3.7 Transportation and Circulation

Introduction

This section describes the existing and future conditions for transportation and circulation both with and without the proposed project. The analysis provides information on local roadway networks, levels of service, and potential effects on the local transportation system associated with traffic generated by project. In addition, this section provides an assessment of the site access and internal site circulation.

Environmental Setting

The Emerson Property includes 140 acres and is located north of Cypress Road within the proposed 303-acre Dutch Slough Area in the City of Oakley. The Emerson Property is proposed for residential development consisting of 578 single-family residential units. The project is proposing to include four different neighborhoods with lot sizes ranging from approximately 3,000 to 6,000 square feet. The project would also include a shopping center with approximately 280,000 square feet of commercial space anchored by a supermarket.

Implementation of the project would increase vehicular traffic in the area, which could adversely affect traffic operations, particularly at critical intersections in the area. Figure 1 shows the project location and the study intersections that were included in the analysis. Figure 2 shows the project site plan. A discussion of the existing traffic and transportation conditions in the project study area is provided below.

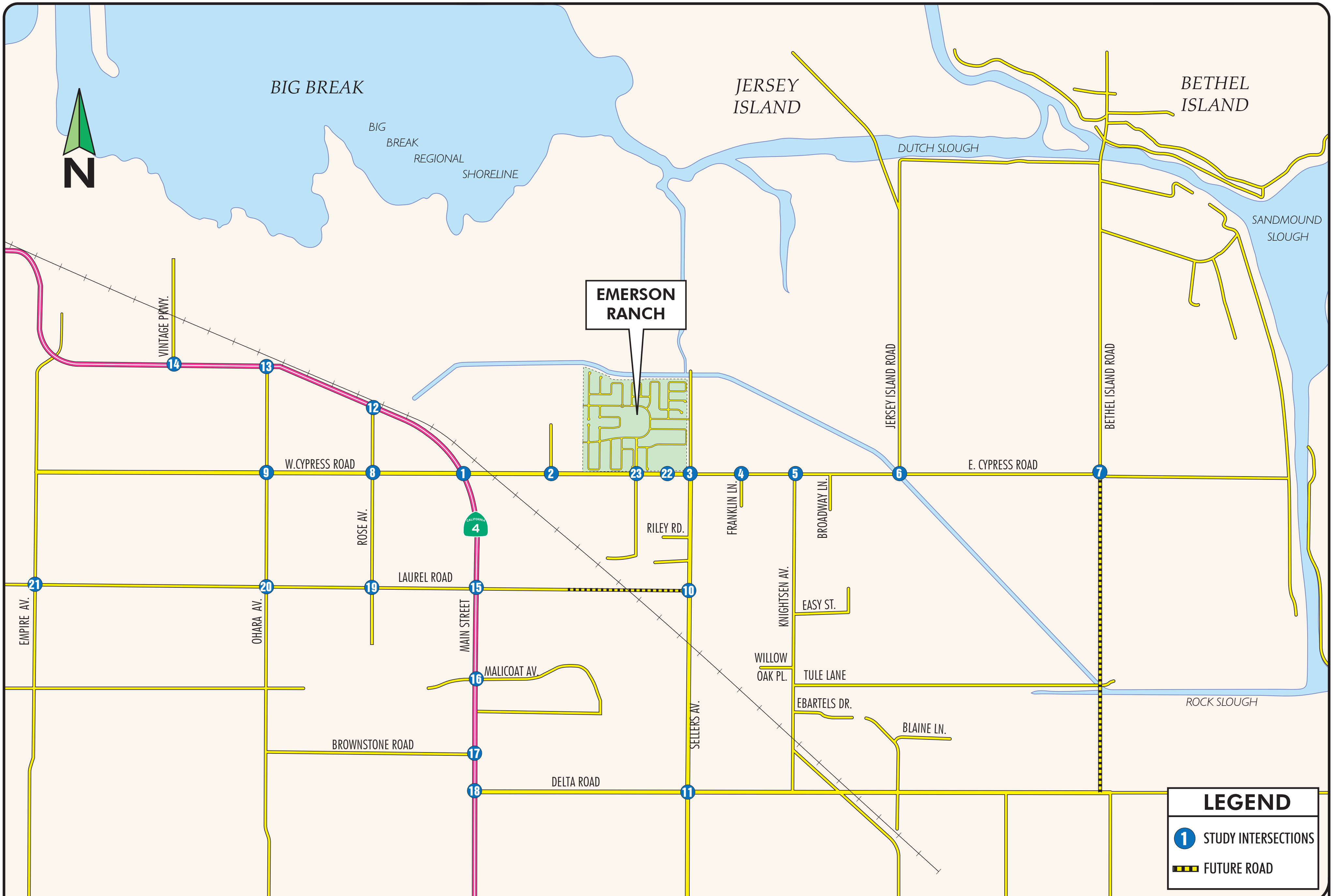


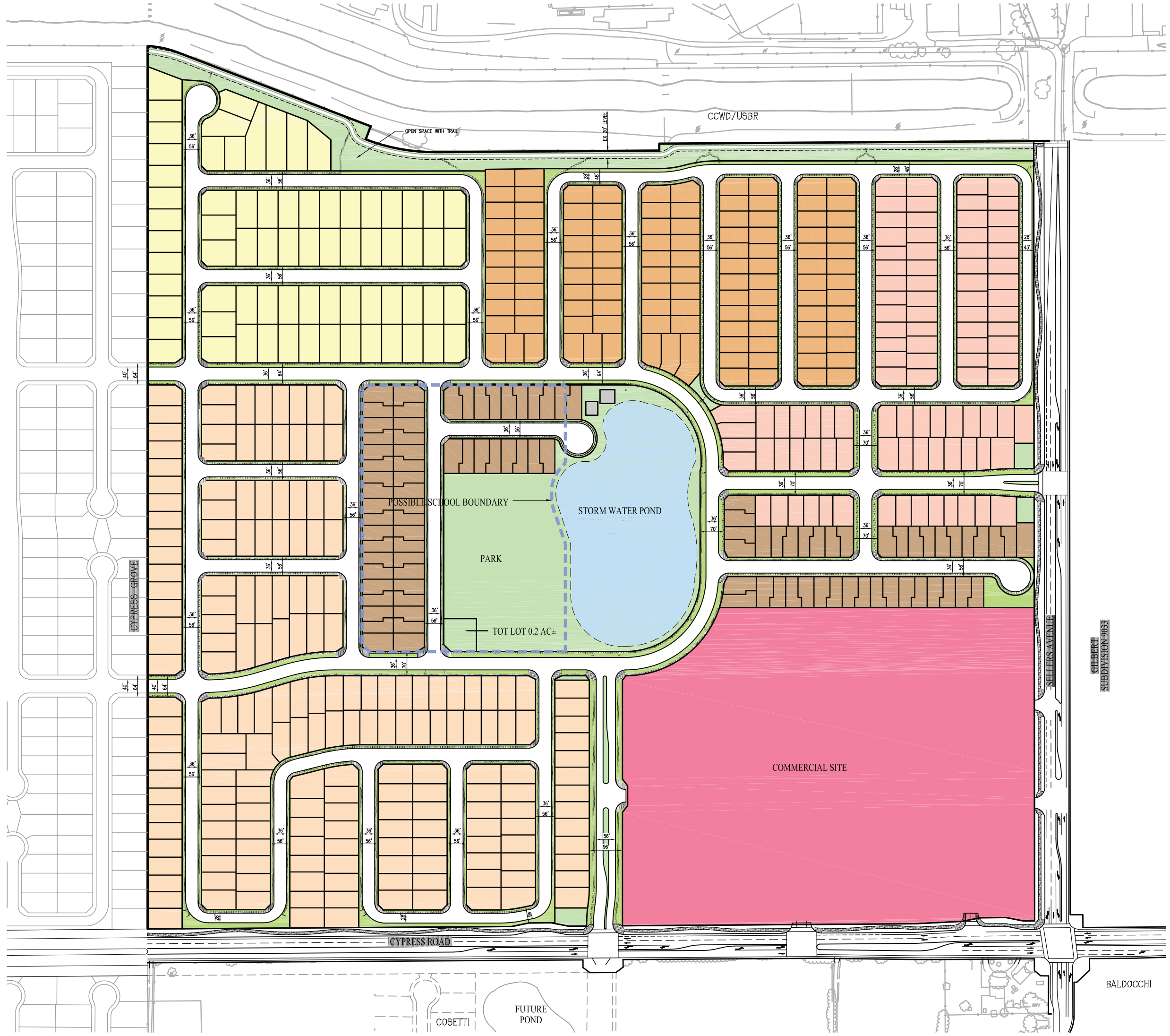
FIGURE 1 | PROJECT LOCATION AND STUDY INTERSECTIONS

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.



PROPOSED REVISED CONCEPTUAL LAND USE PLAN

UNIT BREAKDOWN

71	6,000 SF LOTS (60' x 100')
193	5,000 SF LOTS (50' x 100')
101	4,050 SF LOTS (45' x 90')
117	3,825 SF LOTS (45' x 85')
96	3,510 SF LOTS (39' x 90')
578	TOTAL UNITS

SUBDIVISION 9032

EMERSON RANCH

CITY OF OAKLEY CONTRA COSTA COUNTY, CALIFORNIA

0' 100' 300' 400'

SCALE: 1"= 100'

JANUARY 22, 2008

cbg Carlson, Barbee & Gibson, Inc.

CIVIL ENGINEERS • SURVEYORS • PLANNERS

6111 Bollinger Canyon Road, Suite 150 • San Ramon, CA 94583

925-866-0322 • fax 925-866-8575

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FIGURE 2│EMERSON RANCH MASTER SITE PLAN

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates

Transportation • Traffic • Engineering • Planning

Existing Conditions

Land Use

The project site has historically been used for dairy and agricultural purposes and is located to the east of the approved and partially developed Cypress Grove residential project, the Delta Vista Middle School and the Iron House Elementary School. The project site is bounded on the north by the Contra Costa Water District Canal (CCWD/USBR Canal), which segregates the project site from the open space acreage to the north currently owned by the State of California. A 55-acre portion of land immediately to the north of the CCWD/USBR canal and the project site at the end of Sellers Avenue is held in escrow for future conveyance to the City of Oakley as a community park.

Roadways

Abrams Associates conducted an extensive analysis of the existing roadways in the vicinity of the project site. The following are descriptions of the primary roadways studied: State Route 4 (SR-4)/Main Street, Cypress Road, Sellers Avenue, Knightsen Avenue, Laurel Road, and Delta Road.

State Route 4 (SR-4)/Main Street is a two-lane major arterial that carries approximately 25,500 vehicles per day. Main Street is currently the only major north-south transportation corridor in the vicinity of the project that provides direct access from Oakley to the greater Bay Area and a link between Contra Costa County and San Joaquin County to the east. Mixed residential, commercial, and agricultural uses characterize the lands along both sides of SR-4 between Rose Avenue and Laurel Road. Maximum speeds posted on SR-4 in the project vicinity are: 35 miles per hour (mph) west of Rose Avenue, 45 mph between Rose and Bernard Road, and 40 mph south of Bernard Road.

Cypress Road is an east-west, two-lane residential arterial west of SR-4 and a two- to four lane arterial east of SR-4 that is referred to as East Cypress Road. The posted speed limit on Cypress Road is 50 mph east of SR-4 in the vicinity of the project site.

Sellers Avenue is a north-south, two-lane rural road that currently has residential lots south of Cypress Road and farmlands to the north.

Knightsen Avenue is a north-south, two-lane rural road that extends north from Eden Plains Road to terminate at East Cypress Road.

Laurel Road is an east-west two-lane residential collector street with residential and vacant land on both sides. The posted speed on Laurel Road is 45 mph. Laurel Road is located approximately one-half mile south of the project site, parallel to Cypress Road, and is planned to be extended to Sellers Avenue.

Delta Road is an east-west, two-lane rural road that extends east from Main Street and provides a connection to the north end of the Byron Highway.

Traffic Operations

During the AM peak hour, the primary direction of traffic in the vicinity of the project is westbound as area residents use SR 4 and other roadways to travel to employment in the Bay Area. During the PM peak hour, the primary direction of traffic is eastbound as residents return home. Main Street is currently used as the primary route of travel to the nearest freeway (SR 4). Since Main Street is designated as a state highway in the study area, it also serves a high truck volume (about 10 percent of vehicles are multi-axle trucks) that contributes to the congestion along the corridor. As mentioned previously, the Union Pacific (UP) Railroad crosses East Cypress Road about 650 feet east of Main Street. The crossing is currently at-grade and controlled by gates on East Cypress Road. Based on current observations, when trains cross East Cypress Road the eastbound East Cypress Road traffic can back to Main Street and interfere with the regular operations at the East Cypress Road/Main Street intersection, mainly during the PM peak hour. Although East Cypress Road is being improved in the area there are no plans to grade-separate the railroad crossing.

Intersection Operations

Traffic count information for the project study intersections were obtained from the River Oaks Crossing Specific Plan FEIR[1] and calibrated with data from the East Cypress Road Corridor Specific Plan Traffic Study[2]. In addition, new traffic counts were conducted at three key intersections in May, 2008 to verify that the traffic volumes are accurately portrayed. The existing peak hour traffic volumes are shown on Figure 3 and the existing lane configurations are shown in Figure 4. Each project study intersection was analyzed according to the methodology and standards set forth in the "Impacts and Mitigations" section.

Existing intersection operations were evaluated for the weekday AM and PM peak hours at the study intersections. Detailed intersection LOS calculation worksheets are provided in Appendix. All signalized study intersections currently operate at acceptable levels-of-service (LOS) which is LOS D or better according to City and County standards. However, there were two unsignalized intersections that had side street approaches operating at LOS F.

[1] River Oaks Crossing Specific Plan Final Environmental Impact Report, City of Oakley, March, 2008

[2] East Cypress Road Specific Plan – Draft Traffic Study, Fehr & Peers Associates, March, 2005.

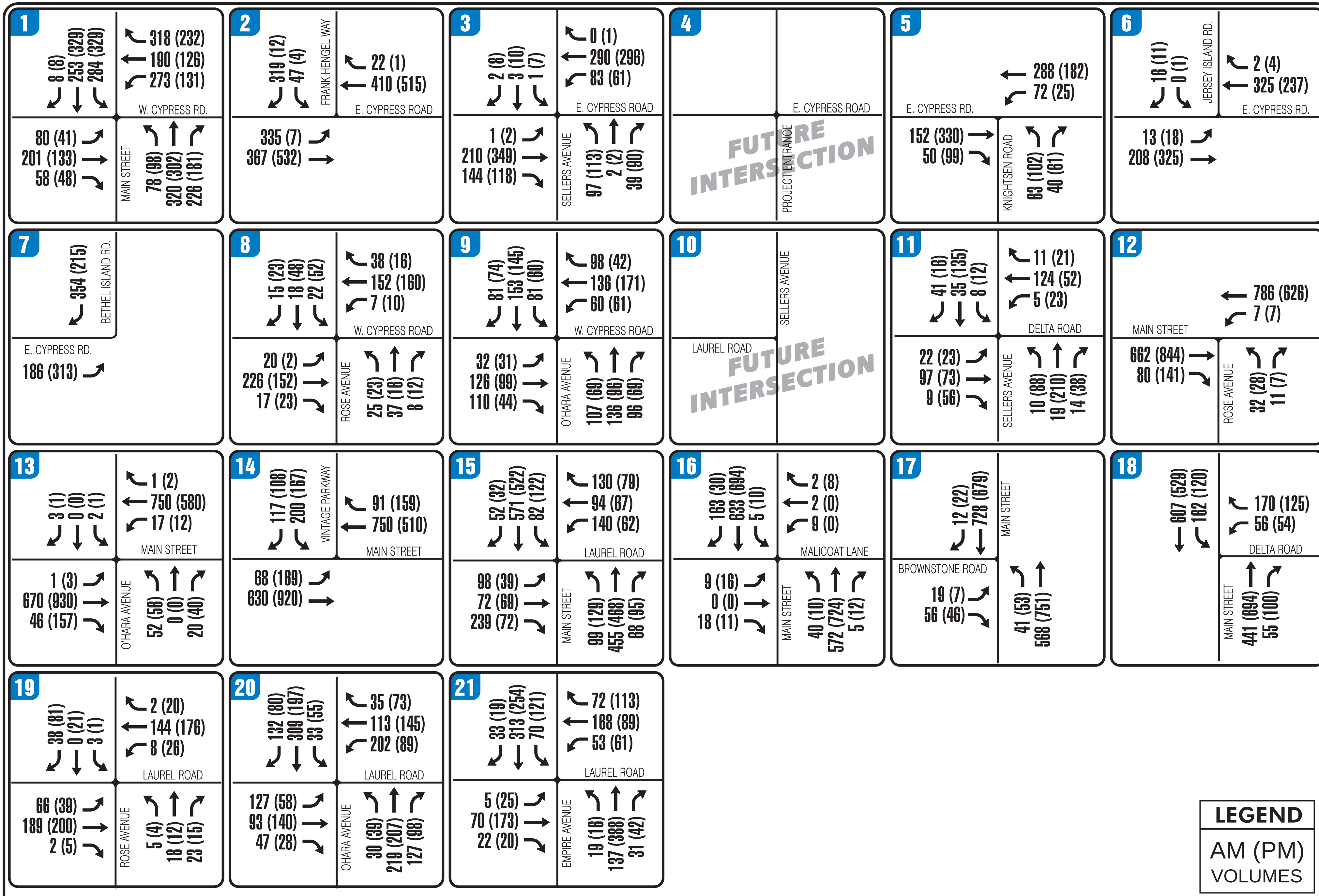

FIGURE 3 | AM (PM) EXISTING PEAK HOUR TRAFFIC VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.

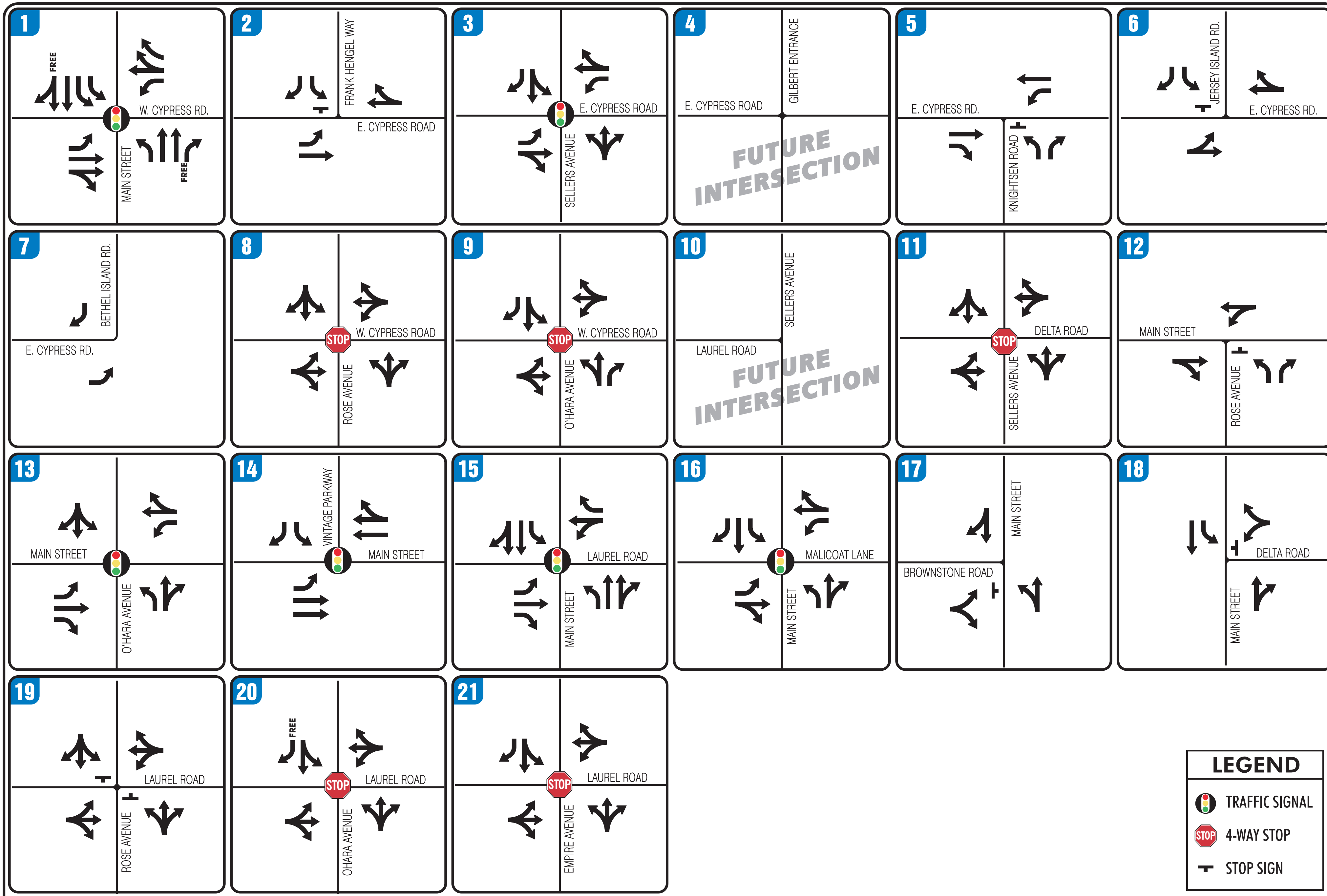

FIGURE 4 | EXISTING LANE CONFIGURATIONS

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.

The stop-controlled T-intersections of Main Street with Rose Avenue and with Delta Road, though operating at LOS A overall, both operate at LOS F on the stop-controlled side street movements during the peak hours. The motorists on unsignalized side streets such as these often have substantial delays before they can enter the stream of traffic on Main Street. The Main Street/Rose Avenue intersection currently does not meet any of the Caltrans' traffic signal warrants. However, the intersection of Main Street with Delta Road already meets the peak hour volume warrant under existing conditions. A review of the queue lengths for the southbound left-turn movement on Main Street indicates that the current traffic controls do not cause problems to the mainline operations. Observations at this intersection indicate that the current operations are acceptable with stop control on the Delta Road approach since the majority of traffic on the side street turns right onto Main Street. It should be noted that the majority of this side street traffic appears to be generated by commuters attempting to bypass congestion on SR 4 in Brentwood by using side streets such as the Byron Highway and Delta Road. Table 1 summarizes the existing conditions at the project study intersections.

Transit Service

Tri-Delta Transit provides transit service in the area, providing three lines connecting Brentwood and the Pittsburg/Bay Point Bay Area Rapid Transit (BART) station. Tri-Delta Transit Route 391 operates during the commute hours on weekdays and Route 392 operates on weekends only. Both routes travel through local streets in Brentwood, Oakley, and Antioch. Route 300 is an express route on SR-4 with only four stops between Brentwood and the BART station. In the vicinity of the project, all three lines have bus stops located at the Main Street (SR-4)/Cypress Road intersection just to the southwest of the project site. However, service is not currently provided on Cypress Road east of SR-4/Main Street.

Baseline Conditions

In order to provide a more accurate forecast of the impact of the Emerson Ranch Project on traffic in the area an analysis was also conducted to determine the traffic that will be added from approved projects that could affect the study area. The adjusted data is based on a complete list of approved projects provided by the City of Oakley and contained in the East Cypress Road Specific Plan Traffic Study[1]. For the purposes of this analysis it was assumed that no more than about 50% of the East Cypress Road Specific Plan development could be constructed and occupied before the proposed project is completed. Figure 5 shows the Baseline traffic volumes that were used in this analysis. The data was used to analyze the baseline (or "background") traffic conditions from which the effects of the Emerson Ranch project will be measured. The baseline represents the traffic conditions that are forecast to exist once already approved projects (and other reasonably foreseeable projects) are completed and occupied.

TABLE 1
EXISTING INTERSECTION OPERATIONS

INTERSECTION		CONTROL	PEAK HOUR	EXISTING	
				MEASURE	LOS
1	Main Street (SR 4) and Cypress Road	Traffic Signal	AM PM	v/c = 0.44 v/c = 0.34	A A
2	East Cypress Road/Frank Hengel Way	Stop Sign	AM PM	23.1 sec 13.7 sec	C B
3	East Cypress Road/Sellers Avenue	Traffic Signal	AM PM	v/c = 0.20 v/c = 0.24	A A
4	East Cypress Road/Main Project Entrance	Future	AM PM	N/A N/A	N/A N/A
5	East Cypress Road/Knightsen Avenue	Stop Sign	AM PM	12.3 sec 13.1 sec	B B
6	East Cypress Road/Jersey Island Road	Stop Sign	AM PM	10.1 sec 9.8 sec	B A
7	East Cypress Road/Bethel Island Road	Stop Sign	AM PM	9.3 sec 10.1 sec	A B
8	West Cypress Road at Rose Avenue	Stop Sign	AM PM	8.1 sec 7.9 sec	A A
9	West Cypress Road at O'Hara Avenue	Stop Sign	AM PM	10.0 sec 8.9 sec	B A
10	Sellers Avenue at Laurel Road	Future	AM PM	N/A N/A	N/A N/A
11	Sellers Avenue at Delta Road	Stop Sign	AM PM	7.6 sec 8.5 sec	A A
12	Main Street (SR 4) at Rose Avenue	Stop Sign	AM PM	33.5 sec 37.3 sec	D E
13	Main Street (SR 4) at O'Hara Avenue	Traffic Signal	AM PM	v/c = 0.49 v/c = 0.61	A B
14	Main Street (SR 4) at Vintage Parkway	Traffic Signal	AM PM	v/c = 0.40 v/c = 0.39	A A
15	Main Street (SR 4) at Laurel Road	Traffic Signal	AM PM	v/c = 0.45 v/c = 0.35	A A
16	Main Street (SR 4) at Malicoat Avenue	Traffic Signal	AM PM	v/c = 0.42 v/c = 0.47	A A
17	Main Street (SR 4) at Brownstone Rd	Stop Sign	AM PM	36.6 sec 26.3 sec	E D
18	Main Street (SR 4) at Delta Road	Stop Sign	AM PM	>50 sec >50 sec	F F
19	Laurel Road at Rose Avenue	Stop Sign	AM PM	11.6 sec 12.0 sec	B B
20	Laurel Road at O'Hara Avenue	Stop Sign	AM PM	13.1 sec 10.6 sec	B B
21	Laurel Road at Empire Avenue	Stop Sign	AM PM	9.4 sec 12.7 sec	A B

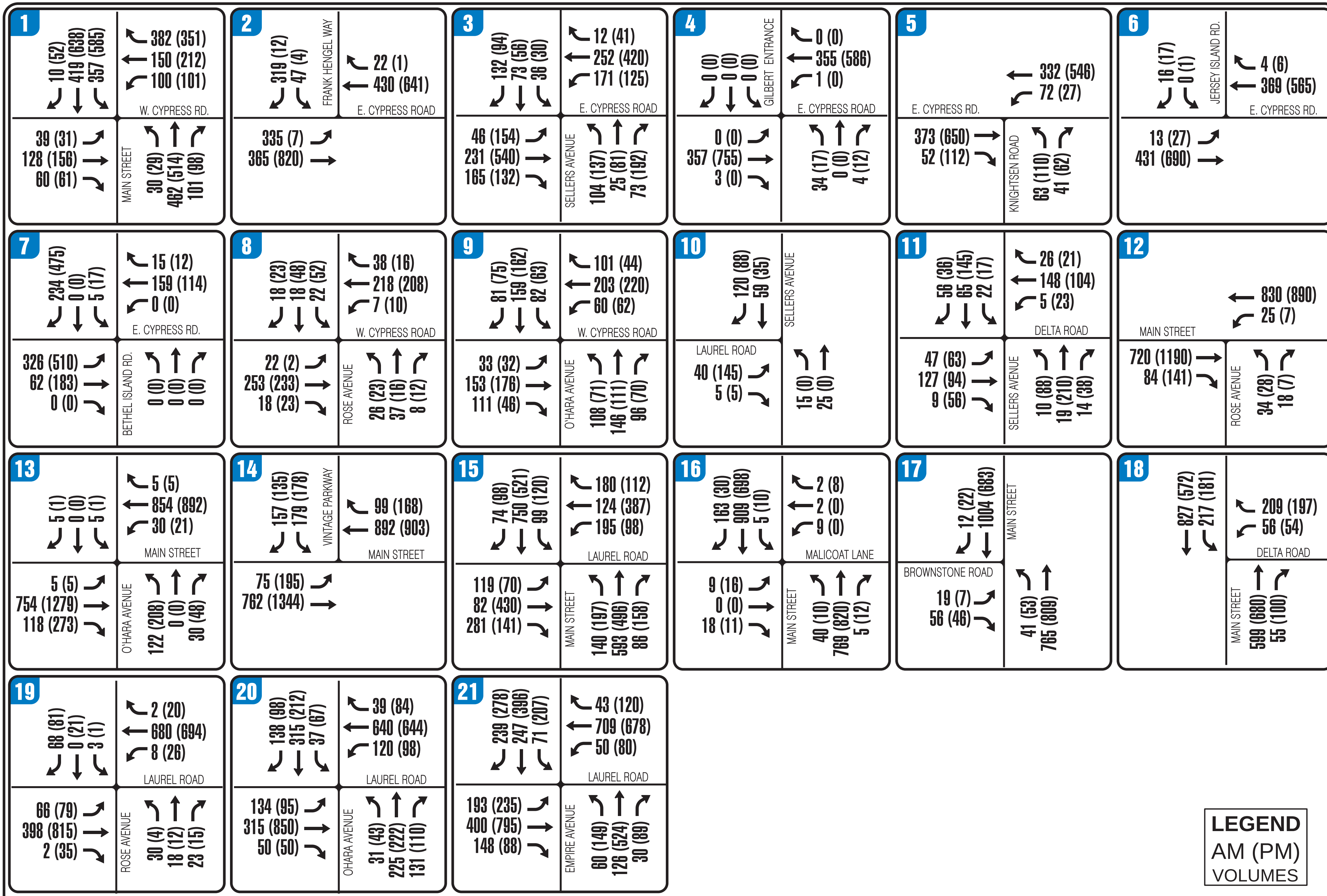

FIGURE 5 | AM (PM) BACKGROUND VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.

Baseline Roadway Improvements

Funded roadway improvements planned for the next few years were assumed to be in place under the Baseline conditions. Major roadway improvements planned in the study area include:

- Extension of Neroly Avenue from its current terminus east to Main Street.
- Extension of East Cypress Road from Bethel Island Road to Sandmound Boulevard as a four-lane arterial.
- Signalization of East Cypress Road/Bethel Island Road intersection.
- Signalization of the Main Street/Live Oak Avenue intersection.
- Widening of East 18th Street to four lanes between Willow Avenue and SR 4
- Addition of a northern leg and signalization of the East 18th Street/Phillips Lane intersection
- Signalization of the Wilbur Avenue/Minaker Drive intersection
- Addition of a second left turn lane on northbound Neroly Road at the Main Street/Bridgehead Road/Neroly Road intersection

Intersections

With the addition of the approved projects traffic to existing traffic volumes several intersections would exceed the standards set forth by the City of Oakley and Contra Costa County (LOS D or better). Since Main Street provides the primary access to regional transportation facilities, most of the expected Baseline traffic would be added to Main Street. As a result, several study intersections along Main Street (SR 4) would degrade to LOS E or LOS F including the intersections at O'Hara Avenue, Malicoat Avenue, and Brownstone Road.

One other unsignalized intersection would also operate at LOS F on the side street approach – East Cypress Road at Knightsen Avenue. In general, it is clear that some additional roadway improvements are already needed to adequately accommodate the projected traffic growth due to approved projects. Although they are not assumed to be in place as part of the Baseline, the improvements required to address these problems are already planned for the area and are discussed in the "Impacts and Mitigations Measures" section. The results of the levels of service analysis for the baseline conditions are given in Table 2. Detailed level-of-service calculations are contained in Appendix.

Regulatory Context

Existing policies, laws and regulations that would apply to the proposed project are summarized below.

TABLE 2
BASELINE INTERSECTION OPERATIONS

	INTERSECTION	CONTROL	PEAK HOUR	BASELINE	
				MEASURE	LOS
1	Main Street (SR 4) and Cypress Road	Traffic Signal	AM PM	v/c = 0.39 v/c = 0.50	A A
2	East Cypress Road/Frank Hengel Way	Traffic Signal	AM PM	v/c = 0.35 v/c = 0.24	A A
3	East Cypress Road/Sellers Avenue	Traffic Signal	AM PM	v/c = 0.34 v/c = 0.40	A A
4	East Cypress Road/Main Project Entrance	Future	AM PM	N/A N/A	N/A N/A
5	East Cypress Road/Knightsen Avenue	Stop Sign	AM PM	14.2 sec 23.6 sec	B C
6	East Cypress Road/Jersey Island Road	Stop Sign	AM PM	9.5 sec 10.7 sec	A B
7	East Cypress Road/Bethel Island Road	Traffic Signal	AM PM	v/c = 0.22 v/c = 0..30	A A
8	West Cypress Road at Rose Avenue	Stop Sign	AM PM	8.5 sec 8.3 sec	A A
9	West Cypress Road at O'Hara Avenue	Stop Sign	AM PM	11.4 sec 9.9 sec	B A
10	Sellers Avenue at Laurel Road	Stop Sign	AM PM	9.2 sec 9.3 sec	A A
11	Sellers Avenue at Delta Road	Stop Sign	AM PM	7.9 sec 9.1 sec	A A
12	Main Street (SR 4) at Rose Avenue	Stop Sign	AM PM	40.2 sec >50 sec	E F
13	Main Street (SR 4) at O'Hara Avenue	Traffic Signal	AM PM	v/c = 0.60 v/c = .92	A E
14	Main Street (SR 4) at Vintage Parkway	Traffic Signal	AM PM	v/c = 0.44 v/c = 0.53	A A
15	Main Street (SR 4) at Laurel Road	Traffic Signal	AM PM	v/c = 0.60 v/c = 0.81	A D
16	Main Street (SR 4) at Malicoat Avenue	Traffic Signal	AM PM	v/c = 037 v/c = 0.27	A A
17	Main Street (SR 4) at Brownstone Rd	Stop Sign	AM PM	>50 sec 28.5 sec	F D
18	Main Street (SR 4) at Delta Road	Stop Sign	AM PM	>50 sec >50 sec	F F
19	Laurel Road at Rose Avenue	Stop Sign	AM PM	40.3 sec >50 sec	E F
20	Laurel Road at O'Hara Avenue	Traffic Signal	AM PM	v/c = 0.50 v/c = 0.49	A A
21	Laurel Road at Empire Avenue	Traffic Signal	AM PM	v/c = 0.53 v/c = 0.70	A B

State

The California Department of Transportation (Caltrans) has jurisdiction over state highways. Therefore, Caltrans controls all construction, modification, and maintenance of state highways, such as SR-4. Any improvements to SR-4 would require Caltrans' approval.

Contra Costa County Transportation Authority

The Contra Costa Transportation Authority (CCTA) serves as the Congestion Management Agency (CMA) for Contra Costa County. CCTA adopted the county's first Congestion Management Program (CMP) in October 1991. The most recent CMP, referred to as the 2001 CMP Update, represents the fifth biennial update that the Authority has prepared.

<u>Measure C</u>

The overall goal of the CCTA Growth Management Program (GMP) called for in Measure C-1988 is to "achieve a cooperative process for Growth Management on a countywide basis, while maintaining local authority over land use decisions and the establishment of performance standards." Using a formula based on road miles and population, CCTA allocates 18 percent of the sales tax revenues it receives to local jurisdictions that comply with GMP requirements. Oakley participates in the Measure C program as a member of the TRANSPLAN subregional transportation planning committee, which consists of Antioch, Brentwood, Oakley, Pittsburg, and Contra Costa County.

Local

<u>General Plan Policies</u>

The Transportation and Circulation Element included in the General Plan is prepared pursuant to Section 65302(b) of the California Government Code, and has been a mandatory component of local General Plans since 1955. The Transportation and Circulation Element is required to address the location and extent of existing and planned transportation routes, terminals, and other local public utilities and facilities. Furthermore, the Transportation and Circulation Element must be consistent with the other elements of the General Plan, accommodating future travel demand and contributing to, rather than inhibiting, the attainment of desired land use patterns in the Land Use Element.

The General Plan identifies several roadway and transit goals and policies that have been adopted to ensure that the transportation system of the city will have adequate capacity to serve planned growth. These goals and policies are intended to provide a plan and implementation measures for an integrated, multi-modal transportation system that will safely and efficiently meet the transportation needs of all economic and social segments of the city and provide for the transport of goods and services within the City. The following applicable goals and policies are from the Oakley 2020 General Plan[3]:

Roadway and Transit Goals:

Goal 3.1	Provide an efficient and balanced transportation system.
Policy 3.1.1	Strive to maintain Level of Service D as the minimum acceptable service standard for intersections during peak periods (except those facilities identified as Routes of Regional Significance).
Policy 3.1.2	For those facilities identified as Routes of Regional Significance, maintain the minimum acceptable service standards specified in the East County Action Plan Final 2000 Update, or future Action Plan updates as adopted.
Policy 3.1.3	Keep roadway facilities in optimal condition.
Policy 3.1.5	Encourage a multi-modal circulation system that supports non-automobile travel.
Policy 3.1.6	Address future roadway needs through both new road construction and management of existing and planned roadway capacity.
Policy 3.1.8	Mitigate conflicts between new roadway improvements and existing rural roadways when the identified conflicts threaten public health, safety and welfare.

Bicycles and Pedestrians:

Goal 3.2	Promote and encourage walking and bicycling.
Policy 3.2.1	Provide maximum opportunities for bicycle and pedestrian circulation on existing and new roadway facilities.
Policy 3.2.2	Enhance opportunities for bicycle and pedestrian activity in new public and private development projects.
Policy 3.2.3	Create a bicycle and pedestrian system that provides connections throughout Oakley and with neighboring areas, and serves both recreational and commuter users.

[3] Oakley 2020 General Plan, City of Oakley, August 30, 2002.

Public Transportation:

Goal 3.3	Provide adequate, convenient, and affordable public transportation.
Policy 3.3.1	Design new roadways and facilities to accommodate public transit.
Policy 3.3.2	Ensure that new public and private development supports public transit.
Policy 3.3.3	Encourage transit providers to improve transit routes, frequency, and level of service to adequately serve the mobility needs of Oakley residents, including those dependent on public transit.

Neighborhood Traffic Management:

Goal 3.4	Minimize the intrusion of through traffic on residential streets.
Policy 3.4.1	Direct non-local traffic onto collector streets and arterials.
Policy 3.4.2	Maintain traffic speeds and volumes on neighborhood streets consistent with residential land uses.
Policy 3.4.3	Provide adequate capacity on collector and arterial streets to accommodate travel within the City.

IMPACTS AND MITIGATIONS

Standards of Significance

Based on the adopted policies of CCTA, the City of Oakley, and Contra Costa County a traffic impact would be considered significant if any of the following conditions, or potential thereof, would result from implementation of the proposed project.

- Substantially increased traffic volumes in relation to existing traffic load and capacity of the street system;
- A decline in LOS at a signalized intersection to unacceptable Level E (V/C = 0.90) or lower;
- A decline in LOS at an unsignalized intersection to unacceptable level - LOS E (Average Delay = 35 seconds) or lower;
- An unsignalized intersection is forecast to meet the warrants for installation of a traffic signal, as set forth by Caltrans;
- Failure of any street or portion of a street to meet accepted safety and design standards or guidelines;
- Failure to meet adopted alternative transportation policies, plans, or programs.
- Inadequate access for emergency vehicles.

Analysis Methodology

Abrams Associates Traffic Engineering, Inc. conducted a Traffic Impact Analysis for the Emerson Ranch Project. The analysis is intended to quantify the traffic impacts of the project and to address the circulation and roadway improvements needed to mitigate these impacts. The analysis, summarized herein, addresses traffic conditions occurring during the morning and evening peak hours, and the area studied encompasses all of the major intersections that would be affected by the proposed project. The analysis considers the project's impacts on the baseline traffic conditions as well as conditions occurring in the future under the City of Oakley and Contra Costa County General Plans.

Intersections Studied

The following intersections were studied for project-related impacts:

No.	Intersection Name	Traffic Control
1)	East Cypress Road and Main Street (State Route 4)	Traffic Signal
2)	East Cypress Road and Hengel Way (Middle School)	Stop sign
3)	East Cypress Road and Sellers Avenue	Traffic Signal
4)	East Cypress Road and Entrance to (Franklin)	Future
5)	East Cypress Road and Knightsen Avenue	Stop sign
6)	East Cypress Road and Jersey Island Road	Stop sign
7)	East Cypress Road and Bethel Island Road	Future
8)	West Cypress Road and Rose Avenue	All-way stop
9)	West Cypress Road and O'Hara Avenue	Traffic Signal
10)	Seller Avenue and Laurel Road	Future
11)	Seller Avenue and Delta Road	All-way stop
12)	Main Street (State Route 4) and Rose Avenue	Stop sign
13)	Main Street (State Route 4) and O'Hara Avenue	Traffic Signal
14)	Main Street (State Route 4) and Vintage Parkway	Traffic Signal
15)	Main Street (State Route 4) and Laurel Road	Traffic Signal
16)	Main Street (State Route 4) and Malicoat Avenue	Traffic Signal
17)	Main Street (State Route 4) and Brownstone Road	Stop sign
18)	Main Street (State Route 4) and Delta Road	Stop sign
19)	Laurel Avenue and Rose Avenue	Stop sign
20)	Laurel Road and O'Hara Avenue	All-way stop
21)	Laurel Road and Empire Avenue	All-way stop

Levels of Service Evaluations

Levels of service at each of the intersections studied were evaluated to demonstrate how the proposed project would impact the transportation and circulation system. Three near-term and two long-term cumulative scenarios were considered:

- *Existing Conditions* – The current (2001) traffic volumes and roadway conditions were evaluated.
- *Existing-Plus-Approved-Projects (Baseline) Conditions* – This scenario evaluates conditions that would result when adding traffic generated by already approved projects that might affect the study intersections to existing traffic conditions.
- *Baseline-Plus-Project Conditions* – This scenario begins with the conditions determined for the existing-plus-approved-projects scenario and adds traffic that would be generated by the proposed Emerson Ranch Project.
- *Year 2030 Conditions* – Future traffic conditions at the study intersections were projected based on "Eastern Contra Costa County Travel Demand Model" developed by the Contra Costa Transportation Authority (CCTA).
- *Year 2030 Plus Project Conditions* – This scenario begins with the conditions determined for the year 2030 conditions above and adds traffic that would be generated by the proposed Emerson Ranch Project.

Already approved projects consist of developments that are either under construction, are completed but fully or partially unoccupied, or that are not yet built but have final development-plan approval from the City. The methodology used assumes that all approved projects are completed and fully occupied in the year 2030 traffic scenarios.

Trip Generation

Trip generation is defined as the number of one-way vehicle trips produced by a particular land use or study site. Trips generated by the Emerson Ranch Project were estimated using the rates contained in *Trip Generation, Seventh Edition,* published by the Institute of Transportation Engineers.

Trip Distribution and Assignment

Trip distribution is the process of determining in what proportion vehicle trips will travel between different locations within a traffic study area. Trip assignment is the allocation of vehicle trips to available routes (local streets) between locations in the traffic study area. Traffic was distributed to the roadway system manually based on existing travel patterns. Future traffic generated by approved and buildout developments was distributed and assigned to the local street system using information from the City of Oakley and Contra Costa County General Plans and from the "Eastern Contra Costa County Travel Demand Model," which takes into account likely peak-hour route choices.

Roadway Improvements Assumptions

Based on information provided to Abrams Associates by the City and the data contained in the East County Travel Demand Model, the long-term scenarios include major improvements to the traffic network including a SR-4 bypass, improvements to Laurel Road, an extension of Laurel Road connecting to Sellers Avenue, and improvements to Sellers Avenue between Cypress Road and Laurel Road. The Year 2030 analyses were prepared based on the assumption that these key roadway improvements in the study area will be fully completed as planned.

Intersection Capacity Analysis

The level of service (LOS) measurement is a qualitative description of traffic operating conditions for intersections and roadways. Levels of service describe these conditions in terms of such factors as speed, travel time, delays, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Levels of service are given letter designations ranging from A to F, which are defined in Tables 3 and 4 below. The LOS measurement that is used to determine the significance of any impacts a project might have on traffic and circulation is an intersection's *overall* LOS. Separate methodologies are used to determine levels of service at signalized and unsignalized intersections.

Signalized Intersections

The operating conditions at the signalized study intersections were evaluated using the most recent 1995 update of the Contra Costa County Transportation Authority's CCTALOS Program (Version 2.35). This is the intersection analysis methodology currently required by the CCTA. This program uses the TRB (Transportation Research Board) Circular 212 methodology to analyze the operations at signalized intersections based on the utilization of intersection capacity. The LOS definitions for signalized intersections are included in Table 3.

Table 3
Level of Service for Signalized Intersections

The **2000 HIGHWAY CAPCITY MANUAL** methodology for analyzing signalized intersections measures the performance by the control delay per vehicle in seconds. The **CRITICAL MOVEMENT ANALYSIS METHODOLOGY**[4], required by the CCTA is described in Transportation Research Board's Circular 212, defines Level of Service (LOS) for signalized intersections in terms of the ratio of critical movement traffic volumes to an estimate of the maximum capacity for critical volume at an intersection. Critical movements at an intersection are calculated by determining the maximum traffic volumes for conflicting traffic movements (i.e., left-turns plus opposing through traffic) per single stream of traffic (by lane). For the Critical Movement Methodology the **LOS** for intersections is determined by the ratio of critical movement volume to critical movement capacity (volume-to-capacity ratio = V/C) for the entire intersection. Six categories of LOS are defined, ranging from **LOS "A"** with minor delay to **LOS "F"** with delays averaging more than 40 seconds during the peak hour.

Level-of-Service		Description
LOS "A" V/C Range Average Stop Delay (seconds)	 0.00 - 0.60 0.0 - 10.0	Free flow. If signalized, conditions are such that no vehicle phase is fully utilized and no vehicle waits through more than one red indication. Very slight or no delay.
LOS "B" V/C Range Average Stop Delay (seconds)	 0.61 - 0.70 10.1 - 20.0	Stable flow. If signalized, an occasional approach phase is fully utilized; vehicle platoons are formed. Slight delay.
LOS "C" V/C Range Average Stop Delay (seconds)	 0.71 - 0.80 20.1 – 35.0	Stable flow or operation. If signalized, drivers occasionally may have to wait through more than one red indication. Acceptable delay.
LOS "D" V/C Range Average Stop Delay (seconds)	 0.81 - 0.90 35.1 - 55.0	Approaching unstable flow or operation; queues develop but quickly clear. Tolerable delay.
LOS "E" V/C Range Average Stop Delay (seconds)	 0.91 - 1.00 55.1 - 80.0	Unstable flow or operation; the intersection has reached ultimate capacity; Congestion and intolerable delay.
LOS "F" V/C Range[5] - Measured - Forecast Average Stop Delay (seconds)	 1.00 or less 1.01 or more > 80	Forced flow or operation. Intersection operates below capacity. Jammed

Unsignalized Intersections

For unsignalized intersections the methodology set forth in Chapter 10 of the 2000 Highway Capacity Manual was used. This methodology is based on average total delay (seconds/vehicle).

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[4] Source: "Planning Level Methodology - Signalized Intersections" *Circular 212*, Transportation Research Board, Washington D.C., January, 1980

[5] While forecast demands can exceed maximum capacity, actual measured volumes theoretically cannot. Since traffic inefficiencies arise at capacity demand conditions, the calculated V/C ratios for LOS "F" conditions can be substantially below a V/C of 1.00.

The HCM analysis was conducted using Traffix 7.7 and the level-of-service calculations are included in the appendix to this report.

As with signalized intersections, there are six levels of service for unsignalized intersections, A through F, which represent conditions from best to worst, respectively. Table 4 shows the corresponding average total delay per vehicle at unsignalized intersections for each LOS category from A to F.

Table 4
Level-of-Service for Unsignalized Intersections

Level of Service (LOS)	Ave Total Delay (sec/veh)	Traffic Condition
A	< 10	No Delay
B	>10 - 15	Short Delay
C	>15 – 25	Moderate Delay
D	>25 – 35	Long Delay
E	>35 – 50	Very Long Delay
F	> 50	Volume>Capacity

Baseline Plus Project Conditions

<u>Trip Generation – Emerson Ranch Project</u>

As mentioned previously, the Emerson Ranch is proposed for residential development consisting of 578 single-family residential units and would also include an approximately 278,000 square-foot neighborhood shopping center. The trip generation rates for this project were based on the most current ITE rates from the seventh edition of the ITE Trip Generation Manual for Single-family Detached Housing (Land Use Code 210) and Shopping Center (Land Use Code 820) as shown in Table 5. Based on these ITE trip rates, the daily and peak hour project trips have been calculated. At the three proposed entrances the project is expected to generate about 13,408 vehicle trips per day, with about 623 trips during the AM peak hour and about 1,272 trips during the PM peak hour. A summary of the estimated trip generation during the AM and PM peak hours is shown on Table 6. The project trips forecast to be added to each of the study intersections are shown on Figure 6.

Table 5
Trip Generation Rates for the Emerson Ranch Project

ITE Trip Generation Rates (Trips per 1,000 sq ft)							
		AM Peak Hour (8:00-9:00 AM)			PM Peak Hour (5:00-6:00 PM)		
Development	**Daily**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Single-Family Detached Housing	9.57	0.19	0.56	0.75	0.64	0.37	1.01
Shopping Center	42.92	0.63	0.40	1.03	1.80	1.95	3.75

Table 6
Trip Generation for the Emerson Ranch Project

Number of Vehicle Trips							
		AM Peak Hour (8:00-9:00 AM)			PM Peak Hour (5:00-6:00 PM)		
Development	**Daily Trips**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Single-Family Detached Housing (578 units)	5,531	110	324	434	370	214	584
Shopping Center (278,000 square feet)	11,934	175	112	286	500	542	1,043
Shopping Center Pass-By Traffic (34 percent)	4,057	59	38	97	170	184	355
Net New Shopping Center Trips	7,876	115	74	189	330	358	688
Total Project Trips	13,408	225	397	623	700	572	1,272

Pass-By Traffic

Pass-by trips are project trips that are assumed to enter the site and then resume travel in the same direction. They are trips made as intermediate stops on the way from an origin to a primary destination. For the purposes of this analysis the pass-by adjustments have only been applied to the shopping center component of the Emerson project.

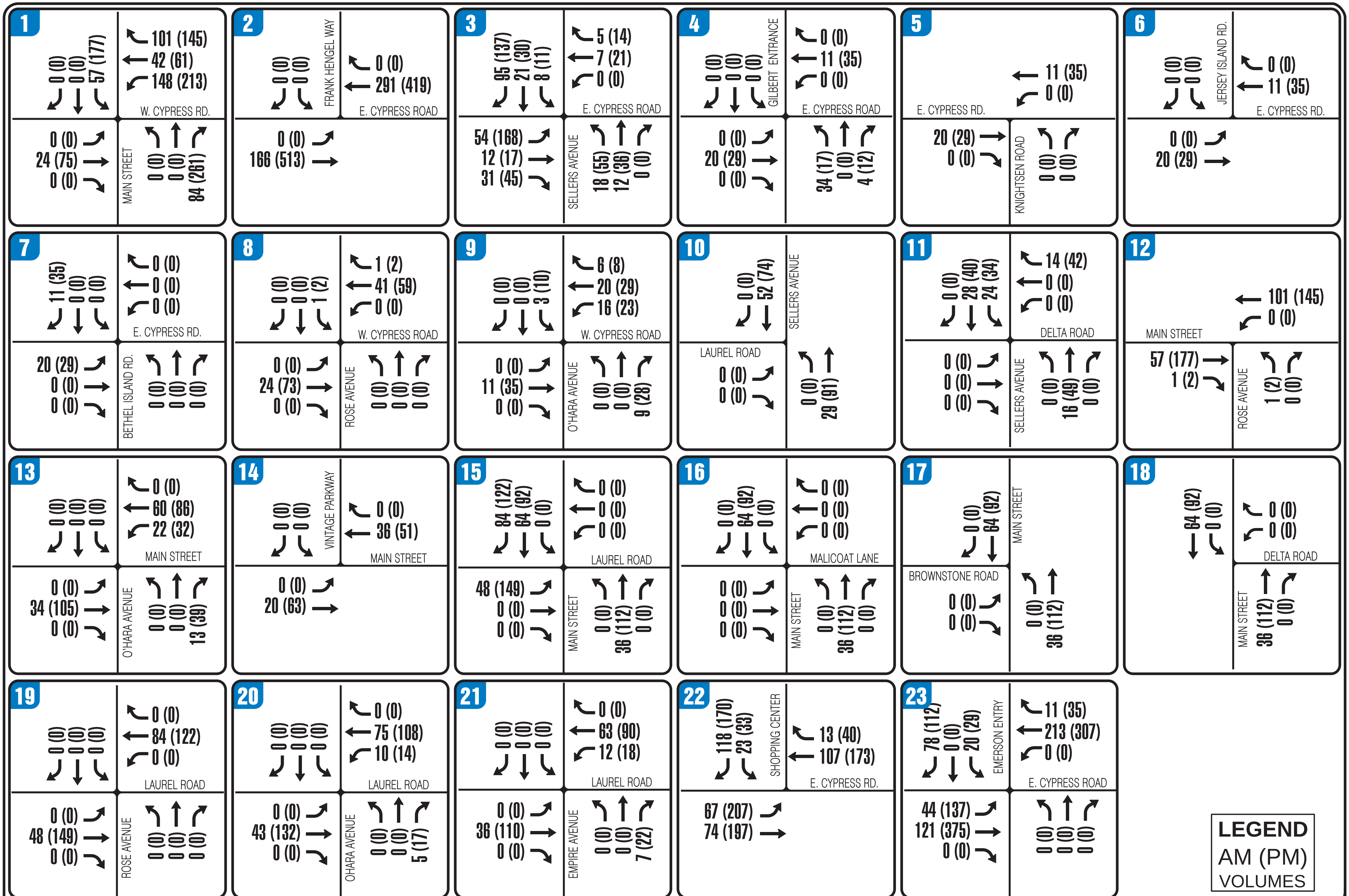

FIGURE 6 | AM (PM) PROJECT TRIP GENERATION VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

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Trip Distribution – Emerson Project

Figure 7 shows the trip distribution percentages that were used in the analysis. Figure 8 shows the resulting existing plus project turning movements at each of the study intersections. Although Cypress Road would remain the primary access to the project, in the future a large portion of the traffic from this area is assumed to travel to and from the south on Sellers Avenue to access the SR 4 Bypass via the planned extension of Laurel Road. It should also be noted that it is forecast that approximately 22 percent of the project traffic would be internal trips within the Oakley city limits.

Project Roadway Improvements

Consistent with the Oakley 2020 General Plan, roadway infrastructure would be constructed to meet the needs of new residential neighborhoods and provide access to this portion of Oakley. Street widths would be designed in accordance with traffic studies completed for the project as well as the Oakley 2020 General Plan.

Cypress Road will be improved along the project boundary with a landscaped median, as well as a landscaped corridor with a trail on the north side of the road. The project would complete the northern half of Cypress Road with two westbound through lanes from Sellers Avenue to the western boundary of the project.

Sellers Avenue will be constructed as a two lane divided road from Cypress Road north to the project boundary with the CCWD/USBR Right of Way (see Figure 2.4), as adopted by the Development Agreement.

Local streets will be designed and constructed per City of Oakley and Contra Costa County standards.

