 91361

Attention: Mr. Mike Penrod

Subject: Preliminary Geotechnical Investigation Report for East Area 1 Specific Plan, Santa Paula Area of Unincorporated Ventura County, California.

In accordance with your request and authorization, Leighton and Associates, Inc. (Leighton) has completed a feasibility-level geotechnical investigation for the proposed development of roughly 375 acres of an approximately 500-acre parcel known as East Area 1, located immediately east of the Santa Paula city limits in unincorporated Ventura County, California. We understand that the site is proposed to be developed with low- to mid-rise residential, civic, and commercial buildings.

The purpose of our investigation was to evaluate the subsurface conditions of the site, identify the geologic hazards that may impact the feasibility of the proposed development, and provide preliminary geotechnical recommendations for use in planning and conceptual design. The investigation was also intended to develop geotechnical input for use in preparation of an environmental impact report for the site. We understand that Huitt-Zollars, Inc. will be preparing a feasibility study for the site infrastructure and that Impact Sciences, Inc. will be preparing the Technical Background Report for the Environmental Impact Report.

The proposed development is feasible from a geotechnical standpoint provided our recommendations are implemented in the design and construction of the project. Additional geotechnical investigation will be required to develop final design recommendations.

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If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

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EXECUTIVE SUMMARY

Leighton and Associates, Inc. (Leighton) has performed a preliminary geotechnical investigation for the East Area 1 Specific Plan. The project site is located immediately east of the City of Santa Paula, California at the base of the foothills of the Topatopa Mountains. The site is bounded roughly by the Southern Pacific Railroad on the south, Haun Creek on the east, Santa Paula Creek on the west, and the foothills of the Topatopa Mountains on the north. The majority of the site is actively cultivated with citrus and avocado orchards and row crops. Santa Paula Creek has been channelized along the length of the project site while Haun Creek has been channelized in the central to southerly extent of the property. The site generally drains towards the Santa Clara River to the south.

Development of the site is proposed to include low- to mid-rise civic, educational, park, residential, and commercial buildings. Infrastructure improvements to accommodate access to the site will include a bridge across Santa Paula Creek at Santa Paula Street and extension of Hallock Drive.

Leighton's investigation included background studies, borings, test pits, and laboratory testing to characterize the on-site soils and bedrock; geologic mapping; and a fault investigation. The background studies included review of readily available geologic and geotechnical reports and aerial photos for the site and vicinity. The fault investigation included geologic logging and radio carbon dating of exposures in an excavator trench.

The subsurface materials encountered at the site consisted of undocumented fill, (younger) alluvium, older alluvium, colluvium, landslide debris, and bedrock of the Saugus Formation. While high groundwater levels have not been reported at the site by the California Geological Survey, our explorations encountered groundwater as shallow as 21 feet below the ground surface in the southeast portion of the site.

Faulting in the vicinity of the site strikes east-west. There are no mapped faults on the site and the site is not within an Alquist-Priolo (A-P) Earthquake Fault Hazard Special Studies Zone. A fault investigation conducted to assess suspect geomorphology within the project site determined that no active faults are present. Therefore, the potential for surface fault rupture affecting the site is considered to be low.

Natural slopes up to approximately 290 feet in height face Santa Paula Creek along the northwest portion of the site. Much of the foothill area in the northern end of the site is within a State of California designated hazard area for earthquake-induced landslides. The high slopes facing Santa Paula Creek were found to be only marginally stable and a structural set-back line is recommended to mitigate the hazard from these slopes. Habitable structures should not be constructed within the structural setback zone.

Although the site is not is within a State of California designated liquefaction hazard area, our explorations encountered shallow groundwater and soils with low relative densities in the southeast portion of the site, which when combined are indicative of liquefaction hazard. However, the soils encountered in the southeast portion of the site appear to be sufficiently clayey and the soils in the remainder of the site sufficiently dense for the potential of liquefaction occurring beneath the site to be low. Some seismically-induced settlement could impact the development of the southeast portion of the site. Additional studies are required to better delineate the potential for liquefaction and seismic settlement at the site, especially in the southeastern portion of the site. Seismically-induced differential settlement can generally be mitigated using common construction techniques.

The near-surface soils are expected to have been disturbed by agricultural activities and additional disturbance is expected during demolition of the existing on-site structures and orchards. Disturbed near-surface soils should be excavated and replaced as compacted fill to provide support for proposed structures. Oversized boulders are expected to be encountered and will require special handling during grading.

Shallow groundwater is not expected to impact construction of the proposed buildings. However, site-specific explorations should be performed for the proposed bridge to evaluate the possible impact of groundwater on its construction.

Generally, buildings in the western portion of the site may be supported by spread footings with the floor slabs supported on grade. Buildings in the eastern portion of the site will likely have to be supported on post-tensioned slabs or mat-type foundations due to potential seismically-induced differential settlement.

Based on the results of our preliminary investigation, the proposed development of the site is feasible from a geotechnical perspective. Additional geotechnical investigation will be required to develop final design recommendations.

1. INTRODUCTION

1.1 Purpose

This report presents the results of a preliminary geotechnical investigation performed by Leighton and Associates (Leighton) for the East Area 1 Specific Plan. The project site is located immediately east of Santa Paula, California. The site is proposed to be developed for civic, educational, residential, commercial, and open space/park uses.

The purpose of our investigation was to explore the subsurface conditions, provide preliminary geotechnical recommendations for use in the conceptual-level planning and design of development, and provide geotechnical input for preparation of an environmental impact report (EIR) for the project site. This report includes a preliminary assessment of the seismic and geologic hazards that might affect the site as well as evaluation of the geotechnical characteristics of the site with regard to a low- to mid-rise mixed-use development.

Since a tentative tract map was not available for Leighton's review at the time of this study, this report is not intended to address concerns that would apply to such a map beyond those that are applicable to an EIR.

1.2 Site Location and Description

The project site is located adjacent to the east side of the City of Santa Paula and is bounded roughly by the Southern Pacific Railroad and properties with frontage on Telegraph Road on the south, Haun Creek on the east, Santa Paula Creek on the west, and the foothills of the Topatopa Mountains on the north (Figure 1).

The majority of the site is actively cultivated with citrus and avocado orchards and row crops. The main access to the site is from Telegraph Road via Padre Lane. Several paved and dirt access roads traverse the site and foothills to the north. Houses, storage sheds and a barn exist in the southern and southeastern portions of the site. Other site features include rock- and concrete-lined drainage ditches, earthen berms, and a network of irrigation pipes. Both Haun Creek and Santa Paula Creek have been channelized along the east and west edges of the site, respectively. Several utility and oil line easements exist along the southern boundary of the site, parallel to and within the southern Pacific Railway easement. Petroleum pipeline markers associated with Seneca Oil near the eastern edge of the site roughly parallel to Haun Creek were observed during our site reconnaissance.

1.3 Proposed Development

Leighton understands that proposed development of the site will include low- to mid-rise civic, educational, park, residential, and commercial units. We also understand that the planned approach is to develop the flatter portions of the site while (with exception of water tank sites) the hillsides to the north are to remain as undeveloped open space or agricultural preserve. The portion of the site planned to be developed has an area of approximately 375 acres, which includes approximately 72 acres of parks and greenways, 23 acres of athletic fields, and 85 acres of public rights-of-way. Infrastructure improvements to accommodate access to the site will include a bridge across Santa Paula Creek at Santa Paula Street and extension of Hallock Drive. Leighton also understands that detention basins are planned adjacent to Haun Creek. The proposed development is illustrated on the Proposed Regulating Plan (HDR | Town Planning, 2007b) attached herewith as Figure 2.

1.4 Scope of Work

Leighton performed the following tasks as part of its scope of work:

- Reviewed readily available reports, aerial photos, and published maps pertinent to the project site and vicinity. The resources reviewed are listed in Appendix A, References.
- Marked exploratory excavation locations and obtained clearance from Underground Service Alert.
- Coordinated exploration activities with on-going agricultural operations at the site.
- Performed subsurface explorations to allow characterization of the site's geologic, soil, and groundwater conditions. The explorations included drilling, logging, and sampling of 12 hollow-stem auger borings, 3 mud-rotary borings, and 4 bucket-auger borings; performing 6 Cone Penetrometer Test (CPT) soundings, excavating and logging of 8 backhoe trenches and are excavation trench (ET-1). Exploration locations are shown on Plate 1, Preliminary Geotechnical Map. The explorations are discussed in Section 2 with details presented in Appendix B, Field Exploration Program.
- Performed preliminary geologic mapping of the exposed earth units at the site such as landslides, bedrock exposures, and alluvium as shown on Plate 1.
- Performed laboratory testing to evaluate the properties of selected samples obtained from borings. The tests are listed in Section 3 and described and the results are presented in Appendix C, Laboratory Test Results.

- Performed stereoscopic analyses of aerial photographs of the site and vicinity from our in-house air-photo library collection to assess general geologic conditions and the presence or absence of topographic landforms that may be indicative of faulting and landsliding.

- Assessed potential seismic ground motions at the site that may be generated by future, nearby earthquakes in accordance with current California Building Code criteria.

- Performed preliminary slope stability evaluation. Details of these analyses are presented in Appendix D, Slope Stability Analyses. Geologic sections are shown on Plate 2, Cross-Sections A-A' through I-I'.

- Assessed the potential for liquefaction, lateral spreading, and seismic settlement per the DMG SP 117 (DMG, 1997) guidelines.

- Assessed the impact of the groundwater table on design and construction.

- Performed a fault investigation of a lineament that included excavation of a trench, detailed geologic logging, sampling, and geologic analyses of the exposed bedrock and soils. Details of the investigation are presented in Sections 4 and 5 of this report. The log of the trench is presented as Plate 3, Excavator Trench Log.

- Retained Earth Consultants International to perform sampling, radiocarbon dating, and soil stratigraphy of the soils exposed in the excavator trench. The results of the Earth Consultants International study are presented in Appendix E, Earth Consultants International Age Estimate Report.

- Identified weak layers and compressible soils.

- Evaluated potential shrinkage and/or bulking during grading.

- Prepared this report presenting our findings, conclusions, and recommendations relating to the geotechnical feasibility of developing the site and proposed methods of mitigating the identified potential geologic and geotechnical hazards or constraints.

2. FIELD EXPLORATION PROGRAM

The geotechnical investigation included geologic mapping and subsurface explorations. Field explorations were performed between January 18, 2006, and January 4, 2007. The explorations included excavation of 12 hollow-stem auger borings (HSA-1 through HSA-12), 3 mud-rotary borings (RW-1 through 3), 8 backhoe trenches (LT-1 through LT-8), 4 bucket-auger borings (LB-1 through LB-4), 6 CPT soundings (CPT-1 through CPT- 6), and 1 excavator trench (ET-1). The locations of Leighton's explorations are shown on Plate 1. Logs of the borings and backhoe trenches and the results of the CPT soundings are presented in Appendix B along with details of our field investigation.

3. LABORATORY TESTING

Laboratory tests were performed to aid in classification of the soils and to determine the properties of selected specimens of the materials encountered at the site. The following tests were performed with the details and results of the tests presented in Appendix C:

- In-situ dry density and moisture content;
- Particle-Size Analyses;
- One-Dimensional Swell or Settlement;
- Consolidation;
- Direct shear;
- Maximum dry density and optimum moisture content determination;
- Expansion Index; and
- Soil Corrosivity.

In addition, carbon or charcoal samples were collected and analyzed for radiocarbon dating to assess the age of sediments exposed in ET-1 (Plates 1 and 3). The results of these tests are presented in Appendix E.

4. SITE GEOLOGY

4.1 Physiography

The area is located on the northern side of the Santa Clara River Valley near the base of the foothills of Topatopa Mountain which is in Los Padres National Forest. The Santa Clara River trends and drains to the west-southwest toward the Pacific Ocean. The project site is located between Santa Paula Creek and Haun Creek near the coalescence of their respective flood plains. Both natural drainage courses have been altered and channelized by grading, as evidenced by existing earthen berms and the linear appearance of their active channels.

The site generally slopes and drains toward the Santa Clara River to the south. The southern two-thirds of the site are gently sloping, while the northern portion of the site is characterized by gentle to very steep slopes, ridgelines, cliffs, and deeply-incised canyons. Generally the canyons trend roughly north-south, and drain to the lower portions of the site via sheet flow and along man-made channels. The ground surface at the site ranges from approximately Elevation +305 feet mean sea level (msl) in the southern portion to approximately Elevation +785 feet msl in the hills to the north. Natural slopes, up to approximately 290 feet tall, rise above the planned development areas in the northwest corner of the site. Portions of the slopes are near-vertical and have effective gradients as steep as approximately 1:1 (horizontal: vertical) and are considered the most critical for the proposed development in terms of slope stability. Consequently, these slopes were specifically explored with bucket auger borings, backhoe trenches, and geologic mapping.

4.2 Regional Geologic Setting

The property is located within the Transverse Ranges physiographic province of California. This geomorphic province is characterized by an east-west trending geologic grain, meaning that its primary faults, folds, mountains and valleys are all aligned in an east-west direction. The Transverse Ranges are a tectonically active region, with high rates of uplift, folding, and sedimentation. This deformation is driven by north-south compression associated with the convergence of the North American Plate and the Pacific Plate, which has caused folding and faulting in the rock units and overlying sediments in the region.

The site is on the north side of the Santa Clara River Valley, which is a deep synclinal trough with a very thick sequence of Plio-Pleistocene sediments that were deposited contemporaneously with regional folding. The site is on the northern limb of the Santa Clara Syncline. The Santa Clara Syncline is truncated by the Oak Ridge Fault to the south and by the San Cayetano Fault to the north.

Several zoned active faults are delineated near the site. Approximately ¾ of a mile south of the site is the Oak Ridge fault, which is a south-dipping reverse fault. Other significant faults located approximately 1½ to 3½ miles north of the site include, from south to north, the Orcutt, Timber Canyon, Sissar, and San Cayetano faults (Dibblee, 1992a, b). Several smaller unnamed secondary faults have been mapped between the larger fault systems. These smaller faults accommodate a fraction of the regional strain relative to the primary faults (discussed in more detail in Section 4.6).

4.3 Earth Materials

The aerial extent of exposed earth materials at the site is depicted on Plate 1. The following is a list of geologic units and their general descriptions as observed or anticipated:

Fill (Map Symbol Af): Undocumented or uncertified fill associated with construction of dirt roads, drainage channels, and general agricultural activities are widespread throughout the site. The limits of uncertified fills were delineated where significant amounts were obvious based on aerial photo review and field mapping. Fills generally consist of reddish brown mixtures of sand and clayey silt with abundant gravel and boulders. The material encountered is generally moist, loose or soft, and somewhat rich in organic content in some areas. Estimated thicknesses observed on-site range from 1 to 15 feet. Thicknesses may vary greatly in areas that have not been explored, particularly along the embankments adjacent to Santa Paula Creek and Haun Creek or where drainages have been filled in.

Colluvium (Map Symbol Qc): Colluvium accumulates along steep slopes, in swales, and on dip slopes. Colluvium is a collection of loose and generally heterogeneous soil materials and rock fragments forming as a result of weathering and downslope creep. As observed in LB-1, the colluvium is generally clayey in nature, very porous and somewhat organic.

Debris Flows (refer to Plate 1 for map symbol): Evidence of shallow debris flows was observed on the hillsides throughout the mountainous portions of the project site, particularly in the steep swales and near the top of steep slopes. These deposits are generated when the unconsolidated earth materials (like topsoil, colluvium/slopewash, and/or highly weathered bedrock) on steep slopes or at the heads of small drainage courses become saturated, liquefy, and are mobilized downslope. Based on geomorphic expression and observed aerial extent (see Plate 1), the estimated thickness of these deposits ranges from 4 to 15 feet.

Landslide Debris (refer to Plate 1 for map symbol): Deep-seated landslides have not been previously mapped or observed within the limits of the project site. However, several suspected relatively shallow landslide features have been observed and mapped. Many of the mapped landslides appear to be rotational and wedge type failures that failed across bedding planes or along intersecting planes of weakness. A few landslides appear to have failed along bedding planes in localized areas of the project site. Landslide deposits generally consist of mixtures of broken and fractured bedrock material, soil, clay seams, abundant calcium carbonate veins, and debris from adjacent and underlying geologic units.

Alluvium (Map Symbol Qal): Alluvium is deposited in and at the mouths of canyons, active stream channels, and flood plains of Haun and Santa Paula Creeks. The material generally consists of reddish brown interbedded silty sand, sandy silt, and clayey sand with varying amounts of gravel and boulders up to 3 feet in greatest dimension. The consistency generally improves from loose to dense with increasing depth.

Older Alluvium (Map Symbol Qoal): Older alluvium was encountered in the central portion of the site. The material generally consists of interbedded grayish brown and reddish brown silty sand, sandy silt, clayey silt, and silty clay with gravelly and boulder-rich zones. The material is generally moist and dense or stiff with low to high plasticity fines. As encountered in excavations, older alluvium varies slightly from younger alluvium in color and consistency but is generally finer-grained with relatively fewer sandy and gravelly zones. The deposits appear to be those typical of alluvial fan deposits based on grain size and exposed bedding structure.

Saugus Formation (Map Symbol TQs): The Saugus Formation is exposed along the slopes and canyon walls on the north portion of the site. The materials are particularly well exposed along the steep slopes at the northwestern portion of the site, immediately west of borings LB-1 through 4. The Saugus Formation is Pleistocene in age and consists of shallow marine and non-marine (fluvial) deposits (Dibblee, 1992a, b). Onsite materials include interbedded light to medium brown gravelly to subconglomeratic silty sandstone and sandy siltstone, siltstone, with few claystone interbeds. The material is generally well-bedded to massive, light brown to reddish brown, damp to moist, dense, weakly cemented, and weakly indurated.

4.4 Structure and Distribution of Earth Units

Subsurface conditions and the structural relationship of mapped earth units are illustrated on Plate 2. For ease of use, these cross-sections are presented at a scale of 1 inch to 100 feet, while the areal extent of mapped units is presented on Plate 1 at a scale of 1 inch to 200 feet.

The bedrock of the Saugus Formation generally strikes to the east-northeast consistently and dips toward the southeast at angles ranging from 27 to 65 degrees. Dip angles on-site become shallower towards the south. North of the site, progressively older strata of the Las Posas Sand, Pico, Sisquoc Shale, and Monterey Formations are progressively tilted, folded, and overturned until the stratigraphic section is cut off by the San Cayetano fault (Dibblee, 1992a, b).

The Saugus Formation is overlain by surficial deposits including colluvium, shallow debris flow and landslide deposits, alluvium, and older alluvium. The older alluvium south of HSA-6 and HSA-7 generally appears to dip at shallow angles toward the southeast. Older alluvium thicknesses of approximately 50 feet were encountered at HSA-6, HSA-7, HSA-8, CPT-3, and CPT-4. These deposits scour into and overlie the Saugus Formation unconformably as observed in ET-1.

Alluvium derived from the Santa Paula Creek, Haun Creek, and smaller canyons in between is deposited on top of both older alluvium and the Saugus Formation. At HSA-1, approximately 20 feet of alluvium deposited on top of Saugus Formation bedrock was encountered. At CPT-1, CPT-2, HSA-2, HSA-3, HSA-4, HSA-11, HSA-12, and RW-1 through 3, refusal was encountered before the planned total depth of 50 feet was achieved; refer to Appendix B for details. At borings HSA-9, HSA-10, CPT-5, and CPT-6, the thicknesses of alluvium and older alluvium exceed 50 feet.

Other surficial units mapped on-site include uncertified fill, colluvium, landslide, and debris flow deposits.

4.5 Landslides and Debris Flow Hazards

Onsite Hazards

Several suspected landslide and debris flow deposits were identified during our field reconnaissance, mapping, and aerial photo analysis. These features are located on the hillsides in the northern portion of the site. Some of these features have been mapped along the very steep and tall slopes located in the northwestern part of the site. See Plates 1 and 2 for locations and configurations of these features, and refer to Section 6.2, Slope Stability, for more information and discussion.

The slopes north of and within the northern portion of Planning Area B are much less steep and not as tall as those discussed previously (Figure 2). These slopes appear to have significant accumulations of loose unconsolidated soils in some locations. The slope is basically a dip slope, which tends to be prone to landsliding where clay interbeds are present or daylight onto the slope face. Further, unmapped undocumented fill, alluvium, colluvium, as well as landslide and debris flow deposits, may exist within and up-slope from this area. Therefore, a minor potential for isolated shallow debris flow hazard exists along these slopes and near the mouths of the canyons that exit the foothills during periods of heavy rainfall.

Regional/ Off Site Hazards

Many of the natural slopes within and to the north of the site are zoned as susceptible to earthquake-induced landslides according to the California Geological Survey (CGS, 2002a, 2002b; 2003a, and 2003b). Evidence was observed of a large debris flow resulted when a large rock mass broke away from the steep terrain of Santa Paula Ridge near the head of Timber Canyon, which is the next significant drainage east of Haun Creek (Gay, 1975). This debris flow, believed to have occurred in Holocene time, consists of a large section of Eocene strata north of the San Cayetano Fault that broke off and was deposited in Timber Creek (Gay, 1975). Although the likelihood for similar large run-out landslides or debris flows originating from Santa Paula Ridge or the Topatopa Mountains impacting the site is remote, a small potential for such an event exists. Mitigating factors include the presence of irregular terrain and sinuous canyons and the width of the foothills separating the site from Santa Paula Ridge. These factors reduce the risk of such an unlikely event impacting the site to be less than significant.

4.6 Faulting and Ground Rupture Potential

Record Search

As discussed in Section 4.2, several named and unnamed zoned active faults have been mapped in the site vicinity. The most significant controlling faults in the region are the San Cayetano and Oak Ridge faults to the north and south of the site, respectively. The Oak Ridge Fault is an active, mostly south-dipping reverse fault (dipping up to 80 degrees) that trends roughly to the northeast along the south side of the Santa Clara River Valley (CGS, 2002a). The San Cayetano Fault is an active north-dipping reverse fault and roughly trends east-west. South of this fault is a series of secondary, but active, bedding-parallel, flexural-slip, south-side down, normal and reverse faults associated with folding of the Santa Clara syncline (CGS, 2003a). These features are mapped as short strands on the order of 2 to 10 miles in length, whereas the Oakridge and San Cayetano Faults are more laterally continuous, and extend for several tens of miles east and west (CGS, 2003a; Dibblee, 1990, 1992). The California Geological Survey (2003a) reports that eight strands of these secondary bedding-parallel flexural slip faults (known as the Orcutt/Timber Canyon faults) cut Holocene alluvial fan deposits located in Orcutt and Timber Canyons northeast of the site. These faults are not anticipated to generate significant earthquakes of great magnitude

or energy relative to the primary faults (Oakridge, San Cayetano, and San Andreas Faults), but have potential to cause ground rupture off-site.

A photo lineament and suspect geomorphology are shown on the site and extend for several miles to the east and west in DMG Open File Report 76-5 (Gay, 1975) as shown on Figure 3, Inferred Fault Exhibit. On-site, the approximate location of this photo lineament is near coincident with an access road that is transected by ET-1 (Plate 1). This purported feature trends along a west-south-west direction just north of proposed Planning Area B (Figure 2). This photo lineament is expressed by a change in slope gradient along the base of the foothills near the north portion of the site, and trends east-northeast (Plate 1 and Figure 2).

Some of the strands of the Orcutt/Timber Canyon faults are reported on the Ventura County Geographic Information System (VCGIS) website, and are identified as zoned active faults by the State of California. In addition, the VCGIS website identifies a fault that trends along the base of the southernmost foothills of Santa Paula Ridge east of Haun Creek, but not extending onto the project site as shown on Figure 4, Hazards Map (VCGIS, 2004). The feature is not identified as a zoned active fault, but was derived from DMG Open File Report 76-5 (Gay, 1975) as shown on Figure 3.

Fault Investigation

Leighton has performed an investigation of the inferred fault/ photo lineament (Gay, 1975) that included review of published reports and aerial photos, geologic mapping, subsurface explorations, laboratory testing, and soil stratigraphic analyses.

Because of current and historical agricultural and grading activities at the site, the identified expression of the photo lineament is somewhat subdued. In addition, no other photo lineaments or suspected fault traces have been identified on-site at this time. Aerial photos that predate site agriculture were not available for review and may not exist.

Leighton performed geologic mapping of outcrop exposures of Saugus Formation and older alluvium on west-facing slopes between cross-sections C-C' and D-D'. The exposures appear to be uncut by faulting.

Leighton's subsurface explorations included excavation of approximately 370 lineal feet of excavator trenching as deep as 20 feet. The trench exposed fill, topsoil, alluvium, older alluvium (pre-Holocene), and Saugus Formation. No evidence of faulting was observed in ET-1. Refer to Plate 3 for the log of ET-1. Earth Consultants International (ECI) performed detailed analyses for age dating purposes of the soils exposed in the trench designated Excavator Trench 1 (ET-1). ECI's report, including their findings, analyses, and conclusions, is attached herewith as Appendix E.

