SITE INVESTIGATION AND SITE CONCEPTUAL MODEL REPORT

Former Chemoil Refinery
Site Cleanup Program Number 0453A
Site ID No. 2047W00
Global ID SL 2047W2348

2020 Walnut Avenue
Signal Hill, California

093-CHEMOIL-001

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EXECUTIVE SUMMARY

This Site Investigation and Conceptual Model Report was prepared on behalf of Signal Hill Enterprises, LLC (SHE) and RE | Solutions, LLC (RES) for the former Chemoil Refinery located at 2020 Walnut Avenue in Signal Hill, California (Site). The Site is currently owned by SHE and negotiation is underway between SHE and RES to transfer property ownership for redevelopment purposes. Activities documented herein have been conducted in anticipation of plans to remediate the Site to acceptable levels which will allow property redevelopment for light industrial and commercial purposes.

The Site is an approximately 8.2-acre vacant lot that formerly operated as an oil refinery beginning in 1922. From early 1994 to early 1997, the refinery was shut down with only occasional operation of its waste water system. Operation of the waste water system was discontinued and the above ground structures were dismantled in early 1997. It has been reported that all known below ground structures, including piping, sumps, footings, and foundations, were also removed at that time. For purposes of this report, the Site has been divided into the three parcel areas referred to as the East Parcel, the Northwest Parcel, and the Southwest Parcel.

The scope of work conducted as part of the Site investigation and documented herein include:

- The advancement of 18 Cone Penetration Testing-Ultra-Violet Optical Scanning Technology (CPT-UVOST™) borings in the Northwest, Southwest and East Parcels;
- The advancement of six onsite and one offsite soil borings to further delineate impacts to soil and groundwater;
- Soil vapor sampling at four locations in the northern portion of the Northwest Parcel;
- Installation of one monitoring well in the Southwest Parcel; and
- Completion of a light non-aqueous phase liquid (LNAPL) bail-down test at monitoring well MW-11, within the Northwest Parcel.

Site-specific screening levels (SLs) were developed for the Site media (soil, groundwater, and soil vapor), and laboratory analytical data were compared to SLs to determine the chemicals of potential concern (COPCs). COPCs for soil, groundwater, and soil vapor are presented in Section 6 and consist of compounds typical of those found at petroleum refining facilities, including total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX) and benzene derivatives.

Site investigation results, combined with historical data collected from the Site indicate that COPCs are present in soil above SLs within a significant portion of the Northwest Parcel and Southwest Parcel and isolated to the northern portion of the East Parcel. Data indicate that except for a few isolated locations, soil vapor COPC detections above applicable screening levels are limited to onsite. It is expected that remediation or mitigation of soil and soil vapor will be required prior to Site redevelopment.

Groundwater data collected to date indicate that TPH as gasoline (TPHg [C4-C12]), TPH as diesel (TPHd [C13-C22]), BTEX, and naphthalene are the COPCs detected in the highest concentrations in groundwater at the Site. TPHg and benzene were generally detected at the highest concentrations in the Northwest Parcel (up to 170,000 micrograms per liter [µg/L] and 6,960 µg/L, respectively) with lower concentrations of TPHg detected in groundwater samples collected from the Southwest Parcel.

Data indicate that the concentrations of COPCs in groundwater generally decrease with depth. However, the vertical extent of petroleum-impacted groundwater has not been defined. Vertical delineation of impacted groundwater at the Site will be required prior to submittal of the Response Plan.

Methyl tert-butyl ether (MtBE) has historically been detected in groundwater samples collected offsite west of Gundry Avenue. The lack of MtBE detections in soil and groundwater samples collected onsite coupled with the highest concentration of MtBE detected in an offsite well located west and hydrologically cross-gradient of the Site (well MW-17) suggests that an offsite source of MtBE is present.

Site investigation activities have defined three isolated areas of the Site where LNAPL has been observed or UVOST™ data suggest the potential exists for LNAPL to be present. LNAPL bail-down testing was performed to assess the volume of LNAPL present beneath the Site and to assist with the quantification of LNAPL transmissivity. Based on the estimated LNAPL thickness in the formation, the LNAPL petrophysical analysis results, and the apparent slow LNAPL recharge rate into wells, it is anticipated that passive LNAPL skimmers will be the most feasible LNAPL removal method for this Site.

The results of the Site investigation were evaluated, along with other data collected from the Site, and a conceptual site model (CSM) was developed which will be used to guide preparation of a Response Plan. The hypothetical receptors and exposure pathways considered potentially complete are summarized as follows:

Hypothetical Receptor	Potentially Complete Exposure Pathway
Future Onsite Construction/Utility Trench Worker:	Incidental ingestion of soil; Dermal contact with soil; and Inhalation of vapors in outdoor air.
Future Onsite Commercial Worker:	Incidental ingestion of soil; Dermal contact with soil; and Inhalation of vapors in indoor air.
Current/Future Offsite Commercial/Industrial Worker Receptor	Inhalation of vapors in indoor air.
Current/Future Offsite Resident Receptor	Inhalation of vapors in indoor air.

Based on the CSM and available Site data, Remedial Action Objectives (RAOs) are summarized as follows:

- Reduce and/or maintain human health risks to acceptable levels to allow redevelopment of the Site for light industrial/commercial purposes.
- Prevent soil-related exposures (i.e., incidental ingestion, direct dermal contact, particulate inhalation and outdoor vapor inhalation of VOCs) to constituent concentrations that exceed commercial/industrial cleanup goals.
- Prevent indoor inhalation through vapor intrusion of constituent concentrations that exceed commercial/industrial cleanup goals.
- Reduce the potential for adsorbed-phase petroleum constituents in soil to leach to groundwater underlying the Site.
- Remove to the extent practical, mobile LNAPL within the three defined LNAPL areas of occurrence (source removal).
- Control the dissolved-phase hydrocarbon groundwater plume to prevent further offsite migration of contaminants at concentrations above levels that present a risk.

A Response Plan is currently being prepared to address the Site cleanup that will be required to meet the above RAOs. Section 8 of this report documents the preliminary conceptual remedial approach which is expected to be included in the upcoming Response Plan, and summarized as follows:

- Develop Site-specific, risk-based cleanup goals based on commercial land use to determine whether remediation or mitigation is warranted and to provide a benchmark for the cessation of remedial action.
- Implement actions in conjunction with Site redevelopment in areas where grading is required.
- Remediate secondary sources and onsite dissolved phase contaminants to the extent practicable, using technologies including LNAPL recovery, soil vapor extraction, and air sparging.
- Reduce offsite contaminant migration through implementation of a barrier zone remediation program.
- Implement institutional and engineering controls to reduce potential exposure pathways including an environmental land use covenant (LUC), Site Management Plan (SMP), and vapor mitigation system(s) that will be installed as part of the future buildings constructed at the Site.
- Implement a monitored natural attenuation program for offsite groundwater.

The Response Plan is expected to be submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) within 90 days of submission of this report.

1.0 INTRODUCTION

The Source Group, Inc. a division of Apex Companies, LLC (Apex-SGI) has prepared this Site Investigation and Site Conceptual Model Report on behalf of Signal Hill Enterprises, LLC (SHE) and RE | Solutions, LLC (RES). The subject property is the former Chemoil Refinery located at 2020 Walnut Avenue in Signal Hill, California (Site, Figure 1-1). It is currently owned by SHE and negotiation is underway between SHE and RES to transfer property ownership for redevelopment purposes. Activities documented herein are driven by requirements from the Los Angeles Regional Water Quality Control Board (LARWQCB) and by plans to remediate the Site to acceptable levels to allow property redevelopment for light industrial and commercial purposes.

A Site investigation was required to fill identified data gaps necessary to develop a Conceptual Site Model (CSM) that can be used to guide the preparation of a remedial response plan. APEX-SGI prepared a *Site Investigation Workplan* (Workplan), dated October 25, 2016, which was approved by LARWQCB on November 23, 2016. The Site investigation was subsequently performed December 2016 through January 2017 and is documented in this report. Additionally, this report presents a CSM and conceptual remedial approach based on available data and considering the anticipated land use of the property.

The general outline of this report is as follows:

- Section 2 provides a brief Site description and background.
- Section 3 summarizes the scope and procedures of the Site investigation that was performed by APEX-SGI in December 2016 through January 2017.
- Section 4 documents the screening levels that were deemed appropriate for the Site and used to evaluate Site investigation data.
- Section 5 provides the results of the Site investigation completed by APEX-SGI, including a comparison of data to screening levels.
- Section 6 identifies the chemicals of potential concern (COPCs) in soil, soil vapor, and groundwater. COPCs were identified as chemicals that were detected in the subsurface at concentrations that exceed their applicable screening levels.
- Section 7 presents the CSM for the Site. The CSM compiles the results of Site data and anticipated land use to assess the need for additional risk assessment and/or mitigation.
- Section 8 provides a preliminary conceptual remedial approach for the Site, which is expected to be part of a Response Plan that will be prepared and submitted to LARWQCB within 90 days.

Site data collected during this investigation supplement environmental data previously collected by others. Soil and groundwater data collected by Tetra Tech in 2006 as well as current Site-wide groundwater monitoring data collected during the fourth quarter 2016 monitoring event (most recent

event) are incorporated herein to allow for a more comprehensive understanding of Site environmental conditions and to aid in the preparation of the CSM.

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 Site Description

The property known as the former Chemoil Refinery is located at 2020 Walnut Avenue in Signal Hill, California (Figure 1-1). The Site was developed as an oil refinery in 1922. The MacMillan-Ring Free Oil Company owned and operated the facility from 1922 until 1988. Chemoil Corporation purchased the refinery in August 1988 and operated it until February 1994. From early 1994 to early 1997, the refinery was shut down with occasional operation of its waste water system. Operation of the waste water system was discontinued and all of the above ground structures were dismantled in early 1997. It has been reported that known below ground structures, including piping, sumps, footings, and foundations, were also removed at that time (S. Testa, verbal communication, October 2016). Since December 2013, the property owner of title has been Signal Hill Enterprises, LLC.

The Site is approximately 8.2 acres, located north of the intersection of East 20th Street, East Wesley Drive, Walnut Avenue, and Alamitos Avenue. The Site is divided into an East Parcel, situated immediately east of Walnut Avenue and a West Parcel, situated immediately west of Walnut Avenue. The East Parcel encompasses approximately 2.4 acres and the West Parcel encompasses approximately 5.8 acres. The West Parcel is further subdivided into the Northwest and Southwest Parcels by East 21st Street. Hereafter, the three parcel areas will be referred to within this document as the East Parcel, the Northwest Parcel, and the Southwest Parcel. A portion of the Southwest Parcel includes the Raymond Tract Parcels, which are currently owned by a separate entity (MPO Walnut Partners, LLC). RES has signed a Letter of Intent and is negotiating a purchase agreement for acquisition of this property. The Raymond Tract Parcels will be addressed in the Response Plan because of the historical lease and operations of Chemoil on those parcels. The division of the Site into the above-indicated parcels is shown on Figure 2-1.

2.2 Refinery History

The refinery and supporting structures were dismantled between 1997 and 1998. The Northwest Parcel is a rectangular-shaped parcel and was formerly occupied by approximately 40 above ground storage tanks, truck loading racks, and support structures such as warehouses. The Southwest Parcel is a triangular-shaped parcel and was formerly occupied by approximately 25 aboveground storage tanks (ASTs), boilers, heater units, loading racks, and a cooling tower. The East Parcel is somewhat a rectangular-shaped parcel except for its southern perimeter and was formerly occupied by six ASTs as well as support structures (warehouse, offices, laboratory, and maintenance facilities). The oldest active area of the Site lies within the Southwest Parcel, where crude oil processing related activities took place (TEC Earth Sciences and Environmental Specialists [TEC], 2011). Currently the Site is vacant, and does not contain any ASTs or known underground storage tanks (USTs).

2.3 Surrounding Community/Properties

Land use in the vicinity of the Site includes commercial, office, and light industrial development to the north, light industrial development to the west, east and south of the Site, and a former railroad corridor to the south, with residential properties located south and west of the former railway corridor.

2.4 Constituents of Interest

Soil and underlying groundwater at the Site are impacted by historic petroleum releases. Historically, light non-aqueous phase liquid (LNAPL) presence was reported as three onsite separate occurrences. The LNAPL occurrences were characterized as heavy crude oil or lubricating oil, or a combination of naphtha, kerosene, and gas oil. Primary constituents of interest (COIs) for the Site include total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs; primarily aromatic constituents), and fuel oxygenates (including methyl tert-butyl ether [MtBE] and tertiary-butyl alcohol [TBA]. MtBE has been documented at elevated concentrations in monitoring wells located offsite and cross-gradient from the Site. Onsite concentrations of MtBE are significantly lower and do not appear to be related to historical operations at the Chemoil Refinery. An evaluation of potential onsite MtBE sources was conducted as part of the Site investigation and results are discussed in Section 5.6 of this report.

2.5 Source Elimination and Remediation Status

An LNAPL recovery program was conducted on the West Parcel starting in March 1987. The recovery system was terminated in February 1994 when the refinery shut down. The estimated volume of total fluids removed is approximately 253,902 barrels. Of this volume, an estimated volume of 27.9 barrels of LNAPL was recovered (TEC, 2011).

A flow-through barrier groundwater treatment system (a Subsurface Metabolism Enhancement [SME] system) was installed along the western and southern boundaries of the Site in 2013 and 2014. A total of 92 injection wells, 46 vapor extraction wells, and 12 groundwater monitoring wells were installed to a maximum depth of 40 feet below ground surface (bgs), and the SME system started operation in March 2014. The system is currently operating with air injection to increase the concentration of oxygen in the subsurface, which was found to be oxygen deficient. Nutrients are injected in batched intervals to stimulate the metabolism of petroleum constituents by native microbes. An estimated 7,604 pounds of total petroleum hydrocarbons as gasoline (TPHg) has been removed by the SME system through January 2016 (AA&AI, 2016a).

2.6 Geology and Hydrogeology

2.6.1 Regional and Local Geology

The Site is located within the Los Angeles Coastal Plain (California Department of Water Resources [CDWR], 1961) of the Peninsular Ranges geomorphic province of southern California (Norris and Webb, 1990). The Los Angeles Coastal Plain is a deep structural trough that has been filled primarily with unconsolidated Miocene through Recent age sediments or alluvium that are underlain by earlier

Cenozoic bedrock. The Los Angeles Coastal Plain is bounded on the north by the Santa Monica Mountains; on the northeast by the low-lying Elysian, Repetto, Merced, and Puente Hills; on the east and southeast by the Santa Ana Mountains and San Joaquin Hills; on the south by the Palos Verdes Hills and the Pacific Ocean; and on the west by the Pacific Ocean (CDWR, 1961).

The geologic structure beneath the Coastal Plain is referred to as the Los Angeles Basin and consists of undifferentiated, pre-Pleistocene bedrock overlain by approximately 2,200 feet of layered, semi-consolidated and unconsolidated water-bearing terrestrial and marine sediments. The uppermost section of these sediments, the early Pleistocene-age San Pedro Formation and the late Pleistocene-age Lakewood Formation, have been warped by geologically-recent tectonic activity into northwest- to southeast-oriented folds that are periodically disrupted by northwest-trending regional faults. The San Pedro Formation and Lakewood Formations vary in thickness from tens to several hundreds of feet thick. Flat-lying Recent (Holocene-age) alluvium, derived from alluvial fans and overflow of river systems, overlie the folded and faulted Pleistocene formations in topographically lower portions of the Coastal Plain. Where present, the Holocene alluvium can be up to 200 feet thick.

The Site is underlain by deposits of unconsolidated, laterally discontinuous sequences of silt and fine to coarse-grained sand. Coarse-grained soils consist of sand (SP) and silty sand (SM); whereas, subordinate fine-grained soils consist of silt (ML and MH) and, to a lesser degree, clay (CL).

2.6.2 Regional and Local Hydrogeology

The Los Angeles Coastal Plain has been spatially divided by the CDWR into four groundwater basins (West Coast Basin, Central Basin, Santa Monica Basin, and Hollywood Basin) based on the hydrogeologic characteristics of the underlying strata and the locations of bounding geologic structures such as non-water-bearing rock and/or faults that impede groundwater movement. The Site is located within the West Coast Basin.

The West Coast Basin is bordered on the east by the Newport-Inglewood Fault; on the west by Santa Monica Bay; on the north by the Ballona Gap (north of the Los Angeles International Airport), and on the south by the Palos Verdes Hills. Based on lateral distribution and varying hydrogeologic characteristics, five major aquifers have been identified in the geologic formations underlying the West Coast Basin (CDWR, 1961). The aquifers consist of (from oldest to youngest) the Silverado and Lynwood Aquifers of the San Pedro Formation, the Gage Aquifer of the Lakewood Formation, and the Gaspur and Semi-perched Aquifers of the recent Holocene-age Alluvium. In general, the older/deeper Silverado and Lynwood Aquifers are currently designated as drinking water sources and the younger/shallow aquifers (Gage, Gaspur, and Semi-perched) are not currently used for drinking water purposes due to low yield and/or generally poor quality. Shallow groundwater beneath the Site is encountered in the semi-perched Aquifer in the southern portion of the West Coast Basin. Groundwater quality within the Site vicinity is generally poor due to seawater intrusion and elevated salinity.

Due to Site topography, the difference between depth to water measurements in existing monitoring wells is approximately 30 feet. Depth to water in the northern portion of the Site is approximately 43

feet bgs (well MW-3), whereas depth to water in the southern portion of the Site is approximately 15 feet bgs (well MW-14). As of the June 2016 (Second Quarter) sampling event, groundwater occurred at elevations ranging from 2.09 to 3.94 feet relative to mean sea level. Groundwater flow beneath the Site was generally toward the south-southeast. The hydraulic gradient calculated based on Second Quarter 2016 groundwater gauging data was 0.0013 foot/foot (AA&AI, 2016b).

2.7 Surface Water

The nearest surface water body to the Site is the Los Angeles River, which is located 1.9 miles west of the Site. The section of the Los Angeles River west of the Site is contained in a north-south trending concrete lined flood control channel. The Los Angeles River accepts treated industrial discharge and stormwater runoff from the greater Los Angeles area.

3.0 SITE INVESTIGATION ACTIVITIES

Site investigation activities were conducted in December 2016 and January 2017 and were designed to meet the following objectives:

- Delineate the extent of LNAPL present in the subsurface beneath the West and East Parcels;
- Delineate the vertical migration of dissolved-phase contaminants in groundwater;
- Conduct studies to determine the extent and mobility of LNAPL in the Site subsurface, including an evaluation of soil physical properties and results from bail-down testing;
- Assess MtBE in groundwater in relation to potential offsite sources;
- Further delineate offsite benzene concentrations in groundwater west of Gundy Avenue; and
- Conduct additional assessment of the northern portion of the West Parcel to verify whether remedial activities will be warranted in this area.

Details regarding implementation of the Site investigation are provided in the sections that follow. Field notes are provided in Appendix A and investigation results are provided in Section 5.

3.1 Field Preparatory Activities

A Site-specific Health and Safety Plan (HASP) was prepared in compliance with Federal Occupational Safety and Health Administration regulations (OSHA; 29 Code of Federal Regulations, Section 1910.120) and State OSHA regulations (California Code of Regulations, Title 8, Section 5192). Apex-SGI personnel and subcontractors associated with the project were required to be familiar and comply with all provisions of the Site-specific HASP.

Soil boring and well construction permits were obtained from the Los Angeles County Department of Public Health (LACDPH). In addition, an encroachment permit was obtained from the City of Signal Hill to complete one offsite boring in the public right-of-way (Gundy Avenue). Copies of the approved permits are included in Appendix B.

A Site visit was completed to mark the locations of the proposed soil borings. Following the Site visit, the proposed soil boring locations were marked and DigAlert, a one-call notification alert for underground utility providers, was contacted. In addition, Apex-SGI obtained a geophysical services contractor to confirm the locations were clear of any subsurface utilities, pipelines, or other structures. Apex-SGI conferred with SHE representatives regarding the known or suspected location of any utilities or subsurface structures associated with Site-specific operations.

As an additional precaution, each drilling location was manually cleared using an air-knife/vacuum rig or a hand auger to a minimum depth of approximately 5 feet bgs to ensure that no utilities would be impacted by the drilling operations.

3.2 CPT, UVOST™, and MIP© Reconnaissance Screening

To obtain a more detailed understanding of the lithology and approximate the location and extent of petroleum hydrocarbon impacts, Apex supervised the advancement of 18 Cone Penetration Testing-Ultra-Violet Optical Scanning Technology (CPT-UVOST™) borings to a maximum depth of approximately 44 feet bgs in the Northwest, Southwest and East Parcels of the Site. These data were used in conjunction with historical Site data to evaluate the soil characteristics, correlate these characteristics across the Site, and identify locations for additional soil and groundwater investigation.

Investigations of soil and groundwater impacts were conducted using a direct-push CPT drill rig equipped with a piezocone and a UVOST™ sensor operated by Fugro, a State of California-licensed (C-57) drilling contractor. A Membrane Interface Probe (MIP©) was also deployed in selected locations, as described below, for groundwater screening purposes. The objectives of the reconnaissance assessment were to: 1) document subsurface geologic and hydrogeologic conditions; 2) assess the lateral extent of petroleum hydrocarbons and potential LNAPL in subsurface soil; and 3) assess the vertical distribution of dissolved-phase petroleum hydrocarbons in groundwater underlying the Site. The drilling locations were chosen based on areas where data gaps were identified in the existing data set, including a ROST™ study completed in 2006.

CPT-UVOST™ testing occurred between December 13 and 15, 2016. A total of 18 CPT/ UVOST™ borings were advanced at the Site, eight borings in the Northwest Parcel (AN-09, AN-10, AN-11, AN-12, AN-15, AN-16, AN-17, and AN-18), seven borings in the Southwest Parcel (AS-01 through AS-06 and AS-09), and three borings in the East Parcel (AE-01, AE-02, and AE-03). Based on results of the CPT-UVOST™ testing (discussed in Section 5.2), three locations were selected to advance a MIP© screening tool to define the vertical impacts to groundwater. In the Northwest Parcel, boring AN-19 was advanced with a MIP© tool adjacent to monitoring well MW-11, where LNAPL is present, and boring AN-21 was advanced with a MIP© tool adjacent to boring AN-11, where UVOST™ data suggest that LNAPL may be present. In the Southwest Parcel, boring AS-10 was advanced with a MIP© tool near boring AS-06 and downgradient from boring AS-03, where UVOST™ data suggest that LNAPL may be present. Based on the UVOST™ data collected within the East Parcel (which did not indicate LNAPL), combined with groundwater monitoring data from well MW-10, a MIP© boring was not advanced in the East Parcel. Figure 3-1 summarizes the location of UVOST™ and MIP© borings advanced at the Site.

Each CPT-UVOST™ direct-push boring was abandoned upon completion by grouting the boring with a 5 percent (%) bentonite/Portland cement slurry.

3.3 Direct-Push Soil Boring Assessment

As part of this investigation, and as detailed in the sections that follow, the following soil borings were advanced using a truck-mounted, direct-push drilling rig operated by Kehoe Testing and Engineering, a State of California-licensed (C-57) drilling contractor.

- Soil borings AN-01, AN-02, AN-03, and AN-05 were collected from the northern portion of the Northwest Parcel where limited historical data are available. Soil and groundwater samples were collected from these borings to assess the subsurface conditions within the northern portion of the Northwest Parcel (previously defined as a Site data gap) and to ultimately determine whether remediation of this area is warranted;
- Soil borings AN-13 and AN-20 were advanced within the southern portion of the Northwest Parcel to confirm elevated UVOST responses and the presence of LNAPL. Soil and groundwater samples were collected from these borings to assess subsurface conditions. LNAPL was encountered in boring AN-13 at a depth of 28 feet; a LNAPL sample was collected from this location for laboratory analysis described in Section 3.3.1; and
- Boring AO-01 was advanced offsite in Gundy Avenue to characterize the benzene plume west of well BMW-10. Soil samples were not collected from boring AO-01. The boring was advanced specifically to conduct stratified groundwater sampling to the west of the Site, using a Hydropunch® groundwater sampler.

Direct push soil boring locations are depicted on Figure 3-2 and methodologies are described below.

3.3.1 Soil Sampling Methodology and Analytical Program

During the advancement of each borehole, the soil was continuously cored with stainless steel coring equipment for soil sampling and lithologic logging purposes and scanned with a photo-ionization detector (PID) for the presence of VOCs. The sampler was equipped with a replaceable acetate inner sleeve for sample retention. Soil samples, drill cuttings, or continuous cores recovered from each boring were logged by an experienced Apex-SGI geologist working under the direct supervision of a California Professional Geologist or Certified Engineering Geologist. Soils were logged visually/manually and classified by the Unified Soil Classification System (USCS) according to American Society for Testing and Materials (ASTM) Method D2488-00.

Soil samples from each borehole advanced onsite were retained from the recovered core for laboratory analysis. Soil samples collected for laboratory analysis were retained in acetate liners cut from the desired interval and the ends of the sample were immediately covered with Teflon® tape and plastic caps on each end. Samples were immediately labeled with the sample identification, date and time of collection, and placed on ice in an insulated cooler. All samples were logged on to a chain-of-custody document for delivery to American Analytics, Inc. for the following analysis:

- TPH Carbon Chain (C6-C44) by U.S. Environmental Protection Agency (USEPA) Method 8015M;
- VOCs and fuel oxygenates by USEPA Method 8260B; and
- Polynuclear Aromatic Hydrocarbons (PAHs) by USEPA Method 8270.

The presence of free product was observed in boring AN-13 at a depth of approximately 28 feet bgs. A soil core was collected subsequently from 27 to 28 feet bgs and submitted to PTS Laboratories in Santa Fe Springs, California for the following analyses:

- Soil Properties: native state permeability to water, total and air filled porosity, grain and bulk density, moisture content, and total pore fluid saturation (reported as water only) using: American Petroleum Institute (API) RP40 and ASTM D2216;
- Hydraulic Conductivity: native state permeability to water, total and air filled porosity, grain and bulk density, moisture content, total pore fluid saturation (reported as water only) using: API RP40, EPA 9100, and ASTM D2216; and
- Free Product Mobility: centrifuge of sample to demonstrate degree of product mobility, residual saturations by Dean-Stark, total porosity, and grain and bulk density using ASTM D425 and API RP40.

3.3.2 Groundwater Sampling Methodology

Groundwater grab samples were collected using a Hydropunch® groundwater sampling system. At each desired depth interval, a 4-foot long stainless steel screen housed within the drilling rod was exposed to the subsurface, and allowed to fill with groundwater. Groundwater was allowed to equilibrate within the sampling device prior to extraction using small diameter polyethylene tubing and a check valve assembly. Groundwater samples were decanted into analysis-specific laboratory supplied containers, labeled, and handled under standard chain-of-custody procedures for delivery to American Analytics, Inc. in Chatsworth California for analysis. After each sample was collected, the Hydropunch®-type screen was removed from the borehole for decontamination, resealed, and then driven to the next sample interval. In addition, LNAPL was encountered in boring AN-13 and a sample was collected.

Groundwater samples collected were analyzed for the following parameters:

- TPH Carbon Chain (C6-C44) by EPA Method 8015M;
- VOCs and fuel oxygenates by EPA Method 8260B; and
- PAHs by EPA Method 8270.

The LNAPL sample collected from boring AN-13 was analyzed by PTS Laboratories for fluid properties and free product mobility parameters including viscosity, density, and specific gravity.

3.4 Monitoring Well Installation Methodology

ROST/UVOST™ data collected by Apex-SGI during this study suggested LNAPL could be present in the Southwest Parcel in the vicinity of boring AS-03. To further assess for the presence of LNAPL in this area, groundwater monitoring well MW-20 was installed at the location shown on Figure 3-2.

The soil boring for the groundwater monitoring well was advanced using a hollow-stem auger drill rig, equipped with 8-inch outside diameter augers. Upon reaching the target depth, the borehole was

converted into a groundwater monitoring well, installed in accordance with LARWQCB standards and LACDPH permit specifications.

The monitoring well was constructed using 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) casing, and 15 feet of 0.020-inch slot pipe for the screened interval. To ensure the observation of any LNAPL present, the screened interval extends from approximately 5 feet above to 10 feet below first-encountered groundwater. A sand filter pack consisting of #2/16 sand Monterey sand was emplaced by pouring the sand through the augers from the bottom of the boring to approximately 2 feet above the screened interval. A transition seal, consisting of 3 feet of bentonite chips was installed above the filter pack, was poured through the auger and hydrated in place. The remainder of the annular space was backfilled with a mixture of Portland cement and bentonite grout (per LACDPH permit requirements). The well was completed at the surface in a flush-mounted, traffic-rated well box, set in concrete to grade.

After the completion of well installation activities (a minimum of 48 hours after installation), the groundwater monitoring well was developed using a Smeal-type development rig, equipped with an appropriately-sized surge block, stainless steel bailer, and submersible pump. All reusable equipment was decontaminated according to the methods described within Section 3.5.

3.5 Decontamination Methods

To support the quality of data and to minimize the potential for cross-contamination between sampling events, all reusable downhole equipment used during drilling, sampling, or well development was thoroughly decontaminated prior to, and in between each use. Decontamination procedures for all reusable sampling equipment included: physical removal of excess soil and debris; thorough washing of all equipment with non-phosphate detergent/potable water solution; and triple rinse with deionized or distilled water.

3.6 LNAPL Field Mobility Study

The mobility of LNAPL at the Site was investigated using bail-down testing and physical testing of the LNAPL. LNAPL bail-down testing was performed to assess the volume of LNAPL present beneath the Site and to assist with the quantification of LNAPL transmissivity. LNAPL bail-down testing was conducted at the existing well MW-11 located in the northern portion of the West Parcel where recent monitoring showed 1.6 feet of product was present.

LNAPL was not observed at new monitoring well MW-20 and was therefore not included in the field mobility study.

3.6.1 Bail-Down Testing Methodology

To estimate LNAPL volume underlying the Site, an approximation of actual LNAPL thickness in the formation must first be developed. The LNAPL thickness observed in a well is typically not representative of the actual thickness of LNAPL that resides in the surrounding formation. The thickness of LNAPL observed in a particular well is highly dependent on a number of factors including

LNAPL type (i.e., crude oil, gasoline, diesel fuel, etc.), well construction, and the lithologic characteristics of the surrounding formation. To estimate the LNAPL thickness in the formation, and the approximate LNAPL recharge into Site wells, Apex-SGI conducted bail-down testing on well MW-11 on January 18, 2017. Bail-down testing was generally conducted per procedures outlined in *Determination of a Realistic Estimate of the Actual Formation Product Thickness Using Monitor Wells: A Field Bailout Test* (Gruszczenski, 1987). Bail-down testing procedures are summarized as follows:

1. Measured and recorded stabilized (i.e., pre-test) water/LNAPL levels.
2. Bailed LNAPL/water from well MW-11 until a generally constant and minimal LNAPL thickness was measured.
3. Periodically measured and recorded depth to LNAPL and depth to water (i.e., water/product interface) during the recovery phase of testing using an interface probe.
4. Graphed depth to LNAPL and the water/product interface measurements versus time.
5. Evaluated the slope of the water/product interface line to determine the inflection point.
6. Measured the difference between the LNAPL line and water/product interface line at the approximate inflection point to determine the actual product thickness.
7. Measured the difference between the water/product interface at the time of the inflection and the stabilized top of product level. This is the sum of the actual product thickness and the capillary fringe.
8. Subtracted the measurement in step 7 from the measurement in step 6 to determine the height of the capillary fringe.

In addition to completing the bail-down test, LNAPL samples were collected from monitoring well MW-11 and boring AN-13 and chemically analyzed to identify the nature of the LNAPL present. The MW-11 sample was collected at the start of the bail-down test using a disposable bailer. The AN-13 sample was collected from the Hydropunch® sampler using small diameter polyethylene tubing with a check-valve. LNAPL samples were decanted into laboratory supplied containers, labeled, and handled under standard chain-of-custody procedures for delivery to PTS Laboratory. LNAPL samples were analyzed for fluid properties and free product mobility parameters including viscosity, density, and specific gravity.

3.7 Soil Vapor Investigation Northwest Parcel

Four (4) temporary vapor probes were installed and sampled to assess vapor risk in the northern portion of the Northwest Parcel, at the locations shown on Figure 3-3. Borings AN-04, AN-06, AN-07 and AN-08 were advanced using a 4-inch diameter hand-auger to a depth of 5 feet bgs. Soil vapor probes were constructed using 1/4-inch diameter Nylaflow™ tubing, fitted with vapor probe implant at approximately 5 feet bgs and a three-way valve at the surface. The annulus surrounding the vapor probe implant was filled with #3 sand to 6-inches above and below the implant, followed

by a layer of dry bentonite chips up to 1-foot thick, and hydrated bentonite chips to near ground surface.

3.7.1 Vapor Probe Sampling Methodology

After allowing at least 48-hours for equilibration, the vapor probes were sampled in accordance with the Department of Toxic Substances Control (DTSC)/RWQCB *Advisory – Active Soil Gas Investigations* document dated July 2015 (Advisory). Vapor sampling was conducted by American Analytics Laboratory under the direction of Apex-SGI. After completion of successful leak and purge/vacuum tests, soil vapor samples were collected from each location in summa canisters, labeled, and handled under standard chain-of-custody procedures for delivery to American Analytics Laboratory in Chatsworth, California for VOC analysis by gas chromatography/mass spectrometry (GC/MS; EPA Method TO-15).

3.7.1.1 Leak Testing

Leak testing was conducted to evaluate whether an adequate seal had been established in the sampling train, ground surface, and soil vapor probe boring to ensure that soil vapor samples were not being diluted by infiltrating ambient air.

A shut-in test was conducted on surface components of the sampling train to check for leaks prior to purging or sampling from each of the soil vapor probes. The above-ground sampling apparatus was assembled and attached to a soil vapor sampling probe, and a vacuum applied to the sampling train. A vacuum of approximately 100 inches of water column (in-H2O; or 7.3 inches of mercury [in-Hg]) was applied to evacuate the lines of the sample train. The sampling train remained under vacuum for approximately one minute to assess whether there was any loss of vacuum.

Tracer testing was conducted at each probe location to check for communication between the ground surface and the sampling implant at depth. A cloth towel saturated with the isopropanol (IPA) tracer compound was placed at the ground surface adjacent to the soil vapor probe tubing to evaluate if ambient air had broken through the well seal (or sampling apparatus seals) during sample collection.

3.7.1.2 Purge Volume Calculation

Purging is required to remove ambient air from, and induce the flow of in-situ soil vapor into, the sample train. In accordance with the DTSC/RWQCB Advisory, no purge volume test was conducted during the proposed assessment activities. Instead, a standard purge volume of 3 was used for each sampling point. The purge volume was calculated using standard methods outlined in the guidance which account for the borehole diameter, well construction material porosity and the tubing diameter and length. The probes were purged at a flow-rate of 150 milliliters per minute.

3.8 Site Survey

Soil borings performed during this study were surveyed to existing and established vertical and horizontal data by a State of California licensed surveyor in accordance with the California State

Water Resources Control Board Geotracker requirements. The survey report is provided in Appendix C.

3.9 Management of Investigation Derived Waste

Investigation-derived waste (IDW) generated during this project including soil cuttings, decontamination water, and purge water were stored in UN-rated, 55-gallon drums and will be profiled and disposed of in accordance with local, State and Federal regulations.

4.0 DEVELOPMENT OF SCREENING LEVELS

This section summarizes the rationale and derivation of soil, soil vapor, and groundwater screening levels that were used to evaluate the Site investigation data, to identify COPCs and to determine if further action is warranted to evaluate potential health impacts from exposure to Site-related constituents.

The following sections describe the media-specific screening criteria for soil, soil vapor, and groundwater data. Screening values pursuant to the criteria defined below, are included on analytical data summary tables provided as Tables 4-1 through 4-7. It should be noted that screening levels are not intended to be proposed cleanup goals. As discussed in Section 8, Site-specific, risk-based cleanup goals will be developed for the Site and will be included in the Response Plan.

4.1 Soil Screening Levels

Future planned redevelopment of the Site will include light industrial/commercial buildings and concrete/asphalt paving across the Site, which will limit direct contact with soil for potential onsite receptors. Although direct contact with soil is likely an incomplete exposure pathway for future onsite receptors, it was conservatively included as a potential exposure pathway. For soil, the exposure point is assumed to be the area within the Site. Current and future offsite receptors are not expected to have direct contact with soil at the Site. Based on the anticipated future commercial land use, the following soil screening levels were used, as appropriate:

VOCs and TPH

Direct Contact Exposure Pathways

In order of priority:

- California DTSC modified screening levels (SLs) for residential and commercial/industrial soil (DTSC, 2016). DTSC SLs for soil were developed for direct exposure to soil via ingestion, dermal contact, and inhalation exposure pathways; and
- USEPA Regional Screening Levels (RSLs) for residential and industrial soil (USEPA, 2016). USEPA RSLs for soil were developed for direct exposure to soil via ingestion, dermal contact, and inhalation exposure pathways.

Protection of Groundwater Exposure Pathway

- LARWQCB SLs for soil (LARWQCB, 1996). The Site-specific LARWQCB SLs were developed for the protection of groundwater, as described in Appendix D.

PAHs and Lead

Direct Contact Exposure Pathways

In order of priority:

- California DTSC modified SLs for residential and commercial/industrial soil (DTSC, 2016). DTSC SLs for soil were developed for direct exposure to soil via ingestion, dermal contact, and inhalation exposure pathways; and
- USEPA RSLs for residential and industrial soil (USEPA, 2016). USEPA RSLs for soil were developed for direct exposure to soil via ingestion, dermal contact, and inhalation exposure pathways.

Protection of Groundwater Exposure Pathway

- California Regional Water Quality Control Board, San Francisco Bay (SFRWQCB) environmental screening levels (ESLs) for soil leaching to groundwater (SFRWQCB, 2016). The SFRWQCB ESLs for protection of groundwater were developed for potential leaching of chemicals from vadose-zone soil and subsequent migration to groundwater. The SFRWQCB ESLs are based on a target groundwater screening levels for groundwater use as a nondrinking water resource (lowest of the ecological aquatic habitat SL, gross contamination water SL, groundwater vapor intrusion SL, and non-drinking water odor nuisance SL).

4.2 Soil Vapor Screening Levels

Future planned redevelopment of the Site will include light industrial/commercial building(s). Current and future offsite receptors include commercial/industrial worker and resident receptors. Based on the anticipated onsite land use and existing offsite land use, the following soil screening levels were used, as appropriate:

DTSC-SLs and USEPA RSLs have been developed for indoor air, but not soil vapor. The residential and commercial/industrial soil vapor SLs are based on applying a DTSC default attenuation factor to the lowest of DTSC and USEPA air SLs. The resident air SLs and industrial air SLs were divided by DTSC default attenuation factors for new building construction of 0.001 and 0.0005, respectively (DTSC, 2011). The resulting values represent the soil vapor SLs.

In order of priority, the following air SLs were used to estimate soil vapor SLs:

- California DTSC modified SLs for residential and commercial/industrial air (DTSC, 2016). DTSC SLs for residential and industrial air were developed for direct exposure to indoor air via the inhalation exposure pathway; and
- USEPA RSLs for residential and industrial air (USEPA, 2016). USEPA RSLs for air were developed for direct exposure to indoor air via the inhalation exposure pathway.

4.3 Groundwater Screening Levels

Based on the anticipated onsite land use and existing offsite land use, the following groundwater SLs were used, as appropriate:

- SFRWQCB ESLs for residential and industrial groundwater vapor intrusion into indoor air (SFRWQCB, 2016). The SFRWQCB ESLs for groundwater vapor intrusion were developed

for potential volatilization of chemicals from groundwater to indoor air and subsequent direct exposure to indoor air via the inhalation exposure pathway.

For evaluation of long-term groundwater goals, the following groundwater SLs were used, as appropriate:

- California maximum contaminant levels (MCLs), which are health protective drinking water standards to be met by public water systems; and
- SWRCB drinking water notification levels, which are health-based advisory levels for nonregulated chemicals in drinking water without MCLs.

5.0 INVESTIGATION RESULTS

Data collected during the Site investigation, described in Section 3, are presented in the following sections.

5.1 Soil Conditions

CPT results were generally consistent with historical CPT and logging data, which indicate the presence of both coarse-grained and fine-grained soil types to a maximum explored depth of 20 feet below mean sea level (MSL; boring AS-10). Coarser-grained fill deposits were encountered at the surface to a maximum depth of approximately 6 feet bgs from soil boring logs. In sharp contact with the fill is a fine-grained, low permeability soil that extends to an average depth of 10 feet bgs. A thick, coarse-grained soil is encountered in a generally gradational contact with the overlying fine-grained unit and extends to a depth of approximately 2 feet below MSL. A discontinuous fine-grained unit is encountered at approximately 2 feet below MSL and extends to a depth of 5 feet below MSL. The lithology below this depth to the depth explored (20 feet below MSL) consists of interbedded silty and sandy soils.

Boring logs are provided in Appendix E. Schematic geologic cross-sections, the locations of which are shown on Figure 5-1, are provided in Figures 5-2 and 5-3. These cross-sections include CPT and logged data from this investigation.

5.2 UVOST™ and MIP© Screening Results

The UVOST™ and MIP© boring logs from the 2016 investigation are provided in Appendices F and G, respectively. Figure 5-4 and Table 5-1 summarizes the maximum UVOST™ output observed at each location and the corresponding depth. In summary, UVOST™ screening results indicated that elevated hydrocarbon concentrations are present in areas investigated within both the Northwest and Southwest Parcels.

Within the Northwest Parcel, at locations surrounding well MW-11 (borings AN-15 through AN-18), UVOST™ responses were not at levels which suggest LNAPL is present, indicating that LNAPL in that general area is limited to the area immediately adjacent to well MW-11. Approximately 200 feet to the northwest of well MW-11, UVOST™ responses suggest that a second area of LNAPL is present. High UVOST™ responses (greater than 50% response relative to reference emitter [RE]) were observed in borings AN-9, AN-11, and AN-12. Elevated responses within the aforementioned borings were detected between depths of approximately 27 feet bgs and 35 feet bgs, corresponding to the water table interface and capillary fringe zone. The location and relative UVOST™ responses defining this potential LNAPL presence are depicted on Figure 5-4.

Within the Southwest Parcel, UVOST™ responses indicate that LNAPL may be present in the vicinity of borings AS-1, AS-02, AS-03, and AS-06 (north-central portion of the Southwest Parcel). Similar to the Northwest Parcel, elevated UVOST™ responses were detected at depths corresponding to the water table interface and capillary fringe zone (Figure 5-4).

UVOST™ screening at the three locations in the East Parcel did not indicate the presence of LNAPL at the locations investigated. UVOST™ responses indicated an approximate 20% response in boring AE-02, and responses were significantly lower in borings AE-1 and AE-03 (generally less than 1% response).

5.3 Soil

The purpose of the limited soil assessment conducted during this investigation was to: 1) confirm hydrocarbon and LNAPL impacts through visual and laboratory chemical analysis as preliminarily defined by the CPT-UVOST™ responses, and 2) provide chemical data to further quantify COPC concentrations within the subsurface. Six soil borings were advanced within the Northwest Parcel (borings AN-01, AN-02, AN-03, AN-05, AN-13, and AN-20) and one boing (the pilot boring for well MW-20) was advanced within the Southwest Parcel. Soil sampling was conducted within borings advanced within the northern portion of the Northwest Parcel (borings AN-01, AN-02, AN-03, and AN-05) to fill a previously defined data gap in this area. No soil sampling was conducted within the East Parcel, as UVOST™ screening within the East Parcel did not indicate the presence of elevated hydrocarbon concentrations.

Soil sample results are summarized in Tables 4-1 through 4-3 and depicted on Figures 5-5 through 5-13. Results were compared to screening levels based on direct contact to soil within a commercial land use scenario, as well as protection of groundwater for a non-drinking water aquifer. Soil sampling results are summarized as follows.

Northwest Parcel

Petroleum hydrocarbons, VOCs and PAHs were detected in soil collected from the six soil borings from the Northwest Parcel. Sample depths range from 5 feet bgs to 20.5 feet bgs. With the exception of naphthalene, all PAHs detected were below SLs. Lead was detected at concentrations below the SLs. A summary of the results for TPH, benzene, and MtBE is provided below:

- TPHg (C4-C12) was detected in 18 of 20 samples analyzed (including one duplicate sample) at concentrations that ranged from 1.5 milligrams per kilogram (mg/kg; boring AN-02 at 10 feet bgs) to 19,000 mg/kg (boring AN-03 at 5.5 feet bgs). Twelve soil samples, including a duplicate sample, exceeded the USEPA RSL for commercial land use and/or the LARWQCB SL for protection of groundwater at 20 feet bgs (Table 4-2).
- TPHd (C13-C22) was detected in 18 of 19 samples analyzed at concentrations that ranged from 2.1 mg/kg (boring AN-01 at 20 feet bgs) to 11,490 mg/kg (boring AN-13 at 9 feet bgs). Six soil samples exceeded the USEPA RSL for commercial land use and/or the LARWQCB SL for protection of groundwater at 20 feet bgs (Table 4-1).
- Benzene was detected in 8 of 20 samples analyzed (including one duplicate sample) at concentrations that ranged from 0.089 mg/kg (boring AN-02 at 6.5 feet bgs) to 8.4 mg/kg (boring AN-20 at 8 feet bgs). Seven soil samples exceeded the USEPA RSL for commercial land use and/or the LARWQCB SL for protection of groundwater at 20 feet bgs (Table 4-2).

- MtBE was not detected above method detection limits in any soil sample analyzed.

Southwest Parcel

Petroleum hydrocarbons, VOCs and PAHs were detected in soil samples collected from the one boring advanced within the Southwest Parcel (boring MW-20). Sample depths ranged from 7 feet bgs to 19 feet bgs. Phenanthrene and naphthalene were the only PAHs detected above method detection limits in soil samples analyzed from boring MW-20. Naphthalene was the only PAH detected at concentrations exceeding the LARWQCB SL for protection of groundwater at 20 feet bgs. Naphthalene concentrations did not exceed the USEPA RSL. Lead was detected at concentrations below the SLs. A summary of the soil sampling results for TPH, benzene, and MtBE is provided below:

- TPHg (C4-C12) was detected in all 3 samples analyzed at concentrations that ranged from 11 mg/kg (boring MW-20 at 7 feet bgs) to 600 mg/kg (boring MW-20 at 19 feet bgs). Only one soil sample exceeded the USEPA RSL for commercial land use. TPHg concentrations did not exceed the LARWQCB SL for protection of groundwater at 20 feet bgs (Table 4-2).
- TPHd (C13-C22) was detected in all 3 samples analyzed at concentrations that ranged from 134 mg/kg (boring MW-20 at 7 feet bgs) to 5,040 mg/kg (boring MW-20 at 19 feet bgs). Two soil samples exceeded the USEPA RSL for commercial land use. TPHd concentrations did not exceed the LARWQCB SL for protection of groundwater at 20 feet bgs (Table 4-1).
- Benzene was not detected above method detection limits in any soil sample analyzed (Table 4-2).
- MtBE was not detected above method detection limits in any soil sample analyzed.

East Parcel

No soil analytical data were collected from the East Parcel during this investigation.

5.4 Soil Vapor

Soil vapor analytical results for VOCs are summarized in Table 4-4 and benzene concentrations are summarized in Figure 5-14. Sample results were compared to DTSC SLs and USEPA RSL vapor intrusion screening levels within a commercial land use scenario. Soil vapor points AN-04 and AN-06, contained petroleum constituents above screening levels, including benzene. Benzene concentrations in points AN-04 and AN-06 were 194,876 micrograms per cubic meter ($\mu g/m^3$) and 271,548 $\mu g/m^3$, respectively. No constituents were detected above laboratory reporting limits in soil vapor collected from soil vapor points AN-07 and AN-08.

No helium (leak check compound) was detected in any of the samples analyzed. Soil vapor helium results are summarized in Table 5-2.

5.5 Groundwater

Groundwater data obtained during Apex's 2017 Site assessment investigation include screening data collected via Hydropunch®, as well as the sampling of newly installed monitoring well MW-20 within the Southwest Parcel. Groundwater analytical results are summarized in Tables 4-5 through 4-7. Groundwater, TPHg, benzene, and MtBE data are presented on Figures 5-15 through 5-17, which additionally incorporates the most recent (Fourth Quarter, 2016) Site-wide groundwater monitoring and sampling data prepared by Ami Adini & Associates, Inc. (AA&AI, 2017). Results were compared to SFRWQCB groundwater vapor intrusion screening levels. Although groundwater samples were analyzed for PAHs, only naphthalene is considered a potentially volatile PAH. Therefore, groundwater vapor intrusion screening levels were only available for VOCs and naphthalene.

Northwest Parcel

Petroleum hydrocarbons, BTEX and benzene derivatives, other VOCs (refer to Table 4-6) and PAHs (refer to Table 407) were detected in groundwater underlying the Northwest Parcel. At boring locations in the northern portion of the Northwest Parcel (borings AN-01, AN-02, AN-03, and AN-05), samples were collected from one depth (first encountered groundwater). Samples exceeded screening levels for at least one constituent at all locations.

Groundwater samples were collected from borings AN-13 and AN-20 (in the highest concentration areas based on UVOST™ screening results) at multiple depths to provide vertical assessment of petroleum impacts in groundwater. Samples were collected at 41 feet bgs and 54 feet bgs from boring AN-13; and 32 feet bgs, 42 feet bgs, 52 feet bgs, and 62 feet bgs from boring AN-20. All locations exceeded screening levels for at least one constituent. Although decreasing concentrations were observed with depth, groundwater impacts were not vertically delineated based on the grab groundwater samples.

Naphthalene was detected at concentrations exceeding the groundwater vapor intrusion screening level for commercial land use. A summary of the results for TPH, benzene, and MtBE in groundwater is provided below:

- TPHg (C4-C12) was detected in all ten samples analyzed at concentrations ranging from 240 microgram per liter (μg/L; boring AN-13 at 54 feet bgs) to 170,000 μg/L (boring AN-05 at 40 feet bgs) (Table 4-6).
- TPHd (C13-C22) was detected in all ten samples analyzed at concentrations that ranged from 1,273 μg/L (boring AN-20 at 62 feet bgs) to 1,026,000 μg/L (boring AN-02 at 38 feet bgs) (Table 4-5).
- Benzene was detected in 9 of 10 samples analyzed at concentrations ranging from 10 μg/L (boring AN-13 at 54 feet bgs) to 6,300 μg/L (boring AN-20 at 42 feet bgs). Eight groundwater samples exceeded the groundwater vapor intrusion screening level for commercial land use. (Table 4-5).

- MtBE was not detected in any groundwater sample analyzed.

Southwest Parcel

As discussed previously, well MW-20 was installed to the west of UVOST™ boring AS-03, in an area suspected for LNAPL. Monitoring well MW-20 was sampled on January 18, 2017. No LNAPL was present within the well at the time of the initial sampling event. Naphthalene was not detected at concentrations exceeding the groundwater vapor intrusion screening level for commercial land use. Dissolved-phase TPHg (C4-C12) was detected in groundwater at a concentration of 360 µg/L, and dissolved phase TPHd (C13-C22) was detected at a concentration of 7,050 µg/L. Benzene was not detected above laboratory detection limits. Analytical results are summarized on Tables 4-5 through 4-7.

Offsite (West of Gundry Avenue)

One boring (AO-01) was advanced offsite in Gundry Avenue to better delineate the western extent of the dissolved-phase benzene in groundwater. Samples were collected from first-encountered water at 34 feet bgs, 44 feet bgs, and 60 feet bgs to further define the vertical distribution of petroleum constituents in groundwater. Analytical results are included in Tables 4-5 through 4-7. Benzene, ethylbenzene, and naphthalene were detected at concentrations exceeding the groundwater vapor intrusion screening levels for residential land use.

A summary of the results for TPH, benzene, and MtBE are provided below:

- TPHg (C4-C12) was detected in all three samples at concentrations ranging from 920 µg/L at 60 feet bgs to 32,000 µg/L at 34 feet bgs.
- TPHd (C13-C22) was detected in all three samples at concentrations ranging from 1,800 µg/L at 44 feet bgs to 3,800 µg/L at 34 feet bgs.
- Benzene was only detected in one sample at a concentration of 1.4 µg/L at 60 feet bgs.
- MtBE was not detected in any groundwater sample analyzed.

East Parcel

No groundwater analytical data were collected from the East Parcel during this investigation.

5.6 MtBE Discussion

MtBE has historically been detected in groundwater west and southwest of the West Parcel. As documented in prior reports, data suggest an offsite source situated west or northwest of the Site, with migration toward the east and beneath the Site. Data collected during the Site investigation provide further evidence that the Site is not a source of MtBE based on the following:

- A file review was conducted at the Los Angeles County Fire Department. Based on available records, there is no indication that MtBE was ever stored or used at the Site or part of former refinery operations. Copies of the available materials are provided in Appendix H.

- At least 60 soil samples have been collected from the Site and analyzed for MtBE. None of the samples contained detectable levels of MtBE (Table 4-2).
- None of the onsite groundwater samples collected from the Site during this investigation contained detections of MtBE. Figure 5-17 shows the concentration of MtBE in groundwater during Quarter 4, 2016. Based on this data, the MtBE in groundwater originates from an offsite source and is not associated with operations at the Former Chemoil Refinery.

5.7 LNAPL Bail-Down Test and Sampling

LNAPL bail-down testing was performed to assess the volume of LNAPL present beneath the Site and to assist with the quantification of LNAPL transmissivity. Bail-down testing data from well MW-11 are shown on Table 5-3 and plotted on Figure 5-18. On the date of testing (January 18, 2017), approximately 1.60 feet of LNAPL was gauged in well MW-11. As shown on Graph 1, the estimated LNAPL thickness in the formation was approximately 0.18 feet. The data collected during the bail-down test from well MW-11 were applied to the three observed/suspect LNAPL areas (vicinity of well MW-11 and borings AN-13 and AS-03) to calculate a total LNAPL estimated volume. Based on similar UVOST™ responses in the three LNAPL areas, LNAPL in the other two areas, if present, is also inferred to be relatively thin.

Using the areas of observed or suspected LNAPL (Figure 5-15), the estimated LNAPL thickness from the bail-down testing (0.18 feet), and assuming a 30% porosity, the estimated LNAPL volume beneath the Site is approximately 5,958 gallons. This estimation will be recalculated during implementation of the Response Plan, when monitoring wells are installed in the vicinity of borings AN-11 and AS-03 and the LNAPL thickness in those two areas can be verified.

As shown on Table 5-3, the rate of liquid phase hydrocarbon (LPH) recovery into the well MW-11 well casing during bail-down testing was slow, averaging approximately 0.12 gallons per day (average recovery throughout testing) with 100% LNAPL recovery into well MW-11 estimated at slightly more than one (1) week. Based on the bail-down testing results, and the petrophysical laboratory analysis results of LNAPL from well MW-11, LNAPL conductivity and transmissivity in well MW-11 are estimated at approximately 0.79 feet/day and 0.14 $feet^2$/day, respectively. The transmissivity of LNAPL in the vicinity of borings AN-11 and AS-03 is expected to be similar or lower than the transmissivity of LNAPL observed at well MW-11. As further detailed in the following section, laboratory data of the LNAPL sample collected from boring AN-11 indicated that it has a slightly higher specific gravity and viscosity. The UVOST™ log from boring AS-03 had a multi-wavelength fingerprint consistent with that of a heavier or more weathered petroleum product (indicated by the orange/yellow color of the UVOST™ log) compared to the logs from the Northwest Parcel in the vicinity of well MW-11 and boring AN-11.

Based on the estimated LNAPL thickness in the formation, the LNAPL petrophysical analysis results, and the apparent slow LNAPL recharge rate into wells, Apex-SGI anticipates that passive LNAPL skimmers will be the most feasible LNAPL remedial method for this Site.

5.7.1 Physical Properties Analysis of LNAPL and LNAPL Affected Soil

Two LNAPL samples and one LNAPL-affected soil sample were collected and submitted to PTS Laboratories for physical properties analysis. LNAPL samples were collected from monitoring well MW-11 using a bailer and from soil boring AN-13 using a Hydropunch® sampler. In addition, a soil sample from boring AN-13 was retained from the soil interval where LNAPL was encountered (approximately 27 feet bgs).

Table 5-4 summarizes the results of the physical property data for soil collected from boring AN-13. Total porosity within the sample interval was measured between 40% and 47%, with a total pore fluid saturation between 20.8% and 54.3%.

Table 5-5 summarizes the results of the physical property data for LNAPL samples collected from well MW-11 and boring AN-13. The measured specific gravity of the two LNAPL samples collected from well MW-11 and boring AN-13 were 0.8185 and 0.8492 (at 70 degrees Fahrenheit), respectively, which correspond to API gravity of 41.5 and 35.0. The range of API gravity is consistent with a mixture of light-to mid-range products, similar to the naphtha, kerosene, and gas-oil mixture, previously reported to occur beneath the Site.

6.0 IDENTIFICATION OF COPCS

Based on a comparison of the screening criteria (Section 4) with Site data, the most toxic, persistent, and prevalent site-related chemicals detected at the Site can be identified. In this way, the environmental assessment can focus solely on those chemicals that are expected to account for the majority of estimated health impacts at the Site. These identified chemicals in soil, soil vapor, and groundwater are known as COPCs. This section identifies COPCs at the Site based on Site investigation data presented in Section 5.

6.1 Soil

The concentrations of the following constituents exceeded the lowest available soil SL; therefore, it was retained as a COPC:

Sampling Unit (SU)	Commercial/Industrial Exposure Scenario
Direct Contact Exposure Pathways	
Soil (Surface to 10 feet bgs)	TPH (C6-C12) TPH (C13-C22) TPHg Ethylbenzene Naphthalene
Protection of Groundwater Exposure Pathway (Groundwater at 20 feet bgs)	
Soil (Surface to 10 feet bgs)	TPH (C6-C12) TPH (C13-C22) TPHg Benzene Naphthalene 1,3,5-Trimethylbenzene 1,2,4-Trimethylbenzene Total Xylenes
Soil (10 to 20 feet bgs)	TPH (C6-C12) TPHg Benzene Naphthalene

6.2 Soil Vapor

The concentrations of the following constituents exceeded the lowest available soil vapor SL; therefore, they were retained as COPCs. Note that as mentioned previously, COPCs were derived for the Site using data collected during the Site investigation activities. However, in order to develop

soil vapor COPCs for the residential area downgradient from the Site, Apex-SGI has reviewed prior soil vapor data collected from the downgradient residential area (Geosyntec, 2012) and results are included in the table below for the residential exposure scenario. A copy of soil vapor data tables and figures showing sampling locations are provided in Appendix I.

Sampling Unit (SU)	Commercial/Industrial Exposure Scenario	Residential Exposure Scenario
Vapor Intrusion into Indoor Air Exposure Pathway		
Soil Vapor	Benzene Ethylbenzene Xylenes 1,2,4-Trimethylbenzene	Chloroform Ethylbenzene

6.3 Groundwater

The concentrations of the following constituents exceeded the lowest available groundwater SL; therefore, they were retained as a COPC:

Sampling Unit (SU)	Residential Exposure Scenario	Commercial/Industrial Exposure Scenario
Vapor Intrusion into Indoor Air Exposure Pathway		
Groundwater	Benzene 1,2-Dichloroethane cis-1,2-Dichloroethene Ethylbenzene Naphthalene Tetrachloroethylene	Benzene Ethylbenzene Naphthalene

Considering long-term groundwater goals, the concentrations of the following constituents exceeded the California MCL or State Water Resource Control Board (SWRCB) drinking water notification level.

Sampling Unit (SU)	Maximum Contaminant Level (MCL)	Notification Level
Groundwater	Benzene 1,2-Dichloroethane cis-1,2-Dichloroethene Ethylbenzene Tetrachloroethylene	tert-Butyl Alcohol sec-Butylbenzene n-Butylbenzene Naphthalene n-Propylbenzene 1,2,4-Trimethylbenzene

7.0 CONCEPTUAL SITE MODEL

A CSM is a representation of the characteristic of the Site to demonstrate the possible and confirmed relationship(s) between the source(s) of contamination, pathways, and receptors. The objectives of the CSM are to:

- Convey an understanding of the origin, nature, and extent of contamination;
- To identify potential contaminant fate-and-transport processes and pathways;
- To identify potential human and environmental receptors that may be impacted by contamination associated with the Site; and
- To frame the evaluation of risk to human health, safety, and the environment posed by releases from the Site.

As defined by the U.S. Environmental Protection Agency (USEPA, 1989), all of the following four components are necessary for a chemical exposure pathway to be considered complete and for chemical exposure to occur:

- A chemical source and a mechanism of chemical release to the environment;
- An environmental transport medium (e.g., soil) for the released chemical;
- A point of contact between the contaminated medium and the receptor (i.e., the exposure point); and
- An exposure route (e.g., dermal contact with chemically-impacted soils) at the exposure point.

The following sections describe these components and provide a basis for the CSM. This will be used to develop the Response Plan for the Site. Information is outlined schematically on Figure 7-1.

7.1 Potential Source Evaluation

The sources of potential contamination at a Site are related to exposure setting (Site characteristics and past and current Site operations) and land and groundwater uses at the Site and surrounding area. Environmental impacts beneath the Site are a result of the Site's prior use as an oil refinery from 1922 until 1997. Former operations included above ground storage tanks, truck loading racks, boilers, heating units, sumps, a cooling tower, and support structures including a warehouse, laboratory, and maintenance facilities. Currently the Site is vacant, and does not contain any above ground storage tanks or known underground storage tanks.

The primary sources for potential contamination at the Site are related to former Site operations as a refinery and subsequent releases to onsite soil. Following a release to soil, secondary sources may include fugitive dust, soil vapor, ambient air, and groundwater.

7.2 Exposure Setting and Land Use

The Site is approximately 8.2-acres in size and was formerly occupied by refinery operations. Land use in the vicinity of the Site includes commercial, office, and light industrial development to the north, light industrial development to the west, east and south of the Site, and a former railroad corridor to the south, with residential properties located south and west of the former railway corridor. There are five schools located within ¼-mile of the Site. Signal Hill Elementary School is located upgradient and north of the Site. Alvarado Elementary School and Jessie Elwin Nelson Academy Middle School are located crossgradient and east of the Site. Mary Butler Middle School and Renaissance High School for the Arts are located downgradient and south of the Site. There are two day care centers located within a ½-mile of the Site, Central Child Development Center to the west and LBCC Children Development Center to the south. No known hospitals are located within a ½-mile of the Site. There are no known active public water supply wells located within a mile radius of the Site. Groundwater quality within the Site vicinity is generally poor due to seawater intrusion and elevated salinity. Los Angeles County Department of Public Works (LADPW) maintains a well located approximately 850 feet south of the Site (LADPW Well 420); however, based on personal communication with the LADPW, this well is used only for groundwater monitoring purposes. The nearest surface water body to the Site is the Los Angeles River, which is located 1.9 miles west of the Site.

Currently the Site is vacant, and all former refinery and supporting structures have been removed from the Site. In the future, the Site will be redeveloped for light industrial/commercial land use. Future remedies for the Site will include engineering controls to mitigate vapor intrusion into office space and stormwater runoff into offsite areas. A land use covenant (LUC) or deed restriction for the Site will restrict future land use to commercial/industrial.

A brief summary of Site characteristics is provided in the following sections. Section 2 provides more detailed Site description and background information.

7.3 Geologic and Hydrogeologic Conditions

The Site consists of unconsolidated sequences of silt and fine to coarse grained sand. Coarse-grained soils consist of sand (SP and SW) and silty sand (SM); whereas, subordinate fine-grained soils consist of silt (ML and MH) and to a lesser degree clay (CL) (this report; TEC, 2011). The majority of the Site is capped with a coarse-grained fill that ranges in thickness from less than 0.5 foot to greater than 5 feet thick in places.

Due to Site topography, the difference between depth to water measurements in existing monitoring wells is approximately 30 feet. Depth to water in the northern portions of the Site is approximately 43 feet bgs (well MW-3), whereas depth to water in the southern portions of the Site is measured at approximately 15 feet bgs (well MW-14). Groundwater flow beneath the Site was generally toward the south-southeast. The hydraulic gradient calculated based on Second Quarter 2016 groundwater gauging data was 0.0013 feet/foot (AA&AI, 2016b).

7.4 Selection of Chemicals of Potential Concern

The compounds observed in soil beneath the Site are typical of those found at petroleum refining facilities and include petroleum hydrocarbons and VOCs, including BTEX and benzene derivatives. COPCs identified for the Site are detailed in Section 6.

7.5 Distribution of COPCs

7.5.1 Soil

Soil data collected to date indicate that COPCs are present in soil throughout the vadose zone in the Northwest and Southwest Parcels and in a relatively small portion of the East Parcel. A discussion of the interpreted exceedance area in soil for each parcel is presented below and shown on Figure 7-2.

Total Petroleum Hydrocarbons in the gasoline, diesel, and oil range as well as VOCs have been identified as COPCs in vadose soil for the subject property. VOCs detected include aromatic - benzene derivative compounds, typical of petroleum refining facilities. Of note, fuel oxygenates, including MtBE and TBA, have not been historically detected in significant concentrations in Site soil, and are not considered COPCs for the Site. Soil analytical data collected during this investigation supplement and support the historical soil database for the Site, which confirms the presence of petroleum related constituents in subsurface soil within a significant portion of the Northwest and Southwest Parcels. Soil sampling conducted during this investigation within the northern area of the Northwest Parcel (previously recognized as a data gap area) identified elevated concentrations (above soil screening levels) of petroleum hydrocarbon constituents, ranging from light to heavy end, in the upper five to ten feet of soil.

TPHg (C4-C12) and TPHd (C13-C22) range are present above screening levels in soil within a significant portion of the Northwest Parcel and Southwest Parcel. Typical of sites where releases originated from the surface, elevated hydrocarbon concentrations in vadose zone have been detected throughout the vertical soil column to groundwater in some areas of the Site and have been shown to attenuate with depth within other areas of the Site.

Hydrocarbon impact to near surface soils (surface to 5 feet bgs) appears to occur throughout the Site, including the previously un-assessed northern portion of the Northwest Parcel. Hydrocarbon fractions in this near surface soil (much of which is fill) ranges from light end (gasoline range) to heavy end (oil range). Field screening of soil with a photo-ionization detector conducted during the current Site assessment activities, indicated significant areas of the Site where elevated VOCs are present within near surface and underlying soil. Upon redevelopment of the Site, excavation or grading activities will likely require a soil management plan be prepared and implemented.

Current and historic Site data indicate that volatile hydrocarbon constituents (i.e., VOCs) occur in vadose zone soil at concentrations above screening levels across both the Northwest and Southwest Parcels. These constituents represent the most mobile COPCs for the Site and are also considered the primary risk drivers for future Site occupants and protection of groundwater. Lithologic data have

identified a fine-grained, low permeability soil horizon that extends to an average depth of 10 feet bgs across the Site, which is underlain by coarser-grained sediments, including sand and silty sand. Based on this Site lithology and the significant presence of VOCs within vadose zone soils, soil vapor extraction (SVE) is a suitable remedial technology for the reduction of VOCs within the vadose zone.

7.5.2 Soil Vapor

Soil vapor data have been collected from on and offsite locations during investigations in 2006 (Tetra Tech), 2012 (Geosyntec), and 2016 (Apex-SGI). Data indicated that with the exception of a few isolated locations, COPC detections above applicable screening levels are limited to onsite. Figure 5-14 presents the benzene concentration in soil vapor samples at 5 feet bgs. Benzene concentrations are highest in the Northwest Parcel and generally exceed the SLs for commercial/industrial land use (840 µg/m^3). Soil vapor collected from offsite locations collected during prior studies (Appendix I) reported benzene concentrations that were below the residential land use SL of 97 µg/m^3. As mentioned previously in Section 6, offsite soil vapor concentrations exceeded SLs for chloroform and ethylbenzene; however, these concentrations were isolated to two locations and are not expected to be remedial drivers for the Site.

It is expected that remediation or mitigation of soil vapor will be required prior to Site redevelopment.

7.5.3 Groundwater

Groundwater data collected to date indicate that TPHg, TPH in the C13 to C22 carbon range (similar carbon range to TPH as diesel), BTEX, and naphthalene are generally the COPCs detected in the highest concentration in groundwater at the Site, which is consistent with its historical use a petroleum refinery. As shown on Figure 5-15 and Figure 5-16, TPHg and benzene were generally detected at the highest concentrations in the Northwest Parcel (up to 170,000 µg/L and 6,960 µg/L, respectively) with lower concentrations of TPHg detected in groundwater samples collected from the Southwest Parcel. Two localized areas of observed LNAPL and one suspected area of LNAPL are present as further discussed in Section 7.5.4 below.

Grab groundwater samples collected at multiple depths in the Northwest Parcel indicate that the highest concentration of petroleum compounds are generally found in shallow groundwater samples with lower concentrations found in deeper samples. The concentrations found in deeper samples appear to be due to diffusion from upper, higher-concentration areas. However, the vertical extent of petroleum-impacted groundwater has not been defined. As discussed in Section 8, additional grab groundwater samples will be collected to define the vertical extent of impacted groundwater at the Site prior to submission of the Response Plan.

Petroleum constituents were not detected in groundwater underlying the East Parcel at concentrations above SLs.

MtBE was primarily detected in groundwater samples collected offsite west of Gundry Avenue. The lack of MtBE detections in groundwater samples collected onsite coupled with the highest

concentration of MtBE detected in an offsite well located west and hydrologically cross-gradient of the Site (well MW-17) suggests that an offsite source of MtBE is present.

7.5.4 Nature and Extent of LNAPL

Site investigation activities have defined two areas of the Site where LNAPL is present in the subsurface, and one area where LNAPL is suspected to be present.

Historically (mid to late 1980's), LNAPL presence was reported to occur at the Site in three separate and localized areas (TEC, 2001). LNAPL was reportedly encountered within two locations in the Northwest Parcel and at a third location within the southern portion of the Southwest Parcel. The two LNAPL areas previously defined within the Northwest Parcel coincide with the two locations of LNAPL occurrence, as defined by the current investigation. The LNAPL presence identified through UVOST™ screening during this investigation within the Southwest Parcel, does not appear to have been previously identified within past environmental investigations.

The two areas of documented LNAPL occurrence within the Northwest Parcel are defined for the purpose of this investigation as the eastern LNAPL area and the western LNAPL area. These two areas generally coincide with the two areas where LNAPL was present historically (mid to late 1980's) and where product recovery wells R-4 and R-5 were previously located. The eastern LNAPL area within the Northwest Parcel is documented by the continued presence of LNAPL within groundwater monitoring well MW-11 (Figure 5-15). Prior to bail-down testing conducted in January 2017, an LNAPL thickness of approximately 1.6 feet was present within well MW-11. The western LNAPL area was inferred from high UVOST™ responses (greater than 50% of the response for the Reference Solution) in borings AN-09, AN-11, and AN-12, and confirmed through the collection of an LNAPL sample within boring AN-13. Elevated UVOST™ responses generally coincided with current groundwater elevations, and based on follow-on soil sampling are interpreted as potentially representing LNAPL at the water table interface. The potential lateral extent of LNAPL estimated in the two Northwest Parcel occurrences is depicted in Figure 5-15.

Historically, the LNAPL in the two above-referenced Northwest Parcel locations was characterized as a combination of naphtha, kerosene, and gas-oil, with an API gravity ranging between 44.9 and 47.3 (TEC, 2011). The measured specific gravity of the two LNAPL samples collected during this investigation (from well MW-11 and boring AN-13) were 0.8185 and 0.8492, respectively, which corresponds to an API gravity of 41.5 and 35 (similar to the light- to mid-range products encountered historically beneath the Northwest Parcel).

A third LNAPL presence is inferred in the northern portion of the Southwest Parcel, based upon elevated UVOST™ responses in borings AS-01, AS-02, AS-03 and AS-06. This potential LNAPL presence is located north of the LNAPL area identified in the mid to late 1980s (location of former recovery well R-6), at the southern boundary of the Southwest Parcel. Historically, LNAPL within the southern portion of Southwest Parcel was characterized as heavy crude oil or lubricating oil. An LNAPL sample from the recently defined northern LNAPL area has not been collected, and the

character of the LNAPL has not been defined. The estimated extent of LNAPL within the northern portion of the Southwest Parcel is depicted in Figure 5-15.

Using the areas of observed or suspected LNAPL at the Site from monitoring wells and/or UVOST data (Figure 5-15, the estimated LNAPL thickness from the bail-down testing (0.18 feet), and assuming a 30% formation porosity, the estimated LNAPL volume beneath the Site is approximately 5,958 gallons.

The rate of LPH recovery into the MW-11 well casing during bail-down testing was slow, averaging approximately 0.12 gallons per day (average recovery throughout testing) with 100% LNAPL recovery into well MW-11 estimated at slightly more than one (1) week. LNAPL accumulation at the water table interface is inferred to be relatively thin (0.18 foot to 0.5 foot in thickness). Due to the relatively thin accumulations as well as the apparent slow LNAPL recharge rates, passive methods of LNAPL recovery, such as passive skimmers, will likely be the most feasible LNAPL remedial method for this Site.

7.6 Chemical Release Mechanisms and Identification of Transport Media

In this section, chemical properties of the COPCs and the physical characteristics of the Site were reviewed to identify the factors that might allow the release of a chemical to the environment, and transport to or through soil, soil vapor, and groundwater.

Future planned redevelopment of the Site will include commercial building(s) and concrete/asphalt paving across the Site, which will limit direct contact with soil for potential onsite receptors. Although direct contact with soil is likely an incomplete exposure pathway for future onsite receptors, it was conservatively included as a potential exposure pathway. Further release of chemicals can potentially occur through volatilization, wind and/or mechanical erosion (i.e., during construction), migration of chemicals into the groundwater, lateral migration of chemicals in groundwater, or migration of chemicals via stormwater runoff. These types of releases may result in chemical vapor or dust (with sorbed chemicals) emissions in air, or the movement of chemicals downward into groundwater with infiltrating rain water (i.e., leaching from soil) or stormwater runoff into surface water and sediment. These potential release mechanisms are discussed in more detail below.

7.6.1 Volatilization of Chemical Vapors

Some of the chemicals detected at the Site are VOCs. These chemicals typically have a low organic-carbon partition coefficient (K_{oc}), a low molecular weight, and a high Henry's Law constant, indicating that these chemicals may volatilize. Therefore, volatilization of VOCs was considered a potential release mechanism for COPCs.

7.6.2 Emission of Fugitive Dust

Some chemicals (e.g., metals in soil) adsorb readily to dust particles. Chemicals adsorbed to soil particles can be blown into the air by wind and/or mechanical erosion. This is referred to as fugitive dust. The predominant Site-related contaminants include VOCs, which typically volatilize.

Therefore, exposure to chemicals in soil via fugitive dust emissions was not considered a significant release mechanism for COPCs.

7.6.3 Leaching

The potential for chemicals to leach from soil depends on the physical and chemical properties of the chemicals, soil type, pH (for metals), and other site-specific conditions. For example, chemicals with high water solubilities tend to leach more readily than chemicals with lower solubilities. In addition, a chemical's K_{oc} is important for assessing the degree of chemical sorption to soil particles; chemicals with a high sorption potential do not tend to leach as readily (i.e., metals). Site-specific conditions are also important for assessing whether leaching may occur, such as soil type (leaching occurs more readily in sandy soils than in clayey or silty soils), amount of rainfall, gradient, etc.

The evaluation of chemical concentrations in soil for groundwater protection (soil leaching) is designed to address the potential leaching of chemicals from vadose zone soils and their subsequent impact on groundwater. Leaching potential of COPCs from vadose zone soil into groundwater may be a potential chemical release mechanism.

7.6.4 Lateral Migration of Groundwater into Offsite Areas

The surrounding offsite area includes industrial and residential land use. Groundwater flow at the Site is generally to the south-southeast with a low horizontal hydraulic gradient. Due to the approximate depth to first encountered groundwater of 15 feet bgs in the southern portion of the Site to 43 feet bgs in the northern portion of the Site, hypothetical receptors in offsite areas are not expected to have direct contact with groundwater. However, any Site-related contaminants in groundwater may migrate offsite and potentially impact indoor air via vapor intrusion. Potential vapor intrusion exposure pathways from contaminants in the subsurface (soil, soil vapor, and groundwater) are generally evaluated using soil vapor data. During previous Site investigations, soil vapor samples were collected along the southern downgradient boundaries of the Site and in the offsite areas. Therefore, exposure to chemicals in soil vapor via lateral migration into offsite areas was considered a potential release mechanism for COPCs.

In 2010, an evaluation of soil vapor intrusion was completed related to the assessment of human health risk due to indoor inhalation of vapors migrating from the subsurface into residences located south of the Site. Results of the study indicated that potential soil vapor intrusion is not likely to be a concern for current residents south of the property boundary (Exponent, 2010). Office of Environmental Health Hazard Assessment (OEHHA) generally concurred with this conclusion in a letter dated January 21, 2011, pending the collection of additional samples. An offsite soil gas investigation was conducted in 2012 and results were incorporated into a second updated vapor intrusion evaluation. The updated evaluation was documented in a letter dated October 8, 2012 (ToxStrategies, 2012) and concluded that "*potential soil vapor intrusion is not likely to be of concern for current offsite residents south or southwest of the former Chemoil Refinery property under the conditions evaluated*".

7.6.5 Stormwater Runoff

Stormwater runoff from areas of contaminated soil has the potential to transport contaminants bound to soil particles. There are no known surface water bodies within a ½-mile of the Site. Future redevelopment plans include commercial building(s) and concrete/asphalt paving across the Site, and will include engineering controls related to stormwater runoff from the Site. The potential chemical release via stormwater runoff is not identified as a significant chemical release mechanism.

7.7 Potential Human Receptors

The third component necessary for an exposure pathway to be complete is identification of potential receptors at the Site. The following hypothetical human receptors were identified on the basis of proximity to the Site, proposed activities that could possibly result in direct or indirect contact with Site-related chemicals, and anticipated Site use.

- Future Onsite Construction/Utility Trench Worker Receptor;
- Future Onsite Commercial/Industrial Worker Receptor;
- Current/Future Offsite Commercial/Industrial Worker Receptor; and
- Current/Future Offsite Resident Receptor.

7.8 Potential Exposure Points

The other portion of the third component necessary for an exposure pathway to be complete is a point of contact between the contaminated medium and the receptor (i.e., the exposure point). For the purposes of this CSM, it is assumed that access to the Site is unrestricted and that onsite receptors may be exposed directly to contaminated soil and indirectly to soil vapor and groundwater. During redevelopment of the Site, outdoor construction/utility trench worker receptors may be directly exposed to soil. Future planned redevelopment of the Site will include commercial building(s) and concrete/asphalt paving across the Site, which will limit direct contact with soil for potential onsite receptors. For soil, the exposure point is assumed to be the area within the Site boundaries.

In general, any hypothetical onsite construction worker receptor will be performing activities consistent with an SMP and a Site-specific HASP. The HASP will require the use of proper personal protective equipment (PPE) and the best management practices (BMPs) will require dewatering to preclude any direct contact with groundwater for workers at the Site. With depth to groundwater ranging from 15 feet bgs in the southern portion of the Site to 43 feet bgs in the northern portion of the Site, direct contact with groundwater for onsite workers was not considered further.

Volatile compounds can be released from the subsurface into outdoor and indoor air resulting in an indirect exposure to contaminants in soil, soil vapor, and groundwater. Inhalation of VOCs in outdoor air is generally negligible due to dispersion in ambient air. For the volatilization pathway into indoor air, exposure to subsurface contamination is best characterized through the collection of soil vapor or groundwater samples. For onsite and offsite receptors, the exposure point for vapor intrusion into

indoor air is assumed to be the soil vapor or groundwater beneath areas occupied by onsite commercial buildings or offsite residences.

7.9 Exposure Pathways Considered Potentially Complete and Significant

The fourth and final component, a complete exposure pathway (i.e., route of exposure) is discussed in combination with the third component (i.e., presence of receptors at an exposure point) to define those exposure pathways considered to be complete and significant. The following sections summarize those pathways considered complete and significant for each receptor. This information is summarized schematically on Figure 7-1.

7.9.1 Hypothetical Future Onsite Construction/Utility Trench Worker Receptor

The hypothetical onsite construction/utility trench worker receptor is included in this CSM in the event any construction or redevelopment occurs at the Site. This receptor is expected to be a short-term outdoor worker (i.e., 2 weeks to 7 years [USEPA, 1989]) that spends 250 days per year performing construction projects at the Site. The exposure duration for this receptor is one year. This receptor spends the workday outdoors performing construction-related tasks. This receptor is expected to encounter both surface and subsurface soils down to a depth of 10 feet bgs and has a very high soil ingestion rate of 330 milligrams per day (mg/day). Inhalation of chemical vapors while indoors was not considered a complete and significant exposure pathway because this receptor is not expected to be working inside buildings. The exposure pathways assumed to be complete and significant for the hypothetical onsite construction/utility trench worker receptor are:

- Incidental ingestion of soil;
- Dermal contact with soil; and
- Inhalation of vapors in outdoor air.

7.9.2 Hypothetical Future Onsite Commercial/Industrial Worker Receptor

The hypothetical onsite commercial/industrial worker receptor is included in this CSM based on expected future land use. This receptor is a long-term receptor (i.e., greater than 7 years [USEPA, 1989]). This receptor is a full-time employee that is assumed to spend 250 days per year at work for 25 years. This receptor spends the workday (8 hours per day) conducting activities indoors and outdoors. Although inhalation of vapors in outdoor air may be complete, outdoor air concentrations are typically lower than indoor air concentrations due to dispersion; such relatively minor exposures are subsumed by the assumption that all exposure is from indoor air. The Site is expected to be capped by a building and concrete/asphalt paving, which would significantly limit any direct contact with soil. The exposure pathways assumed to be complete and significant for the hypothetical onsite commercial/industrial worker receptor are:

- Incidental ingestion of soil;
- Dermal contact with soil; and

- Inhalation of vapors in indoor air.

7.9.3 Hypothetical Current/Future Offsite Commercial/Industrial Worker Receptor

The hypothetical offsite commercial/industrial worker receptor is included in this CSM based on current and expected offsite land use. This receptor is a long-term receptor (i.e., greater than 7 years [USEPA, 1989]). This receptor is a full-time employee that is assumed to spend 250 days per year at work for 25 years. This receptor spends the workday (8 hours per day) conducting activities indoors and outdoors. Although inhalation of vapors in outdoor air may be complete, it is a relatively minor exposure due to significant dispersion in outdoor air that is subsumed by the assumption that all exposure is from indoor air. Since this receptor is located offsite, this receptor will not have direct contact with the Site and will only be potentially exposed to vapor intrusion impacts from subsurface sources (e.g., soil vapor and groundwater). The exposure pathway assumed to be complete and significant for the hypothetical offsite commercial/industrial worker receptor is:

- Inhalation of vapors in indoor air.

7.9.4 Hypothetical Current/Future Offsite Resident Receptor

The hypothetical offsite resident receptor is included in this CSM based on current and expected offsite land use. This receptor is expected to be a long-term resident that lives offsite. This receptor is assumed to spend 350 days per year as a resident for a period of 26 years (as both a child [6 years] and an adult [20 years]). Potential exposures for this receptor are expected to occur both outdoors and indoors. Although inhalation of vapors in outdoor air may be complete, it is a relatively minor exposure due to significant dispersion in outdoor air that is subsumed by the assumption that all exposure is from indoor air. Since this receptor is located offsite, this receptor will only be potentially exposed to vapor intrusion impacts from subsurface sources (e.g., soil vapor and groundwater). The exposure pathway assumed to be complete and significant for the hypothetical offsite resident receptor is:

- Inhalation of vapors in indoor air.

Groundwater quality within the Site vicinity is generally poor due to seawater intrusion and elevated salinity. Shallow groundwater is not currently used and is not likely to be developed for beneficial use. Risk management measures can be implemented to ensure that groundwater is not used. Therefore, domestic use of groundwater was not considered a complete exposure pathway.

8.0 CONCEPTUAL REMEDIAL APPROACH

Based on the results of the information herein, remedial actions are warranted in groundwater, soil, and soil vapor prior to redevelopment of the Site. A Response Plan will be prepared to provide rationale and detail a proposed remedial approach to mitigate Site risk to levels acceptable for the proposed Site redevelopment plan. The paragraphs below provide the remedial action objectives (RAOs) and a conceptual remedial approach which is expected to be included in the upcoming Response Plan.

8.1 Remedial Action Objectives

The preliminary conceptual remedial approach has been developed considering the RAOs, which take into account exposure pathways to human receptors and the environment. The RAOs for this project are defined by medium-specific criteria to be protective of human health and the environment at the facility and surrounding properties. The RAOs were developed to address:

- Contaminant sources and affected media of concern (soil, soil vapor, and groundwater),
- Site-specific contaminants of concern, and
- Potential exposure pathways for human and ecological receptors.

The following RAOs have been developed for the Site:

- Reduce and/or maintain human health risks to acceptable levels to allow redevelopment of the Site for light industrial/commercial purposes.
- Prevent soil-related exposures (i.e., incidental ingestion, direct dermal contact, particulate inhalation and outdoor vapor inhalation of VOCs) to constituent concentrations exceeding commercial/industrial cleanup goals (to be determined).
- Prevent indoor inhalation through vapor intrusion of constituent concentrations exceeding commercial/industrial cleanup goals (to be determined).
- Reduce the potential for adsorbed-phase petroleum constituents in soil to leach to groundwater underlying the Site.
- Remove to the extent practical, mobile LNAPL within the three defined LNAPL areas of occurrence (source removal).
- Control the dissolved-phase hydrocarbon groundwater plume to prevent further offsite migration of contaminants at concentrations above levels that present a risk.

8.2 Conceptual Remedial Approach

The preliminary conceptual remedial approach which will be presented in detail in the upcoming Response Plan is as follows:

1) Develop Site-Specific, Risk-Based Cleanup Goals

Values presented in Section 4 are screening levels used to determine COPCs for the Site. Site-specific cleanup goals will be derived to determine whether remediation or mitigation is ultimately warranted and to provide a benchmark for the cessation of remediation actions. Details regarding the rationale and derivation of Site-specific cleanup goals will be included in the Response Plan.

2) Implement Actions in Conjunction with Site Redevelopment

Site redevelopment activities will require portions of the Site be graded. During grading, impacted soil (where encountered) can be managed for offsite disposal. Removal of hydrocarbon-impacted shallow soils will reduce the potential for incidental exposure (i.e., ingestion and dermal contact), as well as potentially reducing vapor intrusion risk following Site redevelopment.

3) Remediate Secondary Sources and Onsite Dissolved Phase Contaminants to the Extent Practicable

The compounds observed in Site media are typical of those found at petroleum refining facilities and include petroleum hydrocarbons and VOCs including BTEX and benzene derivatives. Based on the distribution of petroleum hydrocarbons (including isolated areas of LNAPL) within the affected Site media, various remedial technologies will be required for removal of secondary sources and dissolved phase contaminants. Remedial technologies which are expected to be included in the proposed remedial approach are:

- LNAPL Recovery: Soil screening utilizing UVOST™ and laboratory analysis of LNAPL and LNAPL affected soil indicates that LNAPL is localized to two known and one potential area of the Site. Preliminary testing has shown that hydrocarbon recovery rates are likely to be low, based upon the Site lithology and nature of the LNAPL. Passive recovery techniques, such as passive skimmers or absorbent socks, or potentially recurrent product bailing would be employed to remove LNAPL to the extent practicable.
- Soil Vapor Extraction (SVE): SVE is an effective and proven remedial technology for removing the volatile and more mobile light end petroleum constituents from subsurface soil. Removal of VOCs from the subsurface by SVE will reduce the potential for vapor intrusion risk following redevelopment activities and the potential for the more mobile lighter end petroleum constituents in soil to leach to groundwater.
- Air Sparging (AS): The observed chemistry has established that a significant portion of the dissolved phase hydrocarbon mass is volatile, treatable using AS, and recoverable using the SVE system. Air sparging is an effective and proven remedial technology for removing the volatile and more mobile light end petroleum constituents from groundwater.

4) Reduce Further Offsite Contaminant Migration

Currently, a flow-through barrier groundwater treatment system (the SME system) is operating along the western and southern boundaries of the Site. The Response Plan will include continuation of a boundary zone remediation system to reduce offsite migration of contaminants to levels that do not pose an unacceptable risk. The barrier approach may include elements of the existing SME system or a new approach may be proposed, based on results of a feasibility study.

5) Implement Administrative and Institutional Controls to Reduce Potential Exposure Pathways

Administrative and institutional controls will be implemented prior to development on each portion of the property, as required in the California Land Reuse and Revitalization Act Agreement (CLRRA)prepared for the Site. Expected controls include a land use covenant (LUC) and Site Management Plan (SMP). The LUC will prohibit use of underlying groundwater and prohibit unrestricted or sensitive land uses. Engineering controls, that will be included as a requirement of the SMP, will include vapor mitigation system(s) that will be installed as part of the future buildings constructed for the Site.

6) Implement a Monitored Natural Attenuation Program for Offsite Groundwater

As indicated by prior assessments (discussed previously in Section 7.6.4), potential vapor intrusion is not likely to be of concern for residents downgradient from the Site. Concentrations in offsite groundwater are expected to decline over time with the implementation of remedial activities onsite and requirements for an active, downgradient remedial program are not expected in the Response Plan. A monitored natural attenuation (MNA) program will be proposed for groundwater downgradient from the Site.

8.3 Schedule

Apex-SGI recognizes that vertical delineation of groundwater was not accomplished as part of the Site investigation. Because dissolved concentrations below existing known depths are related to the higher, shallower concentrations, the preliminary conceptual approach outlined above is not expected to change based on results of vertical delineation. Sufficient data are available to prepare a Response Plan and initiate steps toward approval of a remedial program for the Site. Vertical delineation of contaminants in groundwater will be conducted prior to submission of the Response Plan.

As indicated in the CLRRA Agreement, the Response Plan shall be submitted to LARWQCB by June 14, 2017. Prior to submitting the Response Plan, Apex-SGI is requesting a meeting to review our conceptual approach and to address any immediate concerns with LARWQCB. We are requesting a meeting with LARWQCB within 30 days of submission of this report.

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USEPA. 2016. Regional Screening Levels (RSLs). May.

10.0 LIMITATIONS

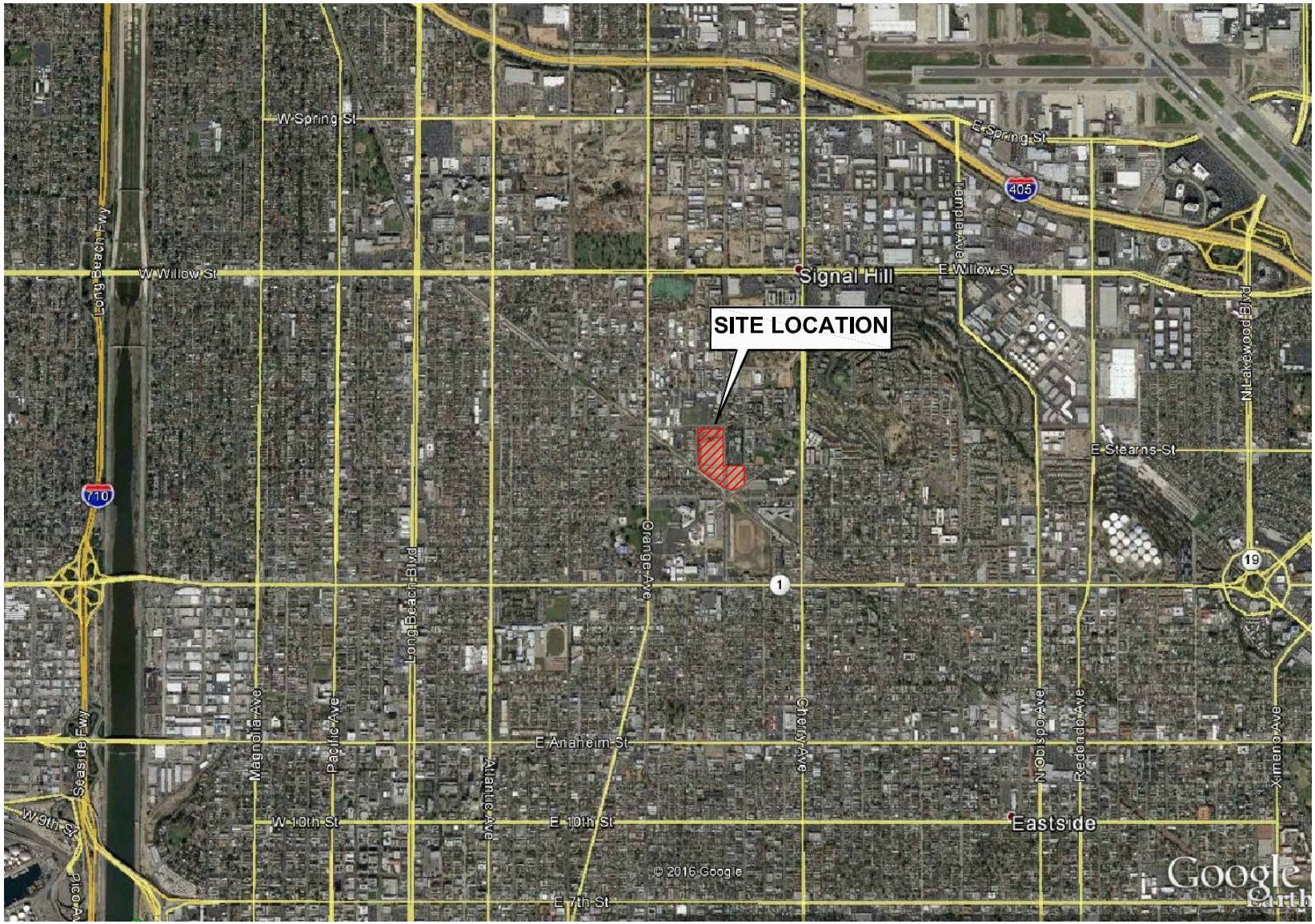
This document has been prepared for the exclusive use of SHE, RES, and their representatives as it pertains to the affected property as described above. Any interpretation of the data represents our professional opinions, and is based in part on information supplied by the client. These opinions and information are based on currently available data and are arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location.

The data presented in this transmittal are intended only for the purpose, site location, and project indicated. This report is not a definitive study of contamination at the site and should not be interpreted as such. The data reported are limited by the scope of the work as defined by the request of the client, the time, availability of access to the site, and information passed to Apex-SGI.

There are no representations or guarantees that the sampling points are representative of the entire site. Data collected in response to this work may reflect the conditions at specific locations at a specific point in time and does not reflect subsurface variations that may exist between sampling points. These variations cannot be anticipated nor can they be entirely accounted for even with exhaustive additional testing. No other interpretations, warranties, guarantees, expressed or implied, are included or intended in the contents of this transmittal.

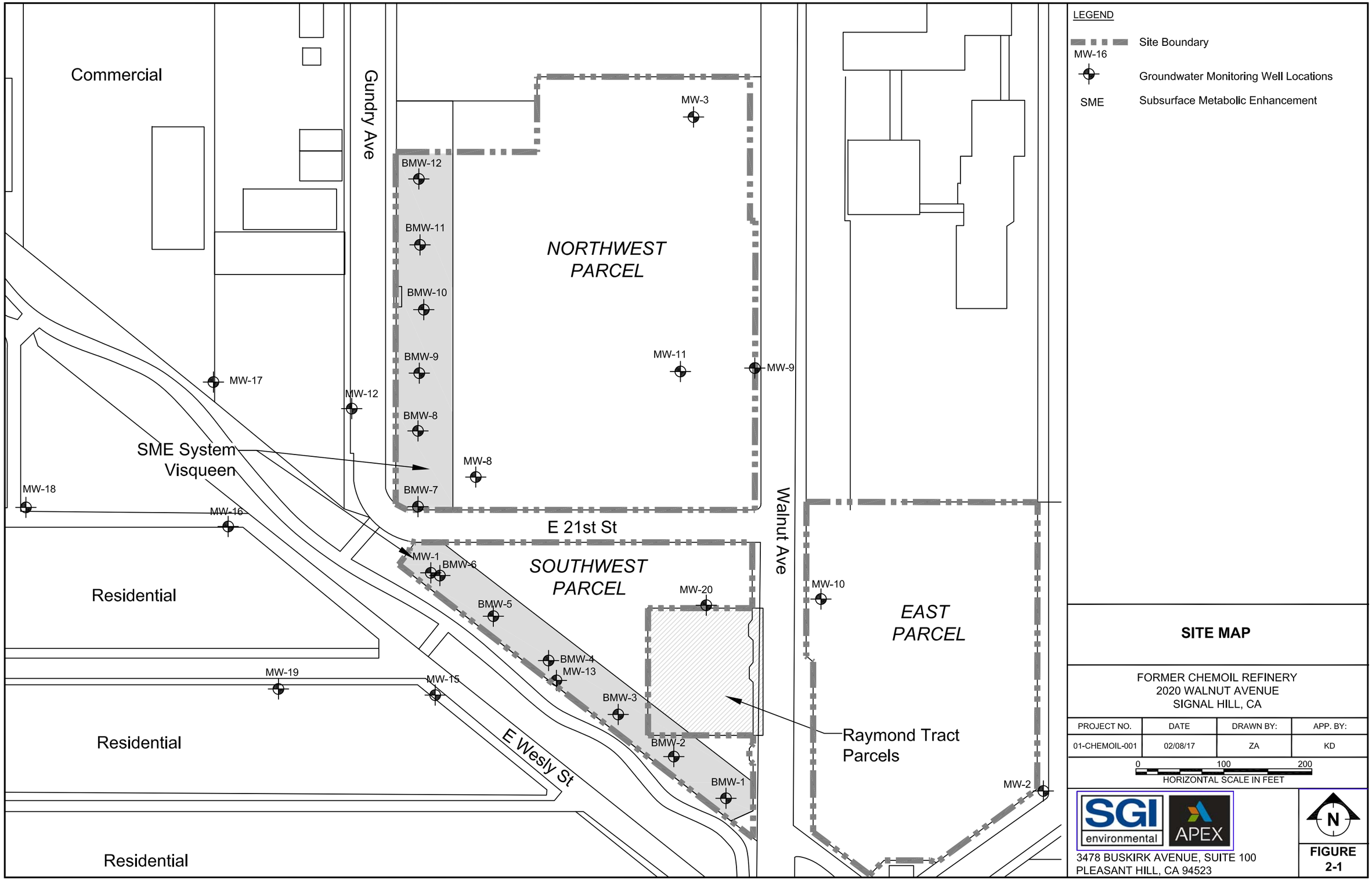
As required, all proposed work will be performed under the direct supervision of a Professional Geologist or Registered Civil Engineer as defined in the Registered Geologist Act of the California Code of Regulations.

