EG&G MOUND-22-03-10-02-01-9505300017

Environmental Restoration Program

BEDROCK TOPOGRAPHY MAPPING OPERABLE UNIT 2, MAIN HILL PHASE I TECHNICAL MEMORANDUM

MOUND PLANT
MIAMISBURG, OHIO

February 1995

FINAL

(Revision 0)

Department of Energy
Ohio Field Office

Environmental Restoration Program
EG&G Mound Applied Technologies

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LIST OF ACRONYMS
MOUND PLANT, ER PROGRAM

AEC	Atomic Energy Commission
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CPT	cone penetrometer testing
DOE	U.S. Department of Energy
EG&G	EG&G Mound Applied Technologies
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration (Program)
FFA	Federal Facility Agreement
fps	feet per second
FS	Feasibility Study
GPR	ground-penetrating radar
GSSI	Geophysical Survey Systems Incorporated
MRC	Monsanto Research Corporation
MSL	mean sea level
NPL	National Priorities List
ns	nano second
OU	operable unit
RI	remedial investigation
TSF	tons per square foot
USGS	U.S. Geological Survey
WD	waste disposal

EXECUTIVE SUMMARY

Mound Plant is a research and manufacturing facility for the production of radioactive power sources and military detonators. The facility is located in Miamisburg, Ohio and is operated by EG&G Mound Applied Technologies (EG&G) for the Department of Energy (DOE). Mound Plant was placed on the Comprehensive Environmental Response, Conservation, and Liability Act (CERCLA) National Priority List (NPL) in November of 1989. DOE and the U.S. Environmental Protection Agency (USEPA) signed a Federal Facility Agreement (FFA) in October of 1990. In response to being placed on the NPL, Mound was divided into Operable Units (OUs) to simplify project management. The Main Hill of Mound Plant is designated as Operable Unit 2 (OU-2).

The objective of the OU-2 Remediation Investigation and Feasibility Study (RI/FS) is to determine the nature and extent of contamination on the Main Hill, characterize the risks to human health and the environment posed by exposure to impacted medium, to evaluate potential remedies and to determine the affect of potential releases of contaminants to the environment.

Phase I of the OU-2 RI/FS was performed to provide additional information necessary to prepare the scope of activities for subsequent phases of investigation. Phase I consists of five tasks. This memorandum presents the activities and results of Task 1 which consisted of the bedrock topography mapping for the OU-2 area.

Task 1 was started in May 1994 and consisted of reviewing previous OU-2 well logs and boring data, a general fracture analysis, a seismic refraction investigation, a ground penetrating radar test, and a cone penetrometer investigation. The data from these investigations were reviewed and integrated to construct an overall map of the bedrock surface at OU-2. In addition, information was collected regarding potential subsurface migration pathways.

Based on the results of the Phase I, Task 1 activities, a bedrock surface map was prepared (see Figure 2.3). The figure shows linear depressions around the perimeter of the site as well as slight mounds and depressions within the interior of the site.

An apparent linear depression beneath Building OSE is located above seeps 0604 and 0605. This linear depression is not anticipated to be a significant pathway for groundwater for this area, because perched groundwater has not been encountered in this area and highly fractured bedrock is interpreted to be less than 5 feet in thickness.

The top of the less weathered/fractured bedrock was evaluated and interpreted with seismic refraction. Seismic P-wave velocities were noted to significantly increase from depths of zero to 46 feet (see Figures 4.1 through 4.9). The elevations of the less fractured bedrock surface were contoured (see Figure 4.10).

A linear depression was noted in the top of the less fractured bedrock in the area northwest of Building OSE. This depression agrees with lineations observed in the fracture trace analysis. This depression also aligns with seeps 0604, 0605, and 0606. These seeps emerge at an elevation that generally corresponds to the basal portion of the Liberty Formation which is dominated by shale, as opposed to limestone in the upper portion of this formation. Therefore, this linear depression may facilitate the lateral migration of groundwater.

Another sublinear depression was noted in the southeast section of OU-2 and correlates with a second fracture trace. No seeps were observed associated with this feature, however, the entire downslope area is covered with asphalt and/or concrete.

The upper highly fractured bedrock is interpreted to be variable in thickness and averages between 10 and 20 feet thick. In the northeastern portion of the site the highly fractured bedrock is very thin or not observed.

Groundwater elevation data for OU-2 was limited. The available data indicates that groundwater occurs within the less fractured bedrock.

The bottom of the less fractured bedrock could not be evaluated at OU-2.

Section 1

1. INTRODUCTION

1.1. SITE BACKGROUND

Mound Plant originated as part of the Manhattan Engineer District in 1943; its purpose was to determine the chemical and metallurgical properties of polonium (DOE 1986). The work was performed for the U.S. Army at several locations in Dayton, Ohio, by Monsanto Research Corporation (MRC 1985). In 1946, 182 acres were purchased for the permanent Mound Plant site on the outskirts of the city of Miamisburg, in Montgomery County, Ohio (Figure 1.1). The site is approximately 10 miles south-southwest of Dayton and 45 miles north of Cincinnati. In 1948, work being performed at the Dayton units was moved to this site, and in January 1949, operations involving radionuclides began.

Early Mound Plant programs investigated the chemical and metallurgical properties of polonium-210 and its applications, particularly the fabrication of neutron and alpha sources for weapon and nonweapon use. Investigations involving uranium, protactinium-231, and plutonium-239 were performed from 1950 to 1963 as part of the national civilian power reactor program. In 1954, separation of the stable isotopes of noble gases began. Development of plutonium-238 heat sources started at Mound Plant in 1961 because of its high specific activity and relatively short half-life (87.74 years). Since that time, heat sources fueled with plutonium-238 have been developed and fabricated.

In 1957, a new mission assigned to Mound Plant was the development, production, and surveillance of detonators for military applications. Development of explosives timers in 1959 led to their manufacture starting in 1963. The development and manufacture of ferroelectric transducers and firing sets (components that control initiation of detonators) began in 1962. All these programs are continuing.

The first of several programs requiring tritium-handling technology was initiated in 1958. Today, Mound Plant has an extensive capability for handling and studying tritium and tritium compounds for weapons or nonweapons applications. A facility also exists for the recovery and purification of tritium from all types of wastes generated at DOE sites which handle tritium. Facilities also exist for the development of tritium-containing materials and processes for weapons applications and possible manufacture (MRC 1985).

On the Main Hill, several buildings have histories that included the use of chemicals. Organic solvents were used or stored in the GW Building, Paint Shop, DS Building Solvent Storage Shed, M Building, E Building Solvent Storage Shed, B Building Solvent Storage Shed and Building 28. Waste oils, fuel oils, gasoline, and diesel fuel were used in the G Building, B Building, and Building 28. The WD Building also

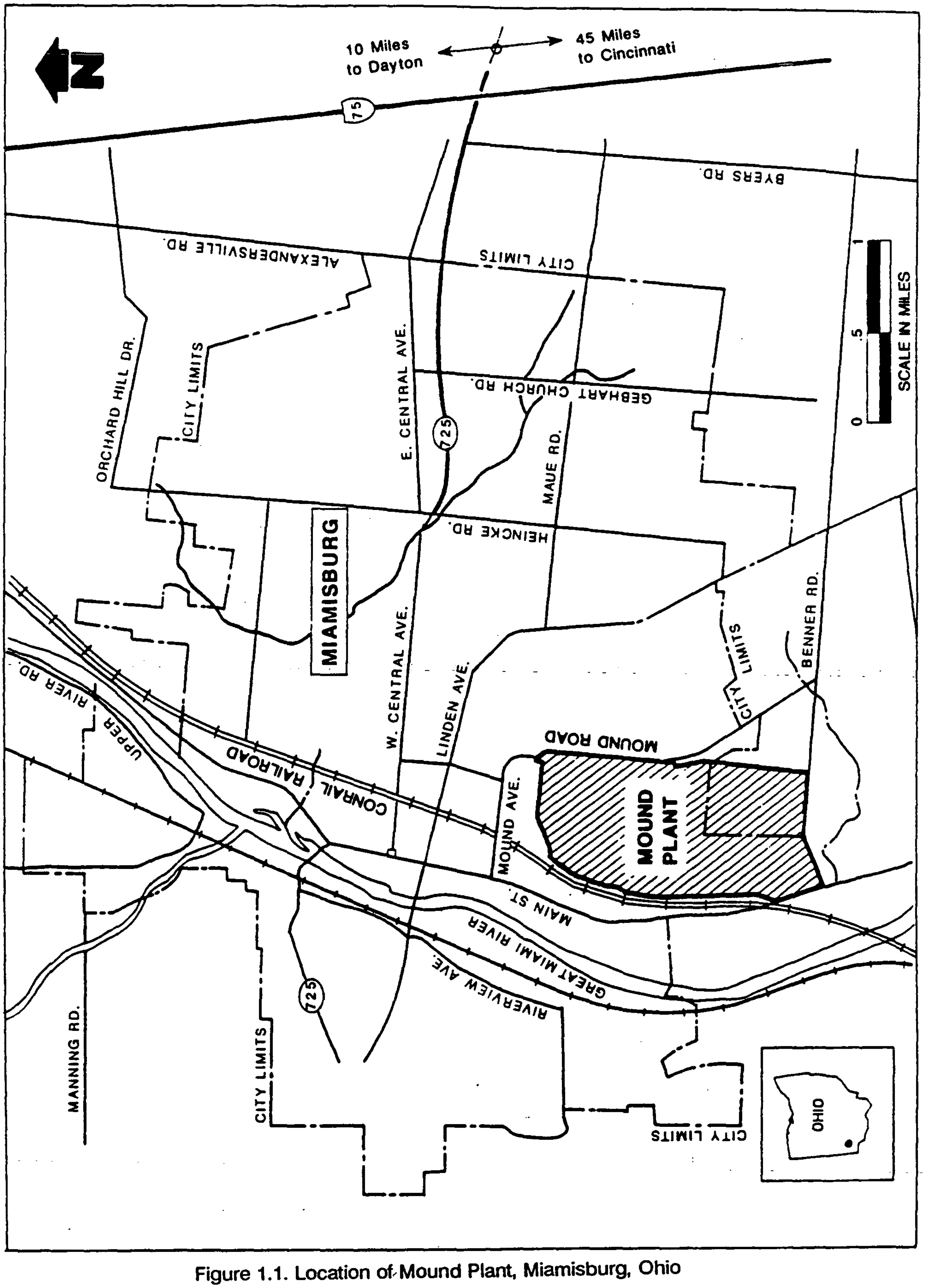

Figure 1.1. Location of Mound Plant, Miamisburg, Ohio

treated wastes from these buildings (DOE 1992). Solvents were used as cleaning agents during manufacturing processes while waste oils were often the by-product of metal cutting during manufacturing.

In the early 1970s, as national concerns about the environment and the conservation of resources grew, Mound Plant expanded its comprehensive programs in environmental control, waste management, and energy conservation. In January 1975, Mound Plant formally came under the jurisdiction of the Energy Research and Development Administration upon dissolution of the Atomic Energy Commission (AEC). In October 1977, Mound Plant was incorporated into the DOE complex.

Mound Plant was placed on the CERCLA (Superfund) National Priority List (NPL) in November, 1989. Pursuant to that status, a CERCLA Section 120 Federal Facility Agreement (FFA) was signed between DOE, EPA and OEPA (Administrative Docket Number V-W-90-C-075), and became effective October 12, 1990. A RI/FS was initiated at Mound to characterize the nature and extent of risks faced by uncontrolled hazardous waste and for evaluating potential remedial options.

In response to being placed on the NPL, an Environmental Restoration (ER) Program was initiated by DOE at Mound to fulfill its obligations under the FFA. The site was divided into Operable Units to simplify the investigation and program management. The Main Hill of Mound Plant (Figure 1.2) is OU-2. Operable Unit 2 comprises the portion of the site where the majority of the research and manufacturing took place.

1.2. OBJECTIVE

The objective of the OU-2 RI/FS is to define the nature and extent of contamination on the Main Hill, characterize the risks to human health and the environment posed by exposure to affected medium, to evaluate potential remedies and to determine the affect of potential releases of contaminants to groundwater. The objectives for Phase I of the OU-2 RI/FS, are to obtain information to help establish the scope for the subsequent phases of the investigation. Phase I consists of five separate tasks. The scope of this technical memorandum is to present the activities and results of Task 1 which consists of the bedrock topography mapping in the vicinity of the Main Hill at Mound Plant. The objective of Task 1 is to assess the configuration of the bedrock surface which may indicate the presence of bedrock channels, weathered zones, and possible preferential fracture zones all of which may act as contaminant migration pathways.

Task 1 consists of reviewing OU-2 well log and boring log data from previous investigations, general fracture analysis, a seismic refraction investigation, a ground penetrating radar test investigation, and a

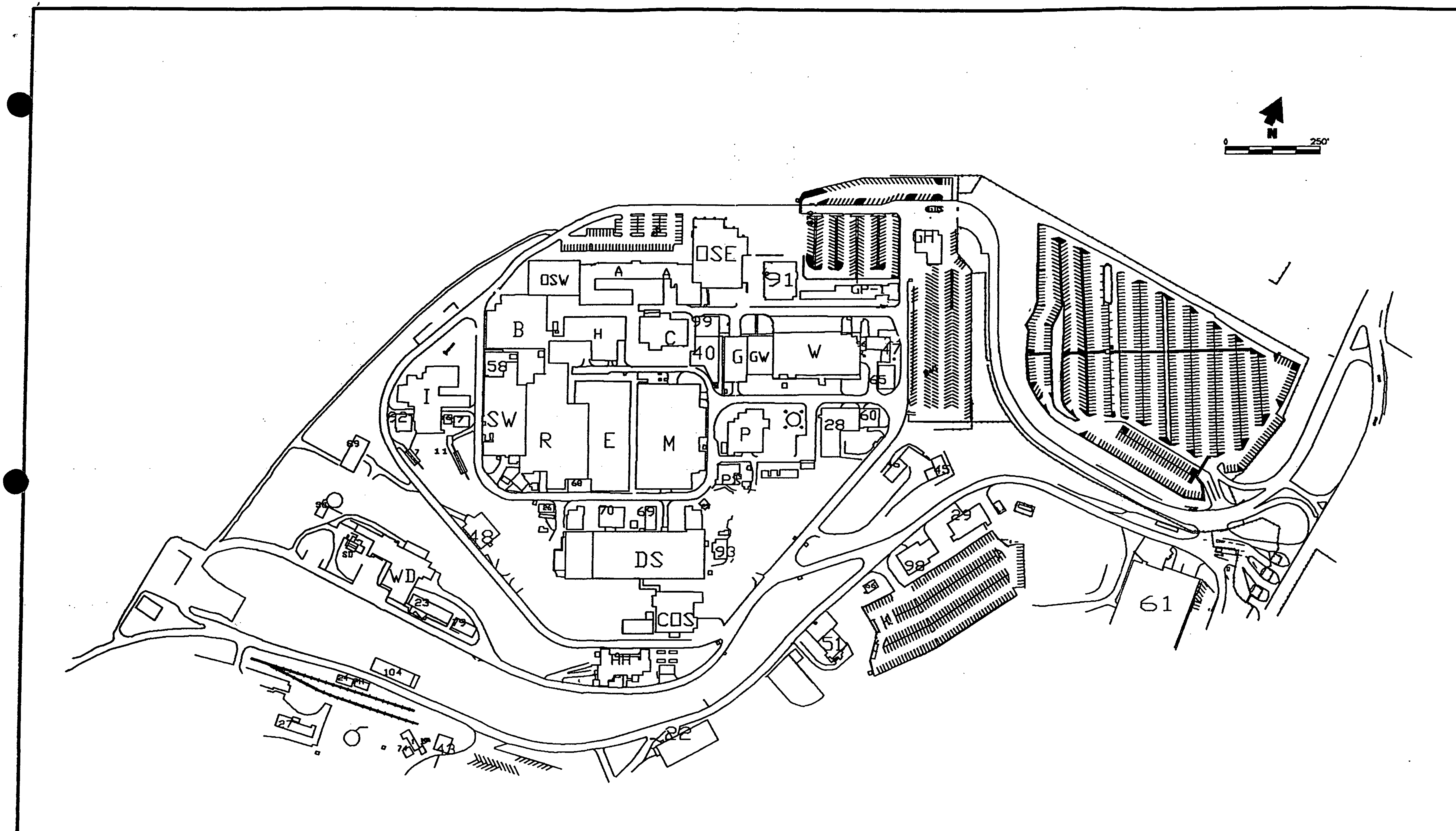

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Figure 1.2. Mound Plant Areas and Main Building

cone penetrometer investigation. The data from each of these investigations were reviewed and integrated to produce an overall map of the bedrock surface at OU-2 and to investigate bedrock physical characteristics regarding possible migration pathways. The activities and results for each of these investigations are presented in Section 2 through Section 6 of this report. Section 7 presents the overall conclusions of Task 1.

Section 2

2. HYDROGEOLOGIC CONDITIONS

2.1. SUMMARY OF GEOLOGIC UNITS

The geologic units encountered at the site consist of a soil veneer overlying interbedded limestone and shale bedrock. The soil is composed of Quaternary glacial deposits and recent fill material. Bedrock encountered beneath the site is composed of Ordovician marine shales and limestone of the following formations, from lowest to highest: the Corryville Formation, the Mount Auburn Formation, the Oregonia Formation, the Waynesville Formation, the Liberty Formation, and the Whitewater Formation (see Figure 2.1). The stratigraphic units at the site are reported to be horizontal and undeformed; the contacts between the various limestone-shale formations are reported to be gradational (DOE 1994).

At the site, only the Quaternary deposits and the Whitewater, Liberty, and Waynesville Formations are encountered within the top 100 feet; the depth at which the majority of the groundwater flow is thought to occur, as explained below in Section 2.3. The lithology of these water bearing formations are discussed below.

2.1.1. Quaternary Deposits

The soils covering the site consist of Quaternary glacial deposits (till) and recent fill. The glacial till is a highly variable mix of clay, silt, sand, and gravel. In many of the soil borings, the till was logged as consisting primarily of clay and silt with varying amounts of sand and gravel. In places, the fill material was logged as containing predominantly sand and gravel with varying amounts of fines. Generally, these soils are less than ten feet thick and were thickest around the perimeter of the site. The color of the soils were highly variable and were typically logged as either blue-grey, brown, or yellow.

2.1.2. Whitewater Formation

The Whitewater Formation is composed of irregular thin beds of limestone and fossiliferous shale. Boring logs (Appendix A) from the site indicate that the Whitewater Formation may contain up to 40 percent shale which is much more than the 14 percent shale which this Formation is reported to generally contain (Tobin 1986). The limestone is frequently logged as having a blue-gray to dark gray color. Bryzoa and brachiopods are among the fossil species identified in the Whitewater Formation (DOE 1994). The shale generally occurs as relatively thin (less than six-inch-thick) beds. Near the surface, the shale was frequently logged as brown clay seams within the limestone. The Whitewater Formation is reportedly intensely fractured locally (Weston 1994).

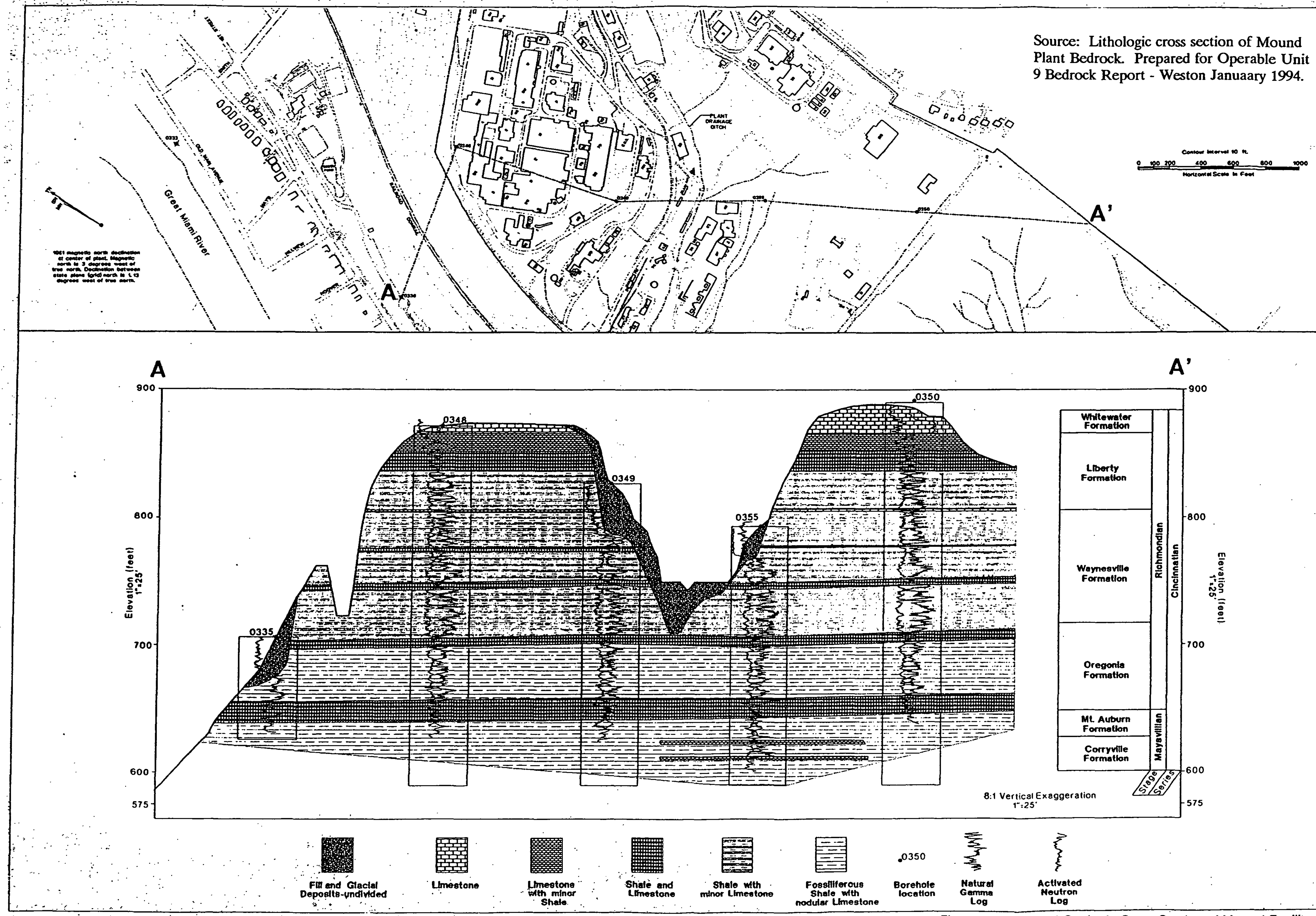

Figure 2.1. General Geologic Cross-Section of Mound Facility

The bottom of the Whitewater Formation was reported at an elevation of 866 feet above mean sea level (msl) in a boring made outside of the study area (Boring 0350) (DOE 1994). However, the Whitewater Formation was not recognized in Boring 0348 which starting at an elevation of approximately 877 feet above msl. As previously mentioned, the shale content of 40 percent that was logged in the limestone was interpreted to be the Whitewater Formation. The shale content was greater than expected for the Whitewater Formation (14 percent) and more representative of the shale content expected in the underlying the Liberty Formation (45 percent), as discussed below. It appears as though there is some uncertainty in the elevation of the contact between the Whitewater and the Liberty Formations. The base of the Whitewater Formation is interpreted to be at an elevation of 866 feet and some of the logs calling the Whitewater Formation with up to 40 percent shale may have actually been the Liberty Formation.

2.1.3. The Liberty Formation

The Liberty Formation is described as limestone with up to 45 percent interbedded shale (Tobin 1986). However, the shale content increases with depth; at the base, this formation is predominantly shale with intercalated limestone. The transition to predominantly shale was logged in the deep borings at the site as occurring at an elevation of approximately 815 feet. The base of this formation is reported at an elevation of approximately 805 feet msl. The thickness was estimated to be approximately 61 feet (DOE 1994 and Tobin 1986). Locally, the Liberty Formation is reported to be highly fractured (DOE 1994). An indicator fossil of the Liberty Formation is the brachiopod *sp. Thaerodonta* (Davis 1992).

The logs of the wells and borings that penetrate the Liberty Formation indicate that the limestone is dark gray, fossiliferous, and coarsely to microcrytaline. The shale layers were logged as gray, fossiliferous, and dense.

2.1.4. The Waynesville Formation

The Waynesville Formation generally consists of thick shale beds with evenly spaced intercalated limestone beds. Limestone with intercalated shale beds were noted in the middle portion of this formation (DOE 1994). Shale beds account for approximately 67 percent of the formation. The thickness of the Waynesville Formation ranges from approximately 88 to 100 feet (Tobin 1986 and DOE 1994). The Waynesville Formation was encountered between elevations of approximately 717 and 805 feet msl. A pyrite zone was noted at the top of this formation in Boring 2. This boring also noted that the shale content in the Waynesville Formation increased with depth. The Waynesville Formation is observed to be highly fractured in the core samples from Boring 0348.

2.2. SUMMARY OF HYDROGEOLOGY

Groundwater at the site occurs primarily within the bedrock. However, two borings had reported saturated conditions at shallow depths (less than ten feet) within till (Borings 392 and 394). The shallow groundwater within the till appears to be very limited because other adjacent borings did not report the detection of saturated conditions. The approximate elevation of the shallow groundwater within the till is 873 feet msl.

Groundwater elevation data is limited to Wells 114 through 116 and logs of soil Borings 2 and 0348. In 1990, the groundwater elevations in the wells range from approximately 835 feet msl in Well 115 to approximately 820 feet in Well 116. In 1993, the static groundwater elevation in Boring 0348 was approximately 860 feet msl; and in 1973, the groundwater elevation in Boring 2 was approximately 830 feet msl.

Eight seeps have been noted around the perimeter of the site. The majority of the seeps occur on the northern portion of the property and at elevations between approximately 800 and 820 feet msl. These elevations generally correspond with the basal portion of the Liberty Formation which is composed predominantly of shale, as explained above in Section 2.1.3.

In the vicinity of the site, potable water generally occurs above an elevation of approximately 800 feet msl, which approximately corresponds with the upper portions of the Waynesville Formation. Below an elevation of approximately 800 feet msl, the salinity is reported to increase rapidly. The increased salinity has been attributed to dissolved marine salts that may be remnants from deposition during the Ordovician.

2.3. CONCEPTUAL MODEL OF HYDROGEOLOGIC SYSTEM

The conceptual model of the hydrologic system consits of two general zones: a fractured carapace, which includes an upper fractured carapace and a lower, less-fractured carapace, and competent bedrock (see Figure 2.2)(DOE 1994). Each of these zones and their role in the conceptual model are explained below.

The upper fractured carapace occurs from the top of bedrock and is estimated to extend to a maximum depth of approximately 50 feet. This zone exhibits frequent, interconnected fractures that are partially saturated. Meteoric water migrates primarily vertically through fractures in the upper carapace. Bedding

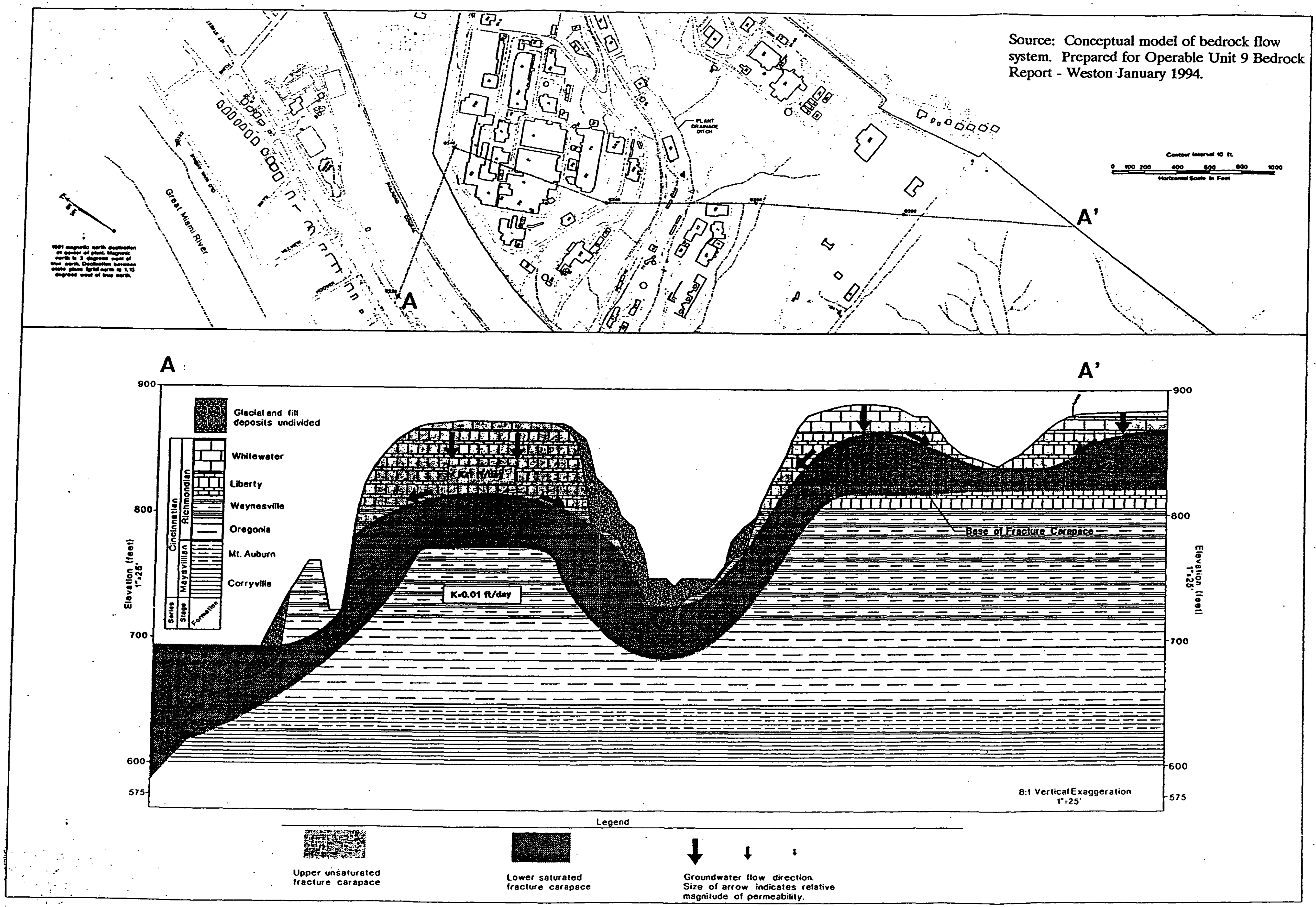

Figure 2.2. Previous Conceptual Model of Hydrogeologic System

plane fractures may divert flow horizontally in places. Field permeability tests (Dames and Moore 1973) indicated that most of the groundwater flow occurs in the upper 30 to 35 feet of weathered bedrock. Calculated hydraulic conductivities are approximately 1 ft/day.

The lower less fractured carapace is estimated to extend to a maximum depth of approximately 100 feet in the bedrock. In the lower fractured carapace, the fractures become less frequent/less interconnected and appear to be saturated with groundwater. Groundwater flow is thought to be primarily horizontal within the lower fractured carapace. The degree of interconnection between the fractures is assumed to decrease with depth until the permeability approaches that of unfractured rock (.01 ft/day).

The competent bedrock occurs at depths greater than approximately 100 feet and is generally unfractured to slightly fractured rock. Permeability tests conducted within the competent bedrock resulted in estimates of hydraulic conductivity ranging from 1.3×10^{-3} to 2.9×10^{-2} ft/day. The significantly lower hydraulic conductivity in the bedrock indicates much slower groundwater flow. Within the competent bedrock, groundwater is increasingly connate, with depth.

The top of the upper fractured carapace (top of fractured bedrock) was evaluated by carefully examining the depth to bedrock as logged in the many previous soil borings that have been drilled at the site. Figure 2.3 is a contour map of the top of (fractured) bedrock. Figure 2.3 indicates that the top of fractured bedrock is not flat but exhibits a number of localized topographic features (e.g. troughs and mounds). The contour map for fractured bedrock is discussed in detail in conjunction with the geophysical and CPT data in Section 7 of this report.

The surface of the competent bedrock was difficult to evaluate. First of all, a vast majority of the borings did not penetrate the bedrock deep enough to evaluate the presence of competent bedrock. In addition, the presence of fractures are seldom described in lithologic logs in the detail needed to determine whether competent bedrock was encountered. Because of this, the surface of the competent bedrock was not contoured. The competent bedrock zone suggested in the previous study (DOE 1994) was based on borehole geophysical information from one boring on the Main Hill whose information was extrapolated over the entire hill. This is not enough information to construct a contour map of the competent bedrock surface.

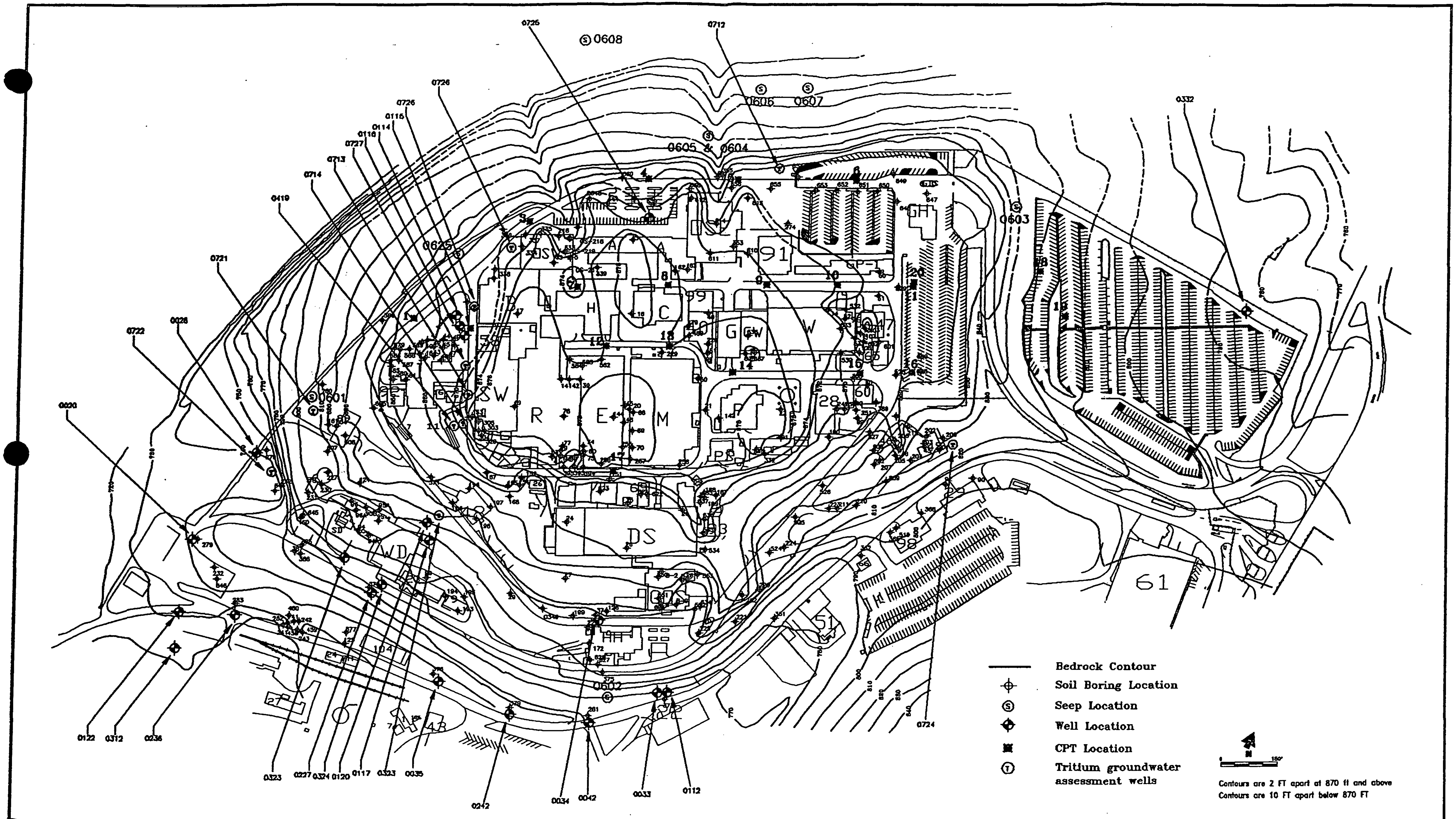

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Figure 2.3. Fractured Bedrock Contour Map

Section 3

3. FRACTURE STUDIES

3.1. SUMMARY OF ACTIVITIES

A fracture trace analysis was performed on the Main Hill to evaluate structural trends and assess the relationship between fracture traces and bedrock features. The analysis entailed reviewing historical aerial photographs, topographic maps, and relevant geologic literature.

The Franklin and Miamisburg Quadrangles of the United States Geological Survey (USGS) 7.5-Minute Series topographic maps were reviewed. The Franklin quadrangle was revised in 1992 and the Miamisburg Quadrangle was photorevised in 1987. These topographic maps show regional stream drainage patterns, surface depressions, ridges, and other potentially linear features which may be influenced by subsurface fractures.

Black and white aerial photographs from 1938, 1949, 1968, 1980, and 1987 were examined. These aerial photographs were on a scale of approximately 1:9,600. The aerial photographs were reviewed for stereoscopilly linear features and other features which may indicate subsurface fractures such as tonal variations in soils and alignment of vegetation. Care was taken to avoid recording cultural features, such as fence lines or little-used roadways. Similarly, photographic artifacts, such as slight creases or photographic development irregularities, were avoided.

3.2. FRACTURE TRACE ANALYSIS

A previous fracture trace analysis was performed measuring fracture orientation and frequency in outcrops (DOE 1994). Two predominant fracture sets were identified in the study; one trending N50°W to N70°W and a second set trending N10°E to N30°E. Theses structural trends are consistent with those reported regionally, and are attributed to Late Ordovician structural warping associated with the Cincinnati Arch (DOE 1994). These predominant fractures are reported to be present in limestones and shales. Two minor sets of fractures were also identified that trend N30°W to N40°W and N60°E to N80°E. This second set is more predominant in limestones.

Fractures were observed in lithologic core samples obtained from five boreholes during the previous bedrock investigation at the Mound Facility (DOE 1994). As explained in Section 2.3, the frequency of fractures observed in boreholes indicate that the upper 50 feet of bedrock are reported to be the most fractured and that fracture frequency appears to decrease with depth. This is supported by measurements of aquifer hydraulic conductivities which were up to four orders of magnitude lower in the apparently unfractured competent bedrock (see Section 2.3).

3.3. DISCUSSION OF FRACTURES ON THE MAIN HILL

On the Miamisburg Quadrangle, in Section 30 of Township 3 north and Range 5 east (3N/5E-30), which is approximately four miles northwest of the site, there are very prominent stream channel lineations trending approximately N60°W, approximately the same trend of one fracture trace measured in the previous investigation (DOE 1994). These lineaments, if extrapolated, would intersect the Main Hill. Closer to the site in Miamisburg, Sycamore Creek and an unnamed creek south of the Hill Grove Cemetery also show a lineation trending N60°W. Approximately five miles north of the site, in 3N/5E-10, Opossum Creek has a strong linear feature that trends N50°W.

On the Franklin Quadrangle in 2N/5E-21 and 2N/5E-22, the stream channels show a lineation trending approximately N20°E, and to lesser of an extent, due north. Crains Run, located approximately two miles south of the site, has a prominent lineation that trends N60°W.

Historical aerial photographs were of most value in evaluating lineations. The majority of natural drainage patterns in the vicinity of Mound Plant were obscured by urban and agricultural development. However, an aerial photograph taken in 1938, that pre-dates construction of the Mound Plant, shows surface lineaments in the vicinity of the plant that trend N60°W, N20°E and N50°E. These lineaments trend directly through the Main Hill site. Stream channels south and east of the site show lineaments trending N60°W, N20°W to N30°W, and N10°E to N20°E.

Section 4

4. SEISMIC REFRACTION SURVEY

This section of the report presents the seismic refraction methodology as well as the procedures and results of the seismic refraction investigation performed by ICF Kaiser Engineers, Inc., (ICF KE) at OU-2. This investigation was one of the first tasks in Phase 1 of the OU-2 RI/FS. The field survey was performed from May 2 through May 10, 1994.

4.1. INTRODUCTION AND OBJECTIVES

The purpose of the seismic refraction investigation at OU-2 is to approximate the depth, configuration and physical characteristics of the bedrock on the Main Hill. That information will be used to assess the location of bedrock features that may act as preferential flowpaths (conduits) or barriers to local groundwater flow and possible contamination. Bedrock features effecting groundwater flow include possible subsurface channels (lows), bedrock highs and possibly preferential fracture zones within OU-2 the area. Due to the decreased permeability of deeper portions of the bedrock, these features could have an effect on the distribution of analytes and their concentrations. Therefore, knowledge of these features is important information regarding site characterization.

The shallow bedrock underlying OU-2 is reported to consist of the Whitewater and Liberty Formations comprised of poorly bedded limestones and limestones with interbedded shales. Vertical fractures and bedding plane fractures are believed to control the infiltration and horizontal flow of groundwater. Both interconnections between vertical fractures and the number of vertical fractures decrease with depth, reducing the vertical permeability. Some of the groundwater flow is believed to be diverted laterally through the shallower hydraulically conductive portions of the rock until it emerges as hillside seeps. The configuration of the bedrock surface may affect shallow groundwater flow as bedrock channels may act as preferred pathways. The physical characteristics of the bedrock, such as the amount of weathering/fracturing, is another consideration in the evaluation of groundwater flow.

Seismic refraction data was collected to assess the depth, configuration, and seismic velocity of each seismic layer. These data were used to interpret the physical characteristics of the bedrock and its configuration. The seismic refraction data will be correlated with previous borehole data and cone penetrometer data obtained during this task of the RI/FS to interpret the location of possible subsurface channels, flow barriers and possible fracture zones.

Due to the numerous interferences on site, the seismic refraction method was first tested at OU-2 to determine if usable data could be collected. Usable data was collected in a number of areas at OU-2.

In some areas the data was unusable due to the numerous interferences and structures present at those locations.

4.2. SEISMIC REFRACTION METHOD

The seismic refraction method determines the seismic velocity of subsurface layers as well as their thickness and configuration. Seismic velocity is effected by composition, degree of hardness, degree of weathering and fracturing, consolidation, and other physical characteristics of the subsurface materials. Igneous rocks and sedimentary rocks that are highly consolidated or lithified typically have higher seismic velocities than materials such as alluvium, colluvium, soil, landslide debris and fill material.

In the seismic refraction method, data is collected along geophone spreads. Each spread is a collinear array of geophones (sensors) distributed at predetermined intervals. Seismic energy is generated at a number of locations along these spreads (shotpoints). Shotpoints are typically located at the end of each spread, in the middle of each spread, and offset a number of feet from both ends of each spread. The time it takes for a compressional seismic wave (P-wave) to travel from a shotpoint to each geophone (arrival times) is recorded by an engineering seismograph for each shotpoint. Hard copies of the seismic waves are produced in the field and the information is also recorded on computer disk.

The seismic data display the amount of time it takes for a P-wave to travel from a given shotpoint to each geophone in the spread (arrival time). The arrival times from each of the shotpoints to each geophone are first picked using a computer program (SIPIK) and plotted versus their respective distances from each shotpoint (time-distance graph). Straight line segments are fit through the arrival times which identifies various seismic layers and their apparent velocities. Each arrival time is assigned to its respective seismic layer. These parameters then serve as input to inversion modeling programs (SIPT2, Rimrock Geophysics). The output consists of the average seismic velocity and depth of each seismic layer beneath the shotpoints and geophones. Computer generated seismic velocity cross-sections were generated and are used for geologic and hydrogeologic interpretation.