It appears that on-site the photo lineament is a result of continuing growth of the Santa Clara Syncline, specifically continued tilting and folding of the strata both underlying and overlying the Saugus Formation.

Note that ECI reports that Unit D on Plate 3 "correlates with the Qt_6 of Rockwell et al. (1984; 1985)" and thereby applies the terminology of Older Alluvium to Unit D. For engineering purposes, Leighton has chosen to designate Unit D as Saugus Formation due to its structural characteristics and greater density relative to the overlying sediments.

4.7 Groundwater

During our investigation, free-flowing water was observed in Santa Paula Creek and Haun Creek. In addition, very small, free-flowing streams were observed along the drainage channels within the site. It is not clear how much of this water is associated with irrigation of the existing orchards.

During our investigation, groundwater was encountered as high as 21 feet below the existing ground surface (bgs) in HSA-5 at the central portion of the site.

At monitoring well 3N/ 21W-16 K2, located approximately 1.5 miles west of the site, historical groundwater has been measured at approximately 10 feet bgs (USGS, 2003).

4.8 Flood Hazards

Portions of the site located adjacent to Haun Creek and Santa Paula Creek have been zoned as being within in a Federal Emergency Management Agency (FEMA) 100-year flood plain (Figure 5). However, the City of Santa Paula has obtained a Letter of Map Revision (LOMR) from FEMA (2001) after improvements to the Santa Paula Creek drainage. According to the LOMR, the 100-year flood zone associated with Santa Paula Creek adjacent to the project is confined within the newly constructed channel banks. Therefore, the area of 100-year flood zone on the west side of the project is reduced compared to that depicted on Figure 5. The project design is also expected to improve drainage conditions and reduce flood potential along Haun Creek. In addition the southern portion of the site is located in a Dam Inundation Zone (URS Corporation, 2005). Please refer to the project hydrologic report prepared by others for details, discussion, and mitigations.

5. SEISMIC HAZARD ASSESSMENT

5.1 Faulting

Please refer to Section 4.6 for expanded discussion of potential on- and off-site faulting. No Alquist-Priolo Earthquake Fault Zones (AP Zone) are currently mapped within the proposed development areas, but do exist to the north and northeast of the site (CDMG, 2000).

5.2 Probabilistic Seismic Hazard Assessment

A probabilistic seismic hazard analysis (PSHA) was performed for the site in accordance with the requirements of the 2001 edition of the California Building Code (CBC). The CBC states that the Design-Basis Earthquake (DBE) is the ground motion that has a 10% probability of exceedance in 50 years, that is, a ground motion with an average 475-year return period. A portion of the site is expected to be developed with schools that will be subject to review by the Division of the State Architect (DSA). For these school sites, the Upper-Bound Earthquake (UBE) with a ground motion that has a 10% probability of exceedance in 100 years (950-year return period) has to be considered. In order to estimate these ground motions, PSHA was performed for the site using the computer program FRISKSP (Blake, 2000).

The PSHA considered various magnitudes of earthquakes that major active or potentially active faults within a 100-km radius of the site could produce along their respective fault lengths. For the project site, we performed the analysis for the northern (N34.3732, W119.0427), central (N34.3660, W119.0452), and southern (N34.3596, W119.0475) locations within the site; however, the resulting ground motions were insufficiently different to warrant zoning the site for different ground motions. The fault parameters that were used were derived by Cao et al. (2003). The attenuation relationships of Boore et al. (1997), Campbell (1997, 2000), and Sadigh et al. (1997) were used in the analyses.

The following table summarizes the DBE and UBE peak horizontal ground acceleration (PHGA) for the site and the magnitude-weighted (Mw = 7.5) PHGA.

	Design Basis Earthquake (10% in 50 years)		Upper Bound Earthquake (10% in 50 years)	
Attenuation Relationship	**PHGA (g)** ***(Not Mag. Weighted)***	**PHGA (g)** ***(M_w = 7.5)***	**PHGA (g)** ***(Not Mag. Weighted)***	**PHGA (g)** ***(M_w = 7.5)***
Boore et al., (1997): 310 m/s	0.85	0.65	1.06	0.82
Campbell (1997, 2000): Alluvium	0.87	0.62	1.04	0.75
Sadigh et al., (1997): Deep Soil	0.92	0.65	1.12	0.80
Average Estimated PHGA	**0.88**	**0.64**	**1.07**	**0.79**

5.3 Tsunami and Seiche Potential

The potential for tsunamis to impact the site is considered negligible, given that the site is approximately 14 miles inland from the Pacific Ocean and is at above Elevation +300 feet msl. The potential for seiches to impact the site is also considered negligible, given the fact that there are no lakes or ponds adjacent to the site.

5.4 Liquefaction Potential

According to the CGS Seismic Hazards Reports Seismic Hazard Maps for the Santa Paula and Santa Paula Peak quadrangles (CGS, 2002a, 2002b, 2003a, and 2003b), the site is not within a liquefaction hazard zone. The referenced CGS reports report the historic high ground water level as being deeper than 40 feet. Based on these references, the potential for liquefaction occurring at the site is very low.

However, our current explorations encountered ground water as shallow as 21 feet at HSA-5 in the central portion of the site. Groundwater was encountered between 28 and 39 feet bgs in the vicinity of Haun Creek along the eastern edge of the site. Our explorations in the eastern portion of the site found relatively low N-values (from SPTs in the hollow-stem-auger borings) and low tip resistances (from the CPT soundings). These are indicative of liquefaction potential. However, the soil layers within which these low values occur appear to be sufficiently clayey to not be susceptible to liquefaction. While additional explorations and testing should be performed for confirmation, the potential for liquefaction affecting the site is considered to be low based on the current subsurface exploration data and test results.

Although the potential for liquefaction occurring beneath the site is low, seismically induced settlement is expected to occur at the site. In the western portions of the site, the seismically induced settlement is expected to be negligible. In the eastern portion of the site, up to several inches of seismically induced settlement may occur in the event of strong ground motions at the site.

5.5 Seismically-Induced Landslides

The north and northwestern portions of the site border hillsides that are zoned to require investigation to address the potential for seismically-induced landslides (CGS, 2002b; 2003b). Therefore, the geologic hazard of seismically induced landslides exists on-site, and will likely require further investigation and mitigation at later planning stages.

Based on preliminary field investigations, slope stability analyses indicate that slopes east of and adjacent to Planning Area A, do not meet the required factor of safety. A preliminary setback zone, which is depicted on Plate 1, has been established for planning purposes. Additional details are included below.

6. GEOTECHNICAL FINDINGS

6.1 Subsurface Conditions

Based on the data obtained during our in-house research and field investigation, the subsurface earth materials observed at the site consist of undocumented fill, alluvium, older alluvium, colluvium, debris flow deposits, landslide debris, and bedrock of the Saugus Formation.

6.2 Slope Stability

Along Santa Paula Creek, the existing on-site slopes range from approximately 150 to 290 feet in height with localized slope-inclinations of up to near-vertical. Based on our analyses, these slopes range from marginally stable (factor of safety of approximately 1.0) to just below the minimum required static factor of safety of 1.50. The results of our slope stability analyses are attached in Appendix D.

Additional explorations, laboratory testing, and analyses may show that the factors of safety of these slopes are somewhat higher; however, the steepest and tallest of the slopes are considered unlikely to have the required factor of safety of at least 1.50. Observed landslides and surficial failures substantiate the calculated relatively low factors of safety.

East of the Santa Paula Creek area, the slopes are up to 250 feet high and are generally inclined at 3:1 or flatter. These slopes have factors of safety in excess of the required minimum of 1.5 and are considered to be grossly and surficially stable.

6.3 Hydro-Collapse Potential

The potential for hydro-collapse of the soils due to inundation was evaluated. Relatively undisturbed soil samples were tested for hydro-collapse potential at normal pressures comparable to in-situ pressures. Test results indicate that the potential for hydro-collapse affecting the on-site soils is low.

6.4 Swell / Expansion Potential

Swell tests and expansion index tests were performed to evaluate the swell / expansion potential of the on-site soils. The tests indicate that the soils encountered at the site have a low expansion potential.

6.5 Soil Corrosivity

Soil corrosivity tests were performed on two soil samples. The results are summarized below and details are presented in Appendix C.

Soil pH: A pH level less than 5.5 is considered detrimental to concrete. The test results on on-site soil samples indicate a negligible potential for corrosion due to soil pH.

Sulfate Content: High concentrations of soluble sulfate in soils can cause deterioration of concrete in contact with the soils. The sulfate content of one of the tested soil samples was moderate while the content of the other sample was considered negligible.

Chloride Content: Soils with high chloride concentrations are considered corrosive to steel and concrete. The tested soil samples indicated a negligible amount of chlorides with respect to corrosion of steel or deterioration of concrete.

Minimum Resistivity: A minimum resistivity value between 1,000 and 2000 ohm-cm is considered corrosive to metal. Resistivity tests on the two selected soil samples showed one of them to be corrosive to ferrous metals.

7. CONCLUSIONS

Based upon our evaluation, the proposed development of the site is feasible from a geotechnical perspective provided that the findings and recommendations in this report are followed and incorporated in the design and construction of the project. Additional geotechnical investigation will be required to develop final design recommendations.

Based on the available data, the potential for liquefaction impacting the site is considered to be low. Seismically-induced settlement is not expected to significantly impact the western portion of the site, but several inches of seismically-induced settlement may occur in the eastern portion. Additional subsurface explorations and laboratory testing are required to confirm the conditions encountered and better quantify the anticipated amount of seismic settlement. Seismically-induced settlement can be mitigated using common construction techniques.

Shallow groundwater is not expected to impact construction of the proposed buildings. However, site-specific explorations should be performed for the proposed bridge to evaluate the possible impact of groundwater on its construction.

The near-surface soils are expected to have been disturbed by agricultural activities and additional disturbance is expected during demolition of the existing on-site structures and orchards. The near-surface soils are therefore not considered suitable for support of the proposed structures. If these soils are excavated and replaced as compacted fill, the resulting compacted fill is expected to be suitable for support of typical low- to mid-rise buildings. The on-site soils may be used in the required compacted fill.

Buildings in the western portion of the site may be supported by spread footings with the floor slabs supported on grade. Buildings in the eastern portion of the site will likely have to be supported on post-tensioned slabs or mat-type foundations due to potential seismically-induced settlement.

Based on subsurface excavations at the site, a significant proportion of the on-site soils contain large boulders. Much of this material will be considered oversize and will likely require special handing and processing (including screening and crushing) or removal from the site.

At least some of the on-site soils are considered corrosive to ferrous metals with moderate sulfate attack potential for concrete. These conditions can be mitigated using common construction techniques.

Significantly tall and steep natural slopes ascend from Santa Paula Creek in the northwestern part of the site. Several landslides and surficial scars have been mapped along these slopes. The potential for further slope failures, debris flows, and landslides to impact any proposed habitable structures within the established setback zone is high based on preliminary slope stability analyses and direct observational evidence of existing landslides. Landsliding is not expected to adversely impact other proposed development areas of the site.

Based on the preliminary slope stability analyses and derived factors of safety for the slopes above and north of Planning Area B, the siting of water tanks is expected to be feasible from a geotechnical perspective pending site-specific evaluations.

The site is not located within an AP Zone. The most likely location of potential active faulting has been investigated; the suspect geomorphology/ photo lineament is likely a result of active folding rather than active faulting. Active faulting, as defined by State of California criteria, was not observed on-site, and therefore, the potential for surface ground rupture at the site is considered remote.

8. RECOMMENDATIONS

8.1 General

The following recommendations are necessarily preliminary and general since they are based on limited field explorations and laboratory testing. Additional field explorations, laboratory testing, and engineering analyses should be performed to develop final, project-specific recommendations.

8.2 Field Explorations

Leighton has performed what we consider sufficient exploration of the site for feasibility-level planning purposes. However, additional explorations should be performed at the tentative tract map and grading plan review stages of the development planning. The purpose of the explorations would be to establish removal depths and delineate the transition from the potentially liquefiable soils in the eastern portion of the site to the more competent soils of the western part that are unlikely to liquefy.

Depending on the project design, additional explorations (including but not limited to deep bucket auger borings or continuous core drilling) of the slope and ridgelines above Planning Area A and at planned water tank sites should be performed at the tentative tract map stage.

The site has areas that are rocky. To the extent possible, equipment that can penetrate very boulder-rich strata should be used for the exploratory drilling.

The CGS (2002a and 2003a) reports for the site show groundwater at deeper that 40 feet bgs. Our explorations at the site encountered groundwater as shallow as 21 feet bgs. To aid in planning and to provide data for use in geotechnical analyses, water level monitoring wells should be installed at the site. We suggest at least four monitoring wells, one well in each quadrant of the site, be installed. The wells should be screened to at least 20 feet below ground water and be protected with vaults or standpipes. The wells should be installed as soon as possible and monitored at approximately monthly intervals until the basic water level patterns and seasonal fluctuations have been determined.

8.3 Preliminary Structural Setback Zone

Within the northwest corner of the site, below the slope that faces west toward Santa Paula Creek, habitable or essential service structures should not be planned within the "Preliminary Setback" zone depicted on Plate 1 or the adjacent slopes. The setback line is based on the location of the toe of an imaginary slope composed of same materials as the existing slope and having a static factor of safety of at least 1.5 and a pseudo-static (seismic) factor of safety of at least 1.1.

8.4 Surface Drainage

Water should not be allowed to pond or accumulate anywhere on the site except in designated detention or debris basins. Pad drainage should be designed to collect and direct surface water away from structures to approved drainage facilities.

There are several minor canyon drainages between Santa Paula and Haun Creeks. These drainages have the potential to carry a significant amount of water and sediment. Therefore, detention basins or debris basins should be incorporated into the project design below canyon areas.

8.5 Flood Potential

Since portions of the site are zoned as being within in a FEMA 100-year flood plain and located within a Dam Inundation Zone (URS Corporation, 2005), proper hydrologic analyses should be performed for the site and surrounding drainage courses that may impact the site. Proper drainage design and mitigation measures (including but not limited to debris basins, detention basins, culverts, strom drains, etc.) should be incorporated into the project design. Please refer to the project hydrologic report prepared by others for details, discussion, and proposed mitigations.

8.6 Grading

Grading at the site is expected to consist of removal and replacement of the near-surface on-site soils and placement of compacted fill. Overexcavation of the upper soils should be performed to provide support for foundations, floor slabs, and paving. Backfills will be required for underground utilities, walls, and foundations.

Based on our field explorations, a significant amount of oversize material (boulders) will be encountered during grading. Oversize materials (generally greater than 8 inches; refer to "Material for Fill" below) can cause problems with utility trenching and foundations for structures. The presence of the oversize materials may make it prudent to overexcavate areas where utilities and other subsurface construction will occur. The need for processing and special handling of oversize materials (i.e., screening, crushing, or disposal of) should be considered.

Site Preparation: Site preparation should include the following:

- Removal of existing vegetation and debris from the site.
- Overexcavation of the upper soils to remove soils disturbed by past site uses and demolition activities.
- Additional overexcavation to allow placement of compacted fill beneath the proposed building foundations. For preliminary planning purposes, the overexcavation should be expected to extend at least 5 feet below the existing grade or as required to allow placement of at least 3 feet of compacted fill beneath the proposed building foundations. The overexcavation should extend beyond the building footings in plan view at least a distance equal to the thickness of the fill underlying the footings, but no less than 5 feet. Deeper removals should be made where obviously unsuitable materials are encountered.
- Generally, to provide suitable soils for support of the proposed paving, at least the upper 2 feet of the soils in those areas should be excavated. The overexcavation should extend at least 2 feet beyond the paved areas in plan. However, for roads under the jurisdiction of the California Department of Transportation (Caltrans), the overexcavation should comply with the Caltrans requirements. Deeper removals should be made where obviously unsuitable materials are encountered.
- To facilitate installation of utilities, including storm drains, the on-site materials should be overexcavated to at least one-half of the diameter/width of the utility or 1-foot, whichever is deeper, below the proposed invert of the utilities. The excavated materials should be replaced with soils containing materials less than 3 inches in size with no more than 25% larger than 1½ inches in size. The overexcavation should extend in plan view 1 foot beyond the utility or one-half the depth of the overexcavation, whichever is greater.

Compaction: Required fill soils should be placed in accordance with the following recommendations:

- The fill soils should be placed in loose layers that do not exceed 8 inches in thickness per layer. Each layer should be spread evenly and thoroughly mixed during spreading to promote uniformity of the materials and moisture content.
- The moisture content of the fill soils at the time of compaction should be brought to approximately 110% to 120% of optimum moisture content. The moisture content should be uniform throughout the soils.

- Fill soils should be mechanically compacted to at least 90% of their maximum dry density as determined by the ASTM Designation D1557 Method of Soil Compaction. Flooding should not be permitted. For Caltrans roads, the upper 2½ feet of the subgrade soils should be compacted to at least 95%.

- The placement and compaction of fill materials should be under the continuous observation of the Geotechnical Consultant.

Materials for Fill: The on-site soils, less debris or organic matter, may be used in required fills and backfills. Soils with an expansion index of 30 or higher should not be used within 5 feet of the subgrade beneath floor slabs. The expansion index of the upper fill soils should be checked prior to and at the completion of grading. Some of the on-site clay soils are expansive and their placement in fills beneath buildings, flatwork, pools, and other structures should be avoided.

Generally, rocks larger than 8 inches in greatest dimension should not be placed in fills. However, in deeper (approximately 15-foot deep) fills, rocks up to 12 inches in size may be placed in the deeper portions of the fills in accordance with specific recommendations. Rocks larger that 4 inches in greatest dimension should not be placed in utility backfills. Gravel and cobbles incorporated into fills should be thoroughly mixed into the soil, and should not be clumped or segregated in heaps. Observations of the materials at the site indicate a significant amount of oversize material should be expected to require processing for use in compacted fills.

Shrinkage: Approximately 15% shrinkage of the upper, approximately 5 feet, soils should be expected when they are overexcavated and replaced as compacted fill. Crushing of oversize materials will cause apparent bulking that is not considered in the quoted shrinkage value.

Manufactured Permanent Slopes: Manufactured permanent slopes should be inclined at 2:1 or flatter.

Geotechnical Observation: The reworking of the upper soils and the compaction of all required fill and backfill should be observed and tested during placement by the Geotechnical Consultant of Record.

The governmental agencies having jurisdiction over the project should be notified before commencement of grading so that the necessary grading permits can be obtained and arrangements made for required inspection(s).

8.7 Foundations

Provided that the soils loosened by clearing of the site, together with overexcavation and recompacted of the upper soils, we expect that low- to relatively light mid-rise buildings in the western portion of the site may be supported on convention shallow footings underlain by compacted fill. In the eastern portion of the site, the low-rise buildings may be supported on post-tensioned slabs or mat-type foundations. More detailed recommendations can be developed at the completion of additional explorations and testing.

We expect that taller or relatively heavy buildings or structures in the western portion of the site can be supported on convention shallow footings. In the eastern portion of the site, building specific investigations should be performed and project specific recommendations developed.

8.8 Floor Slabs

As with foundations, provided that the soils loosened by clearing of the site, together with overexcavation and recompacted of the upper soils, we expect that floor slabs in the western portions of the site may be supported on-grade. If desired, post-tensioned floor slabs may be used for these structures. Floor slabs beneath indoor living spaces, as opposed to garages or patios, in all areas of the site should be underlain by a vapor retarder or barrier.

8.9 Site Coefficient

Under the Earthquake Design regulations of Chapter 16, Divisions IV and V of the 2001 edition of the CBC, the following coefficients and factors apply to lateral-force design for structures at the site:

Seismic Coefficients

Seismic Zone, Z	0.4
Soil Profile Type	S_C
Near-Source Factor N_a	1.3
Near-Source Factor N_v	1.6
Seismic Coefficient C_a	0.57
Seismic Coefficient C_v	1.02
Period, T_o*	0.14
Period, T_s*	0.72

* Use with Figure 16-3 of the CBC.

Fault Type	Nearest Fault	Distance (km)	Magnitude
A	San Andreas (1857 Rupture)	52	7.8
B	Oak Ridge	1.5	7.0

9. LIMITATIONS

Leighton's work was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional opinions included in this report.

As in many projects, conditions revealed in excavations may be at variance with preliminary findings. If this occurs, the changed conditions must be evaluated by the geotechnical consultant and additional recommendations be obtained, as warranted.

The identification and testing of hazardous, toxic, or contaminated materials were outside the scope of Leighton's work. Should such materials be encountered at any time, or their existence be suspected, and all measures stipulated in local, County, State and Federal regulations, as applicable, should be implemented.

This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the necessary design consultants for the project and incorporated into the plans; and that the necessary steps are taken to see that the contractors carry out such recommendations in the field.

The findings of this report are considered valid as of the present date. However, changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of man on the subject or adjacent properties. In addition, changes in standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may at some future time be invalidated wholly or partially by changes outside Leighton's control.

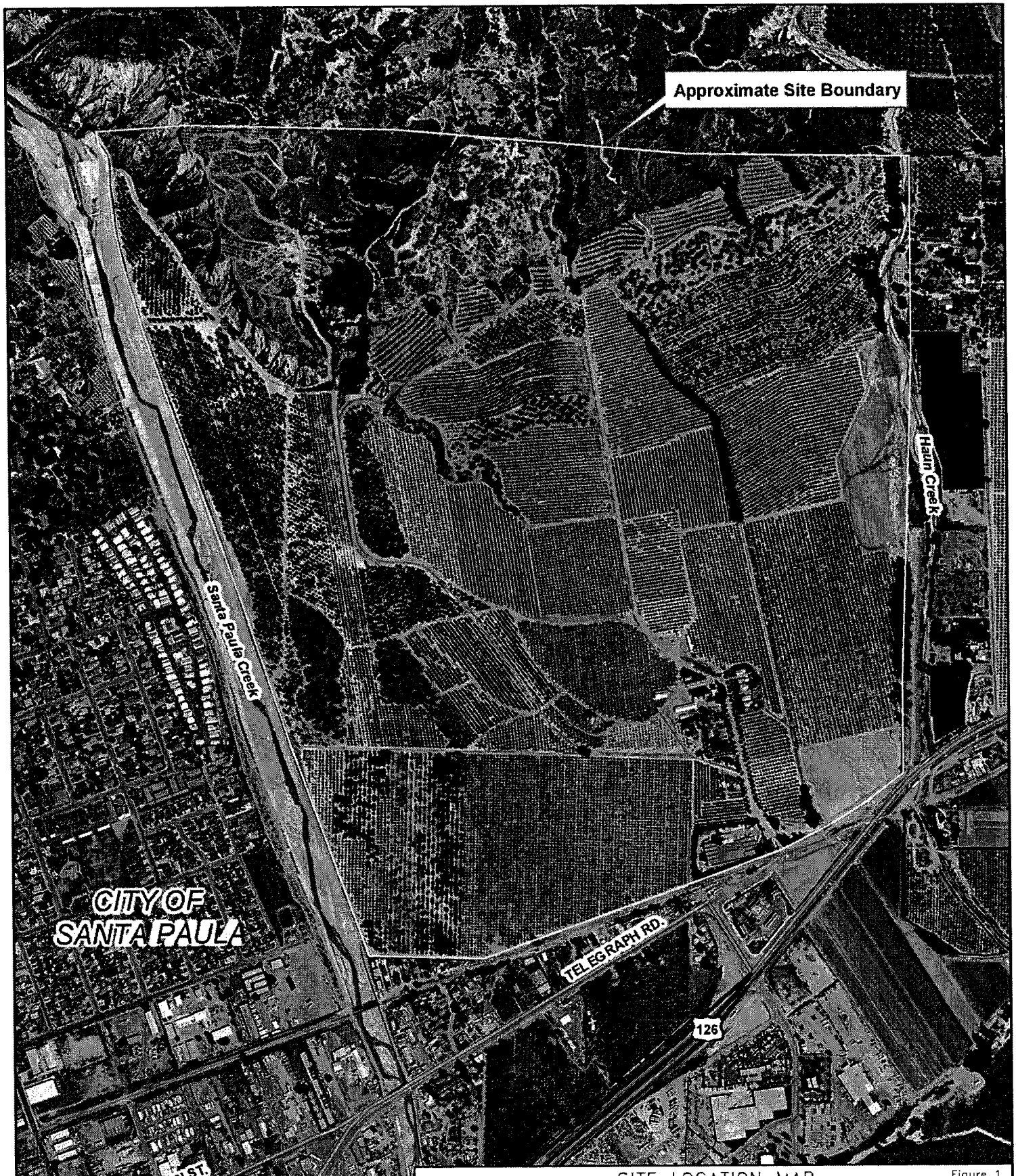
The conclusions and recommendations in this report are based in part upon data that were obtained from a necessarily limited number of observations, site visits, excavations, samples, and tests. Such information can be obtained only with respect to the specific locations explored, and therefore may not completely define all subsurface conditions throughout the site. The nature of many sites is that differing geotechnical or geological conditions can occur within small distances and under varying climatic conditions. Furthermore, changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report should be considered preliminary and additional explorations, testing, and analyses should be performed to develop more definitive recommendations.