FIGURE 7 | TRIP DISTRIBUTION

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Emerson Ranch

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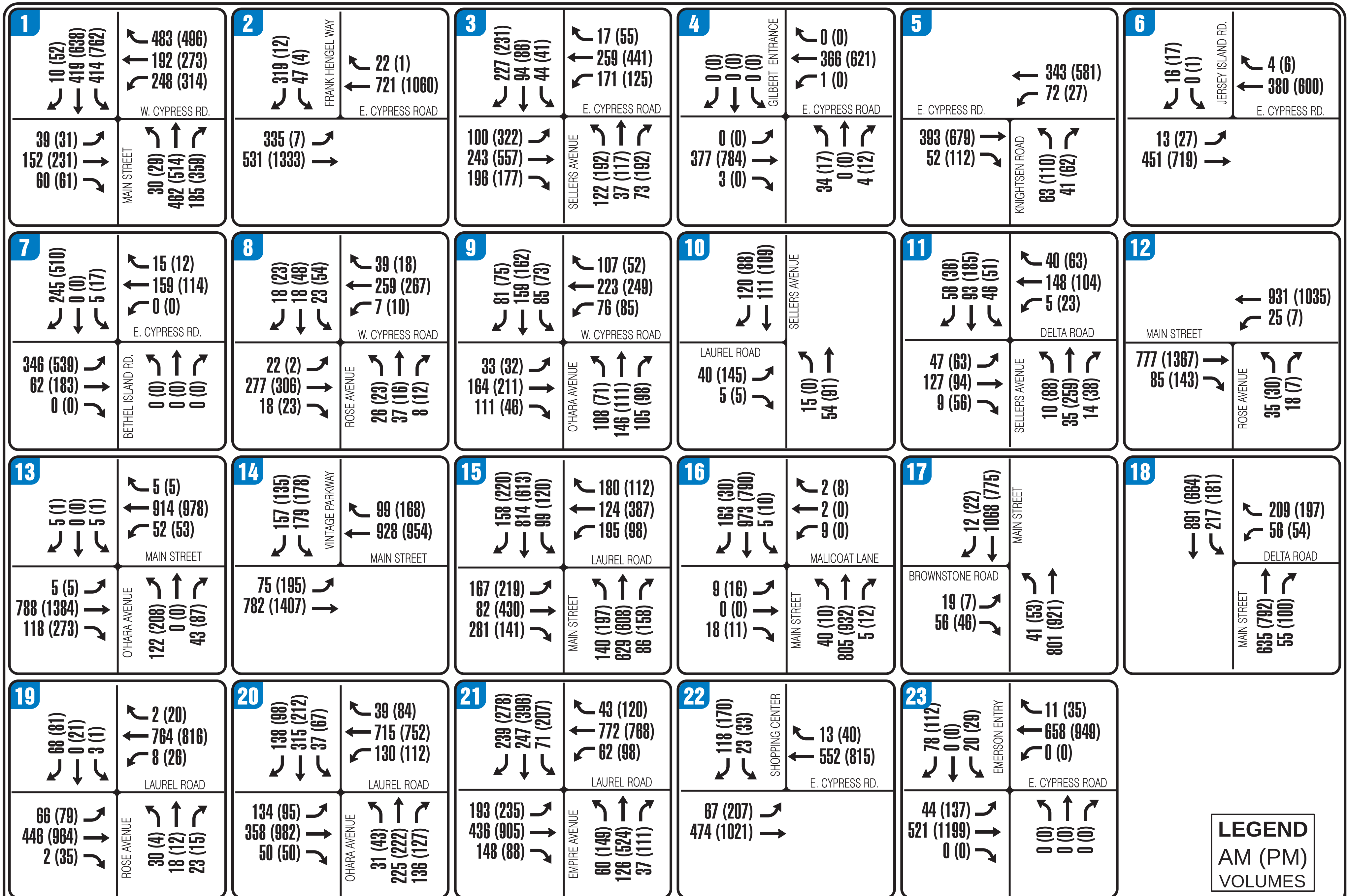

FIGURE 8 | AM (PM) BACKGROUND PLUS PROJECT VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

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Other roadway improvements associated with the Emerson Ranch project include the following:

- Transition of Sellers Avenue north to the future community park;
- Modification of existing traffic signal at Sellers Avenue and East Cypress Road and installation of two new traffic signals at the main entrances to the residential area and to the shopping center.
- Modification of existing driveways to adjacent properties.
- Modification of existing Cypress Road improvements (adjacent to Cypress Grove development) along western boundary for connection;
- Transition of Sellers Avenue north to the future community park;

Intersection Operations

The capacity calculations for the Baseline Plus Project scenario are shown in Table 7. As seen in this table, the addition of traffic from the Proposed Project does not result in any other intersections degrading to unacceptable levels. In general, the analysis indicated the project would not cause any other significant impacts on traffic operations in the area.

The project LOS shown in Table 7 does not include the mitigation measures discussed in the "2006 Baseline Plus Project Impacts and Mitigation Measures" section. Many of the proposed mitigation measures are intended to accommodate cumulative traffic conditions. With these mitigations in place all intersections would have acceptable operations (LOS "D" or better) and the project's impacts on traffic operations would be mitigated to a less than significant level. The complete LOS calculations for all the alternatives are included in the appendix.

Intersection Signalization Needs

Traffic signals are used to provide for an orderly flow of traffic through an intersection. Many times they are needed to provide side street traffic and opportunity to access a major road where high volumes and/or high vehicle speeds block crossing or turn movements. They do not, however, necessarily increase the capacity of an intersection (i.e., increase the intersection's ability to accommodate additional vehicles) and, in fact, often slightly reduce the number of total vehicles

TABLE 7
BASELINE PLUS PROJECT INTERSECTION OPERATIONS

	INTERSECTION	CONTROL	PEAK HOUR	BASELINE		CONTROL	BASELINE + EMERSON	
				MEASURE	LOS		MEASURE	LOS
1	Main Street (SR 4) and Cypress Road	Traffic Signal	AM PM	v/c = 0.39 v/c = 0.50	A A	Traffic Signal	v/c = 0.49 v/c = 0.69	A B
2	East Cypress Road/Frank Hengel Way	Traffic Signal	AM PM	v/c = 0.35 v/c = 0.24	A A	Traffic Signal	v/c = 0.44 v/c = 0.39	A A
3	East Cypress Road/Sellers Avenue	Traffic Signal	AM PM	v/c = 0.34 v/c = 0.40	A A	Traffic Signal	v/c = 0.39 v/c = 0.51	A A
4	East Cypress Road/Main Project Entrance	Future	AM PM	N/A N/A	N/A N/A	Traffic Signal	v/c = 0.23 v/c = 0.49	A A
5	East Cypress Road/Knightsen Avenue	Stop Sign	AM PM	14.2 sec 23.6 sec	B C	Stop Sign	14.6 sec 25.7 sec	B D
6	East Cypress Road/Jersey Island Road	Stop Sign	AM PM	9.5 sec 10.7 sec	A B	Stop Sign	9.5 sec 10.9 sec	A B
7	East Cypress Road/Bethel Island Road	Traffic Signal	AM PM	v/c = 0.22 v/c = 0..30	A A	Traffic Signal	v/c = 0.23 v/c = 0..31	A A
8	West Cypress Road at Rose Avenue	Stop Sign	AM PM	8.5 sec 8.3 sec	A A	Stop Sign	8.8 sec 8.9 sec	A A
9	West Cypress Road at O'Hara Avenue	Stop Sign	AM PM	11.4 sec 9.9 sec	B A	Stop Sign	12.6 sec 11.2 sec	B B
10	Sellers Avenue at Laurel Road	Stop Sign	AM PM	9.2 sec 9.3 sec	A A	Stop Sign	9.7 sec 10.5 sec	A B
11	Sellers Avenue at Delta Road	Stop Sign	AM PM	7.9 sec 9.1 sec	A A	Stop Sign	8.1 sec 9.8 sec	A A
12	Main Street (SR 4) at Rose Avenue	Stop Sign	AM PM	40.2 sec >50 sec	E F	Stop Sign	>50 sec >50 sec	F F
13	Main Street (SR 4) at O'Hara Avenue	Traffic Signal	AM PM	v/c = 0.60 v/c = 0.92	A E	Traffic Signal	v/c = 0.64 v/c = 1.00	B E
14	Main Street (SR 4) at Vintage Parkway	Traffic Signal	AM PM	v/c = 0.44 v/c = 0.53	A A	Traffic Signal	v/c = 0.45 v/c = 0.54	A A
15	Main Street (SR 4) at Laurel Road	Traffic Signal	AM PM	v/c = 0.60 v/c = 0.64	A B	Traffic Signal	v/c = 0.67 v/c = 0.80	B C
16	Main Street (SR 4) at Malicoat Avenue	Traffic Signal	AM PM	v/c = 0.37 v/c = 0.27	A A	Traffic Signal	v/c = 0.38 v/c = 0.31	A A
17	Main Street (SR 4) at Brownstone Rd	Stop Sign	AM PM	>50 sec 28.5 sec	F D	Stop Sign	>50 sec >50 sec	F F
18	Main Street (SR 4) at Delta Road	Stop Sign	AM PM	>50 sec >50 sec	F F	Stop Sign	>50 sec >50 sec	F F
19	Laurel Road at Rose Avenue	Stop Sign	AM PM	40.3 sec >50 sec	E F	Stop Sign	>50 sec >50 sec	F F
20	Laurel Road at O'Hara Avenue	Traffic Signal	AM PM	v/c = 0.50 v/c = 0.49	A A	Traffic Signal	v/c = 0.52 v/c = 0.54	A A
21	Laurel Road at Empire Avenue	Traffic Signal	AM PM	v/c = 0.53 v/c = 0.70	A B	Traffic Signal	v/c = 0.55 v/c = 0.73	A C

that can pass through an intersection in a given period of time. Signals can also cause an increase in traffic accidents if installed at improper locations.

There are eleven possible tests (called "warrants") set forth by Caltrans (and the Manual of Uniform Traffic Control Devices) for determining whether a traffic signal should be considered for installation. These tests consider criteria such as traffic volumes and delay, pedestrian volumes, presence of school children, and accident history. Usually, two or more warrants must be met before a signal is installed. If the Peak Hour Volume Warrant (Warrant #11) is met at an intersection that is usually a strong indication that a more detailed signal warrant analysis covering all possible warrants is appropriate.

For this report observations of peak hour traffic conditions and a test for peak hour volumes were conducted at all unsignalized project study intersections. Future traffic signals are already planned at the four unsignalized intersections that have side streets that operate at LOS E or LOS F. Although the project will contribute to the need for these traffic signals, they would not be required as mitigations since the overall LOS at these intersections would remain at acceptable levels and the traffic from the proposed project alone would not cause any intersections to meet the warrants where they were not already warranted. In summary, our review indicated that no new unsignalized study intersections would meet Caltrans warrants for installation of a traffic signal as a result of project traffic.

<u>Site Access and Circulation</u>

On Cypress Road the Emerson Ranch Project would have a signalized primary entrance on Cypress Road at the main residential entrance, another signalized entrance into the shopping center, and a secondary stop controlled entrance for the shopping center. Please note that the stop controlled exit from the shopping center onto Cypress Road would need to be restricted to right turns only. On Sellers Avenue there would be two unsignalized entrances to the project, one of which would be aligned with the potential future entrance to the Gilbert Property. The project would also have two internal connections to the existing Cypress Grove neighborhood to the west.

The proposed site plan should function well and would not cause any safety or operational problems. The project site design has been required to conform to City design standards and would not create any significant impacts to pedestrians, bicyclists or traffic operations. We also reviewed the site plan for truck access and found that that all necessary truck turning movements can be accommodated.

Emergency Vehicle Access

Factors such as number of access points, roadway width, and proximity to fire stations determine whether a project has sufficient emergency access. In this case the proposed project would provide multiple access points from the arterials in the area. Therefore, if one of the roadways is blocked or obstructed, an emergency vehicle could use an alternate route to access the project. All lane widths within the project would meet the minimum width that can accommodate an emergency vehicle; therefore the width of the internal roadways is adequate. A fire station located on East Cypress Road, just east of Bethel Island Road would allow for timely emergency response within the project area. Based on these considerations, there would be no significant impacts associated with the planned emergency vehicle access.

Alternative Transportation Access

This section discusses the pedestrian, bicycle and transit access and circulation within the project site and the consistency with adopted policies, plans and programs. For pedestrian access the roadways within the project would provide sidewalks on at least one side of the roadway. Trails would also be provided on top of the levees surrounding the project site. For bicycles off-street multi-use trails (class I facilities) would be located along the on top of the levees surrounding the project site, and through some of the parks within the site. On-street bicycle lanes (class II) would be provided along both sides of East Cypress Road and Sellers Avenue. Dedicated bicycle facilities would not be provided along the internal roads or local streets within the neighborhoods.

There is currently no transit at the site. However, given the amount of planned development in the area surrounding the project, Tri Delta Transit, the local transit service provider, may decide to provide regular transit service in the area. The arterials and collectors within the project area would provide adequate lane widths to accommodate future transit vehicles and bus pullouts are currently planned for East Cypress Road at Sellers Avenue. In general, the project's current design would not conflict with the City's adopted alternative transportation policies and plans.

Parking

The proposed project is expected to provide a minimum of two off-street parking spaces for each residential unit and will provide adequate parking for the shopping center to ensure consistency with the County requirements. There will also be new on-street parking spaces created along the new internal project roadways. Therefore the proposed project is not expected to create negative parking impacts on the surrounding area.

Potential Elementary School Site

An analysis was conducted of the potential trip generation effects of a new elementary school planned to be constructed in the area. Our review indicated the presence of a school in any of the proposed locations would not change any of the results or conclusions in this report. This assumes that the future school access intersections will be properly designed so that no new safety problems are created. At this stage of planning it appears that vehicle and pedestrian access can be safely accommodated since there will be numerous new signalized intersections in the area.

A large portion of the students for any elementary school would come from the planned homes in the Cypress corridor. Therefore, many of the school trips in question would already be using Cypress Road and would not be new trips to the area. It should also be noted that a school would not significantly affect the PM commute peak hour (which is the design hour / critical hour in this area). In summary, a new elementary school in the project area would not result in a substantial increase in trips generated during the critical peak hour and should not require additional analysis as part of this report. A detailed comparison of the trip generation from a potential school has been included in the appendix as Table A-1.

Baseline Plus Project Impacts and Mitigation Measures

3.7-1 The addition of project traffic would contribute to unacceptable LOS F operations during the peak hours at East Cypress Road and the minor (stop-controlled) shopping center entrance and on Main Street at O'Hara Avenue, Cypress Road, and at Malicoat Avenue.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

3.7-1 (a) Mitigation of the unacceptable conditions at intersections on Main Street will be partially achieved through the planned completion of the SR 4 Bypass and improvements to Laurel Road and Sellers Avenue as discussed below. This mitigation would provide an alternative to route to Main Street and alleviate some of its congestion. The proposed project would contribute to this mitigation by paying its fair share of the cost through the payment of regional traffic fees to the East Contra Costa Regional Fee and Finance Authority (ECCRFFA) and the East County Transportation Improvement Authority (ECTIA).

Improvements to Laurel Road would include widening it to a four-lane arterial between Empire Avenue and Main Street, and extending it on the east from its current terminus just west of the Union Pacific Railroad to Sellers Avenue. Sellers Avenue would be upgraded to a four-lane arterial between East Cypress Road and Laurel Road. These roadway improvements on Laurel Road and Sellers Avenue in conjunction with the construction of Segment 1 of the SR 4 Bypass would provide access to and from the SR 4 freeway, and improve operations along East Cypress Road and Main Street. These roadway improvements have been identified in the City's General Plan and are included in the City's Transportation Impact Fee Program.

3.7-5(b) Complete mitigation of the unacceptable conditions at Main Street/O'Hara Avenue intersection can be achieved through the construction of the Main Street Downtown Bypass. This project would realign Main Street north of its current alignment as a new four-lane arterial between west of Vintage Parkway and 2nd Street and provide an alternative to Main Street through Downtown Oakley. The Main Street Downtown Bypass was included in the *Old Town Oakley Specific Plan* in 1999. The project is also included in the City's General Plan and the City's Transportation Impact Fee Program. The proposed project would contribute to this mitigation by paying its fair share of the cost through the payment of the City's Transportation Impact Fee.

3.7-5(c) Restrict the minor (stop-controlled) shopping center driveway on East Cypress Road to right-turns only. This location would exceed the City's Standards without the proposed restriction and it is also clear that it would not be possible to safely accommodate left-turns unless the driveway were located in advance of the eastbound left-turn lane for the traffic signal at Sellers Avenue.

3.7-2 The addition of project traffic would contribute to the need for traffic signals at Main Street and Rose Avenue, Main Street and Brownstone Road, Main Street and Delta Road, and East Cypress Road and Knightsen Avenue.

<u>Mitigation Measure(s)</u>
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

3.7-2 (a) Although the overall LOS at these unsignalized intersections would remain acceptable with the addition of project generated trips, traffic would be added to minor movements that would continue to operate at LOS F. Traffic signals will ultimately be warranted at each of these locations regardless of whether or not the proposed project is implemented. However, the proposed project would be required to contribute by paying its fair share of the signals through the payment of the City's Transportation Impact Fee. The project does not require installation of these signals to meet the LOS standards but it is recommended that the City continue to monitor these intersections in the interim for higher than normal accident rates.

3.7-3 The project could result in impacts to the Railroad Crossing on Cypress Road.

The proposed project is expected to generate 232 eastbound trips on Cypress Road during the evening peak hour. Even with the widening of Cypress Road to four lanes a ***potentially significant*** impact would result from the proposed project to the railroad crossing on Cypress Road.

<u>Mitigation Measure(s)</u>
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

3.7-3(a) Implement mitigation measure 3.7-1(a).

3.7-4 The project could create a need for expanded access to public transit.

The project area is currently provided transit service by Tri-Delta Transit. The proposed project would increase demand for public transit service. The proposed roadway improvements are designed to meet minimum City of Oakley standards, which could accommodate transit services. Tri-Delta Transit, after reviewing the Final Development Plan, indicated that the proposed project could be served in the future if bus stops and/or shelters are included in the designs, which has been proposed. The lack of service to the project area would be a *potentially significant* impact.

Mitigation Measure

Implementation of the following mitigation measure would reduce the impact from the proposed project to a *less-than-significant* level.

3.7-4(a) *The project shall include bus stops on both sides of Cypress Road near Sellers Avenue. The final design and location of these bus stops are subject to the approval of the Oakley City Engineer and Tri-Delta Transit.*

Cumulative Conditions

Cumulative (2030) Traffic Forecasts

Cumulative traffic forecasts for this study were based on information obtained from the East County Travel Demand Model and the East Cypress Road Specific Plan Traffic Study[1]. The model was executed with the following land use assumptions:

- Buildout of the Oakley General Plan within the City of Oakley.
- The Association of Bay Area Governments (ABAG) Projections 2000 land use forecasts extended to year 2030 for areas outside of Oakley.

The resulting Cumulative (no project) traffic volumes at each of the project study intersections are shown on Figure 9**.**

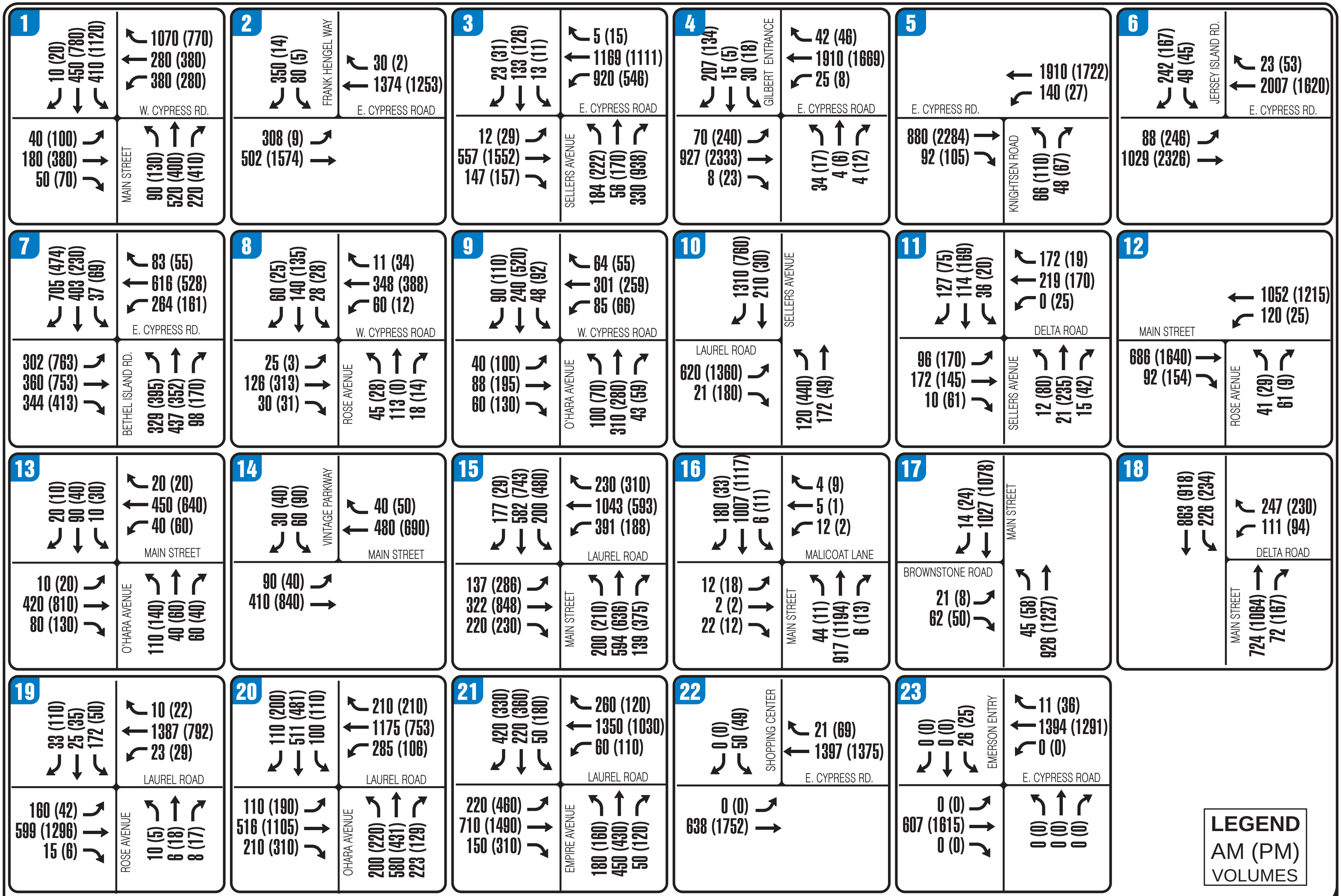

FIGURE 9 | AM (PM) CUMULATIVE (NO PROJECT) VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

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Cumulative (2030) Planned Roadway Improvements

This analysis assumes that several roadway improvements would be constructed in the interim period between the Baseline and Cumulative analysis years. Only roadway improvements with identified funding or identified as mitigation measures under the Baseline conditions were included in this scenario. Please note that some portions of these improvements would be constructed as part of the proposed project. Major roadway improvements that are fully funded and planned to be completed by 2030 include:

- Completion of SR 4 Bypass Segment 2 as a four-lane freeway between Lone Tree Way and Balfour Road with interchanges at Sand Creek Road and Balfour Road
- Completion of SR 4 Bypass Segment 3 as a two-lane expressway between Balfour Road and Vasco Road with at-grade intersections at Marsh Creek Road and Walnut Boulevard
- Widening of Main Street to a six-lane arterial between Big Break Road and SR 160
- Extension of Laurel Road from Empire Avenue to Antioch City Limits
- Completion of a two-lane bridge over Rock Slough connecting Bethel Island Road and Byron Highway
- Widening of East Cypress Road to a six-lane arterial between Sellers Avenue and Jersey Island Road
- Extension of Laurel Road between Union Pacific Railroad and Sellers Avenue as a four-lane arterial
- Widening of Sellers Road to a four-lane arterial between East Cypress Road and Laurel Road
- Widening of Laurel Road to a four-lane arterial between Empire Avenue and Main Street
- Signalization of the intersections of Main Street with Rose Avenue, Brownstone Road, and Delta Road and the intersections of Sellers Avenue with Laurel Road and Delta Road.
- Completion of the Main Street Downtown Bypass

Cumulative (Year 2030) Without Project Scenario

The results of the Year 2030 (No Project) levels of service are summarized in Table 8. Under the No Project scenario, the above-listed assumptions were made as to transportation improvements. Based on the information provided by the City and the data contained in the East County Travel Demand Model, the long-term scenarios considered major improvements to the traffic network including the SR-4 Bypass and the extension of Laurel Road to Sellers Avenue. Assuming completion

TABLE 8
CUMULATIVE AND CUMULATIVE PLUS PROJECT INTERSECTION OPERATIONS

	INTERSECTION	CONTROL	PEAK HOUR	CUMULATIVE NO PROJECT		CUMULATIVE + PROJECT	
				MEASURE	LOS	MEASURE	LOS
1	Main Street (SR 4) and Cypress Road	Traffic Signal	AM	v/c = 0.65	B	v/c = 0.71	C
			PM	v/c = 0.75	C	v/c = 0.88	D
2	East Cypress Road/Frank Hengel Way	Traffic Signal	AM	v/c = 0.63	B	v/c = 0.72	C
			PM	v/c = 0.46	A	v/c = 0.61	B
3	East Cypress Road/Sellers Avenue	Traffic Signal	AM	v/c = 0.67	B	v/c = 0.69	B
			PM	v/c = 0.83	D	v/c = 0.89	D
4	East Cypress Road/Main Project Entrance	Traffic Signal	AM	v/c = 0.72	C	v/c = 0.72	C
			PM	v/c = 0.76	C	v/c = 0.78	C
5	East Cypress Road/Knightsen Avenue	Traffic Signal	AM	v/c = 0.59	A	v/c = 0.60	A
			PM	v/c = 0.74	C	v/c = 0.77	C
6	East Cypress Road/Jersey Island Road	Traffic Signal	AM	v/c = 0.73	C	v/c = 0.73	C
			PM	v/c = 0.70	B	v/c = 0.71	C
7	East Cypress Road/Bethel Island Road	Traffic Signal	AM	v/c = 0.73	C	v/c = 0.74	C
			PM	v/c = 0.79	C	v/c = 0.80	C
8	West Cypress Road at Rose Avenue	Stop Sign	AM	10.6 sec	B	11.9 sec	B
			PM	10.5 sec	B	13.0 sec	B
9	West Cypress Road at O'Hara Avenue	Stop Sign	AM	16.4 sec	C	20.0 sec	C
			PM	38.8 sec	E	46.0 sec	E
10	Sellers Avenue at Laurel Road	Traffic Signal	AM	v/c = 0.58	A	v/c = 0.58	A
			PM	v/c = 0.71	C	v/c = 0.75	C
11	Sellers Avenue at Delta Road	Traffic Signal	AM	v/c = 0.47	A	v/c = 0.51	A
			PM	v/c = 0.47	A	v/c = 0.59	A
12	Main Street (SR 4) at Rose Avenue	Traffic Signal	AM	v/c = 0.36	A	v/c = 0.39	A
			PM	v/c = 0.55	A	v/c = 0.61	B
13	Main Street (SR 4) at O'Hara Avenue	Traffic Signal	AM	v/c = 0.43	A	v/c = 0.47	A
			PM	v/c = 0.66	B	v/c = 0.74	C
14	Main Street (SR 4) at Vintage Parkway	Traffic Signal	AM	v/c = 0.24	A	v/c = 0.25	A
			PM	v/c = 0.30	A	v/c = 0.31	A
15	Main Street (SR 4) at Laurel Road	Traffic Signal	AM	v/c = 0.72	C	v/c = 0.79	C
			PM	v/c = 0.70	B	v/c = 0.84	D
16	Main Street (SR 4) at Malicoat Avenue	Traffic Signal	AM	v/c = 0.41	A	v/c = 0.43	A
			PM	v/c = 0.39	A	v/c = 0.42	A
17	Main Street (SR 4) at Brownstone Rd	Traffic Signal	AM	v/c = 0.38	A	v/c = 0.40	A
			PM	v/c = 0.41	A	v/c = 0.44	A
18	Main Street (SR 4) at Delta Road	Traffic Signal	AM	v/c = 0.45	A	v/c = 0.46	A
			PM	v/c = 0.57	A	v/c = 0.61	B
19	Laurel Road at Rose Avenue	Traffic Signal	AM	v/c = 0.62	B	v/c = 0.64	B
			PM	v/c = 0.47	A	v/c = 0.51	A
20	Laurel Road at O'Hara Avenue	Traffic Signal	AM	v/c = 0.82	D	v/c = 0.85	D
			PM	v/c = 0.82	D	v/c = 0.87	D
21	Laurel Road at Empire Avenue	Traffic Signal	AM	v/c = 0.97	E	v/c = 0.99	E
			PM	v/c = 0.93	E	v/c = 0.96	E

of the proposed transportation network improvements, only the intersection of West Cypress Road at O'Hara Avenue is forecast to degrade to unacceptable operations with the traffic growth estimated by the year 2030.

Year 2030 With Project Scenario

The Cumulative (2030) traffic volumes with the addition of traffic from the proposed project are shown in Figure 10 and the future lane configurations are shown in Figure 11. The resulting levels of service for the "Cumulative plus Project" scenario are compared to the "No Project" scenario in Table 8.

Assuming completion of the proposed transportation network improvements, only the intersection of West Cypress Road at O'Hara Avenue is forecast to have unacceptable operations with the traffic growth estimated by the year 2030. As mentioned above, this intersection is forecast to operate at LOS F in the PM peak hour regardless of whether or not the proposed project is implemented. Although some of the intersections would be operating at a high LOS D (Near LOS E), all study intersections would have acceptable operations with the implementation of the recommended mitigation measures outlined in this report.

3.7-5 The project would result in cumulative impacts to the intersection at West Cypress Road/O'Hara Avenue

The proposed project would contribute to the deterioration of the all-way stop-controlled West Cypress Road/O'Hara Avenue intersection to LOS F during the PM peak hour. The degradation of the intersection from an LOS D to an LOS F during a peak hour is considered a *significant impact*.

Mitigation Measure(s)
Implementation of the following mitigation measures would mitigate potential impacts to a *less-than-significant* level. These measures would minimize impacts to the intersection and change the LOS F to an LOS C during the evening peak hour.

3.7-7(a) *Applicant shall be responsible for the project's fair share of a traffic signal or additional turn lanes and the project's fair share funding shall be submitted as determined by the City Engineer prior to the recording of final maps.*

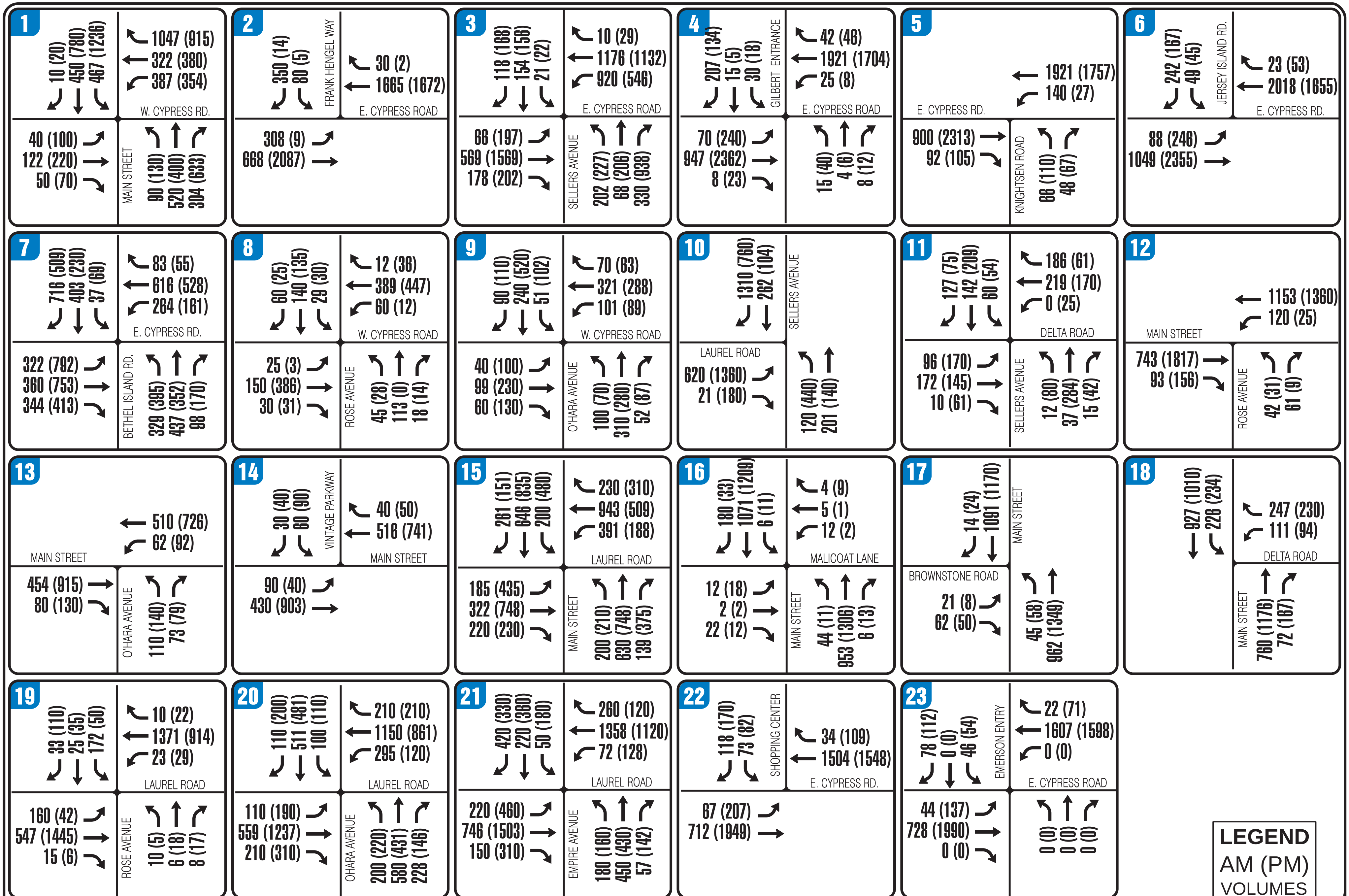

FIGURE 10 | AM (PM) CUMULATIVE PLUS PROJECT VOLUMES

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.

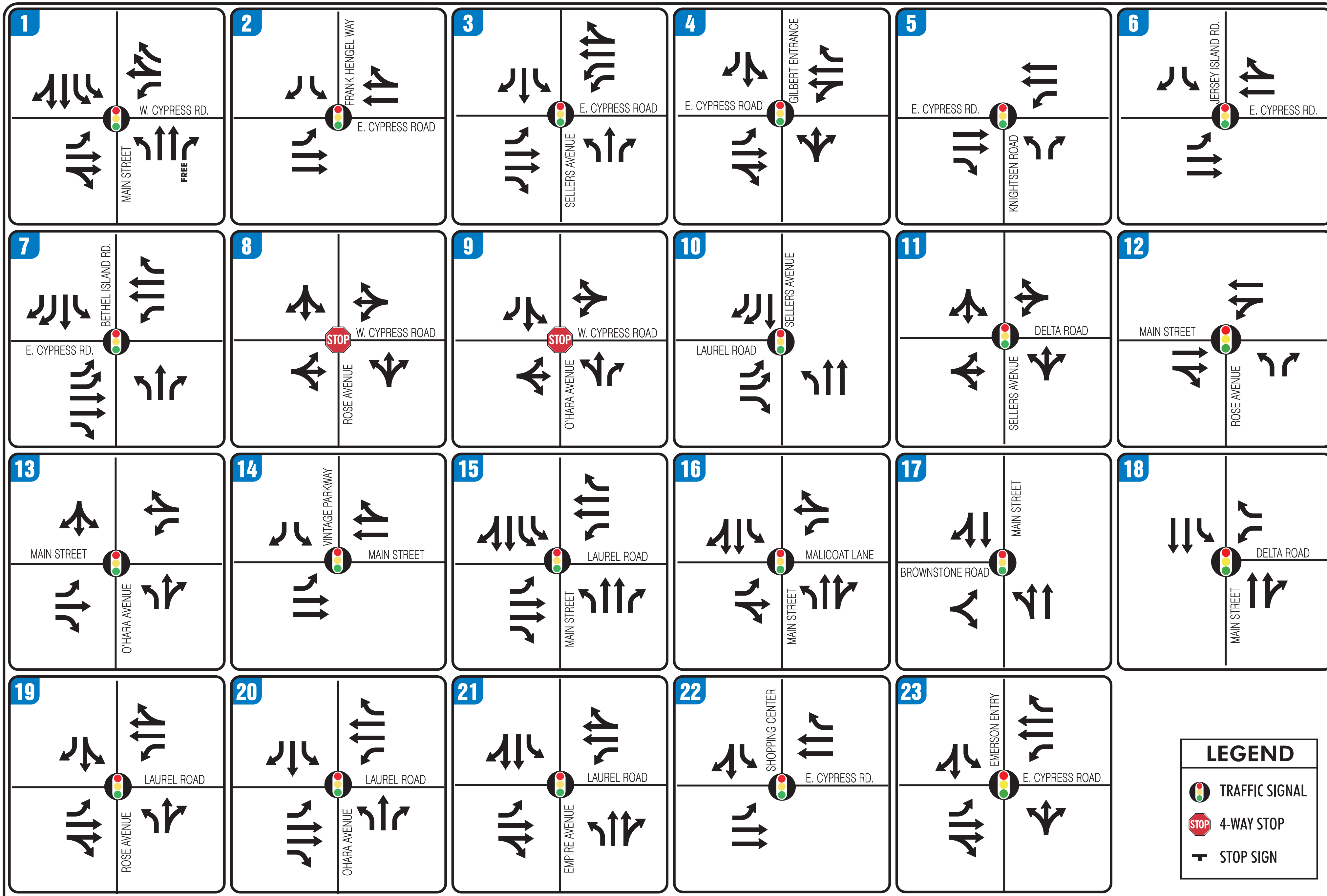

FIGURE 11 | CUMULATIVE PLUS PROJECT LANE CONFIGURATIONS

TRAFFIC IMPACT STUDY

Emerson Ranch

City of Oakley

Abrams Associates
TRAFFIC ENGINEERING, INC.

3.7-6 The addition of project traffic would contribute to the unacceptable LOS E or LOS F operations at the Laurel Road/Empire Avenue intersection during both AM and PM peak hours under Cumulative with Project conditions.

The proposed project would contribute to the intersection of Laurel Road and Empire Avenue deteriorating to unacceptable operations. Please note that this intersection is forecast to have unacceptable operations regardless of whether or not the proposed project is implemented.

Mitigation Measure(s)
Implementation of the following mitigation measures would mitigate potential impacts to a *less-than-significant* level. These measures would minimize impacts to the intersection and change the LOS F to an LOS D during the evening peak hour.

3.7-6(a) *Mitigation of the unacceptable conditions at the Laurel Road/Empire Avenue intersection can be achieved through providing exclusive right-turn lanes on all approaches. This improvement project is not included in the City's Transportation Impact Fee Program. The proposed project would contribute to this mitigation by paying its fair share of the cost.*

APPENDIX

EMERSON RANCH
CITY OF OAKLEY

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Tel: 925.945.0201

Abrams Associates
TRAFFIC ENGINEERING, INC.

NOVEMBER, 2008

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Existing AM Peak Hour Volumes                         11/14/08
=========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                  Time              Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------             8  253  284
                        |   |    |
             ^          |   |    |         ^
             |       <---   v   --->       | Split? N
LEFT    80 ---  1.0   1.1  2.1  2.0   2.1 ---  318  RIGHT
                                                            STREET NAME:
THRU   201 ---> 2.1  (NO. OF LANES)   1.1<---  190  THRU  W.Cypress Rd.

RIGHT   58 ---  1.1   1.0  2.0  1.0   1.0 ---  273  LEFT
             |       <---   ^   --->       |
             v          |   |    |         v
  N                     |   |    |                         SIG WARRANTS:
W + E                  78  320  226                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	226	0 *	1650	0.0000	
	THRU (T)	320	320	3300	0.0970	0.0970
	LEFT (L)	78	78	1650	0.0473	
SB	RIGHT (R)	8	8	1650	0.0048	
	THRU (T)	253	253	3300	0.0767	
	LEFT (L)	284	284	3000	0.0947	0.0947
	T + R		261	3300	0.0791	
EB	RIGHT (R)	58	58	1650	0.0352	
	THRU (T)	201	201	3300	0.0609	
	LEFT (L)	80	80	1650	0.0485	
	T + R		259	3300	0.0785	0.0785
WB	RIGHT (R)	318	162 *	3000	0.0540	
	THRU (T)	190	190	1650	0.1152	
	LEFT (L)	273	273	1650	0.1655	0.1655
	T + R		352	3000	0.1173	

```
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.44
     INTERSECTION LEVEL OF SERVICE:                                A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Existing AM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------             2    3    1
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     1 ---  2.0   1.1  1.1  1.0   1.0 ---    0  RIGHT
                                                           STREET NAME:
THRU   210 ---> 2.1  (NO. OF LANES)   2.0<---  290  THRU   E. Cypress Rd.

RIGHT  144 ---  1.1   1.0  1.1  1.1   2.0 ---   83  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  97    2   39                          Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	39	39	1650	0.0236	
THRU (T)	2	2	1650	0.0012	
LEFT (L)	97	97	1650	0.0588	0.0588
T + R		41	1650	0.0248	
SB RIGHT (R)	2	2	1650	0.0012	
THRU (T)	3	3	1650	0.0018	
LEFT (L)	1	1	1650	0.0006	
T + R		5	1650	0.0030	0.0030
EB RIGHT (R)	144	144	1650	0.0873	
THRU (T)	210	210	3300	0.0636	
LEFT (L)	1	1	3000	0.0003	
T + R		354	3300	0.1073	0.1073
WB RIGHT (R)	0	0	1650	0.0000	
THRU (T)	290	290	3300	0.0879	
LEFT (L)	83	83	3000	0.0277	0.0277

TOTAL VOLUME-TO-CAPACITY RATIO:	0.20
INTERSECTION LEVEL OF SERVICE:	A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Existing AM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                    Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------             3    0    2
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     1 ---  1.0   1.1  1.1  1.1   1.1 ---    1  RIGHT
                                                          STREET NAME:
THRU   670 ---> 1.0  (NO. OF LANES)   1.1<---  750  THRU  Main Street

RIGHT   46 ---  1.0   1.0  1.1  1.1   1.0 ---   17  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                  52    0   20                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	20	20	1650	0.0121	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	52	52	1650	0.0315	0.0315
	T + R		20	1650	0.0121	
SB	RIGHT (R)	3	3	1650	0.0018	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	2	2	1650	0.0012	
	T + R		3	1650	0.0018	
	T + L		2	1650	0.0012	
	T + R + L		5	1650	0.0030	0.0030
EB	RIGHT (R)	46	0 *	1650	0.0000	
	THRU (T)	670	670	1650	0.4061	
	LEFT (L)	1	1	1650	0.0006	0.0006
WB	RIGHT (R)	1	1	1650	0.0006	
	THRU (T)	750	750	1650	0.4545	
	LEFT (L)	17	17	1650	0.0103	
	T + R		751	1650	0.4552	0.4552

TOTAL VOLUME-TO-CAPACITY RATIO: 0.49

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CAS.INT,VOL=...EX.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

```
===========================================================================
Condition: Existing AM Peak Hour Volumes                           11/14/08
===========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
---------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           3-PHASE SIGNAL
-----------           117    0  200
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    68 ---  1.0   1.0  0.0  1.0   1.1 ---   91  RIGHT
                                                          STREET NAME:
THRU   630 ---> 2.0  (NO. OF LANES)   2.1<---  750  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB	RIGHT (R)	117	49 *	1720	0.0285	
	LEFT (L)	200	200	1720	0.1163	0.1163
EB	THRU (T)	630	630	3440	0.1831	
	LEFT (L)	68	68	1720	0.0395	0.0395
WB	RIGHT (R)	91	91	1720	0.0529	
	THRU (T)	750	750	3440	0.2180	
	T + R		841	3440	0.2445	0.2445

TOTAL VOLUME-TO-CAPACITY RATIO: 0.40

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CAS.INT,VOL=...EX.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Existing AM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                 Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            52  571   82
                        |   |   |
             ^          |   |   |         ^
             |      <---   v   --->      | Split? N
LEFT    98 ---  1.0   1.1  2.1  1.0   1.0 ---  130  RIGHT
                                                          STREET NAME:
THRU    72 ---> 1.0  (NO. OF LANES)   1.1<---   94  THRU  Laurel Road

RIGHT  239 ---  1.0   1.0  2.1  1.1   1.1 ---  140  LEFT
             |      <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  99  455   68                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      68         68       1650     0.0412
    THRU (T)      455        455       3300     0.1379
    LEFT (L)       99         99       1650     0.0600     0.0600
    T + R                    523       3300     0.1585
------------------------------------------------------------------------
SB  RIGHT (R)      52         52       1650     0.0315
    THRU (T)      571        571       3300     0.1730
    LEFT (L)       82         82       1650     0.0497
    T + R                    623       3300     0.1888     0.1888
------------------------------------------------------------------------
EB  RIGHT (R)     239        140 *     1650     0.0848
    THRU (T)       72         72       1650     0.0436
    LEFT (L)       98         98       1650     0.0594     0.0594
------------------------------------------------------------------------
WB  RIGHT (R)     130         48 *     1650     0.0291
    THRU (T)       94         94       1650     0.0570
    LEFT (L)      140        140       1650     0.0848
    T + L                    234       1650     0.1418     0.1418
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.45
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Existing AM Peak Hour Volumes                         11/14/08
=========================================================================
INTERSECTION    16 Main Street/Malicoat Lane
Count Date                Time                 Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------           163  633    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT     9 ---  1.0   1.0  1.0  1.0   1.1 ---    2  RIGHT
                                                        STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)   1.1<---    2  THRU  Malicoat Lane

RIGHT   18 ---  1.1   1.0  1.1  1.1   1.0 ---    9  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                     SIG WARRANTS:
W + E                  40  572    5                       Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	572	572	1650	0.3467	
	LEFT (L)	40	40	1650	0.0242	0.0242
	T + R		577	1650	0.3497	
SB	RIGHT (R)	163	154 *	1650	0.0933	
	THRU (T)	633	633	1650	0.3836	0.3836
	LEFT (L)	5	5	1650	0.0030	
EB	RIGHT (R)	18	18	1650	0.0109	0.0109
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	9	9	1650	0.0055	
	T + R		18	1650	0.0109	
WB	RIGHT (R)	2	2	1650	0.0012	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	9	9	1650	0.0055	0.0055
	T + R		4	1650	0.0024	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.42

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CAS.INT,VOL=...EX.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Existing PM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                     Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------             8  329  329
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    41 ---  1.0   1.1  2.1  2.0   2.1 ---  232  RIGHT
                                                           STREET NAME:
THRU   133 ---> 2.1  (NO. OF LANES)   1.1<---  126  THRU   W.Cypress Rd.

RIGHT   48 ---  1.1   1.0  2.0  1.0   1.0 ---  131  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  98  302  181                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	181	50 *	1650	0.0303	
THRU (T)	302	302	3300	0.0915	0.0915
LEFT (L)	98	98	1650	0.0594	
SB RIGHT (R)	8	8	1650	0.0048	
THRU (T)	329	329	3300	0.0997	
LEFT (L)	329	329	3000	0.1097	0.1097
T + R		337	3300	0.1021	
EB RIGHT (R)	48	48	1650	0.0291	
THRU (T)	133	133	3300	0.0403	
LEFT (L)	41	41	1650	0.0248	
T + R		181	3300	0.0548	0.0548
WB RIGHT (R)	232	51 *	3000	0.0170	
THRU (T)	126	126	1650	0.0764	
LEFT (L)	131	131	1650	0.0794	0.0794
T + R		177	3000	0.0590	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.34

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CAS.INT,VOL=...EX.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Existing PM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------             8   10    7
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     2 ---  2.0   1.1  1.1  1.0   1.0 ---    1  RIGHT
                                                           STREET NAME:
THRU   349 ---> 2.1  (NO. OF LANES)   2.0<---  296  THRU  E. Cypress Rd.

RIGHT  118 ---  1.1   1.0  1.1  1.1   2.0 ---   61  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 113    2   90                          Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
==========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      90         90       1650     0.0545
    THRU (T)        2          2       1650     0.0012
    LEFT (L)      113        113       1650     0.0685     0.0685
    T + R                     92       1650     0.0558
--------------------------------------------------------------------------
SB  RIGHT (R)       8          8       1650     0.0048
    THRU (T)       10         10       1650     0.0061
    LEFT (L)        7          7       1650     0.0042
    T + R                     18       1650     0.0109     0.0109
--------------------------------------------------------------------------
EB  RIGHT (R)     118        118       1650     0.0715
    THRU (T)      349        349       3300     0.1058
    LEFT (L)        2          2       3000     0.0007
    T + R                    467       3300     0.1415     0.1415
--------------------------------------------------------------------------
WB  RIGHT (R)       1          0 *     1650     0.0000
    THRU (T)      296        296       3300     0.0897
    LEFT (L)       61         61       3000     0.0203     0.0203
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.24
     INTERSECTION LEVEL OF SERVICE:                             A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Existing PM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------             1    0    1
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT     3 ---  1.0   1.1  1.1  1.1   1.1 ---    2  RIGHT
                                                          STREET NAME:
THRU   930 ---> 1.0  (NO. OF LANES)   1.1<---  580  THRU  Main Street

RIGHT  157 ---  1.0   1.0  1.1  1.1   1.0 ---   12  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  56    0   40                         Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      40          40        1650     0.0242
    THRU (T)        0           0        1650     0.0000
    LEFT (L)       56          56        1650     0.0339     0.0339
    T + R                      40        1650     0.0242
------------------------------------------------------------------------
SB  RIGHT (R)       1           1        1650     0.0006
    THRU (T)        0           0        1650     0.0000
    LEFT (L)        1           1        1650     0.0006
    T + R                       1        1650     0.0006
    T + L                       1        1650     0.0006
    T + R + L                   2        1650     0.0012     0.0012
------------------------------------------------------------------------
EB  RIGHT (R)     157         101 *      1650     0.0612
    THRU (T)      930         930        1650     0.5636     0.5636
    LEFT (L)        3           3        1650     0.0018
------------------------------------------------------------------------
WB  RIGHT (R)       2           2        1650     0.0012
    THRU (T)      580         580        1650     0.3515
    LEFT (L)       12          12        1650     0.0073     0.0073
    T + R                     582        1650     0.3527
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                             0.61
     INTERSECTION LEVEL OF SERVICE:                                 B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Existing PM Peak Hour Volumes 11/14/08

INTERSECTION 14 Vintage Parkway/Main Street

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------           108    0  167
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   169 ---  1.0   1.0  0.0  1.0   1.1 ---  159  RIGHT
                                                          STREET NAME:
THRU   920 ---> 2.0  (NO. OF LANES)   2.1<---  510  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB	RIGHT (R)	108	0 *	1720	0.0000	
	LEFT (L)	167	167	1720	0.0971	0.0971
EB	THRU (T)	920	920	3440	0.2674	
	LEFT (L)	169	169	1720	0.0983	0.0983
WB	RIGHT (R)	159	159	1720	0.0924	
	THRU (T)	510	510	3440	0.1483	
	T + R		669	3440	0.1945	0.1945

TOTAL VOLUME-TO-CAPACITY RATIO:	0.39
INTERSECTION LEVEL OF SERVICE:	A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CAS.INT,VOL=...EX.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Existing PM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            32  522  122
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    39 ---  1.0   1.1  2.1  1.0    1.0 ---   79  RIGHT
                                                       STREET NAME:
THRU    69 ---> 1.0  (NO. OF LANES)   1.1<---   67  THRU  Laurel Road

RIGHT   72 ---  1.0   1.0  2.1  1.1    1.1 ---   62  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                  129  468   95                     Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      95          95       1650     0.0576
    THRU (T)      468         468       3300     0.1418
    LEFT (L)      129         129       1650     0.0782     0.0782
    T + R                     563       3300     0.1706
------------------------------------------------------------------------
SB  RIGHT (R)      32          32       1650     0.0194
    THRU (T)      522         522       3300     0.1582
    LEFT (L)      122         122       1650     0.0739
    T + R                     554       3300     0.1679     0.1679
------------------------------------------------------------------------
EB  RIGHT (R)      72           0 *     1650     0.0000
    THRU (T)       69          69       1650     0.0418
    LEFT (L)       39          39       1650     0.0236     0.0236
------------------------------------------------------------------------
WB  RIGHT (R)      79           0 *     1650     0.0000
    THRU (T)       67          67       1650     0.0406
    LEFT (L)       62          62       1650     0.0376
    T + L                     129       1650     0.0782     0.0782
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.35
     INTERSECTION LEVEL OF SERVICE:                               A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Existing PM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION    16 Main Street/Malicoat Lane
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            30  694   10
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    16 ---  1.0   1.0  1.0  1.0   1.1 ---    8  RIGHT
                                                         STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)   1.1<---    0  THRU  Malicoat Lane