FIGURES



SGI environmental / APEX 3478 BUSKIRK AVENUE, SUITE 100 PLEASANT HILL, CA 94523	FORMER CHEMOIL REFINERY 2020 WALNUT AVENUE SIGNAL HILL, CA			**SITE LOCATION MAP**	N
	PROJECT NO. 093-CHEMOIL-001	DATE 02/13/17	DR.BY: ZA	APP. BY: KD	0 2500 5000 HORIZONTAL SCALE IN FEET

FIGURE 1-1



S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.2-1-Site Map.dwg, 3/29/2017 10:54:42 AM

SITE MAP

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-CHEMOIL-001	02/08/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 2-1

Commercial

Gundry Ave

Walnut Ave

E 21st St

E Wesly St

Residential

Residential

Residential

SME System
Visqueen

Raymond Tract
Parcels

MW-17
MW-12
MW-18
MW-16
MW-19
MW-15
MW-1
MW-8
MW-7
MW-3
MW-11
MW-9
MW-10
MW-20
MW-13
MW-2

BMW-12
BMW-11
BMW-10
BMW-9
BMW-8
BMW-7
BMW-6
BMW-5
BMW-4
BMW-3
BMW-2
BMW-1

N1
N2
N5
N-8
SB-1
SB-2
SB-3
SB-4
S1
S2
S3
S4
S-5
S-6
S-7

AN-12
AN-11
AN-21
AN-15
AN-09
AN-10
AN-16
AN-18
AN-19
AN-17
AS-01
AS-02
AS-05
AS-03
AS-06
AS-10
AS-04
AS-09

AE-01
AE-02
AE-03
E1
E2
E3
E6

LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- S4 — 2006 ROST™ Boring Location
- AN-15 — 2016 UVOST™ Boring Location
- AN-19 — 2016 MIP© Boring Location
- MIP — Membrane Interface Probe
- SME — Subsurface Metabolism Enhancement
- UVOST — Ultra-Violet Optical Screening Tool
- ROST — Rapid Optical Screening Tool

UVOST™/MIP© BORING LOCATIONS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/13/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

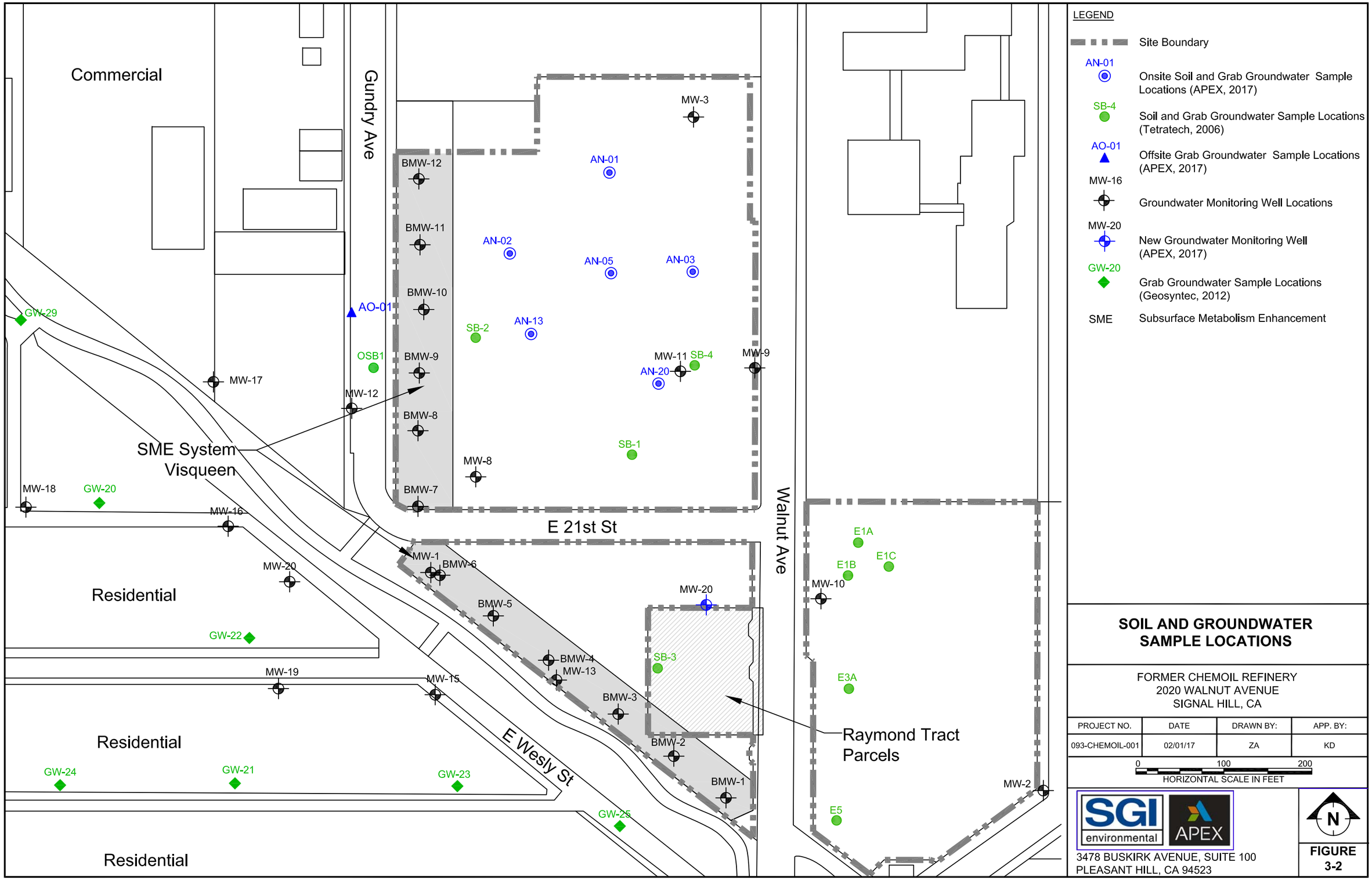
SGI environmental | APEX

3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 3-1

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.3-1-UVOST-MIP Boring Locations.dwg, 3/29/2017 10:56:08 AM



SOIL AND GROUNDWATER SAMPLE LOCATIONS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 3-2

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.3-2-Soil and GW Sample Locations.dwg, 3/29/2017 10:57:25 AM

LEGEND

- Site Boundary
- Wnt-4 — Soil Vapor Sampling Locations, (TEC, 2009/2010)
- AN-06 — Soil Vapor Sample Locations, (APEX, 2017)
- E1 — Soil Vapor Sample Locations, (Tetratech, 2006)
- SV-20 — Soil Gas Sampling Locations, (Geosyntec, 2012)

SOIL VAPOR SAMPLE LOCATIONS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-ChemOil-001	01/31/17	ZA	KD

0 150 300
HORIZONTAL SCALE IN FEET

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 3-3

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.3-3-SV Sample Locations.dwg, 3/29/2017 10:58:17 AM

Commercial

Gundry Ave

Walnut Ave

E 21st St

E Wesly St

SME System
Visqueen

Residential

Residential

Residential

Raymond Tract
Parcels

MW-1 MW-2 MW-3 MW-4 MW-5 MW-6 MW-7 MW-8 MW-9 MW-10 MW-11 MW-12 MW-13 MW-15 MW-16 MW-17 MW-18 MW-19 MW-20

BMW-1 BMW-2 BMW-3 BMW-4 BMW-5 BMW-6 BMW-7 BMW-8 BMW-9 BMW-10 BMW-11 BMW-12

AN-01 AN-02 AN-03 AN-05 AN-09 AN-10 AN-11 AN-12 AN-13 AN-15 AN-16 AN-17 AN-18 AN-19 AN-20 AN-21

AS-01 AS-02 AS-03 AS-04 AS-05 AS-06 AS-09 AS-10

AE-01 AE-02 AE-03

A0-01

A A'

B B'

LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Location
- AN-20 — Soil Boring and Grab Groundwater Location (Apex, 2017)
- AN-10 — 2016 UVOST™ Boring Location
- AN-21 — 2016 MIP© Boring Location
- UVOST — Ultra-Violet Optical Screening Tool
- SME — Subsurface Metabolism Enhancement

CROSS-SECTION LOCATION MAP

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-CHEMOIL-001	02/08/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

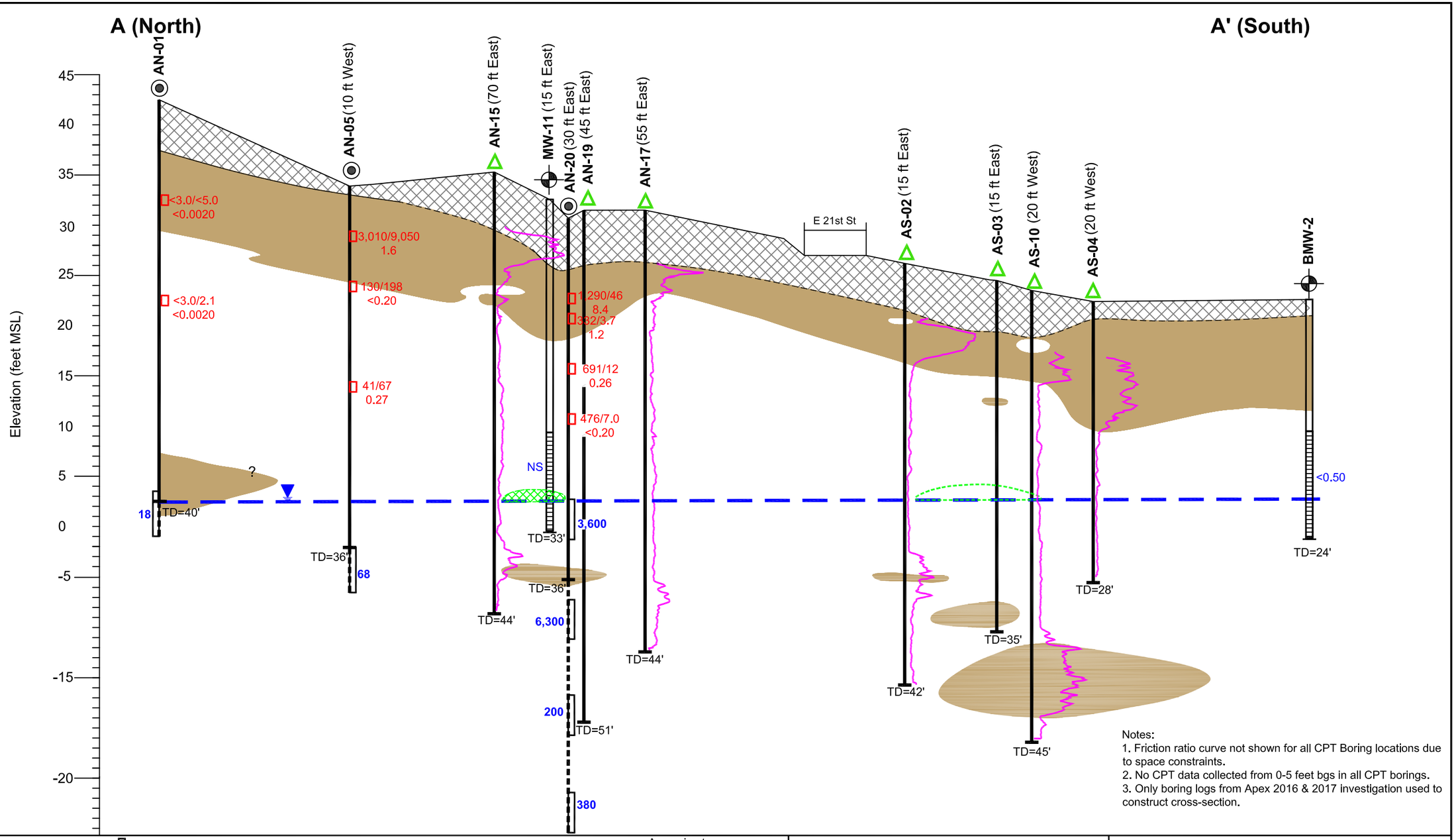
SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE
5-1

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-1,5-2,5-3-Cross Section Locations &Cross sections A-A' & B-B'.dwg, 3/29/2017 11:02:21 AM

A (North) — A' (South)



Notes:
1. Friction ratio curve not shown for all CPT Boring locations due to space constraints.
2. No CPT data collected from 0-5 feet bgs in all CPT borings.
3. Only boring logs from Apex 2016 & 2017 investigation used to construct cross-section.

LEGEND

- Fill
- Fine Grained Material
- Coarse Grained Material
- Lithologic Contact (Dashed Where Inferred)
- MSL — Mean Sea Level
- TD — Total Depth of Logged Boring In Feet
- Grab Groundwater Sample
- 68 — Benzene Concentration in Groundwater (micrograms per Liter)
- <0.50 — Not Detected Above Indicated Reporting Limit
- NS — Not Sampled
- Soil Not Logged. Boring Advanced For Grab Groundwater Sample Only
- Screened Interval, Monitoring Well Sample
- Potentiometric Surface
- CPT Boring (Apex, 2016)
- Soil Boring and Grab Groundwater Location (Apex, 2017)
- Monitoring Well Location
- 41/67 / 0.27 — Soil Sample: TPH(C5-C12) Concentration in Soil (milligrams per kilogram); TPH(C13-C22) Concentration in Soil (milligrams per kilogram); Benzene Concentration in Soil (milligrams per kilogram)
- Approximate Groundwater Elevation Measured in December 2016 Monitoring event by (AA&AI, 2016b)
- Friction Ratio From CPT Report (Apex, 2016)
- Free Product Observed
- Suspected Area of Free Product

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/21/17	ZA	KD

0 60 120
HORIZONTAL SCALE IN FEET

CROSS-SECTION A-A'

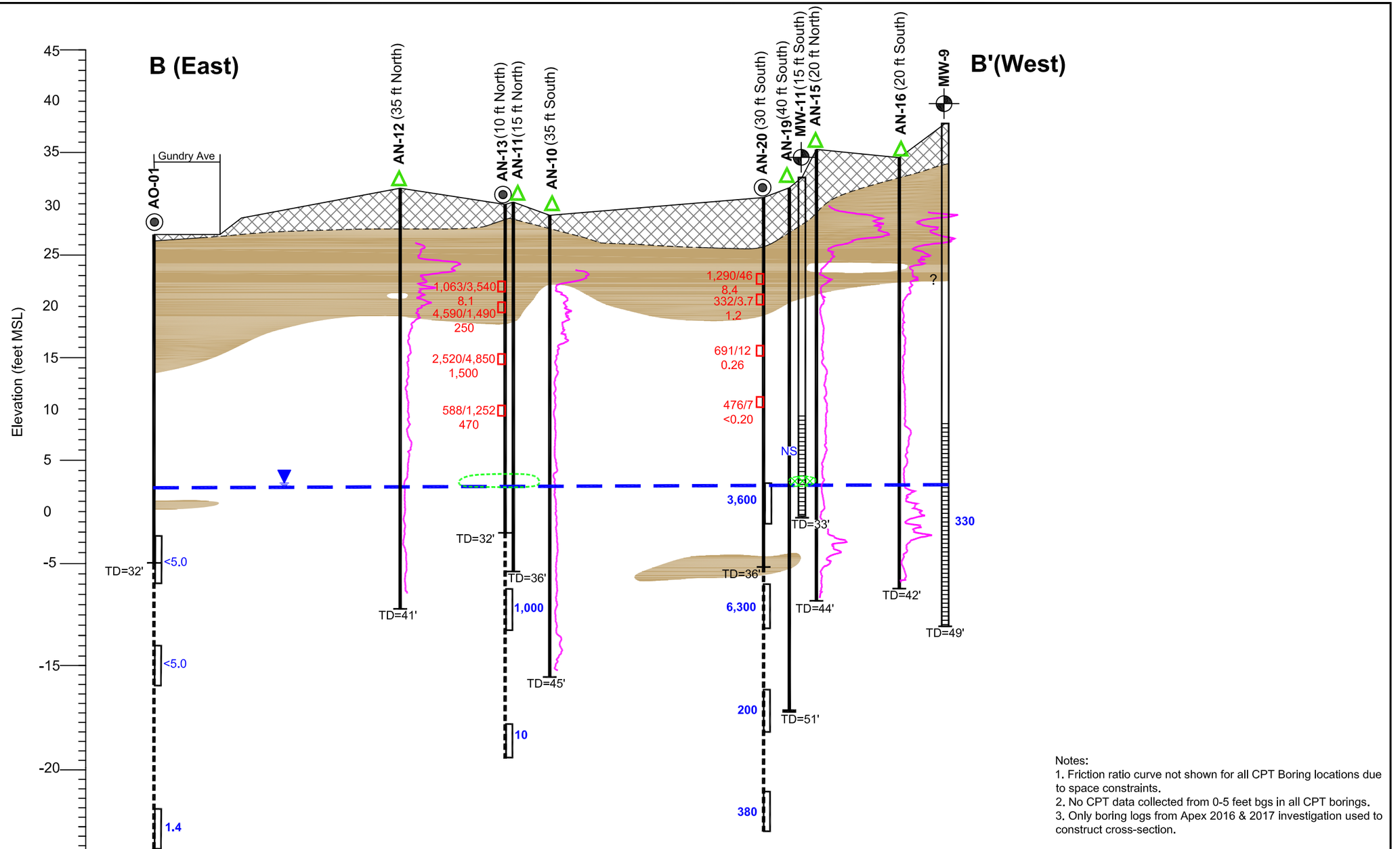
SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-2

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-1,5-2,5-3-Cross Section Locations &Cross sections A-A' & B-B'.dwg, 3/29/2017 11:03:22 AM

B (East) — B'(West)



Notes:
1. Friction ratio curve not shown for all CPT Boring locations due to space constraints.
2. No CPT data collected from 0-5 feet bgs in all CPT borings.
3. Only boring logs from Apex 2016 & 2017 investigation used to construct cross-section.

LEGEND

- Fill
- Fine Grained Material
- Coarse Grained Material
- Lithologic Contact (Dashed Where Inferred)
- MSL — Mean Sea Level
- TD — Total Depth of Logged Boring
- Grab Groundwater Sample
- 200 — Benzene Concentration in Groundwater (micrograms per Liter)
- Not Detected Above Indicated Reporting Limit
- NS — Not Sampled
- Soil Not Logged. Boring Advanced For Grab Groundwater Sample Only
- Screened Interval, Monitoring Well Sample
- Potentiometric Surface
- CPT Boring (Apex, 2016)
- Soil Boring and Grab Groundwater Location (Apex, 2017)
- Monitoring Well Location
- 2,520/4,850 / 1,500 — Soil Sample
- TPH(C5-C12) Concentration in Soil (milligrams per kilogram)
- TPH(C13-C22) Concentration in Soil (milligrams per kilogram)
- Benzene Concentration in Soil (milligrams per kilogram)
- Approximate Groundwater Elevation Measured in December 2016 Monitoring event by (AA&AI, 2016b)
- Friction Ratio From CPT Report (Apex, 2016)
- Free Product Observed
- Suspected Area of Free Product

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/21/17	ZA	KD

0 60 120
HORIZONTAL SCALE IN FEET

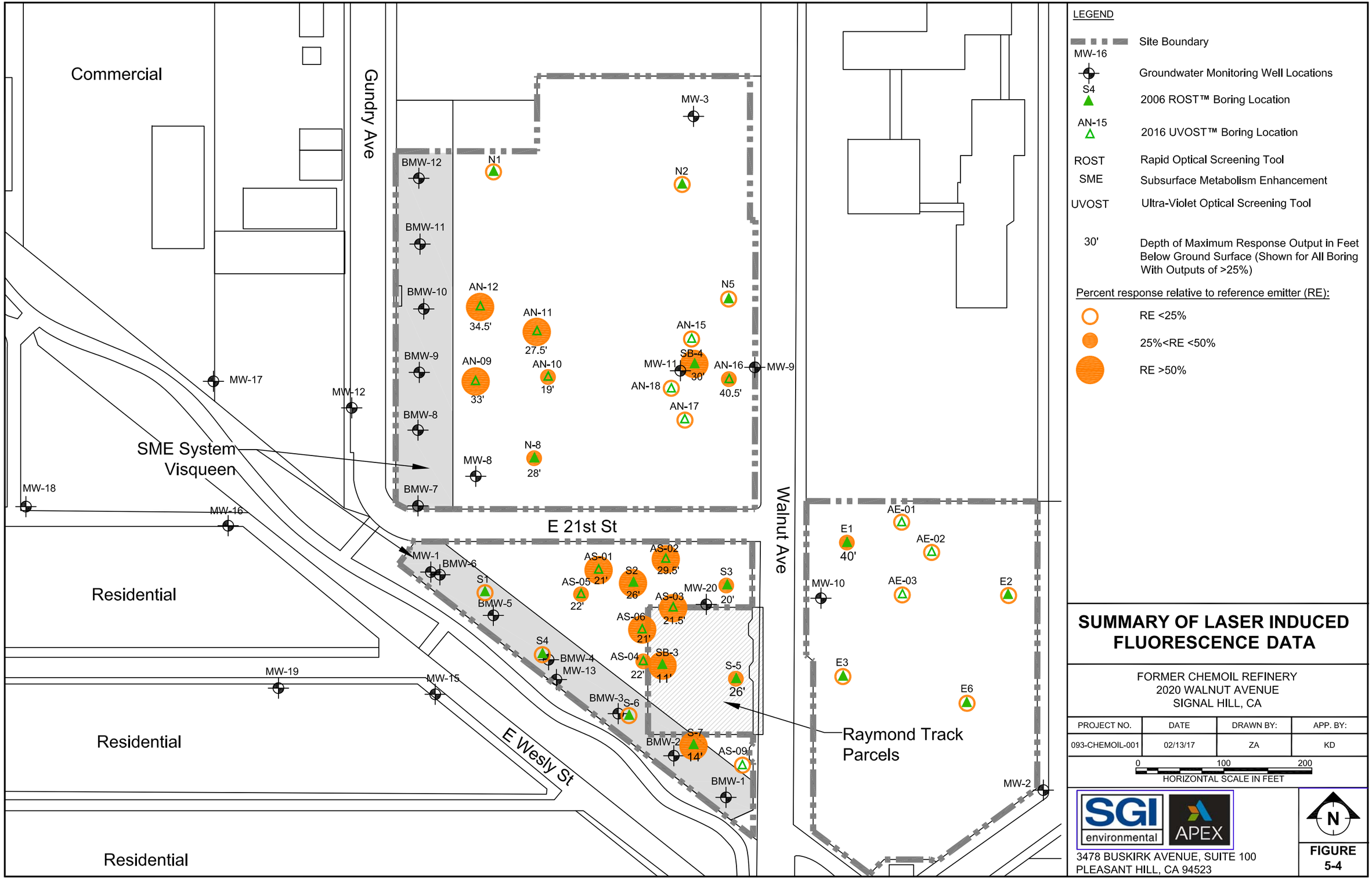
CROSS-SECTION B-B'

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-3

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-1,5-2,5-3-Cross Section Locations &Cross sections A-A' & B-B'.dwg, 3/29/2017 11:01:21 AM



LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- S4 — 2006 ROST™ Boring Location
- AN-15 — 2016 UVOST™ Boring Location
- ROST — Rapid Optical Screening Tool
- SME — Subsurface Metabolism Enhancement
- UVOST — Ultra-Violet Optical Screening Tool
- 30' — Depth of Maximum Response Output in Feet Below Ground Surface (Shown for All Boring With Outputs of >25%)

Percent response relative to reference emitter (RE):

- RE <25%
- 25%<RE <50%
- RE >50%

SUMMARY OF LASER INDUCED FLUORESCENCE DATA

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/13/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-4

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-4-Summary of Laser Induced Flouresence Results.dwg, 3/29/2017 11:05:02 AM

Commercial

Gundry Ave

AN-01
10' <0.50

AN-02
6.5' 370
10' 1.5

AN-05
5.0' 3,800
10' 620

AN-03
5.5' 19,000
10' 6,800

SB-2
5.0' 2,592
10' <4.5

AN-13
5.5' 8.1
9' 250

AN-20
8' 5,500
10' 1,200

SB-4
5.0' 11,782
10' 3,134

SB-1
4.0' 3,112
10' 440

SME System
Visqueen

E 21st St

Walnut Ave

7.0' 11

MW-20

4.0' 2,939
10' 1,124

SB-3

E1B
5.0' <4.5

E1C
5.0' 94

E3A
10' <4.5

Raymond Tract
Parcels

E5
5.0' <4.5
10' <4.5

Residential

Residential

E Wesly St

Residential

LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 5.5' | 19,000 — Depth in feet bgs; TPHg Concentration in mg/kg
- TPHg — Total Petroleum Hydrocarbons as Gasoline (C4-C12)
- (C4-C12) — Carbon Range
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <0.50 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of TPHg (C4-C12) are Above the Lowest Screening Level of 420 mg/kg

Note:
TPHg (C4-C12) measured by EPA method 8260B in APEX, 2017 samples. TPHg (C4-C12) measured by EPA method 8015 in Tetratech, 2006 samples.

SUMMARY OF TPHg (C4-C12) CONCENTRATIONS IN SOIL 0 to 10 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

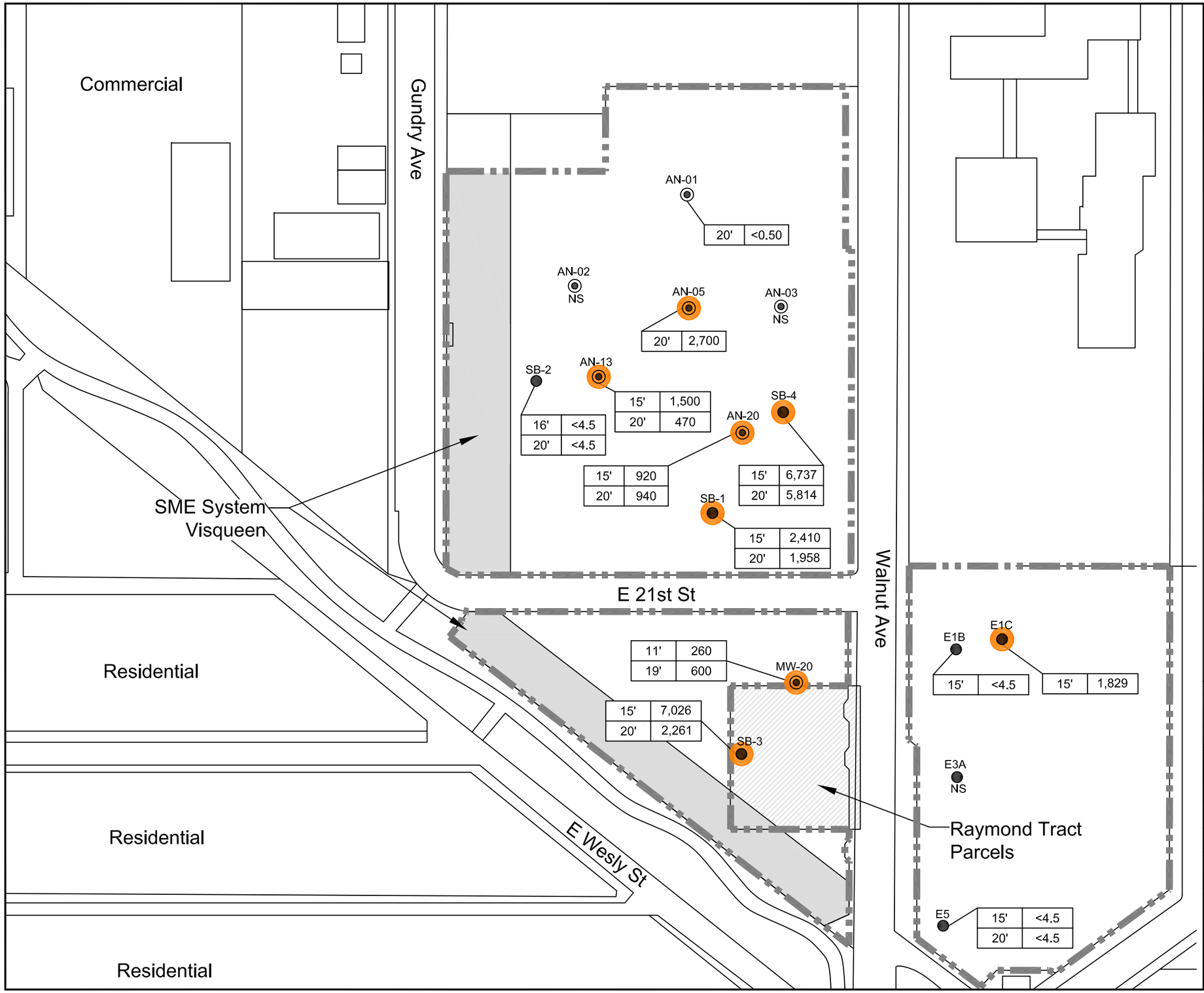
0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-5

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-5-Summary of TPHg (C4-C12) Concentration in Soil-0-10' BGS.dwg, 3/29/2017 11:34:27 AM



LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 20' | 2,700 — Depth in feet bgs | TPHg Concentration in mg/kg
- TPHg — Total Petroleum Hydrocarbons as Gasoline (C4-C12)
- (C4-C12) — Carbon Range
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <0.50 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of TPHg (C4-C12) are Above the Lowest Screening Level of 420 mg/kg

Note:
TPHg (C4-C12) measured by EPA method 8260B in APEX, 2017 samples. TPHg (C4-C12) measured by EPA method 8015 in Tetratech, 2006 samples.

SUMMARY OF TPHg (C4-C12) CONCENTRATIONS IN SOIL >10 to 20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-6

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-6-Summary of TPHg (C4-C12) Concentration in Soil-10-20' BGS.dwg, 3/29/2017 11:08:38 AM

Commercial

Gundry Ave

AN-01
NS

AN-02
30' | 380

AN-05
NS

AN-03
20.5' | 250

SB-2

AN-13
NS

25'	3.23
30'	2.7
35'	3,252

AN-20
NS

SB-4

25'	1,752
30'	3,799
35'	11,840
40'	5,769

SB-1

25'	2,243
30'	1,562
35'	1,296

SME System
Visqueen

E 21st St

Walnut Ave

Residential

Residential

Residential

MW-20
NS

25'	3,483

SB-3

E1B

E1C

25'	5.72

25'	4,999

E3A
NS

Raymond Tract
Parcels

E5
NS

E Wesly St

LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 30' | 380 — Depth in feet bgs | TPHg Concentration in mg/kg
- TPHg — Total Petroleum Hydrocarbons as Gasoline (C4-C12)
- (C4-C12) — Carbon Range
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of TPHg (C4-C12) are Above the Lowest Screening Level of 420 mg/kg

Note:
TPHg (C4-C12) measured by EPA method 8260B in APEX, 2017 samples. TPHg (C4-C12) measured by EPA method 8015 in Tetratech, 2006 samples.

SUMMARY OF TPHg (C4-C12) CONCENTRATIONS IN SOIL >20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

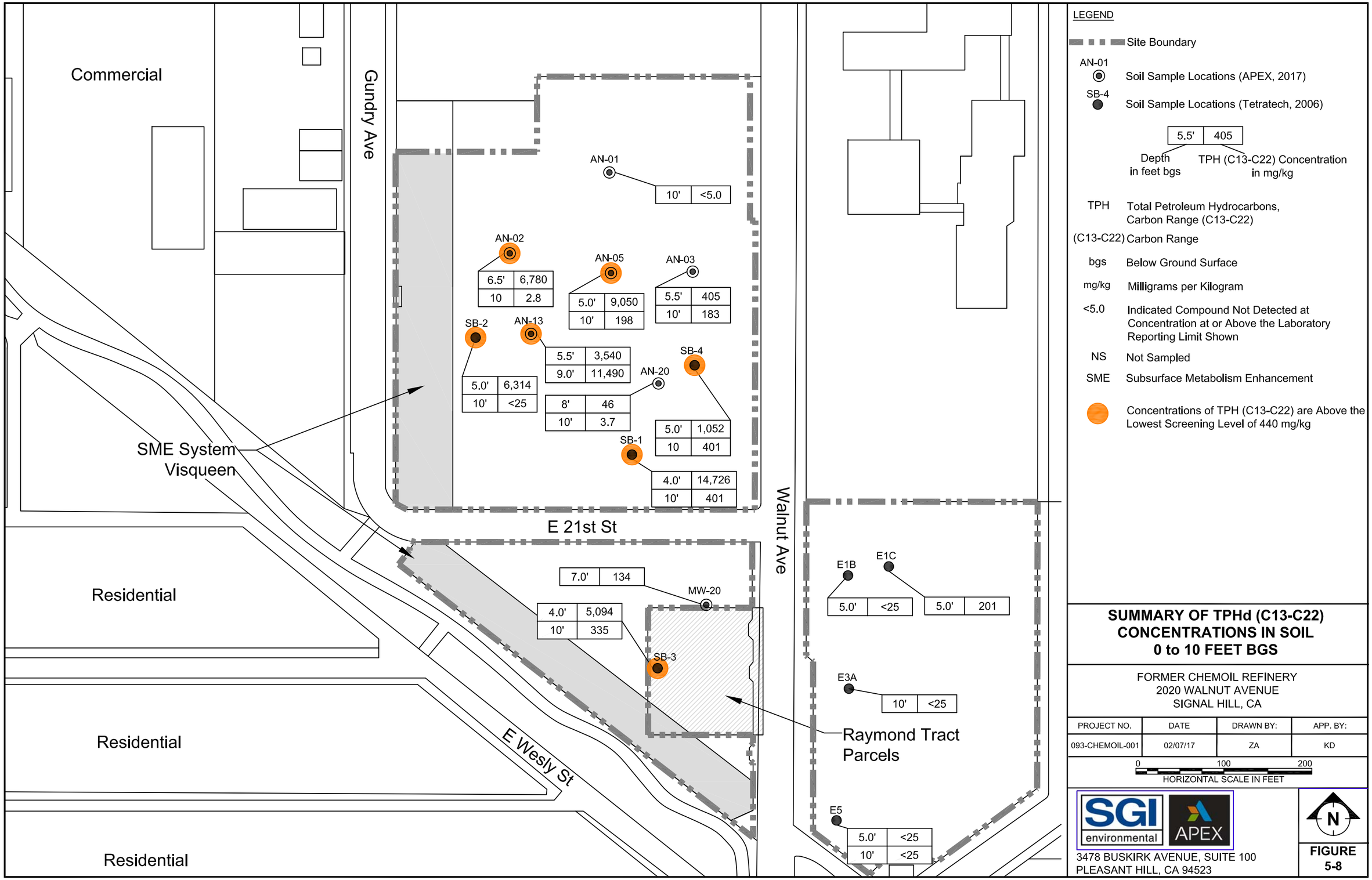
0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-7

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-7-Summary of TPHg (C4-C12)Concentration in Soil-20' BGS.dwg, 3/29/2017 11:11:55 AM



LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 5.5' | 405 — Depth in feet bgs | TPH (C13-C22) Concentration in mg/kg
- TPH — Total Petroleum Hydrocarbons, Carbon Range (C13-C22)
- (C13-C22) — Carbon Range
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <5.0 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of TPH (C13-C22) are Above the Lowest Screening Level of 440 mg/kg

SUMMARY OF TPHd (C13-C22) CONCENTRATIONS IN SOIL 0 to 10 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/07/17	ZA	KD

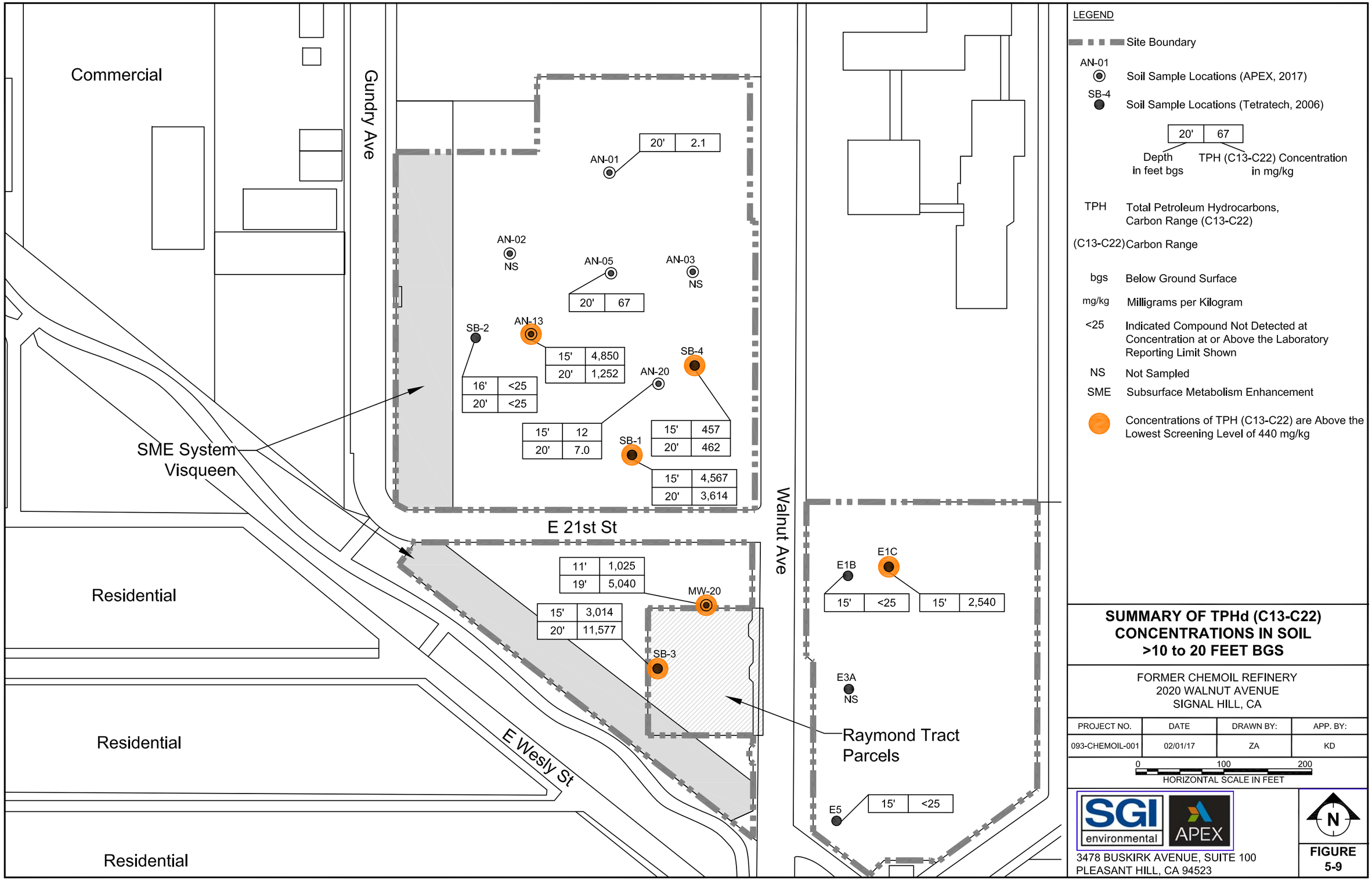
0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-8

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-8-Summary of TPH (C13-C22) Concentration in Soil-0-10' BGS.dwg, 3/29/2017 11:14:04 AM



LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 20' | 67 — Depth in feet bgs | TPH (C13-C22) Concentration in mg/kg
- TPH — Total Petroleum Hydrocarbons, Carbon Range (C13-C22)
- (C13-C22) — Carbon Range
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <25 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of TPH (C13-C22) are Above the Lowest Screening Level of 440 mg/kg

SUMMARY OF TPHd (C13-C22) CONCENTRATIONS IN SOIL >10 to 20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

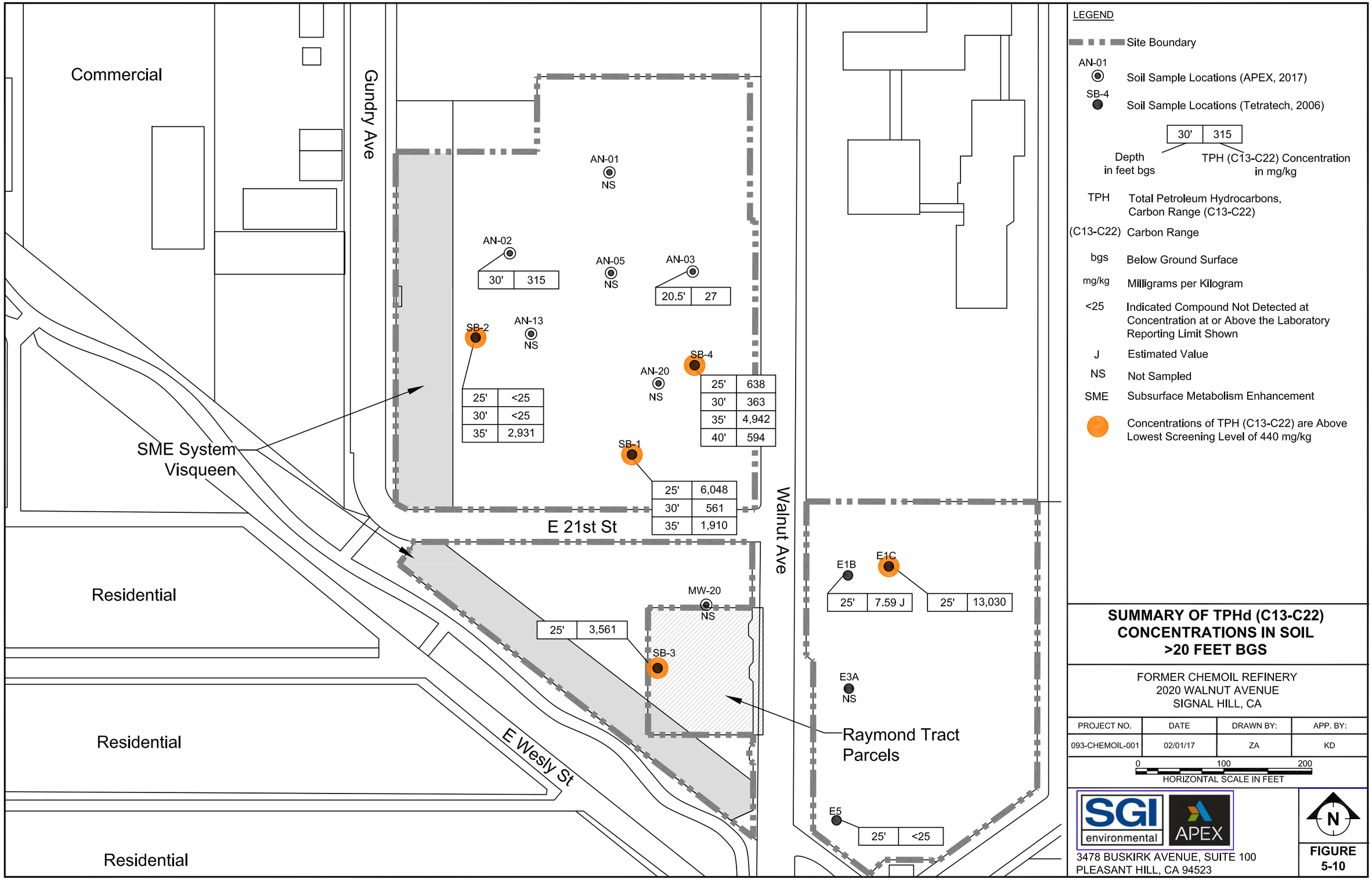
0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-9

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-9-Summary of TPH (C13-C22) Concentration in Soil-10-20' BGS.dwg, 3/29/2017 11:15:27 AM



SUMMARY OF TPHd (C13-C22) CONCENTRATIONS IN SOIL >20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-10

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-10-Summary of TPH (C13-C22) Concentration in Soil-20' BGS.dwg, 3/29/2017 11:16:43 AM

Commercial

Gundry Ave

SME System
Visqueen

E 21st St

Residential

Residential

Residential

E Wesly St

Walnut Ave

Raymond Tract
Parcels

AN-01
10' <0.0020

AN-02
6.5' 0.089
10' <0.0020

AN-05
5.0' 1.6
10' <0.20

AN-03
5.5' 1.7
10' <2.0

SB-2
5.0' 11.300
10' 0.173

AN-13
5.5' <0.0040
9.0' 0.17

AN-20
8.0' 8.4
10' 1.2

SB-4
5.0' 5.900
10' 3.47

SB-1
4.0' 0.486
10' 0.076

7.0' <0.0040

MW-20

4.0' <0.008
10' 0.373

SB-3

E1B
5.0' <0.0020

E1C
5.0' <0.0020

E3A
10' <0.0020

E5
5.0' <0.0020
10' <0.0020

LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 5.5' | 1.7 — Depth in feet bgs; Benzene Concentration in mg/kg
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <0.0040 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentrations of Benzene are Above the LARWQCB Screening Level of 0.62 mg/kg
- LARWQCB — Los Angeles Regional Water Quality Control Board

SUMMARY OF BENZENE CONCENTRATIONS IN SOIL 0 to 10 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

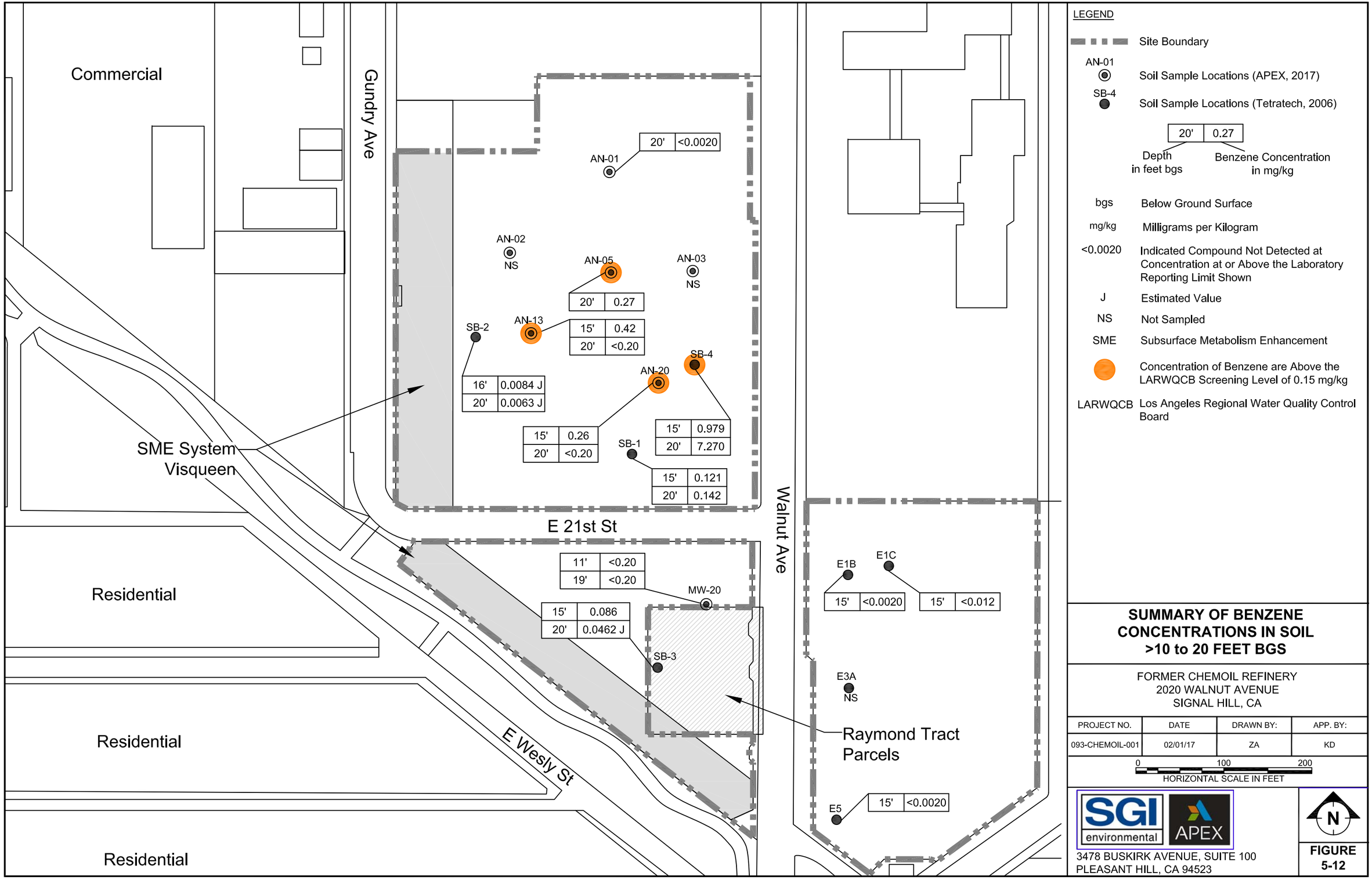
SGI environmental | APEX

3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-11

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-11-Summary of Benzene Concentration in Soil-0-10' BGS.dwg, 3/29/2017 11:18:08 AM



LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 20' | 0.27 — Depth in feet bgs | Benzene Concentration in mg/kg
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <0.0020 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- J — Estimated Value
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- 2 — Concentration of Benzene are Above the LARWQCB Screening Level of 0.15 mg/kg
- LARWQCB — Los Angeles Regional Water Quality Control Board

SUMMARY OF BENZENE CONCENTRATIONS IN SOIL >10 to 20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE 5-12

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-12-Summary of Benzene Concentration in Soil-10-20' BGS.dwg, 3/29/2017 11:19:32 AM

Commercial

Gundry Ave

Walnut Ave

E 21st St

E Wesly St

Residential

Residential

Residential

SME System
Visqueen

Raymond Tract
Parcels

AN-01
NS

AN-02
30' | <0.0040

AN-05
NS

AN-03
20.5' | <0.20

SB-2
AN-13
NS
25' | 0.0049 J
30' | 0.018
35' | 3.280

AN-20
NS
SB-4
25' | 0.092
30' | 10.800
35' | 4.080
40' | 1.200

SB-1
25' | 0.202
30' | 0.236
35' | 0.110

MW-20
NS
25' | <0.010
SB-3

E1B
25' | <0.0020

E1C
25' | <0.012

E3A
NS

E5
25' | <0.0020

LEGEND

- Site Boundary
- AN-01 — Soil Sample Locations (APEX, 2017)
- SB-4 — Soil Sample Locations (Tetratech, 2006)
- 35' | 3.280 — Depth in feet bgs; Benzene Concentration in mg/kg
- bgs — Below Ground Surface
- mg/kg — Milligrams per Kilogram
- <0.0020 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- J — Estimated Value
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Concentration of Benzene are Above the LARWQCB Screening Level of 0.15 mg/kg
- LARWQCB — Los Angeles Regional Water Quality Control Board

SUMMARY OF BENZENE CONCENTRATIONS IN SOIL >20 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	02/01/17	ZA	KD

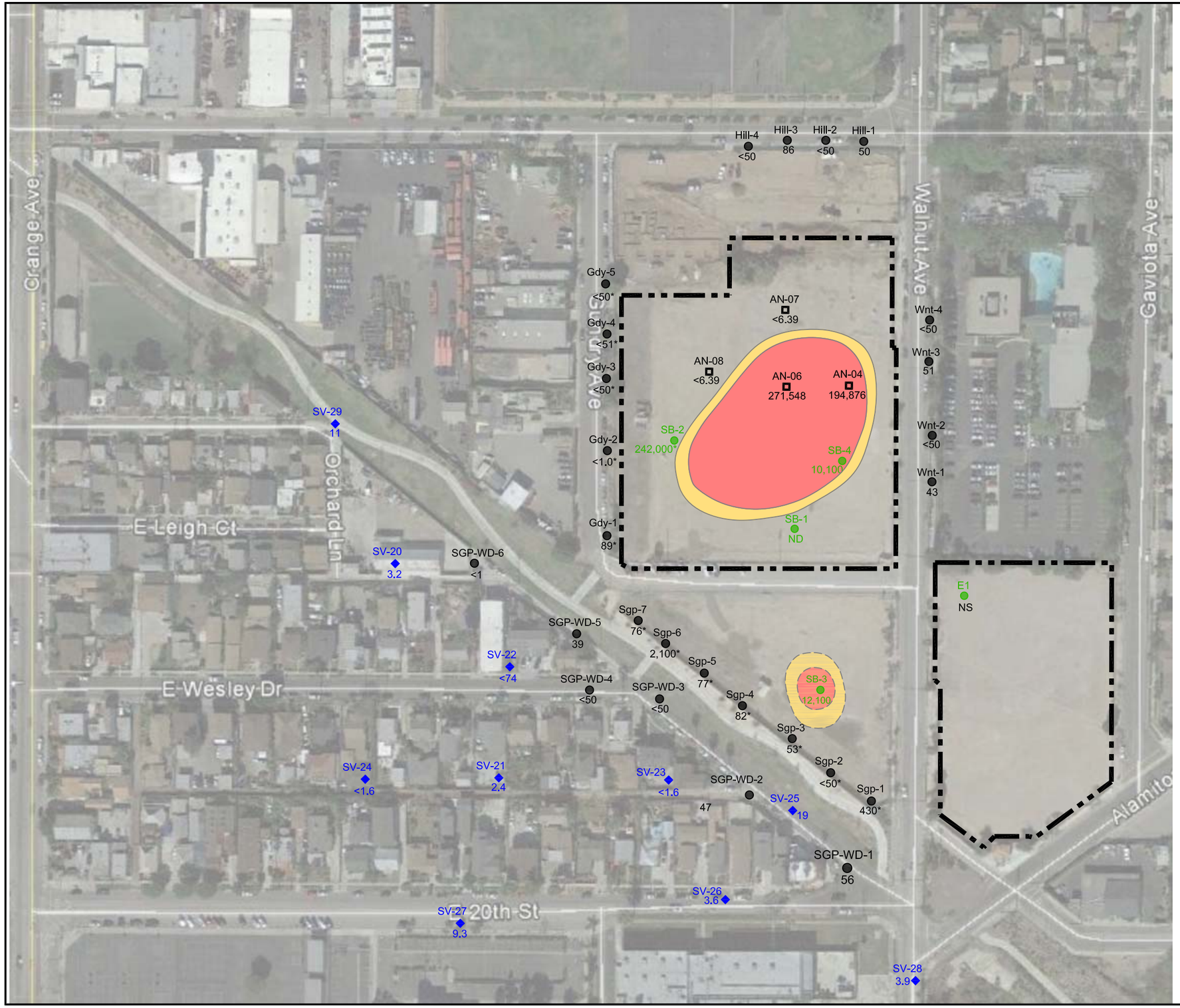
0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE
5-13

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-13-Summary of Benzene Concentration in Soil-20' BGS.dwg, 3/29/2017 11:20:58 AM



LEGEND

- Site Boundary
- Wnt-4 — Soil Vapor Sampling Locations, (TEC, 2009/2010)
- AN-06 — Soil Vapor Sample Locations, (APEX, 2017)
- E1 — Soil Vapor Sample Locations, (Tetratech, 2006)
- SV-20 — Soil Gas Sampling Locations, (Geosyntec, 2012)
- <50 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- * — Data Not Used in Contouring due to Proximity of SME System Which Began Operation After Collection of Samples
- bgs — Below Ground Surface
- ND — Not Detected
- NS — Not Sampled
- Isoconcentration Contour, Dashed Where Inferred
- Concentrations > 840 µg/m³
- Concentrations > 10,000 µg/m³
- µg/m³ — Micrograms per Cubic Meter

Note:
1. Concentration of benzene in micrograms per cubic meter (µg/m³)
2. 840 µg/m³ = DTSC SL/USEPA RSL for vapor intrusion to indoor air based on commercial land use.

SUMMARY OF BENZENE CONCENTRATIONS IN SOIL VAPOR AT 5 FEET BGS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-ChemOil-001	01/31/17	ZA	KD

0 150 300
HORIZONTAL SCALE IN FEET

SGI environmental / APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

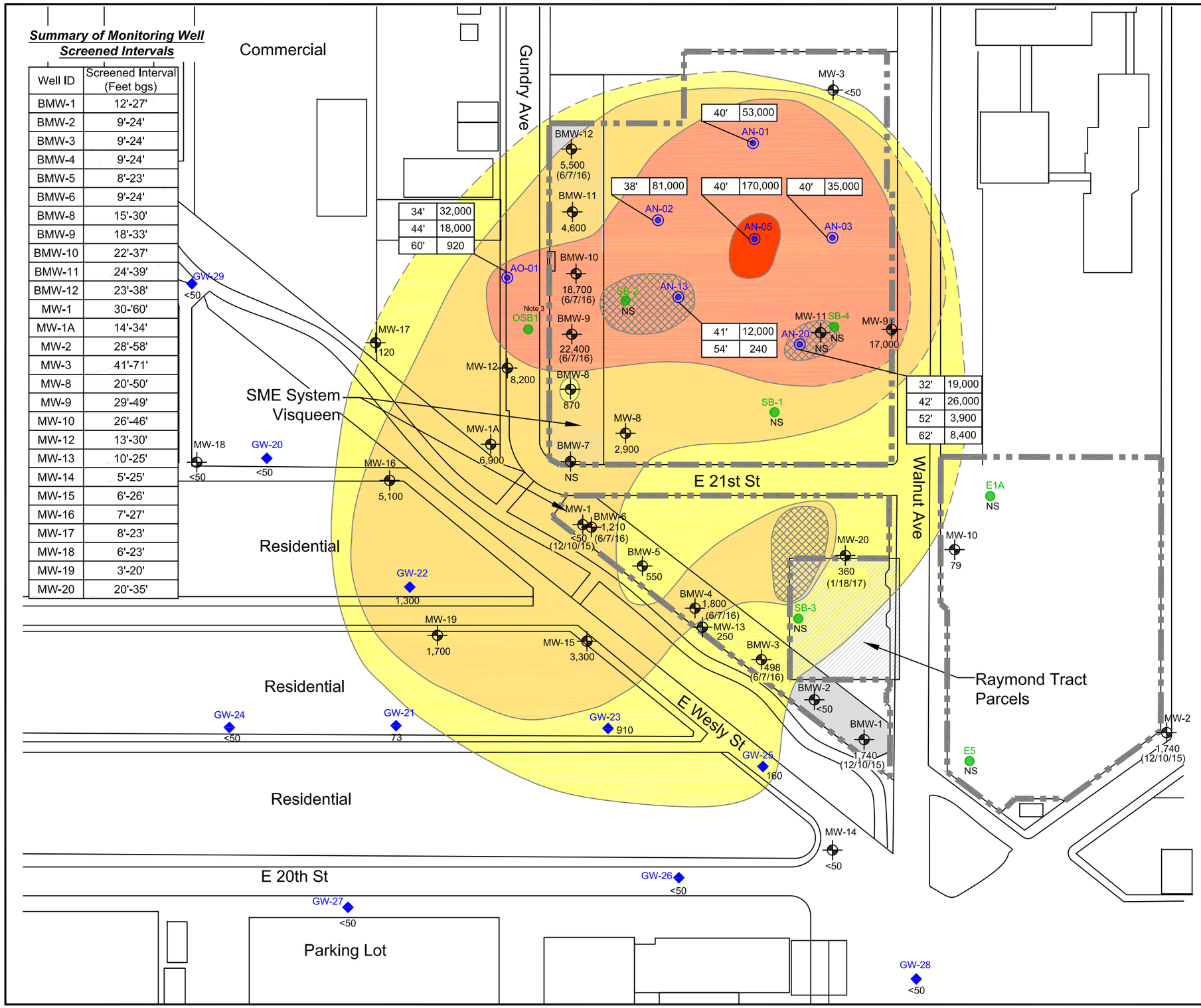
N

FIGURE 5-14

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-14-Summary of Benzene Concentratiosn in Soil Vapor-5 ft BGS.dwg, 3/29/2017 11:22:14 AM

Summary of Monitoring Well Screened Intervals

Well ID	Screened Interval (Feet bgs)
BMW-1	12'-27'
BMW-2	9'-24'
BMW-3	9'-24'
BMW-4	9'-24'
BMW-5	8'-23'
BMW-6	9'-24'
BMW-8	15'-30'
BMW-9	18'-33'
BMW-10	22'-37'
BMW-11	24'-39'
BMW-12	23'-38'
MW-1	30-'60'
MW-1A	14'-34'
MW-2	28'-58'
MW-3	41'-71'
MW-8	20'-50'
MW-9	29'-49'
MW-10	26'-46'
MW-12	13'-30'
MW-13	10'-25'
MW-14	5'-25'
MW-15	6'-26'
MW-16	7'-27'
MW-17	8'-23'
MW-18	6'-23'
MW-19	3'-20'
MW-20	20'-35'



LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- AN-01 — Grab Groundwater Sample Locations, APEX, 2017
- SB-2 — Grab Groundwater Sample Locations, Tetratech, 2006
- GW-29 — Grab Groundwater Sample Locations, Geosyntec, 2012. Samples Collected for First Encountered Groundwater.
- 40' | 35,000 — Depth in feet bgs | TPHg Concentration in µg/L
- bgs — Below Ground Surface
- µg/L — Micrograms per Liter
- <50 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Isoconcentration Contour, Dashed Where Inferred
- Area of Observed or Suspected LNAPL
- Concentrations > 100 µg/L
- Concentrations > 1,000 µg/L
- Concentrations > 10,000 µg/L
- Concentrations > 100,000 µg/L

Note:
1. Locations sampled during Quarter 4, 2016 unless otherwise indicated.
2.With the exception of MW-20, monitoring wells were sampled by Ami Adini & Associates.
3. OSBI was advanced and sampled prior to installation of the SME barrier. Results no longer representative are not shown.

SUMMARY OF TPHg (C4-C12) CONCENTRATIONS IN GROUNDWATER

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	01/23/17	ZA	KD

0 120 240
HORIZONTAL SCALE IN FEET

SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

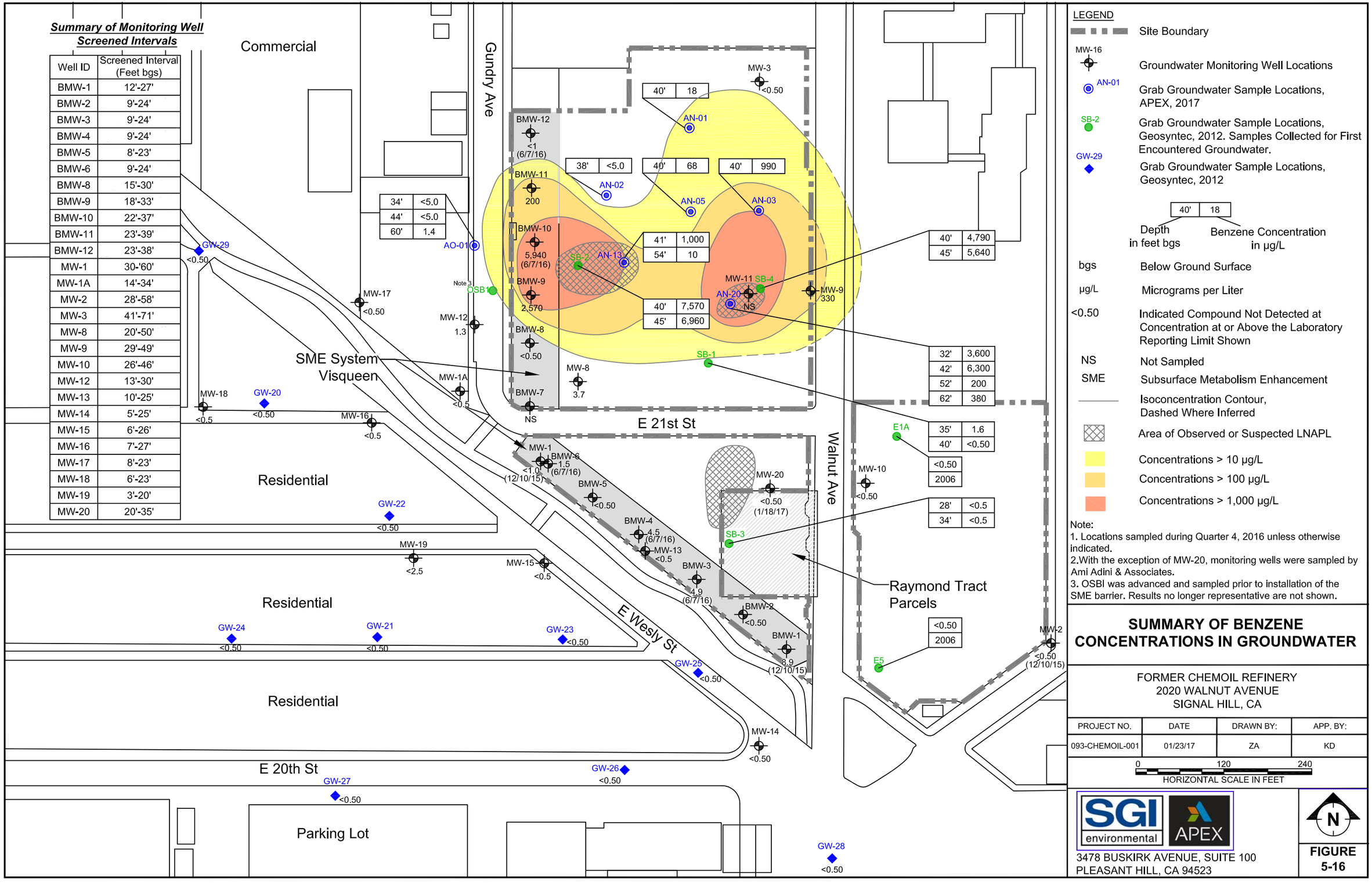
N

FIGURE 5-15

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-15-Summary of TPHg (C4-C12) in GW.dwg, 3/29/2017 11:25:19 AM

Summary of Monitoring Well Screened Intervals

Well ID	Screened Interval (Feet bgs)
BMW-1	12'-27'
BMW-2	9'-24'
BMW-3	9'-24'
BMW-4	9'-24'
BMW-5	8'-23'
BMW-6	9'-24'
BMW-8	15'-30'
BMW-9	18'-33'
BMW-10	22'-37'
BMW-11	23'-39'
BMW-12	23'-38'
MW-1	30-'60'
MW-1A	14'-34'
MW-2	28'-58'
MW-3	41'-71'
MW-8	20'-50'
MW-9	29'-49'
MW-10	26'-46'
MW-12	13'-30'
MW-13	10'-25'
MW-14	5'-25'
MW-15	6'-26'
MW-16	7'-27'
MW-17	8'-23'
MW-18	6'-23'
MW-19	3'-20'
MW-20	20'-35'



LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- AN-01 — Grab Groundwater Sample Locations, APEX, 2017
- SB-2 — Grab Groundwater Sample Locations, Geosyntec, 2012. Samples Collected for First Encountered Groundwater.
- GW-29 — Grab Groundwater Sample Locations, Geosyntec, 2012
- 40' | 18 — Depth in feet bgs | Benzene Concentration in µg/L
- bgs — Below Ground Surface
- µg/L — Micrograms per Liter
- <0.50 — Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
- NS — Not Sampled
- SME — Subsurface Metabolism Enhancement
- Isoconcentration Contour, Dashed Where Inferred
- Area of Observed or Suspected LNAPL
- Concentrations > 10 µg/L
- Concentrations > 100 µg/L
- Concentrations > 1,000 µg/L

Note:
1. Locations sampled during Quarter 4, 2016 unless otherwise indicated.
2.With the exception of MW-20, monitoring wells were sampled by Ami Adini & Associates.
3. OSBI was advanced and sampled prior to installation of the SME barrier. Results no longer representative are not shown.

SUMMARY OF BENZENE CONCENTRATIONS IN GROUNDWATER

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	01/23/17	ZA	KD

0 120 240
HORIZONTAL SCALE IN FEET

SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

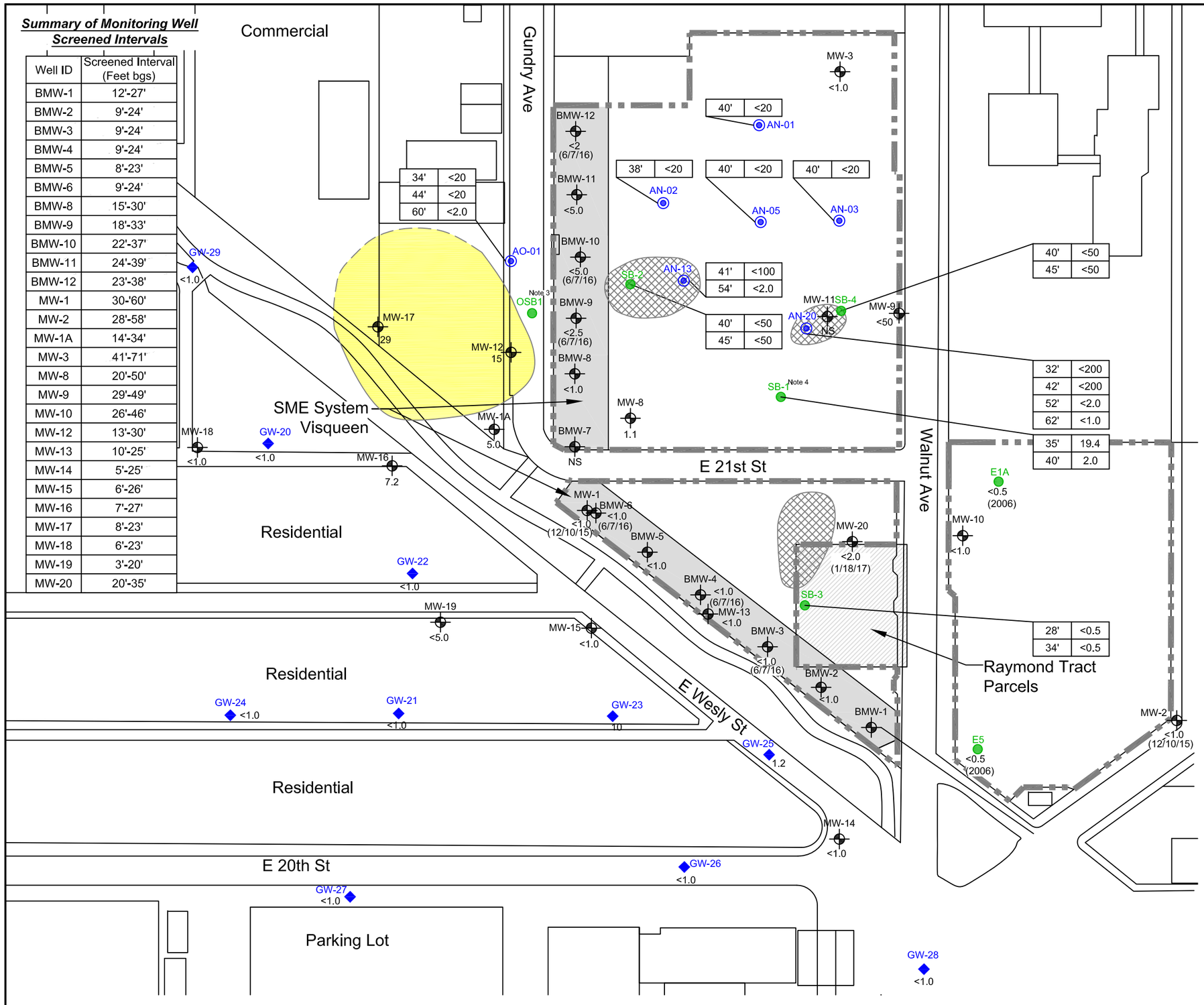
N

FIGURE 5-16

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-16-Summary of Benzene Concentration in GW.dwg, 3/29/2017 11:26:23 AM

Summary of Monitoring Well Screened Intervals

Well ID	Screened Interval (Feet bgs)
BMW-1	12'-27'
BMW-2	9'-24'
BMW-3	9'-24'
BMW-4	9'-24'
BMW-5	8'-23'
BMW-6	9'-24'
BMW-8	15'-30'
BMW-9	18'-33'
BMW-10	22'-37'
BMW-11	24'-39'
BMW-12	23'-38'
MW-1	30-'60'
MW-2	28'-58'
MW-1A	14'-34'
MW-3	41'-71'
MW-8	20'-50'
MW-9	29'-49'
MW-10	26'-46'
MW-12	13'-30'
MW-13	10'-25'
MW-14	5'-25'
MW-15	6'-26'
MW-16	7'-27'
MW-17	8'-23'
MW-18	6'-23'
MW-19	3'-20'
MW-20	20'-35'



LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- AN-01 — Grab Groundwater Sample Locations, APEX, 2017
- SB-2 — Grab Groundwater Sample Locations, Tetratech, 2006
- GW-29 — Grab Groundwater Sample Locations, Geosyntec, 2012. Samples Collected for First Encountered Groundwater.

35' | 19.4
Depth in feet bgs | MTBE Concentration in µg/L

MTBE	Methyl tert-butyl ether
bgs	Below Ground Surface
µg/L	Micrograms per Liter
<20	Indicated Compound Not Detected at Concentration at or Above the Laboratory Reporting Limit Shown
NS	Not Sampled
SME	Subsurface Metabolism Enhancement

- Isoconcentration Contour, Dashed Where Inferred
- Area of Observed or Suspected LNAPL
- Concentrations > 10 µg/L

Note:
1. Locations sampled during Quarter 4, 2016 unless otherwise indicated.
2.With the exception of MW-20, monitoring wells were sampled by Ami Adini & Associates.
3. OSBI was advanced and sampled prior to installation of the SME barrier. Results no longer representative are not shown.
4. 2006 data from SB-1 not included in contouring.

SUMMARY OF MTBE CONCENTRATIONS IN GROUNDWATER

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
093-CHEMOIL-001	01/23/17	ZA	KD

0 120 240
HORIZONTAL SCALE IN FEET

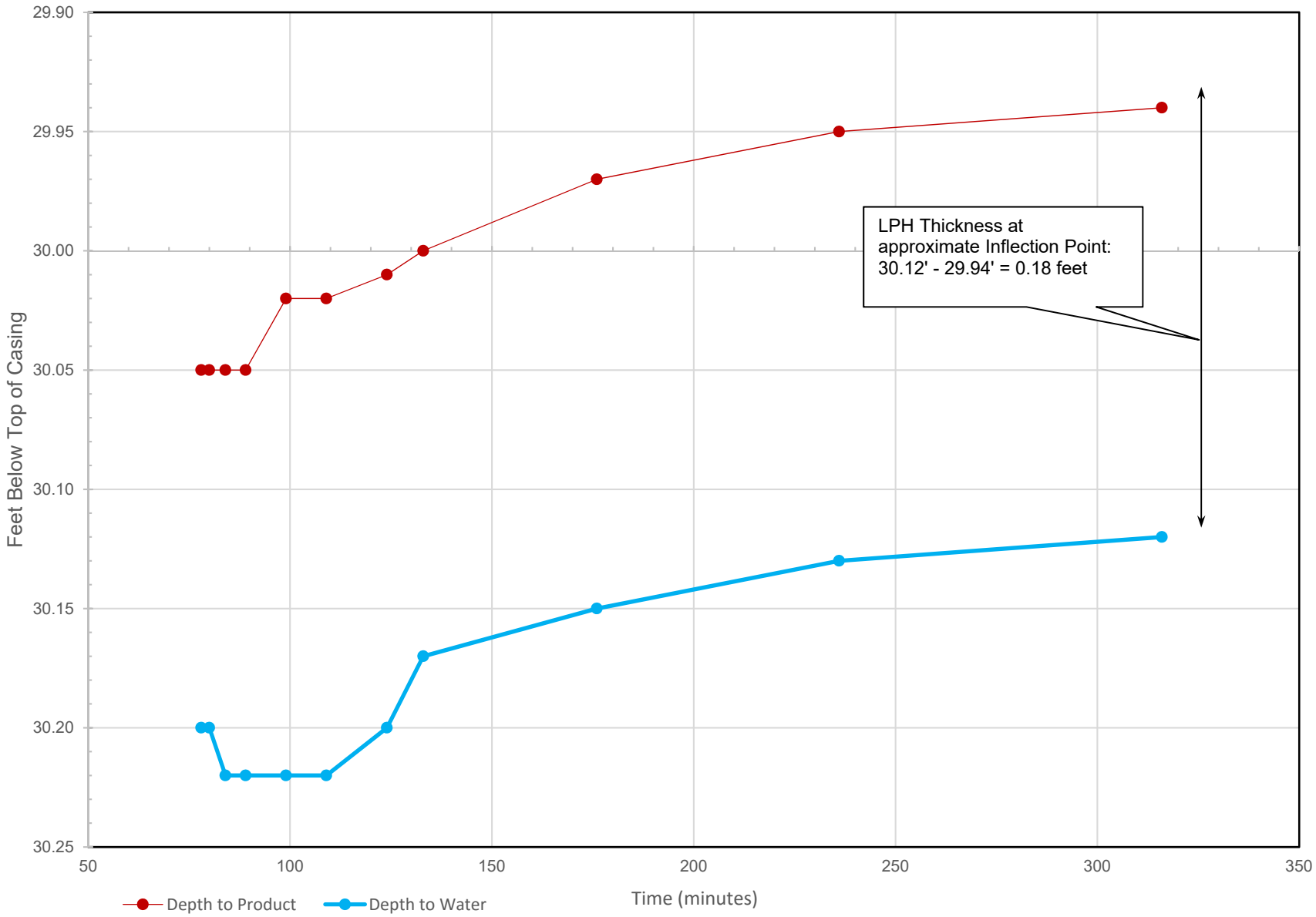
SGI environmental | APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

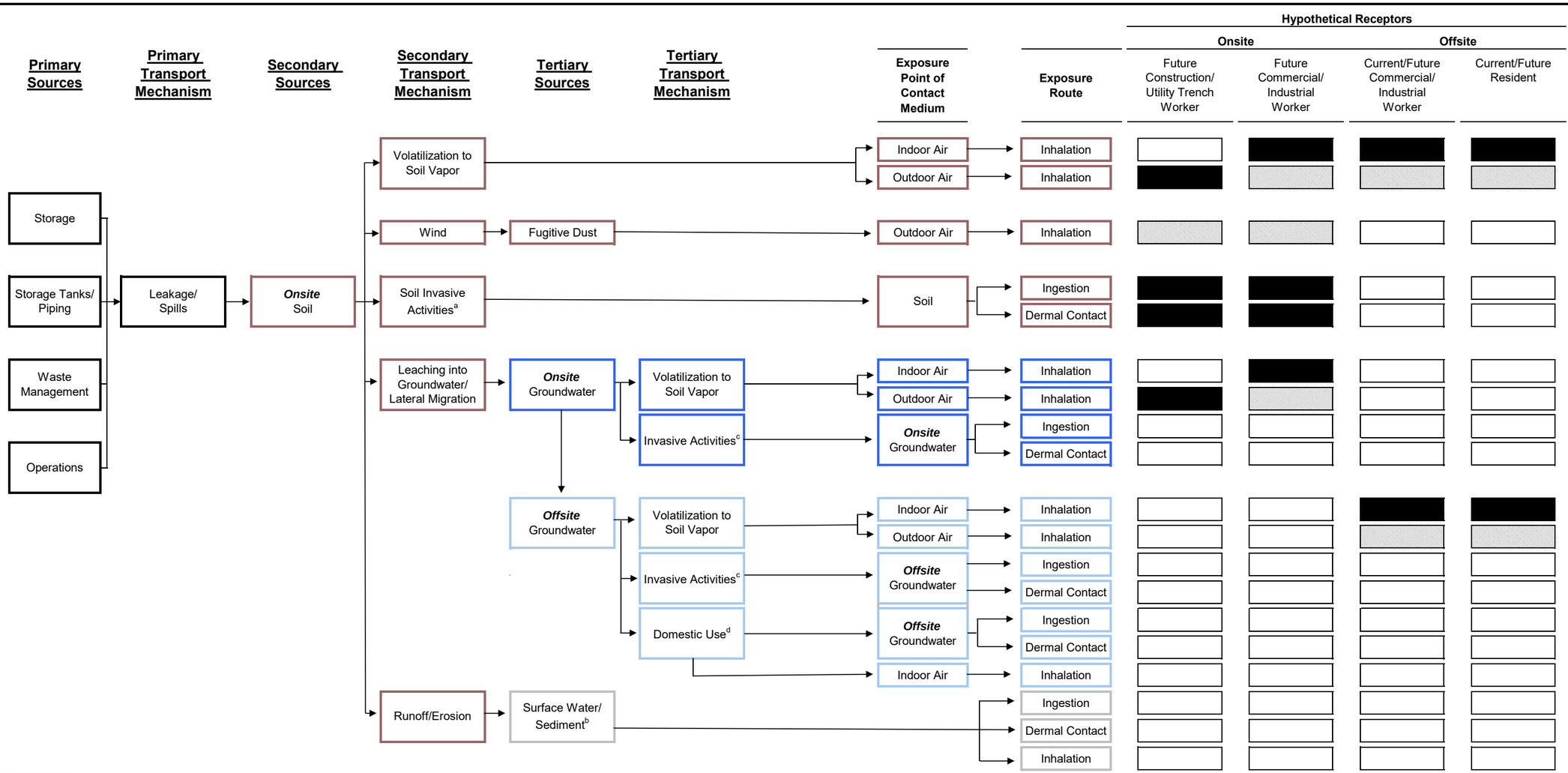
N

FIGURE 5-17

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.5-17-Summary of MTBE in GW.dwg, 3/29/2017 11:27:38 AM

Figure 5-18
Bail-Down Test Data Graph





CSM components related to soil.

CSM components related to onsite groundwater.

CSM components related to offsite groundwater.

CSM components related to surface water.

Receptor likely to be exposed via this route, so pathway is considered potentially complete.

Receptor may be exposed via this route, so pathway is considered potentially complete; however, pathway is considered minor.

Pathway is incomplete, no further evaluation required.

[a] Soil invasive activities may extend to 10 feet below ground surface (bgs) and include construction and development for commercial/industrial land use.

[b] No surface water bodies were identified within a one-half mile radius of the site.

[c] Surface invasive activities are not expected to extend beyond 10 feet bgs during construction and development. Due to Site topography, depth to water in existing monitoring wells ranges from approximately 15 feet bgs in the southern portions of the Site to 43 feet bgs in the northern portions of the Site.

[d] Groundwater quality within the Site vicinity is generally poor due to seawater intrusion and elevated salinity. Shallow groundwater is not currently used and is not likely to be developed for beneficial use. Risk management measures can be implemented to ensure that groundwater is not used. The nearest public water supply well is located downgradient approximately 850 feet south of the Site (Los Angeles County Department of Public Works Well 420), however is used for groundwater monitoring purposes only.

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CALIFORNIA

HUMAN HEALTH CONCEPTUAL SITE MODEL

PROJECT NO.	DATE	DRAWN BY	APP. BY
093-CHEMOIL-001	03/07/17	II	KD

SGI environmental | APEX
299 WEST HILLCREST DRIVE, SUITE 220
THOUSAND OAKS, CA 91360

FIGURE 7-1

Commercial

Gundry Ave

SME System
Visqueen

Residential

Residential

Residential

E 21st St

E Wesly St

Walnut Ave

Raymond Track
Parcels

MW-3
MW-17
MW-18
MW-16
MW-12
MW-19
MW-15
MW-8
MW-1
MW-13
MW-20
MW-11
MW-9
MW-10
MW-2
A0-01

BMW-12
BMW-11
BMW-10
BMW-9
BMW-8
BMW-7
BMW-6
BMW-5
BMW-4
BMW-3
BMW-2
BMW-1

AN-01
AN-02
AN-03
AN-05
AN-09
AN-10
AN-11
AN-12
AN-13
AN-15
AN-16
AN-17
AN-18
AN-19
AN-20
AN-21

AS-01
AS-02
AS-03
AS-04
AS-05
AS-06
AS-09
AS-10

AE-01
AE-02
AE-03

LEGEND

- Site Boundary
- MW-16 — Groundwater Monitoring Well Locations
- AN-20 — Soil Boring and Grab Groundwater Location (Apex, 2017)
- AN-10 — 2016 UVOST™ Boring Location
- AN-21 — 2016 MIP Boring Location
- Approximate Extent of Vadose Zone Above Screening Level

UVOST — Ultra-Violet Optical Screening Tool

INTERPRETED VADOSE ZONE AREA ABOVE SCREENING LEVELS

FORMER CHEMOIL REFINERY
2020 WALNUT AVENUE
SIGNAL HILL, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-CHEMOIL-001	02/08/17	ZA	KD

0 100 200
HORIZONTAL SCALE IN FEET

SGI environmental
APEX
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

N

FIGURE
7-2

S:\Clients A - F\ChemOil Refinery\Report\Figures\Report Figures\Fig.7-2-Interpreted Vadox Zone Area Above Screenig Level.dwg, 3/29/2017 11:28:46 AM

TABLES

Table 4-1
Summary of Soil Analytical Results - Hydrocarbon Chain Characterization
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Hydrocarbon Chain Identification																TPH (C5-C12)[Note 1]	TPH (C13-C22)[Note 2]	TPH (C23-C44)[Note 3]
			C6-C8 mg/kg	C8-C10 mg/kg	C10-C12 mg/kg	C12-C14 mg/kg	C14-C16 mg/kg	C16-C18 mg/kg	C18-C20 mg/kg	C20-C22 mg/kg	C22-C24 mg/kg	C24-C26 mg/kg	C26-C28 mg/kg	C28-C32 mg/kg	C32-C34 mg/kg	C34-C36 mg/kg	C36-C40 mg/kg	C40-C44 mg/kg	mg/kg	mg/kg	mg/kg
USEPA RSL[4] Direct Contact - Commercial/Industrial			NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	420	440	33,000
LARWQCB SL[5] Protection of Groundwater Aquifer is not a source of drinking water			NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	1,000	10,000	50,000
NORTHWEST PARCEL																					
AN-01	1/4/2017	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<3.0	<5.0	<8.0
	1/4/2017	20	<1.0	<1.0	<1.0	**2.0**	**1.1**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<3.0	**2.1**	<8.0
AN-02	1/4/2017	6.5	<50	<50	**430**	**1,600**	**2,000**	**1,300**	**880**	**1,800**	**2,900**	**4,200**	**5,000**	**8,700**	**2,100**	**1,600**	**1,800**	**1,400**	**430**	**6,780**	**26,250**
	1/4/2017	10	<1.0	<1.0	<1.0	**1.7**	**1.9**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<3.0	**2.8**	<8.0
	1/4/2017	30	**6.0**	**70**	**140**	**170**	**120**	**64**	**36**	**10**	**6.7**	**3.4**	**1.3**	**1.7**	<1.0	<1.0	<1.0	<1.0	**216**	**315**	**10**
AN-03	1/5/2017	5.5	**260**	**3,100**	**2,700**	**810**	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	**6,060**	**405**	<400
	1/5/2017	10	**46**	**650**	**750**	**320**	**23**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**1,446**	**183**	<80
	1/5/2017	20.5	**2.6**	**84**	**140**	**51**	**1.4**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**227**	**27**	<8.0
AN-05	1/5/2017	5	**380**	**930**	**1,700**	**1,700**	**3,000**	**2,600**	**1,400**	**1,200**	**780**	**200**	**140**	**140**	**22**	**11**	<10	<10	**3,010**	**9,050**	**892**
	1/5/2017	10	**4.9**	**33**	**92**	**92**	**59**	**49**	**23**	**21**	**13**	**6.0**	**6.4**	**5.7**	<1.0	<1.0	<1.0	<1.0	**130**	**198**	**25**
	1/5/2017	20	<1.0	**10**	**31**	**43**	**25**	**9.3**	**6.3**	**4.9**	**2.8**	**2.6**	**1.6**	**2.8**	<1.0	<1.0	<1.0	<1.0	**41**	**67**	**8**
AN-13	1/9/2017	5.5	**23**	**150**	**890**	**1,400**	**1,200**	**790**	**640**	**210**	**120**	**72**	**13**	**12**	<10	<10	<10	<10	**1,063**	**3,540**	**157**
	1/9/2017	9	**680**	**810**	**3,100**	**4,900**	**3,800**	**2,600**	**1,800**	**840**	**430**	**220**	**44**	**24**	<10	<10	<10	<10	**4,590**	**11,490**	**503**
	1/9/2017	15	**310**	**610**	**1,600**	**2,300**	**1,700**	**970**	**700**	**330**	**160**	**93**	**21**	**18**	<10	<10	<10	<10	**2,520**	**4,850**	**212**
	1/9/2017	20	**28**	**170**	**390**	**550**	**440**	**250**	**190**	**97**	**40**	**22**	<10	<10	<10	<10	<10	<10	**588**	**1,252**	**42**
AN-20	1/18/2017	8	**100**	**760**	**430**	**92**	<10	<10	<10	<10	<10	<10	<10	**16**	**10**	<10	**10**	<10	**1,290**	**46**	**36**
	1/18/2017	10	**24**	**230**	**78**	**7.3**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**332**	**3.7**	<8.0
	1/18/2017	15	**31**	**450**	**210**	**24**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**691**	**12**	<80
	1/18/2017	20	**16**	**320**	**140**	**14**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**476**	**7**	<80
SB1	5/16/2006	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3,112**	**14,726**	**1,053**
	5/16/2006	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**440**	**3,731**	**231**
	5/16/2006	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,410**	**4,567**	**185**
	5/16/2006	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,958**	**3,614**	**147**
	5/16/2006	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,243**	**6,048**	**268**
	5/16/2006	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,562**	**561**	**17**
	5/16/2006	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,296**	**1,910**	**71**
SB-2	5/15/2016	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,592**	**6,314**	**7,337**
	5/15/2016	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	5/15/2016	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	5/15/2016	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	5/15/2016	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3.2**	<25	<48
	5/15/2016	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2.7**	<25	<48
	5/15/2016	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3,252**	**2,931**	**30**
SB-4	5/16/2016	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**11,782**	**1,052**	<48
	5/16/2016	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3,134**	**401**	<48
	5/16/2016	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6,737**	**457**	<48
	5/16/2016	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5,814**	**462**	<48
	5/16/2016	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,752**	**638**	<48
	5/16/2016	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3,799**	**363**	<48
	5/16/2016	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**11,840**	**4,942**	<238
	5/16/2016	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5,769**	**594**	<48

Table 4-1
Summary of Soil Analytical Results - Hydrocarbon Chain Characterization
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Hydrocarbon Chain Identification																TPH (C5-C12)[Note 1]	TPH (C13-C22)[Note 2]	TPH (C23-C44)[Note 3]
			C6-C8	C8-C10	C10-C12	C12-C14	C14-C16	C16-C18	C18-C20	C20-C22	C22-C24	C24-C26	C26-C28	C28-C32	C32-C34	C34-C36	C36-C40	C40-C44			
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
USEPA RSL[4] Direct Contact - Commercial/Industrial			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**420**	**440**	**33,000**
LARWQCB SL[5] Protection of Groundwater Aquifer is not a source of drinking water			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**1,000**	**10,000**	**50,000**
SOUTHWEST PARCEL																					
MW-20	1/10/2017	7	<1.0	**17**	**24**	**30**	**35**	**32**	**30**	**22**	**17**	**16**	**15**	**31**	**13**	**6.6**	**16**	**5.1**	**41**	**134**	**111**
	1/10/2017	11	<5.0	**130**	**230**	**310**	**250**	**230**	**230**	**160**	**160**	**130**	**140**	**320**	**130**	**68**	**140**	**81**	**360**	**1,025**	**1,089**
	1/10/2017	19	<10	**390**	**1,200**	**2,000**	**1,600**	**1,200**	**840**	**400**	**180**	**120**	**51**	**71**	**16**	**12**	**10**	<10	**1,590**	**5,040**	**370**
SB-3	5/15/2016	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,939**	**5,094**	**1,375**
	5/15/2016	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,124**	**335**	**16**
	5/15/2016	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7,026**	**3,014**	**206**
	5/15/2016	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,261**	**11,577**	**793**
	5/15/2016	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3,483**	**3,561**	**250**
EAST PARCEL																					
E1B	6/1/2006	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	6/1/2006	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	6/1/2006	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5.72**	**7.59J**	**5.04J**
E1C	6/1/2006	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**94**	**201**	**92**
	6/1/2006	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,829**	**2,540**	**2,162**
	6/1/2006	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4,999**	**13,030**	**8,238**
E3A	6/1/2006	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
E5	6/1/2006	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	6/1/2006	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	6/1/2006	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48
	6/1/2006	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.5	<25	<48

Notes:
TPH = Total petroleum hydrocarbons, by EPA Method 8015M.
C4-C12 = Carbon range.
ft bgs = feet below ground surface.
mg/kg = milligram per kilogram.
USEPA RSL = U.S. Environmental Protection Agency Regional Screening Level (USEPA, 2016).
LARWQCB SL = Los Angeles Regional Water Quality Control Board Screening Level (LARWQCB, 1996).
NV = No value.
- = Data not presented herein. Refer to Tetra Tech, 2006.
<X.XX = Not detected above indicated reporting limit (RL).

Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds lowest of USEPA RSL for commercial land use and LARWQCB SL for protection of groundwater.
[1] TPH (C5-C12) was calculated based on summing detected results from C6-C8, C8-C10, and C10-C12.
[2] TPH (C13-C22) was calculated based on summing detected results of one half C12-C13 and the results between C14 and C22.
[3] TPH (C23-C44) was calculated based on summing the results of one half C22-C24 and the results between C24 and C44.
[4] USEPA RSLs for industrial soil for direct contact exposure pathways. RSLs for TPH (C6-C12), TPH (C13-C22), and TPH (C23-C44) represent lowest of aliphatic and aromatic RSLs for TPH Low (C5-C8), TPH Middle (C9-C18), and TPH High (C17-C32), respectively.
[5] LARWQCB SL for soil for protection of groundwater. As recommended by LARWQCB (1996), for non-drinking water aquifers, screening level for TPH carbon ranges represent the LARWQCB SLs for TPH where distance above groundwater is greater than 150 feet (>150 feet).

References:
LARWQCB. 1996. Interim Site Assessment & Cleanup Guidebook. California Regional Water Quality Control Board, Los Angeles and Ventura Counties, Region 4. May 1996.
Tetra Tech. 2006. Environmental Due Diligence Site Assessment Results, Former Chemoil Refinery Property, Signal Hill, California. August 8.
USEPA. 2016. Regional Screening Levels (TR=1E-06, HQ=1). May.