This report is intended only for the use of Limoneira Company and its design consultants, and only as related expressly to the assessment of the feasibility of developing the subject site, for planning purposes, and for use in preparation of an Environmental Impact Report.

10. CLOSURE

If parties other than Leighton are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or by providing alternative recommendations.

Any persons using this report for bidding or construction purposes should perform such independent investigations as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on the subject site.



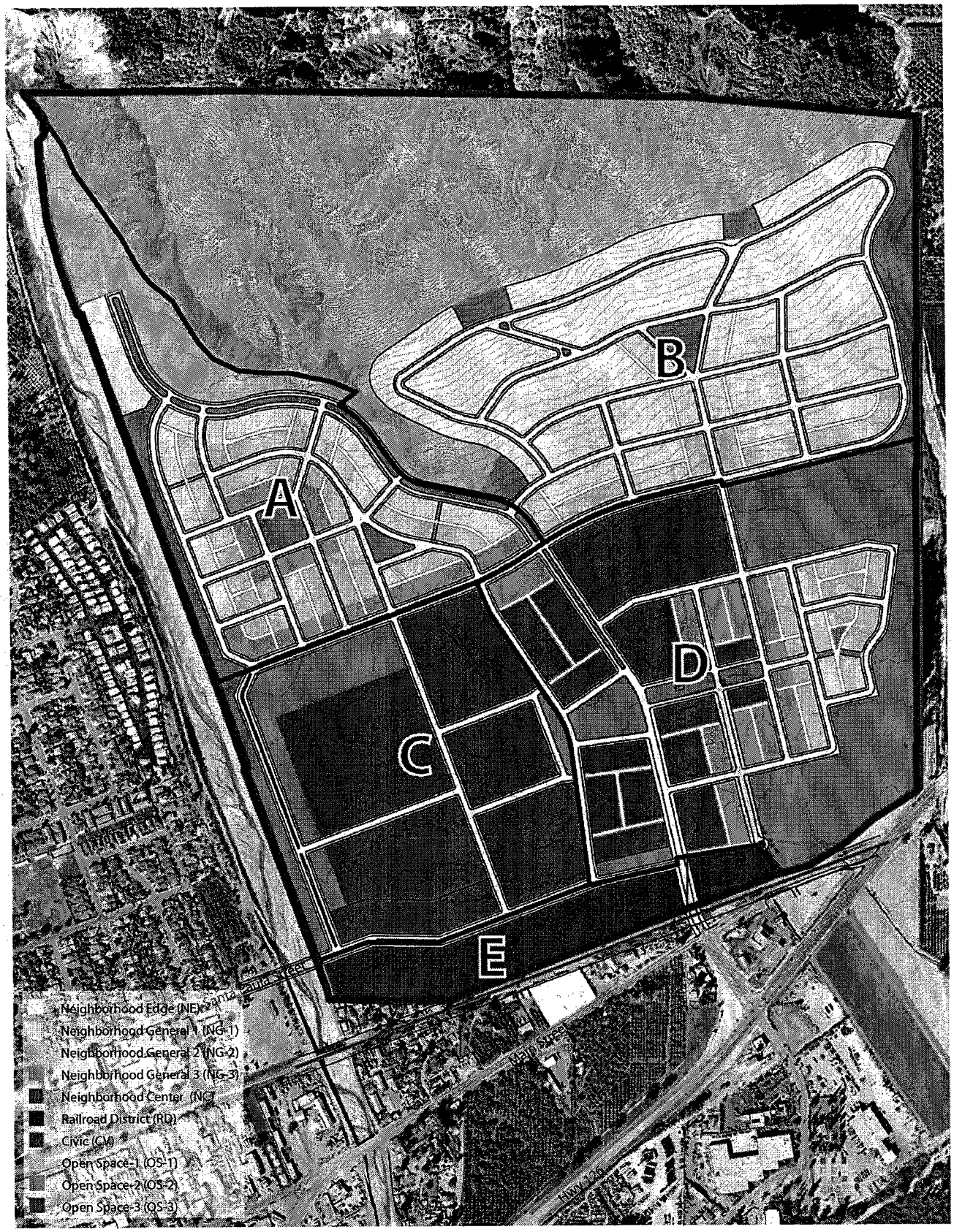
SITE LOCATION MAP
EAST AREA 1 SPECIFIC PLAN
VENTURA COUNTY, CALIFORNIA

Figure 1

Proj: 031852-001	Scale: 1"=800'	Plot Date: 4/19/07
Eng/Geol: CCK/ARH	Created by: KMT	Updated: 4/19/07

Leighton & Associates, Inc.
A LEIGHTON GROUP COMPANY

P:\031852\PROJECT\VENTURA\031852_east_area_1\031852_fig1_location.mxd

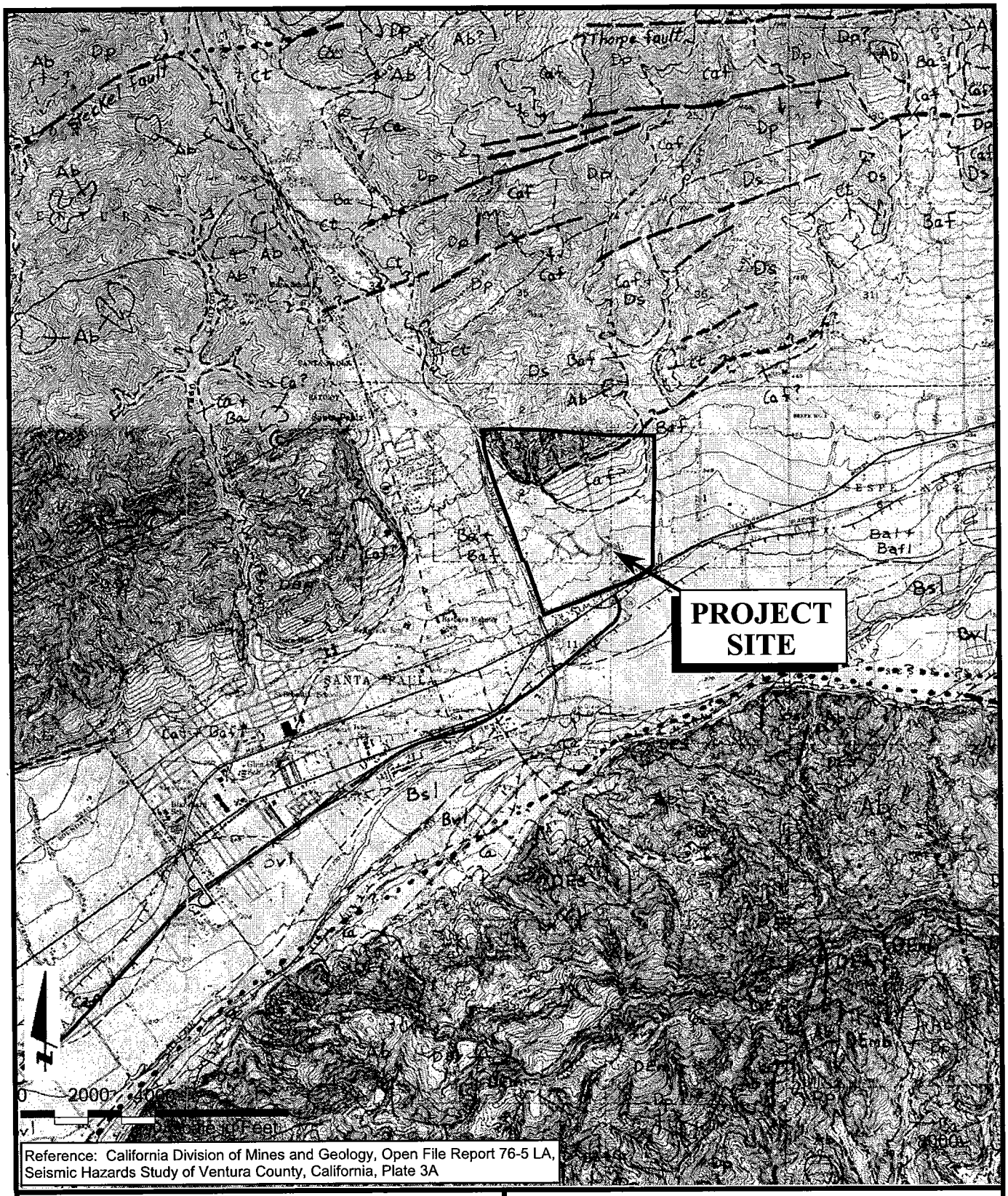


East Area 1 - Proposed Regulating Plan
Santa Paula, California
04-17-07

HDR | Town Planning

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

Figure 2



Reference: California Division of Mines and Geology, Open File Report 76-5 LA, Seismic Hazards Study of Ventura County, California, Plate 3A

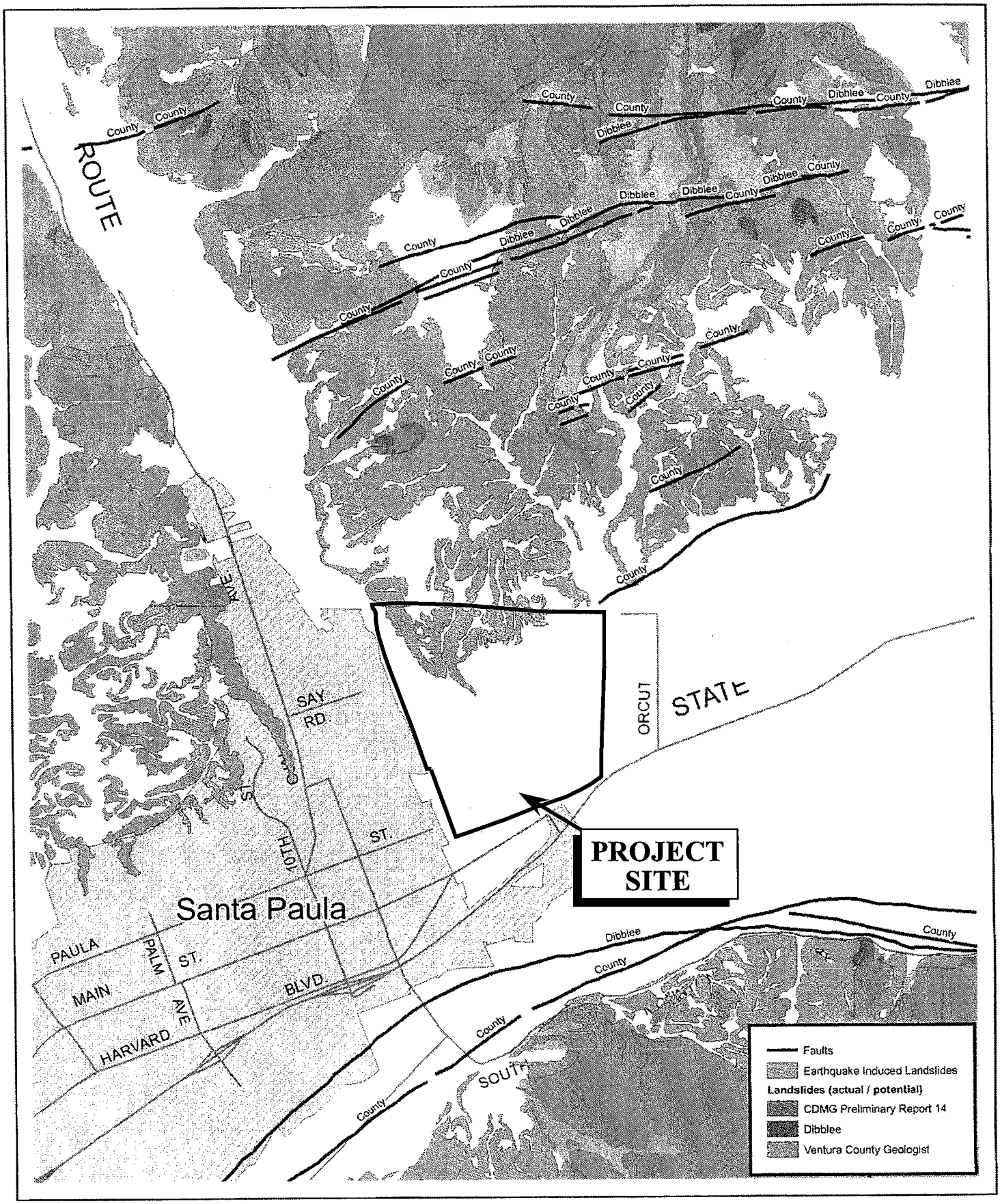
INFERRED FAULT EXHIBIT
EAST AREA 1 SPECIFIC PLAN

UNINCORPORATED VENTURA COUNTY, CALIFORNIA

Project No.	031852-001
Scale (approx)	1:48,000
Engr./Geol.	CCK/ARH
Drafted By	PM
Date	April 19, 2007

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

Figure 3



Ventura County, California
Resource Management Agency
Mapping Services - GIS
6/15/06

HAZARDS MAP

***Faults:** Illustrates the location of all fault lines identified in October 1974 as part of the Seismic and Safety Element of the Ventura County General Plan, plus faults identified by Dibblee.*

N

0 3,300 6,600 Feet

Disclaimer, this map was created by the Ventura County Resource Management Agency, Planning Division, which is designed and operated solely for the convenience of the County and related public agencies. The County does not warrant the accuracy of this map and no decision involving a risk of economic loss or physical injury should be made in reliance thereon.

Figure 4

Base Map: Aerials Express, 2005; Flood Data: FEMA Q3 Flood Hazard Data Ventura County

FLOOD HAZARD MAP

EAST AREA 1 SPECIFIC PLAN

VENTURA COUNTY, CALIFORNIA

N

0 4,000 8,000

SCALE FEET

Project No.	031852-001
Scale	1 Inch to 800 feet
Engr./Geol.	CCK / ARH
Drafted By	PDB
Date	April 19, 2007

Figure No. 5

Important Information About Your

Geotechnical Engineering Report

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

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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APPENDIX A

REFERENCES

APPENDIX A

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Aerial Photographs

Date	Flight	Frames	Scale	Agency
4-20-72	107	9-11	1" to 4000'	Continental Aerial Photo, Inc.
3-2-77	1 VEN-F	3-4	1" to 2200'	Continental Aerial Photo, Inc.
4-3-79	2-VEN	14, 3, 4	1" to 4000'	Continental Aerial Photo, Inc.
2-80	2-VEN	16, 19, 20	1" to 2000'	Continental Aerial Photo, Inc.
1-8-88	VEN-3	10, 11	1" to 4000'	Continental Aerial Photo, Inc.
2-2-99	C-132-18	249, 250	1" to 4000'	Continental Aerial Photo, Inc.

APPENDIX B

FIELD EXPLORATION PROGRAM

APPENDIX B

FIELD EXPLORATION PROGRAM

General

Leighton's subsurface explorations consisted of hollow stem auger borings, rotary wash borings, bucket auger borings, backhoe trenches, cone penetration test (CPT) soundings, and an excavator trench. These explorations were supervised and logged by qualified Leighton representatives. The earth materials encountered were visually classified in accordance with the Unified Soil Classification System (USCS). Geologic contacts and stratigraphic boundaries are indicated on the logs. Some soil types transition gradually. The approximate locations of the borings and CPT soundings are shown on Plate 1.

Reconnaissance

Prior to conducting the subsurface explorations, a reconnaissance of the site was carried out by Leighton's personnel. The locations of the subsurface explorations were chosen to obtain subsurface information at locations appropriate for the objective of this preliminary report.

Underground Service Alert (USA) was contacted to provide clearance for drilling with respect to any underground utility lines. Locations and scheduling of explorations were coordinated with on-site agricultural activities and utilities. Leighton encountered no underground utility lines during its explorations.

Leighton also performed preliminary field mapping of surface exposures of the site earth materials. The approximate limits and distribution of the earth materials are presented on Plate 1.

Subsurface Explorations

Subsurface explorations on the subject site included excavation of 12 hollow-stem auger borings (HSA-1 through HSA-12), 3 mud-rotary borings (RW-1 through RW-3), 8 backhoe trenches (LT-1 through LT-8), 4 bucket-auger borings (LB-1 through LB-4), 6 CPT soundings (CPT-1 through CPT-6), and 1 excavator trench (ET-1). The explorations were performed from January 19, 2006, through January 4, 2007.

Materials encountered during the explorations were visually logged by a qualified Leighton representative under the supervision of a Certified Engineering Geologist. The locations of Leighton's subsurface explorations are shown on the attached Preliminary Geotechnical Map (Plate 1). The logs of the explorations are presented in this appendix.

The hollow-stem auger borings were drilled by Martini Drilling using a truck mounted drill rig with 6.75-inch diameter hollow stem augers. Of the 12 hollow-stem auger borings, 10 were drilled between January 23 and 27, 2006. The remaining two borings were drilled on January 4, 2007. The exploratory borings were excavated to depths ranging from 29 feet to 51½ feet below the existing grade. Refusal was encountered at HSA-2, HSA-4, HSA-8, HSA-11, and HSA-12. For borings HSA-2, HSA-4, HSA-11, and HSA-12, the drill rig was relocated by approximately 5 feet, and the borings were redrilled in an effort to reach the planned depth. When refusal was encountered at the alternate locations, attempts to deepen these borings were terminated.

The rotary wash borings were drilled on May 10, 2006, by C&L Drilling using a truck mounted drill rig with a 6-inch diameter tri-cone bit. All three of the borings encountered refusal at shallow depths, with a maximum depth of 10.75 feet, due to large boulders.

The subsurface conditions in the hillside areas were explored by drilling 4 borings to depths of between 90 and 110 feet below ground surface (bgs) using a truck-mounted drill rig with a 24-inch diameter bucket-auger. The drilling was performed by Tri-Valley Drilling Company between April 23 and May 2, 2006. In addition to surface logging of samples and cuttings, the borings were down-hole logged by a Certified Engineering Geologist. The borings were backfilled with materials generated during their excavation and tamped per standard practice.

The shallow subsurface conditions were explored by excavating a total of 8 backhoe trenches. The trenches were excavated by Adobe Company on May 24, 2006, using a four-wheel drive, rubber-tired backhoe. The trenches were backfilled with the materials generated during their excavation.

The Cone Penetration Test (CPT) soundings were performed to maximum depths of 51 feet bgs. Kehoe Testing and Engineering performed the CPT soundings on January 27, 2006. The CPT soundings were designated CPT-1 through CPT-6. The presence of cobbles and boulders resulted in refusal at shallow depths at CPT-1, CPT-2, and CPT-5. At these locations, the CPT soundings were relocated approximately 3 to 5 feet from the original test location and reattempted. For data mapping and analysis purposes, the deepest CPT at each location was used. The CPT data are attached.

The excavator trench was excavated by Adobe Company using a track mounted excavator and rubber-tired loader. The trench was excavated between May 8 and May 11, 2006. Excavation of the trench was supervised by Leighton's personnel and the walls of the trench were logged by Leighton's Certified Engineering Geologists and further observed by representatives from Earth Consultants International (ECI). The log of the trench is depicted on Plate 3. Refer to Appendix E and the report text for more information.

Sampling

Leighton personnel obtained relatively undisturbed and bulk samples for laboratory inspection and testing from the borings at the depths indicated on the logs. The number of blows to drive the sampler 6 inches was recorded and is shown on the logs. The blow counts provide an indication of the density or consistency of the in-situ earth materials.

The undisturbed samples were obtained by driving a Modified California Split-Spoon Sampler, with a 3.0-inch outside diameter, into the bottom of the boring as it was being incrementally advanced. The barrel of the sampler was lined with six 1-inch-high by 2.41-inch-inside-diameter sampling rings. The rings containing the undisturbed samples were placed in plastic cans and labeled. The bulk samples were placed in plastic bags.

In addition to obtaining undisturbed and large bulk samples, Standard Penetration Tests (SPT) were performed in each of the hollow-stem auger borings. The results of the tests are indicated on the boring logs. The SPTs were performed in accordance with the ASTM D1586 Test Method. Samples of the materials obtained from the SPT sampler were placed in plastic bags and transported to our laboratory.

FIGURES

Geotechnical Boring Logs:

HSA-1 through HSA-12
RW-1 through RW-3
LT-1 through LT-8
LB-1 through LB-4

Cone Penetration Test Soundings:

CPT-1 through CPT-6

GEOTECHNICAL BORING LOG HSA-1

Date 1-23-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 400' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
400	0							SM/ML	**ALLUVIUM (Qal):** interbedded SILTY SAND and SANDY SILT with few to some coarse gravel and boulders, light to medium brown, moist, medium dense	
				R-1	27 50/5"	98	15.9		0.5" diameter root in top of sample	
395	5			R-2	50/2"				no sample recovery	
				B-1						
				SPT-1	16 21 22					
390	10			R-3	10 21 50	126	5.0		fewer gravel and boulders below 13 feet	
385	15			SPT-2	13 22 26				no sample recovery	
									SAUGUS FORMATION (TQs) : SILTSTONE, light olive brown, damp to moist, hard, cohesive with trace clay, trace to few claystone and fine-grained sandstone interlaminae, steeply-dipping beds observed	DS
				B-2						
380	20			R-4	15 28 50/4"	118	14.9			
375	25			SPT-3	16 29 44					
				B-3						
370	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-1

Date 1-23-06 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 400' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
370	30			R-5	27 50/6"	116	14.7		SILTSTONE: light brown, slightly moist, very stiff/hard	
365	35			SPT-4	40 50/2"				GRAVELLY SANDSTONE, medium brown, moist, very dense	
									Total Depth Drilled = 35' **Total Depth Sampled = 35.8'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
360	40									
355	45									
350	50									
345	55									
340	60									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
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- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-2

Date 1-23-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 346' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
345	0	N S		B-1				SM	ALLUVIUM (Qal): SILTY SAND, medium-grained, medium brown, damp, loose, few SANDY SILT interbeds (EI = 4, very low)	EI
				R-1	3 6 4	108	13.3			
340	5			R-2	11 16 50/3"	120	6.0		GRAVELLY SILTY SAND, slightly moist, medium dense, medium-to coarse-grained	
				SPT-1	26 50/6"				zones of gravel and boulders between 8' and 15'	
335	10			R-3	50/4			GP	SANDY GRAVEL to GRAVELLY SAND with little silt, medium brown, dense, clasts are generally SANDSTONE and limey sandstone with little limestone and granitics No sample recovery	
				SPT-2	22 27 50/5"			SP	GRAVELLY SAND with SILT, medium brown, slightly moist, dense, medium-grained	
330	15									
325	20			R-4	23 26 35	128	5.0			
				B-2						
320	25			SPT-3	10 20 37			SM	SILTY SAND, brown, slightly moist, dense course gravel/boulders @ 27', drilling difficult	
	30				24					

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-2

Date 1-23-06 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 346' | Location Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
315	30			R-5	19 50/2"				large clast fragments in tip of sampler; no sample recovery. refusal at 34' (see note below)	
310	35								**Total Depth Drilled = 34.0'** **Total Depth Sampled = 31.5'** **No Groundwater Encountered** **Boring backfilled with soil cuttings** **Note: Following refusal, the drill rig was moved approximately 5 feet west and a second boring was attempted in an effort to observe soil below 34'; however, refusal was encountered at 14' bgs.**	
305	40									
300	45									
295	50									
290	55									
	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-3

Date 1-23-06 Sheet 1 of 2

Project Limoneira Company, East Area I Project No. 031852-001

Drilling Co. Martini Drilling Type of Rig Hollow-Stem-Auger

Hole Diameter 7" Drive Weight 140 lbs. Drop 30"

Elevation Top of Hole 355' Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
355	0	N S						ML	ALLUVIUM (Qal): CLAYEY SILT, dark brown, moist, medium stiff	
				R-1	4 4 12/1"				coarse gravel @ 3.5'	
								SM	SILTY SAND with GRAVEL, red-brown, moist, dense, medium-grained gravel	
350	5			SPT-1	23 34 50					
				R-2	23 50/6"	125	4.1		same as above, medium-to coarse-grained, slightly moist (EI=4, very low)	EI
				B-1						
345	10			SPT-2	5 4 5				as above, low sample recovery, clast in the tip of sampler	
340	15			R-3	20 50/4"	129	4.7			
335	20			SPT-3	7 3 4/6"				No sample recovery	
330	25			R-4	44 50/5"	126	4.1			
									refusal at 29.5'	
325	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-3

Date 1-23-06 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 355' | Location Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
325	30								Logged By ARH Sampled By ARH Total Depth Drilled = 29.5' Total Depth Sampled = 25.9' No Groundwater Encountered Boring backfilled with soil cuttings	
320	35									
315	40									
310	45									
305	50									
300	55									
295	60									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-4