RIGHT   11 ---  1.1   1.0  1.1  1.1   1.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                  10  724   12                        Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
==========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      12         12        1650     0.0073
    THRU (T)      724        724        1650     0.4388
    LEFT (L)       10         10        1650     0.0061
    T + R                    736        1650     0.4461     0.4461
--------------------------------------------------------------------------
SB  RIGHT (R)      30         14 *      1650     0.0085
    THRU (T)      694        694        1650     0.4206
    LEFT (L)       10         10        1650     0.0061     0.0061
--------------------------------------------------------------------------
EB  RIGHT (R)      11         11        1650     0.0067
    THRU (T)        0          0        1650     0.0000
    LEFT (L)       16         16        1650     0.0097     0.0097
    T + R                     11        1650     0.0067
--------------------------------------------------------------------------
WB  RIGHT (R)       8          8        1650     0.0048     0.0048
    THRU (T)        0          0        1650     0.0000
    LEFT (L)        0          0        1650     0.0000
    T + R                      8        1650     0.0048
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.47
     INTERSECTION LEVEL OF SERVICE:                               A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CAS.INT,VOL=...EX.PMV,CAP=
```

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	335	367	410	22	47	319
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	335	367	410	22	47	319
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		794	1015			
pX, platoon unblocked						
vC, conflicting volume	432				1458	421
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	432				1458	421
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	70				53	50
cM capacity (veh/h)	1128				100	632

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	335	367	432	47	319
Volume Left	335	0	0	47	0
Volume Right	0	0	22	0	319
cSH	1128	1700	1700	100	632
Volume to Capacity	0.30	0.22	0.25	0.47	0.50
Queue Length (ft)	31	0	0	51	71
Control Delay (s)	9.5	0.0	0.0	69.3	16.3
Lane LOS	A			F	C
Approach Delay (s)	4.6		0.0	23.1	
Approach LOS				C	

Intersection Summary			
Average Delay	7.8		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	152	50	72	288	63	40
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	152	50	72	288	63	40
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked						
vC, conflicting volume			202		584	152
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			202		584	152
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		86	96
cM capacity (veh/h)			1370		449	894

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	152	50	72	288	63	40
Volume Left	0	0	72	0	63	0
Volume Right	0	50	0	0	0	40
cSH	1700	1700	1370	1700	449	894
Volume to Capacity	0.09	0.03	0.05	0.17	0.14	0.04
Queue Length (ft)	0	0	4	0	12	4
Control Delay (s)	0.0	0.0	7.8	0.0	14.3	9.2
Lane LOS			A		B	A
Approach Delay (s)	0.0		1.6		12.3	
Approach LOS					B	

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	25.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	13	208	325	2	0	16
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	13	208	325	2	0	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449				
pX, platoon unblocked						
vC, conflicting volume	327				560	326
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	327				560	326
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1233				484	715

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	221	327	0	16
Volume Left	13	0	0	0
Volume Right	0	2	0	16
cSH	1233	1700	1700	715
Volume to Capacity	0.01	0.19	0.00	0.02
Queue Length (ft)	1	0	0	2
Control Delay (s)	0.6	0.0	0.0	10.1
Lane LOS	A		A	B
Approach Delay (s)	0.6	0.0	10.1	
Approach LOS			B	

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	27.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	186	0	0	0	0	0	0	0	0	0	0	354
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	186	0	0	0	0	0	0	0	0	0	0	354
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0	0	0	177	354	0	354			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	0	0	177	354	0	354			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	100	100	100	100	100	100			100		
cM capacity (veh/h)	1023	896	1085	785	571	1085	1205			1623		

Direction, Lane #	EB 1	SB 1
Volume Total	186	354
Volume Left	186	0
Volume Right	0	354
cSH	1023	1700
Volume to Capacity	0.18	0.21
Queue Length (ft)	17	0
Control Delay (s)	9.3	0.0
Lane LOS	A	
Approach Delay (s)	9.3	0.0
Approach LOS	A	

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	226	17	7	152	38	25	37	8	22	18	15
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	20	226	17	7	152	38	25	37	8	22	18	15

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	263	197	70	55
Volume Left (vph)	20	7	25	22
Volume Right (vph)	17	38	8	15
Hadj (s)	0.0	-0.1	0.0	0.0
Departure Headway (s)	4.4	4.8	5.0	5.0
Degree Utilization, x	0.32	0.26	0.10	0.08
Capacity (veh/h)	786	581	657	678
Control Delay (s)	8.0	8.2	8.2	8.1
Approach Delay (s)	8.0	8.2	8.2	8.1
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	32	126	110	60	136	98	107	136	96	81	153	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	126	110	60	136	98	107	136	96	81	153	81

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	268	294	243	96	234	81
Volume Left (vph)	32	60	107	0	81	0
Volume Right (vph)	110	98	0	96	0	81
Hadj (s)	-0.2	-0.1	0.3	-0.7	0.2	-0.7
Departure Headway (s)	6.2	6.1	6.9	6.0	6.9	6.1
Degree Utilization, x	0.46	0.50	0.47	0.16	0.45	0.14
Capacity (veh/h)	546	502	486	559	499	566
Control Delay (s)	10.4	10.6	10.2	8.1	10.1	8.1
Approach Delay (s)	10.4	10.6	9.6		9.6	
Approach LOS	B	B	A		A	

Intersection Summary			
Delay	10.0		
HCM Level of Service	B		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	22	97	9	5	124	11	10	19	14	8	35	41
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	22	97	9	5	124	11	10	19	14	8	35	41

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	128	140	43	84
Volume Left (vph)	22	5	10	8
Volume Right (vph)	9	11	14	41
Hadj (s)	0.0	0.0	-0.1	-0.2
Departure Headway (s)	4.4	4.4	4.5	4.3
Degree Utilization, x	0.15	0.17	0.05	0.10
Capacity (veh/h)	800	603	756	812
Control Delay (s)	7.5	7.7	7.5	7.4
Approach Delay (s)	7.5	7.7	7.5	7.4
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.6		
HCM Level of Service	A		
Intersection Capacity Utilization	27.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	662	80	7	786	32	11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	662	80	7	786	32	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			742		1502	702
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			742		1502	702
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		76	97
cM capacity (veh/h)			865		133	438

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	742	793	32	11
Volume Left	0	7	32	0
Volume Right	80	0	0	11
cSH	1700	865	133	438
Volume to Capacity	0.44	0.01	0.24	0.03
Queue Length (ft)	0	1	22	2
Control Delay (s)	0.0	0.2	40.5	13.4
Lane LOS		A	E	B
Approach Delay (s)	0.0	0.2	33.5	
Approach LOS			D	

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	56	41	568	728	12
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	56	41	568	728	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.69	0.69	0.69			
vC, conflicting volume	1384	734	740			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1556	615	623			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	83	94			
cM capacity (veh/h)	80	339	661			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	75	609	740
Volume Left	19	41	0
Volume Right	56	0	12
cSH	187	661	1700
Volume to Capacity	0.40	0.06	0.44
Queue Length (ft)	45	5	0
Control Delay (s)	36.6	1.7	0.0
Lane LOS	E	A	
Approach Delay (s)	36.6	1.7	0.0
Approach LOS	E		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	56	170	441	55	162	607
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	56	170	441	55	162	607
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.85					
vC, conflicting volume	1400	468			496	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1471	468			496	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	44	71			85	
cM capacity (veh/h)	101	595			1068	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	226	496	162	607
Volume Left	56	0	162	0
Volume Right	170	55	0	0
cSH	269	1700	1068	1700
Volume to Capacity	0.84	0.29	0.15	0.36
Queue Length (ft)	173	0	13	0
Control Delay (s)	62.3	0.0	9.0	0.0
Lane LOS	F		A	
Approach Delay (s)	62.3	0.0	1.9	
Approach LOS	F			

Intersection Summary			
Average Delay	10.4		
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	66	189	2	8	144	2	5	18	23	3	0	38
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	189	2	8	144	2	5	18	23	3	0	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	146			191			521	484	190	515	484	145
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	146			191			521	484	190	515	484	145
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			99	96	97	99	100	96
cM capacity (veh/h)	1436			1383			429	458	852	427	458	902

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	257	154	46	41
Volume Left	66	8	5	3
Volume Right	2	2	23	38
cSH	1436	1383	590	834
Volume to Capacity	0.05	0.01	0.08	0.05
Queue Length (ft)	4	0	6	4
Control Delay (s)	2.3	0.4	11.6	9.5
Lane LOS	A	A	B	A
Approach Delay (s)	2.3	0.4	11.6	9.5
Approach LOS			B	A

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	127	93	47	202	113	35	30	219	127	33	309	132
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	127	93	47	202	113	35	30	219	127	33	309	132

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total (vph)	267	350	376	342	132
Volume Left (vph)	127	202	30	33	0
Volume Right (vph)	47	35	127	0	132
Hadj (s)	0.0	0.1	-0.2	0.1	-0.7
Departure Headway (s)	7.4	7.1	7.0	7.5	6.7
Degree Utilization, x	0.55	0.69	0.73	0.71	0.25
Capacity (veh/h)	445	461	494	462	517
Control Delay (s)	12.6	13.7	14.1	13.4	9.1
Approach Delay (s)	12.6	13.7	14.1	12.2	
Approach LOS	B	B	B	B	

Intersection Summary			
Delay	13.1		
HCM Level of Service	B		
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	70	22	53	168	72	19	137	31	70	313	33
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	70	22	53	168	72	19	137	31	70	313	33

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total (vph)	97	293	187	383	33
Volume Left (vph)	5	53	19	70	0
Volume Right (vph)	22	72	31	0	33
Hadj (s)	-0.1	-0.1	0.0	0.1	-0.7
Departure Headway (s)	5.9	5.2	5.6	5.9	5.1
Degree Utilization, x	0.16	0.43	0.29	0.63	0.05
Capacity (veh/h)	545	574	583	599	688
Control Delay (s)	9.2	9.2	9.2	10.0	7.0
Approach Delay (s)	9.2	9.2	9.2	9.8	
Approach LOS	A	A	A	A	

Intersection Summary			
Delay	9.4		
HCM Level of Service	A		
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

25: Delta Road & Knightsen Avenue — Existing AM Volumes

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	72	16	4	70	34	18	46	18	36	74	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	72	16	4	70	34	18	46	18	36	74	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	90	108	82	111
Volume Left (vph)	2	4	18	36
Volume Right (vph)	16	34	18	1
Hadj (s)	-0.1	-0.1	-0.1	0.1
Departure Headway (s)	4.4	4.3	4.4	4.5
Degree Utilization, x	0.11	0.13	0.10	0.14
Capacity (veh/h)	786	616	777	780
Control Delay (s)	7.5	7.4	7.5	7.7
Approach Delay (s)	7.5	7.4	7.5	7.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.5		
HCM Level of Service	A		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	7	532	515	1	4	12
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	532	515	1	4	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		794	1015			
pX, platoon unblocked						
vC, conflicting volume	516				1062	516
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	516				1062	516
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	98
cM capacity (veh/h)	1050				246	559

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	7	532	516	4	12
Volume Left	7	0	0	4	0
Volume Right	0	0	1	0	12
cSH	1050	1700	1700	246	559
Volume to Capacity	0.01	0.31	0.30	0.02	0.02
Queue Length (ft)	1	0	0	1	2
Control Delay (s)	8.5	0.0	0.0	19.9	11.6
Lane LOS	A			C	B
Approach Delay (s)	0.1		0.0	13.7	
Approach LOS				B	

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	330	99	25	182	102	61
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	330	99	25	182	102	61
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked						
vC, conflicting volume			429		562	330
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			429		562	330
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		79	91
cM capacity (veh/h)			1130		477	712

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	330	99	25	182	102	61
Volume Left	0	0	25	0	102	0
Volume Right	0	99	0	0	0	61
cSH	1700	1700	1130	1700	477	712
Volume to Capacity	0.19	0.06	0.02	0.11	0.21	0.09
Queue Length (ft)	0	0	2	0	20	7
Control Delay (s)	0.0	0.0	8.3	0.0	14.6	10.5
Lane LOS			A		B	B
Approach Delay (s)	0.0		1.0		13.1	
Approach LOS					B	

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	18	325	237	4	1	11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	18	325	237	4	1	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449				
pX, platoon unblocked						
vC, conflicting volume	241				600	239
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	241				600	239
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1326				458	800

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	343	241	1	11
Volume Left	18	0	1	0
Volume Right	0	4	0	11
cSH	1326	1700	458	800
Volume to Capacity	0.01	0.14	0.00	0.01
Queue Length (ft)	1	0	0	1
Control Delay (s)	0.5	0.0	12.9	9.6
Lane LOS	A		B	A
Approach Delay (s)	0.5	0.0	9.8	
Approach LOS			A	

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

7: Cypress Road & Bethel Island Rd. — Existing PM Volumes

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	313	0	0	0	0	0	0	0	0	0	0	215
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	313	0	0	0	0	0	0	0	0	0	0	215
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0	0	0	108	215	0	215			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	0	0	108	215	0	215			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	69	100	100	100	100	100	100			100		
cM capacity (veh/h)	1023	896	1085	872	683	1085	1355			1623		

Direction, Lane #	EB 1	SB 1
Volume Total	313	215
Volume Left	313	0
Volume Right	0	215
cSH	1023	1700
Volume to Capacity	0.31	0.13
Queue Length (ft)	33	0
Control Delay (s)	10.1	0.0
Lane LOS	B	
Approach Delay (s)	10.1	0.0
Approach LOS	B	

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	20.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	152	23	10	160	16	23	16	12	52	48	23
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	152	23	10	160	16	23	16	12	52	48	23

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	177	186	51	123
Volume Left (vph)	2	10	23	52
Volume Right (vph)	23	16	12	23
Hadj (s)	0.0	0.0	0.0	0.0
Departure Headway (s)	4.5	4.6	4.8	4.8
Degree Utilization, x	0.22	0.24	0.07	0.16
Capacity (veh/h)	771	593	686	716
Control Delay (s)	7.8	8.0	7.9	8.0
Approach Delay (s)	7.8	8.0	7.9	8.0
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.9		
HCM Level of Service	A		
Intersection Capacity Utilization	30.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	31	99	44	61	171	42	69	96	69	60	145	74
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	31	99	44	61	171	42	69	96	69	60	145	74

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	174	274	165	69	205	74
Volume Left (vph)	31	61	69	0	60	0
Volume Right (vph)	44	42	0	69	0	74
Hadj (s)	-0.1	0.0	0.2	-0.7	0.2	-0.7
Departure Headway (s)	5.6	5.5	6.3	5.4	6.2	5.4
Degree Utilization, x	0.27	0.42	0.29	0.10	0.35	0.11
Capacity (veh/h)	588	542	533	613	559	644
Control Delay (s)	9.2	9.5	8.8	7.4	8.9	7.3
Approach Delay (s)	9.2	9.5	8.4		8.5	
Approach LOS	A	A	A		A	

Intersection Summary			
Delay	8.9		
HCM Level of Service	A		
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	23	73	56	23	52	21	88	210	38	12	135	16
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	23	73	56	23	52	21	88	210	38	12	135	16

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	152	96	336	163
Volume Left (vph)	23	23	88	12
Volume Right (vph)	56	21	38	16
Hadj (s)	-0.2	0.0	0.0	0.0
Departure Headway (s)	5.0	5.1	4.7	4.9
Degree Utilization, x	0.21	0.14	0.44	0.22
Capacity (veh/h)	654	531	731	697
Control Delay (s)	8.4	8.3	8.7	8.3
Approach Delay (s)	8.4	8.3	8.7	8.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.5		
HCM Level of Service	A		
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	844	141	7	626	28	7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	844	141	7	626	28	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			985		1554	914
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			985		1554	914
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		77	98
cM capacity (veh/h)			701		123	331

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	985	633	28	7
Volume Left	0	7	28	0
Volume Right	141	0	0	7
cSH	1700	701	123	331
Volume to Capacity	0.58	0.01	0.23	0.02
Queue Length (ft)	0	1	21	2
Control Delay (s)	0.0	0.3	42.6	16.1
Lane LOS		A	E	C
Approach Delay (s)	0.0	0.3	37.3	
Approach LOS			E	

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	7	46	53	751	679	22
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	46	53	751	679	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.71	0.71	0.71			
vC, conflicting volume	1547	690	701			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1771	563	579			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	88	92			
cM capacity (veh/h)	60	373	706			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	53	804	701
Volume Left	7	53	0
Volume Right	46	0	22
cSH	221	706	1700
Volume to Capacity	0.24	0.08	0.41
Queue Length (ft)	23	6	0
Control Delay (s)	26.3	2.0	0.0
Lane LOS	D	A	
Approach Delay (s)	26.3	2.0	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	54	125	694	100	120	529
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	54	125	694	100	120	529
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.99					
vC, conflicting volume	1513	744			794	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1517	744			794	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	51	70			85	
cM capacity (veh/h)	111	415			827	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	179	794	120	529
Volume Left	54	0	120	0
Volume Right	125	100	0	0
cSH	227	1700	827	1700
Volume to Capacity	0.79	0.47	0.15	0.31
Queue Length (ft)	143	0	13	0
Control Delay (s)	61.9	0.0	10.1	0.0
Lane LOS	F		B	
Approach Delay (s)	61.9	0.0	1.9	
Approach LOS	F			

Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	39	200	5	26	176	20	4	12	15	1	21	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	39	200	5	26	176	20	4	12	15	1	21	81
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	196			205			610	528	202	540	521	186
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	196			205			610	528	202	540	521	186
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			99	97	98	100	95	91
cM capacity (veh/h)	1377			1366			342	434	838	420	438	856

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	244	222	31	103
Volume Left	39	26	4	1
Volume Right	5	20	15	81
cSH	1377	1366	542	711
Volume to Capacity	0.03	0.02	0.06	0.14
Queue Length (ft)	2	1	5	13
Control Delay (s)	1.4	1.0	12.0	10.9
Lane LOS	A	A	B	B
Approach Delay (s)	1.4	1.0	12.0	10.9
Approach LOS			B	B

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	58	140	28	89	145	73	39	207	98	55	197	80
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	58	140	28	89	145	73	39	207	98	55	197	80

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total (vph)	226	307	344	252	80
Volume Left (vph)	58	89	39	55	0
Volume Right (vph)	28	73	98	0	80
Hadj (s)	0.0	-0.1	-0.1	0.1	-0.7
Departure Headway (s)	6.5	6.2	6.1	6.8	6.0
Degree Utilization, x	0.41	0.53	0.59	0.48	0.13
Capacity (veh/h)	508	499	553	507	570
Control Delay (s)	10.6	11.0	11.2	10.2	8.1
Approach Delay (s)	10.6	11.0	11.2	9.7	
Approach LOS	B	B	B	A	

Intersection Summary			
Delay	10.6		
HCM Level of Service	B		
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	25	173	20	61	89	113	16	388	42	121	254	19
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	25	173	20	61	89	113	16	388	42	121	254	19

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total (vph)	218	263	446	375	19
Volume Left (vph)	25	61	16	121	0
Volume Right (vph)	20	113	42	0	19
Hadj (s)	0.0	-0.2	0.0	0.2	-0.7
Departure Headway (s)	7.1	6.4	6.4	7.0	6.1
Degree Utilization, x	0.43	0.47	0.79	0.73	0.03
Capacity (veh/h)	456	475	548	496	564
Control Delay (s)	11.4	10.8	14.4	13.0	8.0
Approach Delay (s)	11.4	10.8	14.4	12.7	
Approach LOS	B	B	B	B	

Intersection Summary			
Delay	12.7		
HCM Level of Service	B		
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	22	35	3	20	42	52	129	1	4	82	3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	22	35	3	20	42	52	129	1	4	82	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	59	65	182	89
Volume Left (vph)	2	3	52	4
Volume Right (vph)	35	42	1	3
Hadj (s)	-0.3	-0.3	0.1	0.0
Departure Headway (s)	4.2	4.1	4.3	4.4
Degree Utilization, x	0.07	0.07	0.22	0.11
Capacity (veh/h)	799	622	803	806
Control Delay (s)	7.3	7.2	7.6	7.5
Approach Delay (s)	7.3	7.2	7.6	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.5		
HCM Level of Service	A		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline AM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           10  419  357
                       |    |    |
             ^         |    |    |         ^
             |      <---    v    --->      | Split? N
LEFT    39 ---  1.0   1.1  2.1  2.0   2.1 ---  382  RIGHT
                                                         STREET NAME:
THRU   128 ---> 2.1  (NO. OF LANES)   1.1<---  150  THRU  W.Cypress Rd.

RIGHT   60 ---  1.1   1.0  2.0  1.0   1.0 ---  100  LEFT
             |      <---    ^    --->      |
             v         |    |    |         v
  N                    |    |    |                       SIG WARRANTS:
W + E                 30  462  101                         Urb=Y, Rur=Y
  S                 LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)     101          1 *     1650     0.0006
    THRU (T)      462        462       3300     0.1400     0.1400
    LEFT (L)       30         30       1650     0.0182
------------------------------------------------------------------------
SB  RIGHT (R)      10         10       1650     0.0061
    THRU (T)      419        419       3300     0.1270
    LEFT (L)      357        357       3000     0.1190     0.1190
    T + R                    429       3300     0.1300
------------------------------------------------------------------------
EB  RIGHT (R)      60         60       1650     0.0364
    THRU (T)      128        128       3300     0.0388
    LEFT (L)       39         39       1650     0.0236     0.0236
    T + R                    188       3300     0.0570
------------------------------------------------------------------------
WB  RIGHT (R)     382        186 *     3000     0.0620
    THRU (T)      150        150       1650     0.0909
    LEFT (L)      100        100       1650     0.0606
    T + R                    336       3000     0.1120     0.1120
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.39
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline AM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                  Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------           319    0   47
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   335 ---  1.0   1.0  0.0  1.0   1.1 ---   22  RIGHT
                                                           STREET NAME:
THRU   365 ---> 2.0  (NO. OF LANES)   2.1<---  430  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   0    0    0                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
========================================================================
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	319	0 *	1720	0.0000	
LEFT (L)	47	47	1720	0.0273	0.0273
EB THRU (T)	365	365	3440	0.1061	
LEFT (L)	335	335	1720	0.1948	0.1948
WB RIGHT (R)	22	22	1720	0.0128	
THRU (T)	430	430	3440	0.1250	
T + R		452	3440	0.1314	0.1314

TOTAL VOLUME-TO-CAPACITY RATIO: 0.35

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline AM Peak Hour Volumes                         11/14/08
=========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                   Time               Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           132   73   36
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT    46 ---  1.0   1.0  1.0  1.0   1.1 ---   12  RIGHT
                                                           STREET NAME:
THRU   231 ---> 2.1  (NO. OF LANES)   2.1<---  252  THRU  E. Cypress Rd.

RIGHT  165 ---  1.1   1.0  1.0  1.0   1.0 ---  171  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 104   25   73                          Urb=N, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
=========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      73           0 *     1650     0.0000
    THRU (T)       25          25       1650     0.0152
    LEFT (L)      104         104       1650     0.0630     0.0630
-------------------------------------------------------------------------
SB  RIGHT (R)     132          86 *     1650     0.0521     0.0521
    THRU (T)       73          73       1650     0.0442
    LEFT (L)       36          36       1650     0.0218
-------------------------------------------------------------------------
EB  RIGHT (R)     165         165       1650     0.1000
    THRU (T)      231         231       3300     0.0700
    LEFT (L)       46          46       1650     0.0279
    T + R                     396       3300     0.1200     0.1200
-------------------------------------------------------------------------
WB  RIGHT (R)      12          12       1650     0.0073
    THRU (T)      252         252       3300     0.0764
    LEFT (L)      171         171       1650     0.1036     0.1036
    T + R                     264       3300     0.0800
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                              0.34
     INTERSECTION LEVEL OF SERVICE:                                  A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline AM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           234    0    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   326 ---  2.0   2.0  0.0  1.0   1.1 ---   15  RIGHT
                                                            STREET NAME:
THRU    62 ---> 1.0  (NO. OF LANES)   1.1<---  159  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                   0    0    0                           Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
==========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
--------------------------------------------------------------------------
SB  RIGHT (R)     234         55 *     3127     0.0176     0.0176
    LEFT (L)        5          5       1720     0.0029
--------------------------------------------------------------------------
EB  THRU (T)       62         62       1720     0.0360
    LEFT (L)      326        326       3127     0.1043     0.1043
--------------------------------------------------------------------------
WB  RIGHT (R)      15         15       1720     0.0087
    THRU (T)      159        159       1720     0.0924
    T + R                    174       1720     0.1012     0.1012
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.22
     INTERSECTION LEVEL OF SERVICE:                              A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline AM Peak Hour Volumes                         11/14/08
=========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------             5    0    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     5 ---  1.0   1.1  1.1  1.1   1.1 ---    5  RIGHT
                                                           STREET NAME:
THRU   754 ---> 1.0  (NO. OF LANES)   1.1<---  854  THRU  Main Street

RIGHT  118 ---  1.0   1.0  1.1  1.1   1.0 ---   30  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 122    0   30                          Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	30	30	1650	0.0182	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	122	122	1650	0.0739	0.0739
	T + R		30	1650	0.0182	
SB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	5	5	1650	0.0030	
	T + R		5	1650	0.0030	
	T + L		5	1650	0.0030	
	T + R + L		10	1650	0.0061	0.0061
EB	RIGHT (R)	118	0 *	1650	0.0000	
	THRU (T)	754	754	1650	0.4570	
	LEFT (L)	5	5	1650	0.0030	0.0030
WB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	854	854	1650	0.5176	
	LEFT (L)	30	30	1650	0.0182	
	T + R		859	1650	0.5206	0.5206

TOTAL VOLUME-TO-CAPACITY RATIO: 0.60

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline AM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           157    0  179
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    75 ---  1.0   1.0  0.0  1.0   1.1 ---   99  RIGHT
                                                            STREET NAME:
THRU   762 ---> 2.0  (NO. OF LANES)   2.1<---  892  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                   0    0    0                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
SB  RIGHT (R)     157         82 *     1720     0.0477
    LEFT (L)      179        179       1720     0.1041     0.1041
------------------------------------------------------------------------
EB  THRU (T)      762        762       3440     0.2215
    LEFT (L)       75         75       1720     0.0436     0.0436
------------------------------------------------------------------------
WB  RIGHT (R)      99         99       1720     0.0576
    THRU (T)      892        892       3440     0.2593
    T + R                    991       3440     0.2881     0.2881
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.44
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline AM Peak Hour Volumes                        11/14/08
==========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                        Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------            74  750   99
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   119 ---  1.0   1.1  2.1  1.0    1.0 ---  180  RIGHT
                                                           STREET NAME:
THRU    82 ---> 1.0  (NO. OF LANES)   1.1<---  124  THRU  Laurel Road

RIGHT  281 ---  1.0   1.0  2.1  1.1    1.1 ---  195  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                  140  593   86                     Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	86	86	1650	0.0521	
	THRU (T)	593	593	3300	0.1797	
	LEFT (L)	140	140	1650	0.0848	0.0848
	T + R		679	3300	0.2058	
SB	RIGHT (R)	74	74	1650	0.0448	
	THRU (T)	750	750	3300	0.2273	
	LEFT (L)	99	99	1650	0.0600	
	T + R		824	3300	0.2497	0.2497
EB	RIGHT (R)	281	141 *	1650	0.0855	
	THRU (T)	82	82	1650	0.0497	
	LEFT (L)	119	119	1650	0.0721	0.0721
WB	RIGHT (R)	180	81 *	1650	0.0491	
	THRU (T)	124	124	1650	0.0752	
	LEFT (L)	195	195	1650	0.1182	
	T + L		319	1650	0.1933	0.1933

```
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                              0.60
     INTERSECTION LEVEL OF SERVICE:                                  A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline AM Peak Hour Volumes 11/14/08

INTERSECTION 16 Main Street/Malicoat Lane

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------           163  909    5
                        |    |    |
             ^          |    |    |          ^
             |       <---    v   --->        | Split? N
LEFT     9 ---  1.0   1.1  2.1  1.0    1.1 ---    2  RIGHT
                                                            STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)    1.1<---    2  THRU   Malicoat Lane

RIGHT   18 ---  1.1   1.0  2.1  1.1    1.0 ---    9  LEFT
             |       <---    ^   --->        |
             v          |    |    |          v
  N                     |    |    |                         SIG WARRANTS:
W + E                  40  769    5                           Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	769	769	3300	0.2330	
	LEFT (L)	40	40	1650	0.0242	0.0242
	T + R		774	3300	0.2345	
SB	RIGHT (R)	163	163	1650	0.0988	
	THRU (T)	909	909	3300	0.2755	
	LEFT (L)	5	5	1650	0.0030	
	T + R		1072	3300	0.3248	0.3248
EB	RIGHT (R)	18	18	1650	0.0109	0.0109
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	9	9	1650	0.0055	
	T + R		18	1650	0.0109	
WB	RIGHT (R)	2	2	1650	0.0012	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	9	9	1650	0.0055	0.0055
	T + R		4	1650	0.0024	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.37

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline AM Peak Hour Volumes                           11/14/08
========================================================================
INTERSECTION    20 O'Hara Avenue/Laurel Road
Count Date                        Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           138  315   37
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   134 ---  1.0   1.0  1.0  1.0   1.1 ---   39  RIGHT
                                                            STREET NAME:
THRU   315 ---> 2.0  (NO. OF LANES)   2.1<---  640  THRU    Laurel Road

RIGHT   50 ---  1.0   1.0  1.0  1.0   1.0 ---  120  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  31  225  131                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
========================================================================
               ORIGINAL   ADJUSTED                  V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO        V/C
------------------------------------------------------------------------
NB  RIGHT (R)     131          11 *     1650     0.0067
    THRU (T)      225         225       1650     0.1364
    LEFT (L)       31          31       1650     0.0188     0.0188
------------------------------------------------------------------------
SB  RIGHT (R)     138           4 *     1650     0.0024
    THRU (T)      315         315       1650     0.1909     0.1909
    LEFT (L)       37          37       1650     0.0224
------------------------------------------------------------------------
EB  RIGHT (R)      50          19 *     1650     0.0115
    THRU (T)      315         315       3300     0.0955
    LEFT (L)      134         134       1650     0.0812     0.0812
------------------------------------------------------------------------
WB  RIGHT (R)      39          39       1650     0.0236
    THRU (T)      640         640       3300     0.1939
    LEFT (L)      120         120       1650     0.0727
    T + R                     679       3300     0.2058     0.2058
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.50
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline AM Peak Hour Volumes 11/14/08

INTERSECTION 21 Empire Avenue/Laurel Road

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------           239  247   71
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   193 ---  1.0   1.1  2.1  1.0   1.1 ---   43  RIGHT
                                                         STREET NAME:
THRU   400 ---> 2.1  (NO. OF LANES)   2.1<---  709  THRU  Laurel Road

RIGHT  148 ---  1.1   1.0  2.1  1.1   1.0 ---   50  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                  60  126   30                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	30	30	1650	0.0182	
	THRU (T)	126	126	3300	0.0382	
	LEFT (L)	60	60	1650	0.0364	0.0364
	T + R		156	3300	0.0473	
SB	RIGHT (R)	239	239	1650	0.1448	
	THRU (T)	247	247	3300	0.0748	
	LEFT (L)	71	71	1650	0.0430	
	T + R		486	3300	0.1473	0.1473
EB	RIGHT (R)	148	148	1650	0.0897	
	THRU (T)	400	400	3300	0.1212	
	LEFT (L)	193	193	1650	0.1170	0.1170
	T + R		548	3300	0.1661	
WB	RIGHT (R)	43	43	1650	0.0261	
	THRU (T)	709	709	3300	0.2148	
	LEFT (L)	50	50	1650	0.0303	
	T + R		752	3300	0.2279	0.2279

TOTAL VOLUME-TO-CAPACITY RATIO: 0.53

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline PM Peak Hour Volumes                      11/14/08
========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------            52  638  585
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    31 ---  1.0   1.1  2.1  2.0   2.1 ---  351  RIGHT
                                                          STREET NAME:
THRU   156 ---> 2.1  (NO. OF LANES)   1.1<---  212  THRU  W.Cypress Rd.

RIGHT   61 ---  1.1   1.0  2.0  1.0   1.0 ---  101  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  29  514   98                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      98           0 *     1650     0.0000
    THRU (T)      514         514       3300     0.1558      0.1558
    LEFT (L)       29          29       1650     0.0176
------------------------------------------------------------------------
SB  RIGHT (R)      52          52       1650     0.0315
    THRU (T)      638         638       3300     0.1933
    LEFT (L)      585         585       3000     0.1950      0.1950
    T + R                     690       3300     0.2091
------------------------------------------------------------------------
EB  RIGHT (R)      61          61       1650     0.0370
    THRU (T)      156         156       3300     0.0473
    LEFT (L)       31          31       1650     0.0188      0.0188
    T + R                     217       3300     0.0658
------------------------------------------------------------------------
WB  RIGHT (R)     351          29 *     3000     0.0097
    THRU (T)      212         212       1650     0.1285      0.1285
    LEFT (L)      101         101       1650     0.0612
    T + R                     241       3000     0.0803
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.50
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline PM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                     Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------            12    0    4
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT     7 ---  1.0   1.0  0.0  1.0   1.1 ---    1  RIGHT
                                                           STREET NAME:
THRU   820 ---> 2.0  (NO. OF LANES)   2.1<---  641  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   0    0    0                          Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
==========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
--------------------------------------------------------------------------
SB  RIGHT (R)      12          5 *     1720     0.0029     0.0029
    LEFT (L)        4          4       1720     0.0023
--------------------------------------------------------------------------
EB  THRU (T)      820        820       3440     0.2384     0.2384
    LEFT (L)        7          7       1720     0.0041
--------------------------------------------------------------------------
WB  RIGHT (R)       1          1       1720     0.0006
    THRU (T)      641        641       3440     0.1863
    T + R                    642       3440     0.1866
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.24
     INTERSECTION LEVEL OF SERVICE:                                A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline PM Peak Hour Volumes                           11/14/08
==========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------            94   56   30
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   154 ---  1.0   1.0  1.0  1.0   1.1 ---   41  RIGHT
                                                               STREET NAME:
THRU   540 ---> 2.1  (NO. OF LANES)   2.1<---  420  THRU  E. Cypress Rd.

RIGHT  132 ---  1.1   1.0  1.0  1.0   1.0 ---  125  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                  137   81  192                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
==========================================================================
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	192	67 *	1650	0.0406	
	THRU (T)	81	81	1650	0.0491	
	LEFT (L)	137	137	1650	0.0830	0.0830
SB	RIGHT (R)	94	0 *	1650	0.0000	
	THRU (T)	56	56	1650	0.0339	0.0339
	LEFT (L)	30	30	1650	0.0182	
EB	RIGHT (R)	132	132	1650	0.0800	
	THRU (T)	540	540	3300	0.1636	
	LEFT (L)	154	154	1650	0.0933	
	T + R		672	3300	0.2036	0.2036
WB	RIGHT (R)	41	41	1650	0.0248	
	THRU (T)	420	420	3300	0.1273	
	LEFT (L)	125	125	1650	0.0758	0.0758
	T + R		461	3300	0.1397	

```
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                               0.40
     INTERSECTION LEVEL OF SERVICE:                                   A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline PM Peak Hour Volumes                          11/14/08
==========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------           475    0   17
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   510 ---  2.0   2.0  0.0  1.0   1.1 ---   12  RIGHT
                                                         STREET NAME:
THRU   183 ---> 1.0  (NO. OF LANES)   1.1<---  114  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                   0    0    0                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
==========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
--------------------------------------------------------------------------
SB  RIGHT (R)     475        194 *     3127     0.0620     0.0620
    LEFT (L)       17         17       1720     0.0099
--------------------------------------------------------------------------
EB  THRU (T)      183        183       1720     0.1064
    LEFT (L)      510        510       3127     0.1631     0.1631
--------------------------------------------------------------------------
WB  RIGHT (R)      12         12       1720     0.0070
    THRU (T)      114        114       1720     0.0663
    T + R                    126       1720     0.0733     0.0733
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.30
     INTERSECTION LEVEL OF SERVICE:                              A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline PM Peak Hour Volumes 11/14/08

INTERSECTION 13 O'Hara Avenue/Main Street
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                      4-PHASE SIGNAL
-----------            1    0    1
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT     5 ---  1.0   1.1  1.1  1.1   1.1 ---    5  RIGHT
                                                         STREET NAME:
THRU  1279 ---> 1.0  (NO. OF LANES)   1.1<---  892  THRU  Main Street

RIGHT  273 ---  1.0   1.0  1.1  1.1   1.0 ---   21  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                       SIG WARRANTS:
W + E                 208    0   48                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	48	48	1650	0.0291	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	208	208	1650	0.1261	0.1261
	T + R		48	1650	0.0291	
SB	RIGHT (R)	1	1	1650	0.0006	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	1	1	1650	0.0006	
	T + R		1	1650	0.0006	
	T + L		1	1650	0.0006	
	T + R + L		2	1650	0.0012	0.0012
EB	RIGHT (R)	273	65 *	1650	0.0394	
	THRU (T)	1279	1279	1650	0.7752	0.7752
	LEFT (L)	5	5	1650	0.0030	
WB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	892	892	1650	0.5406	
	LEFT (L)	21	21	1650	0.0127	0.0127
	T + R		897	1650	0.5436	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.92

INTERSECTION LEVEL OF SERVICE: E

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline PM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                  Time                 Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------          135    0  178
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT   195 ---  1.0   1.0  0.0  1.0   1.1 ---  168  RIGHT
                                                          STREET NAME:
THRU  1344 ---> 2.0  (NO. OF LANES)   2.1<---  903  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                        SIG WARRANTS:
W + E                  0    0    0                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB	RIGHT (R)	135	0 *	1720	0.0000	
	LEFT (L)	178	178	1720	0.1035	0.1035
EB	THRU (T)	1344	1344	3440	0.3907	
	LEFT (L)	195	195	1720	0.1134	0.1134
WB	RIGHT (R)	168	168	1720	0.0977	
	THRU (T)	903	903	3440	0.2625	
	T + R		1071	3440	0.3113	0.3113

TOTAL VOLUME-TO-CAPACITY RATIO: 0.53

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline PM Peak Hour Volumes                        11/14/08
========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            98  521  120
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT    70 ---  1.0   1.1  2.1  1.0    1.0 ---  112  RIGHT
                                                          STREET NAME:
THRU   430 ---> 1.0  (NO. OF LANES)   1.1<---  387  THRU  Laurel Road

RIGHT  141 ---  1.0   1.0  2.1  1.1    1.1 ---   98  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                       SIG WARRANTS:
W + E                  197  496  158                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)     158        158        1650     0.0958
    THRU (T)      496        496        3300     0.1503
    LEFT (L)      197        197        1650     0.1194     0.1194
    T + R                    654        3300     0.1982
------------------------------------------------------------------------
SB  RIGHT (R)      98         98        1650     0.0594
    THRU (T)      521        521        3300     0.1579
    LEFT (L)      120        120        1650     0.0727
    T + R                    619        3300     0.1876     0.1876
------------------------------------------------------------------------
EB  RIGHT (R)     141          0 *      1650     0.0000
    THRU (T)      430        430        1650     0.2606
    LEFT (L)       70         70        1650     0.0424     0.0424
------------------------------------------------------------------------
WB  RIGHT (R)     112          0 *      1650     0.0000
    THRU (T)      387        387        1650     0.2345
    LEFT (L)       98         98        1650     0.0594
    T + L                    485        1650     0.2939     0.2939
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.64
     INTERSECTION LEVEL OF SERVICE:                              B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline PM Peak Hour Volumes                          11/14/08
========================================================================
INTERSECTION    16 Main Street/Malicoat Lane
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                      4-PHASE SIGNAL
-----------            30  698   10
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    16 ---  1.0   1.1  2.1  1.0   1.1 ---    8  RIGHT
                                                          STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)   1.1<---    0  THRU  Malicoat Lane

RIGHT   11 ---  1.1   1.0  2.1  1.1   1.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  10  820   12                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	12	12	1650	0.0073	
	THRU (T)	820	820	3300	0.2485	
	LEFT (L)	10	10	1650	0.0061	
	T + R		832	3300	0.2521	0.2521
SB	RIGHT (R)	30	30	1650	0.0182	
	THRU (T)	698	698	3300	0.2115	
	LEFT (L)	10	10	1650	0.0061	0.0061
	T + R		728	3300	0.2206	
EB	RIGHT (R)	11	11	1650	0.0067	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	16	16	1650	0.0097	0.0097
	T + R		11	1650	0.0067	
WB	RIGHT (R)	8	8	1650	0.0048	0.0048
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	0	0	1650	0.0000	
	T + R		8	1650	0.0048	

```
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.27
     INTERSECTION LEVEL OF SERVICE:                                A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline PM Peak Hour Volumes                          11/14/08
=========================================================================
INTERSECTION    20 O'Hara Avenue/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           98  212   67
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT    95 ---  1.0   1.0  1.0  1.0   1.1 ---   84  RIGHT
                                                           STREET NAME:
THRU   850 ---> 2.0  (NO. OF LANES)   2.1<---  644  THRU   Laurel Road

RIGHT   50 ---  1.0   1.0  1.0  1.0   1.0 ---   98  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                         SIG WARRANTS:
W + E                 43  222  110                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
=========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)     110          12 *     1650     0.0073
    THRU (T)      222         222       1650     0.1345     0.1345
    LEFT (L)       43          43       1650     0.0261
-------------------------------------------------------------------------
SB  RIGHT (R)      98           3 *     1650     0.0018
    THRU (T)      212         212       1650     0.1285
    LEFT (L)       67          67       1650     0.0406     0.0406
-------------------------------------------------------------------------
EB  RIGHT (R)      50           7 *     1650     0.0042
    THRU (T)      850         850       3300     0.2576     0.2576
    LEFT (L)       95          95       1650     0.0576
-------------------------------------------------------------------------
WB  RIGHT (R)      84          84       1650     0.0509
    THRU (T)      644         644       3300     0.1952
    LEFT (L)       98          98       1650     0.0594     0.0594
    T + R                     728       3300     0.2206
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.49
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline PM Peak Hour Volumes                         11/14/08
========================================================================
INTERSECTION    21 Empire Avenue/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                            4-PHASE SIGNAL
-----------           278  396  207
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   235 ---  1.0   1.1  2.1  1.0   1.1 ---  120  RIGHT
                                                           STREET NAME:
THRU   795 ---> 2.1  (NO. OF LANES)   2.1<---  678  THRU  Laurel Road

RIGHT   88 ---  1.1   1.0  2.1  1.1   1.0 ---   80  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 149  524   89                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	89	89	1650	0.0539	
	THRU (T)	524	524	3300	0.1588	
	LEFT (L)	149	149	1650	0.0903	
	T + R		613	3300	0.1858	0.1858
SB	RIGHT (R)	278	278	1650	0.1685	
	THRU (T)	396	396	3300	0.1200	
	LEFT (L)	207	207	1650	0.1255	0.1255
	T + R		674	3300	0.2042	
EB	RIGHT (R)	88	88	1650	0.0533	
	THRU (T)	795	795	3300	0.2409	
	LEFT (L)	235	235	1650	0.1424	0.1424
	T + R		883	3300	0.2676	
WB	RIGHT (R)	120	120	1650	0.0727	
	THRU (T)	678	678	3300	0.2055	
	LEFT (L)	80	80	1650	0.0485	
	T + R		798	3300	0.2418	0.2418

```
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.70
     INTERSECTION LEVEL OF SERVICE:                                B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BA.PMV,CAP=
```

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	373	52	72	332	63	41
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	373	52	72	332	63	41
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked						
vC, conflicting volume			425		683	186
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			425		683	186
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		82	95
cM capacity (veh/h)			1131		359	824

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	186	186	52	72	166	166	63	41
Volume Left	0	0	0	72	0	0	63	0
Volume Right	0	0	52	0	0	0	0	41
cSH	1700	1700	1700	1131	1700	1700	359	824
Volume to Capacity	0.11	0.11	0.03	0.06	0.10	0.10	0.18	0.05
Queue Length (ft)	0	0	0	5	0	0	16	4
Control Delay (s)	0.0	0.0	0.0	8.4	0.0	0.0	17.2	9.6
Lane LOS				A			C	A
Approach Delay (s)	0.0			1.5			14.2	
Approach LOS							B	

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	27.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	13	431	369	4	0	16
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	13	431	369	4	0	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449	462			
pX, platoon unblocked						
vC, conflicting volume	373				612	186
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	373				612	186
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1182				420	824

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	13	216	216	246	127	0	16
Volume Left	13	0	0	0	0	0	0
Volume Right	0	0	0	0	4	0	16
cSH	1182	1700	1700	1700	1700	1700	824
Volume to Capacity	0.01	0.13	0.13	0.14	0.07	0.00	0.02
Queue Length (ft)	1	0	0	0	0	0	1
Control Delay (s)	8.1	0.0	0.0	0.0	0.0	0.0	9.5
Lane LOS	A					A	A
Approach Delay (s)	0.2			0.0		9.5	
Approach LOS						A	

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	20.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	22	253	18	7	218	38	26	37	8	22	18	18
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	22	253	18	7	218	38	26	37	8	22	18	18

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	293	263	71	58
Volume Left (vph)	22	7	26	22
Volume Right (vph)	18	38	8	18
Hadj (s)	0.0	0.0	0.0	-0.1
Departure Headway (s)	4.6	5.0	5.3	5.2
Degree Utilization, x	0.37	0.37	0.10	0.08
Capacity (veh/h)	765	573	617	645
Control Delay (s)	8.2	8.8	8.4	8.3
Approach Delay (s)	8.2	8.8	8.4	8.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.5		
HCM Level of Service	A		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	33	153	111	60	203	101	108	146	96	82	159	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	33	153	111	60	203	101	108	146	96	82	159	81

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	297	364	254	96	241	81
Volume Left (vph)	33	60	108	0	82	0
Volume Right (vph)	111	101	0	96	0	81
Hadj (s)	-0.2	-0.1	0.2	-0.7	0.2	-0.7
Departure Headway (s)	6.6	6.7	7.4	6.5	7.5	6.6
Degree Utilization, x	0.55	0.68	0.53	0.17	0.50	0.15
Capacity (veh/h)	512	489	455	515	465	521
Control Delay (s)	11.5	12.9	11.2	8.7	11.0	8.7
Approach Delay (s)	11.5	12.9	10.5		10.4	
Approach LOS	B	B	B		B	

Intersection Summary			
Delay	11.4		
HCM Level of Service	B		
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	40	5	15	25	59	120
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	5	15	25	59	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					1316	
pX, platoon unblocked						
vC, conflicting volume	114	59	179			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	114	59	179			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	99			
cM capacity (veh/h)	873	1007	1397			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	40	5	15	25	59	120
Volume Left	40	0	15	0	0	0
Volume Right	0	5	0	0	0	120
cSH	873	1007	1397	1700	1700	1700
Volume to Capacity	0.05	0.00	0.01	0.01	0.03	0.07
Queue Length (ft)	4	0	1	0	0	0
Control Delay (s)	9.3	8.6	7.6	0.0	0.0	0.0
Lane LOS	A	A	A			
Approach Delay (s)	9.2		2.9		0.0	
Approach LOS	A					

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	47	127	9	5	148	26	10	19	14	22	65	56
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	47	127	9	5	148	26	10	19	14	22	65	56

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	183	179	43	143
Volume Left (vph)	47	5	10	22
Volume Right (vph)	9	26	14	56
Hadj (s)	0.1	0.0	-0.1	-0.2
Departure Headway (s)	4.6	4.6	4.8	4.6
Degree Utilization, x	0.23	0.23	0.06	0.18
Capacity (veh/h)	745	597	695	746
Control Delay (s)	7.9	7.9	7.8	7.8
Approach Delay (s)	7.9	7.9	7.8	7.8
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.9		
HCM Level of Service	A		
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	720	84	25	830	34	18
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	720	84	25	830	34	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			804		1642	762
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			804		1642	762
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		68	96
cM capacity (veh/h)			820		107	405

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	804	855	34	18
Volume Left	0	25	34	0
Volume Right	84	0	0	18
cSH	1700	820	107	405
Volume to Capacity	0.47	0.03	0.32	0.04
Queue Length (ft)	0	2	31	3
Control Delay (s)	0.0	0.8	53.9	14.3
Lane LOS		A	F	B
Approach Delay (s)	0.0	0.8	40.2	
Approach LOS			E	

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	56	41	765	1004	12
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	56	41	765	1004	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.51	0.51	0.51			
vC, conflicting volume	1857	1010	1016			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2682	1020	1031			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	62	88			
cM capacity (veh/h)	11	146	343			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	75	806	1016
Volume Left	19	41	0
Volume Right	56	0	12
cSH	35	343	1700
Volume to Capacity	2.13	0.12	0.60
Queue Length (ft)	209	10	0
Control Delay (s)	766.0	4.3	0.0
Lane LOS	F	A	
Approach Delay (s)	766.0	4.3	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	32.1		
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	56	209	599	55	217	827
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	56	209	599	55	217	827
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.66					
vC, conflicting volume	1888	626			654	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2355	626			654	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	57			77	
cM capacity (veh/h)	20	484			933	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	265	654	217	827
Volume Left	56	0	217	0
Volume Right	209	55	0	0
cSH	81	1700	933	1700
Volume to Capacity	3.27	0.38	0.23	0.49
Queue Length (ft)	Err	0	23	0
Control Delay (s)	Err	0.0	10.0	0.0
Lane LOS	F		B	
Approach Delay (s)	Err	0.0	2.1	
Approach LOS	F			

Intersection Summary			
Average Delay	1350.9		
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	66	398	2	8	680	2	30	18	23	3	0	68
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	398	2	8	680	2	30	18	23	3	0	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	682			400			1296	1229	399	1260	1229	681
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	682			400			1296	1229	399	1260	1229	681
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			99			73	89	96	98	100	85
cM capacity (veh/h)	911			1159			111	164	651	122	164	450

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	466	690	71	71
Volume Left	66	8	30	3
Volume Right	2	2	23	68
cSH	911	1159	171	405
Volume to Capacity	0.07	0.01	0.42	0.18
Queue Length (ft)	6	1	46	16
Control Delay (s)	2.1	0.2	40.3	15.8
Lane LOS	A	A	E	C
Approach Delay (s)	2.1	0.2	40.3	15.8
Approach LOS			E	C

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	650	112	27	546	110	62
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	650	112	27	546	110	62
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked			0.96		0.96	0.96
vC, conflicting volume			762		977	325
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			712		935	257
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		55	91
cM capacity (veh/h)			849		246	713

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	325	325	112	27	273	273	110	62
Volume Left	0	0	0	27	0	0	110	0
Volume Right	0	0	112	0	0	0	0	62
cSH	1700	1700	1700	849	1700	1700	246	713
Volume to Capacity	0.19	0.19	0.07	0.03	0.16	0.16	0.45	0.09
Queue Length (ft)	0	0	0	2	0	0	54	7
Control Delay (s)	0.0	0.0	0.0	9.4	0.0	0.0	31.0	10.5
Lane LOS				A			D	B
Approach Delay (s)	0.0			0.4			23.6	
Approach LOS							C	

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	27	690	565	6	1	17
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	27	690	565	6	1	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449	462			
pX, platoon unblocked						
vC, conflicting volume	571				967	286
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	571				967	286
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	98
cM capacity (veh/h)	998				245	711

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	27	345	345	377	194	1	17
Volume Left	27	0	0	0	0	1	0
Volume Right	0	0	0	0	6	0	17
cSH	998	1700	1700	1700	1700	245	711
Volume to Capacity	0.03	0.20	0.20	0.22	0.11	0.00	0.02
Queue Length (ft)	2	0	0	0	0	0	2
Control Delay (s)	8.7	0.0	0.0	0.0	0.0	19.8	10.2
Lane LOS	A					C	B
Approach Delay (s)	0.3			0.0		10.7	
Approach LOS						B	

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	233	23	10	208	16	23	16	12	52	48	23
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	233	23	10	208	16	23	16	12	52	48	23

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	258	234	51	123
Volume Left (vph)	2	10	23	52
Volume Right (vph)	23	16	12	23
Hadj (s)	0.0	0.0	0.0	0.0
Departure Headway (s)	4.6	4.9	5.2	5.1
Degree Utilization, x	0.33	0.32	0.07	0.17
Capacity (veh/h)	745	578	628	666
Control Delay (s)	8.2	8.5	8.3	8.4
Approach Delay (s)	8.2	8.5	8.3	8.4
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.3		
HCM Level of Service	A		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	32	176	46	62	220	44	71	111	70	63	162	75
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	176	46	62	220	44	71	111	70	63	162	75

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	254	326	182	70	225	75
Volume Left (vph)	32	62	71	0	63	0
Volume Right (vph)	46	44	0	70	0	75
Hadj (s)	0.0	0.0	0.2	-0.7	0.2	-0.7
Departure Headway (s)	6.0	6.0	6.9	6.0	6.7	5.9
Degree Utilization, x	0.43	0.55	0.35	0.12	0.42	0.12
Capacity (veh/h)	554	516	480	550	510	579
Control Delay (s)	10.1	10.8	9.6	8.0	9.8	7.9
Approach Delay (s)	10.1	10.8	9.1		9.3	
Approach LOS	B	B	A		A	

Intersection Summary			
Delay	9.9		
HCM Level of Service	A		
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	145	5	0	0	35	88
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	145	5	0	0	35	88
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					1316	
pX, platoon unblocked						
vC, conflicting volume	35	35	123			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	35	35	123			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	100	100			
cM capacity (veh/h)	978	1038	1464			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	145	5	0	0	35	88
Volume Left	145	0	0	0	0	0
Volume Right	0	5	0	0	0	88
cSH	978	1038	1700	1700	1700	1700
Volume to Capacity	0.15	0.00	0.00	0.00	0.02	0.05
Queue Length (ft)	13	0	0	0	0	0
Control Delay (s)	9.3	8.5	0.0	0.0	0.0	0.0
Lane LOS	A	A				
Approach Delay (s)	9.3		0.0		0.0	
Approach LOS	A					

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	18.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	63	94	56	23	104	21	88	210	38	17	145	36
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	63	94	56	23	104	21	88	210	38	17	145	36

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	213	148	336	198
Volume Left (vph)	63	23	88	17
Volume Right (vph)	56	21	38	36
Hadj (s)	-0.1	0.0	0.0	-0.1
Departure Headway (s)	5.4	5.4	5.2	5.3
Degree Utilization, x	0.32	0.22	0.48	0.29
Capacity (veh/h)	614	510	658	647
Control Delay (s)	9.0	8.8	9.3	8.8
Approach Delay (s)	9.0	8.8	9.3	8.8
Approach LOS	A	A	A	A

Intersection Summary			
Delay	9.1		
HCM Level of Service	A		
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1190	141	7	890	28	7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1190	141	7	890	28	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1331		2164	1260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1331		2164	1260
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		45	97
cM capacity (veh/h)			519		51	208

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	1331	897	28	7
Volume Left	0	7	28	0
Volume Right	141	0	0	7
cSH	1700	519	51	208
Volume to Capacity	0.78	0.01	0.55	0.03
Queue Length (ft)	0	1	53	3
Control Delay (s)	0.0	0.4	140.0	22.9
Lane LOS		A	F	C
Approach Delay (s)	0.0	0.4	116.6	
Approach LOS			F	

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	7	46	53	809	683	22
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	46	53	809	683	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.71	0.71	0.71			
vC, conflicting volume	1609	694	705			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1862	567	583			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	88	92			
cM capacity (veh/h)	52	370	701			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	53	862	705
Volume Left	7	53	0
Volume Right	46	0	22
cSH	206	701	1700
Volume to Capacity	0.26	0.08	0.41
Queue Length (ft)	25	6	0
Control Delay (s)	28.5	2.1	0.0
Lane LOS	D	A	
Approach Delay (s)	28.5	2.1	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	54	197	680	100	181	572
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	54	197	680	100	181	572
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.95					
vC, conflicting volume	1664	730			780	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1696	730			780	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	29	53			78	
cM capacity (veh/h)	76	422			837	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	251	780	181	572
Volume Left	54	0	181	0
Volume Right	197	100	0	0
cSH	213	1700	837	1700
Volume to Capacity	1.18	0.46	0.22	0.34
Queue Length (ft)	309	0	20	0
Control Delay (s)	164.2	0.0	10.5	0.0
Lane LOS	F		B	
Approach Delay (s)	164.2	0.0	2.5	
Approach LOS	F			

Intersection Summary			
Average Delay	24.2		
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	79	815	35	26	694	20	4	12	15	1	21	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	79	815	35	26	694	20	4	12	15	1	21	81
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	714			850			1838	1756	832	1768	1764	704
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	714			850			1838	1756	832	1768	1764	704
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			97			88	84	96	98	72	81
cM capacity (veh/h)	886			788			34	75	369	50	74	437

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	929	740	31	103
Volume Left	79	26	4	1
Volume Right	35	20	15	81
cSH	886	788	97	211
Volume to Capacity	0.09	0.03	0.32	0.49
Queue Length (ft)	7	3	31	61
Control Delay (s)	2.3	0.9	58.7	37.4
Lane LOS	A	A	F	E
Approach Delay (s)	2.3	0.9	58.7	37.4
Approach LOS			F	E

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	91.5%	ICU Level of Service	F
Analysis Period (min)	15		

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project AM Peak Hour Volumes   11/14/08

```
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                  Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            10  419  414
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    39 ---  1.0   1.1  2.1  2.0   2.1 ---  483  RIGHT
                                                           STREET NAME:
THRU   152 ---> 2.1  (NO. OF LANES)   1.1<---  192  THRU   W.Cypress Rd.

RIGHT   60 ---  1.1   1.0  2.0  1.0   1.0 ---  248  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                          SIG WARRANTS:
W + E                  30  462  185                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	185	0 *	1650	0.0000	
	THRU (T)	462	462	3300	0.1400	0.1400
	LEFT (L)	30	30	1650	0.0182	
SB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	419	419	3300	0.1270	
	LEFT (L)	414	414	3000	0.1380	0.1380
	T + R		429	3300	0.1300	
EB	RIGHT (R)	60	60	1650	0.0364	
	THRU (T)	152	152	3300	0.0461	
	LEFT (L)	39	39	1650	0.0236	
	T + R		212	3300	0.0642	0.0642
WB	RIGHT (R)	483	255 *	3000	0.0850	
	THRU (T)	192	192	1650	0.1164	
	LEFT (L)	248	248	1650	0.1503	0.1503
	T + R		447	3000	0.1490	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.49

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes        11/14/08
========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------           319    0   47
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   335 ---  1.0   1.0  0.0  1.0   1.1 ---   22  RIGHT
                                                          STREET NAME:
THRU   531 ---> 2.0  (NO. OF LANES)   2.1<---  721  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
SB  RIGHT (R)     319          0 *     1720     0.0000
    LEFT (L)       47         47       1720     0.0273     0.0273
------------------------------------------------------------------------
EB  THRU (T)      531        531       3440     0.1544
    LEFT (L)      335        335       1720     0.1948     0.1948
------------------------------------------------------------------------
WB  RIGHT (R)      22         22       1720     0.0128
    THRU (T)      721        721       3440     0.2096
    T + R                    743       3440     0.2160     0.2160
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.44
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes        11/14/08
========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           227   94   44
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT   100 ---  1.0   1.0  1.0  1.0   1.1 ---   17  RIGHT
                                                           STREET NAME:
THRU   243 ---> 2.1  (NO. OF LANES)   2.1<---  259  THRU   E. Cypress Rd.

RIGHT  196 ---  1.1   1.0  1.0  1.0   1.0 ---  171  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                        SIG WARRANTS:
W + E                 122   37   73                          Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      73          0 *     1650     0.0000
    THRU (T)       37         37       1650     0.0224
    LEFT (L)      122        122       1650     0.0739     0.0739
------------------------------------------------------------------------
SB  RIGHT (R)     227        127 *     1650     0.0770     0.0770
    THRU (T)       94         94       1650     0.0570
    LEFT (L)       44         44       1650     0.0267
------------------------------------------------------------------------
EB  RIGHT (R)     196        196       1650     0.1188
    THRU (T)      243        243       3300     0.0736
    LEFT (L)      100        100       1650     0.0606
    T + R                    439       3300     0.1330     0.1330
------------------------------------------------------------------------
WB  RIGHT (R)      17         17       1650     0.0103
    THRU (T)      259        259       3300     0.0785
    LEFT (L)      171        171       1650     0.1036     0.1036
    T + R                    276       3300     0.0836
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.39
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes         11/14/08
==========================================================================
INTERSECTION     4 Project Entrance/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |          ^
             |        <---   v   --->        | Split? N
LEFT     0 ---  1.0   1.0  1.1  1.1   1.1 ---    0  RIGHT
                                                            STREET NAME:
THRU   377 ---> 1.1  (NO. OF LANES)   3.1<---  366  THRU  E. Cypress Rd.

RIGHT    3 ---  1.1   1.1  1.1  1.1   1.0 ---    1  LEFT
             |        <---   ^   --->        |
             v          |    |    |          v
  N                     |    |    |                         SIG WARRANTS:
W + E                   0    0    0                           Urb=N, Rur=N
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
==========================================================================
               ORIGINAL   ADJUSTED                  V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY      RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)       0          0       1650      0.0000     0.0000
    THRU (T)        0          0       1650      0.0000
    LEFT (L)        0          0       1650      0.0000
    T + R                      0       1650      0.0000
    T + L                      0       1650      0.0000
    T + R + L                  0       1650      0.0000
--------------------------------------------------------------------------
SB  RIGHT (R)       0          0       1650      0.0000
    THRU (T)        0          0       1650      0.0000
    LEFT (L)        0          0       1650      0.0000     0.0000
    T + L                      0       1650      0.0000
--------------------------------------------------------------------------
EB  RIGHT (R)       3          3       1650      0.0018
    THRU (T)      377        377       1650      0.2285
    LEFT (L)        0          0       1650      0.0000
    T + R                    380       1650      0.2303     0.2303
--------------------------------------------------------------------------
WB  RIGHT (R)       0          0       1650      0.0000
    THRU (T)      366        366       4950      0.0739
    LEFT (L)        1          1       1650      0.0006     0.0006
    T + R                    366       4950      0.0739
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.23
     INTERSECTION LEVEL OF SERVICE:                              A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------           245    0    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   346 ---  2.0   2.0  0.0  1.0   1.1 ---   15  RIGHT
                                                           STREET NAME:
THRU    62 ---> 1.0  (NO. OF LANES)   1.1<---  159  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   0    0    0                          Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
=========================================================================
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	245	55 *	3127	0.0176	0.0176
LEFT (L)	5	5	1720	0.0029	
EB THRU (T)	62	62	1720	0.0360	
LEFT (L)	346	346	3127	0.1106	0.1106
WB RIGHT (R)	15	15	1720	0.0087	
THRU (T)	159	159	1720	0.0924	
T + R		174	1720	0.1012	0.1012

```
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.23
     INTERSECTION LEVEL OF SERVICE:                                A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

===

Condition: Baseline plus Project AM Peak Hour Volumes   11/14/08

===

INTERSECTION   13 O'Hara Avenue/Main Street

Count Date   Time   Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------             5    0    5
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT     5 ---  1.0   1.1  1.1  1.1   1.1 ---    5  RIGHT
                                                            STREET NAME:
THRU   788 ---> 1.0  (NO. OF LANES)   1.1<---  914  THRU  Main Street