Table 4-2
Summary of Soil Analytical Results - Volatile Organic Compounds
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	TPHg (C4-C12) mg/kg	Acetone mg/kg	Benzene mg/kg	TBA mg/kg	tert-Butylbenzene mg/kg	sec-Butylbenzene mg/kg	n-Butylbenzene mg/kg	Ethylbenzene mg/kg	Isopropylbenzene mg/kg	4-Isopropyltoluene mg/kg	MTBE mg/kg	Naphthalene mg/kg	n-Propylbenzene mg/kg	Toluene mg/kg	1,3,5-TMB mg/kg	1,2,4-TMB mg/kg	o-Xylene mg/kg	m,p-Xylenes mg/kg	Total Xylenes mg/kg
DTSC SL/USEPA RSL [6] Direct Contact - Commercial			**420 [1]**	**670,000**	**1.4**	**1,500,000 [2]**	**12,000**	**12,000**	**6,400**	**25**	**9,900**	**9,900 [3]**	**210**	**17**	**24,000**	**5,400**	**1,100**	**240**	**2,800**	**2,400 [4]**	**2,500**
LARWQCB SL - Protection of Groundwater at 20 ft bgs, Aquifer is not a source of drinking water [7]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**163**	**0.62**	**1.3**	**28**	**28**	**28**	**68**	**84**	**84 [2]**	**1.3**	**1.8**	**28**	**25**	**36**	**36**	**NV**	**NV**	**225**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**150**	**0.15**	**1.2**	**26**	**26**	**26**	**32**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**16**	**33**	**33**	**NV**	**NV**	**176**
LARWQCB SL - Protection of Groundwater at 40 ft bgs, Aquifer is not a source of drinking water [9]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**406**	**7.5**	**3.2**	**70**	**70**	**70**	**254**	**208**	**208 [2]**	**2.0**	**4.6**	**70**	**75**	**89**	**89**	**NV**	**NV**	**689**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**243**	**1.2**	**1.9**	**42**	**42**	**42**	**110**	**125**	**125 [2]**	**1.4**	**2.8**	**42**	**37**	**53**	**53**	**NV**	**NV**	**284**
100X LARWQCB Soil SLs (20 to 39 ft bgs) [8]			**1,000 [5]**	**150**	**0.16**	**1.2**	**26**	**26**	**26**	**38**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**17**	**33**	**33**	**NV**	**NV**	**191**
NORTHWEST PARCEL																					
AN-01	1/4/2017	10	<0.50	<0.050	<0.0020	<0.020	<0.0050	<0.0050	<0.0050	<0.0020	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0020	<0.0050	<0.0050	<0.0020	<0.0020	<0.0040
	1/4/2017	20	<0.50	<0.050	<0.0020	<0.020	<0.0050	<0.0050	<0.0050	<0.0020	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0020	<0.0050	<0.0050	<0.0020	<0.0020	<0.0040
AN-02	1/4/2017	6.5	**370**	<0.10	**0.089**	<0.040	<0.010	<0.010	**0.011**	**0.12**	**0.020**	**0.011**	<0.010	**0.05**	**0.021**	**0.0052**	**0.014**	**0.070**	**0.015**	**0.022**	**0.037**
	1/4/2017	10	**1.5**	**0.065**	<0.0020	<0.020	<0.0050	<0.0050	<0.0050	<0.0020	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0020	<0.0050	<0.0050	<0.0020	<0.0020	<0.0040
	1/4/2017	30	**380**	<0.10	<0.0040	<0.040	**0.016**	**0.20**	**0.14**	**0.0045**	**0.24**	<0.010	<0.010	**1.6**	**0.53**	<0.0040	<0.010	<0.010	<0.0040	<0.0040	<0.0080
AN-03	1/5/2017	5.5	**19,000**	<20	**1.7**	<8.0	<2.0	**10**	**8.8**	**28**	**13**	**16**	<2.0	**19**	**19**	<0.80	**250**	**170**	**36**	**210**	**246**
	1/5/2017	10	**6,800**	<50	<2.0	<20	<5.0	**7.1**	<5.0	**8.7**	<5.0	<5.0	<5.0	<10	**15**	<2.0	**7.9**	**12**	<2.0	**3.7**	**3.7**
	1/5/2017	20.5	**250**	<5.0	<0.20	<2.0	<0.50	**0.73**	<0.50	<0.20	<0.50	**0.75**	<0.50	**1.6**	<0.50	<0.20	<0.50	<0.50	<0.20	<0.20	<0.40
AN-05	1/5/2017	5	**3,800**	<5.0	**1.6**	<2.0	<0.50	**3.7**	**6.7**	**7.8**	**3.1**	**4.3**	<0.50	**13**	**6.2**	<0.20	**8.7**	**32**	**1.4**	**12**	**13.4**
	1/5/2017	10	**510**	<5.0	<0.20	<2.0	<0.50	<0.50	**0.77**	**0.93**	<0.50	<0.50	<0.50	**1.7**	**0.79**	<0.20	**0.77**	**2.6**	<0.20	**0.56**	**0.56**
	1/5/2017	10 (DUP)	**620**	<5.0	<0.20	<2.0	<0.50	<0.50	**0.85**	**0.79**	<0.50	<0.50	<0.50	**1.9**	**0.65**	<0.20	**0.74**	**2.7**	<0.20	**0.52**	**0.52**
	1/5/2017	20	**2,700**	<5.0	**0.27**	<2.0	<0.50	**1.7**	**2.5**	**6.5**	**2.1**	**1.5**	<0.50	**6.4**	**3.8**	<0.20	**2.2**	**8.9**	<0.20	**2.0**	**2.0**
AN-13	1/9/2017	5.5	**8.1**	<0.10	<0.0040	<0.040	<0.010	**0.034**	**0.048**	<0.0040	**0.012**	<0.010	<0.010	**0.11**	**0.033**	<0.0040	<0.010	<0.010	<0.0040	<0.0040	<0.0080
	1/9/2017	9	**250**	<0.10	**0.17**	<0.040	<0.010	**0.20**	**0.29**	**0.96**	**0.38**	<0.010	<0.010	**2.9**	**0.40**	<0.0040	<0.010	<0.010	**0.0080**	<0.0040	**0.0080**
	1/9/2017	15	**1,500**	<5.0	**0.42**	<2.0	<0.50	**2.7**	**4.0**	**7.9**	**4.3**	<0.50	<0.50	**16**	**5.4**	<0.20	<0.50	<0.50	<0.20	<0.20	<0.40
	1/9/2017	20	**470**	<5.0	<0.20	<2.0	<0.50	**0.90**	**1.0**	**2.0**	**1.0**	<0.50	<0.50	**5.2**	**1.8**	<0.20	<0.50	<0.50	<0.20	<0.20	<0.40
AN-20	1/18/2017	8	**5,500**	<10	**8.4**	<4.0	<1.0	**5.5**	**9.4**	**27**	**12**	**8.5**	<1.0	**9.9**	**15**	**9.2**	**16**	**54**	**36**	**70**	**106**
	1/18/2017	10	**1,200**	<5.0	**1.2**	<2.0	<0.50	**1.9**	**2.6**	**6.6**	**3.0**	**2.6**	<0.50	**2.2**	**4.3**	**0.26**	**4.6**	**13**	**5.0**	**15**	**20**
	1/18/2017	15	**920**	<5.0	**0.26**	<2.0	<0.50	**1.5**	**2.3**	**3.9**	**1.9**	**2.2**	<0.50	**1.6**	**3.0**	<0.20	**3.5**	**10**	**1.3**	**7.4**	**8.7**
	1/18/2017	20	**940**	<5.0	<0.20	<2.0	<0.50	**1.1**	**1.8**	**1.9**	**0.79**	**1.6**	<0.50	**1.2**	**1.9**	<0.20	**2.0**	**7.4**	**0.43**	**2.7**	**3.1**
SB1	5/16/2006	4	--	ND	**0.486**	<0.100	**0.104**	**1.300**	<0.025	**1.310**	**0.528**	ND	ND	**16.800**	**1.000**	**0.263**	**0.0261J**	**2.770**	**0.218**	**0.200**	**0.200**
	5/16/2006	10	--	ND	**0.076**	**0.0888J**	<0.005	**0.012**	<0.005	**0.182**	**0.037**	ND	ND	**0.124**	**0.037**	**0.0030J**	**0.0050J**	**0.012**	**0.0048J**	**0.0067J**	**0.0067J**
	5/16/2006	15	--	ND	**0.121**	<0.200	**0.121**	**2.070**	<0.050	**2.500**	**2.450**	ND	ND	**9.960**	**3.390**	**0.467**	**1.700**	**7.710**	**0.229**	**0.890**	**0.890**
	5/16/2006	20	--	ND	**0.142**	<0.120	**0.073**	**1.270**	<0.030	**1.270**	**1.650**	ND	ND	**6.040**	**2.260**	**0.297**	**0.957**	**4.380**	**0.136**	**0.518**	**0.518**
	5/16/2006	25	--	ND	**0.202**	<0.100	**0.079**	**1.330**	<0.025	**2.530**	**1.840**	ND	ND	**6.190**	**2.430**	**0.308**	**0.800**	**3.850**	**0.149**	**0.560**	**0.560**
	5/16/2006	30	--	ND	**0.236**	<0.080	**0.066**	**1.050**	<0.020	**1.780**	**1.550**	ND	ND	**5.140**	**2.000**	**0.230**	**0.775**	**3.530**	**0.134**	**0.513**	**0.513**
	5/16/2006	35	--	ND	**0.110**	<0.220	**0.0692J**	**1.040**	<0.055	**1.150**	**1.980**	ND	ND	**4.060**	**2.300**	**0.566**	**0.211**	**1.250**	**0.0915J**	**0.279**	**0.279**

Table 4-2
Summary of Soil Analytical Results - Volatile Organic Compounds
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	TPHg (C4-C12) mg/kg	Acetone mg/kg	Benzene mg/kg	TBA mg/kg	tert-Butylbenzene mg/kg	sec-Butylbenzene mg/kg	n-Butylbenzene mg/kg	Ethylbenzene mg/kg	Isopropylbenzene mg/kg	4-Isopropyltoluene mg/kg	MTBE mg/kg	Naphthalene mg/kg	n-Propylbenzene mg/kg	Toluene mg/kg	1,3,5-TMB mg/kg	1,2,4-TMB mg/kg	o-Xylene mg/kg	m,p-Xylenes mg/kg	Total Xylenes mg/kg
DTSC SL/USEPA RSL [6] Direct Contact - Commercial			**420 [1]**	**670,000**	**1.4**	**1,500,000 [2]**	**12,000**	**12,000**	**6,400**	**25**	**9,900**	**9,900 [3]**	**210**	**17**	**24,000**	**5,400**	**1,100**	**240**	**2,800**	**2,400 [4]**	**2,500**
LARWQCB SL - Protection of Groundwater at 20 ft bgs, Aquifer is not a source of drinking water [7]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**163**	**0.62**	**1.3**	**28**	**28**	**28**	**68**	**84**	**84 [2]**	**1.3**	**1.8**	**28**	**25**	**36**	**36**	**NV**	**NV**	**225**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**150**	**0.15**	**1.2**	**26**	**26**	**26**	**32**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**16**	**33**	**33**	**NV**	**NV**	**176**
LARWQCB SL - Protection of Groundwater at 40 ft bgs, Aquifer is not a source of drinking water [9]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**406**	**7.5**	**3.2**	**70**	**70**	**70**	**254**	**208**	**208 [2]**	**2.0**	**4.6**	**70**	**75**	**89**	**89**	**NV**	**NV**	**689**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**243**	**1.2**	**1.9**	**42**	**42**	**42**	**110**	**125**	**125 [2]**	**1.4**	**2.8**	**42**	**37**	**53**	**53**	**NV**	**NV**	**284**
100X LARWQCB Soil SLs (20 to 39 ft bgs) [8]			**1,000 [5]**	**150**	**0.16**	**1.2**	**26**	**26**	**26**	**38**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**17**	**33**	**33**	**NV**	**NV**	**191**
SB2	5/15/2006	5	--	ND	**11.300**	<0.100	**0.068**	**0.533**	<0.025	**9.970**	**1.480**	ND	ND	**0.431**	**1.260**	**0.472**	**0.290**	**1.020**	**0.184**	**0.640**	**0.640**
	5/15/2006	10	--	ND	**0.173**	<0.020	<0.005	<0.005	<0.005	**0.024**	<0.005	ND	ND	<0.005	<0.005	0.002J	<0.005	<0.005	<0.002	<0.002	<0.002
	5/15/2006	16	--	ND	**0.0084J**	<0.020	<0.005	<0.005	<0.005	**0.0079J**	<0.005	ND	ND	<0.005	<0.005	<0.002	<0.005	<0.005	<0.002	<0.002	<0.002
	5/15/2006	20	--	ND	**0.0063J**	<0.020	<0.005	<0.005	<0.005	**0.0047J**	<0.005	ND	ND	**0.011**	<0.005	<0.002	<0.005	<0.005	<0.002	<0.002	<0.002
	5/15/2006	25	--	ND	**0.0049J**	<0.020	<0.005	<0.005	<0.005	**0.0063J**	<0.005	ND	ND	**0.0081J**	<0.005	<0.002	<0.005	<0.005	<0.002	<0.002	<0.002
	5/15/2006	30	--	ND	**0.018**	<0.020	<0.005	**0.017**	**0.013**	**0.111**	**0.039**	ND	ND	**0.079**	**0.054**	**0.0033J**	<0.005	**0.018**	<0.002	**0.003J**	**0.003J**
	5/15/2006	35	--	ND	**3.280**	<0.080	**0.162**	**2.110**	<0.020	**13.300**	**3.300**	ND	ND	**10.800**	**4.920**	**0.307**	**2.970**	**10.300**	**0.240**	**0.945**	**0.945**
SB4	5/16/2006	5	--	ND	**5.900**	<0.200	**0.590**	**10.700**	<0.050	**17.700**	**10.900**	ND	ND	**21.900**	**18.000**	**0.488**	**0.151**	**60.000**	**0.157**	**7.290**	**7.290**
	5/16/2006	10	--	ND	**3.470**	<0.200	**0.304**	**5.140**	<0.050	**13.900**	**5.140**	ND	ND	**6.400**	**8.350**	**0.855**	**9.700**	**29.600**	**6.230**	**35.200**	**35.200**
	5/16/2006	15	--	ND	**0.979**	<0.080	**0.150**	**2.050**	<0.020	**5.570**	**2.160**	ND	ND	**4.770**	**3.640**	**1.470**	**6.340**	**18.100**	**7.180**	**23.000**	**23.000**
	5/16/2006	20	--	ND	**7.270**	<0.260	**0.631**	**11.100**	<0.065	**19.600**	**10.700**	ND	ND	**24.300**	**17.900**	**1.930**	**9.080**	**61.000**	**3.080**	**19.600**	**19.600**
	5/16/2006	25	--	ND	**0.092**	<0.180	**0.113**	**1.540**	<0.045	**2.270**	**1.310**	ND	ND	**4.880**	**2.170**	**0.711**	**4.640**	**13.800**	**3.650**	**11.200**	**11.200**
	5/16/2006	30	--	ND	**10.800**	<0.200	**0.322**	**5.200**	<0.050	**18.800**	**6.110**	ND	ND	**19.900**	**10.300**	**0.478**	**13.600**	**44.500**	**3.350**	**40.000**	**40.000**
	5/16/2006	35	--	ND	**4.080**	<0.100	**0.558**	**7.970**	<0.025	**20.900**	**8.270**	ND	ND	**36.800**	**14.500**	**3.390**	**27.200**	**79.400**	**26.600**	**90.300**	**90.300**
	5/16/2006	40	--	ND	**1.200**	<0.200	**0.289**	**3.970**	<0.050	**8.280**	**3.760**	ND	ND	**11.200**	**6.020**	**1.860**	**12.300**	**34.800**	**12.100**	**38.300**	**38.300**
SOUTHWEST PARCEL																					
MW-20	1/10/2017	7	**11**	<0.10	<0.0040	<0.040	<0.010	**0.037**	**0.017**	**0.019**	**0.043**	<0.010	<0.010	**0.052**	**0.062**	<0.0040	<0.010	<0.010	<0.0040	<0.0040	<0.0080
	1/10/2017	11	**260**	<5.0	<0.20	<2.0	<0.50	**0.66**	<0.50	<0.20	<0.50	<0.50	<0.50	<1.0	**1.1**	<0.20	<0.50	<0.50	<0.20	<0.20	<0.40
	1/10/2017	19	**600**	<5.0	<0.20	<2.0	<0.50	**2.3**	**1.7**	<0.20	**2.1**	<0.50	<0.50	**12**	**3.5**	<0.20	<0.50	<0.50	<0.20	<0.20	<0.40
SB3	5/15/2006	5	--	ND	ND	ND	**0.606**	**6.230**	**3.000**	**8.990**	**7.800**	ND	ND	**19.000**	**12.500**	**0.257**	ND	**0.050**	**0.051**	**0.051J**	**0.051J**
	5/15/2006	10	--	ND	**0.373**	ND	**0.102**	**0.792**	ND	**3.230**	**1.200**	ND	ND	**4.200**	**1.700**	**3.900**	**4.530**	**10.900**	**5.760**	**20.400**	**20.400**
	5/15/2006	15	--	ND	**0.086**	ND	**0.926**	**8.200**	ND	**15.600**	**9.770**	ND	ND	**50.700**	**15.200**	**0.966**	**12.500**	**96.500**	**7.600**	**23.700**	**23.700**
	5/15/2006	20	--	ND	**0.0462J**	ND	**0.587**	**5.970**	ND	ND	**7.160**	ND	ND	**30.600**	**10.100**	**0.449**	**1.220**	**60.000**	**1.450**	**9.000**	**9.000**
	5/15/2006	25	--	ND	ND	ND	**0.477**	**5.060**	ND	**0.268**	**6.930**	ND	ND	**23.100**	**10.600**	**0.284**	**0.490**	**45.100**	**0.103**	**9.200**	**9.200**

Table 4-2
Summary of Soil Analytical Results - Volatile Organic Compounds
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	TPHg (C4-C12) mg/kg	Acetone mg/kg	Benzene mg/kg	TBA mg/kg	tert-Butylbenzene mg/kg	sec-Butylbenzene mg/kg	n-Butylbenzene mg/kg	Ethylbenzene mg/kg	Isopropylbenzene mg/kg	4-Isopropyltoluene mg/kg	MTBE mg/kg	Naphthalene mg/kg	n-Propylbenzene mg/kg	Toluene mg/kg	1,3,5-TMB mg/kg	1,2,4-TMB mg/kg	o-Xylene mg/kg	m,p-Xylenes mg/kg	Total Xylenes mg/kg
DTSC SL/USEPA RSL [6] Direct Contact - Commercial			**420 [1]**	**670,000**	**1.4**	**1,500,000 [2]**	**12,000**	**12,000**	**6,400**	**25**	**9,900**	**9,900 [3]**	**210**	**17**	**24,000**	**5,400**	**1,100**	**240**	**2,800**	**2,400 [4]**	**2,500**
LARWQCB SL - Protection of Groundwater at 20 ft bgs, Aquifer is not a source of drinking water [7]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**163**	**0.62**	**1.3**	**28**	**28**	**28**	**68**	**84**	**84 [2]**	**1.3**	**1.8**	**28**	**25**	**36**	**36**	**NV**	**NV**	**225**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**150**	**0.15**	**1.2**	**26**	**26**	**26**	**32**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**16**	**33**	**33**	**NV**	**NV**	**176**
LARWQCB SL - Protection of Groundwater at 40 ft bgs, Aquifer is not a source of drinking water [9]																					
100X LARWQCB Soil SLs (0 to 10 ft bgs) [8]			**1,000 [5]**	**406**	**7.5**	**3.2**	**70**	**70**	**70**	**254**	**208**	**208 [2]**	**2.0**	**4.6**	**70**	**75**	**89**	**89**	**NV**	**NV**	**689**
100X LARWQCB Soil SLs (10 to 20 ft bgs) [8]			**1,000 [5]**	**243**	**1.2**	**1.9**	**42**	**42**	**42**	**110**	**125**	**125 [2]**	**1.4**	**2.8**	**42**	**37**	**53**	**53**	**NV**	**NV**	**284**
100X LARWQCB Soil SLs (20 to 39 ft bgs) [8]			**1,000 [5]**	**150**	**0.16**	**1.2**	**26**	**26**	**26**	**38**	**77**	**77 [2]**	**1.3**	**1.7**	**26**	**17**	**33**	**33**	**NV**	**NV**	**191**
EAST PARCEL																					
E1B	6/1/2006	5	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	15	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	25		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
E1C	6/1/2006	5	--	ND	ND	ND	ND	ND	ND	**0.0088J**	ND	ND	ND	**0.0050J**	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	15	--	ND	ND	ND	**0.175**	**3.100**	**1.100**	ND	**2.600**	ND	ND	**4.32**	ND	**0.114**	ND	ND	ND	ND	ND
	6/1/2006	25	--	ND	ND	ND	**0.281**	**4.760**	**1.190**	**0.0594J**	**4.020**	ND	ND	**9.08**	ND	**0.136**	ND	ND	**0.0458J**	ND	**0.0458J**
E3A	6/1/2006	10	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
E5	6/1/2006	5	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	10	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	15	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/1/2006	20	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
VOC = Volatile organic compounds , fuel oxygenates, and TPHg, by EPA Method 8260B.
TPHg = Total petroleum hydrocarbons as gasoline.
TBA = tert-Butyl alcohol.
MTBE = Methyl-tert-butyl ether.
TMB = Trimethylbenzene.
ft bgs = feet below ground surface.
mg/kg = milligram per kilogram.
ND = Not detected at laboratory reporting limit. See Tetra Tech, 2006 for laboratory reporting limit.
-- = Not analyzed.

DTSC SL = Department of Toxic Substances Control Screening Level (DTSC, 2016).
USEPA RSL = U.S. Environmental Protection Agency Regional Screening Level (USEPA, 2016).
LARWQCB SL = Los Angeles Regional Water Quality Control Board Screening Level (LARWQCB, 1996).
100X = One hundred times.
NV = No published water quality value to calculate soil cleanup goal.
<X.XX = Not detected above indicated reporting limit (RL).
J = Analyte was detected; however, analyte concentration is an estimated value which is between the method detection limit and the practical quantitation limit.

Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds lowest of DTSC SL/USEPA RSL for commercial land use and LARWQCB SL for protection of groundwater at 20 ft bgs.

[1] Screening level for TPHg represents the lowest of aliphatic and aromatic USEPA RSLs for TPH Low (C5-C8).
[2] Screening level for 4-Isopropyltoluene was not available; therefore, the value for Isopropylbenzene was used.
[3] Screening level for tert-butyl alcohol was not available; therefore, the value for sec-butyl alcohol was used.
[4] Screening level for m,p-xylenes represents the value for m-xylene.
[5] As recommended by LARWQCB (1996), for non-drinking water aquifers, screening level for TPHg represents the LARWQCB SL for TPH (C4-C12) where distance above groundwater is greater than 150 feet (>150 feet).
[6] DTSC SLs/USEPA RSL for industrial soil for direct contact exposure pathways represents the lowest of the available DTSC SL or USEPA RSL.
[7] LARWQCB SL respresents soil SL for protection of groundwater at 20 ft bgs, assuming groundwater aquifer is not a source of drinking water.
[8] As recommended by LARWQCB (1996), for non-drinking water aquifers, benzene, toluene, ethylbenzene, and xylene (BTEX) screening levels are set at 100 times (100X) respective MCLs as preliminary levels to be protection of human health and the environment. This method was applied to all VOCs.
[9] LARWQCB SL respresents soil SL for protection of groundwater at 40 ft bgs, assuming groundwater aquifer is not a source of drinking water.

References:

DTSC. 2016. Human Health Risk Assessment (HHRA) Note Number 3, DTSC-modified Screening Levels (DTSC SLs). Human and Ecological Risk Office (HERO). June.
LARWQCB. 1996. Interim Site Assessment & Cleanup Guidebook. California Regional Water Quality Control Board, Los Angeles and Ventura Counties, Region 4. May 1996.
Tetra Tech. 2006. Environmental Due Diligence Site Assessment Results, Former Chemoil Refinery Property, Signal Hill, California. August 8.
USEPA. 2016. Regional Screening Levels (TR=1E-06, HQ=1). May.

Table 4-3
Summary of Soil Analytical Results - Polycyclic Aromatic Hydrocarbons and Lead
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Acenaphthene mg/kg	Acenaphthylene mg/kg	Anthracene mg/kg	Benz(a)anthracene mg/kg	Benzo(a)pyrene mg/kg	Benzo(b)fluoranthene mg/kg	Benzo(g,h,i)perylene mg/kg	Benzo(k)fluoranthene mg/kg	Chrysene mg/kg	Dibenzo(a,h)anthracene mg/kg	Fluoranthene mg/kg	Fluorene mg/kg	Indeno(1,2,3-cd)pyrene mg/kg	Naphthalene mg/kg	Phenanthrene mg/kg	Pyrene mg/kg	Lead mg/kg
DTSC SL/USEPA RSL [3] Direct Contact - Commercial			**45,000**	**45,000 [1]**	**230,000**	**2.9**	**0.29**	**2.9**	**NV**	**29**	**290**	**0.29**	**30,000**	**30,000**	**2.9**	**17**	**230,000 [2]**	**23,000**	**320**
USEPA RSL [4] Protection of Groundwater Aquifer is not a source of drinking water			**5.5**	**5.5 [1]**	**58**	**0.0042**	**0.004**	**0.041**	**NV**	**0.4**	**1.2**	**0.013**	**89**	**5.4**	**0.13**	**0.00054**	**58 [2]**	**13**	**NV**
NORTHWEST PARCEL																			
AN-01	1/4/2017	10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	<0.010	<0.010	<0.010	--
	1/4/2017	20	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	<0.010	<0.010	<0.010	--
AN-02	1/4/2017	6.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20	<5.0	<5.0	<5.0	**34**
	1/4/2017	10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	<0.010	<0.010	<0.010	--
	1/4/2017	30	**0.043**	**0.022**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	**0.090**	<0.040	**0.67**	**0.084**	<0.010	--
AN-03	1/5/2017	5.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	**24**	<0.20	<0.20	**4.4**
	1/5/2017	10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.40	**3.0**	<0.10	<0.10	--
	1/5/2017	20.5	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.20	**0.43**	<0.050	<0.050	--
AN-05	1/5/2017	5	<0.50	<0.50	**2.0**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.57**	**3.7**	<2.0	**11**	**9.2**	**1.2**	**6.8**
	1/5/2017	10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.40	**0.76**	**0.20**	<0.10	--
	1/5/2017	20	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.0	**4.0**	**0.69**	<0.50	--
AN-13	1/9/2017	5.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.33**	<0.40	**0.62**	**0.34**	<0.10	--
	1/9/2017	9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**2.2**	<2.0	**14**	**2.0**	<0.50	**5.1**
	1/9/2017	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**1.4**	<2.0	**15**	**1.2**	<0.50	--
	1/9/2017	20	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.65**	<2.0	**3.2**	**0.55**	<0.50	--
AN-20	1/18/2017	8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.40	**7.3**	<0.10	<0.10	--
	1/18/2017	10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	**0.59**	<0.010	<0.010	--
	1/18/2017	15	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	**0.96**	<0.010	<0.010	--
	1/18/2017	20	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	**0.86**	<0.010	<0.010	--
SB1	5/16/2006	4	**0.794**	ND	**0.114**	ND	ND	ND	ND	ND	ND	ND	**0.097**	**3.680**	ND	**17.300**	**26.500**	**1.240**	--
	5/16/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	30	**0.033**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.104**	ND	**0.226**	**0.424**	ND	--
	5/16/2006	35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SB2	5/15/2006	5	**0.122**	ND	**0.160**	ND	ND	ND	ND	ND	**1.083**	ND	**0.063**	**1.340**	ND	ND	**4.050**	**0.712**	**4.20J**
	5/15/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/15/2006	16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**4.90J**
	5/15/2006	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/15/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/15/2006	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	5/15/2006	35	--	--	--	--	--	--	--	--	--		--	--		--	--	--	--
SB4	5/16/2006	5	**0.159**	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.010	**0.068**	ND	**3.300**	**1.040**	ND	**22.1**
	5/16/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**4.00J**
	5/16/2006	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	30	**0.045**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.0180J**	ND	**3.130**	**0.059**	ND	ND
	5/16/2006	35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/16/2006	40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4-3
Summary of Soil Analytical Results - Polycyclic Aromatic Hydrocarbons and Lead
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Acenaphthene mg/kg	Acenaphthylene mg/kg	Anthracene mg/kg	Benz(a)anthracene mg/kg	Benzo(a)pyrene mg/kg	Benzo(b)fluoranthene mg/kg	Benzo(g,h,i)perylene mg/kg	Benzo(k)fluoranthene mg/kg	Chrysene mg/kg	Dibenzo(a,h)anthracene mg/kg	Fluoranthene mg/kg	Fluorene mg/kg	Indeno(1,2,3-cd)pyrene mg/kg	Naphthalene mg/kg	Phenanthrene mg/kg	Pyrene mg/kg	Lead mg/kg
DTSC SL/USEPA RSL [3] Direct Contact - Commercial			**45,000**	**45,000 [1]**	**230,000**	**2.9**	**0.29**	**2.9**	**NV**	**29**	**290**	**0.29**	**30,000**	**30,000**	**2.9**	**17**	**230,000 [2]**	**23,000**	**320**
USEPA RSL [4] Protection of Groundwater Aquifer is not a source of drinking water			**5.5**	**5.5 [1]**	**58**	**0.0042**	**0.004**	**0.041**	**NV**	**0.4**	**1.2**	**0.013**	**89**	**5.4**	**0.13**	**0.00054**	**58 [2]**	**13**	**NV**
SOUTHWEST PARCEL																			
MW-20	1/10/2017	7	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.040	<0.010	<0.010	<0.010	**4.9**
	1/10/2017	11	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	**0.24**	<0.20	<0.20	<0.20
	1/10/2017	19	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.40	**8.3**	**0.80**	<0.10	<0.10
SB3	5/15/2006	4	**0.409**	ND	ND	**1.010**	ND	ND	ND	ND	**0.688**	ND	**0.048**	**0.870**	ND	**11.100**	**7.630**	**7.630**	**0.522**
	5/15/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/15/2006	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5/15/2006	20	**0.564**	ND	**0.900**	ND	ND	ND	ND	ND	**0.832**	ND	**0.089**	**4.350**	ND	**52.900**	**30.900**	**30.900**	**10.700**
	5/15/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EAST PARCEL																			
E1B	6/1/2006	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
E1C	6/1/2006	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	15	**0.221**	ND	ND	ND	ND	ND	ND	ND	**1.59**	ND	**0.036**	**0.387**	ND	**1.19**	**1.95**	**1.95**	--
	6/1/2006	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
E3A	6/1/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
E5	6/1/2006	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/1/2006	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
PAH = Polycyclic aromatic hydrocarbons, by EPA Method 8270C.
Total lead, by EPA Method 6010B.
ft bgs = feet below ground surface.
mg/kg = milligram per kilogram.
ND = Not detected at laboratory reporting limit. See Tetra Tech, 2006 for laboratory reporting limit.
-- = Not analyzed.

DTSC SL = Department of Toxic Substances Control Screening Level (DTSC, 2016).
USEPA RSL = U.S. Environmental Protection Agency Regional Screening Level (USEPA, 2016).
LARWQCB SL = Los Angeles Regional Water Quality Control Board Screening Level (LARWQCB, 1996).
<X.XX = Not detected above indicated reporting limit (RL).
NV = No published value.
J = Analyte was detected; however, analyte concentration is an estimated value which is between the method detection limit and the practical quantitation limit.

Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds lowest of DTSC SL/USEPA RSL for commercial land use and USEPA RSL for protection of groundwater.
[1] Screening level for acenaphthylene was not available; therefore, the value for acenaphthene was used.
[2] Screening level for phenanthrene was not available; therefore, the value for anthracene was used.
[3] DTSC SLs/USEPA RSL for industrial soil for direct contact exposure pathways represents the lowest of the available DTSC SL or USEPA RSL.
[4] USEPA RSL respresents soil SL for protection of groundwater, assuming groundwater aquifer is not a source of drinking water. Values from LARWQCB (1996) for PAHs were not available.

References:

DTSC. 2016. Human Health Risk Assessment (HHRA) Note Number 3, DTSC-modified Screening Levels (DTSC SLs). Human and Ecological Risk Office (HERO). June.
LARWQCB. 1996. Interim Site Assessment & Cleanup Guidebook. California Regional Water Quality Control Board, Los Angeles and Ventura Counties, Region 4. May 1996.
Tetra Tech. 2006. Environmental Due Diligence Site Assessment Results, Former Chemoil Refinery Property, Signal Hill, California. August 8.
USEPA. 2016. Regional Screening Levels (TR=1E-06, HQ=1). May.

Table 4-4
Summary of Soil Vapor Analytical Results - Volatile Organic Compounds
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth feet bgs	Benzene µg/m³	Toluene µg/m³	Ethylbenzene µg/m³	o-Xylene µg/m³	m,p-Xylenes µg/m³	Xylenes µg/m³	Naphthalene µg/m³	Methyl tert-Butyl Ether µg/m³	4-Ethyltoluene[2] µg/m³	1,2,4-Trimethylbenzene µg/m³	1,3,5-Trimethylbenzene µg/m³	Heptane[3] µg/m³	Cyclohexane µg/m³	n-Hexane µg/m³
DTSC SL/USEPA RSL[1] Vapor Intrusion to Indoor Air - Residential			**9.7E+01**	**3.1E+05**	**1.1E+03**	**1.0E+05**	**1.0E+05**	**1.0E+05**	**8.3E+01**	**1.1E+04**	**4.2E+05**	**7.3E+03**	**4.2E+04**	**7.3E+05**	**6.3E+06**	**7.3E+05**
DTSC SL/USEPA RSL[1] Vapor Intrusion to Indoor Air - Commercial			**8.4E+02**	**2.6E+06**	**9.8E+03**	**8.8E+05**	**8.8E+05**	**8.8E+05**	**7.2E+02**	**9.4E+04**	**3.6E+06**	**6.20E+04**	**3.6E+05**	**6.2E+06**	**5.2E+07**	**6.2E+06**
NORTHWEST PARCEL																
AN-04	1/17/2017	5	**194,875.66**	<45,222.09	**208,431.90**	**191,062.58**	**955,312.88**	**1,146,375.46**	<62,905.52	<43,263.80	**103,239.26**	**167,149.28**	**93,399.18**	**819,713.70**	**2,478,331.29**	**458,216.77**
AN-06	1/17/2017	5	**271,548.06**	<22,611.04	**28,255.15**	<26,053.99	<52,107.98	<78,161.97	<31,452.76	<21,631.90	<29,496.93	<29,496.93	<29,494.48	**393,462.58**	**2,099,697.34**	**634,453.99**
AN-07	1/17/2017	5	<6.39	<7.54	<8.68	<8.68	<17.37	<26.05	<10.48	<7.21	<9.83	<9.83	<9.83	<8.20	<6.88	<7.05
AN-08	1/17/2017	5	<6.39	<7.54	<8.68	<8.68	<17.37	<26.05	<10.48	<7.21	<9.83	<9.83	<9.83	<8.20	<6.88	<7.05
	1/17/2017	5 (DUP)	<6.39	<7.54	<8.68	<8.68	<17.37	<26.05	<10.48	<7.21	<9.83	<9.83	<9.83	<8.20	<6.88	<7.05
SB1	5/30/2006	5	<820	<820	**2,100**	<800	<1,640	<2,460	--	<820	--	**4,300**	<1,230	--	--	--
	5/30/2006	15	**24,000**	<800	**26,900**	<800	**10,800**	**10,800**	--	<800	--	**4,380**	<1,200	--	--	--
SB2	5/30/2006	5	**242,000**	<820	**15,200**	<820	<1,640	<2,460	--	<820	--	<1,230	<1,230	--	--	--
	5/30/2006	19.5	**230,000**	<800	**108,000**	<800	<1,600	<2,400	--	<800	--	<1,200	<1,200	--	--	--
SB4	5/30/2006	5	**10,100**	<800	**6,810**	<800	**9,040**	**9,040**	--	**1,680**	--	**10,300**	**5,490**	--	--	--
	5/30/2006	16.5	**802,000**	**70,800**	**159,000**	**41,100**	**221,000**	**262,100**	--	<800	--	**7,770**	**5,830**	--	--	--
SOUTHWEST PARCEL																
SB3	5/18/2006	15	**3,400**	<800	**31,900**	<800	<1,600	<2,400	--	<800	--	**2,490**	**1,720**	--	--	--
	5/18/2006	15	**2,500**	<800	**22,300**	<800	<1,600	<2,400	--	<800	--	**3,460**	**3,370**	--	--	--
	5/18/2006	15	**2,940**	<820	**48,400**	<800	<1,600	<2,400	--	<800	--	**3,500**	**3,070**	--	--	--
	5/30/2006	5	**12,100**	<820	**25,600**	<800	<1,640	<2,440	--	<820	--	<1,230	<1,230	--	--	--
	5/30/2006	15	**7,140**	<800	**60,600**	<800	<1,600	<2,400	--	<800	--	<1,200	<1,200	--	--	--
EAST PARCEL																
E1	6/2/2006	15	<796	<796	**10,800**	<796	<1,592	<2,388	--	<796	--	<1,194	<1,194	--	--	--

Notes:
VOCs measured by EPA Method TO-15.
µg/m³ = microgram per cubic meter.
DTSC SL= Department of Toxic Substances Control Screening Level (DTSC, 2016).
USEPA RSL= U.S. Environmental Protection Agency Regional Screening Level (USEPA, 2016).
<X.XX = Not detected at or above the indicated laboratory reporting limit.
NV = No published value.
ND = Not detected at laboratory reporting limit. See Tetra Tech, 2006 for laboratory reporting limit.
- = Not analyzed.
DUP = Duplicate sample.

Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds DTSC SL/USEPA RSL for commercial land use.

[1] The soil gas screening level is calculated by dividing the air screening level for residential air and industrial air by the DTSC (2011) default attenuation factor for new building construction of 0.001 and 0.0005, respectively. The most stringent (i.e., lowest) indoor air screening level from DTSC SLs (DTSC, 2016) and USEPA RSLs (USEPA, 2016) was used.

[2] Screening level for 4-ethyltoluene was not available; therefore, the value for isopropylbenzene was used.

[3] Screening level for heptane was not available; therefore, the value for hexane was used.

References:
DTSC. 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. California Environmental Protection Agency. October.
DTSC. 2016. Human Health Risk Assessment (HHRA) Note Number 3, DTSC-modified Screening Levels (DTSC SLs). Human and Ecological Risk Office (HERO). June.
Tetra Tech. 2006. Environmental Due Diligence Site Assessment Results, Former Chemoil Refinery Property, Signal Hill, California. August 8.
USEPA. 2016. Regional Screening Levels (TR=1E-06, HQ=1). May.

Table 4-5
Summary of Groundwater Analytical Results - Hydrocarbon Chain Characterization, January 2017
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth	Hydrocarbon Chain Identification															TPH (C6-C12)[Note 1]	TPH (C13-C22)[Note 2]	TPH (C23-C44)[Note 3]	TPH (C6-C44)
			C6-C8	C8-C10	C10-C12	C12-C14	C14-C16	C16-C18	C18-C20	C20-C22	C22-C24	C24-C26	C26-C28	C28-C32	C32-C34	C34-C36	C36-C40	C40-C44				
		ft bgs	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
California MCL[4] / *Notification Level*[5]			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**
SFRWQCB ESLs[6] Groundwater Vapor Intrusion - Residential			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**
SFRWQCB ESLs[6] Groundwater Vapor Intrusion - Commercial/Industrial			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**
NORTHWEST PARCEL																						
AN-01	1/4/2017	40	<1.0	**1.1**	**20**	**70**	**45**	**37**	**27**	**20**	**8.6**	**5.1**	**2.2**	**3.4**	<1.0	<1.0	<1.0	<1.0	**21**	**164**	**15**	**240**
AN-02	1/5/2017	38	**14**	**200**	**420**	**520**	**400**	**220**	**96**	**50**	**23**	**11**	<10	<10	<10	<10	<10	<10	**634**	**1026**	**22.5**	**2,000**
AN-03	1/5/2017	40	**0.78**	**4.6**	**9.4**	**9.0**	**5.8**	**2.5**	**1.7**	**1.1**	**0.41**	**0.29**	**0.36**	**0.14**	<0.10	<0.10	<0.10	<0.10	**15**	**16**	**1.00**	**36**
AN-05	1/5/2017	40	**1.6**	**14**	**35**	**44**	**35**	**21**	**12**	**6.4**	**2.7**	**1.3**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**51**	**96**	**2.7**	**170**
AN-13	1/9/2017	41	**1.3**	**8.0**	**26**	**33**	**25**	**14**	**7.0**	**3.3**	**1.2**	**0.50**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**35**	**66**	**1.1**	**120**
	1/9/2017	54	<0.10	**0.62**	**4.2**	**4.1**	**0.69**	**0.28**	**0.17**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**4.8**	**3.2**	<0.90	**10**
AN-20	1/18/2017	32	**7.0**	**25**	**18**	**15**	**12**	**3.7**	**1.1**	**0.58**	**0.12**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**50**	**25**	**0.06**	**83**
	1/18/2017	42	**14**	**48**	**49**	**30**	**9.4**	**1.4**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**111**	**26**	<2.5	**150**
	1/18/2017	62	**0.36**	**1.2**	**1.4**	**1.5**	**0.23**	**0.092**	**0.081**	**0.12**	**0.047**	**0.030**	**0.64**	**0.072**	<0.010	<0.010	**0.026**	<0.010	**2.96**	**1.273**	**0.77**	**5.9**
SOUTHWEST PARCEL																						
MW-20	1/18/2017	20-35	<0.050	**0.10**	**0.81**	**1.5**	**3.1**	**1.8**	**0.80**	**0.60**	**0.38**	**0.11**	**0.10**	**0.073**	<0.050	<0.050	<0.050	<0.050	**0.91**	**7.05**	**0.47**	**9.4**
WEST OF GUNDRY AVENUE, OFFSITE																						
AO-1	1/10/2017	34	**4.3**	**17**	**15**	**5.5**	**0.91**	**0.13**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**36**	**3.8**	<1.0	**44**
	1/10/2017	44	**2.1**	**7.7**	**6.2**	**2.4**	**0.57**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**16**	**1.8**	<1.10	**19**
	1/10/2017	60	**0.035**	**0.19**	**0.61**	**0.78**	**0.55**	**0.44**	**0.33**	**0.27**	**0.18**	**0.084**	**0.57**	**0.097**	**0.022**	**0.030**	**0.013**	<0.010	**0.8**	**2.0**	**0.86**	**4.2**

Notes:
TPH = Total petroleum hydrocarbons measured by EPA Method 8015M.
C4-C12 = Carbon range.
ft bgs = feet below ground surface.
mg/L = milligram per liter.
MCL = Maximum Contaminant Level.
SFRWQCB ESL = San Francisco Bay Regional Water Quality Control Board Groundwater Screening Level for Vapor Intrusion (SFRWQCB, 2016).
NV = No value.
<X.XX = Not detected above indicated reporting limit (RL).
-- = Not analyzed.

Bold values were reported above laboratory detection limits.
[1] TPH_{C4-C12} was calculated based on summing detected results from C6-C8, C8-C10, and C10-C12.
[2] $TPH_{C13-C22}$ was calculated based on summing detected results of one half C12-C13 and the results between C14 and C22.
[3] $TPH_{C23-C44}$ was calculated based on summing the results of one half C22-C24 and the results between C24 and C44.
[4] California MCLs shown in bold font. MCLs are enforceable standards. No values for TPH mixtures were available.
[5] California notification levels shown in italic font. Notification levels are advisory in nature and not enforceable standards. No values for TPH mixtures were available.
[6] SFRWQCB ESL for groundwater vapor intrusion. No values for TPH mixtures were available.
References:
SFRWQCB. 2016. Environmental Screening Levels (ESLs). Revision 3. February.

Table 4-6
Summary of Groundwater Analytical Results - Volatile Organic Compounds, January 2017
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Acetone µg/L	Benzene µg/L	TBA µg/L	sec-Butylbenzene µg/L	tert-Butylbenzene µg/L	n-Butylbenzene µg/L	1,2-Dichloroethane µg/L	cis-1,2-Dichloroethene µg/L	Ethylbenzene µg/L	TPHg (C4-C12) µg/L	Isopropylbenzene µg/L	4-Isopropyltoluene µg/L	Naphthalene µg/L	n-Propylbenzene µg/L	Tetrachloroethylene µg/L	Toluene µg/L	1,3,5-TMB µg/L	1,2,4-TMB µg/L	2-Butanone (MEK) µg/L	MTBE µg/L	o-Xylene µg/L	m,p-Xylenes µg/L	total Xylenes µg/L
California MCL[1] / *Notification Level*[2]			**NV**	**1**	*12*	*260*	*260*	*260*	**0.5**	**6**	**300**	**NV**	*770*	**NV**	*17*	*260*	**5**	**150**	*330*	*330*	**NV**	**13**	**1,750**	**1,750**	**1,750**
SFRWQCB ESLs[3] Groundwater Vapor Intrusion - Residential			**4.5E+07**	**1.4**	**NV**	**NV**	**NV**	**NV**	**7.4**	**140**	**16**	**NV**	**NV**	**NV**	**25**	**NV**	**3.7**	**4,300**	**NV**	**NV**	**5.5E+06**	**1,500**	**1,600**	**1,600**	**1,600**
SFRWQCB ESLs[3] Groundwater Vapor Intrusion - Commercial/Industrial			**3.7E+08**	**12**	**NV**	**NV**	**NV**	**NV**	**64**	**1,100**	**140**	**NV**	**NV**	**NV**	**220**	**NV**	**32**	**37,000**	**NV**	**NV**	**4.6E+07**	**13,000**	**13,000**	**13,000**	**13,000**
NORTHWEST PARCEL																									
AN-01	1/4/2017	40	<100	**18**	<100	**28**	<5.0	**24**	<5.0	<5.0	<5.0	**53,000**	**57**	<10	**560**	**63**	<5.0	<5.0	<5.0	<5.0	<100	<20	<5.0	<10	<15
AN-02	1/5/2017	38	<100	<5.0	**110**	**180**	**18**	**160**	<5.0	<5.0	<5.0	**81,000**	**290**	<10	**1,300**	**380**	<5.0	<5.0	<5.0	<5.0	<100	<20	<5.0	<10	<15
AN-03	1/5/2017	40	<100	**990**	<100	**420**	**48**	**370**	<5.0	**7.6**	**91**	**35,000**	**710**	**16**	**1,600**	**850**	<5.0	<5.0	**9.0**	**19**	<100	<20	**13**	**34**	**47**
AN-05	1/5/2017	40	<100	**68**	**140**	**66**	<5.0	**73**	<5.0	<5.0	**9.2**	**170,000**	**110**	<10	**830**	**150**	<5.0	<5.0	<5.0	<5.0	<100	<20	<5.0	<10	<15
AN-13	1/9/2017	41	<500	**1,000**	<500	<25	<25	**27**	<25	<25	**370**	**12,000**	**85**	<50	**380**	**110**	<25	<25	<25	<25	<500	<100	<25	<50	<75
	1/9/2017	54	<10	**10**	<10	**1.1**	<0.50	**1.4**	**38**	<0.50	**5.7**	**240**	**1.6**	<1.0	**12**	**2.1**	<0.50	<0.50	<0.50	<0.50	<10	<2.0	<0.50	<1.0	<1.5
AN-20	1/18/2017	32	<1000	**3,600**	<1000	<50	<50	<50	<50	**120**	**1,000**	**19,000**	**120**	<100	<200	**130**	<50	<50	**99**	**410**	<1,000	<200	<50	**460**	**460**
	1/18/2017	42	<1000	**6,300**	<1000	<50	<50	<50	<50	**150**	**1,200**	**26,000**	**130**	<100	**380**	**160**	<50	<50	**220**	**680**	<1,000	<200	<50	**1,400**	**1,400**
	1/18/2017	52	**120**	**200**	<10	**6.2**	<0.50	**5.9**	<0.50	**5.0**	**83**	**3,900**	**19**	**7.4**	**16**	**22**	**3.2**	**2.2**	**24**	**63**	**18**	<2.0	**8.4**	**130**	**138**
	1/18/2017	62	**160**	**380**	<50	**11**	<2.5	**11**	<2.5	**5.6**	**300**	**8,400**	**57**	**14**	**72**	**63**	**7.7**	**13**	**63**	**190**	<50	<10	**24**	**320**	**344**
SOUTHWEST PARCEL																									
MW-20	1/18/2017	20-35	<10	<0.50	**100**	**3.5**	<0.50	**1.2**	<0.50	<0.50	**1.1**	**360**	**6.8**	<1.0	**120**	**10**	**0.74**	<0.50	<0.50	<0.50	<10	<2.0	<0.50	<1.0	<1.5
WEST OF GUNDRY AVENUE, OFFSITE																									
AO-01	1/10/2017	34	<100	<5.0	<100	**45**	<5.0	**42**	<5.0	<5.0	**320**	**32,000**	**150**	**41**	**160**	**200**	<5.0	<5.0	**65**	**310**	<100	<20	<5.0	<10	<15
	1/10/2017	44	<100	<5.0	<100	**65**	<5.0	**83**	<5.0	<5.0	**590**	**18,000**	**150**	**78**	**180**	**190**	<5.0	<5.0	**210**	**520**	<100	<20	**32**	**850**	**882**
	1/10/2017	60	**33**	**1.4**	<10	**1.8**	<0.50	**1.9**	<0.50	**1.6**	**13**	**920**	**4.1**	**1.8**	**5.7**	**4.9**	<0.50	<0.50	**5.6**	**16**	<10	<2.0	**0.97**	**22**	**23**

Notes:
Volatile organic compounds, fuel oxygenates, and TPHg measured by EPA Method 8260B.
ft bgs = feet below ground surface.
µg/L = microgram per liter.
TPHg = Total petroleum hydrocarbons as gasoline.
TBA = tert-Butyl alcohol.
MTBE = Methyl-t-butyl ether.
TMB = Trimethylbenzene
MCL = Maximum Contaminant Level.
SFRWQCB ESL = San Francisco Bay Regional Water Quality Control Board Groundwater Screening Level for Vapor Intrusion (SFRWQCB, 2016).
NV = No value published.
<X.XX = Not detected above indicated reporting limit (RL).
-- = Not analyzed.
Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds lowest of SFRWQCB ESL groundwater vapor intrusion for commercial/industrial land use or California MCL or California notification level.
[1] California MCLs shown in bold font. MCLs are enforceable standards.
[2] California notification levels shown in italic font. Notification levels are advisory in nature and not enforceable standards.
[3] SFRWQCB ESL for groundwater vapor intrusion, deep groundwater (≥10 feet bgs), sand scenario for resident and commercial/industrial land use.
References:
SFRWQCB. 2016. Environmental Screening Levels (ESLs). Revision 3. February.

Table 4-7
Summary of Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons, January 2017
Former ChemOil Refinery
Signal Hill, California

Boring	Sample Date	Depth ft bgs	Acenaphthene µg/L	Acenaphthylene µg/L	Anthracene µg/L	Benz(a)anthracene µg/L	Benzo(a)pyrene µg/L	Benzo(b)fluoranthene µg/L	Benzo(g,h,i)perylene µg/L	Benzo(k)fluoranthene µg/L	Chrysene µg/L	Dibenzo(a,h)anthracene µg/L	Fluoranthene µg/L	Fluorene µg/L	Indeno(1,2,3-cd)pyrene µg/L	Naphthalene µg/L	Phenanthrene µg/L	Pyrene µg/L
California MCL[1] / *Notification Level*[2]			**NV**	**NV**	**NV**	**NV**	**0.2**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	*17*	**NV**	**NV**
SFRWQCB ESLs[3] Groundwater Vapor Intrusion - Residential			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**25**	**NV**	**NV**
SFRWQCB ESLs[3] Groundwater Vapor Intrusion - Commercial/Industrial			**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**NV**	**220**	**NV**	**NV**
NORTHWEST PARCEL																		
AN-02	1/5/2017	38	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	**110**	<40	**1,100**	**170**	<40
AN-03	1/5/2017	40	**4.4**	**3.2**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**9.6**	<2.0	**560**	**10**	<2.0
AN-05	1/5/2017	40	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**28**	<10	**580**	**31**	<10
AN-13	1/9/2017	41	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**12**	<2.0	**260**	**10**	<2.0
	1/9/2017	54	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**0.72**	<0.20	**11**	**1.0**	<0.20
AN-20	1/18/2017	32	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**230**	**3.1**	<0.20
	1/18/2017	42	**17**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**7.0**	<2.0	**550**	**4.5**	<2.0
	1/18/2017	62	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**0.20**	<0.20	**4.5**	**0.26**	<0.20
SOUTHWEST PARCEL																		
MW-20	1/18/2017	20-35	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**2.2**	<0.20	**160**	**1.4**	<0.20
WEST OF GUNDRY AVENUE, OFFSITE																		
AO-01	1/10/2017	34	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**0.98**	<0.20	**110**	**0.69**	<0.20
	1/10/2017	44	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**91**	**0.65**	<0.20
	1/10/2017	60	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**0.48**	<0.20	**3.6**	**0.57**	<0.20

Notes:
Polycyclic aromatic hydrocarbons (PAHs) measured by EPA Method 8270C.
ft bgs = feet below ground surface.
µg/L = microgram per liter.
MCL = Maximum Contaminant Level.
SFRWQCB ESL = San Francisco Bay Regional Water Quality Control Board Groundwater Screening Level for Vapor Intrusion (SFRWQCB, 2016).
NV = No value published.
<X.XX = Not detected above indicated reporting limit (RL).
-- = Not analyzed.

Bold values were reported above laboratory detection limits.
Shaded and bold value exceeds lowest of SFRWQCB ESL groundwater vapor intrusion for commercial/industrial land use or California MCL or California notification level.
[1] California MCLs shown in bold font. MCLs are enforceable standards.
[2] California notification levels shown in italic font. Notification levels are advisory in nature and not enforceable standards.
[3] SFRWQCB ESL for groundwater vapor intrusion, deep groundwater (≥10 feet bgs), sand scenario for resident and commercial/industrial land use.
References:
SFRWQCB. 2016. Environmental Screening Levels (ESLs). Revision 3. February.

Table 5-1
Summary of UVOST™ and MIP© Borings
Former ChemOil Refinery
Signal Hill, California

Area	Approximate Depth to Groundwater (feet bgs)	Boring Type	Boring ID	Total Depth (feet bgs)	Maximum UVOST™ / MIP© Output and Corresponding Depth (feet bgs)
Northwest Parcel	28-31	UVOST™	AN-09	44.36	94% 33'
			AN-10	44.19	32.5% 19'
			AN-11	34.88	82% 27.5'
			AN-12	38.89	67 % 34.5'
			AN-15	43.73	12% 42.5'
			AN-16	40.32	27% 40.5'
			AN-17	43.08	3.5% 41.5'
			AN-18	34.21	4.6% 34'
		MIP©	AN-19	50.60	~$4x10^7$ µV 32'
			AN-21	44.00	~$3.8x10^6$ µV 40'
Southwest Parcel	20-24	UVOST™	AS-01	37.80	56% 21'
			AS-02	41.08	82% 29.5'
			AS-03	33.41	160% 21.5'
			AS-04	27.96	48% 22'
			AS-05	27.49	44% 22'
			AS-06	27.89	94% 21'
			AS-09	34.55	25% 23.5
		MIP©	AS-10	44.00	$1.8x10^6$/$1.6x10^6$ µV 7'/39'
East Parcel	30	UVOST™	AE-01	32.16	1.3% 14.5'
			AE-02	32.15	20% 16.5'
			AE-03	31.24	0.8% 28'

Notes:
UVOST™ = Ultra-Violet Optical Screening Tool.
MIP© = Membrane Interface Probe.
bgs = Below ground surface.
% = Percent response relative to reference emitter.
µV = Microvolt.

Table 5-2
Summary of Soil Vapor Analytical Results - Methane and Helium - January 17, 2017
Former ChemOil Refinery
Signal Hill, California

Sample	Purge Volume	Methane	Helium in Sample	Average Helium Under Shroud	Leak Ratio[1]
		ppmv	(%)	(%)	(%)
AN-04	3	**60,000**	<0.20	20.1	- -
AN-06	3	**63,000**	<0.20	21.0	- -
AN-07	3	<40	<0.20	20.7	- -
AN-08	3	<40	<0.20	21.2	- -
AN-08 (DUP)	3	<40	<0.20	21.2	- -

Notes:
Methane measured by GC/FID.
Helium measured by ASTM D1946M.
ppmv = parts per million by volume.
% = Percent.
<X.XX = Not detected at or above the indicated laboratory reporting limit.
DUP = Duplicate sample.
- - = Not calculated, helium not detected in sample.
Bold values were reported above laboratory detection limits.
[1] Estimated leak ratio (%) = [Concentration of Helium in Sample (%)] / [Concentration of Helium in Shroud (%)] X100.

Table 5-3
Well MW-11 Bail-Down Test Results
Former ChemOil Refinery
Signal Hill, California

Date	Time	Elapsed Time		Well MW-11 (4-inch diameter casing)						
		(D:H:M)	(Min)	Depth to Product	Product Level	Depth to Water	Water Level	Thickness	Percent Recovery	LPH Recovery Rate Into Well Casing During Various Stages of Testing
				ft btoc	ft amsl	ft btoc	ft amsl	ft		gal/day
01/18/17	9:06 AM	0:0:00	0	29.80	2.82	31.40	1.22	1.60	NA	
01/18/17	9:44 AM	0:0:38	38	30.10	2.52	30.50	2.12	0.40	NA	
01/18/17	9:55 AM	0:0:49	49	30.10	2.52	30.40	2.22	0.30	NA	
01/18/17	10:12 AM	0:1:06	66	30.10	2.52	30.25	2.37	0.15	NA	
01/18/17	10:24 AM	0:1:18	78	30.05	2.57	30.20	2.42	0.15	0.00%	For the first 21 minutes following bailing, NAPL recovered into Well MW-11 at a rate of approximately 2.2 gpd.
01/18/17	10:26 AM	0:1:20	80	30.05	2.57	30.20	2.42	0.15	0.00%	
01/18/17	10:30 AM	0:1:24	84	30.05	2.57	30.22	2.40	0.17	1.25%	
01/18/17	10:35 AM	0:1:29	89	30.05	2.57	30.22	2.40	0.17	1.25%	
01/18/17	10:45 AM	0:1:39	99	30.02	2.60	30.22	2.40	0.20	3.12%	
01/18/17	10:55 AM	0:1:49	109	30.02	2.60	30.22	2.40	0.20	3.12%	Throughout the entire recovery period, NAPL in Well MW-11 recovered at a rate of approximately 0.12 gpd.
01/18/17	11:10 AM	0:2:04	124	30.01	2.61	30.20	2.42	0.19	2.50%	
01/18/17	11:19 AM	0:2:13	133	30.00	2.62	30.17	2.45	0.17	1.25%	
01/18/17	12:02 PM	0:2:56	176	29.97	2.65	30.15	2.47	0.18	1.87%	
01/18/17	1:02 PM	0:3:56	236	29.95	2.67	30.13	2.49	0.18	1.87%	
01/18/17	2:22 PM	0:5:16	316	29.94	2.68	30.12	2.50	0.18	1.87%	
Estimated time for 100% recovery in well MW-11 following nearly complete LPH baildown appears to be slightly more than a week with overall LPH recovery rate into casing during testing at approximately 0.12 gal/day.										

Notes:
ft amsl = Feet above mean sea level
ft btoc = Feet below top of casing
NA = Not Applicable
gpd = Gallon per day
LPH = Liquid phase hydrocarbon
NAPL = Non-aqueous phase liquid

Table 5-4
Summary of Soil Physical Property Data
Former ChemOil Refinery
Signal Hill, California

Boring ID	Date Sampled	Sample Depth	Moisture Content	Density		Porosity		Total Pore Fluid Saturation [1]	Effective [2] Permeability to Air	Effective [2] [3] Permeability to Water	Hydraulic Conductivity [1] [2]	Pore Fluid Saturations [4]			
				Dry Bulk	Grain	Total	Air-filled					Pre-Centrifuge		Post-Centrifuge	
		feet bgs	% weight	g/cc	g/cc	%Vb	%Vb	%Pv	millidarcy	millidarcy	cm/s	Water (Swi) Saturation	NAPL (Soi) Saturation	Water (Srw) Saturation	NAPL (Sor) Saturation
NORTHWEST PARCEL															
AN-13	1/9/2017	27.35	15.0	1.41	2.69	47.6	25.5	20.8	5,090	--	--	--	--	--	--
		27.25	32	1.46	2.69	45.6	8.4	54.3	--	1,070	1.05E-03	--	--	--	--
		27.1	--	1.59	2.68	40.6	--	--	--	--	--	32	29.6	12.4	11.6

Notes:
Moisture content measured by ASTM D2216 and API RP40.
Density, porosity, total pore fluid saturations, and effective permeability to air measured by API RP40.
Effective permeability to water and hydraluic conductivity measured by API RP40 and EPA 9100.
Pore fluid saturations measured by ASTM D425M and Dean-Stark.
bgs = below ground surface.
g/cc = gram per cubic centimeter.
% = percent.
Vb = bulk volume.
Pv = pore volume.
Air = Nitrogen.
cm/s = centimeter per second.
-- = not applicable.
Total porosity = all interconnected por channels.
Air-filled porosity = pore channels not occupied by pore fluids.
Fluid density (Water = 0.9996 g/cc) used to calculate pore fluid saturations.
Swi = Initial water saturation as received prior to centrifuging at 100xG.
Soi = Initial non-aqueous phase liquid (NAPL) saturation as received prior to centrifuging at 100xG.
Srw = Residual water saturation after centrifuging at 100xG.
Sor = Residual NAPL saturation after centrifuging at 100xG.
[1] Fluid density used to calculate pore fluid saturations is water = 0.996 g/cc.
[2] With as-received fluids in place.
[3] Permeability to water and hydraulic conductivity measured at saturated conditions.
[4] Fluid densities used to calculate pore fluid saturations are water = 0.996 g/cc and NAPL = 0.8600 g/cc.

Table 5-5
Summary of LNAPL Physical Property Data
Former ChemOil Refinery
Signal Hill, California

Boring / Well ID	Date Sampled	Sample Depth	Description	Temperature	Specific Gravity	Density	Viscosity	
		feet bgs		°F		g/cc	centistokes	centipoise
NORTHWEST PARCEL								
MW-11	1/18/2017	30	NAPL	70	0.8185	0.8169	1.84	1.50
				100	0.8101	0.8045	1.40	1.13
				130	0.8035	0.7923	1.13	0.899
AN-13	1/9/2017	31	NAPL	70	0.8492	0.8475	3.45	2.92
				100	0.8411	0.8353	2.41	2.01
				130	0.8350	0.8233	1.81	1.49

Notes:
Viscosity, density and specific gravity data by methods ASTM D445, ASTM D1481, and API RP40.
bgs = below ground surface.
g/cc = gram per cubic centimeter.
°F = degree Farenheit.
NAPL = Non-aqueous phase liquid.

APPENDIX A

FIELD NOTES

(On File with The Source Group, Inc., a Division of Apex Companies, LLC and Available Upon Request)

APPENDIX B

PERMITS

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2040 Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- **NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.**

Juan Rodriguez 626-430-5386 or JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

On 11/29/16 $ Fees were submitted for Permit# SR0089853 to advance 5 soil borings into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED:	REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED	REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED:	REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED:	REHS signature

Revised: October 2012

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2071 N Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- **NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.**

Juan Rodriguez 626-430-5386 or JRodrigue2@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

On 11/29/16 $ Fees were submitted for Permit #5R00B9855 to advance a soil boring into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED
DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED
DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT
DATE ACCEPTED: REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2105 Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- **NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.**

Juan Rodriguez 626-430-5386 on Jurodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST COUNTY OF LOS ANGELES CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

On 11/29/16 $Fees were submitted for Permit#SR0089859 to advance 13 soil borings at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED
DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED
DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT
DATE ACCEPTED: REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2105 Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.

Juan Rodriguez 626-430-5386 or JuRodrigue2@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 1/3/17

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIF.

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

on 12/30/16 $130.00 was paid for Permit# SR0092628 to advance a soil boring into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED: REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS In the street along Gundry Avenue (in front of 2109 Gundry Avenue)	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
	Signal Hill	90755	casey huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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Juan Rodriguez 626-430-5386 or JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

on 11/29/16 $ Fees were submitted for Permit# 5R008985 to advance a soil boring into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED:	REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED:	REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED:	REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2165 Walnut Avenue	Signal Hill	90755	casey huff@apexcos.com

NOTICE:

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Juan Rodriguez 626-430-5386 or JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

on 12/2/16 Permit SA#0089857 was issued to advance 2 soil boring locations into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED: REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL
2185 Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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Juan Rodriguez 626-430-5420 or JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO. 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

On 11/29/16 $ Fees were submitted for Permit #SR0089856 to advance a soil boring location at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED
DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED
DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED
DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT
DATE ACCEPTED: REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMITAPPROVAL
East 21st Street & Walnut Avenue	Signal Hill	90755	casey huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- THIS WELL PERMIT APPROVAL IS LIMITED TO COMPLIANCE WITH THE CALIFORNIA WELL STANDARDS AND THE LOS ANGELES COUNTY CODE AND DOES NOT GRANT ANY RIGHTS TO CONSTRUCT, RENOVATE, OR DECOMMISSION ANY WELL. THE APPLICANT IS RESPONSIBLE FOR SECURING ALL OTHER NECESSARY PERMITS SUCH AS WATER RIGHTS, PROPERTY RIGHTS, COASTAL COMMISSION APPROVALS, USE COVENANTS, ENCROACHMENT PERMISSIONS, UTILITY LINE SETBACKS, CITY/COUNTY PUBLIC WORKS RIGHTS OF WAY, ETC.
- ALL FIELD WORK MUST BE CONDUCTED UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL GEOLOGIST LICENSED IN THE STATE OF CALIFORNIA.
- THIS PERMIT IS NOT COMPLETE UNTIL ALL OF THE FOLLOWING REQUIREMENTS ARE SIGNED BY THE DEPUTY HEALTH OFFICER. WORK SHALL NOT BE INITIATED WITHOUT A WORK PLAN APPROVAL STAMPED BY THE DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM.
- **NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.**

Juan Rodriguez 626-430-5386 on JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 12/2/16

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

on 11/29/16 $ Fees were submitted for Permit #SR0089858 to advance 7 soil borings into groundwater at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED:	REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED:	REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED:	REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED:	REHS signature

ENVIRONMENTAL HEALTH

Drinking Water Program

5050 Commerce Drive, Baldwin Park, CA 91706
Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov
http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:

WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMITAPPROVAL
East 21st Street & Walnut Avenue	Signal Hill	90755	casey.huff@apexcos.com

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
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- NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN.

Juan Rodriguez 626-430-5386 or JRodriguez@ph.lacounty.gov

TO BE COMPLETED BY DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM:

☐ WORK PLAN INCOMPLETE; SUBMIT THE FOLLOWING:

☑ WORK PLAN APPROVED

DATE: 1/3/17

Los Angeles County Drinking Water stamp

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST — COUNTY OF LOS ANGELES — CALIFORNIA

R.E.H.S. NO: 6330

Juan Rodriguez

ADDITIONAL APPROVAL CONDITIONS:

On 12/30/16 $ 519.00 was paid for Permit# 5900092630 to install a groundwater monitoring well at above-mentioned site.

☐ ANNULAR SEAL FINAL INSPECTION REQUIRED

DATE ACCEPTED: REHS signature

☐ WELL COMPLETION LOG REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—BACTERIOLOGICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER QUALITY—CHEMICAL STANDARDS REQUIRED

DATE ACCEPTED: REHS signature

☐ WATER SUPPLY YIELD REQUIRED

DATE ACCEPTED: REHS signature

☐ OTHER REQUIREMENT

DATE ACCEPTED: REHS signature

CITY OF SIGNAL HILL

2175 Cherry Avenue • Signal Hill, California 90755-3799

ENGINEERING DEPARTMENT
PUBLIC WORKS
EXCAVATION/ENCROACHMENT PERMIT

DATE	12/13/16		
PERMIT NO.	**16 149**	DIG ALERT NO.	
APPLICANT	**THE SOURCE GROUP**		

Hereby names application for a permit to excavate in the public streets of the City of Signal Hill, subject to the provisions of ordinances 487 and 496. In consideration of the execution of an excavation permit pursuant to this application the applicant hereby agrees to indemnify, save, and keep the City of Signal ever, which the City of Signal Hill, its officers, agents or employees may suffer, sustain, incur, pay out as a result of any and all actions, suits, proceedings, claims and demands which may be brought, made, or filed against the City, its officers, agents and employees by reason of or arising out of, or in any manner connected with any and all operations authorized or permitted by the permit.

SITE ADDRESS	**GUNDRY AVENUE (IN STREET AT 2109 GUNDRY AVENUE)**		
PURPOSE	**INSTALL 6 INCH GROUNDWATER TEST WELL**		
START DATE	**12/13/2016**	EXPIRATION DATE	**01/12/2017**

*** WORK MUST BEGIN WITHIN 30 DAYS OF ISSUANCE DATE.

EXCAV / ENCR / INSP	Units	Permit Fee	Quantities	
1. Unimproved Dirt				
2. AC Paving				
3. P.C.C. Sidewalk	1	$ 55.00		$ 55.00
4. Curb & Gutter l/f				
5. Driveway Aprons				
6. Traffic Inspection	1	$ 35.00		$ 35.00
ENCROACHMENT ONLY	**Units**	**Permit Fee**		
7. Disposal Bin		$ 25.00		
8. Storage Bin/Moving Pod		$ 25.00		
TOTAL				$ 90.00

☐ Workers Comp. Insurance

☐ Business License

License Number

☐ BILL LATER

PERMIT FEE	Acct #: 100-32-911	$ 55.00
TRAFFIC FEE	Acct #: 100-32-911	$ 35.00
INSPECTION FEE	Acct #: 100-34-911	$ 100.00
ENCROACHMENT ONLY	Acct #: 100-32-911	$ -
($100 per lateral) *# of LATERALS>*		$ -
	TOTAL FEE:	**$ 190.00**

24 HOUR EMERGENCY CONTACT

NAME *(print)*	**KIRSTEN DUEY**	PHONE NO.	925-951-6376
MAILING ADDRESS	3478 BUSKIRK AVENUE, SUITE 100, PLEASANT HILL, CA 94523		

SIGNATURE: Kirsten Duey **DATE:** 12/13/16

APPROVED: Anthony Carrasco **DATE:** 12/13/16

ORIGINAL: ***PERMITEE*** 1 COPY: ***INSPECTOR*** 1 COPYwith license & insurance ***FILE***

Paid:_____ Project Complete:_____ Date:_____

APPENDIX C

SURVEY REPORT

Evans Land Surveying and Mapping

The Source Group, Inc.

former Chemoil Refinery
2020 Walnut Avenue Signal Hill, California

Groundwater Monitoring Well and Soil Boring Locations
January 13, 2017

Designation	Northing	Easting	Elevation (ft.)	Description
MW-1	1,747,887.4	6,509,005.7	22.23	TOC(PVC) (check)
MW-10	1,747,857.6	6,509,449.3	31.61	TOC(PVC) (check)
MW-11	1,748,116.3	6,509,289.5	32.60	CAP(steel) (check)
MW-8 (??) marked on lid	1,747,996.3	6,509,056.8	24.49 25.22 24.9	TOC (new well ??) COVER GS
MW-12	1,748,074.1	6,508,915.9	23.48 24.07 24.0	TOC COVER GS
MW-20	1,747,850.6	6,509,318.9	24.79 25.55 25.4	TOC COVER GS
AE-01	1,747,942.4	6,509,541.2	38.6	GS
AE-02	1,747,908.7	6,509,575.3	38.6	GS
AE-03	1,747,860.5	6,509,542.0	33.2	GS

3436 Paloma Avenue, La Verne, CA 91750 **ph (909) 592-5501**

Evans Land Surveying and Mapping

The Source Group, Inc.

former Chemoil Refinery
2020 Walnut Avenue Signal Hill, California

Groundwater Monitoring Well and Soil Boring Locations
January 13, 2017

Designation	Northing	Easting	Elevation (ft.)	Description
AN-01	1,748,342.4	6,509,208.8	42.5	GS
AN-02	1,748,250.4	6,509,095.5	35.4	GS
AN-03	1,748,229.6	6,509,303.5	35.8	GS
AN-04	1,748,229.6	6,509,305.6	35.7	GS
AN-05	1,748,228.0	6,509,210.6	33.9	GS
AN-06	1,748,225.3	6,509,210.5	33.7	GS
AN-07	1,748,344.4	6,509,208.7	42.6	GS
AN-08	1,748,252.4	6,509,094.2	35.5	GS
AN-09	1,748,102.9	6,509,056.6	28.4	GS
AN-10	1,748,108.0	6,509,139.2	28.8	GS
AN-11	1,748,160.2	6,509,126.1	30.2	GS
AN-12	1,748,187.9	6,509,062.0	31.4	GS
AN-13	1,748,158.8	6,509,119.7	29.9	GS
AN-15	1,748,151.1	6,509,302.3	35.3	GS
AN-16	1,748,105.2	6,509,345.0	34.5	GS
AN-17	1,748,059.5	6,509,294.5	31.5	GS
AN-18	1,748,094.6	6,509,279.2	31.7	GS
AN-19	1,748,097.6	6,509,279.1	31.7	GS
AN-20	1,748,102.4	6,509,264.6	30.7	GS
AN-21	1,748,162.5	6,509,125.1	30.2	GS

3436 Paloma Avenue, La Verne, CA 91750 **ph (909) 592-5501**

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former Chemoil Refinery
2020 Walnut Avenue Signal Hill, California

Groundwater Monitoring Well and Soil Boring Locations
January 13, 2017

Designation	Northing	Easting	Elevation (ft.)	Description
AS-01	1,747,888.5	6,509,196.6	23.3	GS
AS-02	1,747,900.9	6,509,272.9	26.2	GS
AS-03	1,747,845.5	6,509,281.3	24.5	GS
AS-04	1,747,784.5	6,509,247.3	22.4	GS
AS-05	1,747,860.8	6,509,176.6	22.4	GS
AS-06	1,747,820.6	6,509,246.1	23.5	GS
AS-09	1,747,666.1	6,509,360.0	22.6	GS
AS-10	1,747,822.1	6,509,242.7	23.4	GS
AO-01	1,748,181.9	6,508,915.6	27.0	GS
BMW-1	1,747,631.1	6,509,341.3	22.0	COVER
BMW-2	1,747,678.5	6,509,282.0	22.1	COVER
BMW-3	1,747,726.4	6,509,218.8	22.0	COVER
BMW-4	1,747,787.7	6,509,139.6	23.2	COVER
BMW-5	1,747,838.1	6,509,076.8	23.4	COVER
BMW-6	1,747,884.3	6,509,016.0	23.3	COVER
BMW-7	1,747,962.7	6,508,991.1	24.7	COVER
BMW-8	1,748,048.8	6,508,991.1	27.0	COVER
BMW-9	1,748,114.4	6,508,992.6	29.6	COVER

3436 Paloma Avenue, La Verne, CA 91750 **ph (909) 592-5501**

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former Chemoil Refinery
2020 Walnut Avenue Signal Hill, California

Groundwater Monitoring Well and Soil Boring Locations
January 13, 2017

Designation	Northing	Easting	Elevation (ft.)	Description
BMW-10	1,748,186.6	6,508,997.7	32.0	COVER
BMW-11	1,748,260.3	6,508,993.4	34.5	COVER
BMW-12	1,748,335.2	6,508,992.1	35.7	COVER

Legend:

TOC = Top of PVC well Casing
COVER = Existing Well access Cover
GS = Existing Ground Surface

Datum:

Horizontal = North American Datum of 1983 **(NAD'83)**
CCS'83, Zone V (0405) (2000.35 epoch)
Prior well survey, (provided by SGI, Inc.)

Vertical = National Geodetic Vertical Datum of 1929 (**NGVD'29**)
based on existing wells MW-1, MW-10 & MW-11
Prior well survey, (provided by SGI, Inc.)

LICENSED LAND SURVEYOR
STEPHEN E. EVANS
Expires 6/30/18
No. 7017
STATE OF CALIFORNIA

Stephen E. Evans , PLS 7017
Project Surveyor

3436 Paloma Avenue, La Verne, CA 91750 **ph (909) 592-5501**

APPENDIX D

METHODOLOGY FOR LARWQCB SOIL SCREENING LEVELS FOR PROTECTION OF GROUNDWATER

METHODOLOGY FOR LARWQCB SOIL SCREENING LEVELS FOR PROTECTION OF GROUNDWATER

Soil screening levels (SLs) are used to evaluate the site investigation data, to identify chemicals of potential concern (COPCs), and to determine if further action is warranted to evaluate potential health impacts from exposure to Site-related constituents at the former Chemoil Refinery located in Signal Hill, California (the Site). This appendix describes the methodology used to develop soil SLs for total petroleum hydrocarbon (TPH) and volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, and total xylenes (BTEX) and methyl tert-butyl ether (MTBE), using the procedures described in the *California Regional Water Quality Control Board – Los Angeles (LARWQCB) 1996 Interim Site Assessment and Cleanup Guidebook* (Guidebook; LARWQCB, 1996). The Guidebook–based soil SLs are site-specific and designed to be protective of leaching to the groundwater pathway through the vadose zone. These soil SLs are based on chemical toxicity, lithology of the soil, distance above groundwater, and groundwater designation as a source of drinking water.

Lithology determinations for the Site were based on Unified Soil Classification System (USCS) lithologies, using boring logs from the January 2017 site investigation. Depth to groundwater was determined using monitoring well data from the December 2016 groundwater monitoring event (Ami Adini & Associates, Inc. [AA&A], 2017). Due to Site topography, depth to groundwater in the northern portions of the Site is approximately 43 feet below ground surface (bgs; well MW-3), whereas depth to water in the southern portions of the Site is measured at approximately 15 feet bgs (well MW-14). A conservative, Site-wide groundwater depth of 20 feet bgs was selected to calculate the soil SLs. Since the depth to groundwater greatly varies across the entire Site, soil SLs were also calculated for a depth to groundwater of 40 feet bgs, which is the dominant groundwater depth in the northern portions of the Site.

TPH Soil Screening Levels

Soil SLs for TPH were developed by the LARWQCB based on the length of the carbon chain and the distance of vadose zone soil above groundwater. The Guidebook separates TPH into the following carbon chain ranges: C4-C12, C13-C22, and C23-C44. Shallow groundwater is not currently used and is not likely to be developed for beneficial use. Since groundwater is not a source of drinking water, the maximum soil SL for soil greater than 150 feet above groundwater is used for all TPH carbon chain ranges (reproduced below from Table 4-1 of the Guidebook [LARWQCB, 1996]).

Table 4-1
Maximum Soil Screening Levels (mg/kg) for TPH
above Drinking Water Aquifers

Distance Above Groundwater	Hydrocarbon Chain Identification		
	C4-C12	C13-C22	C23-C44
>150 feet	1,000	10,000	50,000
20-150 feet	500	1,000	10,000
<20 feet	100	100	1,000

Notes:
mg/kg = milligram per kilogram

VOC Soil Screening Levels

Soil SLs for VOCs were developed by the LARWQCB based on the attenuation factor (AF) method as described in Appendix A of the Guidebook (LARWQCB, 1996). The AF method is used to calculate soil SLs using a soil to groundwater leaching model, which takes into consideration the physical properties of the site-specific soil types, physical properties of the chemicals, average infiltration rates through the site-specific lithology, distance to groundwater, and water quality standards (WQSs).

In order to simplify the calculation of the AF, the Guidebook presents average AFs based on distance above groundwater and lithology type (Table 5-1 [LARWQCB, 1996]). These average AFs are compiled from soil physical property data from the Los Angeles region, overall maximum average AFs for 29 common VOCs, distance above groundwater, and common vadose zone lithology. Table 5-1 is reproduced below from the Guidebook (LARWQCB, 1996).

Table 5-1
Average Attenuation Factor for Different Distances Above Groundwater
and Lithology

Distance Above Groundwater	Lithology			
	Gravel	Sand	Silt	Clay
150 feet	13	26	51	255
120 feet	10	19	39	193
100 feet	8	15	20	151
80 feet	3	7	13	67
60 feet	1	3	5	26

Table 5-1 (Continued)
Average Attenuation Factor for Different Distances Above Groundwater and Lithology

Distance Above Groundwater	Lithology			
	Gravel	Sand	Silt	Clay
40 feet	1	1	3	13
20 feet	1	1	1	7

Notes:
Average attenuation factors for 1) a given depth above groundwater and 2) lithology.
Distance (feet) between groundwater and the measured point.
Lithology (USCS Standard) between groundwater and the measured point.

If the vadose zone is a combination of more than one lithology type, AF values should be proportional to the thickness of each lithology type represented within the vadose zone for the given depth above groundwater. The attenuation factor for multiple lithology types is calculated as follows:

$$AF_T = \%_{gravel} \times AF_{gravel} + \%_{sand} \times AF_{sand} + \%_{silt} \times AF_{silt} + \%_{clay} \times AF_{clay}$$

where:
AF_T = Total attenuation factor (liters per kilogram).
% = percent.

For distances above groundwater not included on Table 5-1, the average attenuation factor for each lithologic constituent can be linearly interpolated between the points given in Table 5-1.

To calculate the soil SL for VOCs, the AF_T is multiplied by the applicable WQS for the chemical. Water quality standards for VOCs were obtained from the most conservative water quality value from MCL, SFRWQCB ESLs (SFRWQCB, 2016), SWRCB notification levels (NLs) (SWRCB, 2015), and USEPA RSLs (USEPA, 2016). Since groundwater is not considered a source of drinking water, the WQS was set at 100 times the WQS as a preliminary level determined to be protective of human health and the environment (LAWRQCB, 1996).

$$\text{VOC Soil SL} = AF_T \times (100 \times WQS)$$

where:
WQS = Water quality standard in milligrams per liter.
VOC Soil SL in milligrams per kilogram.

BTEX and MTBE Soil Screening Levels

Soil SLs for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and methyl tert-butyl ether (MTBE) were pre-determined by the LARWQCB using the AF method (LARWQCB, 1996), which was described above. Maximum soil SLs for BTEX and MTBE above drinking water aquifers are calculated based on Table 4-1 (revised January 5, 2005) of the Guidebook. For alternate depths, the soil screening levels for BTEX and MTBE can be linearly interpolated from Table 4-1 of the Guidebook. Since groundwater is not considered a source of drinking water, the pre-determined maximum soil SLs shown in the table below for BTEX and MTBE were multiplied by 100.

Table 4-1
Maximum Soil Screening Levels (mg/kg) for TPH, BTEX and MTBE above Drinking Water Aquifers

	Distance Above Groundwater	Lithology			
		Gravel	Sand	Silt	Clay
BTEX & MTBE	150 feet	B=0.044	B=0.077	B=0.165	B=0.8
		T=2	T=4	T=9	T=43
		E=8	E=17	E=34	E=170
		X=23	X=48	X=93	X=465
		MTBE = 0.039	MTBE = 0.078	MTBE = 0.156	MTBE = 0.78
	120 feet	B=0.035	B=0.058	B=0.123	B=0.603
		T=1.57	T=3.1	T=7	T=32
		E=6.3	E=12.7	E=25.9	E=128
		X=17.9	X=36	X=70.3	X=351
		MTBE = 0.028	MTBE = 0.061	MTBE = 0.117	MTBE = 0.591
	100 feet	B=0.028	B=0.046	B=0.094	B=0.471
		T=1.3	T=2.57	T=5.4	T=25
		E=5.1	E=9.86	E=20.4	E=101
		X=14.4	X=28	X=55.1	X=276
		MTBE = 0.020	MTBE = 0.05	MTBE = 0.091	MTBE = 0.464
	80 feet	B=0.022	B=0.033	B=0.066	B=0.34
		T=1	T=2	T=4	T=18
		E=4	E=7	E=15	E=73
		X=11	X=20	X=40	X=200
		MTBE = 0.013	MTBE = 0.039	MTBE = 0.065	MTBE = 0.338
	60 feet	B=0.018	B=0.026	B=0.048	B=0.241
		T=0.72	T=1.4	T=2.8	T=13
		E=2.9	E=4.9	E=10.7	E=52
		X=7.9	X=13.9	X=28.4	X=141.5
		MTBE = 0.013	MTBE = 0.03	MTBE = 0.048	MTBE = 0.247
	40 feet	B=0.015	B=0.018	B=0.029	B=0.143
		T=0.43	T=0.87	T=1.6	T=7.5
		E=1.8	E=2.8	E=6.3	E=30
		X=4.8	X=7.8	X=16.9	X=83
		MTBE = 0.013	MTBE = 0.022	MTBE = 0.03	MTBE = 0.156
	20 feet	B=0.011	B=0.011	B=0.011	B=0.044
		T=0.15	T=0.3	T=0.45	T=2.3
		E=0.7	E=0.7	E=2	E=9
		X=1.75	X=1.75	X=5.3	X=24.5
		MTBE = 0.013	MTBE = 0.013	MTBE = 0.013	MTBE = 0.065

mg/kg = milligram per kilogram.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
MTBE = Methyl tert-butyl ether.
Respective MCLs (parts per million): B=0.001, T=0.15, E=0.7, X=1.75, MTBE=0.013.

Summary of Soil Screening Levels

Calculated soil SLs where groundwater is a non-drinking water aquifer are shown on Tables D-1 through D-4. Since depth to groundwater varies at the Site, scenarios for depth to groundwater at 20 feet bgs and 40 feet bgs were both considered. For the scenario where groundwater is at 20 feet bgs (Tables D-1 and D-2), soil SLs were calculated for 0 to 10 feet bgs (10 feet above groundwater) and 10 to 19 feet bgs (1 foot above groundwater). For the scenario where groundwater is at 40 feet bgs (Tables D-3 and D-4), soil SLs are calculated for 0 to 10 feet bgs (30 feet above groundwater), 10 to 20 feet bgs (20 feet above groundwater), and 20 to 39 feet bgs (1 foot above groundwater). Where the soil SLs are typically more conservative than the laboratory reporting limits, the screening levels have been modified to represent laboratory detection and reporting limitations.

REFERENCES

Department of Toxic Substances Control (DTSC). 2016. Human Health Risk Assessment (HHRA) Note Number 3: DTSC-modified Screening Levels (DTSC-SLs). Human and Ecological Risk Office (HERO). June.

Los Angeles Region – Regional Water Quality Control Board (LARWQCB). 1996. Interim Site Assessment and Cleanup Guidebook: May 1996 California Regional Water Quality Control Board Los Angeles and Ventura Counties Region 4. May. Table 4-1 updated January 5, 2005.

State Water Resources Control Board (SWRCB). 2015. Drinking Water Notification Levels and Response Levels: An Overview. Division of Drinking Water. State Water Resources Control Board (CWRCB). February 4.

U.S. Environmental Protection Agency (USEPA). 2016. Regional Screening Levels Summary Table (TR=1E-06, HQ=1). May.

TABLES

Table D-1
Soil Screening Levels for TPH, BTEX and MTBE -
Groundwater at 20 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 0 to 10 feet bgs[1]
(10 feet Above Groundwater)

Soil Types (10 - 20 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	55.6	13.5	1.00
Soil Type Percentage[4]	0%	79%	19%	1%

Constituent	Gravel SL[5] (mg/kg)	Sand SL[5] (mg/kg)	Silt SL[5] (mg/kg)	Clay SL[5] (mg/kg)	Soil SL[5] (mg/kg)
TPH (C4-C12)	1,000	1,000	1,000	1,000	**1,000**
TPH (C13-C22)	10,000	10,000	10,000	10,000	**10,000**
TPH (C23-C44)	50,000	50,000	50,000	50,000	**50,000**
Benzene	0.6	0.6	0.6	2.3	**0.62**
Toluene	15	23	30	123	**25**
Ethylbenzene	50	50	115	465	**68**
Xylenes	175	175	353	1313	**225**
MTBE	1.3	1.3	1.3	3.9	**1.3**

Soil Screening Level - 11 to 20 feet bgs[1]
(1 foot Above Groundwater)

Soil Types (19 - 20 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	6.60	0.40	0.00
Soil Type Percentage[4]	0%	94%	6%	0%

Constituent	Gravel SL[5] (mg/kg)	Sand SL[5] (mg/kg)	Silt SL[5] (mg/kg)	Clay SL[5] (mg/kg)	Soil SL[5] (mg/kg)
TPH (C4-C12)	1,000	1,000	1,000	1,000	**1,000**
TPH (C13-C22)	10,000	10,000	10,000	10,000	**10,000**
TPH (C23-C32)	50,000	50,000	50,000	50,000	**50,000**
Benzene	0.15	0.15	0.15	0.32	**0.15**
Toluene	15	16	17	26	**16**
Ethylbenzene	32	32	39	74	**32**
Xylenes	175	175	193	289	**176**
MTBE	1.3	1.3	1.3	1.6	**1.3**

Notes:

TPH = Total petroleum hydrocarbons.

C4-C12 = Carbon range.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

MTBE = Methyl tert-butyl ether.

bgs = below ground surface.

SL = screening level.

mg/kg = milligram per kilogram.

[1] Screening level calculations based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

[2] Represents soil interval that contaminant vertically migrates through to groundwater. Soil types are compiled from January 2017 soil boring logs with data from the indicated depth range.

[3] Average soil thickness is the total thickness of each soil type encountered within January 2017 soil borings for the indicated depth range based on the USCS classification.

[4] Soil type percentage is equal to the average soil thickness of each soil type divided by the total summed thickness of all soil types.

[5] SLs are from LARWQCB (1996) Table 4-1. Values not included on the table are linearly interpolated between distance above groundwater and are proportional to fraction of each lithological thickness. SLs are multiplied by a factor of 100 to account for a non-drinking water aquifer.

References:

LARWQCB. 1996. Interim Site Assessment and Cleanup Guidebook: May 1996 California Regional Water Quality Control Board, Los Angeles and Ventura Counties Region 4 (LARWQCB). May. Updated January 5, 2005.

Table D-2
Soil Screening Levels for VOCs -
Groundwater at 20 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 0 to 10 feet bgs[1]
(10 feet Above Groundwater)

Soil Types (10 - 20 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	55.6	13.5	1.00
Soil Type Percentage[4]	0.00	0.79	0.19	0.01
Average Attenuation Factor[5]	1	1	1	7

Constituent	Water Quality Standard (WQS)[6]			AF_T [(8)]	Soil SL
	WQS (mg/L)	100xWQS[7] (mg/L)	Source	(L/kg)	(mg/kg)
1,2,4-Trimethylbenzene	0.33	33	NL	1.09	**36**
1,3,5-Trimethylbenzene	0.33	33	NL	1.09	**36**
Acetone	1.5	150	ESL	1.09	**163**
Isopropylbenzene	0.77	77	NL	1.09	**84**
n-Butylbenzene	0.26	26	NL	1.09	**28**
n-Propylbenzene	0.26	26	NL	1.09	**28**
sec-Butylbenzene	0.26	26	NL	1.09	**28**
tert-Butylbenzene	0.26	26	NL	1.09	**28**
Naphthalene	0.017	1.7	NL	1.09	**1.8**
tertiary-Butyl Alcohol (TBA)	0.012	1.2	NL	1.09	**1.3**
4-Isopropyltoluene	No Value	No Value	- -	1.08	**- -**

Soil Screening Level - 11 to 20 feet bgs[1]
(1 foot Above Groundwater)

Soil Types (19 - 20 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	6.60	0.40	0.00
Soil Type Percentage[4]	0.00	0.94	0.06	0.00
Average Attenuation Factor[5]	1	1	1	1

Constituent	Water Quality Standard (WQS)[6]			AF_T [(8)]	Soil SL
	WQS (mg/L)	100xWQS[7] (mg/L)	Source	(L/kg)	(mg/kg)
1,2,4-Trimethylbenzene	0.33	33	NL	1.00	**33**
1,3,5-Trimethylbenzene	0.33	33	NL	1.00	**33**
Acetone	1.5	150	ESL	1.00	**150**
Isopropylbenzene	0.77	77	NL	1.00	**77**
n-Butylbenzene	0.26	26	NL	1.00	**26**
n-Propylbenzene	0.26	26	NL	1.00	**26**
sec-Butylbenzene	0.26	26	NL	1.00	**26**
tert-Butylbenzene	0.26	26	NL	1.00	**26**
Naphthalene	0.017	1.7	NL	1.00	**1.7**
tertiary-Butyl Alcohol (TBA)	0.012	1.2	NL	1.00	**1.2**
4-Isopropyltoluene	No Value	No Value	- -	1.00	**- -**

Table D-2
Soil Screening Levels for VOCs -
Groundwater at 20 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Notes:

VOCs = Volatile organic compounds.

mg/L = milligram per liter.

L/kg = liter per kilogram.

AF_T = total attenuation factor.

mg/kg = milligram per kilogram.

- - = Not applicable.

NL = Notification Level (CWRCB, 2015).

ESL = Environmental Screening Levels (SFBRWQCB, 2016).

[1] Screening level calculations based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

[2] Represents soil interval that contaminant vertically migrates through to groundwater. Soil types are compiled from January 2017 soil boring logs with data from the indicated depth range.

[3] Average soil thickness is the total thickness of each soil type encountered within January 2017 soil borings for the indicated depth range based on the USCS classification.

[4] Soil type percentage is equal to the average soil thickness of each soil type divided by the total summed thickness of all soil types.

[5] Average attenuation factors are from LARWQCB (1996) Table 5-1. Values not included on the table are linearly interpolated between distance above groundwater and are proportional to fraction of each lithological thickness. At 1-foot above groundwater the average attenuation factor is equal to one for all soil types. SLs are multiplied by a factor of 100 to account for a non-drinking water aquifer.

[6] Water quality standards for VOCs were obtained from the most conservative water quality value from maximum contaminant level (MCL), SFRWQCB ESLs (SFRWQCB, 2016), SWRCB notification levels (NLs) (SWRCB, 2015).

[7] Based on LARWQCB (1996), WQS was multiplied by a factor of 100 to account for a non-drinking water aquifer.

[8] Calculated based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

References

LARWQCB. 1996. Interim Site Assessment and Cleanup Guidebook: May 1996 California Regional Water Quality Control Board Los Angeles and Ventura Counties Region 4 (LARWQCB). May.

SFRWQCB. 2016. Environmental Screening Levels (ESLs). San Francisco Bay. February (Revision 3).

SWRCB. 2015. Drinking Water Notification Levels and Response Levels: An Overview. Division of Drinking Water. February 4.

Table D-3
Soil Screening Levels for TPH, BTEX and MTBE -
Groundwater at 40 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 0 to 10 feet bgs[1]
(30 feet Above Groundwater)

Soil Types (10 - 40 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	167.5	38.4	4.08
Soil Type Percentage[4]	0%	80%	18%	2%

Constituent	Gravel SL[5] (mg/kg)	Sand SL[5] (mg/kg)	Silt SL[5] (mg/kg)	Clay SL[5] (mg/kg)	Soil SL[5] (mg/kg)
TPH (C4-C12)	1,000	1,000	1,000	1,000	**1,000**
TPH (C13-C22)	10,000	10,000	10,000	10,000	**10,000**
TPH (C23-C44)	50,000	50,000	50,000	50,000	**50,000**
Benzene	1.3	6.4	11.9	9.3	**7.5**
Toluene	29.2	58	104	492	**75**
Ethylbenzene	125	175	417	1967	**254**
Xylenes	329	479	1108	5375	**689**
MTBE	1.3	1.7	2.2	11.1	**2.0**

Soil Screening Level - 10 to 20 feet bgs[1]
(20 feet Above Groundwater)

Soil Types (20 - 40 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	112.0	25.0	3.08
Soil Type Percentage[4]	0%	80%	18%	2%

Constituent	Gravel SL[5] (mg/kg)	Sand SL[5] (mg/kg)	Silt SL[5] (mg/kg)	Clay SL[5] (mg/kg)	Soil SL[5] (mg/kg)
TPH (C4-C12)	1,000	1,000	1,000	1,000	**1,000**
TPH (C13-C22)	10,000	10,000	10,000	10,000	**10,000**
TPH (C23-C44)	50,000	50,000	50,000	50,000	**50,000**
Benzene	1.1	1.1	1.1	4.4	**1.2**
Toluene	15	30	45	230	**37**
Ethylbenzene	70	70	200	900	**110**
Xylenes	175	175	530	2450	**284**
MTBE	1.3	1.3	1.3	6.5	**1.4**

Table D-3
Soil Screening Levels for TPH, BTEX and MTBE -
Groundwater at 40 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 20 to 39 feet bgs[1]
(1 foot Above Groundwater)

Soil Types (39 - 40 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	3.70	2.75	0.55
Soil Type Percentage[4]	0%	53%	39%	8%

Constituent	Gravel SL[5] (mg/kg)	Sand SL[5] (mg/kg)	Silt SL[5] (mg/kg)	Clay SL[5] (mg/kg)	Soil SL[5] (mg/kg)
TPH (C4-C12)	1,000	1,000	1,000	1,000	**1,000**
TPH (C13-C22)	10,000	10,000	10,000	10,000	**10,000**
TPH (C23-C32)	50,000	50,000	50,000	50,000	**50,000**
Benzene	0.15	0.15	0.15	0.32	**0.16**
Toluene	15	15.75	16.5	25.8	**17**
Ethylbenzene	32	32	38.50	73.50	**38**
Xylenes	175	175	193	289	**191**
MTBE	1.3	1.3	1.3	1.6	**1.3**

Notes:

TPH = Total petroleum hydrocarbons.

C4-C12 = Carbon range.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

MTBE = Methyl tert-butyl ether.

bgs = below ground surface.

SL = screening level.

mg/kg = milligram per kilogram.

[1] Screening level calculations based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

[2] Represents soil interval that contaminant vertically migrates through to groundwater. Soil types are compiled from January 2017 soil boring logs with data from the indicated depth range.

[3] Average soil thickness is the total thickness of each soil type encountered within January 2017 soil borings for the indicated depth range based on the USCS classification.

[4] Soil type percentage is equal to the average soil thickness of each soil type divided by the total summed thickness of all soil types.

[5] SLs are from LARWQCB (1996) Table 4-1. Values not included on the table are linearly interpolated between distance above groundwater and are proportional to fraction of each lithological thickness. SLs are multiplied by a factor of 100 to account for a non-drinking water aquifer.

References:

LARWQCB. 1996. Interim Site Assessment and Cleanup Guidebook: May 1996 California Regional Water Quality Control Board, Los Angeles and Ventura Counties Region 4 (LARWQCB). May. Updated January 5, 2005.

Table D-4
Soil Screening Levels for VOCs -
Groundwater at 40 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 0 to 10 feet bgs[1]
(30 feet Above Groundwater)

Soil Types (10 - 40 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	167.5	38.4	4.08
Soil Type Percentage[4]	0%	80%	18%	2%
Average Attenuation Factor[5]	1	2	4	20

Constituent	Water Quality Standard (WQS)[6]			AF_T [(8)]	Soil SL
	WQS (mg/L)	100xWQS[7] (mg/L)	Source	(L/kg)	(mg/kg)
1,2,4-Trimethylbenzene	0.33	33	NL	2.71	**89**
1,3,5-Trimethylbenzene	0.33	33	NL	2.71	**89**
Acetone	1.5	150	ESL	2.71	**406**
Isopropylbenzene	0.77	77	NL	2.71	**208**
n-Butylbenzene	0.26	26	NL	2.71	**70**
n-Propylbenzene	0.26	26	NL	2.71	**70**
sec-Butylbenzene	0.26	26	NL	2.71	**70**
tert-Butylbenzene	0.26	26	NL	2.71	**70**
Naphthalene	0.017	1.7	NL	2.71	**4.6**
tertiary-Butyl Alcohol (TBA)	0.012	1.2	NL	2.71	**3.2**
4-Isopropyltoluene	No Value	No Value	- -	2.71	**- -**

Soil Screening Level - 10 to 20 feet bgs[1]
(20 feet Above Groundwater)

Soil Types (20 - 40 feet bgs)[2]	Gravel	Sand	Silt	Clay
Average Soil Thickness (feet)[3]	0.00	112.0	25.0	3.08
Soil Type Percentage[4]	0%	80%	18%	2%
Average Attenuation Factor[5]	1	1	3	13

Constituent	Water Quality Standard (WQS)[6]			AF_T [(8)]	Soil SL
	WQS (mg/L)	100xWQS[7] (mg/L)	Source	(L/kg)	(mg/kg)
1,2,4-Trimethylbenzene	0.33	33	NL	1.62	**53**
1,3,5-Trimethylbenzene	0.33	33	NL	1.62	**53**
Acetone	1.5	150	ESL	1.62	**243**
Isopropylbenzene	0.77	77	NL	1.62	**125**
n-Butylbenzene	0.26	26	NL	1.62	**42**
n-Propylbenzene	0.26	26	NL	1.62	**42**
sec-Butylbenzene	0.26	26	NL	1.62	**42**
tert-Butylbenzene	0.26	26	NL	1.62	**42**
Naphthalene	0.017	1.7	NL	1.62	**2.8**
tertiary-Butyl Alcohol (TBA)	0.012	1.2	NL	1.62	**1.9**
4-Isopropyltoluene	No Value	No Value	RSL	1.08	**- -**

Table D-4
Soil Screening Levels for VOCs -
Groundwater at 40 feet bgs, Non-Drinking Water Aquifer
Former ChemOil Refinery
Signal Hill, California

Soil Screening Level - 20 to 39 feet bgs[1]
(1 foot Above Groundwater)

Soil Types (39 - 40 feet bgs)[2]	Gravel	**Sand**	**Silt**	**Clay**
Average Soil Thickness (feet)[3]	0.00	3.70	2.75	0.55
Soil Type Percentage[4]	0%	53%	39%	8%
Average Attenuation Factor[5]	1	1	1	1

Constituent	**Water Quality Standard (WQS)[6]**			**AF_T [(8)]**	**Soil SL**
	WQS (mg/L)	**100xWQS[7]** (mg/L)	**Source**	(L/kg)	(mg/kg)
1,2,4-Trimethylbenzene	0.33	33	NL	1.00	**33**
1,3,5-Trimethylbenzene	0.33	33	NL	1.00	**33**
Acetone	1.5	150	ESL	1.00	**150**
Isopropylbenzene	0.77	77	NL	1.00	**77**
n-Butylbenzene	0.26	26	NL	1.00	**26**
n-Propylbenzene	0.26	26	NL	1.00	**26**
sec-Butylbenzene	0.26	26	NL	1.00	**26**
tert-Butylbenzene	0.26	26	NL	1.00	**26**
Naphthalene	0.017	1.7	NL	1.00	**1.7**
tertiary-Butyl Alcohol (TBA)	0.012	1.2	NL	1.00	**1.2**
4-Isopropyltoluene	No Value	No Value	- -	1.00	**- -**

Notes:

VOCs = Volatile organic compounds.

mg/L = milligram per liter.