Date 1-23-06 | Sheet 1 of 1

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 330' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
330	0	N S						ML	**ALLUVIUM (Qal):** SILT with trace SAND, red-brown, moist, medium stiff, fine-grained sand	
				B-1						
				SPT-1	4 4 4					
325	5			R-1	36 26 34	125	4.0	GP	@4' large clast, drilling difficult SANDY GRAVEL to GRAVELLY SAND, light brown, slightly moist, dense, coarse-grained sand, (large clast in top of sample)	
				SPT-2	4 9"					
				B-2						
320	10			R-2	44 50/2"	99	3.9			
									refusal at 14.0' (see note below)	
315	15			SPT-3	10 38 50/4"				refusal at 17' on second boring	
									Total Depth Drilled = 17.0' **Total Depth Sampled = 16.3'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
310	20								**Note: Following refusal the drill rig was moved approximately 5 feet west and a second boring was attempted'; however, refusal was encountered at 17' bgs.**	
305	25									
300	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-5

Date 1-23-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 341' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
340	0	N S						ML	**OLDER ALLUVIUM (Qoal):** SILT and CLAYEY SILT, red brown, slightly moist, medium stiff, trace to few distinct strong red claystone gravel	
				R-1	2 3 4	104	18.9			
	5			B-1					(EI = 36, low)	EI
335				SPT-1	2 3 2					
				R-2	1 2 2	107	17.2	CL	SILTY CLAY, olive brown, moist, stiff, little SAND (Gravel: 0% Sand: 18% Fines: 82%)	SA CN
	10			SPT-2	1 2 2					
330									as above, red brown, slightly moist, medium stiff (Gravel: 0% Sand: 20% Fines: 80%)	
	15			R-3	3 6 9	114	16.4			SA
325										
	20			SPT-3	3 4 9				as above, trace gravel, very moist, stiff	
320									groundwater @ ~ 21.5'	
	25			R-4	7 8 8	127	7.8	ML	SANDY SILT with GRAVEL, orange to red brown, very moist, stiff	
315				B-2						
	30								SILT, red brown, very moist, soft	

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE
PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-5

Date 1-23-06 Sheet 2 of 2

Project Limoneira Company, East Area I Project No. 031852-001

Drilling Co. Martini Drilling Type of Rig Hollow-Stem-Auger

Hole Diameter 7" Drive Weight 140 lbs. Drop 30"

Elevation Top of Hole 341' Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
310	30			SPT-4	1 1 1/6"			ML	SILT, red brown, very moist, soft	
305	35			R-5	2 2 3	100	26.3			
300	40			SPT-5	3 4 6				as above,medium stiff	
295	45			R-6	4 8 10	103	25.3		as above, trace fine-grained sand	
290	50			SPT-6	3 3 4					
285	55								**Total Depth Drilled = 50'** **Total Depth Sampled= 51.5'** **Groundwater at 21.5'** **Boring backfilled with soil cuttings**	
	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-6

Date 1-24-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 343' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
340	0			B-1				ML	**OLDER ALLUVIUM (Qoal):** SILT, light red-brown, moist, medium stiff, trace gravel, fine-grained sand, and clay with distinctive red (brick colored), 0.2" to 0.5" weathered claystone clasts	
				SPT-1	5 5 6				(EI = 34, low)	EI
335	5			R-1	7 9 12	109	12.5			
				SPT-2	4 4 6				distinct color change @ ~9'	
330	10			R-2	8 15 14	110	10.5		SILT, dark red-brown, slightly moist, stiff, with few gravel (distinct rounded red claystone clasts up to 0.5" diamter), mostly massive bedding	DS CN
325	15			SPT-3	3 3 4				SILT to CLAYEY SILT, dark red brown, slightly moist, medium stiff, thin ~1/10" thick fine-grained sand interbeds	
320	20			R-3	6 9 11	108	15.0		as above, with few GRAVEL	
	25			SPT-4	9 19 29			SM	SILTY SAND, light red-brown, slightly moist, dense	
315				B-2					increased moisture content below 30'	
	30							ML	SILT, red brown, moist, medium stiff to stiff, trace to little clay	

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-6

Date 1-24-06 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 343' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			R-4	9 13 15	109	13.6	ML	SILT, red brown, very moist, medium stiff to stiff, trace to little clay, low plasticity	DS
310										
	35			SPT-5	4 5 6				as above, slightly moist	
305									GRAVELLY SILT, moist, stiff, large clast in the bottom of the sampler	
	40			R-5	7 22 34	122	6.7			
300				B-3						
	45			SPT-6	5 8 11				SILT, red brown, moist, stiff, trace clay	
295										
	50			R-6	16 19 28	115	14.3		as above, trace gravel	
290									**Total Depth Drilled = 50'** **Total Depth Sampled = 51.5'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
	55									
285										
	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-7

Date 1-24-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 474' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
474	0							SM	**OLDER ALLUVIUM (Qoal):** SILTY SAND, medium-grained, red brown, damp, dense, few gravel, massive, few SANDY SILT interbeds	
				R-1	10 11 12	106	3.9			
470				B-1						
	5			SPT-1	2 6 6				as above, loose to medium dense	
				R-2	3 6 7	117	8.6		as above, with few gravel, dense, trace clay	DS
465										
	10			SPT-2	7 25 25				as above, light red-brown, dry to slightly moist, coarse gravel/boulders @ 11'	
460										
	15			R-3	12 22 20	130	5.7		as above, dry, few gravel, and trace clay	
									OLDER ALLUVIUM (Qoal):	
455								ML	CLAYEY SILT, red brown, slightly moist, medium stiff, massive, low plasticity	
	20			SPT-3	5 4 8					
450										
	25			R-4	5 9 15	111	18.7	CL	SILTY CLAY, dark brown, slightly moist, stiff	CN
				B-2						
445	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-7

Date 1-24-06 | Sheet 2 of 2
Project Limoneira Company, East Area I | Project No. 031852-001
Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger
Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"
Elevation Top of Hole 474' | Location Refer to Geotechnical Map

Logged By ARH
Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			SPT-4	23 24 50			SM	SILTY SAND, light red-brown, slightly moist, dense, few gravel	
440										
	35			R-5	45 50/11"	117	8.2		as above, dense to very dense increased moisture content below 35' in some zones	
435								ML-CL	CLAYEY SILT to SILTY CLAY, medium to dark brown, moist, stiff, few gravel, trace to little sand, and few fine-to-medium-grained SAND interbeds, low plasticity	
	40			SPT-5	12 23 13					
430				B-3						
	45			R-6	18 20 24	122.6	13.7		as above, very moist below 45'	
425										
	50			SPT-6	4 12 14			CL-ML		
420									**Total Depth Drilled = 50'** **Total Depth Sampled = 51.5'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
	55									
415										
	60									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-8

Date 1-24-06 Sheet 1 of 2

Project Limoneira Company, East Area I Project No. 031852-001

Drilling Co. Martini Drilling Type of Rig Hollow-Stem-Auger

Hole Diameter 7" Drive Weight 140 lbs. Drop 30"

Elevation Top of Hole 390' Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
390	0									
				B-1				ML	OLDER ALLUVIUM (Qoal): SILT, dark-brown, moist, soft, trace SAND, high organic content	
				SPT-1	1 1 1					
385	5			R-1	21 22 17	128	6.0		SANDY SILT, medium brown, damp, dense, few gravel and little clay, massive, few SILTY SAND interbeds	
				SPT-2	3 3 3					
380	10			R-2	6 12 16	122	12.6		as above, trace to little clay	
									interbedded SILT and SILTY SAND, light orange brown, medium-grained sand, moist, medium stiff/ medium dense	
375	15			SPT-3	5 9 12					
370	20			R-3	3 9 12	121	14.1		SILT, dark red brown, very moist, medium stiff, very moist	
365	25			SPT-4	3 5 7				SILT to CLAYEY SILT, low to medium plasticity	
360	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-8

Date 1-24-06 | Sheet 2 of 2
Project Limoneira Company, East Area I | Project No. 031852-001
Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger
Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"
Elevation Top of Hole 390' | Location Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By ARH, Sampled By ARH)	Type of Tests
360	30			R-4	4 13 17	16.8	113.0		SILT, red brown, moist, low plasticity, trace to little clay	
									Groundwater at 31'	
				B-2						
355	35			SPT-5	5 11 17			CL	SILTY CLAY, brown, wet, medium stiff, trace SAND (Gravel: 0% Sand: 16% Fines: 84%)	SA
				B-3						
350	40			R-5	11 24 34	14.4	120.0	ML	SANDY SILT, dark red brown, very moist, hard	
								GM	SILTY GRAVEL, dark-red brown, wet, very dense	
345	45			SPT-6	21 50/3"				refusal at 47', large boulder/coarse gravel	
									Total Depth Drilled = 47.0' **Total Depth Sampled = 46.0'** **Groundwater at 31.0'** **Boring backfilled with soil cuttings**	
340	50									
335	55									
330	60									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-9

Date 1-24-06 | Sheet 1 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 339' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								4-6" of wood chips-organic debris	
								SM	ALLUVIUM (Qal):	
									SILTY SAND with GRAVEL, light brown, moist, loose	
335				R-1	9 6 5	124	4.3			
	5			SPT-1	9 7 6				as above, medium-to coarse-grained	
				B-1	5					
				R-2	11 18	119	5.0		as above, with GRAVEL, medium brown, damp, dense, very gravelly from 7'-15'	
330										
	10			SPT-2	12 19 19				as above, light brown, dense	
325										
	15			R-3	44 50/6"	119	4.8			
320										
	20			SPT-3	3 4 5			ML/SM	interbedded SILT and little SAND, light brown, damp, medium stiff	
315										
	25			R-4	4 5 5	101	8.6		as above, fine-grained sand fraction, crude bedding	
310										
	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-9

Date 1-24-06 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 339' | Location Refer to Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30	N S		SPT-4	3 10 27			SM/ML	interbedded SILTY SAND and CLAYEY SILT, light to dark red brown, damp, dense (upper clay portion of sample not retained).	
305										
	35			R-5	32 20 14	126	5.3	SM	SILTY SAND, medium brown, moist, dense, few to little fine gravel	
300									Groundwater at 39'	
	40			B-2						SA
				SPT-5	1 2 1			CL	SILTY CLAY, dark red brown, very moist, very soft, little sand (Gravel: 0% Sand: 19% Fines: 81%)	
295										
	45			R-6	1 2 3	105	22.4		as above, soft	
290										
	50			SPT-6	2 2 3					
									Total Depth Drilled =50' **Total Depth Sampled = 51.5'** **Groundwater at 39.0'** **Boring backfilled with soil cuttings**	
285	55									
280	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-10

Date 1-24-06 | Sheet 1 of 2
Project Limoneira Company, East Area I | Project No. 031852-001
Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger
Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"
Elevation Top of Hole 307' | Location Refer to Geotechnical Map

Logged By ARH
Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
307	0	N S							**ALLUVIUM (Qal):**	
								ML	SILT, light brown, damp, very soft	
305				R-1	3 3 3	96.7	14.8			
	5			SPT-1	1 1 1				very soft, trace to little clay occasional rootlets	
300				R-2	3 4 5	101	19.2			
	10			SPT-2	2 2 3			SM	SILTY SAND, fine-grained sand fraction, moist, loose, massive	
295				B-1 R-3	3 4 5	100	17.6	CL	SILTY CLAY, olive brown, moist, medium stiff, little SAND (Gravel: 0% Sand: 22% Fines: 77%)	SA CN
290	15									
	20			SPT-3	3 3 3			ML/SM	interbedded SILT and SILTY SAND, light brown, loose/soft, massive, fine grained sand fraction	
285				B-2					gravelly below 24'	
	25			R-4	30 50/6	131	3.6	SM	SILTY SAND with GRAVEL, light brown, damp, very dense, medium to coarse-grained sand	
280									Groundwater at 28'	
	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-10

Date 1-24-06 | Sheet 2 of 2
Project Limoneira Company, East Area I | Project No. 031852-001
Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger
Hole Diameter 7" | Drive Weight 140 lbs. | Drop 30"
Elevation Top of Hole 307' | Location Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By ARH, Sampled By ARH)	Type of Tests
275	30			SPT-4	8 2 2			CL	SILTY CLAY, light orange brown, wet, soft, trace fine-grained SAND, clast on top of sampler (Gravel: 0% Sand: 13% Fines: 87%)	SA
270	35			R-5	1 2 6	94	27.8	ML	clean SILT, light orange brown, wet, medium stiff, trace fine-grained SAND	
265	40			SPT-5	3 3 5			CL	SILTY CLAY, olive brown, moist, medium stiff (Gravel: 0% Sand: 6% Fines: 94%)	SA
260	45			R-6	5 6 8/6	91.5	29.9		as above, interbedded with CLAYEY SILT, cohesive	
255	50			SPT-6	2 4 7					
250	55								**Total Depth Drilled = 50'** **Total Depth Sampled = 51.5'** **Groundwater at 28.0'** **Boring backfilled with soil cuttings**	
	60									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE
PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-11

Date 1-4-07 Sheet 1 of 2

Project Limoneira Company, East Area I Project No. 031852-001

Drilling Co. Martini Drilling Type of Rig Hollow-Stem-Auger

Hole Diameter 7 Drive Weight 140 lbs. Drop 30"

Elevation Top of Hole ' Location Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							Logged By PM Sampled By PM	
	0							SM	TOPSOIL: SILTY SAND, brown, moist, medium dense	
								ML	ALLUVIUM: CLAYEY SILT, light brown, moist, medium stiff	
				R-1	8 10 11	113	10.9		SANDY SILT, brown, moist, stiff, fine grained sand	
	5			R-2	3 7 12	108	10.0	SM	SILTY SAND with GRAVEL, brown, moist, medium dense, coarse grained sand and coarse gravel	
								GM	SILTY GRAVEL and SAND, brown, moist, dense, coarse grained sand and coarse gravel	
				R-3	57 50 for 4			GP	SANDY GRAVEL with SILT, brown, damp, very dense, coarse grained sand and coarse gravel	
	10			R-4	17 50 for 2					
				R-5	50 for 6					
	15			R-6	27 50 for 6				medium grained sand, fine to coarse gravel	
	20			SPT-1	24 21 16			GM	SILTY GRAVEL, brown, damp, very dense, trace medium grained sand, fine to coarse gravel	
	25			SPT-2	19 19 42			GP	SANDY GRAVEL, brown, damp, very dense, coarse grained sand, fine to coarse gravel	
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
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PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-11

Date 1-4-07 | Sheet 2 of 2

Project Limoneira Company, East Area I | Project No. 031852-001

Drilling Co. Martini Drilling | Type of Rig Hollow-Stem-Auger

Hole Diameter 7 | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole ' | Location Refer to Geotechnical Map

Logged By PM

Sampled By PM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30	N S		SPT-3	50 for 6			GP	SANDY GRAVEL, brown, damp, very dense, coarse grained sand, fine to coarse gravel	
	35			SPT-4	50 for 6				Refusal at 36'	
	40								**Total Depth Drilled = 36'** **Total Depth Sampled = 35.5'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
	45									
	50									
	55									
	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG HSA-12

Date 1-4-07 **Sheet** 1 of 1

Project Limoneira Company, East Area I **Project No.** 031852-001

Drilling Co. Martini Drilling **Type of Rig** Hollow-Stem-Auger

Hole Diameter 7 **Drive Weight** 140 lbs. **Drop** 30"

Elevation Top of Hole ' **Location** Refer to Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							**Logged By** PM **Sampled By** PM	
	0								**TOPSOIL:** SILTY SAND, brown, moist, medium dense	
								SM	**ALLUVIUM:** SILTY SAND, brown, moist, medium stiff encountered cobble	
				R-1	35 39 50	122	4.1			
								GP	SANDY GRAVEL, brown, damp, coarse grained sand and coarse gravel	
	5			R-2	50 for 6					
				R-3	50 for 1					
	10			R-4	23 28 24	120	3.9		GRAVEL, trace silt, gray brown, damp, coarse gravel	
				R-5	24 50 for 1	131	3.9		Refusal at 13'	
									Total Depth Drilled = 13' **Total Depth Sampled = 12.5'** **No Groundwater Encountered** **Boring backfilled with soil cuttings**	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-1

Date 5-10-06 | Sheet 1 of 1

Project Limoneira Company, East Area 1 | Project No. 031852-002

Drilling Co. C&L Drilling | Type of Rig Rotory Wash

Hole Diameter 6" | Drive Weight 140 lbs. | Drop 30"

Elevation Top of Hole 321' | Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By PM; Sampled By PM)	Type of Tests
320	0							ML	ARTIFICIAL FILL (Afu) SANDY SILT, tan, dry, medium dense, fine grained some gravel occasional cobbles medium grained, some gravel, no cobbles	
315	5			R-1	4 4 5			SM	SILTY SAND, brown, medium dense, medium to coarse grained, occasional gravel	
				R-2	15 18 27			SP-SM	ALLUVIUM (Qal) SAND with SILT, brown, dense, coarse grained, some gravel encountered cobbles	
310	10			R-3	40 for 6"			SP	GRAVELLY SAND, yellow brown, very dense, coarse grained sand encountered cobble refusal @ 10.75' Total Depth Drilled 10.75' Total Depth Sampled 10.5 No Groundwater Boring Backfilled with spoils	
305	15									
300	20									
295	25									
	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-2

Date 5-10-06 Sheet 1 of 1

Project Limoneira Company, East Area 1 Project No. 031852-002

Drilling Co. C&L Drilling Type of Rig Rotory Wash

Hole Diameter 6" Drive Weight 140 lbs. Drop 30"

Elevation Top of Hole 347' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								Logged By PM Sampled By PM	
345									**ARTIFICIAL FILL (Afu)** SANDY SILT, tan, dry, medium dense, fine grained	
				R-1	12 4 for 4.5"			ML	**ALLUVIUM (Qal)** SANDY SILT, dark brown, firm, gravel in the tip of the sampler encountered gravel and cobbles	
	5								refusal @ 4.5 Total Depth Drilled 4.5' Total Depth Sampled 3.5' No Groundwater Boring Backfilled with spoils	
340										
	10									
335										
	15									
330										
	20									
325										
	25									
320										
	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-3

Date 5-10-06 **Sheet** 1 of 1

Project Limoneira Company, East Area 1 **Project No.** 031852-002

Drilling Co. C&L Drilling **Type of Rig** Rotory Wash

Hole Diameter 6" **Drive Weight** 140 lbs. **Drop** 30"

Elevation Top of Hole 374' **Location** Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							**Logged By** PM **Sampled By** PM	
	0							SM	ARTIFICIAL FILL (Afu) SILTY SAND, tan to brown, medium dense, fine to medium grained some gravel	
370				R-1	12 18 20			GP	ALLUVIUM (Qal) SANDY GRAVEL, gray-black, dense, coarse grained sand, large gravel	
	5			R-2	12 50 for 6"				encountered cobbles refusal @ 6.5'	
365									Total Depth Drilled 6.5' Total Depth Sampled 4.0' No Groundwater Boring Backfilled with spoils	
	10									
360										
	15									
355										
	20									
350										
	25									
345										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

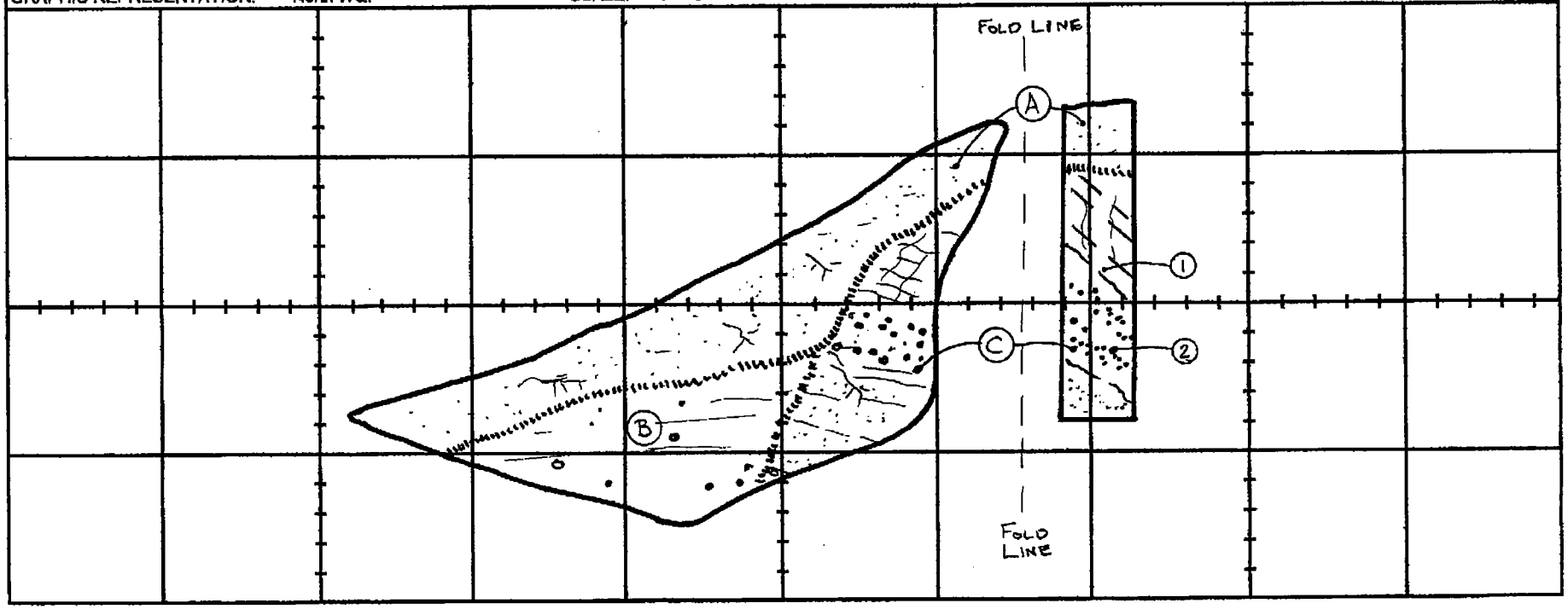
LEIGHTON AND ASSOCIATES, INC.