RIGHT  118 ---  1.0   1.0  1.1  1.1   1.0 ---   52  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                         SIG WARRANTS:
W + E                 122    0   43                           Urb=B, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	43	43	1650	0.0261	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	122	122	1650	0.0739	0.0739
	T + R		43	1650	0.0261	
SB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	5	5	1650	0.0030	
	T + R		5	1650	0.0030	
	T + L		5	1650	0.0030	
	T + R + L		10	1650	0.0061	0.0061
EB	RIGHT (R)	118	0 *	1650	0.0000	
	THRU (T)	788	788	1650	0.4776	
	LEFT (L)	5	5	1650	0.0030	0.0030
WB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	914	914	1650	0.5539	
	LEFT (L)	52	52	1650	0.0315	
	T + R		919	1650	0.5570	0.5570

===

TOTAL VOLUME-TO-CAPACITY RATIO: 0.64

INTERSECTION LEVEL OF SERVICE: B

===

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           157    0  179
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    75 ---  1.0   1.0  0.0  1.0   1.1 ---   99  RIGHT
                                                            STREET NAME:
THRU   782 ---> 2.0  (NO. OF LANES)   2.1<---  928  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   0    0    0                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
SB  RIGHT (R)     157         82 *     1720     0.0477
    LEFT (L)      179        179       1720     0.1041     0.1041
------------------------------------------------------------------------
EB  THRU (T)      782        782       3440     0.2273
    LEFT (L)       75         75       1720     0.0436     0.0436
------------------------------------------------------------------------
WB  RIGHT (R)      99         99       1720     0.0576
    THRU (T)      928        928       3440     0.2698
    T + R                   1027       3440     0.2985     0.2985
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.45
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project AM Peak Hour Volumes 11/14/08

INTERSECTION 15 Main Street/Laurel Road

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           158  814   99
                        |    |    |
             ^          |    |    |          ^
             |        <---   v   --->        | Split? N
LEFT   167 ---  1.0   1.1  2.1  1.0    1.0 ---  180  RIGHT
                                                            STREET NAME:
THRU    82 ---> 1.0  (NO. OF LANES)    1.1<---  124  THRU   Laurel Road

RIGHT  281 ---  1.0   1.0  2.1  1.1    1.1 ---  195  LEFT
             |        <---   ^   --->        |
             v          |    |    |          v
  N                     |    |    |                         SIG WARRANTS:
W + E                 140  629   86                           Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	86	86	1650	0.0521	
THRU (T)	629	629	3300	0.1906	
LEFT (L)	140	140	1650	0.0848	0.0848
T + R		715	3300	0.2167	
SB RIGHT (R)	158	158	1650	0.0958	
THRU (T)	814	814	3300	0.2467	
LEFT (L)	99	99	1650	0.0600	
T + R		972	3300	0.2945	0.2945
EB RIGHT (R)	281	141 *	1650	0.0855	
THRU (T)	82	82	1650	0.0497	
LEFT (L)	167	167	1650	0.1012	0.1012
WB RIGHT (R)	180	81 *	1650	0.0491	
THRU (T)	124	124	1650	0.0752	
LEFT (L)	195	195	1650	0.1182	
T + L		319	1650	0.1933	0.1933

TOTAL VOLUME-TO-CAPACITY RATIO: 0.67

INTERSECTION LEVEL OF SERVICE: B

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

==

Condition: Baseline plus Project AM Peak Hour Volumes   11/14/08

==

INTERSECTION   16 Main Street/Malicoat Lane

Count Date   Time   Peak Hour

```
------------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                            4-PHASE SIGNAL
-----------           163  973    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     9 ---  1.0   1.1  2.1  1.0   1.1 ---    2  RIGHT
                                                       STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)   1.1<---    2  THRU  Malicoat Lane

RIGHT   18 ---  1.1   1.0  2.1  1.1   1.0 ---    9  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                  40  805    5                      Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	805	805	3300	0.2439	
	LEFT (L)	40	40	1650	0.0242	0.0242
	T + R		810	3300	0.2455	
SB	RIGHT (R)	163	163	1650	0.0988	
	THRU (T)	973	973	3300	0.2948	
	LEFT (L)	5	5	1650	0.0030	
	T + R		1136	3300	0.3442	0.3442
EB	RIGHT (R)	18	18	1650	0.0109	0.0109
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	9	9	1650	0.0055	
	T + R		18	1650	0.0109	
WB	RIGHT (R)	2	2	1650	0.0012	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	9	9	1650	0.0055	0.0055
	T + R		4	1650	0.0024	

==

TOTAL VOLUME-TO-CAPACITY RATIO: 0.38

INTERSECTION LEVEL OF SERVICE: A

==

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project AM Peak Hour Volumes 11/14/08

INTERSECTION 20 O'Hara Avenue/Laurel Road
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           138  315   37
                        |    |    |
             ^          |    |    |        ^
             |       <---    v   --->      | Split? N
LEFT   134 ---  1.0   1.0  1.0  1.0   1.1 ---   39  RIGHT
                                                             STREET NAME:
THRU   358 ---> 2.0  (NO. OF LANES)   2.1<---  715  THRU   Laurel Road

RIGHT   50 ---  1.0   1.0  1.0  1.0   1.0 ---  130  LEFT
             |       <---    ^   --->      |
             v          |    |    |        v
  N                     |    |    |                          SIG WARRANTS:
W + E                  31  225  136                            Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	136	6 *	1650	0.0036	
	THRU (T)	225	225	1650	0.1364	
	LEFT (L)	31	31	1650	0.0188	0.0188
SB	RIGHT (R)	138	4 *	1650	0.0024	
	THRU (T)	315	315	1650	0.1909	0.1909
	LEFT (L)	37	37	1650	0.0224	
EB	RIGHT (R)	50	19 *	1650	0.0115	
	THRU (T)	358	358	3300	0.1085	
	LEFT (L)	134	134	1650	0.0812	0.0812
WB	RIGHT (R)	39	39	1650	0.0236	
	THRU (T)	715	715	3300	0.2167	
	LEFT (L)	130	130	1650	0.0788	
	T + R		754	3300	0.2285	0.2285

TOTAL VOLUME-TO-CAPACITY RATIO: 0.52
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Baseline plus Project AM Peak Hour Volumes         11/14/08
==========================================================================
INTERSECTION    21 Empire Avenue/Laurel Road
Count Date                        Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           239  247   71
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   193 ---  1.0   1.1  2.1  1.0   1.1 ---   43  RIGHT
                                                              STREET NAME:
THRU   436 ---> 2.1  (NO. OF LANES)   2.1<---  772  THRU  Laurel Road

RIGHT  148 ---  1.1   1.0  2.1  1.1   1.0 ---   62  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                  60  126   37                            Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	37	37	1650	0.0224	
	THRU (T)	126	126	3300	0.0382	
	LEFT (L)	60	60	1650	0.0364	0.0364
	T + R		163	3300	0.0494	
SB	RIGHT (R)	239	239	1650	0.1448	
	THRU (T)	247	247	3300	0.0748	
	LEFT (L)	71	71	1650	0.0430	
	T + R		486	3300	0.1473	0.1473
EB	RIGHT (R)	148	148	1650	0.0897	
	THRU (T)	436	436	3300	0.1321	
	LEFT (L)	193	193	1650	0.1170	0.1170
	T + R		584	3300	0.1770	
WB	RIGHT (R)	43	43	1650	0.0261	
	THRU (T)	772	772	3300	0.2339	
	LEFT (L)	62	62	1650	0.0376	
	T + R		815	3300	0.2470	0.2470

TOTAL VOLUME-TO-CAPACITY RATIO: 0.55

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes        11/14/08
========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                     Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            52  638  762
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT    31 ---  1.0   1.1  2.1  2.0   2.1 ---  496  RIGHT
                                                        STREET NAME:
THRU   231 ---> 2.1  (NO. OF LANES)   1.1<---  273  THRU  W.Cypress Rd.

RIGHT   61 ---  1.1   1.0  2.0  1.0   1.0 ---  314  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                     SIG WARRANTS:
W + E                  29  514  359                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)     359         45 *      1650     0.0273
    THRU (T)      514        514        3300     0.1558     0.1558
    LEFT (L)       29         29        1650     0.0176
------------------------------------------------------------------------
SB  RIGHT (R)      52         52        1650     0.0315
    THRU (T)      638        638        3300     0.1933
    LEFT (L)      762        762        3000     0.2540     0.2540
    T + R                    690        3300     0.2091
------------------------------------------------------------------------
EB  RIGHT (R)      61         61        1650     0.0370
    THRU (T)      231        231        3300     0.0700
    LEFT (L)       31         31        1650     0.0188
    T + R                    292        3300     0.0885     0.0885
------------------------------------------------------------------------
WB  RIGHT (R)     496         77 *      3000     0.0257
    THRU (T)      273        273        1650     0.1655
    LEFT (L)      314        314        1650     0.1903     0.1903
    T + R                    350        3000     0.1167
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.69
     INTERSECTION LEVEL OF SERVICE:                              B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes        11/14/08
=========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------            12    0    4
                        |    |    |
             ^          |    |    |          ^
             |       <---    v   --->        | Split? N
LEFT     7 ---  1.0   1.0  0.0  1.0   1.1 ---    1  RIGHT
                                                             STREET NAME:
THRU  1333 ---> 2.0  (NO. OF LANES)   2.1<--- 1060  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->        |
             v          |    |    |          v
  N                     |    |    |                      SIG WARRANTS:
W + E                   0    0    0                        Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
=========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
SB  RIGHT (R)      12          5 *     1720     0.0029     0.0029
    LEFT (L)        4          4       1720     0.0023
-------------------------------------------------------------------------
EB  THRU (T)     1333       1333       3440     0.3875     0.3875
    LEFT (L)        7          7       1720     0.0041
-------------------------------------------------------------------------
WB  RIGHT (R)       1          1       1720     0.0006
    THRU (T)     1060       1060       3440     0.3081
    T + R                   1061       3440     0.3084
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.39
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes        11/14/08
=========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           231   86   41
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT   322 ---  1.0   1.0  1.0  1.0   1.1 ---   55  RIGHT
                                                          STREET NAME:
THRU   557 ---> 2.1  (NO. OF LANES)   2.1<---  441  THRU  E. Cypress Rd.

RIGHT  177 ---  1.1   1.0  1.0  1.0   1.0 ---  125  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                       SIG WARRANTS:
W + E                 192  117  192                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
=========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)     192         67 *     1650     0.0406
    THRU (T)      117        117       1650     0.0709
    LEFT (L)      192        192       1650     0.1164     0.1164
-------------------------------------------------------------------------
SB  RIGHT (R)     231          0 *     1650     0.0000
    THRU (T)       86         86       1650     0.0521     0.0521
    LEFT (L)       41         41       1650     0.0248
-------------------------------------------------------------------------
EB  RIGHT (R)     177        177       1650     0.1073
    THRU (T)      557        557       3300     0.1688
    LEFT (L)      322        322       1650     0.1952     0.1952
    T + R                    734       3300     0.2224
-------------------------------------------------------------------------
WB  RIGHT (R)      55         55       1650     0.0333
    THRU (T)      441        441       3300     0.1336
    LEFT (L)      125        125       1650     0.0758
    T + R                    496       3300     0.1503     0.1503
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.51
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project PM Peak Hour Volumes 11/14/08

INTERSECTION 4 Project Entrance/E. Cypress Rd.
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                      4-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT     0 ---  1.0   1.0  1.1  1.1   1.1 ---    0  RIGHT
                                                          STREET NAME:
THRU   784 ---> 1.1  (NO. OF LANES)   3.1<---  621  THRU  E. Cypress Rd.

RIGHT    0 ---  1.1   1.1  1.1  1.1   1.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	0	0	1650	0.0000	0.0000
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	0	0	1650	0.0000	
	T + R		0	1650	0.0000	
	T + L		0	1650	0.0000	
	T + R + L		0	1650	0.0000	
SB	RIGHT (R)	0	0	1650	0.0000	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	0	0	1650	0.0000	0.0000
	T + L		0	1650	0.0000	
EB	RIGHT (R)	0	0	1650	0.0000	
	THRU (T)	784	784	1650	0.4752	0.4752
	LEFT (L)	0	0	1650	0.0000	
	T + R		784	1650	0.4752	
WB	RIGHT (R)	0	0	1650	0.0000	
	THRU (T)	621	621	4950	0.1255	
	LEFT (L)	0	0	1650	0.0000	0.0000
	T + R		621	4950	0.1255	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.48
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

```
==========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes        11/14/08
==========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                     3-PHASE SIGNAL
-----------           510    0   17
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   539 ---  2.0   2.0  0.0  1.0   1.1 ---   12  RIGHT
                                                        STREET NAME:
THRU   183 ---> 1.0  (NO. OF LANES)   1.1<---  114  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                     SIG WARRANTS:
W + E                   0    0    0                       Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB	RIGHT (R)	510	214 *	3127	0.0684	0.0684
	LEFT (L)	17	17	1720	0.0099	
EB	THRU (T)	183	183	1720	0.1064	
	LEFT (L)	539	539	3127	0.1724	0.1724
WB	RIGHT (R)	12	12	1720	0.0070	
	THRU (T)	114	114	1720	0.0663	
	T + R		126	1720	0.0733	0.0733

TOTAL VOLUME-TO-CAPACITY RATIO: 0.31
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                   Time               Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------             1    0    1
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     5 ---  1.0   1.1  1.1  1.1   1.1 ---    5  RIGHT
                                                           STREET NAME:
THRU  1384 ---> 1.0  (NO. OF LANES)   1.1<---  978  THRU   Main Street

RIGHT  273 ---  1.0   1.0  1.1  1.1   1.0 ---   53  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 208    0   87                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
=========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      87         87        1650     0.0527
    THRU (T)        0          0        1650     0.0000
    LEFT (L)      208        208        1650     0.1261     0.1261
    T + R                     87        1650     0.0527
-------------------------------------------------------------------------
SB  RIGHT (R)       1          1        1650     0.0006
    THRU (T)        0          0        1650     0.0000
    LEFT (L)        1          1        1650     0.0006
    T + R                      1        1650     0.0006
    T + L                      1        1650     0.0006
    T + R + L                  2        1650     0.0012     0.0012
-------------------------------------------------------------------------
EB  RIGHT (R)     273         65 *      1650     0.0394
    THRU (T)     1384       1384        1650     0.8388     0.8388
    LEFT (L)        5          5        1650     0.0030
-------------------------------------------------------------------------
WB  RIGHT (R)       5          5        1650     0.0030
    THRU (T)      978        978        1650     0.5927
    LEFT (L)       53         53        1650     0.0321     0.0321
    T + R                    983        1650     0.5958
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          1.00
     INTERSECTION LEVEL OF SERVICE:                              E
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project PM Peak Hour Volumes 11/14/08

INTERSECTION 14 Vintage Parkway/Main Street
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------           135    0  178
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   195 ---  1.0   1.0  0.0  1.0   1.1 ---  168  RIGHT
                                                          STREET NAME:
THRU  1407 ---> 2.0  (NO. OF LANES)   2.1<---  954  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	135	0 *	1720	0.0000	
LEFT (L)	178	178	1720	0.1035	0.1035
EB THRU (T)	1407	1407	3440	0.4090	
LEFT (L)	195	195	1720	0.1134	0.1134
WB RIGHT (R)	168	168	1720	0.0977	
THRU (T)	954	954	3440	0.2773	
T + R		1122	3440	0.3262	0.3262

TOTAL VOLUME-TO-CAPACITY RATIO: 0.54
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           220  613  120
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   219 ---  1.0   1.1  2.1  1.0    1.0 ---  112  RIGHT
                                                             STREET NAME:
THRU   430 ---> 1.0  (NO. OF LANES)    1.1<---  387  THRU   Laurel Road

RIGHT  141 ---  1.0   1.0  2.1  1.1    1.1 ---   98  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                 197  608  158                            Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	158	158	1650	0.0958	
	THRU (T)	608	608	3300	0.1842	
	LEFT (L)	197	197	1650	0.1194	0.1194
	T + R		766	3300	0.2321	
SB	RIGHT (R)	220	220	1650	0.1333	
	THRU (T)	613	613	3300	0.1858	
	LEFT (L)	120	120	1650	0.0727	
	T + R		833	3300	0.2524	0.2524
EB	RIGHT (R)	141	0 *	1650	0.0000	
	THRU (T)	430	430	1650	0.2606	
	LEFT (L)	219	219	1650	0.1327	0.1327
WB	RIGHT (R)	112	0 *	1650	0.0000	
	THRU (T)	387	387	1650	0.2345	
	LEFT (L)	98	98	1650	0.0594	
	T + L		485	1650	0.2939	0.2939

```
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.80
     INTERSECTION LEVEL OF SERVICE:                                C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project PM Peak Hour Volumes 11/14/08

```
INTERSECTION    16 Main Street/Malicoat Lane
Count Date                   Time               Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            30  790   10
                        |   |    |
             ^          |   |    |         ^
             |       <---   v   --->       | Split? N
LEFT    16 ---  1.0   1.1  2.1  1.0   1.1 ---    8  RIGHT
                                                       STREET NAME:
THRU     0 ---> 1.1  (NO. OF LANES)   1.1<---    0  THRU  Malicoat Lane

RIGHT   11 ---  1.1   1.0  2.1  1.1   1.0 ---    0  LEFT
             |       <---   ^   --->       |
             v          |   |    |         v
  N                     |   |    |                     SIG WARRANTS:
W + E                  10  932   12                      Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	12	12	1650	0.0073	
	THRU (T)	932	932	3300	0.2824	
	LEFT (L)	10	10	1650	0.0061	
	T + R		944	3300	0.2861	0.2861
SB	RIGHT (R)	30	30	1650	0.0182	
	THRU (T)	790	790	3300	0.2394	
	LEFT (L)	10	10	1650	0.0061	0.0061
	T + R		820	3300	0.2485	
EB	RIGHT (R)	11	11	1650	0.0067	
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	16	16	1650	0.0097	0.0097
	T + R		11	1650	0.0067	
WB	RIGHT (R)	8	8	1650	0.0048	0.0048
	THRU (T)	0	0	1650	0.0000	
	LEFT (L)	0	0	1650	0.0000	
	T + R		8	1650	0.0048	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.31

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Baseline plus Project PM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    20 O'Hara Avenue/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------            98  212   67
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    95 ---  1.0   1.0  1.0  1.0   1.1 ---   84  RIGHT
                                                          STREET NAME:
THRU   982 ---> 2.0  (NO. OF LANES)   2.1<---  752  THRU  Laurel Road

RIGHT   50 ---  1.0   1.0  1.0  1.0   1.0 ---  112  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  43  222  127                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
========================================================================
               ORIGINAL   ADJUSTED                V/C      CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      127          15 *     1650     0.0091
    THRU (T)       222         222       1650     0.1345     0.1345
    LEFT (L)        43          43       1650     0.0261
------------------------------------------------------------------------
SB  RIGHT (R)       98           3 *     1650     0.0018
    THRU (T)       212         212       1650     0.1285
    LEFT (L)        67          67       1650     0.0406     0.0406
------------------------------------------------------------------------
EB  RIGHT (R)       50           7 *     1650     0.0042
    THRU (T)       982         982       3300     0.2976     0.2976
    LEFT (L)        95          95       1650     0.0576
------------------------------------------------------------------------
WB  RIGHT (R)       84          84       1650     0.0509
    THRU (T)       752         752       3300     0.2279
    LEFT (L)       112         112       1650     0.0679     0.0679
    T + R                      836       3300     0.2533
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.54
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Baseline plus Project PM Peak Hour Volumes 11/14/08

INTERSECTION 21 Empire Avenue/Laurel Road
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------           278  396  207
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   235 ---  1.0   1.1  2.1  1.0   1.1 ---  120  RIGHT
                                                          STREET NAME:
THRU   905 ---> 2.1  (NO. OF LANES)   2.1<---  768  THRU  Laurel Road

RIGHT   88 ---  1.1   1.0  2.1  1.1   1.0 ---   98  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                 149  524  111                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	111	111	1650	0.0673	
	THRU (T)	524	524	3300	0.1588	
	LEFT (L)	149	149	1650	0.0903	
	T + R		635	3300	0.1924	0.1924
SB	RIGHT (R)	278	278	1650	0.1685	
	THRU (T)	396	396	3300	0.1200	
	LEFT (L)	207	207	1650	0.1255	0.1255
	T + R		674	3300	0.2042	
EB	RIGHT (R)	88	88	1650	0.0533	
	THRU (T)	905	905	3300	0.2742	
	LEFT (L)	235	235	1650	0.1424	0.1424
	T + R		993	3300	0.3009	
WB	RIGHT (R)	120	120	1650	0.0727	
	THRU (T)	768	768	3300	0.2327	
	LEFT (L)	98	98	1650	0.0594	
	T + R		888	3300	0.2691	0.2691

TOTAL VOLUME-TO-CAPACITY RATIO: 0.73

INTERSECTION LEVEL OF SERVICE: C

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASFUT2.INT,VOL=...BAPR.PMV,CAP=

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	393	52	72	343	63	41
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	393	52	72	343	63	41
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked						
vC, conflicting volume			445		708	196
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			445		708	196
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		82	95
cM capacity (veh/h)			1112		345	812

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	196	196	52	72	172	172	63	41
Volume Left	0	0	0	72	0	0	63	0
Volume Right	0	0	52	0	0	0	0	41
cSH	1700	1700	1700	1112	1700	1700	345	812
Volume to Capacity	0.12	0.12	0.03	0.06	0.10	0.10	0.18	0.05
Queue Length (ft)	0	0	0	5	0	0	16	4
Control Delay (s)	0.0	0.0	0.0	8.5	0.0	0.0	17.8	9.7
Lane LOS				A			C	A
Approach Delay (s)	0.0			1.5			14.6	
Approach LOS							B	

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	13	451	380	4	0	16
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	13	451	380	4	0	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449	462			
pX, platoon unblocked						
vC, conflicting volume	384				634	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	384				634	192
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1171				407	817

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	13	226	226	253	131	0	16
Volume Left	13	0	0	0	0	0	0
Volume Right	0	0	0	0	4	0	16
cSH	1171	1700	1700	1700	1700	1700	817
Volume to Capacity	0.01	0.13	0.13	0.15	0.08	0.00	0.02
Queue Length (ft)	1	0	0	0	0	0	1
Control Delay (s)	8.1	0.0	0.0	0.0	0.0	0.0	9.5
Lane LOS	A					A	A
Approach Delay (s)	0.2			0.0		9.5	
Approach LOS						A	

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	22	277	18	7	259	39	26	37	8	23	18	18
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	22	277	18	7	259	39	26	37	8	23	18	18

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	317	305	71	59
Volume Left (vph)	22	7	26	23
Volume Right (vph)	18	39	8	18
Hadj (s)	0.0	0.0	0.0	-0.1
Departure Headway (s)	4.7	5.3	5.5	5.4
Degree Utilization, x	0.41	0.45	0.11	0.09
Capacity (veh/h)	742	568	591	619
Control Delay (s)	8.4	9.3	8.7	8.5
Approach Delay (s)	8.4	9.3	8.7	8.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.8		
HCM Level of Service	A		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	33	164	111	76	223	107	108	146	105	85	159	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	33	164	111	76	223	107	108	146	105	85	159	81

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	308	406	254	105	244	81
Volume Left (vph)	33	76	108	0	85	0
Volume Right (vph)	111	107	0	105	0	81
Hadj (s)	-0.2	-0.1	0.2	-0.7	0.2	-0.7
Departure Headway (s)	6.9	7.0	7.7	6.8	7.8	6.9
Degree Utilization, x	0.59	0.79	0.55	0.20	0.53	0.16
Capacity (veh/h)	485	483	437	492	447	498
Control Delay (s)	12.2	15.4	11.8	9.1	11.6	9.0
Approach Delay (s)	12.2	15.4	11.0		11.0	
Approach LOS	B	C	B		B	

Intersection Summary			
Delay	12.6		
HCM Level of Service	B		
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	40	5	15	54	111	120
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	5	15	54	111	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					1316	
pX, platoon unblocked						
vC, conflicting volume	195	111	231			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	195	111	231			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	99	99			
cM capacity (veh/h)	785	942	1337			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	40	5	15	54	111	120
Volume Left	40	0	15	0	0	0
Volume Right	0	5	0	0	0	120
cSH	785	942	1337	1700	1700	1700
Volume to Capacity	0.05	0.01	0.01	0.03	0.07	0.07
Queue Length (ft)	4	0	1	0	0	0
Control Delay (s)	9.8	8.8	7.7	0.0	0.0	0.0
Lane LOS	A	A	A			
Approach Delay (s)	9.7		1.7		0.0	
Approach LOS	A					

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

11: Delta Road & Sellers Avenue — Baseline + Project AM Volumes

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	47	127	9	5	148	40	10	35	14	46	93	56
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	47	127	9	5	148	40	10	35	14	46	93	56

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	183	193	59	195
Volume Left (vph)	47	5	10	46
Volume Right (vph)	9	40	14	56
Hadj (s)	0.1	-0.1	-0.1	-0.1
Departure Headway (s)	4.8	4.6	4.9	4.7
Degree Utilization, x	0.24	0.25	0.08	0.26
Capacity (veh/h)	709	595	667	724
Control Delay (s)	8.2	8.0	8.0	8.2
Approach Delay (s)	8.2	8.0	8.0	8.2
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	777	85	25	931	35	18
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	777	85	25	931	35	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			862		1800	820
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			862		1800	820
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		59	95
cM capacity (veh/h)			780		85	375

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	862	956	35	18
Volume Left	0	25	35	0
Volume Right	85	0	0	18
cSH	1700	780	85	375
Volume to Capacity	0.51	0.03	0.41	0.05
Queue Length (ft)	0	2	42	4
Control Delay (s)	0.0	0.9	74.4	15.1
Lane LOS		A	F	C
Approach Delay (s)	0.0	0.9	54.3	
Approach LOS			F	

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	56	41	801	1068	12
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	56	41	801	1068	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.45	0.45	0.45			
vC, conflicting volume	1957	1074	1080			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3118	1164	1177			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	48	85			
cM capacity (veh/h)	5	107	268			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	75	842	1080
Volume Left	19	41	0
Volume Right	56	0	12
cSH	17	268	1700
Volume to Capacity	4.46	0.15	0.64
Queue Length (ft)	Err	13	0
Control Delay (s)	Err	6.7	0.0
Lane LOS	F	A	
Approach Delay (s)	Err	6.7	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	378.4		
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	56	209	635	55	217	891
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	56	209	635	55	217	891
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.61					
vC, conflicting volume	1988	662			690	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2626	662			690	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	55			76	
cM capacity (veh/h)	12	462			905	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	265	690	217	891
Volume Left	56	0	217	0
Volume Right	209	55	0	0
cSH	52	1700	905	1700
Volume to Capacity	5.06	0.41	0.24	0.52
Queue Length (ft)	Err	0	23	0
Control Delay (s)	Err	0.0	10.2	0.0
Lane LOS	F		B	
Approach Delay (s)	Err	0.0	2.0	
Approach LOS	F			

Intersection Summary			
Average Delay	1285.5		
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	66	446	2	8	764	2	30	18	23	3	0	68
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	446	2	8	764	2	30	18	23	3	0	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	766			448			1428	1361	447	1392	1361	765
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	766			448			1428	1361	447	1392	1361	765
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			99			66	87	96	97	100	83
cM capacity (veh/h)	847			1112			88	136	612	97	136	403

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	514	774	71	71
Volume Left	66	8	30	3
Volume Right	2	2	23	68
cSH	847	1112	138	356
Volume to Capacity	0.08	0.01	0.51	0.20
Queue Length (ft)	6	1	61	18
Control Delay (s)	2.1	0.2	55.6	17.6
Lane LOS	A	A	F	C
Approach Delay (s)	2.1	0.2	55.6	17.6
Approach LOS			F	C

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	679	112	27	581	110	62
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	679	112	27	581	110	62
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	663			590		
pX, platoon unblocked			0.95		0.95	0.95
vC, conflicting volume			791		1024	340
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			724		969	248
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		52	91
cM capacity (veh/h)			828		230	713

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	340	340	112	27	290	290	110	62
Volume Left	0	0	0	27	0	0	110	0
Volume Right	0	0	112	0	0	0	0	62
cSH	1700	1700	1700	828	1700	1700	230	713
Volume to Capacity	0.20	0.20	0.07	0.03	0.17	0.17	0.48	0.09
Queue Length (ft)	0	0	0	3	0	0	59	7
Control Delay (s)	0.0	0.0	0.0	9.5	0.0	0.0	34.2	10.5
Lane LOS				A			D	B
Approach Delay (s)	0.0			0.4			25.7	
Approach LOS							D	

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	27	719	600	6	1	17
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	27	719	600	6	1	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)		449	462			
pX, platoon unblocked						
vC, conflicting volume	606				1016	303
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	606				1016	303
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	98
cM capacity (veh/h)	968				227	693

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	27	360	360	400	206	1	17
Volume Left	27	0	0	0	0	1	0
Volume Right	0	0	0	0	6	0	17
cSH	968	1700	1700	1700	1700	227	693
Volume to Capacity	0.03	0.21	0.21	0.24	0.12	0.00	0.02
Queue Length (ft)	2	0	0	0	0	0	2
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	20.9	10.3
Lane LOS	A					C	B
Approach Delay (s)	0.3			0.0		10.9	
Approach LOS						B	

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	306	23	10	267	18	23	16	12	54	48	23
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	306	23	10	267	18	23	16	12	54	48	23

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	331	295	51	125
Volume Left (vph)	2	10	23	54
Volume Right (vph)	23	18	12	23
Hadj (s)	0.0	0.0	0.0	0.0
Departure Headway (s)	4.8	5.2	5.6	5.5
Degree Utilization, x	0.44	0.43	0.08	0.19
Capacity (veh/h)	725	563	574	617
Control Delay (s)	8.7	9.2	8.7	8.8
Approach Delay (s)	8.7	9.2	8.7	8.8
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.9		
HCM Level of Service	A		
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	32	211	46	85	249	52	71	111	98	73	162	75
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	211	46	85	249	52	71	111	98	73	162	75

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	289	386	182	98	235	75
Volume Left (vph)	32	85	71	0	73	0
Volume Right (vph)	46	52	0	98	0	75
Hadj (s)	0.0	0.0	0.2	-0.7	0.2	-0.7
Departure Headway (s)	6.5	6.6	7.4	6.5	7.3	6.4
Degree Utilization, x	0.52	0.71	0.37	0.18	0.48	0.13
Capacity (veh/h)	522	502	448	509	475	534
Control Delay (s)	11.2	13.1	10.3	8.7	10.7	8.5
Approach Delay (s)	11.2	13.1	9.7		10.2	
Approach LOS	B	B	A		B	

Intersection Summary			
Delay	11.2		
HCM Level of Service	B		
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	145	5	0	91	109	88
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	145	5	0	91	109	88
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					1316	
pX, platoon unblocked						
vC, conflicting volume	200	109	197			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	200	109	197			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	99	100			
cM capacity (veh/h)	789	945	1376			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	145	5	0	91	109	88
Volume Left	145	0	0	0	0	0
Volume Right	0	5	0	0	0	88
cSH	789	945	1700	1700	1700	1700
Volume to Capacity	0.18	0.01	0.00	0.05	0.06	0.05
Queue Length (ft)	17	0	0	0	0	0
Control Delay (s)	10.6	8.8	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	10.5		0.0		0.0	
Approach LOS	B					

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	20.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	63	94	56	23	104	63	88	259	38	51	185	36
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	63	94	56	23	104	63	88	259	38	51	185	36

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	213	190	385	272
Volume Left (vph)	63	23	88	51
Volume Right (vph)	56	63	38	36
Hadj (s)	-0.1	-0.1	0.0	0.0
Departure Headway (s)	5.9	5.7	5.5	5.6
Degree Utilization, x	0.35	0.30	0.59	0.43
Capacity (veh/h)	557	502	622	608
Control Delay (s)	9.7	9.3	10.3	9.7
Approach Delay (s)	9.7	9.3	10.3	9.7
Approach LOS	A	A	B	A

Intersection Summary			
Delay	9.8		
HCM Level of Service	A		
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1367	143	7	1035	30	7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1367	143	7	1035	30	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1510		2488	1438
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1510		2488	1438
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		6	96
cM capacity (veh/h)			443		32	163

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	1510	1042	30	7
Volume Left	0	7	30	0
Volume Right	143	0	0	7
cSH	1700	443	32	163
Volume to Capacity	0.89	0.02	0.94	0.04
Queue Length (ft)	0	1	81	3
Control Delay (s)	0.0	0.6	325.2	28.1
Lane LOS		A	F	D
Approach Delay (s)	0.0	0.6	269.0	
Approach LOS			F	

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	7	46	53	921	775	22
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	46	53	921	775	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					525	
pX, platoon unblocked	0.64	0.64	0.64			
vC, conflicting volume	1813	786	797			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2262	668	685			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	73	84	91			
cM capacity (veh/h)	26	295	585			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	53	974	797
Volume Left	7	53	0
Volume Right	46	0	22
cSH	126	585	1700
Volume to Capacity	0.42	0.09	0.47
Queue Length (ft)	46	7	0
Control Delay (s)	53.0	2.8	0.0
Lane LOS	F	A	
Approach Delay (s)	53.0	2.8	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	54	197	792	100	181	664
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	54	197	792	100	181	664
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1124
pX, platoon unblocked	0.75					
vC, conflicting volume	1868	842			892	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2155	842			892	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	46			76	
cM capacity (veh/h)	30	364			760	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	251	892	181	664
Volume Left	54	0	181	0
Volume Right	197	100	0	0
cSH	108	1700	760	1700
Volume to Capacity	2.33	0.52	0.24	0.39
Queue Length (ft)	554	0	23	0
Control Delay (s)	692.5	0.0	11.2	0.0
Lane LOS	F		B	
Approach Delay (s)	692.5	0.0	2.4	
Approach LOS	F			

Intersection Summary			
Average Delay	88.5		
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		

Baseline + Project PM Volumes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	79	964	35	26	816	20	4	12	15	1	21	81
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	79	964	35	26	816	20	4	12	15	1	21	81
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					1273							
pX, platoon unblocked												
vC, conflicting volume	836			999			2109	2028	982	2038	2035	826
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	836			999			2109	2028	982	2038	2035	826
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			96			77	76	95	97	57	78
cM capacity (veh/h)	798			693			18	50	302	29	49	372

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1078	862	31	103
Volume Left	79	26	4	1
Volume Right	35	20	15	81
cSH	798	693	60	152
Volume to Capacity	0.10	0.04	0.52	0.68
Queue Length (ft)	8	3	51	97
Control Delay (s)	3.0	1.1	116.8	67.8
Lane LOS	A	A	F	F
Approach Delay (s)	3.0	1.1	116.8	67.8
Approach LOS			F	F

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           10  450  410
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT    40 ---  1.0   1.1  2.1  2.0   2.1 ---  946  RIGHT
                                                       STREET NAME:
THRU    98 ---> 2.1  (NO. OF LANES)   1.1<---  280  THRU  W.Cypress Rd.

RIGHT   50 ---  1.1   1.0  2.0  1.0   1.0 ---  239  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                        SIG WARRANTS:
W + E                 90  520  220                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME    VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)     220          0 *     1650     0.0000
    THRU (T)      520        520       3300     0.1576     0.1576
    LEFT (L)       90         90       1650     0.0545
------------------------------------------------------------------------
SB  RIGHT (R)      10         10       1650     0.0061
    THRU (T)      450        450       3300     0.1364
    LEFT (L)      410        410       3000     0.1367     0.1367
    T + R                    460       3300     0.1394
------------------------------------------------------------------------
EB  RIGHT (R)      50         50       1650     0.0303
    THRU (T)       98         98       3300     0.0297
    LEFT (L)       40         40       1650     0.0242     0.0242
    T + R                    148       3300     0.0448
------------------------------------------------------------------------
WB  RIGHT (R)     946        721 *     3000     0.2403
    THRU (T)      280        280       1650     0.1697
    LEFT (L)      239        239       1650     0.1448
    T + R                   1001       3000     0.3337     0.3337
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.65
     INTERSECTION LEVEL OF SERVICE:                              B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           350    0   80
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   308 ---  1.0   1.0  0.0  1.0   1.1 ---   30  RIGHT
                                                          STREET NAME:
THRU   502 ---> 2.0  (NO. OF LANES)   2.1<--- 1374  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
SB  RIGHT (R)     350         42 *     1720     0.0244
    LEFT (L)       80         80       1720     0.0465     0.0465
-------------------------------------------------------------------------
EB  THRU (T)      502        502       3440     0.1459
    LEFT (L)      308        308       1720     0.1791     0.1791
-------------------------------------------------------------------------
WB  RIGHT (R)      30         30       1720     0.0174
    THRU (T)     1374       1374       3440     0.3994
    T + R                   1404       3440     0.4081     0.4081
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.63
     INTERSECTION LEVEL OF SERVICE:                              B
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            23  133   13
                        |    |    |
             ^          |    |    |          ^
             |       <---    v   --->        | Split? N
LEFT    12 ---  1.0   1.0  1.0  1.0   1.1 ---    5  RIGHT
                                                           STREET NAME:
THRU   557 ---> 2.0  (NO. OF LANES)   2.1<--- 1169  THRU  E. Cypress Rd.

RIGHT  147 ---  1.0   1.0  1.0  1.9   2.0 ---  920  LEFT
             |       <---    ^   --->        |
             v          |    |    |          v
  N                     |    |    |                      SIG WARRANTS:
W + E                  184   56  330                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	330	330	1650	0.2000	
	THRU (T)	56	56	1650	0.0339	
	LEFT (L)	184	184	1650	0.1115	0.1115
SB	RIGHT (R)	23	11 *	1650	0.0067	
	THRU (T)	133	133	1650	0.0806	0.0806
	LEFT (L)	13	13	1650	0.0079	
EB	RIGHT (R)	147	0 *	1650	0.0000	
	THRU (T)	557	557	3300	0.1688	0.1688
	LEFT (L)	12	12	1650	0.0073	
WB	RIGHT (R)	5	5	1650	0.0030	
	THRU (T)	1169	1169	3300	0.3542	
	LEFT (L)	920	920	3000	0.3067	0.3067
	T + R		1174	3300	0.3558	

```
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.67
     INTERSECTION LEVEL OF SERVICE:                              B
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes            11/14/08
==========================================================================
INTERSECTION     4 Project Entrance/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           207   15   30
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    70 ---  1.0   1.0  1.1  1.1   1.0 ---   42  RIGHT
                                                      STREET NAME:
THRU   927 ---> 2.1  (NO. OF LANES)   2.1<--- 1910  THRU  E. Cypress Rd.

RIGHT    8 ---  1.1   1.1  1.1  1.1   1.1 ---   25  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                   SIG WARRANTS:
W + E                  15    4    8                     Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
==========================================================================
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	8	8	1650	0.0048	
	THRU (T)	4	4	1650	0.0024	
	LEFT (L)	15	15	1650	0.0091	0.0091
	T + R		12	1650	0.0073	
	T + L		19	1650	0.0115	
	T + R + L		27	1650	0.0164	
SB	RIGHT (R)	207	137 *	1650	0.0830	0.0830
	THRU (T)	15	15	1650	0.0091	
	LEFT (L)	30	30	1650	0.0182	
	T + L		45	1650	0.0273	
EB	RIGHT (R)	8	8	1650	0.0048	
	THRU (T)	927	927	3300	0.2809	
	LEFT (L)	70	70	1650	0.0424	0.0424
	T + R		935	3300	0.2833	
WB	RIGHT (R)	42	12 *	1650	0.0073	
	THRU (T)	1910	1910	3300	0.5788	
	LEFT (L)	25	25	1650	0.0152	
	T + L		1935	3300	0.5864	0.5864

```
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.72
     INTERSECTION LEVEL OF SERVICE:                               C
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes            11/14/08
=========================================================================
INTERSECTION     5 Kightsen Road/E. Cypress Rd
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                           STREET NAME:
THRU   880 ---> 2.0  (NO. OF LANES)   2.0<--- 1910  THRU  E. Cypress Rd

RIGHT   92 ---  1.0   1.0  0.0  1.0   1.0 ---  140  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  66    0   48                          Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Kightsen Road
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      48          0 *     1720     0.0000
    LEFT (L)       66         66       1720     0.0384     0.0384
-------------------------------------------------------------------------
EB  RIGHT (R)      92         26 *     1720     0.0151
    THRU (T)      880        880       3440     0.2558
-------------------------------------------------------------------------
WB  THRU (T)     1910       1910       3440     0.5552     0.5552
    LEFT (L)      140        140       1720     0.0814
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.59
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION     6 Jersey Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           242    0   49
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    88 ---  1.0   1.0  0.0  1.0   1.1 ---   23  RIGHT
                                                          STREET NAME:
THRU  1029 ---> 2.0  (NO. OF LANES)   2.1<--- 2007  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Jersey Island Rd
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
SB  RIGHT (R)     242        154 *     1720     0.0895     0.0895
    LEFT (L)       49         49       1720     0.0285
------------------------------------------------------------------------
EB  THRU (T)     1029       1029       3440     0.2991
    LEFT (L)       88         88       1720     0.0512     0.0512
------------------------------------------------------------------------
WB  RIGHT (R)      23         23       1720     0.0134
    THRU (T)     2007       2007       3440     0.5834
    T + R                   2030       3440     0.5901     0.5901
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.73
     INTERSECTION LEVEL OF SERVICE:                              C
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

==

Condition: Cumulative no Project AM Peak Hour Volumes 11/14/08

==

INTERSECTION 7 Bethel Island Rd/E. Cypress Rd.

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           705  403   37
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   302 ---  2.0   2.0  1.0  1.0   1.0 ---   83  RIGHT
                                                          STREET NAME:
THRU   360 ---> 2.0  (NO. OF LANES)   2.0<---  616  THRU  E. Cypress Rd.

RIGHT  344 ---  1.0   1.0  1.0  1.0   1.0 ---  264  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                 329  437   98                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	98	0 *	1650	0.0000	
	THRU (T)	437	437	1650	0.2648	
	LEFT (L)	329	329	1650	0.1994	0.1994
SB	RIGHT (R)	705	539 *	3000	0.1797	
	THRU (T)	403	403	1650	0.2442	0.2442
	LEFT (L)	37	37	1650	0.0224	
EB	RIGHT (R)	344	15 *	1650	0.0091	
	THRU (T)	360	360	3300	0.1091	
	LEFT (L)	302	302	3000	0.1007	0.1007
WB	RIGHT (R)	83	46 *	1650	0.0279	
	THRU (T)	616	616	3300	0.1867	0.1867
	LEFT (L)	264	264	1650	0.1600	

==

TOTAL VOLUME-TO-CAPACITY RATIO: 0.73

INTERSECTION LEVEL OF SERVICE: C

==

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION    10 Sellers Avenue/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------          1310  210    0
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT   620 ---  2.0   2.0  1.0  0.0   0.0 ---    0  RIGHT
                                                        STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Laurel Road

RIGHT   21 ---  1.0   1.0  2.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                     SIG WARRANTS:
W + E                 120  172    0                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
========================================================================
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB THRU (T)	172	172	3440	0.0500	
LEFT (L)	120	120	1720	0.0698	0.0698
SB RIGHT (R)	1310	969 *	3127	0.3099	0.3099
THRU (T)	210	210	1720	0.1221	
EB RIGHT (R)	21	0 *	1720	0.0000	
LEFT (L)	620	620	3127	0.1983	0.1983

```
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.58
     INTERSECTION LEVEL OF SERVICE:                               A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION    11 Sellers Avenue/Delta Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD        RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------          127  114   36
                       |    |    |
             ^         |    |    |        ^
             |      <---    v   --->      | Split? N
LEFT    96 ---  1.1   1.1  1.1  1.1   1.1 ---  172  RIGHT
                                                      STREET NAME:
THRU   172 ---> 1.1  (NO. OF LANES)   1.1<---  219  THRU  Delta Road

RIGHT   10 ---  1.1   1.1  1.1  1.1   1.1 ---    0  LEFT
             |      <---    ^   --->      |
             v         |    |    |        v
  N                    |    |    |                    SIG WARRANTS:
W + E                 12   21   15                      Urb=N, Rur=Y
  S                 LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)      15         15       1650     0.0091
    THRU (T)       21         21       1650     0.0127
    LEFT (L)       12         12       1650     0.0073     0.0073
    T + R                     36       1650     0.0218
    T + L                     33       1650     0.0200
    T + R + L                 48       1650     0.0291
------------------------------------------------------------------------
SB  RIGHT (R)     127        127       1650     0.0770
    THRU (T)      114        114       1650     0.0691
    LEFT (L)       36         36       1650     0.0218
    T + R                    241       1650     0.1461
    T + L                    150       1650     0.0909
    T + R + L                277       1650     0.1679     0.1679
------------------------------------------------------------------------
EB  RIGHT (R)      10         10       1650     0.0061
    THRU (T)      172        172       1650     0.1042
    LEFT (L)       96         96       1650     0.0582     0.0582
    T + R                    182       1650     0.1103
    T + L                    268       1650     0.1624
    T + R + L                278       1650     0.1685
------------------------------------------------------------------------
WB  RIGHT (R)     172        172       1650     0.1042
    THRU (T)      219        219       1650     0.1327
    LEFT (L)        0          0       1650     0.0000
    T + R                    391       1650     0.2370     0.2370
    T + L                    219       1650     0.1327
    T + R + L                391       1650     0.2370
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.47
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes             11/14/08
=========================================================================
INTERSECTION    12 Rose Avenue/Main Street
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------            0    0    0
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                          STREET NAME:
THRU   686 ---> 2.1  (NO. OF LANES)   2.1<--- 1052  THRU  Main Street

RIGHT   92 ---  1.1   1.0  0.0  1.0   1.1 ---  120  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                        SIG WARRANTS:
W + E                 41    0   61                          Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      61          0 *     1720     0.0000
    LEFT (L)       41         41       1720     0.0238     0.0238
-------------------------------------------------------------------------
EB  RIGHT (R)      92         92       1720     0.0535
    THRU (T)      686        686       3440     0.1994
    T + R                    778       3440     0.2262
-------------------------------------------------------------------------
WB  THRU (T)     1052       1052       3440     0.3058
    LEFT (L)      120        120       1720     0.0698
    T + L                   1172       3440     0.3407     0.3407
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.36
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes               11/14/08
==========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                   Time                 Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------            20   90   10
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    10 ---  1.0   1.1  1.1  1.1   1.1 ---   20  RIGHT
                                                            STREET NAME:
THRU   420 ---> 1.0  (NO. OF LANES)   1.1<---  450  THRU  Main Street

RIGHT   80 ---  1.0   1.0  1.1  1.1   1.0 ---   40  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                 110   40   60                           Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
==========================================================================
               ORIGINAL   ADJUSTED                  V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO        V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      60          60       1650     0.0364
    THRU (T)       40          40       1650     0.0242
    LEFT (L)      110         110       1650     0.0667     0.0667
    T + R                     100       1650     0.0606
--------------------------------------------------------------------------
SB  RIGHT (R)      20          20       1650     0.0121
    THRU (T)       90          90       1650     0.0545
    LEFT (L)       10          10       1650     0.0061
    T + R                     110       1650     0.0667
    T + L                     100       1650     0.0606
    T + R + L                 120       1650     0.0727     0.0727
--------------------------------------------------------------------------
EB  RIGHT (R)      80           0 *     1650     0.0000
    THRU (T)      420         420       1650     0.2545
    LEFT (L)       10          10       1650     0.0061     0.0061
--------------------------------------------------------------------------
WB  RIGHT (R)      20          20       1650     0.0121
    THRU (T)      450         450       1650     0.2727
    LEFT (L)       40          40       1650     0.0242
    T + R                     470       1650     0.2848     0.2848
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.43
     INTERSECTION LEVEL OF SERVICE:                               A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------            30    0   60
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    90 ---  1.0   1.0  0.0  1.0   1.1 ---   40  RIGHT
                                                         STREET NAME:
THRU   410 ---> 2.0  (NO. OF LANES)   2.1<---  480  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                   0    0    0                        Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
SB  RIGHT (R)      30          0 *     1720     0.0000
    LEFT (L)       60         60       1720     0.0349     0.0349
-------------------------------------------------------------------------
EB  THRU (T)      410        410       3440     0.1192
    LEFT (L)       90         90       1720     0.0523     0.0523
-------------------------------------------------------------------------
WB  RIGHT (R)      40         40       1720     0.0233
    THRU (T)      480        480       3440     0.1395
    T + R                    520       3440     0.1512     0.1512
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.24
     INTERSECTION LEVEL OF SERVICE:                             A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           177  582  200
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   137 ---  1.0   1.1  2.1  2.0   1.0 ---  230  RIGHT
                                                           STREET NAME:
THRU   322 ---> 2.0  (NO. OF LANES)   2.0<---  943  THRU   Laurel Road

RIGHT  220 ---  1.0   1.0  2.0  1.0   1.0 ---  391  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 200  594  139                          Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	139	0 *	1650	0.0000	
	THRU (T)	594	594	3300	0.1800	
	LEFT (L)	200	200	1650	0.1212	0.1212
SB	RIGHT (R)	177	177	1650	0.1073	
	THRU (T)	582	582	3300	0.1764	
	LEFT (L)	200	200	3000	0.0667	
	T + R		759	3300	0.2300	0.2300
EB	RIGHT (R)	220	20 *	1650	0.0121	
	THRU (T)	322	322	3300	0.0976	
	LEFT (L)	137	137	1650	0.0830	0.0830
WB	RIGHT (R)	230	120 *	1650	0.0727	
	THRU (T)	943	943	3300	0.2858	0.2858
	LEFT (L)	391	391	1650	0.2370	

```
TOTAL VOLUME-TO-CAPACITY RATIO:                          0.72
INTERSECTION LEVEL OF SERVICE:                              C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project AM Peak Hour Volumes 11/14/08

INTERSECTION 16 Main Street/Malicoat Lane
Count Date Time Peak Hour

```
CCTA METHOD          RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            180 1007    6
                         |    |    |
             ^           |    |    |         ^
             |       <---    v   --->        | Split? N
LEFT    12 ---  1.0   1.1  2.1  1.0   1.1 ---    4  RIGHT
                                                           STREET NAME:
THRU     2 ---> 1.1  (NO. OF LANES)   1.1<---    5  THRU  Malicoat Lane

RIGHT   22 ---  1.1   1.0  2.1  1.1   1.0 ---   12  LEFT
             |       <---    ^   --->        |
             v           |    |    |         v
  N                      |    |    |                       SIG WARRANTS:
W + E                   44  917    6                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	6	6	1650	0.0036	
	THRU (T)	917	917	3300	0.2779	
	LEFT (L)	44	44	1650	0.0267	0.0267
	T + R		923	3300	0.2797	
SB	RIGHT (R)	180	180	1650	0.1091	
	THRU (T)	1007	1007	3300	0.3052	
	LEFT (L)	6	6	1650	0.0036	
	T + R		1187	3300	0.3597	0.3597
EB	RIGHT (R)	22	22	1650	0.0133	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	12	12	1650	0.0073	
	T + R		24	1650	0.0145	0.0145
WB	RIGHT (R)	4	4	1650	0.0024	
	THRU (T)	5	5	1650	0.0030	
	LEFT (L)	12	12	1650	0.0073	0.0073
	T + R		9	1650	0.0055	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.41
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION    17 Main Street/Brownstrone Road
Count Date                  Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------            14 1027    0
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    21 ---  1.1   1.1  2.1  0.0   0.0 ---    0  RIGHT
                                                          STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Brownstrone Road

RIGHT   62 ---  1.1   1.1  2.1  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  45  926    0                         Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                  V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
------------------------------------------------------------------------
NB  THRU (T)      926         926       3440     0.2692
    LEFT (L)       45          45       1720     0.0262     0.0262
    T + L                     971       3440     0.2823
------------------------------------------------------------------------
SB  RIGHT (R)      14          14       1720     0.0081
    THRU (T)     1027        1027       3440     0.2985
    T + R                    1041       3440     0.3026     0.3026
------------------------------------------------------------------------
EB  RIGHT (R)      62          62       1720     0.0360
    LEFT (L)       21          21       1720     0.0122
    T + R + L                  83       1720     0.0483     0.0483
------------------------------------------------------------------------
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.38
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION    18 Main Street/
Count Date                   Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------            0  863  226
                       |   |   |
             ^         |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT     0 ---  0.0   0.0  2.0  1.0   1.0 ---  247  RIGHT
                                                         STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU

RIGHT    0 ---  0.0   0.0  2.1  1.1   1.0 ---  111  LEFT
             |       <---   ^   --->      |
             v         |   |   |         v
  N                    |   |   |                          SIG WARRANTS:
W + E                  0  724   72                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	72	72	1650	0.0436	
	THRU (T)	724	724	3300	0.2194	
	T + R		796	3300	0.2412	0.2412
SB	THRU (T)	863	863	3300	0.2615	
	LEFT (L)	226	226	1650	0.1370	0.1370
WB	RIGHT (R)	247	21 *	1650	0.0127	
	LEFT (L)	111	111	1650	0.0673	0.0673

TOTAL VOLUME-TO-CAPACITY RATIO: 0.45

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    19 Rose Avenue/Laurel Road
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            33   25  172
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   160 ---  1.0   1.0  1.1  1.1   1.1 ---   10  RIGHT
                                                           STREET NAME:
THRU   499 ---> 2.1  (NO. OF LANES)   2.1<--- 1287  THRU  Laurel Road

RIGHT   15 ---  1.1   1.0  1.1  1.1   1.0 ---   23  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  10    6    8                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	8	8	1650	0.0048	
	THRU (T)	6	6	1650	0.0036	
	LEFT (L)	10	10	1650	0.0061	0.0061
	T + R		14	1650	0.0085	
SB	RIGHT (R)	33	0 *	1650	0.0000	
	THRU (T)	25	25	1650	0.0152	
	LEFT (L)	172	172	1650	0.1042	
	T + L		197	1650	0.1194	0.1194
EB	RIGHT (R)	15	15	1650	0.0091	
	THRU (T)	499	499	3300	0.1512	
	LEFT (L)	160	160	1650	0.0970	0.0970
	T + R		514	3300	0.1558	
WB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	1287	1287	3300	0.3900	
	LEFT (L)	23	23	1650	0.0139	
	T + R		1297	3300	0.3930	0.3930

```
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                             0.62
     INTERSECTION LEVEL OF SERVICE:                                 B
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    20 O'Hara Avenue/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           110  511  100
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   110 ---  1.0   1.0  1.0  1.0   1.0 ---  210  RIGHT
                                                          STREET NAME:
THRU   516 ---> 2.0  (NO. OF LANES)   2.0<--- 1075  THRU  Laurel Road

RIGHT  210 ---  1.0   1.0  1.0  1.0   1.0 ---  285  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                 200  580  223                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	223	0 *	1650	0.0000	
	THRU (T)	580	580	1650	0.3515	
	LEFT (L)	200	200	1650	0.1212	0.1212
SB	RIGHT (R)	110	0 *	1650	0.0000	
	THRU (T)	511	511	1650	0.3097	0.3097
	LEFT (L)	100	100	1650	0.0606	
EB	RIGHT (R)	210	10 *	1650	0.0061	
	THRU (T)	516	516	3300	0.1564	
	LEFT (L)	110	110	1650	0.0667	0.0667
WB	RIGHT (R)	210	110 *	1650	0.0667	
	THRU (T)	1075	1075	3300	0.3258	0.3258
	LEFT (L)	285	285	1650	0.1727	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.82

INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative no Project AM Peak Hour Volumes             11/14/08
==========================================================================
INTERSECTION    21 Empire Avenue/Laurel Road
Count Date                   Time                 Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           420  220   50
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   220 ---  1.0   1.1  2.1  1.0   1.1 ---  260  RIGHT
                                                              STREET NAME:
THRU   710 ---> 2.1  (NO. OF LANES)   2.1<--- 1295  THRU  Laurel Road

RIGHT  150 ---  1.1   1.0  2.1  1.1   1.0 ---   60  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                 180  450   50                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
==========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      50          50       1650     0.0303
    THRU (T)      450         450       3300     0.1364
    LEFT (L)      180         180       1650     0.1091     0.1091
    T + R                     500       3300     0.1515
--------------------------------------------------------------------------
SB  RIGHT (R)     420         420       1650     0.2545     0.2545
    THRU (T)      220         220       3300     0.0667
    LEFT (L)       50          50       1650     0.0303
    T + R                     640       3300     0.1939
--------------------------------------------------------------------------
EB  RIGHT (R)     150         150       1650     0.0909
    THRU (T)      710         710       3300     0.2152
    LEFT (L)      220         220       1650     0.1333     0.1333
    T + R                     860       3300     0.2606
--------------------------------------------------------------------------
WB  RIGHT (R)     260         260       1650     0.1576
    THRU (T)     1295        1295       3300     0.3924
    LEFT (L)       60          60       1650     0.0364
    T + R                    1555       3300     0.4712     0.4712
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.97
     INTERSECTION LEVEL OF SERVICE:                               E
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project PM Peak Hour Volumes 11/14/08

```
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                     Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            20  780 1059
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   100 ---  1.0   1.1  2.1  2.0   2.1 ---  770  RIGHT
                                                          STREET NAME:
THRU   145 ---> 2.1  (NO. OF LANES)   1.1<---  319  THRU  W.Cypress Rd.

RIGHT   70 ---  1.1   1.0  2.0  1.0   1.0 ---  141  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  130  400  372                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	372	231 *	1650	0.1400	0.1400
	THRU (T)	400	400	3300	0.1212	
	LEFT (L)	130	130	1650	0.0788	
SB	RIGHT (R)	20	20	1650	0.0121	
	THRU (T)	780	780	3300	0.2364	
	LEFT (L)	1059	1059	3000	0.3530	0.3530
	T + R		800	3300	0.2424	
EB	RIGHT (R)	70	70	1650	0.0424	
	THRU (T)	145	145	3300	0.0439	
	LEFT (L)	100	100	1650	0.0606	0.0606
	T + R		215	3300	0.0652	
WB	RIGHT (R)	770	188 *	3000	0.0627	
	THRU (T)	319	319	1650	0.1933	0.1933
	LEFT (L)	141	141	1650	0.0855	
	T + R		507	3000	0.1690	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.75

INTERSECTION LEVEL OF SERVICE: C

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION     2 Frank Hengel Way/E. Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------            14    0    5
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT     9 ---  1.0   1.0  0.0  1.0   1.1 ---    2  RIGHT
                                                          STREET NAME:
THRU  1574 ---> 2.0  (NO. OF LANES)   2.1<--- 1253  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
SB  RIGHT (R)      14          5 *     1720     0.0029
    LEFT (L)        5          5       1720     0.0029     0.0029
------------------------------------------------------------------------
EB  THRU (T)     1574       1574       3440     0.4576     0.4576
    LEFT (L)        9          9       1720     0.0052
------------------------------------------------------------------------
WB  RIGHT (R)       2          2       1720     0.0012
    THRU (T)     1253       1253       3440     0.3642
    T + R                   1255       3440     0.3648
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.46
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project PM Peak Hour Volumes 11/14/08

```
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            31  126   11
                        |    |    |
             ^          |    |    |         ^
             |      <---    v    --->       | Split? N
LEFT    29 ---  1.0   1.0  1.0  1.0   1.1 ---   15  RIGHT
                                                             STREET NAME:
THRU  1552 ---> 2.0  (NO. OF LANES)   2.1<--- 1111  THRU   E. Cypress Rd.