L/kg = liter per kilogram.

AF_T = total attenuation factor.

mg/kg = milligram per kilogram.

- - = Not applicable.

NL = Notification Level (CWRCB, 2015).

ESL = Environmental Screening Levels (SFBRWQCB, 2016).

[1] Screening level calculations based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

[2] Represents soil interval that contaminant vertically migrates through to groundwater. Soil types are compiled from January 2017 soil boring logs with data from the indicated depth range.

[3] Average soil thickness is the total thickness of each soil type encountered within January 2017 soil borings for the indicated depth range based on the USCS classification.

[4] Soil type percentage is equal to the average soil thickness of each soil type divided by the total summed thickness of all soil types.

[5] Average attenuation factors are from LARWQCB (1996) Table 5-1. Values not included on the table are linearly interpolated between distance above groundwater and are proportional to fraction of each lithological thickness. At 1-foot above groundwater the average attenuation factor is equal to one for all soil types. SLs are multiplied by a factor of 100 to account for a non-drinking water aquifer.

[6] Water quality standards for VOCs were obtained from the most conservative water quality value from maximum contaminant level (MCL), SFRWQCB ESLs (SFRWQCB, 2016), SWRCB notification levels (NLs) (SWRCB, 2015).

[7] Based on LARWQCB (1996), WQS was multiplied by a factor of 100 to account for a non-drinking water aquifer.

[8] Calculated based on Interim Site Assessment & Cleanup Guidebook (LARWQCB, 1996).

References

LARWQCB. 1996. Interim Site Assessment and Cleanup Guidebook: May 1996 California Regional Water Quality Control Board Los Angeles and Ventura Counties Region 4 (LARWQCB). May.

SFRWQCB. 2016. Environmental Screening Levels (ESLs). San Francisco Bay. February (Revision 3).

SWRCB. 2015. Drinking Water Notification Levels and Response Levels: An Overview. Division of Drinking Water. February 4.

APPENDIX E

BORING LOGS

BOREHOLE LOG

BORING / WELL ID: **AN-01**

TOTAL DEPTH: **40'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel, north side.**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**42.5 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/04/17 (0750)**
FINISH DATE (TIME):	**01/04/17 (1000)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100 ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
	1.5				0		Boring cleared to five feet bgs with hand auger. ML: Sandy silt with gravel, very dark brown (10YR 3/2), moderately hard, dry, trace concrete debris, fill.	
	0.2				5		ML: Clayey silt, dark yellowish brown (10YR 4/6), moderately soft, dry, trace fine grained sand.	
0840	22							
0840					10		ML: Dark greenish gray (GLEY 4/1), moderately soft, dry, trace fine grained sand.	
	13				15		SM: Silty sand, gray (5Y 5/1), loose, dry, well sorted fine to very fine grained sand, micaceous.	

BOREHOLE LOG

BORING / WELL ID: **AN-01**

TOTAL DEPTH: **40'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel, north side.**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
0900							Grades coarser sand, less silt.	
	44						SP: Sand, gray (2.5Y 6/1), loose, dry, well sorted fine to medium grained sand, trace shell fragments.	
0915	82				20			Boring backfilled with bentonite.
	5.5				25			
							SW: Sand, light brownish gray (2.5Y 6/2), loose, dry, moderately poorly sorted fine to coarse grained sand, abundant shell fragments.	
					30		SP: Sand, gray (2.5Y 6/1), loose, dry, well sorted fine grained sand, no shell fragments.	
					35		ML: Silt with clay, gray (5Y 5/1), moderately hard, dry, abundant shell fragments, (0,0,75,25).	
	34						CL: Clayey silt, olive gray (5Y 5/2), dense, moist, very fine grained sand, abundant shell fragments, (0,20,40,40).	
1000	4.4				40		Hydropunch sampling performed at the following interval: 39 to 43 feet bgs (AN-01-40'GW, 1100).	

BOREHOLE LOG

BORING / WELL ID: **AN-02**

TOTAL DEPTH: **38'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**35.4 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/04/17 (1320)**
FINISH DATE (TIME):	**01/04/17 (1440)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75' x 48"**
MONITORING DEVICE:	**PID 100ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Boring cleared to five feet bgs with hand auger. SM: Sandy silt with gravel, fill.	
							SM: Sandy silt, dark grayish brown (10YR 4/2), moderately hard, trace gravel, fine to coarse grained sand.	
					5		Grades with gravel and oil, very dark brown oil (asphaltic).	
1335	>15,000							
							ML: Silt, very dark gray (5Y 3/1) to black (5Y 2.5/1), moderately soft, dry, abundant oily staining, micaceous.	
							Grades to trace staining, dark gray (GLEY 4/0), strong hydrocarbon odor.	
1340	86				10			
1345								
	126						SP: Sand, gray (5Y 6/1), loose, dry, fine to very fine grained sand, well sorted, micaceous, hydrocarbon odor.	
					15			

BOREHOLE LOG

BORING / WELL ID: **AN-02**

TOTAL DEPTH: **38'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
	184						Grades coarser sand, trace shell fragments.	Boring backfilled with bentonite.
1355	10.8				20		SW: Sand, gray (5Y 6/1), loose, dry, poorly sorted, fine to coarse grained sand, abundant shell fragments.	
	85				25		SP: Sand, gray (5Y 6/1), loose, dry, poorly sorted, predominately fine grained sand, shell fragments.	
							Grades no shell fragments.	
1410	>15,000				30			
1420	>15,000						SW: Sand, gray (5Y 6/1), looe, dry to wet at 36 feet bgs, poorly sorted, fine to coarse grained sand, abundant shell fragments, strong hydrocarbon odor.	
	>15,000				35		Hydropunch sampling performed at the following interval: 34 to 38 feet bgs (AN-02-38'GW, 0810).	

BOREHOLE LOG

BORING / WELL ID: **AN-03**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **East side of north parcel**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**35.8 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/05/17 (1245)**
FINISH DATE (TIME):	**01/05/17 (1345)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100 ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Boring cleared to five feet bgs with hand auger. Fill: Sandy silt with gravel, gray (2.5Y 6/1).	
	>15,000						Mixed Fill: Native soil, silt with gravel (ML), debris, dark gray (5Y 4/1).	
1310					5		ML: Silt, dark yellowish brown (10YR 4/4), moderately soft, dry, trace fine grained sand, strong hydrocarbon odor.	
	>15,000						ML: Silt, gray (5Y 6/1), soft, dry, strong hydrocarbon odor.	
							Grades with fine grained sand.	
1320					10		SP: Sand, gray (5Y 5/1), loose, dry, well sorted fine grained sand, strong hydrocarbon odor.	
	>15,000						Grades coarse grained sand with shell fragments.	
							Predominately medium grained sand.	
					15			

BOREHOLE LOG

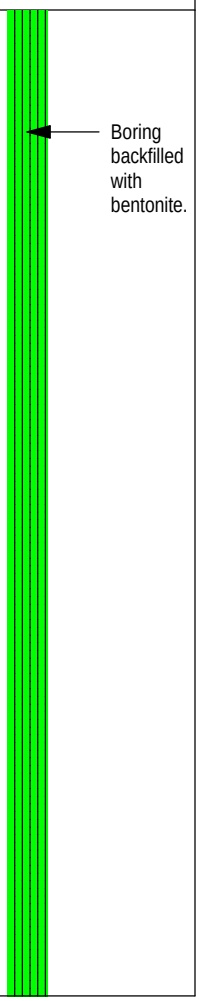
BORING / WELL ID: **AN-03**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **East side of north parcel**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
							SW: Sand, gray (5Y 5/1), loose, dry, poorly sorted fine to coarse grained sand, abundant shell fragments.	
							CL: Silty clay, olive (5Y 5/3), hard, dry.	
							SW: Sand, gray (5Y 5/1), loose, dry, poorly sorted fine to coarse grained sand, abundant shell fragments.	
1330	>15,000				20		SP: Sand, gray (5Y 5/1), loose, dry, well sorted fine grained sand, no shell fragments, strong hydrocarbon odor.	
	>15,000						Grades with trace shell fragments.	
							Grades light yellowish brown (2.5Y 6/3).	
					25		Grades light yellowish brown (2.5Y 6/3) and gray (5Y 5/1) mottled, no shell fragments.	
1340					30		SW: Sand, gray (5Y 5/1), loose, dry, poorly sorted fine to coarse grained sand, abundant shell fragments.	
	>15,000						SM: Silty sand, gray (5Y 5/1) and light olive brown (2.5Y 5/3) mottled, soft, moist, micaceous, no shell fragments, strong hydrocarbon odor.	
					35		Hydropunch sampling performed at the following interval: 36 to 40 feet bgs (AN-03-40'GW, 1430). Very slow recharge.	
1345								



BOREHOLE LOG

BORING / WELL ID: **AN-05**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel, central area**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**33.9 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/05/17 (0845)**
FINISH DATE (TIME):	**01/05/17 (1010)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Boring cleared to five feet bgs with hand auger. Fill: Silty sand with gravel.	
	>15,000						ML: Silt, dark gray (5Y 4/1), moderately soft, dry, trace fine grained sand, strong hydrocarbon odor.	
0930					5			
	>15,000						CL: Clayey silt, gray (5Y 5/1), moderately hard, dry, trace caliche, strong hydrocarbon odor. Grades with fine grained sand.	
0940					10		SP: Sand, gray (5Y 5/1), loose, dry, fine to medium grained sand, grades coarser with depth with silt at top.	
	>15,000						Grades with trace shell fragments.	
					15			

BOREHOLE LOG

BORING / WELL ID: **AN-05**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **North parcel, central area**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
1000	>15,000				20		Abundant shell fragments, strong hydrocarbon odor.	Boring backfilled with bentonite.
	>15,000						Grades no shell fragments, predominately fine grained sand.	
					25			
					30			
1010	>15,000				35		Hydropunch sampling performed at the following interval: 36 to 40 feet bgs (AN-05-40'GW, 1100). No oil blebs, slight sheen, strong hydrocarbon odor.	

BOREHOLE LOG

BORING / WELL ID: **AN-13**

TOTAL DEPTH: **32'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Center of north parcel**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**29.9 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/09/17 (1200)**
FINISH DATE (TIME):	**01/09/17 (1620)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100 ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Boring cleared to five feet bgs with hand auger. Fill: Silty sand with gravel and debris.	
1210	208				5		CL: Clayey silt, dark gray (2.5Y 4/1), moderately hard, dry, trace fine grained sand, moderate hydrocarbon odor, (0,0,80,20).	
	>15,000						ML: Silt, gray (5Y 5/1), moderately soft, dry, trace clay, micaceous, strong hydrocarbon odor.	
1220	>15,000				10		Grades with increasing clay (0,0,80,20) (2 inches only). Grades with fine grained sand (0,30,70,0).	
							SM: Silty sand, gray (5Y 5/1), loose, dry, well sorted fine grained sand, trace medium grained sand, strong hydrocarbon odor.	
1225	>15,000				15		Grades increasing medium grained sand.	

BOREHOLE LOG

BORING / WELL ID: **AN-13**

TOTAL DEPTH: **32'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Center of north parcel**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
1245	>15,000				20		(Sampler jammed in rods.)	Boring backfilled with bentonite.
					25			
1320	>15,000							
1330							Observed free product in soil.	
					30		Hydropunch sampling performed at the following intervals: 27 to 31 feet bgs (AN-13-31' GW, 09:00). Mostly oil and oily water, low viscosity, dark brown. 37 to 41 feet bgs (AN-13-41' GW, 10:00). Heavy sheen. 51 to 54 feet bgs (AN-13-54' GW, 11:00). No sheen.	

BOREHOLE LOG

BORING / WELL ID: **AN-20**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Southwest of MW-11, northwest parcel**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**A. Czuba**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**30.7 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/18/17 (0805)**
FINISH DATE (TIME):	**01/18/17 (0850)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 6610DT**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Fill: Boring cleared to five feet bgs with hand auger. Fill.	
					5		ML: Sandy silt, brown (10YR 4/3), moist, poorly graded very fine grained sand, non-plastic, slight hydrocarbon odor, (0,40,60,0).	
0813	>15,000						Olive brown (2.5Y 4/3), strong hydrocarbon odor.	
0816	>15,000				10			
							SP: Poorly graded sand, gray (GLEY1 5/10Y), dry, fine to coarse grained sand, hydrocarbon odor, (0,100,0,0).	
0820	>15,000				15			

BOREHOLE LOG

BORING / WELL ID: **AN-20**

TOTAL DEPTH: **36'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Southwest of MW-11, northwest parcel**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
0826	3946						Poorly graded fine to medium grained sand, strong hydrocarbon odor.	Boring backfilled with bentonite.
0830	>15,000				20		Very fine grained sand, (0,90,10,0).	
0840	>15,000				25			
0845	>15,000				30		SM: Silty sand, gray (GLEY 5/10Y), very moist, poorly graded fine grained sand, non-plastic, very strong hydrocarbon odor, (0,80,20,0).	
0850	>15,000						At 33.5 feet bgs: Sheen observed on soil/water.	
0850	>15,000				35		ML: Sandy silt, olive brown (2.5Y 4/1), slightly moist, hard, trace clay, strong hydrocarbon odor, (0,10,85,5). Hydropunch sampling performed at the following intervals: 28 to 32 feet bgs (AN-20-32'GW, 0943). 38 to 42 feet bgs (AN-20-42'GW, 1032). 48 to 52 feet bgs (AN-20-52'GW, 1130). 58 to 62 feet bgs (AN-20-62'GW, 1345).	

BOREHOLE LOG

BORING / WELL ID: **AO-01**

TOTAL DEPTH: **32'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **In the street in fron tof 2109 Gundry Avenue**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	
LOGGED BY:	**R. Robitaille**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**27.0 feet amsl**
CASING TOP ELEVATION:	**NA**
START DATE (TIME):	**01/10/17 (0700)**
FINISH DATE (TIME):	**01/10/17 (0930)**

DRILLING INFORMATION

SUBCONTRACTOR:	**Kehoe Testing & Engineering**
EQUIPMENT:	**GeoProbe 7800**
SAMPLING METHOD:	**Continuous 1.75" x 48"**
MONITORING DEVICE:	**PID 100ppm Hexane**
BORING DIAMETER (IN):	**2.5 inches**
ANNULUS MATERIAL:	**NA**
BORING ANGLE: **Vertical**	CASING DIAMETER: **NA**
SCREEN INTERVAL: **NA**	

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.	WELL CONSTRUCTION DETAILS
					0		Boring cleared to five feet bgs with hand auger. Asphalt to 0.25 feet bgs.	
	0.8						Base coarse fill material.	
0830					5		ML: Silt, dark grayish brown (2.5Y 4/2), moderately soft, dry, trace clay and fine grained sand. At 2.9 feet bgs: Grades dark gray (2.5Y 4/1). At 4.5 feet bgs: Grades dark yellowish brown (10YR 4/4).	
0835	8.0				10		ML: Clayey silt, dark grayish brown (2.5Y 4/2), soft, moist, trace fine grained sand, (0,0,75,25).	
							ML: Silt, olive gray (5Y 5/2), soft, dry, trace fine grained sand.	
	5.2						Grades increasing sand.	
0845					15		SM: Silty sand, light olive gray (5Y 6/2), loose, dry, micaceous,	

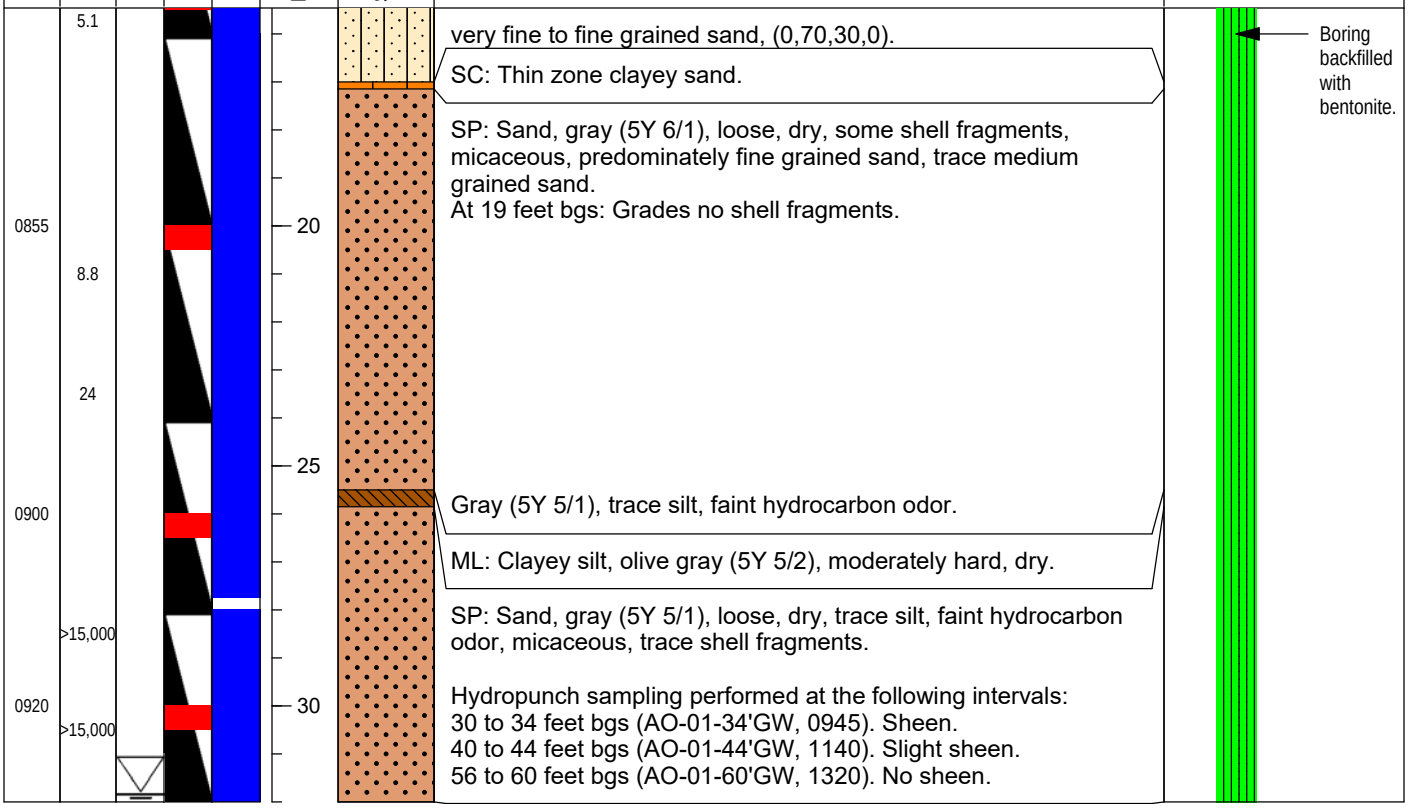
BOREHOLE LOG

BORING / WELL ID: **AO-01**

TOTAL DEPTH: **32'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **In the street in fron tof 2109 Gundry Avenue**



BOREHOLE LOG

BORING / WELL ID: **MW-20**

TOTAL DEPTH: **35'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Southwest parcel near AS-03.**

PROJECT INFORMATION

PROJECT NO.:	**093-CHEMOIL-001**
PERMIT NO.:	**SR0092630**
LOGGED BY:	**A. Czuba**
REVIEWED BY:	**P. Fuller**
SURFACE ELEVATION:	**25.4 feet amsl**
CASING TOP ELEVATION:	**24.79 feet amsl**
START DATE (TIME):	**01/10/17**
FINISH DATE (TIME):	**01/10/17**

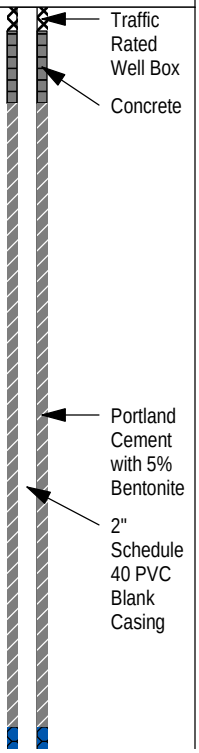
DRILLING INFORMATION

SUBCONTRACTOR:	**Gregg Drilling**
EQUIPMENT:	**Truck-mounted HSA**
SAMPLING METHOD:	**Split Spoon**
MONITORING DEVICE:	**PID**
BORING DIAMETER (IN):	**8 inches**
ANNULUS MATERIAL:	**#2/12 Monterey Sand**
BORING ANGLE: **Vertical**	CASING DIAMETER: **2 inches**
SCREEN INTERVAL:	**20 to 35 feet bgs**

▽ First Water Encountered ▼ Stabilized Water Level ■ Sample Packaged for Analysis

TIME	PID READING	DEPTH	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.
0920	0	0	Boring cleared to five feet bgs with hand auger. SM: Silty sand, brown, slightly moist, poorly graded fine to coarse grained sand, low plasticity, no odor, (0,80,20,0).
0943	40	5	SM: Silty sand, olive gray, dry, moderately soft, poorly graded, trace clay, slight hydrocarbon odor.
0943	40		Grades brown.
0949	34.2		Grades olive gray, poorly graded very fine grained sand.
0955	>15,000		ML: Clayey silt, dark olive gray, dry, hard, poorly graded, low plasticity, no odor.
1000	>15,000	10	SM: Silty sand, olive gray, dry, very fine grained sand, slight hydrocarbon odor, (0,70,30,0).
1006	>15,000		Grades increasing silt, (0,60,40,0).
1015	>15,000		SP: Poorly graded sand, dark gray, dry, fine to medium grained sand, trace silt, slight hydrocarbon odor, (0,100,0,0).
1015	>15,000		
1020	81	15	SM: Silty sand, gray, dry, poorly graded fine to medium grained

WELL CONSTRUCTION DETAILS



BOREHOLE LOG

BORING / WELL ID: **MW-20**

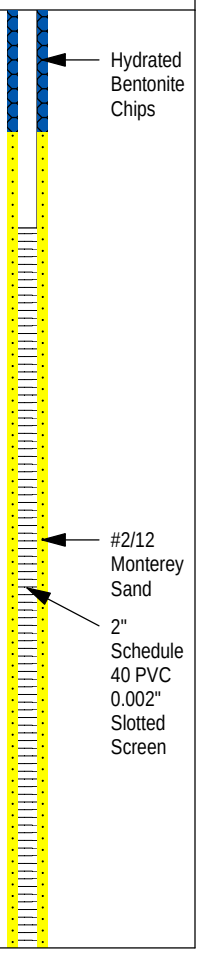
TOTAL DEPTH: **35'**

PROJECT NAME AND SITE ADDRESS: **Former ChemOil Facility, Signal Hill, California**

BORING LOCATION / DESCRIPTION: **Southwest parcel near AS-03.**

TIME	PID READING	WATER LEVEL	SAMPLE INTERVAL	RECOVERY (%)	DEPTH	STRATIGRAPHY	LITHOLOGIC DESCRIPTION (classification, color, moisture, density, grain size / plasticity, other) ALL PERCENTAGES ARE APPROXIMATE UNLESS OTHERWISE STATED.
1026							sand, non-plastic, slight hydrocarbon odor, (0,80,20,0).
							SP: Poorly graded sand, gray, dry, fine to medium graned, slight hydrocarbon odor, (0,100,0,0).
1033	>15,000						SM: Silty sand, gray, dry, poorly graded fine to medium grained sand, non-plastic, slight hydrocarbon odor, (0,80,20,0).
1040					20		Olive gray, hydrocarbon odor, (0,75,25,0).
1045	300						Very fine grained sand, hydrocarbon odor, (0,70,30,0).
1055							Strong hydrocarbon odor, (0,75,25,0).
1338					25		ML: Sandy silt, olive gray, saturated, poorly graded very fine grained sand, non-plastic, strong hydrocarbon odor, (0,20,80,0).
1340	276						SM: Silty sand, olive gray, poorly graded very fine grained sand, non-plastic, strong hydrocarbon odor, (0,60,40,0).
1346	>15,000						
1352	>15,000				30		Grades increasing sand, (0,70,30,0).
1358	249						
1405	>15,000						
1405	28.5				35		ML: Clayey silt, light olive gray, saturated, poorly graded, medium plasticity, hydrocarbon odor, (0,0,75,25).

WELL CONSTRUCTION DETAILS



APPENDIX F

UVOST™ LOGS, 2016 INVESTIGATION

FUGRO USA LAND, INC.
469 Roland Way
Oakland, CA 9621
T +1 510-430-8851

Date: February 20, 2017
Report Number 04.0916-0020

Apex Companies, LLC
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Attn.: Kirsten L. Duey

REPORT FOR PIEZOCONE PENETRATION TESTING
ULTRA-VIOLET OPTICAL SCREENING TOOL PCPT/UVOST™) TESTING
AND RELATED SERVICES
SIGNAL HILL, CALIFORNIA

Dear Ms. Duey:

Fugro USA Land, Inc. (Fugro) is pleased to present this data report for Piezocone Penetration (PCPT) and Ultra-Violet Optical Screening Tool (UVOST™) testing at the above-referenced site to The Source Group, a division of Apex Companies. PCPT/UVOST™ provided continuous characterization of stratigraphy and petroleum hydrocarbon distribution at the testing location. A description of the PCPT and UVOST™ technologies and a discussion of general UVOST™ data interpretation follow. PCPT and UVOST™ logs are included as attachments.

Scope of Services

We performed eighteen (18) PCPT/ UVOST™ soundings as directed by client representative. Fugro is pleased to present data report for Piezocone Penetration Testing (PCPT) services and Ultra-Violet Optical Screening Tool (UVOST™) screening performed at the above-referenced site in accordance with Fugro Proposal PLC16-042 dated November 16, 2016 to The Source Group.

PCPT Testing

The PCPT soundings were conducted in general accordance with ASTM D5778-12, Electronic Friction Cone and Piezocone Penetration Testing of Soils using a 30-ton truck mounted PCPT unit. The in-situ soil data was obtained by hydraulically advancing a cylindrical steel rod, with an instrumented probe at the base, vertically into the subsurface materials at a constant rate of 2 centimeters per second. The instrumented probe consists of a cone-shaped tip element, with an apex angle of 60 degrees with a base area of 15 square centimeters (cm2), a

cylindrical-shaped side friction with a surface area of 200 cm2 Measurements of penetration resistance at the cone tip (qc), frictional resistance along the friction sleeve (fs), and pore water pressure (u2), were recorded with depth during penetration. PCPT sounding measurements collected for this project are presented on the logs attached at the end of this report.

PCPT methods test the soil in situ and soil samples are not obtained. There are several methods to identify the soil type using the PCPT data collected. For your reference, we have presented soil stratigraphy using the attached Campanella and Robertson's Simplified Soil Behavior Chart (12-zone, 1986). Please note that because of the empirical nature of the soil behavior chart, the soil identification should be verified locally from soil borings and laboratory testing. Some soils, such as cemented or calcareous soils, or glacial tills are outside the limits of the soil behavior chart.

UVOST™ Testing

Fugro USA Land's UVOST™ Laser-Induced Fluorescence system was used for this investigation to screen soils for petroleum hydrocarbon materials containing aromatic hydrocarbon constituents. The system consists of a laser mounted in the CPT unit that is connected to a down-hole sensor. The down-hole sensor consists of a sapphire window mounted flush with the side of the cone penetrometer probe.

The laser and associated equipment transmit pulsed of light to the sensor through a fiber optic cable. The wavelength of the pulsed excitation light is set to an excitation wavelength of 308 nm.

The laser light passes through the sapphire window and is absorbed by aromatic hydrocarbon molecules in contact with the window, as the probe is advanced. This addition of energy (photons) to the aromatic hydrocarbons causes them to fluoresce. A portion of the fluorescence emitted from any encountered aromatic constituents is returned through the sapphire window and conveyed by a second fiber optic cable to a detection system within the CPT unit. The emission data resulting from the pulsed laser light is averaged into one reading per one-second interval (approximately one reading per 2 cm vertical interval) and is recorded continuously.

Several characteristics of the emitted fluorescence are measured and recorded simultaneously at four (4) specific wavelengths (340, 390, 440, and 490 nm). These four wavelengths represent the spectrum of fluorescence typically produced by aromatic hydrocarbons ranging from light fuels through heavy contaminants such as coal tar and creosote. The recorded data is then presented as a color graph of fluorescence intensity (the combined fluorescence of all four monitored wavelengths) versus depth (FVD).

On the FVD graph, each of the four monitored wavelengths is assigned a color. These colors are combined based on the proportional fluorescence intensity of each of the individual wavelengths. The combined color is then used on the FVD graph. Changes in color on the FVD graph typically represent changes in product type. Similarly, like colors on the FVD graph typically represent the same product, regardless of the total fluorescence intensity. Changes in the total fluorescence intensity typically indicate changes in contaminant concentration,

with higher fluorescence intensities representing proportionally higher concentrations when compared to lower fluorescence intensities.

In addition to the FVD graph, randomly selected depth specific waveforms are presented at up to five (5) depths throughout the sounding. These waveform graphs are presented to the left of the FVD graph on each plot. On each waveform graph, shorter waves are shown on the left and increase from left to right. For general interpretation purposes, lighter aromatic hydrocarbon molecules will emit fluorescence at the shorter wavelengths, and heavier, longer chained hydrocarbons will emit fluorescence at the longer wavelengths. The presented waveforms can be compared to waveforms typical of common hydrocarbon products to determine the likely product type that has been encountered. Please note that the waveforms are available at every two-centimeter interval throughout the entire sounding. Additional waveforms can be generated at any time during or after testing is complete.

REFERENCE SOLUTION: The fluorescence intensity of a reference solution placed on the sapphire window was measured immediately prior to conducting each test. This reference solution measurement serves two purposes. First, as a quality control check, the solution is used to ensure that the performance of the system is within specifications. Second, it allows for normalization of the data from different test locations for variation in laser power, operating conditions, and monitored emission wavelength. The reference solution used for this project was the standard M1 reference, which is a proprietary PHC containing solution. M1 provides consistent fluorescence response across the portion of the spectrum analyzed by UVOST™ and therefore, allows the fluorescence data collected to be consistently normalized to intensities recorded as a percentage of M1.

LIMITATIONS OF ENVIRONMENTAL SUBSURFACE WORK

Fugro's report is based upon our observations made during fieldwork, the information provided to Fugro and the results of the UVOST™/PCPT survey. Given the inherent limitation of environmental subsurface work, Fugro cannot guarantee that the site is free of hazardous or potentially hazardous materials or conditions or that latent or undiscovered conditions will not become evident in the future. Fugro's report was prepared in accordance with our proposal and the General Conditions agreed to between Fugro and Client and no warranties, representations, or certifications are made.

Closing

Fugro appreciates the opportunity to be of service to THE SOURCE GROUP. If you have any questions, please feel free to contact me at 510-430-8851.

Best Regards,
FUGRO USA LAND, INC.

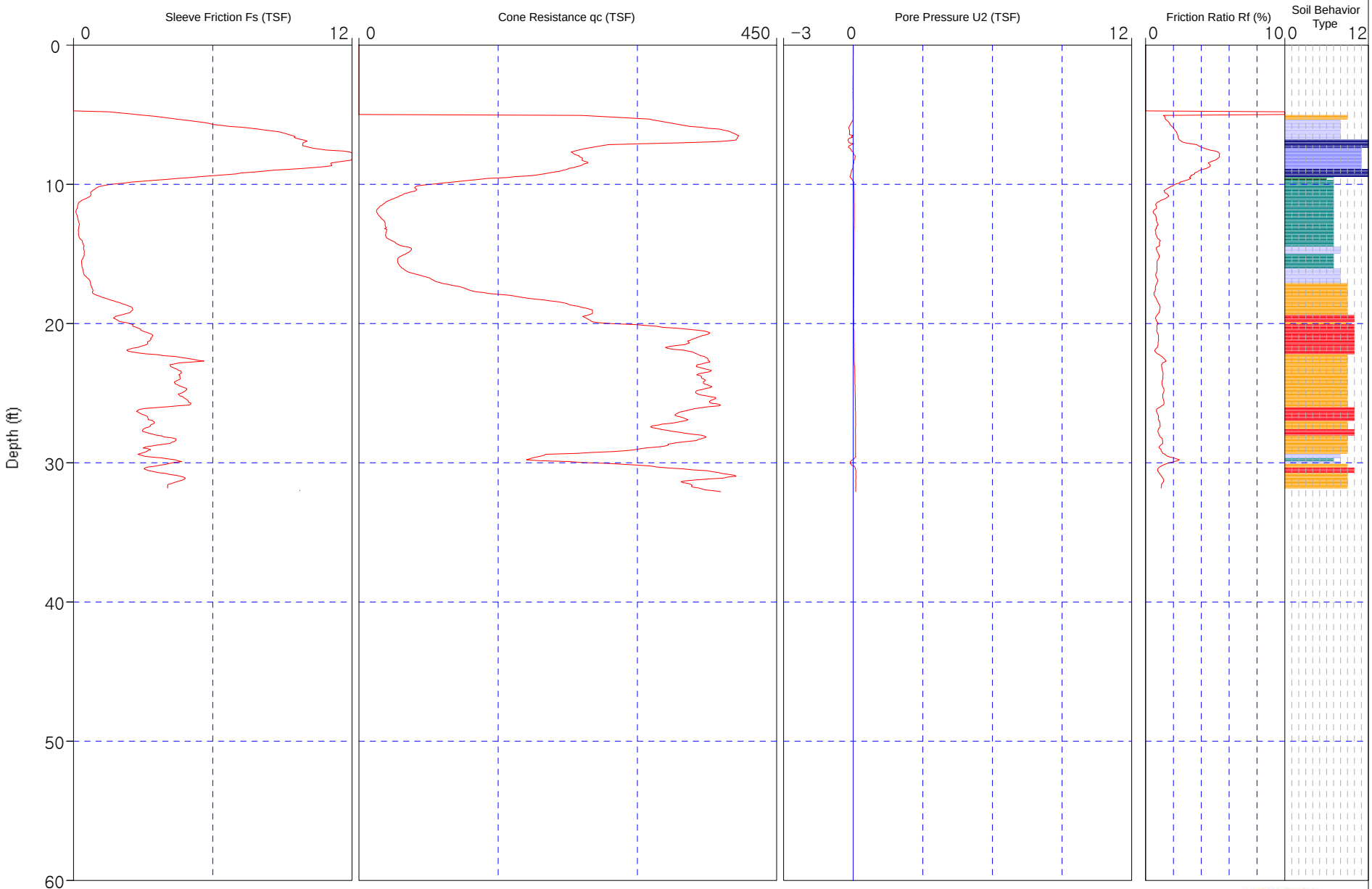
Virgil A. Baker
CPT Manager

Attachments: PCPT Sounding Logs (18 pages)
UVOST™ Sounding Logs (18 pages)
Additional PCPT Sounding Logs Generated During PCPT/MIP Testing (3 pages)
Campanella and Robertson's Simplified Soil Behavior Chart (1 page)
"Interpreting LIF Waveforms", Dakota Technologies (6 pages)

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AE-01
Date: 13-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



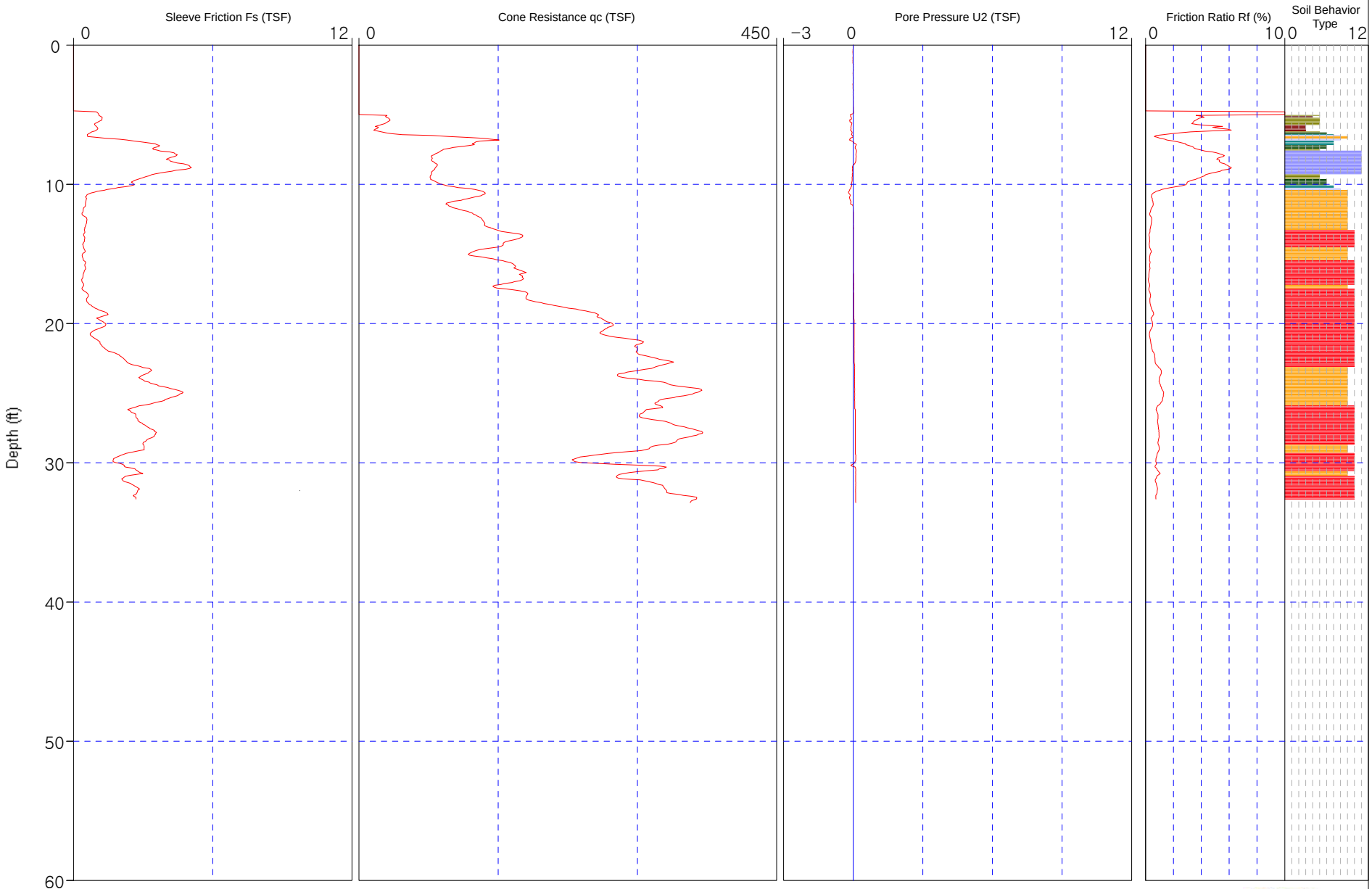
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AE-02
Date: 13-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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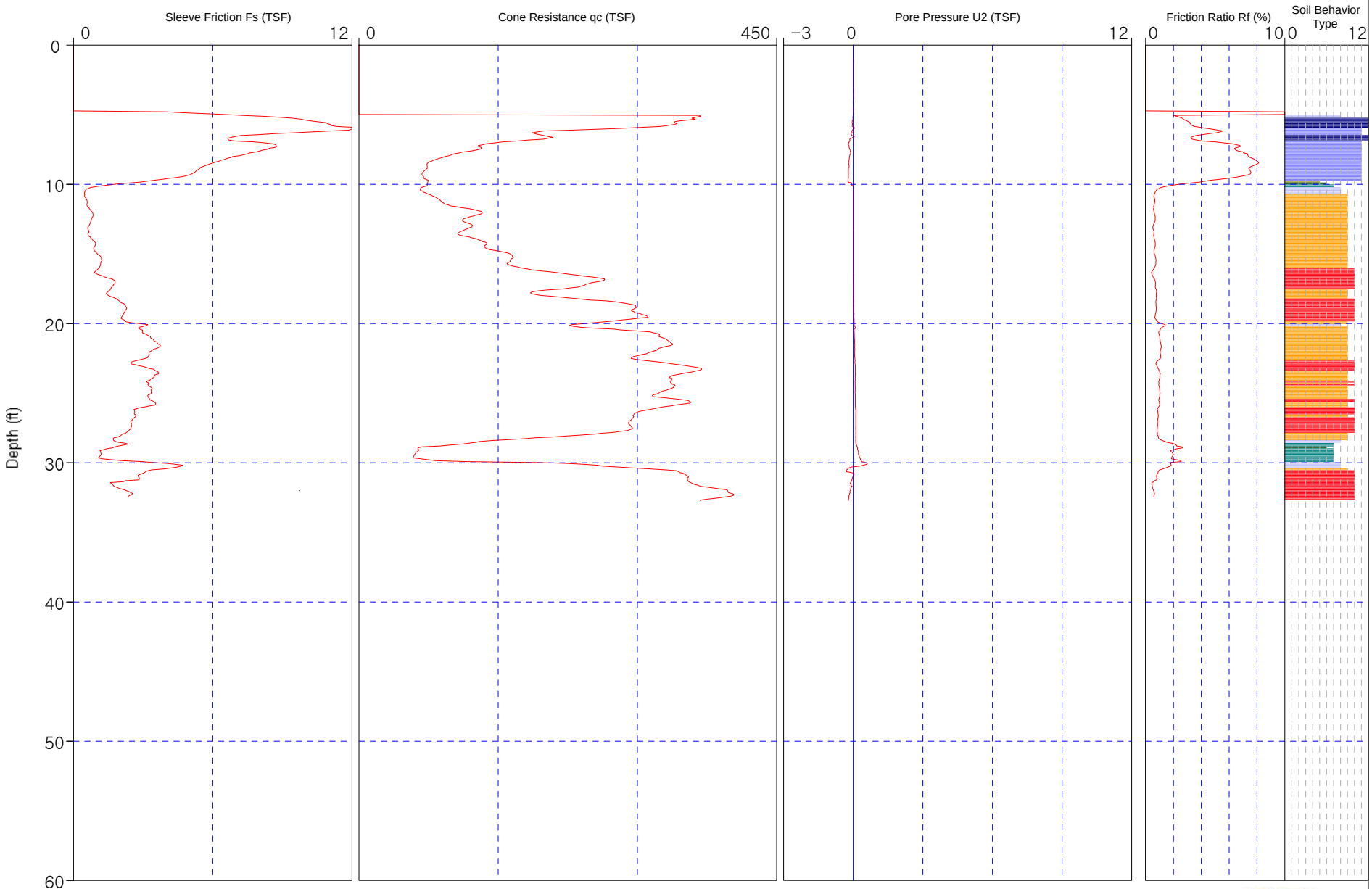
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AE-03
Date: 13-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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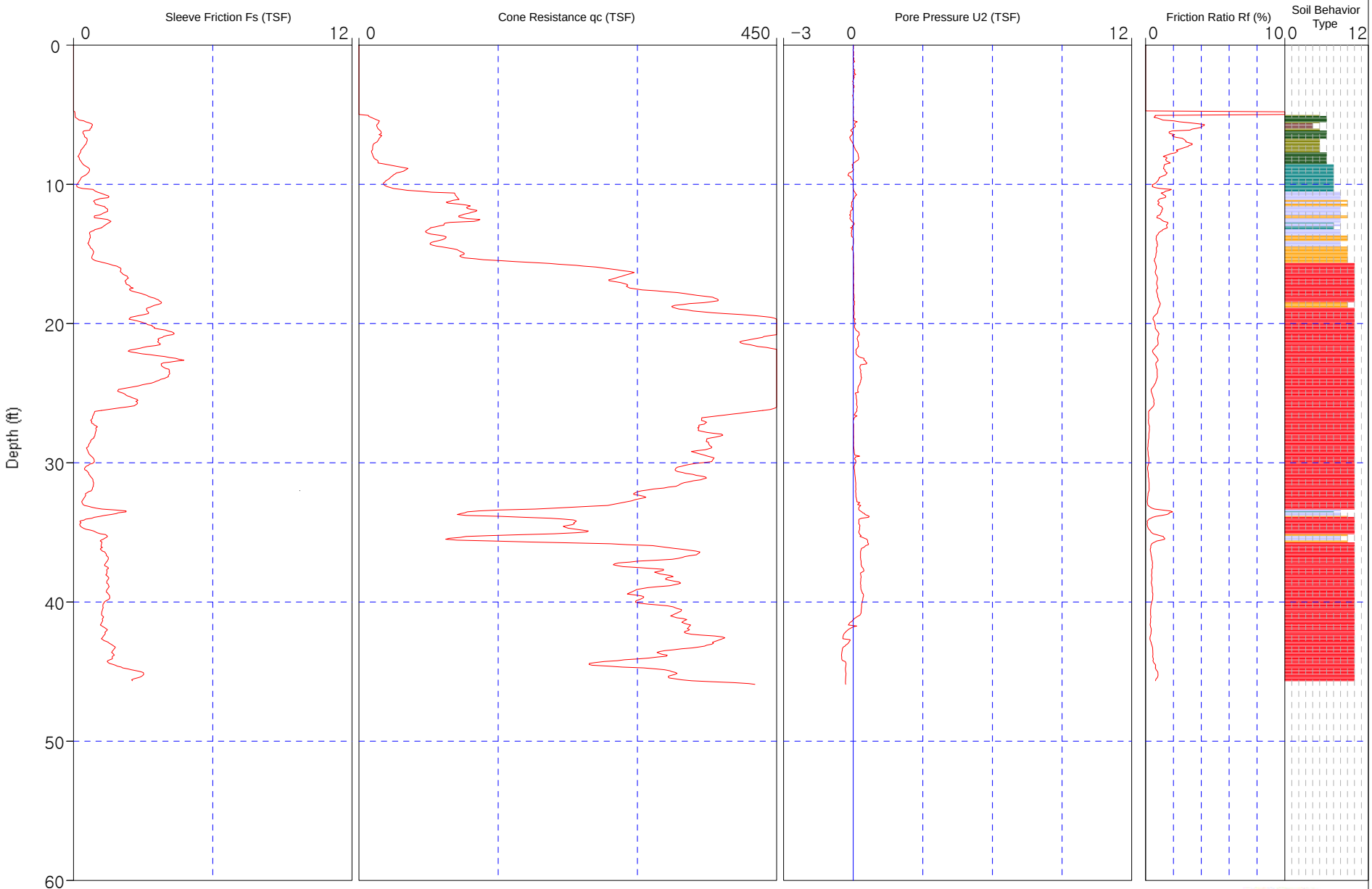
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-09
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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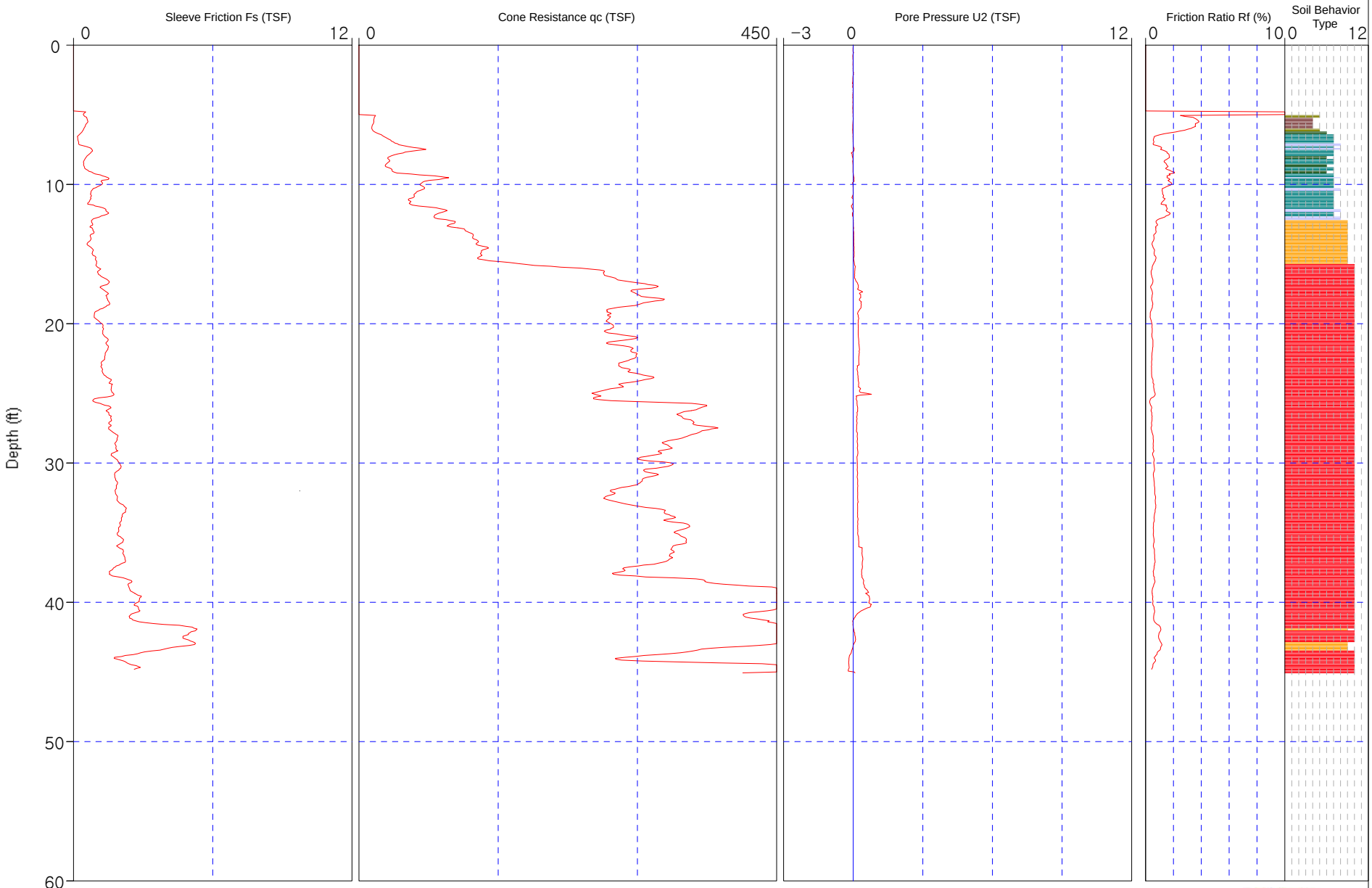
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-10
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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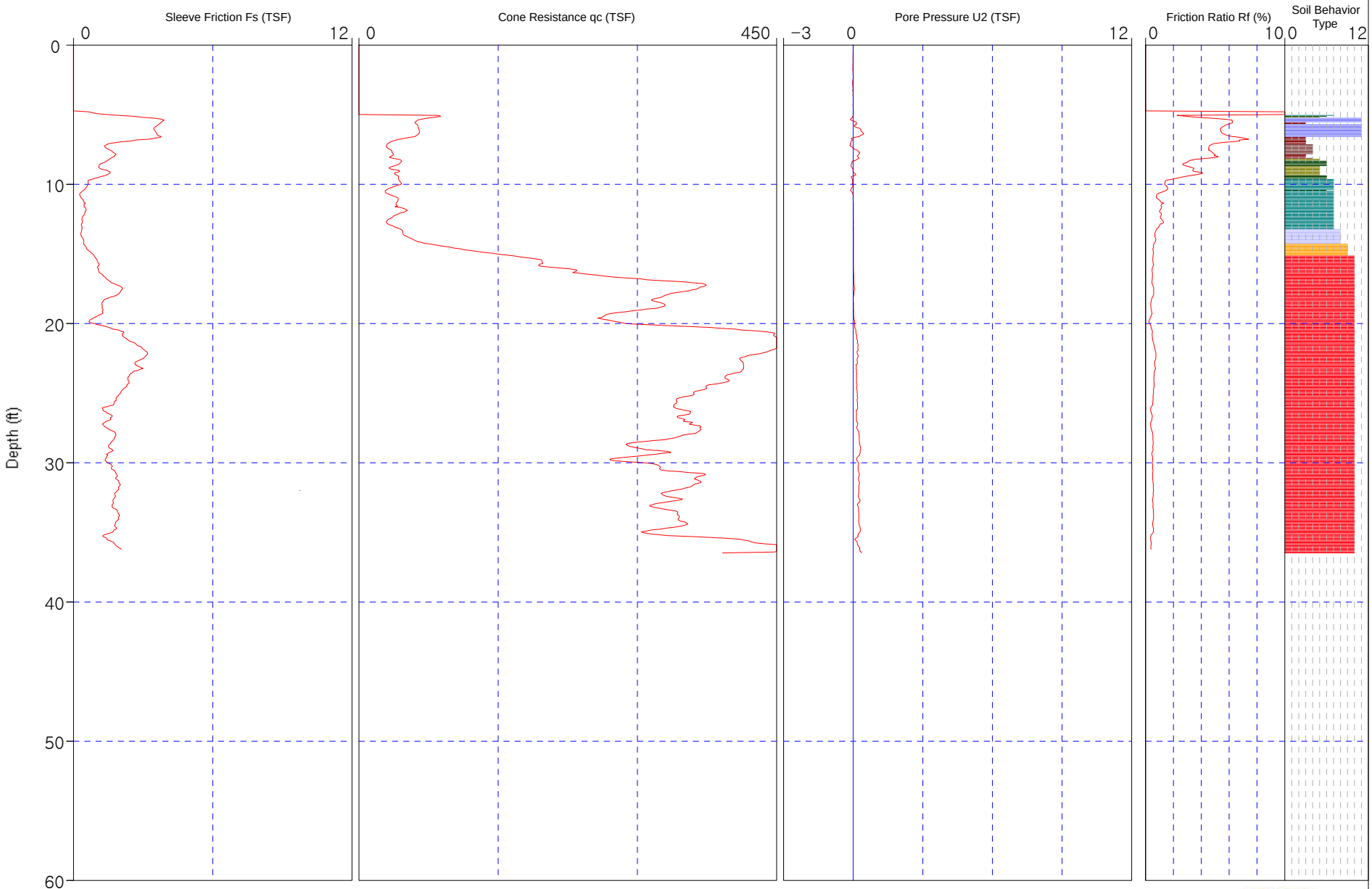
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-11
Date: 15-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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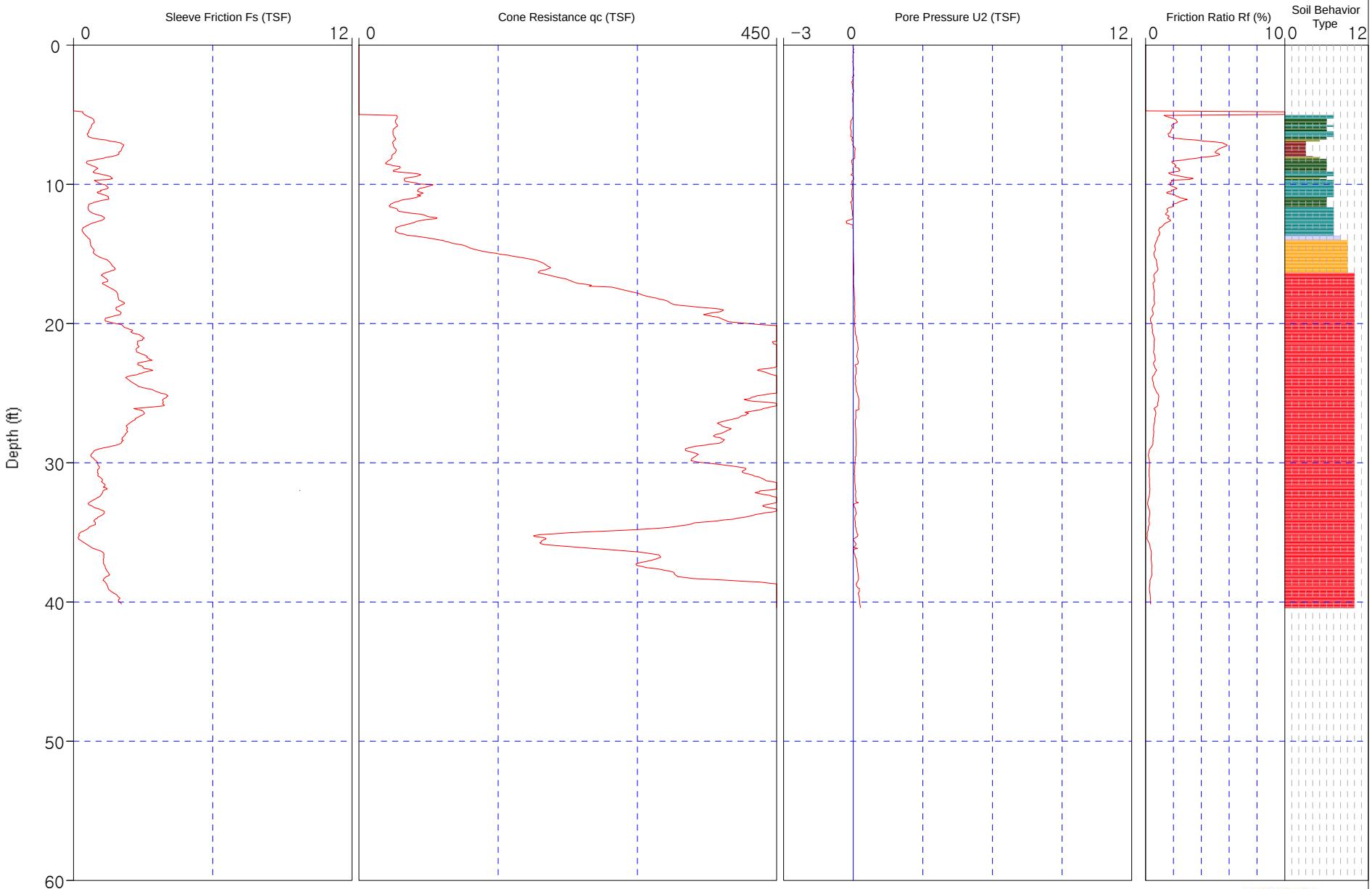
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-12
Date: 15-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519

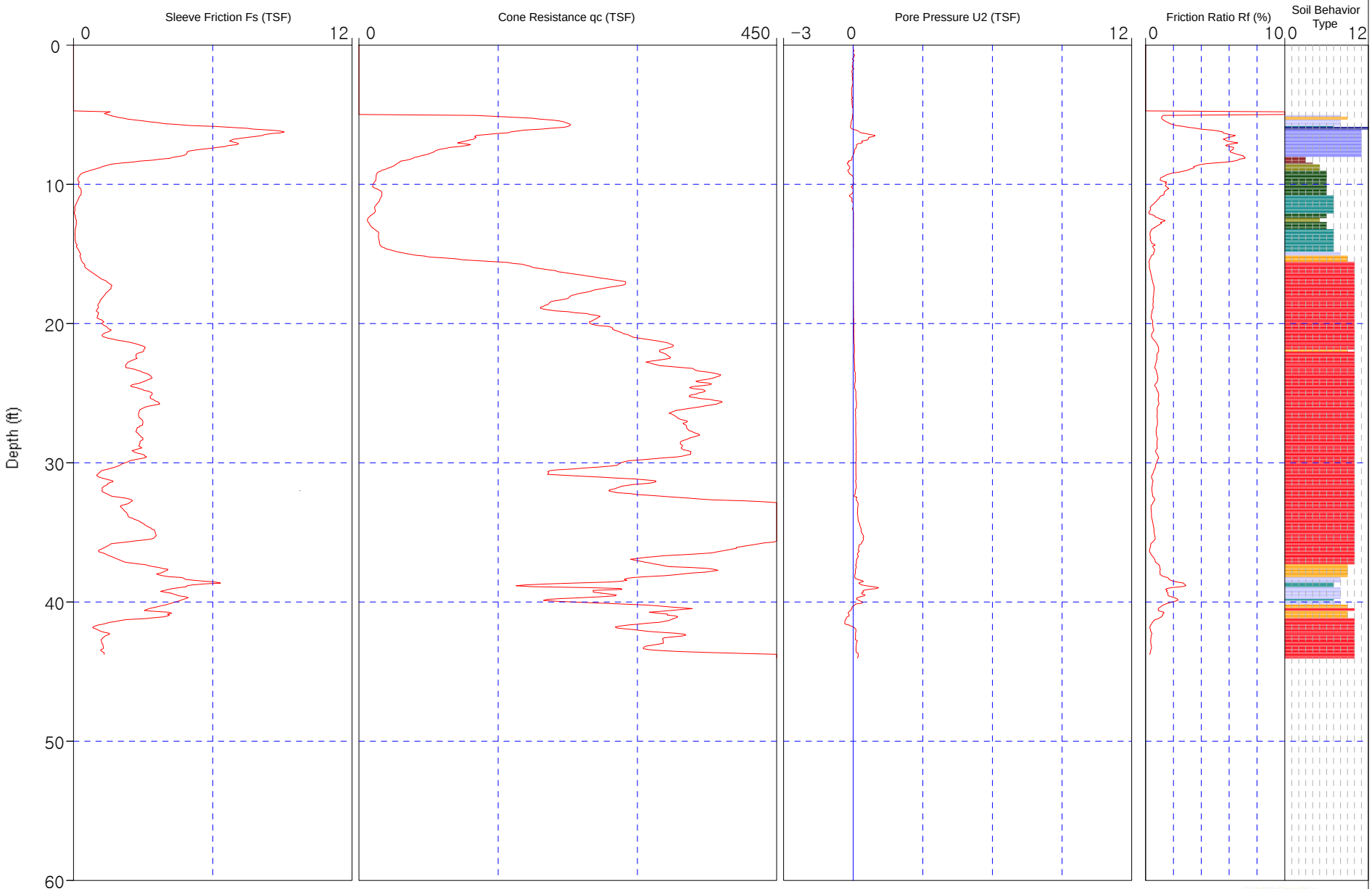


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-15
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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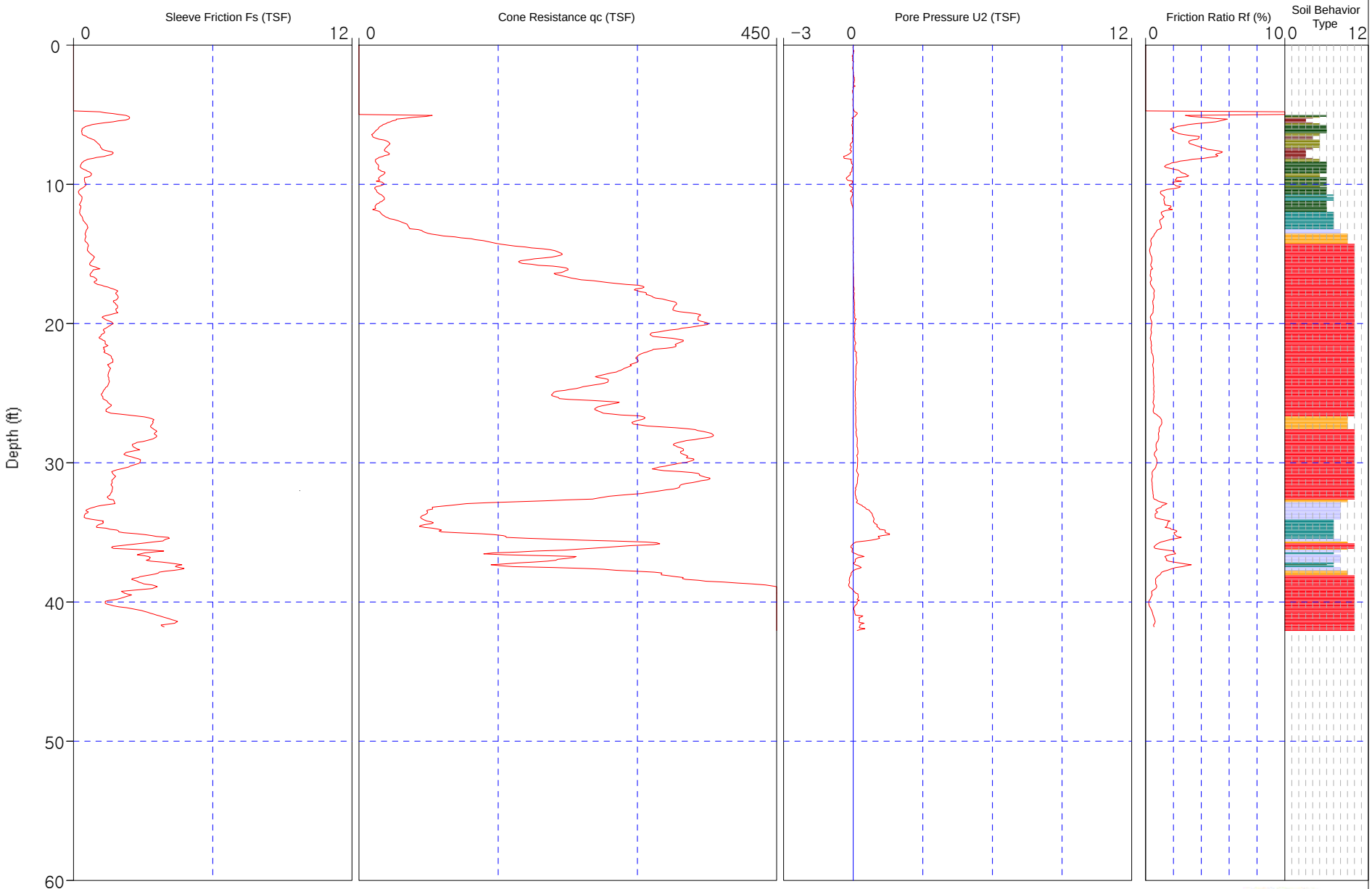
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 0409160020
Operator: D. Garza
Location: Signal Hill, CA

CPT Number: AN-16
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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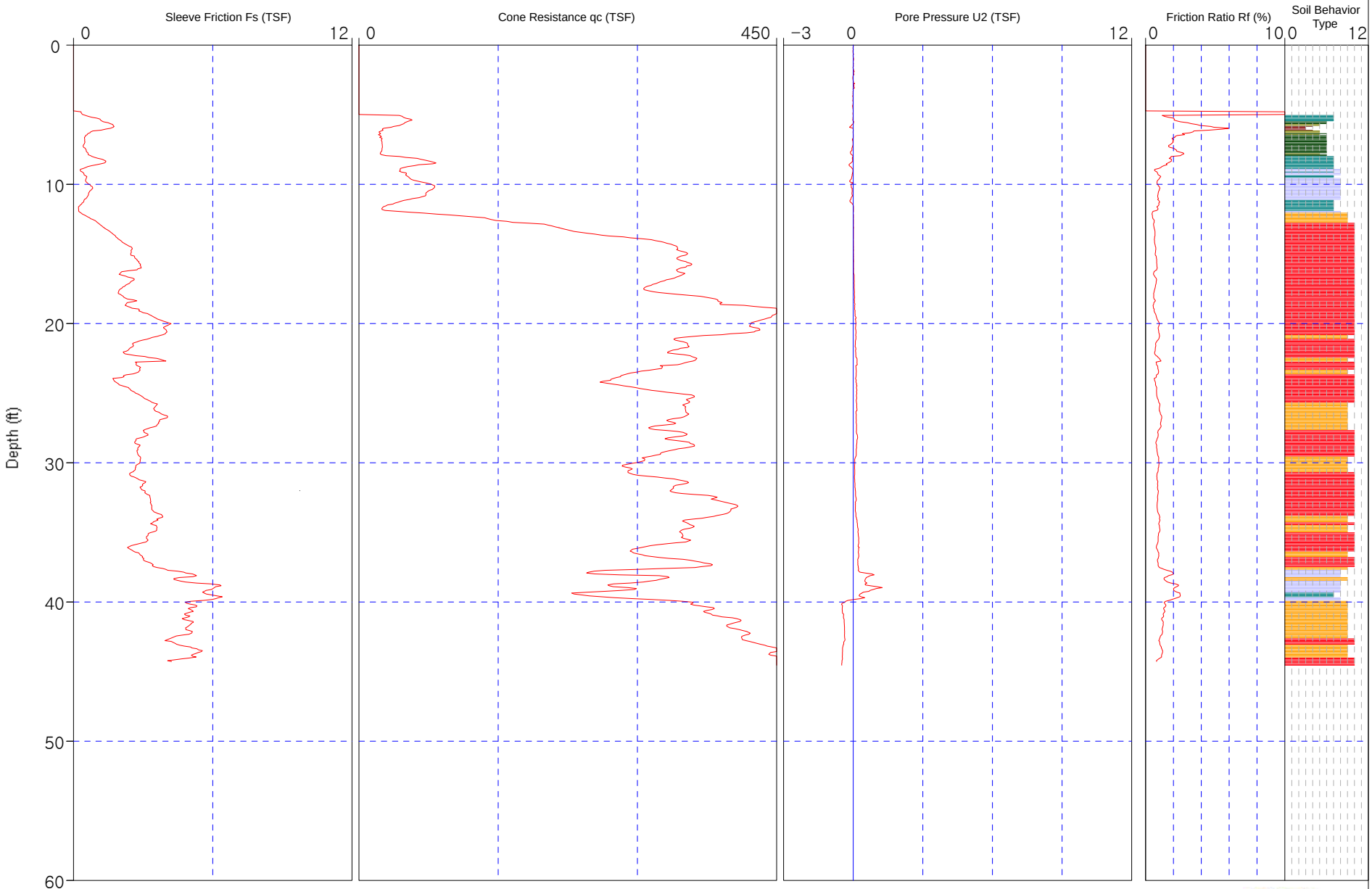
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-17
Date: 15-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519

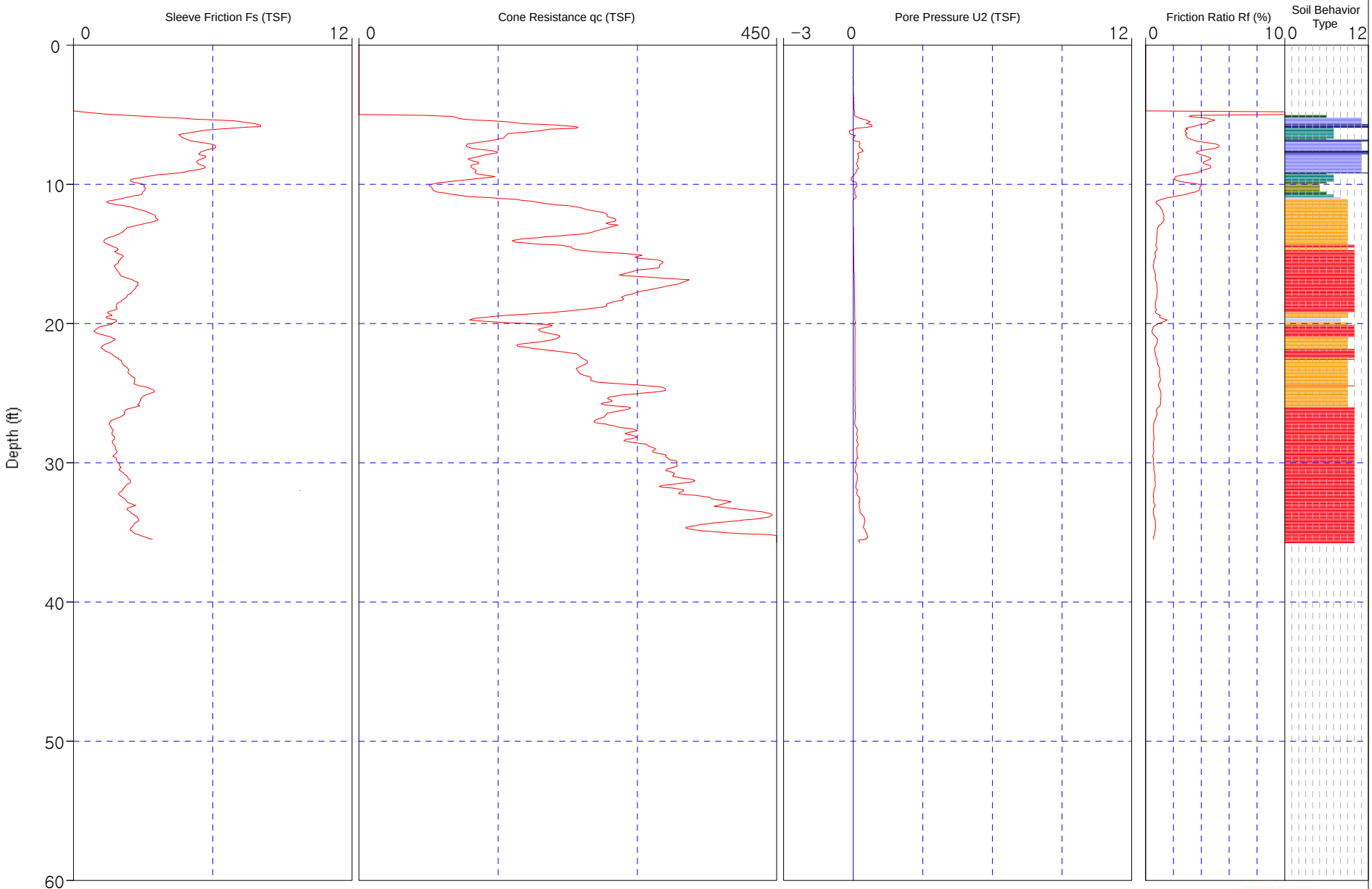


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-18
Date: 15-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519

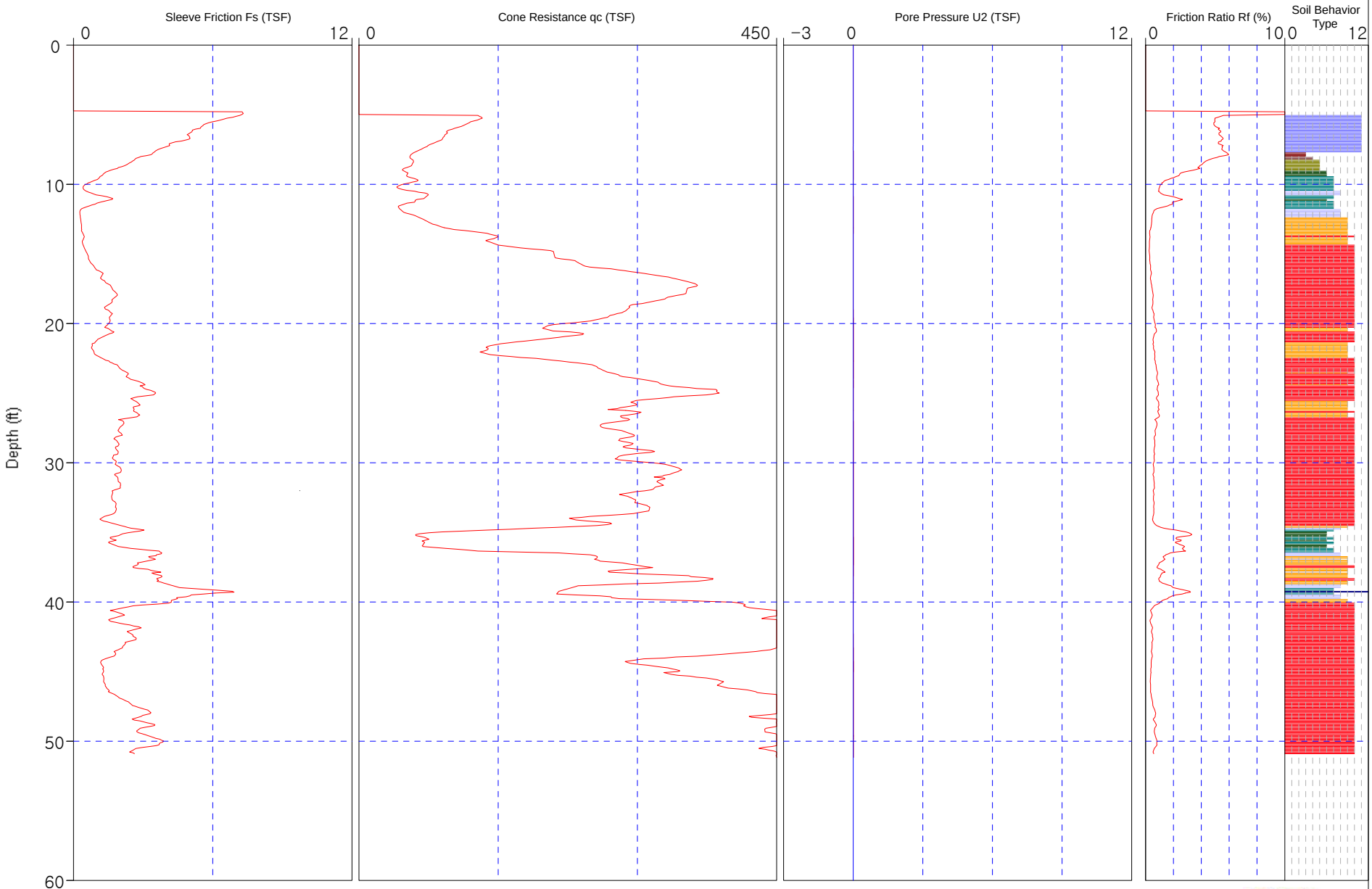


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-19
Date: 19-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 2095



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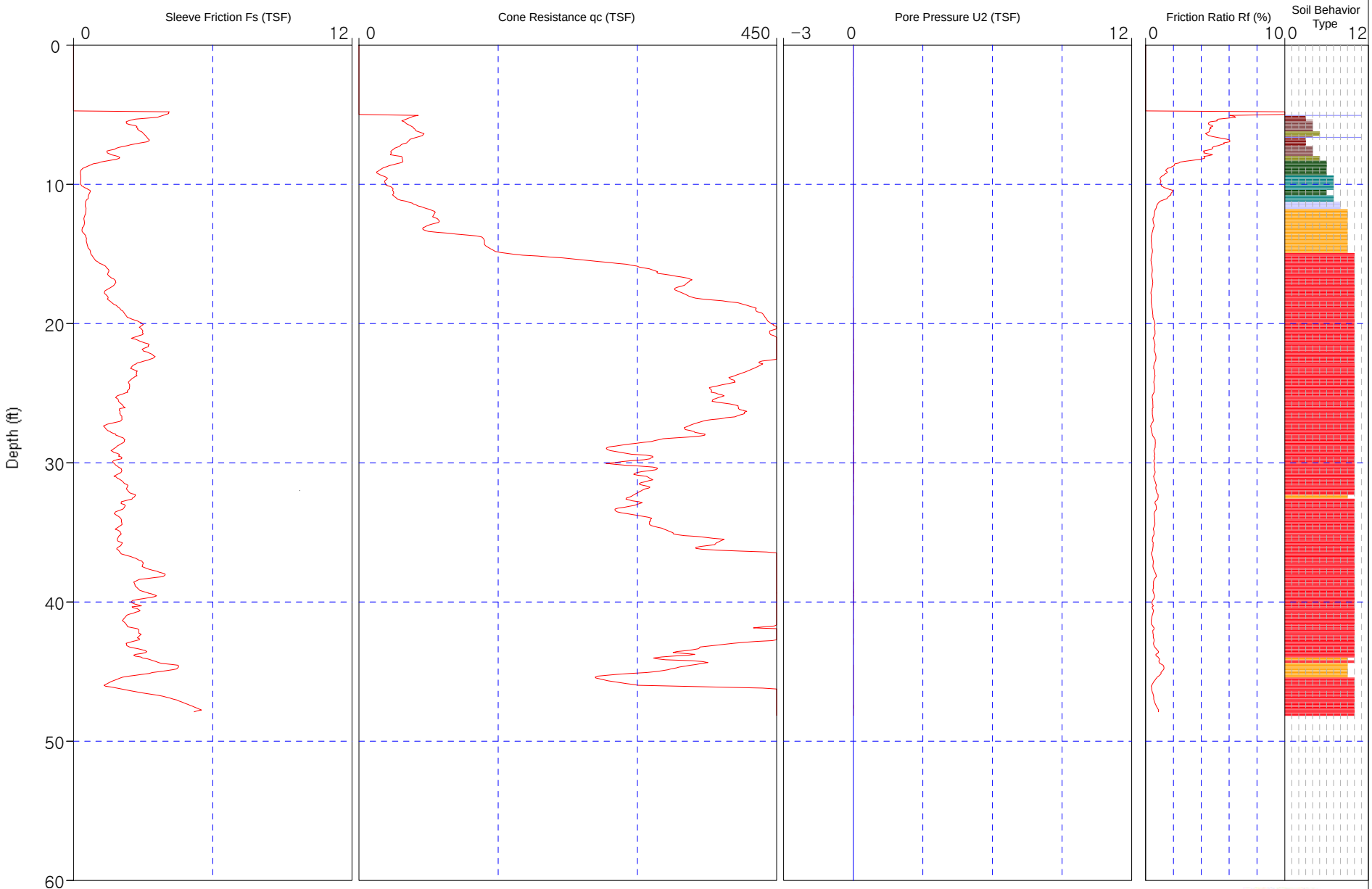
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AN-21
Date: 19-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 2095



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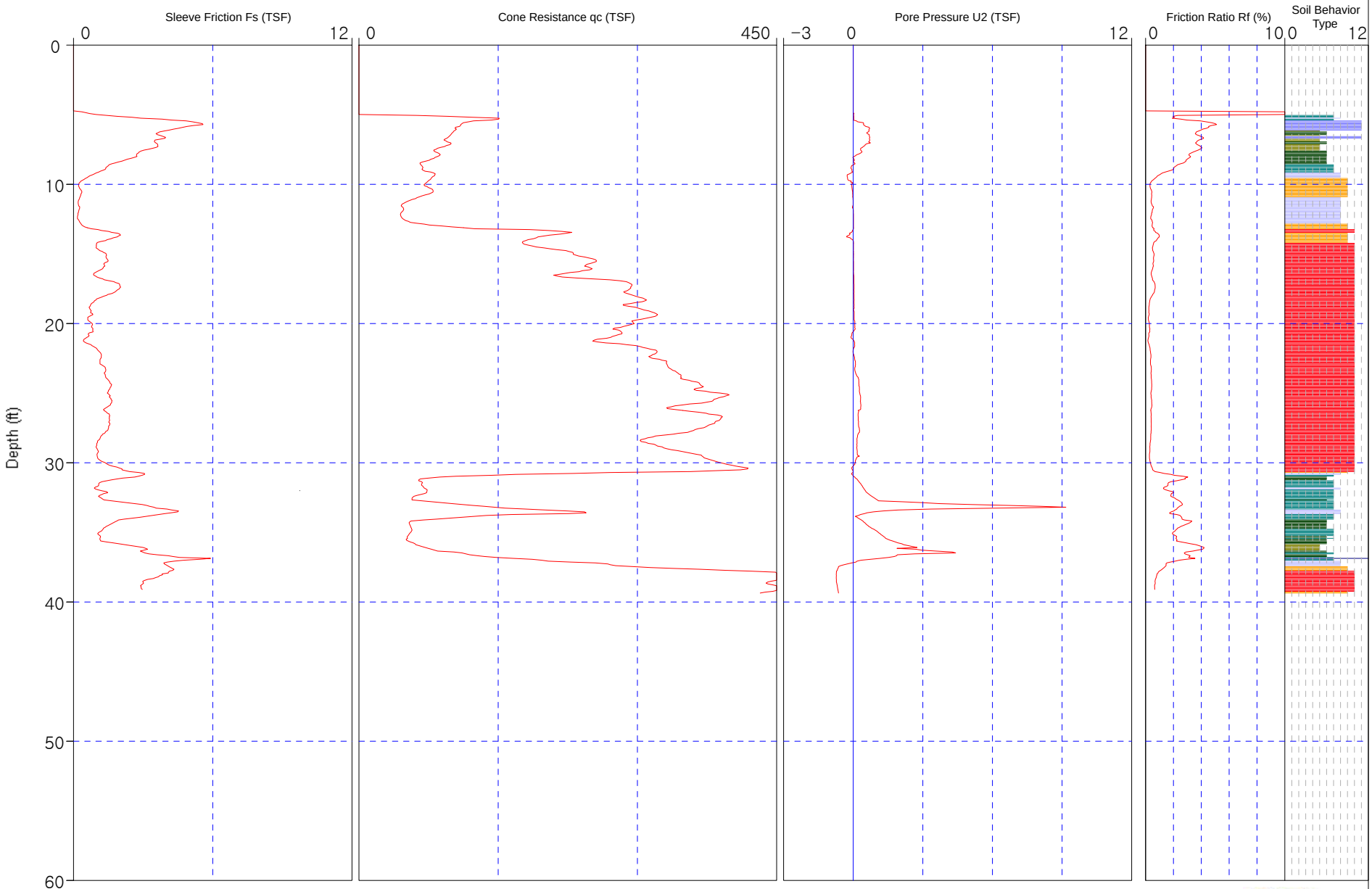
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-01
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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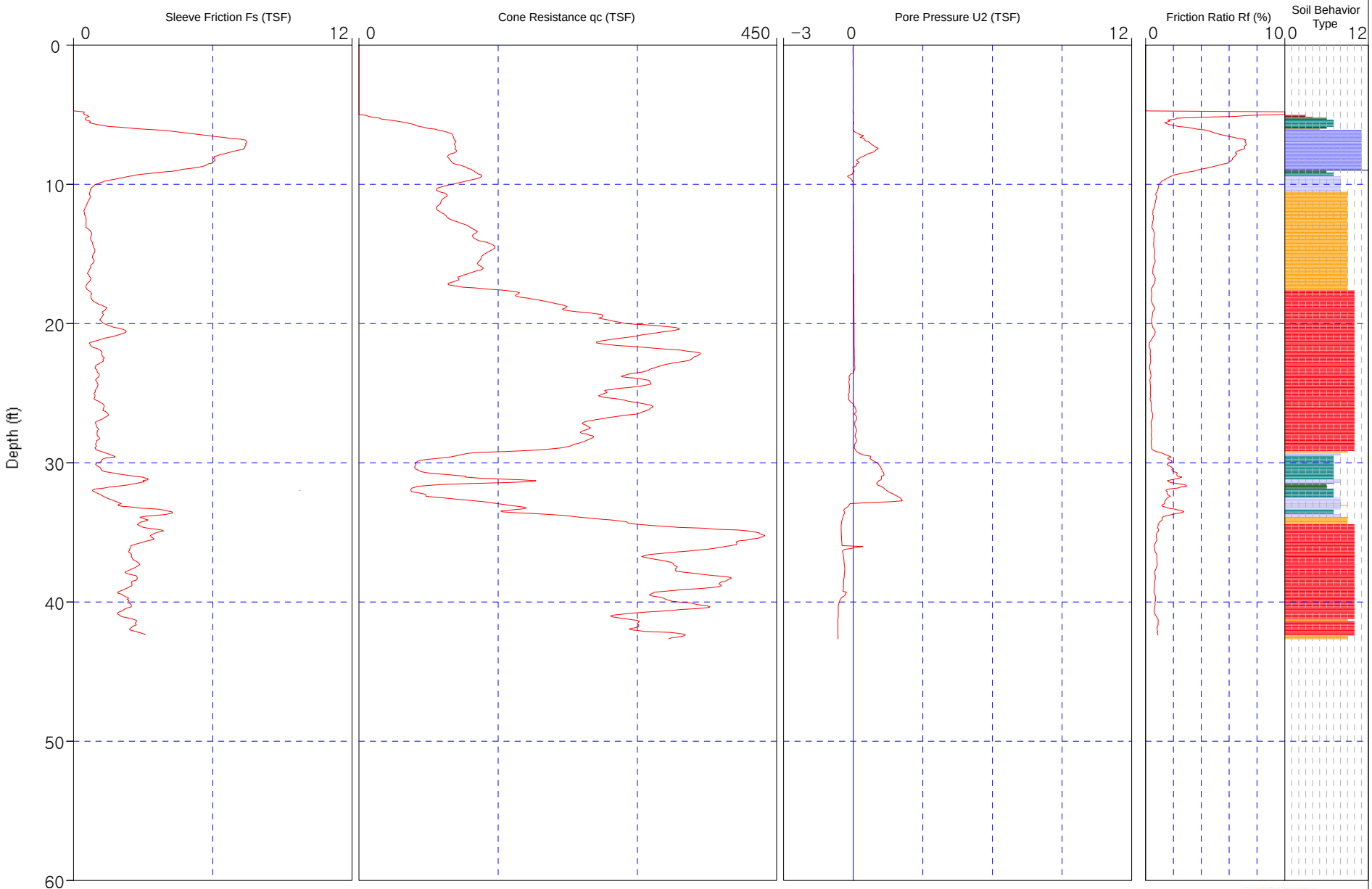
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-02
Date: 13-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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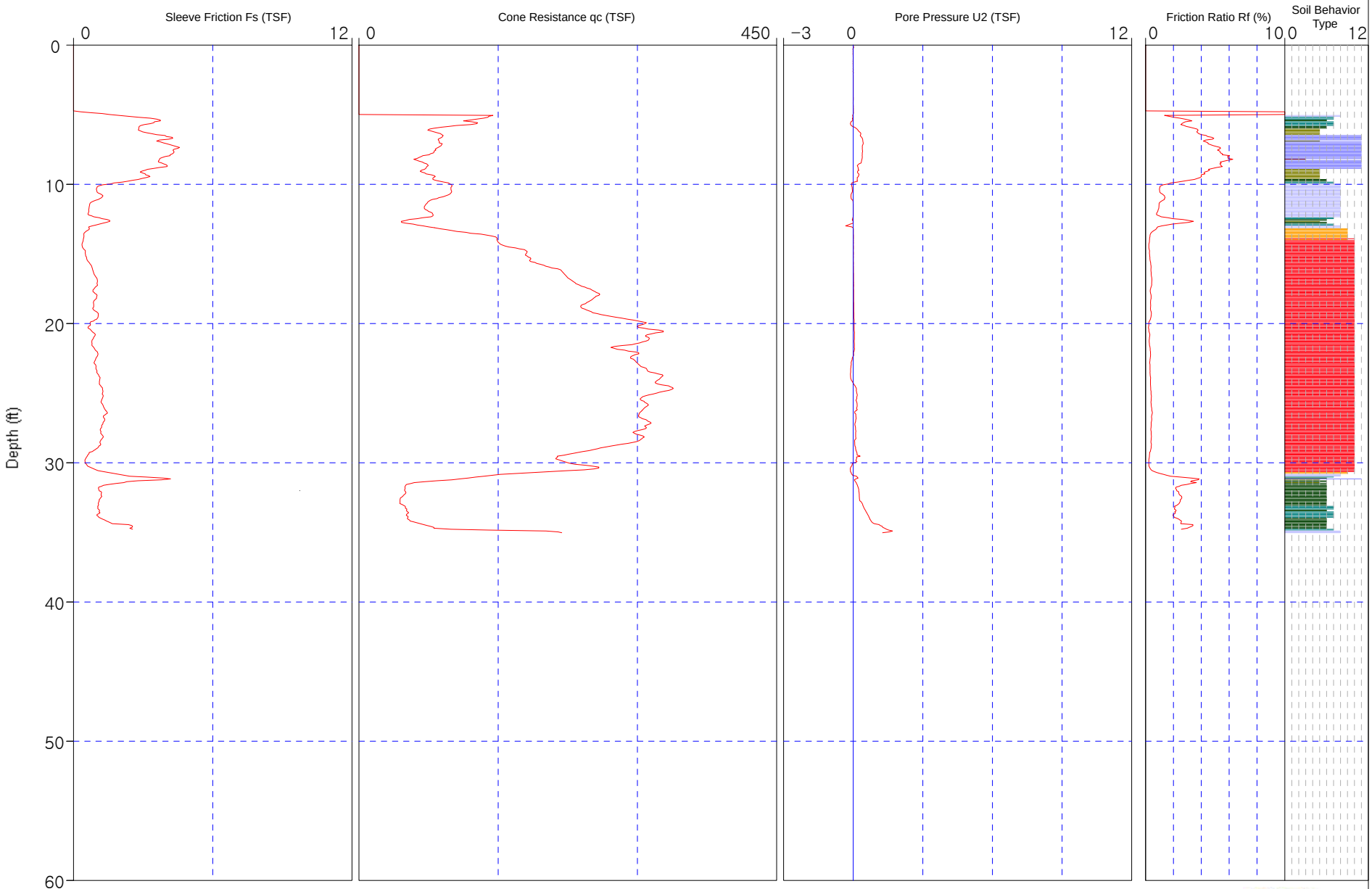
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-03
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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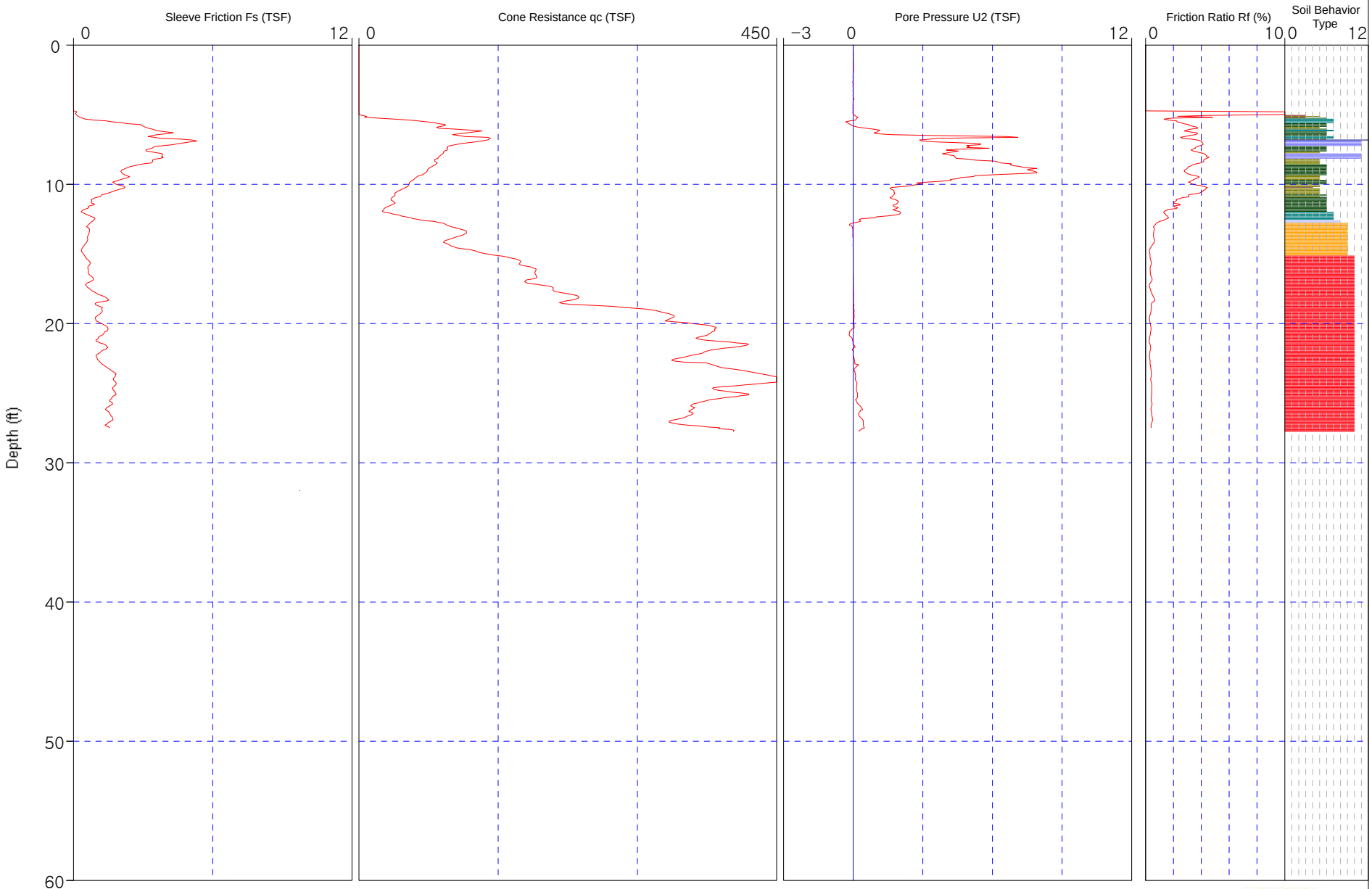
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-04
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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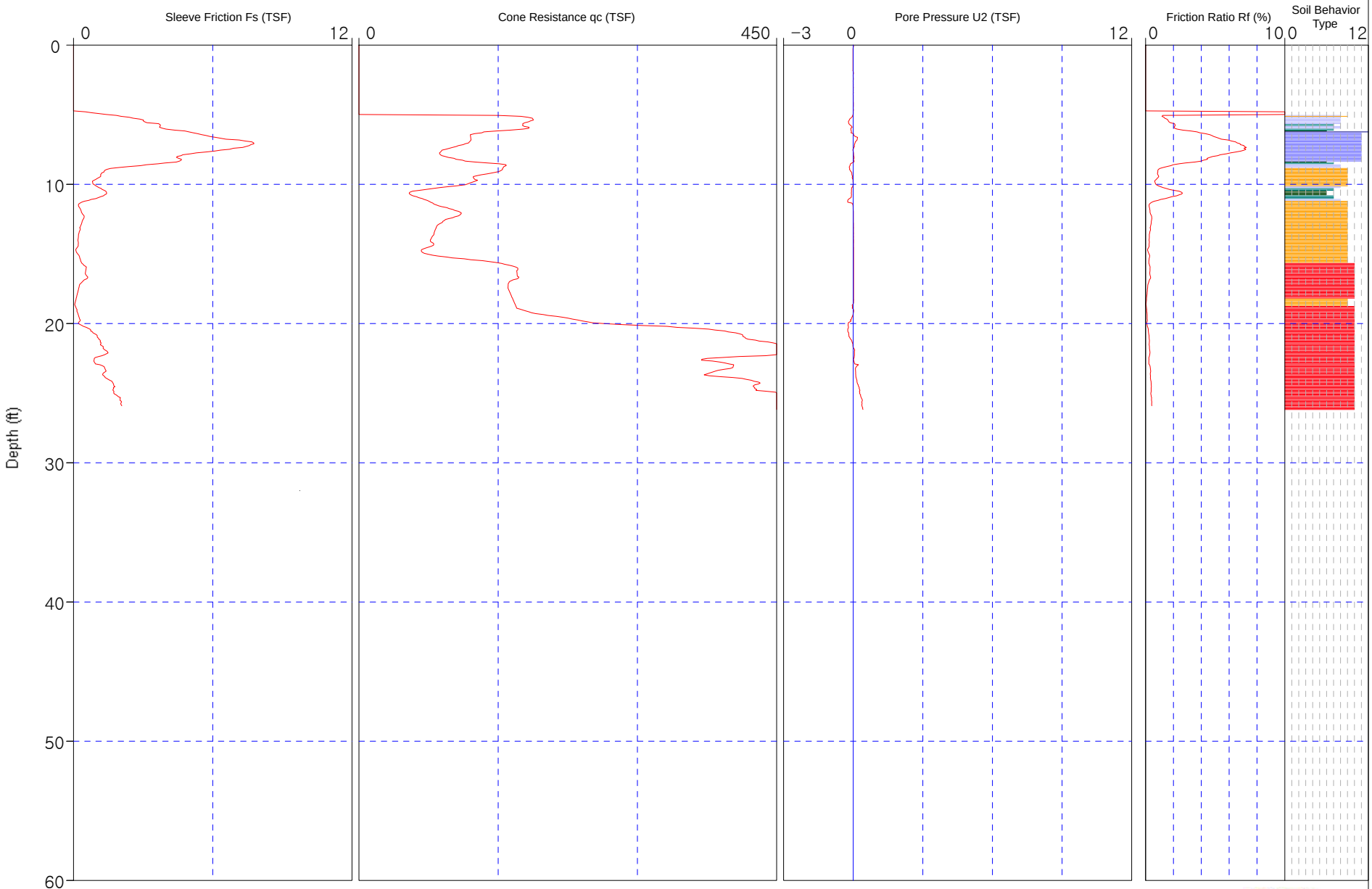
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-05
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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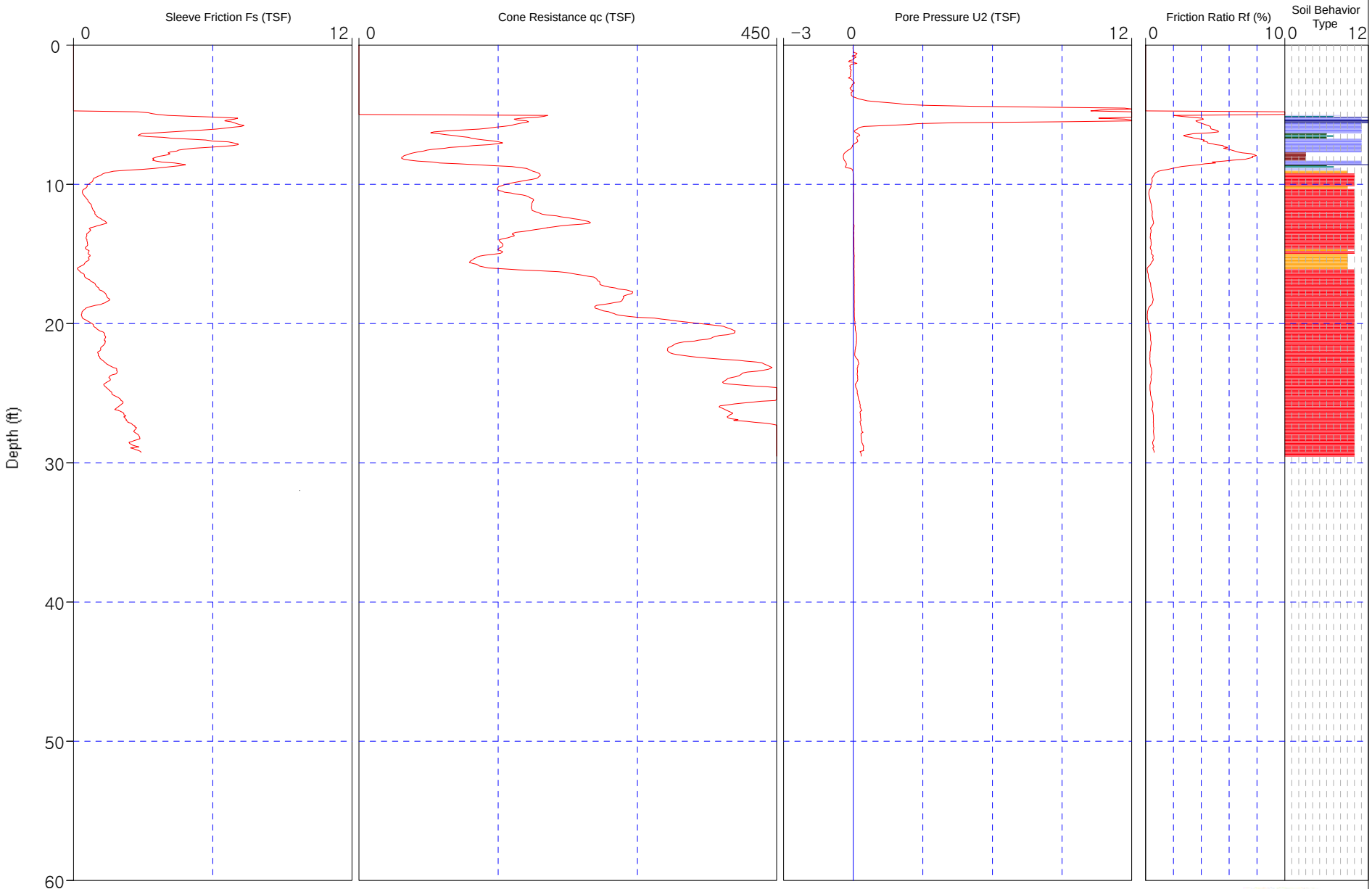
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 0409160020
Operator: D. Garza
Location: Signal Hill, CA