Several assumptions and limiting factors should be considered when interpreting and/or applying seismic refraction information. These assumptions and limitations are inherent to the technique and are common to most interpretation routines. They are as follows:

- The seismic velocity must increase with depth. The velocity of each layer must be greater than the layers overlying it. This is usually the case in the real world especially in situations with shallow bedrock. However in rare cases where velocity decreases occur, the low velocity layer will not be detected and the computed depth to all layers underlying it will be erroneous.

- Lithologic layers will not be individually resolved unless their velocity contrasts with that of adjacent layers. Conversely, variation in elastic properties of a given lithologic unit may result in two or more seismic layers corresponding to a single lithologic layer.

- Unless otherwise designated, seismic layers are assumed to have a constant velocity along the entire length of the geophone spread.

- Steeply dipping seismic velocity layers may cause slightly inaccurate depth estimates.

- The computed depth to a seismic interface may not be directly below the profile. There may be a slight difference if a shallow interface dips at a large angle in a direction transverse to the profile.

- The velocity of a seismic layer can vary with direction depending upon the orientation of sedimentary structure, bedding planes, fractures, joints, etc. relative to the seismic profile. This can result in a slight discrepancy in the computed velocity and depth of seismic layers between crossing profiles.

4.3. FIELD INVESTIGATION AND DATA ACQUISITION

High quality seismic refraction data was difficult to obtain at Mound Plant since data were only obtainable from paved roads. On-going pedestrian and vehicle traffic created noise and interference as well as logistical problems. Portions of the roads were cordoned off during the surveys and data were obtained during quiet periods in the traffic flow. Geophones were affixed (taped) to bricks in attempt to achieve a good coupling with the street surface. Shotpoint data were stacked several times to increase the signal to noise ratio in attempt to overcome interferences. The asphalt/concrete surface generated high frequency noise which overshadowed or muted out the first arrivals (signal) at the first four to five geophone locations along most of the spreads. Therefore, first arrivals had to be approximated for several of these geophone locations.

Another major problem in collecting high quality data at Mound Plant was due to the numerous buried utilities located under the roads and sidewalks. Subsurface utilities cause interference and, in many cases, eradicate the signal and preclude the collection of usable seismic refraction data. This problem was encountered during the first few attempts to collect data. However, utility maps of the Mound Plant (supplied by facility personnel) were used to locate the seismic refraction spreads in areas where few utilities existed. This improved the capability to collect useful data, however, not all attempts proved to be successful.

Attempts were made to collect seismic refraction data in all of the proposed areas. Seismic refraction data were collected from eleven profiles referred to as Profiles A through K (Figure 1.1). Each profile differs in length and are comprised of one to five geophone spreads. The highest quality data were collected from the perimeter of the facility along Profiles C, H, I, J and K. In some areas the data were useful, however, the data were effected by the interferences discussed above and some approximations were made. These areas include Profiles A, D, E and F (center of the facility between buildings). The data obtained along Profiles B and G were not useful for interpretation.

Each seismic refraction spread consisted of 24 geophones located at 10 to 20 foot intervals. Three shot points were utilized for each spread, 2 end shotpoints and 1 middle shotpoint. Seismic energy at each shotpoint was provided by striking a metal plate located on the ground surface with a 12-pound sledge hammer. Each of the shots were conducted several times and added together (stacked) to increase the signal to noise ratio. The data were recorded on a EG&G Geometrics SmartSeis 24-channel seismograph using digital grade geophones. The data were stored on computer disk and hard copy printouts of the data were made.

Shotpoint data were repeated at approximately 10 percent of the total number of shotpoints. This was performed to establish data reliability. In all cases, the shotpoint data were completely repeatable or reliable. Geophone spreads were overlapped approximately 50 feet along sections of two profiles as an added data quality measure.

Most of the geophone spreads were 200 feet in length, which corresponds to a depth of investigation of approximately 50 to 60 feet. Elevations of the geophones and shotpoints were obtained from a facility contour map.

4.4. RESULTS

The results of the seismic refraction survey are illustrated on the seismic velocity cross-sections labeled Profiles A through K as shown on Figures 4.1 through 4.9. Each profile (cross-section) shows the position of the ground surface and the underlying seismic velocity interfaces beneath the length of each profile. They are constructed by using the calculated depth beneath each geophone and shotpoint. The average seismic velocity of the seismic layers along each profile is also indicated in feet per second (fps). In Figure 4.10, the profiles are offset to indicate their relative locations. A discussion of the general correlation between the seismic and boring log data is presented in Section 7 of this report.

The seismic refraction data resolve the subsurface into two seismic layers along the profiles. The velocity range and general geologic interpretation of each layer is summarized below. Reference should be made to Figures 4.1 through 4.9 for specific elevations of the various layers or the configuration of the layers along a particular profile. The seismic refraction data are presented in two groups of profiles due to the similar seismic velocities within each group. Group 1 includes Profiles D, E, A, and H. Group 2 includes

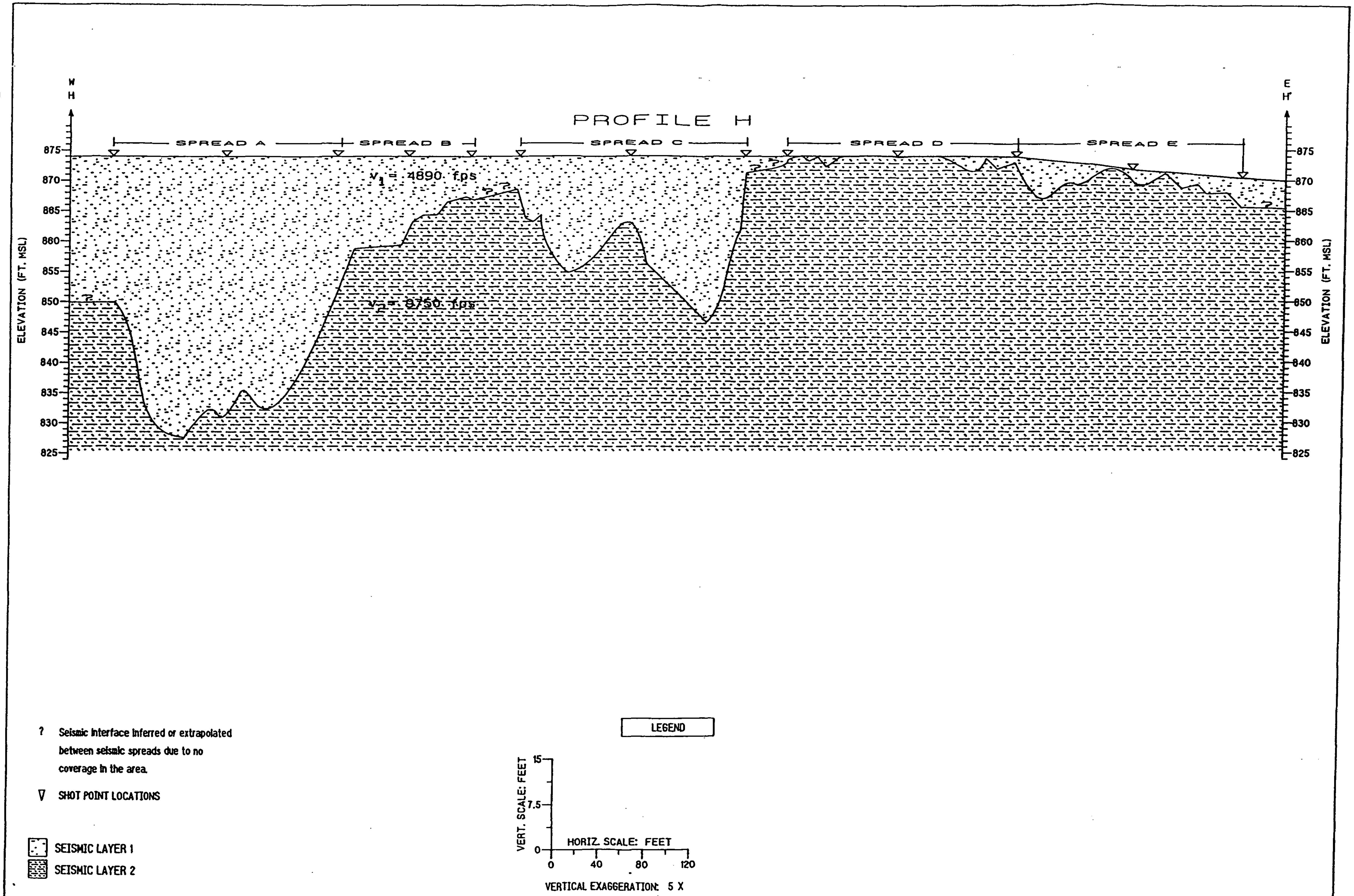
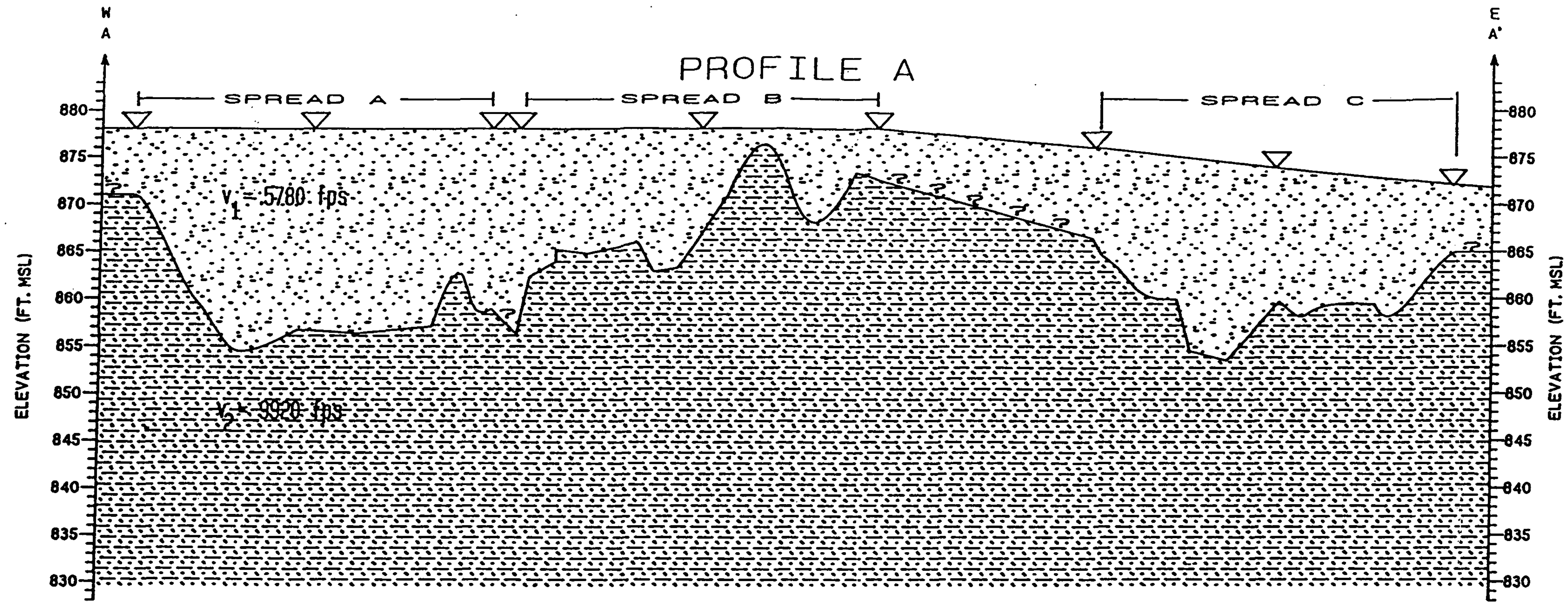


Figure 4.1. Seismic Refraction Profile H



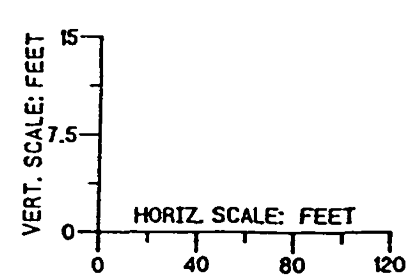
LEGEND

? Seismic interface inferred or extrapolated between seismic spreads due to no coverage in the area.

∇ SHOT POINT LOCATIONS

SEISMIC LAYER 1

SEISMIC LAYER 2



VERTICAL EXAGGERATION: 5 X

Figure 4.2. Seismic Refraction Profile A

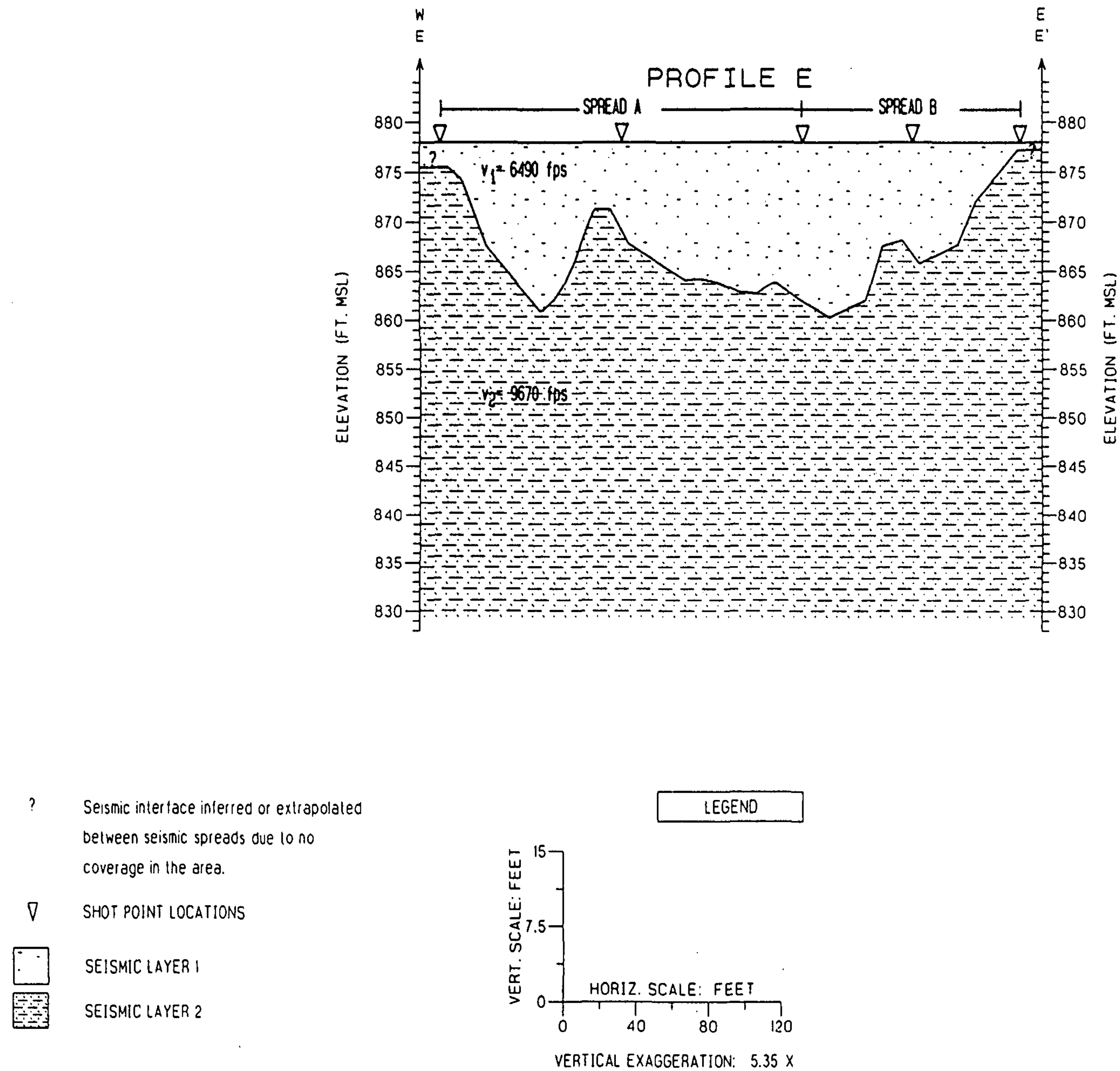


Figure 4.3. Seismic Refraction Profile E

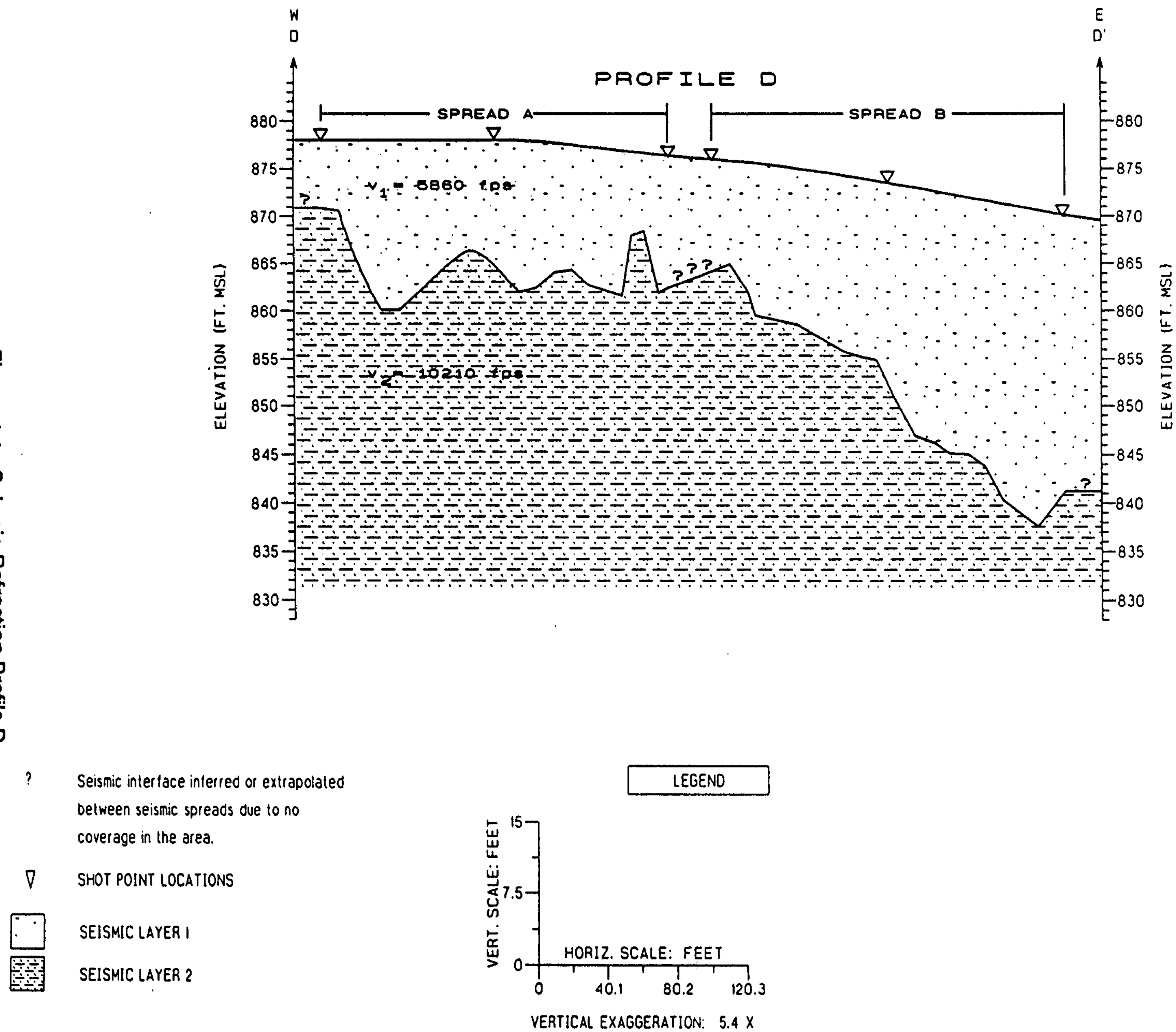


Figure 4.4. Seismic Refraction Profile D

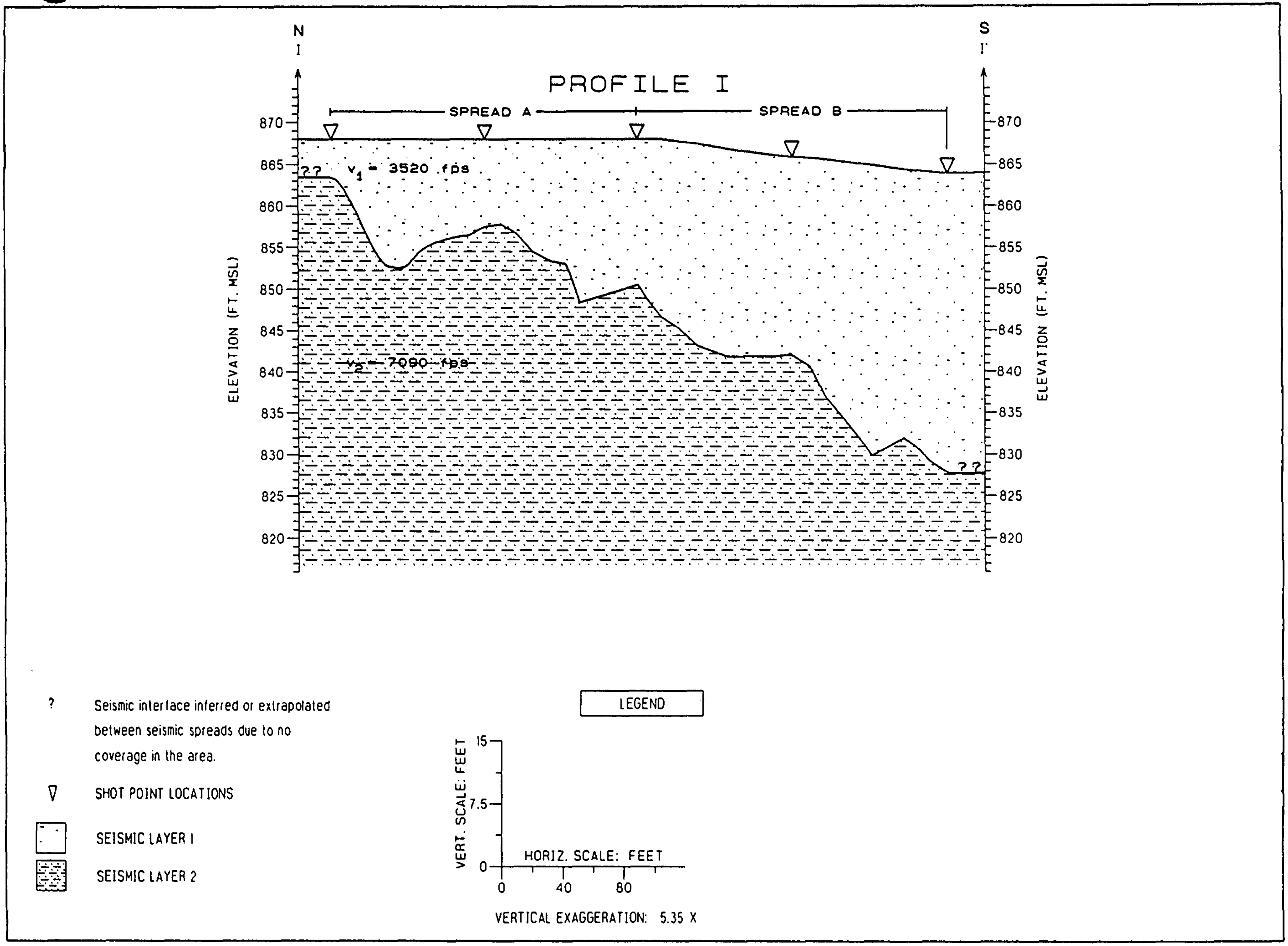


Figure 4.5. Seismic Refraction Profile I

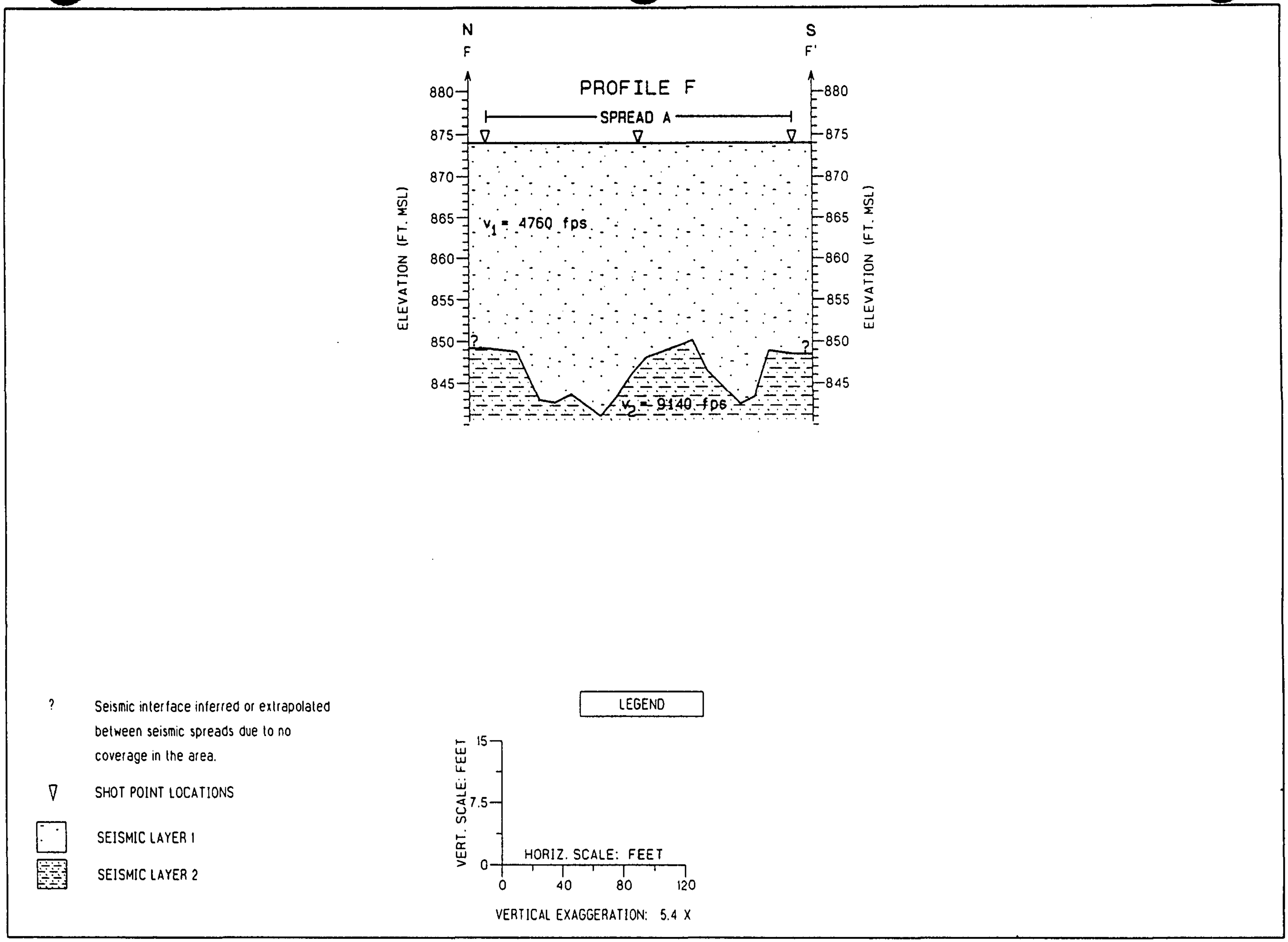


Figure 4.6. Seismic Refraction Profile F

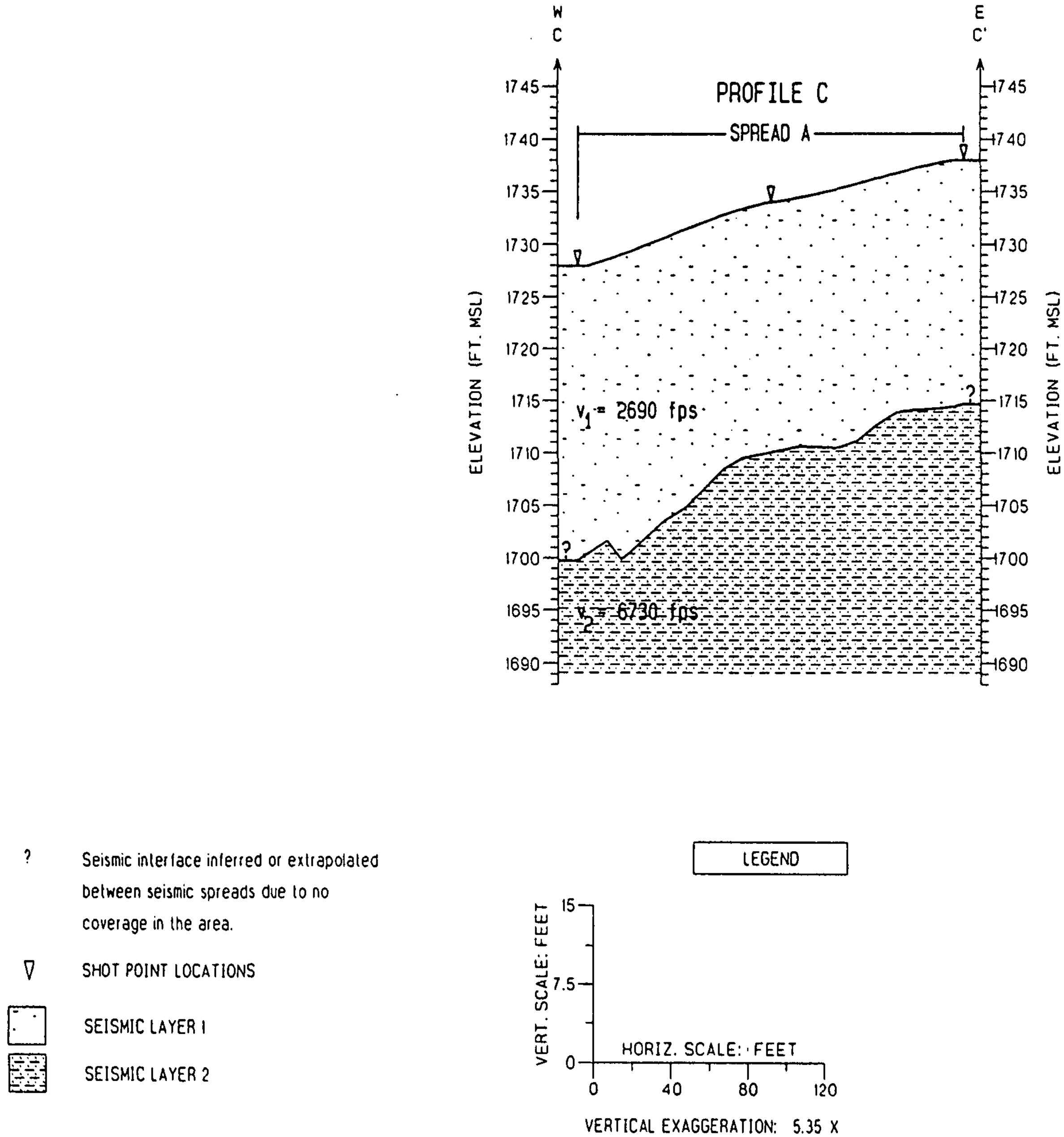


Figure 4.7. Seismic Refraction Profile C

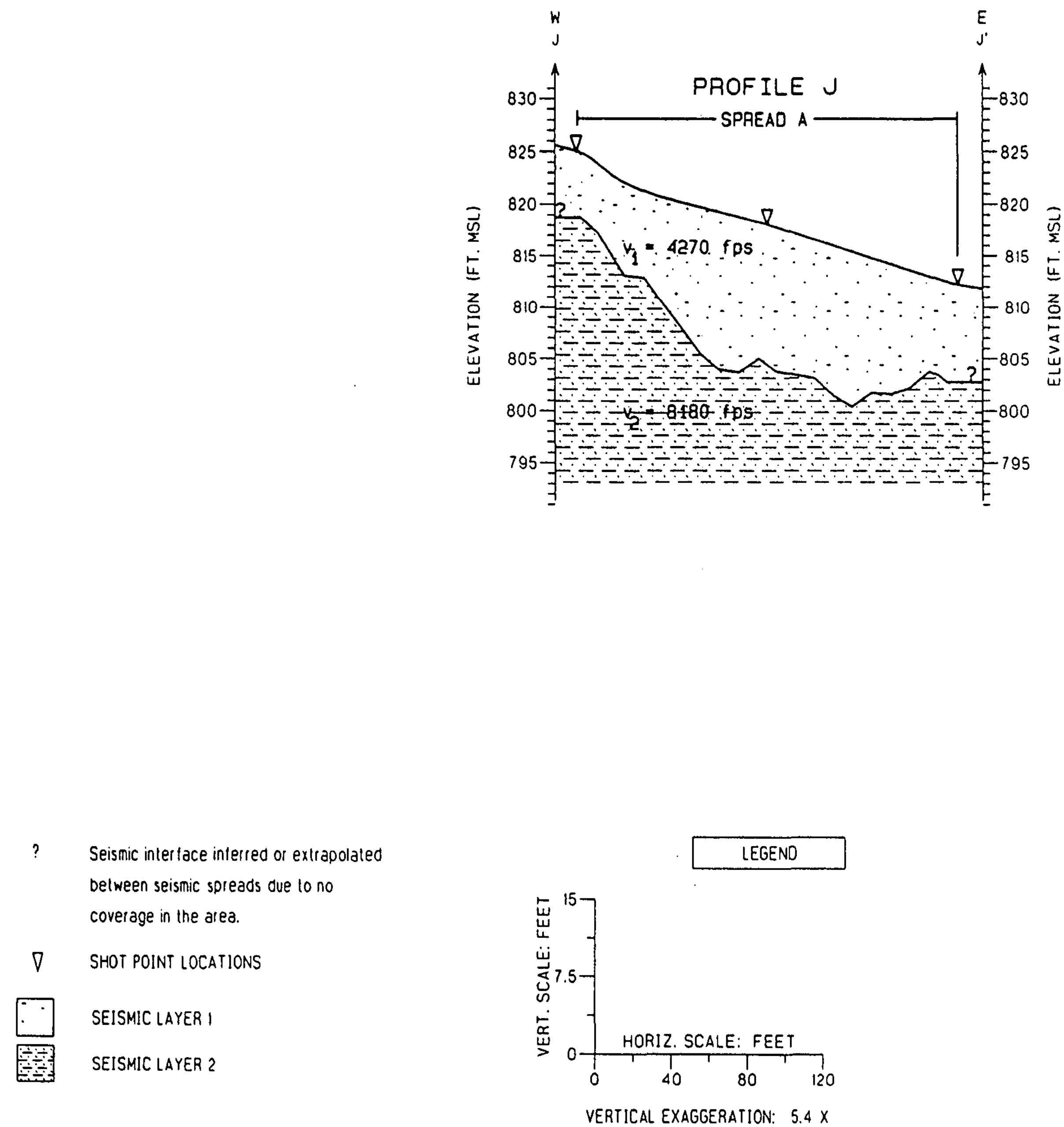


Figure 4.8. Seismic Refraction Profile J

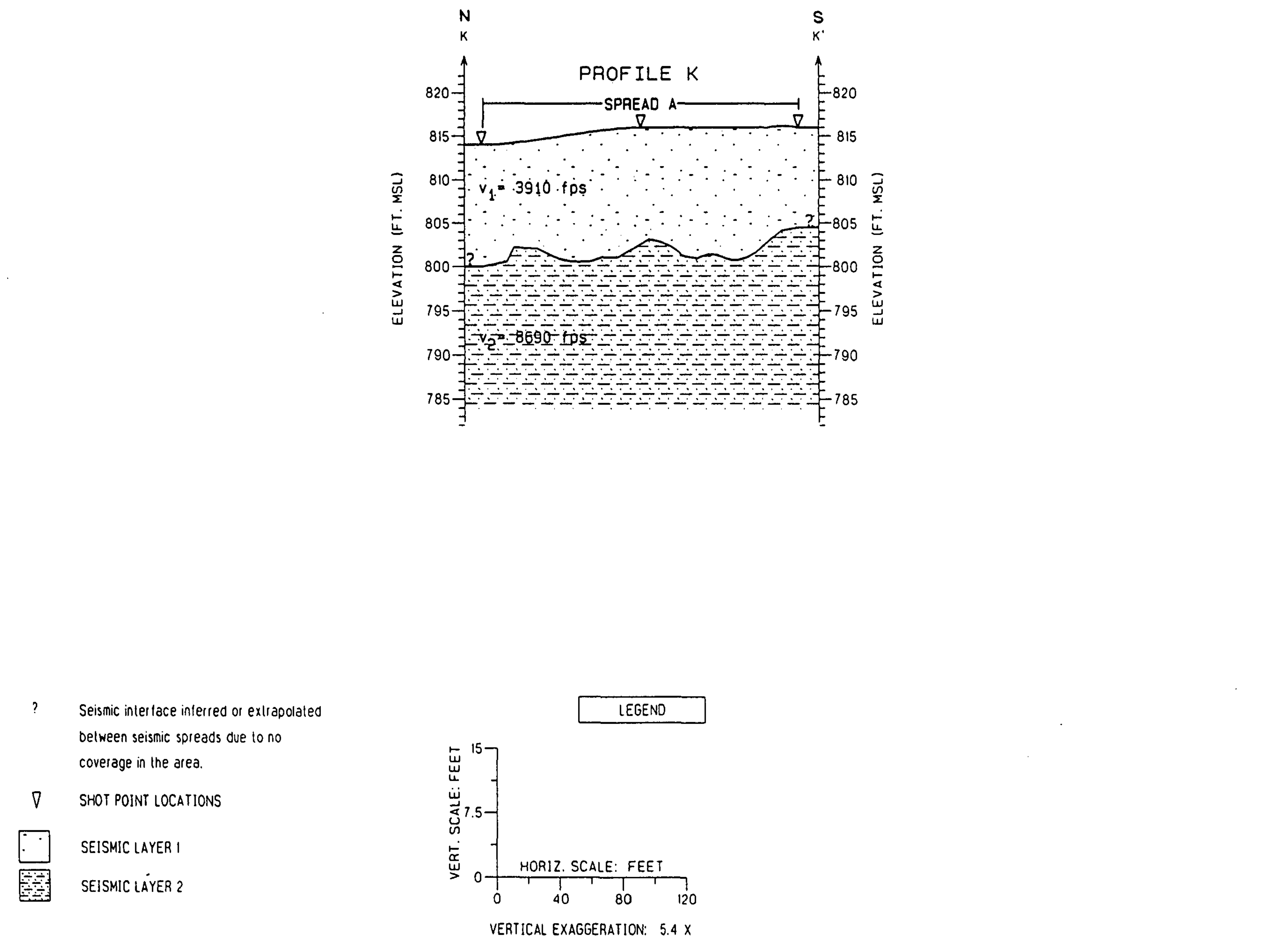


Figure 4.9. Seismic Refraction Profile K

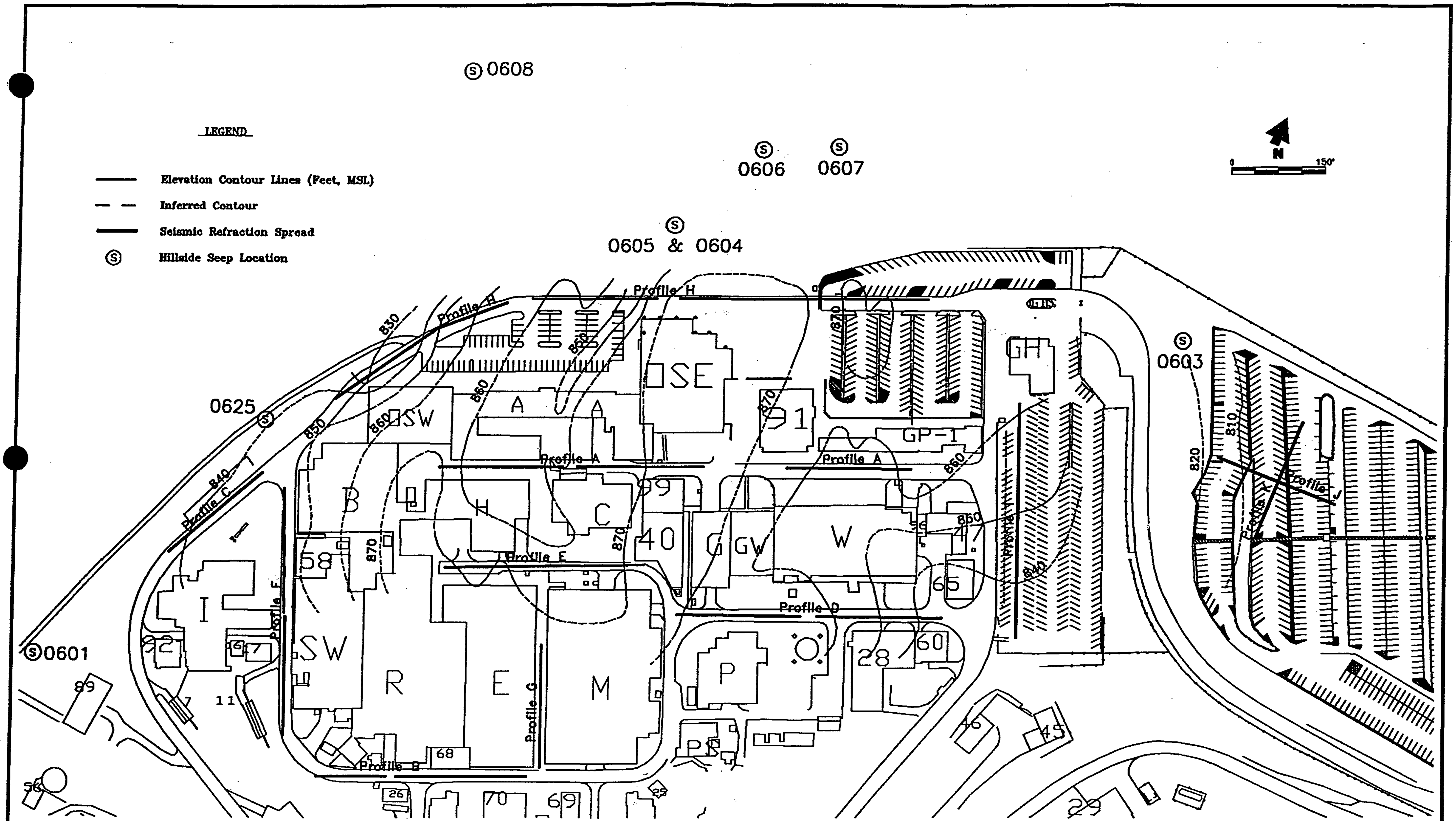


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Figure 4.10. Seismic Layer V2 Contour Map

Profiles C, F, I, J and K. Group 1 profiles trend east-west and are located within the center of the facility and along the northern boundary. Group 2 profiles are located on the eastern and western boundaries and flanks of the hill (mound) that the facility is located on.

Profiles D, E, A and H

- **Layer V1** - 4,890 to 6,490 fps. Layer V1 is a surficial layer and ranges in thickness from zero to approximately 47 feet along these profiles. The velocity range of this layer is typical of semi-consolidated and saturated sediments, soils and colluvium as well as medium to highly weathered or highly fractured bedrock. In some areas this layer may be representative of sediments and in other areas it may represent highly fractured/weathered rock (limestone/shale).