RIGHT  157 ---  1.0   1.0  1.0  1.9   2.0 ---  546  LEFT
             |      <---    ^    --->       |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                  172  170  938                           Urb=Y, Rur=Y
  S                 LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	938	938	1650	0.5685	
THRU (T)	170	170	1650	0.1030	
LEFT (L)	172	172	1650	0.1042	0.1042
SB RIGHT (R)	31	2 *	1650	0.0012	
THRU (T)	126	126	1650	0.0764	0.0764
LEFT (L)	11	11	1650	0.0067	
EB RIGHT (R)	157	0 *	1650	0.0000	
THRU (T)	1552	1552	3300	0.4703	0.4703
LEFT (L)	29	29	1650	0.0176	
WB RIGHT (R)	15	15	1650	0.0091	
THRU (T)	1111	1111	3300	0.3367	
LEFT (L)	546	546	3000	0.1820	0.1820
T + R		1126	3300	0.3412	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.83

INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes            11/14/08
==========================================================================
INTERSECTION     4 Project Entrance/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           134    5   18
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   240 ---  1.0   1.0  1.1  1.1   1.0 ---   46  RIGHT
                                                       STREET NAME:
THRU  2333 ---> 2.1  (NO. OF LANES)   2.1<--- 1669  THRU  E. Cypress Rd.

RIGHT   23 ---  1.1   1.1  1.1  1.1   1.1 ---    8  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                  40    6   12                      Urb=B, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
==========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      12         12       1650     0.0073
    THRU (T)        6          6       1650     0.0036
    LEFT (L)       40         40       1650     0.0242
    T + R                     18       1650     0.0109
    T + L                     46       1650     0.0279
    T + R + L                 58       1650     0.0352     0.0352
--------------------------------------------------------------------------
SB  RIGHT (R)     134          0 *     1650     0.0000
    THRU (T)        5          5       1650     0.0030
    LEFT (L)       18         18       1650     0.0109     0.0109
    T + L                     23       1650     0.0139
--------------------------------------------------------------------------
EB  RIGHT (R)      23         23       1650     0.0139
    THRU (T)     2333       2333       3300     0.7070
    LEFT (L)      240        240       1650     0.1455
    T + R                   2356       3300     0.7139     0.7139
--------------------------------------------------------------------------
WB  RIGHT (R)      46         28 *     1650     0.0170
    THRU (T)     1669       1669       3300     0.5058
    LEFT (L)        8          8       1650     0.0048     0.0048
    T + L                   1677       3300     0.5082
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.76
     INTERSECTION LEVEL OF SERVICE:                               C
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION     5 Kightsen Road/E. Cypress Rd
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                             3-PHASE SIGNAL
-----------            0    0    0
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                      STREET NAME:
THRU  2284 ---> 2.0  (NO. OF LANES)   2.0<--- 1722  THRU  E. Cypress Rd

RIGHT  105 ---  1.0   1.0  0.0  1.0   1.0 ---   27  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                      SIG WARRANTS:
W + E                 110    0   67                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Kightsen Road
=========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      67         40 *     1720     0.0233
    LEFT (L)      110        110       1720     0.0640     0.0640
-------------------------------------------------------------------------
EB  RIGHT (R)     105          0 *     1720     0.0000
    THRU (T)     2284       2284       3440     0.6640     0.6640
-------------------------------------------------------------------------
WB  THRU (T)     1722       1722       3440     0.5006
    LEFT (L)       27         27       1720     0.0157     0.0157
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.74
     INTERSECTION LEVEL OF SERVICE:                             C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION     6 Jersey Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------           167    0   45
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   246 ---  1.0   1.0  0.0  1.0   1.1 ---   53  RIGHT
                                                          STREET NAME:
THRU  2326 ---> 2.0  (NO. OF LANES)   2.1<--- 1620  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                          SIG WARRANTS:
W + E                   0    0    0                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Jersey Island Rd
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	167	0 *	1720	0.0000	
LEFT (L)	45	45	1720	0.0262	0.0262
EB THRU (T)	2326	2326	3440	0.6762	0.6762
LEFT (L)	246	246	1720	0.1430	
WB RIGHT (R)	53	53	1720	0.0308	
THRU (T)	1620	1620	3440	0.4709	
T + R		1673	3440	0.4863	

TOTAL VOLUME-TO-CAPACITY RATIO:	0.70
INTERSECTION LEVEL OF SERVICE:	B

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes              11/14/08
==========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           474  230   69
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   763 ---  2.0   2.0  1.0  1.0   1.0 ---   55  RIGHT
                                                         STREET NAME:
THRU   753 ---> 2.0  (NO. OF LANES)   2.0<---  528  THRU  E. Cypress Rd.

RIGHT  413 ---  1.0   1.0  1.0  1.0   1.0 ---  161  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                 395  352  170                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	170	9 *	1650	0.0055	
THRU (T)	352	352	1650	0.2133	
LEFT (L)	395	395	1650	0.2394	0.2394
SB RIGHT (R)	474	54 *	3000	0.0180	
THRU (T)	230	230	1650	0.1394	0.1394
LEFT (L)	69	69	1650	0.0418	
EB RIGHT (R)	413	18 *	1650	0.0109	
THRU (T)	753	753	3300	0.2282	
LEFT (L)	763	763	3000	0.2543	0.2543
WB RIGHT (R)	55	0 *	1650	0.0000	
THRU (T)	528	528	3300	0.1600	0.1600
LEFT (L)	161	161	1650	0.0976	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.79

INTERSECTION LEVEL OF SERVICE: C

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    10 Sellers Avenue/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------           760   30    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT  1360 ---  2.0   2.0  1.0  0.0   0.0 ---    0  RIGHT
                                                            STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Laurel Road

RIGHT  180 ---  1.0   1.0  2.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                 440   49    0                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
=========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
NB  THRU (T)       49         49       3440     0.0142
    LEFT (L)      440        440       1720     0.2558     0.2558
-------------------------------------------------------------------------
SB  RIGHT (R)     760         12 *     3127     0.0038
    THRU (T)       30         30       1720     0.0174     0.0174
-------------------------------------------------------------------------
EB  RIGHT (R)     180          0 *     1720     0.0000
    LEFT (L)     1360       1360       3127     0.4349     0.4349
-------------------------------------------------------------------------
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.71
     INTERSECTION LEVEL OF SERVICE:                               C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION    11 Sellers Avenue/Delta Road
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------            75  169   20
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   170 ---  1.1   1.1  1.1  1.1   1.1 ---   19  RIGHT
                                                            STREET NAME:
THRU   145 ---> 1.1  (NO. OF LANES)   1.1<---  170  THRU  Delta Road

RIGHT   61 ---  1.1   1.1  1.1  1.1   1.1 ---   25  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                  80  235   42                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      42         42       1650     0.0255
    THRU (T)      235        235       1650     0.1424
    LEFT (L)       80         80       1650     0.0485
    T + R                    277       1650     0.1679
    T + L                    315       1650     0.1909
    T + R + L                357       1650     0.2164     0.2164
------------------------------------------------------------------------
SB  RIGHT (R)      75         75       1650     0.0455
    THRU (T)      169        169       1650     0.1024
    LEFT (L)       20         20       1650     0.0121     0.0121
    T + R                    244       1650     0.1479
    T + L                    189       1650     0.1145
    T + R + L                264       1650     0.1600
------------------------------------------------------------------------
EB  RIGHT (R)      61         61       1650     0.0370
    THRU (T)      145        145       1650     0.0879
    LEFT (L)      170        170       1650     0.1030
    T + R                    206       1650     0.1248
    T + L                    315       1650     0.1909
    T + R + L                376       1650     0.2279     0.2279
------------------------------------------------------------------------
WB  RIGHT (R)      19         19       1650     0.0115
    THRU (T)      170        170       1650     0.1030
    LEFT (L)       25         25       1650     0.0152     0.0152
    T + R                    189       1650     0.1145
    T + L                    195       1650     0.1182
    T + R + L                214       1650     0.1297
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.47
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION    12 Rose Avenue/Main Street
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                          STREET NAME:
THRU  1640 ---> 2.1  (NO. OF LANES)   2.1<--- 1215  THRU  Main Street

RIGHT  154 ---  1.1   1.0  0.0  1.0   1.1 ---   25  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                  29    0    9                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
=========================================================================
                ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT      VOLUME     VOLUME*   CAPACITY     RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)       9          0 *      1720     0.0000
    LEFT (L)       29         29        1720     0.0169     0.0169
-------------------------------------------------------------------------
EB  RIGHT (R)     154        154        1720     0.0895
    THRU (T)     1640       1640        3440     0.4767
    T + R                   1794        3440     0.5215     0.5215
-------------------------------------------------------------------------
WB  THRU (T)     1215       1215        3440     0.3532
    LEFT (L)       25         25        1720     0.0145     0.0145
    T + L                   1240        3440     0.3605
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.55
     INTERSECTION LEVEL OF SERVICE:                               A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project PM Peak Hour Volumes 11/14/08

INTERSECTION 13 O'Hara Avenue/Main Street
Count Date Time Peak Hour

```
CCTA METHOD          RIGHT THRU LEFT                      4-PHASE SIGNAL
-----------             10   40   30
                         |    |    |
             ^           |    |    |          ^
             |       <---    v    --->        | Split? N
LEFT    20 ---  1.0   1.1  1.1  1.1   1.1 ---   20  RIGHT
                                                          STREET NAME:
THRU   810 ---> 1.0  (NO. OF LANES)   1.1<---  640  THRU  Main Street

RIGHT  130 ---  1.0   1.0  1.1  1.1   1.0 ---   60  LEFT
             |       <---    ^    --->        |
             v           |    |    |          v
  N                      |    |    |                      SIG WARRANTS:
W + E                   140   60   40                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	40	40	1650	0.0242	
	THRU (T)	60	60	1650	0.0364	
	LEFT (L)	140	140	1650	0.0848	0.0848
	T + R		100	1650	0.0606	
SB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	40	40	1650	0.0242	
	LEFT (L)	30	30	1650	0.0182	
	T + R		50	1650	0.0303	
	T + L		70	1650	0.0424	
	T + R + L		80	1650	0.0485	0.0485
EB	RIGHT (R)	130	0 *	1650	0.0000	
	THRU (T)	810	810	1650	0.4909	0.4909
	LEFT (L)	20	20	1650	0.0121	
WB	RIGHT (R)	20	20	1650	0.0121	
	THRU (T)	640	640	1650	0.3879	
	LEFT (L)	60	60	1650	0.0364	0.0364
	T + R		660	1650	0.4000	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.66
INTERSECTION LEVEL OF SERVICE: B

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes             11/14/08
=========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------            40    0   90
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    40 ---  1.0   1.0  0.0  1.0   1.1 ---   50  RIGHT
                                                             STREET NAME:
THRU   840 ---> 2.0  (NO. OF LANES)   2.1<---  690  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                   0    0    0                            Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
=========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
SB  RIGHT (R)      40          0 *     1720     0.0000
    LEFT (L)       90         90       1720     0.0523     0.0523
-------------------------------------------------------------------------
EB  THRU (T)      840        840       3440     0.2442     0.2442
    LEFT (L)       40         40       1720     0.0233
-------------------------------------------------------------------------
WB  RIGHT (R)      50         50       1720     0.0291
    THRU (T)      690        690       3440     0.2006
    T + R                    740       3440     0.2151
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.30
     INTERSECTION LEVEL OF SERVICE:                             A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------            29  743  480
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   286 ---  1.0   1.1  2.1  2.0   1.0 ---  310  RIGHT
                                                        STREET NAME:
THRU   748 ---> 2.0  (NO. OF LANES)   2.0<---  509  THRU  Laurel Road

RIGHT  230 ---  1.0   1.0  2.0  1.0   1.0 ---  188  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                     SIG WARRANTS:
W + E                 210  636  375                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	375	187 *	1650	0.1133	
THRU (T)	636	636	3300	0.1927	
LEFT (L)	210	210	1650	0.1273	0.1273
SB RIGHT (R)	29	29	1650	0.0176	
THRU (T)	743	743	3300	0.2252	
LEFT (L)	480	480	3000	0.1600	
T + R		772	3300	0.2339	0.2339
EB RIGHT (R)	230	20 *	1650	0.0121	
THRU (T)	748	748	3300	0.2267	0.2267
LEFT (L)	286	286	1650	0.1733	
WB RIGHT (R)	310	46 *	1650	0.0279	
THRU (T)	509	509	3300	0.1542	
LEFT (L)	188	188	1650	0.1139	0.1139

```
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.70
     INTERSECTION LEVEL OF SERVICE:                              B
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project PM Peak Hour Volumes 11/14/08

INTERSECTION 16 Main Street/Malicoat Lane

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------            33 1117   11
                        |   |    |
             ^          |   |    |         ^
             |       <---   v   --->       | Split? N
LEFT    18 ---  1.0   1.1  2.1  1.0   1.1 ---    9  RIGHT
                                                         STREET NAME:
THRU     2 ---> 1.1  (NO. OF LANES)   1.1<---    1  THRU  Malicoat Lane

RIGHT   12 ---  1.1   1.0  2.1  1.1   1.0 ---    2  LEFT
             |       <---   ^   --->       |
             v          |   |    |         v
  N                     |   |    |                       SIG WARRANTS:
W + E                  11 1194   13                        Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	13	13	1650	0.0079	
	THRU (T)	1194	1194	3300	0.3618	
	LEFT (L)	11	11	1650	0.0067	
	T + R		1207	3300	0.3658	0.3658
SB	RIGHT (R)	33	33	1650	0.0200	
	THRU (T)	1117	1117	3300	0.3385	
	LEFT (L)	11	11	1650	0.0067	0.0067
	T + R		1150	3300	0.3485	
EB	RIGHT (R)	12	12	1650	0.0073	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	18	18	1650	0.0109	0.0109
	T + R		14	1650	0.0085	
WB	RIGHT (R)	9	9	1650	0.0055	
	THRU (T)	1	1	1650	0.0006	
	LEFT (L)	2	2	1650	0.0012	
	T + R		10	1650	0.0061	0.0061

TOTAL VOLUME-TO-CAPACITY RATIO:	0.39
INTERSECTION LEVEL OF SERVICE:	A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION    17 Main Street/Brownstrone Road
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------            24 1078    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     8 ---  1.1   1.1  2.1  0.0   0.0 ---    0  RIGHT
                                                        STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Brownstrone Road

RIGHT   50 ---  1.1   1.1  2.1  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  58 1237    0                          Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  THRU (T)     1237       1237       3440    0.3596
    LEFT (L)       58         58       1720    0.0337
    T + L                   1295       3440    0.3765     0.3765
------------------------------------------------------------------------
SB  RIGHT (R)      24         24       1720    0.0140
    THRU (T)     1078       1078       3440    0.3134
    T + R                   1102       3440    0.3203
------------------------------------------------------------------------
EB  RIGHT (R)      50         50       1720    0.0291
    LEFT (L)        8          8       1720    0.0047
    T + R + L                 58       1720    0.0337     0.0337
------------------------------------------------------------------------
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.41
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION    18 Main Street/
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------             0  918  234
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT     0 ---  0.0   0.0  2.0  1.0   1.0 ---  230  RIGHT
                                                           STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU

RIGHT    0 ---  0.0   0.0  2.1  1.1   1.0 ---   94  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                      SIG WARRANTS:
W + E                   0 1064  167                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
NB  RIGHT (R)     167        167       1650     0.1012
    THRU (T)     1064       1064       3300     0.3224
    T + R                   1231       3300     0.3730     0.3730
------------------------------------------------------------------------
SB  THRU (T)      918        918       3300     0.2782
    LEFT (L)      234        234       1650     0.1418     0.1418
------------------------------------------------------------------------
WB  RIGHT (R)     230          0 *     1650     0.0000
    LEFT (L)       94         94       1650     0.0570     0.0570
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.57
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes           11/14/08
========================================================================
INTERSECTION    19 Rose Avenue/Laurel Road
Count Date                   Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           110   35   50
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    42 ---  1.0   1.0  1.1  1.1   1.1 ---   22  RIGHT
                                                          STREET NAME:
THRU  1296 ---> 2.1  (NO. OF LANES)   2.1<---  792  THRU  Laurel Road

RIGHT    6 ---  1.1   1.0  1.1  1.1   1.0 ---   29  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                   5   18   17                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      17         17       1650     0.0103
    THRU (T)       18         18       1650     0.0109
    LEFT (L)        5          5       1650     0.0030     0.0030
    T + R                     35       1650     0.0212
------------------------------------------------------------------------
SB  RIGHT (R)     110         68 *     1650     0.0412
    THRU (T)       35         35       1650     0.0212
    LEFT (L)       50         50       1650     0.0303
    T + L                     85       1650     0.0515     0.0515
------------------------------------------------------------------------
EB  RIGHT (R)       6          6       1650     0.0036
    THRU (T)     1296       1296       3300     0.3927
    LEFT (L)       42         42       1650     0.0255
    T + R                   1302       3300     0.3945     0.3945
------------------------------------------------------------------------
WB  RIGHT (R)      22         22       1650     0.0133
    THRU (T)      792        792       3300     0.2400
    LEFT (L)       29         29       1650     0.0176     0.0176
    T + R                    814       3300     0.2467
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.47
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative no Project PM Peak Hour Volumes          11/14/08
=========================================================================
INTERSECTION    20 O'Hara Avenue/Laurel Road
Count Date                 Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD          RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            200  481  110
                         |    |    |
             ^           |    |    |         ^
             |       <---    v   --->        | Split? N
LEFT   190 ---  1.0   1.0  1.0  1.0   1.0 ---  210  RIGHT
                                                            STREET NAME:
THRU  1105 ---> 2.0  (NO. OF LANES)   2.0<---  753  THRU  Laurel Road

RIGHT  310 ---  1.0   1.0  1.0  1.0   1.0 ---  106  LEFT
             |       <---    ^   --->        |
             v           |    |    |         v
  N                      |    |    |                    SIG WARRANTS:
W + E                  220  431  129                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	129	23 *	1650	0.0139	
THRU (T)	431	431	1650	0.2612	
LEFT (L)	220	220	1650	0.1333	0.1333
SB RIGHT (R)	200	10 *	1650	0.0061	
THRU (T)	481	481	1650	0.2915	0.2915
LEFT (L)	110	110	1650	0.0667	
EB RIGHT (R)	310	90 *	1650	0.0545	
THRU (T)	1105	1105	3300	0.3348	0.3348
LEFT (L)	190	190	1650	0.1152	
WB RIGHT (R)	210	100 *	1650	0.0606	
THRU (T)	753	753	3300	0.2282	
LEFT (L)	106	106	1650	0.0642	0.0642

TOTAL VOLUME-TO-CAPACITY RATIO: 0.82

INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative no Project PM Peak Hour Volumes 11/14/08

INTERSECTION 21 Empire Avenue/Laurel Road
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           330  360  180
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   460 ---  1.0   1.1  2.1  1.0   1.1 ---  120  RIGHT
                                                            STREET NAME:
THRU  1393 ---> 2.1  (NO. OF LANES)   2.1<--- 1030  THRU  Laurel Road

RIGHT  310 ---  1.1   1.0  2.1  1.1   1.0 ---  110  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                 160  430  120                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	120	120	1650	0.0727	
THRU (T)	430	430	3300	0.1303	
LEFT (L)	160	160	1650	0.0970	0.0970
T + R		550	3300	0.1667	
SB RIGHT (R)	330	330	1650	0.2000	
THRU (T)	360	360	3300	0.1091	
LEFT (L)	180	180	1650	0.1091	
T + R		690	3300	0.2091	0.2091
EB RIGHT (R)	310	310	1650	0.1879	
THRU (T)	1393	1393	3300	0.4221	
LEFT (L)	460	460	1650	0.2788	0.2788
T + R		1703	3300	0.5161	
WB RIGHT (R)	120	120	1650	0.0727	
THRU (T)	1030	1030	3300	0.3121	
LEFT (L)	110	110	1650	0.0667	
T + R		1150	3300	0.3485	0.3485

TOTAL VOLUME-TO-CAPACITY RATIO: 0.93
INTERSECTION LEVEL OF SERVICE: E

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUM.PMV,CAP=

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	25	126	30	60	348	11	45	113	18	28	140	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	25	126	30	60	348	11	45	113	18	28	140	60

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	181	419	176	228
Volume Left (vph)	25	60	45	28
Volume Right (vph)	30	11	18	60
Hadj (s)	0.0	0.0	0.0	-0.1
Departure Headway (s)	5.7	6.0	6.0	5.8
Degree Utilization, x	0.29	0.69	0.29	0.37
Capacity (veh/h)	572	551	536	588
Control Delay (s)	9.3	12.1	9.7	9.7
Approach Delay (s)	9.3	12.1	9.7	9.7
Approach LOS	A	B	A	A

Intersection Summary			
Delay	10.6		
HCM Level of Service	B		
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	40	88	60	85	301	64	100	310	43	48	240	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	88	60	85	301	64	100	310	43	48	240	90

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	188	450	410	43	288	90
Volume Left (vph)	40	85	100	0	48	0
Volume Right (vph)	60	64	0	43	0	90
Hadj (s)	-0.1	0.0	0.2	-0.7	0.1	-0.7
Departure Headway (s)	7.9	7.4	7.8	6.9	8.0	7.2
Degree Utilization, x	0.41	0.93	0.88	0.08	0.64	0.18
Capacity (veh/h)	410	478	451	500	433	482
Control Delay (s)	12.2	20.9	18.3	8.9	13.0	9.4
Approach Delay (s)	12.2	20.9	17.4		12.1	
Approach LOS	B	C	C		B	

Intersection Summary			
Delay	16.4		
HCM Level of Service	C		
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	686	92	120	1052	41	61
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	686	92	120	1052	41	61
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			778		1498	389
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			778		1498	389
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			86		58	90
cM capacity (veh/h)			834		97	610

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	457	321	471	701	41	61
Volume Left	0	0	120	0	41	0
Volume Right	0	92	0	0	0	61
cSH	1700	1700	834	1700	97	610
Volume to Capacity	0.27	0.19	0.14	0.41	0.42	0.10
Queue Length (ft)	0	0	13	0	44	8
Control Delay (s)	0.0	0.0	3.9	0.0	67.1	11.6
Lane LOS			A		F	B
Approach Delay (s)	0.0		1.6		33.9	
Approach LOS					D	

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	3	313	31	12	388	34	28	0	14	28	135	25
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	313	31	12	388	34	28	0	14	28	135	25

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	347	434	42	188
Volume Left (vph)	3	12	28	28
Volume Right (vph)	31	34	14	25
Hadj (s)	0.0	0.0	0.0	0.0
Departure Headway (s)	5.2	5.8	6.3	5.9
Degree Utilization, x	0.50	0.70	0.07	0.31
Capacity (veh/h)	659	562	488	572
Control Delay (s)	9.5	11.9	9.4	9.6
Approach Delay (s)	9.5	11.9	9.4	9.6
Approach LOS	A	B	A	A

Intersection Summary			
Delay	10.5		
HCM Level of Service	B		
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	100	195	130	66	259	55	70	280	59	92	520	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	195	130	66	259	55	70	280	59	92	520	110

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	425	380	350	59	612	110
Volume Left (vph)	100	66	70	0	92	0
Volume Right (vph)	130	55	0	59	0	110
Hadj (s)	-0.1	0.0	0.1	-0.7	0.1	-0.7
Departure Headway (s)	8.5	8.6	9.2	8.4	8.9	8.2
Degree Utilization, x	1.00	0.90	0.89	0.14	1.52	0.25
Capacity (veh/h)	425	410	382	419	415	435
Control Delay (s)	27.3	21.8	21.1	10.5	75.2	10.6
Approach Delay (s)	27.3	21.8	19.6		65.4	
Approach LOS	D	C	C		F	

Intersection Summary			
Delay	38.8		
HCM Level of Service	E		
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes	11/14/08

INTERSECTION 1 Main Street/W.Cypress Rd.
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           10  450  467
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT    40 ---  1.0   1.1  2.1  2.0   2.1 --- 1047  RIGHT
                                                           STREET NAME:
THRU   122 ---> 2.1  (NO. OF LANES)   1.1<---  322  THRU  W.Cypress Rd.

RIGHT   50 ---  1.1   1.0  2.0  1.0   1.0 ---  387  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                         SIG WARRANTS:
W + E                 90  520  304                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	304	0 *	1650	0.0000	
	THRU (T)	520	520	3300	0.1576	0.1576
	LEFT (L)	90	90	1650	0.0545	
SB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	450	450	3300	0.1364	
	LEFT (L)	467	467	3000	0.1557	0.1557
	T + R		460	3300	0.1394	
EB	RIGHT (R)	50	50	1650	0.0303	
	THRU (T)	122	122	3300	0.0370	
	LEFT (L)	40	40	1650	0.0242	0.0242
	T + R		172	3300	0.0521	
WB	RIGHT (R)	1047	790 *	3000	0.2633	
	THRU (T)	322	322	1650	0.1952	
	LEFT (L)	387	387	1650	0.2345	
	T + R		1112	3000	0.3707	0.3707

TOTAL VOLUME-TO-CAPACITY RATIO:	0.71
INTERSECTION LEVEL OF SERVICE:	C

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes   11/14/08

INTERSECTION   2 Frank Hengel Way/E. Cypress Rd.
Count Date   Time   Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------           350    0   80
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   308 ---  1.0   1.0  0.0  1.0   1.1 ---   30  RIGHT
                                                          STREET NAME:
THRU   668 ---> 2.0  (NO. OF LANES)   2.1<--- 1665  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB	RIGHT (R)	350	42 *	1720	0.0244	
	LEFT (L)	80	80	1720	0.0465	0.0465
EB	THRU (T)	668	668	3440	0.1942	
	LEFT (L)	308	308	1720	0.1791	0.1791
WB	RIGHT (R)	30	30	1720	0.0174	
	THRU (T)	1665	1665	3440	0.4840	
	T + R		1695	3440	0.4927	0.4927

TOTAL VOLUME-TO-CAPACITY RATIO: 0.72
INTERSECTION LEVEL OF SERVICE: C

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes          11/14/08
==========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                    Time                 Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                             4-PHASE SIGNAL
-----------           118  154   21
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    66 ---  1.0   1.0  1.0  1.0   1.1 ---   10  RIGHT
                                                             STREET NAME:
THRU   569 ---> 2.0  (NO. OF LANES)   2.1<--- 1176  THRU  E. Cypress Rd.

RIGHT  178 ---  1.0   1.0  1.0  1.9   2.0 ---  920  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                 202   68  330                            Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
==========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)     330        330        1650     0.2000
    THRU (T)       68         68        1650     0.0412
    LEFT (L)      202        202        1650     0.1224     0.1224
--------------------------------------------------------------------------
SB  RIGHT (R)     118         52 *      1650     0.0315
    THRU (T)      154        154        1650     0.0933     0.0933
    LEFT (L)       21         21        1650     0.0127
--------------------------------------------------------------------------
EB  RIGHT (R)     178          0 *      1650     0.0000
    THRU (T)      569        569        3300     0.1724     0.1724
    LEFT (L)       66         66        1650     0.0400
--------------------------------------------------------------------------
WB  RIGHT (R)      10         10        1650     0.0061
    THRU (T)     1176       1176        3300     0.3564
    LEFT (L)      920        920        3000     0.3067     0.3067
    T + R                   1186        3300     0.3594
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.69
     INTERSECTION LEVEL OF SERVICE:                               B
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION     4 Project Entrance/E. Cypress Rd.
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           207   15   30
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    70 ---  1.0   1.0  1.1  1.1   1.0 ---   42  RIGHT
                                                         STREET NAME:
THRU   947 ---> 2.1  (NO. OF LANES)   2.1<--- 1921  THRU  E. Cypress Rd.

RIGHT    8 ---  1.1   1.1  1.1  1.1   1.1 ---   25  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                  15    4    8                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
========================================================================
               ORIGINAL   ADJUSTED             V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)       8          8       1650    0.0048
    THRU (T)        4          4       1650    0.0024
    LEFT (L)       15         15       1650    0.0091     0.0091
    T + R                     12       1650    0.0073
    T + L                     19       1650    0.0115
    T + R + L                 27       1650    0.0164
------------------------------------------------------------------------
SB  RIGHT (R)     207        137 *     1650    0.0830     0.0830
    THRU (T)       15         15       1650    0.0091
    LEFT (L)       30         30       1650    0.0182
    T + L                     45       1650    0.0273
------------------------------------------------------------------------
EB  RIGHT (R)       8          8       1650    0.0048
    THRU (T)      947        947       3300    0.2870
    LEFT (L)       70         70       1650    0.0424     0.0424
    T + R                    955       3300    0.2894
------------------------------------------------------------------------
WB  RIGHT (R)      42         12 *     1650    0.0073
    THRU (T)     1921       1921       3300    0.5821
    LEFT (L)       25         25       1650    0.0152
    T + L                   1946       3300    0.5897     0.5897
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                        0.72
     INTERSECTION LEVEL OF SERVICE:                            C
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes          11/14/08
=========================================================================
INTERSECTION     5 Kightsen Road/E. Cypress Rd
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                            STREET NAME:
THRU   900 ---> 2.0  (NO. OF LANES)   2.0<--- 1921  THRU  E. Cypress Rd

RIGHT   92 ---  1.0   1.0  0.0  1.0   1.0 ---  140  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                         SIG WARRANTS:
W + E                  66    0   48                           Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Kightsen Road
=========================================================================
               ORIGINAL   ADJUSTED                  V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      48          0 *      1720     0.0000
    LEFT (L)       66         66        1720     0.0384     0.0384
-------------------------------------------------------------------------
EB  RIGHT (R)      92         26 *      1720     0.0151
    THRU (T)      900        900        3440     0.2616
-------------------------------------------------------------------------
WB  THRU (T)     1921       1921        3440     0.5584     0.5584
    LEFT (L)      140        140        1720     0.0814
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.60
     INTERSECTION LEVEL OF SERVICE:                              A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION     6 Jersey Island Rd/E. Cypress Rd.
Count Date                  Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       3-PHASE SIGNAL
-----------           242    0   49
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    88 ---  1.0   1.0  0.0  1.0   1.1 ---   23  RIGHT
                                                          STREET NAME:
THRU  1049 ---> 2.0  (NO. OF LANES)   2.1<--- 2018  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                   0    0    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Jersey Island Rd
========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
------------------------------------------------------------------------
SB  RIGHT (R)     242        154 *     1720     0.0895     0.0895
    LEFT (L)       49         49       1720     0.0285
------------------------------------------------------------------------
EB  THRU (T)     1049       1049       3440     0.3049
    LEFT (L)       88         88       1720     0.0512     0.0512
------------------------------------------------------------------------
WB  RIGHT (R)      23         23       1720     0.0134
    THRU (T)     2018       2018       3440     0.5866
    T + R                   2041       3440     0.5933     0.5933
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.73
     INTERSECTION LEVEL OF SERVICE:                               C
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes          11/14/08
==========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           716  403   37
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   322 ---  2.0   2.0  1.0  1.0   1.0 ---   83  RIGHT
                                                           STREET NAME:
THRU   360 ---> 2.0  (NO. OF LANES)   2.0<---  616  THRU  E. Cypress Rd.

RIGHT  344 ---  1.0   1.0  1.0  1.0   1.0 ---  264  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 329  437   98                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
==========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY     RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      98          0 *      1650     0.0000
    THRU (T)      437        437        1650     0.2648
    LEFT (L)      329        329        1650     0.1994     0.1994
--------------------------------------------------------------------------
SB  RIGHT (R)     716        539 *      3000     0.1797
    THRU (T)      403        403        1650     0.2442     0.2442
    LEFT (L)       37         37        1650     0.0224
--------------------------------------------------------------------------
EB  RIGHT (R)     344         15 *      1650     0.0091
    THRU (T)      360        360        3300     0.1091
    LEFT (L)      322        322        3000     0.1073     0.1073
--------------------------------------------------------------------------
WB  RIGHT (R)      83         46 *      1650     0.0279
    THRU (T)      616        616        3300     0.1867     0.1867
    LEFT (L)      264        264        1650     0.1600
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                           0.74
     INTERSECTION LEVEL OF SERVICE:                               C
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes        11/14/08
=========================================================================
INTERSECTION    10 Sellers Avenue/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------          1310  262    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   620 ---  2.0   2.0  1.0  0.0   0.0 ---    0  RIGHT
                                                          STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Laurel Road

RIGHT   21 ---  1.0   1.0  2.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                 120  201    0                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  THRU (T)      201         201       3440     0.0584
    LEFT (L)      120         120       1720     0.0698     0.0698
-------------------------------------------------------------------------
SB  RIGHT (R)    1310         969 *     3127     0.3099     0.3099
    THRU (T)      262         262       1720     0.1523
-------------------------------------------------------------------------
EB  RIGHT (R)      21           0 *     1720     0.0000
    LEFT (L)      620         620       3127     0.1983     0.1983
-------------------------------------------------------------------------
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.58
     INTERSECTION LEVEL OF SERVICE:                                A
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes 11/14/08

INTERSECTION 11 Sellers Avenue/Delta Road
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------           127  142   60
                        |    |    |
             ^          |    |    |        ^
             |       <---    v    --->     | Split? N
LEFT    96 ---  1.1   1.1  1.1  1.1   1.1 ---  186  RIGHT
                                                            STREET NAME:
THRU   172 ---> 1.1  (NO. OF LANES)   1.1<---  219  THRU   Delta Road

RIGHT   10 ---  1.1   1.1  1.1  1.1   1.1 ---    0  LEFT
             |       <---    ^    --->     |
             v          |    |    |        v
  N                     |    |    |                         SIG WARRANTS:
W + E                    12   37   15                         Urb=B, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	15	15	1650	0.0091	
	THRU (T)	37	37	1650	0.0224	
	LEFT (L)	12	12	1650	0.0073	0.0073
	T + R		52	1650	0.0315	
	T + L		49	1650	0.0297	
	T + R + L		64	1650	0.0388	
SB	RIGHT (R)	127	127	1650	0.0770	
	THRU (T)	142	142	1650	0.0861	
	LEFT (L)	60	60	1650	0.0364	
	T + R		269	1650	0.1630	
	T + L		202	1650	0.1224	
	T + R + L		329	1650	0.1994	0.1994
EB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	172	172	1650	0.1042	
	LEFT (L)	96	96	1650	0.0582	0.0582
	T + R		182	1650	0.1103	
	T + L		268	1650	0.1624	
	T + R + L		278	1650	0.1685	
WB	RIGHT (R)	186	186	1650	0.1127	
	THRU (T)	219	219	1650	0.1327	
	LEFT (L)	0	0	1650	0.0000	
	T + R		405	1650	0.2455	0.2455
	T + L		219	1650	0.1327	
	T + R + L		405	1650	0.2455	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.51
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

```
==========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
==========================================================================
INTERSECTION    12 Rose Avenue/Main Street
Count Date                   Time                 Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                            STREET NAME:
THRU   743 ---> 2.1  (NO. OF LANES)   2.1<--- 1153  THRU    Main Street

RIGHT   93 ---  1.1   1.0  0.0  1.0   1.1 ---  120  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                  42    0   61                           Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	61	0 *	1720	0.0000	
	LEFT (L)	42	42	1720	0.0244	0.0244
EB	RIGHT (R)	93	93	1720	0.0541	
	THRU (T)	743	743	3440	0.2160	
	T + R		836	3440	0.2430	
WB	THRU (T)	1153	1153	3440	0.3352	
	LEFT (L)	120	120	1720	0.0698	
	T + L		1273	3440	0.3701	0.3701

TOTAL VOLUME-TO-CAPACITY RATIO: 0.39

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes          11/14/08
========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            20   90   10
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    10 ---  1.0   1.1  1.1  1.1   1.1 ---   20  RIGHT
                                                             STREET NAME:
THRU   454 ---> 1.0  (NO. OF LANES)   1.1<---  510  THRU  Main Street

RIGHT   80 ---  1.0   1.0  1.1  1.1   1.0 ---   62  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                  110   40   73                           Urb=N, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      73         73       1650    0.0442
    THRU (T)       40         40       1650    0.0242
    LEFT (L)      110        110       1650    0.0667     0.0667
    T + R                    113       1650    0.0685
------------------------------------------------------------------------
SB  RIGHT (R)      20         20       1650    0.0121
    THRU (T)       90         90       1650    0.0545
    LEFT (L)       10         10       1650    0.0061
    T + R                    110       1650    0.0667
    T + L                    100       1650    0.0606
    T + R + L                120       1650    0.0727     0.0727
------------------------------------------------------------------------
EB  RIGHT (R)      80          0 *     1650    0.0000
    THRU (T)      454        454       1650    0.2752
    LEFT (L)       10         10       1650    0.0061     0.0061
------------------------------------------------------------------------
WB  RIGHT (R)      20         20       1650    0.0121
    THRU (T)      510        510       1650    0.3091
    LEFT (L)       62         62       1650    0.0376
    T + R                    530       1650    0.3212     0.3212
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.47
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                            3-PHASE SIGNAL
-----------            30    0   60
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT    90 ---  1.0   1.0  0.0  1.0   1.1 ---   40  RIGHT
                                                           STREET NAME:
THRU   430 ---> 2.0  (NO. OF LANES)   2.1<---  516  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   0    0    0                          Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
SB  RIGHT (R)      30          0 *     1720     0.0000
    LEFT (L)       60         60       1720     0.0349     0.0349
------------------------------------------------------------------------
EB  THRU (T)      430        430       3440     0.1250
    LEFT (L)       90         90       1720     0.0523     0.0523
------------------------------------------------------------------------
WB  RIGHT (R)      40         40       1720     0.0233
    THRU (T)      516        516       3440     0.1500
    T + R                    556       3440     0.1616     0.1616
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.25
     INTERSECTION LEVEL OF SERVICE:                              A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    15 Main Street/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------           261  646  200
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   185 ---  1.0   1.1  2.1  2.0   1.0 ---  230  RIGHT
                                                          STREET NAME:
THRU   322 ---> 2.0  (NO. OF LANES)   2.0<---  943  THRU  Laurel Road

RIGHT  220 ---  1.0   1.0  2.0  1.0   1.0 ---  391  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                 200  630  139                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED             V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*  CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)     139         0 *     1650     0.0000
    THRU (T)      630         630     3300     0.1909
    LEFT (L)      200         200     1650     0.1212     0.1212
------------------------------------------------------------------------
SB  RIGHT (R)     261         261     1650     0.1582
    THRU (T)      646         646     3300     0.1958
    LEFT (L)      200         200     3000     0.0667
    T + R                     907     3300     0.2748     0.2748
------------------------------------------------------------------------
EB  RIGHT (R)     220          20 *   1650     0.0121
    THRU (T)      322         322     3300     0.0976
    LEFT (L)      185         185     1650     0.1121     0.1121
------------------------------------------------------------------------
WB  RIGHT (R)     230         120 *   1650     0.0727
    THRU (T)      943         943     3300     0.2858     0.2858
    LEFT (L)      391         391     1650     0.2370
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                             0.79
     INTERSECTION LEVEL OF SERVICE:                                 C
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes 11/14/08

INTERSECTION 16 Main Street/Malicoat Lane
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------           180 1071    6
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    12 ---  1.0   1.1  2.1  1.0   1.1 ---    4  RIGHT
                                                           STREET NAME:
THRU     2 ---> 1.1  (NO. OF LANES)   1.1<---    5  THRU   Malicoat Lane

RIGHT   22 ---  1.1   1.0  2.1  1.1   1.0 ---   12  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                   44  953    6                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	6	6	1650	0.0036	
	THRU (T)	953	953	3300	0.2888	
	LEFT (L)	44	44	1650	0.0267	0.0267
	T + R		959	3300	0.2906	
SB	RIGHT (R)	180	180	1650	0.1091	
	THRU (T)	1071	1071	3300	0.3245	
	LEFT (L)	6	6	1650	0.0036	
	T + R		1251	3300	0.3791	0.3791
EB	RIGHT (R)	22	22	1650	0.0133	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	12	12	1650	0.0073	
	T + R		24	1650	0.0145	0.0145
WB	RIGHT (R)	4	4	1650	0.0024	
	THRU (T)	5	5	1650	0.0030	
	LEFT (L)	12	12	1650	0.0073	0.0073
	T + R		9	1650	0.0055	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.43
INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    17 Main Street/Brownstrone Road
Count Date                        Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------            14 1091    0
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT    21 ---  1.1   1.1  2.1  0.0   0.0 ---    0  RIGHT
                                                      STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Brownstrone Road

RIGHT   62 ---  1.1   1.1  2.1  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                     SIG WARRANTS:
W + E                  45  962    0                      Urb=N, Rur=B
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO      V/C
------------------------------------------------------------------------
NB  THRU (T)      962        962       3440    0.2797
    LEFT (L)       45         45       1720    0.0262     0.0262
    T + L                   1007       3440    0.2927
------------------------------------------------------------------------
SB  RIGHT (R)      14         14       1720    0.0081
    THRU (T)     1091       1091       3440    0.3172
    T + R                   1105       3440    0.3212     0.3212
------------------------------------------------------------------------
EB  RIGHT (R)      62         62       1720    0.0360
    LEFT (L)       21         21       1720    0.0122
    T + R + L                 83       1720    0.0483     0.0483
------------------------------------------------------------------------
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.40
     INTERSECTION LEVEL OF SERVICE:                             A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes          11/14/08
==========================================================================
INTERSECTION    18 Main Street/
Count Date                   Time               Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------            0  927  226
                       |   |    |
             ^         |   |    |          ^
             |       <---   v   --->       | Split? N
LEFT     0 ---  0.0   0.0  2.0  1.0   1.0 ---  247  RIGHT
                                                            STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU

RIGHT    0 ---  0.0   0.0  2.1  1.1   1.0 ---  111  LEFT
             |       <---   ^   --->       |
             v         |   |    |          v
  N                    |   |    |                       SIG WARRANTS:
W + E                  0  760   72                        Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
==========================================================================
               ORIGINAL   ADJUSTED                V/C      CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)      72         72       1650     0.0436
    THRU (T)      760        760       3300     0.2303
    T + R                    832       3300     0.2521     0.2521
--------------------------------------------------------------------------
SB  THRU (T)      927        927       3300     0.2809
    LEFT (L)      226        226       1650     0.1370     0.1370
--------------------------------------------------------------------------
WB  RIGHT (R)     247         21 *     1650     0.0127
    LEFT (L)      111        111       1650     0.0673     0.0673
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                         0.46
     INTERSECTION LEVEL OF SERVICE:                            A
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes   11/14/08

```
INTERSECTION    19 Rose Avenue/Laurel Road
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            33   25  172
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   160 ---  1.0   1.0  1.1  1.1   1.1 ---   10  RIGHT
                                                       STREET NAME:
THRU   547 ---> 2.1  (NO. OF LANES)   2.1<--- 1371  THRU  Laurel Road

RIGHT   15 ---  1.1   1.0  1.1  1.1   1.0 ---   23  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                    SIG WARRANTS:
W + E                  10    6    8                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	8	8	1650	0.0048	
	THRU (T)	6	6	1650	0.0036	
	LEFT (L)	10	10	1650	0.0061	0.0061
	T + R		14	1650	0.0085	
SB	RIGHT (R)	33	0 *	1650	0.0000	
	THRU (T)	25	25	1650	0.0152	
	LEFT (L)	172	172	1650	0.1042	
	T + L		197	1650	0.1194	0.1194
EB	RIGHT (R)	15	15	1650	0.0091	
	THRU (T)	547	547	3300	0.1658	
	LEFT (L)	160	160	1650	0.0970	0.0970
	T + R		562	3300	0.1703	
WB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	1371	1371	3300	0.4155	
	LEFT (L)	23	23	1650	0.0139	
	T + R		1381	3300	0.4185	0.4185

TOTAL VOLUME-TO-CAPACITY RATIO: 0.64

INTERSECTION LEVEL OF SERVICE: B

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project AM Peak Hour Volumes 11/14/08

INTERSECTION 20 O'Hara Avenue/Laurel Road
Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------           110  511  100
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   110 ---  1.0   1.0  1.0  1.0   1.0 ---  210  RIGHT
                                                           STREET NAME:
THRU   559 ---> 2.0  (NO. OF LANES)   2.0<--- 1150  THRU  Laurel Road

RIGHT  210 ---  1.0   1.0  1.0  1.0   1.0 ---  295  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 200  580  228                          Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	228	0 *	1650	0.0000	
	THRU (T)	580	580	1650	0.3515	
	LEFT (L)	200	200	1650	0.1212	0.1212
SB	RIGHT (R)	110	0 *	1650	0.0000	
	THRU (T)	511	511	1650	0.3097	0.3097
	LEFT (L)	100	100	1650	0.0606	
EB	RIGHT (R)	210	10 *	1650	0.0061	
	THRU (T)	559	559	3300	0.1694	
	LEFT (L)	110	110	1650	0.0667	0.0667
WB	RIGHT (R)	210	110 *	1650	0.0667	
	THRU (T)	1150	1150	3300	0.3485	0.3485
	LEFT (L)	295	295	1650	0.1788	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.85
INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project AM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    21 Empire Avenue/Laurel Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD          RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------            420  220   50
                         |    |    |
             ^           |    |    |         ^
             |         <---   v   --->       | Split? N
LEFT   220 ---  1.0   1.1  2.1  1.0   1.1 ---  260  RIGHT
                                                           STREET NAME:
THRU   746 ---> 2.1  (NO. OF LANES)   2.1<--- 1358  THRU  Laurel Road

RIGHT  150 ---  1.1   1.0  2.1  1.1   1.0 ---   72  LEFT
             |         <---   ^   --->       |
             v           |    |    |         v
  N                      |    |    |                       SIG WARRANTS:
W + E                  180  450   57                         Urb=Y, Rur=Y
  S                    LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      57         57        1650     0.0345
    THRU (T)      450        450        3300     0.1364
    LEFT (L)      180        180        1650     0.1091     0.1091
    T + R                    507        3300     0.1536
------------------------------------------------------------------------
SB  RIGHT (R)     420        420        1650     0.2545     0.2545
    THRU (T)      220        220        3300     0.0667
    LEFT (L)       50         50        1650     0.0303
    T + R                    640        3300     0.1939
------------------------------------------------------------------------
EB  RIGHT (R)     150        150        1650     0.0909
    THRU (T)      746        746        3300     0.2261
    LEFT (L)      220        220        1650     0.1333     0.1333
    T + R                    896        3300     0.2715
------------------------------------------------------------------------
WB  RIGHT (R)     260        260        1650     0.1576
    THRU (T)     1358       1358        3300     0.4115
    LEFT (L)       72         72        1650     0.0436
    T + R                   1618        3300     0.4903     0.4903
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.99
     INTERSECTION LEVEL OF SERVICE:                              E
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.AMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     1 Main Street/W.Cypress Rd.
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                            4-PHASE SIGNAL
-----------            20  780 1236
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   100 ---  1.0   1.1  2.1  2.0   2.1 ---  915  RIGHT
                                                       STREET NAME:
THRU   220 ---> 2.1  (NO. OF LANES)   1.1<---  380  THRU  W.Cypress Rd.

RIGHT   70 ---  1.1   1.0  2.0  1.0   1.0 ---  354  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                          SIG WARRANTS:
W + E                  130  400  633                         Urb=Y, Rur=Y
  S                    LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
=========================================================================
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	633	279 *	1650	0.1691	0.1691
	THRU (T)	400	400	3300	0.1212	
	LEFT (L)	130	130	1650	0.0788	
SB	RIGHT (R)	20	20	1650	0.0121	
	THRU (T)	780	780	3300	0.2364	
	LEFT (L)	1236	1236	3000	0.4120	0.4120
	T + R		800	3300	0.2424	
EB	RIGHT (R)	70	70	1650	0.0424	
	THRU (T)	220	220	3300	0.0667	
	LEFT (L)	100	100	1650	0.0606	
	T + R		290	3300	0.0879	0.0879
WB	RIGHT (R)	915	235 *	3000	0.0783	
	THRU (T)	380	380	1650	0.2303	
	LEFT (L)	354	354	1650	0.2145	0.2145
	T + R		615	3000	0.2050	

```
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.88
     INTERSECTION LEVEL OF SERVICE:                               D
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

==

Condition: Cumulative plus Project PM Peak Hour Volumes 11/14/08

==

INTERSECTION 2 Frank Hengel Way/E. Cypress Rd.
Count Date Time Peak Hour

```
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         3-PHASE SIGNAL
-----------            14    0    5
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT     9 ---  1.0   1.0  0.0  1.0   1.1 ---    2  RIGHT
                                                          STREET NAME:
THRU  2087 ---> 2.0  (NO. OF LANES)   2.1<--- 1672  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                       SIG WARRANTS:
W + E                   0    0    0                         Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Frank Hengel Way
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	14	5 *	1720	0.0029	
LEFT (L)	5	5	1720	0.0029	0.0029
EB THRU (T)	2087	2087	3440	0.6067	0.6067
LEFT (L)	9	9	1720	0.0052	
WB RIGHT (R)	2	2	1720	0.0012	
THRU (T)	1672	1672	3440	0.4860	
T + R		1674	3440	0.4866	

==

TOTAL VOLUME-TO-CAPACITY RATIO: 0.61

INTERSECTION LEVEL OF SERVICE: B

==

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     3 Sellers Avenue/E. Cypress Rd.
Count Date                  Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------           168  156   22
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   197 ---  1.0   1.0  1.0  1.0   1.1 ---   29  RIGHT
                                                            STREET NAME:
THRU  1569 ---> 2.0  (NO. OF LANES)   2.1<--- 1132  THRU  E. Cypress Rd.

RIGHT  202 ---  1.0   1.0  1.0  1.9   2.0 ---  546  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                         SIG WARRANTS:
W + E                 227  206  938                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
=========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)     938         938        1650     0.5685
    THRU (T)      206         206        1650     0.1248
    LEFT (L)      227         227        1650     0.1376     0.1376
-------------------------------------------------------------------------
SB  RIGHT (R)     168           0 *      1650     0.0000
    THRU (T)      156         156        1650     0.0945     0.0945
    LEFT (L)       22          22        1650     0.0133
-------------------------------------------------------------------------
EB  RIGHT (R)     202           0 *      1650     0.0000
    THRU (T)     1569        1569        3300     0.4755     0.4755
    LEFT (L)      197         197        1650     0.1194
-------------------------------------------------------------------------
WB  RIGHT (R)      29          29        1650     0.0176
    THRU (T)     1132        1132        3300     0.3430
    LEFT (L)      546         546        3000     0.1820     0.1820
    T + R                    1161        3300     0.3518
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.89
     INTERSECTION LEVEL OF SERVICE:                              D
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     4 Project Entrance/E. Cypress Rd.
Count Date                   Time               Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           134    5   18
                        |    |    |
             ^          |    |    |        ^
             |       <---    v    --->     | Split? N
LEFT   240 ---  1.0   1.0  1.1  1.1   1.0 ---   46  RIGHT
                                                           STREET NAME:
THRU  2362 ---> 2.1  (NO. OF LANES)   2.1<--- 1704  THRU  E. Cypress Rd.

RIGHT   23 ---  1.1   1.1  1.1  1.1   1.1 ---    8  LEFT
             |       <---    ^    --->     |
             v          |    |    |        v
  N                     |    |    |                        SIG WARRANTS:
W + E                  40    6   12                          Urb=B, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Project Entrance
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      12          12       1650     0.0073
    THRU (T)        6           6       1650     0.0036
    LEFT (L)       40          40       1650     0.0242
    T + R                      18       1650     0.0109
    T + L                      46       1650     0.0279
    T + R + L                  58       1650     0.0352     0.0352
-------------------------------------------------------------------------
SB  RIGHT (R)     134           0 *     1650     0.0000
    THRU (T)        5           5       1650     0.0030
    LEFT (L)       18          18       1650     0.0109     0.0109
    T + L                      23       1650     0.0139
-------------------------------------------------------------------------
EB  RIGHT (R)      23          23       1650     0.0139
    THRU (T)     2362        2362       3300     0.7158
    LEFT (L)      240         240       1650     0.1455
    T + R                    2385       3300     0.7227     0.7227
-------------------------------------------------------------------------
WB  RIGHT (R)      46          28 *     1650     0.0170
    THRU (T)     1704        1704       3300     0.5164
    LEFT (L)        8           8       1650     0.0048     0.0048
    T + L                    1712       3300     0.5188
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.77
     INTERSECTION LEVEL OF SERVICE:                                C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
=========================================================================
INTERSECTION     5 Kightsen Road/E. Cypress Rd
Count Date                    Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                            3-PHASE SIGNAL
-----------            0    0    0
                       |    |    |
             ^         |    |    |         ^
             |       <---   v   --->       | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                          STREET NAME:
THRU  2313 ---> 2.0  (NO. OF LANES)   2.0<--- 1757  THRU  E. Cypress Rd

RIGHT  105 ---  1.0   1.0  0.0  1.0   1.0 ---   27  LEFT
             |       <---   ^   --->       |
             v         |    |    |         v
  N                    |    |    |                        SIG WARRANTS:
W + E                 110   0   67                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Kightsen Road
=========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
NB  RIGHT (R)      67         40 *     1720     0.0233
    LEFT (L)      110        110       1720     0.0640     0.0640
-------------------------------------------------------------------------
EB  RIGHT (R)     105          0 *     1720     0.0000
    THRU (T)     2313       2313       3440     0.6724     0.6724
-------------------------------------------------------------------------
WB  THRU (T)     1757       1757       3440     0.5108
    LEFT (L)       27         27       1720     0.0157     0.0157
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.75
     INTERSECTION LEVEL OF SERVICE:                              C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes           11/14/08
=========================================================================
INTERSECTION     6 Jersey Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------           167    0   45
                        |    |    |
             ^          |    |    |         ^
             |       <---    v   --->       | Split? N
LEFT   246 ---  1.0   1.0  0.0  1.0   1.1 ---   53  RIGHT
                                                             STREET NAME:
THRU  2355 ---> 2.0  (NO. OF LANES)   2.1<--- 1655  THRU  E. Cypress Rd.

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |       <---    ^   --->       |
             v          |    |    |         v
  N                     |    |    |                          SIG WARRANTS:
W + E                   0    0    0                            Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Jersey Island Rd
=========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
-------------------------------------------------------------------------
SB  RIGHT (R)     167          0 *     1720     0.0000
    LEFT (L)       45         45       1720     0.0262     0.0262
-------------------------------------------------------------------------
EB  THRU (T)     2355       2355       3440     0.6846     0.6846
    LEFT (L)      246        246       1720     0.1430
-------------------------------------------------------------------------
WB  RIGHT (R)      53         53       1720     0.0308
    THRU (T)     1655       1655       3440     0.4811
    T + R                   1708       3440     0.4965
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.71
     INTERSECTION LEVEL OF SERVICE:                                C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes        11/14/08
=========================================================================
INTERSECTION     7 Bethel Island Rd/E. Cypress Rd.
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           509  230   69
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   792 ---  2.0   2.0  1.0  1.0   1.0 ---   55  RIGHT
                                                         STREET NAME:
THRU   753 ---> 2.0  (NO. OF LANES)   2.0<---  528  THRU  E. Cypress Rd.