TRENCH NO: LT-1

Project No: 031852-002
Project Name: Limoneira, East Area 1
Logged by : ARH
Equipment: 4x4 Backhoe
Location: NW portion of site
Elevation: 442' ± Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES			
			USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Topsoil** SANDY SILT with little CLAY and CLAYEY SILTY SAND, medium-grained, dark brown, damp to moist, soft, abundant roots and pinhole voids					
	(B) **Alluvium/Slopewash** SANDY SILT/SILTYSAND, medium-grained, damp, loose, pinhole voided, massive to crude subhorizontal bedding	Qal				
(1) B: N56E, 50 SE	(C) **Saugus Formation** GRAVELLY SANDSTONE and SANDY SILTSTONE, medium brown, damp, moderately hard, cohesive, well bedded, weathered in zones	TQs				
(2) B: N55E, 48 SE	**T.D. = 10'** No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: North Wall SCALE: 1" = 5' TREND: N65E →



TRENCH NO: LT-2

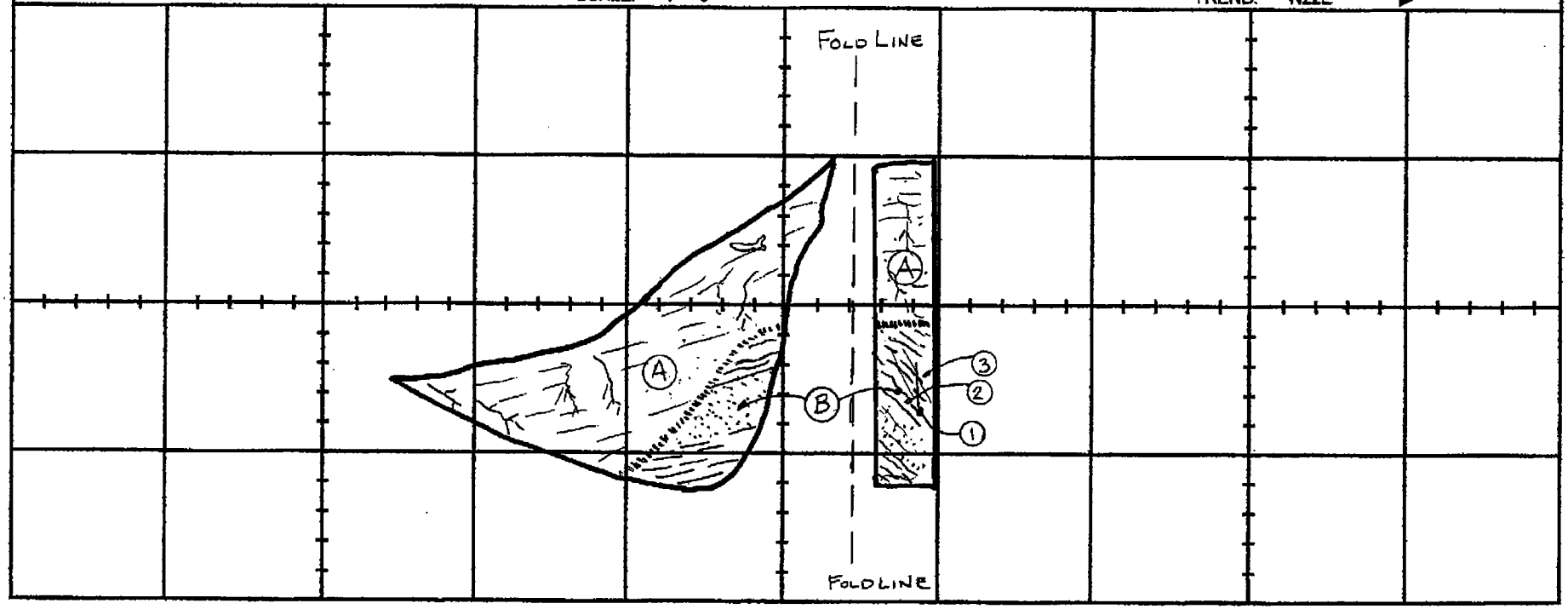
Project No: 031852-002
Project Name: Limoneira, East Area 1

Logged by : ARH
Equipment: 4x4 Backhoe

Location: NW portion of site
Elevation: 437'± Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES: USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Colluvium** SANDY CLAY and SANDY SILT, medium brown, damp , stiff, massive, abundant pinhole voids	Qc				
(1) J: N14E, 49 SE (2) B: N55E, 57 SE (3) B: N64E, 54 SE	(B) **Saugus Formation** Interbedded SILTY SANDSTONE, SANDY SILTSTONE and SILTY CLAYSTONE, medium to dark brown, damp, stiff, weathered, jointed, abundant root hairs along irregular joints **T.D. = 11.5'** No groundwater or seepage Backfilled with spoils	TQS				

GRAPHIC REPRESENTATION: North Wall SCALE: 1" = 5' TREND: N22E →



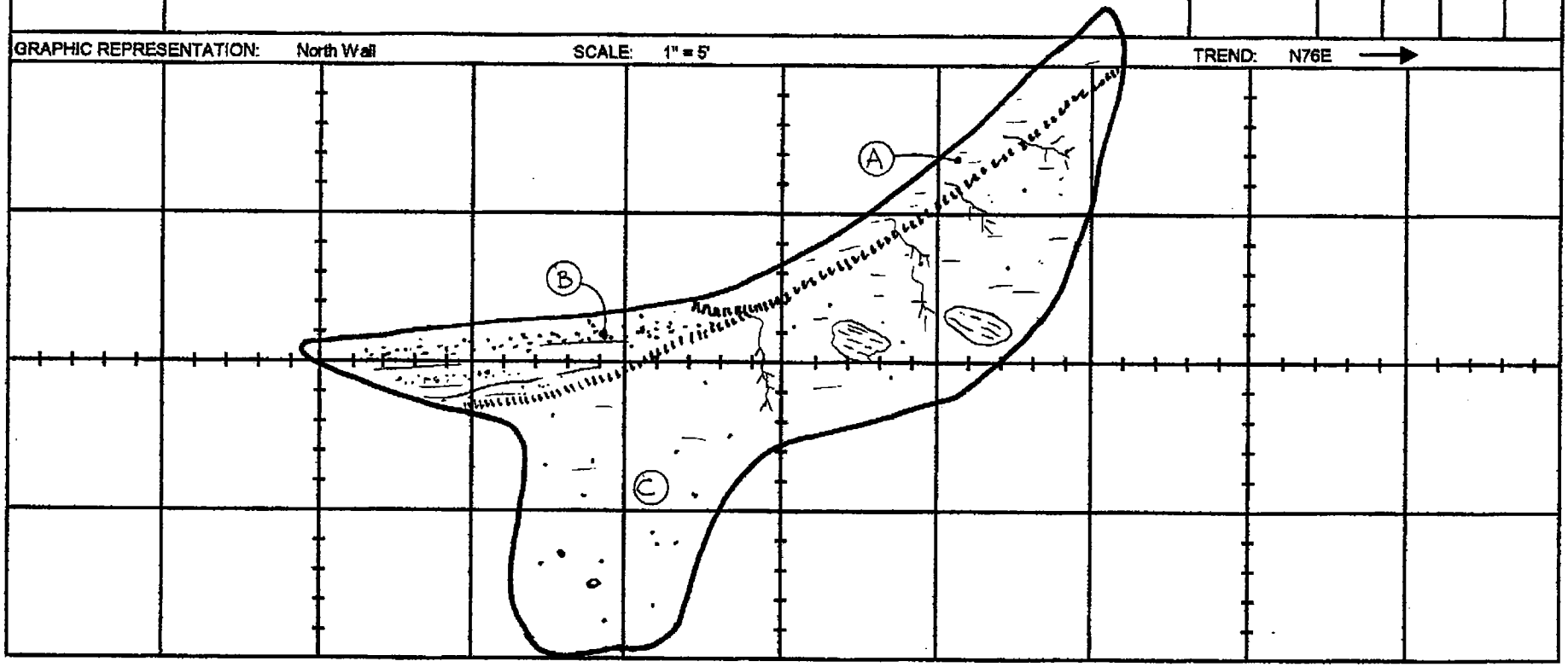
TRENCH NO: LT-3

Project No: 031852-002 | Logged by : ARH | Location: NW portion of site

Project Name: Limoneira, East Area 1 | Equipment: 4x4 Backhoe | Elevation: 433'± | Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES			
			USCS Class	Sample No.	Moist. (%)	Density (pcf)
	Topsoil SANDY CLAY/ SANDY SILTY CLAY, dark brown, damp , soft, highly porous with high organic content, abundant roots and rootlets					
	Alluvium SILTY SAND, light brown, moist, massive, loose					
	Landslide Debris/ Debris Flow Mixture of SILTY SAND and SANDY SILT, light orange brown, damp, moderately dense/stiff, massive, no bedding structure, calcium carbonate absent, very moist below 10'	Qls				
	T.D. = 13' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: North Wall SCALE: 1" = 5' TREND: N76E →



Trench logs lt-1 through lt-8;

LEIGHTON

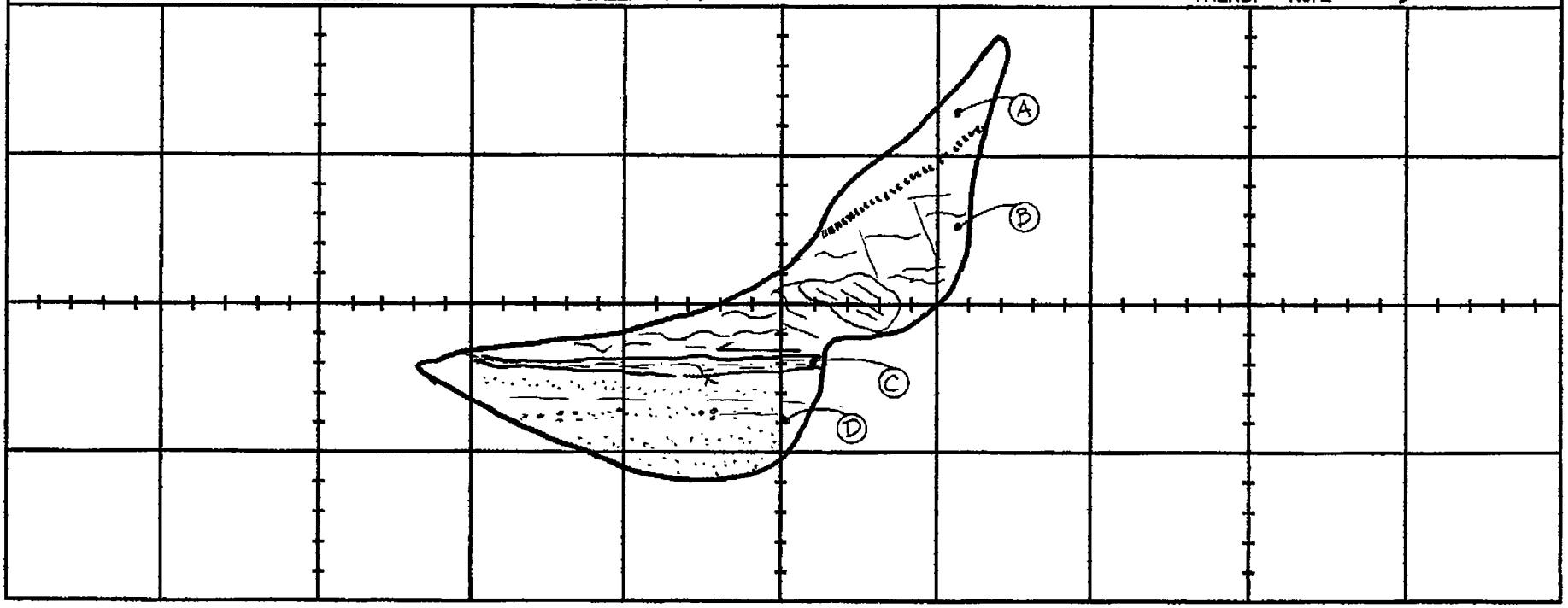
TRENCH NO: LT-4

Project No: 031852-002 | Logged by : ARH | Location: NW portion of site

Project Name: Limoneira, East Area 1 | Equipment: 4x4 Backhoe | Elevation: 424'± | Date: 5/24/06

GEOLOGIC ATTITUDES			GEOLOGIC UNIT	ENGINEERING PROPERTIES			
				USCS Class	Sample No.	Moist. (%)	Density (pcf)
Pseudo/ Remnant Bedding: N50W, 55NE	(A)	**Topsoil** SILT/ CLAYEY SILT, medium brown, damp , soft, abundant rootlets					
	(B)	**Landslide Debris** disturbed and pulverized SILTSTONE, CLAYSTONE and SANDSTONE with multiple shears and joints, jumbled,no pervasive structure	Qls				
	(C)	**Buried Topsoil** similar to above					
	(D)	**Alluvium** Subhorizontally bedded SILTY SAND and GRAVELLY SITLY SAND, medium red brown, moist	Qal				
		T.D. = 13' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: North Wall SCALE: 1" = 5' TREND: N57E →



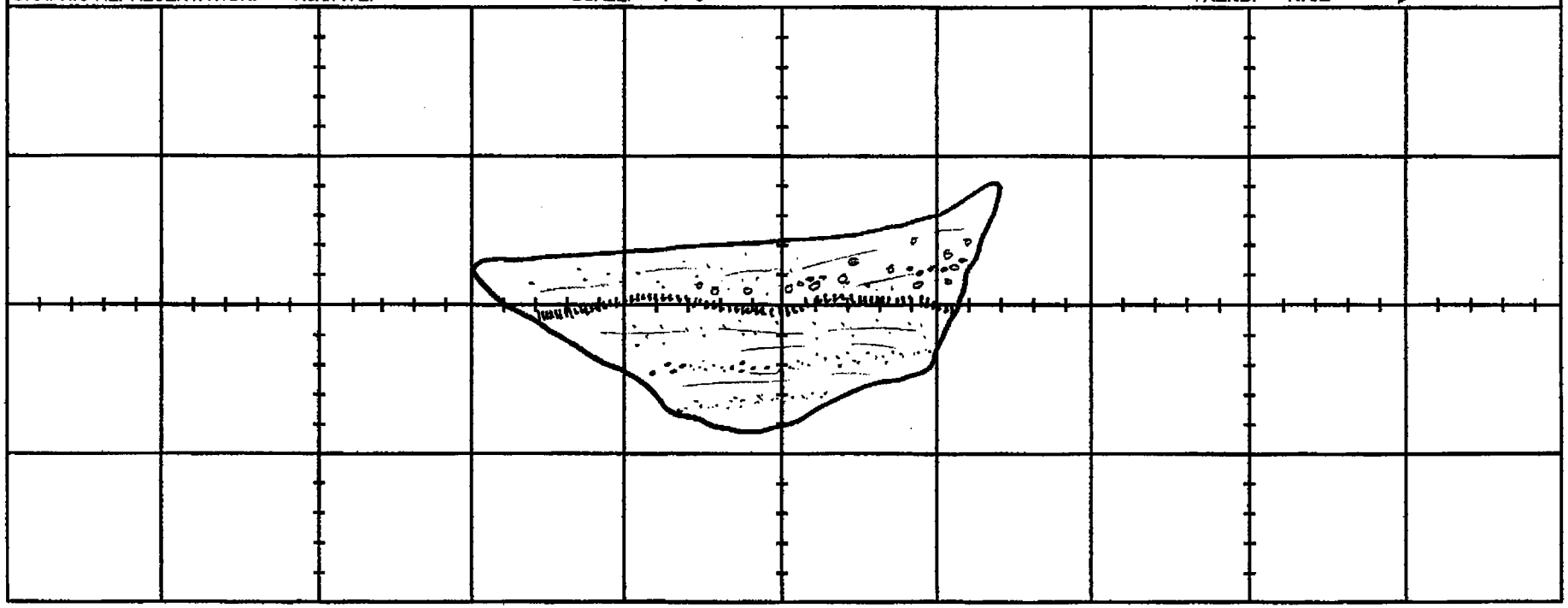
TRENCH NO: LT-5

Project No: 031852-002 | Logged by : ARH | Location: NW portion of site

Project Name: Limoneira, East Area 1 | Equipment: 4x4 Backhoe | Elevation: 422' ± | Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES: USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Slopewash/Colluvium** GRAVELLY SILTY SAND, light brown, moist, loose, massive, indistinct gradational contact	Qc				
	(B) **Alluvium** SILTY SAND, light brown, damp, loose to medium dense, slightly cohesive, crude subhorizontal bedding, few pinole voids in zones	Qal				
	T.D. = 6' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: North Wall SCALE: 1" = 5' TREND: N70E →



TRENCH NO: LT-6

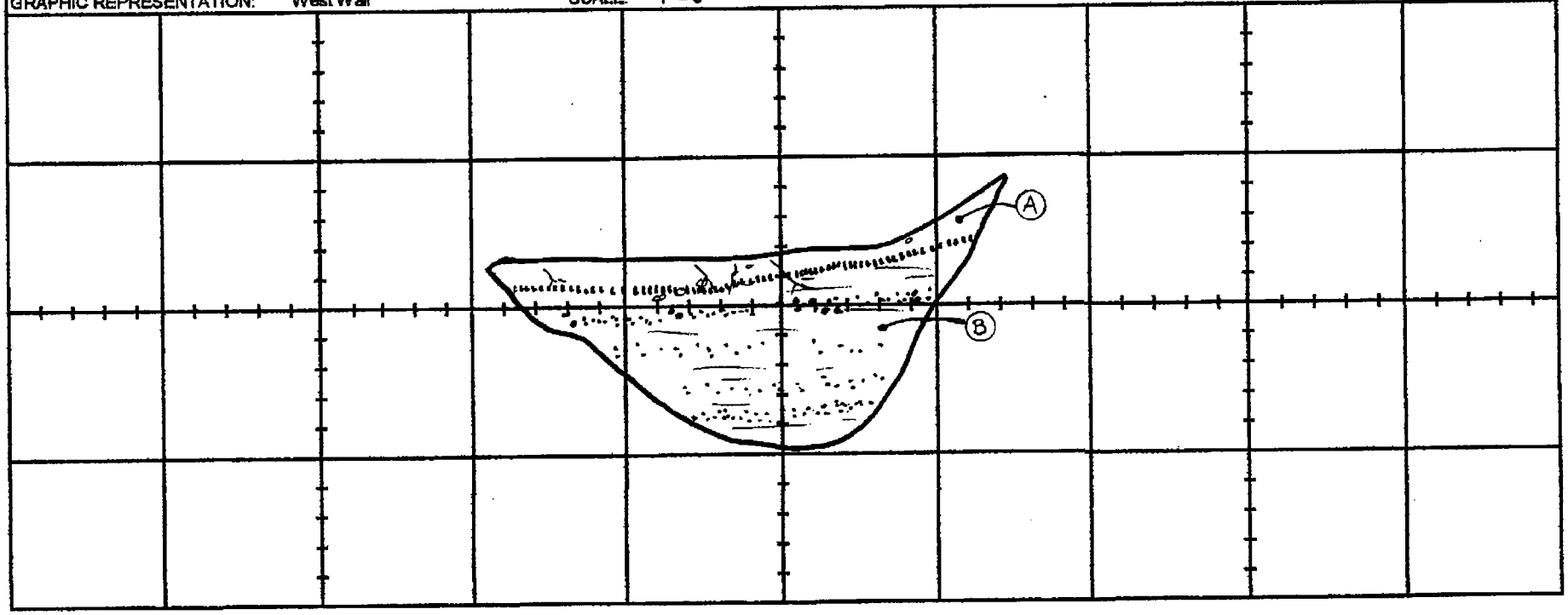
Project No: 031852-002
Project Name: Limoneira, East Area 1

Logged by : ARH
Equipment: 4x4 Backhoe

Location: NW portion of site
Elevation: 611'± Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES			
			USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Topsoil**					
	(B) **Saugus Formation** SILTY SANDSTONE, medium red brown to red, moist, dense, massive, few to some pinhole voids, trace rootlets, slightly weathered	TQs				
	T.D. = 8' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: West Wall SCALE: 1" = 5' TREND: N04E →



TRENCH NO: LT-7

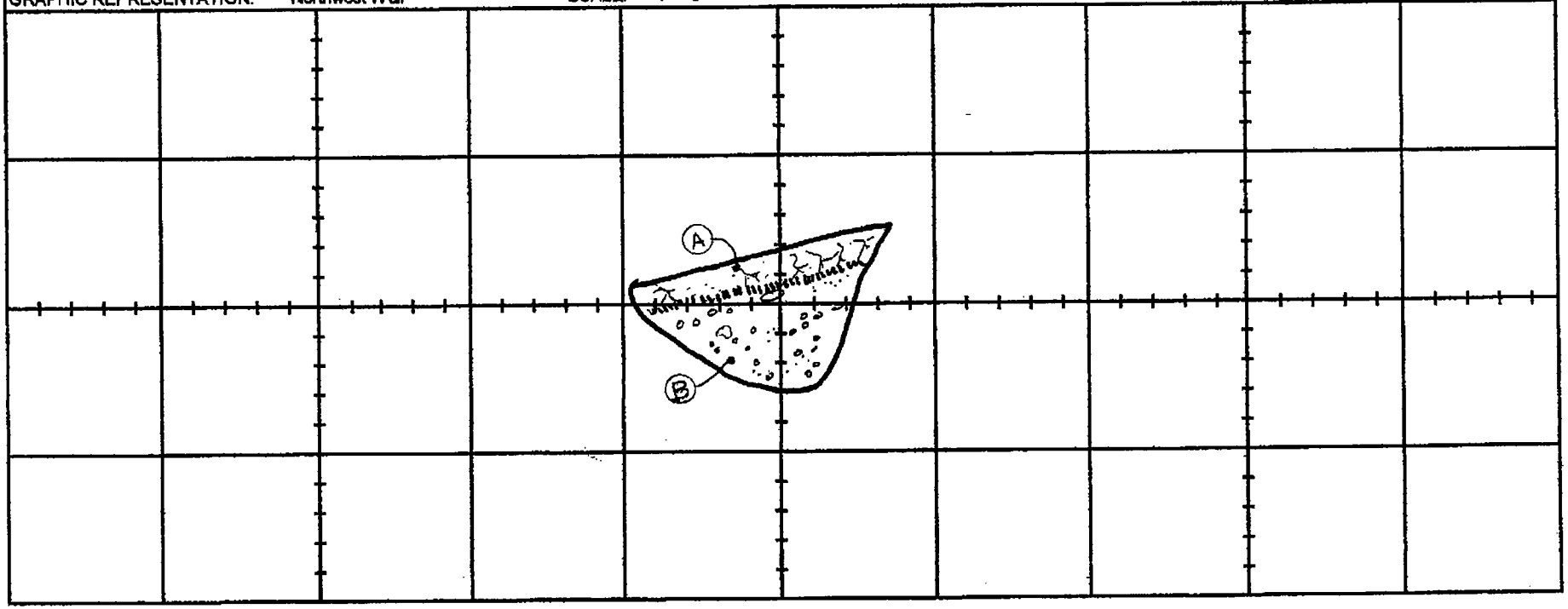
Project No: 031852-002
Project Name: Limoneira, East Area 1

Logged by : ARH
Equipment: 4x4 Backhoe

Location: NW portion of site
Elevation: 556' ± Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES			
			USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Topsoil** SILTY and CLAYEY SAND, dark red brown, damp, loose, few roots					
	(B) **Older Alluvium** GRAVELLY SILTY SAND, red brown, damp, friable, digging difficult for backhoe, massive	Qoal				
	T.D. = 6' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: Northwest Wall SCALE: 1" = 5' TREND: N32E →



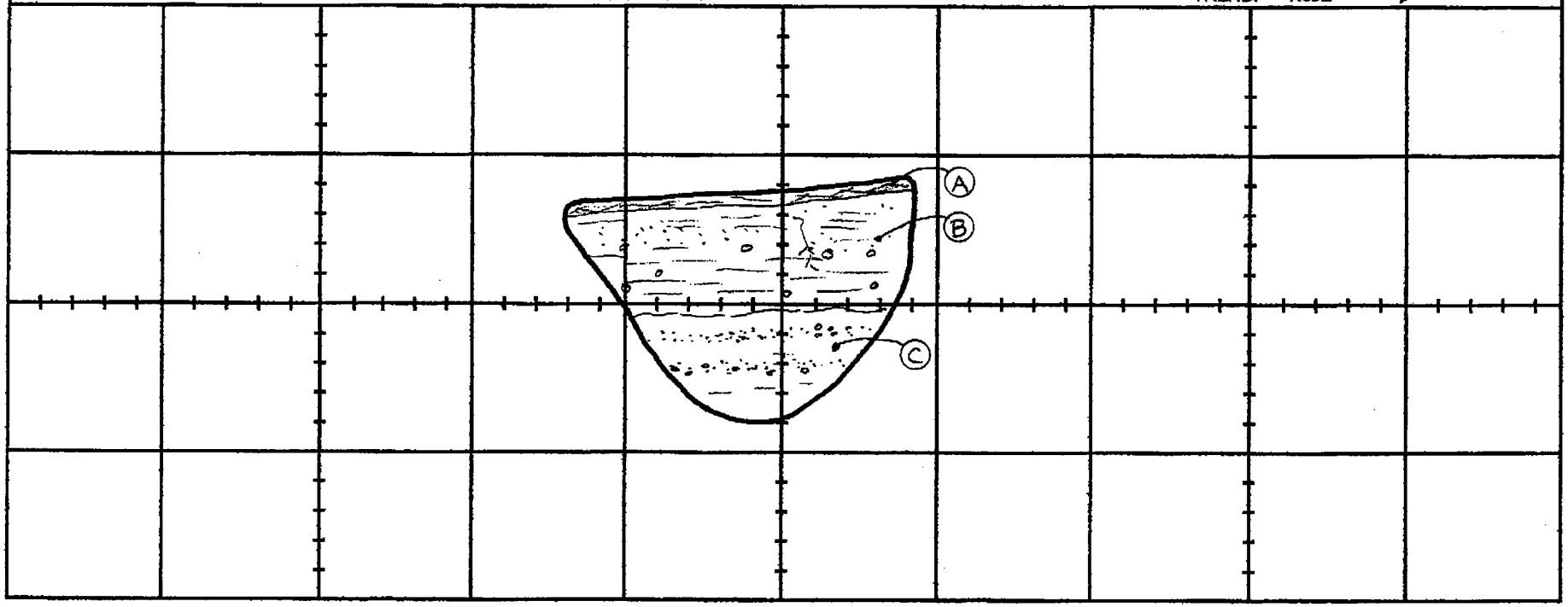
TRENCH NO: LT-8

Project No: 031852-002 | Logged by : ARH | Location: NW portion of site

Project Name: Limoneira, East Area 1 | Equipment: 4x4 Backhoe | Elevation: 484' ± | Date: 5/24/06

GEOLOGIC ATTITUDES		GEOLOGIC UNIT	ENGINEERING PROPERTIES: USCS Class	Sample No.	Moist. (%)	Density (pcf)
	(A) **Organic Layer** 4"-thick, leaves					
	(B) **Topsoil and Agricultural Fill** CLAYEY SAND and SANDY CLAY, dark brown, moist, low plasticity, stiff					
	(C) **Alluvuim/Older Alluvium** gravelly SILTY SAND, orange to red-brown, very moist, dense, massive, few boulders, subhorizontally bedded	Qal/ Qoal				
	T.D. = 8.5' No groundwater or seepage Backfilled with spoils					