CPT Number: AS-06
Date: 15-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



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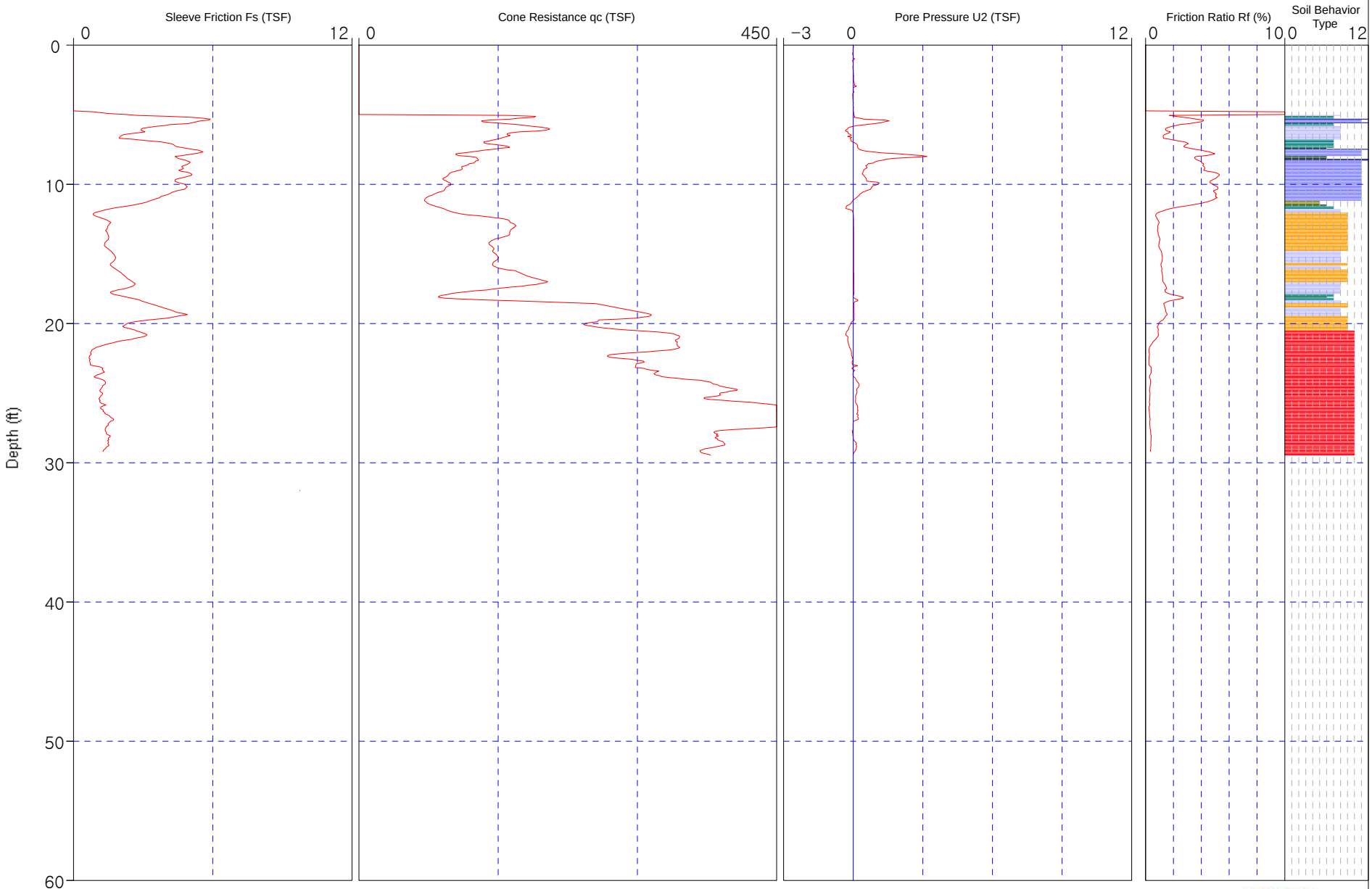
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-09
Date: 14-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 1519



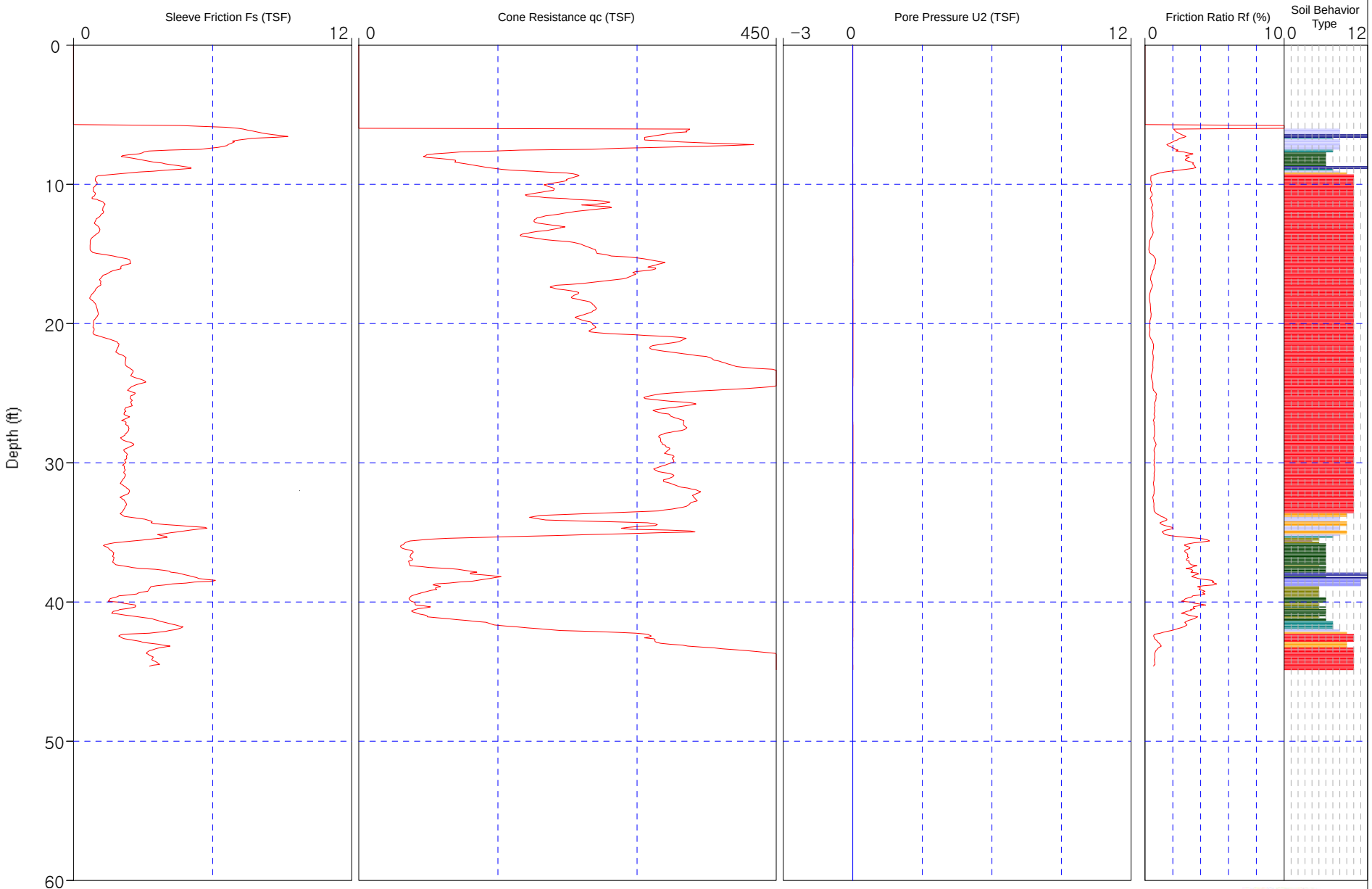
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

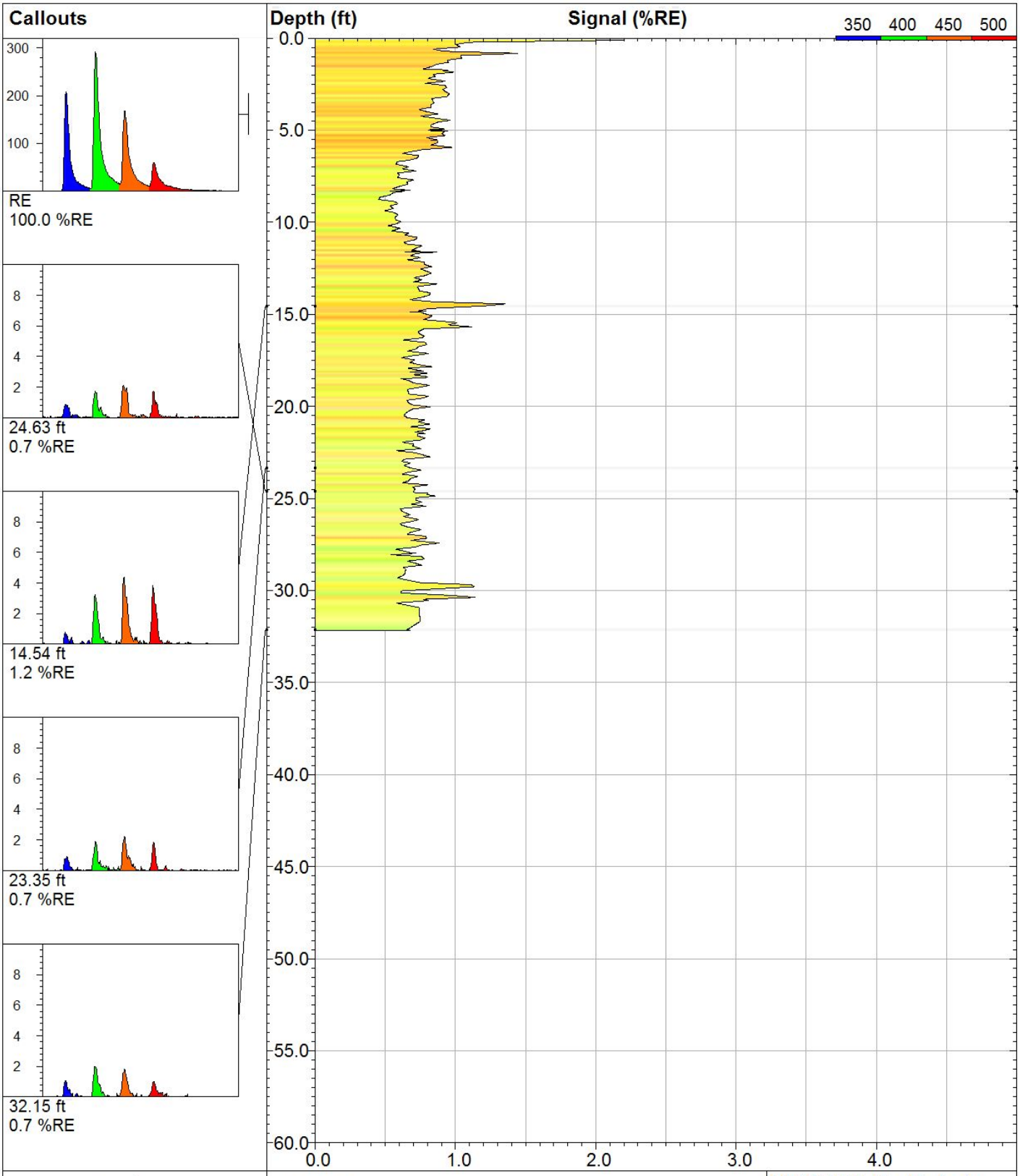
Job Number: 04.0916-0020
Operator: Danny Garza
Location: Signal Hill, CA

CPT Number: AS-10
Date: 19-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF25PB7SN2-P1E1 2095



Robertson et al. 1986 *Overconsolidated or Cemented



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AE-01

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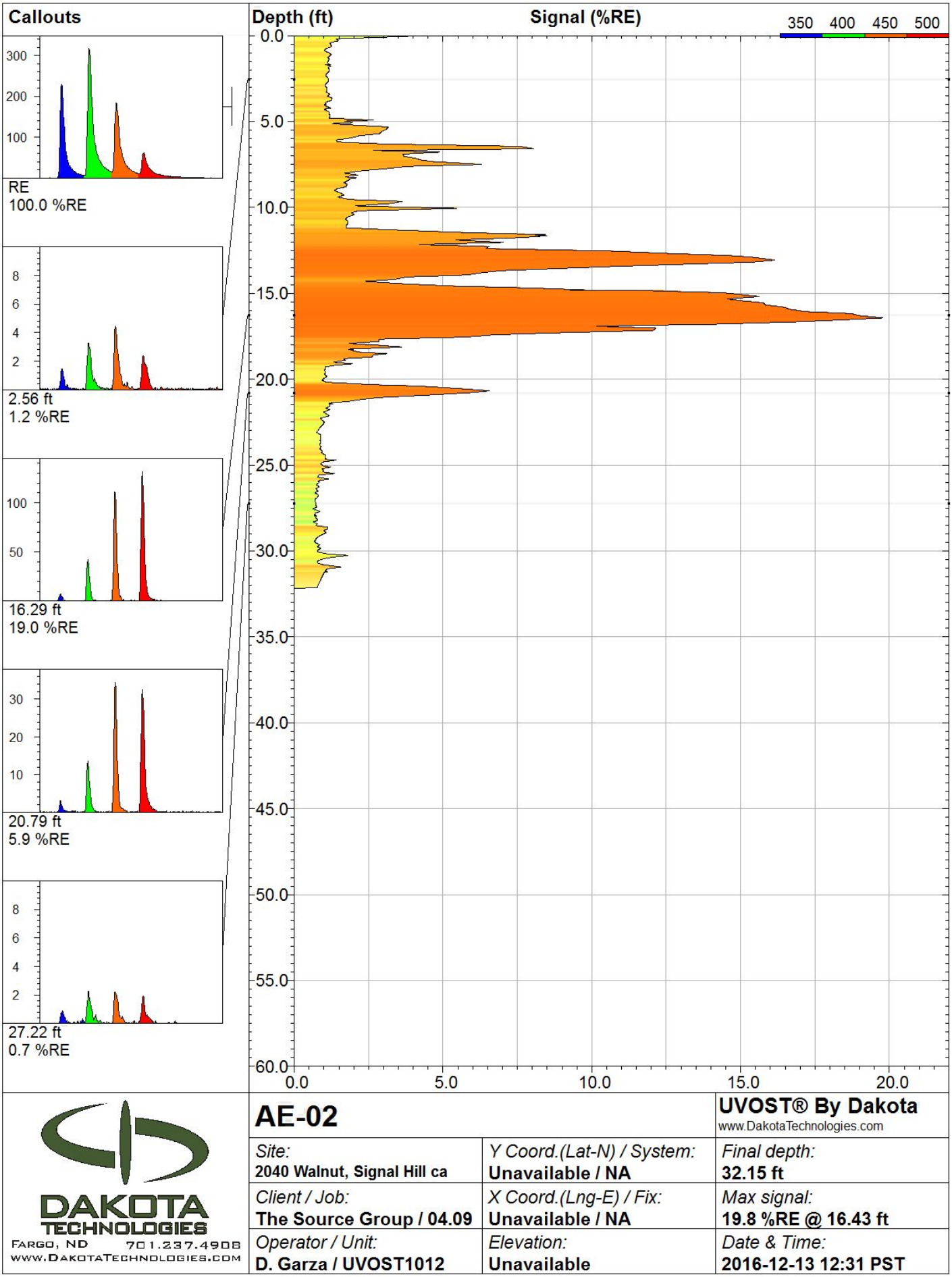
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **32.16 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.2 %RE @ 0.11 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-13 14:28 PST**



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AE-02

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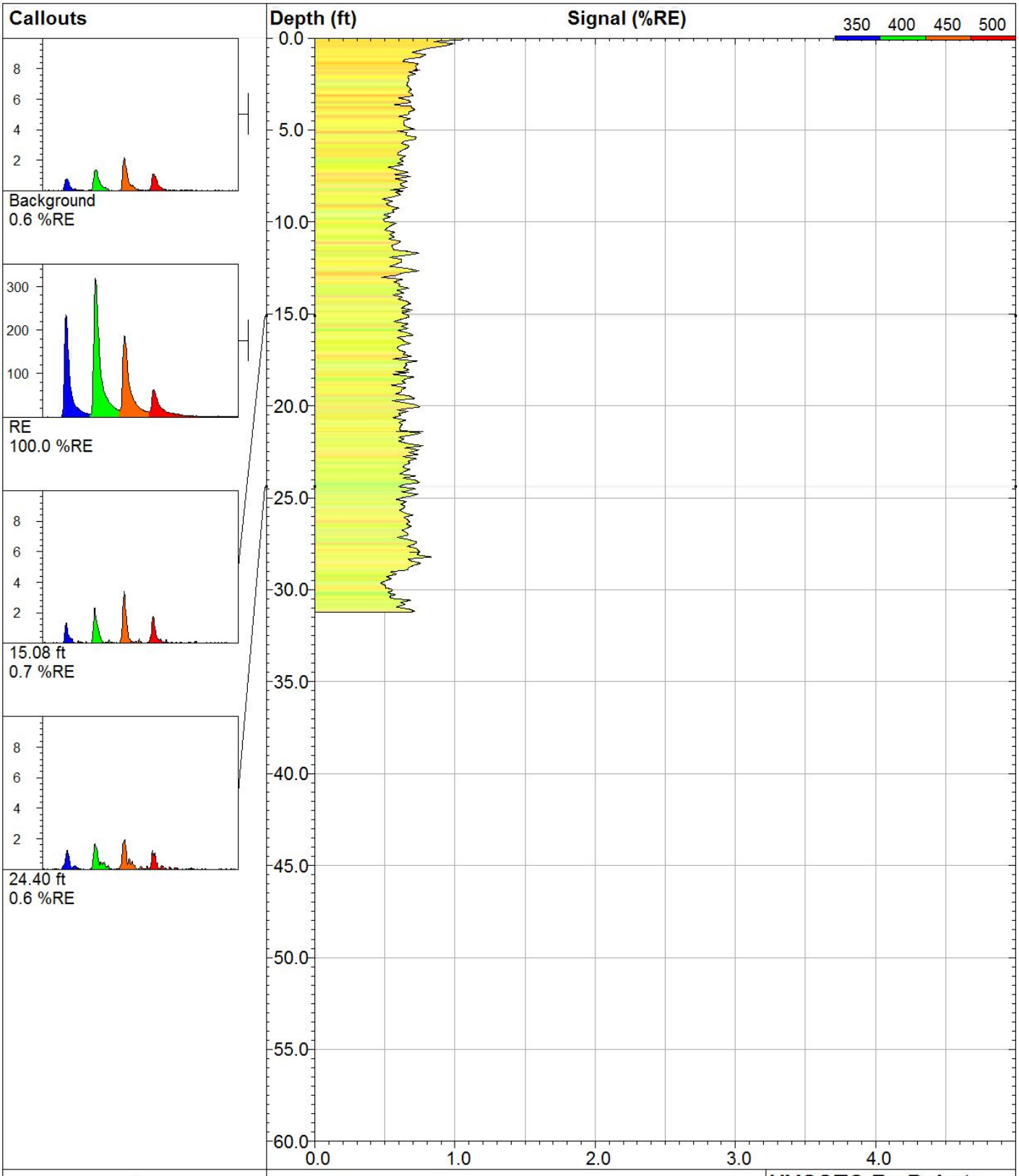
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **32.15 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **19.8 %RE @ 16.43 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-13 12:31 PST**



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AE-03

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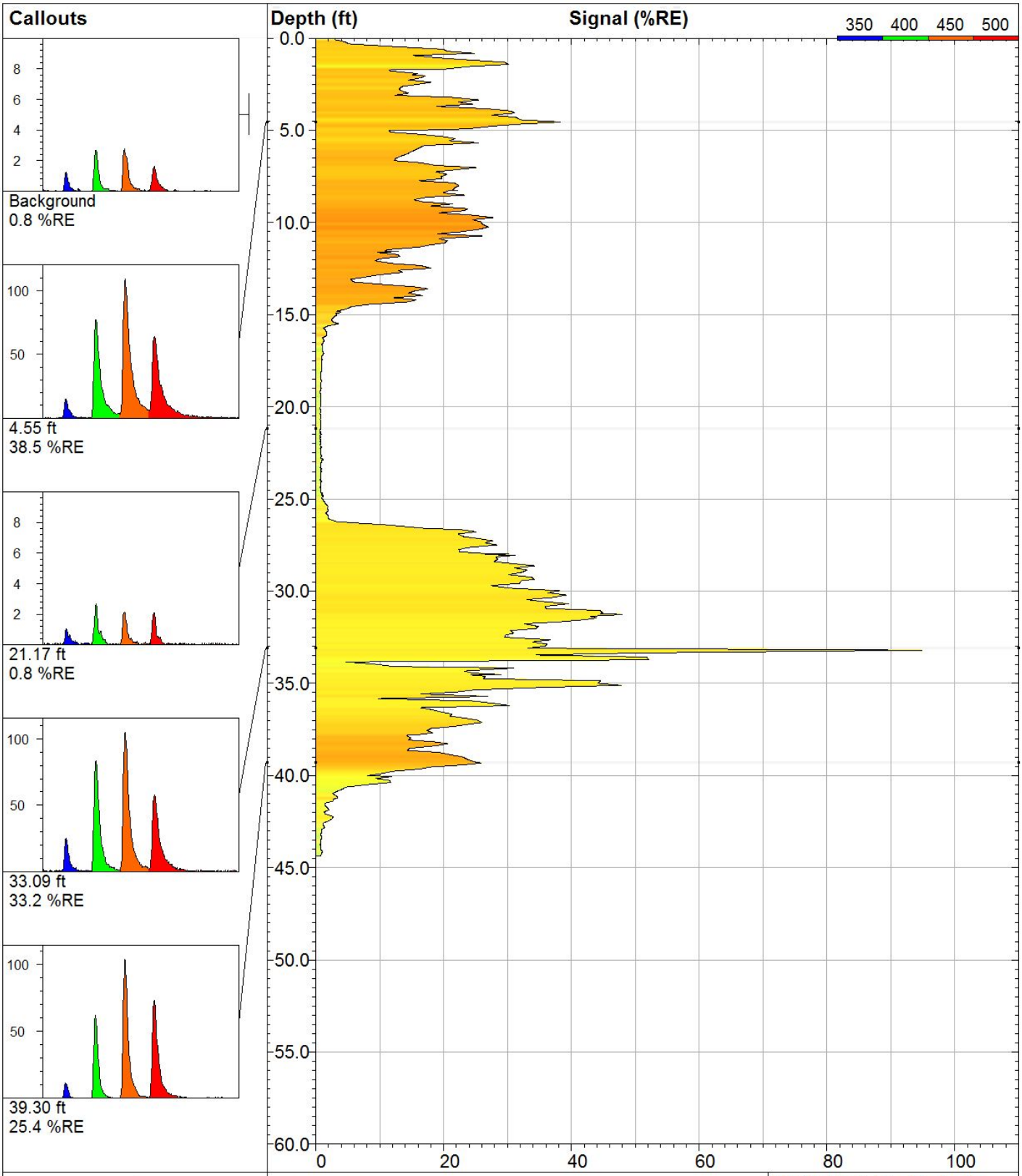
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **31.24 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.1 %RE @ 0.08 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-13 15:12 PST**



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AN-09

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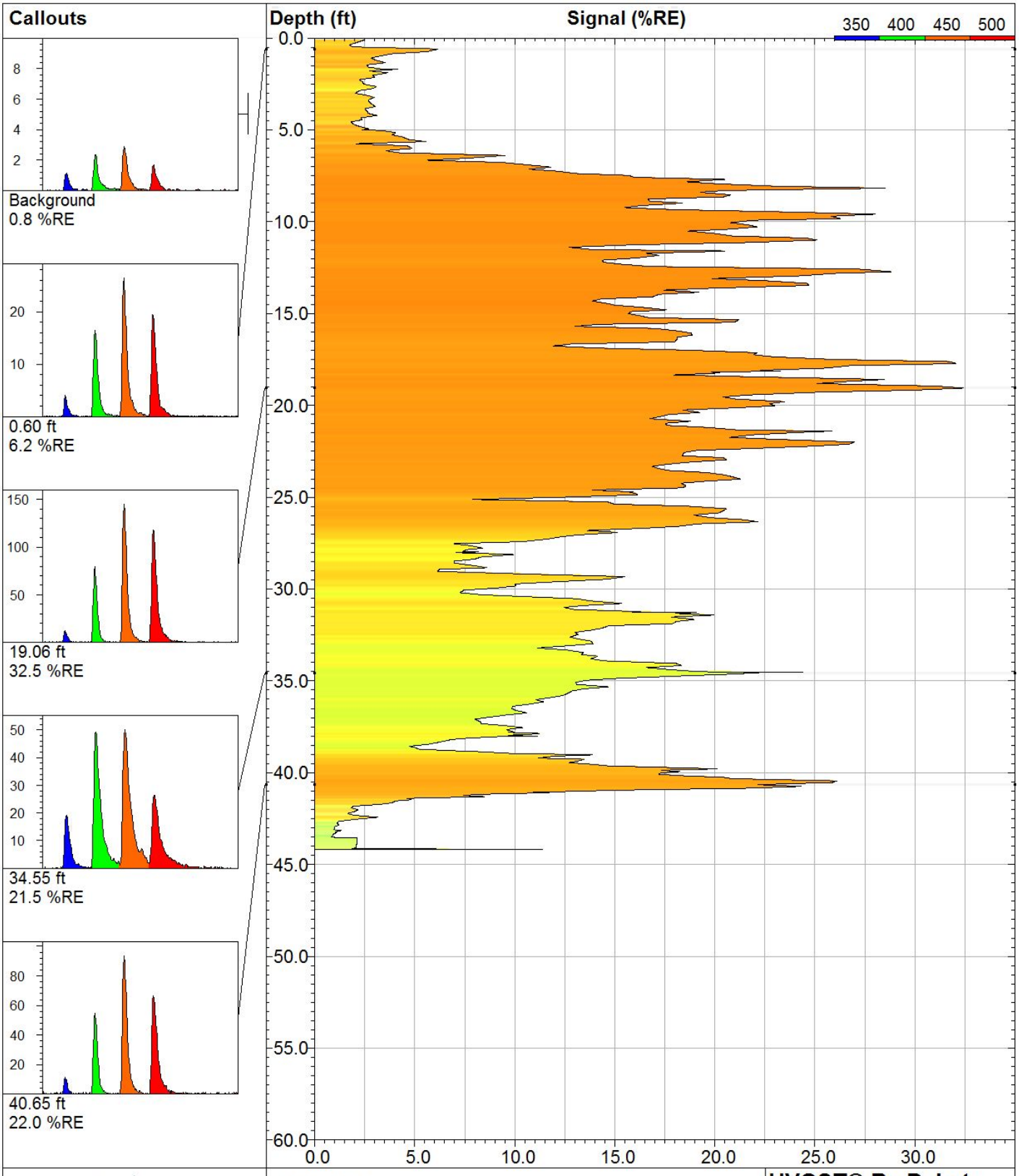
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **44.36 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **95.2 %RE @ 33.20 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 13:34 PST**



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AN-10

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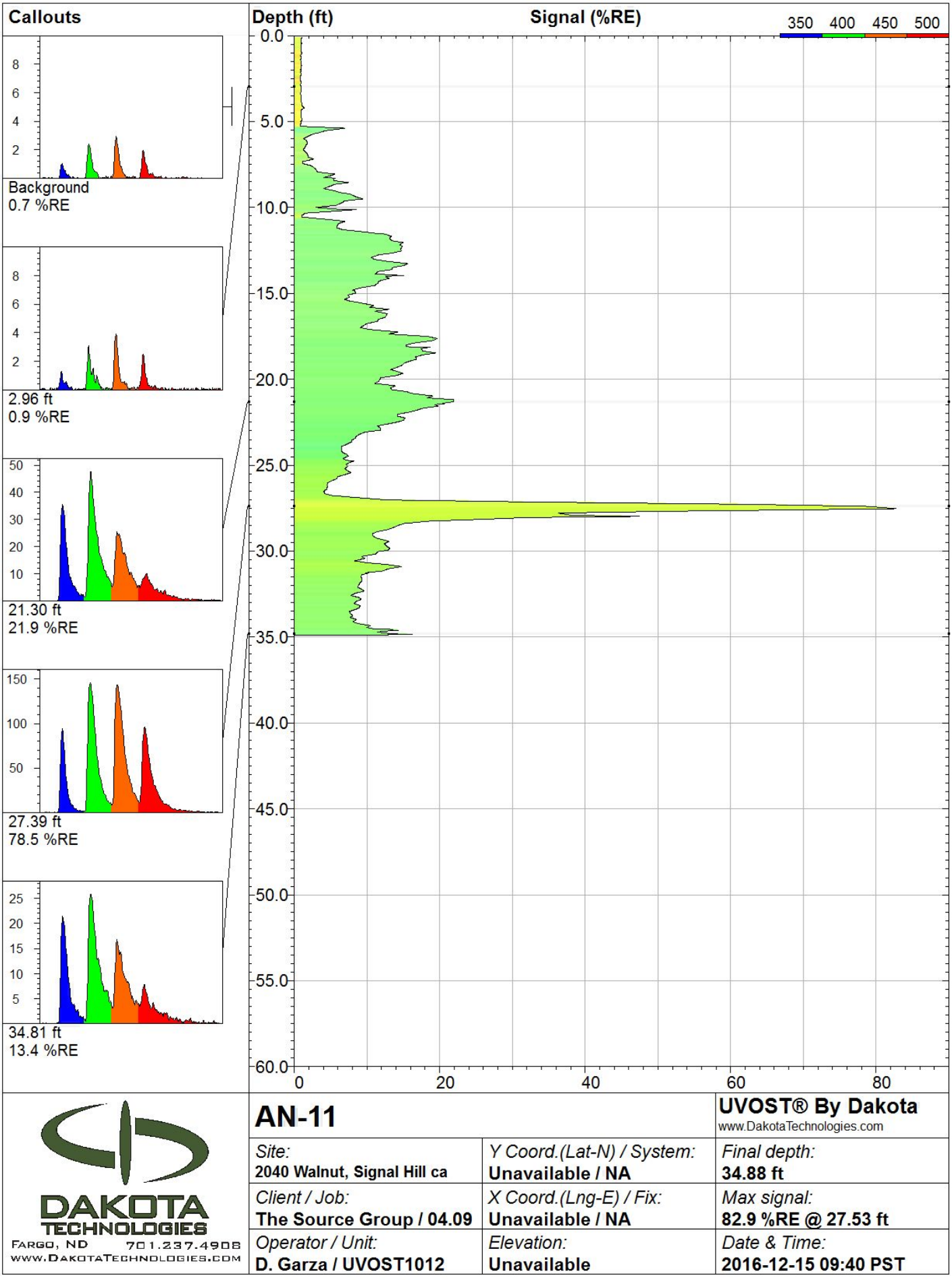
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **44.19 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **32.5 %RE @ 19.06 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 14:32 PST**



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AN-11

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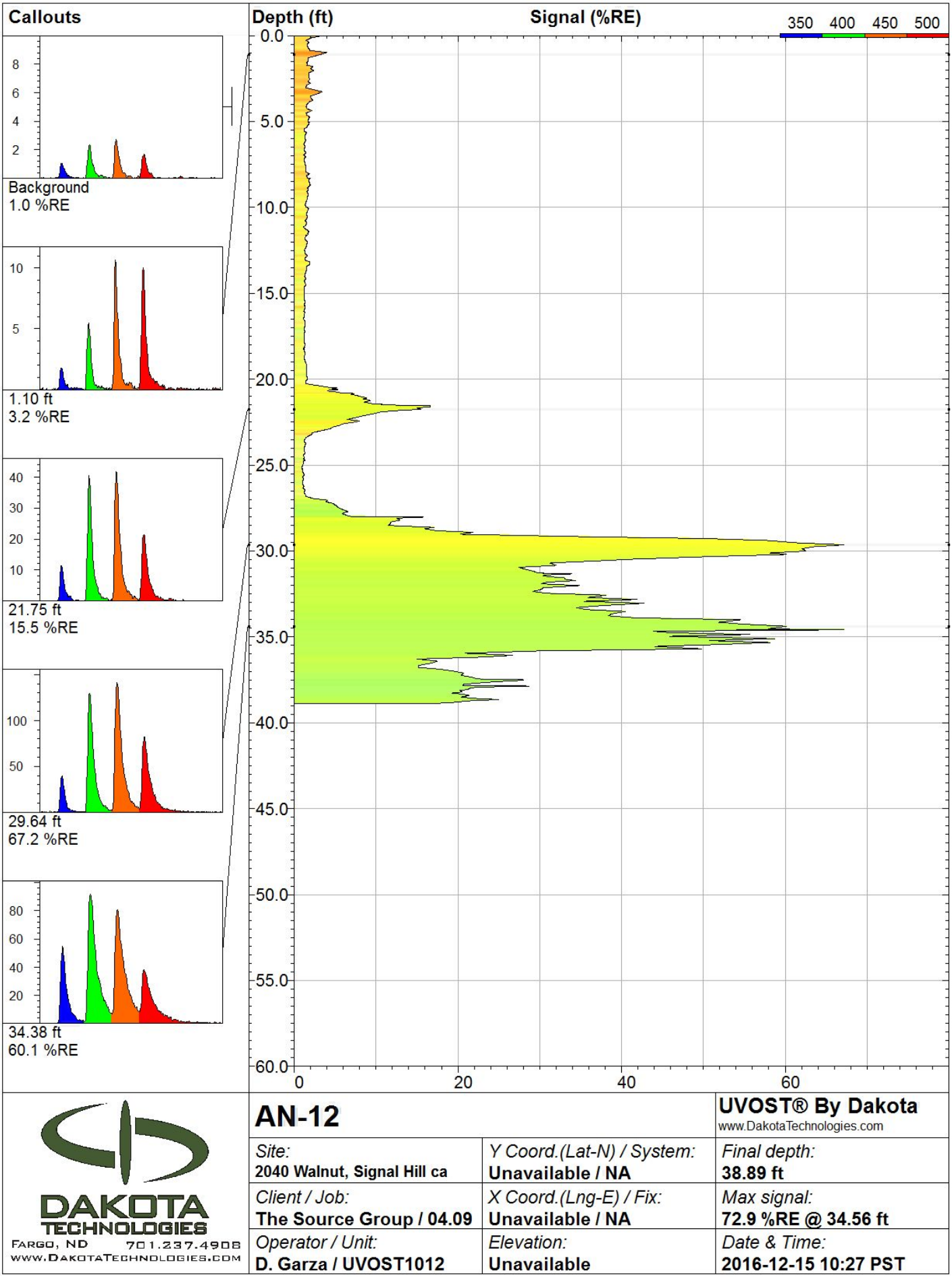
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **34.88 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **82.9 %RE @ 27.53 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-15 09:40 PST**



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AN-12

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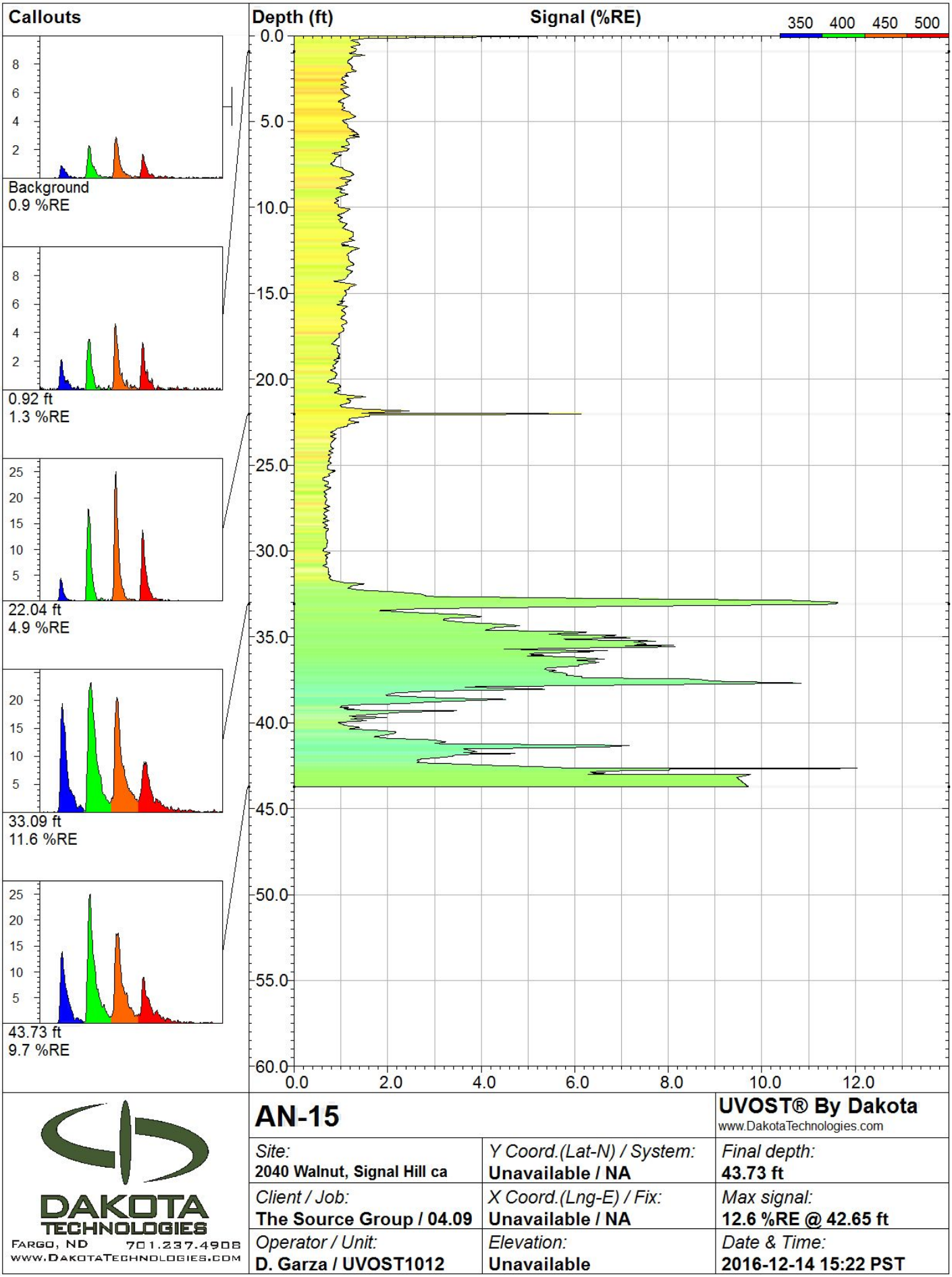
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **38.89 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **72.9 %RE @ 34.56 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-15 10:27 PST**



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AN-15

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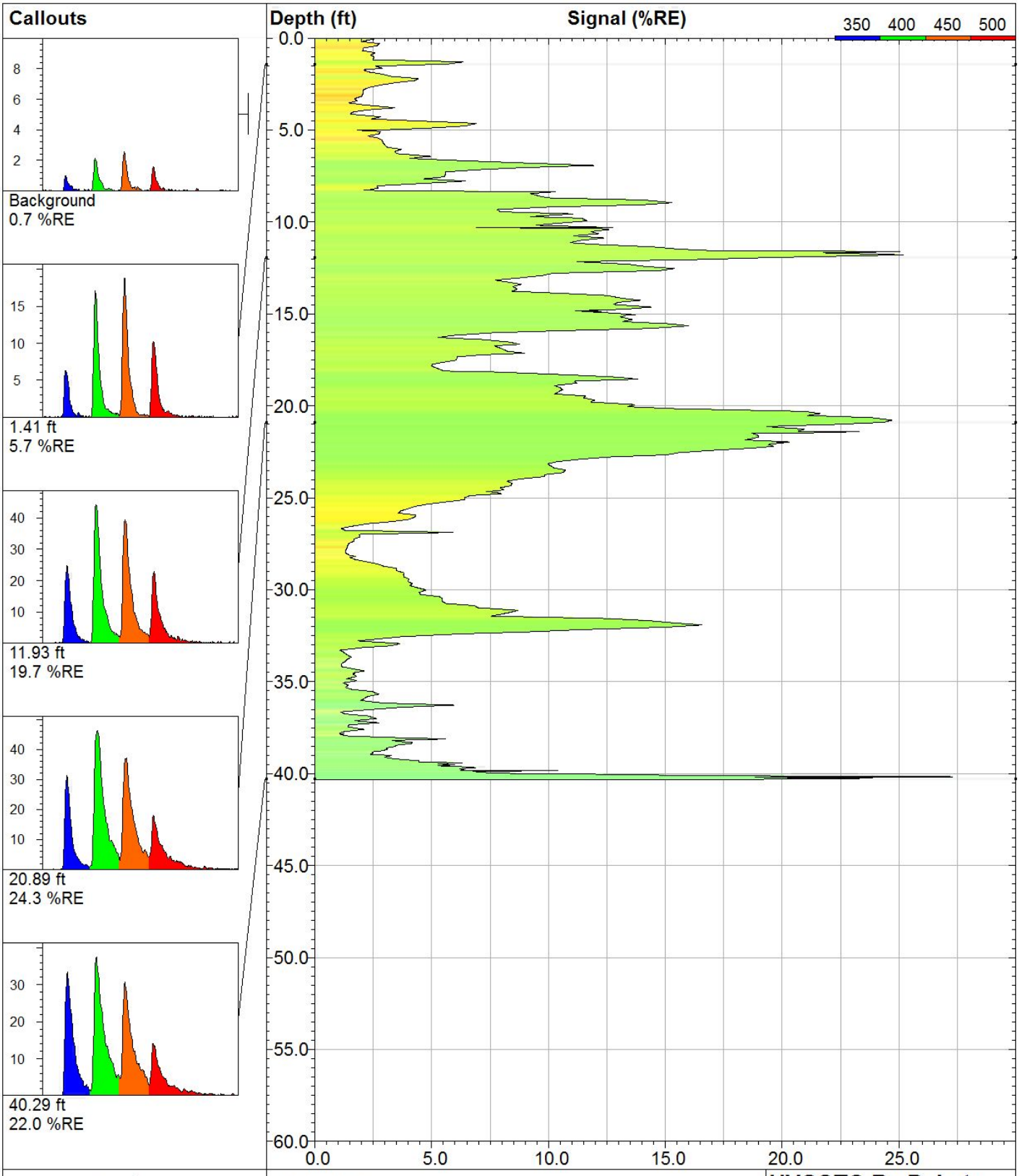
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **43.73 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **12.6 %RE @ 42.65 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 15:22 PST**



AN-16

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Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **40.32 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **28.1 %RE @ 40.17 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 16:11 PST**

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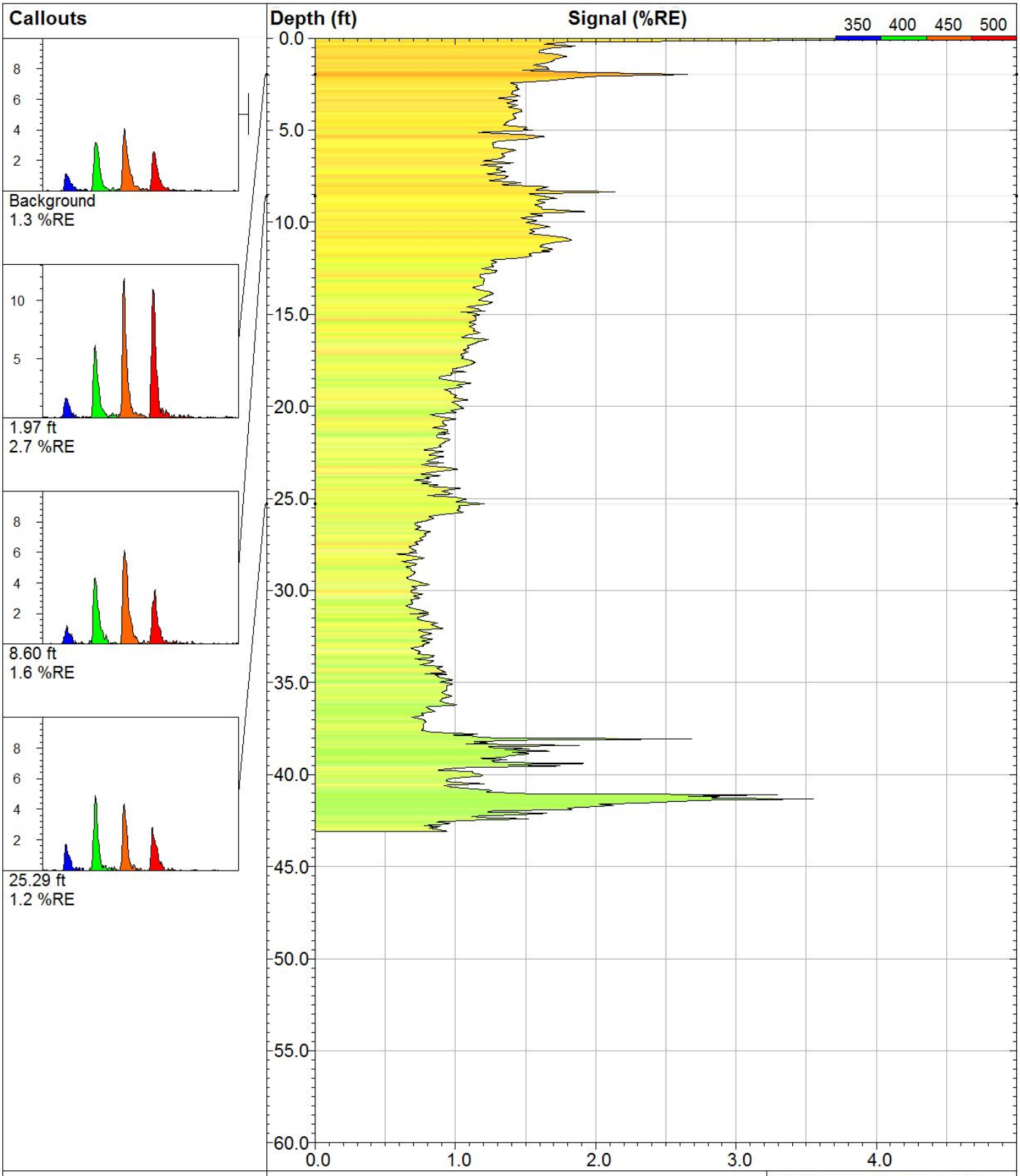

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AN-17

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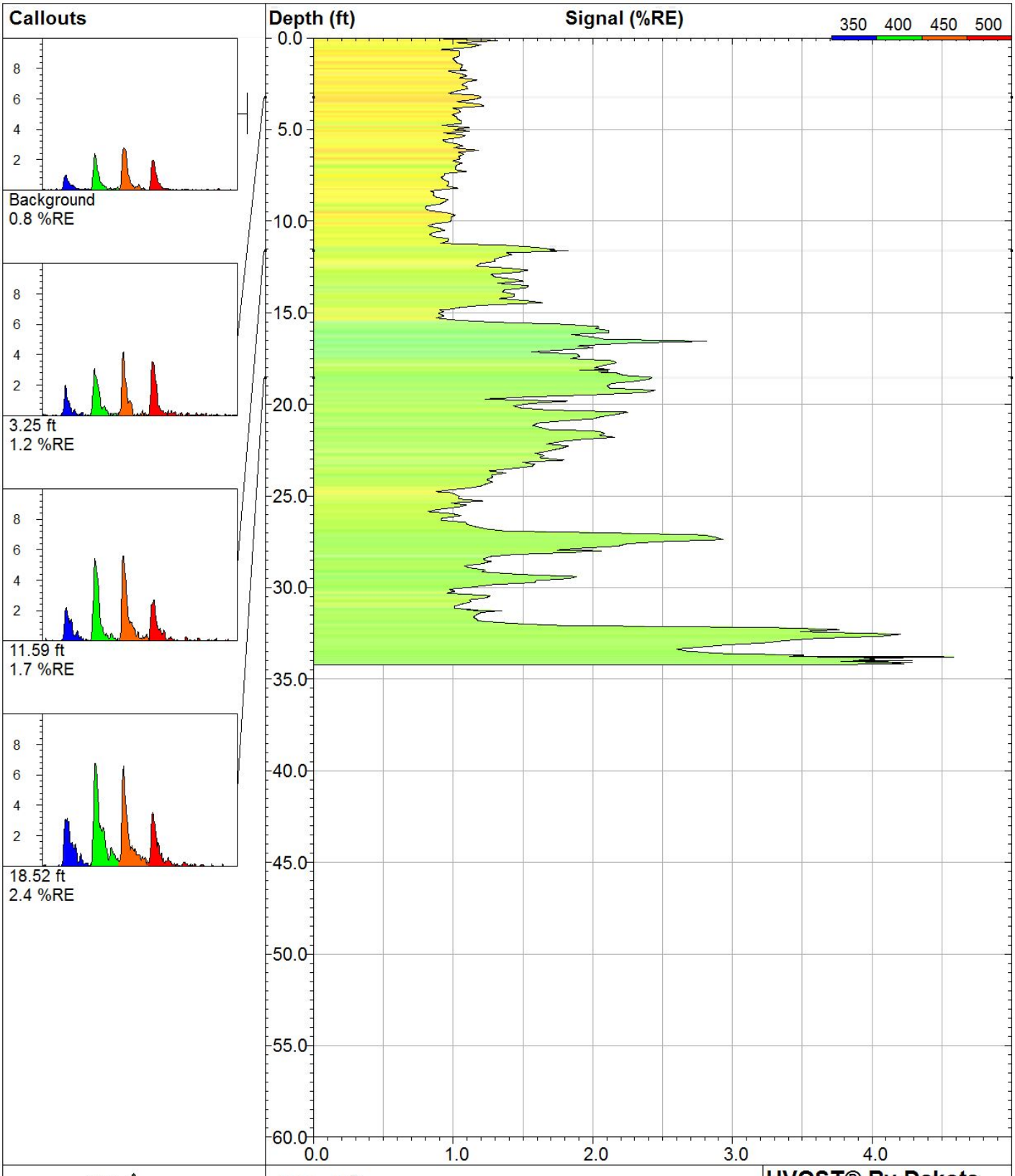
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **43.08 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.1 %RE @ 0.08 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-15 07:54 PST**



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AN-18

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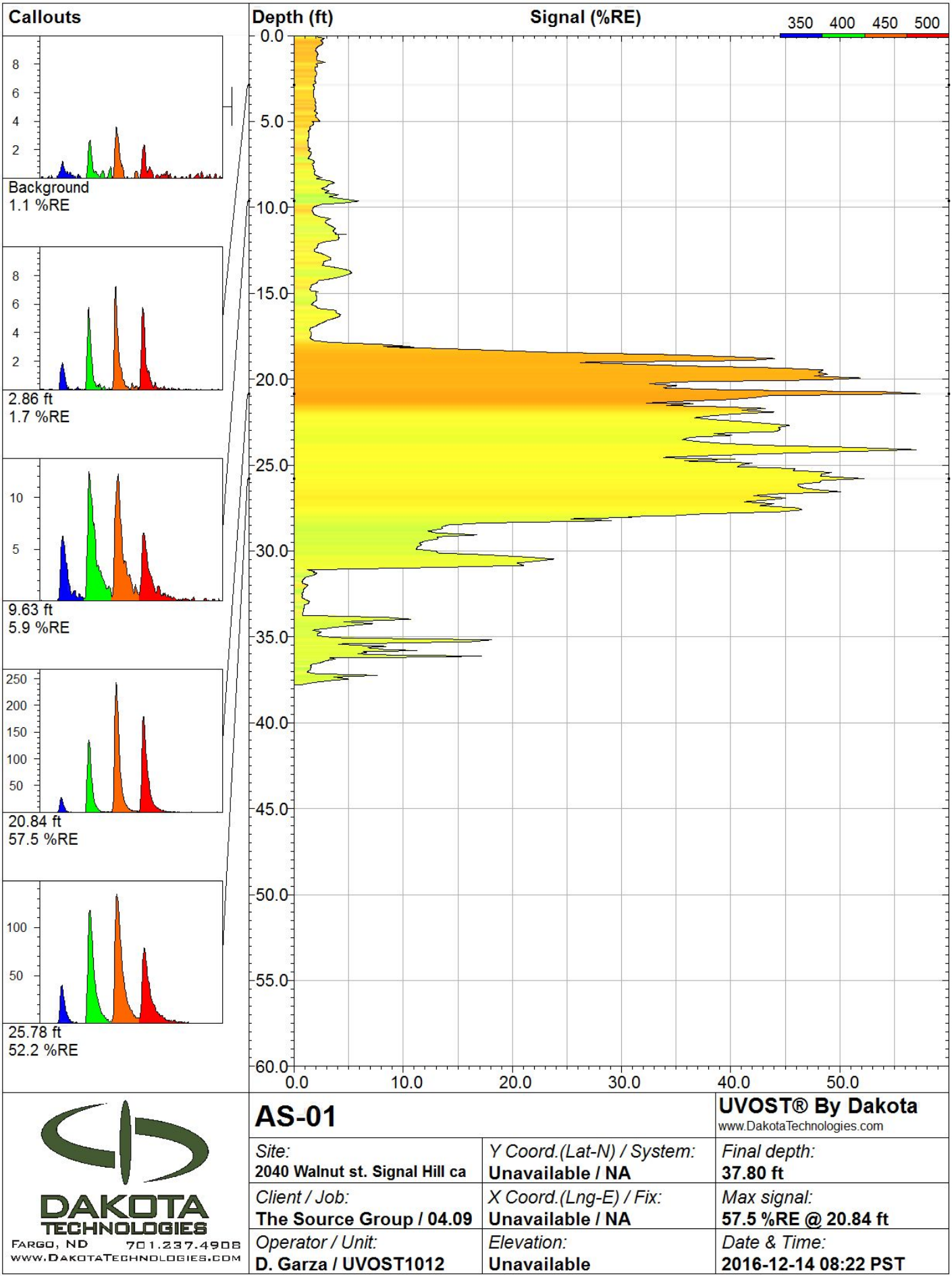
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **34.21 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.6 %RE @ 33.78 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-15 08:47 PST**



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AS-01

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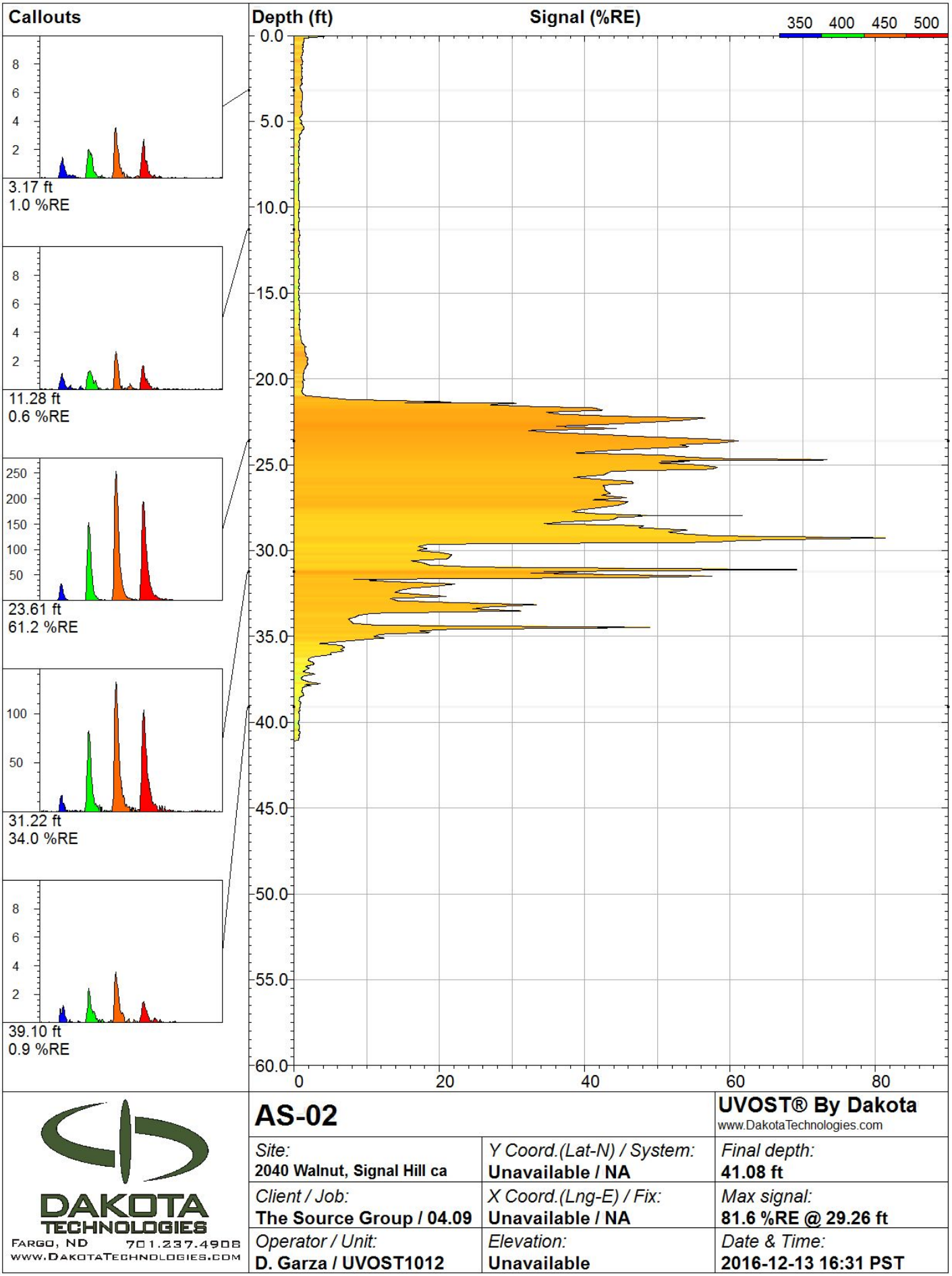
Site: **2040 Walnut st. Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **37.80 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **57.5 %RE @ 20.84 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 08:22 PST**



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AS-02

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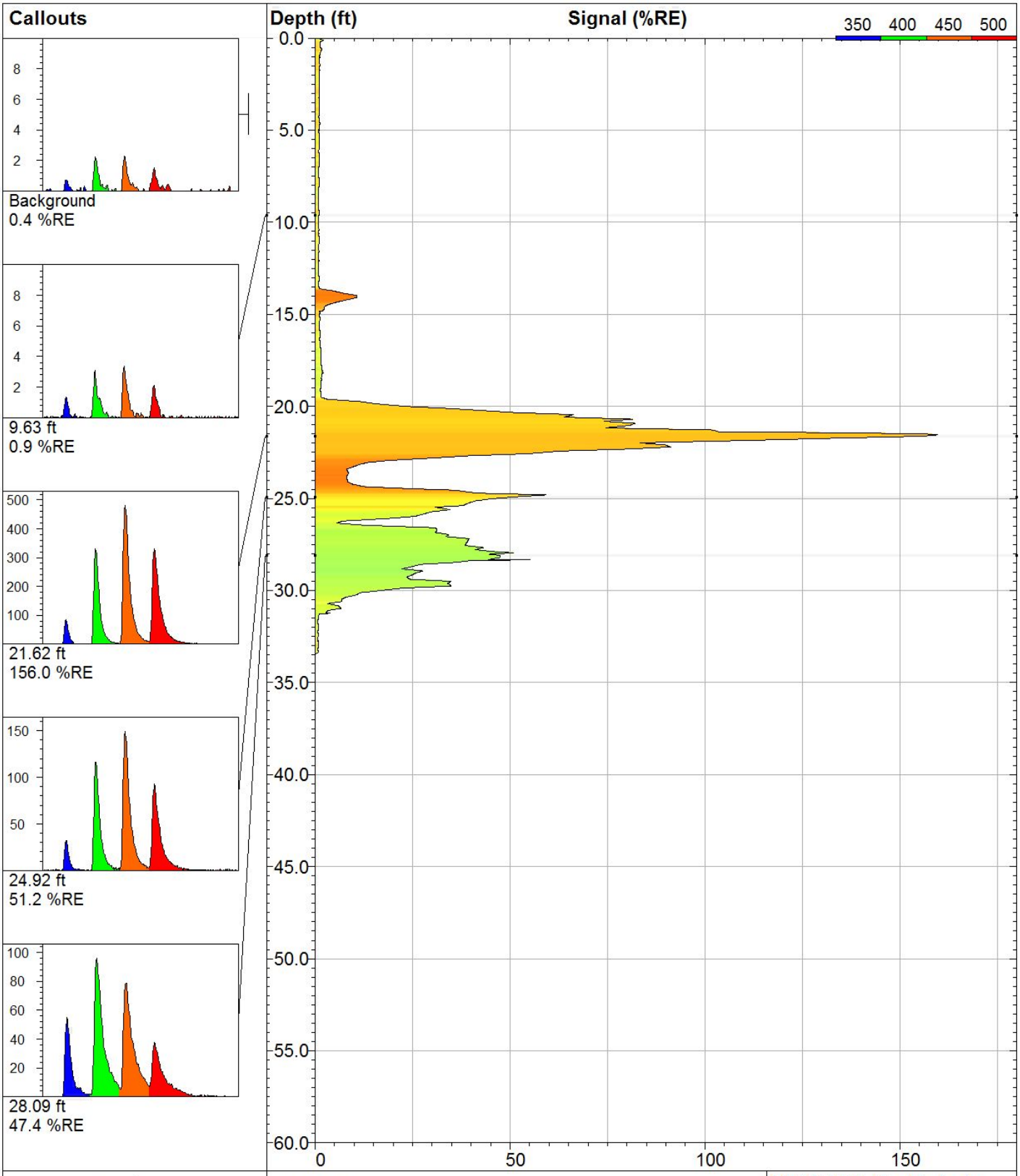
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **41.08 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **81.6 %RE @ 29.26 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-13 16:31 PST**



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AS-03

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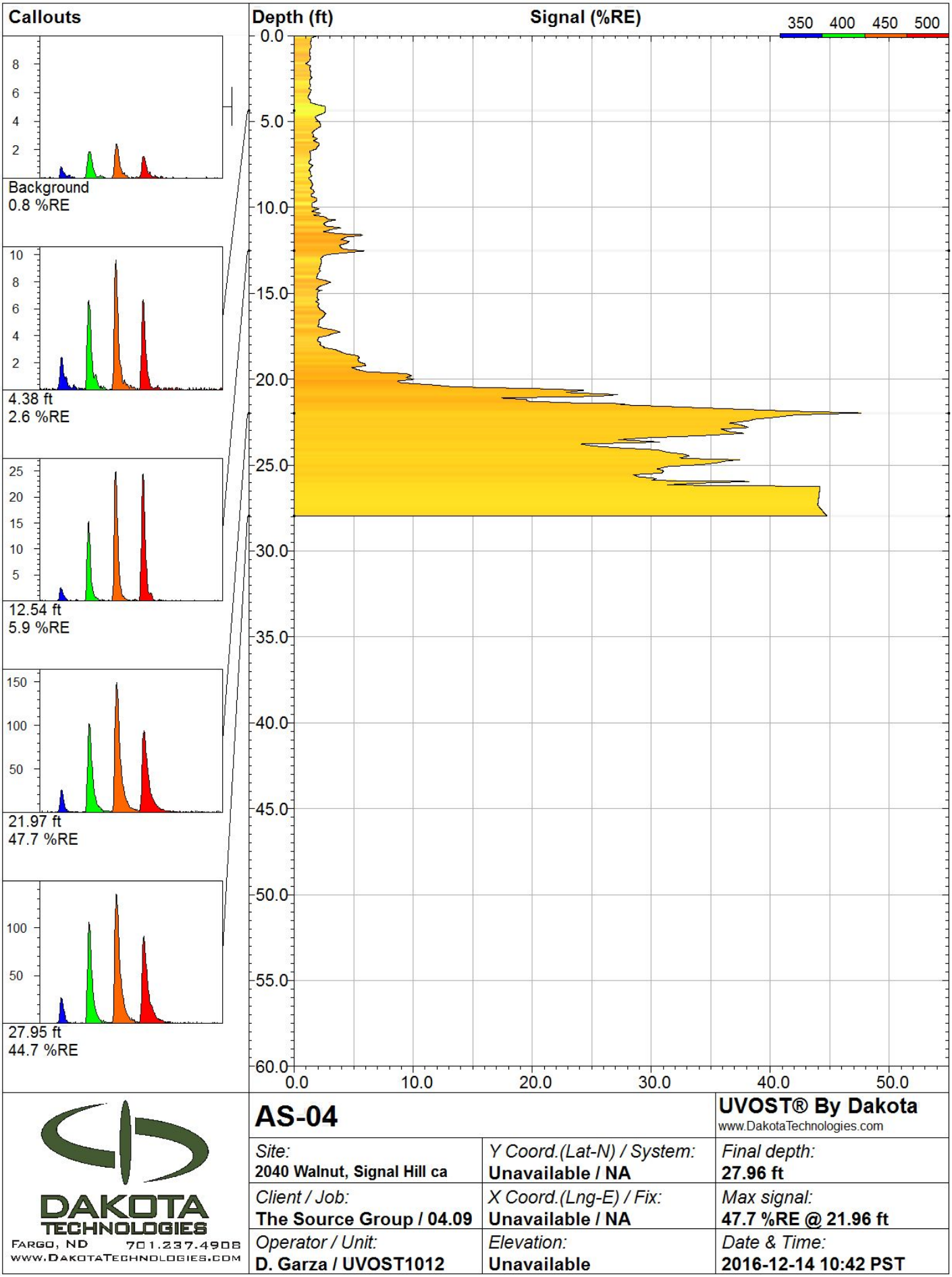
Site: **2040 Walnut st. Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **33.41 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **159.8 %RE @ 21.52 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 09:12 PST**



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AS-04

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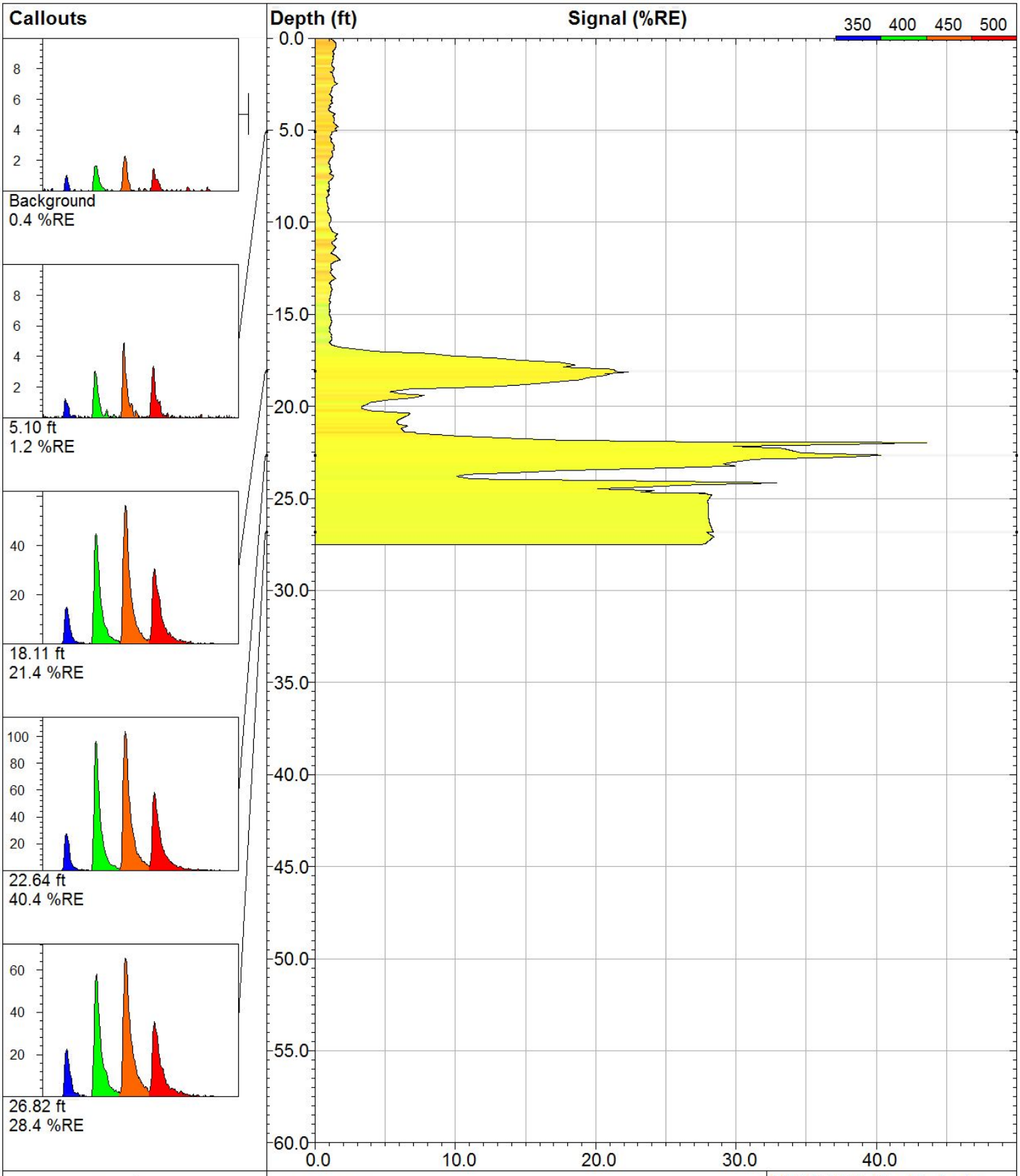
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **27.96 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **47.7 %RE @ 21.96 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 10:42 PST**



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AS-05

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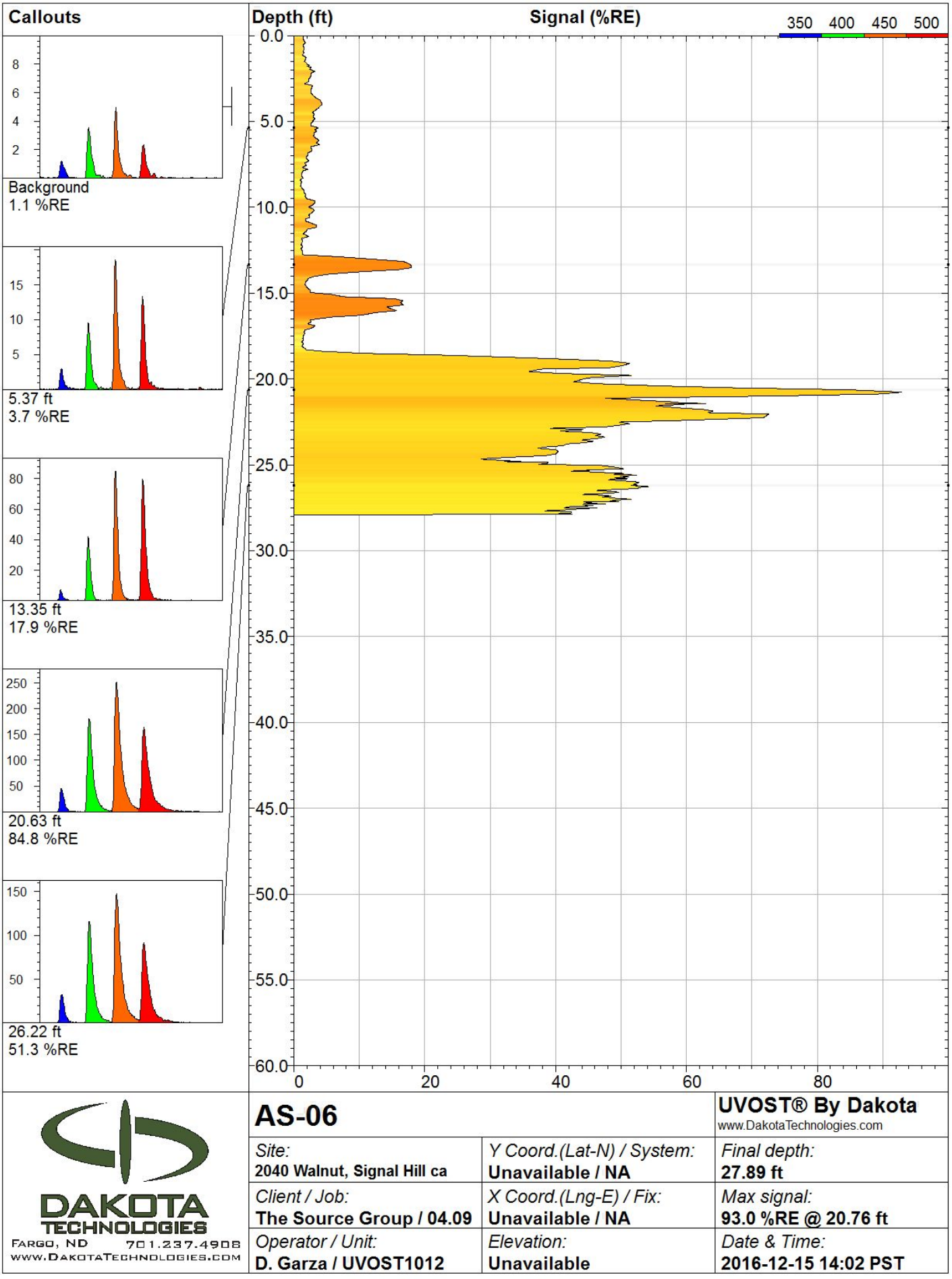
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **27.49 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **43.6 %RE @ 21.96 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 09:54 PST**



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AS-06

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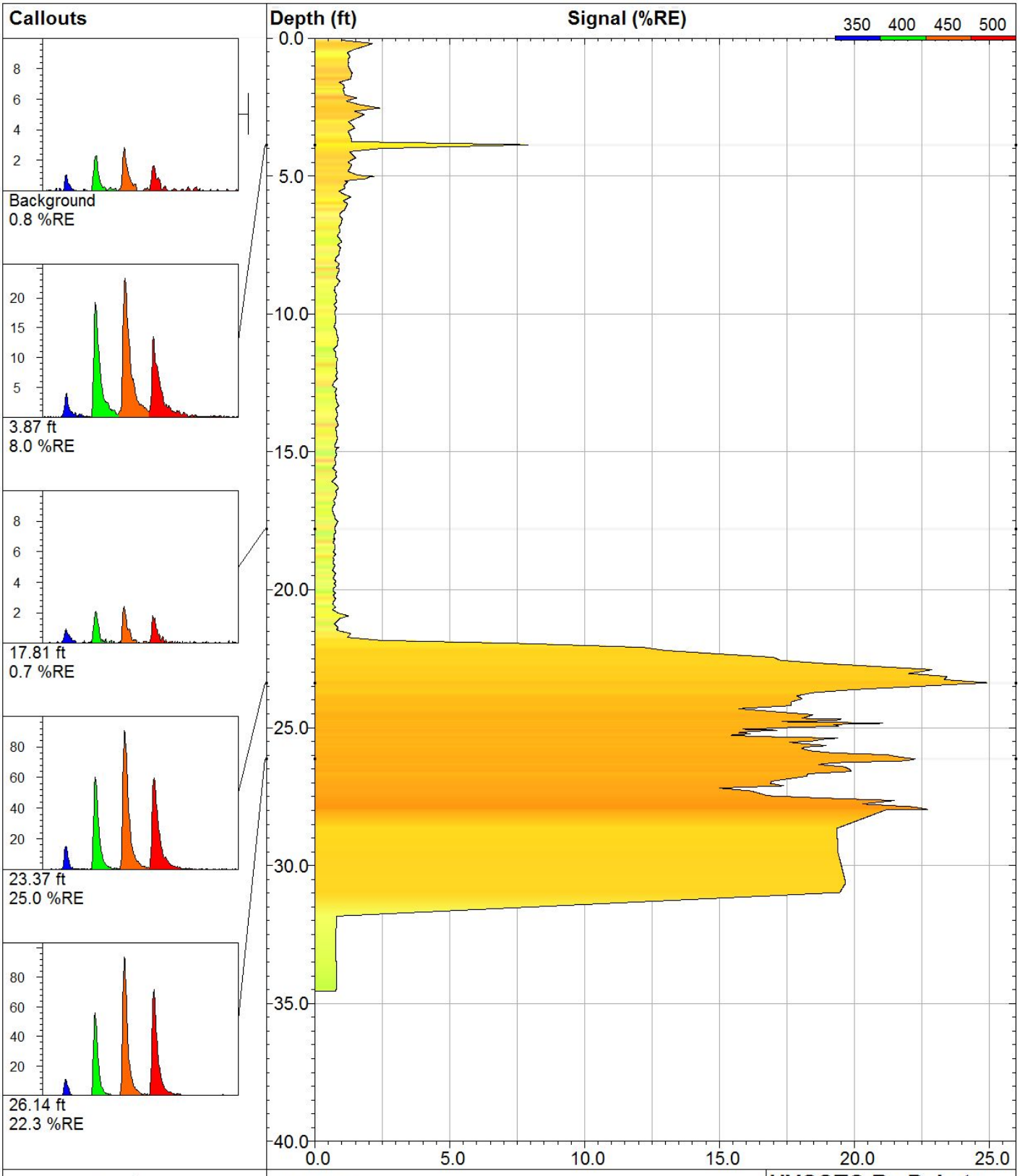
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **27.89 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **93.0 %RE @ 20.76 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-15 14:02 PST**



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AS-09

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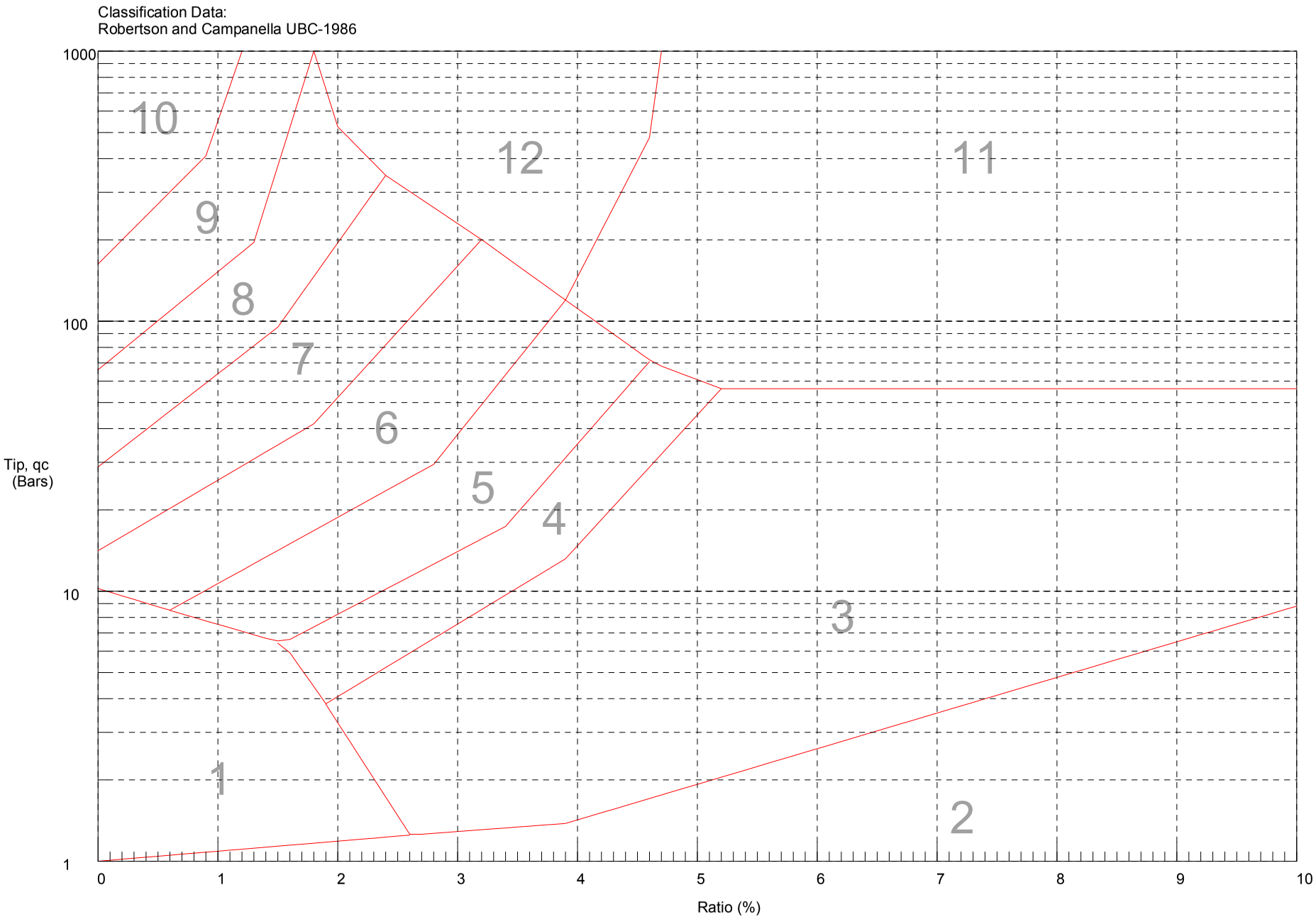
Site: **2040 Walnut, Signal Hill ca**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **34.55 ft**
Client / Job: **The Source Group / 04.09**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **25.0 %RE @ 23.37 ft**
Operator / Unit: **D. Garza / UVOST1012**	*Elevation:* **Unavailable**	*Date & Time:* **2016-12-14 11:28 PST**

12 Zone Soil Behavior Chart



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
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

NEWSLETTERS

< Back To Newsletters

Interpreting LIF Waveforms

Laser-Induced Fluorescence Primer II: Interpreting Waveforms

Randy St. Germain, President

Ultraviolet (UV) laser-induced fluorescence (LIF) screening tools cause fluorescence in light non-aqueous phase liquids (LNAPLs). Total fluorescence readings estimate the quantity of LNAPL present, but LIF can also capture fluorescence "waveforms" to qualitatively evaluate LNAPL type.

[This article focuses on UV LIF's application to petroleum fuels and oils, but NOT creosotes and coal tar. These require the Tar-specific Green Optical Screening Tool or TarGOST. TarGOST and the problem inherent with the fluorescence of heavier hydrocarbons will be discussed in a forthcoming LIF Line]

BACKGROUND:

Optical screening tools (OSTs) "flash" a sample with intense light for a few nanoseconds, then analyze the fluorescence that continues to be emitted long after the flash has stopped. This fluorescence "lifetime" varies, from well under a nanosecond to tens or even hundreds of nanoseconds.

OSTs have this time-resolved LIF capability built in so that they can simultaneously record the "color" (spectral nature) and lifetime (temporal nature) of the fluorescence. OST LIF systems can tentatively identify the type of petroleum, discern false positives, and detect weathering of certain LNAPLs with lifetimes playing a major role.

MULTI-WAVELENGTH WAVEFORMS:

The left side of Figure A illustrates the combined spectral/temporal nature of the fluorescence emitted by the polycyclic aromatic hydrocarbons (PAHs) in diesel, and the right side shows the 2D "shorthand" style waveform characteristic of OST data.

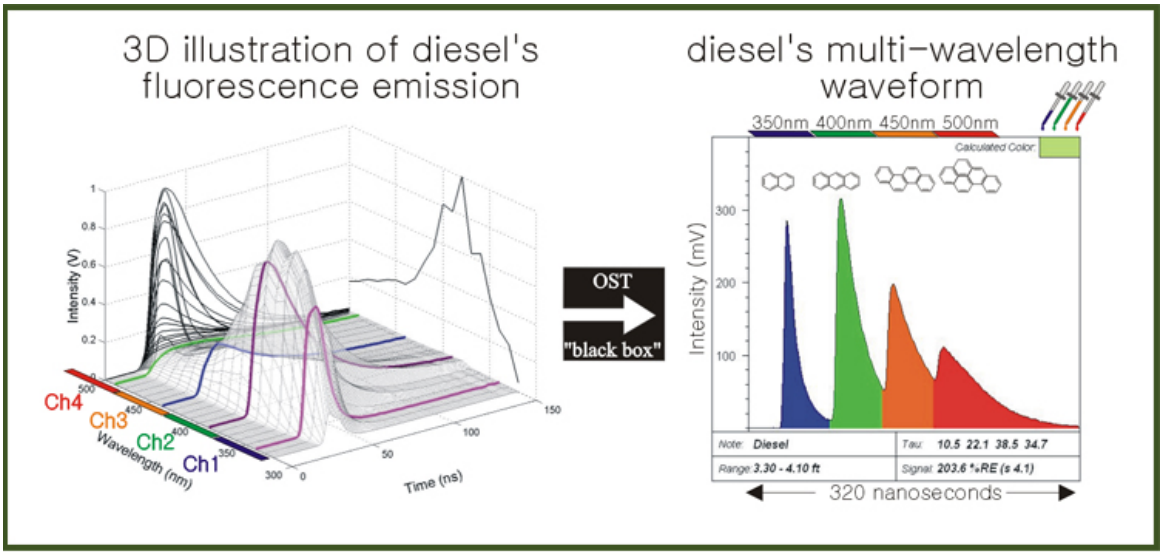


Figure A: The fluorescence emitted by the PAHs in diesel.

Key characteristics of waveforms include:

Intensity (Amount of Fluorescence)

The y-axis represents the intensity or "brightness" of the fluorescence. It is a voltage.

- Intensity generally increases with increasing fuel/oil pore saturation.

- The relative fluorescence intensity is dependent on the composition of the fuel.
  - Some fuels (diesel and crude) fluoresce more intensely than others (gasoline).
  - Low viscosity, high solvent content fuels/oils dominated by smaller 2-3 ring PAHs usually fluoresce better (higher voltages) than large PAHs containing fuels, oils, greases or sludge.

The Four Fluorescence Channels ("Peaks")

The x-axis of Figure A represents 320 nanoseconds of time during which the four wavelength ranges of fluorescence arrive at the detector at sequentially delayed times.

- The four peaks or channels represent 350 nm (blue), 400 nm (green), 450 nm (orange), and 500 nm (red). Each peak is 40 nm wide.

- It is important to note that the blue, green, orange, and red aren't the true colors of those wavelengths – just colors chosen to represent the four peaks.

- The relative intensities between the four channels is used to fill the LIF log with blended color to visualize fluorescence trends "at a glance". [note the fill-color boxes in upper right corner of the example waveforms to follow]

- OST systems are "calibrated" by applying the Reference Emitter (RE) fluid to the window and recording RE's response. The RE is a standard fluorescing NAPL supplied by Dakota to all OST service providers for the last 15 years. The purpose of the RE is to:
  1. Normalize the data for push-to-push fluctuations in optical throughput.
  2. System check to make sure all optics are intact and operating normally.

- All downhole data is normalized to the RE (as percentage) so that data is consistent across all OSTs across the globe, regardless of who is operating them.

- The factory RE is displayed on the oscilloscope along with the latest RE, assisting the operator in assuring that the OST data they generate "matches" all other OSTs.

- The area under the curve of all four channels is summed and divided by the RE waveforms' areas to generate the normalized total fluorescence "Signal" of an LIF log.

- One PAH will usually occupy more than one channel since PAHs fluoresce broadly (naphthalene is a notable exception, fluorescing almost exclusively in the blue channel).

- In general, the shorter wavelength channels (blue/green) are occupied by 2- and 3-ring PAHs, the middle (green/orange) by 3- and 4-ring PAHs, and the rightmost (orange/red) by 4-ring and larger PAHs [Figure A].

- The voltage or height of the waveform generally scales with NAPL saturation for any single NAPL on a single soil type.

Lifetimes (Decaying Fluorescence)

The x-axis of waveforms represents the extremely short time period necessary to capture the pulse of PAH fluorescence. The lifetime is the average time the laser-induced PAH population stays in the excited state prior to fluorescing.

- PAHs fluoresce from a few to hundreds of nanoseconds after excitation.

- In the characteristic diesel example, the blue channel has a shorter lifetime than the green channel (see how the intensity falls back toward baseline more quickly on the right side of the 350 nm peak).

- The lifetimes of some channels “bleed” into subsequent channels (green into orange, for instance) and influence the log’s fill colors.

- Short lifetimes often indicate an energy transfer from smaller excited-state PAHs to surrounding, larger PAHs or the matrix. This leads to quenching (reduction) of fluorescence and red-shifting of the emission toward the right (longer wavelength).

- Long lifetimes often indicate oxygen starvation and/or a solvent-rich fluorescent friendly environment. Natural gas condensates can have unusually long lifetimes.

EXAMPLE WAVEFORMS:

PAHs:

PAH waveforms show the general trend of emission with size/complexity of PAHs (Figure B).

- The upper-left is Naphthalene, fluorescing almost entirely in the blue channel.

- The upper-right is Anthracene, the simple addition of one more benzene ring onto a naphthalene shifted the fluorescence by about 75-100 nm (about 1.5-2 “channels”).

- The lower-left is Pyrene, which is one ring larger but more “compact” so the red-shifting is moderate comparatively.

- The lower-right is Benzo (a) pyrene, emitting almost entirely in the red channel.

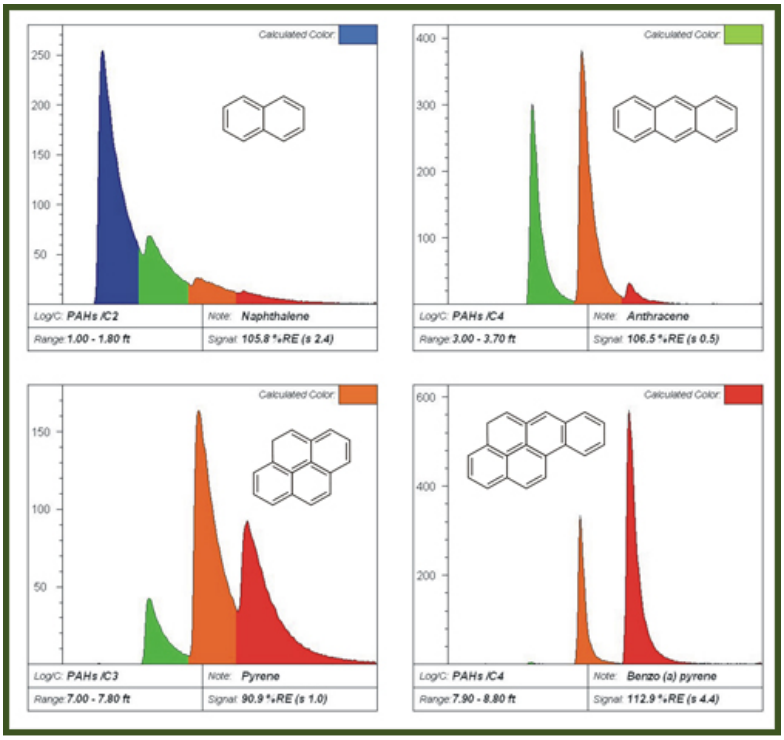


Figure B: The trend of PAH fluorescence "red-shifting" with increasing size and complexity of the PAH.

Fuels/Oils:

Fuels/oils contain complex chemical composition, which results in broad waveforms. The "EPA 16" PAHs only account for approximately 1 percent of the PAHs in crude oil, so there are usually a wide variety of PAHs fluorescing. From "blue to red" some common fuel/oil waveforms, shown in Figure C, include the following:

- Jet/Kerosene [Row 1]:
  - Naphthalene and Jet/Kerosene waveforms are similar because those fuels' PAH content are dominated by the naphthalenes.