- **Layer V2** - 9,670 to 10,215 fps. Layer V2 is the deepest layer resolved and its thickness is undefined. The velocity range of this layer is typical of medium/slightly to non-fractured bedrock. Layer V2 generally corresponds to the Whitewater limestone/shale. It may represent the section where the occurrence of fractures and weathering decrease dramatically in the bedrock, or it may represent competent generally unweathered bedrock. The configuration of the top of Layer V2 is irregular.

Profiles C, F, I, J and K

- **Layer V1** - 2,690 to 4,760 fps. Layer V1 is a surficial layer and ranges in thickness from 7 to approximately 36 feet along these profiles. The velocity range of this layer is typical of unconsolidated unsaturated surface deposits such as residual soils and/or loose sediments to semi-consolidated or saturated sediments/colluvium.

- **Layer V2** - 6,730 to 9,140 fps. Layer V2 is the deepest layer resolved and its thickness is undefined. The seismic velocity of Layer V2 along Profiles C and I is 6730 fps and 7090 fps, respectively. These velocities are typical of highly to medium fractured/weathered bedrock. The seismic velocity of Layer V2 along Profiles F, J and K is 9140 fps, 8180 fps and 8690 fps, respectively. These velocities are typical medium to slightly fractured/weathered bedrock. The configuration of the top of Layer V2 is irregular.

Figures 4.1 through 4.9 indicate that the top of Layer V2 has an irregular configuration. Profile H indicates that Layer V2 occurs near or at the surface in the eastern section of the profile and the western section exhibits irregular topography with two major channel-like features. The remaining profiles also indicate somewhat irregular topography.

The elevations on the top of Layer V2 are generally lower than the elevations on the top of fractured bedrock surface derived from previous borehole logs and CPT data (Section 6) collected in this task (Figure 2.3). As presented above, the seismic velocity range of Layer V1 (along Profiles D, E, A and H) is typical of semi-consolidated and/or saturated sediments to highly weathered and fractured rock. Therefore, the lower portions of Layer V1 probably include the highly fractured, upper sections of bedrock where the high degree of interconnected fractures may transmit water. This may correspond to the upper fracture carapace (DOE 1994). The seismic velocity range for Layer V2 along these profiles is typical of slightly to possibly non-fractured bedrock. The upper portions of Layer V2 may represent the lower fracture carapace in the model (DOE 1994). Layer V2 most likely signifies the interface at which weathering/fracturing of the bedrock is decreased significantly. The upper fracture zone (highly fractured bedrock) apparently varies in thickness laterally.

The elevation data from Profiles A through H were used to construct a contour map of the top of Layer V2 (Figure 4.10). On Figure 4.10, contour lines are interpolated between profiles due to the lack of data. Data were not collected at those locations due to the presence of buildings and other structures. A major channel-like feature (relative low elevations) extends through Profile E, Profile A and Profile H. The relative relief on this feature ranges from 10 feet along Profile E to a maximum of approximately 20 feet along Profile H. The orientation, or axial trend, of the channel-like feature lines up with three hillside groundwater seeps (Seeps 604, 605, and 606). The axial trend of the feature also corresponds with the orientation of one of the two major fracture traces measured in the previous investigation, approximately N 20° E (DOE 1994).

Figure 4.10 also indicates that a linear zone with relatively higher elevations trends approximately north-south through the Main Hill where elevations exceed 870 msl. East of that feature elevations drop and another apparent trough or channel-like feature occurs between Profiles A, D and I. The axial trend of that feature is approximately N 70°W and is generally perpendicular to the trend of the feature discussed in the previous paragraph. The axial trend of this second feature corresponds with the orientation of the other major fracture set measured in the previous investigation.

Section 5

5. GROUND PENETRATING RADAR INVESTIGATION

This section presents the procedures and results of the ground penetrating radar (GPR) test survey. The GPR test survey was performed on May 10, 1994, in conjunction with the seismic refraction survey.

5.1. OBJECTIVE

The objective of the GPR test survey was to assess the effectiveness of GPR in detecting bedrock at OU-2. If the GPR test survey proved successful in detecting the bedrock interface, a sitewide GPR survey would have been performed. The GPR data would be used to complement the seismic refraction and cone penetrometer data to assess the bedrock interface. The success of GPR is dependent upon numerous site specific conditions and therefore, the test survey assessed the effectiveness of GPR in detecting the bedrock interface at OU-2.

5.2. GROUND PENETRATING RADAR METHODOLOGY

Ground penetrating radar is a geophysical method that provides a continuous, high resolution cross-section depicting variations in the electrical properties of the shallow subsurface materials. The method is particularly sensitive to subsurface variations in the electrical conductivity and electrical permittivity (dielectric constant). Conductivity effects the investigation depth of the GPR system. Highly conductive materials, such as clays or groundwater, limit the depth of penetration. Detection of bedrock, buried objects or other materials is dependent upon the dielectric constant contrast between the target and host materials. A sufficient dielectric constant contrast must exist over a short depth interval to produce reflections on the GPR records.

The system operates by radiating an electromagnetic pulse into the ground from a transducer (antenna) as it is moved along a traverse. Since most of the earth materials are transparent to electromagnetic energy, only a portion of the radar signal is reflected back to the surface from interfaces representing variations in electrical properties. The reflected signals are received by the same transducer and are printed in cross-section from a graphical recorder. The resulting records can provide information regarding the location of buried objects, stratification, the thickness and lateral extent of fill material, and changes in material conditions such as saturation, and possibly subsurface chemical differences.

Detection of bedrock is dependent upon a significant contrast in dielectric constants between bedrock and overlying materials, over a relatively short depth interval. Bedrock with a thick weathered zone will usually not produce GPR reflects because there is a gradual change from soil to bedrock. A sharp bedrock interface generally provides the significant contrast in dielectric constants necessary for the detection of the bedrock interface.

Each radar antenna consists of a single frequency. The higher the antenna frequency, the better the subsurface resolution. However, the higher the antenna frequency, the shallower the depth of penetration. The lower antenna frequencies provide better penetration depths, however, the subsurface resolution is limited.

The GPR system consisted of a modified Geophysical Survey Systems Incorporated (GSSI) SIR-10 system. The system is digital and contains an optical disk drive. Both 300 MHz and 100 MHz antennas were used for the test survey.

5.3. SUMMARY OF ACTIVITIES

Ground penetrating surveys were made at four locations within OU-2. To maximize the detection of the bedrock interface, the GPR test surveys were made in areas of reported shallow bedrock. The GPR test surveys were made:

- in the street north of and adjacent to the OSE Building;
- in the parking lots adjacent to and east of the OSE Building;
- in the parking lot adjacent to and west of the OSE Building; and
- in the street and parking lots surrounding the guardhouse at the northeast corner of the Plant.

At least four traverses were made at each location. Two antenna frequencies were tested at each location: a 300 MHz monostotic antenna and a 100 MHz high-powered bistatic antenna. After each traverse, the records were inspected in the field and adjustments were made to optimize the detection of bedrock.

To estimate the depth of penetration, GPR data were collected over a utility corridor, west of the OSE Building, where the depth of the utility was observed and measured. It was estimated that the GPR energy penetrated the local subsurface materials at a rate of approximately 1 inch per nanosecond (ns). The deepest penetration was achieved with the high-powered 100 MHz antenna where data were observed up to a maximum of 30 ns. Therefore the deepest GPR penetration at OU-2 was approximately 30 inches.

5.4. RESULTS

The GPR test survey failed to produce GPR reflections that could be interpreted as the bedrock interface. No continuous or semi-continuous reflectors, typical of bedrock, occurred in the GPR records. The only reflections that occurred in the data were a very few shallow reflectors typical of utilities. Therefore, the GPR test survey proved to be ineffective for detecting or mapping the top of bedrock at OU-2 and the GPR survey was terminated.

There are two reasons why the GPR method proved to be ineffective for detecting the bedrock interface at OU-2. First, the maximum GPR penetration was estimated to be 30 inches. This is generally shallower than the reported depth to bedrock in most OU-2 borehole logs. Second, the bedrock interface is reported to be a gradational contact. This type of contact usually exhibits a gradational distribution of dielectric properties, rather than a significant contracts (necessary to produce reflections on the GPR records).

Section 6

6. CONE PENETROMETER TESTING

The procedures and results of the cone penetrometer tests (CPT) performed at OU-2 during Task 1 of the OU-2 RI/FS are presented in this section of the report. The CPT field investigation was performed between May 24 and May 26, 1994.

6.1. OBJECTIVES

The objective of the CPT investigation was to assess the bedrock surface and to complement the geophysical and boring log information. The CPT method is an intrusive method of collecting data on soil characteristics, along with information regarding depth to the top of bedrock. The CPT method is also valuable for identifying zones of saturation. Possible water bearing zones would be identified in the soil overlying bedrock. A drawback associated with this method is the possible presence of boulders within the soil material on the Main Hill.

6.2. CONE PENETROMETER METHODOLOGY

Cone penetration tests are a tool for evaluating subsurface lithologies and geotechnical parameters without the collection of soil samples or the generation of soil cuttings or drilling fluids. Cone penetration tests consist of hydraulically pushing a 1.7-inch diameter instrumented probe (penetrometer) with a 35-ton thrust capacity into the soil. The resistance of the soil to penetration is measured at the conical tip of the penetrometer (cone end bearing resistance) and the sliding friction between the soil and the penetrometer is measured along a cylindrical sleeve (friction sleeve resistance) mounted just behind the cone tip. The ratio of the friction sleeve resistance to the measured cone end bearing resistance is the friction ratio. A continuous record of cone tip resistance, friction and friction ratio is generated. This information is used to assess subsurface lithologies based on published correlations between CPT data and general lithology.

6.3. SUMMARY OF ACTIVITIES

CPT data were obtained from twenty locations at OU-2. The CPT locations are presented on Figure 1.2. Electrical conductivity data were also collected to supplement the penetration resistance data with data that approximates the relative degree of saturation. These data were transmitted from the penetrometer to a computer data acquisition system at the surface. Sounding logs for each CPT location, showing the friction ratio, cone end bearing resistance, and soil electrical conductivity are presented in Appendix B. The logs also indicate the general lithologic interpretation as described in the following paragraph.

Soil classification was based on published correlations between penetrometer data and soil classification (Douglas and Olsen 1981). These correlations were developed from a relational database on CPT soundings and adjacent drilled boreholes. Figure 6.1 is a chart showing the relationship between CPT data (cone tip resistance and friction ratios) and soil lithologies. This chart was used in assessing the soil lithologies from the CPT sounding logs. The soil classification chart was not calibrated to site conditions. However, there was good agreement between estimated lithologies based on CPT data and lithologies logged in soil borings drilled in the vicinity.

Penetrometers were inserted and pushed into the soil until refusal was encountered (penetration pressures greater than approximately 700 tons per square foot [TSF]). Downhole equipment were steam cleaned upon retrieval. The rinse water was contained for proper disposal.

The open hole resulting from retrieval of the penetrometer was backfilled with a bentonite slurry. At the bottom of the sounding, a bypass valve in the penetrometer was opened to allow the slurry to be pumped into the open hole as the penetrometer was retrieved. Upon completion of each hole, asphalt patch was used to fill the hole to ground surface.

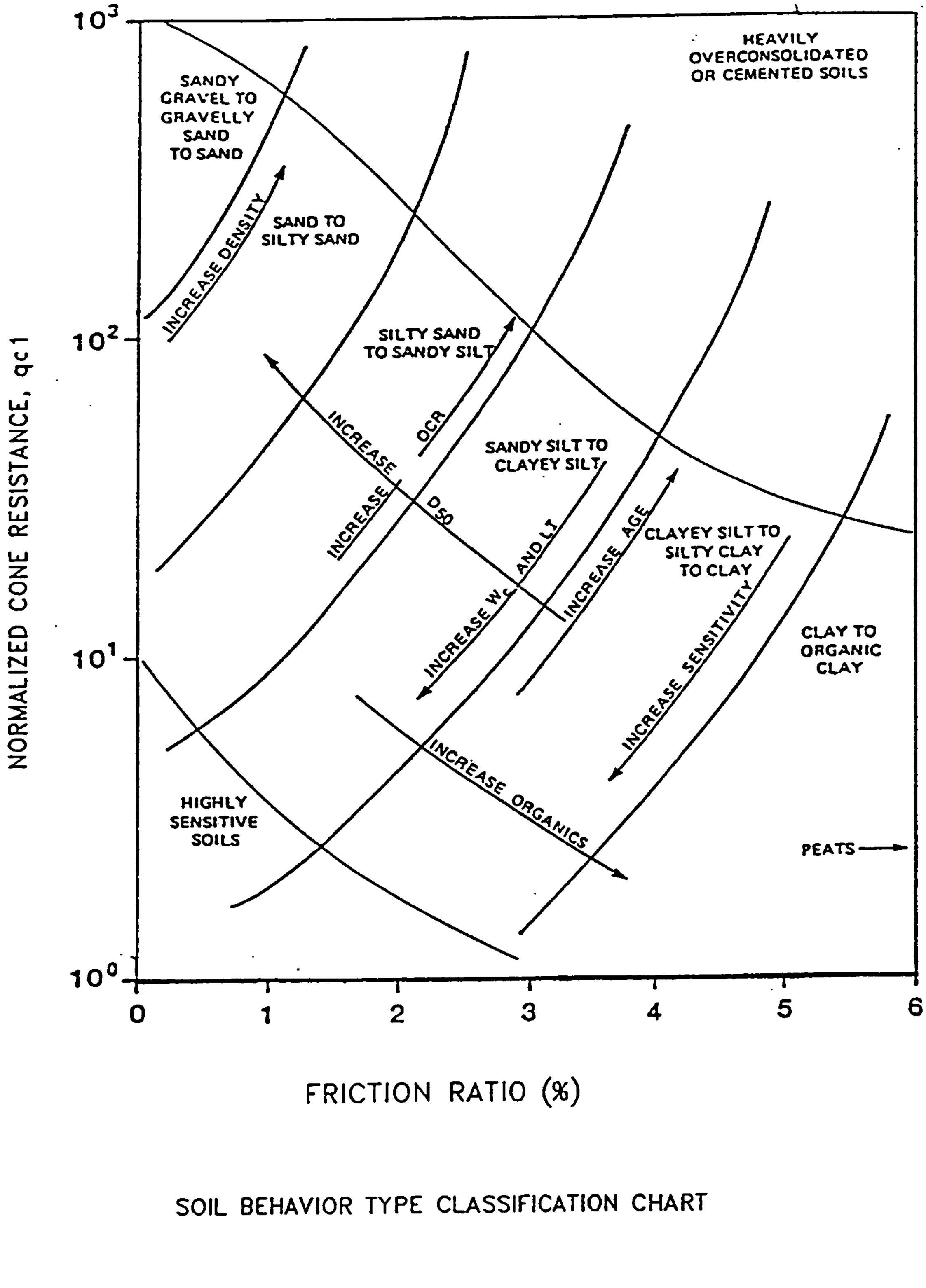
6.4. RESULTS

CPT data were compared to the geologic logs from the numerous previous borings that have been drilled at OU-2. The depths of penetrometer refusal were consistent with the depths to first encountered bedrock (top of fractured bedrock). Due to the good correlation between penetrometer refusal depths and boring log information, the CPT data and previous boring log information are combined on the same map (Figure 2.3) representing the top of fractured bedrock surface.

The deepest sounding (CP-017) was 25.2 feet below ground surface; however, approximately fifty percent of the soundings were less than 6 feet deep and ninety percent were less than twelve feet deep. Table VI.1 presents the depth of each CPT sounding.

The lithologies derived from CPT data for shallow soil classifications at OU-2 correlate well with the boring log information. The soils consisted predominantly of silty clay and silty sand. Occasionally, sand and gravel mixtures containing fines were encountered.

The penetrometer data and the correlation of penetrometer refusal depths with soil boring depths to bedrock indicate that the penetrometer was only able to penetrate the soil veneer. This precluded the use of CPT as a tool for evaluating the interface between the highly fractured upper carapace and the less fractured lower carapace (DOE 1994).



After Douglas and Olsen, 1981

Figure 6.1. Cone Penetrometer Soil Classification Chart

Table VI.1. Depth to Interpreted Top of Rock

Sounding Number	Sounding Depth	Depth to Interpreted Top of Rock	Cone End Bearing at Termination of Sounding	Comments
CP-001	12.9	12.8	321.7	Upper portion of sounding possible following tension failure crack
CP-002	9.4	9.2	467.3	
CP-003	7.3	7.2	630.3	
CP-004	5.6	5.5	804.0	
CP-005	7.4	7.1	610.1	
CP-006	2.7	2.7	623.3	Lift truck
CP-007	5.7	5.4	789.0	
CP-008	2.3	2.0	664.8	
CP-009	2.8	2.3	747.4	Lift truck
CP-010	2.2	2.1	809.7	Lift truck
CP-011	8.9	8.7	661.6	
CP-012	2.7	2.7	589.1	
CP-013	3.5	3.3	674.0	
CP-014	1.6	1.5	855.4	
CP-015	4.3	4.0	452.6	Lift truck
CP-016	14.2	14.2	533.3	
CP-017	25.7	25.3	591.6	
CP-018	7.6	7.5	616.5	
CP-019	11.7	11.6	611.7	
CP-020	9.1	9.0	542.9	

In general, the electrical conductivity data supported the soil classifications made by the CPT data. As expected, cohesive soils containing silt and clay had conductivity values greater than sandy or gravelly soils.

The electrical conductivity data suggest that soils overlying bedrock are not saturated. In general, conductivity values range from slightly above zero to 4 microsiemens per centimeter (mS/cm) in all CPT probe holes. In each sounding, variations in conductivity are observed with depth. These variations are interpreted on the logs to represent varying dry, moist and wet conditions. These high conductivity zones and low conductivity zones do not correlate from probe hole to probe hole.

One of the CPT soundings (CP-017) indicates a zone of extremely high conductivity at a depth of approximately 7.5 feet. This may indicate a local zone of saturation. Logs from three other boreholes in the same general vicinity as CP-017 indicate shallow saturated conditions or perched water at depths from 6 to 8 feet (Boreholes 392, 394 and 553).

Section 7

7. CONCLUSIONS AND RECOMMENDATIONS

The top of the fractured bedrock surface was contoured using data from numerous soil borings and supplemented with CPT data collected in this investigation (see Figure 2.3). Figure 2.3 shows linear depressions around the perimeter of the site as well as slight mounds and depressions within the interior of the site. The linear depressions around the perimeter align with lineations identified regionally in the fracture trace analysis that trend N50°W to N60°W, N30°W, and N10°E to N20°E.

An apparent linear depression beneath the OSE Building is aligned with Seeps 0604 and 0605. However, the thickness of the highly fractured bedrock in this vicinity is interpreted to be less that five feet (see Section 4). Because of this, and the fact that perched groundwater is not observed in this area, this linear depression is not anticipated to be a significant groundwater pathway to the seeps.

The top of the significantly less weathered/fractured bedrock was evaluated and interpreted with seismic refraction. Seismic P-wave velocities were noted to significantly increase at depths of 0 to approximately 46 feet (see Figures 4.1 through 4.9). The elevations of the less fractured bedrock surface were contoured (see Figure 4.10). Thickness of the highly fractured bedrock at OU-2 was evaluated by preparing an isopach map. Elevations for the top of the less fractured bedrock (as determined seismically) were subtracted from elevations of the top of first encountered (fractured) bedrock (as determined from boring logs and CPT data). The isopach map (Figure 7.1) presents the thickness of the highly fractured bedrock.

A linear depression occurs on the top of Seismic Layer V2 in the area northwest of Building OSE (see Figure 4.10). The trend of this depression (N10°E to N20°E) agrees with lineations observed in the fracture trace analysis and aligns with seeps 0604, 0605, and 0606. The thickness of the highly fractured bedrock above this linear depression is up to 20 feet (see Figure 7.1). The seeps that are aligned with this feature emerge at an elevation that approximately corresponds to the basal portion of the Liberty Formation. The basal portion of the formation is dominated by shale, as opposed to limestone in the upper portion. It therefore appears, as though this linear depression reflects a fracture system that may facilitate the lateral migration of groundwater towards the seeps along the top of the less permeable shale.

A second, less defined linear depression or zone of increased fracture thickness occurs in the southeast portion of OU-2 as indicated on Figure 4.10 and 7.1. The axial trend of that feature (approximately N70°W) also correlates with a second major fracture trace. There is no seep associated with the feature, however, the entire downslope area at that location is covered with asphalt and/or concrete.

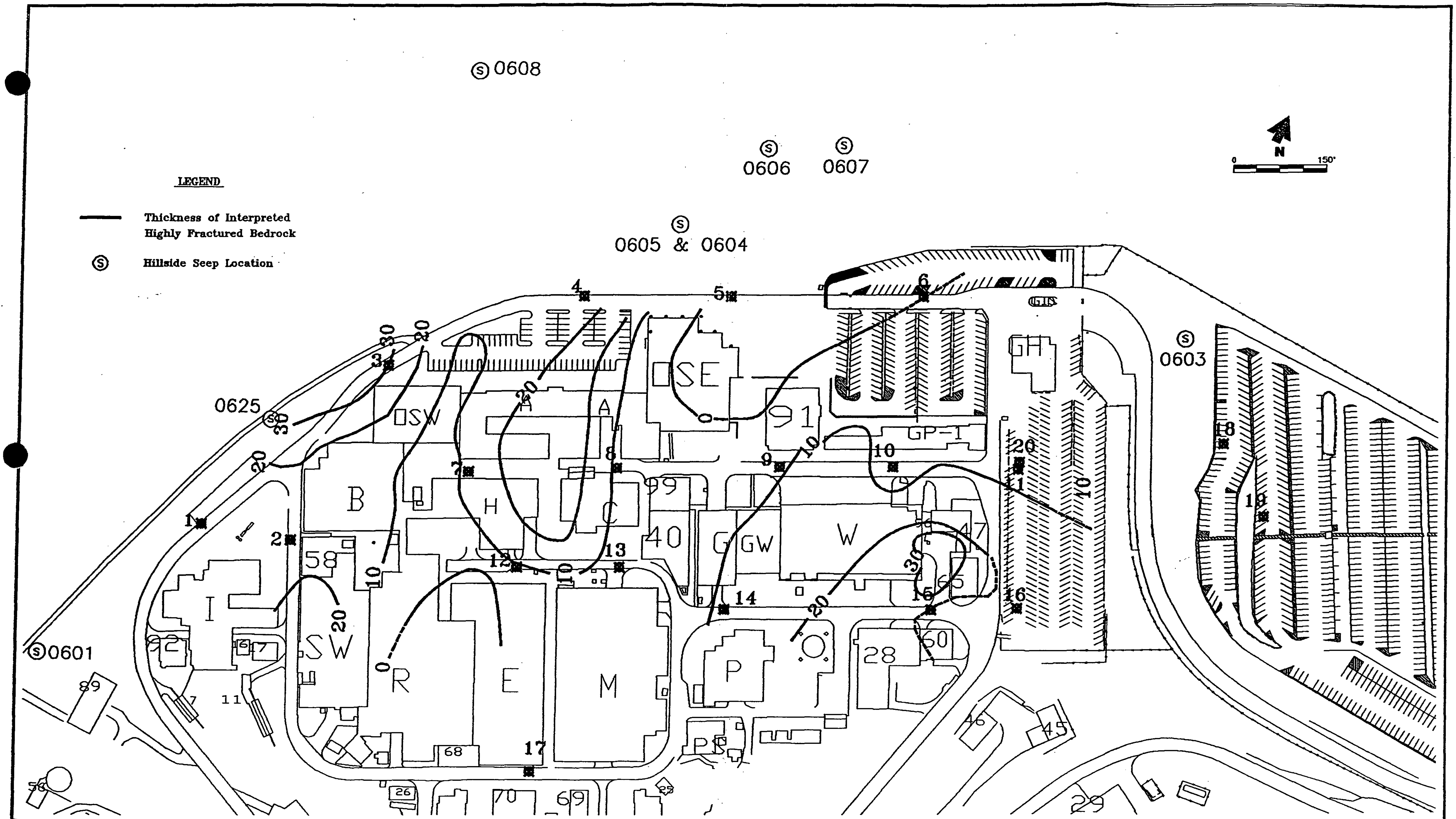


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Figure 7.1. Isopach Map - Interpreted Zone of Highly Fractured Bedrock

The conceptual model of the hydrogeologic system previously interpreted the thickness of the upper highly fractured bedrock to be a uniform 50 feet. The results of this investigation suggest that the upper highly fractured bedrock is of variable thickness and averages between 10 to 20 feet. In the northeastern portion of the study area, where grading activities reportedly occurred, the highly fractured bedrock is either very thin or not observed (see Figure 7.1).

In the eastern portion of the site, east of Building W, the highly fractured bedrock is up to 30 feet thick in an enclosed, approximately circular, localized region (see Figure 7.1). This is attributed to an apparent increased thickness resulting from a relative high in the top of bedrock surface that resulted from linear depressions on two sides of the apparent high; on the north there is a linear depression that trends N20°E and on the south there is a linear depression trending N60°W (see Figure 2.3).

Groundwater elevation data for the site were limited. Groundwater elevation and boring data indicate that groundwater occurs approximately 15 to 25 feet below the top of the less fractured bedrock surface. The depth of groundwater in Boring 0348 approximately corresponds to the top of the less fractured bedrock. The available data suggest that groundwater occurs within the less fractured bedrock which supports the current conceptual model of the site.

The bottom of the less fractured bedrock (top of competent bedrock) at OU-2 could not be assessed with the seismic program planned for this task. It is possible to define the top of competent bedrock using seismic refraction, however, to achieve the required depth of penetration, longer spreads with offset shotpoints would be required. The energy source used at OU-2 was a plate and hammer. A higher energy source is required (explosives or other specially designed devices) for utilizing longer spreads and offset shotpoints. This is unfavorable along the roads and cultural structures on the site as they would be destroyed. However, longer seismic refraction profiles with offset shotpoints could be performed on the flanks of the Main Hill. Properly designed seismic profiles at those locations would complement the information obtained in this study and give a reasonable estimate of the depth and configuration of competent bedrock.

The data from this study should be correlated with all available groundwater data from the monitoring wells installed on the Main Hill. Correlation of the two data sets would add a more definitive perspective to the groundwater system on the Main Hill.

Section 8

8. REFERENCES

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Appendix A

APPENDIX A

BORING DATA

Title: Boring Data
Project: Mound OU-2 Task 1 - Bedrock Topography
File: Borings.WK1 (50942-Data-G)
Date: June 17, 1994

BLOCK 1

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV. OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV. OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH. INFO	REFERENCE	NOTES
17	--	--	S 1350 W 3300	879.70	15.00	3.00	876.70	--	--	--	--	--	(1,2,3,4)	
18	--	--	S 1470 W 3540	867.70	15.00	3.00	864.70	--	--	--	--	--	(1,2,3,4)	
39	--	--	S 1457 W 3550	873.04	20.00 +	20.00	853.04	--	--	--	--	--	(1,2,3,4)	
40	--	--	S 1432 W 3550	872.75	16.00 +	16.00	856.75	--	--	--	--	--	(1,2,3,4)	
41	--	--	S 1427 W 3536	873.25	13.00 +	13.00	860.25	--	--	--	--	--	(1,2,3,4)	
42	--	--	S 1443 W 3519	873.40	12.00 +	12.00	861.40	--	--	--	--	--	(1,2,3,4)	
43	--	--	S 1465 W 3519	873.25	12.00 +	12.00	861.25	--	--	--	--	--	(1,2,3,4)	
44	--	--	S 1423 W 3494	873.80	8.50 +	8.50	865.30	--	--	--	--	--	(1,2,3,4)	
45	--	--	S 1443 W 3494	873.75	11.00 +	11.00	862.75	--	--	--	--	--	(1,2,3,4)	
46	--	--	S 1475 W 3497	873.25	6.00 +	6.00	867.25	--	--	--	--	--	(1,2,3,4)	
47	--	--	S 1470 W 3479	873.70	6.00 +	6.00	867.70	--	--	--	--	--	(1,2,3,4)	
48	--	--	S 1443 W 3467	874.00	6.00 +	6.00	868.00	--	--	--	--	--	(1,2,3,4)	
49	--	--	S 1425 W 3467	874.00	8.00 +	8.00	866.00	--	--	--	--	--	(1,2,3,4)	
143	4/65	--	S 1322 W 3435	874.00	7.00	5.00	869.00	--	--	--	--	--	(1,2,3,4)	
334	3/72	--	S 1178 W 3290	875.10	15.00	3.50	871.60	10.00	885.10	--	--	--	(1,2,3,4)	
335	3/72	--	S 1142 W 3240	875.60	15.80	1.00	874.60	--	--	--	--	--	(1,2,3,4)	
336	3/72	--	S 1131 W 3304	875.10	15.00 +	6.00	869.10	--	--	--	--	--	(1,2,3,4)	
337	3/72	--	S 1147 W 3283	874.80	10.50	4.50	870.30	--	--	--	--	--	(1,2,3,4)	
338	10/68	--	S 1234 W 3363	875.00	5.50	1.00	874.00	--	--	--	--	--	(1,2,3,4)	
369	--	--	S 1369.31 W 367.78	842.40	27.00	7.00	835.40	--	--	--	--	--	(1,2,3,4)	
579	4/30/82	--	S 1148 W 5618	856.70	19.50	6.50	850.20	16.50	840.20	--	--	--	(1,2,3,4)	
580	4/30/82	--	S 1528 W 3620	856.70	29.50	6.50	850.20	20.00	836.70	--	--	--	(1,2,3,4)	

Title: Boring Data
Project: Mound OU-2 Task 1 - Bedrock Topography
File: Borings.WK1 (50942-Data-G)
Date: June 17, 1994

BLOCK 1

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV. OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV. OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH. INFO	REFERENCE	NOTES
581	4/30/82	--	S 1528 W 3586	860.00	24.50	6.50	853.50	20.00	840.00	--	--	--	(1,2,3,4)	
585	10/19/84	--	S 1496.08 W 3629.63	856.00	19.00	6.00	850.00	--	--	--	--	--	(1,2,3,4)	
586	10/19/84	--	S 1472.96 W 3629.28	857.00	19.50	4.00	853.00	--	--	--	--	--	(1,2,3,4)	
587	10/20/84	--	S 1472.67 W 3605.16	857.00	13.50	3.00	854.00	--	--	--	--	--	(1,2,3,4)	
588	10/23/84	--	S 1448.27 W 3604.28	862.00	17.00	6.00	856.00	--	--	--	--	--	(1,2,3,4)	
589	10/23/84	--	S 1447.28 W 3579.29	867.00	25.00	10.00	857.00	--	--	--	--	--	(1,2,3,4)	
B-BLDG-1	--	--	--	875.00	5.50	1.00	874.00	--	--	--	--	--	(7)	

BLOCK 2

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURE BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMP BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
2	2/93	--	--	873.10	200.00	4.00	869.10	36.00	837.10	45.00	--	--	(8)	wl on 3/2/7
13	12/48	--	S 1160 W 3000	884.90	15.00	0.00	884.90	12.00	872.90	--	--	--	(1,2,3,4)	
16	12/48	--	S 1350 W 3000	884.60	15.00	0.00	884.60	8.00	876.60	--	--	--	(1,2,3,4)	
139	4/65	--	S 1525 W 3130	878.00	4.00	0.33	877.67	--	--	--	--	--	(1,2,3,4)	
141	4/65	--	S 1525 W 3180	878.00	3.00	0.33	877.67	--	--	--	--	--	(1,2,3,4)	
142	4/65	--	S 1623 W 2762	878.00	5.67	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
162	4/67	--	S 1238 W 2888	878.30	6.00	2.00	876.30	6.00	872.30	--	--	--	(1,2,3,4)	
OS-215	--	--	--	876.80	8.00	1.00	875.80	--	--	--	--	--	(6)	
OS-216	--	--	--	875.10	15.00	0.50	874.60	--	--	--	--	--	(6)	
OS-217	--	--	--	875.60	15.00	1.00	874.60	--	--	--	--	--	(6)	
OS-218	--	--	--	875.10	22.00	0.00	875.10	--	--	--	--	--	(6)	
OS-219	--	--	--	874.80	10.50	1.00	873.80	--	--	--	--	--	(6)	
229	--	--	S 1452 W 2921	878.00	14.50	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
333	--	--	S 1186 W 3167	876.80	8.00	1.00	875.80	--	--	--	--	--	(1,2,3,4)	
339	--	--	S 1230 W 3092	878.00	1.50	1.20	876.80	--	--	--	--	--	(1,2,3,4)	
582	5/30/80	--	S 1472 W 3056	877.10	13.50	0.00	877.10	3.50	873.60	--	--	--	(1,2,3,4)	
583	5/30/80	--	--	877.80	1.50	1.00	876.80	--	--	--	--	--	(1,2,3,4)	
584	5/30/80	--	S 1472 W 3160	877.12	13.50	1.00	876.12	3.50	873.62	--	--	--	(1,2,3,4)	
659	--	--	--	873.00	--	--	--	--	--	--	--	--	(1)	No Logs
660	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Logs
661	--	--	--	873.00	--	--	--	--	--	--	--	--	(1)	No Logs
0348	--	--	--	876.40	251.00	2.50	873.90	44.00	832.40	--	--	--	(9)	wl on 3/30,

BLOCK 3

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACT BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPT BEDROCK	TOP ELEV OF COMPT BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH INFO	REFERENCE NOTES
40	--	--	S 1432 W 3550	872.80	16.00 +	1.50	871.30	16.00	856.80	--	--	--	(1,2,3,4)
150	--	--	S 1520 W 2830	883.00	7.00	6.00	877.00	--	--	--	--	--	(1,2,3,4)
163	--	--	S 1237 W 2855	878.00	21.00	2.50	875.50	4.00	874.00	--	--	--	(1,2,3,4)
220	--	--	S 2078 W 2646	839.90	15.00	8.00	831.90	--	--	--	--	--	(1,2,3,4)
274	--	--	S 1145 W 2590	873.10	200.00	0.00	873.10	4.10	869.00	--	--	--	(1,2,3,4)
353	--	--	S 1354 W 2798	878.50	5.70	1.10	877.40	--	--	--	--	--	(1,2,3,4)
355	--	--	S 982 W 2769	875.40	--	--	--	--	--	--	--	--	(1,2,3,4)
479	6/8/84	--	S 1382.5 W 2853.5	877.60	2.50	0.70	876.90	1.50	876.10	--	--	--	(1,2,3,4)
480	6/8/84	--	S 1409.2711 W 2850.2866	877.55	8.00	1.50	876.05	8.00	869.55	--	--	--	(1,2,3,4)
481	6/11/84	--	S 145004875 W 2792.7277	877.95	14.50	1.50	876.45	--	--	--	--	--	(1,2,3,4)
610	4/14/84	--	--	874.90	2.50	1.00	873.90	2.50	872.40	--	--	--	(1,2,3,4)
611	4/14/84	--	--	875.70	2.00	1.50	874.20	2.00	873.70	--	--	--	(1,2,3,4)
612	4/14/84	--	--	876.80	2.50	0.20	876.60	2.50	874.30	--	--	--	(1,2,3,4)
613	4/14/84	--	--	875.00	14.00	1.00	874.00	2.00	873.00	--	--	--	(1,2,3,4)
614	4/14/84	--	--	875.30	14.00	3.00	872.30	--	--	--	--	--	(1,2,3,4)
636	1/16/80	--	S 1454 W 2070	878.60	2.00	1.00	877.60	1.50	877.10	--	--	--	(1,2,3,4)
637	1/16/80	--	--	881.30	13.50 +	0.70	880.60	--	--	--	--	--	(1,2,3,4)
638	1/16/80	--	--	881.20	3.50	1.00	880.20	3.50	877.70	--	--	--	(1,2,3,4)
653	--	--	--	872.50	--	--	--	--	--	--	--	--	(1) No Log
654	--	--	--	872.50	--	--	--	--	--	--	--	--	(1) No Log
655	--	--	--	875.00	--	--	--	--	--	--	--	--	(1) No Log
656	--	--	--	875.00	--	--	--	--	--	--	--	--	(1) No Log
657	--	--	--	875.00	--	--	--	--	--	--	--	--	(1) No Log
658	--	--	--	876.00	--	--	--	--	--	--	--	--	(1) No Log

BLOCK 4

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACT. BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMP BEDROCK	DEPTH TO WATER TABLE	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
14	--	--	S 1350 W 2500	879.90 ?	15.00	0.00	879.90	10.00	869.90	--	--	--	(1,2,3,4)	
50	--	--	S 1240 W 2350	870.00	2.00	2.00	868.00	--	--	--	--	--	(1,2,3,4)	
51	--	--	S 1300 W 2350	870.00	3.50	2.00	868.00	--	--	--	--	--	(1,2,3,4)	
52	--	--	S 1360 W 2440	870.00	1.50	--	--	--	--	--	--	--	(1,2,3,4)	
107	--	--	S 1400 W 2400	872.60	2.00	2.00	870.60	--	--	--	--	--	(1,2,3,4)	
108	--	--	S 1450 W 2400	872.90	2.00	1.50	871.40	--	--	--	--	--	(1,2,3,4)	
388	--	--	S 1537 W 2378	870.70	17.00	5.00	865.70	--	--	--	--	--	(1,2,3,4)	
528	5/24/84	N 1509.1097 E 2292.4143	--	866.35	10.50	1.50	864.85	--	--	--	--	--	(1,2,3,4)	
529	5/24/89	N 1275.0807 E 2282.7943	--	868.33	5.50	1.30	867.03	5.50	862.83	--	--	--	(1,2,3,4)	
530	5/18/83	--	S 1452 W 2446	873.80	3.00	2.00	871.80	--	--	--	--	--	(1,2,3,4)	
531	5/17/83	--	--	874.80	16.00	5.00	869.80	--	--	--	--	--	(1,2,3,4)	
532	5/17/83	--	S 1338 W 2438	873.20	14.00	0.30	872.90	--	--	--	--	--	(1,2,3,4)	
533	5/18/83	--	--	875.60	2.80	2.25	873.35	--	--	--	--	--	(1,2,3,4)	pit
601	4/9/81	--	--	871.60	2.00	2.00	869.60	--	--	--	--	--	(1,2,3,4)	
602	4/9/81	--	--	872.20	1.50	1.50	870.70	--	--	--	--	--	(1,2,3,4)	
603	4/9/81	--	--	877.14	11.50	0.50	876.64	--	--	--	--	--	(1,2,3,4)	
608	12/28/82	--	S 1502 W 2230	865.00	34.50	1.00	864.00	24.00	841.00	--	--	--	(1,2,3,4)	
609	12/28/82	--	S 1464 W 2234	866.00	14.00	1.00	865.00	14.00	852.00	--	--	--	(1,2,3,4)	
647	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log
648	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log
649	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log
650	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log
651	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log
652	--	--	--	870.00	--	--	--	--	--	--	--	--	(1)	No Log

BLOCK 5

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVEATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH INFO	REFERENCE	NOTES
29	12/48	--	S 2090 W 3000	824.90	75.00	18.00	806.90	35.00	789.90	--	--	--	(1,2,3,4)	
41	2/52	--	S 1427 W 3536	873.30	13.00 +	13.00	860.30	13.00	860.30	--	--	--	(1,2,3,4)	
89	3/64	--	S 2050 W 3525	792.50	1.50	1.00	791.50	--	--	--	--	--	(1,2,3,4)	
94	3/64	--	S 1925 W 3700	802.10	20.00	1.00	801.10	19.50	782.60	--	--	--	(1,2,3,4)	
94A	2/64	--	S 1225 W 3673	802.30	30.00	0.00	802.30	--	--	--	--	--	(1,2,3,4)	
95	3/64	--	S 1900 W 3650	806.00	5.50	1.00	805.00	5.50	800.50	--	--	--	(1,2,3,4)	
95A	2/64	--	S 1875 W 3657	810.90	22.30	5.30	805.60	--	--	--	--	--	(1,2,3,4)	
95B	2/64	--	S 1883 W 3687	808.50	22.00	0.25	808.25	--	--	--	--	--	(1,2,3,4)	
96	3/64	--	S 1850 W 3725	804.20	19.00	0.00	804.20	18.50	785.70	--	--	--	(1,2,3,4)	
96A	2/64	--	S 1903 W 3717	806.30	16.00	0.25	806.05	--	--	--	--	--	(1,2,3,4)	
124	--	--	S 1800 W 3700	828.60	9.00	0.00	828.60	9.00	819.60	--	--	--	(1,2,3,4)	
125	--	--	S 2260 W 3750	742.00	35.00	12.00	730.00	--	--	--	--	--	(1,2,3,4)	
160	5/66	--	S 1920 W 3930	787.00	3.00 +	0.00	787.00	--	--	--	--	--	(1,2,3,4)	
161	5/66	--	S 1650 W 3790	824.80	1.50 +	0.00	824.80	--	--	--	--	--	(1,2,3,4)	
193	10/68	--	S 2135 W 3440	792.40	20.00	7.50	784.90	--	--	--	--	--	(1,2,3,4)	
194	10/68	--	S 2099 W 3471	793.80	20.00	7.00	786.80	--	--	--	--	--	(1,2,3,4)	
195	10/68	--	S 2100 W 3422	794.20	15.00	14.00	780.20	--	--	--	--	--	(1,2,3,4)	
227	12/71	--	S 1772 W 3784	811.30	19.00	3.50	807.80	--	--	--	--	--	(1,2,3,4)	
230	1/72	--	S 1799 W 3821	807.40	14.50	3.50	803.90	--	--	--	--	--	(1,2,3,4)	
231	1/72	--	S 1825 W 3850	801.60	10.00	3.50	798.10	--	--	--	--	--	(1,2,3,4)	
232	6/70	--	S 2531 W 4078	750.00	14.50	8.50	741.50	--	--	--	--	--	(1,2,3,4)	
241	1/69	--	S 2165 W 3882	745.00	25.00	15.00	730.00	--	--	--	--	--	(1,2,3,4)	
242	1/69	--	S 2162 W 3851	745.00	25.00	10.00	735.00	--	--	--	--	--	(1,2,3,4)	
243	1/69	--	S 2185 W 3857	745.00	30.00	6.00	739.00	--	--	--	--	--	(1,2,3,4)	
279	10/75	--	S 1950 W 4132	749.10	19.00	2.50	746.60	--	--	--	--	--	(1,2,3,4)	

BLOCK 5

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVEATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH INFO	REFERENCE	NOTES
280	10/75	--	S 1695 W 3941	773.00	42.50	1.00	772.00	--	--	--	--	--	(1,2,3,4)	
282	10/75	--	S 2118 W 3910	739.00	27.00	19.50	719.50	--	--	--	--	--	(1,2,3,4)	
283	10/75	--	S 2130 W 4025	740.10	10.00	8.50	731.60	--	--	--	--	--	(1,2,3,4)	
372	--	--	S 2074.19 W 3660.67	785.00	31.50	13.00	772.00	--	--	12.00	--	--	(1,2,3,4)	
376	--	--	S 2308.08 W 3498.86	746.10	20.00	7.00	739.10	20.00	726.10	14.00	--	--	(1,2,3,4)	
377	--	--	S 2196.39 W 3726.49	745.60	30.00	24.00	721.60	--	--	--	--	--	(1,2,3,4)	
379	--	--	S 2397.50 W 3291.25	752.80	13.00	0.50	752.30	--	--	10.00	--	--	(1,2,3,4)	
385	--	--	S 1965 W 3843	789.60	19.50	19.00	770.60	--	--	--	--	--	(1,2,3,4)	
386	--	--	S 1989 W 3851	787.20	22.50	22.00	765.20	--	--	--	--	--	(1,2,3,4)	
387	--	--	S 1979 W 3876	788.00	23.00	22.00	766.00	--	--	--	--	--	(1,2,3,4)	
458	2/15/84	--	S 2180 W 3890	739.70	21.00	14.00	725.70	20.00	719.70	8.50	--	--	(1,2,3,4)	wl on 2/15/
459	2/15/84	--	S 2192 W 3842	740.20	20.00	14.00	726.20	19.00	721.20	--	--	--	(1,2,3,4)	
460	2/15/84	--	S 2144 W 3880	744.90	21.50	19.00	725.90	21.00	723.90	--	--	--	(1,2,3,4)	
604	5/16/83	--	--	827.30	7.50	2.00	825.30	--	--	--	--	--	(1,2,3,4)	
606	5/24/83	--	--	826.80	6.00	0.10	826.70	--	--	--	--	--	(1,2,3,4)	
607	5/17/83	--	--	812.60	15.50	5.50	807.10	--	--	--	--	--	(1,2,3,4)	
645	--	--	--	787.00	--	--	--	--	--	--	--	--	(1)	No Log
646	--	--	--	750.00	--	--	--	--	--	--	--	--	(1)	No Log