GRAPHIC REPRESENTATION: Northwest Wall SCALE: 1" = 5' TREND: N59E →



GEOTECHNICAL BORING LOG LB-1

Date 4-24-06 | Sheet 1 of 4

Project Limoneira, East Area 1 | Project No. 031852-002

Drilling Co. Tri-Valley Drilling | Type of Rig Bucket Auger

Hole Diameter 24" | Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. | Drop 12"

Elevation Top of Hole 582' | Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By SPJ; Sampled By MEK/SPJ)	Type of Tests
580	0			B-1					SAUGUS FORMATION (TOs) interbedded CONGLOMERATIC SANDSTONE and SILTY SANDSTONE, orange brown, moist, weathered slightly at surface, sand is fine to coarse grained, cobbles are up to 10" with the majority less than 6" in diameter	
575	5			R-1	6 10	131.4	7.4		few rootlets beds are generally dipping about 45 ° south; bed thickness varies from a few inches to ~ 3 feet, rock is dense but not cemented, easily friable	
570	10			R-2	11 12					
565	15			R-3	6 8	124.7	11.5			
560	20			R-4	13 3/2"	129.5	3.1			
555	25			R-5	6 7	107.4	15.9		steeply dipping contact with light yellow-brown SANDY SILTSTONE, beds are ~ 2-3 inches thick, slightly plastic, beds are distinct and continuous around hole and do not form surfaces that pull out, top of fining upward sequence	
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-1

Date 4-24-06 Sheet 2 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 582' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By SPJ; Sampled By MEK/SPJ)	Type of Tests
	30			R-6	11 16	117.7	13.9		grades to SILTY SANDSTONE, slightly plastic, beds are 2-to-3 inches thick	DS
550			B: N55E, 44SE							
	35			R-7	9 15	111.7	12.7			
545			B: N60E, 40SE						distinct dark brown layer 2-3 inches thick	
	40			R-8	18 36	112.0	14.1		slightly coarser grained, light yellow brown	
540										
	45		B: N62E, 42SE	R-9	15 23	116.4	13.8		sharp contact with dark brown CLAYEY SILTSTONE, moderately plastic, patches of white at the contact, top of fining upward sequence	
535										
	50			R-10	15 19	121.1	9.7		primarily SILTSTONE, coarsening downward	
530										
	55			R-11	18 15/2"	114.5	12.7		grades interbedded SILTY SANDSTONE and SANDY CONGLOMERATE	
525										
	60		B: N48E, 43SE							

SAMPLE TYPES:

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

TYPE OF TESTS:

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

GEOTECHNICAL BORING LOG LB-1

Date 4-24-06 Sheet 3 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 582' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
									Logged By SPJ Sampled By MEK/SPJ	
	60			R-12	15 20	106.7	16.4		interbedded SILTY SANDSTONE and SANDSTONE, fine to coarse grained, light yellow-brown, damp, very dense	
520										
	65			R-13	9 25	110.4	21.2		CONGLOMERATE bed, clasts are up to 6" in diameter with majority being ~1.5 "	
515			B: N65E, 36SE						light yellow brown, Silty SAND with scattered gravel lenses, continuous around hole	
	70		B: N70E, 51SE	R-14	17 24	115.9	7.1		fine gravel bed, 2" thick	
510										
	75			R-15	36/6"				SANDY CONGLOMERATE, majority of cobbles are ~3" in diameter with the largest up to 8" in diameter	
505									irregular steeply dipping contact	
	80			R-16	16 20/4"	125.5	12.3		reddish brown, CLAYEY to SILTY SANDSTONE, with few gravel CONGLOMERATE interbeds	
500				B-4						
	85		B: N46E, 40SE	R-17	17 27/3"	121.7	11.6		1" thick CLAYEY SILTSTONE bed	
495										
	90									

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

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

GEOTECHNICAL BORING LOG LB-1

Date 4-24-06 Sheet 4 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 582' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			R-18	36/6"	118.7	13.1		Logged By SPJ Sampled By MEK/SPJ	
490									**Total Depth 90'** **Downhole logged to 88'** **Sampled to 90.5'** **No groundwater encountered**	
	95									
485										
	100									
480										
	105									
475										
	110									
470										
	115									
465										
	120									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-2

Date 4-25-06 Sheet 1 of 3

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 597' Location Refer To Geotechnical Map

Logged By ARH

Sampled By ARH/JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
595	0							ML	TOPSOIL SANDY SILT, medium or brown, damp, traces clay, abundant rootlets	
				B-1					SAUGUS FORMATION (TOs): interbedded SILTY SANDSTONE, red brown, damp, soft, easily friable, fine-to medium-grained with few gravel, massive to crude bedding, trace calcium carbonate stringers	
	5			R-1	4/6"	109.1	13.5			
590			AB: N58E, 37SE						trace roots and rootlets to 9.5', slightly weathered	
									indistinct gradational contact	
	10			R-2	4 8/6"	109.9	9.7		mostly SILTY SANDSTONE with SANDY SILTSTONE interbeds, fine-to coarse-grained, light brown to red brown, damp, very dense, friable, few gravelly zones.	
585										
	15			R-3	5 8/6"	114.7	13.2		walls tighten up; friable, massive to planar beds with few broad cross-beds	
580			XB: N40E, 33SE	B-2		115.3	6.2			
	20			R-4	6 10/6"	112.6	9.8		2-foot thick gravelly SILTY SANDSTONE/ SUBCONGLOMERATE, scoured irregular upper and lower contacts	
575										
	25		AB: N50E, 36SE	R-5	6 9					
570										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
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- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-2

Date 4-25-06 Sheet 2 of 3

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 597' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By ARH; Sampled By ARH/JBW)	Type of Tests
	30			R-6	15 12/3"	112.6	9.8		SANDY SILTSTONE, light brown, slightly moist, moderately soft, friable	DS
565									mostly pebble to cobble SUBCONGLOMERATIC to CONGLOMERATIC SANDSTONE with few SILTY SANDSTONE interbeds, red brown to light brown, damp, dense, friable, difficult drilling	
	35		AB: N42E, 55SE	R-7	7 17	113.9	9.4			
560										
	40		XB: N26E, 43SE	R-8	19/5"					
555			B: N65E, 44SE						core bucket used from 42' to total depth intermitantly	
	45			R-9	20/8"					
550										
	50		AB: N70E, 42SE	R-10	20/3"				few discontinuous SANDY SILTSTONE lenses 1 to 4"- thick	
545										
	55		AB: N65E, 44SE	R-11	21 8/1"					
540										
	60									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
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GEOTECHNICAL BORING LOG LB-2

Date 4-25-06 | Sheet 3 of 3

Project Limoneira, East Area 1 | Project No. 031852-002

Drilling Co. Tri-Valley Drilling | Type of Rig Bucket Auger

Hole Diameter 24" | Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. | Drop 12"

Elevation Top of Hole 597' | Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							Logged By ARH Sampled By ARH/JBW	
535	60			R-12	20 19/4"	117.1	11.1		semicontinuous SANDY CLAYSTONE seam, dark grey, damp, very stiff, ~0.5"-thick	
530	65		B: N65E, 54SE	R-13	8 2/6"	118.8	10.4			
				B-3						
525	70		AB: N65E, 45SE	R-14	30 22/2"	116.4	13.3			DS
520	75			R-15	15 26	109.2	14.2			
515	80								**Total Depth Drilled 75'** **Total Depth Sampled 76'** **No Gounidwater** **Downhole Logged to 73'** **No Seepage** **Boring Backfilled 4/27/2006**	
510	85									
	90									

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-3

Date 4-27-06 Sheet 1 of 3

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 628' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							Logged By ARH Sampled By ARH	
	0								**TOPSOIL** SANDY CLAY/SANDY SILT, dark brown, moist, stiff, massive, trace rootlets	
625				B-1					indistinct gradational contact	
	5			R-1	push 12"	110.0	18.1		**SAUGUS FORMATION (Tos):** SILTSTONE and CLAYEY SILTST, grey and orange brown, damp to moist, stiff, trace calcium carbonate stringers, weathered to ~ 9', massive	
620									indistinct gradational contact	
	10		B: N73E, 42SE	R-2	3 6	117.2	15.6		SILTSTONE, medium olive grey and orange brown, damp, very stiff	
615										
	15		J: N10E, 90	R-3	4 6	120.6	13.4			
610				B-2					gradational contact	
	20		AB: N6SE, 45SE	R-4	7 9	128.8	8.4		SILTY GRAVELLY SANDSTONE, redbrown, damp, dense/moderately hard, friable, crude bedding, pebble/gravel alignments	
605									@ 23' sheared bed, 1/4" - thick continuous CLAYSTONE, redbrown, moist, stiff, high plasticity, sandy, rock is less durible in shear zone	
	25		SB:N54E, 38SE	R-5	3 7	113.0	16.7		SANDY SILTSTONE, orange brown, few rounded gravel, friable, trace carbon lenses and blebs in beds	
600			J: N32W, 87SW						well-bedded from 29-35'	
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-3

Date 4-27-06 Sheet 2 of 3

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 628' Location Refer To Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30		B: N57E, 49SE B:N64E, 44SE	R-6	8 15/6"	108.7	19.6		CLAYEY SILTSTONE/SILTY CLAYSTONE, orange brown, damp, hard	
595			B: N63E, 44SE J: N60W, 63NE						SANDSTONE lense @ 34' grades	
	35			R-7	10 17	105.6	19.9		interbedded SILTY fine-grained SANDSTONE and SILTSTONE, orange and grey, damp, hard, cohesive, trace charcoal/carbon, few gravelly zones, well-bedded, weakly cemented light slow seepage below 35'; @ 38' steady seepage at aquartardant layer	
590										
	40		CB: N60E, 59SE	R-8	10 14	112.1	17.3		SILTSTONE, medium orange brown, damp, very hard, massive, capped by a 1/2"- thick CLAYSTONE, dark grey, moist, stiff, high plasticity with few bedding parallel paper-thin shear planes below	
585									distinct planar contact with CLAYSTONE bed ~ 2" thick	
				G-1						
	45			R-9	10 15	111.8	18.8		interbedded CLAYEY SILTSTONE and SILTY CLAYSTONE, unoxidized blue-grey, damp, hard; cohesive, high plasticity, massive to laminated planar beds, few oxidized zones slow seepage at 44 to 46' on CLAYSTONE bed	
580										
	50			R-10	20 28/6"	123.8	12.3		CLAYSTONE, green grey to brown, damp, very hard	DS
575										
	55			R-11	16 17	121.4	14.0		SILTSTONE, very hard, cohesive & cemented	
570									distinct planar contact	
	60								interbeded SANDY SILTSTONE, CLAYEY SILTSTONE, and SILTY GRAVELLY SANDSTONE, blue grey to olive grey, damp, hard,	

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-3

Date 4-27-06 | Sheet 3 of 3

Project Limonelra, East Area 1 | Project No. 031852-002

Drilling Co. Tri-Valley Drilling | Type of Rig Bucket Auger

Hole Diameter 24" | Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. | Drop 12"

Elevation Top of Hole 628' | Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By ARH; Sampled By ARH)	Type of Tests
565	60		AB:N65E, 46SE	R-12	25/5"	108.4	23.4		slightly cemented, clayey in zones	
560	65			R-13	23 17/3"	116.0	18.7		ground water level at 68.5' at the end of down-hole logging	
555	70			R-14	21 10/1"	110.1	18.6		SILTSTONE, grey and light orange brown, damp, hard, little sand content	
550	75			R-15	29 13/2"	113.4	16.8			
545	80			R-16	32/4"	112.4	16.5		SILTSTONE and SILTY fine-grained SANDSTONE, as above, sampler refusal	
540	85								Total Depth Drilled 80' Total Depth Sampled 80.5' Seepage at 35' and 44' Static Groundwater at 68.5' Downhole Logged to 68.5' Backfilled with drilled cuttings 4-28-2006	
	90									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-4

Date 5-1-06 Sheet 1 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 628' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By ARH Sampled By ARH	Type of Tests
	0	N S								
625								CL	TOPSOIL: SANDY CLAY, dark brown, damp to moist, soft to stiff, abundant rootlets, few pinhole voids	
	5			B-1					indistinct gradational contact	
				R-1	push 1	108.9	13.6		COLLUVIUM (Qc): interzoned SILT, CLAYEY SILT, and SANDY CLAYEY SILT with GRAVEL orange-brown, very moist, soft to stiff, ravels easily, massive, rootlets down to 8', trace calcium carbonate blebs, structurless	DS
620										
	10			R-2	push 2	115.8	15.6			
615										
	15			R-3	push 3		14.8		increased SAND and GRAVEL below 16'	
				B-2			6.9		very moist	
610										
	20			R-4	4 5		15.8		distinct planar contact with sheared high plasticity CLAYSTONE paper thin to 1/4"-thick, moist, stiff, continuous	
605			B: N55E, 47SE SB: N66E, 51SE						SAUGUS FORMATION (Tos): mostly SILTSTONE with few interbedded CLAYSTONES, light brown damp to moist, stiff to hard; trace fine-grained SANDSTONE, few sheared beds, well-bedded to laminated	
	25			R-5	4 6				moderate seepage from 27.5' to 32'	
600									sheared zone, at 27.5' and 28.4' two sheared CLAYSTONE beds enter boring on the northwest side; 1/2 to 2"-thick each, soft, high plasticity, down dip lineation	
	30		CB: N54E,							

SAMPLE TYPES:

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

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-4

Date 5-1-06 Sheet 2 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 628' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By ARH; Sampled By ARH)	Type of Tests
	30		46SE	R-6	21 27	108.1	116.6		sheared zone distinct planar contact	DS
595				B-3					SILTSTONE with few very fine-grained SANDSTONE interbeds, light orange brown, moist, stiff, friable, well-bedded to laminated in zones, very slow seepage in zones	
	35			R-7	11 27	110.0	18.8			
590										
	40		J: N87W, 76SW	R-8	16 28	113.7	17.2			
585			J: N70W, 85NE B: N55E, 46SE							
	45			R-9	11 30	107.7	21.1		increased seepage at 48' to 50.5', distinct planar contact, 1/4" to 1/2" thick sheared CLAYSTONE, medium to dark orange brown, soft moist, high plasticity underlain by a 3" to 8" thick gouge, down-dip lineation	
580										
	50		CD: N61E, 51SE	R-10	16 33	118.9	16.1		CLAYEY SILTSTONE, grey blue (unoxidized), damp, hard, moderately cemented, massive, cohesive	
575										
	55			R-11	16 36/ 5"	124.0	13.4			
570										
	60									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC

GEOTECHNICAL BORING LOG LB-4

Date 5-1-06 | Sheet 3 of 4

Project Limoneira, East Area 1 | Project No. 031852-002

Drilling Co. Tri-Valley Drilling | Type of Rig Bucket Auger

Hole Diameter 24" | Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. | Drop 12"

Elevation Top of Hole 628' | Location Refer To Geotechnical Map

Logged By ARH

Sampled By ARH

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60	N S		R-12	28 16/1"	118.9	14.9		CLAYEY SILTSTONE, grey blue(unoxidized), damp, hard, moderately cemented, massive, cohesive	
565									grades to orange brown	
	65			R-13	28 21/1"	115.6	14.8		SILTSTONE with few interbedded fine-to medium-grained SILTY SANDSTONES, generally blue grey with some orange zones, damp, hard, thickly-bedded	
560			B: N64E, 62SE							
	70		B: N49E, 50SE	R-14	22 26/3"	113.9	17.0		minor seepage from 67 to 70'	
555										
	75			R-15	38/6"	115.3	14.8			
550									few CLAYEY SILTSTONE interbeds to total depth, hard	
	80			R-16		112.9	18.6			
545			B: N58E, 43SE							
	85		SLOUGH	R-17	24 22/4"	112.8	18.0			
540										
	90									

SAMPLE TYPES:

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

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
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GEOTECHNICAL BORING LOG LB-4

Date 5-1-06 Sheet 4 of 4

Project Limoneira, East Area 1 Project No. 031852-002

Drilling Co. Tri-Valley Drilling Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 0-30'=5952 lbs; 57-86=2531 lbs; 86-106=1407 lbs. Drop 12"

Elevation Top of Hole 628' Location Refer To Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			R-18	36/4"				Logged By ARH Sampled By ARH	
535									**Total Depth Drilled 90'** **Sampled to 90.5'** **Seepage at 27-32', 48-50' and 67-70'** **Down Hole Logged to 85.5'** **Boring Backfilled with Drilled Cuttings and Tamped**	
	95									
530										
	100									
525										
	105									
520										
	110									
515										
	115									
510										
	120									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

LEIGHTON AND ASSOCIATES, INC

03185Z-001

PRESENTATION

OF

CONE PENETRATION TEST DATA

Project:

E. Telegraph Road & Padre Lane
Santa Paula, CA
January 27, 2006

Prepared for:

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Prepared by:

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TABLE OF CONTENTS

PRESENTATION

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the project located at E. Telegraph Road & Padre Lane in Santa Paula, California. The work was performed by Kehoe Testing & Engineering (KTE) on January 27, 2006. The scope of work was performed as directed by Leighton & Associates personnel.

2. SUMMARY OF FIELD WORK

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

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	6	Refusal
CPT-1A	4	Refusal
CPT-2	2	Refusal
CPT-2A	4	Refusal
CPT-3	50	Hole open to 21 ft (dry)
CPT-4	50	Hole open to 22 ft (dry)
CPT-5	2	Refusal
CPT-5A	3	Refusal
CPT-6	24	Refusal, hole open to 22 ft (dry)

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

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

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

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

4. CONE PENETRATION TEST DATA & INTERPRETATION

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

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

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

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

Sincerely,

KEHOE TESTING & ENGINEERING

Steven P. Kehoe, P.E.
President

02-03/06-ca-64

APPENDIX

Kehoe Testing & Engineering
Office: (714) 901-7270
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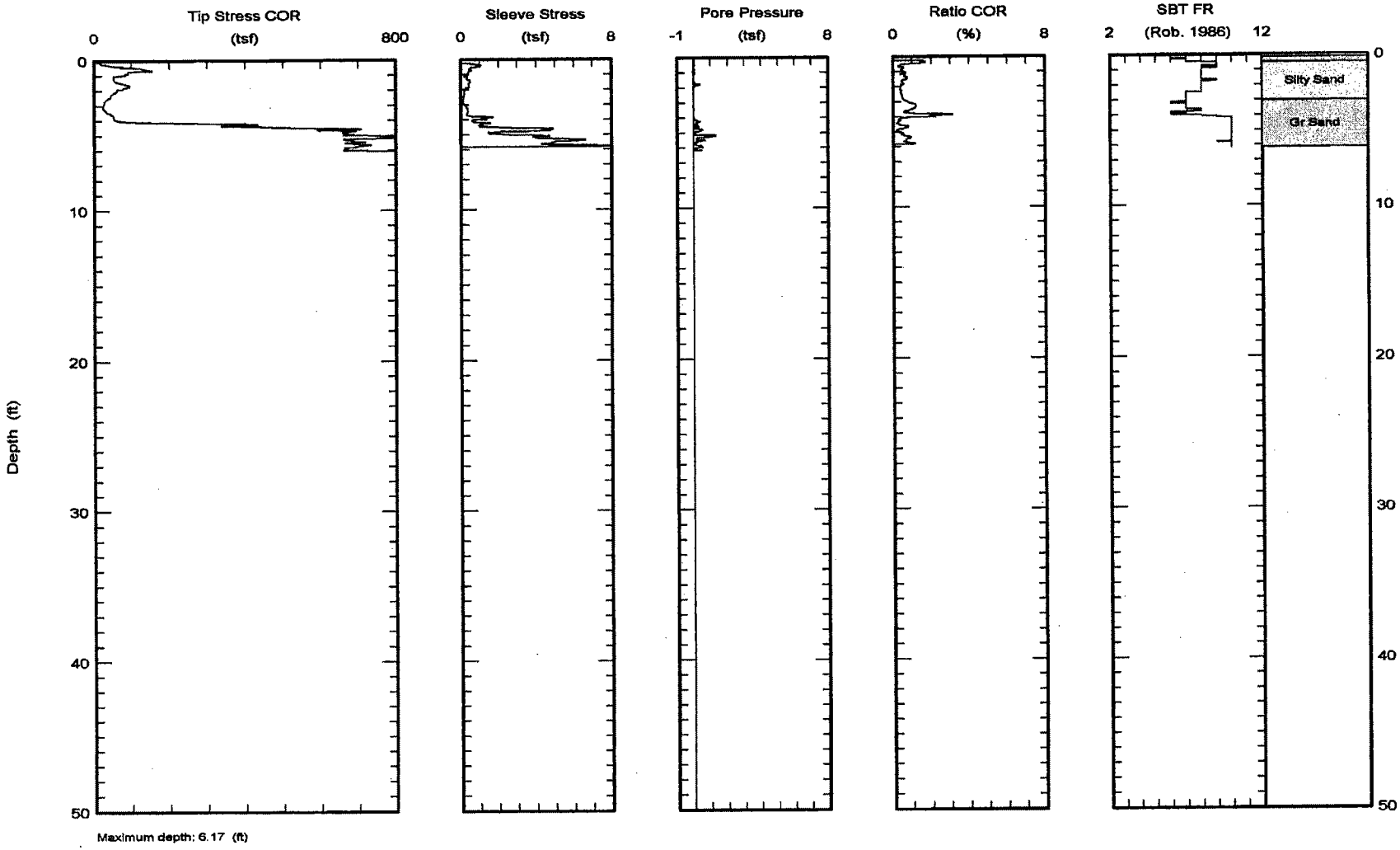
skehoe@msn.com

CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-1
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 6.17 (ft)

Test ID: CPT-1
File: Z27J0603C.ECP

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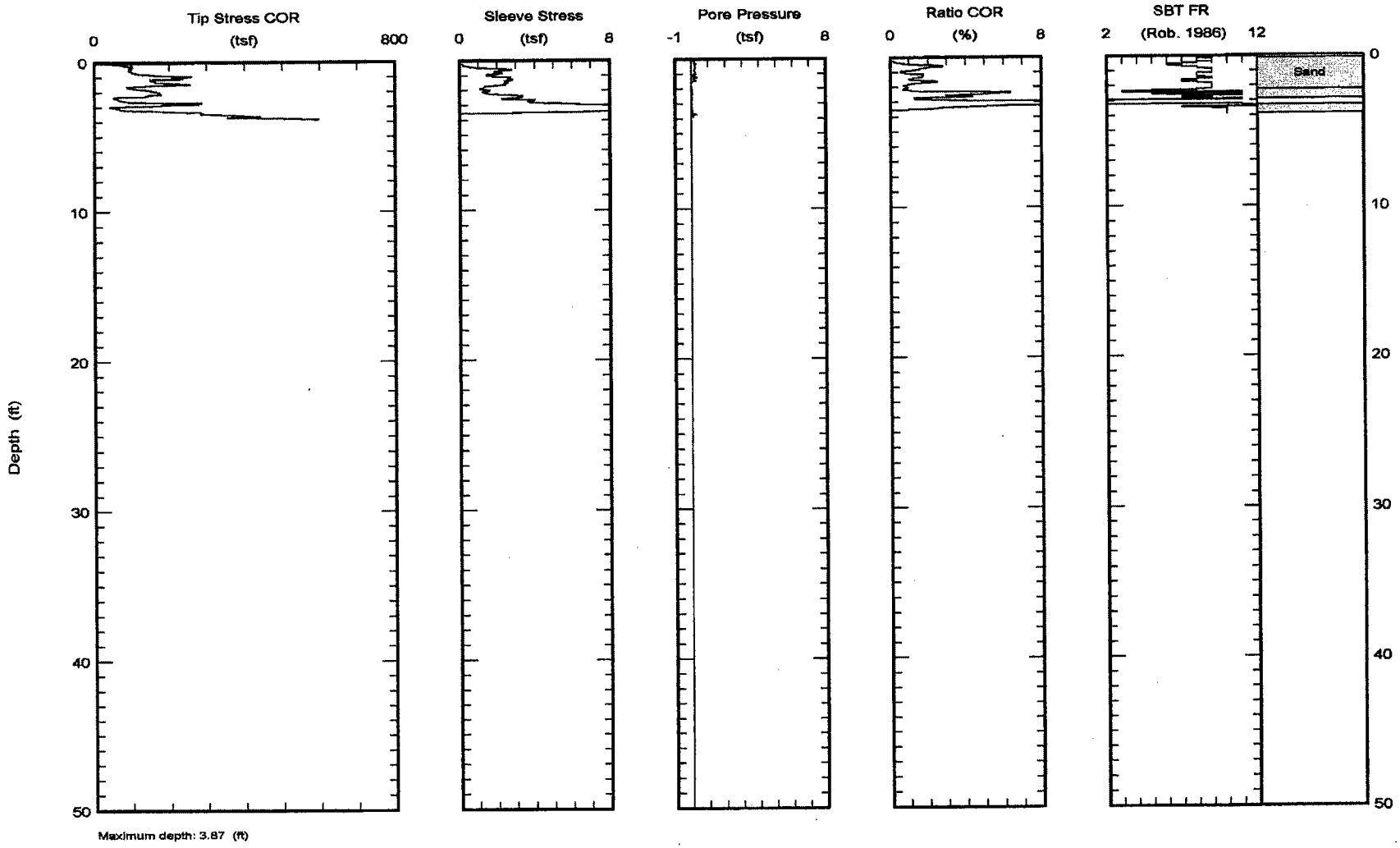
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-1A
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 3.87 (ft)