- Gasoline [Row 2]:
  - Intact (unweathered) gasoline has the typical shape shown and will fluoresce well enough to be delineated with LIF, even though gasoline contains low concentrations of 2- to 3-ring PAHs relative to the benzene, toluene, ethylebenzene and xylenes (BTEX) and aliphatics.

- Diesel [Row 3]:
  - Diesel has a short lifetime blue (2-ring PAH) peak that is about the same height as the longer lifetime green peak. Evidence of weathering in diesels is rare.

- Oils [Row 4]:
  - Oils such as crude, lubricating, and cutting types fluoresce well and are usually found slightly right of center (red-shifted) and have medium to long lifetimes.

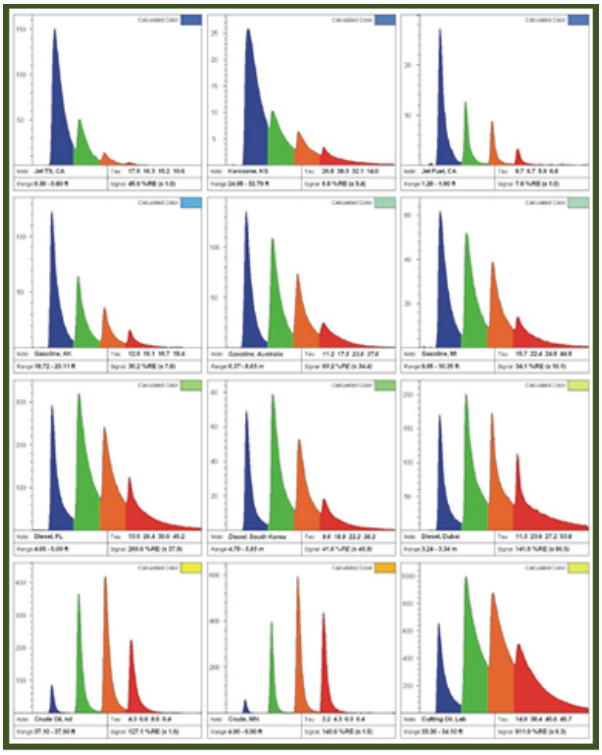


Figure C: Common fuel/oil waveforms.

Weathering:

Weathering typically removes the most soluble, volatile, and readily metabolized PAHs first. Large PAHs remain behind, which causes a red-shift in the fluorescence waveform. Simultaneously there is a loss of solvent aliphatics, which often shortens the lifetime so a weathered light fuel will start to look like oil or even tar. Figure D demonstrates weathering of gasoline in a lab experiment, resulting in red-shifting that can make weathered gasoline display an “oil” waveform. When jet/kerosene weather, they simply “disappear” (become non-fluorescent) because there are too few larger PAHs to fluoresce once the naphthalenes are gone. It is important to appreciate that NAPL (especially gasolines) can vary in their appearance even prior to spilling. The degree of red-shifting is relative to the starting product and site conditions. For instance, one site’s intact (unweathered) gasoline waveform might very well be identical to different site’s moderately weathered gasoline.

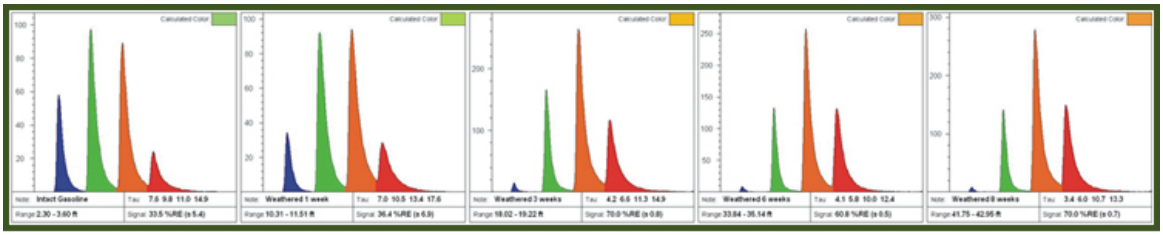


Figure D: Weathering causes red-shifting of gasoline’s fluorescence.

False Positives and Oddities:

Areas with little to no contamination may fluoresce, which generates “false positives.” Figure E contains a variety of noise, false-positives, or highly unusual waveforms. Be prepared to obtain samples in order to figure out what materials are causing any odd fluorescence waveforms.

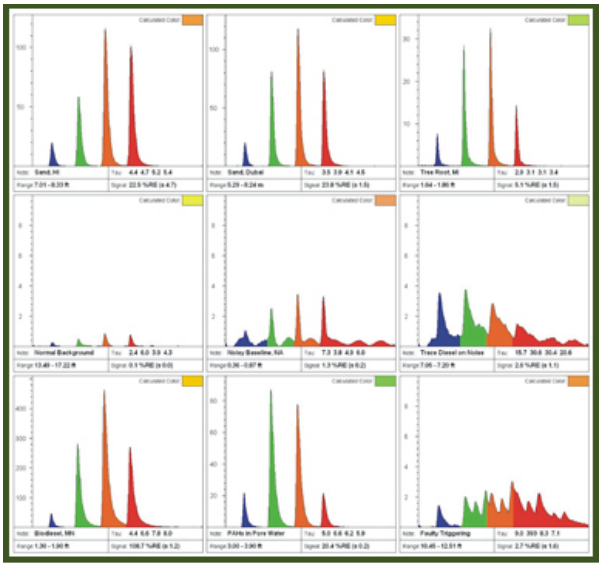


Figure E: Examples of noise, false positives and unusual waveforms.

APPENDIX G

MIP® LOGS

Final Data Package for Membrane Interface Probe Services

Site Location: 2040 Walnut Avenue, Signal Hill, CA

Project Number: 304163412

Report Date: January 9, 2017

Prepared for:
Fugro Consultants, Inc.
V. Baker, Fugro Consultants, Inc.
469 Roland Way
Oakland, California 94621
Tel. / 713.346.4000
E-Mail / vbaker@fugro.com

Prepared by:
Cascade Technical Services
Daniel Caputo
13050 W 43rd Drive, Suite 100
Golden, Colorado 80403
Tel. / 303.423.2547
E-Mail /DCaputo@cascade-env.com

Table of Contents

Project Narrative

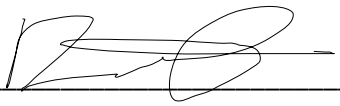
Cascade Technical Services (Cascade) is pleased to present this data report to Fugro Consultants, Inc. for the membrane interface probe cone penetrometer test (MIPCPT) services that were provided on the date of December 19th, 2016 at your site located at 2040 Walnut Avenue in Signal Hill, California

The results associated with the data and plots presented in this report were generated in accordance to Cascade's and Geoprobe's Standard Operating Procedures (SOPs) for MIP services.

All field work and data management were completed by trained, scientific professionals and all quality assurance/quality control (QA/QC) measurements associated with these data were found to be within the tolerances set forth in the SOPs for these services. Response tests conducted previous to, and subsequent to the MIP borings were found to be within the tolerances set forth for this MIP survey and therefore the data are deemed acceptable for use. Exception/deviations regarding these response tests and the related data are noted on the MIP Summary Table that is part of this report.

This report contains two sets of plots for each of the MIP locations; one set is scaled to show the lower level responses and the second set is scaled to show the higher level detector responses.

I certify that the data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the laboratory manager or his designee, as verified by the following signature.

Signature: 

Daniel Caputo, Western Regional Manager of Site Characterization Services

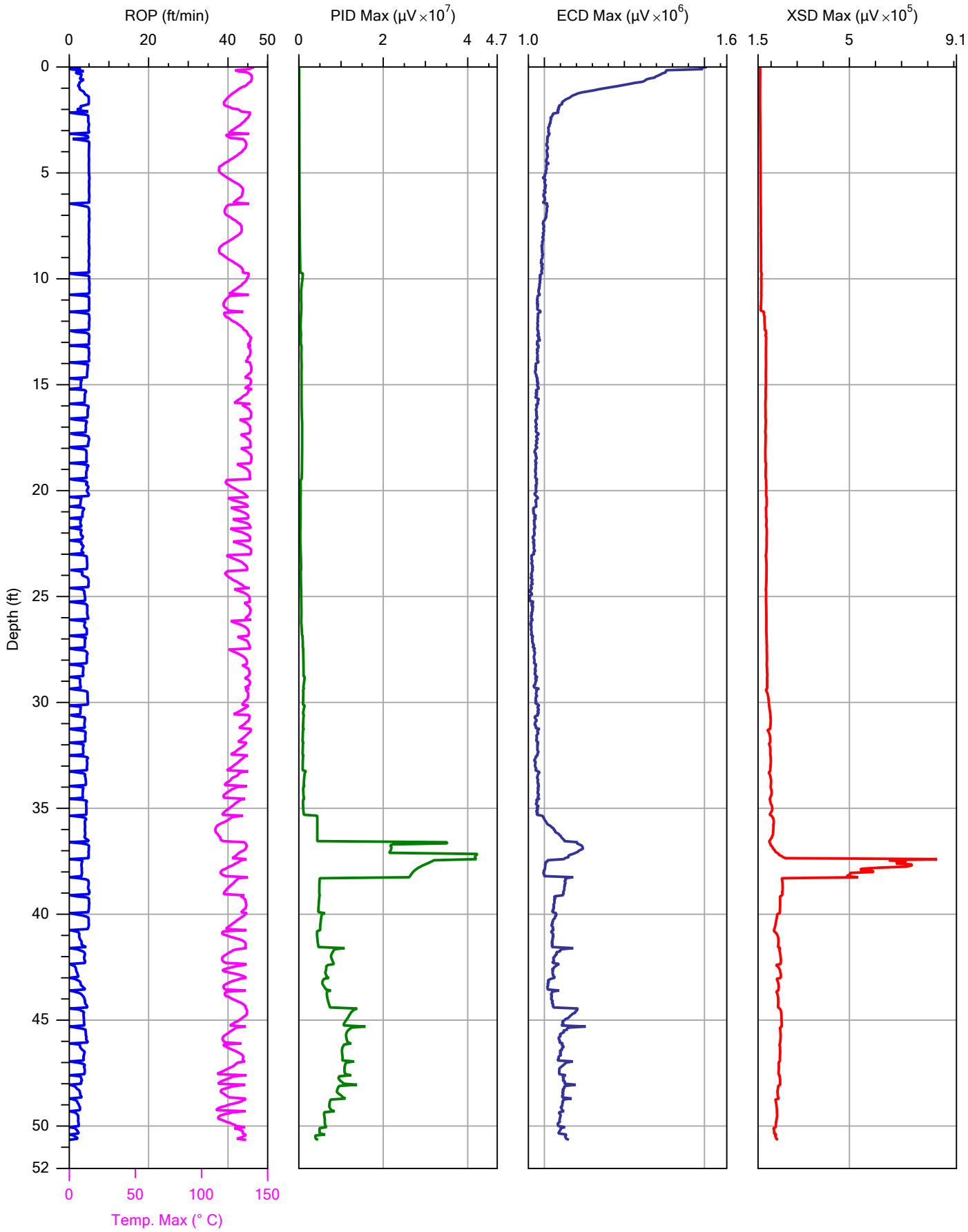
Membrane Interface Probe Data Summary Table

Provided below is a summary of MIP information, including response test acceptability and any deviations from the standard operating procedure that occurred during the field activities.

MIP Location	Total Depth (ft)	Response Test Results, ECD - (mV)			Response Test Results, PID - (mV)			Response Test Results, XSD - (mV)			Comments/Deviations
		Pre	Post	Acceptable*	Pre	Post	Acceptable*	Pre	Post	Acceptable*	
AN-19	50.60	7861	1008	YES	1030	3922	YES	884	20	YES	None.
AS-10	44.00	1008	4389	YES	3922	633	YES	20	274	YES	Noisy PID baseline due to line saturation. Used ECD and XSD to determine system health. Proceeded with client go-ahead.
AN-21	44.00	4389	-	YES	633	-	YES	274	-	YES	Noisy PID baseline due to line saturation. Used ECD and XSD to determine system health. Proceeded with client go-ahead. No post boring RT completed due to CPT / MIP system breakdown requirements.

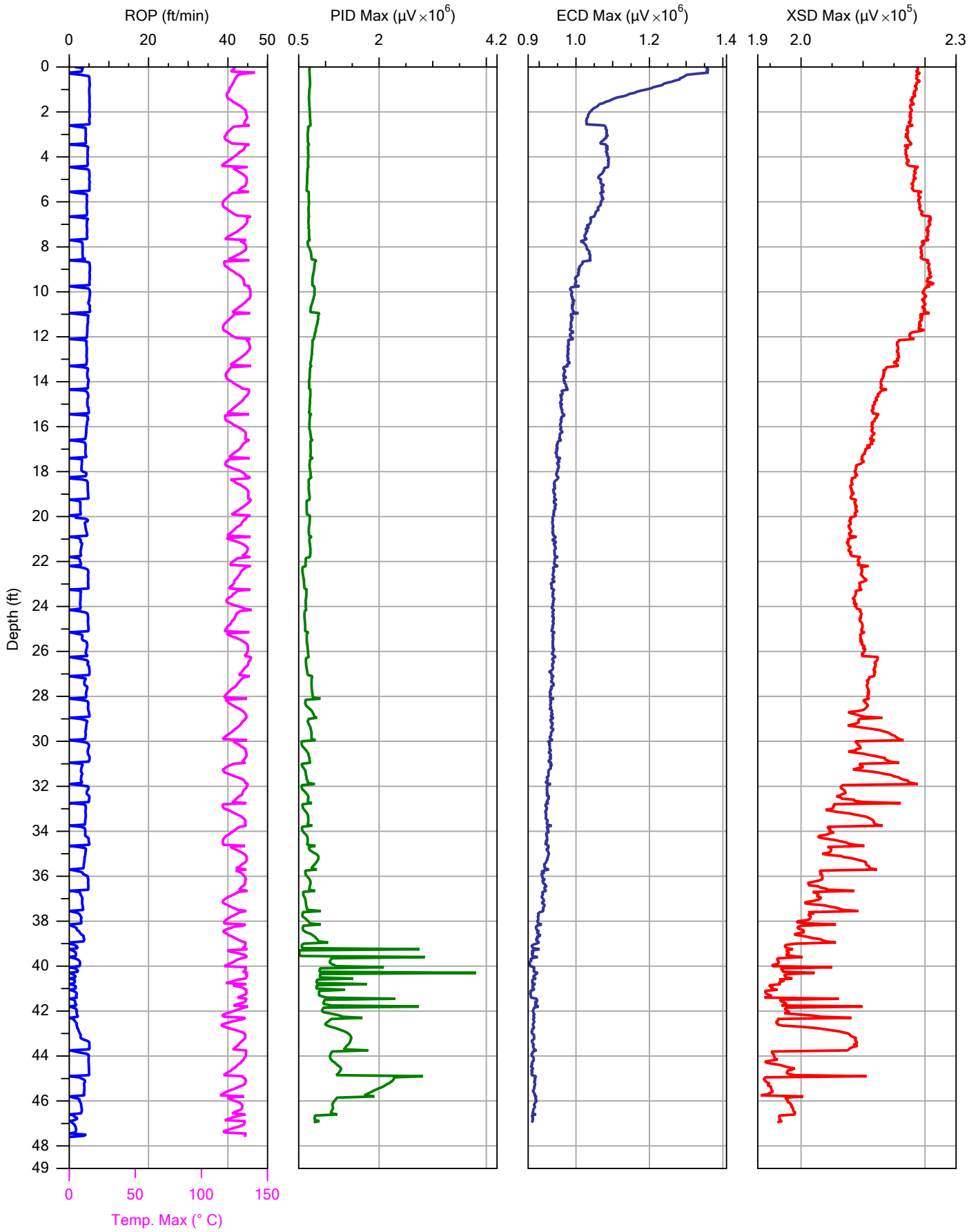
*Acceptable values for ECD, PID, and XSD detectors are 50mV, 2mV, and 2mV, respectively.

Membrane Interface Probe Data Plots – Low Range Scales



CASCADE
DRILLING | TECHNICAL SERVICES

		File: AN-19.MHP
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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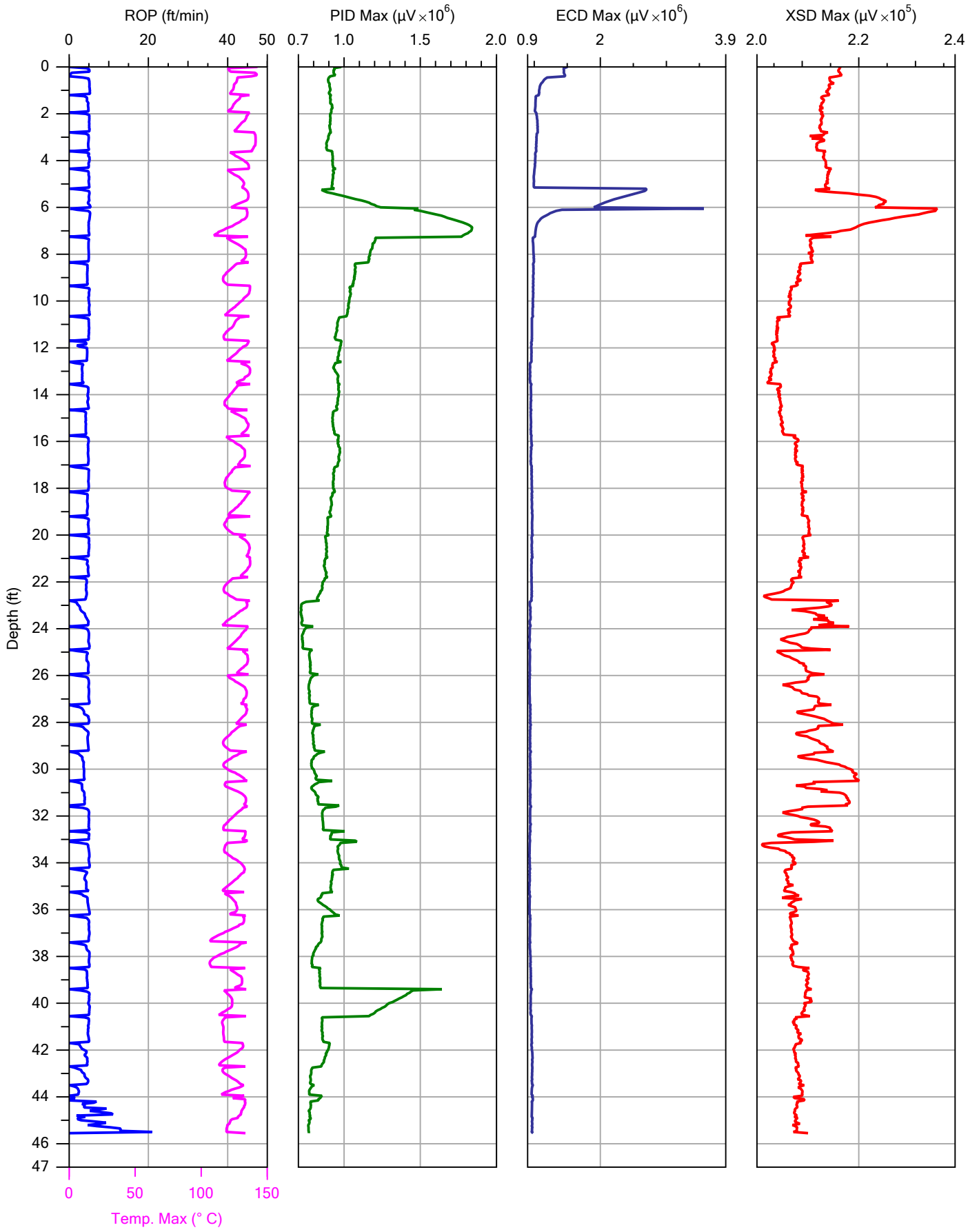
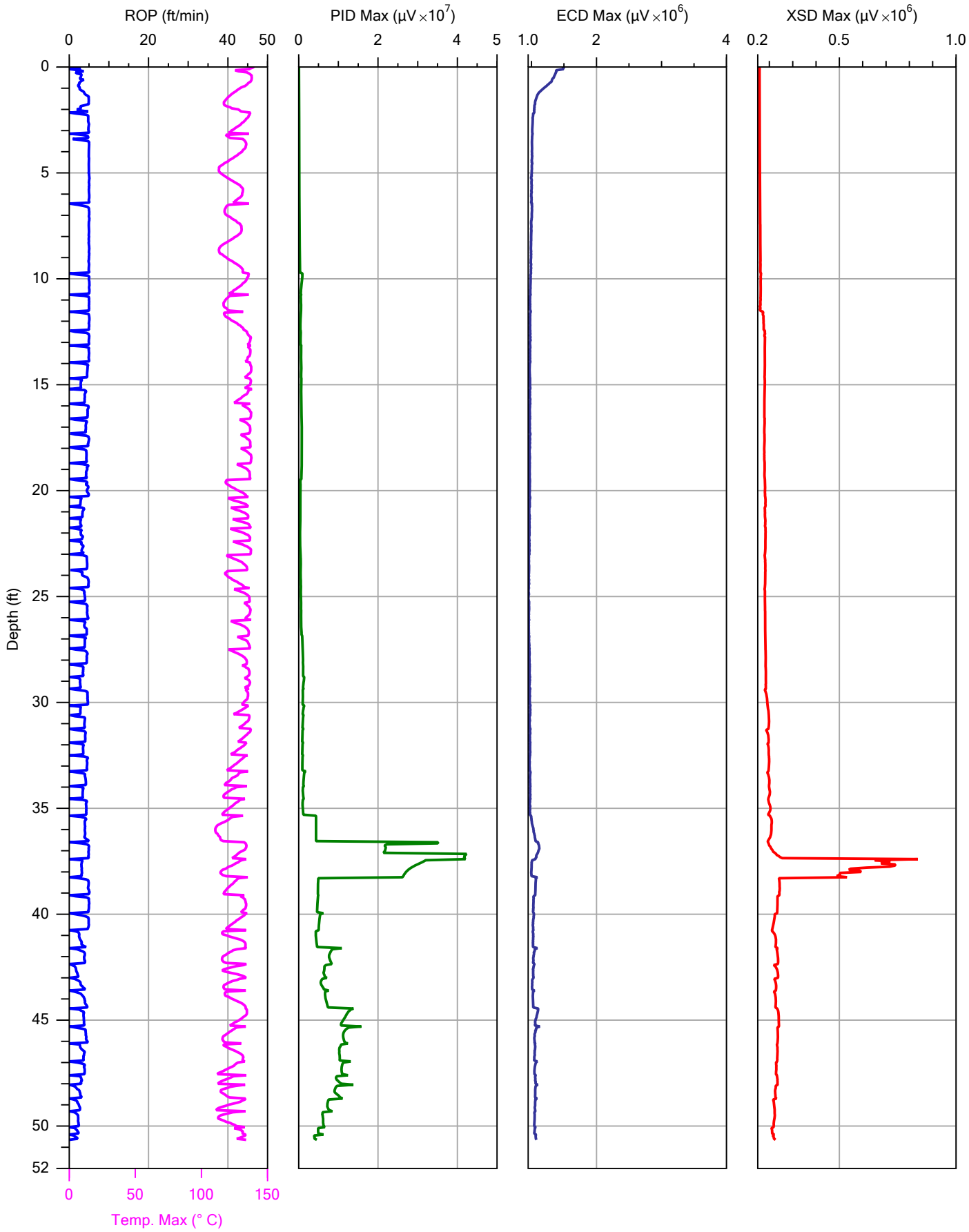
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

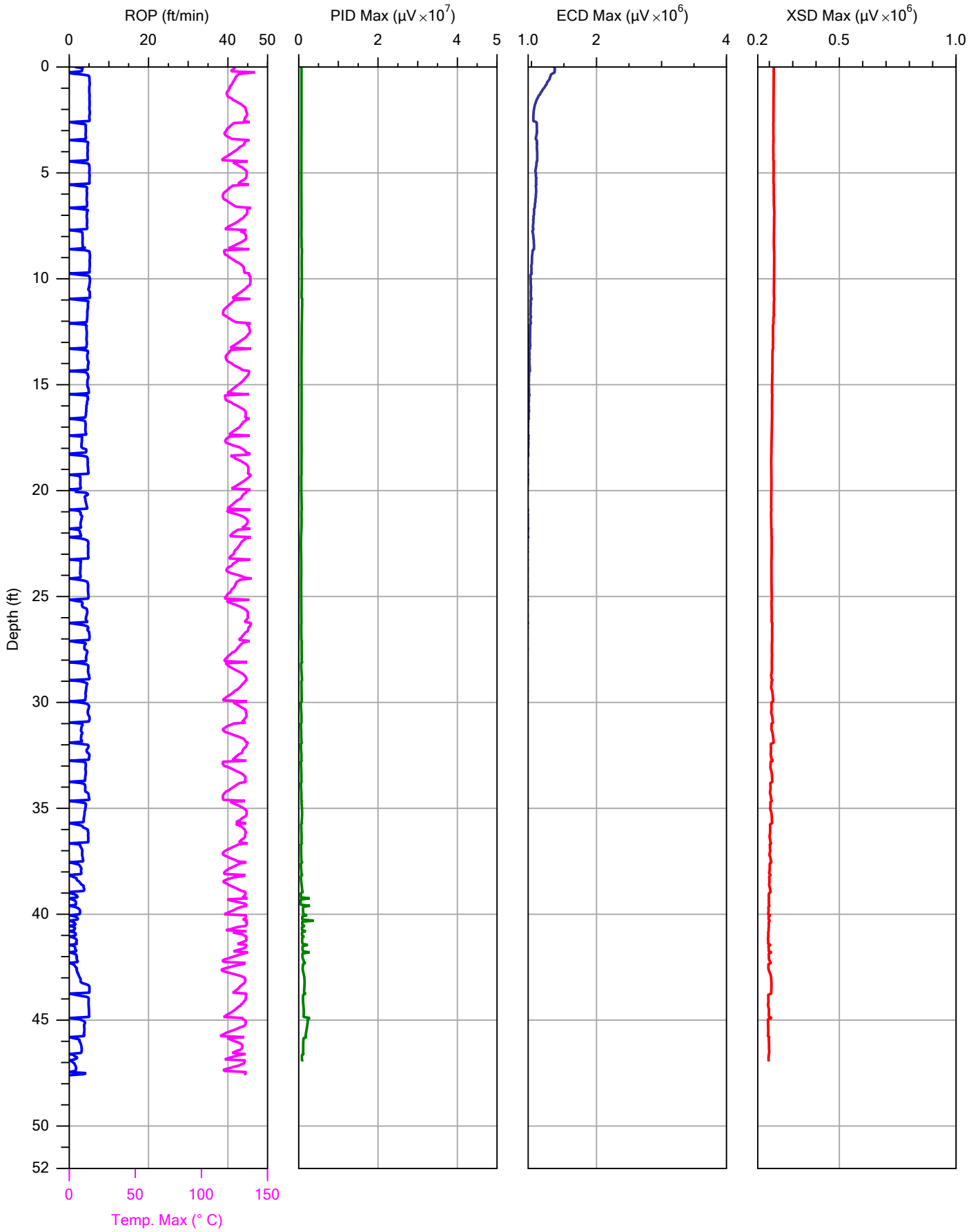
		File: AS-10.MHP
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:

Membrane Interface Probe Data Plots – High Range Scales



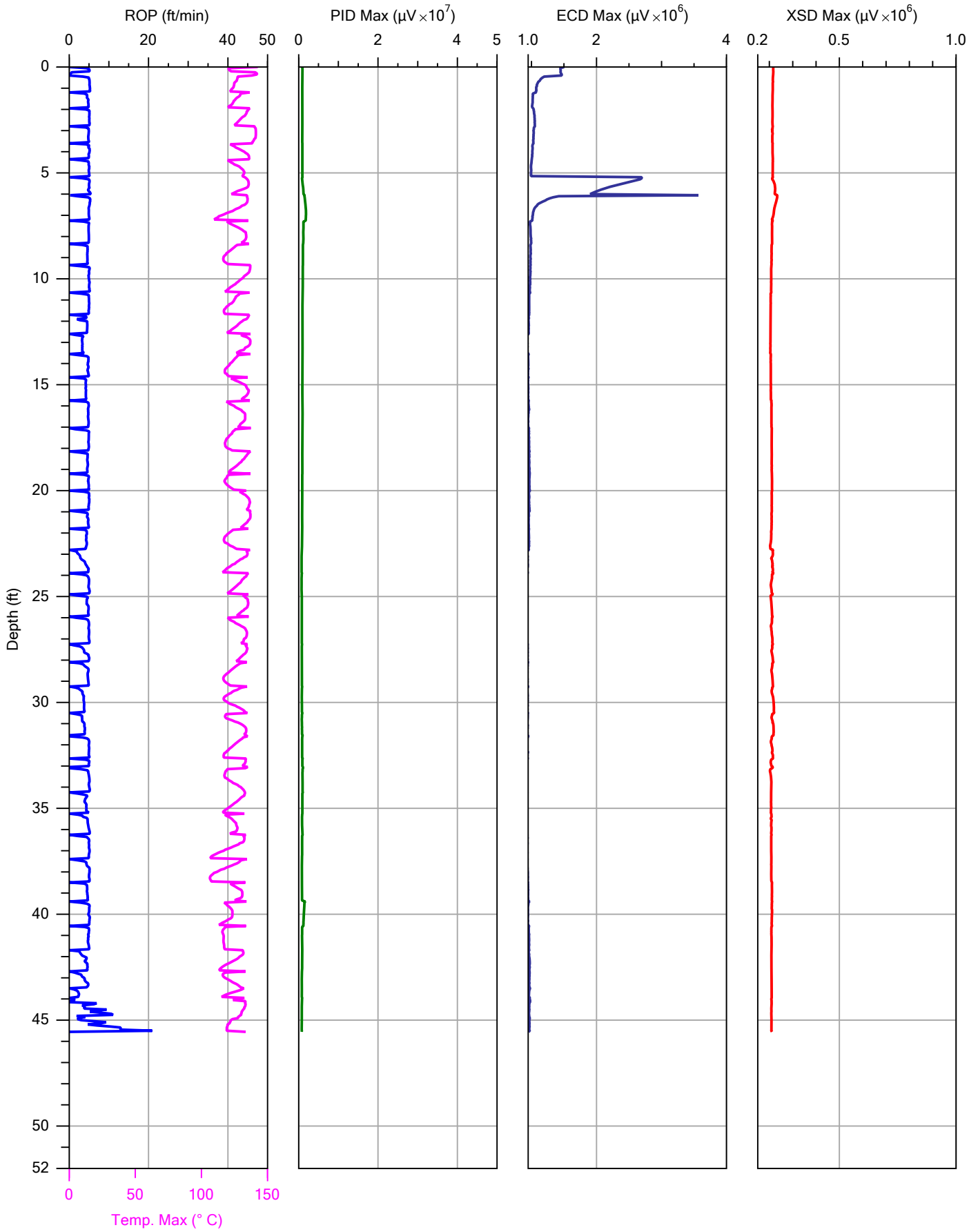
CASCADE
DRILLING | TECHNICAL SERVICES

		File: AN-19.MHP
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

		File: AN-21.MHP
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

		File: AS-10.MHP
Company: CTS	Operator: DEC	Date: 12/19/2016
Project ID:	Client: Fugro	Location:

Reference Material

The sections below provide information regarding the Cascade Personnel present at the site during the field activities, the specific equipment used during field activities, and background information on the MIP system.

Cascade Personnel

The following personnel were present during field activities at the Site:

- Mr. Daniel Caputo, Cascade Technical Services (HRSC Regional Manager)

Equipment

The following equipment was utilized during field activities at the Site:

- Fugro CPT Rig
- MIP Controller (Nitrogen Flow and Heater)
- Geoprobe FI 6000 Computer
- HP 5890 Gas Chromatograph
- ECD (Electron Capture Detector)
- XSD (Halogen Specific Detector)
- PID (Photo Ionization Detector) 10.2 eV Lamp
- 150' MIP Trunkline
- 1.75" O.D. MIP Probe
- 1.75" O.D. Drive Rods
- Ultra-High Purity Nitrogen
- Ultra-High Purity Hydrogen

MIP System Overview

The MIP is commonly used for quickly determining the locations of volatile organic compound (VOC) source zones and plumes. The MIP is most valuable in terms of its ability to provide “spatial correspondence”, meaning that where the MIP detector response show peaks, there is likely to be elevated soil and groundwater concentrations. The MIP can also be used to provide extremely valuable data to streamline subsequent investigative tasks and improve the overall efficiency and accuracy of the site investigation. Vertical profiles, cross sectional views and 3D images of contaminant distribution can all be produced from the electronic data generated by the MIP logs. The unique capability of providing reliable, real-time information allows for informed and timely decision making in the field. The MIP works by heating the soils and groundwater adjacent to the probe to 120 degrees C. This volatilizes the VOCs and allows the VOCs to transfer through a Teflon membrane via a combination of concentration and pressure gradients. These VOCs are then swept into a nitrogen gas loop that carries these vapors to a series of detectors housed at the surface. Continuous chemical profiles are generated from each hole. Electrical conductivity of the soil is also measured and these logs can be compared to the chemical logs to better understand the relationship between the lithology and the contaminant distribution. The MIP technology is only appropriate for VOCs. The following section discusses the various detection systems that are commonly used with the MIP system.

Detector Overview

- ECD – Electron Capture Detector uses a radioactive Beta emitter (electrons) to ionize some of the carrier gas and produce a current between a biased pair of electrodes. When organic molecules contain electronegative functional groups, such as halogens, phosphorous, and

nitro groups pass by the detector, they capture some of the electrons and reduce the current measured between the electrodes.

- XSD – The Halogen Specific Detector converts compounds containing halogens to their oxidation products and free halogen atoms by oxidative pyrolysis. These halogen atoms are adsorbed onto the activated platinum surface of the detector probe assembly resulting in an increase thermionic emission. This emission current provides a corresponding voltage that is measured via an electrometer circuit in the detector controller.
- PID – Photo Ionization Detector sample stream flows through the detector's reaction chamber where it is continuously irradiated with high energy ultraviolet light. When compounds are present that have a lower ionization potential than that of the irradiation energy (10.2 electron volts with standard lamp) they are ionized. The ions formed are collected in an electrical field, producing an ion current that is proportional to compound concentration. The ion current is amplified and output by the gas chromatograph's electrometer.

MIP Data Collection

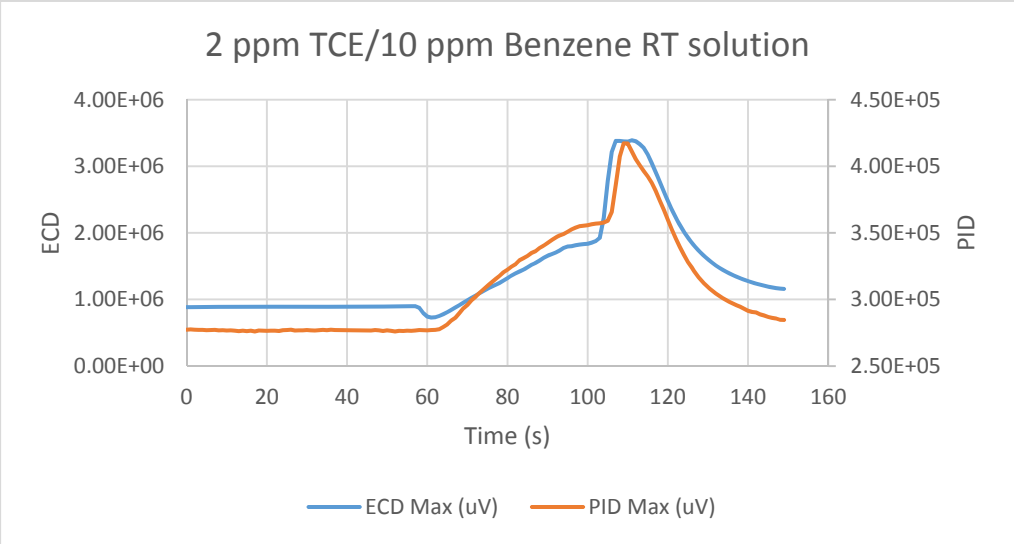
- Depth - Data is collected every 0.05 feet, or twenty points per foot.
- Rate of Penetration - Rate of penetration (ROP) is measured/collected in feet per minute (ft/min). Speed is an indication of the advancement rate of the MIP probe. In order to allow for adequate heating of the MIP tooling, the MIP's ROP should not exceed one foot per minute.
- Temperature - Temperature data is measured/collected in Degrees Celsius. Temperature is an indication of the physical temperature of the MIP block. Minimum and Maximum temperature is collected at each vertical interval. Cascade's temperature protocol indicates that the MIP probe temperature shall maintain a minimum temperature of 90 Degrees Celsius.
- Pressure - Pressure data is measured/collected in PSI. The pressure readings represent the pressure being delivered to the MIP's nitrogen gas line. Deviations greater than of 1.5 PSI outside of the starting pressure indicate a system leak or obstruction is present.
- Detector (XSD, ECD, PID) - Detector responses are measured/collected in micro Volts (uV). Detector responses are an indication of relative contaminant responses. Minimum and Maximum detector responses are collected at each vertical interval.

Response Testing

Response testing (RT) is an integral part of ensuring the quality of data from the MIP system. Response testing is conducted before and after each log. This ensures the validity of the data and the integrity of the system. The RT provides a traceable indication that the MIP system detectors are adequately responding and allows the carrier gas trip time to be calculated on the physical components of the system.

Cascade uses acceptance criteria to evaluate the RTs. The acceptable criteria for an RT is defined for specified concentrations of RT solution and a specified N2 trunkline flow rate. Documenting the RTs will provide a level of quality assurance for each MIP project and will also allow operators and data reviewers to identify systems in need of maintenance.

The trip time is measured by recording the time between the moment when the VOA is placed over the membrane and the response of the detectors, as viewed on the MIP data acquisition unit. The baseline and peak response value are also recorded for comparison with other MIP response tests. The trip time is entered manually into the data acquisition system account for the time it takes for compounds in the subsurface to travel the length of the trunkline during the MIP boring.


2 ppm TCE/10 ppm Benzene RT solution
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
ECD
4.50E+05
4.00E+05
3.50E+05
3.00E+05
2.50E+05
PID
0
20
40
60
80
100
120
140
160
Time (s)
ECD Max (uV)
PID Max (uV)

APPENDIX H

LOS ANGELES COUNTY FIRE DEPARTMENT FILE REVIEW MATERIALS

PHL# 5 7 9 1 7 4 **INDUSTRY SURVEY** Los Angeles County Fire Department • Prevention Bureau — Health Hazardous Materials Division — LACoFD HHMD • IS1 v3.2 • 4/93

Code 1 0 1 | SIC# 2 9 1 1 | EPA# CAD 0 0 8 2 4 9 4 3 5 | ☐ Pending ☐ NA

DBA Chem Oil Refining Corp | Phone 3 1 0 - 4 2 4 - 8 5 1 5

Owner Chem Oil Refining Corp | Interviewed Randy TURKIC

Partner ~~PRES~~; Bob Richardson TONY GARCIA | Title Maint. Supvt

Address 2020 (number) (dir) Walnut (street name) Av (type) | Product/Service Oil Refinery

unit # | City SGH | Zip 9 0 8 0 6

Mailing SAA | Start Date 01-01-20 | # of employees 7

# of shifts 3 | Operating hours 24 HRS

Viol Rank 3	CA Waste Code	1 G11	2 352	3 101	4
☐ HWUT	Amt (PGT) Pounds, Gallons, Tons; per quarter	4500 P	1400 P	1400 P	
☐ HRF	Mtl/Qty				

Referrals ☐ AQMD ☐ B&S ☐ Fire ☐ IW ☐ OSHA ☐ SDHS ☐ _____

Viol 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 99

Visit Date	Start Time	Insp	Action	Time Invested	Special Circumstances
06/09/94	10:30	071	I, O	04:00	
/ /	:			:	
/ /	:			:	
/ /	:			:	

Signature(s) HARRELL, NANADIEGO & STURZENACKER

Action codes: A-Abate C-Complaint E-Enforce H-Hearing I-Insp M-site Mit N-NOV O-no viol P-PHL Inv R-Revisit S-Samples T-Time ext X-other Z-non-gen

Chem oil took over 6 yrs ago but this bus. been around 1920

Spill last week — gas Oil — 3000 barrels
42 gal/barrel

Production is not in operation but eventually will start again in August

PRES: TONY GARCIA

Production shut down in February '94

Light Atmosphere Gas, Fuel Oil, Naptha

Date 06-09-94 Time

PHL# 579174

Los Angeles County
Hazardous Materials Control Program
Industry Survey Continuation Sheet

Insp. 071 Page 2 of 6

DBA Chem. Oil Refining Corp | Interviewed Randy TUREK

PROCESS FLOW CHART

process & materials → hazardous waste & rate generated → storage method (drum/AST/UST) → hauler manifest number & date → disposal method / environmental fate

Crude oil by Pipeline

↓

Light Topping Plant

Distillate 3 column

removes Na

Desalter

↓ input H20

Heated

↓

Oil is clean

↓ heater

↓

distillate Column

piped out ← ↓ made into products

Shipped

Violations / Remarks

Date 06-09-94 Time

PHL# 579174

Los Angeles County
Hazardous Materials Control Program
Industry Survey Continuation Sheet

Insp. 071 Page 3 of 6

DBA Chem Oil Refining Corp | Interviewed Randy Turck

PROCESS FLOWCHART

process & materials → hazardous waste & rate generated → storage method (drum/AST/UST) → hauler manifest number & date → disposal method / environmental fate

Sump — Drains

↓

Holding Tank

↓

Oil/H20 Separator

↓

Holding Tank (work) — Waste H20 → Sewer
(Test the H20) — TXT System

H2SO4 — injected to the cooling tower to adjust pH

Violations / Remarks Zn & Molybdate — waste H20 Treatment

Date 6-9-74 Time

PHL# 5 7 4 1 7 4

Los Angeles County
Hazardous Materials Control Program
Industry Survey Continuation Sheet

Insp. 0 7 1 Page 4 of 10

DBA Chem Oil Refining Corp | Interviewed Randy TUREK

PROCESS FLOW CHART

process & materials → hazardous waste & rate generated → storage method (drum/AST/UST) → hauler manifest number & date → disposal method / environmental fate

Waste Sump → Pumped it out → Chem Waste Mgmt.

55 gl — Toluene, Acetone, Alcohol, Pella Oil — used by the lab for cleaning

55 gl drum — labelled but blank lines

Violations / Remarks

Date 6-9-94 Time

PHL# 579174

Los Angeles County
Hazardous Materials Control Program
Industry Survey Continuation Sheet

Insp. 071 Page 5 of 6

DBA Chem Oil Refining Corp | Interviewed Randy Jared

P R O C E S S F L O W C H A R T

process & materials → hazardous waste & rate generated → storage method (drum/AST/UST) → hauler manifest number & date → disposal method / environmental fate

Waste Solids → Soil (containing oil & plastic) #611 D008 Contaminated Soil from Clean-up → 18 CY 1-21-94 → #92892548 → Gibson Env. Bakersfield

#92892549 18 CY 1-21-94

#92892547 18 CY 1-21-94

Non RCRA Haz. Waste Oil Debri → (8) drums 1400 lbs #352 #611 → #92892541 1400 lbs → Chem Waste Mgmt Kettleman 02-02-94

#92747086 20 yards 9-14-93

#92747062 20 yds

Violations / Remarks

Date 6-4-96 Time

PHL# 579174

Los Angeles County
Hazardous Materials Control Program
Industry Survey Continuation Sheet

Insp. 071 Page 6 of 6

DBA Chem Oil Refining Corp | Interviewed Randy TUREK

PROCESS FLOW CHART

process & materials	→	hazardous waste & rate generated	→	storage method (drum/AST/UST)	→	hauler manifest number & date	→	disposal method / environmental fate

Non RCRA Haz. waste → 10 cy → #241 → #92747165 11-15-93 → Chem Waste Mgmt

Tank Bottom waste, Solid Sorb Plastic → #92747167 10 cy 11-17-93

#92747168 10 cy 11-17-93

Violations / Remarks

HAZARDOUS [illegible]ATERIALS DISCLOSURE – [illegible]RACKING SHEET

SIGNAL HILL *PIPELINE* *WELL SITE* FH ACCOUNT # _____

FP ACCOUNT # _____

BUSINESS NAME: CHEMOIL REFINING CORP.

BUSINESS ADDRESS: 2020 WALNUT AVE SH ZIP: 90806

MAILING ADDRESS IF DIFFERENT: _____ ZIP: _____

CITY: SIGNAL HILL STATE: CA TELEPHONE: (310) 424-8515

#3 _____ J. B Porter

RANGE RANGE CHANGE REVIEWED BY

MB0408

INVENTORY

INVENTORY RECEIVED: 12-13-95

INVENTORY UPDATED: 1-2-97

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

INVENTORY UPDATED: _____

EMERGENCY BUSINESS PLAN

BUSINESS PLAN RECEIVED: 12-13-95

BUSINESS PLAN UPDATED: 12-13-95

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

BUSINESS PLAN UPDATED: _____

COMMENTS: _____

UNDERGROUND TANKS

NUMBER OF TANKS: 2 UST TANKS REMOVED: TANKS MONITORED: No

HAZARDOUS MATERIALS DISCLOSURE - TRACKING SHEET

FH ACCOUNT # SH 2020

FP ACCOUNT # SP 2020

BUSINESS NAME: CHEMOIL REFINING CORPORATION

BUSINESS ADDRESS: 2020 WALNUT Ave ZIP 90806

MAILING ADDRESS IF DIFFERENT: _____ ZIP _____

CITY: SIGNAL HILL TELEPHONE: (213) 424-8515

#3	#473.00	W. A. Hays
RANGE	FEE	REVIEWED BY

INVENTORY

INVENTORY RECEIVED: 3-2-90

INVENTORY UPDATED: 7-3-91

INVENTORY UPDATED: 4-14-93

INVENTORY UPDATED: 12-21-93

INVENTORY UPDATED: 1-6-95

INVENTORY UPDATED: _____

EMERGENCY BUSINESS PLAN

BUSINESS PLAN RECEIVED: 7-3-91

BUSINESS PLAN UPDATED: 4-14-93

BUSINESS PLAN UPDATED: 12-21-93

BUSINESS PLAN UPDATED: 1-6-95

RANGE CHANGE	BY	DATE

COMMENTS: _____

UNDERGROUND TANKS

NUMBER OF TANKS: _____ TANKS REMOVED: _____ TANKS MONITORED: _____

BILLING CRT: 3/6/90 BY: _____

CHEMOIL REFINING CORPORATION
2020 Walnut Avenue
Signal Hill, California 90806
(213) 424-8515
February 28, 1990

Long Beach Fire Department
Fire Prevention Inspection Bureau
Hazardous Materials Section
400 West Broadway, Room 264
Long Beach, Ca 90802

Attn: Captain Richard McIntyr

RE: Hazardous Material Business Plan and Inventory

Dear Captain McIntyr,

Please find enclosed herein the following:

1) One (1) Hazardous Materials Business Plan Certificate of Review
2) Two (2) pages Hazardous Materials Inventory forms
3) One (1) Acutely Hazardous Materials Registration Form
4) A copy of Chemoil's previous correspondence and arrangement with your office.
5) One Site map

According to the EPA regional office in San Francisco, the above filing will satisfy both the state administrative agent (fire department) reporting requirement, and federal SARA III Tier II requirement.

Chemoil has been leasing four (4) 25000, two (2) 10000, and two (2) 15000 barrel petroleum storage tanks from Signal Hill Terminal Corporation at 1724 East Spring Street since early 1989.
A Hazardous Materials Inventory is also included for reporting requirements.

Please contact me if you have any questions.

Sincerely,

Bill W. Leung
Refinery Engineer

Enclosure: (7)

cc: Ted Chrestensen

LONG BEACH FIRE DEPARTMENT

HAZARDOUS MATERIALS DISCLOSURE PROGRAM

BUSINESS EMERGENCY PLAN

This form shall be typed or printed in ink. Return the completed form to:

Long Beach Fire Department
Bureau of Fire Prevention
211 E. Ocean Blvd., Suite 500
Long Beach, Calif. 90802
Telephone (310) 590-2560
Fax (310) 590-2566

Please read attached requirements, definitions and instructions (pages A, B, C, & D) prior to completing the Business Plan.

SECTION I: BUSINESS IDENTIFICATION DATA

BUSINESS NAME			
Chemoil Refining Corporation			
ADDRESS	**CITY**	**ZIP CODE**	**TELEPHONE NUMBER**
2020 Walnut Avenue,	Signal Hill,	90806	(310)424-8515
FACILITY UNIT			
Refinery			
BUSINESS MAILING ADDRESS	**CITY**		**ZIP CODE**
Same as above.			
BUSINESS OWNER			
Chemoil Refining Corporation			
MAILING ADDRESS	**CITY**	**ZIP CODE**	**TELEPHONE NUMBER**
Same as above.			(310)424-8515
PRINCIPLE BUSINESS ACTIVITY			
Petroleum refining			

I certify under penalty of law that I have personally examined and am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

PRINT NAME OF OWNER/OPERATOR	SIGNATURE	DATE
Chemoil Refining Corporation	K Ezoe	12/13/95
DOCUMENTS PREPARED BY	**SIGNATURE**	**DATE**
Ken Ezoe	K Ezoe	12/13/95

SECTION II: OCCUPANCY DATA

A. If your business has a license or permit from any of the following agencies, please indicate the number.

1. Hazardous Materials Underground Storage	NUMBER	3. BUSINESS LICENSE	NUMBER
2. Long Beach Health Dept. Hazardous Waste Control License	NUMBER	4. Business License City of Signal Hill	NUMBER 445
		5. Fire Department Permits	NUMBER SP00002020

B. Does your business have a storage tank(s)? ☒ Yes ☐ No If yes: 1. Is the tank(s) above ground? ☒ Yes ☐ No 2. Is the tank(s) below ground? ☐ Yes ☒ No 3. Is the tank(s) in service at this time? ☒ Yes ☐ No

C. Does your business handle any quantity of radioactive material? ☐ Yes ☒ No

D. Does your business handle a hazardous material or a mixture containing a hazardous material which has a quantity at any one time during the reporting year equal to, or greater than, a total weight of 500 pounds, or a total volume of 55 gallons or 200 cubic feet at standard temperature and pressure for compressed gas, or any quantity of acutely hazardous materials? ☒ Yes ☐ No

If you answered "No" to both question C *and* question D above, complete Sections I and II, and return page 1 only.

If you answered "Yes" to either question C or question D above, you are required to complete Sections III, IV, and Inventory. You are also required to complete the site map. Refer to Site Map Instructions.

SECTION III: EMERGENCY RESPONSE PLANS AND PROCEDURES

A. Your business is required by State Law to provide an immediate verbal report of any release or threatened release of a hazardous material to local fire emergency response personnel, this Administering Agency and the Office of Emergency Services. If you have a release or threatened release of hazardous materials, immediately call:

Fire/Paramedics/Police
Phone: 911

INDIVIDUAL RESPONSIBLE FOR CALLING 911

Any employee discovering the emergency or any so directed by management.

After the local emergency response personnel are notified, you shall then notify this Administering Agency and the Office of Emergency Services.

Local Administering Agency: (310) 590-2560
State Office of Emergency Services: (800) 852-7550 or (916) 427-4341

INDIVIDUAL RESPONSIBLE FOR CALLING THIS ADMINISTERING AGENCY AND THE STATE OFFICE OF EMERGENCY SERVICES.

Any employee discovering the emergency or any so directed by management.

B. List the local emergency medical facility that will be used by your business in the event of an accident or injury caused by a release or threatened release of hazardous materials.

HOSPITAL/CLINIC

Memorial Occupational Medical Services

ADDRESS	CITY	ZIP CODE	PHONE NUMBER
445 E. Columbia St.,	Long Beach,	90806	(310) 933-7690

C. Does your business have a private on-site emergency response team? ☐ Yes ☒ No

If yes, describe what policies and procedures your business will follow to notify your on-site emergency response team in the event of a release or threatened release of hazardous materials.

Any employee discovering the emergency calls out the spill response management team. All employees, including management, will follow Oil Spill Response Plan (OSPR) procedures.

State Law requires your business to complete all sections of this Emergency Response Procedure listed below. "N/A" is not acceptable.

D. Briefly describe your business' standard operating procedures in the event of a release of threatened release of hazardous materials:

1. **Prevention** (prevent the hazard) — Describe the kinds of hazards associated with the hazardous materials present at your facility. What actions would your business take to **prevent** these hazards from occurring? You may include a discussion of safety and storage procedures.

Oil spill causing fire or explosion.
Prevention measures: Regular inspections and quick correction of problems. Compliance with engineering and safety codes.

2. **Mitigation** (reduce the hazard) — Describe what is done to **lessen** the harm or the damage to person(s), property, or the environment, and prevent what has occurred from getting worse or spreading. What is your immediate response to a leak, spill, fire, explosion, or airborne release at your business?

Retention dykes surround oil and chemical storage tanks completely. Quick drainage system helps prevent spill escape. Foam system facilitates fire fighting. Personnel training is important. However, the process equipment of the refinery has been down since 2/14/94, we had no operator to train until December. Chemoil hired one temporary operator for bulk transfer operation, and Process Superintendent is now training him.

3. **Abatement** (remove the hazard) — Describe what you would do to **stop** and **remove** the hazard. How do you handle the complete process of stopping a release, cleaning up, and disposing of released materials at your facility?

The trained personnel will stop leaks by closing valves and shutting down pumps if safe to do so. Oil spill response organization such as Mesa Environmental on contract will remove the release material and clean the site in accordance with the lead agency's requirements.

4. Describe what policies and procedures your business will follow to immediately notify and evacuate your facility in the event of a release or threatened release of hazardous materials.

When the emergency alarm is sounded, trained personnel attend to duties to contain the released material until contractor with equipment arrives. Personnel non-essential to the clean-up operation will evacuate and report to the office area.

5. Your business is required by State Law to keep a copy of this Business Plan, including the Inventory and Site Map. Describe where this copy is located at your business.

Business Plan is in the multipurpose room where many other plans and records stay.

Please see EXAMPLE on page C of the folder for instructions prior to completion of this form.
This form shall be **TYPED** or **LEGIBLY PRINTED IN INK.** Return the completed original.

LONG BEACH FIRE DEPARTMENT

HAZARDOUS MATERIAL INVENTORY

FACILITY UNIT	☐ TRADE SECRET ☒ SITE MAP ATTACHED	
Refinery		
BUSINESS NAME		TELEPHONE #
Chemoil Refining Corporation		310-424-8515
SITE ADDRESS	CITY / STATE	ZIP CODE
2020 Walnut Avenue,	Signal Hill, CA	90806
MAILING ADDRESS	CITY / STATE / ZIP CODE	DUN & BRADSTREET #
Same as above.		

NAME OF EMERGENCY COORDINATOR	TITLE	TELEPHONE #	24-HOUR TELEPHONE #
Fred Williams	Process Superintendent	310-981-2526	310-424-8515
NAME OF ALTERNATE EMERGENCY COORDINATOR	TITLE	TELEPHONE #	24-HOUR TELEPHONE #
Hermilo ("Milo") Soto	Pipeline Superintendent	310-424-8516	310-424-8515

PRINCIPAL BUSINESS ACTIVITY	EPA WASTE GENERATOR ID #	SIC CODE	PURPOSE OF DISCLOSURE
Petroleum Refining	CAD008249435	2911	☒ Annual ☐ Previously Undisclosed Materials ☐ 100% Chg. in Quantity ☐ Chg. of Bus. Name/Address/Owner.

Chemical 1

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #
Gas Oil	1270		64741442	

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☒ Fire ☐ Sudden Pressure Release ☐ Reactivity	☐ Acute ☒ Chronic	☐ Solid ☒ Liquid ☐ Gas	☐ Pure ☒ Mixture ☐ Waste	365	A

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
135,000 ☐ LB ☒ GAL ☐ FT³	125,000 ☐ LB ☒ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	39

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL
	1	4	Storage Tanks 5, 8, 9, 14, 15, 107, 112, 131, 132, 133, 134, 135, 136, 222, 230, 306, 310, 311, 504, 507, 508, 510, 511, 512, 513, 515, 516, 517, 518, 519, 522, 525, 526, 528, 606, 614, 630

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE:

1. Benzene	1 ppm % Wt	C.A.S. #	71432
2. Toluene	1 ppm % Wt	C.A.S. #	108883
3. Xylene	% Wt	C.A.S. #	1210

Chemical 2

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #
Sulfuric Acid	1830		7664939	

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☒ Reactivity ☐ Fire ☐ Sudden Pressure Release	☒ Acute ☐ Chronic	☐ Solid ☒ Liquid ☐ Gas	☒ Pure ☐ Mixture ☐ Waste	365	A

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
1,000 ☐ LB ☒ GAL ☐ FT³	1,000 ☐ LB ☒ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	31

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL
	1	4	Tanks on north end of cooling tower.

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE:

1.	% Wt	C.A.S. #	
2.	% Wt	C.A.S. #	
3.	% Wt	C.A.S. #	

Chemical 3

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #
Liquid Bleach	1791	Sodium Hypochlorite	7681529	

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☒ Reactivity ☐ Fire ☐ Sudden Pressure Release	☐ Acute ☒ Chronic	☐ Solid ☒ Liquid ☐ Gas	☐ Pure ☒ Mixture ☐ Waste	365	A

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
1,100 ☐ LB ☒ GAL ☐ FT³	500 ☐ LB ☒ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	05

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL
	1	4	Tank on east of Wemco water treater on north end of upper yard.

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE:

1. Sodium Hypochlorite	12.5 % Wt	C.A.S. #	7681529
2. Water	87.5 % Wt	C.A.S. #	
3.	% Wt	C.A.S. #	

CERTIFICATION: I certify under penalty of law that I have personally examined and am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

PRINT NAME OF DOCUMENT PREPARER	PRINT NAME OF OWNER/OPERATOR	SIGNATURE OF OWNER/OPERATOR	DATE
Ken Ezoe	Chemoil Refining Corp.	K Ezoe	12/13/95

Please see EXAM[illegible] on page C of the folder for instructions prior to [illegible]mpletion of this form.
This form shall be **TYPED** or **LEGIBLY PRINTED IN INK.** Return the completed original.

LONG BEACH FIRE DEPARTMENT

HAZARDOUS MATERIAL INVENTORY

FACILITY UNIT	☐ TRADE SECRET ☒ SITE MAP ATTACHED	
Refinery		
BUSINESS NAME		TELEPHONE #
Chemoil Refining Corporation		310-424-8515
SITE ADDRESS / CITY / STATE / ZIP CODE		
2020 Walnut Avenue, Signal Hill, CA 90806		
MAILING ADDRESS / CITY / STATE / ZIP CODE		DUN & BRADSTREET #
Same as above.		
NAME OF EMERGENCY COORDINATOR	TITLE	TELEPHONE # / 24-HOUR TELEPHONE #
Fred Williams	Process Superintendent	310-981-2526 / 310-424-8515
NAME OF ALTERNATE EMERGENCY COORDINATOR	TITLE	TELEPHONE # / 24-HOUR TELEPHONE #
Hermilo ("Milo") Soto	Pipeline Superintendent	310-424-8516 / 310-424-8515
PRINCIPAL BUSINESS ACTIVITY	E.P.A. WASTE GENERATOR I.D. # / SIC CODE	PURPOSE OF DISCLOSURE
Petroleum Refining	CAD008249435 / 2911	☒ Annual ☐ Previously Undisclosed Materials ☐ 100% Chg. in Quantity ☐ Chg. of Bus. Name/Address/Owner.

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #
Caustic	1824	Caustic solution (KOH)	1310732	

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☒ Reactivity ☐ Fire ☐ Sudden Pressure Release	☒ Acute ☐ Chronic	☐ Solid ☒ Liquid ☐ Gas	☐ Pure ☒ Mixture ☐ Waste	365	A

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
25 ☐ LB ☒ GAL ☐ FT³	25 ☐ LB ☒ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	44

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL
	1	4	Tank 105

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE

1. Caustic	50	% Wt	C.A.S. # 1310732
2. Water	50	% Wt	C.A.S. #
3.		% Wt	C.A.S. #

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☐ Reactivity ☐ Fire ☐ Sudden Pressure Release	☐ Acute ☐ Chronic	☐ Solid ☐ Liquid ☐ Gas	☐ Pure ☐ Mixture ☐ Waste		

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
☐ LB ☐ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE:

1.		% Wt	C.A.S. #
2.		% Wt	C.A.S. #
3.		% Wt	C.A.S. #

COMMON NAME	UN I.D. #	CHEMICAL NAME	C.A.S. #	STATE WASTE CODE #

PHYSICAL HAZARDS	HEALTH HAZARDS	PHYSICAL STATE	TYPE	DAYS ON SITE	STORAGE CODE
☐ Reactivity ☐ Fire ☐ Sudden Pressure Release	☐ Acute ☐ Chronic	☐ Solid ☐ Liquid ☐ Gas	☐ Pure ☐ Mixture ☐ Waste		

MAXIMUM AMOUNT / UNIT	AVERAGE DAILY AMOUNT / UNIT	ANNUAL AMOUNT (WASTE ONLY) / UNIT	USE CODE
☐ LB ☐ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	☐ LB ☐ GAL ☐ FT³	

WASTE CLASS	STORAGE PRESSURE CODE	TEMPERATURE CODE	LOCATION OF CHEMICAL

THREE MOST HAZARDOUS COMPONENT CHEMICAL NAMES, IF MIXTURE OR WASTE:

1.		% Wt	C.A.S. #
2.		% Wt	C.A.S. #
3.		% Wt	C.A.S. #

CERTIFICATION: I certify under penalty of law that I have personally examined and am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

PRINT NAME OF DOCUMENT PREPARER	PRINT NAME OF OWNER/OPERATOR	SIGNATURE OF OWNER/OPERATOR	DATE
Ken Ezoe	Chemoil Refining Crop.	Kezoe	12/13/95

SECTION IV: EMPLOYEE TRAINING PROGRAM

A. Describe the training for all employees in safety procedures in the event of a release or threatened release of hazardous materials. This training shall include, but not be limited to, the following: new employee training, annual training, periodic refresher courses, and familiarization with Section III (Emergency Plans and Procedures) of this business plan.

1. Training for handling hazardous materials safely:

Regular training is given on the job prior to an operator taking over a job. The matters are updated and discussed in weekly supervisor meetings.

2. Procedures of coordinating activities with response agencies:

Chemoil follows the unified command system established in OPA 90 and State OSPR Plans.

3. Training for proper use of on-site safety equipment:

When Chemoil operates any part of the refinery since the shut-down, such as water treatment or tankage systems, a highly trained and experienced Process Superintendent usually refreshes his memory by use of the equipment. However, when he has employees all receive regular training in use of their safety equipment by their supervisors prior to starting work in a position and weekly on the job. The supervisors in turn receive training from contracted training professionals.

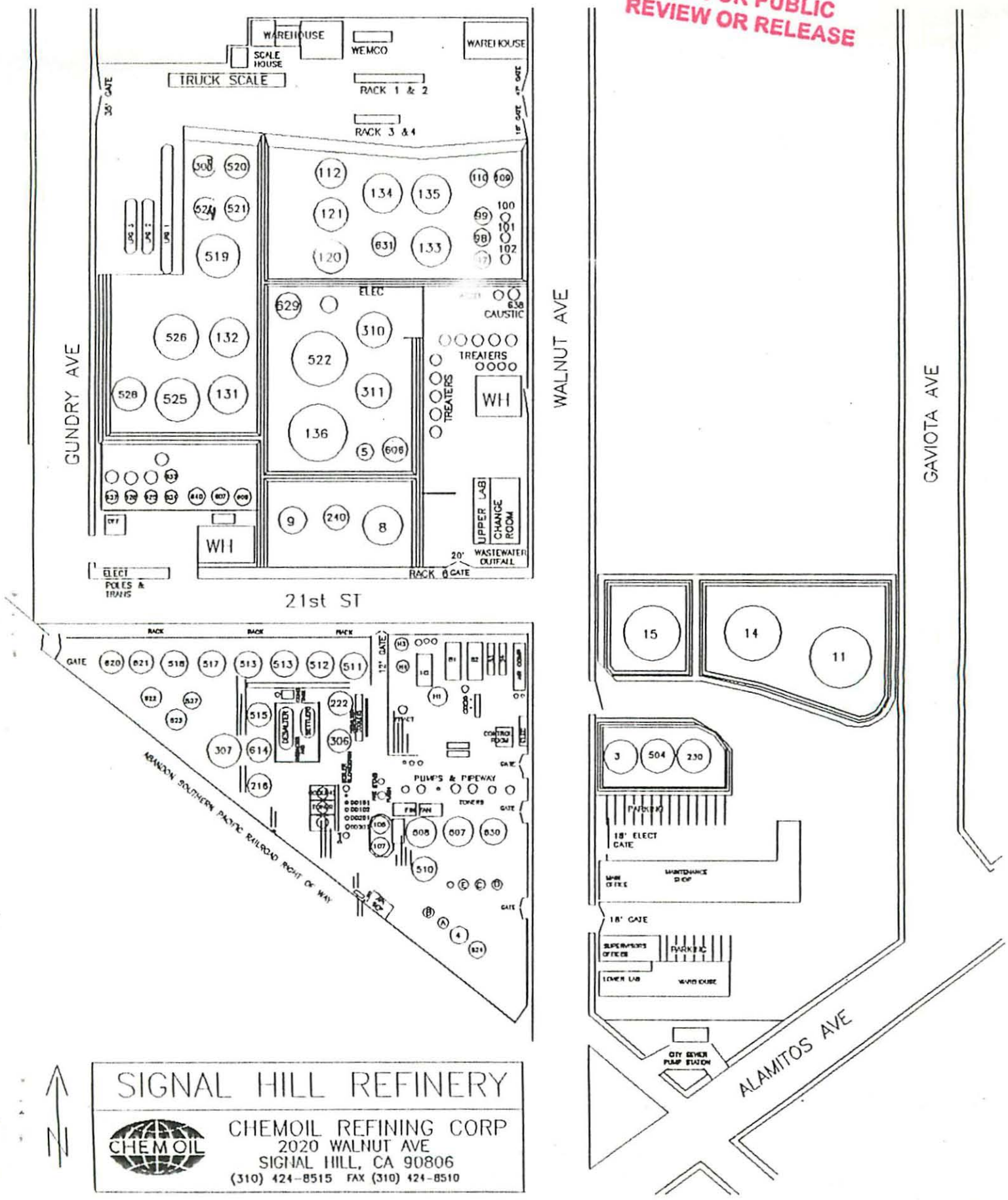
4. Familiarization with the business emergency response plans and procedures:

Employees who are responsible for notification of proper authorities receive instructions from supervisors on the proper procedures. Supervisors follow CA State OSPR Plan.

SECTION V. A BUSINESS IS REQUIRED BY LAW TO NOTIFY THE LONG BEACH FIRE DEPARTMENT OF ANY OF THE FOLLOWING:

1. Change of business address (within 15 days).
2. Change of business ownership (within 15 days).
3. Change of business name (within 15 days).
4. Cessation of business operation (within 15 days).
5. Use or handling of previously undisclosed hazardous material (within 15 days).
6. A 100% increase in the quantity of a previously disclosed hazardous material (within 15 days).
7. Update inventory (annually).
8. Update business emergency plan (every 2 years).

NOT FOR PUBLIC
REVIEW OR RELEASE



SIGNAL HILL REFINERY

CHEMOIL

CHEMOIL REFINING CORP
2020 WALNUT AVE
SIGNAL HILL, CA 90806
(310) 424-8515 FAX (310) 424-8510

State of California—Environmental Protection Agency
Form Approved OMB No 2050-0039 (Expires 9-30-94)
Please print or type Form designed for use on elite (12-pitch) typewriter

40

See Instructions on back of page 6.

5-272

Department of Toxic Substances Control
Sacramento, California

92649907

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No: CAD018214343 | Manifest Document No: 54990717 | 2 Page 1 of 1 | Information in the shaded areas is not required by Federal law: 97-899

3 Generator's Name and Mailing Address
Chemoil Refining Corp.
2020 Walnut Ave., Signal Hill, CA 90806
4. Generator's Phone (562) 424-8515

A. State Manifest Document Number: 92649907
B. State Generator's ID:

5. Transporter 1 Company Name: BDC Special Waste Services | 6 US EPA ID Number: CAR000017657
C. State Transporter's ID:
D. Transporter's Phone: (800) 221-4232

7 Transporter 2 Company Name | 8 US EPA ID Number
E. State Transporter's ID:
F. Transporter's Phone:

9 Designated Facility Name and Site Address
Azusa Land Reclamation
1201 W. Gladstone St.
Azusa, CA 91702
10 US EPA ID Number: CAD009007626
G. State Facility's ID: CAD009007626
H. Facility's Phone: (626) (818) 334-0719

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No	12 Containers Type	13. Total Quantity	14 Unit Wt/Vol	I. Waste Number
a. "R.Q." Asbestos, 9, NA2212, pg III	3 5	0 B	0 0 0 3 5	Y	State 151 / EPA/Other
b.					State / EPA/Other
c.					State / EPA/Other
d.					State / EPA/Other

J. Additional Descriptions for Materials Listed Above
(11. a.) Friable Asbestos Containing Waste
~~ERG 31~~ ERG# 171

K. Handling Codes for Wastes Listed Above
a. 03 | b. | c. | d.

15 Special Handling Instructions and Additional Information: EPA Region IX:SCAQMD 21865 E Copley Dr Diamond Bar, CA 91765
Do not break bags or cause dust. Bury separately and cover with backfill.
TI: BDC Special Waste Services 766 S. Ayon Ave., Azusa, CA 91702 24 Hour Phone: (800) 221-4232
Site: Chemoil Refining 2020 Walnut Ave., Signal Hill, CA 90806
ENVIROCON

16 GENERATOR'S CERTIFICATION: I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable federal, state and international laws.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Sam Bonilla (as an agent for) | Signature: | Month 05 | Day 15 | Year 98

TRANSPORTER

17 Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Richard Roselli | Signature: | Month 05 | Day 15 | Year 98

18 Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month | Day | Year

FACILITY

19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19
Printed/Typed Name: Gloria Barrera | Signature: G. Barrera | Month 05 | Day 15 | Year 98

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (7/92)
EPA 8700—22

White TSDF SENDS THIS COPY TO DTSC WITHIN 30 DAYS
To: P O Box 3000, Sacramento CA 95812

CAD009007626

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-94)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

218

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

92649862

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802. WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. / Manifest Document No.: CAD008243498 652
2. Page 1 of 1
Information in the shaded areas is not required by Federal law. 97-899

GENERATOR

3. Generator's Name and Mailing Address
Chemoil Refining Corp.
2020 Walnut Ave., Signal Hill, CA 90806
4. Generator's Phone (562) 424-8515

A. State Manifest Document Number: 92649862
B. State Generator's ID:
C. State Transporter's ID:
D. Transporter's Phone: (800) 221-4232
E. State Transporter's ID:
F. Transporter's Phone:
G. State Facility's ID: CAD980876826
H. Facility's Phone: (818) 334-0719

5. Transporter 1 Company Name: BDC Special Waste Services
6. US EPA ID Number: CAR000017657
7. Transporter 2 Company Name:
8. US EPA ID Number:
9. Designated Facility Name and Site Address
Azusa Land Reclamation
1201 W. Gladstone St.
Azusa, CA 91702
10. US EPA ID Number: CAD009007626

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. ERG 171 "R.Q." Asbestos, 9, NA2212, pg III	001	CM	00035	Y	State 151 / EPA/Other
b.					State / EPA/Other
c.					State / EPA/Other
d.					State / EPA/Other

J. Additional Descriptions for Materials Listed Above
(11. a.) Friable Asbestos Containing Waste
~~ERG 81~~

K. Handling Codes for Wastes Listed Above
a. T03
b.
c.
d.

15. Special Handling Instructions and Additional Information EPA Region IX:SCAQMD 21865 E Copley Dr Diamond Bar, CA 91765
Do not break bags or cause dust. Bury separately and cover with backfill. Manifest Copy
TI: BDC Special Waste Services 766 S. Ayon Ave., Azusa, CA 91702 24 Hour Phone: (800) 221-4232
Site: Chemoil Refining 2020 Walnut Ave., Signal Hill, CA 90806 BDC-766 S Ayon Azusa CA 91702

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable federal, state and international laws.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Sam Bonilla (as an agent for) Signature: Month 12 Day 04 Year 97

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Richard Roswell Signature: Month 12 Day 04 Year 97

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: Signature: Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Cris Ureta Signature: Month 12 Day 04 Year 97

DO NOT WRITE BELOW THIS LINE.

White: TSDF SENDS THIS COPY TO DTSC WITHIN 30 DAYS.
Tan: P.O. Box 3000, Sacramento, CA 95812

DTSC 8022A (7/92)
EPA 8700—22

ID # 2403.1560

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of [illegible]e 6.

Department of Toxic Substances Control
Sacramento, California

25196006

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CAD008249435 — Manifest Document No. 631443 — 2. Page 1 of 1 — Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Signal Hill Holding Company
2365 East Sepulveda Blvd.
Long Beach, CA 90810
4. Generator's Phone (562-427-6611 Attn: Ken Ezoe

A. State Manifest Document Number: 25196006
B. State Generator's ID:

5. Transporter 1 Company Name: General Environmental Mgmt Inc.
6. US EPA ID Number: CAD983649880
C. State Transporter's ID [Reserved.]:
D. Transporter's Phone: 800-326-1011

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]:
F. Transporter's Phone:

9. Designated Facility Name and Site Address
GEM Rancho Cordova, LLC
11855 White Rock Road
Rancho Cordova, CA 95742
10. US EPA ID Number: CAD980884183
G. State Facility's ID: CAD980884183
H. Facility's Phone: 916 351 0980

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s., 9, NA3077, III (D018)	1 002	DM	EST 00250	P	State 611; EPA/Other D018
b.					State; EPA/Other
c.					State; EPA/Other
d.					State; EPA/Other

J. Additional Descriptions for Materials Listed Above: 11a) 55gal, ERG: 171 BTEX Soil, Approval #R12049 ~~(2x55)~~ (1x55)

K. Handling Codes for Wastes Listed Above: a. 14 b. c. d.

15. Special Handling Instructions and Additional Information
Emergency Phone: (800) 326-1011 (for GEM)
Site Address: 2020 Walnut Avenue, Signal Hill, CA 90755

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
KEN EZOE		01	18	06

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
ERIK W. CAURSEN		01	21	06

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Cory Yamashiro	Cory Yamashiro	01	21	06

DO NOT WRITE BELOW THIS LINE.

S/10#9017 Doc# 9514

DTSC 8022A (1/99)
EPA 8700—22

White: TSDF SENDS THIS COPY TO DTSC WITHIN 30 DAYS.
To: P.O. Box 3000, Sacramento, CA 95812

6251.1897

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

25196190

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CAD008249435 — Manifest Document No. 639721
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.
SWO # 165054

GENERATOR

3. Generator's Name and Mailing Address
Signal Hill Holding Company
2365 East Sepulveda Blvd.
Long Beach, CA 90810
4. Generator's Phone (562-427-6611 Attn: Ken Ezoe

A. State Manifest Document Number: 25196190
B. State Generator's ID:

5. Transporter 1 Company Name: General Environmental Mgmt Inc.
6. US EPA ID Number: CAD983649880
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: 800-326-1011

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
GEM Rancho Cordova, LLC
11855 White Rock Road
Rancho Cordova, CA 95742
10. US EPA ID Number: CAD980884183
G. State Facility's ID: CAD980884183
H. Facility's Phone: 916 351 0980

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, liquid, n.o.s., 9, NA3082, III (D018)	001	DM	00030	G	State 134 / EPA/Other D018
b.					State / EPA/Other
c.					State / EPA/Other
d.					State / EPA/Other

J. Additional Descriptions for Materials Listed Above
11a) 55gal, ERG: 171 BTEX Ground Water, Approval # R13116

K. Handling Codes for Wastes Listed Above
a. 14 b. c. d.

15. Special Handling Instructions and Additional Information
Emergency Phone: (800) 326-1011 (for GEM)
Site Address: 2020 Walnut Avenue, Signal Hill, CA 90755

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Printed/Typed Name: KEN EZOE — Signature: [signature] — Month 08 Day 14 Year 06

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Rudy Negrete — Signature: [signature] — Month 08 Day 15 Year 06

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Justin Pickens — Signature: [signature] — Month 08 Day 24 Year 06

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

S/O#9630 Doc#9935

White: TSDF SENDS THIS COPY TO DTSC WITHIN 30 DAYS.
To: P.O. Box 3000, Sacramento, CA 95812

6271.0770

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

25196190

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UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CAD008249435 — Manifest Document No. 639721
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.
SWO # 165054

GENERATOR

3. Generator's Name and Mailing Address
Signal Hill Holding Company
2365 East Sepulveda Blvd.
Long Beach, CA 90810
4. Generator's Phone (562-427-6611 Attn: Ken Ezoe

A. State Manifest Document Number: 25196190
B. State Generator's ID:

5. Transporter 1 Company Name: General Environmental Mgmt Inc.
6. US EPA ID Number: CAD983649880
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: 800-326-1011

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
GEM Rancho Cordova, LLC
11855 White Rock Road
Rancho Cordova, CA 95742
10. US EPA ID Number: CAD980884183
G. State Facility's ID: CAD980884183
H. Facility's Phone: 916 351 0980

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, liquid, n.o.s., 9, NA3082, III (D018)	001	DM	00030	G	State 134 / EPA/Other D018
b.					State / EPA/Other
c.					State / EPA/Other
d.					State / EPA/Other

J. Additional Descriptions for Materials Listed Above
11a) 55gal, ERG: 171 BTEX Ground Water, Approval # R13116

K. Handling Codes for Wastes Listed Above
a. 14 b. c. d.

15. Special Handling Instructions and Additional Information
Emergency Phone: (800) 326-1011 (for GEM)
Site Address: 2020 Walnut Avenue, Signal Hill, CA 90755

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Printed/Typed Name: KEN EZOE — Signature: [signature] — Month 08 Day 14 Year 06

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Rudy Negrete — Signature: [signature] — Month 08 Day 15 Year 06

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Justin Pickens — Signature: [signature] — Month 08 Day 24 Year 06

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

S/O#9630 Doc#9935

White: TSDF SENDS THIS COPY TO DTSC WITHIN 30 DAYS.
To: P.O. Box 3000, Sacramento, CA 95812

6271.0770

Date run : 5/24/2007 5:57:46PM
Run by : E. Hernandez
FA0024462 CHEMOIL TERMINALS CORP

LA County Fire Department
Facility Information Report

Report # : 5302
Page 1 of 3
Version 101906

OWNER FILE INFORMATION

** Clearly make changes/corrections here.*

Owner ID: OW0024462 — New Owner ID:
Owner Name: CHEMOIL TERMINALS CORP — Tax ID : 943068073
Owner DBA: CHEMOIL TERMINALS CORP — Drvr Licns :
Owner Address: 2365 E SEPULVEDA BLVD
CARSON, CA 908101944
Work/Business Phone: 562-427-6611
Billing/Mailing Address: 2365 E SEPULVEDA BLVD
LONG BEACH, CA 908101944
ATTN/Care of: KEN EZOE
Ownership Type:

New STE ADDRESS! 12A ##

Moved to 2365 E. Sepulveda

FACILITY FILE INFORMATION

Facility ID: FA0024462
Facility Name: CHEMOIL TERMINALS CORP
No. of Employee: 11
Site Location: 2365 E SEPULVEDA BLVD
CARSON, CA 90810
Phone: 562-242-8068
Mailing Address: 2365 E SEPULVEDA BLVD
LONG BEACH, CA 908101944
Operator/Care of: TED CHRESTENSEN — E-Mail Address: craig.smith@chemoil.com
District: SW - SOUTHWEST
City Code: CARS **CARSON**
CUPA Jurisdiction: CO
Operating Hours: Days: Hours:
SIC Code: 4226 Special warehousing and storage, nec — Nature of Business: TANK FARM
Business Type / Code: 3 01 CORPORATION
Station: 127
Date First Became Operational:

41928.00

GENERAL HEALTH PROGRAM ELEMENTS

Record ID	Current Program Element	Current Status	EPA #	Effective Date Beg.	Effective Date End	Changes: Program Element	Changes: Status
PR0006892	3005 - HM HANDLER, FEE GROUP 05	Active, billable		05/22/89			
PR0034092	1102 - HW, RCRA-LQG, 6-19 EMPLOYEES	Active, billable	CAD097039028	07/01/89			
PR0039439	3700 - ABOVE GROUND PETROLEUM TANK	Active, exempt from billing		05/22/89			
PR0045272	2020 - TIER - PBR	Active, billable	CAD 097039028				

Addition Program Element: _____

CA Waste Code					
RCRA Waste Code					
AMOUNT per quarter					
UNITS (PGTY) Pounds, Gallons, Tons, Yards					

CONSENT GIVEN BY: _____ INSPECTOR SIGNATURE: _____ EMPLOYEE ID: _____

1st DATE & TIME OF INSPECTION: _____ 2nd DATE & TIME OF INSPECTION: _____

3rd DATE & TIME OF INSPECTION:

ENVIRONMENTAL CONTACT INFORMATION *** For Haz Mat Handlers.*

Contact Name: KEN EZOE, P.E.
2365 E SEPULVEDA BLVD
LONG BEACH

Phone : 562-427-6611

Dun & Bradst.: * Please Fill-Out

EMERGENCY CONTACT INFORMATION

	PRIMARY CONTACT:	SECONDARY CONTACT:
Name :	GLENN AFFERBACH EXT 4411	CRAIG SMITH
Title :	SUPERINTENDENT	SUPERINTENDENT
Business Phone :	562-427-6611	562-901-1962
24 - Hour Phone :	562-424-8068	562-901-1960
Pager # :	Not Specified	Not Specified

PREVIOUS INSPECTIONS

Activity Date	Program Element	Service	Result	Action	Activity Min	Travel Min	Inspector ID	Violation Code
04/13/00	3005	001	00	12	30	0	EE0000083	0
04/13/00	1002	001	00	12	30	0	EE0000083	0
03/01/02	2020	001	01	12	60	30	EE0000113	
03/20/02	0100	053	00	00	60	0	EE0000113	
04/11/02	2020	002	01	00	30	15	EE0000113	
04/17/02	0100	053	00	00	30	0	EE0000113	
06/06/02	3005	053	00	00	30	0	EE0000058	
06/06/02	1102	053	09	00	30	0	EE0000058	
06/06/02	3700	052	09	00	40	0	EE0000058	
06/06/02	2020	053	09	00	30	0	EE0000058	

VIOLATIONS LIST

Activity Date	Program Element	Viol Status	Service	Result	Action	Violation Code	Violation Degree	Description

CONSENT GIVEN BY: _____ INSPECTOR SIGNATURE: _____ EMPLOYEE ID: _____

1st DATE & TIME OF INSPECTION: _____ 2nd DATE & TIME OF INSPECTION: _____

3rd DATE & TIME OF INSPECTION:

HWTS EPA ID Profile

EPA ID: CAD008249435 **Name:** SIGNAL HILL HOLDING CORP FORMERLY CHEMOI
Status: ACTIVE **Inactive Date:** **Contact:** TED CHRESTENSEN/GENERAL MGR
County: LOS ANGELES **SIC:** 454312 **Record Entered:** 1982-07-23 **Last updated:** 2006-12-04

	Name	Address	City	State	ZIP	Phone
Location	SIGNAL HILL HOLDING CORP FORMERLY CHEMOI	2020 WALNUT AVE	SIGNAL HILL	CA	908060000	
Mailing		2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	
Owner	SIGNAL HILL HOLDING CORP FORME	2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	5624276611
Oper/Contact	TED CHRESTENSEN/GENERAL MGR	2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	5624276611

EPA ID: CAD008249435 **Name:** SIGNAL HILL HOLDING CORP FORMERLY CHEMOI
Status: ACTIVE **Inactive Date:** **Contact:** TED CHRESTENSEN/GENERAL MGR
County: LOS ANGELES **SIC:** 5312 **Record Entered:** 1982-07-23 **Last updated:** 2006-12-04

	Name	Address	City	State	ZIP	Phone
Location	SIGNAL HILL HOLDING CORP FORMERLY CHEMOI	2020 WALNUT AVE	SIGNAL HILL	CA	908060000	
Mailing		2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	
Owner	SIGNAL HILL HOLDING CORP FORME	2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	5624276611
Oper/Contact	TED CHRESTENSEN/GENERAL MGR	2365 E SEPULVEDA BLVD	LONG BEACH	CA	908101944	5624276611

CHEMOIL REFINING CORPORATION

CHEMOIL

2020 Walnut Avenue
Signal Hill, California 90806

RANDY TUREK
Maintenance Supt.
Signal Hill Holding Corp. 562-427-6611

(213) 424-8515
FAX (213) 424-8510

LOS ANGELE… …ERVICES
HA…

Refining Corp.

DATE	TIME	INITIALS	REMARKS
06/09/94		MT	001 Conducted, NO NOV issued ABATE
5/24/07		EH	Routine inspection conducted. Facility no longer in existence at 2020 Walnut address. Reverse directory indicates new location at 2365 E. Sepulveda, Carson. FA#0024462. FILE.

HEALTH HAZMAT

LOG SHEET

Site Name: | #

Address: 2020 Walnut Ave Signal Hill 90755

Date	HMS Init.	Findings /Remarks
01/06/06	G	A ~~permit~~ investigation revealed ~~A~~ fenced in ~~VACANT~~ lot. File.

ChemOil Notes

Hazardous Materials Disclosure in

12-1995 to
1-97

12-13-95 HazMat Inv.

GasOil tank - UN ID# 1270
cont. Benz, Tol, Xyl (& MTBE?)
possibly source

Storage Tanks 5, 8, 9, 14, 15, 107, 112, ... (see form)

5/24/2007 LACFD Facility Info Report
above ground petroleum tank (active, eff. beginning 5/22/89)

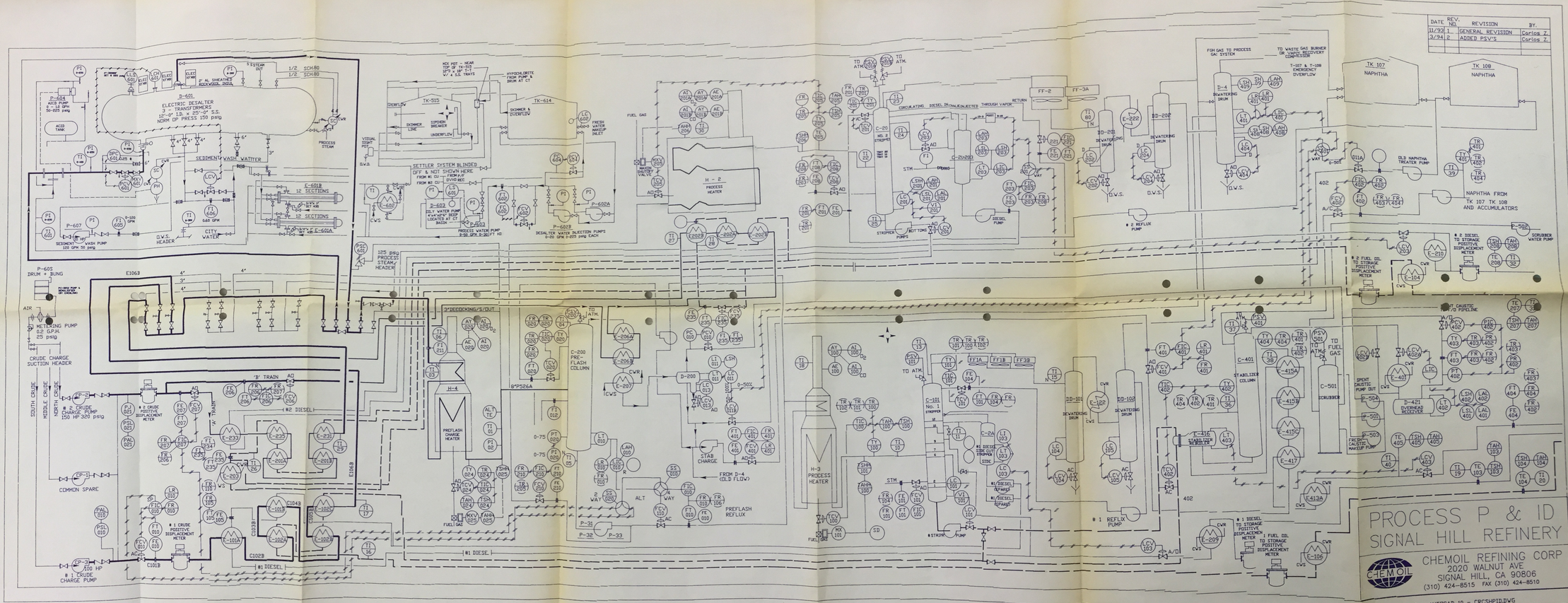
07-2006 HazWaste Manifest : Oil/BTEX Solids - 1 ~~contains~~ from, ~ 250 lbs (P)

08-2006 HazWaste Manifest : BTEX Groundwater - 1 drum, ~30 gal

05-1998 Haz Waste Manifest : Asbestos

12-1997 - " "

2001-01-20 Industry Survey LACFD
Waste Oil Spill - 06-1994 : 3000 barrels @ 42 gal/barrel
= 126,000 gal


PROCESS P & ID
SIGNAL HILL REFINERY
CHEMOIL REFINING CORP
2020 WALNUT AVE.
SIGNAL HILL, CA 90806
(310) 424-8515 FAX (310) 424-8510
JVB CORP - FEB '93 - AUTOCAD 10 - CRCSHPID.DWG
DATE REV. NO. REVISION BY.
11/93 1 GENERAL REVISION Carlos Z.
3/94 2 ADDED FSV'S Carlos Z.
ELECTRIC DESALTER 3 - 'T' TRANSFORMERS 12'-0" I.D. x 25'-0" S.S. NORM DP PRESS 150 psig
SEDIMENT WASH WATTER
CITY WATER
D.W.S. HEADER
SETTLER SYSTEM BLINDED OFF & NOT SHOWN HERE FROM #1 CU FROM P/F DVRS REC
SKIMMER & OVERFLOW
HYPOCHLORITE FROM PUMP & DRUM AT CT
PROCESS STEAM
125 psig PROCESS STEAM HEADER
CRUDE CHARGE SUCTION HEADER
SOUTH CRUDE
MIDDLE CRUDE
NORTH CRUDE
COMMON SPARE
#2 DIESEL
#1 DIESEL
'B' TRAIN
'A' TRAIN
PREFLASH CHARGE HEATER
PREFLASH REFLUX
C-200 PRE-FLASH COLUMN
H-3 PROCESS HEATER
H - 2 PROCESS HEATER
CIRCULATING DIESEL IN-LINE INJECTED THROUGH VAPOR RETURN
STRIPPER BOTTOMS PUMPS
DEVATERING DRUM
2 REFLUX PUMP
1 REFLUX PUMP
C-401 STABILIZER COLUMN
C-501 SCRUBBER
TK 107 NAPHTHA
TK 108 NAPHTHA
OLD NAPHTHA TREATER PUMP
NAPHTHA FROM TK 107 TK 108 AND ACCUMULATORS
SCRUBBER WATER PUMP
SPENT CAUSTIC PUMP OUT
FRESH CAUSTIC MAKE-UP PUMP
TO FUEL GAS
FISH GAS TO PROCESS GAS SYSTEM
TO WASTE GAS BURNER OR VAPOR RECOVERY COMPRESSOR
T-107 & T-108 EMERGENCY OVERFLOW
2 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
2 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
1 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
1 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
OVERHEAD BLOWER
2 CRUDE CHARGE PUMP 150 HP 320 psig
1 CRUDE CHARGE PUMP 100 HP
2 CRUDE POSITIVE DISPLACEMENT METER
1 CRUDE POSITIVE DISPLACEMENT METER
DRUM + BUNG
METERING PUMP 0.2 G.P.H. 25 psig
ACID TANK
ACID PUMP 5 - 15 GPH 50-225 psig
SEDIMENT WASH PUMP 120 GPM 50 psig
MIX POT - NEAR TOP OF TK-515 12'0 x 18'-7 W/ 4 S.S. TRAYS
TK-515
TK-614
P-602 OILY WATER PUMP 4'x4'x6'x9" BSP LOCATED AT CT BASIN
P-602A DESALTER WATER INJECTION PUMPS 0-20 GPM 1-225 psig EACH
PROCESS WATER PUMP 0-50 GPM 0-207 FT HD
FUEL GAS
STEAM OUT
E-601A 12 SECTIONS
E-601B 12 SECTIONS
E-106B
E-104B
E-101A
E-102A
E-102B
E-103A
E-103B
E-201A
E-201B
E-206A
E-206B
E-207
E-233
E-235
E-222
E-209
E-210
E-122
E-415A
E-415B
E-415C
E-417
E-413A
E-401
E-421
E-502
P-501
P-502
P-503
P-504
P-607
P-608
P-609
P-31
P-32
P-33
C-20 NO. 2 STRIPPER
C-20-200
C-2A
C-101 NO. 1 STRIPPER
D-200
D-201
D-202
D-4 DEVATERING DRUM
D-601
H-2
H-3
H-4
TK-515
TK-614
FF-2
FF-3A
FF1A
FF1B
FF3B
DD-101 DEVATERING DRUM
DD-102 DEVATERING DRUM
DD-201 DEVATERING DRUM
DD-202 DEVATERING DRUM
SCRUBBER
STABILIZER REBOILER
STEAM OUT
8"PS26A
0-75%
0-50%
ALT
2 WAY
4 WAY
SPENT CAUSTIC TO PIPELINE
FRESH CAUSTIC MAKE-UP
SPENT CAUSTIC PUMP OUT
OVERHEAD BLOWER
STEAM OUT
TO ATM.
TO FUEL GAS
D.W.S.
CWS
CWR
A/D
SD
SCRUBBER
STABILIZER REBOILER
DEVATERING DRUM
2 REFLUX PUMP
1 REFLUX PUMP
STRIPPER BOTTOMS PUMPS
2 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
2 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
1 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
1 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
OVERHEAD BLOWER
2 CRUDE POSITIVE DISPLACEMENT METER
1 CRUDE POSITIVE DISPLACEMENT METER
DRUM + BUNG
METERING PUMP 0.2 G.P.H. 25 psig
ACID TANK
ACID PUMP 5 - 15 GPH 50-225 psig
SEDIMENT WASH PUMP 120 GPM 50 psig
MIX POT - NEAR TOP OF TK-515 12'0 x 18'-7 W/ 4 S.S. TRAYS
SETTLER SYSTEM BLINDED OFF & NOT SHOWN HERE FROM #1 CU FROM P/F DVRS REC
SKIMMER & OVERFLOW
HYPOCHLORITE FROM PUMP & DRUM AT CT
PROCESS STEAM
125 psig PROCESS STEAM HEADER
CRUDE CHARGE SUCTION HEADER
SOUTH CRUDE
MIDDLE CRUDE
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'A' TRAIN
PREFLASH CHARGE HEATER
PREFLASH REFLUX
C-200 PRE-FLASH COLUMN
H-3 PROCESS HEATER
H - 2 PROCESS HEATER
CIRCULATING DIESEL IN-LINE INJECTED THROUGH VAPOR RETURN
STRIPPER BOTTOMS PUMPS
DEVATERING DRUM
2 REFLUX PUMP
1 REFLUX PUMP
C-401 STABILIZER COLUMN
C-501 SCRUBBER
TK 107 NAPHTHA
TK 108 NAPHTHA
OLD NAPHTHA TREATER PUMP
NAPHTHA FROM TK 107 TK 108 AND ACCUMULATORS
SCRUBBER WATER PUMP
SPENT CAUSTIC PUMP OUT
FRESH CAUSTIC MAKE-UP PUMP
TO FUEL GAS
FISH GAS TO PROCESS GAS SYSTEM
TO WASTE GAS BURNER OR VAPOR RECOVERY COMPRESSOR
T-107 & T-108 EMERGENCY OVERFLOW
2 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
2 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
1 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
1 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
OVERHEAD BLOWER
2 CRUDE CHARGE PUMP 150 HP 320 psig
1 CRUDE CHARGE PUMP 100 HP
2 CRUDE POSITIVE DISPLACEMENT METER
1 CRUDE POSITIVE DISPLACEMENT METER
ELECTRIC DESALTER 3 - 'T' TRANSFORMERS 12'-0" I.D. x 25'-0" S.S. NORM DP PRESS 150 psig
SEDIMENT WASH WATTER
CITY WATER
D.W.S. HEADER
SETTLER SYSTEM BLINDED OFF & NOT SHOWN HERE FROM #1 CU FROM P/F DVRS REC
SKIMMER & OVERFLOW
HYPOCHLORITE FROM PUMP & DRUM AT CT
PROCESS STEAM
125 psig PROCESS STEAM HEADER
CRUDE CHARGE SUCTION HEADER
SOUTH CRUDE
MIDDLE CRUDE
NORTH CRUDE
COMMON SPARE
#2 DIESEL
#1 DIESEL
'B' TRAIN
'A' TRAIN
PREFLASH CHARGE HEATER
PREFLASH REFLUX
C-200 PRE-FLASH COLUMN
H-3 PROCESS HEATER
H - 2 PROCESS HEATER
CIRCULATING DIESEL IN-LINE INJECTED THROUGH VAPOR RETURN
STRIPPER BOTTOMS PUMPS
DEVATERING DRUM
2 REFLUX PUMP
1 REFLUX PUMP
C-401 STABILIZER COLUMN
C-501 SCRUBBER
TK 107 NAPHTHA
TK 108 NAPHTHA
OLD NAPHTHA TREATER PUMP
NAPHTHA FROM TK 107 TK 108 AND ACCUMULATORS
SCRUBBER WATER PUMP
SPENT CAUSTIC PUMP OUT
FRESH CAUSTIC MAKE-UP PUMP
TO FUEL GAS
FISH GAS TO PROCESS GAS SYSTEM
TO WASTE GAS BURNER OR VAPOR RECOVERY COMPRESSOR
T-107 & T-108 EMERGENCY OVERFLOW
2 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
2 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
1 DIESEL TO STORAGE POSITIVE DISPLACEMENT METER
1 FUEL OIL TO STORAGE POSITIVE DISPLACEMENT METER
OVERHEAD BLOWER
2 CRUDE POSITIVE DISPLACEMENT METER
1 CRUDE POSITIVE DISPLACEMENT METER

APPENDIX I

HISTORICAL SOIL VAPOR DATA

Table 4
Analytical Results of Volatile Organic Compounds in Soil Vapor
Former Chemoil Refinery
Signal Hill, California

Sample Location	Sample Depth (ft bgs)	Sample Date	Concentration (µg/m^3)																		
			EPA Method TO-15 Volatile Organic Compounds																		
			Acetone	Benzene	Bromo-dichloro-methane	cis-1,2-Dichloro-ethene	Carbon Disulfide	Chloroform	Chloro-methane	Dibromo-chloro-methane	Dichloro-difluoro-methane	Ethanol	Ethyl-benzene	Methyl-tert Butyl Ether (MTBE)	Naphthalene	o-Xylene	p/m-Xylene	Tert-Butyl Alcohol (TBA)	Tetrachloro-ethene	Toluene	Trichloro-fluoro-methane	Vinyl-Chloride
Residential CHHSLs			**NA**	**36.2**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**420**	**4,000**	**31.9**	**317,000**	**317,000**	**NA**	**180**	**135,000**	**NA**	**13.3**
Residential ESLs			**330,000**	**42**	**69**	**3,700**	**NA**	**230**	**NA**	**NA**	**NA**	**NA**	**490**	**4,700**	**36**	**1,000**	**1,000**	**NA**	**210**	**31,000**	**NA**	**16**
GW/SV-20-5	5	05/30/12	54	3.2	3.6	<2	<6.2	200	<1	<4.3	2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	9.3	2.7	68	<1.3
GW/SV-20-10	10	05/30/12	6.9	<1.6	<3.4	<2	<6.2	220	<1	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	7.3	<1.9	69	<1.3
GW/SV-21-5	5	06/13/12	45	2.4	<3.4	<2	<6.2	6.3	<1.3	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	<3.4	<1.9	<5.6	<1.3
GW/SV-21-10	10	06/13/12	100	<3.3	<6.8	<4	<13	<5.0	<2.7	<8.7	<5.0	60	<4.4	<15	<53	<4.4	<18	<12	<5.5	<3.8	<5.5	<2.6
GW/SV-22-5	5	05/30/12	<220	<74	<150	<92	<290	<110	<48	<200	<110	<440	<100	<330	<1200	<100	<400	<280	<160	<87	<260	<59
GW/SV-22-10	10	05/30/12	1,400	<160	<340	<200	<620	<240	<100	<430	<250	<940	1000	<720	<2600	240	<870	1500	<340	510	<560	<130
GW/SV-22-10/Dup	10	05/30/12	1,800	<160	<340	<200	<620	310	<100	<430	<250	<940	970	<720	<2600	240	<870	<610	<340	320	<560	<130
GW/SV-23-5	5	06/13/12	38	<1.6	<3.4	<2	<6.2	<2.4	<1.3	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	<3.4	2.9	<5.6	<1.3
GW/SV-23-10	10	06/13/12	100	34	<3.4	<2	71	<2.4	<1.3	<4.3	<2.5	<9.4	3.8	<7.2	<26	<2.2	<8.7	<6.1	7.4	14	<5.6	<1.3
GW/SV-23-10/Dup	10	06/13/12	95	11	<11	<6.3	51	<7.8	<4.2	<14	<7.9	<30	<6.9	<23	<83	<6.9	<28	<19	<11	11	<18	<4.1
GW/SV-24-5	5	06/13/12	13	<1.6	<3.4	<2	<6.2	<2.4	<1.3	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	<3.4	2.4	<5.6	<1.3
GW/SV-24-10	10	06/13/12	22	4.1	<3.4	<2	<6.2	17	<1.3	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	9.9	<1.9	<5.6	<1.3
GW/SV-25-5	5	05/30/12	16	19	<3.4	<2	<6.2	3.5	<1	<4.3	<2.5	<9.4	11	<7.2	<26	14	30	<6.1	<3.4	20	<5.6	<1.3
GW/SV-25-10	10	05/30/12	<4.8	1.9	<3.4	<2	<6.2	<2.4	<1	<4.3	<2.5	<9.4	<2.2	9	<26	<2.2	<8.7	<6.1	<3.4	<1.9	<5.6	<1.3
GW/SV-26-5	5	05/31/12	17	3.6	<3.4	4.2	<6.2	<2.4	<1	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	25	3.3	<5.6	<1.3
GW/SV-26-10	10	05/31/12	14	<1.6	<3.4	<2	<6.2	<2.4	<1	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	28	<1.9	<5.6	<1.3
GW/SV-27-5	5	05/31/12	45	9.3	<3.4	<2	<6.2	5.2	<1	<4.3	2.6	<9.4	3.3	<7.2	<26	4.6	12	<6.1	67	16	<5.6	<1.3
GW/SV-27-10	10	05/31/12	21	2.8	<3.4	3.3	<6.2	22	<1	<4.3	<2.5	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	84	2	<5.6	2.9
GW/SV-28-5	5	05/31/12	25	3.9	7.5	<2	<6.2	12	<1	<4.3	<2.5	<9.4	<2.2	<7.2	<26	2.9	<8.7	<6.1	<3.4	5.2	<5.6	<1.3
GW/SV-28-10	10	05/31/12	29	2.3	<3.4	<2	<6.2	11	<1	<4.3	<2.5	12	<2.2	<7.2	<26	<2.2	<8.7	<6.1	<3.4	<1.9	<5.6	<1.3
GW/SV-29-5	5	05/31/12	220	11	5.2	<2	13	14	1.2	4.8	3.3	13	2.8	<7.2	<26	4.2	9.4	<6.1	6.8	11	13	<1.3
GW/SV-29-10	10	05/31/12	15	<1.6	<3.4	<2	<6.2	<2.4	<1	<4.3	2.9	<9.4	<2.2	<7.2	<26	<2.2	<8.7	<6.1	150	<1.9	15	<1.3

Notes:

1. Soil vapor samples collected in batch-certified 1-liter summa canisters and analyzed by CalScience Environmental Laboratories, Inc. of Garden Grove, California using EPA Method TO-15.
2. Except for the target petroleum-based chemicals of potential concern (COPCs), only constituents detected in at least one sample are presented. A full list of analytes from EPA Method TO-15 is presented in the analytical laboratory reports.