BLOCK 6

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
19	--	--	S 1600 W 3300	884.20	15.00	0.00	884.20	3.00	881.20	--	--	--	(1,2,3,4)	
152	--	--	S 1780 W 3275	868.50	20.00	17.00	851.50	--	--	--	--	--	(1,2,3,4)	
153	--	--	S 1625 W 3420	878.50	8.00	2.00	876.50	7.00	871.50	--	--	--	(1,2,3,4)	
154	--	--	S 1782 W 3280	868.10	18.50	16.50	851.60	--	--	--	--	--	(1,2,3,4)	
155	--	--	S 1781 W 3310	865.60	22.50	0.00	865.60	11.00	854.60	--	--	--	(1,2,3,4)	
166	--	--	S 1850 W 3455	836.00	13.00	0.20	835.80	--	--	--	--	--	(1,2,3,4)	
167	--	--	S 1772 W 3370	877.00	22.00	13.00	864.00	19.00	858.00	--	--	--	(1,2,3,4)	
168	--	--	S 1835 W 3308	863.40	17.50	17.50	845.90	--	--	--	--	--	(1,2,3,4)	
196	--	--	S 1814 W 3416	851.90	48.00	16.00	835.90	37.50	814.40	--	--	--	(1,2,3,4)	
197	--	--	S 1862 W 3360	847.80	25.00	9.00	838.80	25.00	822.80	--	--	--	(1,2,3,4)	
198	--	--	S 1894 W 3398	830.90	16.00	11.00	819.90	--	--	--	--	--	(1,2,3,4)	
303	--	--	S 1660 W 3384	878.70	8.00	2.00	876.70	--	--	--	--	--	(1,2,3,4)	
304	--	--	S 1660 W 3398	878.70	18.50	3.50	875.20	10.00	868.70	--	--	--	(1,2,3,4)	
305	--	--	S 1638 W 3398	878.70	7.00	5.50	873.20	--	--	--	--	--	(1,2,3,4)	
320	--	--	S 2867 W 3147	774.80	25.00	0.00	774.80	16.50	758.30	--	--	--	(1,2,3,4)	
370	--	--	S 1611.83 W 3459.08	873.50	19.00	3.00	870.50	--	--	--	--	--	(1,2,3,4)	
371	--	--	S 1780.67 W 3518.16	841.60	17.00	0.30	841.30	--	--	--	--	--	(1,2,3,4)	
605	5/17/83	--	S 1598 W 3672	851.50	45.00	13.00	838.50	--	--	--	--	--	(1,2,3,4)	

BLOCK 7

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER TABLE	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
20	12/48	--	S 1600 W 3000	885.90	15.00	12.00	873.90	--	--	--	--	--	(1,2,3,4)	
23	12/48	--	S 1850 W 3000	873.60	100.00	8.00	865.60	64.00	809.60	--	--	--	(1,2,3,4)	
24	12/48	--	S 1900 W 3160	865.60	100.00	15.00	850.60	30.00	835.60	--	--	--	(1,2,3,4)	
53	7/63	--	S 1730 W 3200	878.00	9.50	4.50	873.50	--	--	--	--	--	(1,2,3,4)	
68	7/63	--	S 1610 W 2992	878.00	8.00	7.50	870.50	--	--	--	--	--	(1,2,3,4)	
69	7/63	--	S 1660 W 2992	878.00	6.50	6.00	872.00	--	--	--	--	--	(1,2,3,4)	
70	7/63	--	S 1705 W 2992	878.00	1.00	0.50	877.50	--	--	--	--	--	(1,2,3,4)	
74	5/63	--	S 1700 W 3120	878.00	2.00	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
75	5/63	--	S 1725 W 3120	878.00	34.30	0.50	877.50	--	--	--	--	--	(1,2,3,4)	
76	5/63	--	S 1619 W 3173	878.00	3.50	0.50	877.50	--	--	--	--	--	(1,2,3,4)	
77	5/63	--	S 1700 W 3173	878.00	13.80	1.50	876.50	--	--	--	--	--	(1,2,3,4)	
78	5/63	--	S 1725 W 3178	878.00	19.00	1.50	876.50	18.50	859.50	--	--	--	(1,2,3,4)	
79	5/63	--	S 1712 W 3178	878.00	3.00	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
80	5/63	--	S 1712 W 3120	878.00	7.50 +	1.00	877.00	7.50	870.50	--	--	--	(1,2,3,4)	
144	5/66	--	S 1634 W 3053	877.90	3.00	1.50	876.40	--	--	--	--	--	(1,2,3,4)	
145	5/66	--	S 1592 W 3015	878.00	3.00	2.50	875.50	--	--	--	--	--	(1,2,3,4)	
146	5/66	--	S 1634 W 3015	878.10	12.50	2.00	876.10	--	--	--	--	--	(1,2,3,4)	
151	10/66	--	S 1780 W 3050	874.00	8.00 +	0.50	873.50	--	--	--	--	--	(1,2,3,4)	
255	3/69	--	S 1702 W 3016	878.00	20.00	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
256	3/69	--	S 1749 W 3072	878.00	15.00	0.00	878.00	--	--	--	--	--	(1,2,3,4)	
257	3/69	--	S 1736 W 2895	878.00	21.50	0.00	878.00	--	--	--	--	--	(1,2,3,4)	
392	--	--	S 1742 W 3148	878.00	34.50	4.50	873.50	--	--	3.00	--	--	(1,2,3,4)	
393	--	--	S 1758 W 3138	877.60	27.00	1.00	876.60	--	--	--	--	--	(1,2,3,4)	
394	--	--	S 1758 W 3117	877.70	32.50	1.00	876.70	--	--	6.00	--	--	(1,2,3,4)	
395	--	--	S 1757 W 3170	877.10	30.50	3.50	873.60	--	--	--	--	--	(1,2,3,4)	
622	--	--	--	874.00	--	--	--	--	--	--	--	--	(1)	No Log

BLOCK 7

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER TABLE	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
623	--	--	--	874.00	--	--	--	--	--	--	--	--	(1)	No Log
624	--	--	--	874.00	--	--	--	--	--	--	--	--	(1)	No Log

BLOCK 8

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
21	12/48	--	S 1600 W 2800	883.80	15.00	2.50	881.30	--	--	--	--	--	(1,2,3,4)	
22	12/48	--	S 1600 W 2600	879.90	15.00	2.50	877.40	--	--	--	--	--	(1,2,3,4)	
25	12/48	--	S 1870 W 2856	672.80	299.00	4.00	668.80	22.00	650.80	--	--	--	(1,2,3,4)	
28	12/48	--	S 2050 W 2840	822.00	75.00	0.00	822.00	19.00	803.00	--	--	--	(1,2,3,4)	
101	3/64	--	S 1675 W 2600	876.60	7.50	0.00	876.60	--	--	--	--	--	(1,2,3,4)	
142	4/65	--	S 1623 W 2762	878.00	5.67	1.00	877.00	--	--	--	--	--	(1,2,3,4)	
185	9/67	--	S 1835 W 2798	872.00	11.50	11.50	860.50	--	--	--	--	--	(1,2,3,4)	
186	9/67	--	S 1825 W 2798	873.00	19.00	6.00	867.00	--	--	--	--	--	(1,2,3,4)	
187	9/67	--	S 1830 W 2768	868.90	35.50	3.00	865.90	--	--	--	--	--	(1,2,3,4)	
220	12/71	--	S 2078 W 2646	839.90	15.00	8.00	831.90	--	--	--	--	--	(1,2,3,4)	
221	12/71	--	S 2163 W 2708	819.20	15.00	6.50	812.70	--	--	--	--	--	(1,2,3,4)	
224	12/71	--	S 1963 W 2584	832.40	13.00	6.00	826.40	--	--	--	--	--	(1,2,3,4)	
225	12/71	--	S 2195 W 2807	821.10	20.00	1.00	820.10	--	--	--	--	--	(1,2,3,4)	
252	2/69	--	S 1583 W 2409	872.40	15.00	6.50	865.90	--	--	--	--	--	(1,2,3,4)	
258	3/69	--	S 1752 W 2869	878.00	20.00	0.58	877.42	--	--	--	--	--	(1,2,3,4)	
331	10/72	--	S 1708 W 2663	880.00	14.50	1.50	878.50	--	--	--	--	--	(1,2,3,4)	
332	10/72	--	S 1719 W 2642	877.50	15.00	1.50	876.00	15.00	862.50	--	--	--	(1,2,3,4)	
351	5/64	--	S 2156 W 2604	788.80	30.00	13.00	775.80	--	--	--	--	--	(1,2,3,4)	
524	5/24/84	N 1981.5443 E 2618.9954	--	826.98	10.50	1.50	825.48	--	--	--	--	--	(1,2,3,4)	
525	5/24/84	N 1905.6425 E 2573.7033	--	829.66	9.00	2.50	827.16	--	--	--	--	--	(1,2,3,4)	
534	5/16/83	--	--	870.40	13.00	13.00	857.40	--	--	--	--	--	(1,2,3,4)	
535	5/13/83	--	--	871.30	10.10	0.00	871.30	--	--	--	--	--	(1,2,3,4)	
536	5/13/83	--	--	871.20	35.50	3.50	867.70	--	--	--	--	--	(1,2,3,4)	
537	5/13/83	--	--	871.30	30.50	22.00	849.30	--	--	--	--	--	(1,2,3,4)	
552	5/2/84	--	S 2168 W 2874	828.00	37.00	18.00	810.00	--	--	--	--	--	(1,2,3,4)	

BLOCK 8

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
553	5/1/84	--	--	858.80	74.00	8.50	850.30	53.50	805.30	3.50	--	--	(1,2,3,4)	
634	--	--	--	828.00	--	--	--	--	--	--	--	--	(1)	No Log
B-1	--	--	--	834.00	--	--	--	--	--	--	--	--	(6)	No Log
B-9	--	--	--	834.00	--	--	--	--	--	--	--	--	(6)	No Log

BLOCK 9

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV TO FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH INFO	REFERENCE	NOTES
45	2/52	--	S 1443 W 3494	873.80	11.00	11.00	862.80	--	--	--	--	--	(1,2,3,4)	
46	2/52	--	S 1475 W 3497	873.30	6.00 +	6.00	867.30	--	--	--	--	--	(1,2,3,4)	
90	3/64	--	S 1775 W 2100	815.20	14.00	13.00	802.20	--	--	--	--	--	(1,2,3,4)	
92	3/64	--	S 1800 W 2150	815.40	18.00	13.00	802.40	--	--	--	--	--	(1,2,3,4)	
99	3/64	--	S 1625 W 2400	868.70	21.20	6.20	862.50	--	--	--	--	--	(1,2,3,4)	
100	3/64	--	S 1675 W 2475	872.20	11.50	11.00	861.20	--	--	--	--	--	(1,2,3,4)	
200	5/68	--	S 1678 W 2171	839.29	16.00	4.00	835.29	--	--	--	--	--	(1,2,3,4)	
201	5/68	--	S 1709 W 2180	834.59	15.50	5.50	829.09	--	--	--	--	--	(1,2,3,4)	
202	5/68	--	S 1667 W 2216	843.92	20.50	7.50	836.42	--	--	--	--	--	(1,2,3,4)	
203	5/68	--	S 1698 W 2222	841.24	16.00	5.00	836.24	--	--	--	--	--	(1,2,3,4)	
204	5/68	--	S 1737 W 2257	838.00	16.00	4.00	834.00	6.00	832.00	--	--	--	(1,2,3,4)	
205	5/68	--	S 1709 W 2287	842.93	20.00	6.00	836.93	--	--	--	--	--	(1,2,3,4)	
206	5/68	--	S 1683 W 2300	845.94	11.00	3.50	842.44	--	--	--	--	--	(1,2,3,4)	
207	5/68	--	S 1736 W 2341	842.23	10.50	3.00	839.23	--	--	--	--	--	(1,2,3,4)	
208	5/68	--	S 1710 W 2355	846.88	15.50	4.00	842.88	--	--	--	--	--	(1,2,3,4)	
209	5/68	--	S 1790 W 2322	832.48	10.00	--	--	--	--	--	--	--	(1,2,3,4)	
210	5/68	--	S 1852 W 2400	825.80	10.00	9.50	816.30	--	--	--	--	--	(1,2,3,4)	
211	5/68	--	S 1868 W 2452	827.99	12.00	2.00	825.99	--	--	--	--	--	(1,2,3,4)	
212	5/68	--	S 1648 W 2262	848.22	15.50	3.50	844.72	--	--	--	--	--	(1,2,3,4)	
222	12/71	--	S 1746 W 2354	843.60	12.00	4.50	839.10	--	--	--	--	--	(1,2,3,4)	
223	12/71	--	S 1866 W 2471	832.90	11.50	5.00	827.90	--	--	--	--	--	(1,2,3,4)	
249	2/69	--	S 1603 W 2458	874.40	17.50	3.50	870.90	--	--	--	--	--	(1,2,3,4)	
250	2/69	--	S 1603 W 2435	874.00	15.00	3.50	870.50	--	--	--	--	--	(1,2,3,4)	
251	2/69	--	S 1603 W 2409	870.70	17.00	8.50	862.20	--	--	--	--	--	(1,2,3,4)	
252	2/69	--	S 1583 W 2409	872.40	15.50	5.50	866.90	--	--	--	--	--	(1,2,3,4)	

BLOCK 9

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV TO FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH INFO	REFERENCE	NOTES
362	8/68	--	S 1985 W 2374	807.50	37.00	15.00	792.50	--	--	--	--	--	(1,2,3,4)	
365	8/68	--	S 1930 W 2291	812.50	19.00	10.00	802.50	--	--	--	--	--	(1,2,3,4)	
368	8/68	--	S 1874 W 2208	813.50	26.00	10.00	803.50	--	--	--	--	--	(1,2,3,4)	
389	--	--	S 1584 W 2351	864.30	4.00	1.00	863.30	--	--	--	--	--	(1,2,3,4)	
519	--	--	--	813.00	--	--	813.00	--	--	--	--	--	(1,2,3,4)	No Log
526	5/24/84	N 1801.4289 E 2484.0029	--	839.82	8.00	3.50	836.32	--	--	--	--	--	(1,2,3,4)	
527	5/24/84	N 1657.6292 E 2362.8950	--	854.10	10.50	4.00	850.10	--	--	--	--	--	(1,2,3,4)	

BLOCK 10

BORING ID	DATE INSTALLED	COORDINATES	MOUND	GROUND ELEVATION	TOTAL DEPTH	DEPTH TO FRACTURED BEDROCK	TOP ELEV OF FRACT. BEDROCK	DEPTH TO COMPTENT BEDROCK	TOP ELEV. OF COMPT. BEDROCK	DEPTH TO WATER LEVEL	PROGRAM	GEOTECH NOTES	REFERENCE	NOTES
26	12/48	--	S 1970 W 3000	853.20	100.00	0.00	853.20	64.00	789.20	--	--	--	(1,2,3,4)	
27	12/48	--	S 2050 W 3160	830.20	75.00	1.00	829.20	22.00	808.20	--	--	--	(1,2,3,4)	
126	--	--	S 2138 W 3048	818.60	6.00	6.00	812.60	--	--	--	--	--	(1,2,3,4)	
172	9/67	--	S 2225 W 3091	822.50	30.00	14.00	808.50	--	--	--	--	--	(1,2,3,4)	
199	4/68	--	S 2149 W 3135	818.95	20.00	9.00	809.95	--	--	--	--	--	(1,2,3,4)	
226	12/71	--	S 2188 W 3091	819.40	15.00	10.50	808.90	--	--	--	--	--	(1,2,3,4)	
281	10/75	--	S 3090 W 2413	763.10	26.50	2.00	761.10	--	--	--	--	--	(1,2,3,4)	
373	--	--	S 2355.57 W 2894.35	775.90	23.00	8.00	767.90	--	--	--	--	--	(1,2,3,4)	
374	--	--	S 2151.09 W 3071.15	818.90	20.00	9.00	809.90	--	--	5.00	--	--	(1,2,3,4)	
375	--	--	S 2289.08 W 3051.90	801.60	24.00	0.50	801.10	--	--	--	--	--	(1,2,3,4)	
550	5/1/84	--	S 2956 W 2086	853.10	44.50	18.50	834.60	--	--	--	--	--	(1,2,3,4)	
551	4/26/84	--	S 2690 W 2088	834.00	44.50	13.50	820.50	--	--	--	--	--	(1,2,3,4)	
627	--	--	--	822.50	--	--	--	--	--	--	--	--	(1)	No Log
628	--	--	--	822.50	--	--	--	--	--	--	--	--	(1)	No Log
635	--	--	--	834.00	--	--	--	--	--	--	--	--	(1)	No Log
B-3	--	--	--	834.00	--	--	--	--	--	--	--	--	(6)	No Log
B-2	--	--	--	834.00	--	--	--	--	--	--	--	--	(6)	No Log
0349	--	--	--	825.00	205.00	20.00	805.00	45.00	780.00	48.50	--	--	(9)	wl on 3/31/9

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References:
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(1) Plate A-1 OU-9 Site Scoping Report: Vol.2 Addendum
Stratigraphic and Lithologic Logs

(2) Plate A-2 through A-10 OU-9 Site Scoping Report: Vol.2 Addendum
Stratigraphic and Lithologic Logs

(3) OU-9 Site Scoping Report: Vol.2 Addendum
Stratigraphic and Lithologic Logs

(4) RI/FS OU-9 Hydrogeologic Investigation Well Information

(5) Map- Project Title: Opreational Support Facility;
Drawing Title: Site Plan

(6) Map- Project Title: Central Operations Support Building
Segment A; Drawing Title: Grading Plan

(7) Map- Project Title: Transducer Fabracation Facility;
Drawing Title: Site Work Site Plan

(8) Dames & Moore pg. 7-95,7-97,7-103; Plate 7.1-2,7.1-4,7.1-10

(9) DOE, 1994. "OU-9 Hydrogeologic Investigation: Bedrock Report", January 1994.

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Notes:
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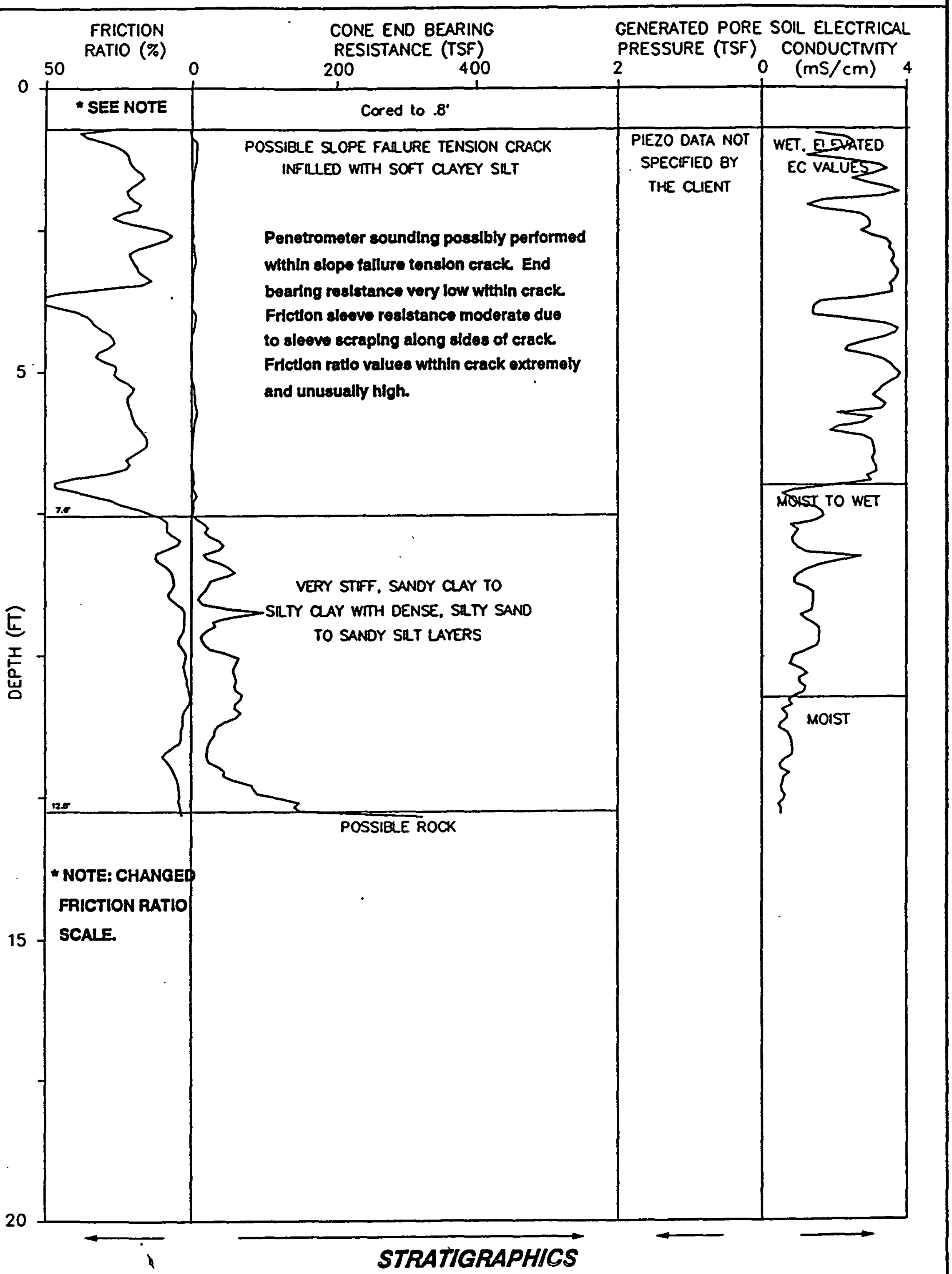
-- Information not Available

Appendix B

APPENDIX B

MAIN HILL CPT LOGS

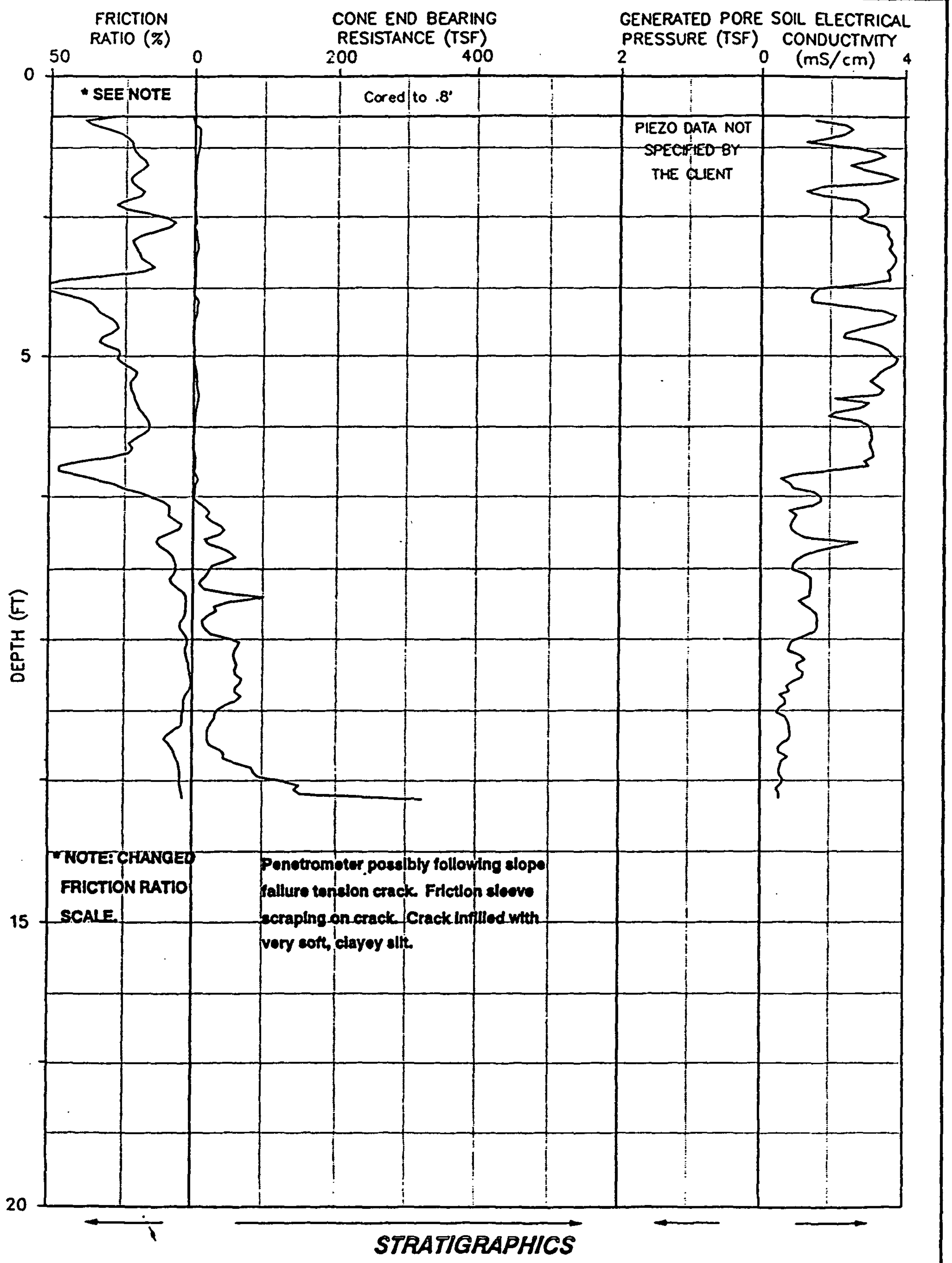
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-001

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-001

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP001

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	4.8	7.3	1.38	17.9		3145								
2.0	4.3	6.2	0.82	19.9		1692								
2.5	3.7	5.2	0.57	13.4		2880	Penetrometer sounding possibly performed							
3.0	7.2	9.9	1.23	21.1		3636	within slope failure tension crack. End							
3.5	4.0	5.4	0.72	19.3		3538	bearing resistance very low within crack.							
4.0	6.9	9.0	1.93	38.4		1469	Friction sleeve resistance moderate due							
4.5	2.0	2.6	1.37	26.7		2976	to sleeve scraping along sides of crack.							
5.0	2.8	3.5	1.21	25.9		3644	Friction ratio values within crack extremely							
5.5	7.1	8.8	1.77	22.1		3133	and unusally high.							
6.0	5.7	7.0	1.44	18.5		2294								
6.5	2.5	3.0	0.83	20.9		3104								
7.0	4.8	5.7	2.78	46.4		2643								
7.5	3.9	4.6	3.08	15.6		1662								
8.0	40.0	46.4	1.12	4.0		891	V stiff, sandy clay to silty clay *			25	3.16	2.24	26 - 28	30 - 33
8.5	56.5	64.8	3.05	8.3		1488	Hard, sandy clay to silty clay **			24	4.67	6.10	+ 87	+ 100
9.0	13.2	14.9	3.87	7.9		1459	Stiff, silty clay to clay *			14	1.80	7.75	13 - 15	15 - 17
9.5	35.0	39.3	1.16	2.6		1493	V stiff, sandy silt to sandy clay			25	2.75	2.32	13 - 15	15 - 17
10.0	57.3	63.6	1.25	2.2		1130	Dense, silty sand to sandy silt	36-37	60-80				21 - 27	23 - 30
10.5	62.3	68.9	1.26	1.7		1090	Med dense, silty sand to sandy silt	36-37	40-60				21 - 27	23 - 30
11.0	69.8	76.8	1.97	2.7		581	Hard, sandy silt to sandy clay			25	5.53	3.94	36 - 42	40 - 46
11.5	27.7	30.4	1.63	3.9		831	V stiff, sandy clay to silty clay *			20	2.71	3.25	16 - 18	17 - 20
12.0	44.7	48.8	5.21	6.8		549	V stiff, sandy clay to silty clay **			30	2.93	10.43	55 - 66	60 - 72
12.5	128.1	139.1	7.46	4.0		676	Hard, gr cl sand to gr sa silt			33	7.72	14.92	+ 92	+ 100

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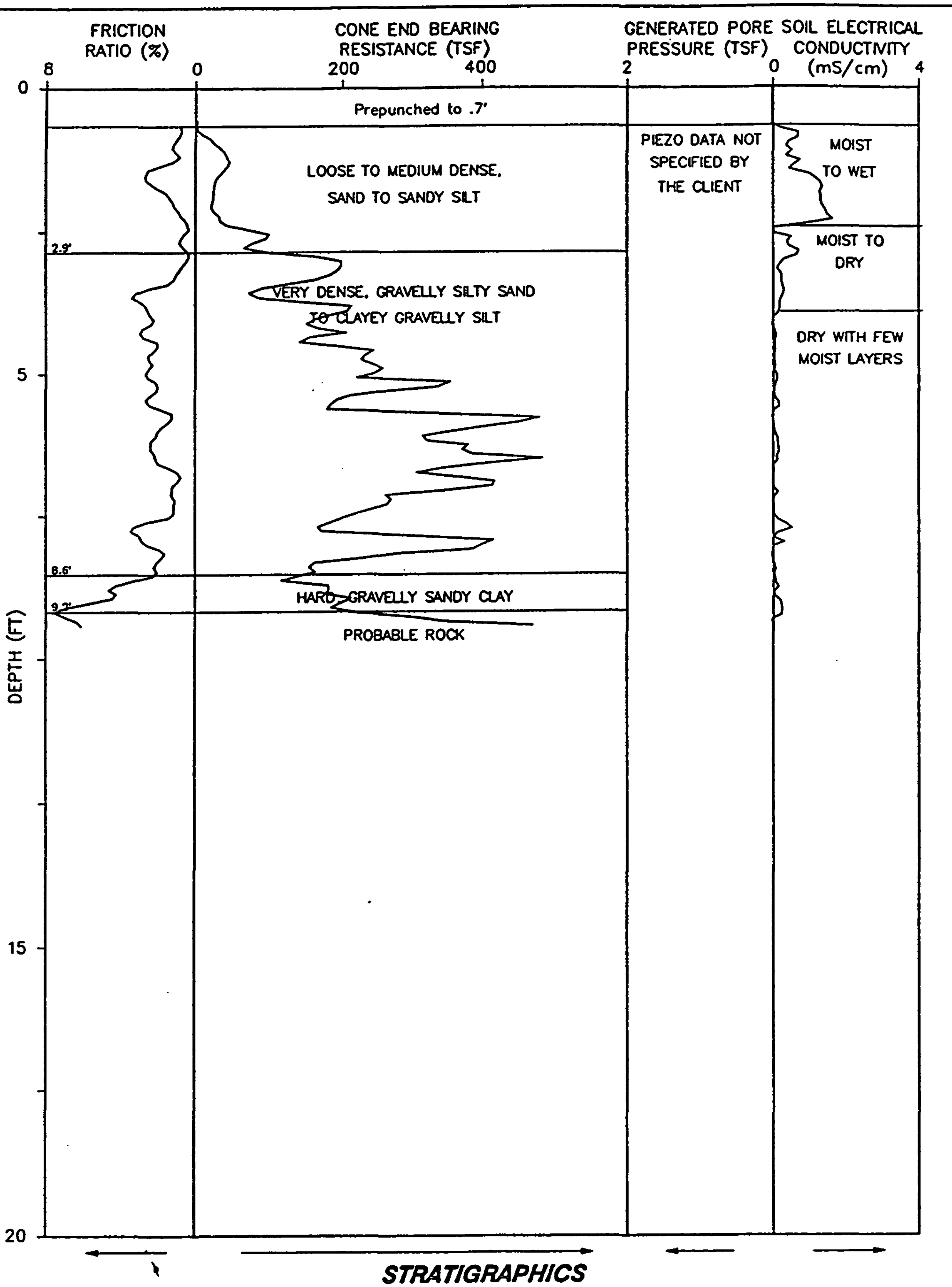
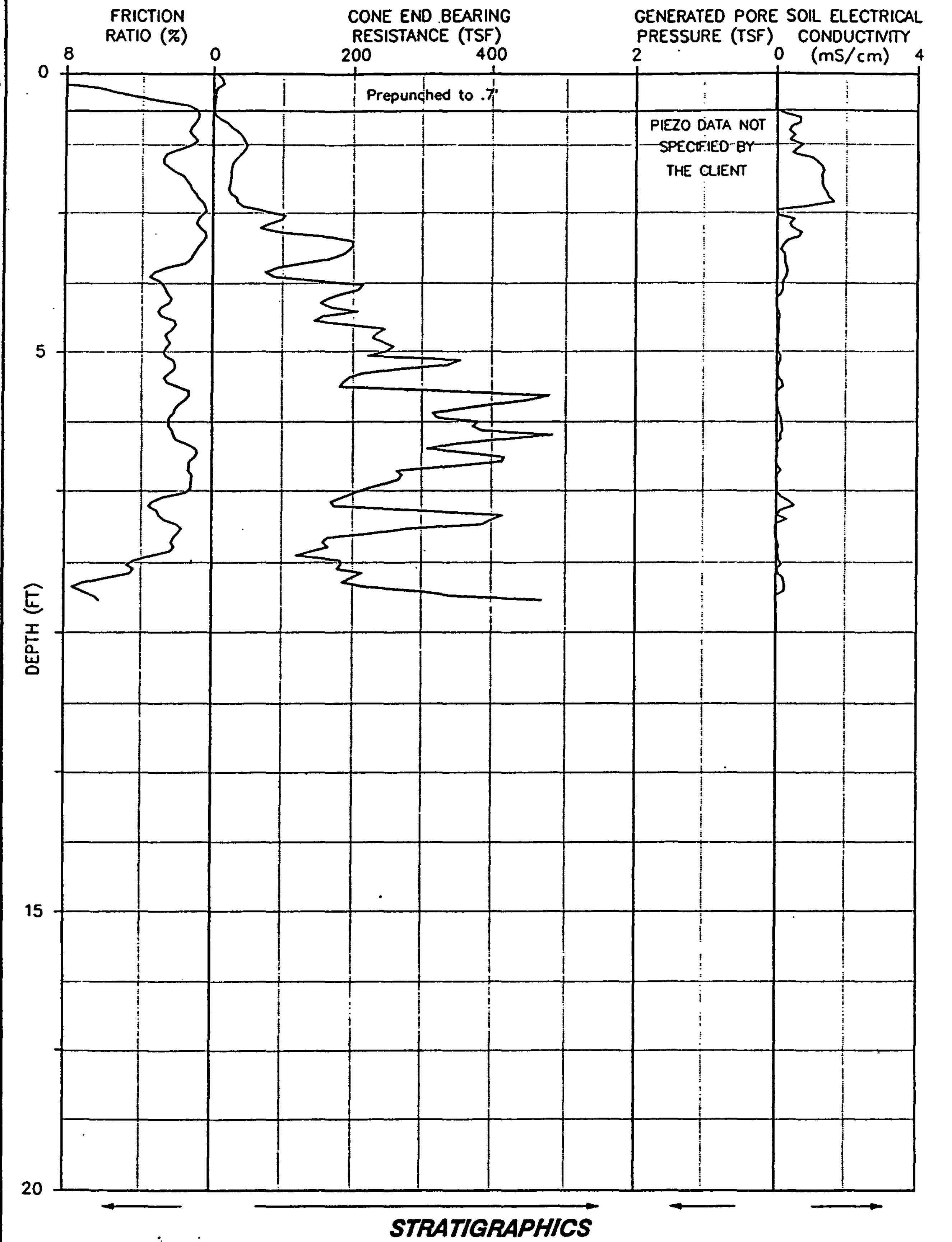
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-002

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-002

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP002

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	32.5	49.5	1.02	2.6		885	V stiff, sandy silt to sandy clay			25	2.59	2.04	13 - 15	20 - 23
2.0	20.9	30.5	0.49	1.3		1310	Loose, silty sand to sandy silt	27-31	20-40				4 - 5	6 - 7
2.5	80.8	114.1	0.51	0.5		43	Med dense, sand to silty sand	40-42	40-60				16 - 21	23 - 30
3.0	186.4	255.8	0.84	0.5		450	Dense, sand to silty sand	42-46	60-80				44 - 52	60 - 72
3.5	88.8	118.9	3.46	2.5		291	V dense, silty sand to sandy silt	37-40	80-100				45 - 54	60 - 72
4.0	178.3	233.5	3.97	2.4		122	V dense, gr si sand to cl gr sand	37-40	+100				+ 76	+ 100
4.5	174.9	224.6	4.33	2.1		81	V dense, gr si sand to cl gr sand	40-42	80-100				+ 78	+ 100
5.0	247.4	312.1	7.87	2.6		62	V dense, gr si sand to cl gr sand	37-40	+100				+ 79	+ 100
5.5	191.6	237.7	9.34	2.6		109	V dense, gr si sand to cl gr sand	37-40	+100				+ 81	+ 100
6.0	371.1	453.4	7.37	2.0		55	V dense, sa gravel to si gr sand	42-46	+100				+ 82	+ 100
6.5	468.5	564.4	8.87	2.1		150	V dense, sa gravel to si gr sand	40-42	+100				+ 83	+ 100
7.0	401.9	477.6	4.12	1.3		33	V dense, sa gravel to si gr sand	42-46	80-100				+ 84	+ 100
7.5	212.3	249.1	3.10	1.3		67	Dense, sand to silty sand	42-46	60-80				61 - 84	72 - 99
8.0	399.6	463.3	7.47	2.6		302	V dense, gr si sand to cl gr sand	40-42	+100				+ 86	+ 100
8.5	161.2	184.8	5.47	2.1		102	V dense, silty sand to sandy silt	40-42	80-100				63 - 86	72 - 99
9.0	205.4	232.9	12.76	5.0		152	Hard, gr sa clay to hardpan **			33	12.42	25.52	+ 88	+ 100

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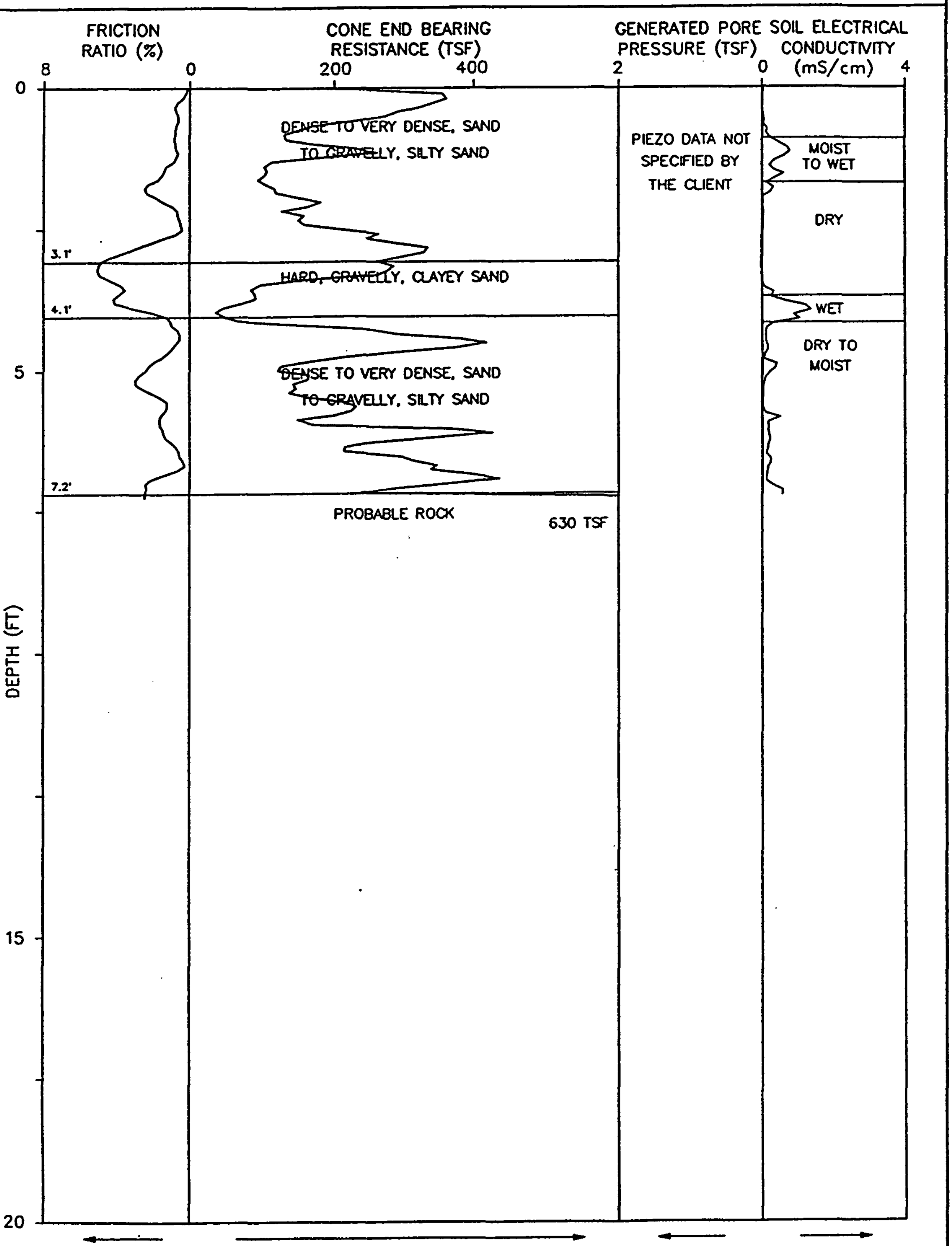
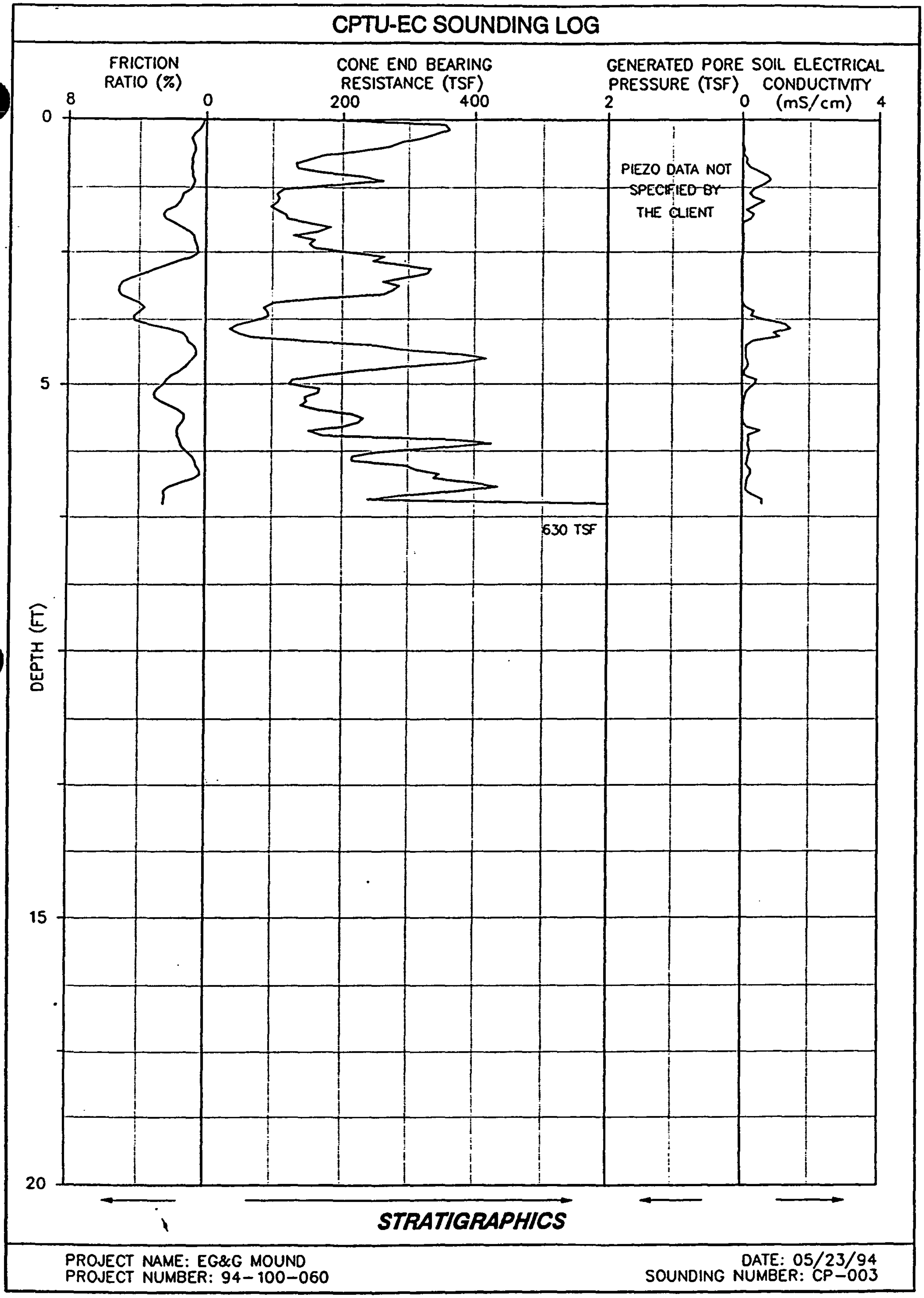
INTERPRETED CPT-EC SOUNDING LOG



STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/23/94
SOUNDING NUMBER: CP-003


CPTU-EC SOUNDING LOG
FRICTION RATIO (%)
CONE END BEARING RESISTANCE (TSF)
GENERATED PORE PRESSURE (TSF)
SOIL ELECTRICAL CONDUCTIVITY (mS/cm)
8
0
200
400
2
0
4
0
5
15
20
DEPTH (FT)
PIEZO DATA NOT SPECIFIED BY THE CLIENT
630 TSF
STRATIGRAPHICS
PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060
DATE: 05/23/94
SOUNDING NUMBER: CP-003

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP003

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (Nf)
1.0	174.5	281.1	1.71	0.8		543	Dense, sand to silty sand	42-46	60-80				37 - 45	60 - 72
1.5	105.5	160.6	2.67	1.5		468	Dense, sand to silty sand	40-42	60-80				39 - 47	60 - 72
2.0	171.4	250.2	2.64	1.6		55	V dense, sand to silty sand	42-46	80-100				49 - 68	72 - 99
2.5	201.8	284.9	1.10	0.5		45	Dense, sa gravel to gr sand	+46	60-80				42 - 51	60 - 72
3.0	292.8	401.8	12.58	4.4		16	Hard, gr cl sand to gr sandy clay			33	17.73	25.16	+ 73	+ 100
3.5	94.7	126.8	7.46	3.8		53	Hard, gr cl sand to gr sa silt			33	5.73	14.91	+ 75	+ 100
4.0	40.1	52.5	2.60	1.7		1180	Med dense, silty sand to sandy silt	36-37	40-60				13 - 15	17 - 20
4.5	400.7	514.6	1.93	0.7		140	V dense, sa gravel to gr sand	+46	80-100				+ 78	+ 100
5.0	122.4	154.4	6.17	2.4		409	V dense, gr si sand to cl gr sand	37-40	80-100				57 - 78	72 - 99
5.5	170.2	211.2	2.92	1.5		61	Dense, sand to silty sand	40-42	60-80				58 - 80	72 - 99
6.0	244.1	298.2	4.45	1.6		213	V dense, sa gravel to si gr sand	42-46	80-100				+ 82	+ 100
6.5	255.1	307.2	2.18	0.6		169	Dense, sand to silty sand	42-46	60-80				50 - 60	60 - 72
7.0	387.8	460.8	6.91	1.9		151	V dense, sa gravel to si gr sand	42-46	+100				+ 84	+ 100

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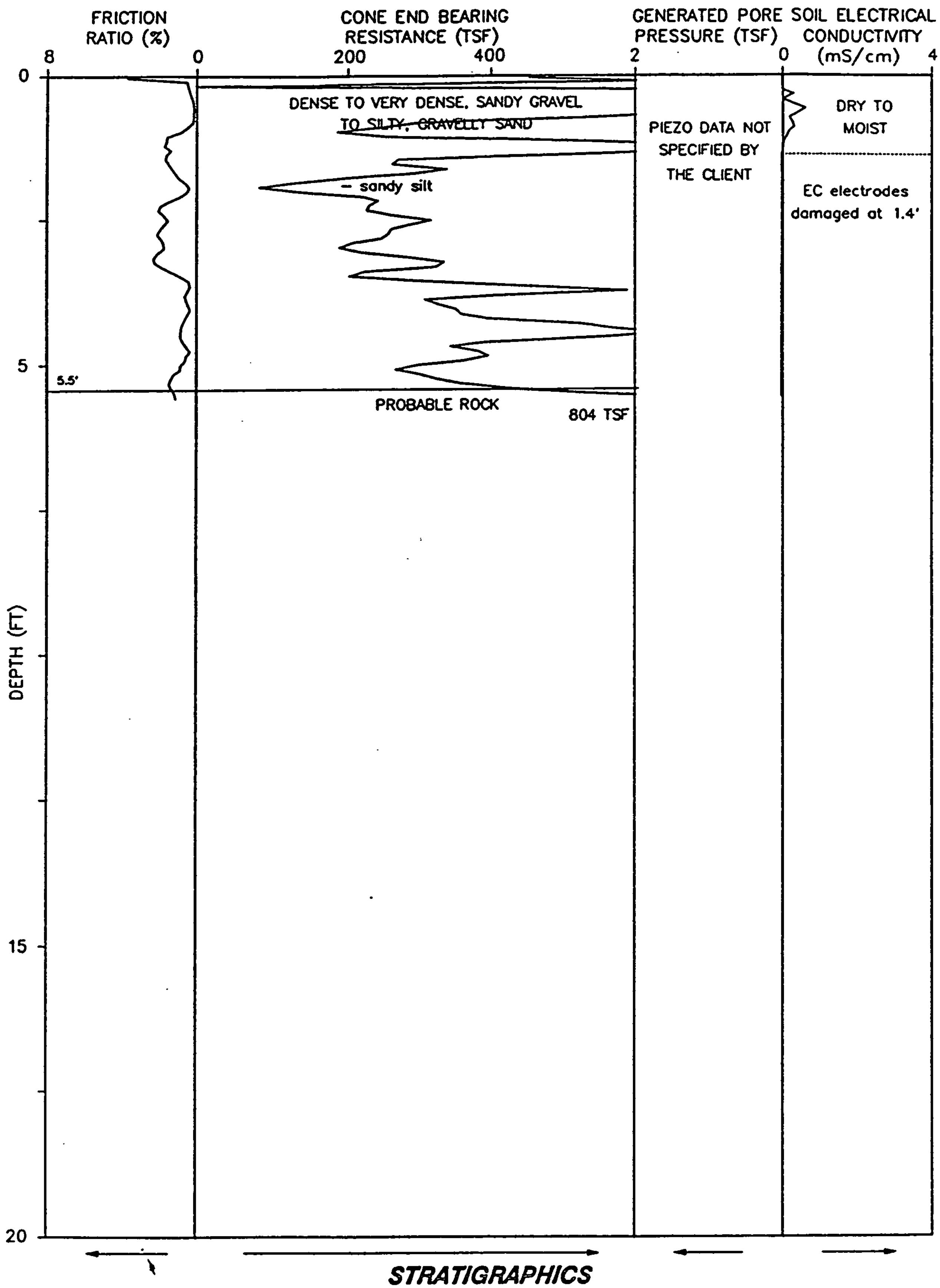
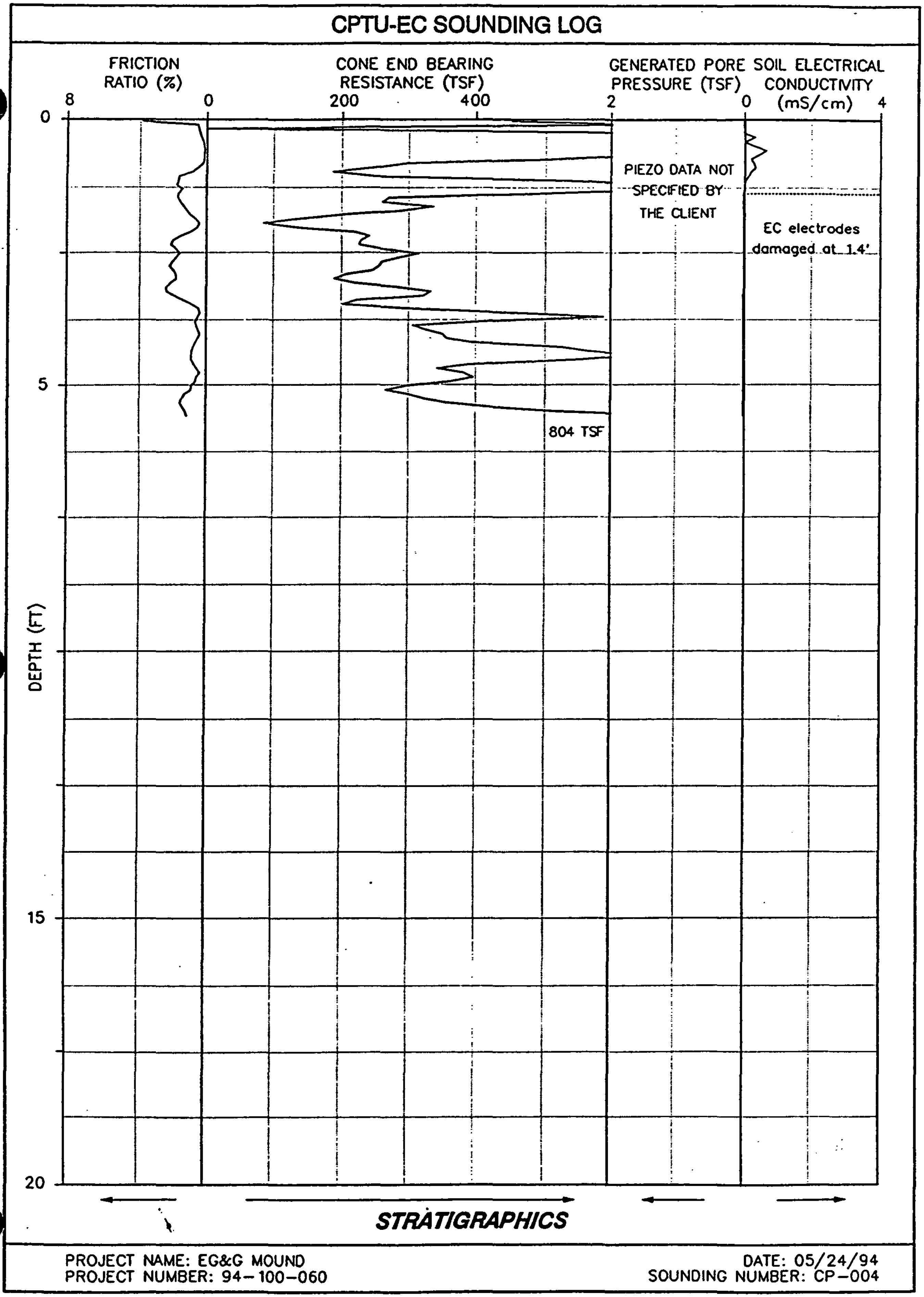
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-004


CPTU-EC SOUNDING LOG
FRICTION RATIO (%)
8
0
CONE END BEARING RESISTANCE (TSF)
200
400
GENERATED PORE PRESSURE (TSF)
2
0
SOIL ELECTRICAL CONDUCTIVITY (mS/cm)
4
0
5
15
20
DEPTH (FT)
PIEZO DATA NOT SPECIFIED BY THE CLIENT
EC electrodes damaged at 1.4'
804 TSF
STRATIGRAPHICS
PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060
DATE: 05/24/94
SOUNDING NUMBER: CP-004

STRATIGRAPHICS

PAGE 1

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP004

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	218.1	351.4	5.36	1.2		172	V dense, sand to silty sand	42-46	80-100				+ 62	+ 100
1.5	262.9	400.3	7.49	1.6		3	V dense, sa gravel to si gr sand	42-46	80-100				+ 66	+ 100
2.0	127.1	185.6	1.05	0.6		4	Med dense, sand to silty sand	42-46	40-60				31 - 41	46 - 60
2.5	309.8	437.4	3.55	1.6		4	V dense, sa gravel to si gr sand	42-46	+100				+ 71	+ 100
3.0	196.6	269.8	4.56	1.9		4	V dense, sa gravel to si gr sand	40-42	80-100				+ 73	+ 100
3.5	248.4	332.6	1.98	0.7		3	Dense, sand to silty sand	+46	60-80				54 - 74	72 - 99
4.0	340.1	445.5	1.91	0.4		3	Dense, sa gravel to gr sand	+46	60-80				55 - 76	72 - 99
4.5	565.2	725.9	4.34	0.9		3	V dense, sa gravel to gr sand	+46	+100				+ 78	+ 100
5.0	293.7	370.5	2.39	0.9		3	V dense, sand to silty sand	42-46	80-100				57 - 78	72 - 99
5.5	592.3	734.9	7.51	1.1		3	V dense, sa gravel to si gr sand	+46	+100				+ 81	+ 100

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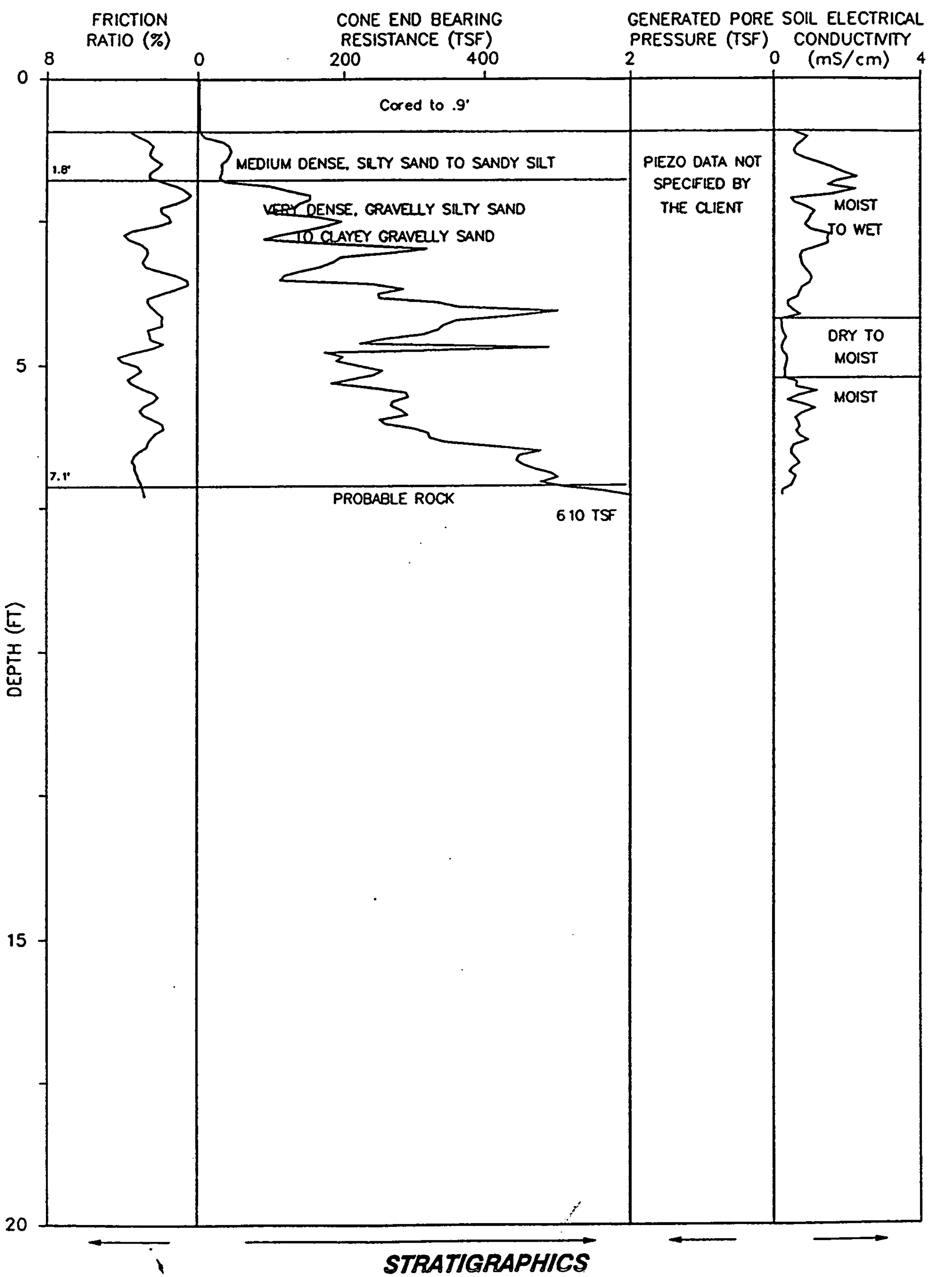
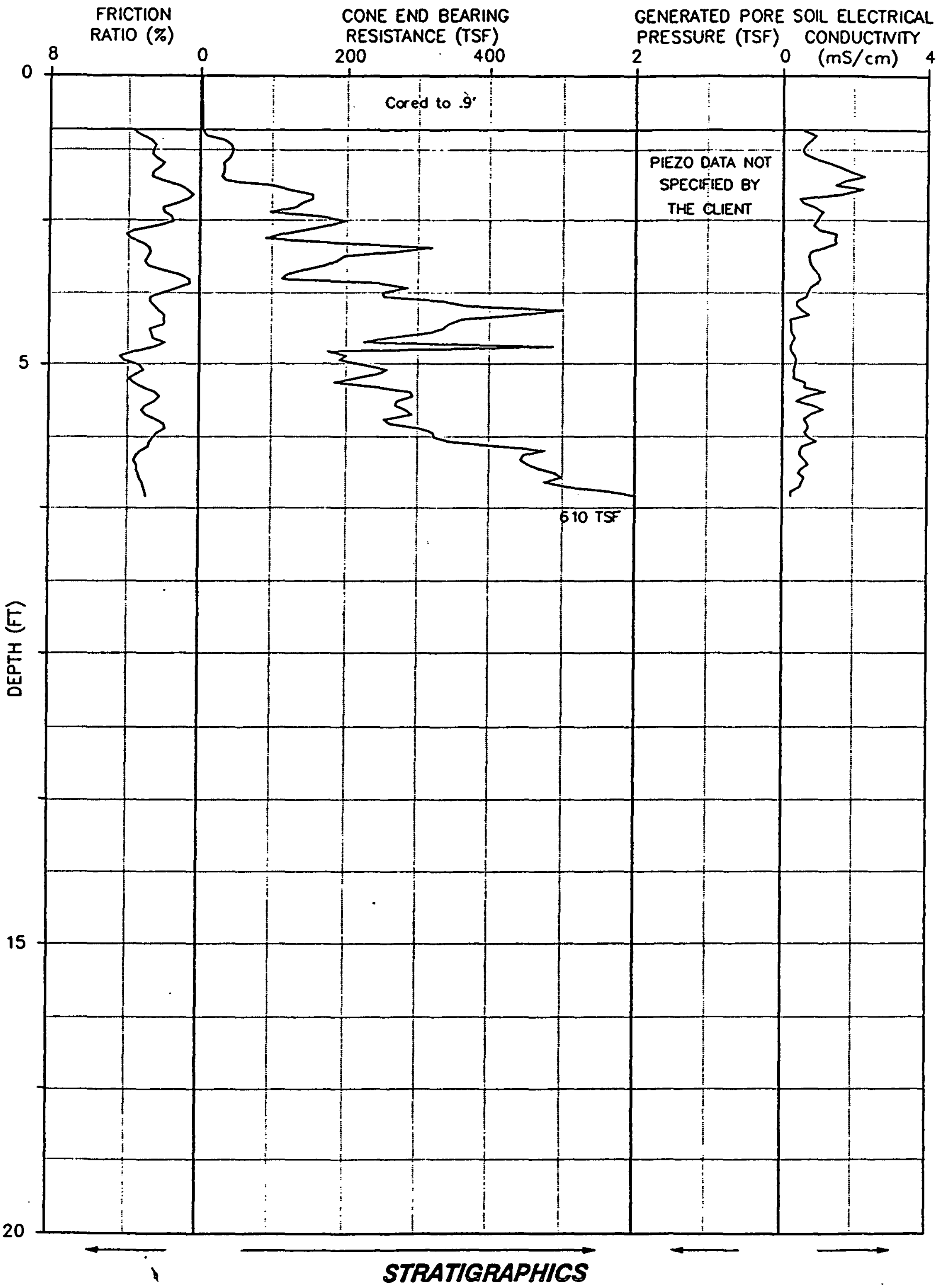
CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-005

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-005

STRATIGRAPHICS

PAGE 1

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP005

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	30.1	45.8	0.86	2.0		1301	Med dense, silty sand to sandy silt	27-31	40-60				10 - 11	15 - 17
2.0	131.4	191.8	0.79	0.6		2008	Med dense, sand to silty sand	42-46	40-60				31 - 41	46 - 60
2.5	188.8	266.5	1.86	1.5		1006	V dense, sand to silty sand	42-46	80-100				51 - 70	72 - 99
3.0	310.7	426.4	5.21	2.7		1133	V dense, gr si sand to cl gr sand	37-40	+100				+ 73	+ 100
3.5	114.2	152.9	1.57	0.9		1048	Med dense, sand to silty sand	40-42	40-60				30 - 34	40 - 46
4.0	358.9	470.1	9.61	2.5		434	V dense, gr si sand to cl gr sand	40-42	+100				+ 76	+ 100
4.5	298.3	383.1	12.99	2.5		314	V dense, gr si sand to cl gr sand	40-42	+100				+ 78	+ 100
5.0	210.5	265.6	8.53	3.5		386	Hard, gr cl sand to gr sa silt			33	12.74	17.07	+ 79	+ 100
5.5	288.7	358.2	6.20	2.3		1213	V dense, gr si sand to cl gr sand	40-42	+100				+ 81	+ 100
6.0	255.5	312.2	6.82	2.2		655	V dense, gr si sand to cl gr sand	40-42	+100				+ 82	+ 100
6.5	459.9	553.9	13.67	3.0		539	V dense, gr si sand to cl gr sand	37-40	+100				+ 83	+ 100
7.0	495.4	588.7	16.26	3.1		629	V dense, gr si sand to cl gr sand	37-40	+100				+ 84	+ 100

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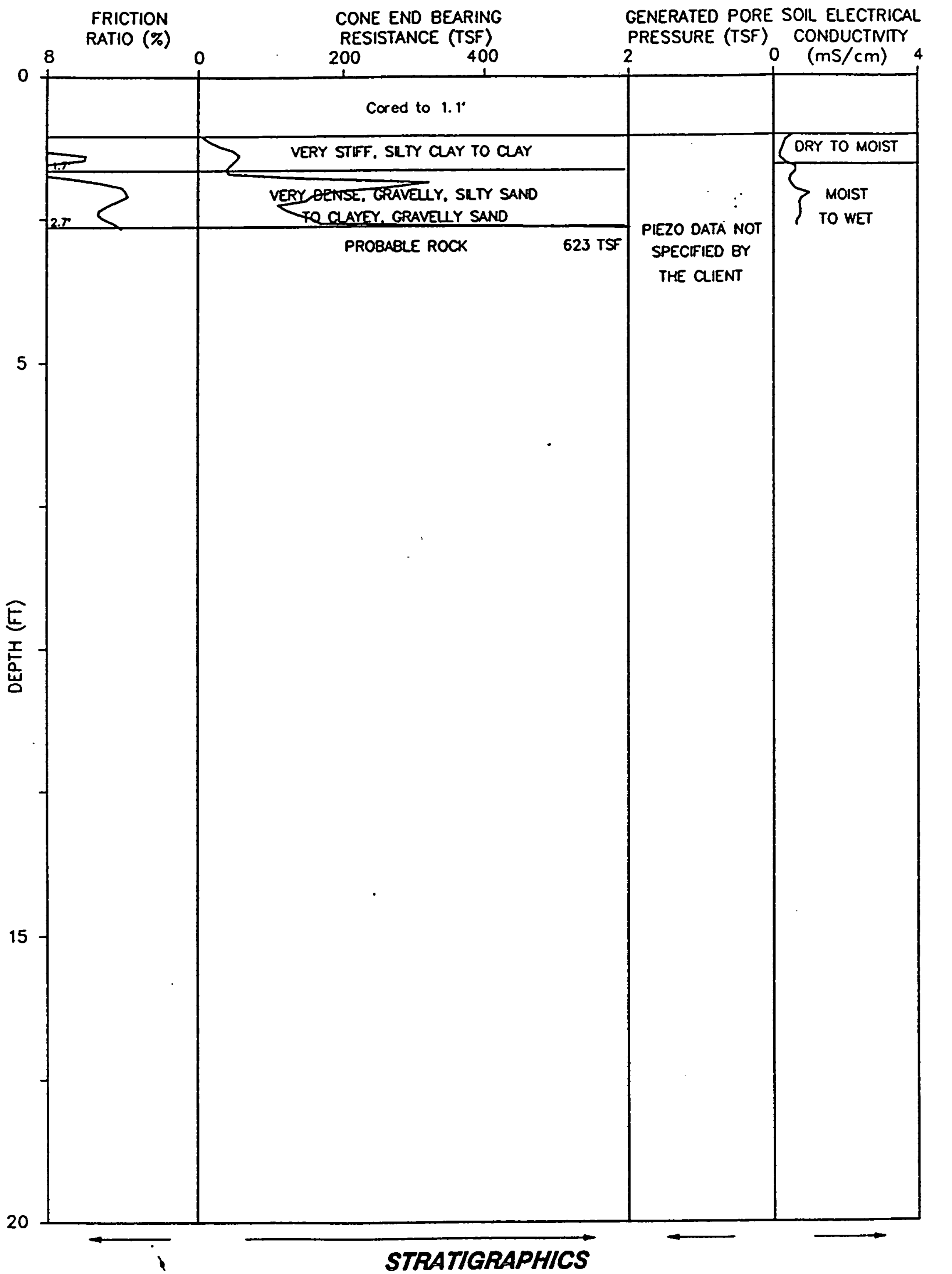
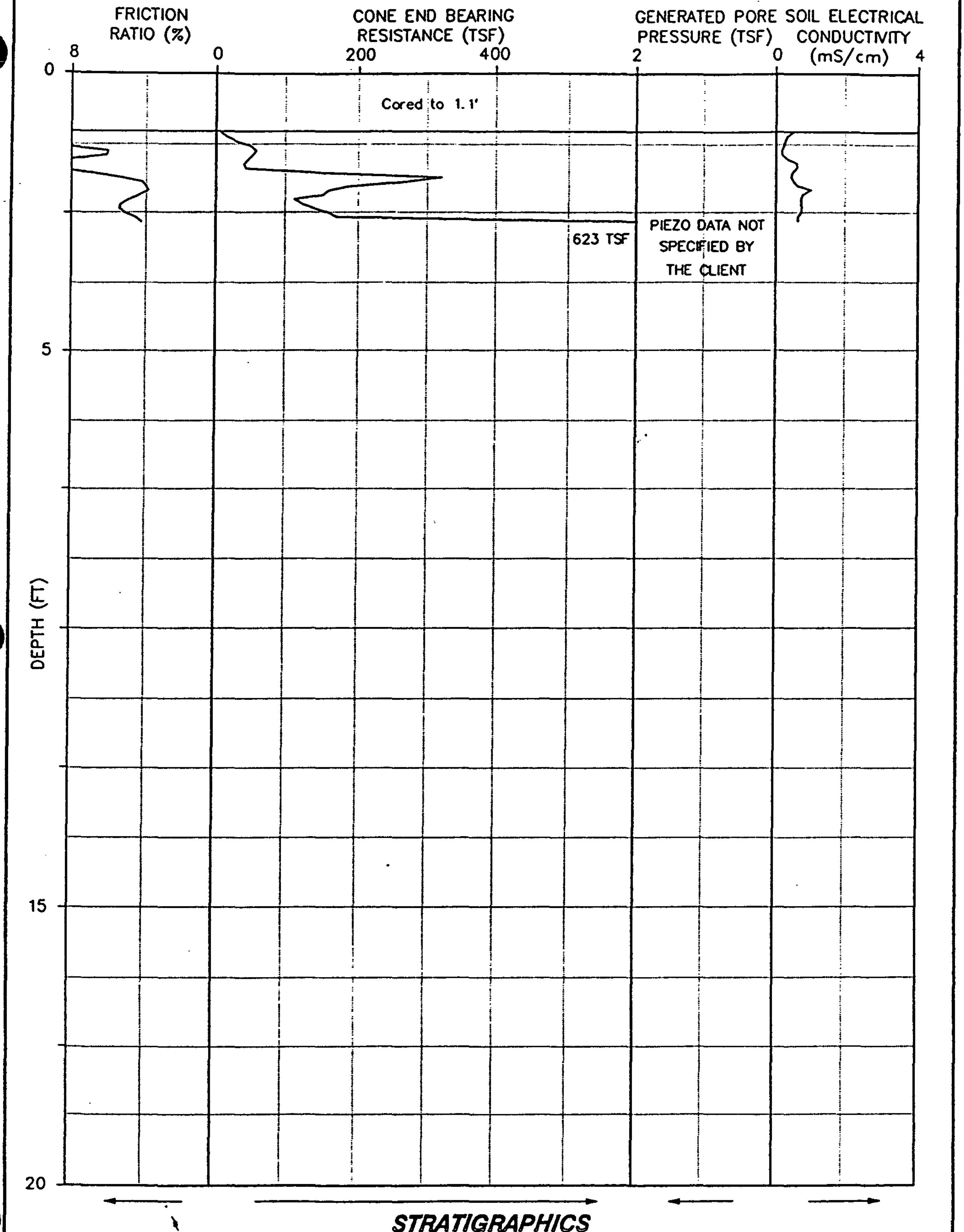
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-006

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-006

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP006

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	48.9	74.4	8.43	6.9		262	V stiff, sandy clay to silty clay **			30	3.25	16.86	+ 66	+ 100
2.0	227.1	331.7	6.02	4.0		578	Hard, gr cl sand to gr sandy clay			33	13.76	12.04	+ 68	+ 100
2.5	153.3	216.4	10.16	3.3		758	V dense, gr si sand to cl gr sand	36-37	+100				+ 71	+ 100

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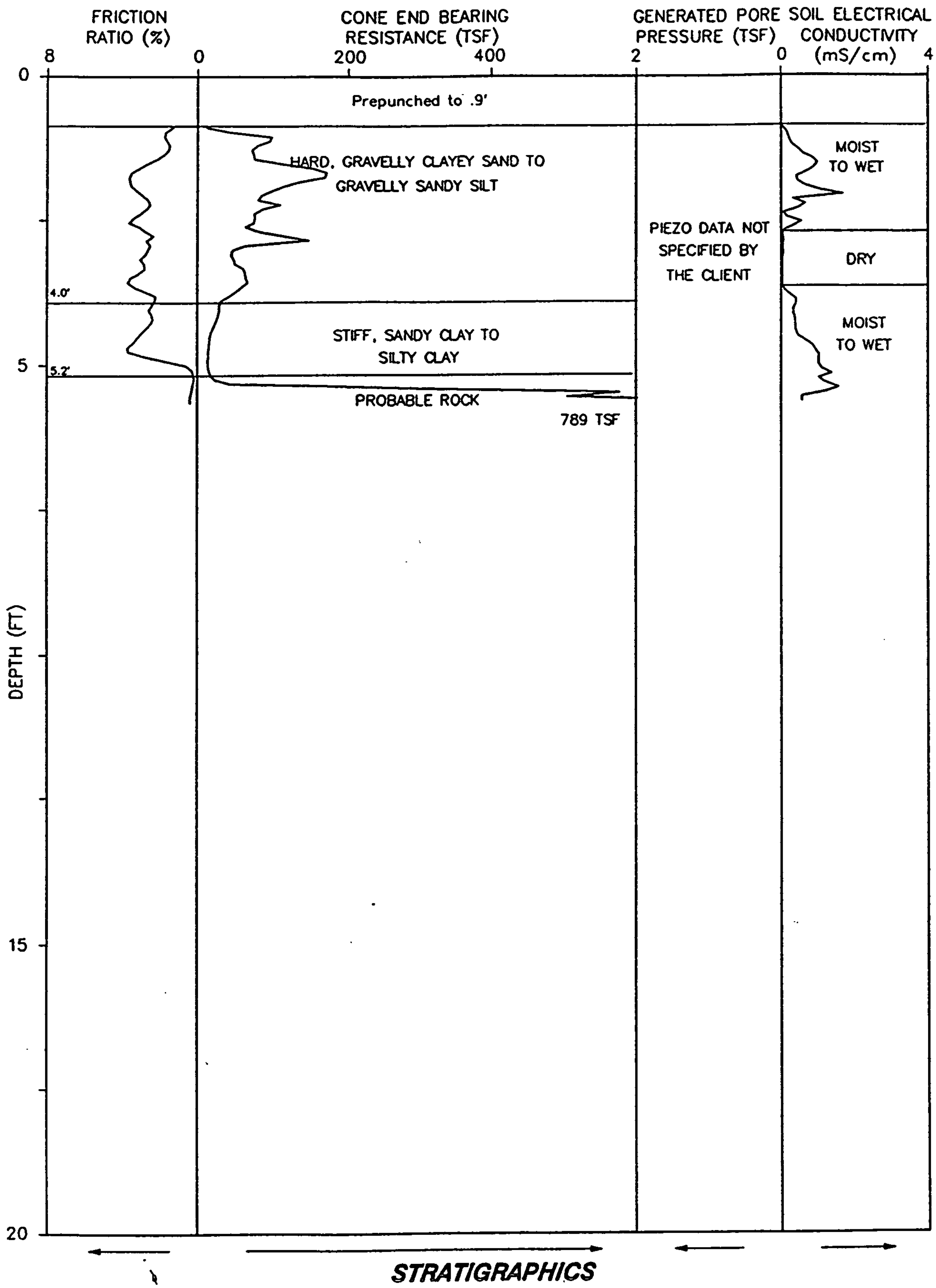
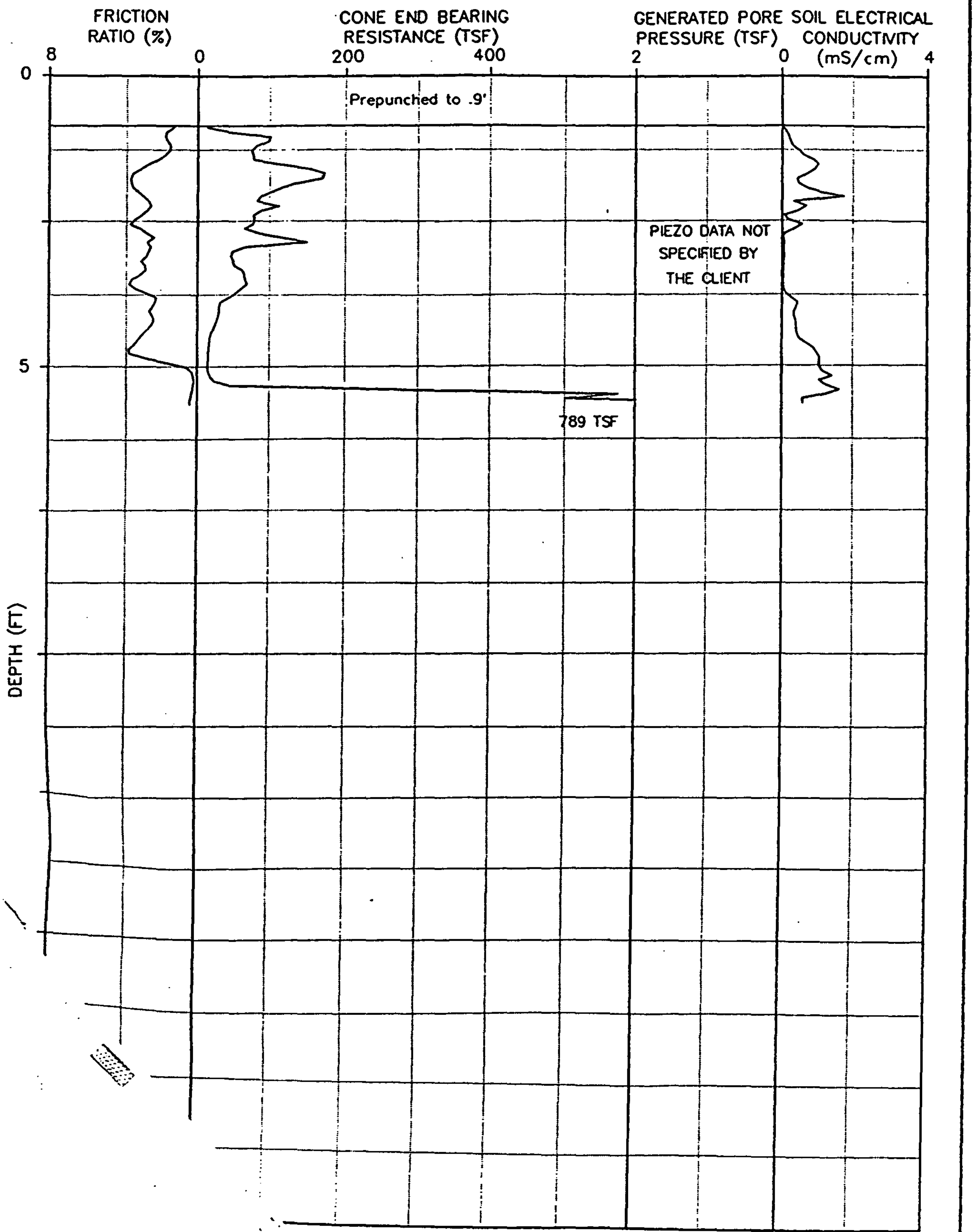
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-007

CPTU-EC SOUNDING LOG



STRATIGRAPHICS

DATE: 05/24/94
SOUNDING NUMBER: CP-007

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP007

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	98.7	150.3	3.25	2.5		917	V dense, gr si sand to cl gr sand	37-40	80-100				47 - 65	72 - 99
2.0	98.3	143.6	4.67	3.2		1040	Hard, gr cl sand to gr sa silt			33	5.95	9.34	+ 68	+ 100
2.5	75.0	105.9	3.05	3.5		228	Hard, gr cl sand to gr sa silt			30	4.99	6.09	51 - 70	72 - 99
3.0	54.3	74.5	2.09	2.6		27	Dense, silty sand to sandy silt	27-31	60-80				24 - 29	33 - 40
3.5	63.1	84.5	1.91	3.5		9	Hard, gr cl sand to gr sa silt			30	4.19	3.82	45 - 54	60 - 72
4.0	28.1	36.8	1.32	2.5		368	V stiff, sandy silt to sandy clay			25	2.23	2.65	11 - 13	15 - 17
4.5	16.6	21.3	0.71	3.1		413	Stiff, sandy clay to silty clay *			20	1.63	1.41	5 - 8	7 - 10
5.0	12.7	16.1	0.67	0.9		1013	Loose, silty sand to sandy silt	27-31	20-40				1 - 2	1 - 3
5.5	575.3	713.8	2.50	0.4		1190	V dense, sa gravel to gr sand	+46	80-100				+ 81	+ 100