Test ID: CPT-1A
File: Z27J0604C.ECP

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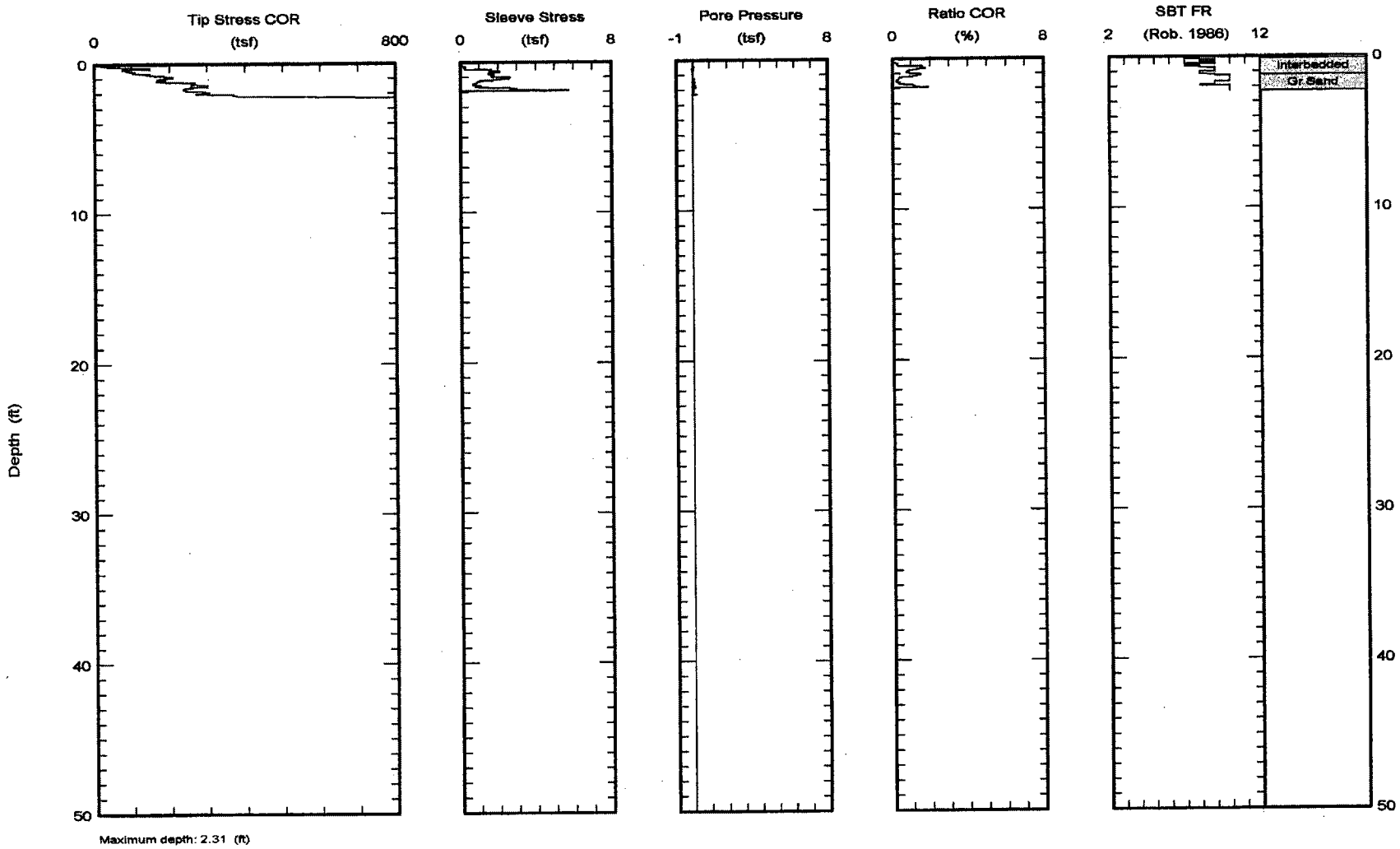
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-2
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 2.31 (ft)

Test ID: CPT-2
File: Z27J0605C.ECP

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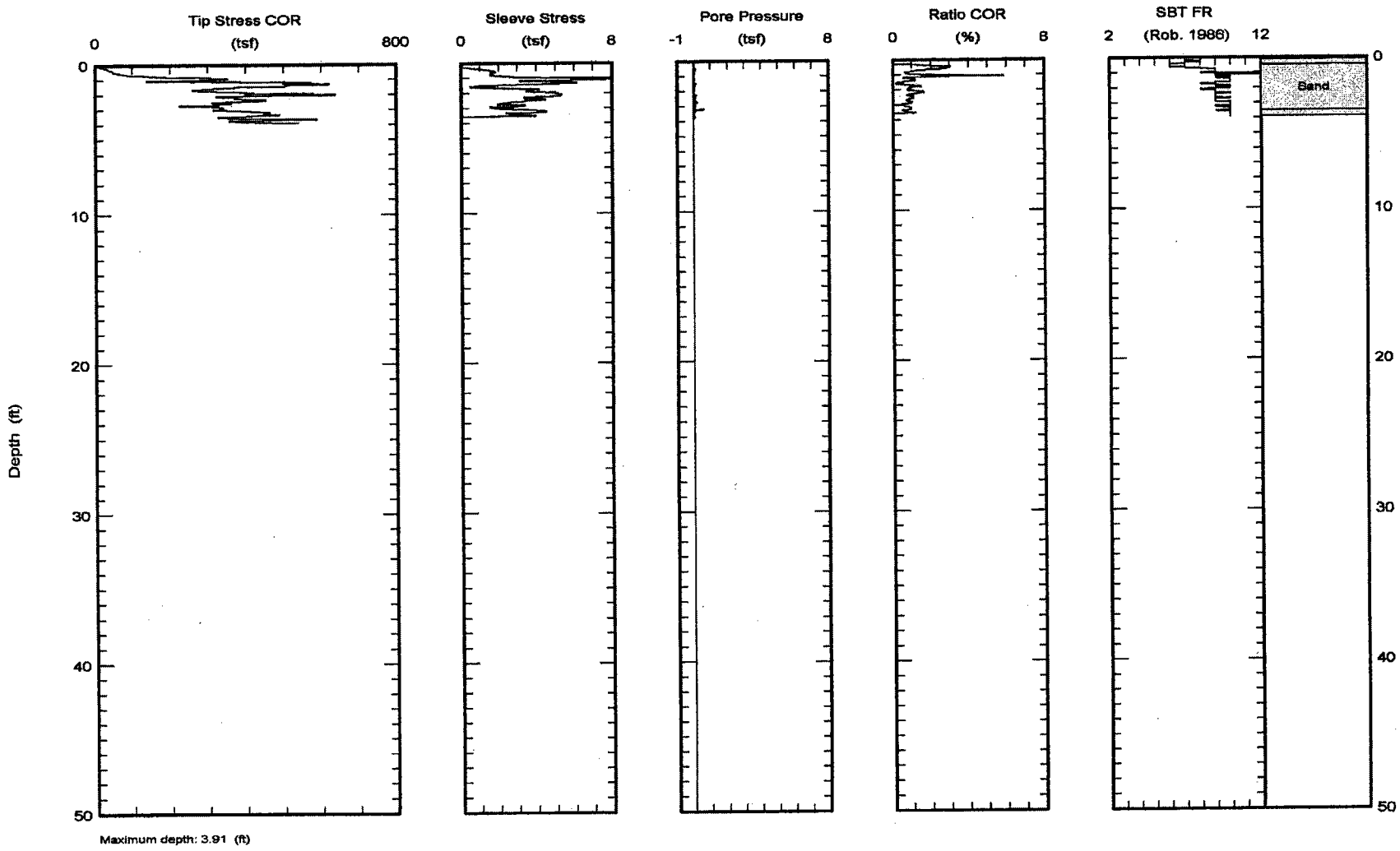
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-2A
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 3.91 (ft)

Test ID: CPT-2A
File: Z27J0606C.ECP

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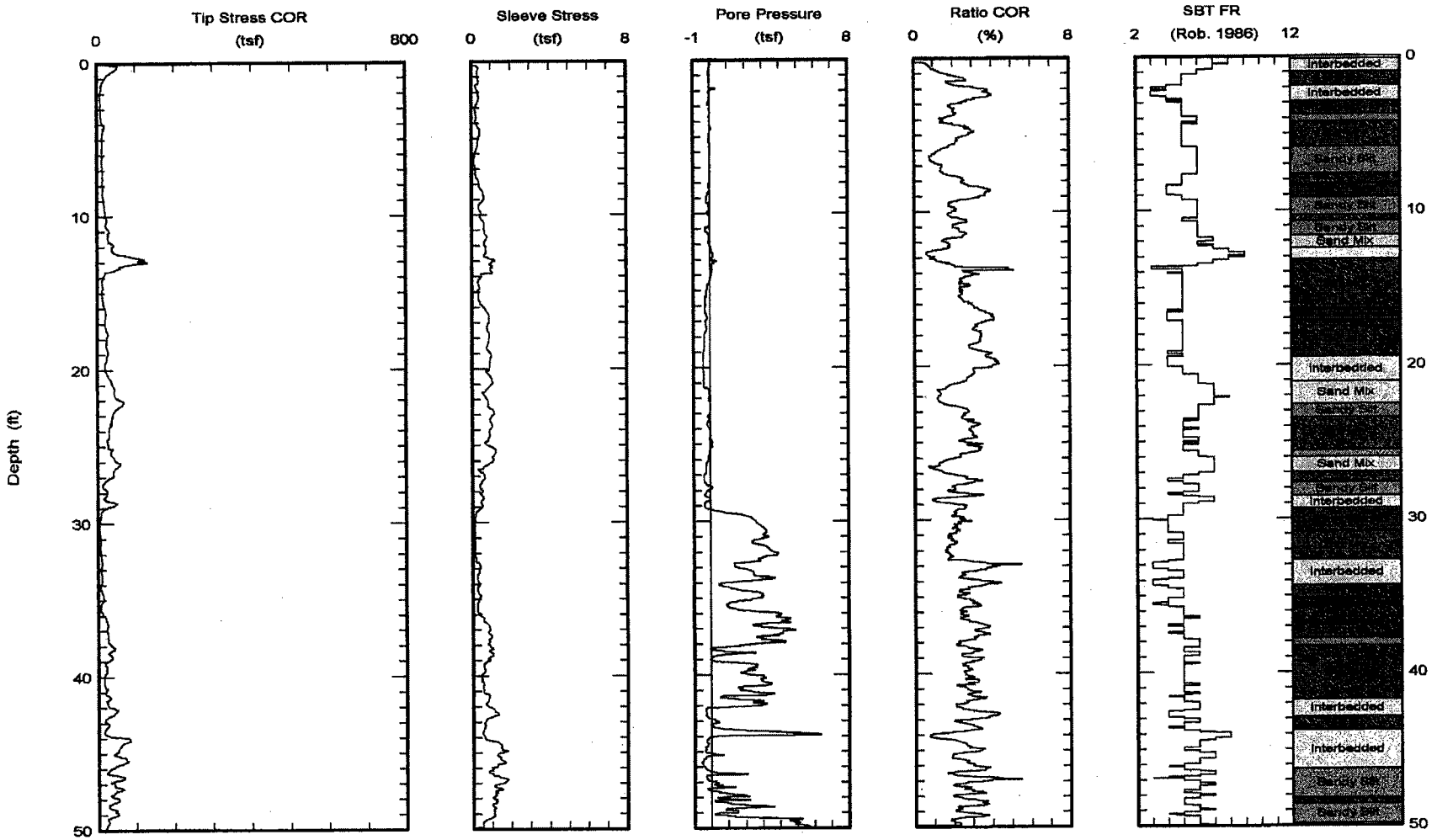
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-3
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 50.25 (ft)

Test ID: CPT-3
File: Z27J0607C.ECP

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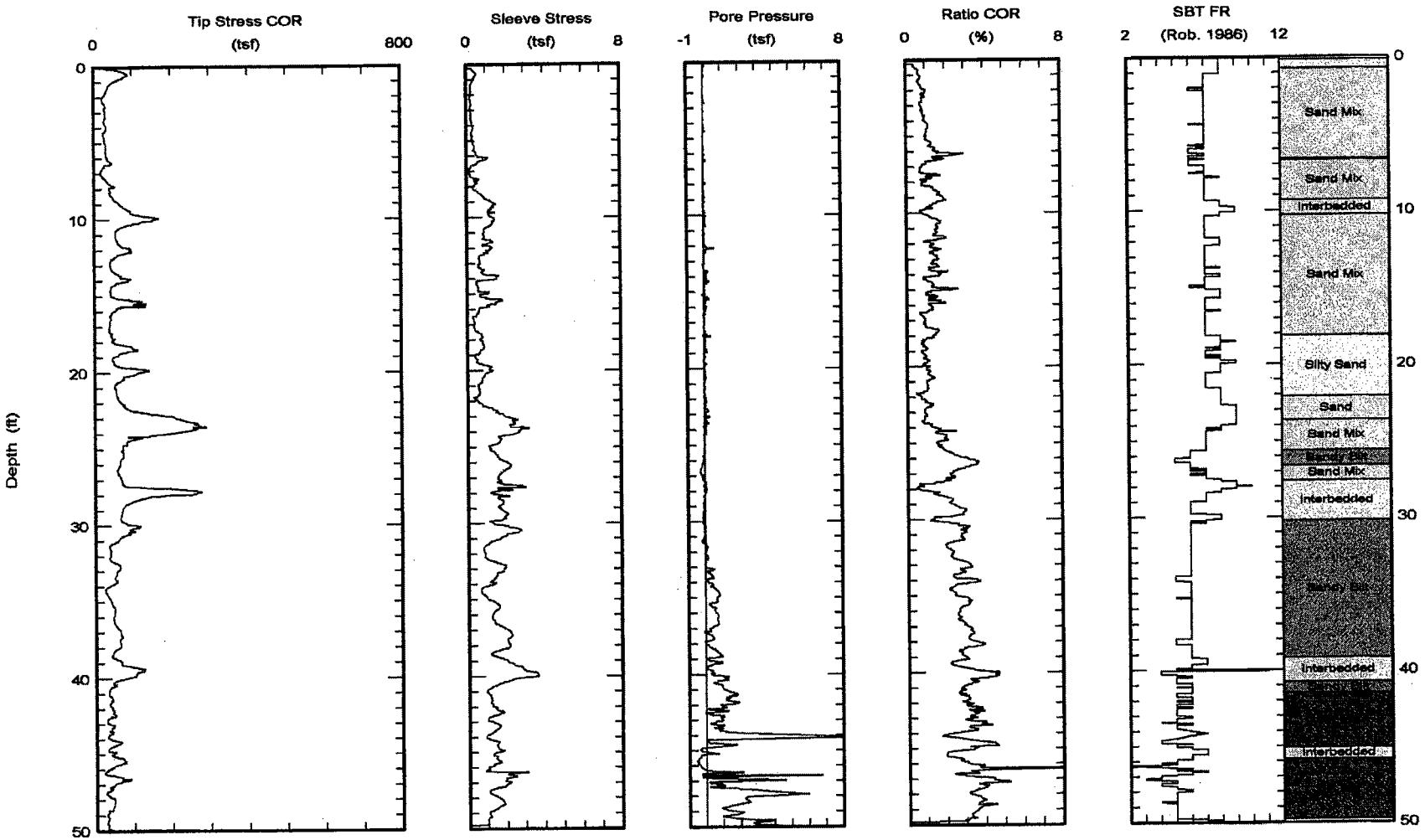
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-4
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 50.14 (ft)

Test ID: CPT-4
File: Z27J0608C.ecp

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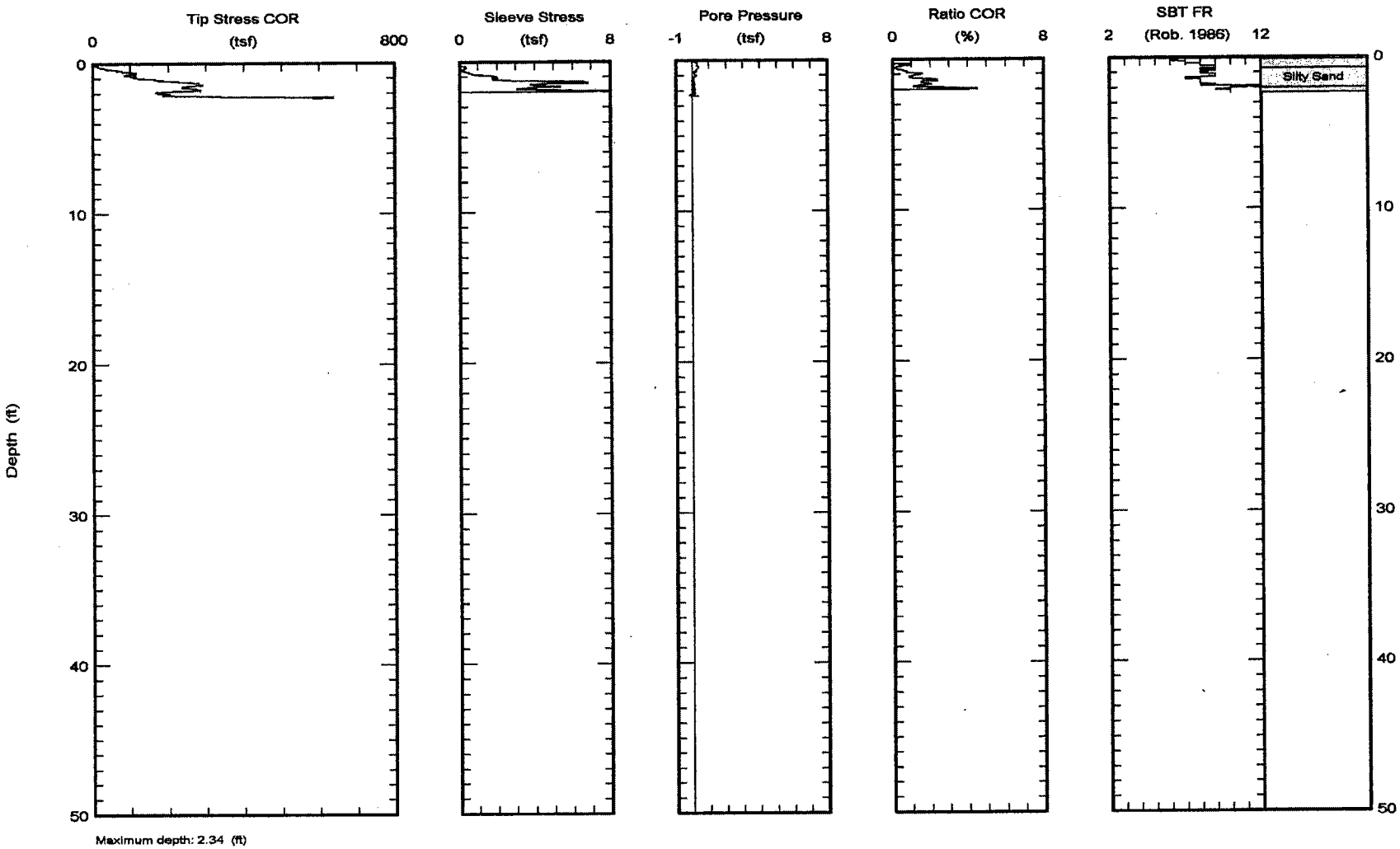
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-5
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 2.34 (ft)

Test ID: CPT-5
File: Z27J0609C.ECP

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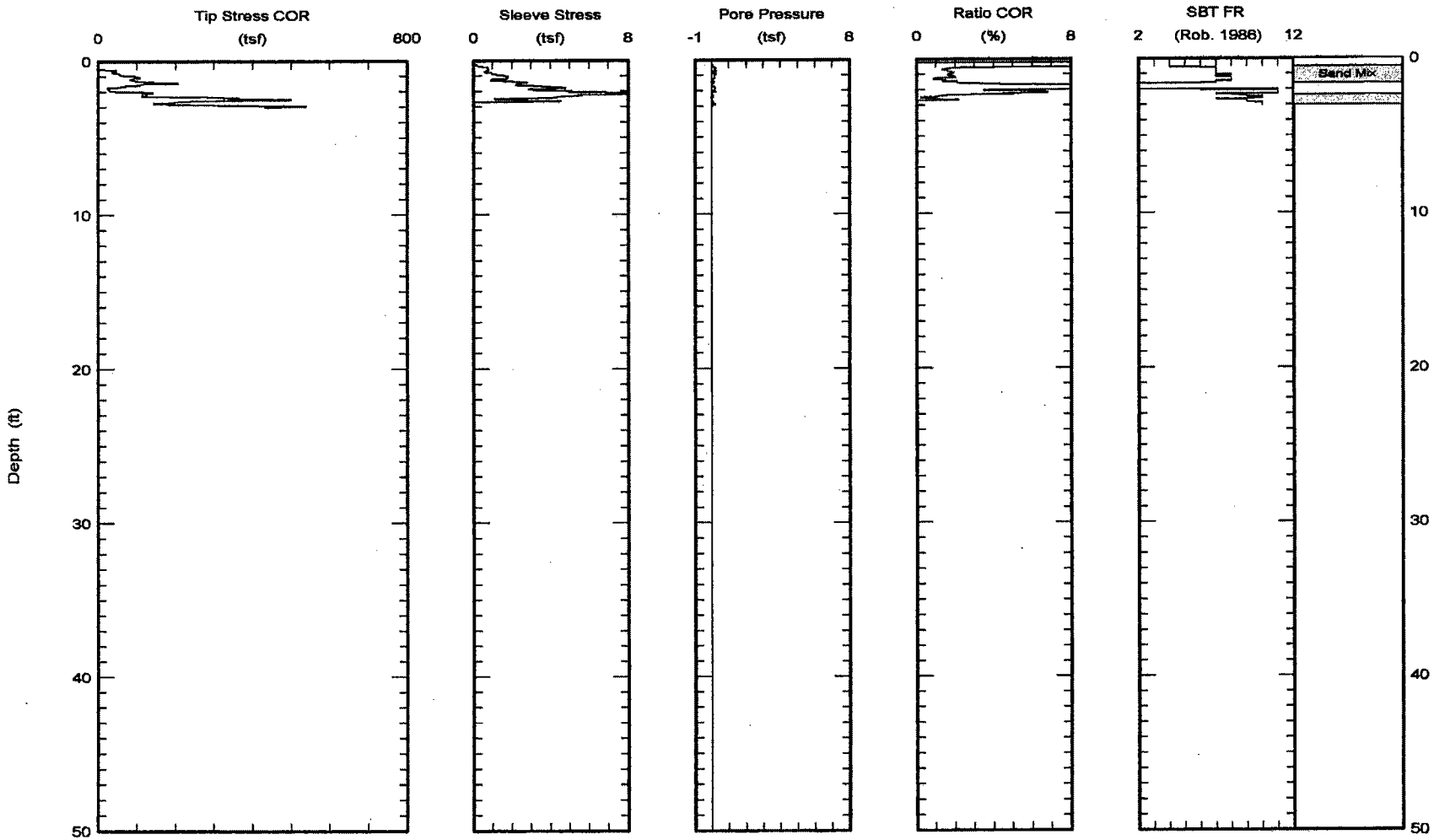
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-5A
Project: SantaPaula

Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 3.06 (ft)