Abbreviations:

ft bgs = feet below ground surface
< indicates that the compound was not detected at or above the laboratory reporting limit shown.
NA = Not Available
CHHSLs = California Human Health Screening Levels (CHHSLs) for volatile chemicals in soil vapor below residential buildings constructed without engineered fill below sub-slab gravel (California Environmental Protection Agency, 2005).
ESLs = Environmental Screening Levels for residential uses, Update to Environmental Screening Levels for Sites with Impacted Soil and Groundwater, Regional Water Quality Control Board, San Francisco Bay, Table E-4 Shallow Soil Gas Screening Levels for Evaluation of Potential Vapor Intrusion Concerns, May 2008.

Table 4
Analytical Results of Volatile Organic Compounds in Soil Vapor
Former Chemoil Refinery
Signal Hill, California

Sample Location	Sample Depth (ft bgs)	Sample Date	Concentration (µg/m^3)						Concentration (% Volume)					
			EPA Method TO-15 Volatile Organic Compounds						Fixed Gases					
			1,1,1-Trichloro-ethane	1,2,4-Trimethyl-benzene	1,3,5-Trimethyl-benzene	2-Butanone	4-Ethyl-toluene	4-Methyl-2-Pentanone	Carbon Dioxide	Carbon Monoxide	Helium	Oxygen + Argon [3]	Methane	Nitrogen
Residential CHHSLs			**991,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Residential ESLs			**230,000**	**420**	**230,000**	**520,000**	**NA**	**310,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
GW/SV-20-5	5	05/30/12	<2.7	<7.4	<2.5	10	<2.5	<6.1	3.75	<0.5	<0.01	16.6	<0.5	79.6
GW/SV-20-10	10	05/30/12	<2.7	<7.4	<2.5	4.9	<2.5	<6.1	<0.5	<0.5	<0.01	21.9	<0.5	78.1
GW/SV-21-5	5	06/13/12	<2.7	<7.4	<2.5	8.7	<2.5	<6.1	<0.5	<0.5	<0.01	21.1	<0.5	78.4
GW/SV-21-10	10	06/13/12	<5.6	<15	<5.0	8.7	<5.0	<13	7.12	<0.5	<0.01	4.76	<0.5	84.8
GW/SV-22-5	5	05/30/12	<130	<340	<110	<200	<110	<280	10.7	<0.5	<0.01	4.52	28.1	56.6
GW/SV-22-10	10	05/30/12	<270	<740	<250	<440	<250	<610	15.9	<0.5	<0.01	2.2	35.2	46.6
GW/SV-22-10/Du	10	05/30/12	<270	<740	<250	<440	<250	<610	15.8	<0.5	<0.01	2.38	34.9	47
GW/SV-23-5	5	06/13/12	<2.7	<7.4	<2.5	9.1	<2.5	<6.1	0.939	<0.5	<0.01	21	<0.5	78
GW/SV-23-10	10	06/13/12	<2.7	<7.4	<2.5	40	<2.5	<6.1	1.23	<0.5	<0.01	14.4	1.43	82.9
GW/SV-23-10/Du	10	06/13/12	<8.7	<23	<7.8	29	<7.8	<20	1.14	<0.5	<0.01	16.1	6.18	76.5
GW/SV-24-5	5	06/13/12	<2.7	<7.4	<2.5	<4.4	<2.5	<6.1	0.866	<0.5	<0.01	20.9	<0.5	78.2
GW/SV-24-10	10	06/13/12	<2.7	<7.4	<2.5	9.3	<2.5	<6.1	3.56	<0.5	<0.01	18.5	<0.5	78
GW/SV-25-5	5	05/30/12	<2.7	8	2.8	18	<2.5	<6.1	9.96	<0.5	<0.01	5.64	3.61	80.8
GW/SV-25-10	10	05/30/12	<2.7	<7.4	<2.5	8.1	<2.5	<6.1	11.9	<0.5	<0.01	2.54	5.64	79.9
GW/SV-26-5	5	05/31/12	<2.7	<7.4	<2.5	<4.4	<2.5	<6.1	7.19	<0.5	<0.01	9.4	<0.5	83.4
GW/SV-26-10	10	05/31/12	<2.7	<7.4	<2.5	<4.4	<2.5	<6.1	6.78	<0.5	<0.01	9.89	<0.5	83.3
GW/SV-27-5	5	05/31/12	3.6	<7.4	<2.5	13	<2.5	<6.1	4.49	<0.5	<0.01	11.6	<0.5	83.9
GW/SV-27-10	10	05/31/12	<2.7	<7.4	<2.5	10	<2.5	<6.1	4.89	<0.5	<0.01	12.1	<0.5	83
GW/SV-28-5	5	05/31/12	<2.7	<7.4	<2.5	6.9	<2.5	<6.1	3.06	<0.5	0.0215	19.3	<0.5	77.7
GW/SV-28-10	10	05/31/12	<2.7	<7.4	<2.5	8.3	<2.5	<6.1	10.1	<0.5	<0.01	11.9	<0.5	78
GW/SV-29-5	5	05/31/12	7	30	8.6	64	4.2	8.4	<0.5	<0.5	<0.01	18	<0.5	82
GW/SV-29-10	10	05/31/12	<2.7	<7.4	<2.5	6.2	<2.5	<6.1	1.58	<0.5	<0.01	15.2	<0.5	83.2

Notes:

1. Soil vapor samples collected in batch-certified 1-liter summa canisters and analyzed by CalScience Environmental Laboratories, Inc. of Garden Grove, California using EPA Method TO-15.
2. Except for the target petroleum-based chemicals of potential concern (COPCs), only constituents detected in at least one sample are presented. A full list of analytes from EPA Method TO-15 is presented in the analytical laboratory reports.
3. Oxygen and Argon gasses are reported together because they convolute with each other and are difficult to separate in the laboratory testing. Typically, Argon is present in insignificant quantities.

Abbreviations:

ft bgs = feet below ground surface
< indicates that the compound was not detected at or above the laboratory reporting limit shown.
NA = Not Available
CHHSLs = California Human Health Screening Levels (CHHSLs) for volatile chemicals in soil vapor below residential buildings constructed without engineered fill below sub-slab gravel (California Environmental Protection Agency, 2005).
ESLs = Environmental Screening Levels for residential uses, Update for Sites with Impacted Soil and Groundwater, Regional Water Quality Control Board, San Francisco Bay, Table E-4 Shallow Soil Gas Screening Levels for Evaluation of Potential Vapor Intrusion Concerns, May 2008.

TABLE 7-2a
SUMMARY OF SOIL GAS SURVEY DATA - SOUTHERN PERIMETER (a)

Location: Along the southern perimeter of the Western Parcel from west to east.																
Parameter			Soil Gas Probe No.													
			SGP-1-5 (b)	SGP-1-15	SGP-2-5	SGP-2-15	SGP-3-5	SGP-3-15	SGP-4-5	SGP-4-15	SGP-5-5	SGP-5-15	SGP-6-5	SGP-6-15	SGP-7-5	SGP-7-15
	CHHSLs Residential Land Use	CHHSLs Commerical/Industrial Land Use														
Benzene	36.2	122	**220**	36	ND	ND	**53**	ND	**82**	ND	**77**	ND	**2,100**	ND	**76**	ND
	36.2	122	**430**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	980*	3,300**	780	ND	ND	**1,500**	ND	580	**990**	ND	220	ND	ND	110	ND	ND
	980*	3,300**	960	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	980*	3,300**	180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NLE	NLE	780	90	ND	580	ND	6,900	1,300	10,000	450	6,500	910	17,000	950	17,000
	NLE	NLE	150	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	4,000	13,400	ND	ND	60	410	3,400	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4,000	13,400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	NLE	NLE	80	ND	ND	ND	ND	5,900	640	ND	280	4,200	740	12,000	6,300	6,200
sec-Butylbenzene	NLE	NLE	ND	ND	ND	ND	1,600	ND	260	3,100	140	2,700	240	3,400	170	3,000
	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tert-Butylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	135,000	378,000	290	ND	ND	950	ND	ND	1,000	ND	ND	ND	ND	ND	ND	ND
	135,000	378,000	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	NLE	NLE	220	220	ND	130	ND	ND	ND	ND	150	ND	ND	ND	ND	ND
	NLE	NLE	190	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	NLE	NLE	50	ND	ND	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	319,000	887,000	50	300	ND	5,200	ND	ND	3,230	ND	150	ND	ND	190	60	ND
	319,000	887,000	1,040	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	319,000	887,000	180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTES:
(a) All units in micrograms per cubic meter (ug/m3).
(b) SGP-1-5 = soil gas probe - probe number - depth in feet below ground surface.
(c) ND = Not detected at or above parameter's respective analytical detection level.
(d) D = Duplicate.
NLE = no level established.
* RWQCB Region 2; Environmental Screening Level, lowest residential.
** RWQCB Region 2; Environmental Screening Level, lowest commercial/industrial.

TABLE 7-2b

SUMMARY OF SOIL GAS SURVEY DATA - WESTERN PERIMETER (a)

Location: Along Gundry Avenue immediately west of the Western Parcel.

Parameter			Soil Gas Probe No.														
	CHHSLs Residential Land Use	CHHSLs Commerical/Industrial Land Use	Gdy-1-5 (b)	Gdy-1-15	Gdy-2-5	Gdy-2-15	Gdy-3-5	Gdy-3-15	Gdy-4-5	Gdy-4-15	Gdy-5-5	Gdy-5-15	Gdy-6-5	Gdy-6-15	Gdy-7-5	Gdy-7-15	Gdy-7-15 (c)
Benzene	36.2	122	89	ND	ND	ND	ND	ND	51	ND	ND	ND	ND	ND	ND	ND	NA
Cyclohexane	NLE	NLE	NA(e)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260
Ethylbenzene	980*	3,300**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Isopropylbenzene	NLE	NLE	100	9,200	ND	630	ND	1,100	ND	1,900	ND	ND	ND	ND	ND	16,000	NA
	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
MTBE	4,000	13,400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
n-Propylbenzene	NLE	NLE	ND	570	ND	ND	ND	670	ND	1,200	ND	ND	ND	ND	ND	5,900	NA
sec-Butylbenzene	NLE	NLE	ND	2,300	ND	1,800	580	3,000	ND	3,900	ND	2,100	ND	ND	ND	2,800	NA
	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Tert-Butylbenzene	NLE	NLE	ND	510	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Toluene	135,000	378,000	250	ND	ND	ND	ND	ND	280	510	93	ND	ND	ND	ND	820	NA
1,2,4-Trimethylbenze	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
1,3,5-Trimethylbenze	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Xylenes	319,000	887,000	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA

NOTES:

(a) All units in micrograms per cubic meter (ug/m3).

(b) Gdy-1-5 = Gundry Avenue - probe number - depth in feet below ground surface.

(c) EPA TO-15 analysis

(d) ND = Not detected at or above parameter's analytical detection level.

(e) NA = Not analyzed

(f) D = Duplicate sample.

* RWQCB Region 2; Environmental Screening Level, lowest residential

** RWQCB Region 2; Environmental Screening Level, lowest commercial/industrial

TABLE 7-2c

SUMMARY OF SOIL GAS SURVEY DATA - EASTERN PERIMETER(a)

Location: Along Walnut Avenue immediately west of the Western Parcel										
Parameter			Soil Gas Probe Number							
	CHHSLs Residential Land Use	CHHSLs Commerical/Industrial Land Use	Wnt-1-5 (b)	Wnt-1-15	Wnt-1-15 (c)	Wnt-2-5	Wnt-2-15	Wnt-3-5	Wnt-3-15	Wnt-4-5
Benzene	36.2	122	43	ND	6	ND	ND	51	ND	ND
Cyclohexane	NLE	NLE	ND	ND	68	ND	ND	ND	ND	ND
cis-1,2-Dichloroethane	NLE	NLE	ND	ND	39	ND	ND	ND	ND	ND
1,1-Dichloroethane	1,500	5,100	ND	ND	3	ND	ND	ND	ND	ND
1,2-Dichloroethane	94	3,100	ND	ND	4	ND	ND	ND	ND	ND
Ethylbenzene	980*	3,300**	61	ND	21	ND	1,600	ND	620	260
Heptane	NLE	NLE	ND	ND	34	ND	ND	ND	ND	ND
Isopropylbenzene	NLE	NLE	ND	75	ND	23,000	ND	280	81,000	ND
MTBE	4,000	13,400	ND	ND	ND	ND	47,000	ND	ND	ND
n-Propylbenzene	NLE	NLE	ND	ND	ND	2,200	8,700	ND	17,000	ND
Propylene	NLE	NLE	ND	ND	190	ND	ND	ND	ND	ND
sec-Butylbenzene	NLE	NLE	ND	ND	ND	1,300	1,800	ND	8,900	ND
Tert-Butylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	630	ND
Toluene	135,000	378,000	150	88	290	840	600	130	740	130
1,1,1-Trichloroethane	NLE	NLE	ND	ND	33	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	319,000	887,000	255	130	26	ND	ND	ND	ND	960

NOTES:

(a) All units in micrograms per cubic meter (ug/m3).

(b) Wnt-1-5 = Walnut Avenue - probe number - depth in feet below ground surface.

(c) EPA TO-15 analysis

(d) ND = Not detected at or above parameter's analytical detection level.

(e) NA = Not analyzed

NLE = no level established

* RWQCB Region 2; Environmental Screening Level, lowest residential

** RWQCB Region 2; Environmental Screening Level, lowest commercial/industrial

TABLE 7-2d

SUMMARY OF SOIL GAS SURVEY DATA - NORTHERN PERIMETER (a)

Parameter			Soil Gas Probe Number							
	CHHSLs Residential Land Use	CHHSLs Commercial/Industrial Land Use	Hill-1-5 (b)	Hill-1-15	Hill-2-15	Hill-2-15	Hill-3-5	Hill-3-15	Hill-4-5	Hill-4-15
Benzene	36.2	122	50	ND	ND	ND	86	ND	ND	ND
Ethylbenzene	980*	3,300**	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	4,000	13,400	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
Tert-Butylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	135,000	378,000	180	ND	ND	68	250	130	ND	ND
	135,000	378,000	ND	ND	ND	69	ND	ND	ND	ND
1,2,4-Trimethylbenzene	NLE	NLE	ND	ND	ND	110	ND	ND	ND	ND
	NLE	NLE	ND	ND	ND	99	ND	ND	ND	ND
1,3,5-Trimethylbenzene	NLE	NLE	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	319,000	887,000	ND	ND	ND	ND	120	ND	ND	ND

NOTES:

(a) All units in micrograms per cubic meter (ug/m3).

(b) Hill-1-5 = Hill Street - probe number - depth in feet below ground surface.

(c) ND = Not detected at or above parameter's respective analytical detection level.

NLE = no level established.

* RWQCB Region 2; Environmental Screening Level, lowest residential.

** RWQCB Region 2; Environmental Screening Level, lowest commercial/industrial.

TABLE 7-3
ANALYTICAL RESULTS FOR OFF SITE SOIL GAS SURVEY (a) - SOUTH OF SITE

Location: Adjacent to southern perimeter, off-site, along Wesley Drive															
Parameter			Soil Gas Probe No. - Depth below ground surface in feet (b)												
			SGP-WD-1-5 (b)	SGP-WD-2-5	SGP-WD-2-5	SGP-WD-2-10	SGP-WD-3-5	SGP-WD-3-10	SGP-WD-4-5	SGP-WD-4-10	SGP-WD-4-10	SGP-WD-5-5	SGP-WD-5-10	SGP-WD-6-5	SGP-WD-6-10
	CHHSLs Residential Land Use	CHHSLs Commerical/Industrial Land Use			EPA TO-15						EPA TO-15				
Acetone	NLE (c)	NLE	ND (d)	ND	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	NLE	NLE	ND	ND	52	ND	ND	ND	ND	ND	ND	D	ND	ND	ND
Benzene	36.2	122	**56(39)**	47(DUP 47)(e)	47	ND	ND	ND	ND	ND	ND	39	ND	71	53
Chlorobenzene	NLE	NLE	**ND**	ND	180	ND	ND	ND	ND	ND	2,500	ND	ND	ND	ND
Ethylbenzene	NLE	NLE	**ND**	ND	81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NLE	NLE	ND	ND	ND	62	ND	4,900	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	NLE	NLE	ND	ND	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	4,000	13,400	ND	ND	ND	150	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	NLE	NLE	ND	ND	ND	ND	ND	1,500	ND	510	ND	ND	ND	ND	ND
Toluene(1V)	135,000	378,000	77	ND	NA (f)	ND	ND	ND	ND	ND	NA	ND	ND	200	ND
Toluene 1V (3V)(7V)	135,000	378,000	77(160)(140)	160(DUP 160)	170	71	ND	ND	66	530	ND	130	ND	ND	130
1,1,1-Trichloroethane	NLE	NLE	100	350(DUP 340)	250	50	ND	ND	270	ND	ND	380	ND	420	170
Xylenes -m,p	319,000	887,000	ND	130(DUP 120)	120	ND	ND	ND	ND	ND	ND	ND	ND	100	ND
Xylenes -o	315,000	879,000	ND	ND	43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (ug/L; C4-C12)			ND (50)	ND (50)		99	5,400	5,300	380	9,100		180	160	ND(50)	100

NOTES:
(a) All units in micrograms per cubic meter (ug/m3).
(b) SGP-WD-1-5 = soil gas probe - Wesley Drive- probe number - depth in feet below ground surface.
(c) NLE = No level established.
(d) ND = Not detected at or above parameter's respective analytical detection level.
(e) DUP = Duplicate.
(f) NA = Not analyzed.

Legend

- Monitoring Well
- Soil Gas Probe (TEC, 2009 and 2010)
- Soil, Soil Gas, and Grab Goundwater Sampling Locations (Geosyntec, 2012)

NOTE:
Approximate locations of monitoring well and soil gas probes from Testa Environmental Corporation's (TEC) June 2011 Report on Phase II and Phase III Additional Site Characterization

N

0 300 600 Feet

Soil, Soil Gas, and Grab Groundwater Sampling Locations

Former Chemoil Refinery
2020 Walnut Avenue, Signal Hill, CA

Geosyntec consultants

Figure 2

WA 1617 | July 2012

P:\GIS\Chemoil\Project\2012Jun_InvRep\Figure2.mxd

Figure 1 - Phase I and II Boring Locations, Former Chemoil Refinery, Signal Hill, California

APPENDIX J

ROST™ LOGS, 2006 INVESTIGATION

FUGRO GEOSCIENCES, INC.

13049 East Florence Avenue
Santa Fe Springs, CA 90670
Phone : 562-903-0055
Fax: 562-903-9005

June 8, 2006
Report Number: 0303-1309

Tetra Tech, Inc.
348 W. Hospitality Lane
Suite 100
San Bernadino, California 92408

Attn.: Mr. Ben Weink

DATA REPORT
PIEZOCONE PENETRATION AND
RAPID OPTICAL SCREENING TOOL TESTING
SIGNAL HILL, CALIFORNIA

Dear Mr. Weink:

Fugro Geosciences (Fugro) is pleased to present this data report for Cone Penetration (CPT) and Rapid Optical Screening Tool (ROST™) testing at the above-referenced site. CPT/ROST™ provided continuous characterization of stratigraphy and petroleum hydrocarbon distribution at the testing locations. A description of the CPT and ROST™ technologies and a discussion of general ROST™ data interpretation follows. CPT and ROST™ logs and electronic data CD are included as attachments.

Cone Penetration Testing

CPT was performed simultaneously with each ROST™ sounding and yielded real-time stratigraphic data. CPT is a proven method for rapidly evaluating the physical characteristics of unconsolidated soils. It is based on the resistance to penetration of an electronically-instrumented cone which is continuously advanced into the subsurface. In accordance with ASTM Standard D5778-95, the cone was advanced at a rate of two centimeters per second with the driving force provided by hydraulic rams.

The CPT cone used at this site had an apex angle of 60 degrees with a base area of 15 square centimeters (cm^2), and friction sleeve with a surface area of 200 cm^2. The standard geotechnical sensors within the cone measure tip resistance and sleeve friction in tons per square foot (TSF). The combined data from the tip resistance and sleeve friction form the basis of the soil classification (e.g., sand, silt, clay, etc.).

Soil stratigraphy was identified using Campanella and Robertson's Simplified Soil Behavior Chart. Please note that because of the empirical nature of the soil behavior chart, the soil identification should be verified locally.

ROST™ Testing

Fugro Geosciences' ROST™ Laser-Induced Fluorescence system was used for this investigation to screen soils for petroleum hydrocarbon materials containing aromatic hydrocarbon constituents. The system consists of a tunable laser mounted in the CPT truck that is connected to a down-hole sensor. The down-hole sensor consists of a small diameter sapphire window mounted flush with the side of the cone penetrometer probe.

The laser and associated equipment transmit 50 pulses of light per second to the sensor through a fiber optic cable. The wavelength of the pulsed excitation light is tunable and can be set to wavelengths of 266 nanometers (nm) or to wavelengths between 280 and 300 nm. An excitation wavelength of 290 nm was used for each test during this project.

The laser light passes through the sapphire window and is absorbed by aromatic hydrocarbon molecules in contact with the window, as the probe is advanced. This addition of energy (photons) to the aromatic hydrocarbons causes them to fluoresce. A portion of the fluorescence emitted from any encountered aromatic constituents is returned through the sapphire window and conveyed by a second fiber optic cable to a detection system within the CPT rig. The emission data resulting from the pulsed laser light is averaged into one reading per one second interval (approximately one reading per 2 cm vertical interval) and is recorded continuously. ROST™ may be operated in single or multi-wavelength mode, depending on project objectives. For this project, ROST™ was operated in multi-wavelength mode (MWL).

Multi-Wavelength Mode (MWL). In MWL mode, several characteristics of the emitted fluorescence are measured and recorded simultaneously at four (4) specific wavelengths (340, 390, 440, and 490 nm). These four wavelengths represent the spectrum of fluorescence typically produced by aromatic hydrocarbons ranging from light fuels through heavy contaminants such as coal tar and creosote. The recorded data is then presented as a color graph of fluorescence intensity (the combined fluorescence of all four monitored wavelengths) versus depth (FVD).

On the FVD graph, each of the four monitored wavelengths is assigned a color. These colors are combined based on the proportional fluorescence intensity of each of the individual wavelengths. The combined color is then used on the FVD graph. Changes in color on the FVD graph typically represent changes in product type. Similarly, like colors on the FVD graph typically represent the same product, regardless of the total fluorescence intensity. Changes in the total fluorescence intensity typically indicate changes in contaminant concentration, with higher fluorescence intensities representing proportionally higher concentrations when compared to lower fluorescence intensities.

In addition to the FVD graph, depth specific waveforms are presented at four (4) selected depths throughout the sounding. These waveform graphs are presented to the right of the FVD graph on each plot. In the waveform graphs, the fluorescence intensity and duration of fluorescence of each of the monitored wavelengths is represented by an individual peak, starting at 340 nm and increasing in 50 nm wavelengths as you move to the right. The intensity of each wavelength is represented by the height of the peaks, and the duration of fluorescence is represented by the width of each peak. For general interpretation purposes, lighter aromatic hydrocarbon molecules will emit fluorescence at the shorter wavelengths, and heavier, longer chained hydrocarbons will emit fluorescence at the longer wavelengths. The presented waveforms can be compared to waveforms typical of common hydrocarbon products to determine the likely product type that has been encountered. Please note that the waveforms are available at every two centimeter interval throughout the entire sounding. Additional waveforms can be generated at any time during or after testing is complete.

Reference Solution. The fluorescence intensity of a reference solution placed on the sapphire window was measured immediately prior to conducting each test. This reference solution measurement serves two purposes. First, as a quality control check, the solution is used to ensure that the performance of the system is within specifications. Second, it allows for normalization of the data from different test locations for variation in laser power, operating conditions, and monitored emission

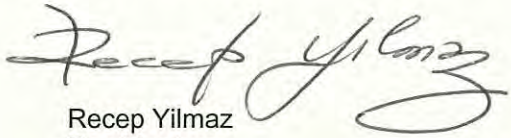
wavelength. The reference solution used for this project was the standard M1 reference, which is a proprietary PHC containing solution. M1 provides consistent fluorescence response across the portion of the spectrum analyzed by ROST and therefore, allows the fluorescence data collected to be consistently normalized to intensities recorded as a percentage of M1.

LIMITATIONS OF ENVIRONMENTAL SUBSURFACE WORK

Fugro Geosciences' report is based upon our observations made during field work, the information provided to Fugro and the results of the ROST/CPT survey. Given the inherent limitation of environmental subsurface work, Fugro cannot guarantee that the site is free of hazardous or potentially hazardous materials or conditions or that latent or undiscovered conditions will not become evident in the future. Fugro's report was prepared in accordance with our proposal and the General Conditions agreed to between Fugro and Client and no warranties, representations, or certifications are made.

Fugro Geosciences, Inc. appreciates the opportunity to be of service to your organization. Please do not hesitate to contact us if we can be of further assistance. We look forward to working with you in the future.

Sincerely,
FUGRO GEOSCIENCES, INC.



Recep Yilmaz
President

RY/jm

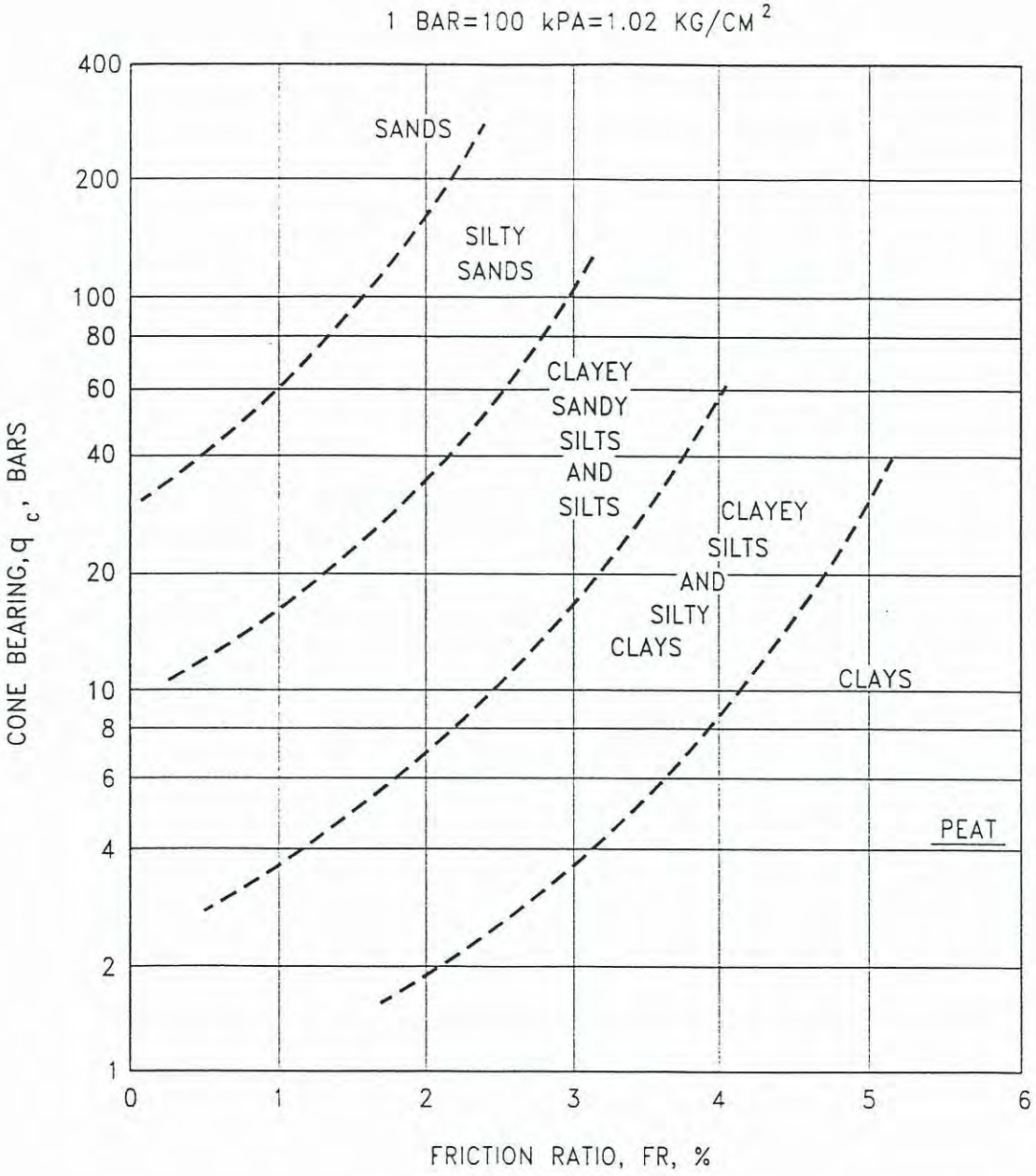
Enclosure: - 1 CD

KEY TO SOIL BEHAVIOR TYPE

SAND AND SANDY SOIL

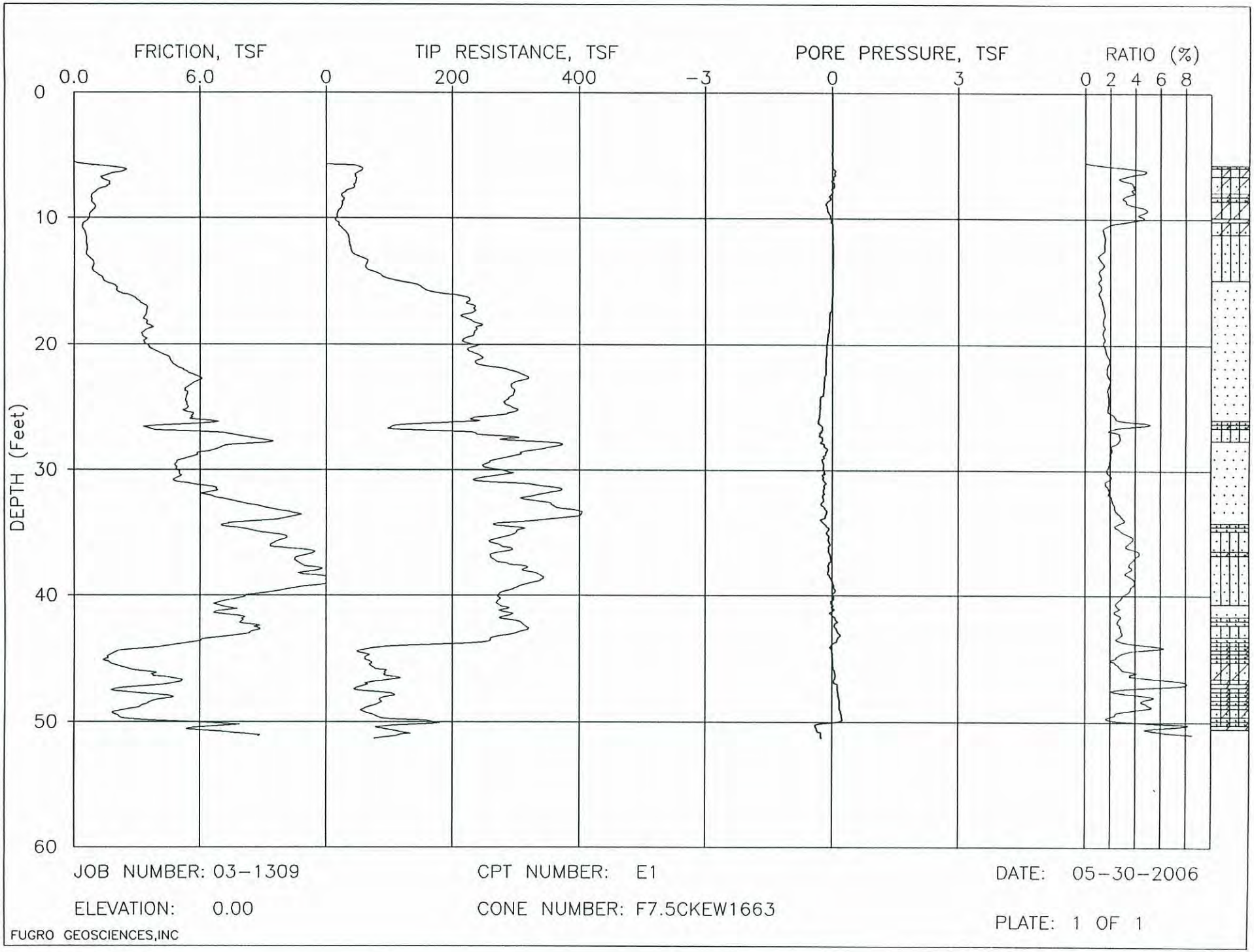
CLAY AND CLAYEY SOIL

SILT AND SILTY SOIL



MODIFIED CAMPANELLA AND ROBERTSON SOIL BEHAVIOR CHART (1983)

CPT LOGS



JOB NUMBER: 03−1309

CPT NUMBER: E1

DATE: 05−30−2006

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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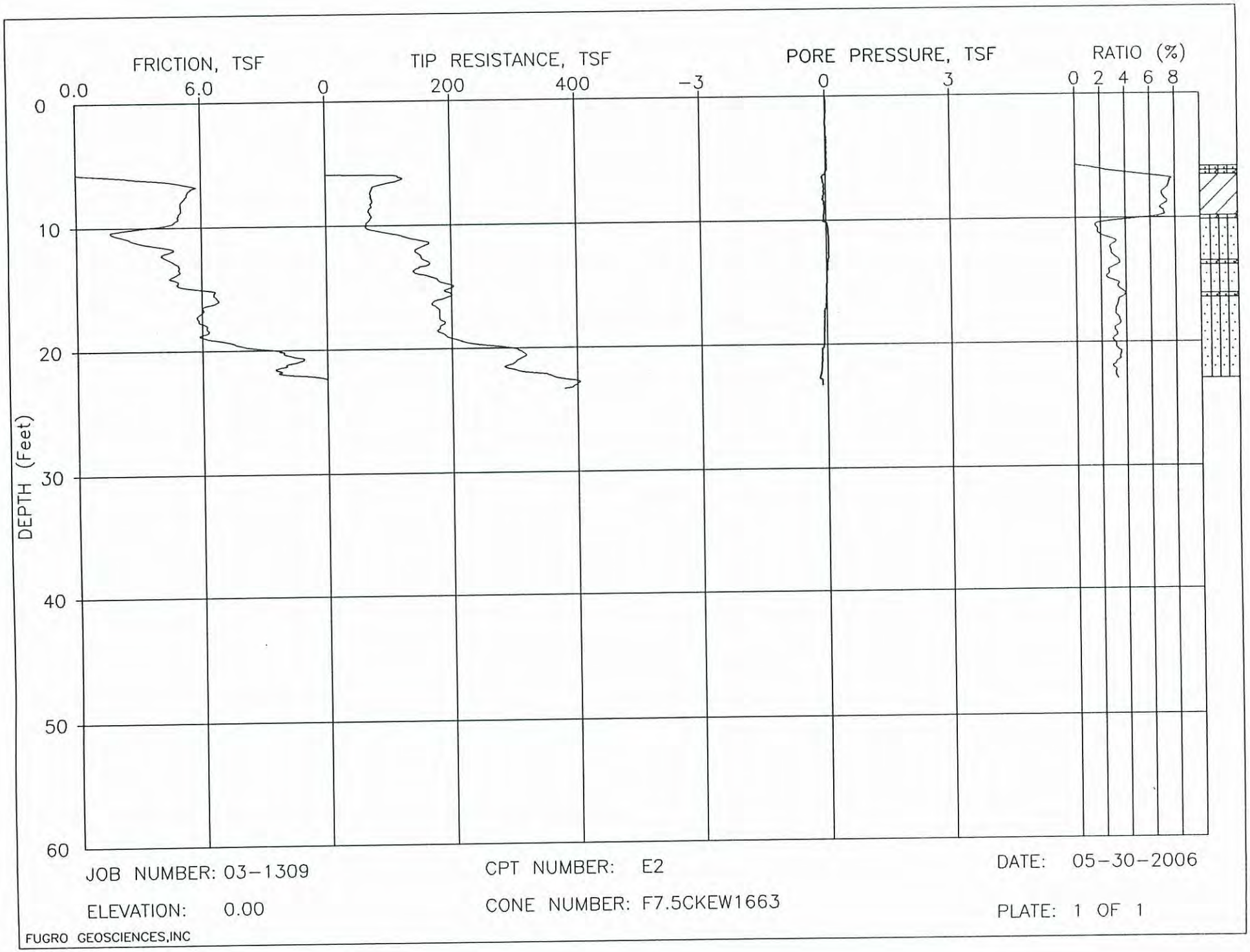
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6.0
TIP RESISTANCE, TSF
0
200
400
PORE PRESSURE, TSF
−3
0
3
RATIO (%)
0
2
4
6
8
DEPTH (Feet)
0
10
20
30
40
50
60
JOB NUMBER: 03−1309
ELEVATION: 0.00
CPT NUMBER: E2
CONE NUMBER: F7.5CKEW1663
DATE: 05−30−2006
PLATE: 1 OF 1
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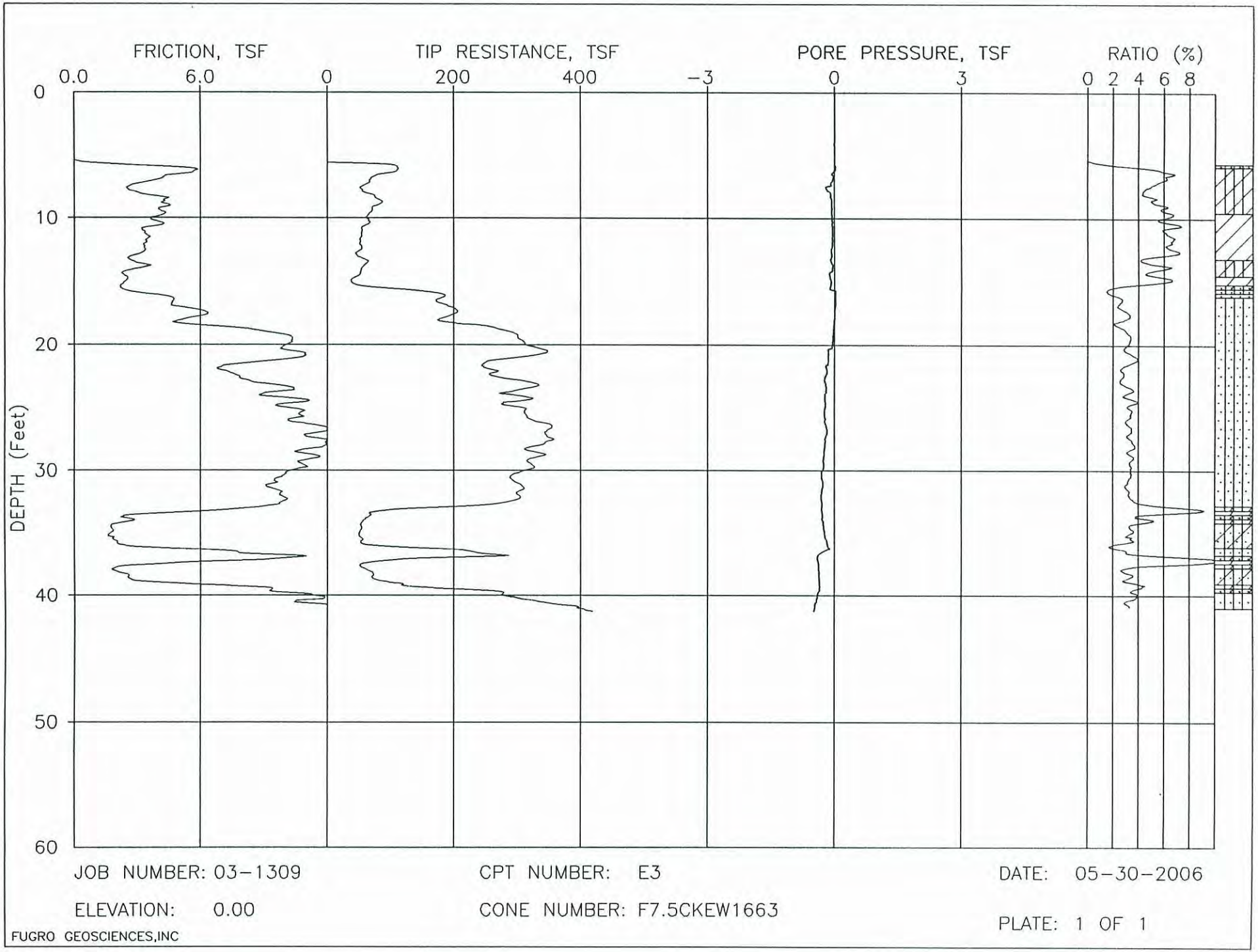

JOB NUMBER: 03−1309

CPT NUMBER: E3

DATE: 05−30−2006

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CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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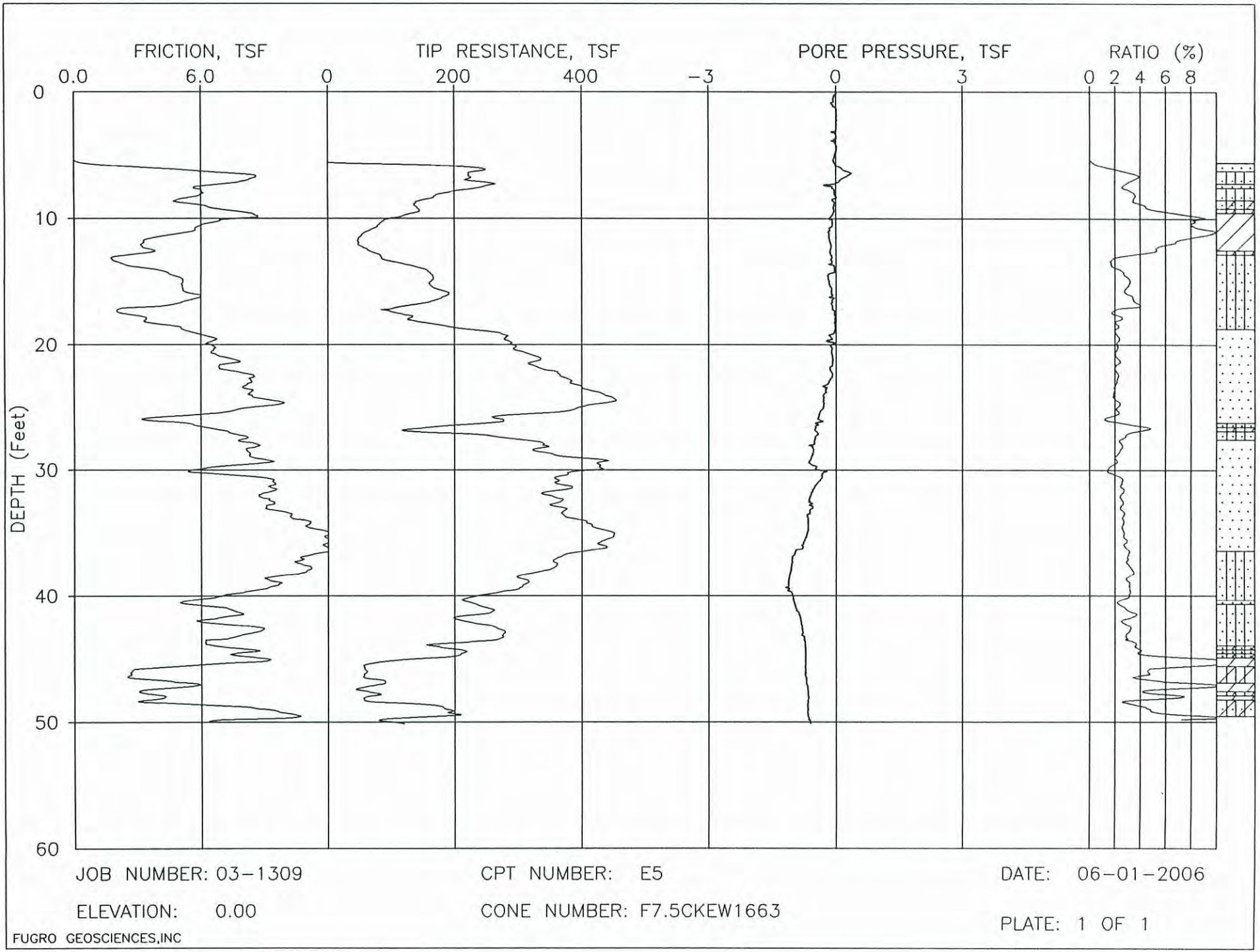

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CPT NUMBER: E5

DATE: 06−01−2006

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CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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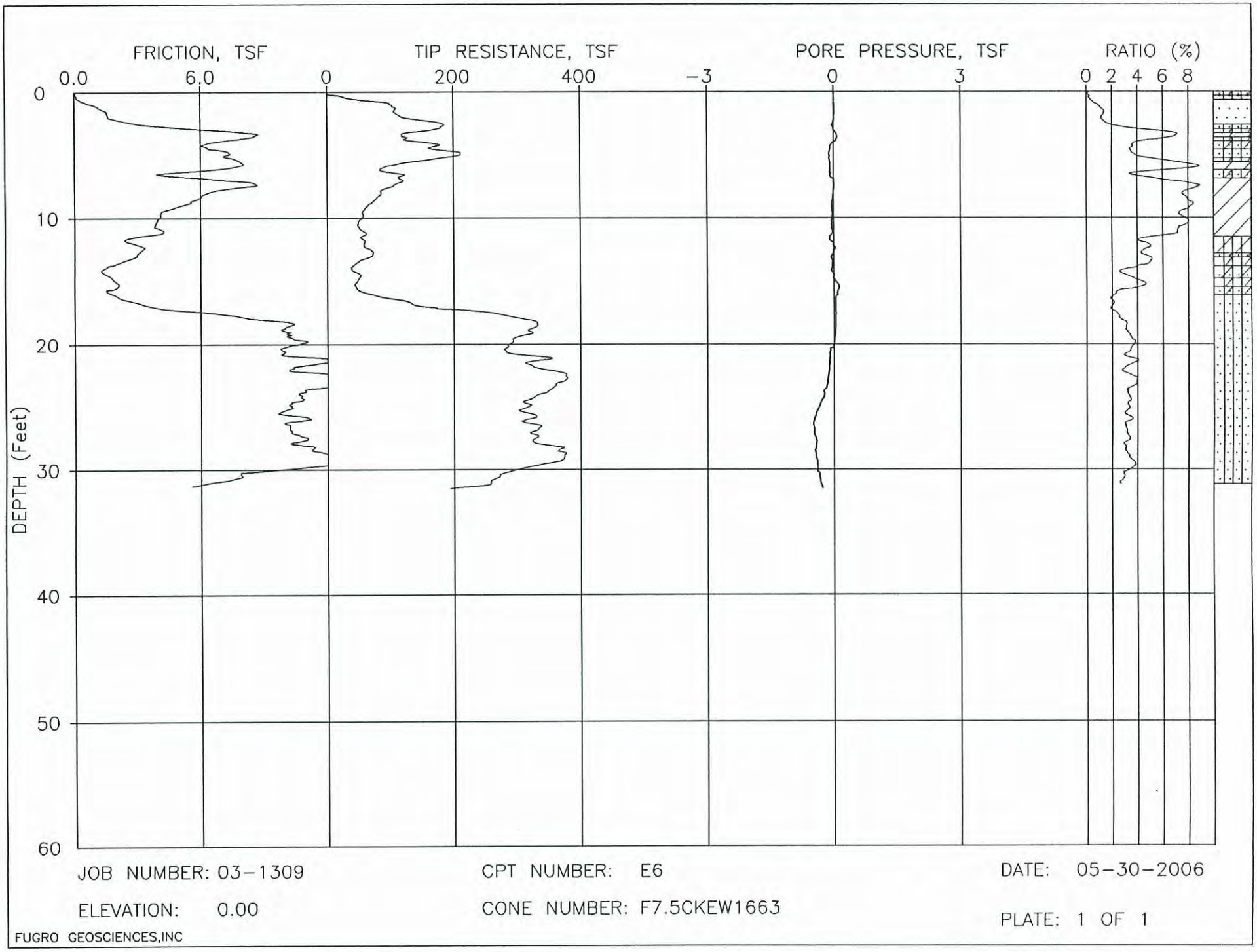

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CPT NUMBER: E6

DATE: 05−30−2006

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CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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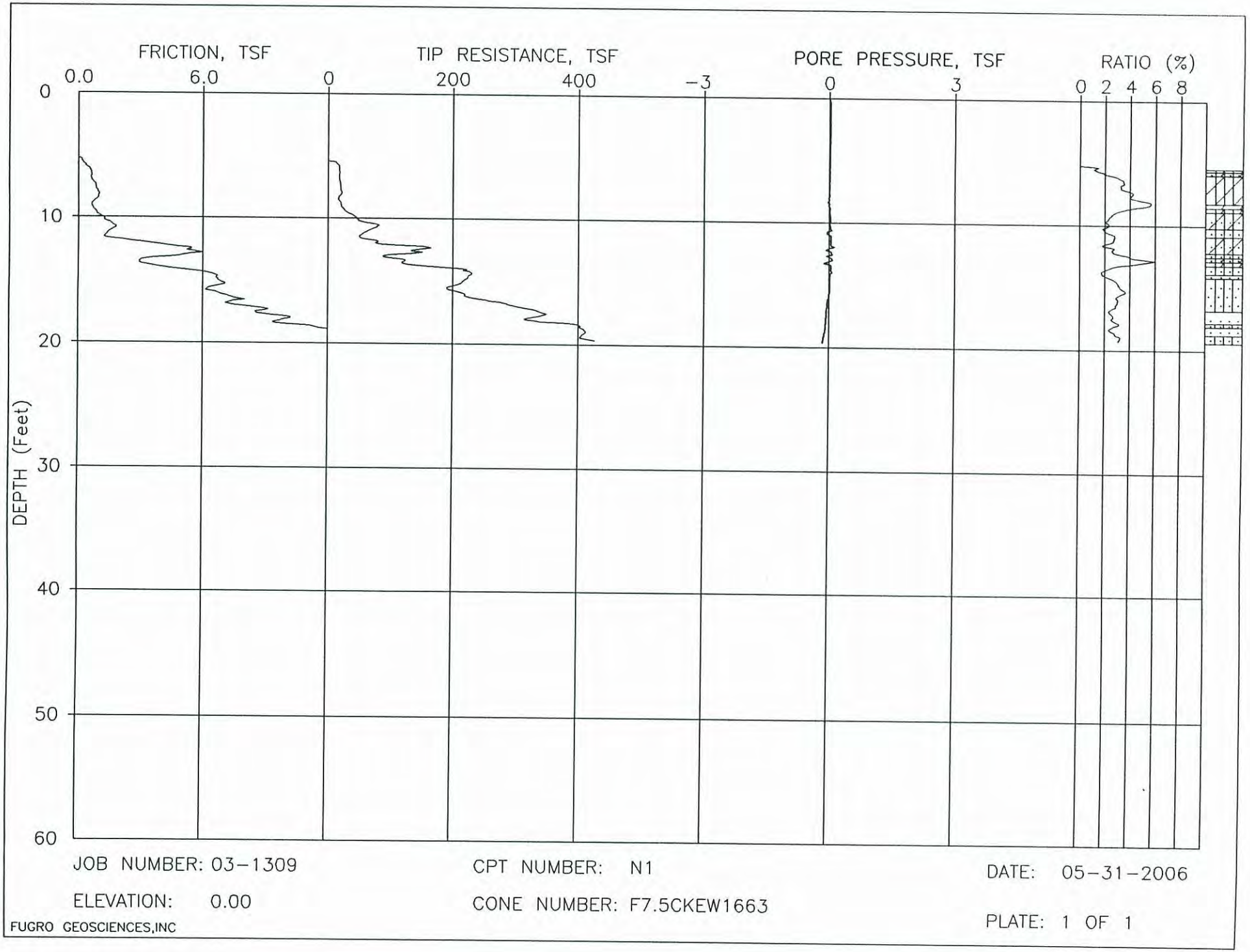

JOB NUMBER: 03−1309

CPT NUMBER: N1

DATE: 05−31−2006

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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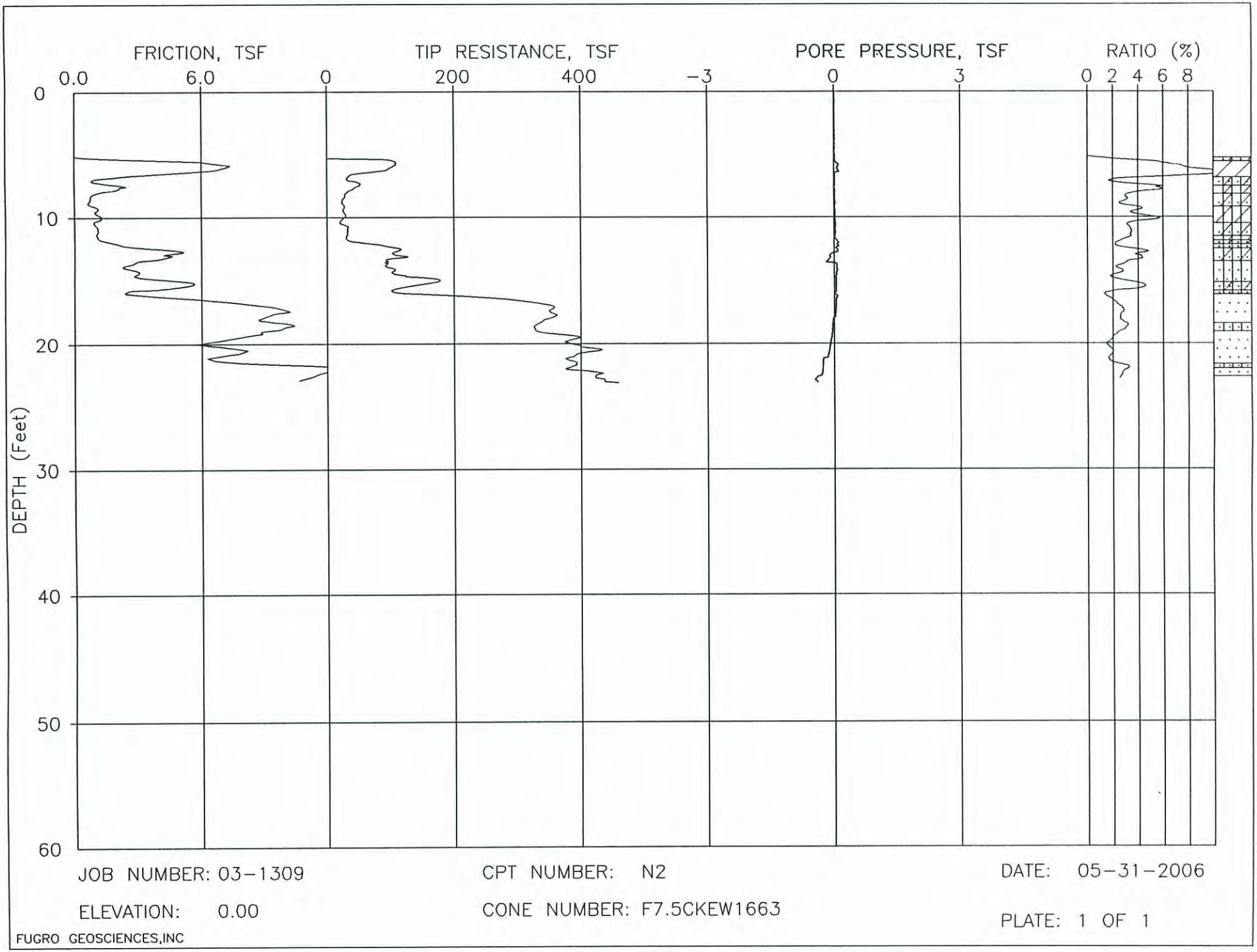

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CPT NUMBER: N2

DATE: 05−31−2006

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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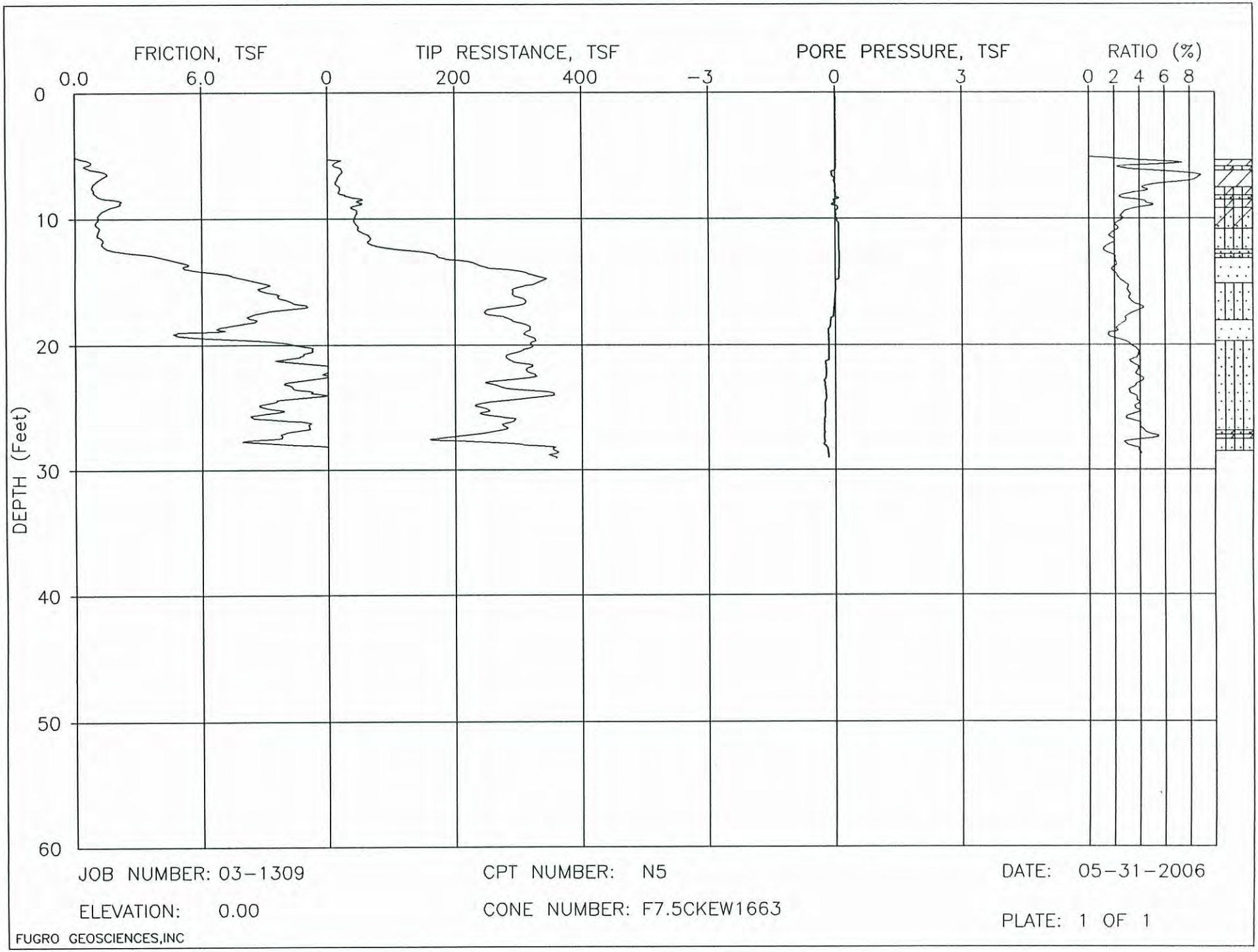

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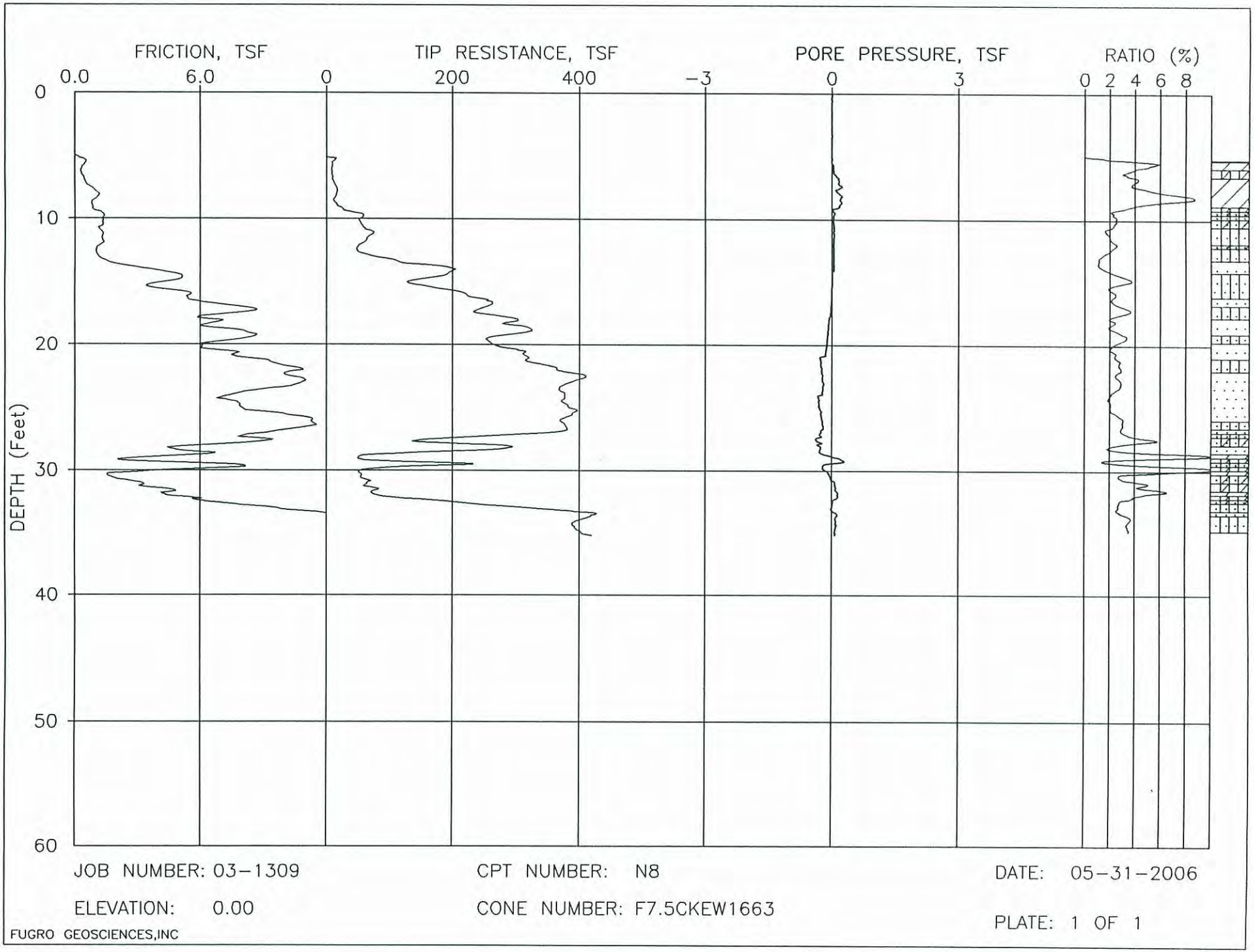

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PLATE: 1 OF 1

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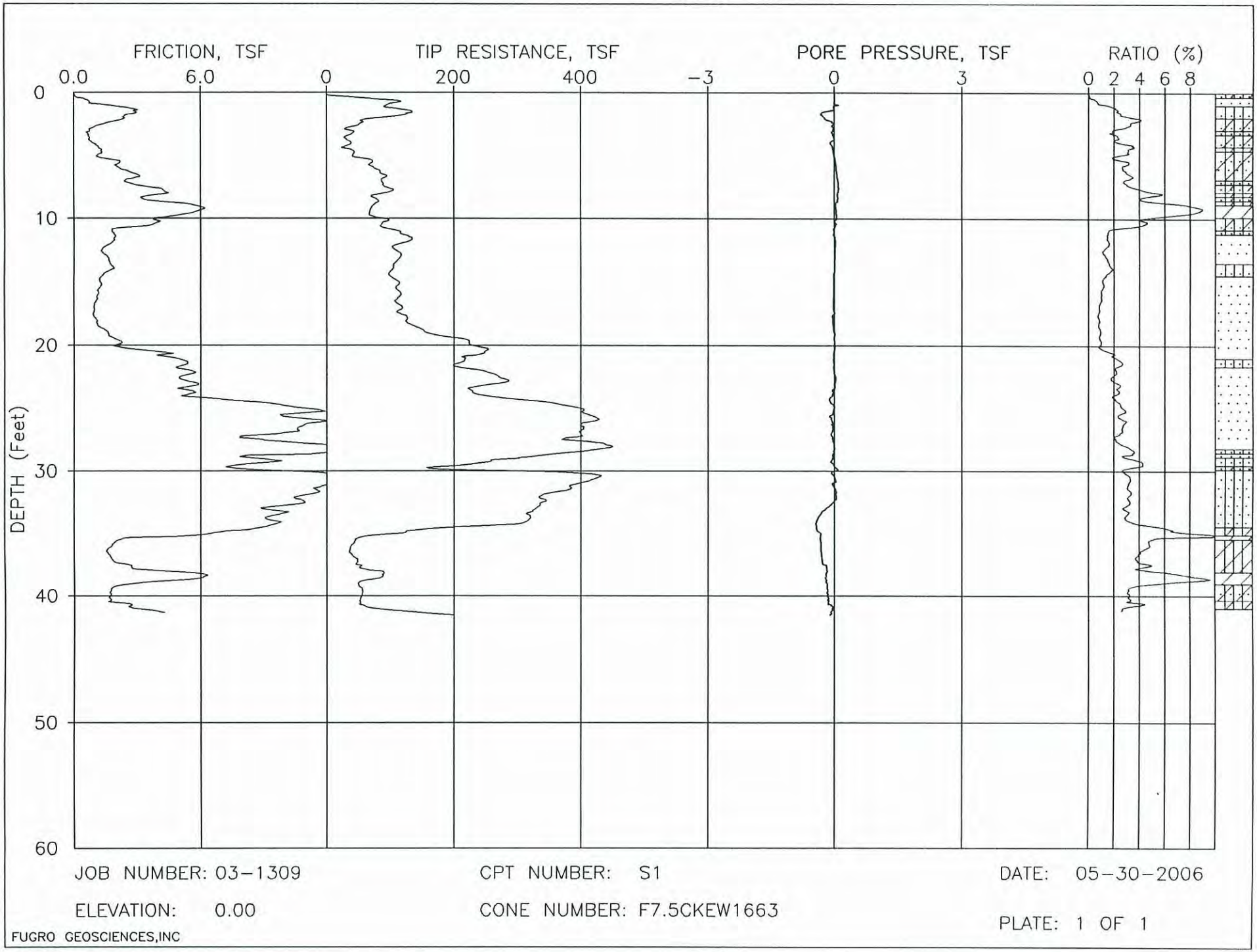

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PLATE: 1 OF 1

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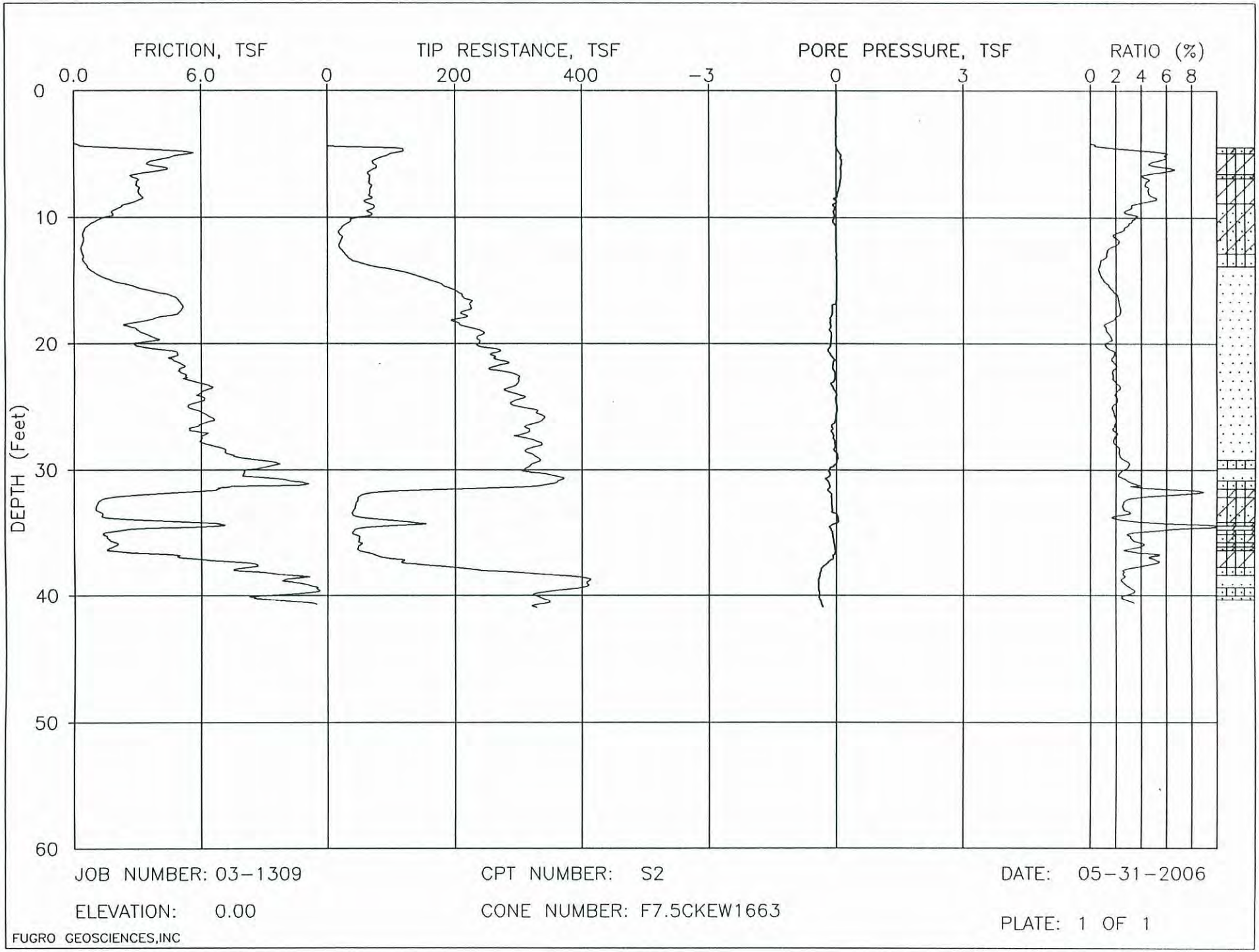

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CPT NUMBER: S2

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ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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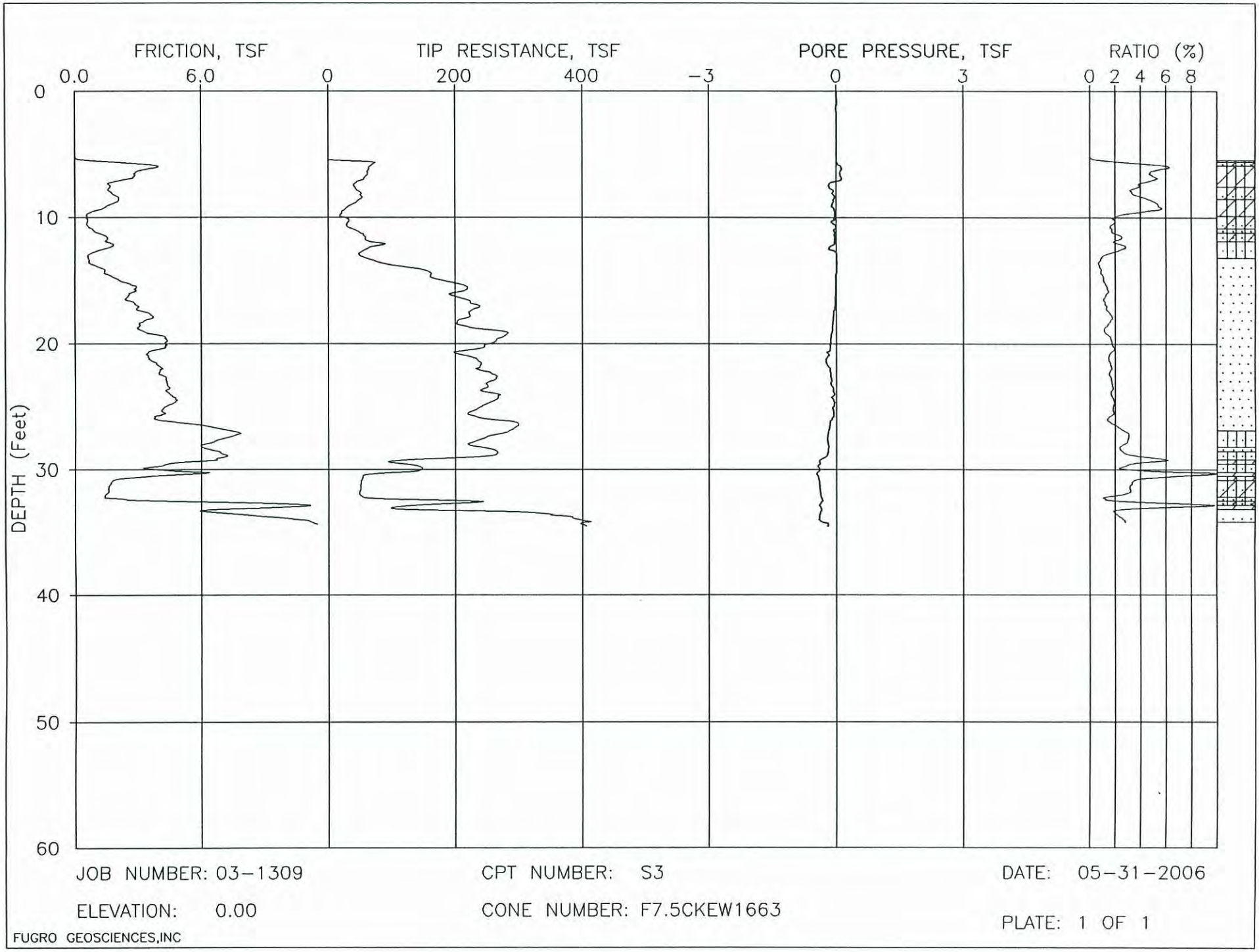

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CPT NUMBER: S3

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PLATE: 1 OF 1

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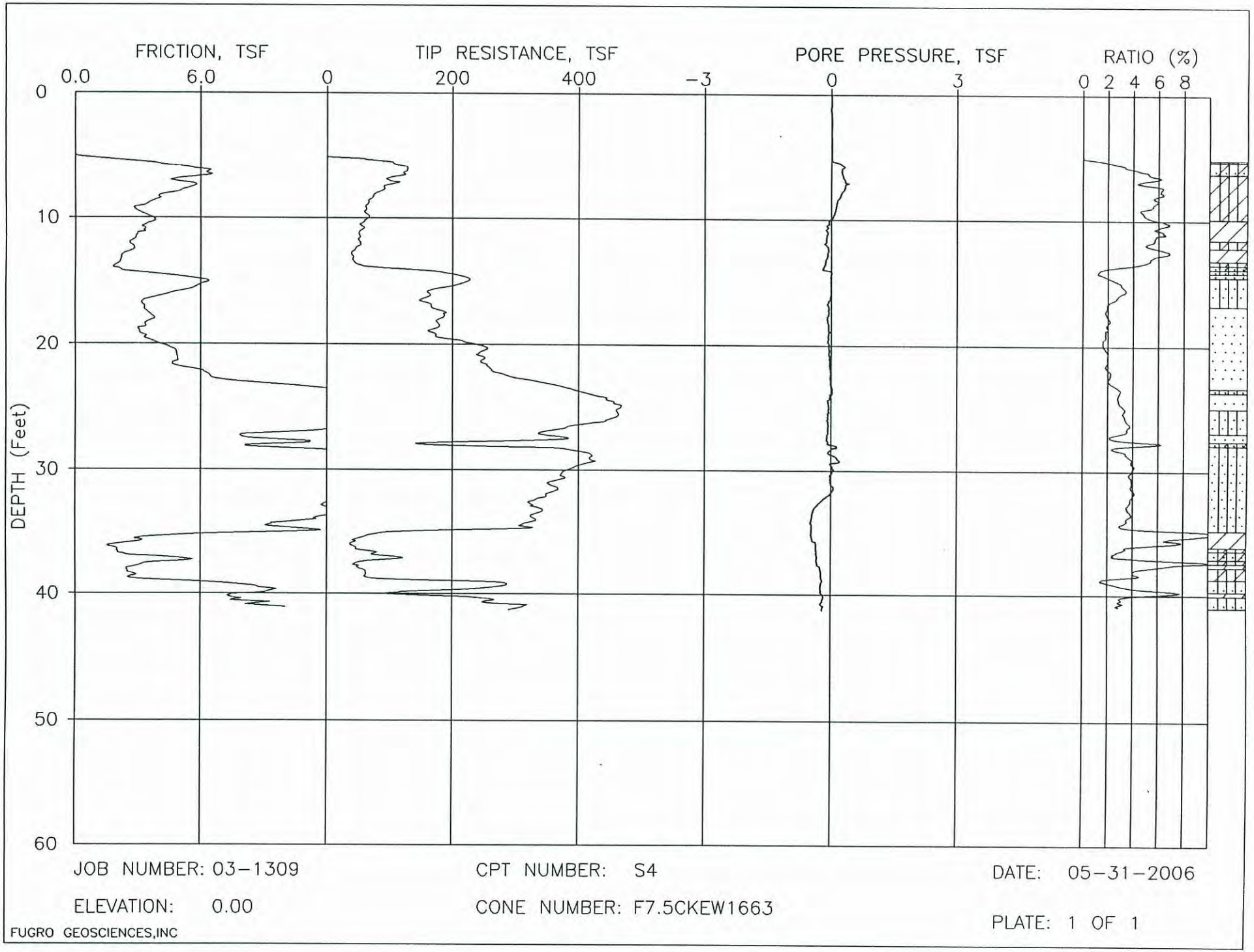

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CPT NUMBER: S4

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PLATE: 1 OF 1

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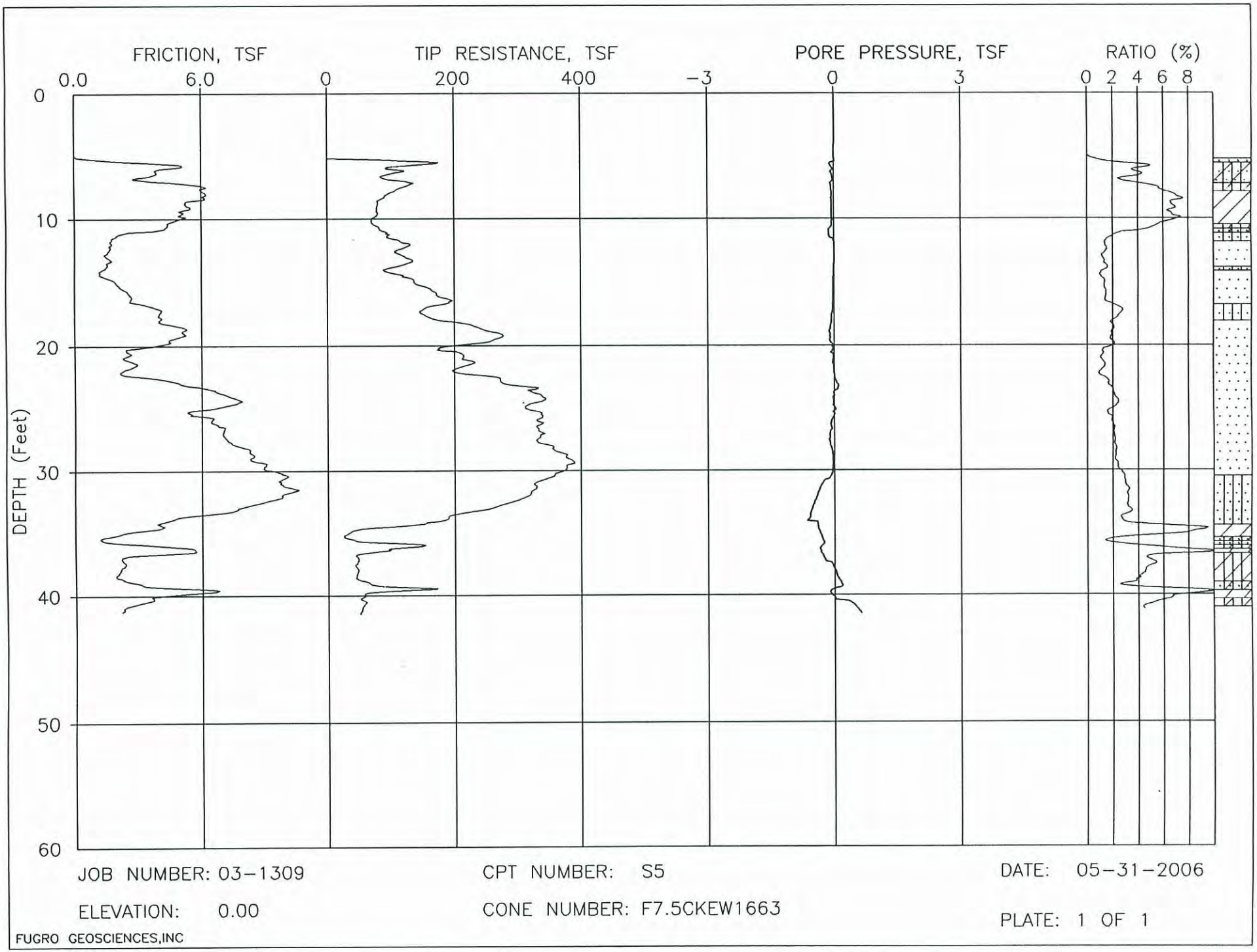


JOB NUMBER: 03−1309

CPT NUMBER: S5

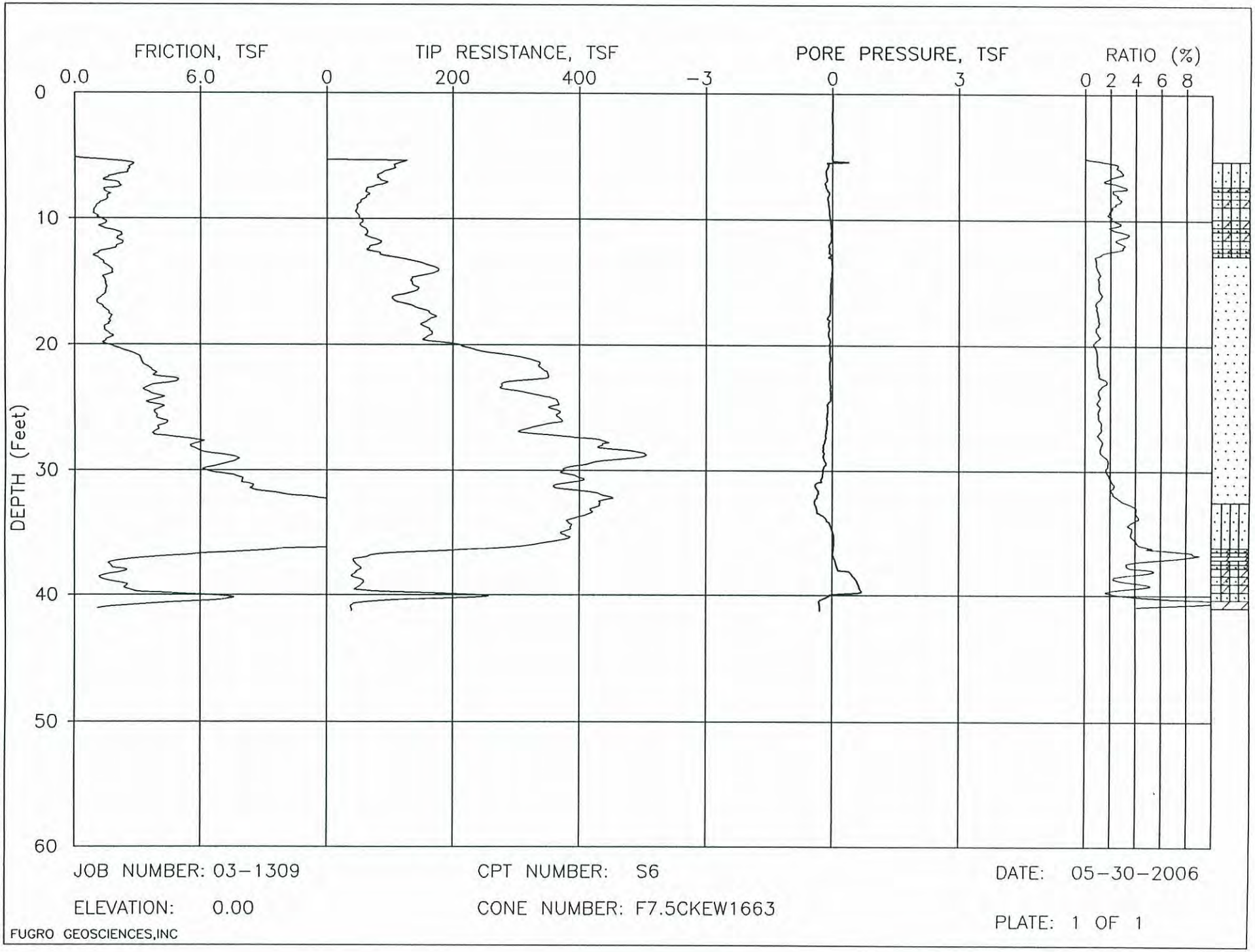
DATE: 05−31−2006

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 03−1309

CPT NUMBER: S6

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ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

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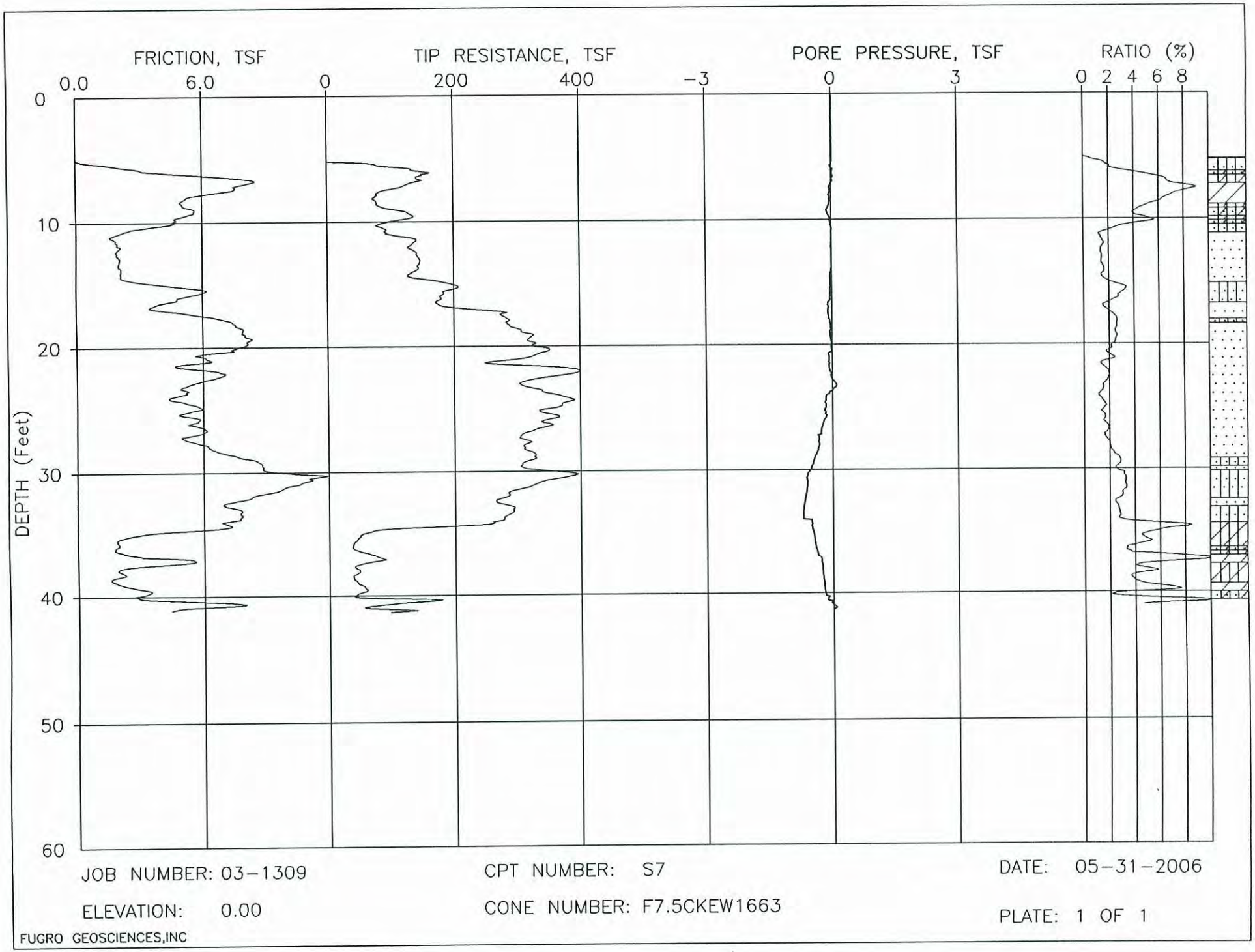

JOB NUMBER: 03−1309

CPT NUMBER: S7

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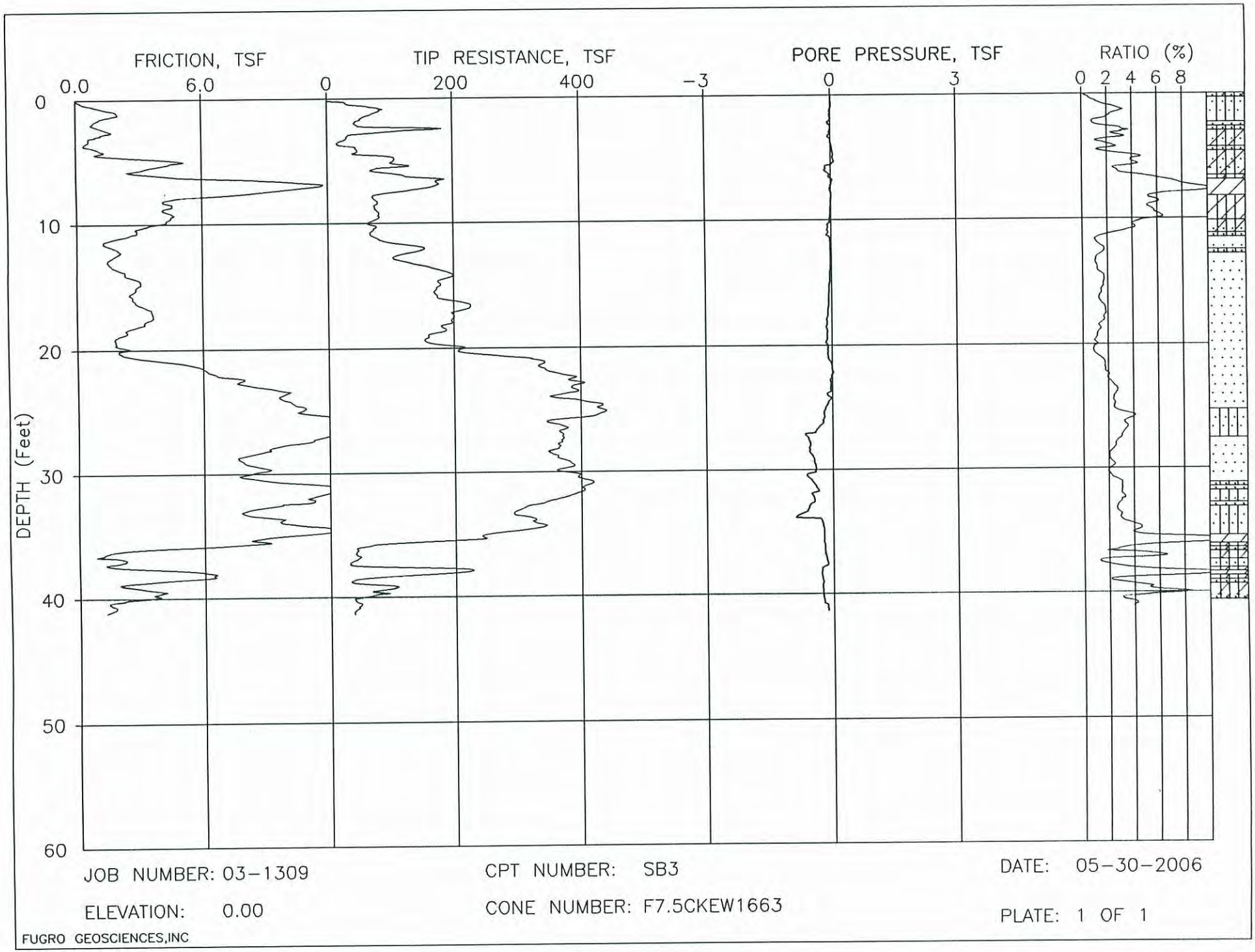
CONE NUMBER: F7.5CKEW1663