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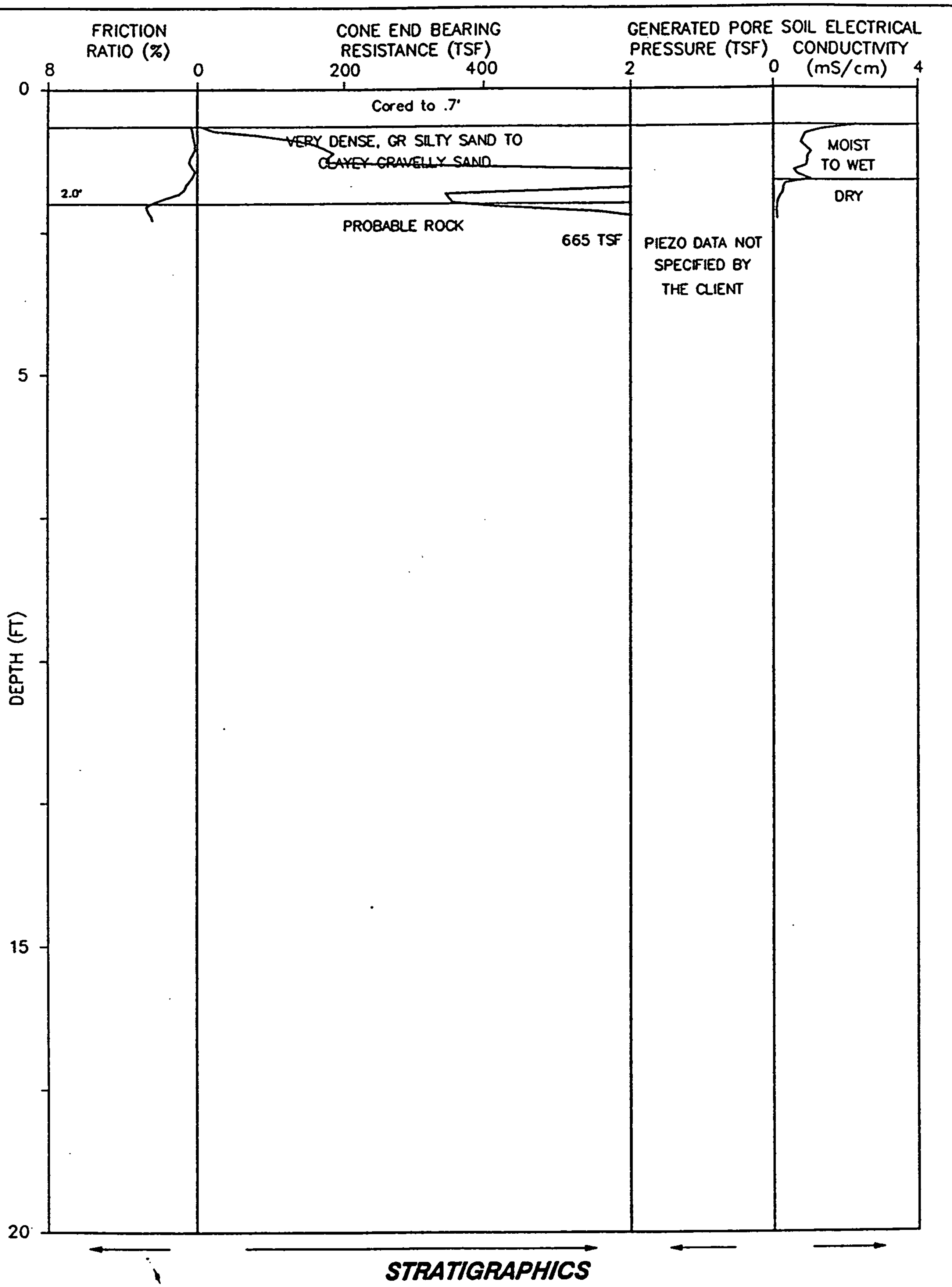
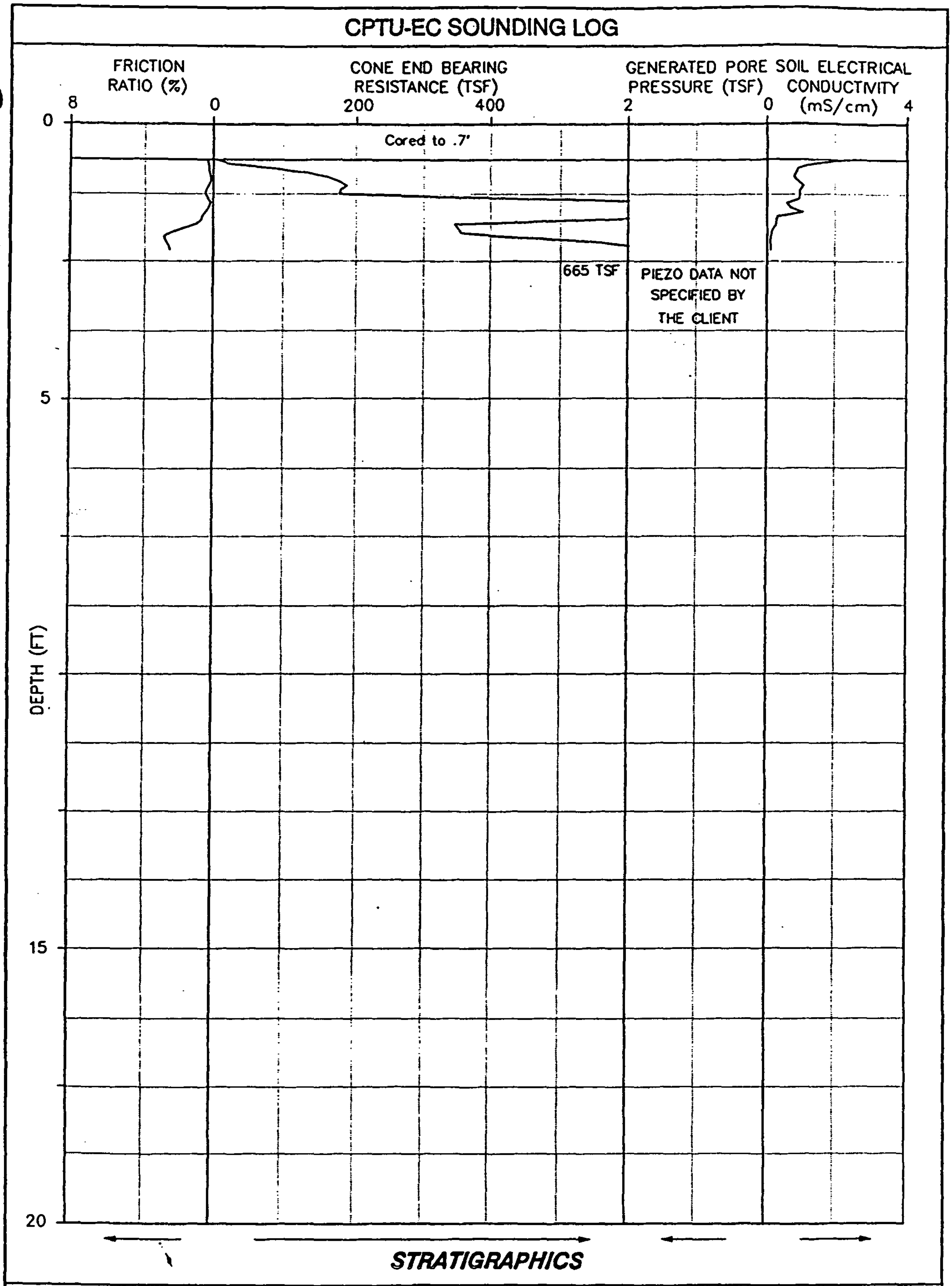
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-008



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-008

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP008

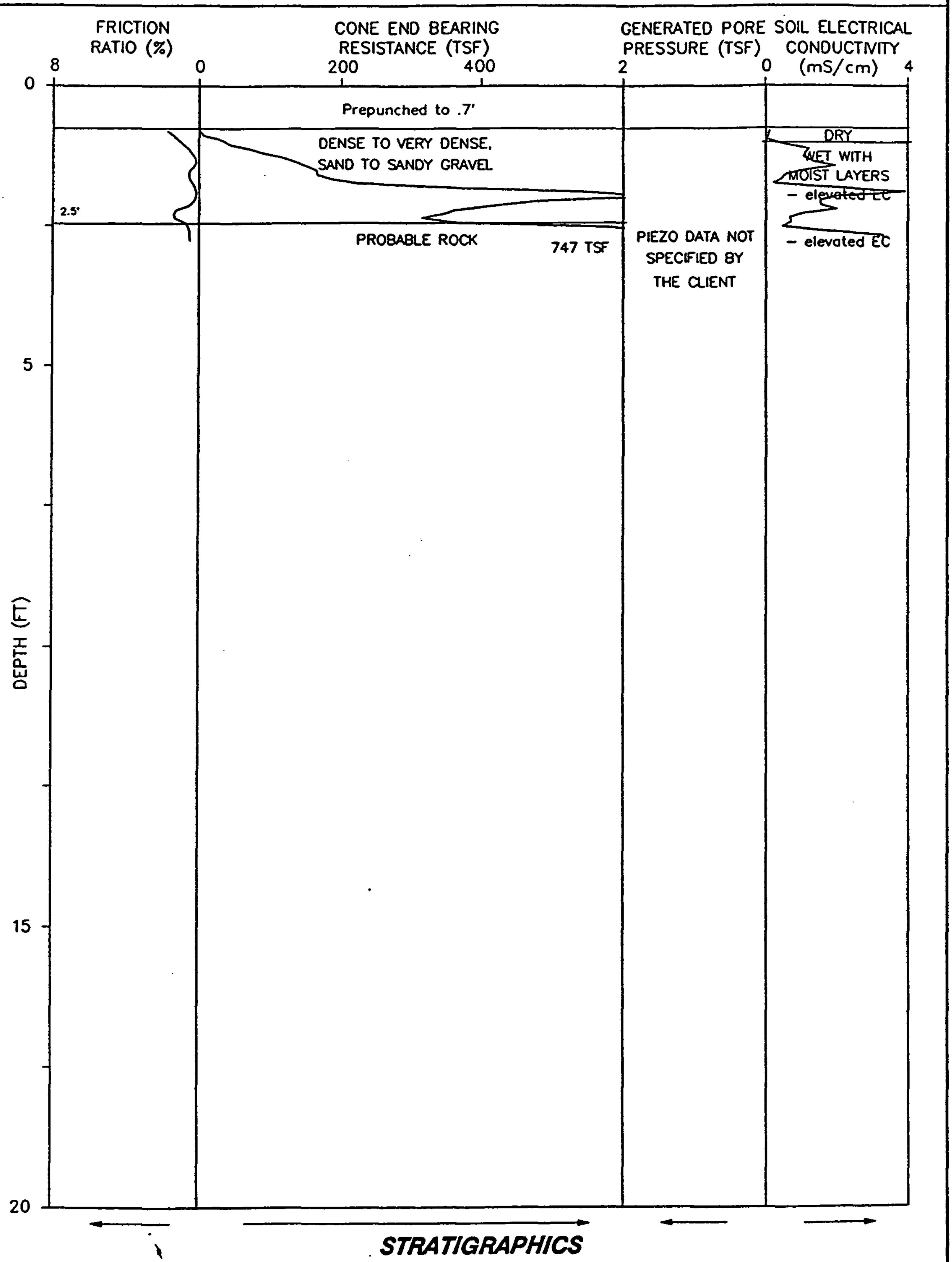
DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	799.7	1217.8	0.35	0.2		710	V dense, gr si sand to cl gr sand	40-42	+100				+ 72	+ 100
2.0	371.6	542.7	16.09	2.5		155	V dense, gr si sand to cl gr sand	40-42	+100				+ 68	+ 100

NOTES:
* Indicates lightly overconsolidated soil
** Indicates heavily overconsolidated or cemented soil

Mixed soils containing both granular and fine grained particles (e.g. clayey sands) may undergo partial drained failure during CPT. Both undrained and drained parameters can be estimated for these soils.

Structure rate of loading should be considered in choosing which strength parameters to use for design. Drained and undrained parameters must not be combined as such combination will result in significant overprediction of in situ shear strength.

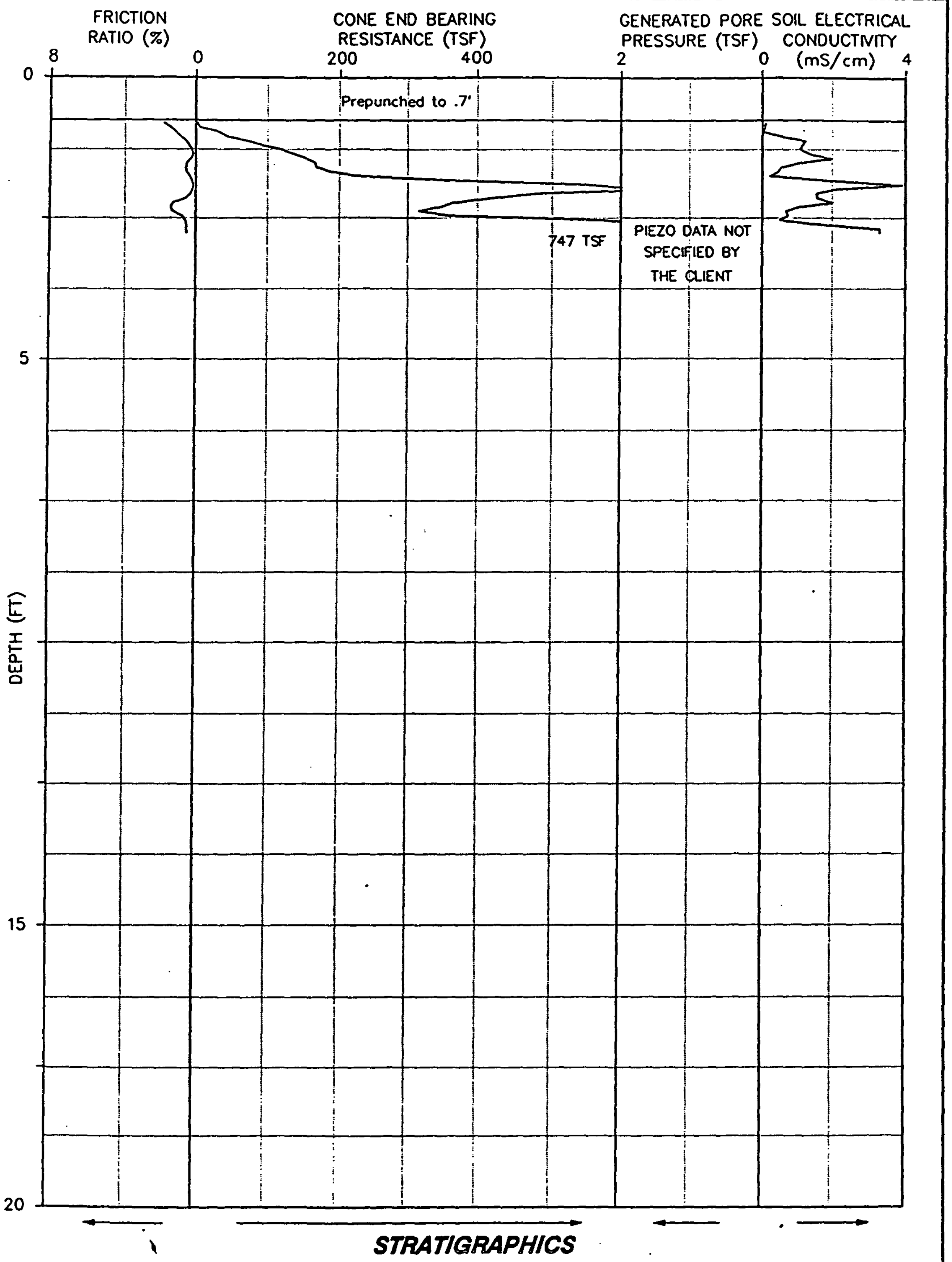
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-009

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-009

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP009

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	162.3	247.1	1.60	0.5		1317	Dense, sand to silty sand	42-46	60-80				39 - 47	60 - 72
2.0	630.3	920.5	0.74	0.2		1962	V dense, sa gravel to gr sand	+46	80-100				+ 68	+ 100
2.5	463.4	654.3	4.07	0.7		625	V dense, sa gravel to gr sand	+46	80-100				+ 71	+ 100

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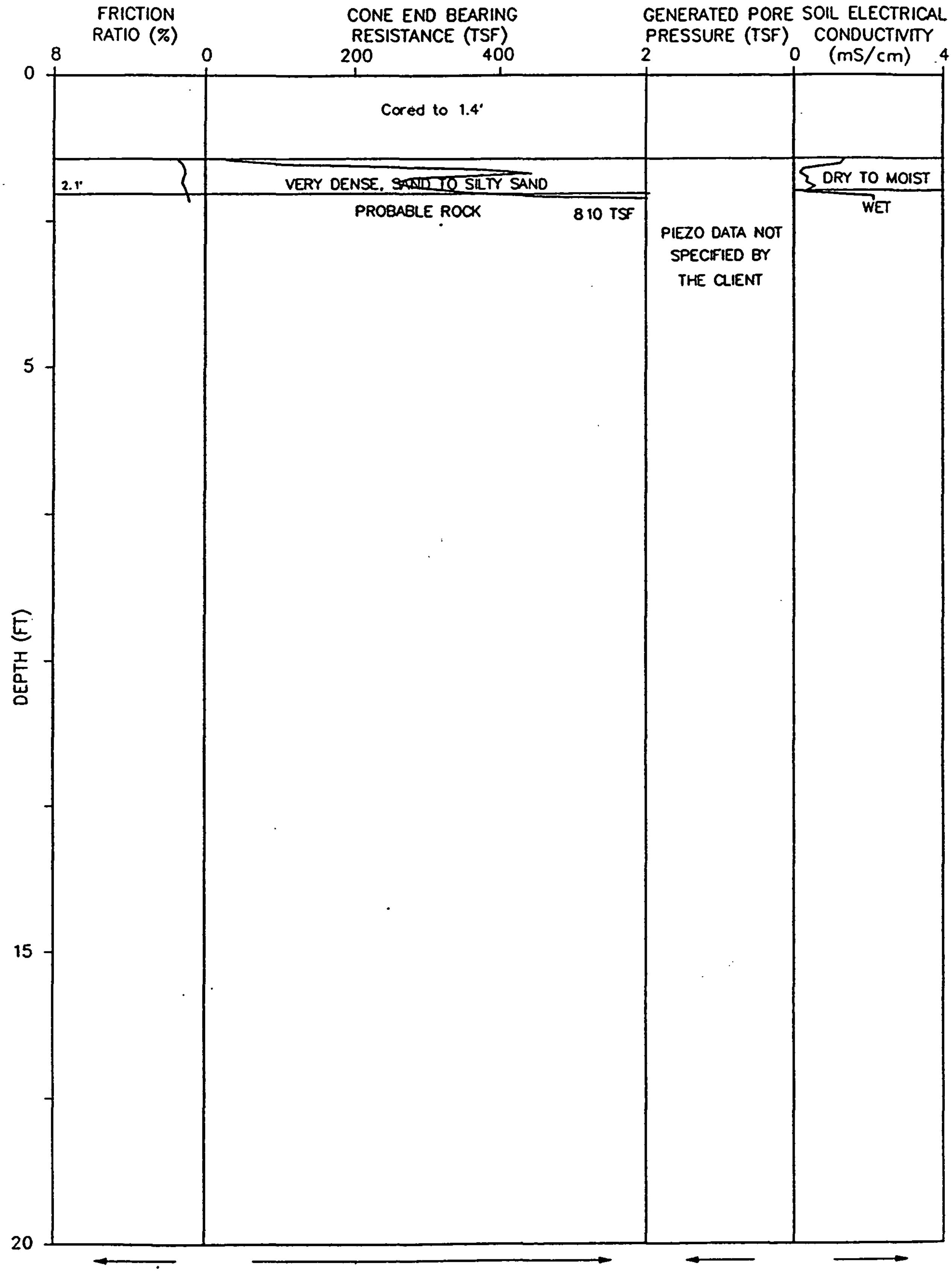
INTERPRETED CPT-EC SOUNDING LOG

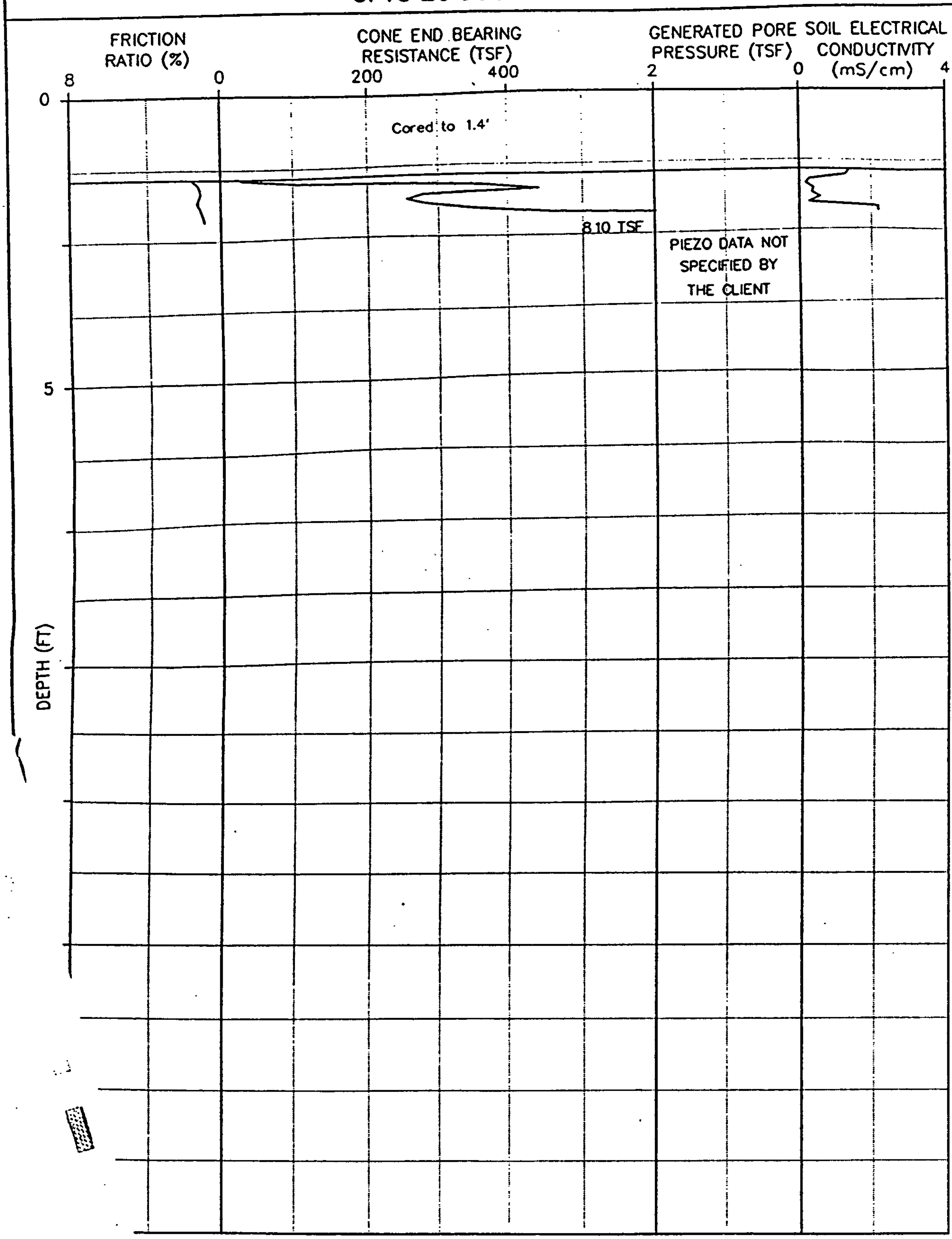


STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-010

CPTU-EC SOUNDING LOG



STRATIGRAPHICS

NAME: EG&G MOUND
NUMBER: 94-100-060

DATE: 05/24/94
SOUNDING NUMBER: CP-010

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP010

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5							PREPUNCH							
2.0	332.4	485.4	4.54	0.9		378	V dense, sand to silty sand	+46	80-100				+ 68	+ 100

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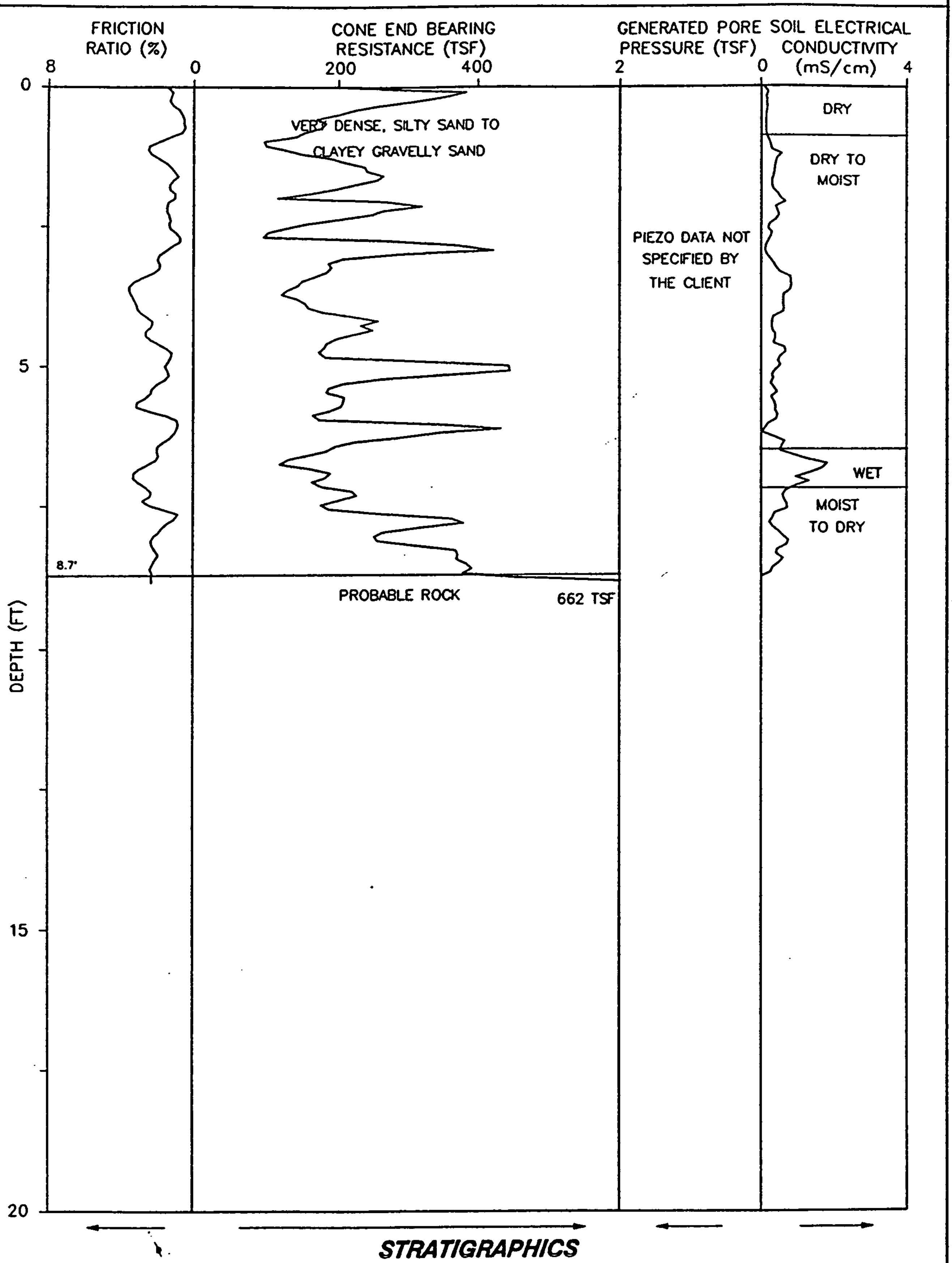
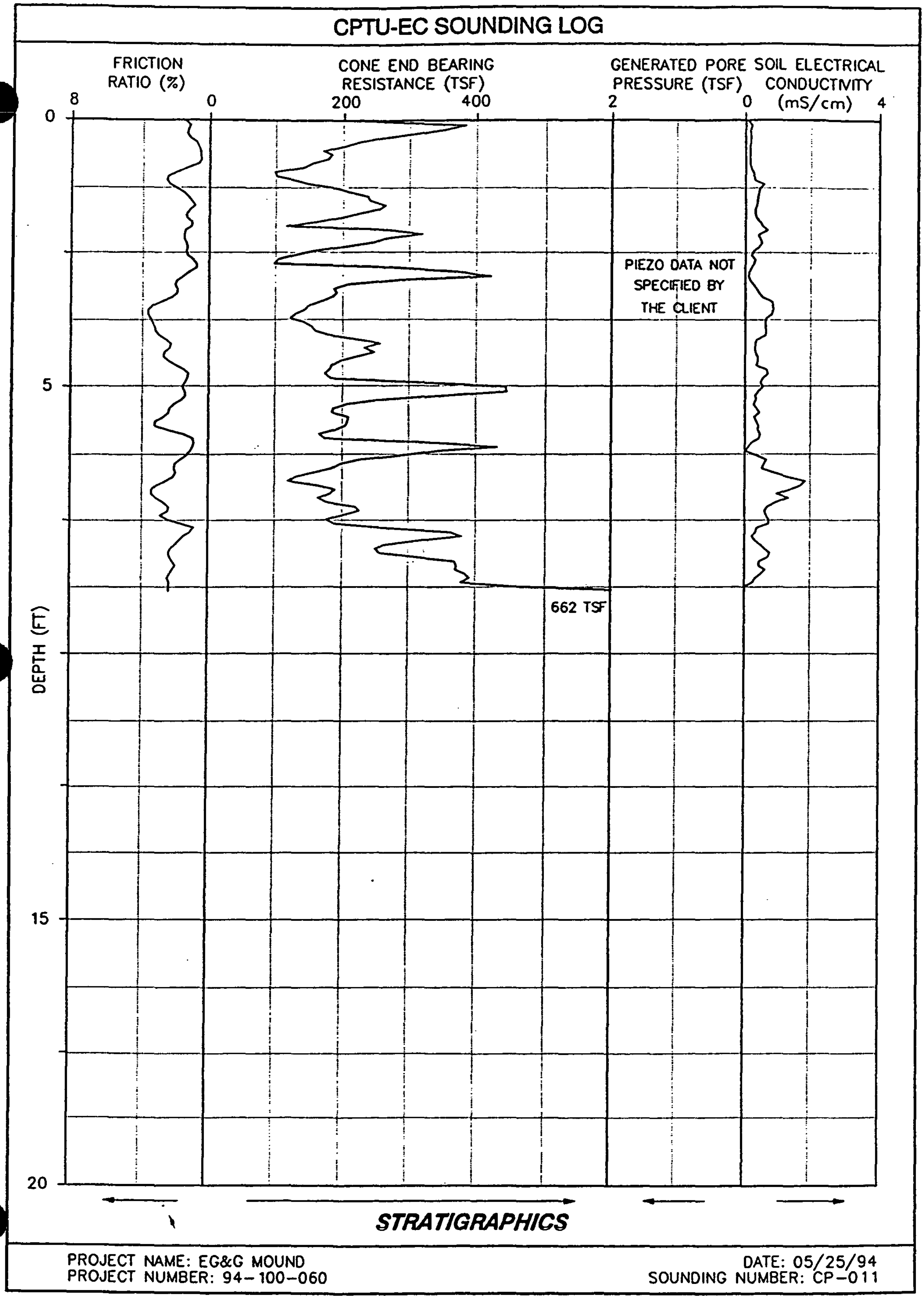
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-011


CPTU-EC SOUNDING LOG
FRICTION RATIO (%)
CONE END BEARING RESISTANCE (TSF)
GENERATED PORE PRESSURE (TSF)
SOIL ELECTRICAL CONDUCTIVITY (mS/cm)
8
0
200
400
2
0
4
0
5
15
20
DEPTH (FT)
PIEZO DATA NOT SPECIFIED BY THE CLIENT
662 TSF
STRATIGRAPHICS
PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060
DATE: 05/25/94
SOUNDING NUMBER: CP-011

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP011

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	96.8	155.9	3.78	2.1		268	V dense, silty sand to sandy silt	37-40	80-100				37 - 45	60 - 72
1.5	239.3	364.3	2.47	1.1		394	V dense, sand to silty sand	42-46	80-100				+ 66	+ 100
2.0	114.3	166.9	2.51	1.0		565	Dense, sand to silty sand	42-46	60-80				31 - 41	46 - 60
2.5	148.1	209.0	2.89	1.3		262	Dense, sand to silty sand	42-46	60-80				42 - 51	60 - 72
3.0	352.1	483.2	4.11	1.7		162	V dense, sa gravel to si gr sand	42-46	+100				+ 73	+ 100
3.5	151.5	202.8	6.54	3.2		854	V dense, gr si sand to cl gr sand	36-37	+100				+ 75	+ 100
4.0	160.7	210.5	6.54	3.1		657	V dense, gr si sand to cl gr sand	36-37	+100				+ 76	+ 100
4.5	213.3	273.9	5.79	2.5		415	V dense, gr si sand to cl gr sand	37-40	+100				+ 78	+ 100
5.0	393.5	496.4	4.59	1.5		539	V dense, sa gravel to si gr sand	42-46	+100				+ 79	+ 100
5.5	184.8	229.3	6.20	2.3		471	V dense, gr si sand to cl gr sand	40-42	+100				+ 81	+ 100
6.0	214.9	262.5	2.49	0.9		392	Dense, sand to silty sand	42-46	60-80				49 - 59	60 - 72
6.5	190.5	229.5	6.13	2.0		574	V dense, gr si sand to cl gr sand	40-42	80-100				+ 83	+ 100
7.0	183.2	217.7	6.44	3.3		1045	V dense, gr si sand to cl gr sand	36-37	+100				+ 84	+ 100
7.5	177.4	208.1	8.73	2.3		746	V dense, gr si sand to cl gr sand	40-42	80-100				+ 85	+ 100
8.0	257.9	299.0	6.54	2.0		566	V dense, gr si sand to cl gr sand	40-42	+100				+ 86	+ 100
8.5	377.3	432.5	9.24	1.9		555	V dense, sa gravel to si gr sand	42-46	+100				+ 87	+ 100

NOTES:
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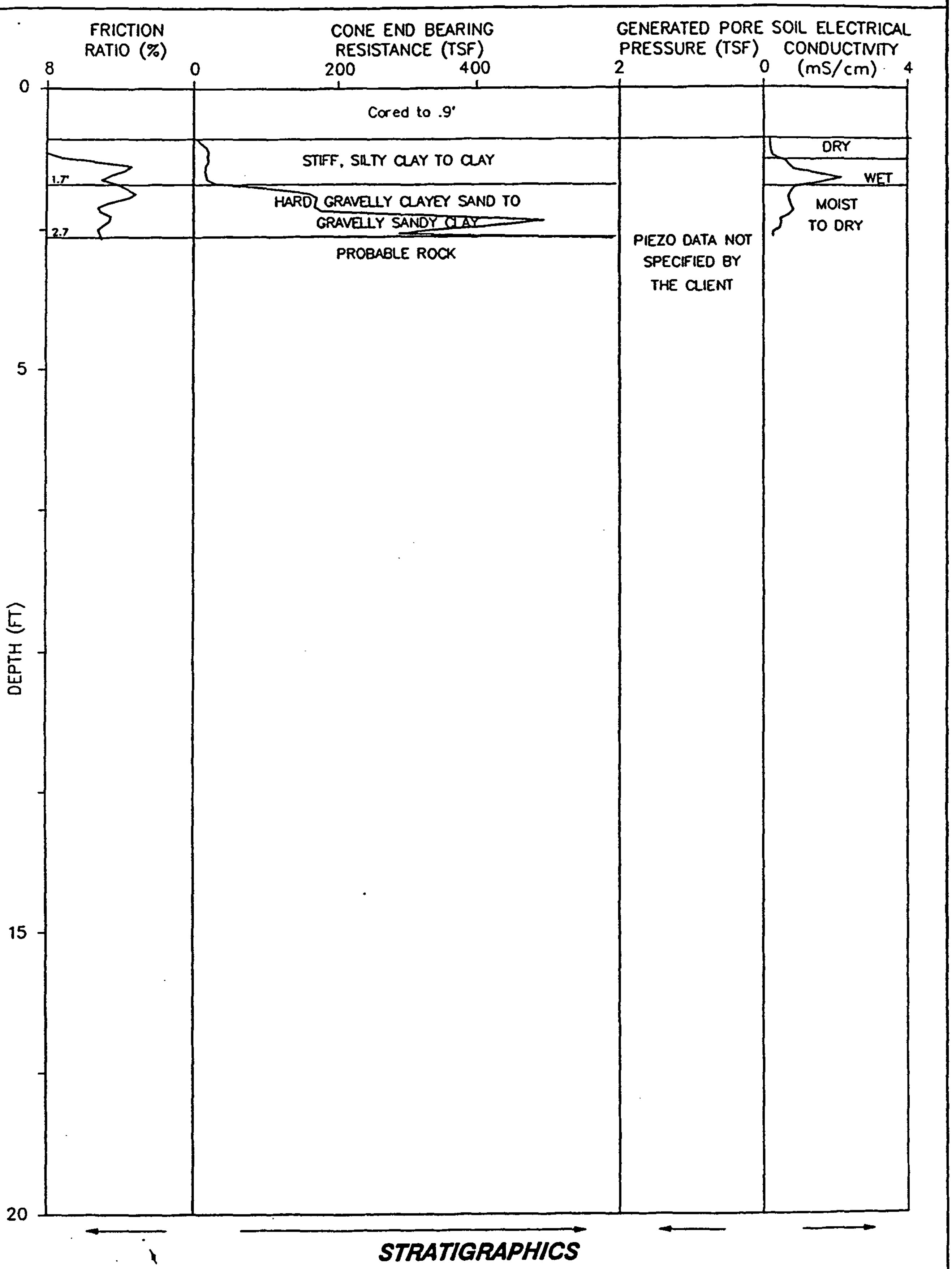
Structure rate of loading should be considered in choosing which strength parameters to use for design. Drained and undrained parameters must not be combined as such combination will result in significant overprediction of in situ shear strength.

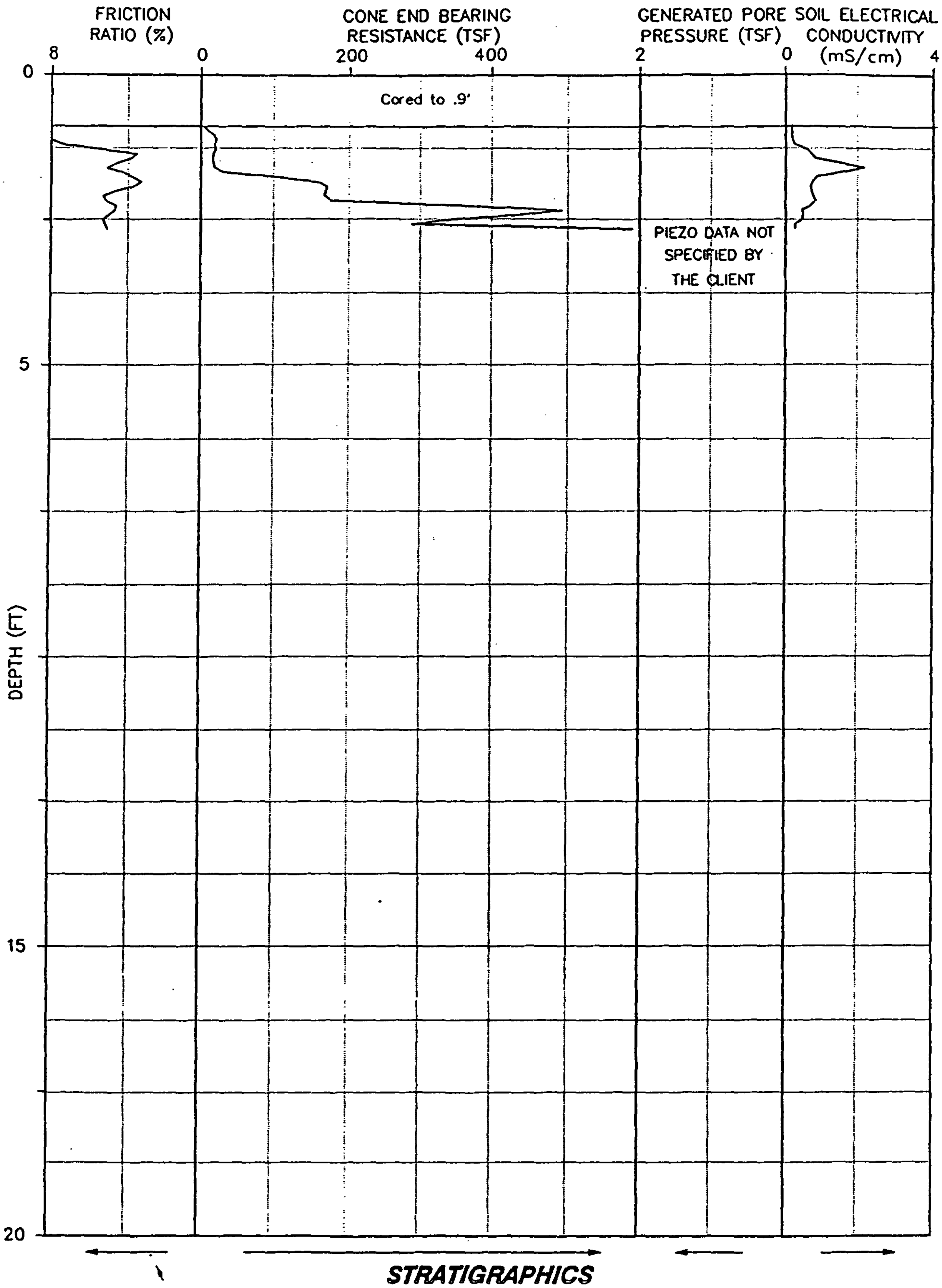
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-012

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-012

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP012

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	14.2	21.6	3.73	4.1		1188	Stiff, silty clay to clay *			20	1.41	7.47	8 - 10	12 - 15
2.0	168.9	246.7	12.09	4.2		747	Hard, gr cl sand to gr sandy clay			33	10.23	24.19	+ 68	+ 100
2.5	366.5	517.6	17.83	4.2		496	Hard, gr cl sand to gr sandy clay			33	22.21	35.66	+ 71	+ 100

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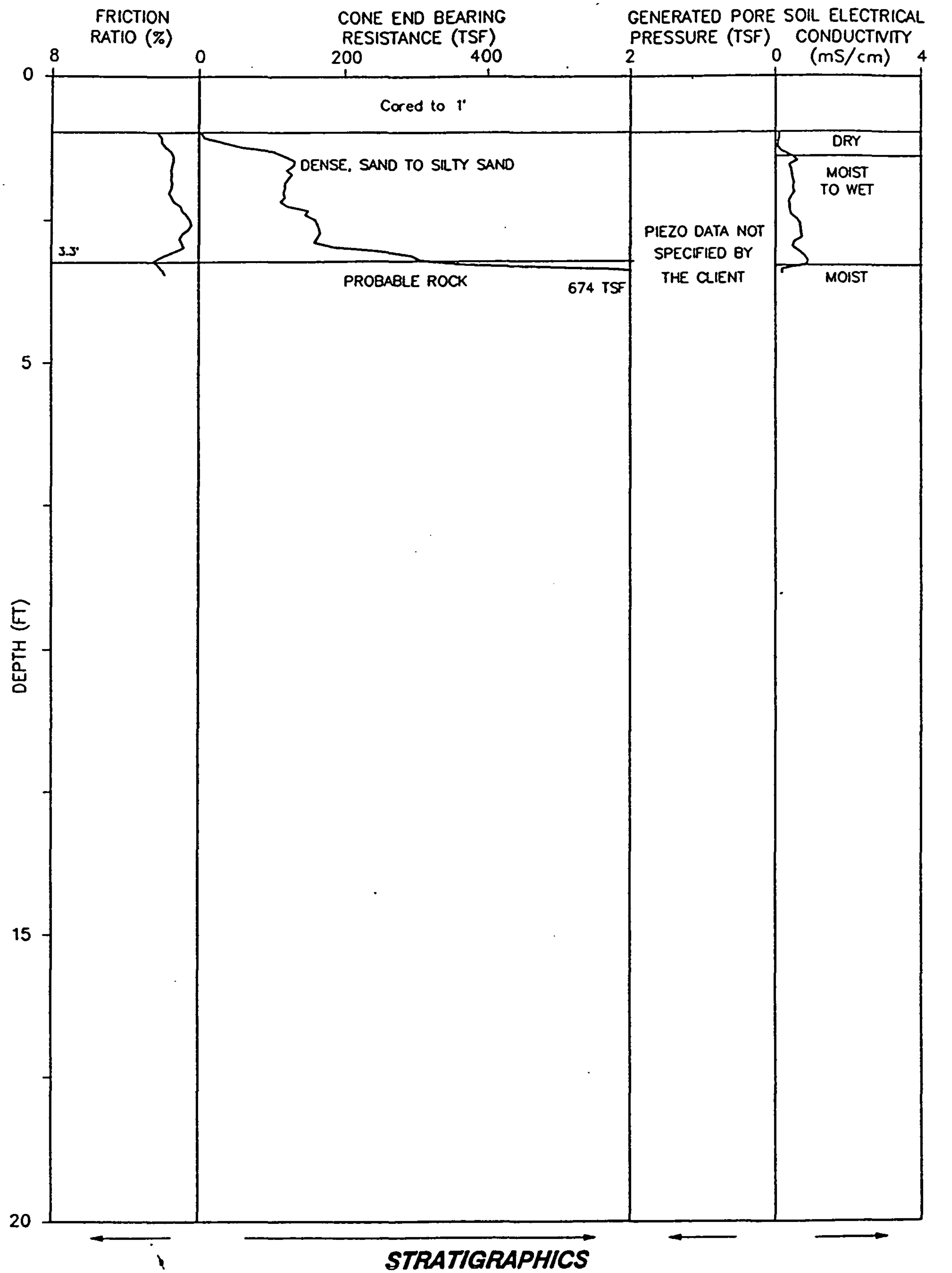
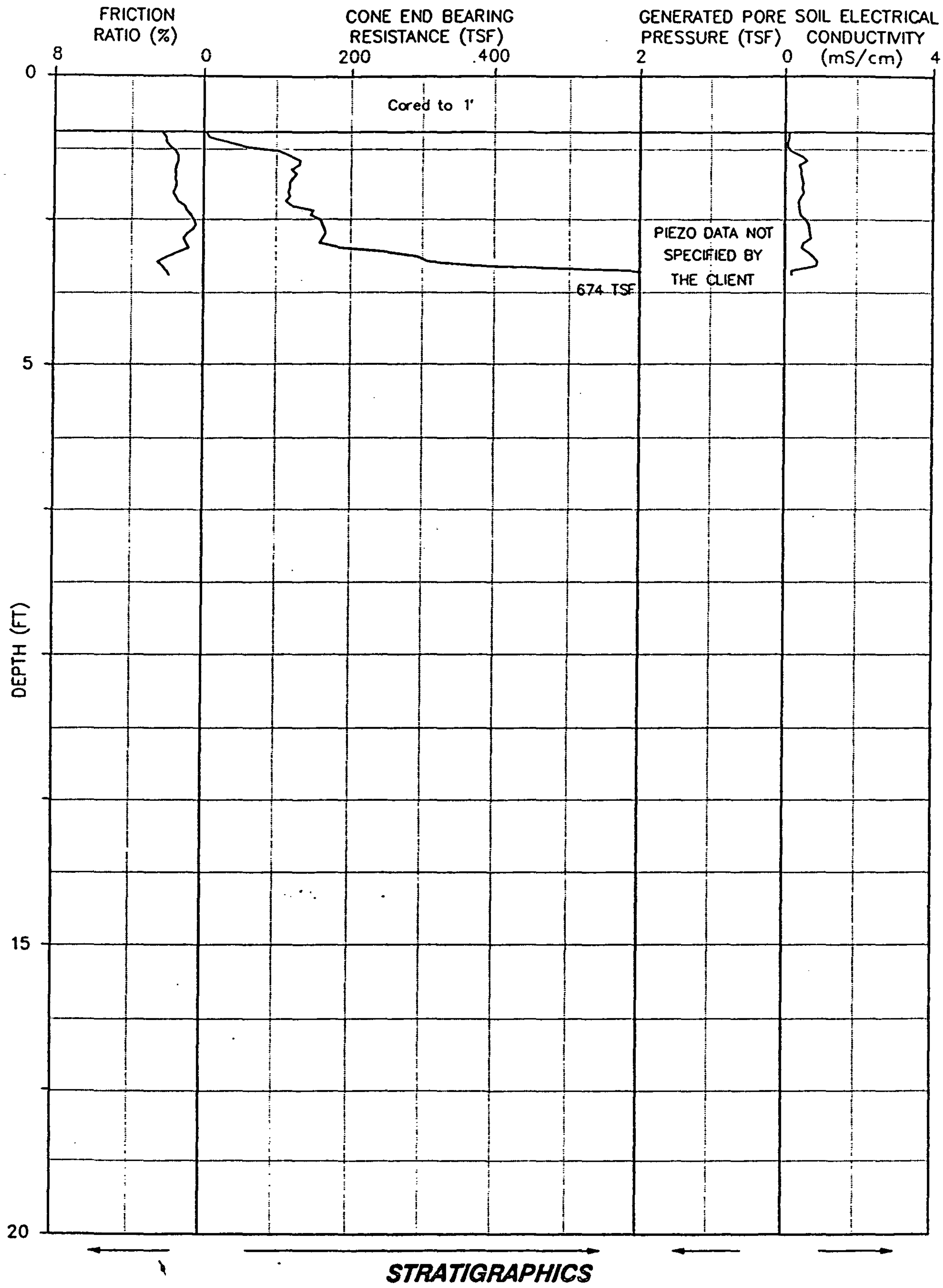
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-013