RIGHT  413 ---  1.0   1.0  1.0  1.0   1.0 ---  161  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                     SIG WARRANTS:
W + E                 395  352  170                       Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Bethel Island Rd
=========================================================================
               ORIGINAL   ADJUSTED               V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
-------------------------------------------------------------------------
NB  RIGHT (R)     170          9 *     1650     0.0055
    THRU (T)      352        352       1650     0.2133
    LEFT (L)      395        395       1650     0.2394     0.2394
-------------------------------------------------------------------------
SB  RIGHT (R)     509         73 *     3000     0.0243
    THRU (T)      230        230       1650     0.1394     0.1394
    LEFT (L)       69         69       1650     0.0418
-------------------------------------------------------------------------
EB  RIGHT (R)     413         18 *     1650     0.0109
    THRU (T)      753        753       3300     0.2282
    LEFT (L)      792        792       3000     0.2640     0.2640
-------------------------------------------------------------------------
WB  RIGHT (R)      55          0 *     1650     0.0000
    THRU (T)      528        528       3300     0.1600     0.1600
    LEFT (L)      161        161       1650     0.0976
=========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.80
     INTERSECTION LEVEL OF SERVICE:                              C
=========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
==========================================================================
INTERSECTION    10 Sellers Avenue/Laurel Road
Count Date                   Time               Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                          3-PHASE SIGNAL
-----------           760  104    0
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT  1360 ---  2.0   2.0  1.0  0.0   0.0 ---    0  RIGHT
                                                       STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Laurel Road

RIGHT  180 ---  1.0   1.0  2.0  0.0   0.0 ---    0  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                    SIG WARRANTS:
W + E                 440  140    0                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
==========================================================================
               ORIGINAL   ADJUSTED                V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO      V/C
--------------------------------------------------------------------------
NB  THRU (T)      140        140        3440     0.0407
    LEFT (L)      440        440        1720     0.2558     0.2558
--------------------------------------------------------------------------
SB  RIGHT (R)     760         12 *      3127     0.0038
    THRU (T)      104        104        1720     0.0605     0.0605
--------------------------------------------------------------------------
EB  RIGHT (R)     180          0 *      1720     0.0000
    LEFT (L)     1360       1360        3127     0.4349     0.4349
--------------------------------------------------------------------------
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.75
     INTERSECTION LEVEL OF SERVICE:                              C
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    11 Sellers Avenue/Delta Road
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                         4-PHASE SIGNAL
-----------            75  209   54
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT   170 ---  1.1   1.1  1.1  1.1   1.1 ---   61  RIGHT
                                                          STREET NAME:
THRU   145 ---> 1.1  (NO. OF LANES)   1.1<---  170  THRU  Delta Road

RIGHT   61 ---  1.1   1.1  1.1  1.1   1.1 ---   25  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                         SIG WARRANTS:
W + E                  80  284   42                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Sellers Avenue
========================================================================
               ORIGINAL   ADJUSTED             V/C      CRITICAL
   MOVEMENT     VOLUME     VOLUME*  CAPACITY    RATIO      V/C
------------------------------------------------------------------------
NB  RIGHT (R)      42          42       1650     0.0255
    THRU (T)      284         284       1650     0.1721
    LEFT (L)       80          80       1650     0.0485
    T + R                     326       1650     0.1976
    T + L                     364       1650     0.2206
    T + R + L                 406       1650     0.2461     0.2461
------------------------------------------------------------------------
SB  RIGHT (R)      75          75       1650     0.0455
    THRU (T)      209         209       1650     0.1267
    LEFT (L)       54          54       1650     0.0327     0.0327
    T + R                     284       1650     0.1721
    T + L                     263       1650     0.1594
    T + R + L                 338       1650     0.2048
------------------------------------------------------------------------
EB  RIGHT (R)      61          61       1650     0.0370
    THRU (T)      145         145       1650     0.0879
    LEFT (L)      170         170       1650     0.1030     0.1030
    T + R                     206       1650     0.1248
    T + L                     315       1650     0.1909
    T + R + L                 376       1650     0.2279
------------------------------------------------------------------------
WB  RIGHT (R)      61          61       1650     0.0370
    THRU (T)      170         170       1650     0.1030
    LEFT (L)       25          25       1650     0.0152
    T + R                     231       1650     0.1400
    T + L                     195       1650     0.1182
    T + R + L                 256       1650     0.1552     0.1552
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                            0.54
     INTERSECTION LEVEL OF SERVICE:                                A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes          11/14/08
==========================================================================
INTERSECTION    12 Rose Avenue/Main Street
Count Date                   Time                Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                           3-PHASE SIGNAL
-----------             0    0    0
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT     0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  RIGHT
                                                         STREET NAME:
THRU  1817 ---> 2.1  (NO. OF LANES)   2.1<--- 1360  THRU  Main Street

RIGHT  156 ---  1.1   1.0  0.0  1.0   1.1 ---   25  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                  31    0    9                        Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	9	0 *	1720	0.0000	
LEFT (L)	31	31	1720	0.0180	0.0180
EB RIGHT (R)	156	156	1720	0.0907	
THRU (T)	1817	1817	3440	0.5282	
T + R		1973	3440	0.5735	0.5735
WB THRU (T)	1360	1360	3440	0.3953	
LEFT (L)	25	25	1720	0.0145	0.0145
T + L		1385	3440	0.4026	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.61

INTERSECTION LEVEL OF SERVICE: B

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    13 O'Hara Avenue/Main Street
Count Date                   Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                       4-PHASE SIGNAL
-----------            10   40   30
                        |   |   |
             ^          |   |   |       ^
             |       <---   v   --->    | Split? N
LEFT    20 ---  1.0   1.1  1.1  1.1   1.1 ---   20  RIGHT
                                                          STREET NAME:
THRU   915 ---> 1.0  (NO. OF LANES)   1.1<---  726  THRU  Main Street

RIGHT  130 ---  1.0   1.0  1.1  1.1   1.0 ---   92  LEFT
             |       <---   ^   --->    |
             v          |   |   |       v
  N                     |   |   |                         SIG WARRANTS:
W + E                 140   60   79                         Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

	MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	79	79	1650	0.0479	
	THRU (T)	60	60	1650	0.0364	
	LEFT (L)	140	140	1650	0.0848	0.0848
	T + R		139	1650	0.0842	
SB	RIGHT (R)	10	10	1650	0.0061	
	THRU (T)	40	40	1650	0.0242	
	LEFT (L)	30	30	1650	0.0182	
	T + R		50	1650	0.0303	
	T + L		70	1650	0.0424	
	T + R + L		80	1650	0.0485	0.0485
EB	RIGHT (R)	130	0 *	1650	0.0000	
	THRU (T)	915	915	1650	0.5545	0.5545
	LEFT (L)	20	20	1650	0.0121	
WB	RIGHT (R)	20	20	1650	0.0121	
	THRU (T)	726	726	1650	0.4400	
	LEFT (L)	92	92	1650	0.0558	0.0558
	T + R		746	1650	0.4521	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.74

INTERSECTION LEVEL OF SERVICE: C

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

```
===========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
===========================================================================
INTERSECTION    14 Vintage Parkway/Main Street
Count Date                   Time                Peak Hour
---------------------------------------------------------------------------
CCTA METHOD          RIGHT THRU LEFT                           3-PHASE SIGNAL
-----------             40    0   90
                         |    |    |
             ^           |    |    |         ^
             |        <---    v   --->       | Split? N
LEFT    40 ---  1.0   1.0  0.0  1.0   1.1 ---   50  RIGHT
                                                              STREET NAME:
THRU   903 ---> 2.0  (NO. OF LANES)   2.1<---  741  THRU  Main Street

RIGHT    0 ---  0.0   0.0  0.0  0.0   0.0 ---    0  LEFT
             |        <---    ^   --->       |
             v           |    |    |         v
  N                      |    |    |                      SIG WARRANTS:
W + E                    0    0    0                        Urb=N, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: Vintage Parkway
===========================================================================
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
SB RIGHT (R)	40	0 *	1720	0.0000	
LEFT (L)	90	90	1720	0.0523	0.0523
EB THRU (T)	903	903	3440	0.2625	0.2625
LEFT (L)	40	40	1720	0.0233	
WB RIGHT (R)	50	50	1720	0.0291	
THRU (T)	741	741	3440	0.2154	
T + R		791	3440	0.2299	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.31

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project PM Peak Hour Volumes 11/14/08

INTERSECTION 15 Main Street/Laurel Road
Count Date Time Peak Hour

```
CCTA METHOD          RIGHT THRU LEFT                           4-PHASE SIGNAL
-----------            151  835  480
                         |    |    |
             ^           |    |    |         ^
             |         <---   v   --->       | Split? N
LEFT   435 ---  1.0   1.1  2.1  2.0   1.0 ---  310  RIGHT
                                                            STREET NAME:
THRU   748 ---> 2.0  (NO. OF LANES)   2.0<---  509  THRU    Laurel Road

RIGHT  230 ---  1.0   1.0  2.0  1.0   1.0 ---  188  LEFT
             |         <---   ^   --->       |
             v           |    |    |         v
  N                      |    |    |                        SIG WARRANTS:
W + E                   210  748  375                         Urb=Y, Rur=Y
  S                    LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	375	187 *	1650	0.1133	
THRU (T)	748	748	3300	0.2267	
LEFT (L)	210	210	1650	0.1273	0.1273
SB RIGHT (R)	151	151	1650	0.0915	
THRU (T)	835	835	3300	0.2530	
LEFT (L)	480	480	3000	0.1600	
T + R		986	3300	0.2988	0.2988
EB RIGHT (R)	230	20 *	1650	0.0121	
THRU (T)	748	748	3300	0.2267	
LEFT (L)	435	435	1650	0.2636	0.2636
WB RIGHT (R)	310	46 *	1650	0.0279	
THRU (T)	509	509	3300	0.1542	0.1542
LEFT (L)	188	188	1650	0.1139	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.84
INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

```
========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes         11/14/08
========================================================================
INTERSECTION    16 Main Street/Malicoat Lane
Count Date                  Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            33 1209   11
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT    18 ---  1.0   1.1  2.1  1.0   1.1 ---    9  RIGHT
                                                           STREET NAME:
THRU     2 ---> 1.1  (NO. OF LANES)   1.1<---    1  THRU  Malicoat Lane

RIGHT   12 ---  1.1   1.0  2.1  1.1   1.0 ---    2  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                  11 1306   13                          Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	13	13	1650	0.0079	
	THRU (T)	1306	1306	3300	0.3958	
	LEFT (L)	11	11	1650	0.0067	
	T + R		1319	3300	0.3997	0.3997
SB	RIGHT (R)	33	33	1650	0.0200	
	THRU (T)	1209	1209	3300	0.3664	
	LEFT (L)	11	11	1650	0.0067	0.0067
	T + R		1242	3300	0.3764	
EB	RIGHT (R)	12	12	1650	0.0073	
	THRU (T)	2	2	1650	0.0012	
	LEFT (L)	18	18	1650	0.0109	0.0109
	T + R		14	1650	0.0085	
WB	RIGHT (R)	9	9	1650	0.0055	
	THRU (T)	1	1	1650	0.0006	
	LEFT (L)	2	2	1650	0.0012	
	T + R		10	1650	0.0061	0.0061

```
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                              0.42
     INTERSECTION LEVEL OF SERVICE:                                  A
========================================================================
```

* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes        11/14/08
========================================================================
INTERSECTION    17 Main Street/Brownstrone Road
Count Date                   Time               Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        3-PHASE SIGNAL
-----------            24 1170    0
                        |   |   |
             ^          |   |   |         ^
             |       <---   v   --->      | Split? N
LEFT     8 ---  1.1   1.1  2.1  0.0   0.0 ---    0  RIGHT
                                                       STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU  Brownstrone Road

RIGHT   50 ---  1.1   1.1  2.1  0.0   0.0 ---    0  LEFT
             |       <---   ^   --->      |
             v          |   |   |         v
  N                     |   |   |                      SIG WARRANTS:
W + E                  58 1349    0                      Urb=N, Rur=N
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
========================================================================
               ORIGINAL   ADJUSTED              V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY   RATIO     V/C
------------------------------------------------------------------------
NB  THRU (T)     1349       1349       3440    0.3922
    LEFT (L)       58         58       1720    0.0337
    T + L                   1407       3440    0.4090    0.4090
------------------------------------------------------------------------
SB  RIGHT (R)      24         24       1720    0.0140
    THRU (T)     1170       1170       3440    0.3401
    T + R                   1194       3440    0.3471
------------------------------------------------------------------------
EB  RIGHT (R)      50         50       1720    0.0291
    LEFT (L)        8          8       1720    0.0047
    T + R + L                 58       1720    0.0337    0.0337
------------------------------------------------------------------------
========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                       0.44
     INTERSECTION LEVEL OF SERVICE:                           A
========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
==========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes        11/14/08
==========================================================================
INTERSECTION    18 Main Street/
Count Date                   Time               Peak Hour
--------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------            0 1010  234
                       |   |   |
             ^         |   |   |         ^
             |       <---  v   --->      | Split? N
LEFT     0 ---  0.0   0.0  2.0  1.0   1.0 ---  230  RIGHT
                                                           STREET NAME:
THRU     0 ---> 0.0  (NO. OF LANES)   0.0<---    0  THRU

RIGHT    0 ---  0.0   0.0  2.1  1.1   1.0 ---   94  LEFT
             |       <---  ^   --->      |
             v         |   |   |         v
  N                    |   |   |                           SIG WARRANTS:
W + E                  0 1176  167                           Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Main Street
==========================================================================
               ORIGINAL   ADJUSTED                 V/C     CRITICAL
   MOVEMENT     VOLUME     VOLUME*   CAPACITY    RATIO       V/C
--------------------------------------------------------------------------
NB  RIGHT (R)     167        167       1650     0.1012
    THRU (T)     1176       1176       3300     0.3564
    T + R                   1343       3300     0.4070     0.4070
--------------------------------------------------------------------------
SB  THRU (T)     1010       1010       3300     0.3061
    LEFT (L)      234        234       1650     0.1418     0.1418
--------------------------------------------------------------------------
WB  RIGHT (R)     230          0 *     1650     0.0000
    LEFT (L)       94         94       1650     0.0570     0.0570
==========================================================================
     TOTAL VOLUME-TO-CAPACITY RATIO:                          0.61
     INTERSECTION LEVEL OF SERVICE:                             B
==========================================================================
* ADJUSTED FOR RIGHT TURN ON RED
INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=
```

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes        11/14/08
========================================================================
INTERSECTION    19 Rose Avenue/Laurel Road
Count Date                    Time                Peak Hour
------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           110   35   50
                        |    |    |
             ^          |    |    |          ^
             |       <---    v    --->       | Split? N
LEFT    42 ---  1.0   1.0  1.1  1.1   1.1 ---   22  RIGHT
                                                           STREET NAME:
THRU  1445 ---> 2.1  (NO. OF LANES)   2.1<---  914  THRU  Laurel Road

RIGHT    6 ---  1.1   1.0  1.1  1.1   1.0 ---   29  LEFT
             |       <---    ^    --->       |
             v          |    |    |          v
  N                     |    |    |                    SIG WARRANTS:
W + E                   5   18   17                      Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Rose Avenue
```

MOVEMENT		ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB	RIGHT (R)	17	17	1650	0.0103	
	THRU (T)	18	18	1650	0.0109	
	LEFT (L)	5	5	1650	0.0030	0.0030
	T + R		35	1650	0.0212	
SB	RIGHT (R)	110	68 *	1650	0.0412	
	THRU (T)	35	35	1650	0.0212	
	LEFT (L)	50	50	1650	0.0303	
	T + L		85	1650	0.0515	0.0515
EB	RIGHT (R)	6	6	1650	0.0036	
	THRU (T)	1445	1445	3300	0.4379	
	LEFT (L)	42	42	1650	0.0255	
	T + R		1451	3300	0.4397	0.4397
WB	RIGHT (R)	22	22	1650	0.0133	
	THRU (T)	914	914	3300	0.2770	
	LEFT (L)	29	29	1650	0.0176	0.0176
	T + R		936	3300	0.2836	

TOTAL VOLUME-TO-CAPACITY RATIO: 0.51

INTERSECTION LEVEL OF SERVICE: A

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

CCTALOS Software ver. 2.35 by TJKM Transportation Consultants

Condition: Cumulative plus Project PM Peak Hour Volumes 11/14/08

INTERSECTION 20 O'Hara Avenue/Laurel Road

Count Date Time Peak Hour

```
CCTA METHOD         RIGHT THRU LEFT                          4-PHASE SIGNAL
-----------           200  481  110
                        |    |    |
             ^          |    |    |         ^
             |        <---   v   --->       | Split? N
LEFT   190 ---  1.0   1.0  1.0  1.0   1.0 ---  210  RIGHT
                                                             STREET NAME:
THRU  1237 ---> 2.0  (NO. OF LANES)   2.0<---  861  THRU  Laurel Road

RIGHT  310 ---  1.0   1.0  1.0  1.0   1.0 ---  120  LEFT
             |        <---   ^   --->       |
             v          |    |    |         v
  N                     |    |    |                      SIG WARRANTS:
W + E                 220  431  146                        Urb=Y, Rur=Y
  S                   LEFT THRU RIGHT Split? N

               STREET NAME: O'Hara Avenue
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	146	26 *	1650	0.0158	
THRU (T)	431	431	1650	0.2612	
LEFT (L)	220	220	1650	0.1333	0.1333
SB RIGHT (R)	200	10 *	1650	0.0061	
THRU (T)	481	481	1650	0.2915	0.2915
LEFT (L)	110	110	1650	0.0667	
EB RIGHT (R)	310	90 *	1650	0.0545	
THRU (T)	1237	1237	3300	0.3748	0.3748
LEFT (L)	190	190	1650	0.1152	
WB RIGHT (R)	210	100 *	1650	0.0606	
THRU (T)	861	861	3300	0.2609	
LEFT (L)	120	120	1650	0.0727	0.0727

TOTAL VOLUME-TO-CAPACITY RATIO: 0.87

INTERSECTION LEVEL OF SERVICE: D

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

```
CCTALOS Software ver. 2.35 by TJKM Transportation Consultants
=========================================================================
Condition: Cumulative plus Project PM Peak Hour Volumes        11/14/08
=========================================================================
INTERSECTION    21 Empire Avenue/Laurel Road
Count Date                   Time                Peak Hour
-------------------------------------------------------------------------
CCTA METHOD         RIGHT THRU LEFT                        4-PHASE SIGNAL
-----------           330  360  180
                        |    |    |
             ^          |    |    |         ^
             |       <---    v    --->      | Split? N
LEFT   460 ---  1.0   1.1  2.1  1.0   1.1 ---  120  RIGHT
                                                           STREET NAME:
THRU  1503 ---> 2.1  (NO. OF LANES)   2.1<--- 1120  THRU  Laurel Road

RIGHT  310 ---  1.1   1.0  2.1  1.1   1.0 ---  128  LEFT
             |       <---    ^    --->      |
             v          |    |    |         v
  N                     |    |    |                        SIG WARRANTS:
W + E                 160  430  142                          Urb=Y, Rur=Y
  S                  LEFT THRU RIGHT Split? N

               STREET NAME: Empire Avenue
=========================================================================
```

MOVEMENT	ORIGINAL VOLUME	ADJUSTED VOLUME*	CAPACITY	V/C RATIO	CRITICAL V/C
NB RIGHT (R)	142	142	1650	0.0861	
THRU (T)	430	430	3300	0.1303	
LEFT (L)	160	160	1650	0.0970	0.0970
T + R		572	3300	0.1733	
SB RIGHT (R)	330	330	1650	0.2000	
THRU (T)	360	360	3300	0.1091	
LEFT (L)	180	180	1650	0.1091	
T + R		690	3300	0.2091	0.2091
EB RIGHT (R)	310	310	1650	0.1879	
THRU (T)	1503	1503	3300	0.4555	
LEFT (L)	460	460	1650	0.2788	0.2788
T + R		1813	3300	0.5494	
WB RIGHT (R)	120	120	1650	0.0727	
THRU (T)	1120	1120	3300	0.3394	
LEFT (L)	128	128	1650	0.0776	
T + R		1240	3300	0.3758	0.3758

TOTAL VOLUME-TO-CAPACITY RATIO: 0.96

INTERSECTION LEVEL OF SERVICE: E

* ADJUSTED FOR RIGHT TURN ON RED

INT=...CASCUM.INT,VOL=...CUMPR.PMV,CAP=

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	25	150	30	60	389	12	45	113	18	29	140	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	25	150	30	60	389	12	45	113	18	29	140	60

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	205	461	176	229
Volume Left (vph)	25	60	45	29
Volume Right (vph)	30	12	18	60
Hadj (s)	0.0	0.0	0.0	-0.1
Departure Headway (s)	5.9	6.3	6.3	6.1
Degree Utilization, x	0.34	0.80	0.31	0.39
Capacity (veh/h)	555	461	509	561
Control Delay (s)	9.7	14.4	10.1	10.1
Approach Delay (s)	9.7	14.4	10.1	10.1
Approach LOS	A	B	B	B

Intersection Summary			
Delay	11.9		
HCM Level of Service	B		
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	40	99	60	101	321	70	100	310	52	51	240	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	99	60	101	321	70	100	310	52	51	240	90

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	199	492	410	52	291	90
Volume Left (vph)	40	101	100	0	51	0
Volume Right (vph)	60	70	0	52	0	90
Hadj (s)	-0.1	0.0	0.2	-0.7	0.1	-0.7
Departure Headway (s)	8.2	7.7	8.0	7.2	8.3	7.5
Degree Utilization, x	0.45	1.05	0.92	0.10	0.67	0.19
Capacity (veh/h)	417	473	439	488	420	466
Control Delay (s)	12.9	29.3	20.2	9.2	13.9	9.7
Approach Delay (s)	12.9	29.3	19.0		12.9	
Approach LOS	B	D	C		B	

Intersection Summary			
Delay	20.0		
HCM Level of Service	C		
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	3	386	31	12	447	36	28	0	14	30	135	25
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	386	31	12	447	36	28	0	14	30	135	25

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	420	495	42	190
Volume Left (vph)	3	12	28	30
Volume Right (vph)	31	36	14	25
Hadj (s)	0.0	0.0	0.0	0.0
Departure Headway (s)	5.4	6.3	6.8	6.4
Degree Utilization, x	0.64	0.87	0.08	0.34
Capacity (veh/h)	638	550	457	533
Control Delay (s)	10.7	16.3	9.9	10.2
Approach Delay (s)	10.7	16.3	9.9	10.2
Approach LOS	B	C	A	B

Intersection Summary			
Delay	13.0		
HCM Level of Service	B		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	100	230	130	89	288	63	70	280	87	102	520	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	230	130	89	288	63	70	280	87	102	520	110

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	460	440	350	87	622	110
Volume Left (vph)	100	89	70	0	102	0
Volume Right (vph)	130	63	0	87	0	110
Hadj (s)	-0.1	0.0	0.1	-0.7	0.1	-0.7
Departure Headway (s)	8.9	9.0	9.4	8.6	9.3	8.5
Degree Utilization, x	1.13	1.09	0.91	0.21	1.60	0.26
Capacity (veh/h)	419	412	375	413	392	420
Control Delay (s)	37.9	34.7	22.7	11.0	84.3	11.0
Approach Delay (s)	37.9	34.7	20.3		73.3	
Approach LOS	E	D	C		F	

Intersection Summary			
Delay	46.0		
HCM Level of Service	E		
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

AIR QUALITY IMPACT ANALYSIS FOR THE PROPOSED EMERSON RANCH PROJECT, CITY OF OAKLEY

Prepared for:

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INTRODUCTION

This report describes the effects of the Emerson Ranch Project on local and regional air quality. This report is intended to meet the requirements of the Bay Area Air Quality Management District's guidance for environmental documents.[1] It addresses existing air quality conditions, the impacts of the project during construction, and permanent local and regional air quality impacts. Where significant air quality impacts are identified, mitigation measures are described that would reduce or eliminate the impact.

EXISTING CONDITIONS

Air Pollution Climatology

Oakley is located on the south side of the San Joaquin River delta, east of the Carquinez Straits. Its location between the greater Bay Area and the Central Valley has great influence on the climate and air quality of the area. It is located at the eastern boundary of the 9-county San Francisco Bay Area Air Basin. Oakley is a few miles west of San Joaquin County, which is part of the 8-county San Joaquin Valley Air Basin.

Oakley has a relatively low potential for air pollution given the persistent and strong winds typical of the area. Wind records from the closest wind-measuring sites show a strong predominance of westerly winds. Average wind speed is relatively high and the frequency of calm winds is quite low.[2] These winds dilute pollutants and transport them away from the area, so that emissions released in the project area have more influence on air quality in the Sacramento and San Joaquin valleys than they do locally. There are, however, several major stationary sources in upwind cities that can influence local air quality and the project's location downwind of the greater Bay Area also means that pollutants from other areas are transported to the area.

Ambient Air Quality Standards

Criteria Pollutants

Both the U. S. Environmental Protection Agency and the California Air Resources Board have established ambient air quality standards for common pollutants. These ambient air quality standards are levels of contaminants which represent safe levels that avoid specific adverse health effects associated with each pollutant. The ambient air quality standards cover what are called "criteria" pollutants because the health and other effects of each pollutant are described in criteria documents. Table 1 identifies the major criteria

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[1]Bay Area Air Quality Management District, BAAQMD CEQA Guidelines, 1996 (Revised 1999).

[2]California Department of Water Resources, Wind in California, Bulletin No. 185, January 1978.

pollutants, characteristics, health effects and typical sources. The federal and California state ambient air quality standards are summarized in Table 2.

The federal and state ambient standards were developed independently with differing purposes and methods, although both processes attempted to avoid health-related effects. As a result, the federal and state standards differ in some cases. In general, the California state standards are more stringent. This is particularly true for ozone and particulate matter (PM_{10} and $PM_{2.5}$)

Toxic Air Contaminants

In addition to the criteria pollutants discussed above, Toxic Air Contaminants (TACs) are another group of pollutants of concern. There are many different types of TACs, with varying degrees of toxicity. Sources of TACs include industrial processes such as petroleum refining and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust. Cars and trucks release at least forty different toxic air contaminants. The most important, in terms of health risk, are diesel particulate, benzene, formaldehyde, 1,3-butadiene and acetaldehyde.

Public exposure to TACs can result from emissions from normal operations, as well as accidental releases. Health effects of TACs include cancer, birth defects, neurological damage and death.

Ambient Air Quality

The Bay Area Air Quality Management District has for many years operated a multi-pollutant monitoring site in nearby Bethel Island. Table 3 shows historical occurrences of pollutant levels exceeding the state/federal ambient air quality standards for the three-year period 2005-2007. The number of days that each standard was exceeded is shown.

Table 3 shows that all federal ambient air quality standards are met in the Oakley area with the exception of ozone. Additionally, the state ambient standards for ozone and PM_{10} are regularly exceeded.

Attainment Status and Regional Air Quality Plans

The federal Clean Air Act and the California Clean Air Act of 1988 require that the State Air Resources Board, based on air quality monitoring data, designate portions of the state where the federal or state ambient air quality standards are not met as "nonattainment areas". Because of the differences between the national and state standards, the designation of nonattainment areas is different under the federal and state legislation.

Table 1: Major Criteria Pollutants

Pollutant	Characteristics	Health Effects	Major Sources
Ozone	A highly reactive photochemical pollutant created by the action of sunshine on ozone precursors (primarily reactive hydrocarbons and oxides of nitrogen. Often called photochemical smog.	●Eye Irritation ●Respiratory function impairment.	The major sources ozone precursors are combustion sources such as factories and automobiles, and evaporation of solvents and fuels.
Carbon Monoxide	Carbon monoxide is an odorless, colorless gas that is highly toxic. It is formed by the incomplete combustion of fuels.	●Impairment of oxygen transport in the bloodstream. ●Aggravation of cardiovascular disease. ●Fatigue, headache, confusion, dizziness. ●Can be fatal in the case of very high concentrations.	Automobile exhaust, combustion of fuels, combustion of wood in woodstoves and fireplaces.
Nitrogen Dioxide	Reddish-brown gas that discolors the air, formed during combustion.	●Increased risk of acute and chronic respiratory disease.	Automobile and diesel truck exhaust, industrial processes, fossil-fueled power plants.
Sulfur Dioxide	Sulfur dioxide is a colorless gas with a pungent, irritating odor.	●Aggravation of chronic obstruction lung disease. ●Increased risk of acute and chronic respiratory disease.	Diesel vehicle exhaust, oil-powered power plants, industrial processes.
Particulate Matter (PM_{10} and $PM_{2.5}$)	Solid and liquid particles of dust, soot, aerosols and other matter which are small enough to remain suspended in the air for a long period of time.	●Aggravation of chronic disease and heart/lung disease symptoms.	Combustion, automobiles, field burning, factories and unpaved roads. Also a result of photochemical processes.

Table 2: Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Primary Standard	State Standard
Ozone	1-Hour 8-Hour	-- 0.075 PPM	0.09 PPM 0.07 PPM
Carbon Monoxide	8-Hour 1-Hour	9.0 PPM 35.0 PPM	9.0 PPM 20.0 PPM
Nitrogen Dioxide	Annual Average 1-Hour	0.05 PPM --	0.03 PPM 0.18 PPM
Sulfur Dioxide	Annual Average 24-Hour 1-Hour	0.03 PPM 0.14 PPM --	-- 0.04 PPM 0.25 PPM
PM_{10}	Annual Average 24-Hour	-- 150 µg/m^3	20 µg/m^3 50 µg/m^3
$PM_{2.5}$	Annual 24-Hour	15 µg/m^3 35 µg/m^3	12 µg/m^3 --
Lead	Calendar Quarter 30 Day Average	1.5 µg/m^3 --	-- 1.5 µg/m^3
Sulfates	24 Hour	25 µg/m^3	--
Hydrogen Sulfide	1-Hour	0.03 PPM	--
Vinyl Chloride	24-Hour	0.01 PPM	--

PPM = Parts per Million
µg/m^3 = Micrograms per Cubic Meter

Source: California Air Resources Board, Ambient Air Quality Standards (04/01/08) http://www.arb.ca.gov/research/aaqs/aaqs2.pdf

Table 3: Air Quality Data Summary for Bethel Island, 2005-2007

Pollutant	**Standard**	**Days Standard Exceeded During:**		
		2005	**2006**	**2007**
Ozone	1-Hour State 8-Hour State 8-Hour Federal	0 2 0	9 14 1	0 4 0
Carbon Monoxide	8-Hour St. Fed. 1-Hour State	0 0	0 0	0 0
Nitrogen Dioxide	1-Hour State	0	0	0
Sulfur Dioxide	1-Hour State 24-Hour State	0 0	0 0	0 0
PM_{10}	24-Hour State 24-Hour Federal	1 0	1 0	0 0

Source: Air Resources Board, Aerometric Data Analysis and Management (ADAM), 2008. (http: //www.arb.ca.gov./adam/cgi-bin/adamtop/d2wstart)

The Bay Area is currently designated as a nonattainment area for 1-hour ozone standard. However, in April 2004, U.S. EPA made a final finding that the Bay Area has attained the national 1-hour ozone standard. The finding of attainment does not mean the Bay Area has been reclassified as an attainment area for the 1-hour standard. The region must submit a re-designation request to EPA in order to be reclassified as an attainment area.

The U.S. EPA has classified the San Francisco Bay Area as a nonattainment area for the federal 8-hour ozone standard. The Bay Area is designated as attainment for the annual condition, and unclassifiable for the 24-hour federal $PM_{2.5}$ standards.

Under the California Clean Air Act, Contra Costa County is a nonattainment area for ozone and particulate matter (PM_{10} and $PM_{2.5}$). The County is either attainment or unclassified for other pollutants. The California Clean Air Act requires local air pollution control districts to prepare air quality attainment plans. These plans must provide for district-wide emission reductions of five percent per year averaged over consecutive three-year periods or, provide for adoption of "all feasible measures on an expeditious schedule."

Sensitive Receptors

The Bay Area Air Quality Management District defines sensitive receptors as facilities where sensitive receptor population groups (children, the elderly, the acutely ill and the chronically ill) are likely to be located. These land uses include residences, schools, playgrounds, childcare centers, retirement homes, convalescent homes, hospitals and medical clinics. Sensitive land uses near the project site include the existing Cypress Grove subdivision, Delta Vista Middle School and Iron House Elementary School, all located directly west of the project site. Scattered single family homes are located south of the site across Cypress Road.

Global Warming Gases

The greenhouse effect is a natural process by which some of the radiant heat from the sun is captured in the lower atmosphere of the earth. The gases that help capture the heat are called greenhouse gases (GHG). While greenhouse gases are not normally considered air pollutants, all of these gases have been identified as forcing the earth's atmosphere and oceans to warm above naturally occurring temperatures. Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide and ozone. Certain human activities add to the levels of most of these natural occurring gases.

According to the 2006 California Climate Action Team Report[3] (CCAT), the following climate change effects are predicted in California over the course of the next century:

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[3] California Environmental Protection Agency Climate Action Team, Climate Action Team Report to Governor Scharzenegger and the Legislation, March 2006.

- A diminishing Sierra snowpack declining by 70% to 90%, threatening the state's water supply.
- Increasing temperatures from 8 to 10.4 degrees Fahrenheit under the higher emission scenarios, leading to a 25 to 35% increase in the number of days ozone pollution levels are exceeded in most urban areas.
- Coastal erosion along the length of California and sea water intrusion into the Delta from a 4- to 33-inch rise in sea level. This would exacerbate flooding in already vulnerable regions.
- Increased vulnerability of forests due to pest infestation and increased temperatures.
- Increased challenges for the state's important agriculture industry from limited water shortage, increasing temperatures, and saltwater intrusion into the Delta.
- Increased electricity demand, particularly in the hot summer months.

In September 2006, the California legislature passed the California Global Warming Solutions Act (CGWSA), which was added to Health and Safety Code Section 38500 (also commonly referred to as AB32). The CGWSA states that global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. Many scientists believe that anthropogenic emissions of greenhouse gases (GHG) (defined as carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) are having a significant impact on the global environment by accelerating or even causing global warming.

The CGWSA requires that the state reduce emissions of GHG to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that will be phased-in starting in 2012. To effectively implement the cap, CGWSA directs CARB to develop appropriate regulations and establish a mandatory reporting system to track and monitor GHG emission levels.

The CGWSA mandates that by January 1, 2008, CARB must determine what the statewide GHG emissions level was in 1990 and approve a statewide GHG emissions limit that is equivalent to the level to be achieved by 2020. On or before January 1, 2011, CARB must adopt GHG emission limits and emission reduction measures by regulation to achieve the maximum technologically feasible and cost-effective reductions in GHG emissions in furtherance of achieving the statewide GHG emissions limit, to become operative beginning on January 1, 2012.

The scientific community has largely agreed that the earth is warming, and that humans are contributing to that change. However, the earth's climate is composed of many complex mechanisms, including: ocean currents, cloud cover, as well as the jet-stream and other pressure/temperature weather guiding systems. These systems are in turn influenced by changes in ocean salinity, changes in the evapotranspiration of vegetation, the reflectivity (albedo) of groundcover, as well as numerous other factors. Some changes have the potential to reduce climate change, while others could form a feedback mechanism that would speed the warming process beyond what is currently projected. The climate system is inherently dynamic; however, the overall trend is towards a gradually warming planet.

REGULATORY CONTEXT

Air quality is monitored through the efforts of various federal, State, regional, and local government agencies. These agencies work jointly and individually to improve air quality through legislation, regulations, planning, policy-making, education, and a variety of programs. The agencies responsible for regulating and improving the air quality within the Brentwood area are discussed below.

Federal

U.S. Environmental Protection Agency (EPA)

The U.S. EPA is responsible for enforcement of National Ambient Air Quality Standards (NAAQS). The EPA has adopted policies requiring states to prepare State Implementation Plans (SIP) that demonstrate attainment and maintenance of the NAAQS. After a review of the SIP, the EPA will further classify non-attainment areas according to a District's projected date of attainment. Districts that project attainment of standards in three to five years would be classified as near-term non-attainment, whereas Districts that cannot meet standards within five years would be classified as long-term non-attainment. For an area to be classified as near-term non-attainment, the District would be required to demonstrate that pollutant reductions of three-percent-per-year are obtainable and that maintenance of standards could occur for ten years.

The USEPA has been directed to develop regulations to address the GHG emissions of cars and trucks. At the time of this writing, USEPA regulations for GHGs do not exist, and are not expected until late 2008 at the earliest.

State

California Clean Air Act

The California Clean Air Act (CCAA) requires that air quality plans be prepared for areas of the State that have not met State air quality standards for ozone, CO, NO_X, and SO_2. Among other requirements of the CCAA, the plans must include a wide range of implemental control measures, which often include transportation control measures and performance standards. In order to implement the transportation-related provisions of the CCAA, local air pollution control districts have been granted explicit authority to adopt and implement transportation controls.

Assembly Bill 1493

In 2002, then-Governor Gray Davis signed Assembly Bill (AB) 1493. AB 1493 requires that the California Air Resources Board (ARB) develop and adopt, by January 1, 2005, regulations that achieve “the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty truck and other vehicles determined by the Air Resources Board (ARB) to be vehicles whose primary use is noncommercial personal transportation in the state.” Currently, the State is waiting for a determination on the State’s request for a waiver from the USEPA to begin regulation of GHG emissions from vehicles.

Executive Order S-3-05

In 2005, Governor Schwarzenegger signed Executive Order S-3-05, which established total GHG emission targets. Specifically, emissions are to be reduced to year 2000 levels by 2010, 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. The Executive Order directed the Secretary of the California Environmental Protection Agency (Cal-EPA) to coordinate a multi-agency effort to reduce GHG emissions to the target levels. The Secretary is also directed to submit biannual reports to the governor and state legislature describing: (1) progress made toward reaching the emission targets; (2) impacts of global warming on California’s resources; and (3) mitigation and adaptation plans to combat these impacts.

To comply with the Executive Order, the Secretary of the Cal-EPA created a Climate Act Team (CAT) made up of members from various state agencies and commissions. In March 2006, CAT released their first report. In addition, the CAT has released several “white papers” addressing issues pertaining to the potential impacts of climate change on California.

Assembly Bill 32, The California Climate Solutions Act of 2006

In September 2006, Governor Arnold Schwarzenegger signed Assembly Bill (AB) 32, the California Climate Solutions Act of 2006. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by the year 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that will be phased starting in 2012. To implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources. AB 32 specifies that regulations adopted in response to AB 1493 should be used to address GHG emissions from vehicles. However, AB 32 also includes language stating that if the AB 1493 regulations cannot be implemented, then ARB should develop new regulations to control vehicle GHG emissions under the authorization of AB 32.

Senate Bill 1368

Senate Bill (SB) 1368 is the companion bill of AB 32 and was signed by Governor Schwarzenegger in September 2006. SB 1368 requires the California Public Utilities Commission (PUC) to establish a GHG emission performance standard for baseload generation from investor owned utilities by February 1, 2007. The California Energy Commission (CEC) must establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the GHG emission rate from a baseload combined-cycle natural gas fired plant. On January 27, 2007, the PUC adopted an interim Greenhouse Gas Emissions Performance Standard to require that all new long-term commitments for baseload power generation to serve Californians do not exceed the emissions of a combined cycle gas turbine plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the PUC and CEC. On May 28, 2007 the Energy Commission adopted regulations pursuant to SB 1368 establishing and implementing a GHG emission performance standard for baseload generation of local publicly owned electric utilities. The final rulemaking package was submitted to the Office of Administrative Law (OAL) on June 1, 2007 with a request for expedited review. On June 29, 2007 OAL issued a decision disapproving the rulemaking action. Revised regulations have not been submitted as of the writing of this DEIR (March 2008).

Senate Bill 1078

SB 1078 establishes a renewable portfolio standard (RPS) for electricity supply. The RPS requires that retail sellers of electricity, including investor-owned utilities and community choice aggregators, provide 20 percent of their supply from renewable sources by 2017. This target date was moved forward by SB 107 to require compliance by 2010. In addition, electricity providers subject to the RPS must increase their renewable share by at least 1 percent each year. The outcomes of this legislation will impact regional transportation powered by electricity.

Executive Order S-01-07

On January 18, 2007, Governor Schwarzenegger signed Executive Order S-01-07, which mandates that a statewide goal be established to reduce carbon intensity of California's transportation fuels by at least 10 percent by 2020. The Order also requires that a Low Carbon Fuel Standard for transportation fuels be established for California.

California Air Resources Board (CARB)

The CARB is the agency responsible for coordination and oversight of State and local air pollution control programs in California and for implementing California's own air quality legislation called the California Clean Air Act (CCAA) adopted in 1988. The CARB has primary responsibility in California to develop and implement air pollution control plans designed to achieve and maintain the NAAQS established by the U.S. EPA. As discussed above, the CARB is charged with developing rules and regulations to cap and reduce GHG emissions.

The CCAA requires that air quality plans be prepared for areas of the State that have not met State air quality standards for ozone, carbon monoxide, nitrogen dioxide, and sulfur dioxide. Areas that met standards by 1994 were classified as moderate, those that attained standards between 1994 and 1997 were classified as serious, and those that could not attain standards until after 1997 were classified as severe. In order to implement the transportation-related provisions of the CCAA, local air pollution control districts have been granted explicit authority to adopt and implement transportation controls.

IMPACTS AND MITIGATION MEASURES

Significance Criteria

California Environmental Quality Act (CEQA) guidelines provide that a project would have a significant air quality impact if it would:

- Conflict with or obstruct implementation of the applicable air quality plan,
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation,
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative threshold for ozone precursors),
- Expose sensitive receptors to substantial pollutant concentrations, or
- Create objectionable odors affecting a substantial number of people.

The document *BAAQMD CEQA Guidelines*[4] provide the following refinements to the definition of a significant air quality impact:

- A project contributing to carbon monoxide (CO) concentrations exceeding the State Ambient Air Quality Standard of 9 parts per million (ppm) averaged over 8 hours or 20 ppm for 1 hour would be considered to have a significant impact.

- A project that generates criteria air pollutant emissions in excess of the BAAQMD annual or daily thresholds would be considered to have a significant air quality impact. The current thresholds are 15 tons/year or 80 pounds/day for Reactive Organic Gases (ROG), Nitrogen Oxides (NO_x) or PM_{10}. Any proposed project that would individually have a significant air quality impact would also be considered to have a significant cumulative air quality impact.

- Any project with the potential to frequently expose members of the public to objectionable odors would be deemed to have a significant impact.

- Any project with the potential to expose sensitive receptors or the general public to substantial levels of toxic air contaminants would be deemed to have a significant impact.

Despite the establishment of both federal and state standards for $PM_{2.5}$ (particulate matter,

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[4] Bay Area Air Quality Management District, BAAQMD CEQA Guidelines, 1996 (Revised December 1999).

2.5 microns), the BAAQMD has not developed a threshold of significance for this pollutant. For this analysis, $PM_{2.5}$ impacts would be considered significant if project emissions of PM_{10} exceed 80 pounds per day.

The BAAQMD significance threshold for construction dust impacts is based on the appropriateness of construction dust controls. The BAAQMD guidelines provide feasible control measures for construction emission of PM_{10}. If the appropriate construction controls are to be implemented, then air pollutant emissions for construction activities would be considered less-than-significant.

Impact 1: Construction Dust Emissions. Construction activities such as demolition, clearing, excavation and grading operations, construction vehicle traffic and wind blowing over exposed earth would generate fugitive particulate matter emissions that would temporarily affect local air quality. This impact is potentially significant, but normally mitigable.

Construction dust would affect local air quality during implementation of the project. The dry, windy climate of the area during the summer months creates a high potential for dust generation when and if underlying soils are exposed to the atmosphere. The proposed project would involve substantial excavation and earthmoving. The movement of earth on the site is a construction activity with a high potential for creating air pollutants. After grading of the site, dust would continue to affect local air quality during construction of the project.

According to the *BAAQMD CEQA Guidelines*, emissions of ozone precursors (ROG and NOx) and carbon monoxide related to construction equipment are already included in the emission inventory that is the basis for regional air quality plans, and thus are not expected to impede attainment or maintenance of ozone and carbon monoxide standards in the Bay Area. Thus, the effects of construction activities would be increased dustfall and locally elevated levels of PM_{10} and $PM_{2.5}$ downwind of construction activity. Construction dust has the potential for creating a nuisance at nearby properties. This is considered a potentially significant impact.

Mitigation Measure 1: Consistent with guidance from the BAAQMD, the following measures shall be required of construction contracts and specifications for the project:

- Water all active construction areas at least twice daily and more often during windy periods; active areas adjacent to existing land uses shall be kept damp at all times, or shall be treated with non-toxic stabilizers or dust palliatives;
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard;
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites;

- Sweep daily (preferably with water sweepers) all paved access roads, parking areas, and staging areas at construction sites; water sweepers shall vacuum up excess water to avoid runoff-related impacts to water quality;
- Sweep streets daily (preferably with water sweepers) if visible soil material is carried onto adjacent public streets;
- Apply non-toxic soil stabilizers to inactive construction areas;
- Enclose, cover, water twice daily, or apply non-toxic soil binders to exposed stockpiles (dirt, sand, etc.);
- Limit traffic speeds on unpaved roads to 15 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways;
- Replant vegetation in disturbed areas as quickly as possible.

The above measures include all feasible measures for construction emissions identified by the Bay Area Air Quality Management District for large sites. According to the District threshold of significance for construction impacts, implementation of the measures would reduce construction impacts of the project to a less-than-significant level.

Impact 2: Construction TAC Emissions. During construction various diesel-powered vehicles and equipment would be in use on the site. Exposure of sensitive receptors to diesel particulate would represent a less-than-significant impact.

In 1998 the California Air Resources Board identified particulate matter from diesel-fueled engines as a toxic air contaminant (TAC). CARB has completed a risk management process that identified potential cancer risks for a range of activities using diesel-fueled engines.[5] High volume freeways, stationary diesel engines and facilities attracting heavy and constant diesel vehicle traffic (distribution centers, truckstop) were identified as having the highest associated risk.

Health risks from Toxic Air Contaminants are function of both concentration and duration of exposure. Unlike the above types of sources, construction diesel emissions are temporary, affecting an area for a period of days or perhaps weeks. Additionally, construction related sources are mobile and transient in nature, and the bulk of the emission occurs within the project site at a substantial distance from nearby receptors. Because of its short duration and the fact that nearby sensitive receptors would not be down-wind of construction activity when the wind is from the prevailing west direction, health risks from construction emissions of diesel particulate would be a less-than-significant impact.

Mitigation Measure 2: None required.

Impact 3: Permanent Local Impacts. Project traffic would add to carbon monoxide

[5] California Air Resources Board, Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles, October 2000.

concentrations near streets and intersections providing access to the site. This impact would be less-than-significant.

On the local scale, the project would change traffic on the local street network, changing carbon monoxide levels along roadways used by project traffic. Carbon monoxide is an odorless, colorless poisonous gas whose primary source in the Bay Area is automobiles. Concentrations of this gas are highest near intersections of major roads.

Carbon monoxide concentrations under worst-case meteorological conditions have been predicted for the intersections most impacted by project traffic and/or operating at the lowest Level of Service. PM peak traffic volumes were applied to the a screening form of the CALINE-4 dispersion model to predict maximum 1-and 8-hour concentrations near these intersections under the worst-case assumption that project traffic changes would occur in 2008. Attachment 1 provides a description of the model and a discussion of the methodology and assumptions used in the analysis. The model results were used to predict the maximum 1- and 8-hour concentrations, corresponding to the 1- and 8-hour averaging times specified in the state and federal ambient air quality standards for carbon monoxide.

Table 4 shows the results of the CALINE-4 analysis for the peak 1-hour and 8-hour traffic periods in parts per million (PPM). The 1-hour values are to be compared to the federal 1-hour standard of 35 PPM and the state standard of 20 PPM. The 8-hour values in Table 4 are to be compared to the state and federal standard of 9 PPM.

Table 4 shows that existing predicted concentrations near the intersections meet the 1-hour and 8-hour standards. Traffic from approved and pending projects would increase concentrations by up to 1.5 PPM. Traffic from the proposed project would increase concentrations by up to 0.5 Parts Per Million, but concentrations would remain well below the state/federal standards. Concentrations with project and cumulative traffic growth in 2030 would also not exceed the state/federal ambient air quality standards.

Since project traffic would not cause any new violations of the 8-hour standards for carbon monoxide, nor contribute substantially to an existing or projected violation, project impacts on local carbon monoxide concentrations are considered to be less-than-significant.

Mitigation Measure 3: None required.

Impact 4: **Permanent Regional Impacts.** Additional trips to and from the project would result in new air pollutant emissions within the air basin. The emissions from these new trips would exceed the BAAQMD thresholds of significance, and therefore represent a significant and unavoidable impact.

Vehicle trips generated by the project would result in air pollutant emissions affecting the entire San Francisco Bay Air Basin. Regional emissions associated with project vehicle use have been calculated using the URBEMIS-2007 emission model. The methodology used in estimating vehicular emissions is described in Attachment 2.

Table 4: Worst Case Carbon Monoxide Concentrations Near Selected Intersections, in Parts Per Million

Intersection	**Existing (2008)**		**Existing + Background (2008)**		**Existing + Background+ Project (2008)**		**Cumulative + Project (2030)**	
	1-Hr	**8-Hr**	**1-Hr**	**8-Hr**	**1-Hr**	**8-Hr**	**1-Hr**	**8-Hr**
Laurel Road/ Empire Avenue	4.4	2.4	5.7	3.3	5.7	3.3	4.0	2.2
Laurel Road/ O'Hara Avenue	4.2	2.3	5.2	3.0	5.3	3.1	4.0	2.1
Laurel Road/ Main Street	4.7	2.6	5.1	2.9	5.6	3.3	4.0	2.2
Main Street/ Cypress Road	4.8	2.7	5.6	3.2	5.9	3.5	4.2	2.3
E. Cypress Road/Sellers Avenue	4.3	2.3	4.8	2.7	5.2	3.0	4.2	2.3
Main Street/ O'Hara Avenue	4.8	2.7	5.6	3.3	5.7	3.4	3.8	2.0
Most Stringent Standard	20.0	9.0	20.0	9.0	20.0	9.0	20.0	9.0

Land use projects also generate area source emissions. Area sources are sources that individually emit fairly small quantities of air pollutants, but which cumulatively may represent significant quantities of emissions. The URBEMIS-2007 program quantifies five types of area source emissions: natural gas combustion, hearth emissions, landscape equipment, architectural coatings and consumer products. Some of these area sources vary seasonally. The URBEMIS-2007 program was used to quantify emissions separately for summer and winter. Summertime emissions were utilized for reactive organic gases (ROG) and oxides of nitrogen (NO_x), as both are ozone precursors (ozone is a summer time pollutant). Winter emissions were utilized for PM_{10} when emissions of this pollutant are at a maximum, primarily due to hearth emissions.

The incremental daily emission increase associated with project area source emissions is identified in Table 5 for reactive organic gases and oxides of nitrogen (two precursors of ozone) and PM_{10}. Table 5 also shows emissions for the School Alternative, which would replace 58 housing units with a 600-student elementary school.

The Bay Area Air Quality Management District has established threshold of significance for ozone precursors and PM_{10} of 80 pounds per day, applicable to vehicular emissions. Project vehicular emissions shown in Table 5 would exceed these thresholds of significance, so the proposed project would have a significant effect on regional air quality.

Mitigation Measure 4: The BAAQMD has identified mitigation measures for reducing vehicle emissions from residential projects. Many of these measures, however, are predicated on the availability of substantial transit service. The site is suburban in nature with only limited transit service available. Feasible mitigation measures to reduce vehicle emissions for a suburban project would include:

- Provide bicycle lanes, sidewalks and/or paths, connecting project residences to adjacent schools, parks, the nearest transit stop and nearby commercial areas. Provide a satellite tele-commute center within or near the development.
- Provide secure and conveniently placed bicycle parking and storage facilities at parks and other facilities.
- Implement feasible travel demand management (TDM) measures for a project of this type. This would include a ride-matching program, coordination with regional ride-sharing organizations, provision of transit information, and provision of shuttle service to major destinations such as the Pittsburg BART station.
- Allow only natural gas fireplaces, pellet stoves or EPA-Certified wood-burning fireplaces or stoves should be permitted. Conventional open-hearth fireplaces should not be permitted. EPA-Certified fireplaces and fireplace inserts are 75 percent effective in reducing emissions from this source.
- Use electric lawn and garden equipment for landscaping.
- Construct transit amenities such as bus turnouts/bus bulbs, benches, shelters, etc.
- Provide direct, safe, attractive pedestrian access from project land uses to transit stops and adjacent development.

Table 5: Project Regional Emissions in Pounds Per Day

	Reactive Organic Gases	**Nitrogen Oxides**	**PM_{10}**
Proposed Project:			
Vehicular Emissions	114.6	119.3	155.2
Area Source Emissions	43.9	10.2	47.4
Total	158.5	129.5	202.6
School Alternative:			
Vehicular Emissions	121.1	119.3	154.9
Area Source Emissions	40.1	9.9	42.7
Total	161.2	129.2	197.6
BAAQMD Significance Threshold	80.0	80.0	80.0

- Utilize reflective (or high albedo) and emissive roofs and light colored construction materials to increase the reflectivity of roads, driveways, and other paved surfaces, and include shade trees near buildings to directly shield them from the sun's rays and reduce local air temperature and cooling energy demand.

The commercial portion of the project should be required to apply TSM measures to reduce trips. Appropriate strategies would be:

- Provide physical improvements, such as sidewalk improvements, landscaping and bicycle parking that would act as incentives for pedestrian and bicycle modes of travel.
- Connect site with regional bikeway/pedestrian trail system.
- Provide transit information kiosks.
- Implement feasible travel demand management (TDM) measures for a project of this type. This would include a ride-matching program, guaranteed ride home programs, coordination with regional ridesharing organizations and transit incentives program.
- Provide showers and lockers for employees bicycling or walking to work.
- Provide secure and conveniently located bicycle parking and storage for workers and patrons.
- Provide electric vehicle charging facilities.
- Provide preferential parking for Low Emission Vehicles (LEVs).
- Utilize reflective (or high albedo) and emissive roofs and light colored construction materials to increase the reflectivity of roads, driveways, and other paved surfaces, and include shade trees near buildings to directly shield them from the sun's rays and reduce local air temperature and cooling energy demand.

The above measures have the potential to reduce project-related regional emissions by 10-20%. Even with a reduction of this magnitude, project emissions would remain well above the BAAQMD significance threshold of 80 pounds per day. Project regional air quality impacts and cumulative impacts would remain significant after mitigation.

Impact 5: Cumulative Impacts. According to BAAQMD significance criteria, any proposed project that would individually have a significant air quality impact would also be considered to have a significant cumulative air quality impact. Since the proposed project would exceed the BAAQMD thresholds of significance for Reactive Organic Gases, Nitrogen Oxides and particulate matter, the project would have a significant cumulative impact on regional air quality.

The cumulative air quality impacts of development projects are primarily related to automobile traffic and areas sources of pollutants such as fuel combustion for heating, maintenance equipment emissions, certain consumer products, evaporation of solvents, etc. The Bay Area Air Quality Management District considers these types of emissions to be secondary in importance to vehicle emissions, so the recommended BAAQMD thresholds of significance is to be compared to vehicular emissions only.

Emissions from development projects have several cumulative impacts. Growth in emissions will delay attainment of the ambient air quality standards for which the region is non-attainment (ozone, particulate matter), contribute to visibility reduction and contribute to mobile-source toxic air contaminant concentrations.

Since ozone, particulate matter and some constituents of ROG that are also TACs have been shown to be correlated with adverse heath effects cumulative emissions increases in the region would have potential cumulative health effects. Studies have shown that children who participated in several sports and lived in communities with high ozone levels were more likely to develop asthma than the same active children living in areas with less ozone pollution. Other studies have found a positive association between some volatile organic compounds and symptoms in asthmatic children. A large body of evidence has shown significant associations between measured levels of particulate matter outdoors and worsening of both asthma symptoms and acute and chronic bronchitis. It is not possible, however, to predict increases in severity of disease, hospital visits or deaths from respiratory diseases such as asthma, bronchitis or lung cancer because:

- It is not currently possible to estimate long-term concentrations of pollutants such as ozone, the TAC components of ROG or particulate matter (PM_{10} and $PM_{2.5}$) resulting from an indirect source of air pollutants such as the project.
- Dose-response relationships are lacking that would allow a quantitative analysis of health effects.

In recognition of the incremental health effects associated with these pollutants, air quality management districts have established thresholds for each pollutant which indicate the limits of acceptability in terms of effect on health. The exceedance of these established thresholds by a project is considered to represent a cumulatively significant air quality impact. Based on the BAAQMD cumulative impact threshold, this project would have a significant cumulative air quality impact.

Mitigation Measure 5: Same as Mitigation Measure 4.

Impact 6: Greenhouse Gas Impacts. Additional trips to and from the project, combustion of fuels and increased electrical demand would result in greenhouse gas emissions.

Carbon dioxide emissions associated with the proposed project were estimated using the URBEMIS-2007 program. The estimated annual emission of carbon dioxide (the primary greenhouse gas associated with development projects) is 17,940 tons per year.

There are currently no federal, state, county or air district thresholds of significance by which the above emissions can be determined to be significant or not. Greenhouse gas impacts of a single project are therefore considered too speculative to allow a determination of significance.

Mitigation Measure 6: None required.

ATTACHMENT 1

CALINE-4 MODELING

The CALINE-4 model is a fourth-generation line source air quality model that is based on the Gaussian diffusion equation and employs a mixing zone concept to characterize pollutant dispersion over the roadway. Given source strength, meteorology, site geometry and site characteristics, the model predicts pollutant concentrations for receptors located within 150 meters of the roadway. The CALINE-4 model allows roadways to be broken into multiple links that can vary in traffic volume, emission rates, height, width, etc.