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 03−1309

ELEVATION: 0.00

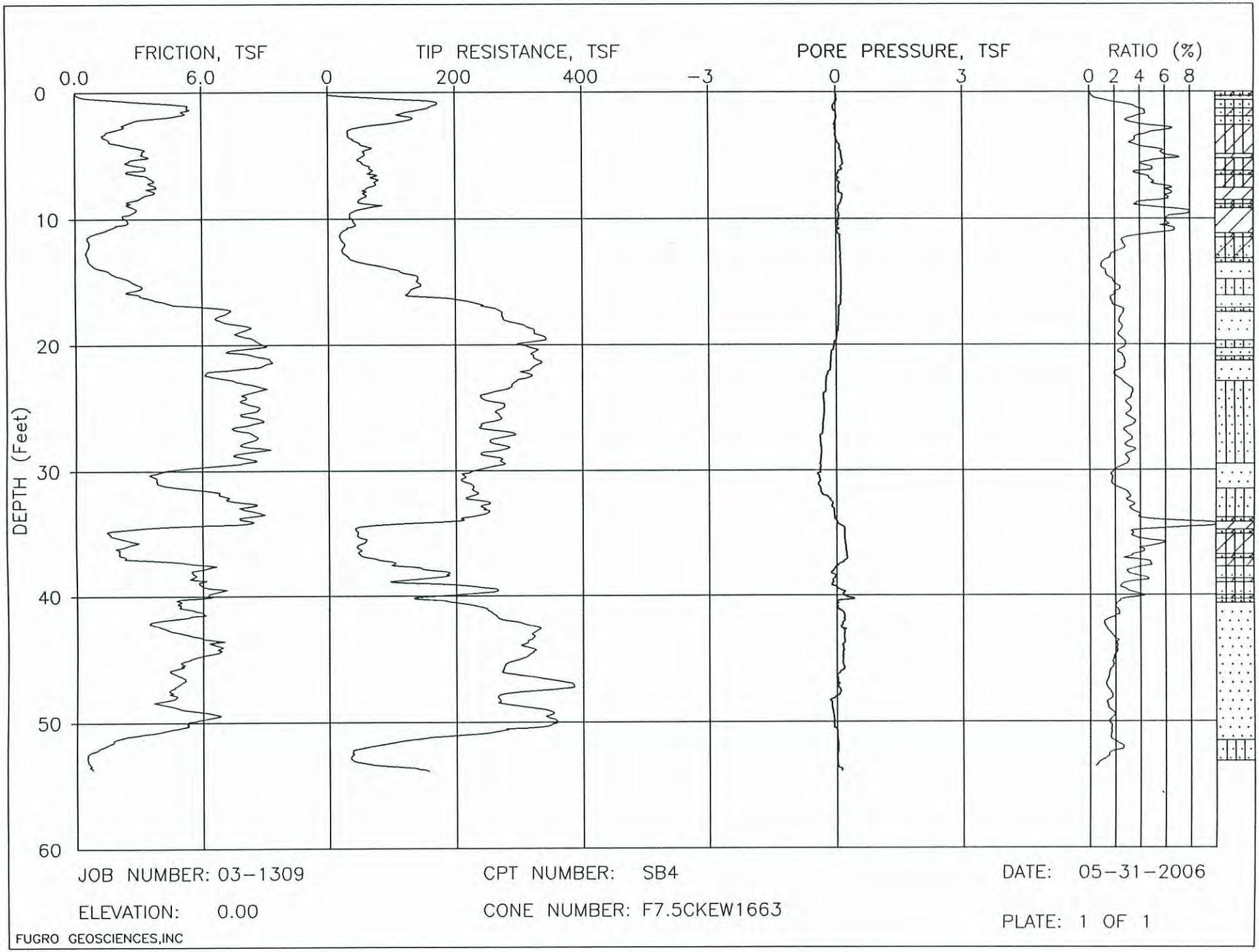
CPT NUMBER: SB3

CONE NUMBER: F7.5CKEW1663

DATE: 05−30−2006

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 03−1309

CPT NUMBER: SB4

DATE: 05−31−2006

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1663

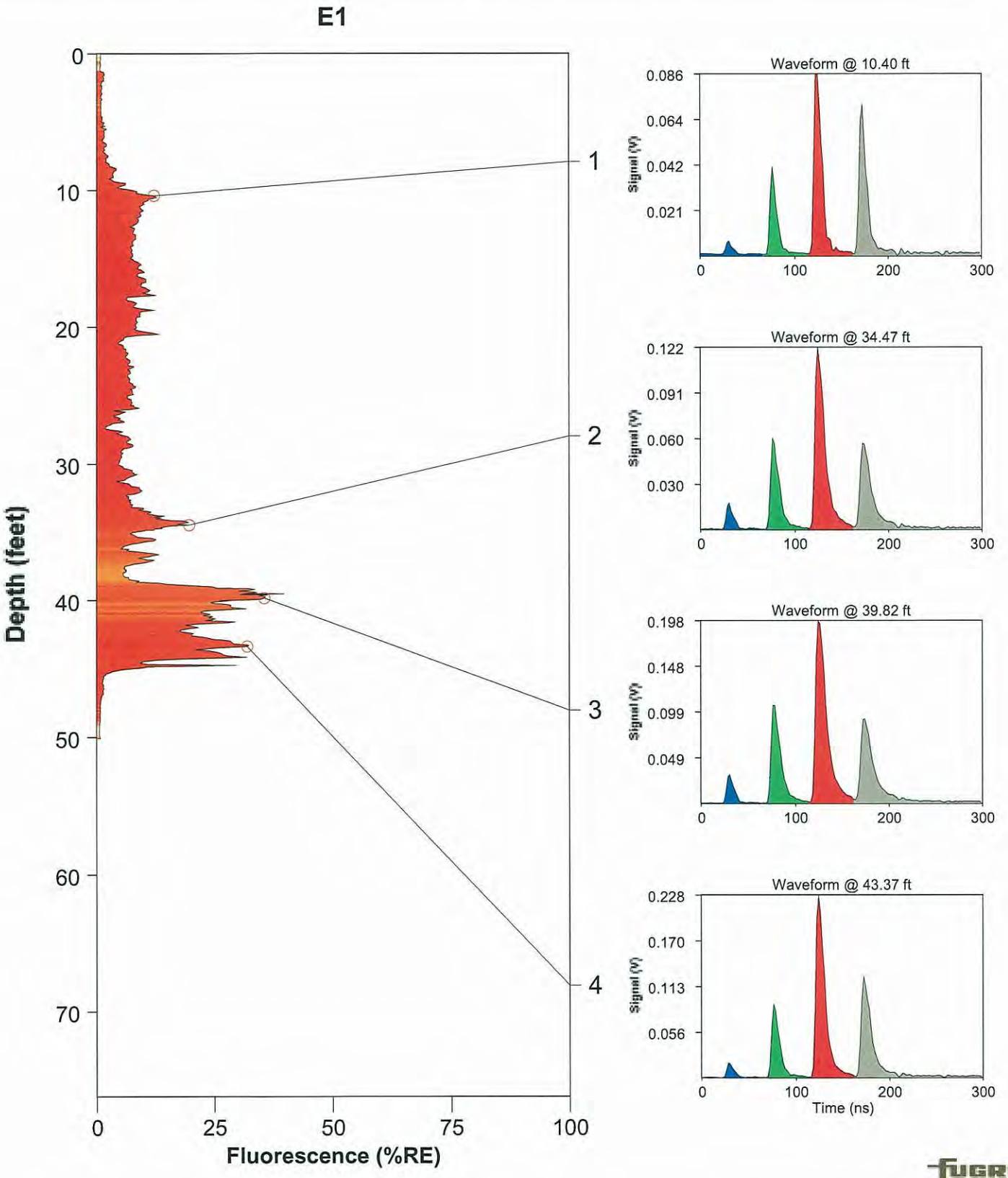
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

ROST™ LOGS

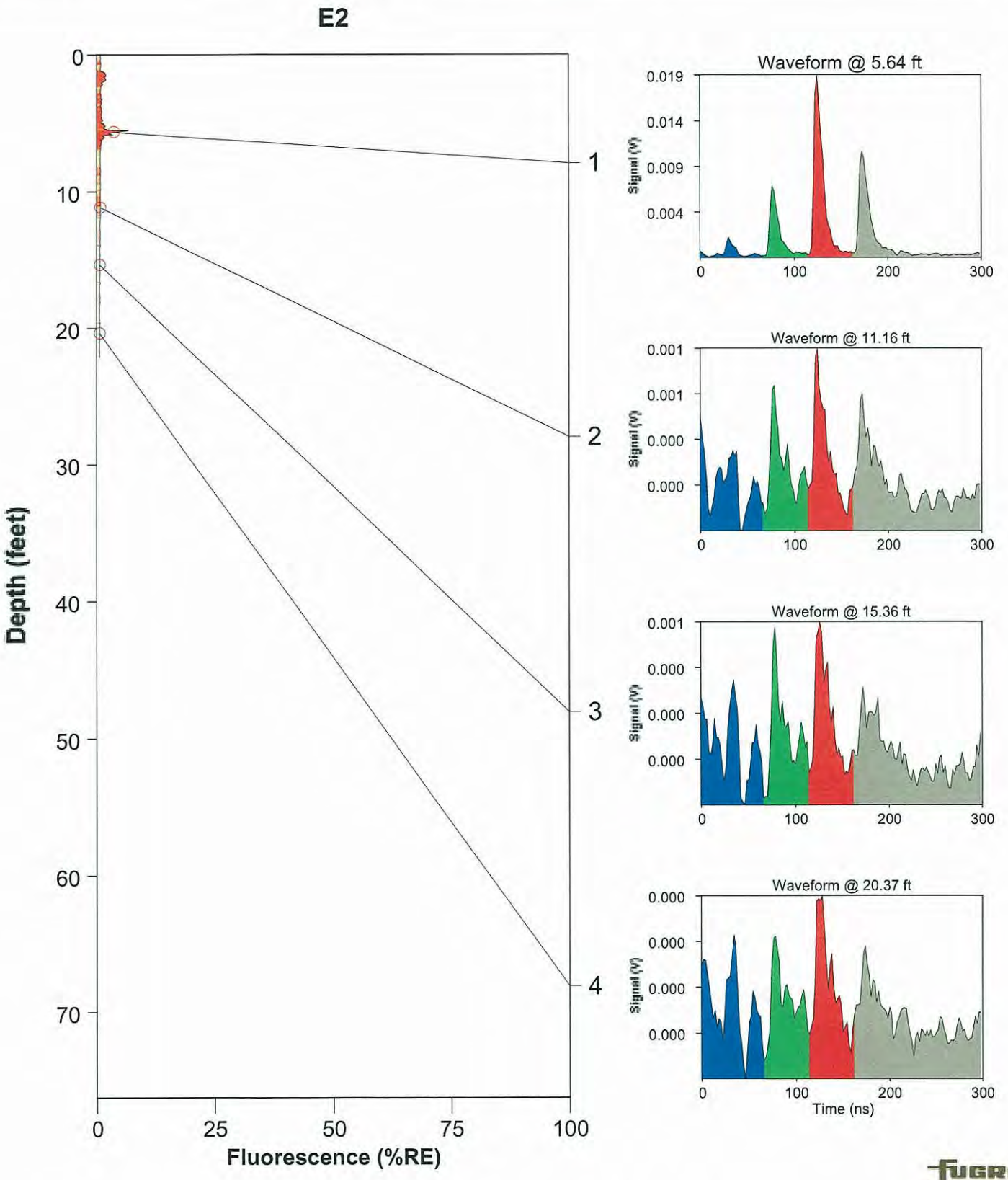
ROST Fluorescence Response Data

Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 1:05:53 PM	Max fluorescence: 39.70% @ 39.51 ft
ROST Unit: 1	Final depth BGS: 50.08 ft



ROST Fluorescence Response Data

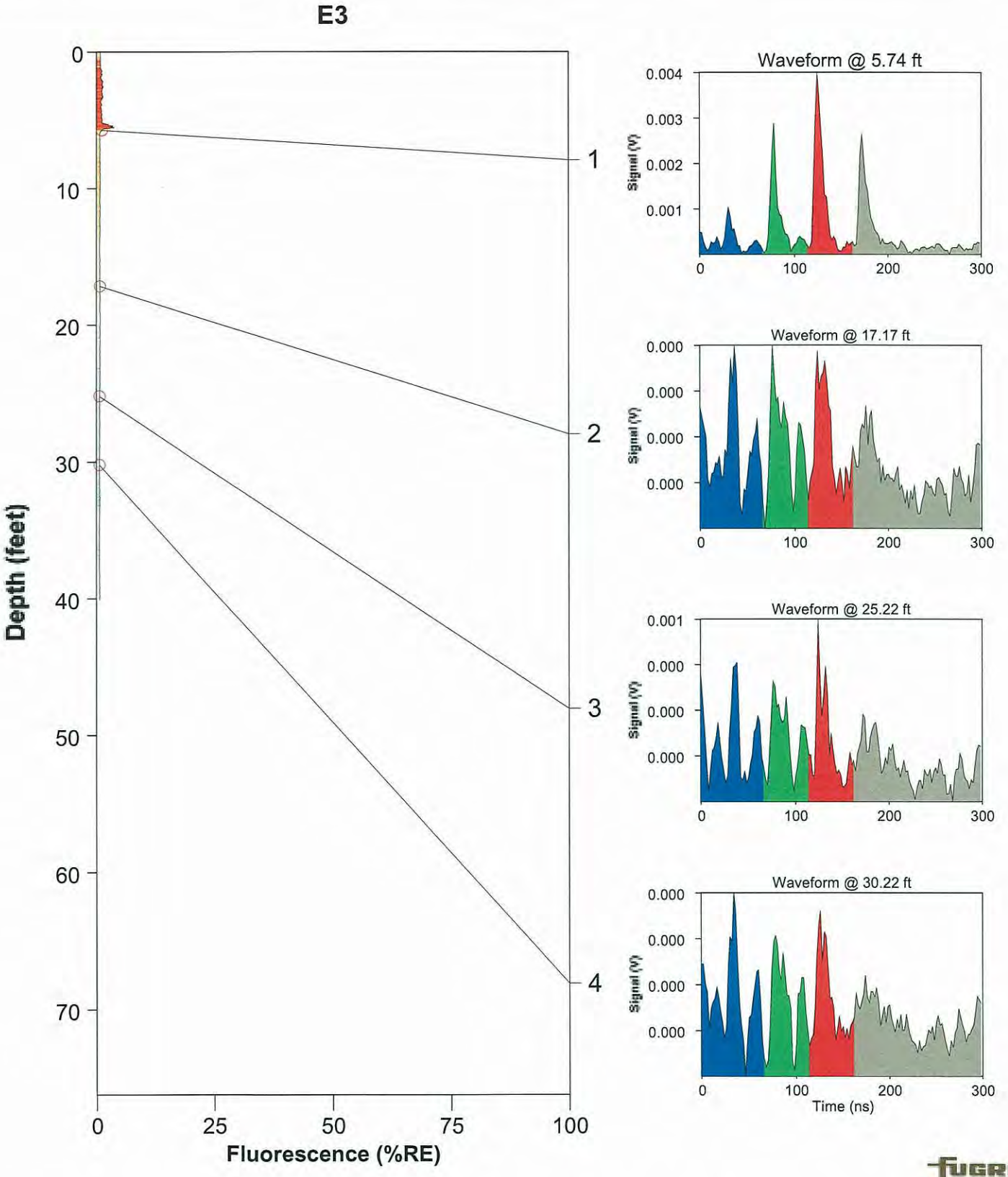
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 2:14:20 PM	Max fluorescence: 6.69% @ 5.54 ft
ROST Unit: 1	Final depth BGS: 22.12 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

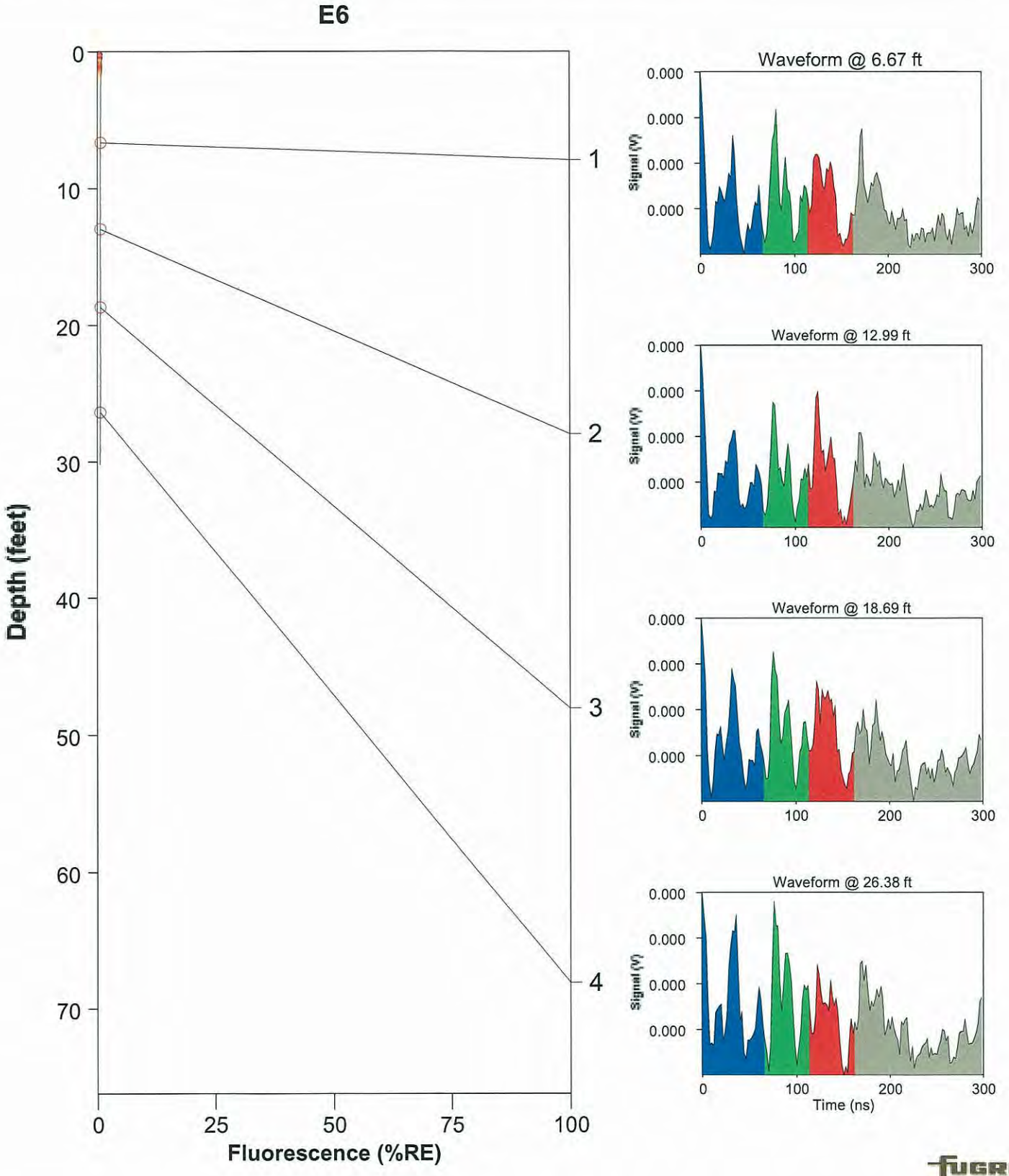
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 11:28:18 AM	Max fluorescence: 3.71% @ 5.53 ft
ROST Unit: 1	Final depth BGS: 40.08 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

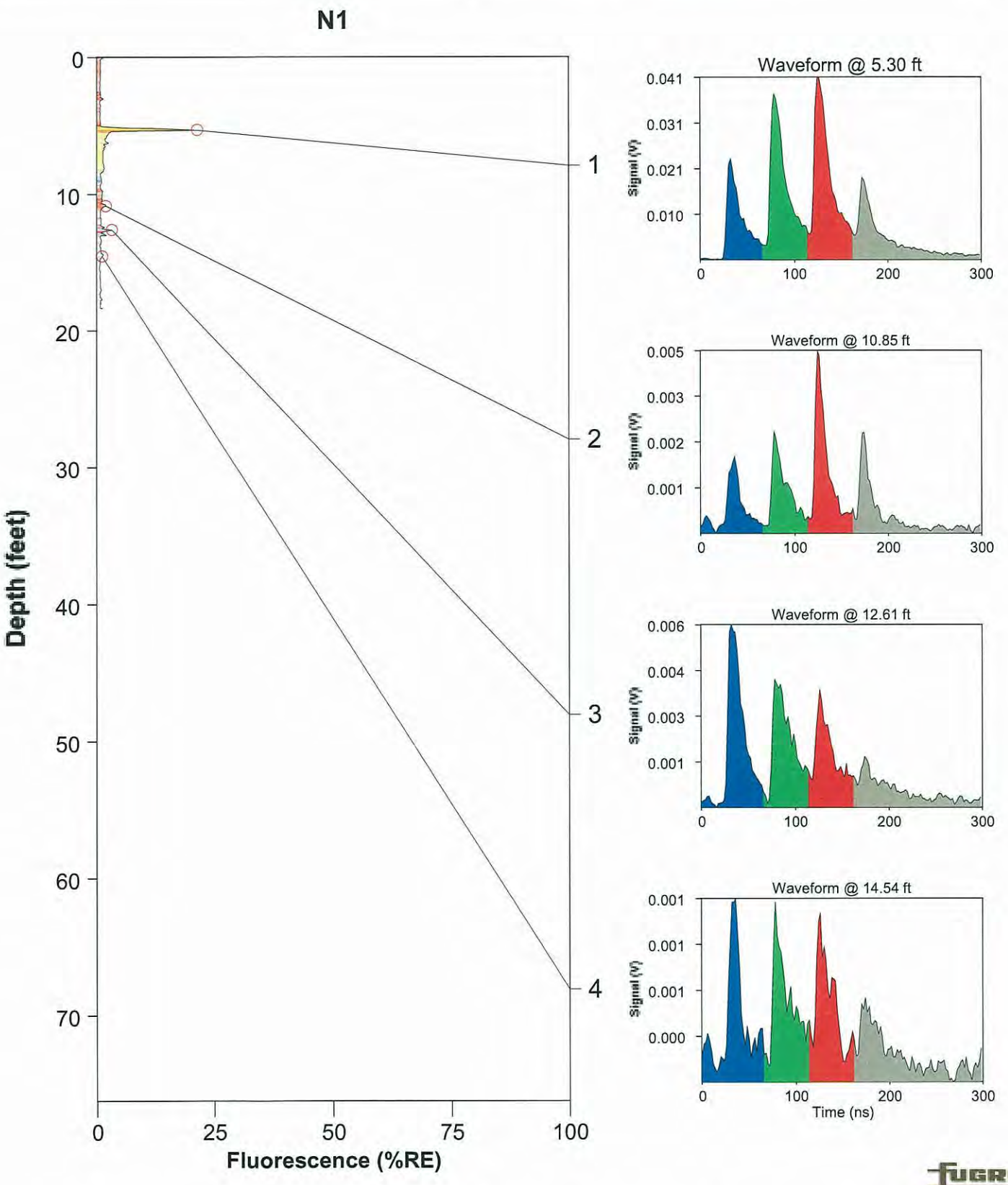
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 2:53:14 PM	Max fluorescence: 0.97% @ 0.14 ft
ROST Unit: 1	Final depth BGS: 30.22 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

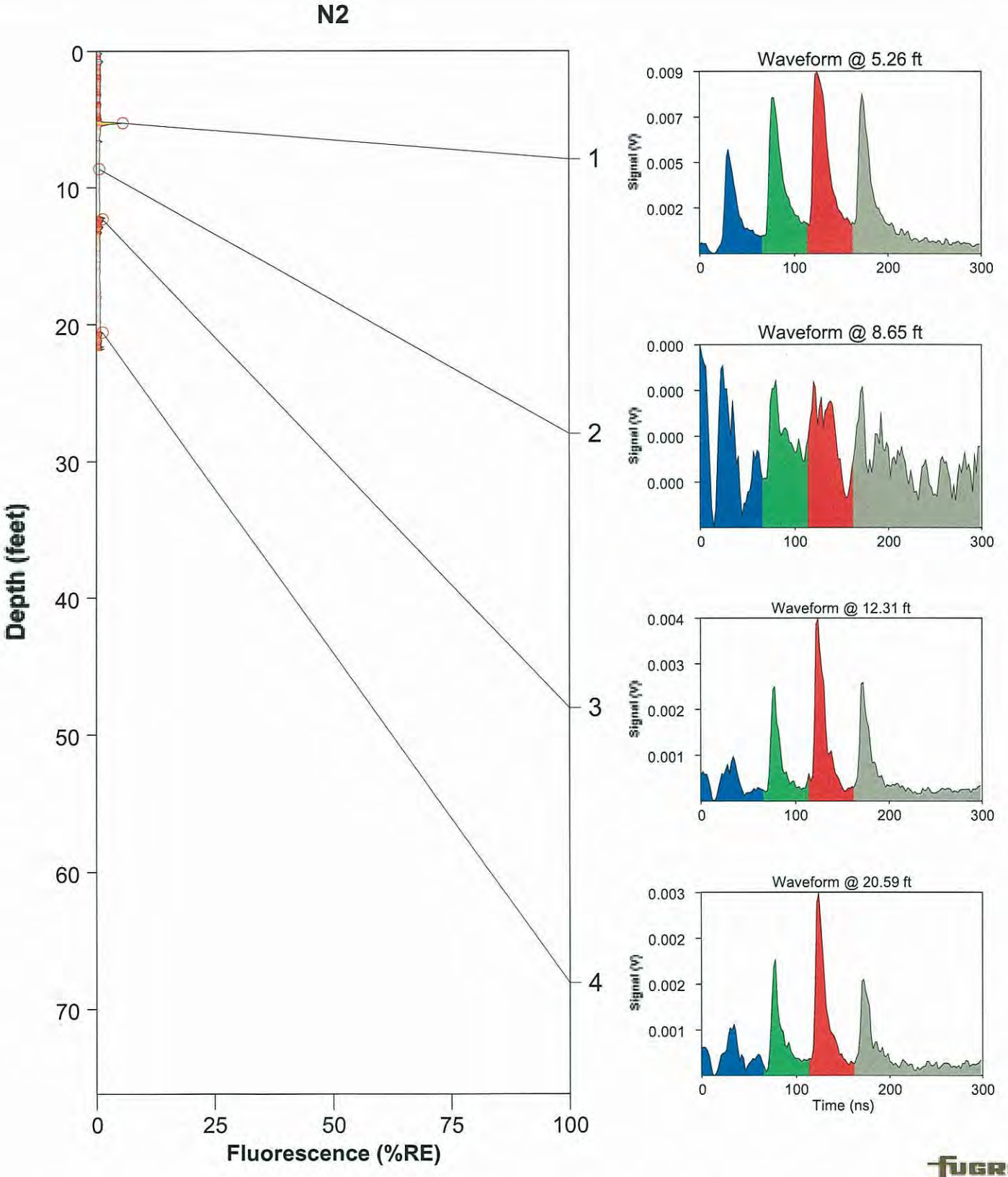
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 12:57:15 PM	Max fluorescence: 21.44% @ 5.30 ft
ROST Unit: 1	Final depth BGS: 18.40 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

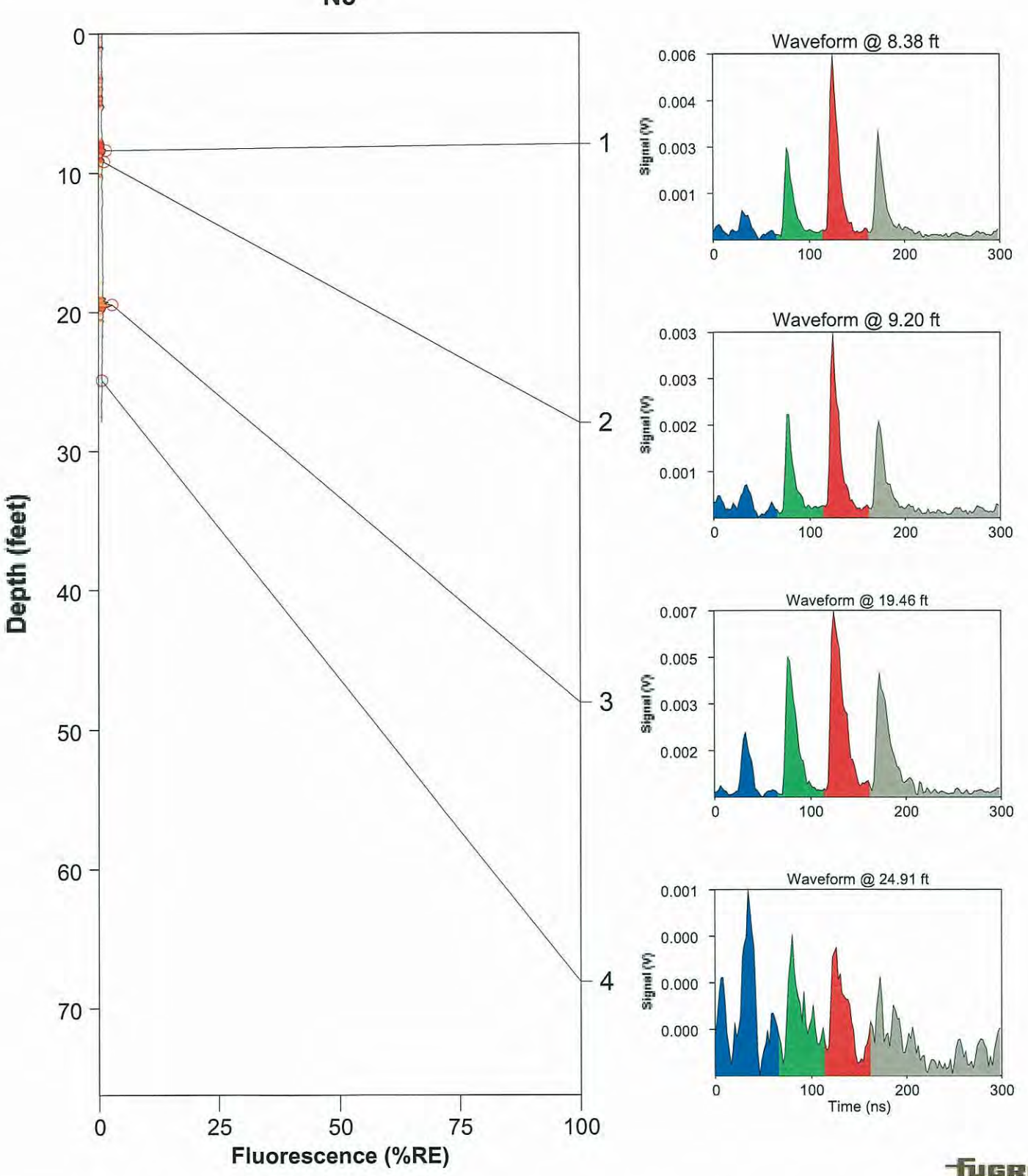
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 1:32:45 PM	Max fluorescence: 5.55% @ 5.26 ft
ROST Unit: 1	Final depth BGS: 21.90 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

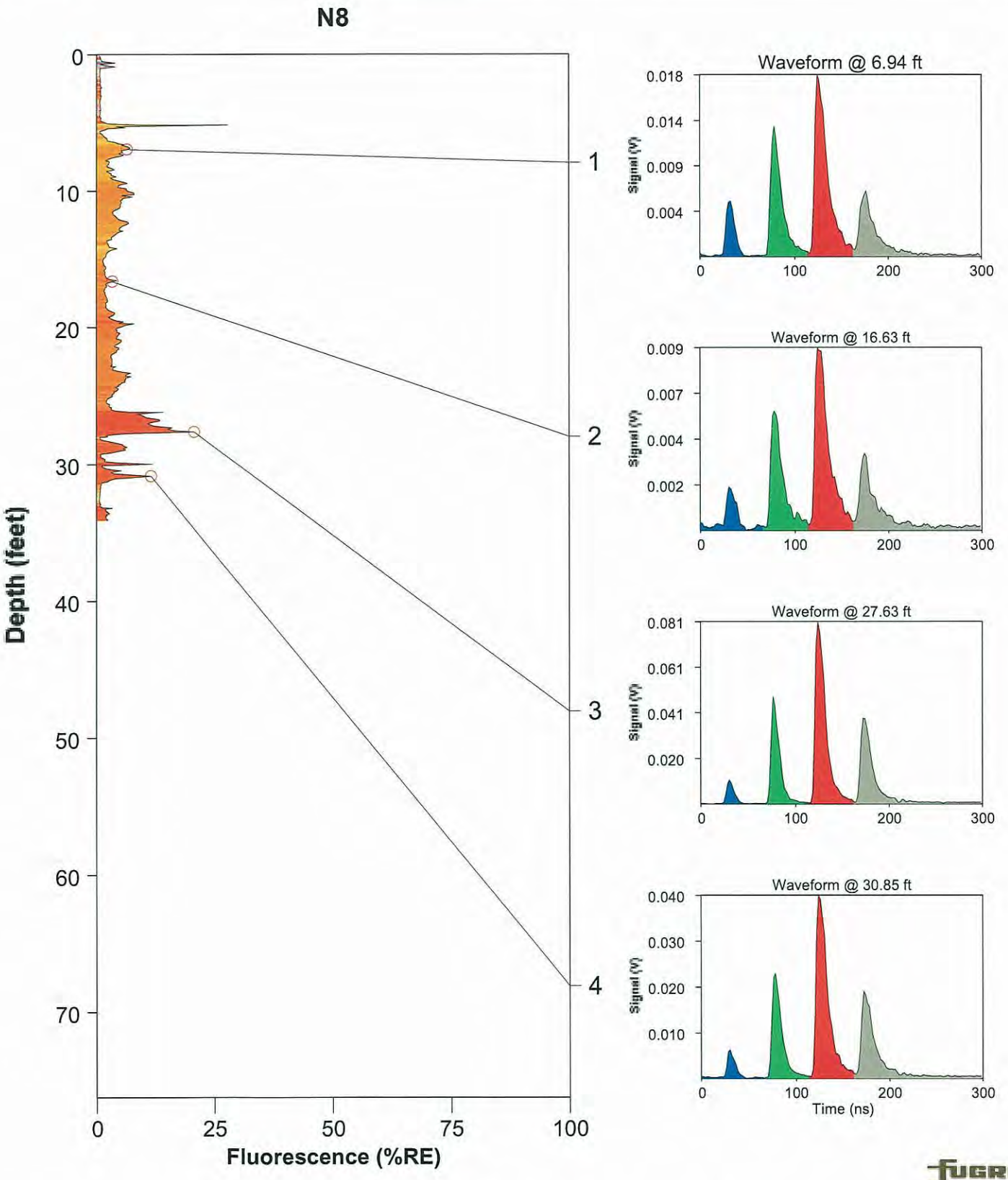
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 2:06:59 PM	Max fluorescence: 2.81% @ 19.46 ft
ROST Unit: 1	Final depth BGS: 27.89 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

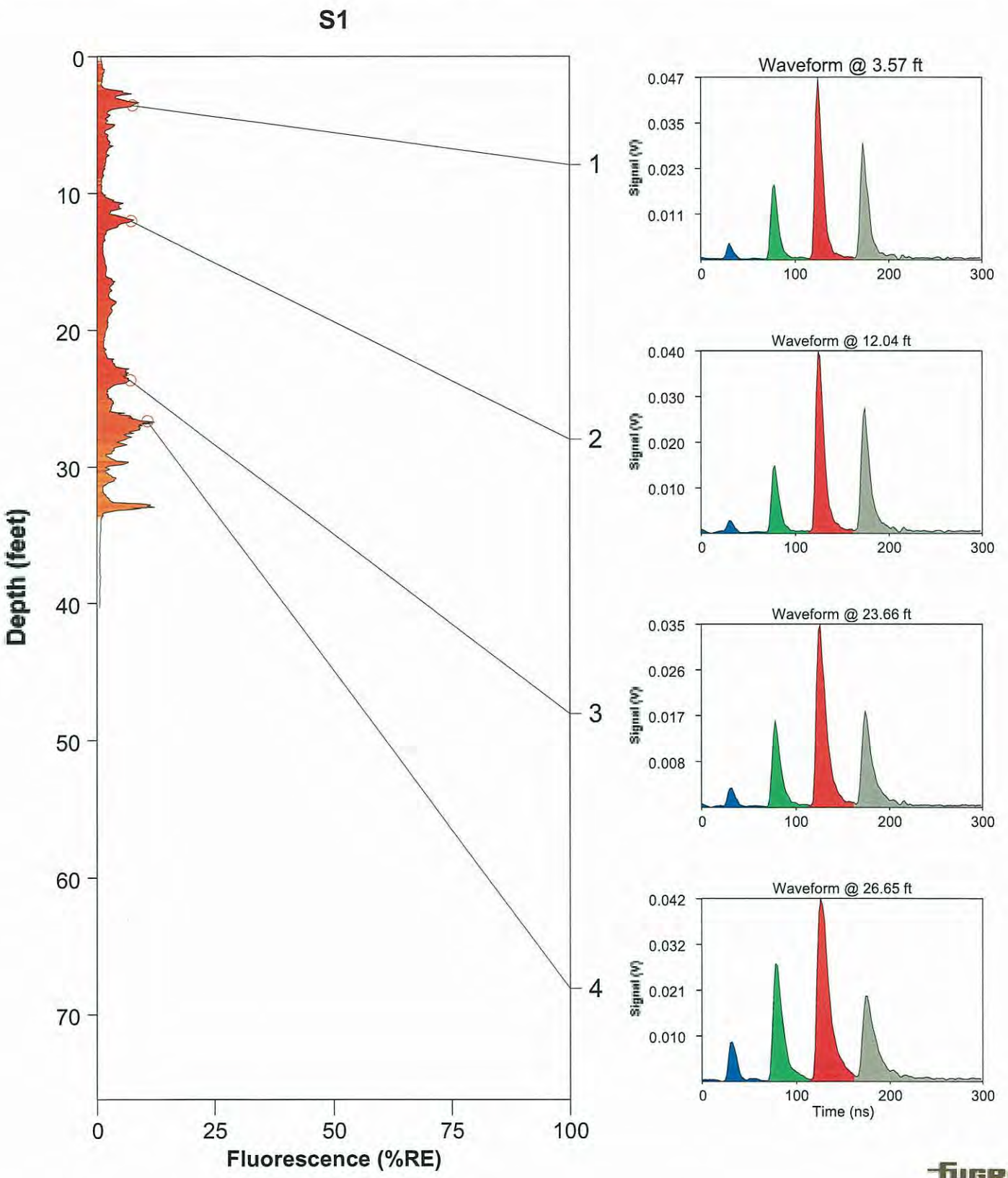
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 3:32:41 PM	Max fluorescence: 27.78% @ 5.15 ft
ROST Unit: 1	Final depth BGS: 34.08 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

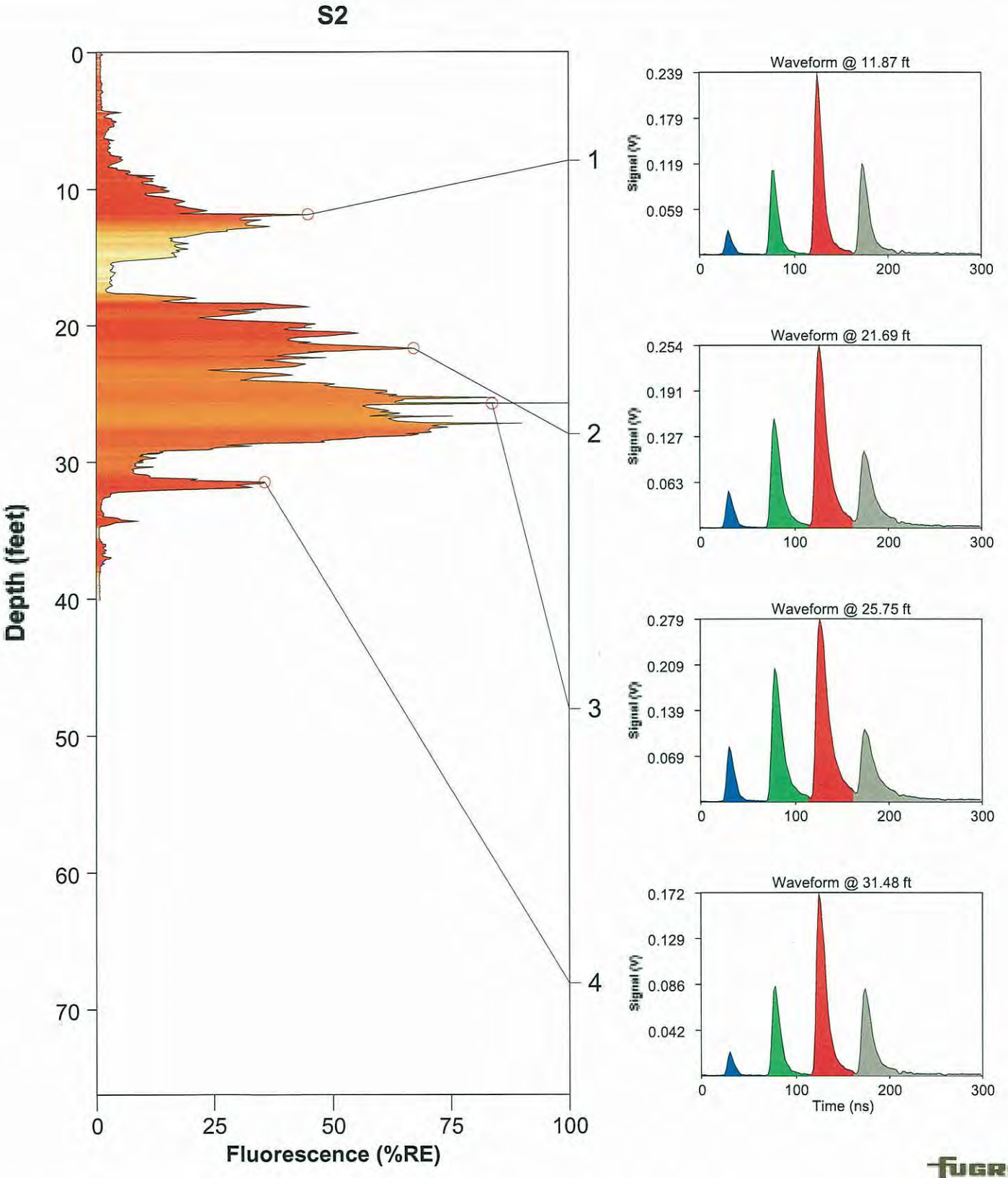
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 3:42:06 PM	Max fluorescence: 12.23% @ 32.97 ft
ROST Unit: 1	Final depth BGS: 40.30 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

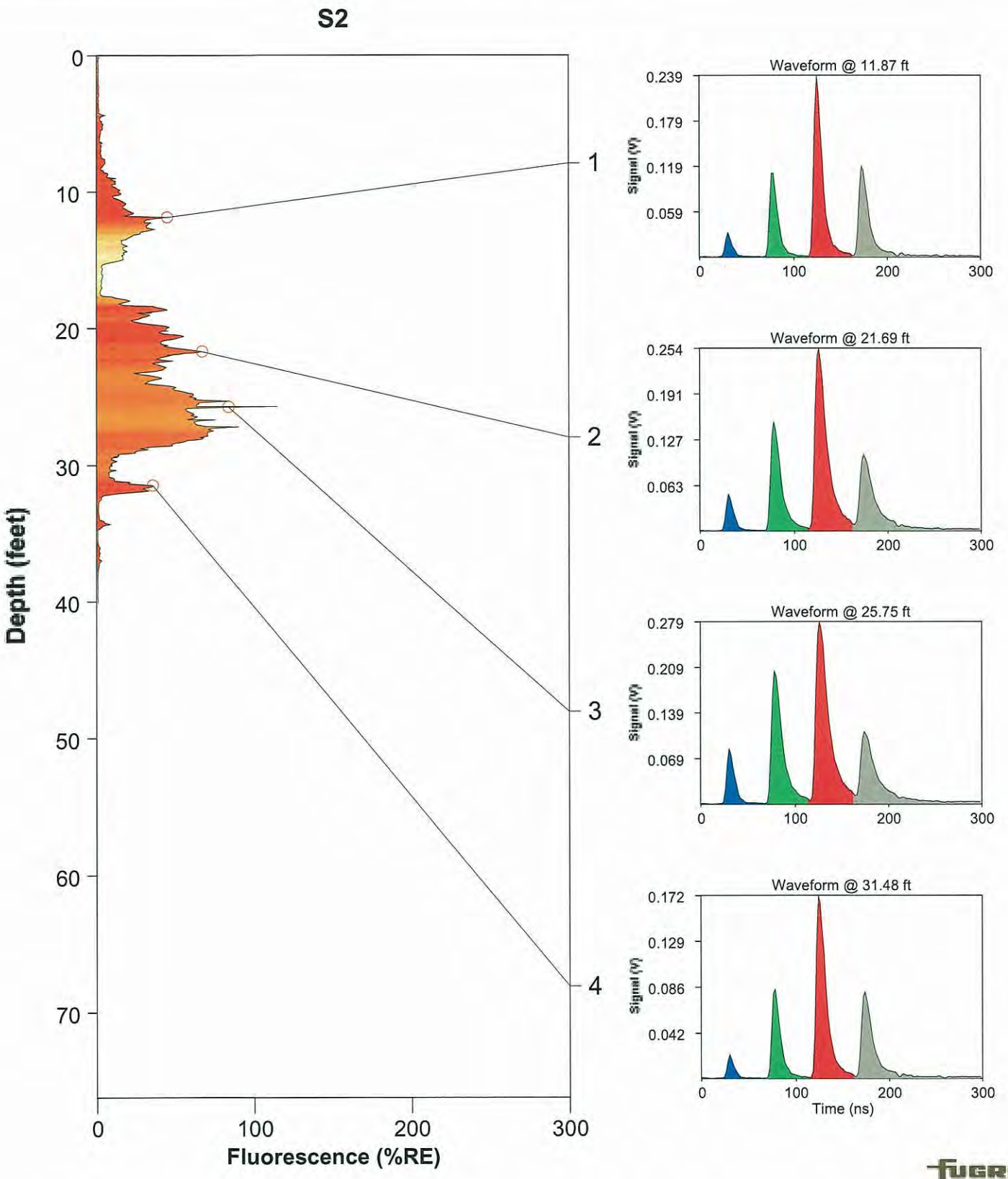
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 11:53:06 AM	Max fluorescence: 114.71% @ 25.72 ft
ROST Unit: 1	Final depth BGS: 40.08 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

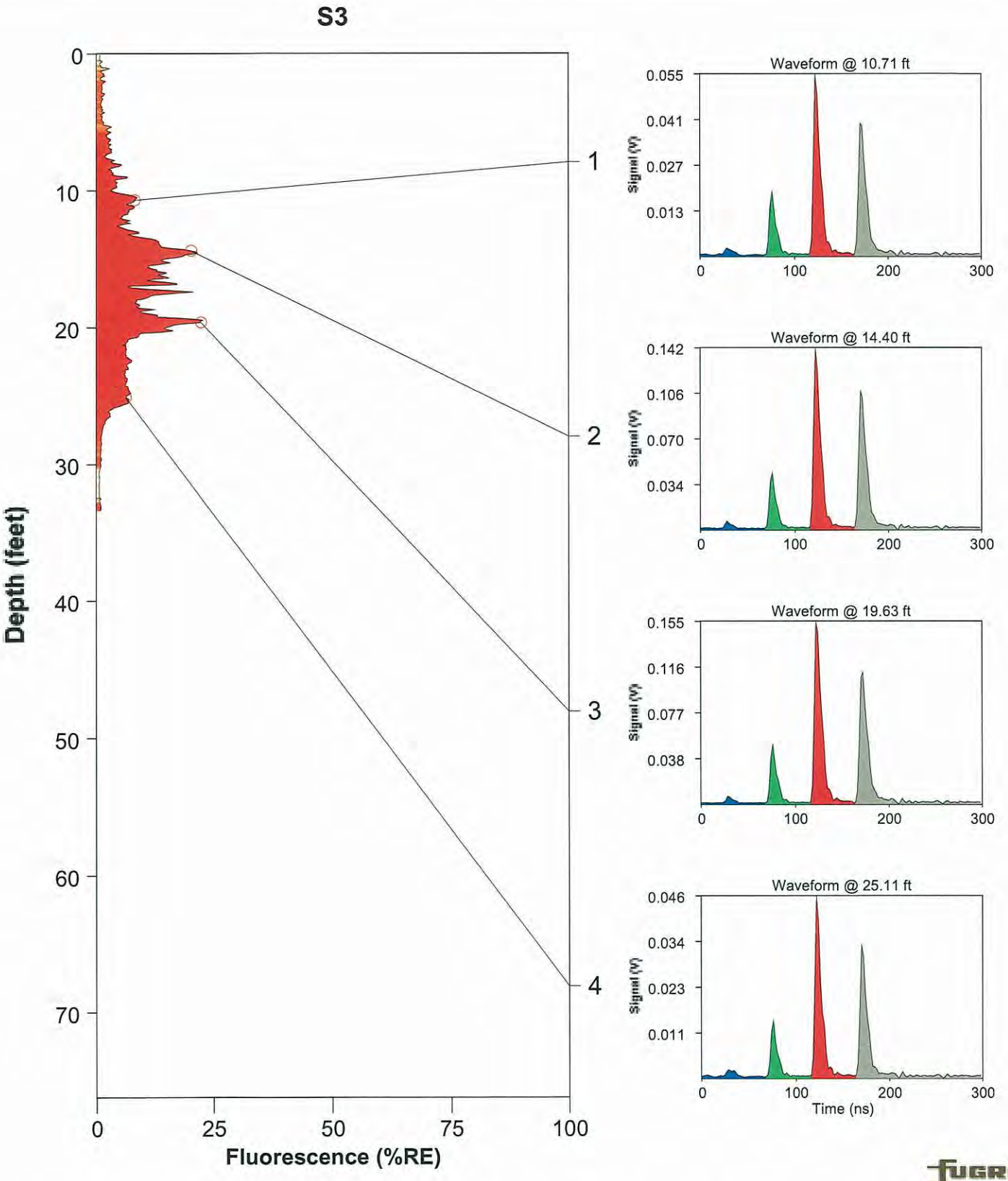
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 11:53:06 AM	Max fluorescence: 114.71% @ 25.72 ft
ROST Unit: 1	Final depth BGS: 40.08 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

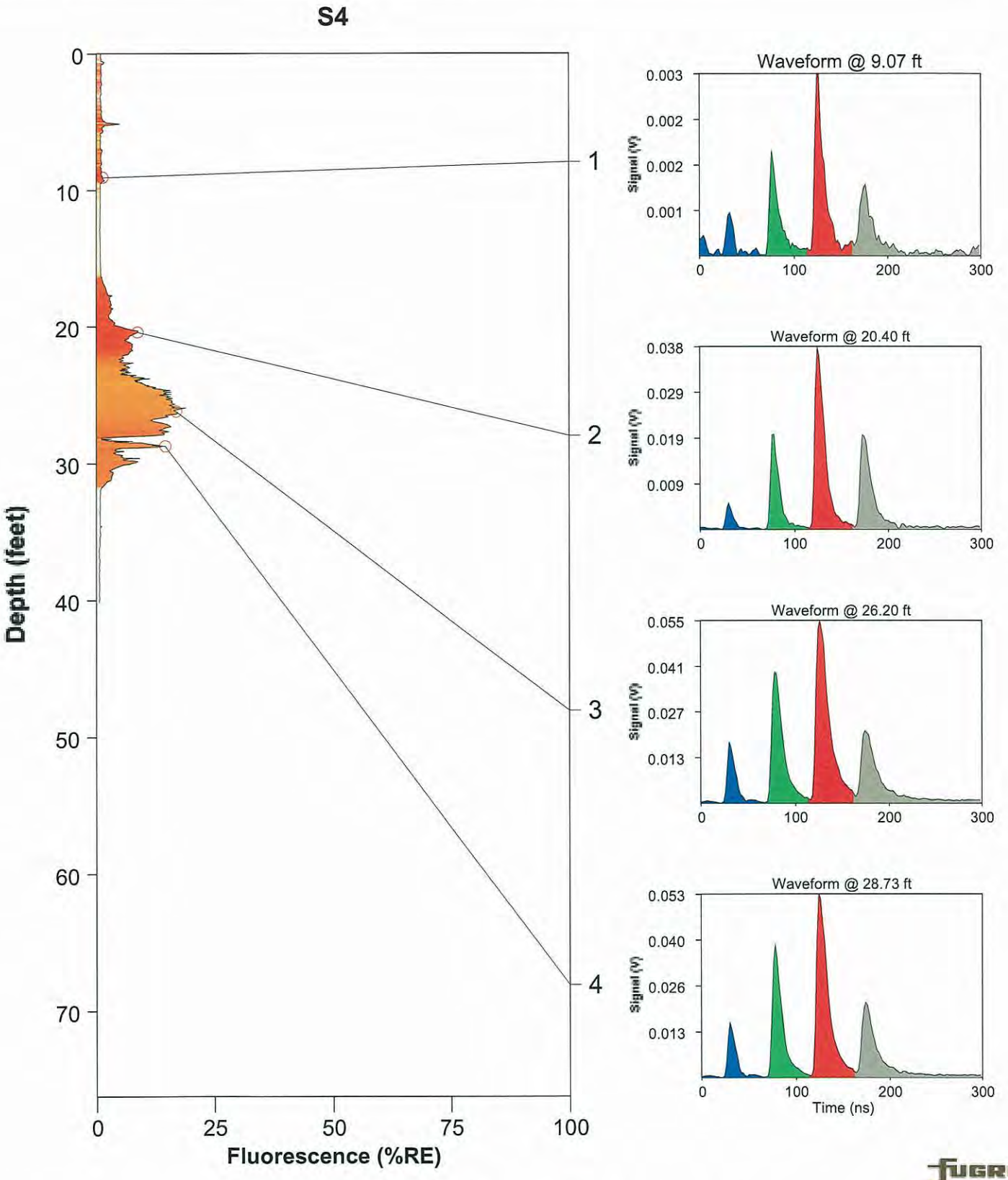
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 10:43:15 AM	Max fluorescence: 22.77% @ 19.46 ft
ROST Unit: 1	Final depth BGS: 33.39 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

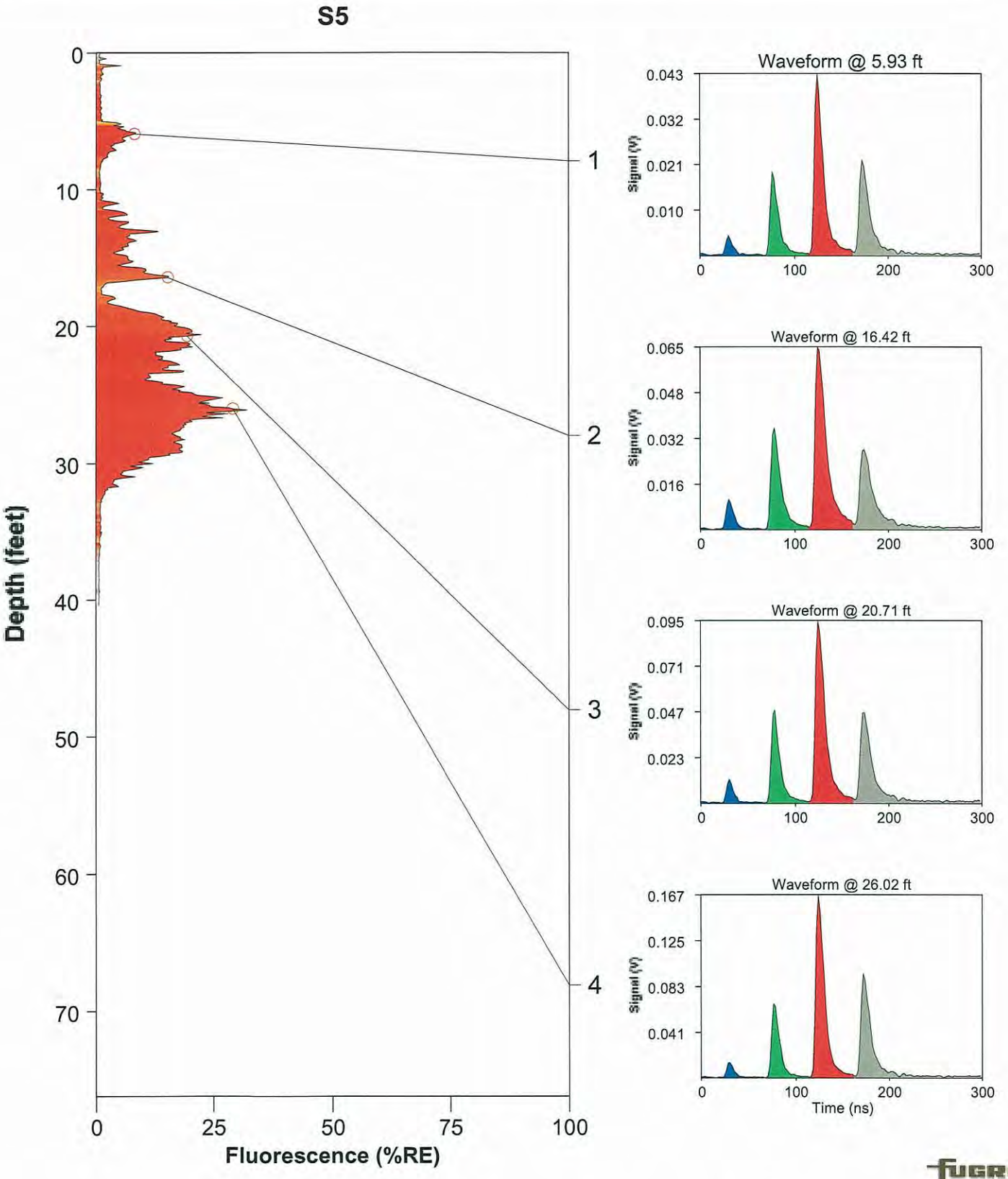
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 8:12:52 AM	Max fluorescence: 18.94% @ 25.95 ft
ROST Unit: 1	Final depth BGS: 40.12 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

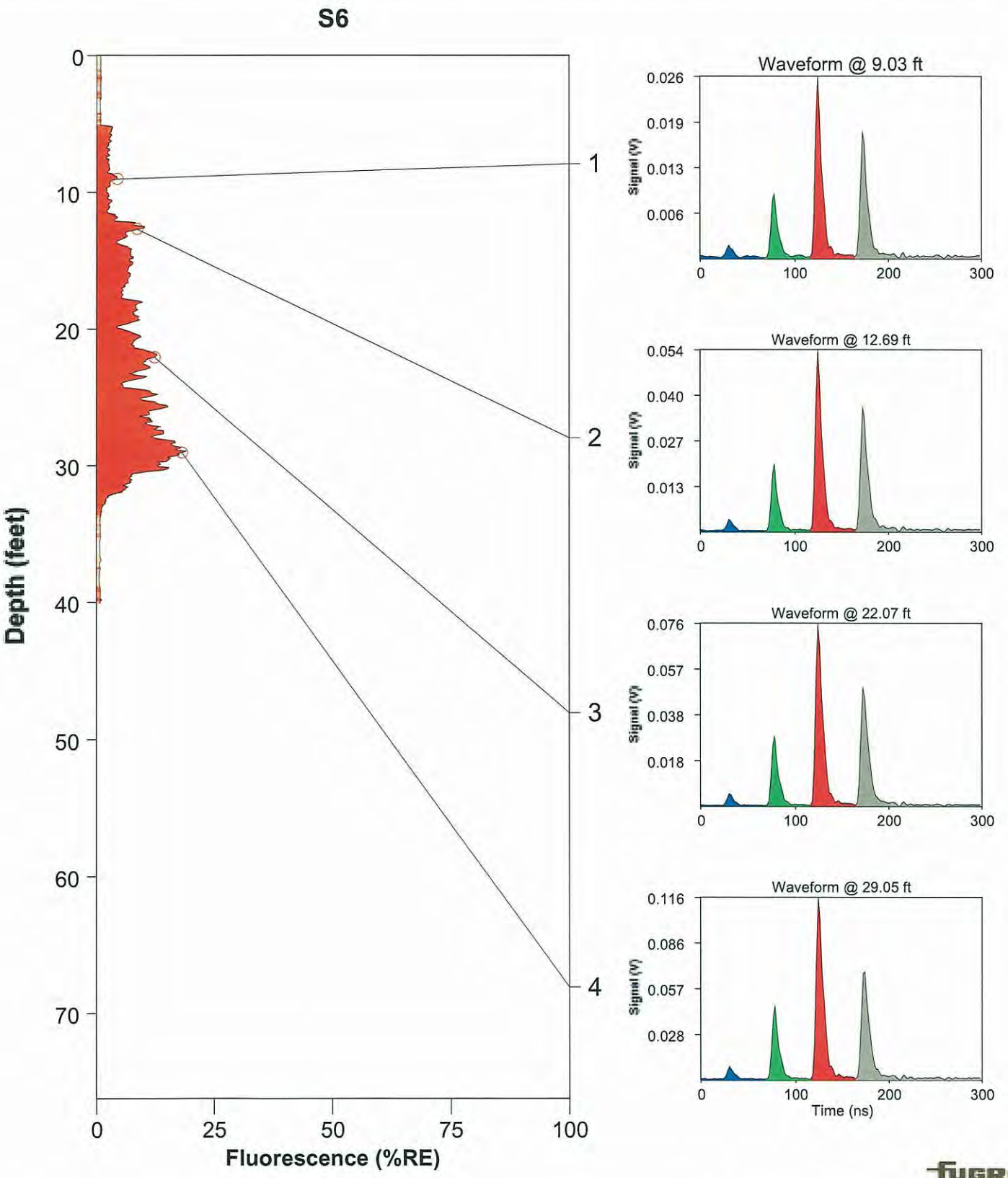
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 9:47:27 AM	Max fluorescence: 31.96% @ 26.11 ft
ROST Unit: 1	Final depth BGS: 40.40 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

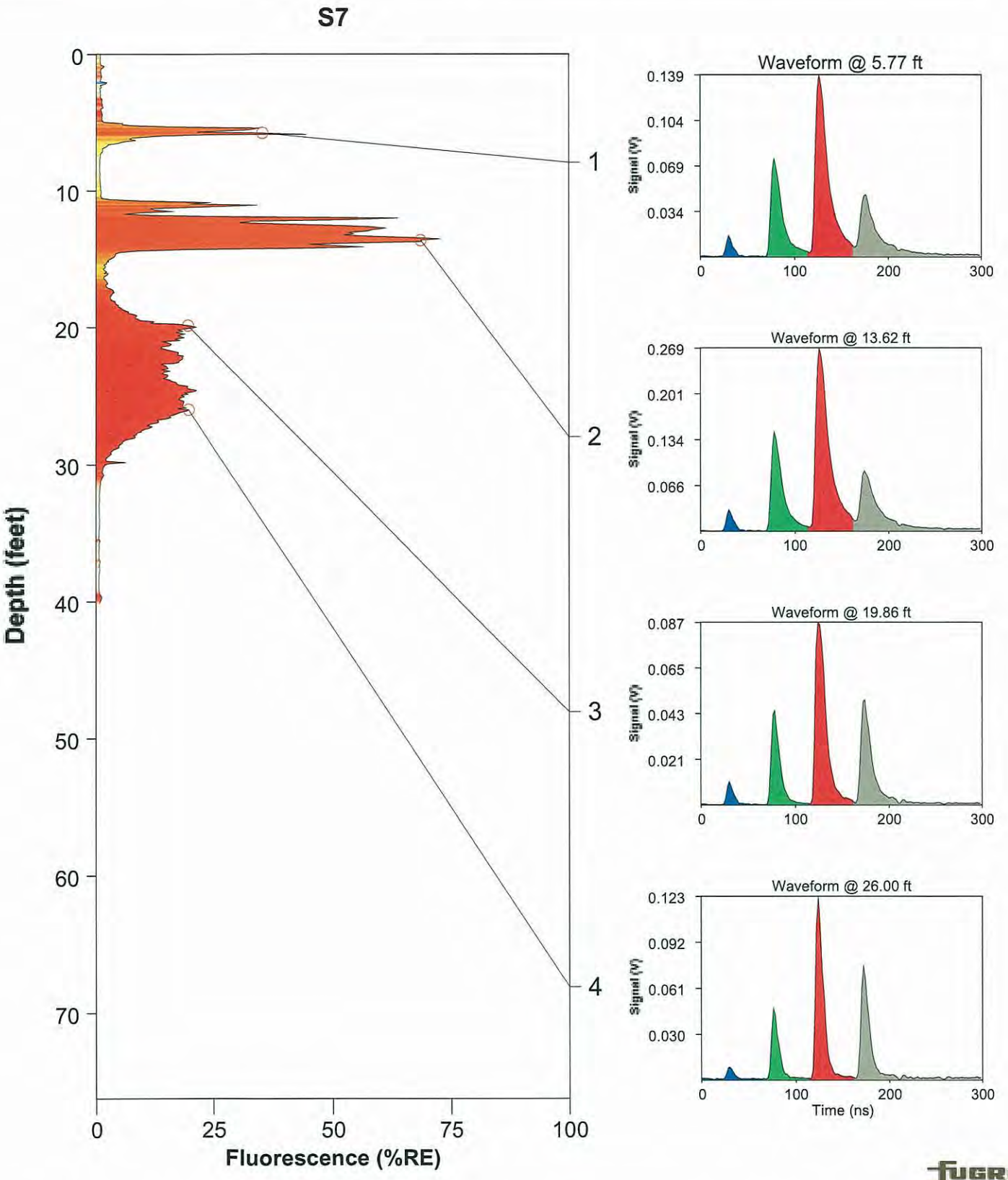
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 9:50:45 AM	Max fluorescence: 19.07% @ 28.94 ft
ROST Unit: 1	Final depth BGS: 40.08 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

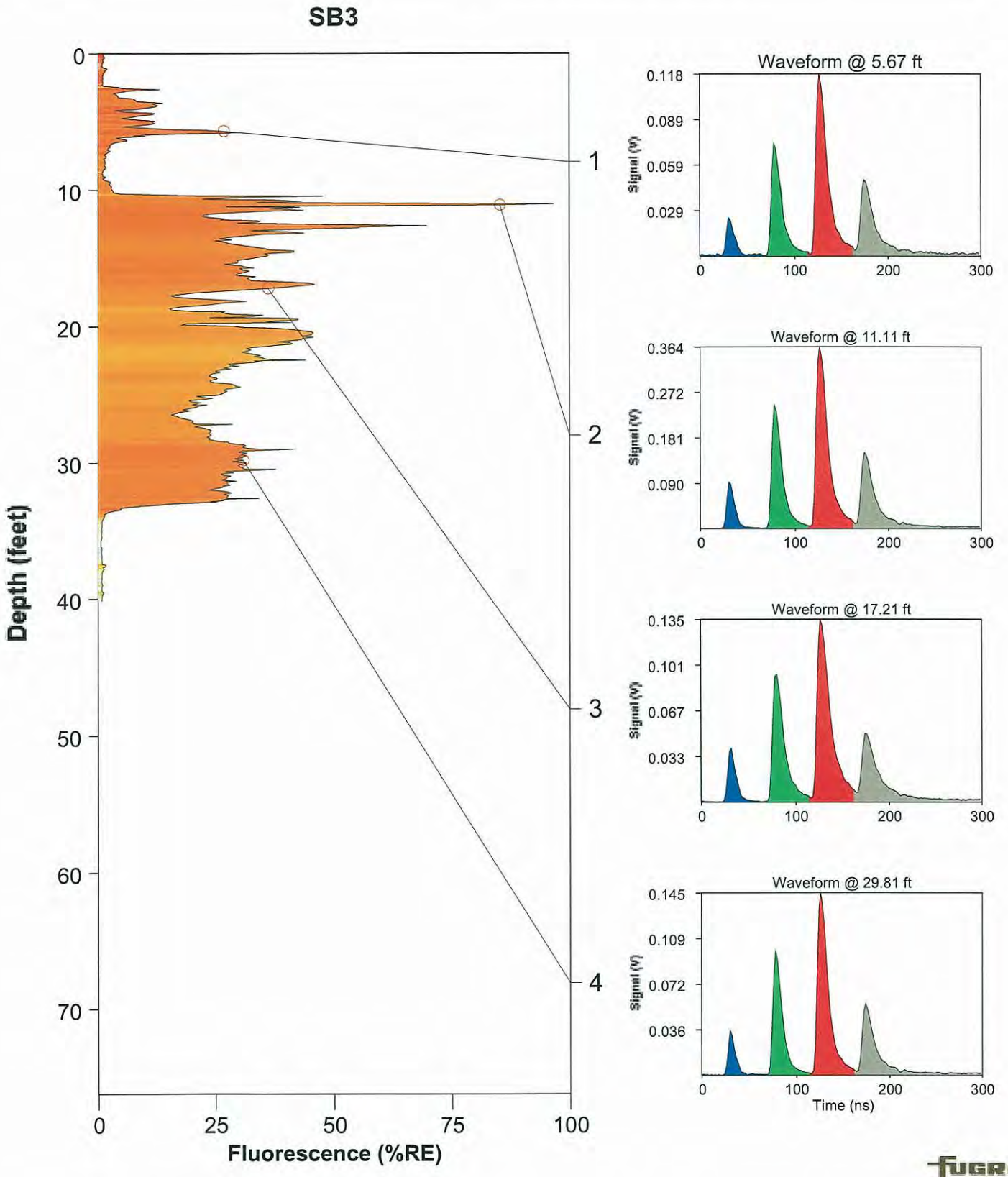
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 9:11:03 AM	Max fluorescence: 72.77% @ 13.52 ft
ROST Unit: 1	Final depth BGS: 40.10 ft



Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

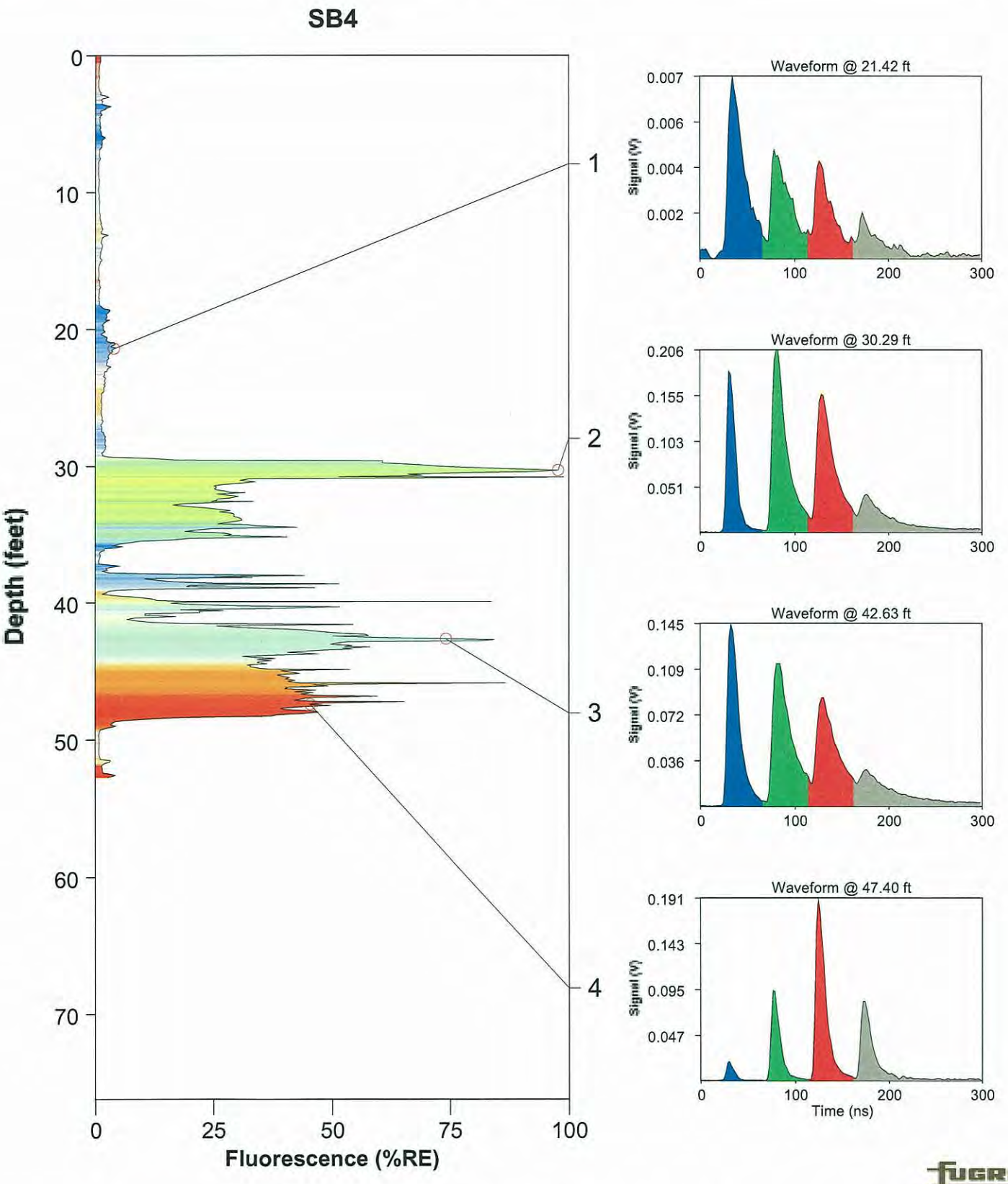
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/30/2006 @ 10:37:45 AM	Max fluorescence: 96.65% @ 11.01 ft
ROST Unit: 1	Final depth BGS: 40.15 ft



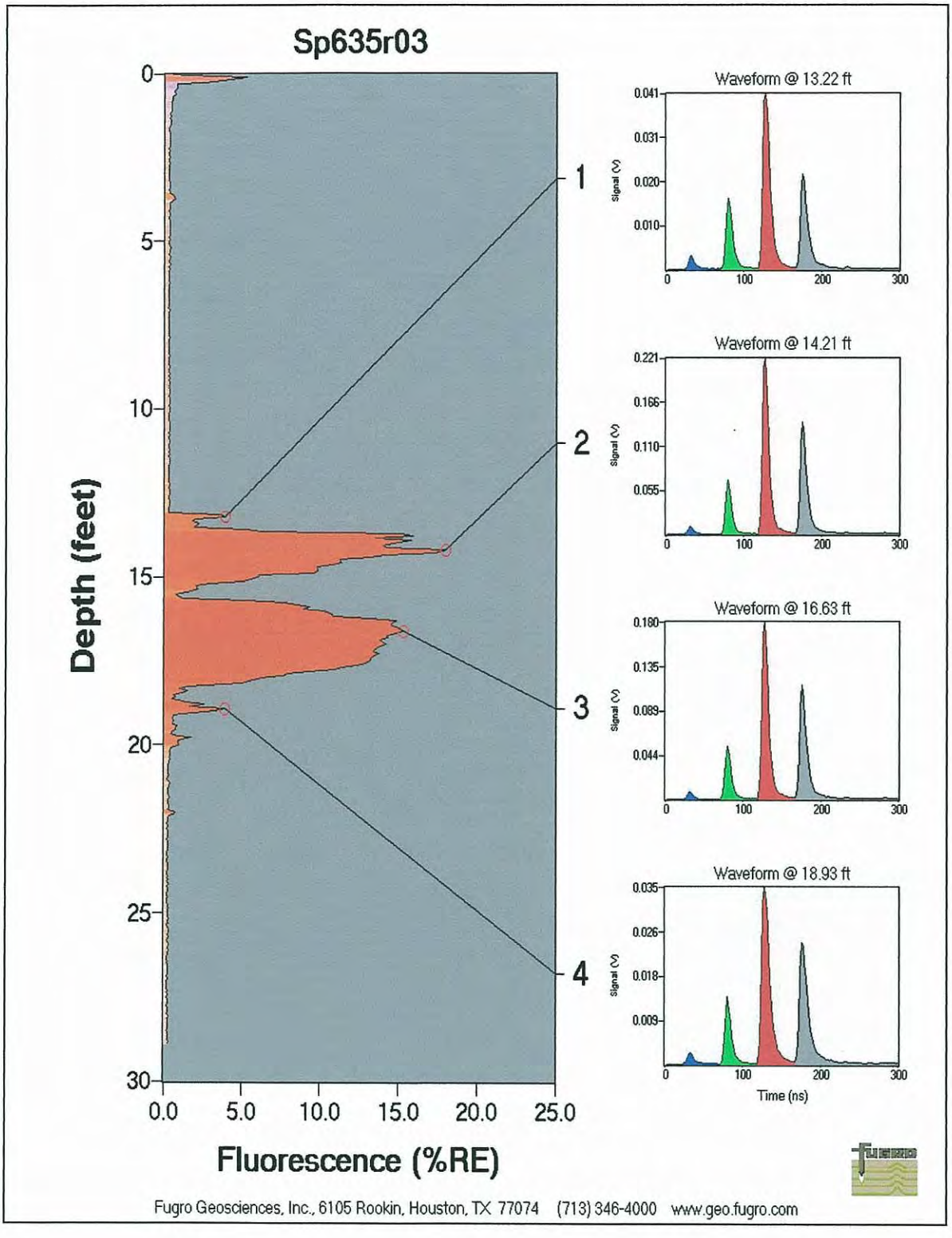
Fugro Geosciences, Inc., 6105 Rookin, Houston, TX 77074 (713) 346-4000 www.geo.fugro.com

ROST Fluorescence Response Data

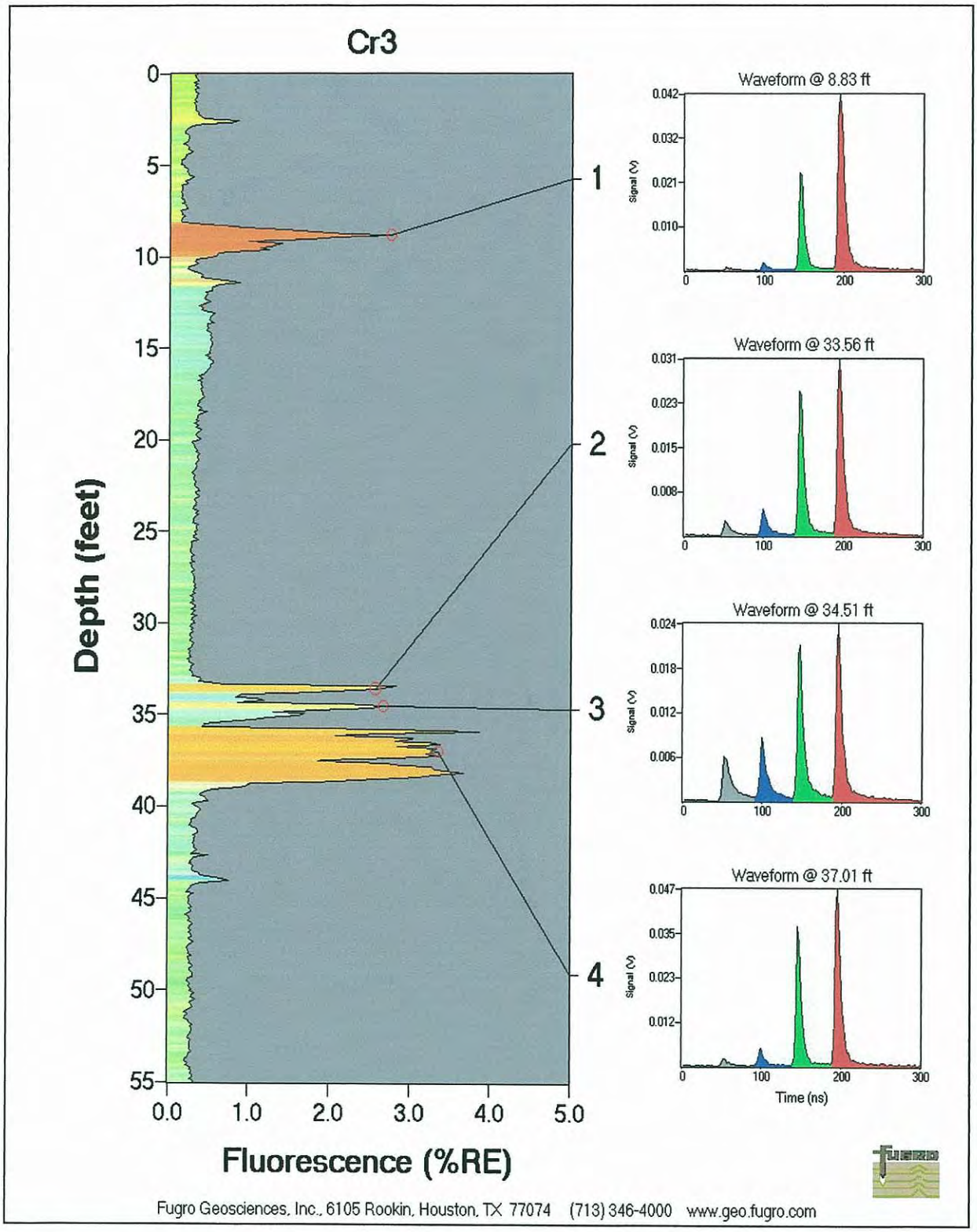
Site: Former ChemOil Refinery	Operator: MITCHELL
Client: TetraTech	Fugro Job #: 03-1309
Date/Time: 5/31/2006 @ 2:39:51 PM	Max fluorescence: 98.96% @ 30.79 ft
ROST Unit: 1	Final depth BGS: 52.75 ft



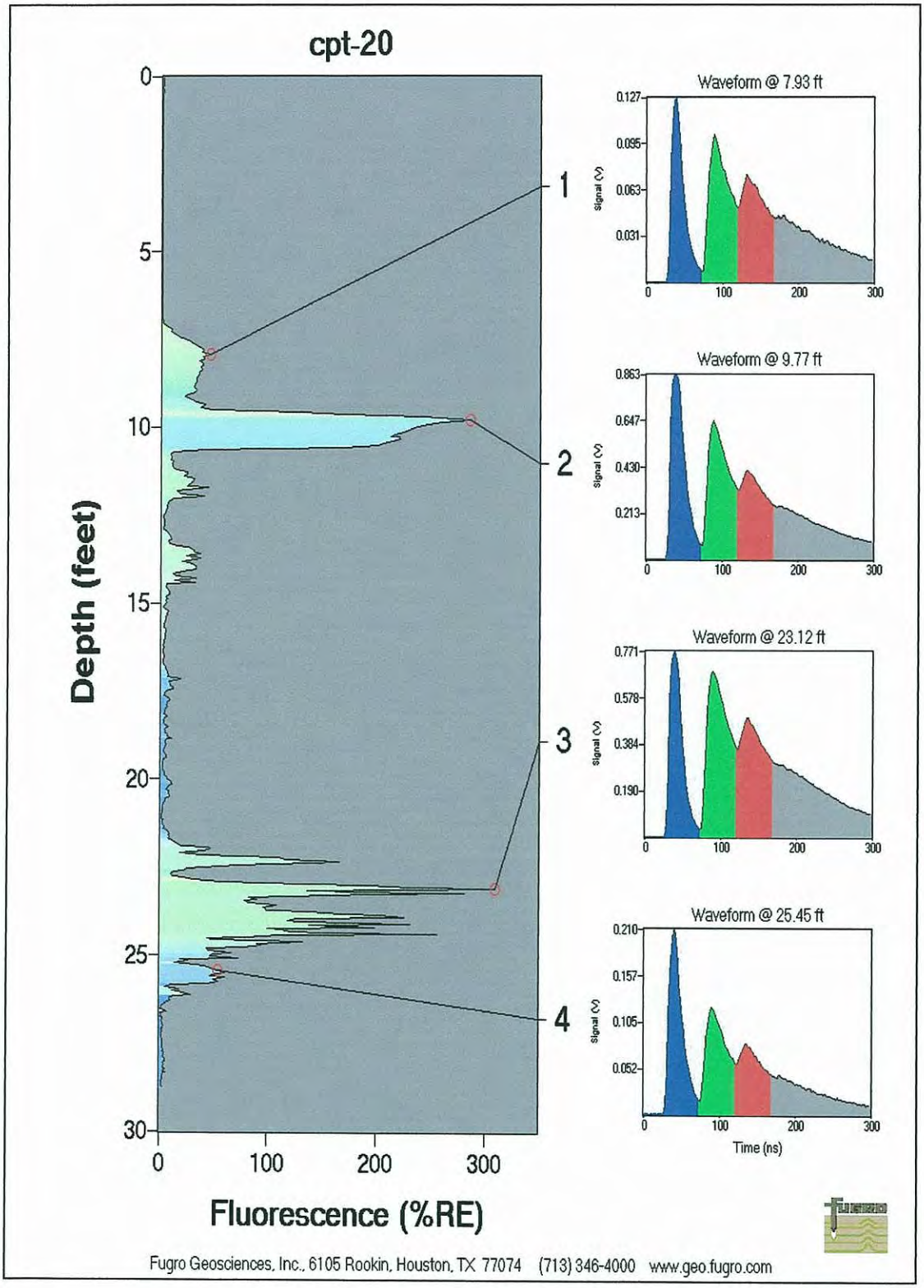
Typical Crude Oil Waveform



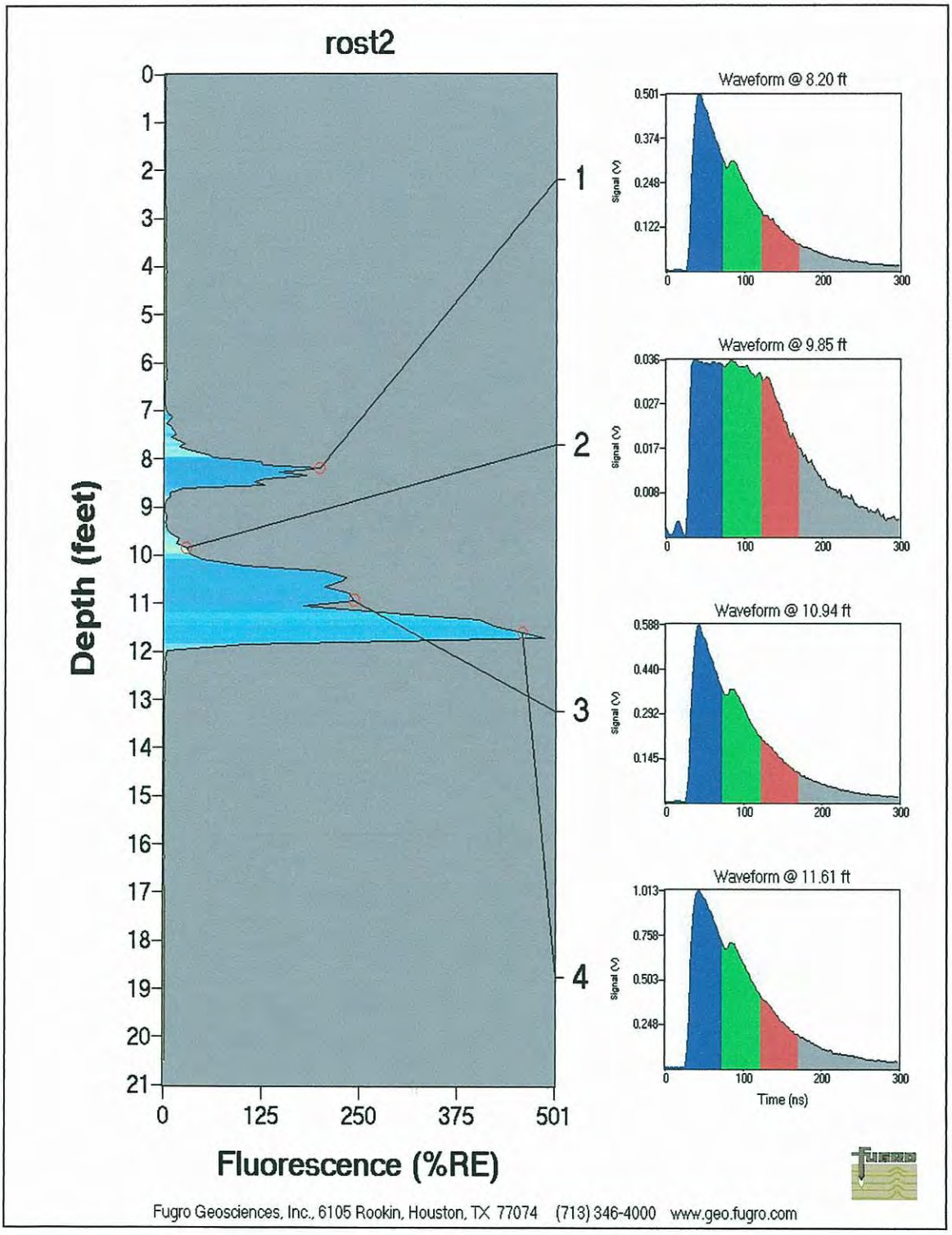
Typical Creosote Waveform



Typical Diesel Waveform



Typical Jet Fuel Waveform



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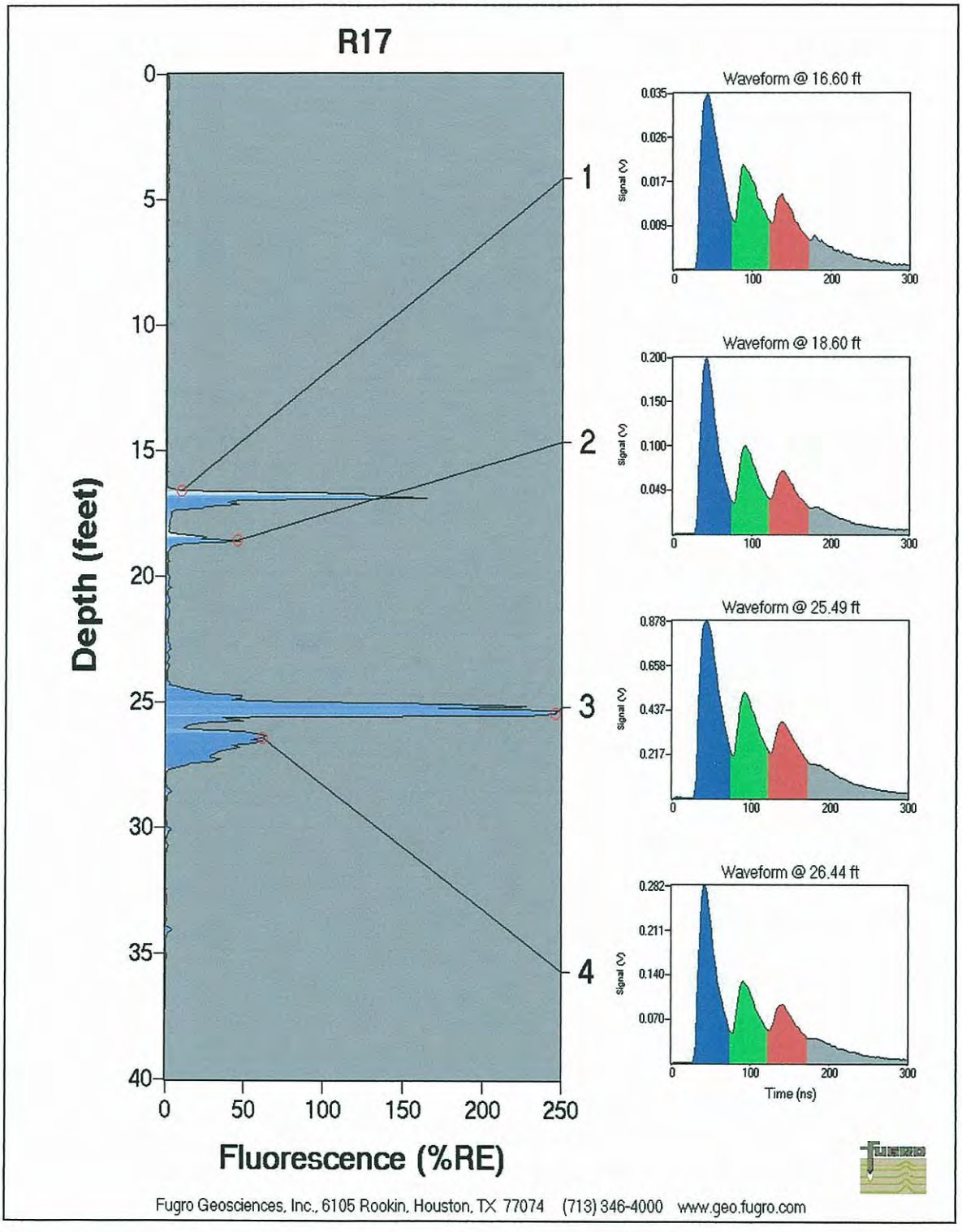
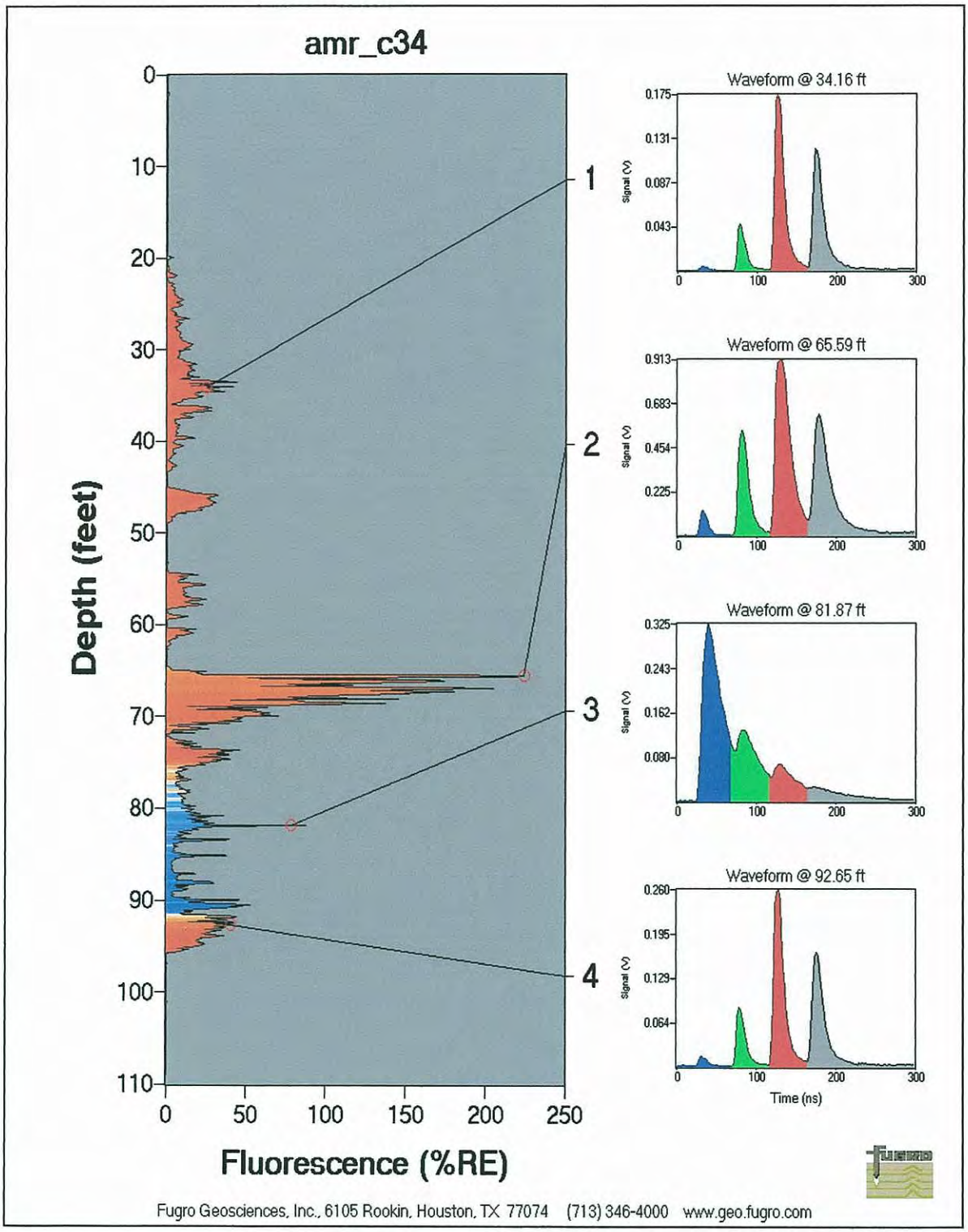
Typical Gasoline Waveform



Multiple Product Waveforms



APPENDIX K

LABORATORY ANALYTICAL DATA

(On File with The Source Group, Inc., a Division of Apex Companies, LLC and Available Upon Request)