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-013

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP013

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (Nf)
1.0							PREPUNCH							
1.5	129.4	197.1	1.77	1.4		549	Dense, sand to silty sand	40-42	60-80				39 - 47	60 - 72
2.0	115.3	168.3	1.93	1.6		531	Dense, sand to silty sand	40-42	60-80				41 - 49	60 - 72
2.5	156.4	220.8	0.93	0.5		601	Dense, sand to silty sand	42-46	60-80				33 - 42	46 - 60
3.0	185.3	254.3	2.41	0.8		498	Dense, sand to silty sand	42-46	60-80				44 - 52	60 - 72

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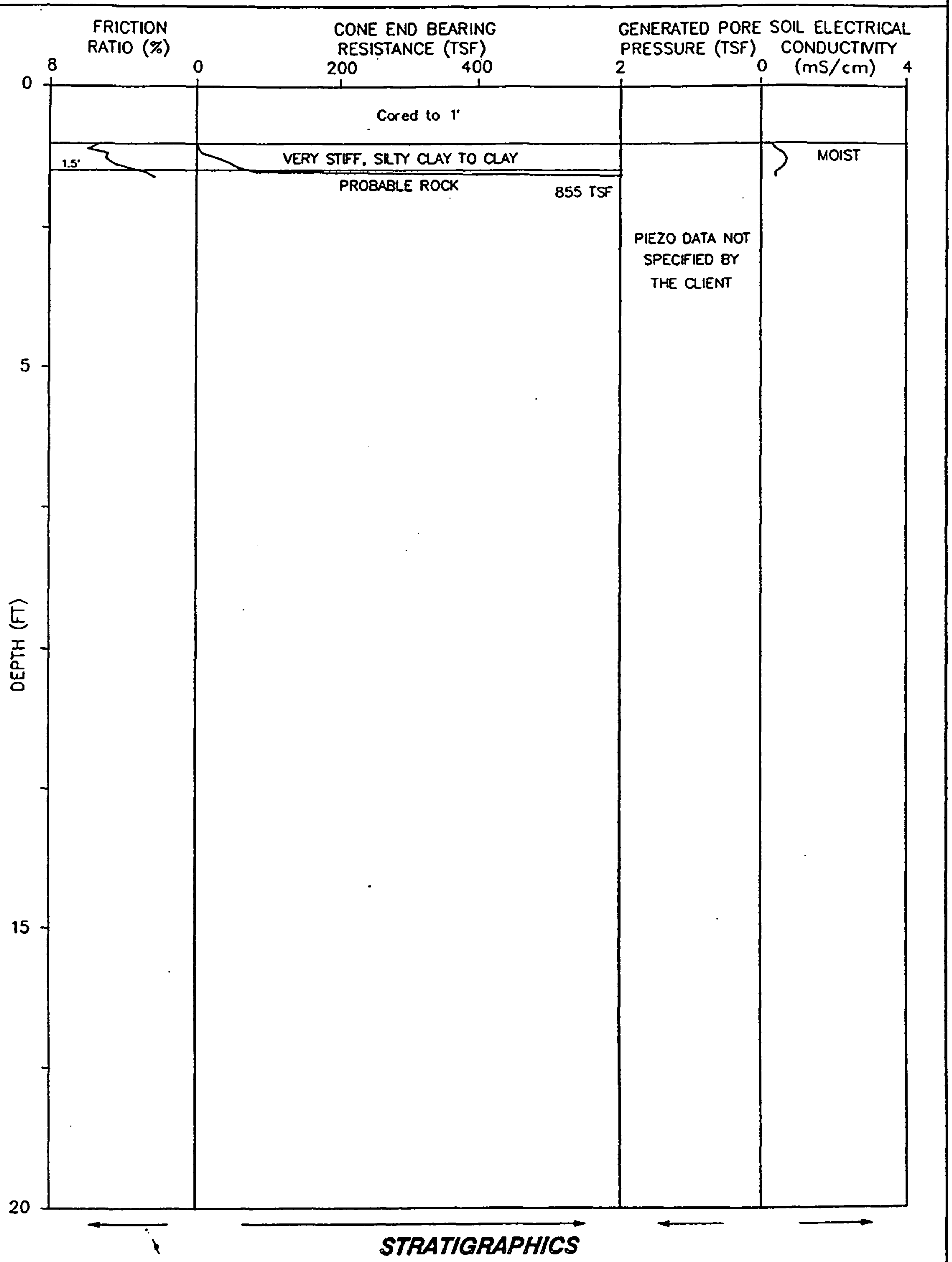
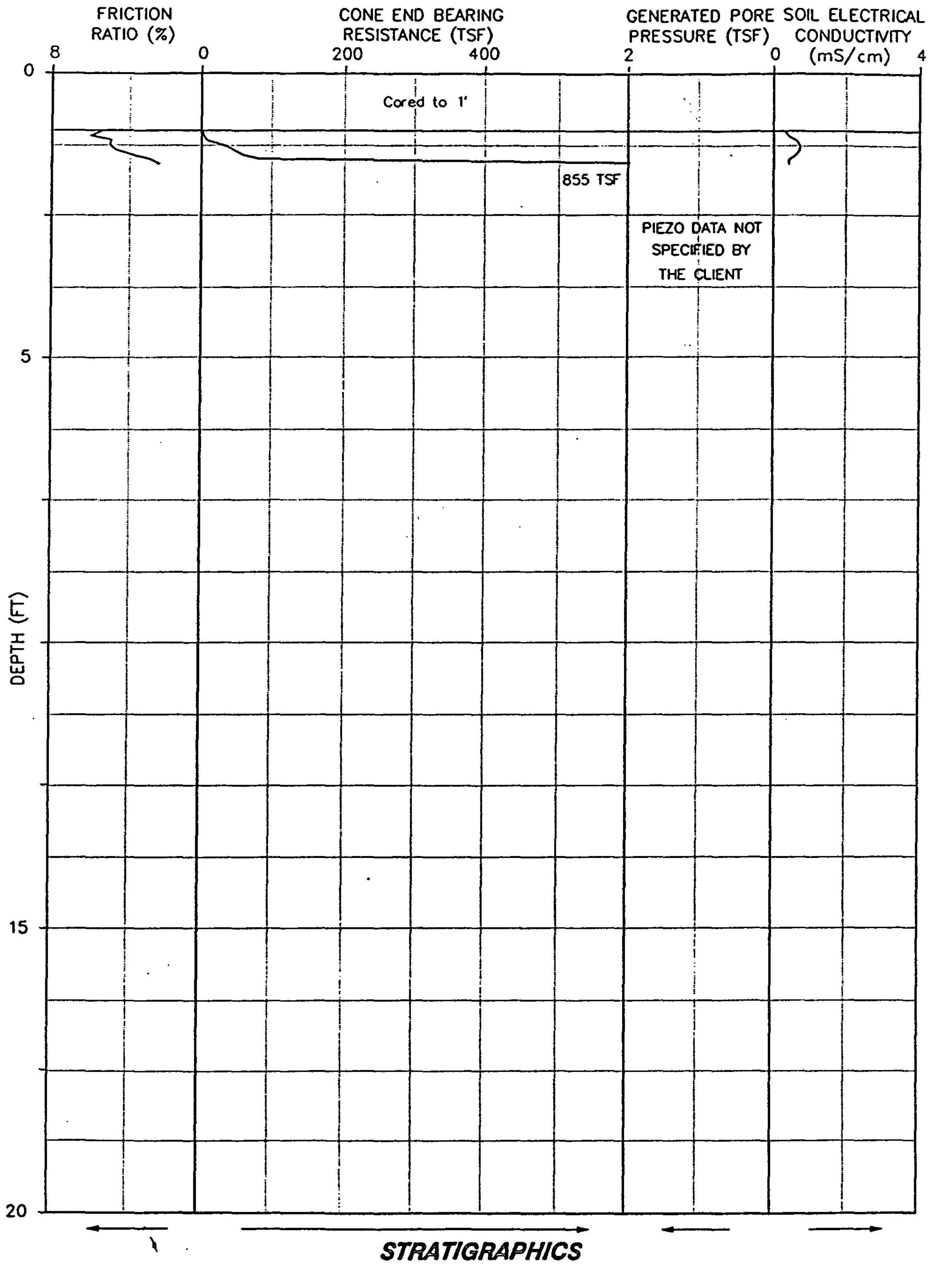
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-014

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060
DATE: 05/25/94
SOUNDING NUMBER: CP-014

STRATIGRAPHICS

JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP014

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0							PREPUNCH							
1.5	72.8	110.9	6.39	3.0		451	Hard, gr cl sand to gr sa silt			30	4.85	12.78	39 - 47	60 - 72

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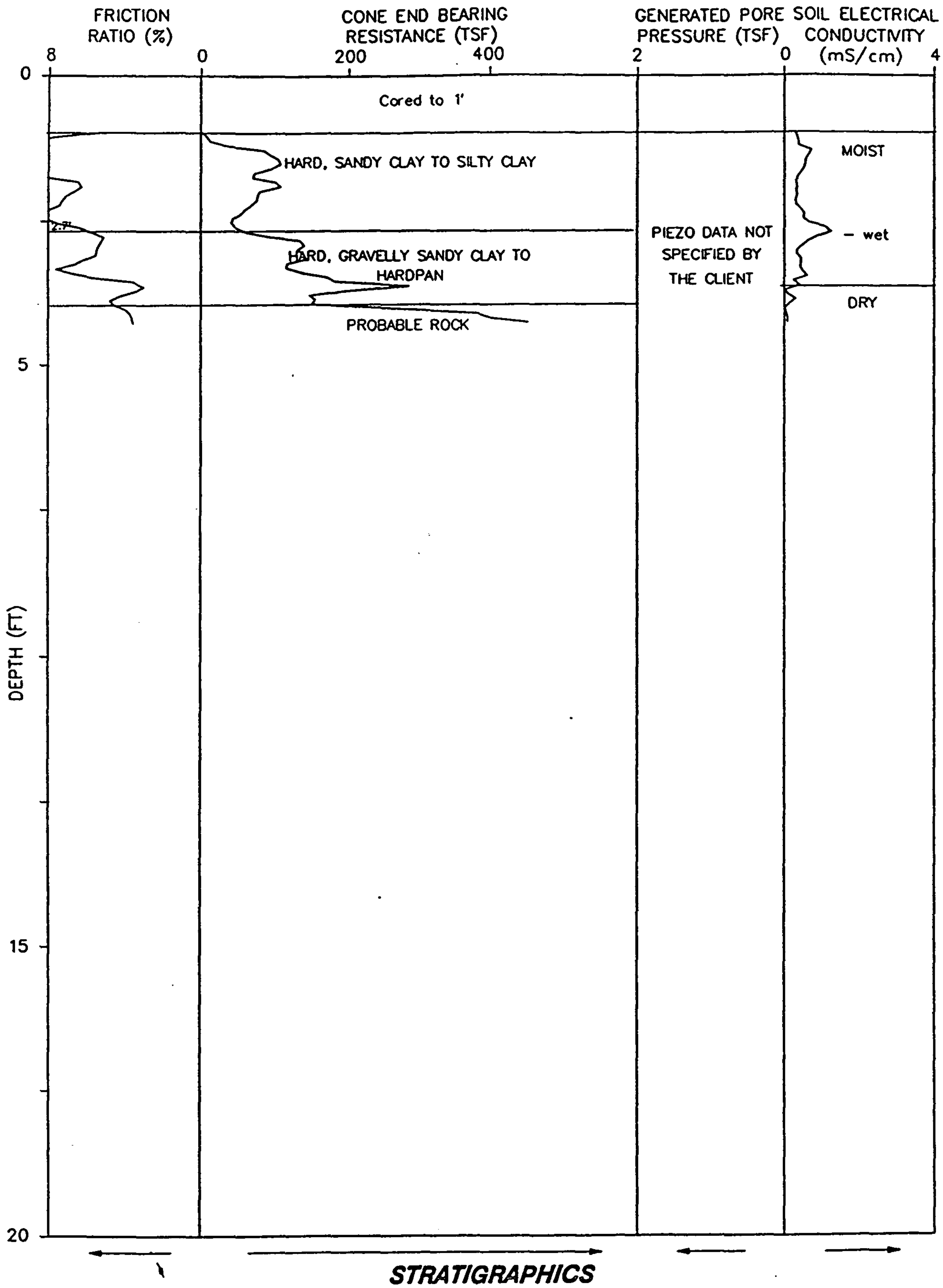
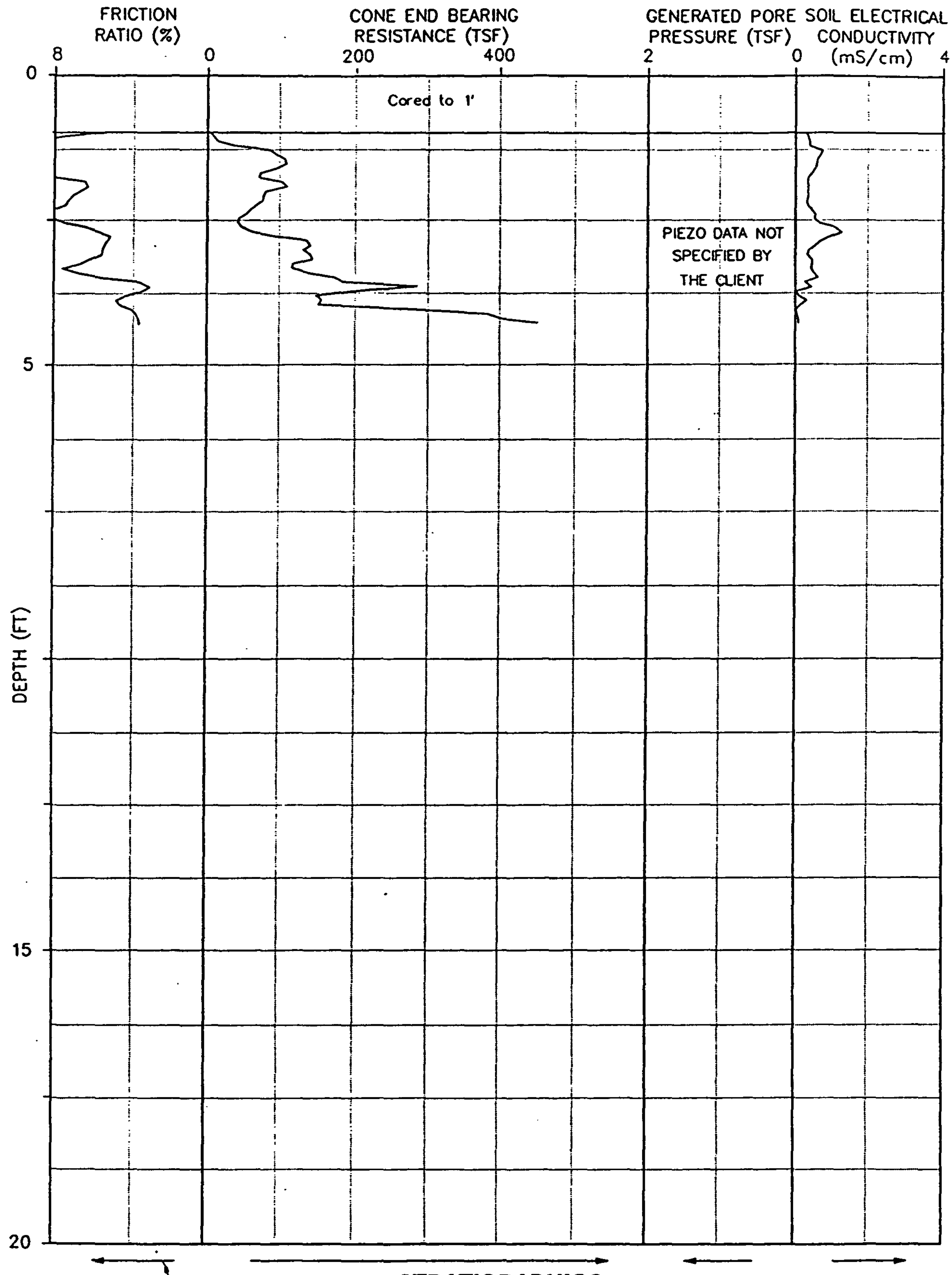
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-015

CPTU-EC SOUNDING LOG



STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-015

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP015

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0						PREPUNCH								
1.5	108.6	165.3	9.27	10.2		604	Hard, hardpan to weak rock			27	8.04	18.55	+ 66	+ 100
2.0	80.3	117.3	6.10	6.6		362	Hard, sandy clay to silty clay **			33	4.86	12.20	+ 68	+ 100
2.5	43.3	61.1	6.82	7.9		586	V stiff, sandy clay to silty clay **			24	3.59	13.65	+ 71	+ 100
3.0	136.8	187.7	7.32	5.4		450	Hard, gr sa clay to hardpan **			33	8.28	14.64	+ 73	+ 100
3.5	169.5	226.9	9.09	5.7		629	Hard, gr sa clay to hardpan **			33	10.26	18.19	+ 75	+ 100
4.0	184.8	242.0	14.06	4.3		142	Hard, gr cl sand to gr sandy clay			33	11.18	28.12	+ 76	+ 100

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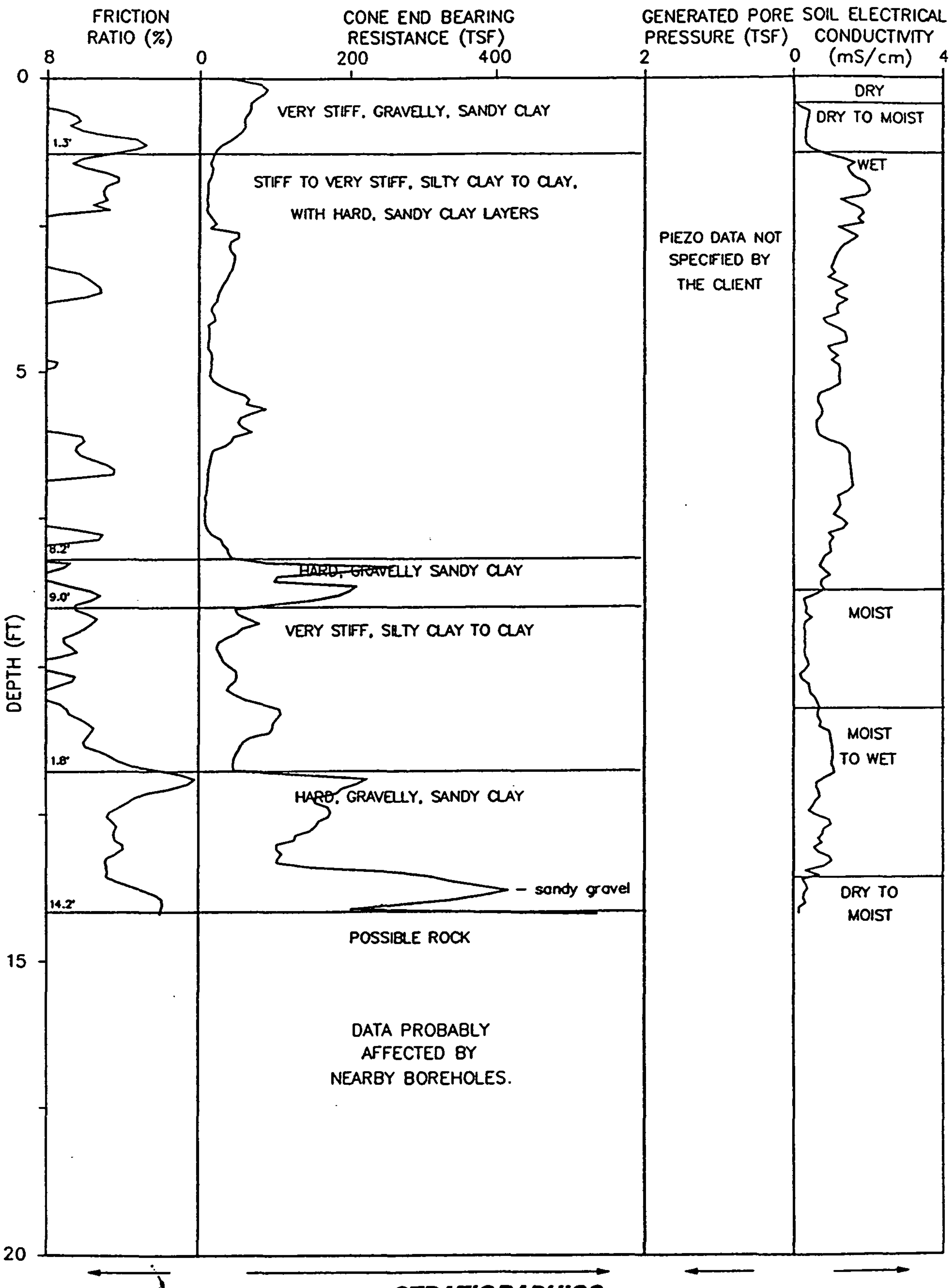
INTERPRETED CPT-EC SOUNDING LOG

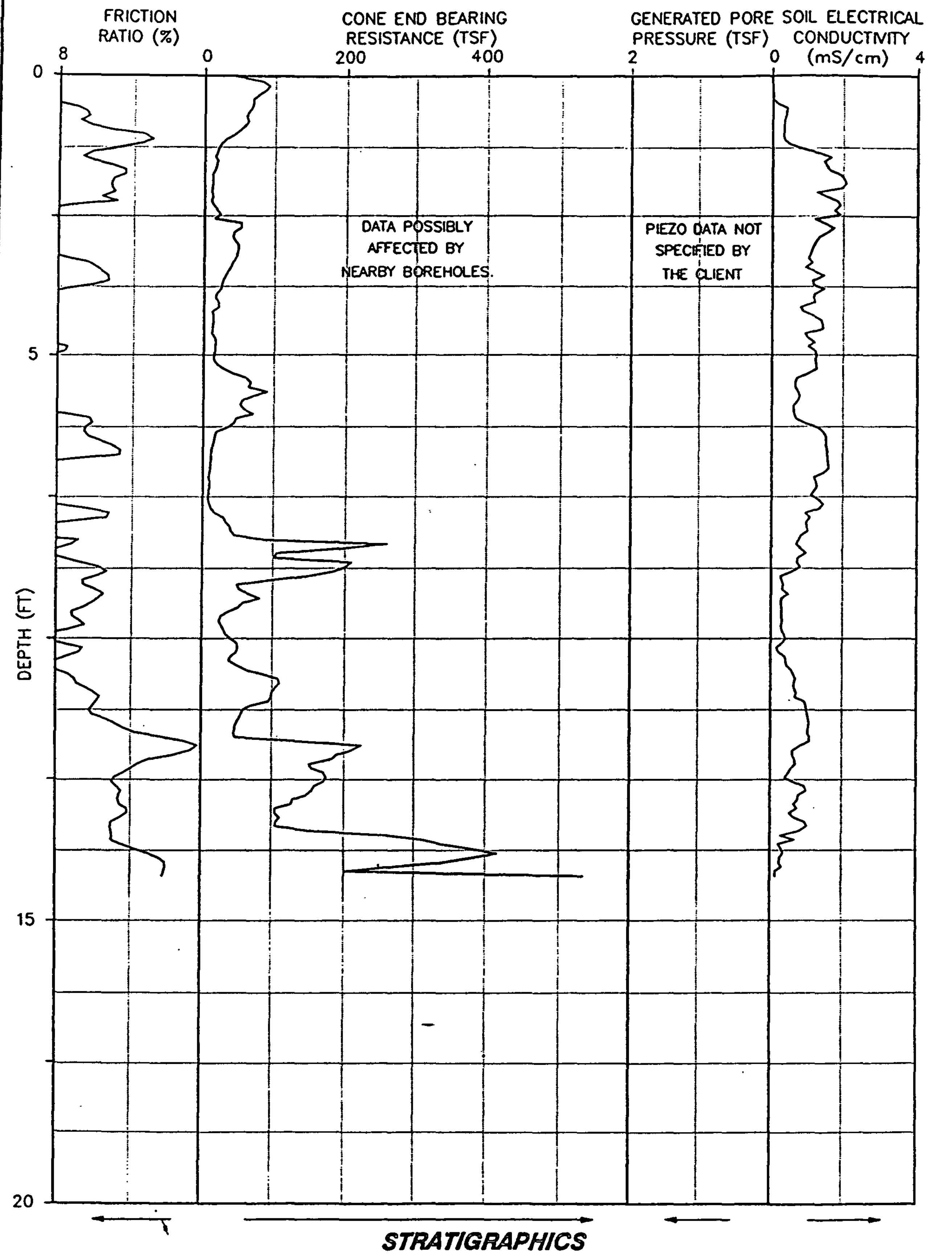


STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94–100–060

DATE: 05/25/94
SOUNDING NUMBER: CP–016

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-016

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP016

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	44.3	71.3	2.14	4.4		358	V stiff, gr sa clay to gr si clay **			30	2.95	4.29	37 - 45	60 - 72
1.5	15.0	22.9	1.47	6.2		1525	Stiff, silty clay to clay *			20	1.50	2.93	13 - 15	20 - 23
2.0	8.5	12.4	0.51	5.0		1942	Stiff, silty clay to clay *			15	1.12	1.02	5 - 7	7 - 10
2.5	18.1	25.6	3.80	10.3		1727	Stiff, silty clay to clay *			18	1.99	7.59	42 - 51	60 - 72
3.0	43.5	59.6	5.11	12.1		1215	V stiff, silty clay to clay **			25	3.47	10.22	22 - 24	30 - 33
3.5	31.0	41.5	2.31	5.6		1207	V stiff, sandy clay to silty clay **			25	2.47	4.62	30 - 34	40 - 46
4.0	14.9	19.6	2.27	10.7		1202	V stiff, clay to organic soil *			14	2.10	4.54	25 - 31	33 - 40
4.5	10.0	12.8	1.80	13.9		1443	Stiff, clay to organic soil			12	1.62	3.6	12 - 13	15 - 17
5.0	12.9	16.3	2.66	8.6		1268	Stiff, silty clay to clay *			14	1.81	5.32	16 - 18	20 - 23
5.5	63.8	79.1	8.30	13.6		691	Hard, clay to organic soil			25	5.08	16.60	48 - 58	60 72
6.0	59.8	73.0	5.48	9.0		661	Hard, silty clay to clay **			24	4.95	10.95	+ 82	+ 100
6.5	12.7	15.3	2.02	5.7		1532	Stiff, silty clay to clay *			15	1.64	4.03	8 - 10	10 - 12
7.0	7.8	9.3	1.58	15.6		1613	Stiff, clay to organic soil			12	1.23	3.16	6 - 8	7 - 10
7.5	5.7	6.6	2.13	14.0		1181	Stiff, clay to organic soil			9	1.17	4.26	3 - 5	4 - 6
8.0	33.4	38.8	10.81	10.1		1016	V stiff, silty clay to clay **			21	3.14	21.62	62 - 85	72 - 99
8.5	113.3	129.9	12.45	8.6		997	Hard, hardpan to weak rock			27	8.36	24.91	+ 87	+ 100
9.0	78.9	89.5	10.25	6.5		343	Hard, sandy clay to silty clay **			30	5.22	20.50	+ 88	+ 100
9.5	41.3	46.4	3.81	6.8		345	V stiff, sandy clay to silty clay **			25	3.26	7.61	53 - 64	60 - 72
10.0	37.3	41.4	4.30	8.7		441	V stiff, silty clay to clay **			21	3.49	8.60	65 - 89	72 - 99
10.5	47.6	52.7	7.62	8.3		504	V stiff, silty clay to clay **			24	3.92	15.24	65 - 90	72 - 99
11.0	96.3	106.0	4.84	5.8		741	Hard, sandy clay to silty clay **			33	5.79	9.69	+ 91	+ 100
11.5	46.9	51.4	4.25	4.8		1098	V stiff, sandy clay to silty clay **			25	3.70	8.50	37 - 42	40 - 46
12.0	209.2	228.2	-0.38	0.6		654	Dense, sand to silty sand	42-46	60-80				55 - 66	60 - 72
12.5	173.3	188.3	8.69	4.8		520	Hard, gr sa clay to hardpan **			33	10.46	17.39	+ 92	+ 100
13.0	110.2	119.1	6.04	4.2		753	Hard, gr sa clay to gr si clay **			33	6.63	12.08	+ 92	+ 100
13.5	250.3	269.6	17.28	4.8		402	Hard, gr sa clay to hardpan **			33	15.12	34.56	+ 93	+ 100
14.0	317.5	340.5	6.61	1.9		310	V dense, sa gravel to si gr sand	40-42	+100				+ 93	+ 100

NOTES:

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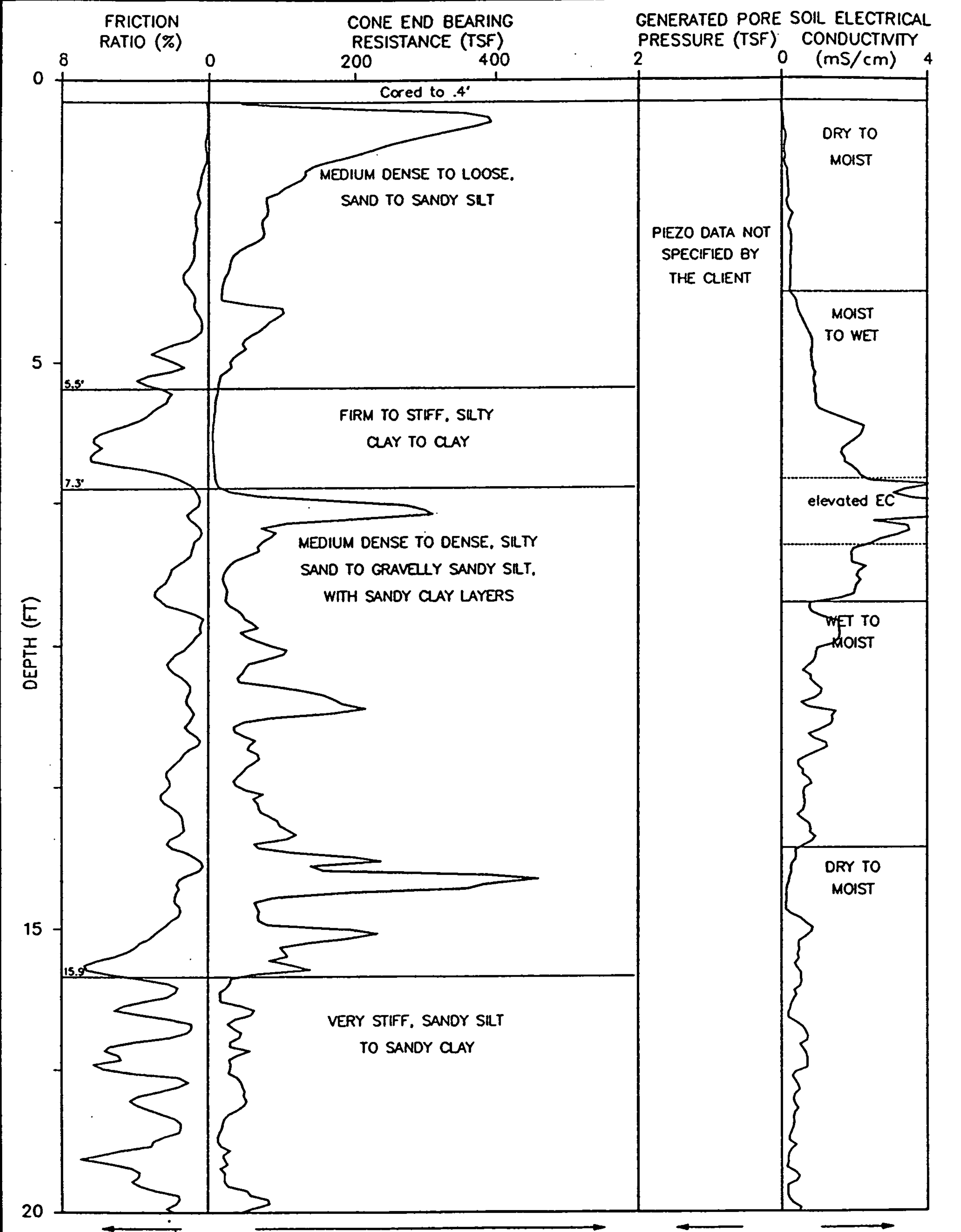
** Indicates heavily overconsolidated or cemented soil

Mixed soils containing both granular and fine grained particles (e.g. clayey sands) may undergo partial drained failure during CPT. Both undrained and drained parameters can be estimated for these soils.

Structure rate of loading should be considered in choosing which strength parameters to use for design. Drained and undrained parameters must not be combined as such combination will result in significant overprediction of in situ shear strength.

INTERPRETED CPT-EC SOUNDING LOG

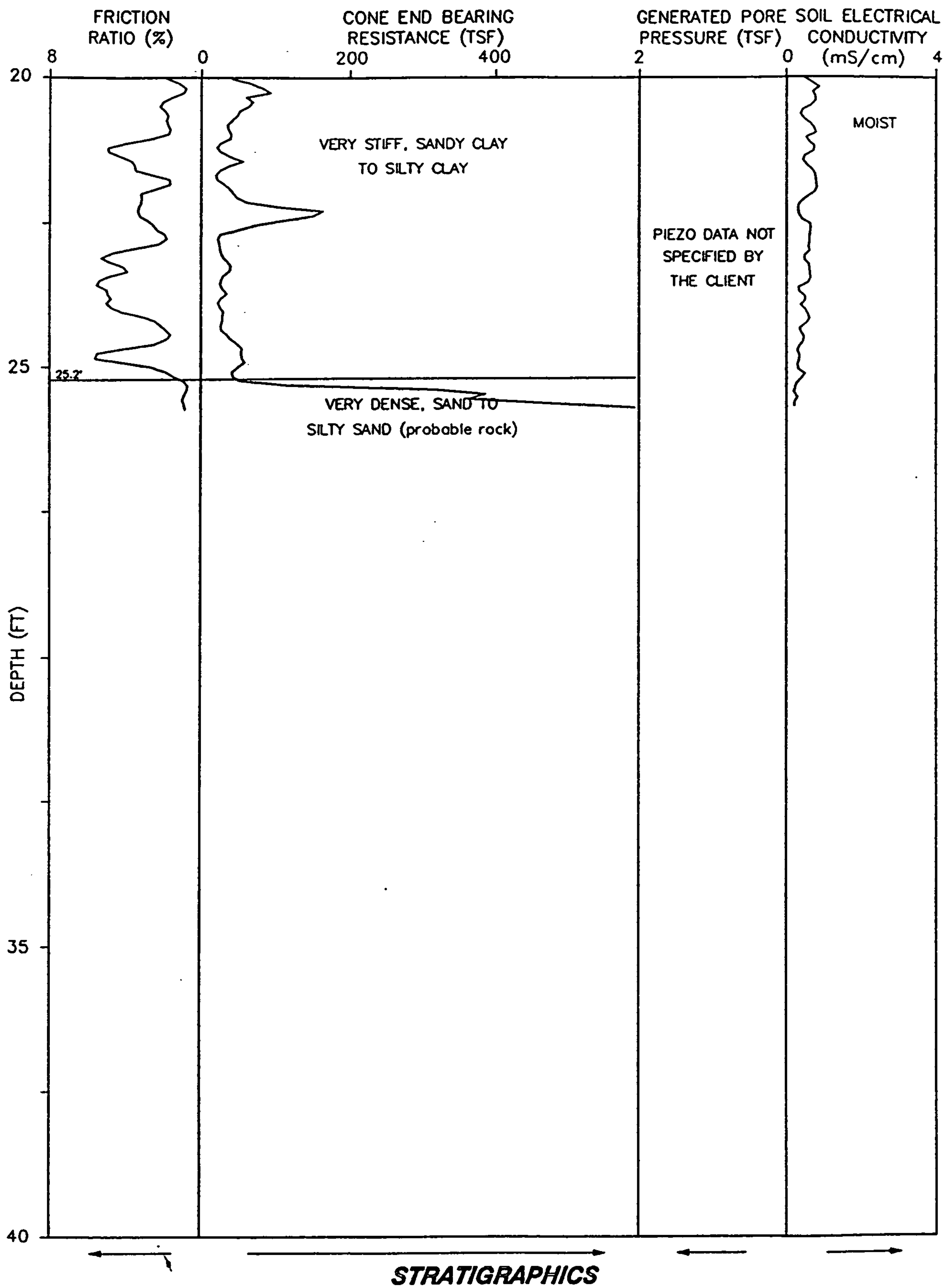


STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-017

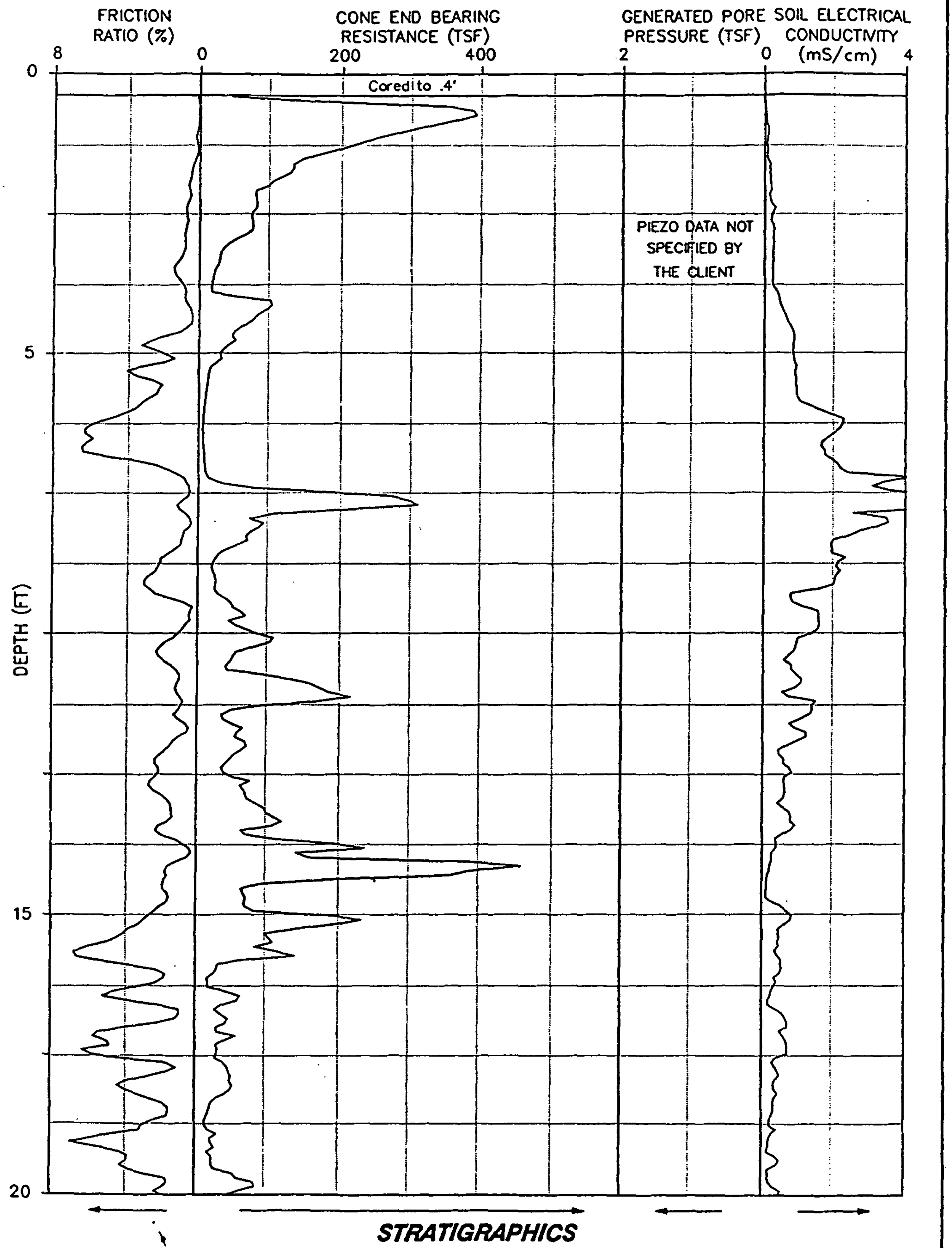
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