A screening-level form of the CALINE-4 program was used to predict concentrations.[6] Normalized concentrations for each roadway size (2 lanes, 4 lanes, etc.) are adjusted for the two-way traffic volume and emission factor. Calculations were made for a receptor at a corner of the intersection, located at the curb. Emission factors were derived from the California Air Resources Board EMFAC7-2002 computer program based on a 2008 and 2030 Bay Area vehicle mix.

The screening form of the CALINE-4 model calculates the local contribution of nearby roads to the total concentration. The other contribution is the background level attributed to more distant traffic. The 1-hour background level was taken as 3.5 PPM and the 8-hour background concentration was taken as 1.8 PPM. These backgrounds were estimated using isopleth maps and correction factors developed by the Bay Area Air Quality Management District.

Eight-hour concentrations were obtained from the 1-hour output of the CALINE-4 model using a persistence factor of 0.7.

[6] Bay Area Air Quality Management District, BAAQMD CEQA Guidelines, 1996.

ATTACHMENT 2: URBEMIS 2007 PROGRAM

Estimates of construction phase emissions and operational emissions generated by project traffic and area sources were made using a program called URBEMIS-2007 (Version 9.2.4). URBEMIS-2007 is a program that estimates the emissions that result from development projects. Land use projects can include residential uses such as single-family dwelling units, apartments and condominiums, and nonresidential uses such as shopping centers, office buildings, and industrial facilities. URBEMIS-2007 contains default values for much of the information needed to calculate emissions. However, project-specific, user-supplied information can also be used when it is available.

On-Road Vehicular Emissions

Inputs to the URBEMIS-2007 program include trip generation rates, vehicle mix, average trip length by trip type and average speed. Default trip lengths and average trip speeds for the Contra Costa County were used. The analysis was carried out assuming a 2009 vehicle mix.

Area Source Emissions

Area source emissions were also quantified using the URBEMIS-2007 program. The URBEMIS-2007 program identifies 5 categories or area source emissions:

Natural Gas Combustion
Hearth Emissions
Landscaping Emissions
Architectural Coatings
Consumer Products

Natural gas emissions result from the combustion of natural gas for space heating and water heating. Estimates are based on the size of project.

Hearth emissions consist of emissions from wood stoves, wood fireplaces, and natural gas fireplaces related to residential uses. The URBEMIS program utilizes county-wide statistics for fuel consumption and the percentage of homes utilizing each type of fireplace.

URBEMIS-2007 calculates emissions from fuel combustion and evaporation of unburned fuel by landscape maintenance equipment. Equipment in this category includes lawn mowers, roto-tillers, shredders/grinders, blowers, trimmers, chain saws, and hedge trimmers used in maintenance of the site.

Architectural coating emissions result from the evaporation of solvents contained in paints, varnished, primers and other surface coatings associated with maintenance of structures.

This category of emission is associated with operation of project land uses rather than with initial construction of the project. The default assumption is that 10% of structures will be painted each year. The URBEMIS 2007 program utilizes VOC (volatile organic compounds) content limits as they have been specified by each air district.

Consumer product emissions are generated by a wide range of product categories, including air fresheners, automotive products, household cleaners and personal care produces. Emissions associated with these products primarily depend on the increase in population in the area associated with residential development.

The URBEMIS-2007 program was used to quantify emissions separately for summer and winter. Summertime emissions were utilized for reactive organic gases (ROG) and oxides of nitrogen (NO_x), as both are ozone precursors (ozone is a summer time pollutant). Winter emissions were utilized for PM_{10} when emissions of this pollutant are at a maximum, primarily due to hearth emissions. The program was also used to estimate project carbon dioxide emissions on an annual basis. The program output is attached.

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name:

Project Name: Emerson Ranch Project

Project Location: Contra Costa County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	CO_2
TOTALS (tons/year, unmitigated)	2,585.91

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	CO_2
TOTALS (tons/year, unmitigated)	15,490.54

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	CO_2
TOTALS (tons/year, unmitigated)	18,076.45

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

Source	CO_2
Natural Gas	2,275.95
Hearth	306.00
Landscape	3.96
Consumer Products	
Architectural Coatings	
TOTALS (tons/year, unmitigated)	2,585.91

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

Source	CO_2
Single family housing	7,115.41
Strip mall	8,375.13
TOTALS (tons/year, unmitigated)	15,490.54

Operational Settings:

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2009 Season: Annual

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Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	192.67	9.57	dwelling units	578.00	5,531.46	41,404.43
Strip mall		42.94	1000 sq ft	278.04	11,939.04	48,678.32
					17,470.50	90,082.75

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	50.9	1.8	97.8	0.4
Light Truck < 3750 lbs	13.3	2.3	93.9	3.8
Light Truck 3751-5750 lbs	20.3	1.0	98.5	0.5
Med Truck 5751-8500 lbs	7.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.1	0.0	72.7	27.3
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	0.7	0.0	14.3	85.7
Heavy-Heavy Truck 33,001-60,000 lbs	0.4	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	3.7	73.0	27.0	0.0
School Bus	0.4	0.0	0.0	100.0
Motor Home	0.8	0.0	87.5	12.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name:

Project Name: Emerson Ranch Project

Project Location: Contra Costa County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5
TOTALS (lbs/day, unmitigated)	43.85	10.20	33.76	0.00	0.10	0.10

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5
TOTALS (lbs/day, unmitigated)	114.62	119.30	1,223.58	0.88	155.17	29.86

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5
TOTALS (lbs/day, unmitigated)	158.47	129.50	1,257.34	0.88	155.27	29.96

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5
Natural Gas	0.75	9.93	5.34	0.00	0.02	0.02
Hearth - No Summer Emissions						
Landscape	4.97	0.27	28.42	0.00	0.08	0.08
Consumer Products	28.28					
Architectural Coatings	9.85					
TOTALS (lbs/day, unmitigated)	43.85	10.20	33.76	0.00	0.10	0.10

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25
Single family housing	48.60	52.38	554.77	0.41	71.31	13.71
Strip mall	66.02	66.92	668.81	0.47	83.86	16.15
TOTALS (lbs/day, unmitigated)	114.62	119.30	1,223.58	0.88	155.17	29.86

Operational Settings:

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2009 Temperature (F): 85 Season: Summer

6/11/2008 10:37:47 AM

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	192.67	9.57	dwelling units	578.00	5,531.46	41,404.43
Strip mall		42.94	1000 sq ft	278.04	11,939.04	48,678.32
					17,470.50	90,082.75

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	50.9	1.8	97.8	0.4
Light Truck < 3750 lbs	13.3	2.3	93.9	3.8
Light Truck 3751-5750 lbs	20.3	1.0	98.5	0.5
Med Truck 5751-8500 lbs	7.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.1	0.0	72.7	27.3
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	0.7	0.0	14.3	85.7
Heavy-Heavy Truck 33,001-60,000 lbs	0.4	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	3.7	73.0	27.0	0.0
School Bus	0.4	0.0	0.0	100.0
Motor Home	0.8	0.0	87.5	12.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name:

Project Name: Emerson Ranch Project

Project Location: Contra Costa County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	120.78	17.85	305.64	0.89	47.44	45.66	23,259.37

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	137.35	177.19	1,398.53	0.77	155.17	29.86	77,115.02

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	258.13	195.04	1,704.17	1.66	202.61	75.52	100,374.39

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.75	9.93	5.34	0.00	0.02	0.02	12,470.95
Hearth	81.90	7.92	300.30	0.89	47.42	45.64	10,788.42
Landscaping - No Winter Emissions							
Consumer Products	28.28						
Architectural Coatings	9.85						
TOTALS (lbs/day, unmitigated)	120.78	17.85	305.64	0.89	47.44	45.66	23,259.37

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	53.57	78.25	604.85	0.35	71.31	13.71	35,419.70
Strip mall	83.78	98.94	793.68	0.42	83.86	16.15	41,695.32
TOTALS (lbs/day, unmitigated)	137.35	177.19	1,398.53	0.77	155.17	29.86	77,115.02

Operational Settings:

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2009 Temperature (F): 40 Season: Winter

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Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	192.67	9.57	dwelling units	578.00	5,531.46	41,404.43
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					17,470.50	90,082.75

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	50.9	1.8	97.8	0.4
Light Truck < 3750 lbs	13.3	2.3	93.9	3.8
Light Truck 3751-5750 lbs	20.3	1.0	98.5	0.5
Med Truck 5751-8500 lbs	7.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.1	0.0	72.7	27.3
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	0.7	0.0	14.3	85.7
Heavy-Heavy Truck 33,001-60,000 lbs	0.4	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	3.7	73.0	27.0	0.0
School Bus	0.4	0.0	0.0	100.0
Motor Home	0.8	0.0	87.5	12.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0

EMERSON PROPERTY PROJECT ENVIRONMENTAL NOISE ASSESSMENT OAKLEY, CALIFORNIA

June 10, 2008

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Job No.: 07-066

INTRODUCTION

This report evaluates the potential noise impacts associated with the residential and commercial development planned at the Emerson Property in the City of Oakley, California. The project includes 578 residential units, parks, and commercial uses including a twenty-four hour grocery and/or drug store(s), in-line shop tenants, gas station, sit down restaurants, drive-thru fast food restaurants, bank and small office spaces. Sellers Avenue and residential land uses would border the site to the east. Cypress Road forms the project's southernmost boundary.

This report describes the existing noise environment in the area, evaluates potential project impacts per the applicable regulatory criteria, and presents mitigation measures as necessary to mitigate potentially significant impacts. Included with this report are a brief description of the fundamentals of environmental noise and a summary of the applicable regulatory criteria.

Fundamentals of Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 1.

Most of the sounds that we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the facts that human hearing is less sensitive at low frequencies and extreme high frequencies than in the frequency mid-range. This is called "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in Table 2 for different types of noise.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1%, 10%, 50%, and 90% of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time.

Table 1 Definitions of Acoustical Terms Used in this Report

Term	Definitions
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Table 2 Typical Noise Levels in the Environment

Common Outdoor Noise Source	Noise Level (dBA)	Common Indoor Noise Source
	120 dBA	
Jet fly-over at 300 meters		Rock concert
	110 dBA	
Pile driver at 20 meters	100 dBA	
		Night club with live music
	90 dBA	
Large truck pass by at 15 meters		
	80 dBA	Noisy restaurant
		Garbage disposal at 1 meter
Gas lawn mower at 30 meters	70 dBA	Vacuum cleaner at 3 meters
Commercial/Urban area daytime		Normal speech at 1 meter
Suburban expressway at 90 meters	60 dBA	
Suburban daytime		Active office environment
	50 dBA	
Urban area nighttime		Quiet office environment
	40 dBA	
Suburban nighttime		
Quiet rural areas	30 dBA	Library
		Quiet bedroom at night
Wilderness area	20 dBA	
Most quiet remote areas	10 dBA	Quiet recording studio
Threshold of human hearing		Threshold of human hearing
	0 dBA	

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, DNL (day/night average sound level), was developed. The DNL divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average which includes both an evening and nighttime weighting.

Regulatory Background

The State of California and the City of Oakley have adopted regulations, plans, and policies designed to limit noise exposure at existing and proposed noise sensitive land uses. These plans and policies are established in the following documents:

(1) The State CEQA Guidelines, Appendix G;
(2) The Noise Element of the City of Oakley's General Plan.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires an evaluation of the significance of potential project noise impacts. Noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
(b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels.
(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excess noise levels.
(f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels. With these guidelines, only Items (a), (c), and (d) are applicable to the proposed projects.

For Item (b), there are no sources of ground-borne noise or vibration associated with the project, and Items (e) and (f) are not applicable as the project is not located within two miles of a public use airport or within the vicinity of a private airstrip.

Noise Element of the City of Oakley 2020 General Plan

Goal 9.1: Protect residents from the harmful and annoying effects of exposure to excessive noise.

Policies

9.1.1 New development shall use the land use compatibility table shown in Figure 9.1 [see Figure 1] and the standards contained within Tables 9.1 and 9.3 [see Tables 3 and 4] for determining noise compatibility.

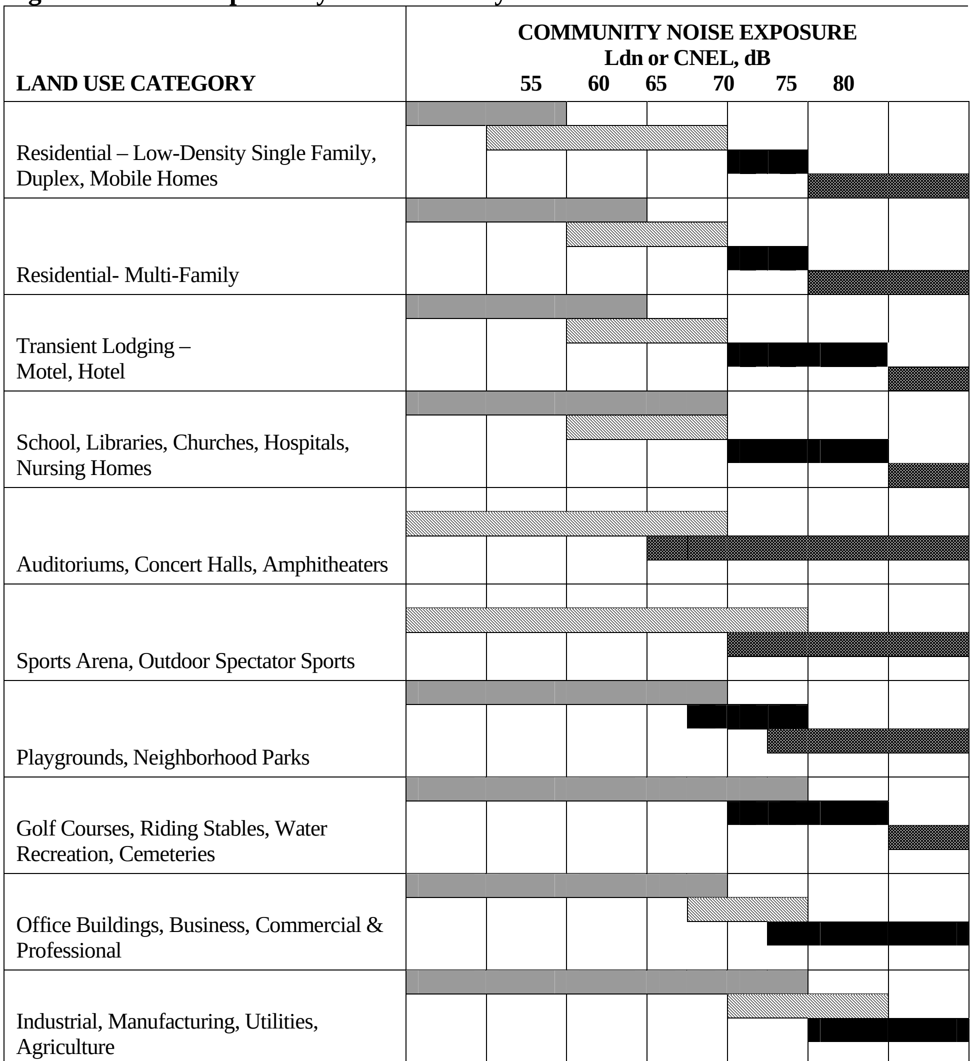
9.1.2 It is anticipated that roadway improvement projects will be needed to accommodate buildout of the general plan. Therefore, existing noise-sensitive uses may be exposed to increased noise levels due to roadway improvement projects as a result of increased roadway capacity, increases in travel speeds, etc. It may not be practical to reduce increased traffic noise levels consistent with those contained in Table 9-3. Therefore, as an alternative, the following criteria may be used as a test of significance for roadway improvement projects:

- Where existing traffic noise levels are less than 60 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +5 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant and
- Where existing traffic noise levels range between 60 and 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +3 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant; and
- Where existing traffic noise levels are greater than 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +1.5 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant.

9.1.3 Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table 9-1 [Table 3] as measured immediately within the property line of lands designated for noise-sensitive uses.

9.1.7 Where noise mitigation measures are required to achieve the standards of Tables 9-1 and 9-3, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

Figure 1 Land Compatibility for Community Noise Environments



Normally Acceptable Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.	**Normally Unacceptable** New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Conditionally Acceptable New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.	**Clearly Unacceptable** New construction or development should generally not be undertaken

Table 3 Noise Level Performance Standards for New Projects Affected by or Including Non-Transportation Noise Sources*

Noise Level Descriptor	Daytime (7:00 AM to 10:00 PM)	Nighttime (10:00 PM to 7:00 AM)
Hourly L_{eq}, dB	**55**	**45**

1. Each of the noise levels specified above shall be lowered five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises (e.g., humming sounds, outdoor speaks systems). These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).
2. The City can impose noise level standards which are more restrictive than those specified above based upon determination of existing low ambient noise levels.
3. Fixed noise sources which are typically of concern include, but are not limited to the following:

HVAC Systems	Cooling Towers/Evaporative Condensers
Pump Stations	Lift Stations
Emergency Generators	Boilers
Steam Valves	Steam Turbines
Generators	Fans
Air Compressors	Heavy Equipment
Conveyor Systems	Transformers
Pile Drivers	Grinders
Drill Rigs	Gas or Diesel Motors
Welders	Cutting Equipment
Outdoor Speakers	Blowers

4. The types of uses which may typically produce the noise sources described above include but are not limited to industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

*Table 9-1 of the Oakley 2020 General Plan.

TABLE 4 Maximum Allowable Noise Exposure Transportation Noise Sources*

Land Use	Outdoor Activities Areas[1] L_{dn}/ CNEL, dB	Interior Space	
		L_{dn}/CNEL, dB	L_{eq}, dB[2]
Residential	65	45	--
Transient Lodging	65[3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls	65	--	40
Office Buildings	00	00	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

1. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patio or balconies pf apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.
2. As determined for a typical worst-case hour during periods of use.
3. In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply.

*Table 9-3 of the Oakley 2020 General Plan.

Existing Noise Environment

Ambient noise levels were measured in November and December 2004 to establish the baseline noise environment for use in the impact assessment[1]. The project site and the surrounding area are primarily used for agricultural purposes, but the area is in transition with recently constructed and planned residential developments in the project vicinity. Scattered residential homes also exist in the area, and most of these are located along Cypress Road and Sellers Avenue. The major existing noise sources in the area are traffic on Cypress Road, Sellers Avenue, and Knightsen Avenue. Other roadways in the area carry little traffic and are not significant noise sources.

A continuous 24-hour noise measurement was conducted on Cypress Road near Machado Lane from 1:00 pm on December 15, 2004 until 1:00 pm on December 16, 2004. The measurement was at a distance of 75 feet from the centerline of Cypress Road. The terrain in this area is flat and the traffic travels at speeds of 50-60 mph. The 24-hour average L_{dn} at this location was measured to be 71 dBA. A 24-hour noise measurement was also conducted on Sellers Avenue south of Cypress Road at a distance of 65 feet from the centerline of the roadway between November 19 and November 22, 2004. The L_{dn} at this location was measured to be 68 dBA.

A spot measurement was made on Knightsen Avenue south of Cypress Road at a distance of 50 feet from the centerline of Knightsen Avenue, typical of the existing setback of residences along Knightsen Avenue. The mid-afternoon average noise level was measured at 65 dBA and the L_{dn} is estimated to be 67 dBA at this distance from Knightsen Avenue.

[1] Emerson Property EIR Noise Section, Illingworth & Rodkin, Inc., February 28, 2006.

Farther from these major streets, noise levels decrease significantly. Noise levels drop off at a rate of 3 to 4.5 decibels per every doubling of distance from the roadway. The City's goal for noise levels not in excess of an L_{dn} of 65 dBA in outdoor use areas in new residential development is currently met at a distance of 220 feet from the center of Cypress Road, 120 feet from the centerline of Sellers Avenue and 80 feet from the center of Knightsen Avenue. There are a number of existing homes within these distances along Cypress Road, Sellers Avenue, and Knightsen Avenue.

Table 5 Existing Noise Level Contour Distances from Roadway Center

Roadway	**70 dBA L_{dn}**	**65 dBA L_{dn}**	**60 dBA L_{dn}**
Cypress Road	100 ft.	220 ft.	475 ft.
Sellers Avenue	--[2]	120 ft.	260 ft.
Knightsen Avenue	--	80 ft.	185 ft.

NOISE IMPACTS AND MITIGATION MEASURES

Impact 1: *Noise and Land Use Compatibility.* Residential uses developed on the project site could be exposed to an exterior noise level greater than an L_{dn} of 65 dB which would exceed the noise and land use compatibility standard for outdoor use areas in new residential developments as set forth in the City of Oakley's General Plan. Interior noise levels could exceed an L_{dn} of 45 dB in some of the units without the incorporation of noise insulation features. This is a potentially significant impact.

The project would develop residential properties along Cypress Road and Sellers Avenue. To accommodate future development in the Oakley area, it is proposed that Cypress Road will be widened to 6 lanes east of Sellers Avenue and 4 lanes west of Sellers Avenue. Sellers Avenue would be 4 lanes. Under cumulative traffic conditions (General Plan Buildout), the average daily traffic volume on Cypress Road is expected to reach 40,000 to 45,000 vehicles per day east of Sellers Avenue and 30,000 to 35,000 vehicles per day west of Sellers Avenue. Sellers Avenue would have an average daily traffic volume of about 6,000 vehicles per day north of Cypress Road. The change in roadway geometry and the significant increase in traffic volumes will result in a significantly different noise environment along these roads that currently exists today.

Traffic noise modeling indicates that at a distance of 55 feet from the edge-of-pavement (typical of the closest yards proposed along Cypress Road), the L_{dn} would reach 74 dB. The L_{dn} at the same distance from the edge-of-pavement of Sellers Avenue north of Cypress Road would reach 63 dB. Without mitigation, noise levels outside of the residences closest to Cypress Road could exceed the City standard of 65 dB.

[2] Noise contour within roadway right-of-way.

Future noise levels along Cypress Road and Sellers Avenue would also be high enough to cause interior noise levels in the homes adjacent these roads to exceed an L_{dn} of 45 dB. Therefore, interior noise levels could also potentially exceed the guidelines contained in the Noise Element of the City of Oakley's General Plan.

The City of Oakley's General Plan would require a project-specific acoustical analysis to demonstrate how interior noise levels would be kept below 45 dB and how outdoor noise levels for residential areas would be kept below 65 dB. Alternative techniques are available to meet these criteria. The Noise Element of the City of Oakley's General Plan encourages the use of site planning and setbacks to achieve compliance with the standards. A 200-foot setback would be required along Cypress Road. Alternatively, sound walls could be built to reduce noise levels in the yards adjacent to the homes. The sound walls would also reduce noise levels inside the first floor of the homes. Preliminary traffic noise modeling was conducted assuming level terrain between Cypress Road and adjacent receivers. Receivers were assumed to be in the center of the rear yard adjacent to the roadway, approximately 20 feet from the noise barrier. The result of this modeling indicates that sound walls 9 feet high would be required along Cypress Road to reduce noise levels in rear yards to 65 dB L_{dn}. Table 6 summarizes the results of the traffic noise modeling and barrier insertion loss calculations. A preliminary barrier design is shown in Figure 4. To be effective, the barriers should be constructed solidly over the entire surface and at the base. Openings or gaps between barrier materials or the ground decrease the reduction provided by a noise barrier. Suitable materials for barrier construction should have a minimum surface weight of 3 lbs./ft^2. (such as one-inch thick wood, masonry block, concrete, or metal).

TABLE 6 Future Exterior Ldn Noise Levels (dBA) With Mitigation

Roadway	No Barrier	6 ft. Barrier	7 ft. Barrier	8 ft. Barrier	9 ft. Barrier	10 ft. Barrier	11 ft. Barrier
Cypress Road	74	68	67	66	65	64	63

Noise barriers would not shield upper level facades of the proposed units. Typically, standard construction with a forced-air mechanical ventilation unit (allowing the occupant to control noise by maintaining the windows shut) provides at least 20 dBA of noise reduction in interior spaces. Exterior noise levels at unshielded facades of residential units nearest Cypress Road would be expected to be approximately 74 L_{dn}. Interior noise levels are approximately 15 decibels lower than exterior noise levels assuming standard residential construction methods and the windows partially open for ventilation. By incorporating some form of forced air mechanical ventilation system into the design of the unit, interior average noise levels would be expected to be about 20 to 25 dBA lower assuming the windows are closed to control noise. Interior average noise levels would exceed 45 L_{dn} assuming standard construction methods with the windows closed. If the sound walls were constructed, noise levels inside of the first floor of homes could be maintained at an L_{dn} of 45 dB or less by requiring that the windows be kept closed.

Sound rated windows would be necessary for the upper floor of units adjacent to Cypress Road. Assuming an exterior noise level of 74 L_{dn} at the façade of the residential unit, stucco exterior siding, and a 30 % window to wall ratio of the exterior wall facing Cypress Road, windows with sound transmission class ratings (STC) of 33 to 36 would be required to maintain interior average noise levels below 45 L_{dn} with an adequate margin of safety. These products are readily available and would adequately reduce interior noise levels to acceptable levels.

Assuming standard residential construction methods, residential units along Sellers Avenue would require a forced-air mechanical ventilation unit to allow the occupant to control noise by maintaining the windows shut. Interior average noise levels with the windows closed would be less than 45 L_{dn}.

Mitigation Measure:

- Construct noise barriers adjacent to Cypress Road to reduce exterior noise levels at private outdoor use areas to 65 dB L_{dn} or less. A preliminary barrier design is shown in Figure 2. The final detailed design of the heights and limits of these barriers shall be confirmed at the time that the final grading plan is submitted.
- Project-specific acoustical analyses are required by the City of Oakley to insure that interior noise levels will be reduced to 45 dBA L_{dn} or lower. These analyses are conducted during final detailed design of the project when building elevations and floor plans are available. The future noise environment at the project site would require sound-rated construction methods and the provision of forced-air mechanical ventilation so that windows could be kept closed at the occupants' discretion to control noise. Noise insulation features include sound rated windows, sound rated doors, careful attenuation to exterior wall detailing (including caulking and possible sound insulating upgrades such as resilient channels, or stucco exterior siding). The final detailed design of noise insulation features necessary to maintain interior noise levels at acceptable levels shall be completed at the time that the final plans are available and prior to the issuance of a building permit. The project specification and detailing and implementation of these treatments will mitigate this impact to a less-than-significant level.

Figure 2: Preliminary Barrier Design

Impact 2: *Operational Noise Sources.* Noise levels generated by the operation of the project could exceed the standards established in the Oakley General Plan. This is a significant impact.

The proposed project would introduce new non-transportation related sources of noise that may adversely affect existing and proposed noise sensitive receivers in the project vicinity. These sources would include medium duty and heavy duty truck deliveries to the major retail stores and shops, parking lot activity (including engine starts, door slams, and vehicular circulation on site), rooftop mechanical equipment, parking lot cleaning activities, and a potential elementary school and parks. Noise levels were calculated based on data collected by Illingworth & Rodkin, Inc. during studies of similar shopping centers, educational facilities and parks. Noise levels generated by typical activities were calculated at the common property line between the nearest residential land uses and the proposed noise-generating land uses.

Truck Circulation

The highest noise levels generated on site would result from medium duty and heavy duty trucks circulating along the west and north boundaries of the site. The shopping center is expected to receive several large truck and independent vendor-owned smaller parcel trucks daily (e.g., soda, chips, etc.). Early morning deliveries are common, although delivery schedules for such retail operations are also typically dictated by locally-imposed loading time restrictions. It is likely that trucks would access the site from the signalized intersection at Cypress Road, turn left and continue along west property boundary of the site to the rear of the market. Noise levels generated during deliveries would be dependent on the speed of trucks, but typical maximum noise levels generated by heavy duty trucks would be approximately 70 to 80 dBA at the common property line (about 30 feet from the center of the driveway). Medium duty trucks would generate maximum noise levels of about 60 to 70 dBA at the property line.

Loading Dock Activity

Trucks would proceed along the west property line of the site and turn right to enter the loading dock area. Heavy duty trucks would back up to rubberized gasket loading bays, with all unloading done directly into the building. The rubberized gasket type of loading bay provides a tight connection between the truck and the building specifically for noise abatement purposes, and field visits to these facilities have indicated that little loading noise escapes into the community from this loading dock type. Occasionally, banging within the truck is audible. Medium duty trucks would typically park near the loading dock area and unloading activities would occur directly out of the truck about 60 to 80 feet from the residential property lines north of the market. Generally, vendors use wheeled carts, hand-trucks or pallet-jacks to deliver products to the stores. Noise is generated as truck doors are opened and closed and as products are loaded onto carts and transported into the store. Typical maximum noise levels generated by these activities at the nearest receiving property lines would be would be approximately 58 to 68 dBA. Hourly average noise levels would typically range from 51 to 61 dBA at the residential property line depending on the number of trucks and intensity of deliveries during a given hour.

Mechanical Equipment

Roof-top mechanical equipment typically includes heating, ventilating, air conditioning, and refrigeration equipment. Noise typically generated by rooftop mounted mechanical equipment varies significantly depending upon the equipment type and size. Project mechanical equipment specifics have not been determined at this preliminary development plan phase. The precise noise impacts of project mechanical equipment cannot be determined without detailed system design specifications regarding location, type, size, capacity, enclosure design, etc.-- details which are typically provided during later phases of the project design and development review along with other more detailed project engineering specifications. However, based on noise measurements made at other similar commercial centers and large supermarkets, noise levels of 60 to 70 dBA at 15 feet from external mechanical systems can be anticipated from the project. Noise generated by project mechanical equipment could range from 44 to 54 dBA at the nearest residential properties and would exceed the daytime and nighttime hourly standards without mitigation. Other pieces of mechanical equipment that could be a source of concern could include trash compactors. Trash compactors typically generate maximum noise levels of 50 to 60 dBA L_{max} at 50 feet.

Parking Lot Activity

Noise generated by normal activities within the parking lot would be introduced to the noise environment at the nearest residential receptors with the operation of the project. Noise would be generated by vehicles circulating within the lot, engine starts, door slams, and by the sound of human voices. The sound of a passing car at 15 mph typically ranges from 55 dBA to 65 dBA at 25 feet. The noise of an engine start is similar. Door slams create noise levels lower than engine starts. The hourly average noise level resulting from all of these noise-generating activities in a busy shopping center parking lot could range from 40 dBA to 50 dBA at the property line.

Gas Station

A gas station would be located at the southwest corner of the project site adjacent to Cypress Road. Sounds generated by the gas station would be similar to those described for the parking lot. Noise is generated as vehicles circulate and idle and when engines are started and doors are open and closed. Noise levels generated by the gas station are calculated to be approximately 58 dBA Leq at the nearest proposed receivers. Noise levels generated by the gas station would be well below noise levels generated by traffic along Cypress Avenue.

Parking Lot Cleaning

The parking area surface at the proposed shopping center would be periodically cleaned using small mechanical parking lot sweepers and hand-held, back-mounted leaf blowers. Noise generated by parking lot cleaning activities would be about 70-75 dBA at a distance of 50 feet but these noise levels would generally occur over short periods of time when cleaning occurs near the project perimeter.

Educational Facilities and Parks

The Emerson Property project could include the development of an elementary school and parks in areas adjacent to proposed residential land uses. Schools would generate noise when students arrive and depart as well as when outdoor activity areas are used.

Active parks, ball fields, or sports complexes could also be a potentially significant source of community noise. Participants and spectators would generate noise while using parks and recreation areas proposed as part of the Emerson Property. Recreation areas may include lighting and, therefore, could be expected to generate noise in the late evening hours. Maximum noise levels from such uses can exceed 80 dBA L_{max} at a distance of approximately 150 feet. For normal active park events such as soccer games, baseball games, dog parks, etc., average noise levels of about 55 to 60 dBA L_{eq} could be expected at a distance of 150 feet from the center of activities. Noise levels generated by these parks could exceed the noise levels established in the City's General Plan at the residential property line, thereby requiring further study.

Passive public parks could contain one or more of the following amenities that are part of most neighborhood parks: tot lot/playground, open turf area, picnic tables with barbeques, pathways, etc. It is not anticipated, given the activities outlined above, that noise from passive parks would cause any adverse noise impacts upon future noise sensitive receptors in the area.

Mitigation Measures:

- Construct an 8 to 10 foot noise barrier along the western and northern boundary of the commercial parcel. The proposed wall would reduce noise levels in the rear yards of adjacent residential land uses by about 8 dBA. To be effective, the barriers should be constructed solidly over the entire surface and at the base. Openings or gaps between barrier materials or the ground decrease the reduction provided by a noise barrier. Suitable materials for barrier construction should have a minimum surface weight of 3 lbs./ft^2. (such as one-inch thick wood, masonry block, concrete, or metal). The final detailed design of the heights and limits of these barriers shall be confirmed at the time that the final grading plan is submitted.

- Deliveries should be limited to daytime hours (7:00 a.m. to 10:00 p.m.) and the posted speed limit should not exceed 15 mph along the truck circulation route. These limits should be clearly posted to advise delivery personnel as to the time and speed restrictions.

- The selection and location of mechanical equipment should be considered during the design phase of the project. Once the selection of the type equipment and the placement of the equipment has been designed, the project plans should be reviewed by an acoustical specialist to verify that daytime and nighttime hourly noise standards are not exceeded at the property line. Potential mitigation for rooftop units could include rooftop unit placement, orientation, screens, or parapet walls. Orienting rooftop units so that the noise produced by the units is directed away from the residences could reduce noise levels (0-5 dBA, depending on the unit). Placing the rooftop units further from the nearby residential uses would also help reduce noise levels. A parapet wall constructed along the edge of the building would also help reduce noise levels at nearby residences. The amount of noise reduction would depend on the wall height, with a taller wall providing more noise reduction (5-10 dBA).

- Parking lot cleaning activities should be limited to daytime hours (7:00 a.m. to 10:00 p.m.).

Impact 3: ***Permanent Noise Increases at Existing Residences.*** **The proposed project alone would not substantially increase noise levels along streets in the area. This is a less-than-significant impact.**

The traffic generated by this project alone would result in a 1 to 2 dBA L_{dn} increase in daily average traffic noise levels along Cypress Road. The project would not result in a measurable increase in traffic noise along Sellers Avenue south of the project site. Project-generated traffic noise levels were calculated by comparing existing plus project traffic volumes to existing traffic volumes along area roadways. Based on this comparison, traffic noise levels are anticipated to increase by about 1 to 2 dBA L_{dn} along Cypress Avenue as a result of the project. Project-generated traffic is not anticipated to measurably increase noise levels along Sellers Avenue, south of Cypress Road.

Mitigation: **NONE**

Impact 4: ***Cumulative Noise Increases at Existing Residences.*** **Traffic noise levels will increase with the development of the project area and other planned developments in Oakley. In some locations, these increases would be substantial, and the project would make a "cumulatively considerable" contribution to the overall cumulative noise impact. This is a significant impact.**

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The Project would result in a significant cumulative traffic noise impact if existing sensitive receivers would be exposed to cumulative traffic noise level increases greater than 3 dBA L_{dn} above existing traffic noise levels and if the Project would make a "cumulatively considerable" contribution to the overall traffic noise level increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA L_{dn} or more attributable solely to the proposed project. Under cumulative conditions, noise levels in the project vicinity will increase by as much as 8 dB L_{dn} along Cypress Road and 8 to 10 dB L_{dn} along Sellers Avenue. These are significant increases in noise. The character of the noise environment will permanently change from rural to a noise environment represented by a more suburban setting. Cumulative traffic noise levels are anticipated to increase by 5 to 7 dBA L_{dn} as a result of cumulative plus project conditions along Cypress Road between Main Street and Sellers Avenue. 1 dB of the 5 to 7 dB increase can be attributed to the project. This would result in a significant cumulative impact at receivers along Cypress Road. The project would contribute less than 1 dB to overall cumulative noise increases on all other area roadways.

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Mitigation Measures:

Noise reduction methods include the following:

- New or larger noise barriers could reduce noise levels by 5 dBA L_{dn}. Final design of such barriers, including an assessment of their feasibility and reasonableness, should be completed during project level review.

- Sound insulation treatments to the buildings, such as sound rated windows and doors, could reduce noise levels in interior spaces.

- In addition, alternative noise reduction techniques should be considered in coordination with the City of Oakley. Such techniques could include: installation of traffic calming measures to slow traffic; coordination of routing and other traffic control measures; repaving the affected roadways with "quiet" pavement types such as Open-Grade Asphalt Concrete. Opportunities to lower noise levels through pavement surface treatments could only be identified after an assessment of the current roadway surface with respect to noise.

Mitigation Discussion:

A combination of mitigation measures such as the repaving of affected roadways, the replacement or construction of noise barriers, traffic calming, and sound insulation could be implemented to reduce the effects of cumulative plus project traffic noise at affected residential units in the vicinity of the project site.

Case studies have shown that the replacement of dense grade asphalt (standard type) with open-grade or rubberized asphalt can reduce traffic noise levels along residential-type streets by 2 to 3 dBA. A possible noise reduction of 2 dBA would be expected using conservative engineering assumptions.

Single-family residential receivers along Cypress Road could be provided with new or larger noise barriers to provide the additional necessary noise attenuation in private outdoor use areas. Typically, increasing the height of an existing barrier results in about 1 dBA of attenuation per 1 foot of additional barrier height. The design of such noise barriers would require additional analysis.

Traffic calming could also be implemented along affected roadways to reduce noise levels expected under the cumulative plus project traffic scenario. Each 5 mph reduction in average speed provides approximately 1 dBA of noise reduction on an average basis (L_{eq}/ L_{dn}). Traffic calming measures that regulate speed improve the noise environment by smoothing out noise levels.

Affected residential receivers along affected roadways, could be provided sound insulation treatments if further study finds that interior noise levels within the affected residential units would exceed 45 dBA L_{dn} assuming cumulative plus project traffic conditions. Treatments to the home may include the replacement of existing windows and doors with sound-rated windows and doors and the provision of a suitable form of forced-air mechanical ventilation to allow the occupants the option of controlling noise to by closing the windows. The specific treatments for each affected residential unit would be identified on a case-by-case basis.

Significance After Mitigation:

Each of these mitigation measures involves other non-acoustical considerations. Other engineering issues may dictate continued use of dense grade asphalt. Noise barriers and sound insulation treatments must be done on private property necessitating agreements with each property owner. Therefore, it may not be reasonable or feasible to reduce project-generated traffic noise at all affected receivers. The impact would be considered significant and unavoidable

.Impact 5: ***Construction Noise.* Construction noise would not significantly impact existing residences in the area. However, construction noise may be significant for future homes, depending on the phasing of projects. This is a potentially significant impact.**

Future construction on the site would generate noise and would temporarily increase noise levels at adjacent land uses. Noise levels generated by specific pieces of construction equipment at a distance of 50 feet are presented in Table 7. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing, and duration of noise-generating activities and the distance between construction noise sources and noise sensitive receptors. Existing residences nearest to the Emerson property are located south of Cypress Road and are currently exposed to high levels of traffic noise. It is anticipated that construction on the Emerson property itself would not normally generate noise levels in excess of traffic noise resulting from Cypress Road. During the period of time that construction is taking place very close to Cypress Road, it is possible that the construction activity could reach the noise levels generated by trucks on Cypress Road. However, during the majority of the time, noise levels would be far lower than current noise levels. In the future as homes are developed in the area, some of these homes may be located very close to construction projects and, therefore, potentially impacted by this construction noise.

Mitigation:

To minimize the effects of project construction activities, implement the following construction noise controls:

- Noise-generating activities at the construction site or in areas adjacent to the construction site associated with the project in any way should be restricted to the hours of 8:00 AM to 8:00 PM, Monday through Friday, and 9:00 AM to 8:00 PM on Saturdays. Construction activities should be restricted to the hours of 10:00 AM to 6:00 PM on Sundays or holidays.

- Equip all internal combustion engine driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses.

- Utilize “quiet” air compressors and other stationary noise sources where technology exists.

- Designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaints (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

- Notify prospective residents within the adjacent subdivision that the development of the commercial portion of the site would generate noise levels during construction that may be considered excessive or annoying.

Table 7 CONSTRUCTION EQUIPMENT 50-FOOT NOISE EMISSION LIMITS

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	**73**	**Continuous**
Auger Drill Rig	**85**	**Continuous**
Backhoe	**80**	**Continuous**
Bar Bender	**80**	**Continuous**
Boring Jack Power Unit	**80**	**Continuous**
Chain Saw	**85**	**Continuous**
Compressor[3]	**70**	**Continuous**
Compressor (other)	**80**	**Continuous**
Concrete Mixer	**85**	**Continuous**
Concrete Pump	**82**	**Continuous**
Concrete Saw	**90**	**Continuous**
Concrete Vibrator	**80**	**Continuous**
Crane	**85**	**Continuous**
Dozer	**85**	**Continuous**
Excavator	**85**	**Continuous**
Front End Loader	**80**	**Continuous**
Generator	**82**	**Continuous**
Generator (25 KVA or less)	**70**	**Continuous**
Gradall	**85**	**Continuous**
Grader	**85**	**Continuous**
Grinder Saw	**85**	**Continuous**
Horizontal Boring Hydro Jack	**80**	**Continuous**
Hydra Break Ram	**90**	**Impact**
Impact Pile Driver	**95**	**Impact**
Insitu Soil Sampling Rig	**84**	**Continuous**
Jackhammer	**85**	**Impact**
Mounted Impact Hammer (hoe ram)	**90**	**Impact**
Paver	**85**	**Continuous**
Pneumatic Tools	**85**	**Continuous**
Pmps	**77**	**Continuous**
Rock Drill	**85**	**Continuous**
Scraper	**85**	**Continuous**
Slurry Trenching Machine	**82**	**Continuous**
Soil Mix Drill Rig	**80**	**Continuous**
Street Sweeper	**80**	**Continuous**
Tractor	**84**	**Continuous**
Truck (dump, delivery)	**84**	**Continuous**
Vacuum Excavator Truck (vac-truck)	**85**	**Continuous**
Vibratory Compactor	**80**	**Continuous**
Vibratory Pile Driver	**95**	**Continuous**

Notes:
1 Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
2 Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
3 Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

PHASE ONE ENVIRONMENTAL SITE ASSESSMENT

EMERSON AND BURROUGHS PROPERTIES
CYPRESS CORRIDOR

OAKLEY, CALIFORNIA

SUBMITTED

DRAFT

TO

SOPAC & ASSOCIATES

PORTERVILLE, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 4603.3.001.01

AUGUST 23, 1999

Project No.
4603.001.01

August 23, 1999

DRAFT

Ms. Soapy Thompkins
Sopac & Associates
32657 Indian Reservation Road
Porterville, CA 93257

Subject: Emerson and Burroughs Properties
Cypress Corridor
Oakley, California

PHASE ONE ENVIRONMENTAL SITE ASSESSMENT

Dear Ms. Tompkins:

ENGEO Incorporated is pleased to present our phase one environmental site assessment of the subject properties located north of Cypress Road, in Oakley, California. The attached report includes a description of the site assessment activities, along with ENGEO's findings regarding the parcels.

We are pleased to be of service to you on this project. If you have any questions concerning the contents of our report, please contact ENGEO.

Very truly yours,

ENGEO INCORPORATED

Shawn Munger
REA 2070/CHG 413

Reviewed by:

Paul C. Guerin
Vice President

sm/ce:esa1

TABLE OF CONTENTS

4603.3.001.01
August 23, 1999

DRAFT REPORT

1.0 SUMMARY

The project site is located north of Cypress Road in a recently incorporated area of Oakley, California (Figure 1). The site is bounded by Dutch Slough to the north, Jersey Island Road to the east, Cypress Road to the south, and the Marsh Creek drainage canal to the west. The study area includes nine parcels, which total ±1,100 acres in area.

The site reconnaissance and records research did not find documentation or physical evidence of significant soil or ground-water impairments associated with the use of the property, with the possible exception of potential soil/ground-water impacts associated with the existing/former natural gas well sites. A review of regulatory databases maintained by county, state, and federal agencies found no documentation of hazardous materials violations or discharge on the property. A review of aerial photographs and available historical records found the subject parcels have been used for pasture, residences, natural gas production and dairy operations.

A review of regulatory agency records did not identify contaminated facilities, within one mile of the site, which could be expected to impact the property.

The property owners were not aware of existing or preexisting environmental conditions associated with the site. The owners were also not aware of previous environmental site assessments, audits or environmentally related permits for the parcels.

ENGEO has performed a Phase One Environmental Site Assessment of the subject property, in accordance with the outlined scope of services. Based on the findings of the assessment, ENGEO has noted the following potential environmental concerns:

Emerson Parcels

- Nitrate Impacts

  Given the current and historical dairy activities, it is possible that site soils and ground water may exhibit elevated nitrate levels.

- Above Ground Fuel Tanks

  The above ground fuels tanks (AGTs) are currently located within a concrete vault; however, we understand the tanks were previously stored above bare ground. It is possible that some impact to soil and/or ground water may have occurred as a result of product usage.

- Waste Oil Tank

  Some soil staining was noted beneath the above ground waste oil tank. It appears that spillage of motor oil has impacted near surface soil.

- Oil House

  No apparent indications of soil impacts were noted in association with the petroleum product storage, with the exception of some discoloration of soil at the east side of the shed. It is conceivable some impact to soil may have occurred as a result of past product spills.

- Pesticide Shed

  No indication of substance release, or soil impact was noted within area of the pesticide shed; however, it is possible that soils may have been impacted as a result of past releases.

- <u>Former Underground Fuel Tank</u>

  Mr. Emerson indicated there was no evidence of a fuel release at the time of the underground storage tank (UST) removal. Based on this observation, it is unlikely that significant impacts exist. It may be prudent to request a UST closure letter from the Contra Costa County Environmental Health Department. This would require the recovery of a soil sample from the former tank area, with laboratory testing.

- <u>Asbestos-Containing Materials</u>

  An asbestos survey was not conducted as part of the site assessment. Given the age of the existing structures, it is conceivable that asbestos containing materials may have been used in construction.

Burroughs Parcels

- <u>Existing/Preexisting Natural Gas Well Sites</u>

  Potential impacts associated with the existing/preexisting well sites could include the following:

  - *Hydrocarbon impacts to soil/ground-water as a result of spillage from condensate tanks*
  - *Spillage from above ground diesel and motor oil tanks*
  - *Hydrocarbon impacts within the area of compressor units*
  - *Mercury impacts adjacent/beneath meter sheds*
  - *Hydrocarbon/barium impacts associated with former drill sumps*
  - *Hydrocarbon impacts around well heads*

- Nitrate Impacts

  Given the current and historical dairy activities is possible that site soils and ground water, may exhibit elevated nitrate levels.

- Above Ground Fuel Tanks

  The AGTs located to the north of the maintenance shed are currently empty; however, some soil staining was observed beneath the tanks. It is possible that some localized impact to site soils may have occurred as a result of past usage of the AGTs.

- Car Port/Garage

  A possible maintenance pit/sump, covered by wooden planks, was observed within the garage unit. Potential soil impacts may have occurred, if motor oil, fuels, or solvents were discharged to the pit.

- Asbestos-Containing Materials

  An asbestos survey was not conducted as part of the site assessment. Given the age of the structures, it is conceivable that asbestos containing materials may have been used in construction.

With regard to the subject parcels, ENGEO provides the following recommendations:

Emerson Parcels

- Demolition/Pre-Grading Observation

An environmental professional should view the property at the time of demolition and pre-grading activities, to observe areas that may have been obscured by structures or debris. In particular, the areas around the oil house, pesticide shed, maintenance building and above ground fuel tanks should be inspected for possible buried structures and stained/odoriferous soil. A soil sample should also be recovered from the former UST location for laboratory testing. Additional recommendations for subsurface assessments could be provided at the time of demolition.

- Asbestos Survey

  An asbestos survey of the existing structures should be undertaken prior to any future demolition work.

- Septic Systems/Water Wells

  Existing septic systems and domestic/irrigation wells should be removed/abandoned in accordance with current regulations.

Burroughs Parcels

- Natural Gas Well Sites

  A Phase II assessment of the existing/former gas well sites should be undertaken. The assessment should include recovery of soil and ground-water samples with laboratory analysis for petroleum hydrocarbons and metals.

- Asbestos Survey

  An asbestos survey of the existing structures should be undertaken prior to any future demolition work.

- Demolition/Pre-Grading Observation

  An environmental professional should view the property at the time of demolition and pre-grading activities, to observe areas that may have been obscured by structures or debris. In particular, the areas around the car port, maintenance building, and the above ground fuel tanks should be inspected for stained/odoriferous soil. Additional recommendations for subsurface assessments may be provided at the time of demolition.

- Septic Systems/Water Wells

  Existing septic systems and domestic/irrigation wells should be removed/abandoned in accordance with current regulations.

2.0 INTRODUCTION

2.1 Purpose and Scope

The purpose of the phase one environmental assessment is to identify, to the extent feasible, recognized environmental conditions associated with the properties. The scope of services included the following:

- A review of publicly available and practically reviewable standard local, state, and federal environmental record sources.
- A review of several publicly available and practically reviewable standard historical sources, aerial photographs, fire insurance maps, and physical setting sources.
- A reconnaissance of the property.
- Interviews with the property owner and government officials.
- Preparation of this report with our findings and conclusions.

2.2 Limitations and Exceptions of Assessment

The professional staff at ENGEO Incorporated strives to perform its services in a proper and professional manner with reasonable care and competence but are not infallible. The recommendations and conclusions presented in this report were based on the findings of our study, which were developed solely from the contracted services. The findings of the report are based in part on contracted database research, out-of-house reports and personal communications. ENGEO Incorporated assumes no liability for the validity of the materials relied upon in the preparation of this report.

This document must not be subject to unauthorized reuse, that is reuse without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time. The findings from a phase one environmental site assessment are typically valid for 180 days after completion of the report, particularly with regard to the regulatory database files.

This phase one environmental site assessment is not intended to represent a complete soil or ground-water characterization. This assessment does not define the extent of soil or ground-water contamination. It is intended to provide an evaluation of potential environmental concerns associated with the use of the property. A more extensive assessment that would include a subsurface exploration with laboratory testing of soil and ground-water samples could provide more definitive information concerning site-specific conditions. If a subsurface investigation is considered for the property and if other entities are retained to provide such services, ENGEO cannot be held responsible for any and all claims arising from or resulting from the performance of such services by other persons or entities, and from any and all claims arising or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

ENGEO Incorporated has prepared this report for the exclusive use of our client, Sopac & Associates. It is recognized and agreed that ENGEO has assumed responsibility only for undertaking the study for the client. The responsibility for disclosures or reports to a third party and for remedial or mitigative action, shall be solely that of the Client.

2.3 Limiting Conditions and Methodology Used

Laboratory testing of soil or ground-water samples was not within the scope of the contracted services. The assessment did not include an asbestos survey, an evaluation of lead-based paint, or an inspection for PCBs. The assessment does not address other environmental issues, which are not specified in the outlined scope of services.

This report is based upon field and other conditions discovered at the time of preparation of ENGEO's work. Visual observations referenced in this report are intended only to represent site conditions at the time of the site visit. ENGEO would not be aware of site contamination, such as dumping and/or accidental spillage, which occurred subsequent to the site reconnaissance conducted by ENGEO personnel.

3.0 SITE DESCRIPTION

3.1 Location and Legal Description

The project site is located north of Cypress Road in a recently incorporated area of Oakley, California (Figure 1). The site is bounded by Dutch Slough to the north, Jersey Island Road to the east, Cypress Road to the south, and the Marsh Creek drainage canal to the west. The study area includes the following Assessors Parcel Numbers:

PARCEL	AREA	ADDRESS	OWNER
032-081-004	98.94	4979 Jersey Island Ave.	Burroughs
032-081-008	44.9	1180 East Cypress Rd.	Burroughs
032-081-013	16.0	--------	Burroughs
032-081-014	308.83	5401 – 5405 Jersey Island Rd	Burroughs
037-191-012	20.0	--------	Burroughs
037-191-009	404.34	7101 - 7125 Sellers Ave.	Emerson
037-191-012-08	68.91	7101 Sellers Ave.	Emerson
037-192-015	.97	6501 Sellers Avenue	Emerson
037-192-016	140.16	6701 - 6715 Sellers Avenue	Emerson

3.2 Site and Vicinity Characteristics

The site topography is relatively level with some slight manmade and natural rises in the terrain. Existing site elevations range from approximately 10 feet below mean sea level (MSL) to approximately 10 feet above MSL (Figure 2). More than half of the site is below mean sea level.

The properties are separated into sections, divided by waterways extending from Dutch Slough. Levees at the perimeter of the parcels rise to elevations ranging from +7.6 to +10 feet. These levees protect the low-lying ground from flooding. The Contra Costa Canal extends east-west through the southern portion of the site. Numerous smaller irrigation and drainage canals traverse the property. A Record Boundary prepared by Carlson, Barbee and Gibson depicts numerous roadway, power, drainage, and pipeline easements throughout the project area (Figure 3). Large overhead transmission lines and a section of Jersey Island Road pass through the northeast corner of the site.

The near-surface sediments across the site consist of eolian, flood plain, and alluvial deposits. These sediments are typically irregularly-stratified, poorly-consolidated deposits of peat, clay, silt, sand, and minor gravels. Ground water is shallow at depths within five feet of the ground surface.

Dutch Slough and Jersey Island are situated to the north of the site. Ranch homes, a service station/market, and several other commercial facilities are located to the south of the study area. The Gilbert property is situated between the Burroughs and Emerson Parcels. Improvements on the Gilbert property include a ranch complex, residences and several existing/former natural gas well sites. The properties west of the site consist of open pasture. Gas well facilities and pasture exist to the east.

3.3 Description of Site Improvements

Emerson Parcels

APN 037-191-009

Two active milk dairy facilities are in operation on the Emerson property (Figure 7). Improvements at the main western dairy site include a modular office building; several hay, grain and commodities barns; grain silos; two dairy processing facilities; employee quarters; a maintenance building; a pesticide storage shed; and a petroleum product storage shed. A small residence also exists at the dairy facility. A dairy pond is located in the northeast area of the dairy facility. The pond collects process water and rinse water from the dairy facility, which is mixed with irrigation water and used for pasture irrigation. At least three septic systems exist on the parcel.

Improvements noted at the western dairy facility include a single dairy processing facility and livestock pens. Two domestic water wells are located on either side of the building. Two above ground fuel tanks are located to the south of the western dairy building (Figure 5).

The remainder of the parcel consists of open pasture and a small vineyard. Several irrigation pumps are located near Dutch Slough, along with a sanitary district force main along the northwest levee.

<u>APN 037-191-012</u>

The parcel consists of undeveloped pasture land, with a small vineyard.

<u>APN 037-192-015</u>

Development of the parcel is limited to a single mobile home.

<u>APN 037-192-016</u>

Improvements on the parcel include two single-family residences and one historical barn structure. The majority of the parcel consists of undeveloped pasture land. The residences are serviced by a private water well and septic systems.

Burroughs Parcels

<u>APN 037-191-012</u>

The parcel consists of undeveloped open space, bounded by Dutch Slough on two sides.

APN 032-081-013

The property includes an undeveloped narrow easement of land that extends along a portion of Dutch Slough.

APN 032-081-014

Parcel 14 includes the primary Burroughs development area, which consists of a residential/ranch complex, and an abandoned dairy facility (Figures 5 and 6). Several small residences are located near the northeast property corner (Jersey Island Road). Improvements within the residential/ranch area include single family structures, a service garage, a small car port/garage, and a barn.

Developments within the abandoned dairy facility include a former administrative office/storage unit, which has been partially converted to a music studio; the dairy processing building; a hay barn; a milk bottle storage unit; and an open vehicle/equipment storage shed. According to the property representative, Mr. Robert Treat, the dairy has been inoperative since the 1970s. In addition to the dairy and residential areas, there are three active natural gas well sites on Parcel 14.

APN 032-081-004

The principal improvements on the parcel consists of the St. Croix/Phillips gas well facility (Well No. 11) and a barn near the gas well compound (Figures 4 and 6). The gas well site includes five large above ground condensate tanks; the abandoned well head cellar; various piping; and two smaller fuel/well additive AGTs. In addition to the gas well site, a storage/maintenance structure is located along Jersey Island Road near the northeast property corner. Apparent pipe risers are visible along the west side of the structure. According to Phillips Petroleum personnel the risers are associated with a septic system. A second former well site also exists in the southern area of the parcel, to the north of the Contra Costa Canal (Well No. 11 - Figure 4).

APN 032-081-008

Improvements across the property include a small mobile home and a former gas well site along Cypress Avenue.

3.4 Current and Past Property Use

Emerson Parcels

The Emerson property is used for an active dairy operation, for residential purposes, and as pasture. Based on a review of aerial photography and topographic maps, the property has been used as a dairy and for residential purposes since at least the early 1900s.

Burroughs Parcels

Based on a review of photographs and topographic maps, structures have existed within the Burroughs residential and dairy area since at least the early 1900s. State Division of Oil and Gas Maps indicate seven existing/former natural gas wells on the property (Figure 4).

3.5 Current and Past Use of Adjoining Properties

Dutch Slough is situated to the north of the site. Open space, Marsh Creek, and some scattered ranch sites exist to the west of the study area. The Gilbert property is located between the Emerson and Burroughs parcels. The Gilbert site includes a ranch complex, residences, storage areas, and several gas well sites. The area east of the site includes open space, with natural gas well developments and scattered ranch sites. The properties south of the site, across Cypress Avenue, include residential parcels, and commercial properties.