Test ID: CPT-5A
File: Z27J0610C.ECP

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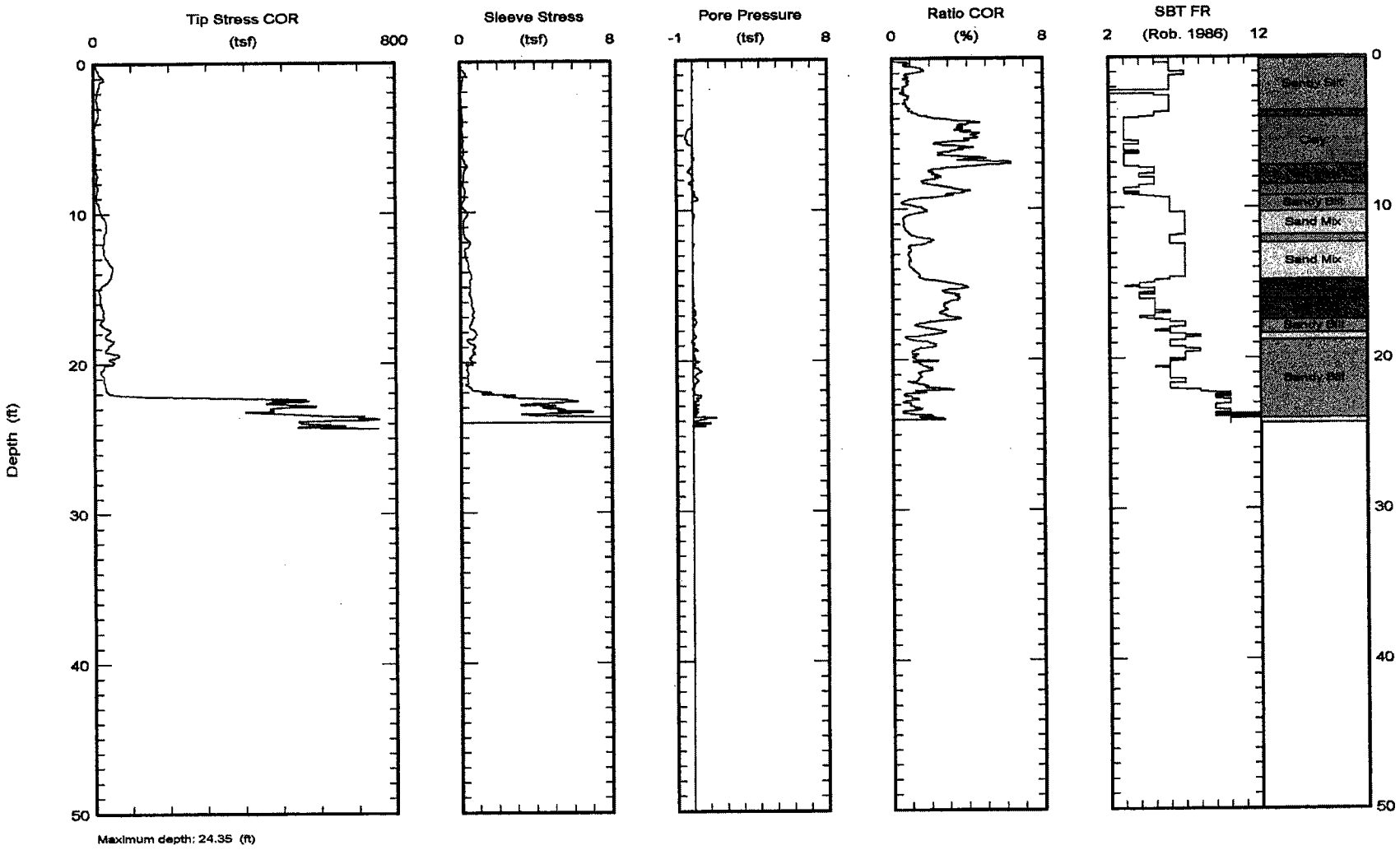
CPT Data
30 ton rig

Date: 27/Jan/2006
Test ID: CPT-6
Project: SantaPaula

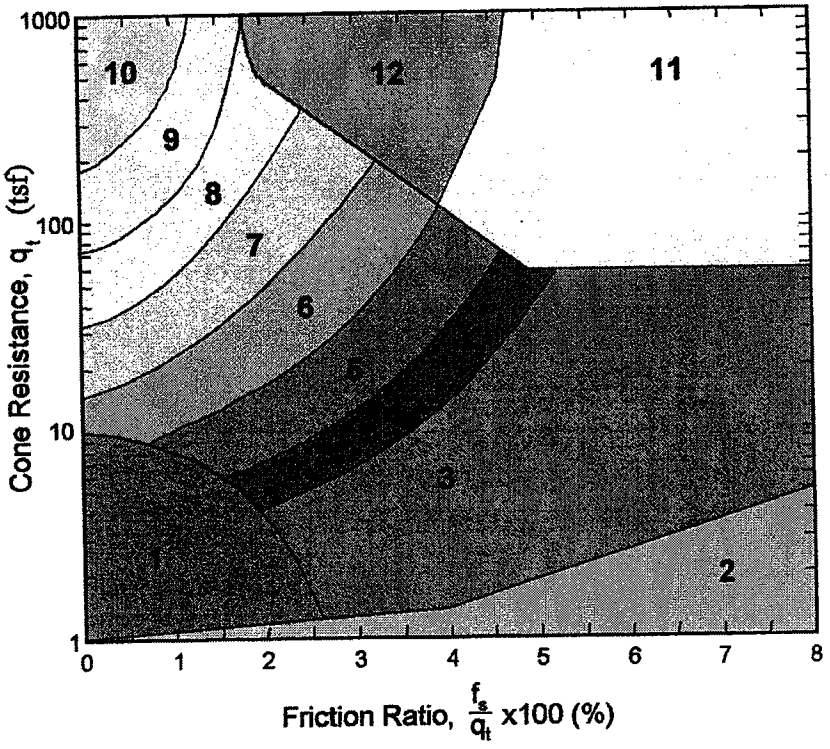
Client: Leighton &
Job Site: E. Telegraph Rd & Padre Ln



Maximum depth: 24.35 (ft)

Test ID: CPT-6
File: Z27J0611C.ECP

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



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

*Overconsolidated or cemented

INPUT FILE: C:\TEMP\CPT-1.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	81.282	0.503	0.618	8	19	29	9E9
1.500	69.917	0.383	0.548	8	17	26	9E9
2.500	40.645	0.188	0.461	7	13	20	9E9
3.500	41.245	0.563	1.366	7	13	20	9E9
4.500	481.644	2.082	0.432	10	77	116	9E9
5.500	710.140	4.422	0.623	10	113	170	9E9
6.500	788.580	0.000	0.000	10	9E9	9E9	9E9

INPUT FILE: C:\TEMP\CPT-1A.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	117.870	1.234	1.047	8	28	42	9E9
1.500	159.588	2.105	1.319	8	38	57	9E9
2.500	132.000	3.295	2.496	7	42	63	9E9
3.500	285.926	5.209	1.822	8	68	102	9E9

INPUT FILE: C:\TEMP\CPT2.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	115.845	0.992	0.856	8	28	42	9E9
1.500	246.232	1.798	0.730	9	47	71	9E9
2.500	472.389	0.000	0.000	10	9E9	9E9	9E9

INPUT FILE: C:\TEMP\CPT2A.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	110.205	1.213	1.101	8	26	39	9E9
1.500	394.644	4.243	1.075	9	76	114	9E9
2.500	363.542	3.637	1.000	9	70	105	9E9
3.500	429.432	1.782	0.415	10	69	104	9E9

INPUT FILE: C:\TEMP\CPT-3.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	38.171	0.267	0.700	7	12	18	9E9
1.500	14.015	0.324	2.312	5	7	11	0.928
2.500	10.215	0.325	3.182	4	7	11	0.671
3.500	12.000	0.227	1.893	5	6	9	0.786
4.500	16.496	0.388	2.352	5	8	12	1.082
5.500	14.679	0.296	2.016	5	7	11	0.956
6.500	14.377	0.147	1.024	6	6	9	9E9
7.500	15.348	0.275	1.790	5	7	11	0.993
8.500	16.136	0.535	3.318	4	10	15	1.042
9.500	20.496	0.457	2.230	6	8	12	9E9
10.500	26.609	0.575	2.163	6	10	14	9E9
11.500	33.180	0.700	2.111	6	13	17	9E9
12.500	73.667	0.777	1.054	8	18	22	9E9
13.500	52.596	0.920	1.750	7	17	20	9E9
14.500	14.640	0.385	2.630	5	7	8	0.917
15.500	16.300	0.413	2.538	5	8	8	1.022
16.500	22.564	0.821	3.644	4	14	14	1.435
17.500	25.377	0.850	3.357	5	12	11	1.617
18.500	26.612	0.846	3.188	5	13	12	1.694
19.500	24.196	0.956	3.966	4	15	13	1.528
20.500	31.804	0.949	2.990	5	15	13	2.032
21.500	46.892	0.743	1.586	7	15	12	9E9
22.500	53.732	0.942	1.752	7	17	13	9E9
23.500	35.496	0.991	2.795	6	14	11	9E9
24.500	29.458	0.843	2.861	5	14	10	1.865
25.500	38.854	1.117	2.875	6	15	11	9E9
26.500	48.246	0.659	1.368	7	15	10	9E9
27.500	21.087	0.509	2.418	5	10	7	1.292
28.500	30.392	0.515	1.696	6	12	8	9E9
29.500	9.900	0.239	2.353	5	5	3	0.556
30.500	5.748	0.138	2.177	4	4	3	0.298
31.500	7.261	0.143	1.828	5	4	2	0.395
32.500	9.938	0.266	2.547	4	7	4	0.564
33.500	10.273	0.321	2.988	4	7	4	0.580
34.500	11.655	0.336	2.796	4	8	5	0.662
35.500	10.477	0.296	2.739	4	7	4	0.577
36.500	22.891	0.691	2.928	5	11	6	1.426
37.500	27.504	0.877	3.109	5	14	8	1.729
38.500	34.509	0.934	2.694	6	13	7	9E9
39.500	20.650	0.589	2.802	5	10	6	1.240
40.500	17.912	0.507	2.751	5	9	5	1.063
41.499	25.504	0.757	2.918	5	12	7	1.560
42.499	33.171	0.991	2.987	5	16	9	2.039
43.499	28.372	0.574	1.999	6	11	6	9E9
44.499	62.238	1.308	2.104	7	20	11	9E9
45.499	56.596	1.362	2.408	6	22	12	9E9
46.499	42.722	1.270	2.972	6	16	8	9E9
47.499	46.591	1.219	2.611	6	18	9	9E9
48.499	41.561	1.110	2.654	6	16	8	9E9
49.499	26.909	0.652	2.359	6	11	6	9E9

INPUT FILE: C:\TEMP\CPT-4.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	70.862	0.351	0.495	8	17	26	9E9
1.500	36.860	0.279	0.757	7	12	18	9E9
2.500	27.386	0.235	0.857	7	9	14	9E9
3.500	30.600	0.274	0.895	7	10	15	9E9
4.500	29.495	0.322	1.093	7	9	14	9E9
5.500	33.045	0.426	1.289	7	11	17	9E9
6.500	30.540	0.512	1.678	6	12	18	9E9
7.500	35.400	0.362	1.024	7	11	17	9E9
8.500	50.148	0.737	1.469	7	16	24	9E9
9.500	105.930	1.279	1.207	8	25	38	9E9
10.500	85.000	1.181	1.390	8	20	28	9E9
11.500	68.239	1.017	1.490	7	22	29	9E9
12.500	59.500	0.847	1.423	7	19	23	9E9
13.500	60.395	0.928	1.537	7	19	22	9E9
14.500	50.822	0.712	1.401	7	16	18	9E9
15.500	84.132	1.119	1.330	8	20	21	9E9
16.500	43.416	0.460	1.060	7	14	14	9E9
17.500	44.204	0.556	1.258	7	14	13	9E9
18.500	78.161	0.737	0.943	8	19	17	9E9
19.500	81.029	0.801	0.989	8	19	17	9E9
20.500	71.494	0.828	1.158	8	17	14	9E9
21.500	60.054	0.564	0.939	8	14	11	9E9
22.500	120.605	1.207	1.001	8	29	23	9E9
23.500	248.305	2.480	0.999	9	48	36	9E9
24.500	100.253	1.771	1.766	7	32	23	9E9
25.500	71.624	1.495	2.087	7	23	16	9E9
26.500	63.818	1.934	3.031	6	24	17	9E9
27.500	166.023	1.814	1.092	9	32	21	9E9
28.500	100.689	1.705	1.694	7	32	21	9E9
29.500	73.579	1.782	2.422	6	28	18	9E9
30.500	86.386	2.171	2.513	6	33	21	9E9
31.500	42.657	1.027	2.408	6	16	10	9E9
32.500	53.705	1.426	2.656	6	21	13	9E9
33.500	52.074	1.474	2.828	6	20	12	9E9
34.500	32.425	0.835	2.567	6	12	7	9E9
35.500	48.124	1.442	2.990	6	18	11	9E9
36.500	54.425	1.515	2.776	6	21	12	9E9
37.500	65.770	2.150	3.267	6	25	14	9E9
38.500	52.353	1.631	3.110	6	20	11	9E9
39.500	100.069	2.882	2.878	6	38	21	9E9
40.500	44.319	1.661	3.734	5	21	12	2.800
41.499	38.804	1.125	2.878	6	15	8	9E9
42.499	39.917	1.346	3.360	5	19	10	2.496
43.499	40.553	1.399	3.436	5	19	10	2.535
44.499	46.800	1.475	3.130	6	18	10	9E9
45.499	56.324	1.369	2.433	6	22	12	9E9
46.499	50.156	1.864	3.702	5	24	12	3.166
47.499	36.522	1.494	4.054	4	24	12	2.262
48.499	40.778	1.543	3.754	5	20	10	2.541
49.499	31.820	0.663	2.047	6	12	6	9E9

INPUT FILE: C:\TEMP\CPT-5.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	63.968	0.349	0.545	8	15	23	9E9
1.500	230.265	4.367	1.896	8	55	83	9E9
2.500	341.067	0.000	0.000	10	9E9	9E9	9E9

INPUT FILE: C:\TEMP\CPT-5A.CSV

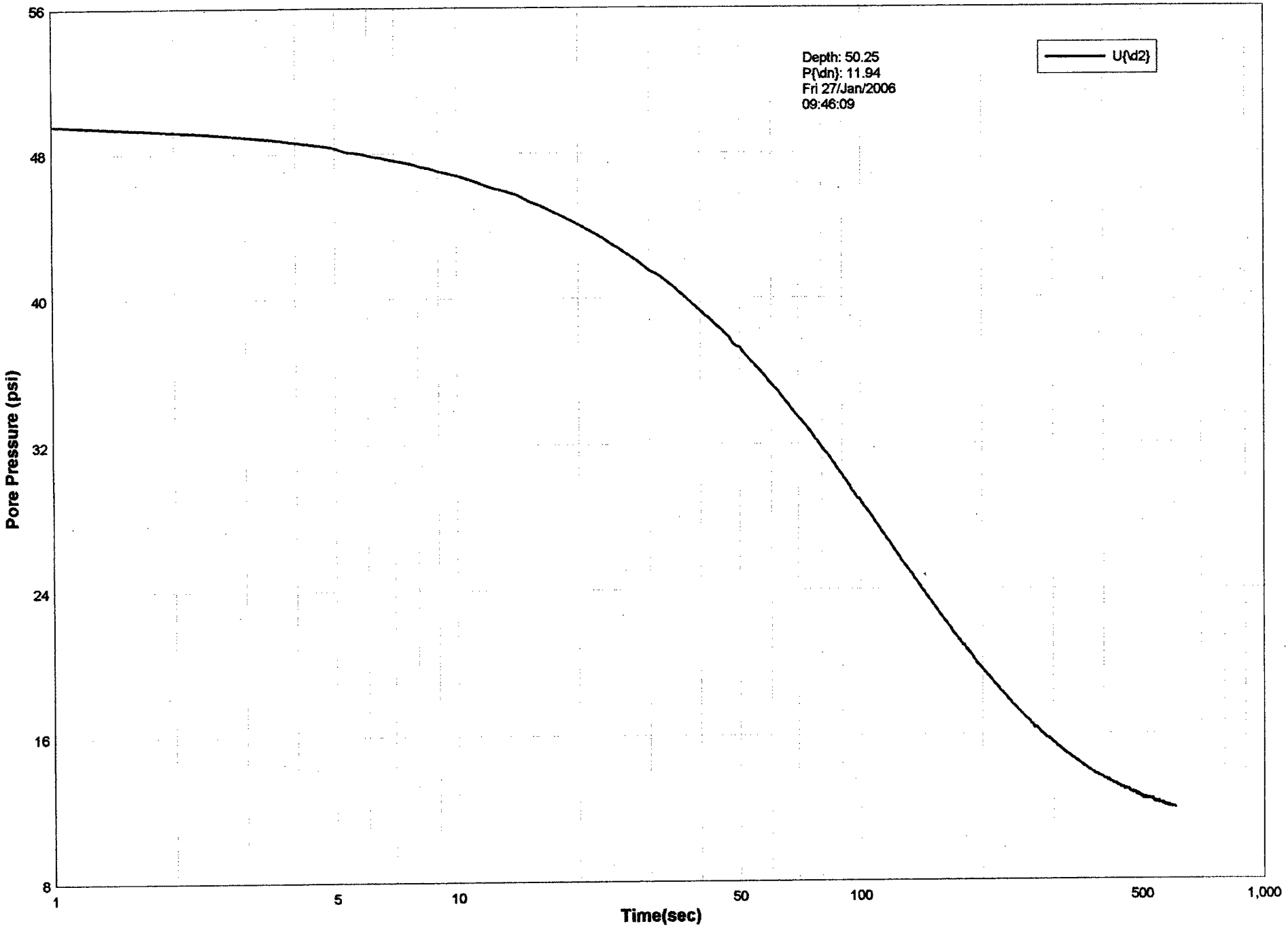
Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	27.577	0.602	2.182	6	11	17	9E9
1.500	82.391	2.713	3.291	6	32	48	9E9
2.500	250.242	3.248	1.298	9	48	72	9E9
3.500	452.250	0.000	0.000	10	9E9	9E9	9E9

INPUT FILE: C:\TEMP\CPT-6.CSV

Depth (feet)	Qc(avg) (TSF)	Fs(avg) (TSF)	Rf (%)	Rf Zone (zone #)	Spt N (blow/ft)	Spt N1 (blow/ft)	Su (TSF)
0.500	13.175	0.154	1.165	6	5	8	9E9
1.500	16.133	0.128	0.794	6	6	9	9E9
2.500	10.557	0.077	0.729	6	4	6	9E9
3.500	11.791	0.129	1.092	6	5	8	9E9
4.500	4.150	0.150	3.642	3	4	6	0.257
5.500	5.240	0.182	3.484	3	5	8	0.325
6.500	5.919	0.229	3.862	3	6	9	0.369
7.500	8.510	0.229	2.697	4	5	8	0.536
8.500	9.048	0.232	2.574	4	6	9	0.568
9.500	14.014	0.182	1.300	6	5	8	9E9
10.500	29.830	0.272	0.912	7	10	14	9E9
11.500	29.400	0.273	0.928	7	9	12	9E9
12.500	27.670	0.356	1.285	6	11	14	9E9
13.500	44.810	0.420	0.938	7	14	16	9E9
14.500	34.970	0.553	1.583	7	11	12	9E9
15.500	16.229	0.543	3.345	4	10	11	1.020
16.500	23.560	0.659	2.797	5	11	11	1.505
17.500	29.410	0.618	2.103	6	11	11	9E9
18.500	40.140	0.668	1.663	7	13	12	9E9
19.500	48.255	0.643	1.332	7	15	13	9E9
20.500	25.390	0.411	1.618	6	10	8	9E9
21.500	31.190	0.508	1.627	6	12	10	9E9
22.500	412.227	3.894	0.944	9	79	62	9E9
23.500	570.577	8.102	1.420	9	109	83	9E9
24.500	626.389	0.000	0.000	10	9E9	9E9	9E9

Leighton & Associates **CPT-3**

Kehoe Testing and Engineering **CPT3-50.TXT**



CPTCP.TBL - CPTINT Correlation and Parameters Table File
----------with NOTES & References at end----------

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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APPENDIX C

LABORATORY TEST RESULTS

APPENDIX C

LABORATORY TEST RESULTS

General

The laboratory test program consisted of testing selected representative specimens, prepared from representative samples of the earth materials to obtain the following properties and characteristics: in-situ moisture content and dry density; particle size distribution; swell/collapse potential, compressibility/consolidation; shear strength, and maximum dry density and optimum moisture content.

The laboratory tests were performed in substantial accordance with the applicable procedures of the American Society for Testing and Materials (ASTM).

Soil Classification: Visual Method (ASTM D2488)

Classifying soils in accordance with standardized methods enables their properties and characteristics to be evaluated in a broad-based manner and to correlate soils found on various sites. Visual classifications made in the field are often refined after more detailed observations of the materials are made in the laboratory and after subsequent laboratory testing.

The classifications made in respect of selected soil samples are shown on the Logs of Borings in Appendix B. The classifications of specific specimens that were tested are indicated with the respective test results in this appendix. Because the types of in-situ materials may change abruptly, there may be apparent discrepancies between the classifications as indicated on the logs and in the test-result documentation.

In-Situ Dry Density and Moisture Content (ASTM D 2937, 2216)

The in-situ dry density provides a measure of the degree of densification of a material, while the moisture content serves to establish a correlation between the properties and behavior of a soil. The in-situ dry density (in pcf) and moisture content (as a percentage of dry weight of soil) were determined for relatively undisturbed specimens. The test results are presented on the logs of the borings (Appendix B).

Particle-Size Analysis (ASTM D 422)

This test establishes the distribution, within a specimen of the soil, of soil particles of given sizes. Tests were performed on 13 specimens; the results are presented in Figures C-1.1 through C-1.13.

One-Dimensional Swell or Settlement (ASTM D4546)

One-Dimensional Swell or Settlement tests were performed to estimate the swell or settlement potential of the soils under a given loading. The tests were performed on four specimens; the test results are presented in Figures C-2.1 through C-2.4. The results of the tests are summarized in the following table:

Swell or Collapse Potential

Specimen	Description	Surcharge (ksf)	Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Dry Density (pcf)	Final Moisture Content (%)	Percent Swell (+) or Collapse (-)
HSA-4	SM	1.2	121	3.8	123	12.8	-0.49
HSA-5	CL-ML	1.2	115	16.4	119	16.2	-0.63
HSA-7	SM	1.2	123	5.7	125	12.9	-0.48
HSA-8	CL-ML	1.2	121	12.7	124	14.5	-0.19
From Consolidation Tests							
HSA-5	CL-ML	2.8	111	17.2	115	16.9	-0.05
HSA-6	SC-SM	2.8	121	10.5	120	15.2	-0.02
HSA-7	CL-ML	2.8	111	18.7	113	18.8	-0.14
HSA-10	CL-ML	2.8	105	17.6	107	19.9	-0.01

Consolidation Tests (ASTM D2435)

Consolidation tests are performed to estimate the compressibility and consolidation characteristics of the earth materials. To illustrate the effect of moisture on the compressibility of the specimens, water was added during the tests to each of the specimens. Tests were performed on 4 specimens; the test results are presented in Figures C-3.1 through C-3.4. Estimates of the swell or settlement potential of the soils can also be obtained from consolidation tests; these results are summarized in the preceding table.

Direct Shear Tests (Modified from ASTM D 3080)

The shear strength of the on-site earth materials was obtained by successively shearing separate specimens partially contained within rings utilizing a direct-shear machine. Varying normal pressures are applied, and the shear stress applied to the specimen was recorded. The cohesion (c, in psf) and angle of internal friction (ϕ, in degrees) were then calculated and these represent the shear strength characteristics of the material.

The shearing stress is applied at a constant rate of strain. In order to simulate possibly adverse moisture conditions, each specimen was soaked prior to the test, and sheared underwater. A total of 10 specimens were tested.

The test results are presented in Figures C-4.1 through C-4.10. Summaries of the test results are presented in Figures C-4.11 through C-4.13. The shear strengths used in the slope stability analyses are tabulated in Appendix D.

Maximum Dry Density and Optimum Moisture Content (ASTM D 1557)

The maximum dry density and optimum moisture content for representative samples of the on-site materials were determined in the laboratory. Tests were performed on 3 samples and the test results are presented in Figures C-5.1 through C-5.3.

Expansion Index (ASTM D 4829)

The Expansion Index for representative samples of the on-site materials was determined in the laboratory. Tests were performed on 4 samples and the test results are presented in Figures C-6.1 through C-6.4 and summarized in the table below.

Expansion Index

Boring Number	Sample Number	Soil Identification	Expansion Index
HSA-2	B-1	Olive Sand with Silt	4
HSA-3	B-1	Yellowish Brown Silty Sand	4
HSA-5	B-1	Olive Clayey Sand	36
HSA-6	B-1	Yellowish Brown, Clayey Sand	34

Soil Corrosivity

Two representative soil samples were tested to determine the corrosion potential. The following tests for corrosivity were performed and the results are presented in Figures C-7.1 and C-7.2.

Soluble Sulfate Content (CTM 417): The soluble sulfate content of a soil is determined to evaluate the potential for concrete deterioration when it is in contact with the soil. The sulfate content is expressed in terms of parts per million (ppm) or as a percentage of weight of soil.

pH (CTM 532): A pH level less than 5.5 is considered detrimental to concrete.

Minimum Resistivity (CTM 643): The resistivity of a soil measures the corrosivity of the soil to ferrous metals. The lower the resistivity, the more corrosive the soil. Soils with a resistivity value below 1,000 ohm-cm is considered severely corrosive to ferrous metals.

Chloride Content (CTM 422): The presence of chloride with concentration in excess of 0.05 percent is considered corrosive to concrete and steel.