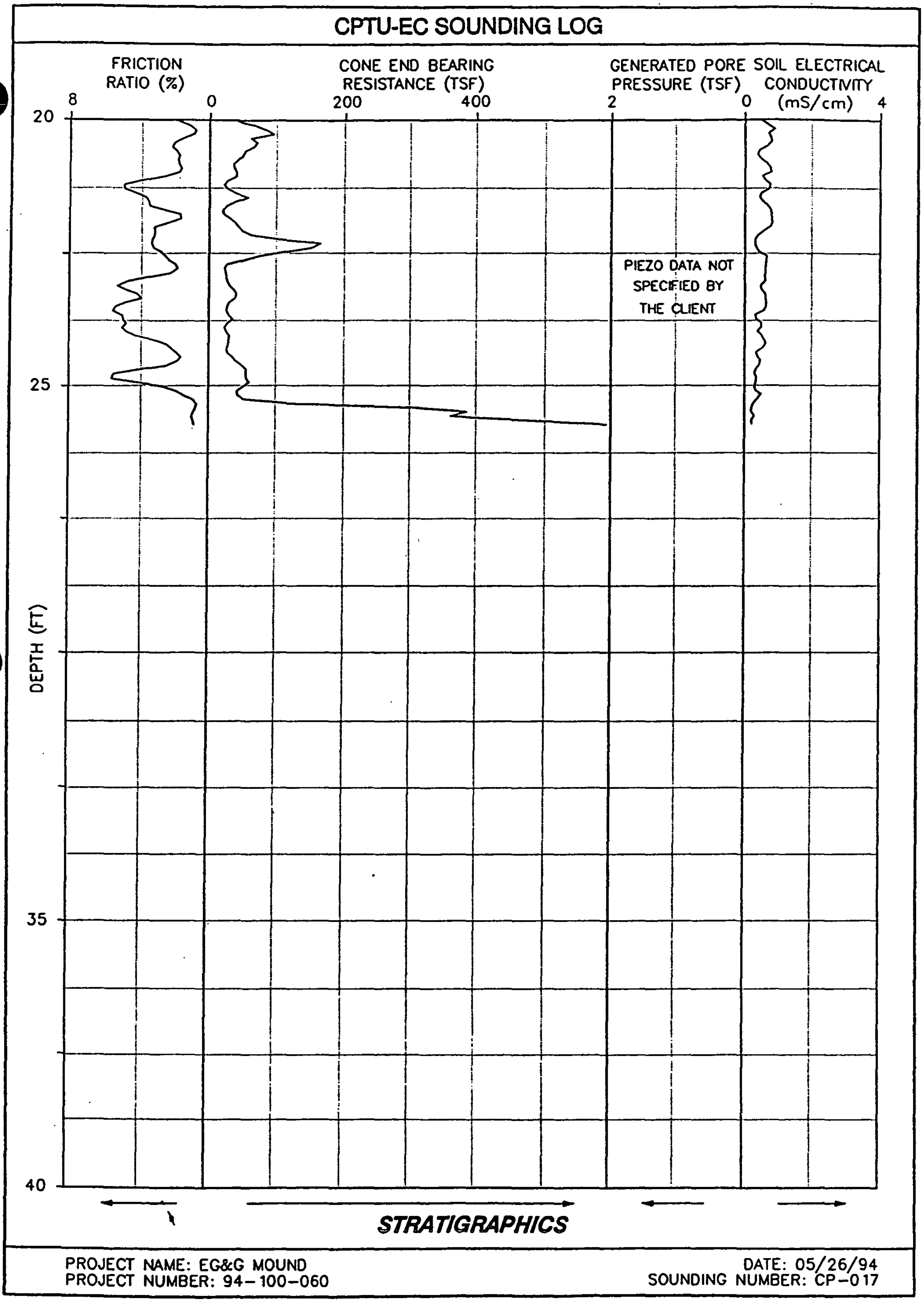
DATE: 05/26/94
SOUNDING NUMBER: CP-017

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/26/94
SOUNDING NUMBER: CP-017



CPTU-EC SOUNDING LOG
FRICTION RATIO (%)
CONE END BEARING RESISTANCE (TSF)
GENERATED PORE PRESSURE (TSF)
SOIL ELECTRICAL CONDUCTIVITY (mS/cm)
8
0
200
400
2
0
4
20
25
35
40
DEPTH (FT)
PIEZO DATA NOT SPECIFIED BY THE CLIENT
STRATIGRAPHICS
PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060
DATE: 05/26/94
SOUNDING NUMBER: CP-017

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP017

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0						PREPUNCH								
1.5	151.8	231.2	0.49	0.2		107	Med dense, sa gravel to gr sand	42-46	40-60				30 - 39	46 - 60
2.0	95.2	139.0	0.84	0.6		215	Med dense, sand to silty sand	40-42	40-60				23 - 27	33 - 40
2.5	72.3	102.1	0.57	0.7		275	Med dense, sand to silty sand	40-42	40-60				16 - 21	23 - 30
3.0	44.3	60.8	0.52	0.8		289	Loose, sand to silty sand	37-40	20-40				9 - 11	12 - 15
3.5	21.1	28.2	0.44	1.4		274	Loose, silty sand to sandy silt	27-31	20-40				4 - 5	6 - 7
4.0	54.7	71.6	0.69	0.8		436	Med dense, sand to silty sand	37-40	40-60				13 - 15	17 - 20
4.5	62.7	80.5	0.35	0.6		759	Med dense, sand to silty sand	40-42	40-60				13 - 16	17 - 20
5.0	28.4	35.8	0.76	2.1		852	Med dense, silty sand to sandy silt	27-31	40-60				10 - 12	12 - 15
5.5	10.8	13.4	0.34	2.5		949	Stiff, clayey silt to silty clay			15	1.40	0.68	2 - 3	3 - 4
6.0	5.7	7.0	0.28	3.5		1464	Stiff, silty clay to clay			10	1.07	0.55	1 - 2	1 - 3
6.5	4.5	5.5	0.33	5.9		1911	Firm, clay			12	0.69	0.67	2 - 3	3 - 4
7.0	7.2	8.6	0.91	2.4		2108	Stiff, clayey silt to silty clay			10	1.36	1.82	1 - 3	1 - 3
7.5	192.3	225.6	0.49	0.5		3934	Dense, sand to silty sand	42-46	60-80				39 - 51	46 - 60
8.0	81.3	94.3	0.77	0.4		3479	Med dense, sand to silty sand	40-42	40-60				17 - 20	20 - 23
8.5	37.2	42.6	0.87	1.3		1949	Med dense, silty sand to sandy silt	36-37	40-60				9 - 10	10 - 12
9.0	22.3	25.3	0.80	2.7		2059	V stiff, sandy clay to silty clay *			20	2.18	1.61	9 - 11	10 - 12
9.5	45.7	51.3	0.04	0.6		990	Loose, sand to silty sand	37-40	20-40				6 - 9	7 - 10
10.0	79.7	88.5	0.65	1.1		1471	Med dense, sand to silty sand	40-42	40-60				21 - 27	23 - 30
10.5	45.1	49.9	1.75	1.9		625	Med dense, silty sand to sandy silt	36-37	40-60				15 - 18	17 - 20
11.0	177.4	195.3	1.62	1.2		811	Dense, sand to silty sand	42-46	60-80				55 - 65	60 - 72
11.5	33.8	37.0	1.51	1.2		1209	Loose, silty sand to sandy silt	36-37	20-40				6 - 9	7 - 10
12.0	67.8	74.0	0.87	1.5		736	Med dense, silty sand to sandy silt	37-40	40-60				21 - 28	23 - 30
12.5	39.7	43.1	1.25	2.2		808	Med dense, silty sand to sandy silt	27-31	40-60				14 - 16	15 - 17
13.0	76.4	82.7	1.38	1.5		543	Med dense, silty sand to sandy silt	37-40	40-60				28 - 31	30 - 33
13.5	67.4	72.6	3.82	2.2		869	Dense, silty sand to sandy silt	36-37	60-80				28 - 31	30 - 33
14.0	185.5	198.9	0.89	0.6		298	Dense, sand to silty sand	42-46	60-80				43 - 56	46 - 60
14.5	78.4	83.7	5.34	1.8		164	Dense, silty sand to sandy silt	37-40	60-80				28 - 31	30 - 33
15.0	165.5	176.1	3.64	2.5		846	V dense, gr si sand to cl gr sand	37-40	80-100				+ 94	+ 100
15.5	108.0	114.5	7.00	5.1		478	Hard, gr sa clay to gr si clay **			33	6.49	14.00	+ 94	+ 100
16.0	26.3	27.7	1.37	2.0		580	V stiff, sandy silt to sandy clay			20	2.53	2.74	7 - 9	7 - 10
16.5	58.8	61.8	1.90	4.2		238	V stiff, gr sa clay to gr si clay **			30	3.85	3.80	44 - 57	46 - 60
17.0	29.9	31.4	1.33	3.7		749	V stiff, sandy clay to silty clay *			20	2.89	2.67	16 - 19	17 - 20
17.5	27.8	29.0	2.95	5.3		664	V stiff, silty clay to clay *			25	2.14	5.89	22 - 29	23 - 30
18.0	48.6	50.5	1.83	4.0		379	V stiff, sandy clay to silty clay *			25	3.80	3.65	32 - 38	33 - 40
18.5	17.4	18.0	0.48	1.5		367	Loose, silty sand to sandy silt	27-31	20-40				3 - 4	3 - 4
19.0	19.5	20.1	1.83	5.9		225	Stiff, silty clay to clay *			20	1.84	3.66	16 - 19	17 - 20
19.5	22.8	23.5	2.33	4.0		358	V stiff, silty clay to clay *			20	2.17	4.66	12 - 15	12 - 15
20.0	43.8	44.9	1.33	1.9		513	Med dense, silty sand to sandy silt	27-31	40-60				15 - 17	15 - 17
20.5	61.5	62.8	1.47	2.2		680	Dense, silty sand to sandy silt	36-37	60-80				23 - 29	23 - 30

STRATIGRAPHICS
JOB NO: 94-100-060
JOB NAME: EG&G MOUND OU2 TASK 1
SOUNDING NO: CP017

DEPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
21.0	37.3	38.0	0.67	1.9	0.00	745	Med dense, silty sand to sandy silt	27-31	40-60				12 - 15	12 - 15
21.5	42.4	43.0	1.13	3.5	0.00	522	V stiff, sandy clay to silty clay *			25	3.28	2.25	23 - 30	23 - 30
22.0	40.2	40.7	2.81	3.0	0.00	791	V stiff, sandy silt to sandy clay			25	3.11	5.61	20 - 23	20 - 23
22.5	105.6	106.5	2.63	2.7	0.00	466	V dense, silty sand to sandy silt	36-37	80-100				60 - 71	60 - 72
23.0	23.5	23.6	1.61	4.0	0.00	622	V stiff, silty clay to clay *			20	2.21	3.22	12 - 15	12 - 15
23.5	25.1	25.1	1.79	5.2	0.00	659	V stiff, silty clay to clay *			20	2.37	3.58	20 - 23	20 - 23
24.0	23.2	23.2	1.43	4.6	0.00	414	V stiff, silty clay to clay *			20	2.18	2.86	15 - 17	15 - 17
24.5	33.9	33.7	0.72	1.7	0.00	446	Med dense, silty sand to sandy silt	27-31	40-60				7 - 10	7 - 10
25.0	51.1	50.8	3.02	3.2	0.00	337	V stiff, sandy silt to sandy clay			25	3.97	6.04	23 - 30	23 - 30
25.5	382.6	378.6	4.83	0.9	0.00	238	V dense, sand to silty sand	42-46	80-100				73 - 100	72 - 99

NOTES:
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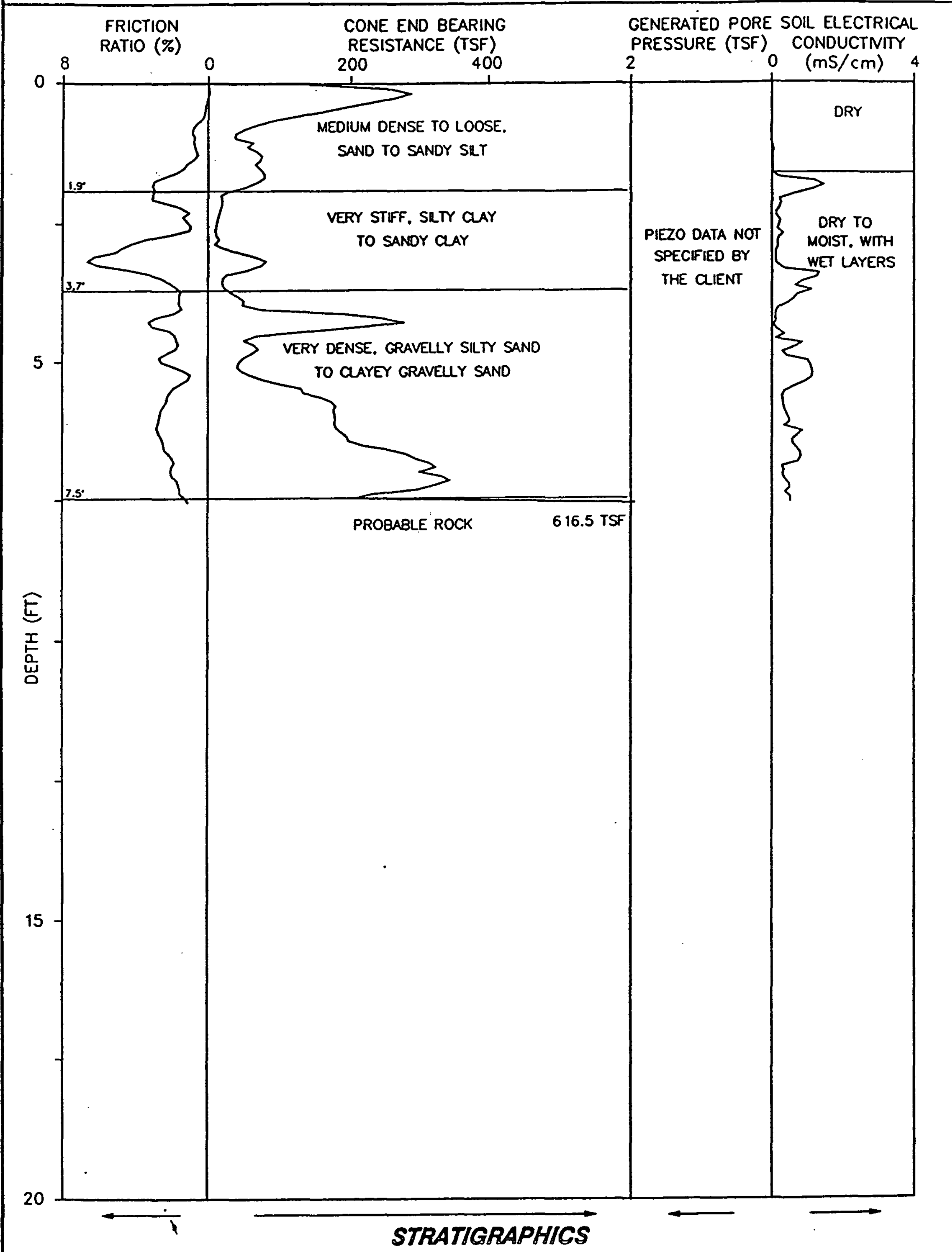
Mixed soils containing both granular and fine grained particles (e.g. clayey sands) may undergo partial drained failure during CPT. Both undrained and drained parameters can be estimated for these soils.

Structure rate of loading should be considered in choosing which strength parameters to use for design. Drained and undrained parameters must not be combined as such combination will result in significant overprediction of in situ shear strength.

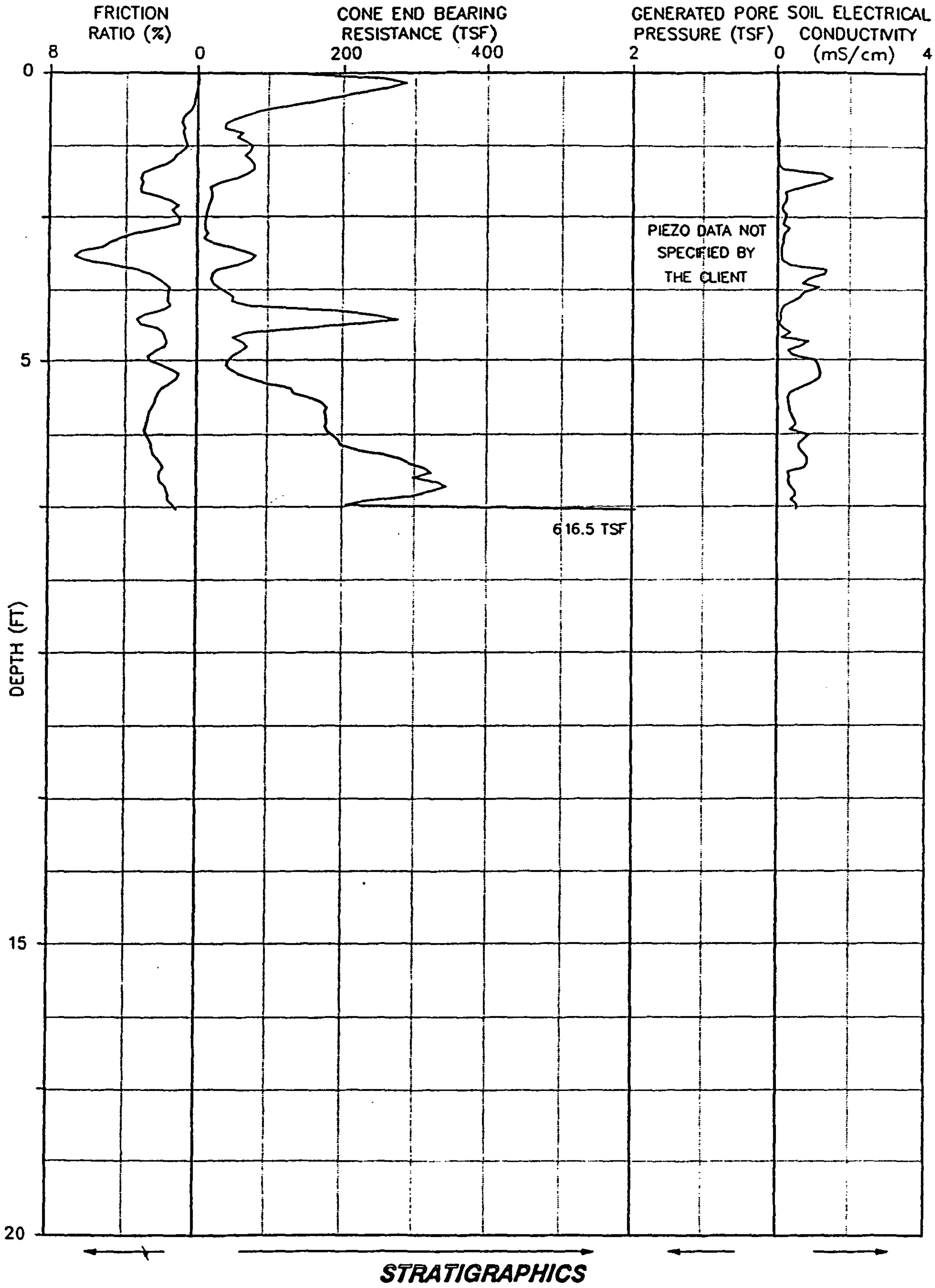
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/23/94
SOUNDING NUMBER: CP-018

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/23/94
SOUNDING NUMBER: CP-018

TRATIGRAPHICS

OB NO: 94-100-060
OB NAME: EG&G MOUND OU2 TASK 1
OUNDING NO: CP018

EPTH FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	44.7	71.9	0.60	0.9		26	Med dense, sand to silty sand	37-40	40-60				11 - 12	17 - 20
1.5	68.1	103.7	0.94	1.4		62	Med dense, sand to silty sand	37-40	40-60				22 - 26	33 - 40
2.0	15.4	22.5	1.69	3.1		634	Stiff, sandy clay to silty clay *			20	1.53	3.38	5 - 7	7 - 10
2.5	10.1	14.2	0.20	1.2		265	Loose, silty sand to sandy silt	27-31	20-40				1 - 2	1 - 3
3.0	31.2	42.9	2.30	4.9		168	V stiff, silty clay to clay *			25	2.49	4.60	24 - 29	33 - 40
3.5	19.1	25.6	1.26	2.8		1305	Stiff, sandy clay to silty clay *			20	1.89	2.52	7 - 9	10 - 12
4.0	48.8	64.0	2.40	1.7		433	Med dense, silty sand to sandy silt	36-37	40-60				15 - 18	20 - 23
4.5	100.0	128.4	3.27	2.1		284	Dense, silty sand to sandy silt	37-40	60-80				47 - 56	60 - 72
5.0	41.8	52.7	1.98	2.7		888	V stiff, sandy silt to sandy clay			25	3.32	3.96	18 - 24	23 - 30
5.5	128.9	159.9	3.27	2.0		645	V dense, silty sand to sandy silt	40-42	80-100				48 - 58	60 - 72
6.0	176.7	215.9	5.14	2.7		453	V dense, gr si sand to cl gr sand	37-40	+100				+ 82	+ 100
6.5	210.6	253.7	7.00	2.5		622	V dense, gr si sand to cl gr sand	37-40	+100				+ 83	+ 100
7.0	295.8	351.5	6.65	2.1		362	V dense, gr si sand to cl gr sand	40-42	+100				+ 84	+ 100
7.5	307.7	361.1	6.01	1.3		540	V dense, sand to silty sand	42-46	80-100				+ 85	+ 100

NOTES:
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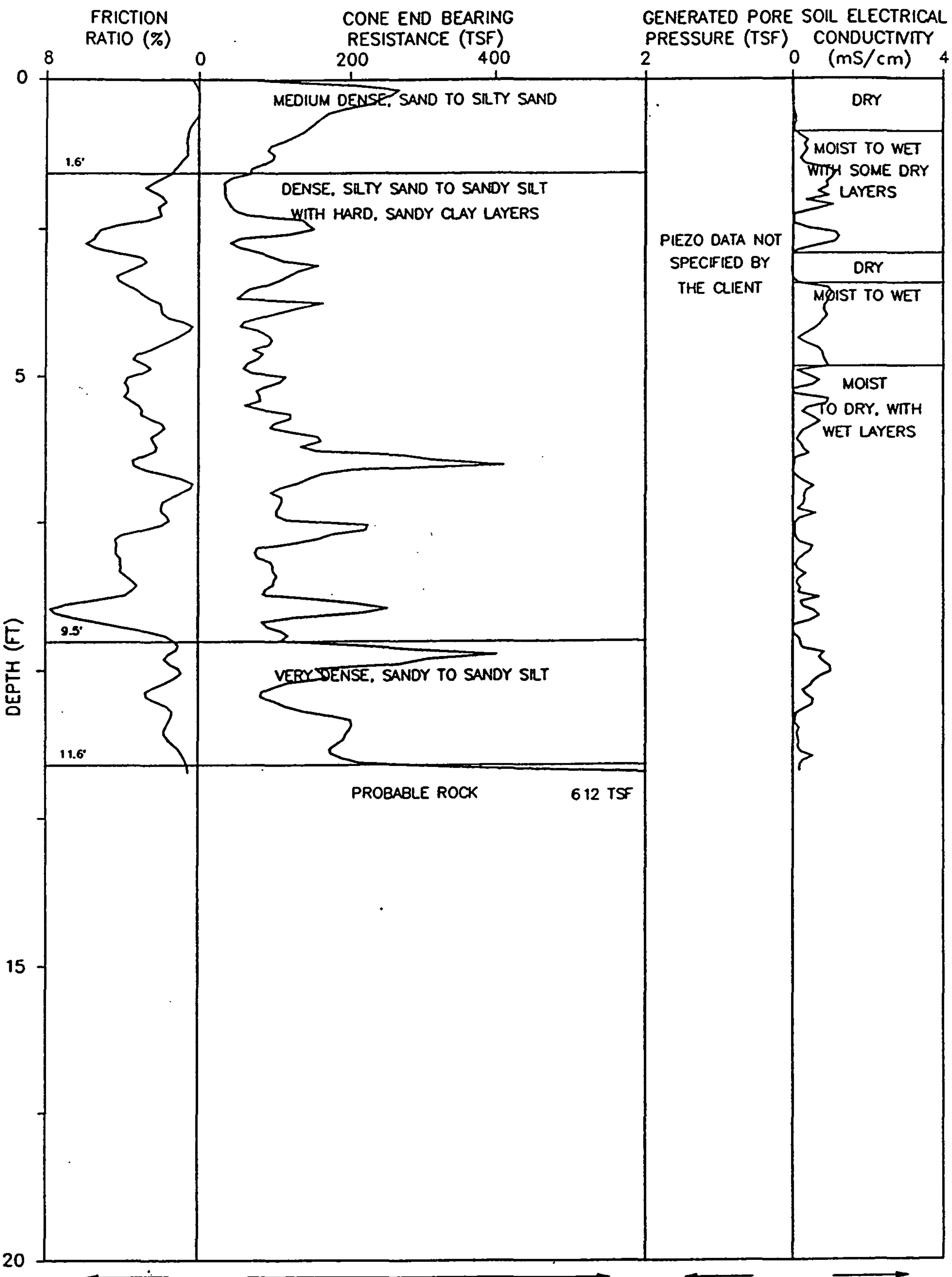
INTERPRETED CPT-EC SOUNDING LOG

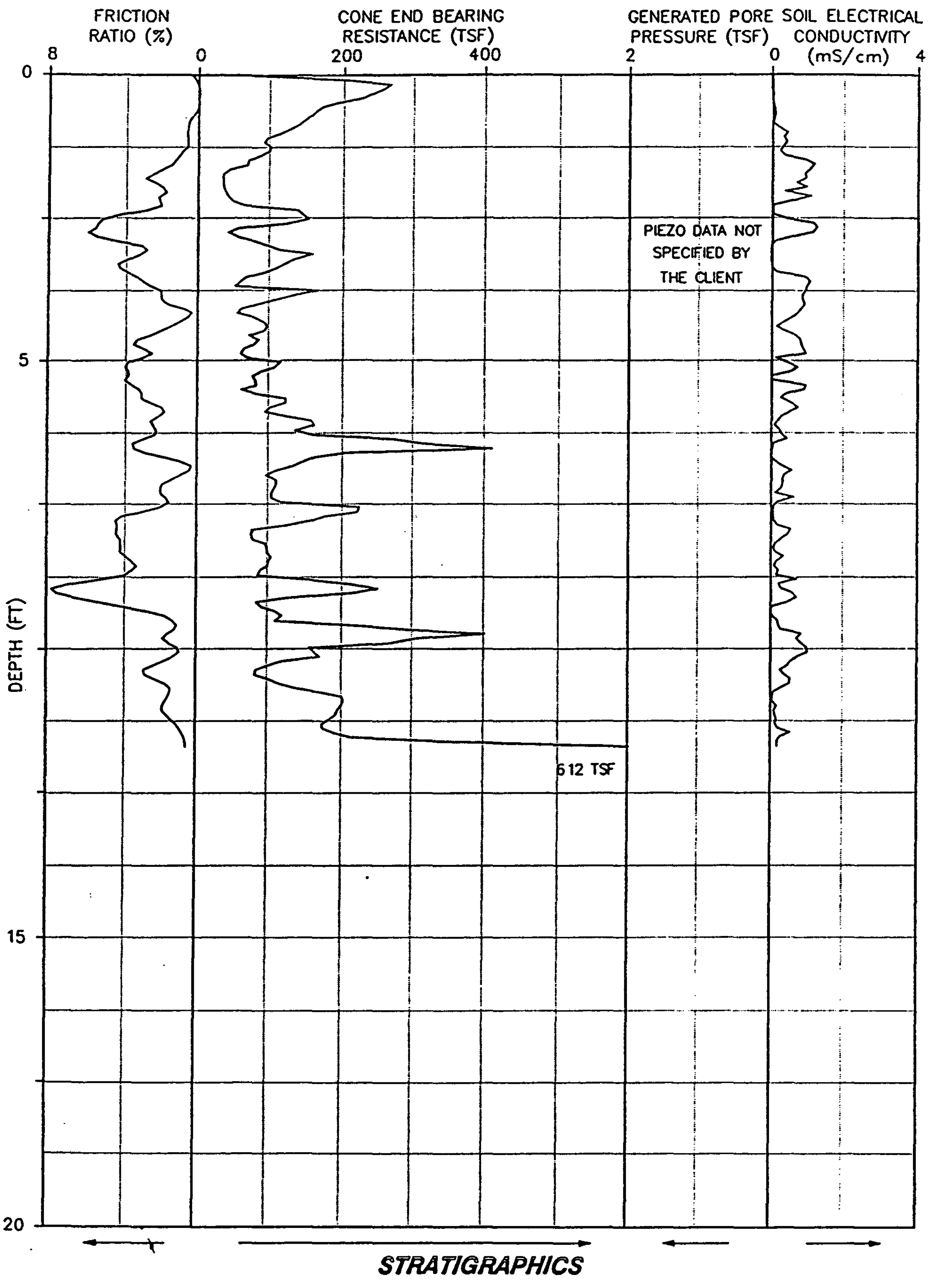


STRATIGRAPHICS

PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/23/94
SOUNDING NUMBER: CP-019

CPTU-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/23/94
SOUNDING NUMBER: CP-019

TRATIGRAPHICS
OB NO: 94-100-060
OB NAME: EG&G MOUND OU2 TASK 1
OUNDING NO: CP019

EPTH (FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	119.0	191.7	0.87	0.6		340	Med dense, sand to silty sand	42-46	40-60				29 - 37	46 - 60
1.5	69.3	105.5	1.05	1.2		891	Med dense, sand to silty sand	40-42	40-60				22 - 26	33 - 40
2.0	33.7	49.2	0.90	1.9		843	Med dense, silty sand to sandy silt	36-37	40-60				10 - 12	15 - 17
2.5	148.1	209.2	4.71	4.8		308	Hard, gr sa clay to hardpan **			33	8.97	9.43	+ 71	+ 100
3.0	95.8	131.5	3.32	3.0		21	V dense, gr si sand to cl gr sand	36-37	+100				52 - 72	72 - 99
3.5	80.6	108.0	4.06	3.6		467	Hard, gr cl sand to gr sa silt			30	5.36	8.13	54 - 74	72 - 99
4.0	86.8	113.8	2.00	1.7		937	Dense, silty sand to sandy silt	37-40	60-80				31 - 35	40 - 46
4.5	88.1	113.1	1.48	2.1		412	Dense, silty sand to sandy silt	37-40	60-80				36 - 47	46 - 60
5.0	90.5	114.2	3.01	3.3		282	Hard, gr cl sand to gr sa silt			30	6.01	6.02	57 - 78	72 - 99
5.5	62.5	77.6	2.82	3.2		941	Hard, sandy silt to sandy clay			30	4.15	5.64	37 - 48	46 - 60
6.0	132.2	161.6	4.78	2.2		282	V dense, silty sand to sandy silt	37-40	80-100				59 - 81	72 - 99
6.5	366.1	440.9	8.16	3.4		68	V dense, gr si sand to cl gr sand	36-37	+100				+ 83	+ 100
7.0	95.4	113.4	1.44	0.9		395	Med dense, sand to silty sand	40-42	40-60				25 - 28	30 - 33
7.5	143.2	168.1	2.05	1.6		181	Dense, sand to silty sand	40-42	60-80				51 - 61	60 - 72
8.0	73.8	85.6	6.60	4.3		518	Hard, gr sa clay to gr si clay **			30	4.89	13.20	62 - 85	72 - 99
8.5	97.9	112.2	4.66	3.5		183	Hard, gr cl sand to gr sa silt			30	6.49	9.32	63 - 86	72 - 99
9.0	237.8	269.6	12.01	7.6		410	Hard, hardpan to weak rock			33	14.38	24.03	+ 88	+ 100
9.5	109.9	123.3	2.97	1.4		182	Dense, sand to silty sand	40-42	60-80				36 - 41	40 - 46
10.0	156.0	173.3	1.57	1.0		1036	Dense, sand to silty sand	42-46	60-80				41 - 54	46 - 60
10.5	89.3	98.7	3.98	2.5		489	V dense, silty sand to sandy silt	36-37	80-100				42 - 54	46 - 60
11.0	200.0	220.1	3.42	1.8		174	V dense, sand to silty sand	40-42	80-100				65 - 90	72 - 99
11.5	196.2	215.0	2.22	0.6		501	Dense, sand to silty sand	42-46	60-80				42 - 55	46 - 60

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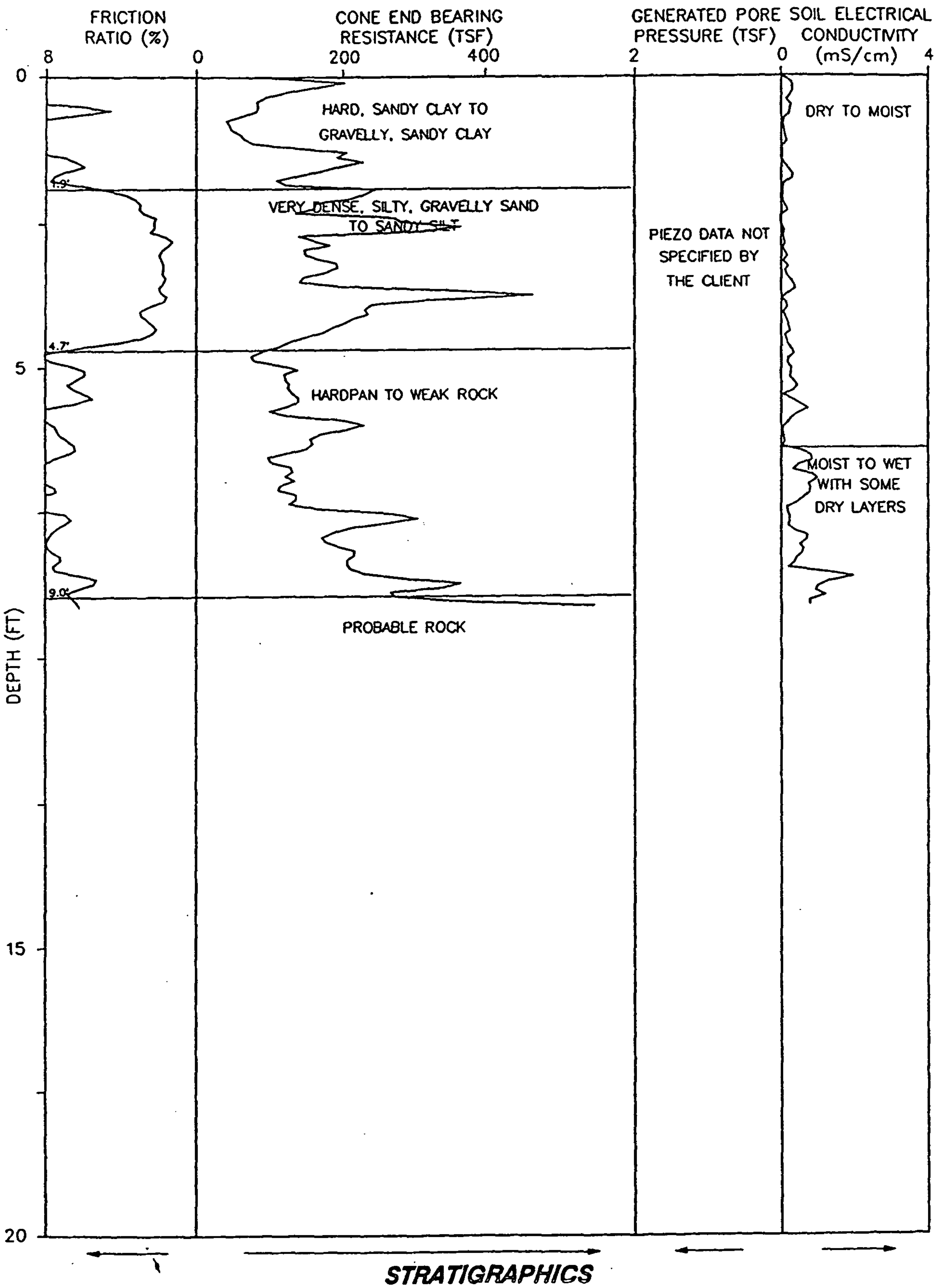
INTERPRETED CPT-EC SOUNDING LOG



PROJECT NAME: EG&G MOUND
PROJECT NUMBER: 94-100-060

DATE: 05/25/94
SOUNDING NUMBER: CP-020

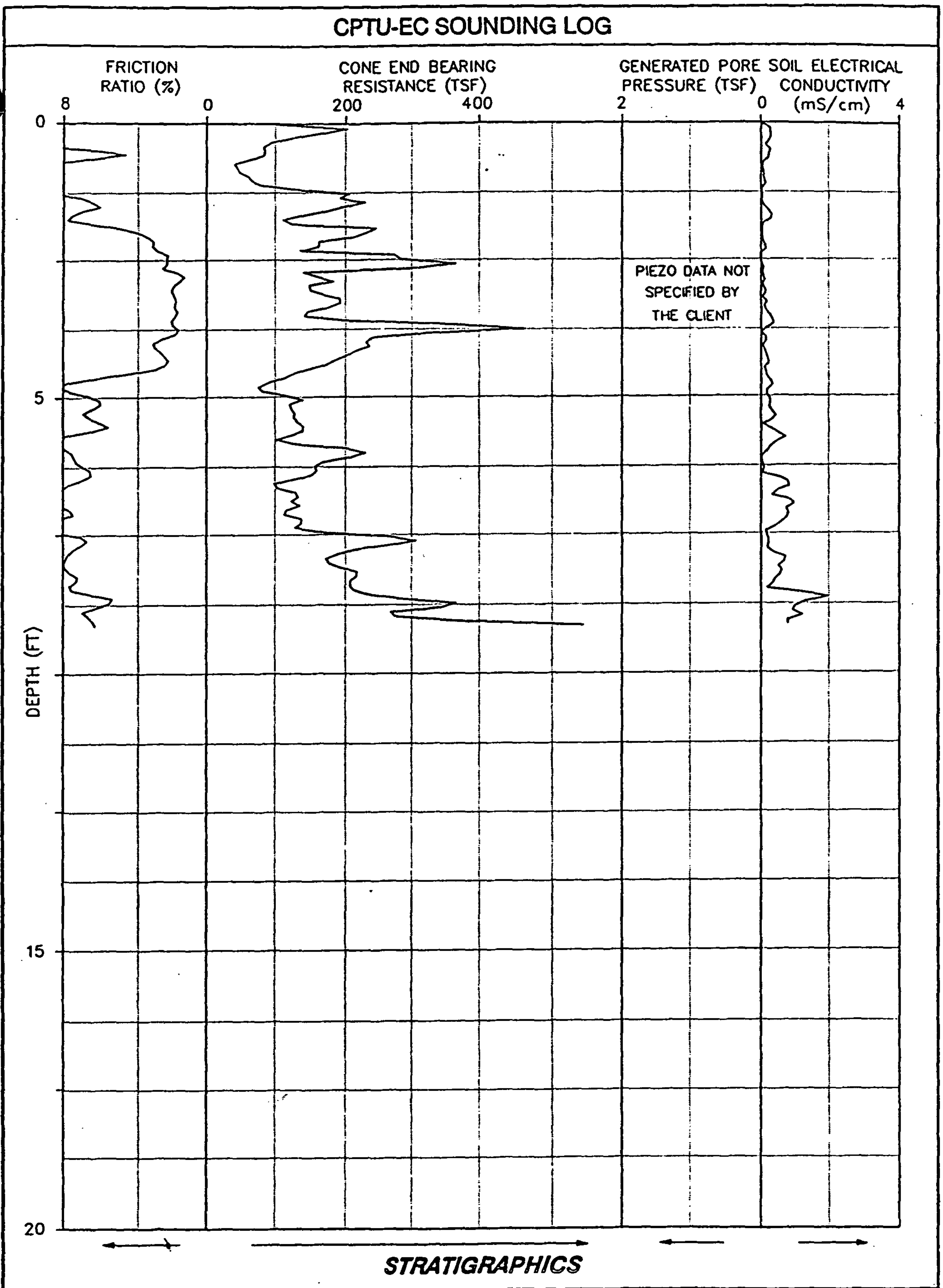
TRATIGRAPHICS
OB NO: 94-100-060
OB NAME: EG&G MOUND OU2 TASK 1
OUNDING NO: CP020

EPTH FT)	CONE (TSF)	NORM CONE (TSF)	FRICTION (TSF)	AVERAGED FRICTION RATIO (%)	GENERATED PORE WATER PRESSURE (TSF)	SOIL CONDUCTIVITY (uS/cm)	SOIL TYPE	DRAINED FRICTION ANGLE (DEG)	RELATIVE DENSITY (%)	Nc	UNDRAINED SHEAR STRENGTH (KSF)	UNDRAINED LARGE STRAIN SHEAR STRENGTH (KSF)	SPT (N)	NORM SPT (N1)
1.0	58.2	93.8	13.60	9.3		119	Hard, sandy clay to silty clay **			24	4.85	27.20	+ 62	+ 100
1.5	213.3	324.8	10.48	6.1		94	Hard, gr sa clay to hardpan **			33	12.92	20.95	+ 66	+ 100
2.0	233.1	340.3	7.46	4.0		78	Hard, gr cl sand to gr sandy clay			33	14.12	14.93	+ 68	+ 100
2.5	282.0	398.2	1.42	2.2		12	V dense, gr si sand to cl gr sand	40-42	+100				+ 71	+ 100
3.0	147.2	202.0	4.49	1.9		89	V dense, silty sand to sandy silt	40-42	80-100				52 - 72	72 - 99
3.5	142.3	190.5	4.21	1.7		245	Dense, sand to silty sand	40-42	60-80				54 - 74	72 - 99
4.0	233.1	305.4	8.24	2.8		187	V dense, gr si sand to cl gr sand	37-40	+100				+ 76	+ 100
4.5	146.7	188.4	5.23	2.9		139	V dense, gr si sand to cl gr sand	37-40	+100				+ 78	+ 100
5.0	118.2	149.1	7.75	6.4		228	Hard, hardpan to weak rock			33	7.14	15.49	+ 79	+ 100
5.5	133.2	165.3	7.68	5.7		217	Hard, hardpan to weak rock			33	8.05	15.37	+ 81	+ 100
6.0	222.4	271.8	12.57	7.6		230	Hard, hardpan to weak rock			33	13.46	25.14	+ 82	+ 100
6.5	122.6	147.7	11.44	6.9		597	Hard, hardpan to weak rock			33	7.41	22.88	+ 83	+ 100
7.0	127.3	151.3	10.79	8.1		933	Hard, hardpan to weak rock			27	9.40	21.58	+ 84	+ 100
7.5	213.9	251.0	16.33	7.6		196	Hard, hardpan to weak rock			33	12.94	32.66	+ 85	+ 100
8.0	175.2	203.2	17.78	7.9		713	Hard, hardpan to weak rock			27	12.94	35.56	+ 86	+ 100
8.5	212.4	243.5	23.17	7.5		213	Hard, hardpan to weak rock			33	12.84	46.34	+ 87	+ 100
9.0	295.3	334.8	22.02	5.4		1121	Hard, gr sa clay to hardpan **			33	17.86	44.04	+ 88	+ 100

NOTES: * Indicates lightly overconsolidated soil
** Indicates heavily overconsolidated or cemented soil

Mixed soils containing both granular and fine grained particles (e.g. clayey sands) may undergo partial drained failure during CPT. Both undrained and drained parameters can be estimated for these soils.

Structure rate of loading should be considered in choosing which strength parameters to use for design. Drained and undrained parameters must not be combined as such combination will result in significant overprediction of in situ shear strength.



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