A review of aerial photography and historical records indicates the adjacent properties have been used for ranching /pasture land or open space since the early 1900s. No indication of industrial use of the abutting parcels was noted from the assessment.

3.6 Environmental Liens/Specialized Knowledge

The property owners/representatives, Mr. Stan Emerson and Mr. Robert Treat, were interviewed with regard to the study area. The property representatives were not aware of existing or preexisting environmental conditions associated with the property. The owners were also not aware of previous environmental site assessments, audits or environmentally related permits for the property.

4.0 RECORDS REVIEW

4.1 Environmental Record Sources

Environmental Data Resources (EDR) database information was used to review local, state and federal agency databases regarding the subject parcels and known contaminated sites in the immediate vicinity. Agency databases reviewed included:

- *Contra Costa County Hazardous Materials Division*
- *California Environmental Protection Agency (CAL-EPA) Department of Toxic Substances Control (DTSC)*
- *State Water Resources Control Board (SWRCB)*
- *California Regional Water Quality Control Board (RWQCB)*
- *State Division of Oil and Gas (DOG)*
- *Environmental Protection Agency (Region IX)*

A list of regulatory agency databases and informational sources is provided in Appendix B.

4.1.1 Subject Site Records Research Summary

The properties are not listed by the county, state, or federal government as a current or former underground storage tank facilities. The parcels are not listed as contaminated sites by the county, state, or federal government (Appendix B).

The Emerson Dairy is listed on the CCCHSD database. A review of the facility file found a request for a Hazardous Material Business Plan. No other information was found in the county file.

Banks Information Solutions, Inc. was contracted to provide a Division of Oil and Gas search for the property. A total of seven existing/preexisting well sites are documented for the property. In addition, four abandoned test holes are also recorded. Figure 4 details the location of the well and test hole locations. The well research report is provided in Appendix C.

4.1.2 Off-Site Property Records Research Summary

- Review of county, state and federal records and databases did not identify Federal National Priority List (NPL) sites, Resource Conservation and Recovery Act (RCRA) treatment/storage/disposal facilities, or state NPL/CERCLIS equivalent sites requiring remedial action within one mile of the subject property.

- A review of available databases identified one leaking underground storage tank site within one-half mile of the property:

  Food & Liquor #86 *101 Cypress Road.*

  Given the distance to this facility and the available database information, this site would not be expected to impact the subject properties.

- No registered hazardous waste generators (GNRTR) are documented within 1/4 mile of the property. Four registered underground storage tank facilities (UST) are listed by CCCHSD within ¼ mile of the property. Two of these facilities have had USTs removed with no evidence of significant soil impacts. The remaining two sites are listed as active.

4.2 Physical Setting Sources

The following sources were reviewed to obtain information regarding the geologic, hydrogeologic, hydrologic, and topographic characteristics of the site:

- *USGS, Jersey Island Quadrangle-7.5' Topographic Maps*

- *Atwater, B.I., 1982, Geologic Maps of the Sacramento – San Joaquin Delta, California; USGS MF 1401.*

A description of the physical setting of the subject property is provided in Section 3.2.

4.3 Historical Use Information

The purpose of the historical record review is to develop a history of the previous uses or occupancies of the property and surrounding area in order to identify those uses or occupancies that are likely to have led to recognized environmental conditions on the property.

4.3.1 Municipal Agencies

The following state/local agencies were contacted for information regarding past land use, development and operations on the parcels:

- *Contra Costa County Building Inspection Department*
- *Contra Costa County Community Development Department*
- *Contra Costa County Assessors Office*

No references to hazardous materials use or commercial/industrial activities were noted in the County Community Development or Building Department files. Permits for mobile homes, lot line adjustments, minor subdivision applications, and use permits (gas wells) were noted on file with the Community Development Department.

4.3.2 Aerial Photographs

The following aerial photographs, provided by Pacific Aerial Survey in Oakland, California, were reviewed for information regarding past conditions and land use at the subject site and in the immediate vicinity:

PHOTO NUMBER	DATE
AV 5200-137-09/10	7-30-96
AV 4230-137-07/08	07-24-92
AV 3368-34-09/10	08-30-88
AV 2655-15-03/04	06-11-85
AV 2050-15-17/18	10-18-81
AV 844-24-32/33	05-02-68
AV 253-35-10/11	05-15-57
ABC-3K-141/142	06-08-53

On-Site Conditions – Emerson Parcels

037-191-009

Conditions appear similar on the 1981 – 1996 photographs. Reduced development is observed at the dairy site on the 1968 photograph. The dairy pond is not observed on the 1957 photograph.

037-191-012-008

The small vineyard area is apparent on the eight photographs. Conditions appear similar on the photographs, with the exception of a small residential structure within the vineyard area, as noted on the 1953 – 1957 photographs.

037-192-015

A mobile home unit is observed on the eight photographs reviewed.

037-192-016

Conditions across the parcel appear similar on the 1981 – 1996 photographs. The eastern of the two residences does not appear on the 1963 – 1968 photographs. The barn structure is apparent on all eight of the photographs.

On-Site Conditions – Burroughs Parcels

032-081-004

The oil well facility and support structure along Jersey Island Road are observed on the 1968 – 1996 photographs. The ranch structure is apparent on the eight photographs reviewed.

032-081-008

A former residence is noted on the pre-1996 photographs. A former gas well site is apparent on the 1968 -1996 photographs.

032-081-013

The parcel appears as undeveloped open space on the photographs reviewed.

032-081-014

Conditions appear generally consistent with current. No gas well sites are evident on the 1953 – 1957 photographs.

037-191-012

The parcel appears as undeveloped open space on the photographs reviewed.

Off-Site Conditions:

The nearby properties appear as undeveloped open space, pasture, or ranch sites prior to the existing developments. Some gas well development is apparent to the east of Jersey Island Road and on the Gilbert Parcels between the Burroughs/Emerson properties.

4.3.3 Fire Insurance Maps

Environmental Data Resources (EDR), Inc. prepared a fire insurance map abstract for the subject site and surrounding properties. No fire insurance maps were located for the target property.

4.3.4 Topographic Maps

US Geological Survey Topographic Maps 7.5 and 15 minute quadrangles dated 1906 - 1978 were reviewed for indications of potential variation in site topography, hydrology, indications of past development, and improvements on the site.

Emerson Parcels

Areas of development noted from the map review include the primary dairy facility, the Emerson homestead/Iron Horse School site, and the mobile home improvements at the southeast corner. In addition, several structures are noted in the vicinity of the small vineyard (northwest area). One structure is denoted at the terminus of a dirt road in the northeast property area.

Burroughs Parcels

No development is shown in the north property area, or the residential area near the Jersey Island fork. Structures are noted within the area of the former dairy farm and the Burroughs homesite since 1906. Fewer structures are observed prior to the 1960s. Structures are noted within the area of the barn at the northwest corner of APN 032-081-004. No evidence of development is shown at the St. Croix gas well site, with the exception of one structure denoted on the 1978 map. Several small structures are observed along the Cypress Road frontage dating back to 1911.

No apparent significant changes in topographic and hydrologic conditions were noted from the map review.

5.0 SITE RECONNAISSANCE

5.1 Site Reconnaissance

An ENGEO Staff Environmental Assessor conducted a site reconnaissance in January 1999. The property was viewed for hazardous materials storage, surficial staining or discoloration, debris, stressed vegetation, or other conditions which may be indicative of potential sources of soil or ground-water contamination. The site was also inspected for fill/ventilation pipes, ground subsidence, or other evidence of existing or preexisting underground storage tanks.

5.1.1 Hazardous Substances in Connection with Identified Uses

Emerson Parcels

Hazardous/potentially hazardous substances noted on the Emerson property included the following:

SUBSTANCE	VOLUME	LOCATION
Kerosene	< 55 gallons	Oil House
Motor Oil	< 250 gallons	Oil House
Lube/Hydraulic Oil	< 250 gallons	Oil House
Antifreeze	< 55 gallons	Oil House
Pesticides/Herbicides	<55 gallons	Pesticide/herbicide shed
Diesel Fuel	10,000 gal.	AGT Compound
Gasoline	10,000 gal.	AGT Compound
Waste Oil	±550 gallons	AGT east of oil house
Vehicle Batteries	Appx. Ten	Garage units

Burroughs Parcels

Existing chemical storage noted on the property was found limited to less than 30 gallons of miscellaneous petroleum products located within the shop building. Diesel fuel, motor oil/waste oil and gas well additives were observed within the existing gas well compounds. Some areas of soil staining were noted within the gas well compounds.

5.1.2 Hazardous Substance Containers

Emerson Parcels

A number of empty petroleum product drums were observed within the maintenance shop and to the northwest of the shop building.

Burroughs Parcels

Ten to twelve empty petroleum drums were observed within the Burroughs homesite area; specifically within the shop building, the carport and near the barn. Several empty boxes of "fly dust" were also observed. Three 5-gallon buckets of a thinner ("xyol") and four roof coating buckets were observed within the abandoned dairy building.

5.1.3 Storage Tanks

Emerson Parcels

Mr. Emerson indicated that a ±250-gallon underground fuel storage tank was removed 15 – 20 years ago at the southwest corner of the maintenance garage structure (Figure 7). Mr. Emerson indicated the UST was removed prior to the requirement of permits. No indication of leakage was observed at the time of the removal. In addition to the aforementioned UST, a sealed sump exists at the east end of the petroleum shed. Mr. Emerson was unaware of discharges to the sump.

A ±550-gallon above ground waste oil tank is located to the east of the oil house (Figure 7). Mr. Emerson indicated the tank is periodically pumped out by recyclers. Some minor staining was noted beneath the AGT.

The existing above ground fuel compound consists of a concrete vault with two 10,000-gallon capacity diesel and gasoline tanks (Figure 7). No indication of a release around the vault was noted. Mr. Emerson was unaware of soil contamination associated with the tanks. Apparently, the AGTs were previously stored above bare soil. Molasses tanks are located adjacent to the fuel AGTs.

Burroughs Parcels

No physical evidence of existing or preexisting underground fuel storage tanks was noted on the property, with the exception of several riser pipes noted behind the Phillips Petroleum storage building. According to Phillips personnel, the pipes are associated with a septic system. The property representative was unaware of underground fuel storage tanks on the property.

Two above ground fuel tanks, 1,000 gallons in capacity are located at the Burroughs homesite, to the north of the maintenance shop building (Figure 5). According to the property representative, the empty AGTs previously contained gasoline and diesel fuel. Some minor staining was noted beneath the AGTs. Above ground diesel, gas well additive, and condensate tanks exist at the three active well sites and the St. Croix/Phillips facility.

5.1.4 PCBs and Radon

Several pole-mounted transformers exist across the property. No indication of leakage from the units was noted.

The USEPA and CAL-EPA have conducted studies of radon risks throughout the state. Results of the studies indicate that average statistical radon concentrations in Contra Costa County are less than the current EPA action level.

5.1.5 Asbestos-Containing Materials

An asbestos survey was not included as part of the scope of services. Based on the age of the existing structures, it is conceivable that asbestos-containing materials may have been used in construction. An addition, we understand that some transite water pipe exists at the Emerson dairy facility.

5.1.6 Solid Waste Disposal

No evidence of hazardous waste disposal was viewed on the property at the time of the site reconnaissance. A dairy pond is used at the Emerson dairy facility to collect rinse water from the livestock pens and dairy facilities. In addition, there are several large manure piles on the property. Mr. Emerson and Mr. Treat were not aware of waste disposal on the property.

6.0 INTERVIEWS WITH OWNERS/OCCUPANTS

Mr. Stan Emerson and Mr. Robert Treat, representing the Emerson and Burroughs properties, were interviewed with regard to the study area. The property representatives were not aware of existing or preexisting environmental conditions associated with the property. The owners were also not aware of previous environmental site assessments, audits or environmentally related permits for the property.

According to Mr. Emerson, the areas outside of the dairy and residential developments have principally been used as pasture. Agricultural use has been limited to cultivation of clover, corn, alfalfa and grasses. Mr. Emerson was unaware of significant pesticide applications past or present.

Mr. Treat indicated that the dairy facility discontinued operation in the 1970s. The property representative stated that the site was currently used for residential use, with some limited natural gas production. Mr. Treat informed ENGEO that several of the well sites had been recently reworked to allow for additional production.

7.0 DISCUSSION

Based on the findings of the assessment, ENGEO has identified the following potential environmental concerns for the properties:

Emerson Parcels

- Nitrate Impacts

  Given the current and historical dairy activities, it is possible that site soils and ground water may exhibit elevated nitrate levels.

- Above Ground Fuel Tanks

  The AGTs are currently located within a concrete vault; however we understand the tanks were previously stored above bare ground. It is possible that some impact to soil and/or ground water may have occurred as a result of product usage.

- Waste Oil Tank

  Some soil staining was noted beneath the above ground waste oil tank. It appears that spillage of motor oil has impacted near surface soil.

- Oil House

  No apparent indication of soil impacts were noted in association with the petroleum product storage, with the exception of some discoloration of soil at the east side of the shed. It is conceivable some impact to soil may have occurred as a result of past product spills.

- Pesticide Shed

No indication of a substance release or soil impacts was noted within the area of the pesticide shed. It is possible that soils may have been impacted as a result of past product spillage.

- Former Underground Fuel Tank

Mr. Emerson indicated there was no evidence of fuel releases at the time of the UST removal. Based on this observation, it is unlikely that significant impacts exist.

- Asbestos-Containing Materials

An asbestos survey was not conducted as part of the site assessment. Given the age of structures, it is conceivable that asbestos containing materials may have been used in construction.

Burroughs Parcels

- Existing/Preexisting Natural Gas Well Sites

Potential impacts associated with the existing/preexisting well sites could include the following:

  - *Hydrocarbon impacts to soil/ground-water as a result of spillage from condensate tanks*
  - *Spillage from above ground diesel and motor oil tanks*
  - *Hydrocarbon impacts within the area of compressor units*
  - *Mercury impacts adjacent/beneath meter sheds*
  - *Hydrocarbon/barium impacts associated with former drill sumps*
  - *Hydrocarbon impacts around well heads*

- <u>Nitrate Impacts</u>

  Given the current and historical dairy activities, is possible that site soils and ground water, may exhibit elevated nitrate levels.

- <u>Above Ground Fuel Tanks</u>

  The AGTs located to the north of the maintenance shed are currently empty; however some soil staining was observed beneath the tanks. It is likely that some localized impact to site soils may have occurred as a result of past leakage/spills from the AGTs.

- <u>Car Port/Garage</u>

  A possible maintenance pit/sump, covered by wooden planks, was observed within the garage unit. Potential soil impacts may have occurred if motor oil, fuels, or solvents were discharged to the pit.

- <u>Asbestos-Containing Materials</u>

An asbestos survey was not conducted as part of the site assessment. Given the age of the structures, it is conceivable that asbestos-containing materials may have been used in construction.

8.0 RECOMMENDATIONS

ENGEO has performed a Phase One Environmental Site Assessment of the subject property in accordance with the outlined scope of services. Based on the findings of this assessment, ENGEO provides the following recommendations:

Emerson Parcels

- Demolition/Pre-Grading Observation

  An environmental professional should view the property at the time of demolition and pre-grading activities, to observe areas that may have been obscured by structures or debris. In particular, the areas around the oil house, pesticide shed, maintenance building and above ground should be inspected for possible buried structures and stained/odoriferous soil. A soil sample should also be recovered from the former UST location for laboratory testing. Additional recommendations for subsurface assessments may be provided at the time of demolition.

- Asbestos Survey

  An asbestos survey of the existing structures should be undertaken prior to any future demolition work.

- Septic Systems/Water Wells

  Existing septic systems and domestic/irrigation wells should be removed/abandoned in accordance with county/state regulations.

Burroughs Parcels

- Natural Gas Well Sites

  A Phase II assessment of the existing/former gas well sites should be undertaken. The assessment should include recovery of soil and ground-water samples with laboratory analysis for petroleum hydrocarbons and metals.

- Asbestos Survey

  An asbestos survey of the existing structures should be undertaken prior to any future demolition work.

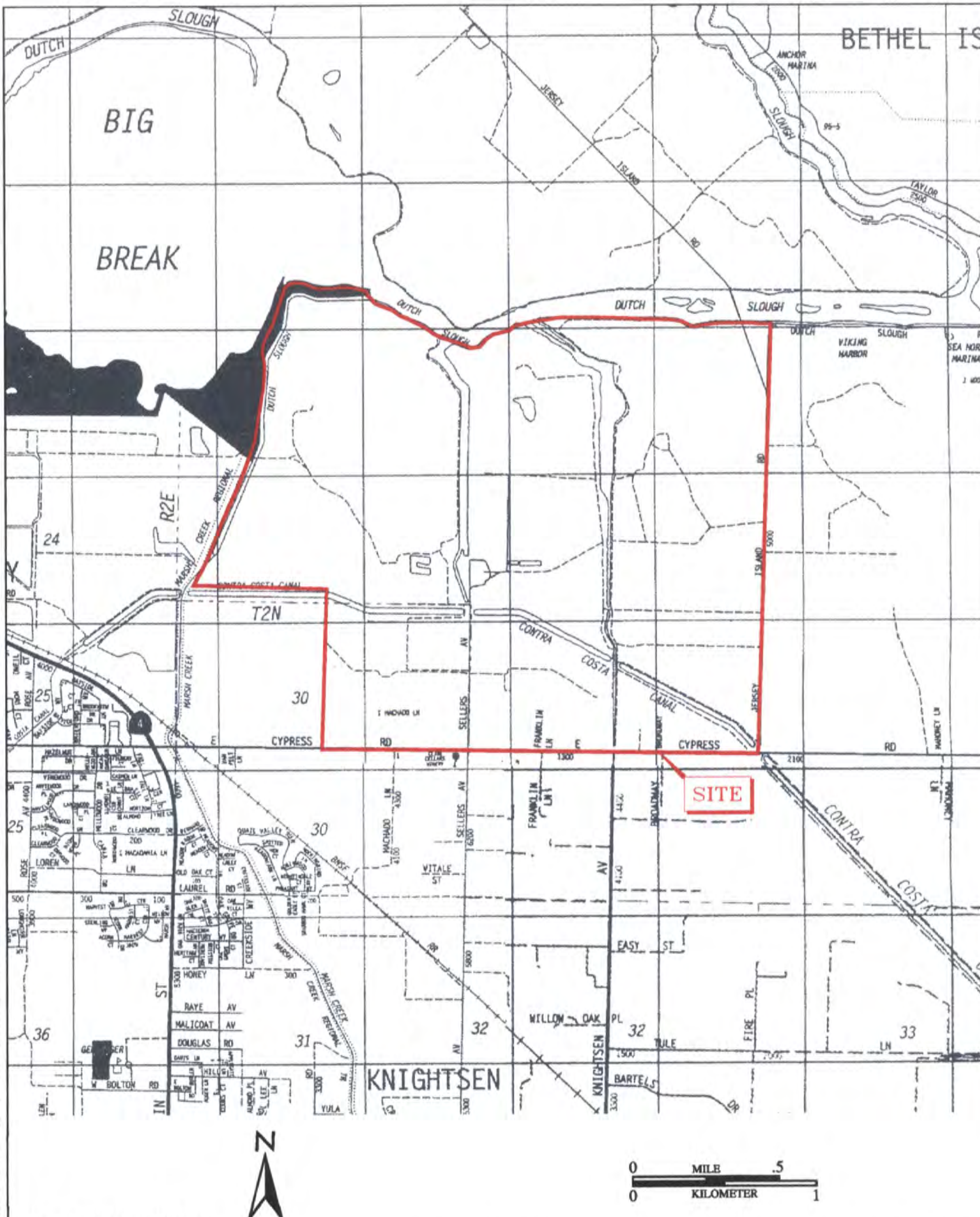
- Demolition/Pre-Grading Observation

  An environmental professional should view the property at the time of demolition and pre-grading activities, to observe areas that may have been obscured by structures or debris. In particular, the areas around the car port, maintenance building above ground tanks and dairy facilities should be inspected for possible buried structures and stained/odoriferous soil. Additional recommendations for subsurface assessments may be provided at the time of demolition.

- Septic Systems/Water Wells

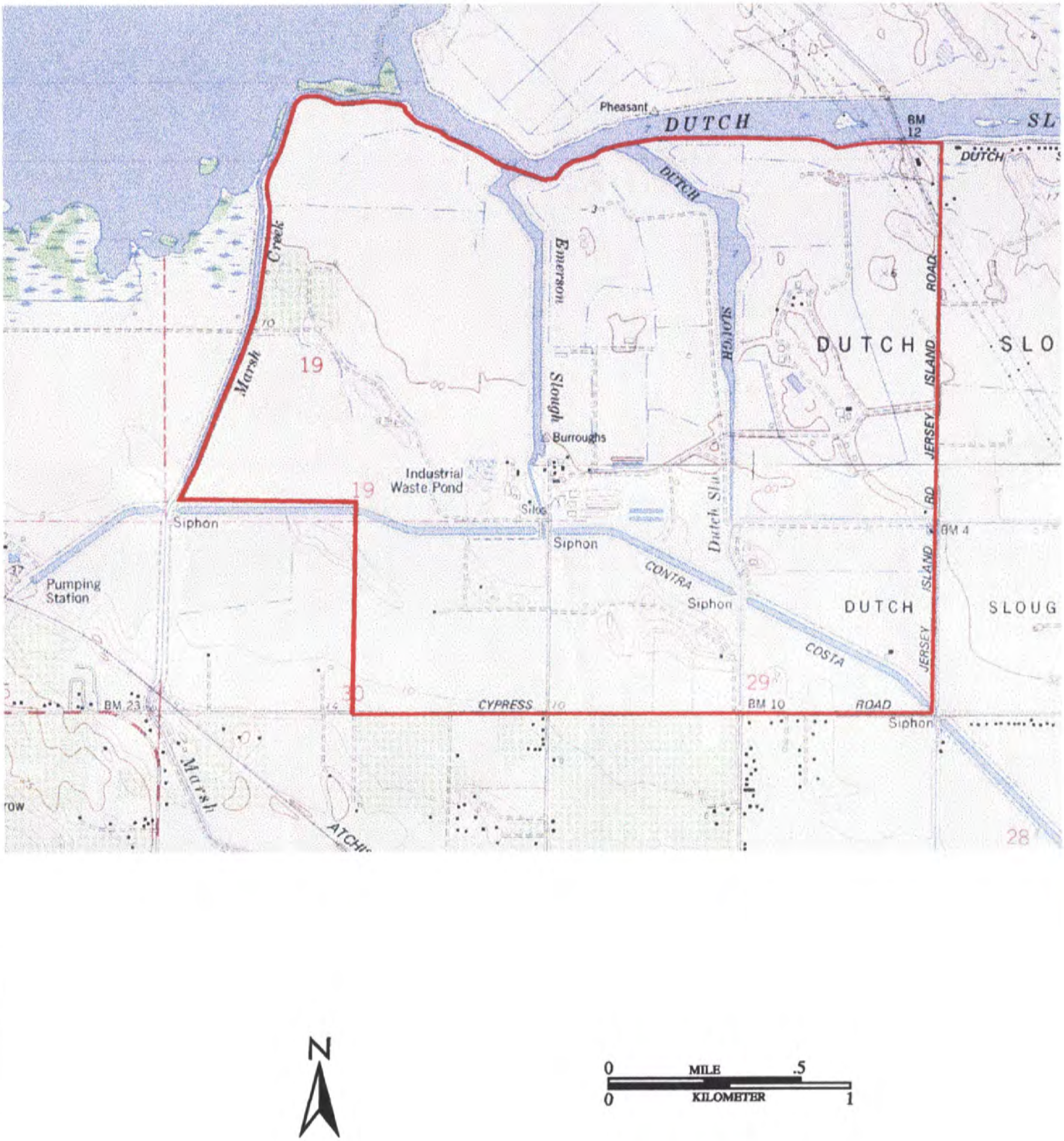
  Existing septic systems and domestic/irrigation wells should be removed/abandoned in accordance with county/state regulations.

APPENDIX A



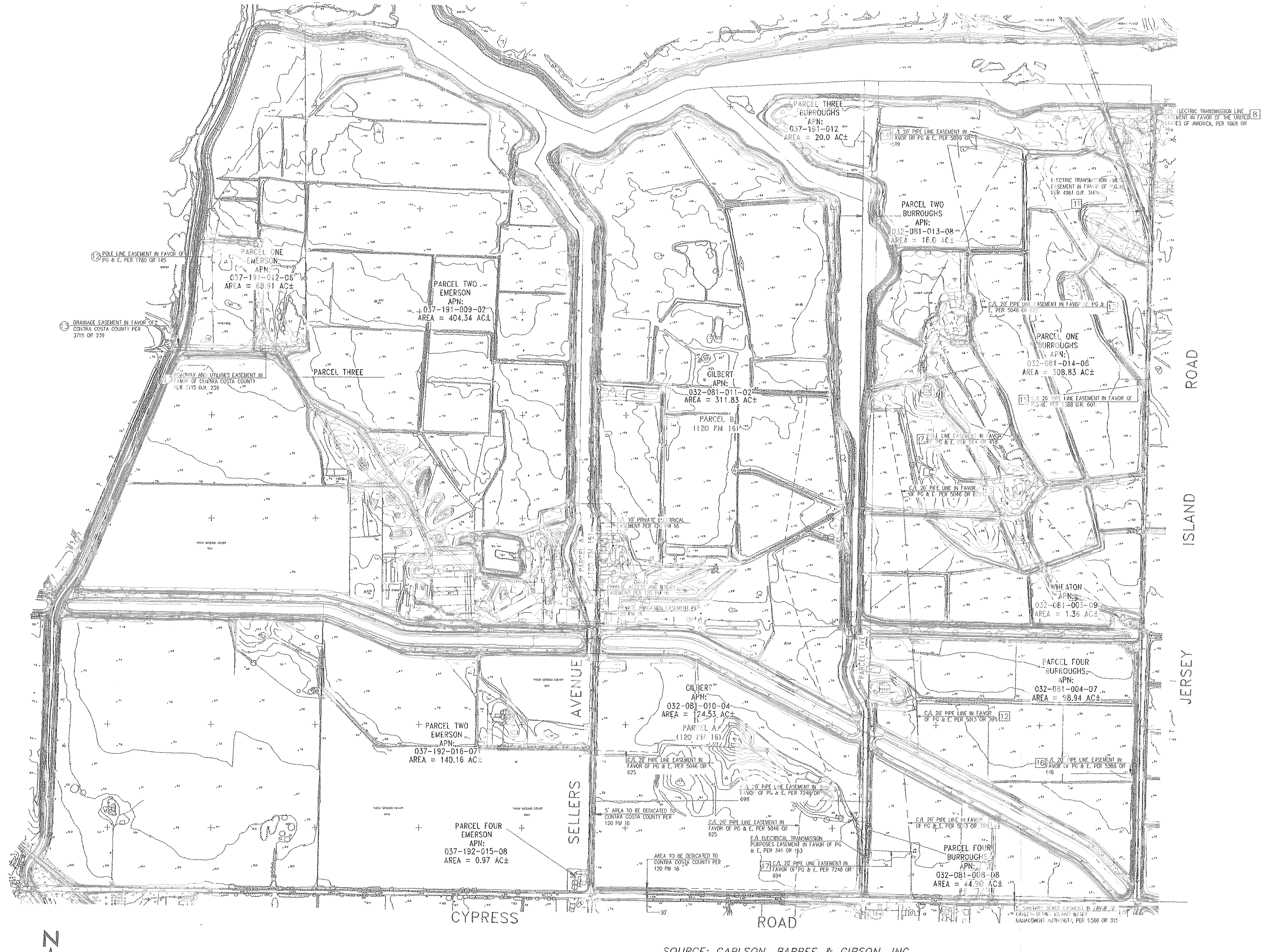
BASE: THOMAS BROTHERS

ENGEO INCORPORATED	**SITE LOCATION MAP** **EMERSON/BURROUGHS PROPERTIES-CYPRESS CORRIDOR** **OAKLEY, CALIFORNIA**	PROJECT NO.: **4603.3.001.01** DATE: **AUGUST 1999** DRAWN BY: JB CHECKED BY: SM	FIGURE NO. **1**



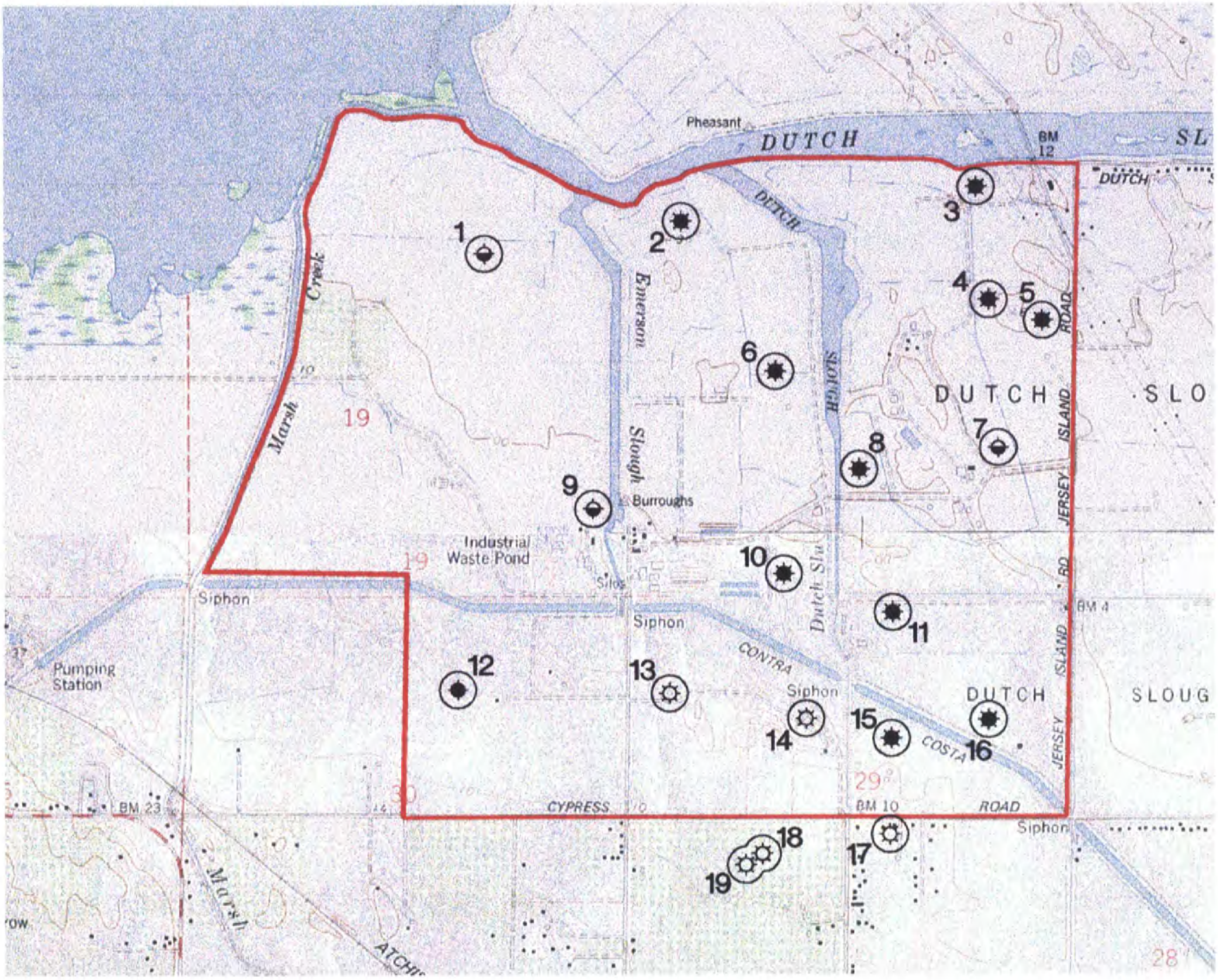
BASE: USGS

ENGEO INCORPORATED	SITE TOPOGRAPHY EMERSON/BURROUGHS PROPERTIES-CYPRESS CORRIDOR OAKLEY, CALIFORNIA	PROJECT NO.: 4603.3.001.01 DATE: AUGUST 1999 DRAWN BY: [signature] CHECKED BY: [signature]	FIGURE NO. 2

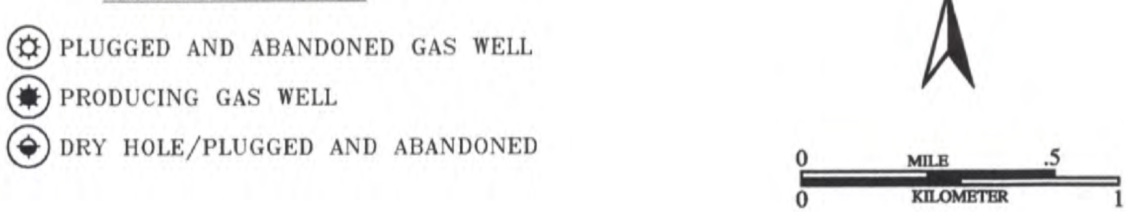


SOURCE: CARLSON, BARBEE & GIBSON, INC.

ENGEO INCORPORATED	RECORD BOUNDARY EMERSON/BURROUGHS PROPERTIES-CYPRESS CORRIDOR OAKLEY, CALIFORNIA	PROJECT NO.: 4603.3.001.01 DATE: AUGUST 1999 DRAWN BY:	CHECKED BY:	FIGURE NO. 3



EXPLANATION



BASE: USGS

ENGEO INCORPORATED	NATURAL GAS WELL SITES EMERSON/BURROUGHS PROPERTIES-CYPRESS CORRIDOR OAKLEY, CALIFORNIA	PROJECT NO.: 4603.3.001.01 DATE: AUGUST 1999 DRAWN BY: JB CHECKED BY: SM	FIGURE NO. 4

MAINTENANCE SHED

CAR PORT/GARAGE

ABOVE GROUND TANKS

BURROUGHS BARN

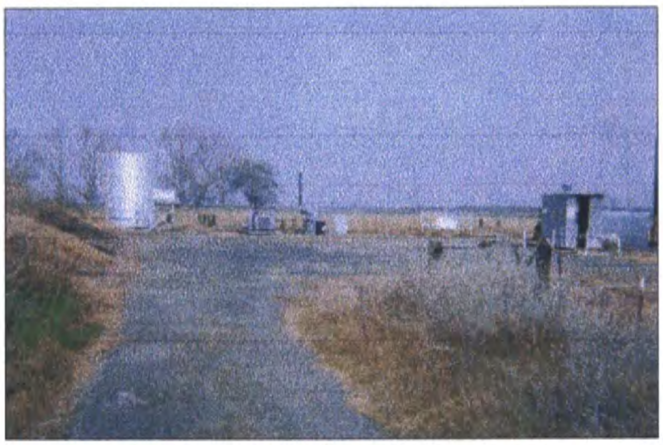
WELL SITE NO.7

BURROUGHS DAIRY FACILITIES

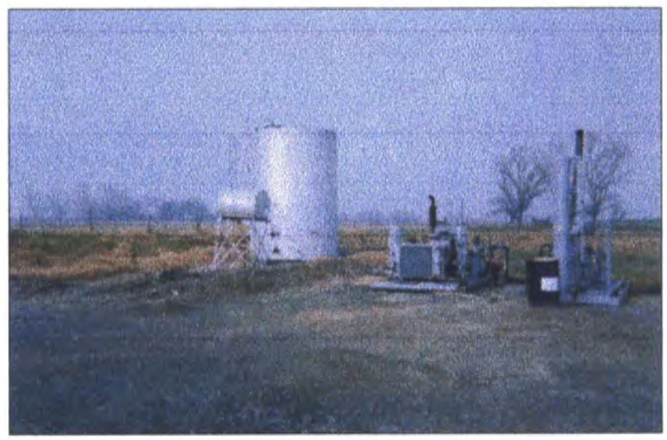
ENGEO INCORPORATED	SITE PHOTOGRAPHS BURROUGHS PROPERTY-CYPRESS CORRIDOR OAKLEY, CALIFORNIA	PROJECT NO.: 4603.3.001.01 DATE: AUGUST 1999 DRAWN BY: JB CHECKED BY: SM	FIGURE NO. 5

BURROUGHS DAIRY FACILITIES

BARN/SILOS - BUROUGHS DAIRY

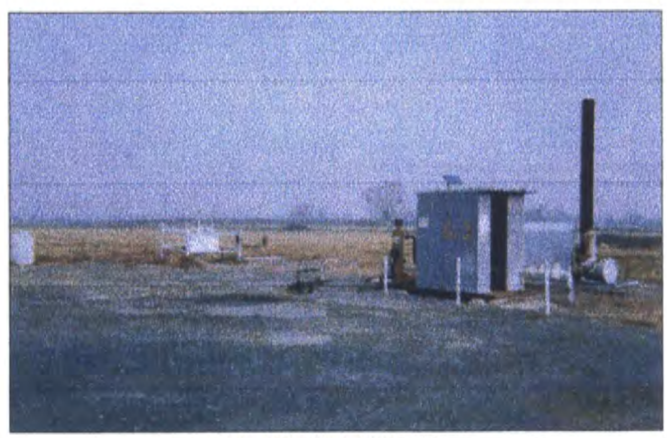


WELL SITE NO. 5



WELL SITE NO 5

WELL SITE NO. 11

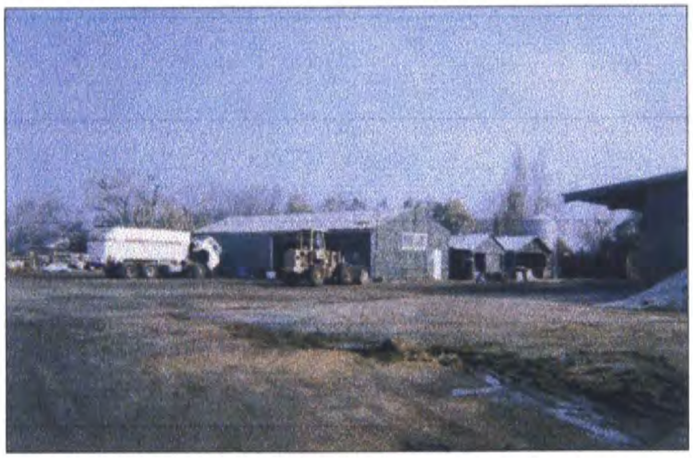


WELL SITE NO. 11

ENGEO INCORPORATED

SITE PHOTOGRAPHS
BURROUGHS PROPERTY-CYPRESS CORRIDOR
OAKLEY, CALIFORNIA

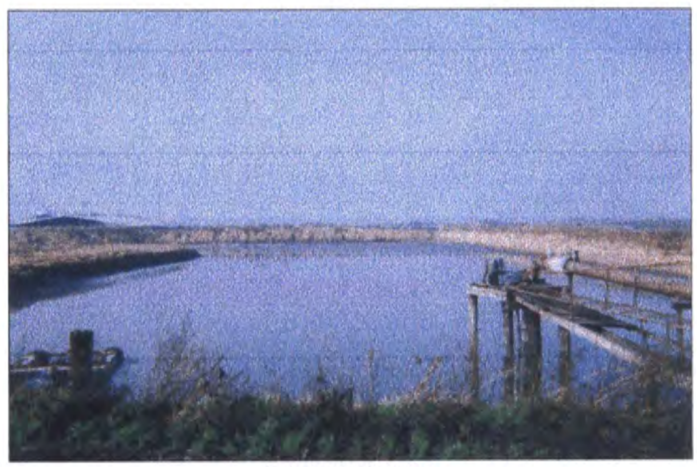
PROJECT NO.: 4603.3.001.01	FIGURE NO. 6
DATE: AUGUST 1999	
DRAWN BY: JB	CHECKED BY: SM



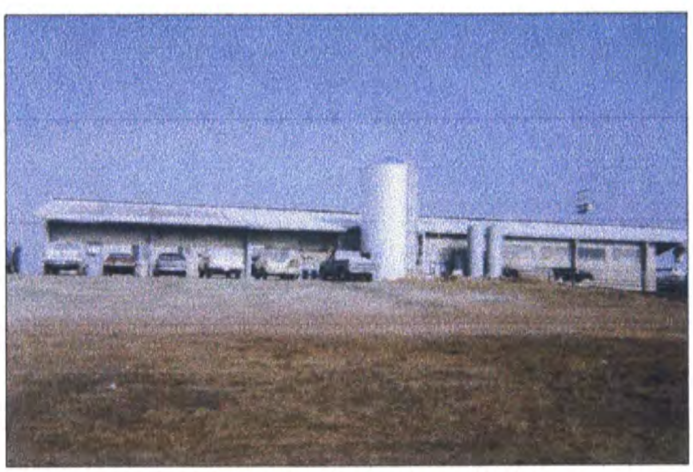
MAINTENANCE SHED

WASTE OIL TANK

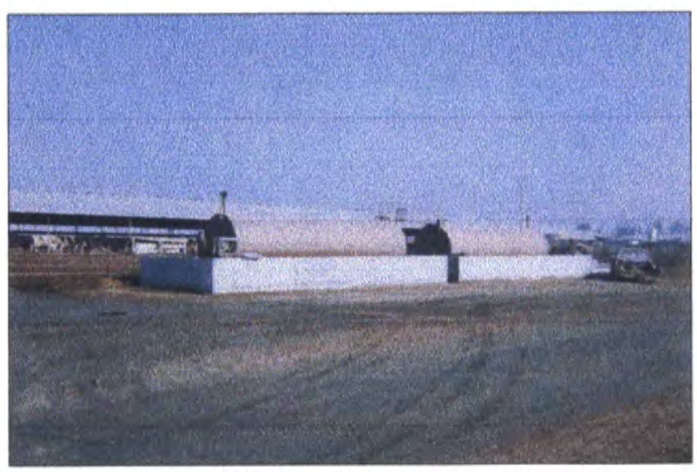
FORMER UST LOCATION



DAIRY POND



WESTERN DAIRY FACILITY



AGT COMPOUND

ENGEO INCORPORATED	SITE PHOTOGRAPHS EMERSON PROPERTY-CYPRESS CORRIDOR OAKLEY, CALIFORNIA	PROJECT NO.: 4603.3.001.01 DATE: AUGUST 1999 DRAWN BY: JB CHECKED BY: SM	FIGURE NO. 7

APPENDIX B

EDR Sanborn Map Report/Radius Report

4594.3.001.01
August 23, 1999

Environmental Data Resources, Inc.
an edr company
"Linking Technology with Tradition"

Sanborn™ Map Report

Ship to:

Shawn Munger
ENGEO Inc.
2401 Crow Canyon Road
San Ramon, CA 94583

Order Date: 11/16/98 **Completion Date:** 11/16/98
Inquiry #: 312391-2
P.O. #: 4603.500.01
Site Name: Cypress Corridor
Address: Cypress Corridor
City/State: Oakley, CA 94561
Cross Streets:

1018035PEK 510-838-1600

This document reports that the largest and most complete collection of Sanborn fire insurance maps has been reviewed based on client-supplied information, and fire insurance maps depicting the target property at the specified address were not identified.

NO COVERAGE

The EDR-Radius Map
with GeoCheck®

Cypress Corridor
Cypress Avenue
Oakley, CA 94561

Inquiry Number: 0312391.1r

November 17, 1998

EDR® Environmental Data Resources, Inc.
an edr company

The Source
For Environmental
Risk Management
Data

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-97. Search distances are per ASTM standard or custom distances requested by the user.

The address of the subject property for which the search was intended is:

CYPRESS AVENUE
OAKLEY, CA 94561

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-97 search radius around the subject property for the following Databases:

NPL:........................ National Priority List
Delisted NPL:................ NPL Deletions
RCRIS-TSD:................... Resource Conservation and Recovery Information System
Notify 65:................... Notify 65
Toxic Pits:.................. Toxic Pits
CERC-NFRAP:.................. Comprehensive Environmental Response, Compensation, and Liability Information System
CORRACTS:.................... Corrective Action Report
SWF/LF:...................... State Landfill
AST:......................... Aboveground Petroleum Storage Tank Facilities
RAATS:....................... RCRA Administrative Action Tracking System
WMUDS:....................... WMUDS/SWAT
RCRIS-LQG:................... Resource Conservation and Recovery Information System
HMIRS:....................... Hazardous Materials Information Reporting System
PADS:........................ PCB Activity Database System
ERNS:........................ Emergency Response Notification System
FINDS:....................... Facility Index System
TRIS:........................ Toxic Chemical Release Inventory System
TSCA:........................ Toxic Substances Control Act
MLTS:........................ Material Licensing Tracking System
NPL Lien:.................... NPL Liens
ROD:......................... ROD
CONSENT:..................... Superfund (CERCLA) Consent Decrees
Ca. WDS:...................... CA WDS
S Bay Reg. 2:................ South Bay Region 2
Coal Gas:.................... Former Manufactured gas (Coal Gas) Sites.

Unmapped (orphan) sites are not considered in the foregoing analysis.

Search Results:

Search results for the subject property and the search radius, are listed below:

Subject Property:

The subject property was not listed in any of the databases searched by EDR.

EXECUTIVE SUMMARY

Surrounding Properties:

Elevations have been determined from the USGS 1 degree Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. EDR's definition of a site with an elevation equal to the subject property includes a tolerance of -10 feet. Sites with an elevation equal to or higher than the subject property have been differentiated below from sites with an elevation lower than the subject property (by more than 10 feet). Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

AWP: California DTSC's Annual Workplan, formerly known as BEP, identifies known hazardous substance sites targeted for cleanup. The source is the California Environmental Protection Agency.

A review of the AWP list, as provided by EDR, has revealed that there is 1 AWP site within approximately 3 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
COOK BATTERY (OAKLEY BATTERY)	***139 HILL AVE***	***>2***	***SSW***	***E19***	***14***

CAL-SITES: Formerly known as ASPIS, this database contains both known and potential hazardous substance sites. The source is the California Department of Toxic Substance Control.

A review of the Cal-Sites list, as provided by EDR, has revealed that there is 1 Cal-Sites site within approximately 3 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
COOK BATTERY (OAKLEY BATTERY)	***139 HILL AVE***	***>2***	***SSW***	***E19***	***14***

CHMIRS: The California Hazardous Material Incident Report System contains information on reported hazardous material incidents, i.e., accidental releases or spills. The source is the California Office of Emergency Services.

A review of the CHMIRS list, as provided by EDR, and dated 12/31/1994 has revealed that there are 3 CHMIRS sites within approximately 3 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
Not reported	HIGHWAY 4 / CYPRESS R	1 - 2	WSW	A6	10
Not reported	HWY 4/MALICOAT AVE	>2	SW	F25	20
Not reported	70AA RT 4 DOUGLAS ROAD	>2	SSW	F33	23

CORTESE: This database identifies public drinking water wells with detectable levels of contamination, hazardous substance sites selected for remedial action, sites with known toxic material identified through the abandoned site assessment program, sites with USTs having a reportable release and all solid waste disposal facilities from which there is known migration. The source is the California Environmental Protection Agency/Office of Emergency Information.

A review of the Cortese list, as provided by EDR, has revealed that there are 3 Cortese sites within approximately 3 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
SAVER'S SS	***4 HWY (2323)***	***>2***	***W***	***45***	***27***

EXECUTIVE SUMMARY

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
OAKLEY BUILDERS SUPPLY	MAIN ST (800)	>2	W	46	28
A & A MARKET (PREVIOUSLY)	*MAIN ST (407)*	*>2*	*W*	*47*	*28*

CERCLIS: The Comprehensive Environmental Response, Compensation and Liability Information System contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).
CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

A review of the CERCLIS list, as provided by EDR, and dated 08/27/1998 has revealed that there is 1 CERCLIS site within approximately 2.5 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
COOKS BATTERY SITE	*138 HILL AVE*	*>2*	*SSW*	*E29*	*22*

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the State Water Resources Control Board Leaking Underground Storage Tank Information System.

A review of the LUST list, as provided by EDR, and dated 04/01/1998 has revealed that there are 3 LUST sites within approximately 2.5 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
FOOD & LIQUOR #86	HWY 4/CYPRESS	1 - 2	WSW	A5	10
OAKLEY BUILDERS SUPPLY	*800 MAIN ST. HWY #4*	*>2*	*W*	*42*	*26*
SAVER'S SS	*4 HWY (2323)*	*>2*	*W*	*45*	*27*

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the State Water Resources Control Board's Hazardous Substance Storage Container Database.

A review of the UST list, as provided by EDR, and dated 10/15/1990 has revealed that there are 8 UST sites within approximately 2.25 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
DELBARBA RANCH	RT. 4 BOX 351 ROSE AVE.	1 - 2	WSW	13	12
PACIFIC BELL	*232 STAR ST*	*>2*	*W*	*D16*	*13*
OAKLEY FIRE DEPARTMENT	2ND & RUBY STREET	>2	W	D21	18
OAKLEY FIRE DEPARTMENT STATION	2ND AND RUBY STREET	>2	W	G32	23
CHARLES & GLADY PETERSON	213 O'HARA AVE. P.O. BO	>2	W	G37	24
KNIGHTSEN FIRE STATION 94	2ND AND A STREET	>2	S	41	25
OAKLEY BUILDERS SUPPLY	*800 MAIN ST. HWY #4*	*>2*	*W*	*42*	*26*
DE FREMERY RANCH	SELLERS AVE 1/4 MI. SO	>2	S	I43	26

EXECUTIVE SUMMARY

CA FID: The Facility Inventory Database contains active and inactive underground storage tank locations. The source is the State Water Resource Control Board.

A review of the Ca. FID list, as provided by EDR, has revealed that there is 1 Ca. FID site within approximately 2.25 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
NORMAN'S BRENTWOOD NURSERY	*RR 3 BOX 526HWY4*	*>2*	*W*	*H39*	*25*

HAZNET: The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000-1,000,000 annually, representing approximately 350,000-500,000 shipments. Data from non-California manifests & continuation sheets are not included at the present time. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, & disposal method. The source is the Department of Toxic Substance Control is the agency

A review of the HAZNET list, as provided by EDR, has revealed that there are 6 HAZNET sites within approximately 2.25 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
BRENTWOOD CHIROPRACTIC	3440 BRENTWOOD BLVD	1 - 2	SW	12	11
CRAFTSMAN'S AUTO BODY	3850 MAIN ST	>2	W	C23	19
OAKLEY VETERINARY HOSPITAL	3807 MAIN ST	>2	W	C24	19
LOYD ENGINEERING	3780 MAIN STREET	>2	W	C26	20
P G & E	3765 MAIN ST	>2	W	C28	21
OAKLEY CHIROPRACTIC CLINIC	3478 MAIN ST	>2	W	H35	24

RCRIS: The Resource Conservation and Recovery Act database includes selected information on sites that generate, store, treat, or dispose of hazardous waste as defined by the Act. The source of this database is the U.S. EPA.

A review of the RCRIS-SQG list, as provided by EDR, and dated 07/01/1998 has revealed that there is 1 RCRIS-SQG site within approximately 2.25 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
PACIFIC BELL	*232 STAR ST*	*>2*	*W*	*D16*	*13*

CA SLIC: SLIC Region comes from the California Regional Water Quality Control Board.

A review of the CA SLIC list, as provided by EDR, has revealed that there is 1 CA SLIC site within approximately 2.5 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
COOKS BATTERY RECLAMATION SITE	139 HILL AVENUE, OAKLEY	>2	SSW	E18	14

BEP: Bond Expenditure Plan comes from the Department of Health Services.

A review of the Ca. BEP list, as provided by EDR, has revealed that there is 1 Ca. BEP site within approximately 3 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
COOK BATTERY RECLAMATION (OAKL	139 HILL AVENUE	>2	SSW	E20	18

EXECUTIVE SUMMARY

SL: Lists includes sites from the Underground Tank Program, Hazardous Waste Generator Program & Business Plan 12185 Program

A review of the Ca. SL list, as provided by EDR, has revealed that there are 23 Ca. SL sites within approximately 2.25 miles of the subject property.

Equal/Higher Elevation	Address	Dist / Dir		Map ID	Page
CCC PUBLIC WORKS DEPT	CYPRESS RD AT SELLERS	1/2 - 1	SSW	1	9
TEXACO INC	JERSEY ISLAND RD/CYPRES	1 - 2	SE	2	9
BENNETT RESIDENCE	MACHADO LANE 4253	1 - 2	SSW	3	9
S & S GAS FOOD & LIQUOR	CYPRESS RD E 101	1 - 2	SW	4	9
CELONI SERVICE STATION	CYPRESS RD W 440	1 - 2	WSW	7	10
A & A AUTO PARTS & SALES	BRENTWOOD BLVD 6240	1 - 2	WSW	B8	10
DISCO BAY DETAIL/DELTA	BRENTWOOD BLVD 6330	1 - 2	WSW	B9	11
H & M AUTO DISMANTLERS	MAIN ST 5740	1 - 2	WSW	B10	11
WAPA/CC SUBSTATION #1	HWY 4 / ROSE AVE	1 - 2	WSW	11	11
PACIFIC BELL/OAKLEY	STAR ST 301	1 - 2	WSW	14	13
OAKLEY SPORTS	MAIN 3903	>2	W	C15	13
LARRY'S AUTO & ELECTRIC	2ND ST 120	>2	W	C17	14
CONTRA COSTA FIRE STA #93	2ND ST 215	>2	W	D22	18
PACIFIC BELL MOBILE	MAIN ST 3775	>2	W	C27	21
WEIL PROPERTY	ACME ST E 115	>2	W	C30	22
OAKLEY 1 HOUR CLEANERS	MAIN ST 3647	>2	W	C31	23
LENA'S ANTIQUES	MAIN ST 3530	>2	W	H34	23
CHEAPER #169	MAIN ST 3475	>2	W	H36	24
CUTINOS FEED & TIRE CENTER	MAIN ST (HWY 4) 500	>2	W	H38	24
NORMAN'S BRENTWOOD NURSERY	*RR 3 BOX 526HWY4*	*>2*	*W*	*H39*	*25*
B & N AUTOMOTIVE SERVICE	BOLTON RD E 23	>2	SSW	40	25
OAKLEY BUILDERS SUPPLY	*800 MAIN ST. HWY #4*	*>2*	*W*	*42*	*26*
QUINTANA PETROLEUM CORP	SELLERS / DELTA RD	>2	S	I44	27

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
GEOTHERMAL INDUSTRIES INC	RCRIS-SQG, FINDS, CORRACTS, CERC-NFRAP
BELLO RANCH	UST
9-1 GAS WELL	UST
PAUL SOMERHALDER	UST
BRUCE SOMERHALDER	UST
KNIGHTSEN FIRE STATION	UST
DANTE MASSONI	UST
OAKLEY TRUCK & TRACTOR REPAIR	UST, Ca. SL
ROBERT DAL PORTO	UST
OAKLEY RANCH	UST, Ca. SL
EMERSON DAIRY	UST
STACY TRUCKING	RCRIS-SQG, FINDS, UST
SILVIO DELL'ANTICO	UST, Ca. SL
ALFRED OR DARLENE DEJESUS	UST
1X BRIDGEHEAD INC	HAZNET
CONTRA COSTA FIRE STA #94	Ca. SL
PG&E 9-1 GAS WELL	Ca. SL
SOMERHALDER, PAUL	Ca. SL
BELLO RANCH	Ca. SL
SOMERHALDER, BRUCE	Ca. SL
KNIGHTSEN POST OFFICE	Ca. SL
KNIGHTSEN BOAT WORKS	Ca. SL
MASSONI, DANTE	Ca. SL
NGC-CESA #1	Ca. SL
OAKLEY MUFFLER	Ca. SL
DAL PORTO, ROBERT	Ca. SL
KENNEDY, HOOVER E.	Ca. SL
BLUE STAR GAS MART	Ca. SL
DOC'S MARINA	Ca. SL
RICH LADEIRA TRUCKING INC	Ca. SL
OAKLEY HOTEL	Ca. SL
G & E SALES AND RENTAL	Ca. SL
SHOSHONE OIL CORPORATION	Ca. SL
COUNTRY INVESTORS	Ca. SL
DELBARBA RANCH	Ca. SL
DEJESUS, JOHN V.	Ca. SL
BACCHINI RANCH	Ca. SL
EMERSON DAIRY	Ca. SL
SUNSET EXPL NGC-NUNN 1&2	Ca. SL
WESTERN CONT'L NGC-KYSH-1	Ca. SL
MIKE BOYD TRANSPORT	Ca. SL

TOPOGRAPHIC MAP - 0312391.1r - ENGEO Inc.

- Major Roads
- Contour Lines
- Waterways
- Earthquake Fault Lines
- Earthquake epicenter, Richter 5 or greater
- Closest Federal Well in quadrant
- Closest State Well in quadrant
- Closest Public Water Supply Well
- Closest Hydrogeological Data
- Oil, gas or related wells

TARGET PROPERTY:	Cypress Corridor	CUSTOMER:	ENGEO Inc.
ADDRESS:	Cypress Avenue	CONTACT:	Shawn Munger
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	0312391.1r
LAT/LONG:	38.0015 / 121.6749	DATE:	November 17, 1998 4:09 pm

GEOCHECK VERSION 2.1
SUMMARY

TARGET PROPERTY COORDINATES

Latitude (North):	38.001499 - 38° 0' 5.4"
Longitude (West):	121.674896 - 121° 40' 29.6"
Universal Transverse Mercator:	Zone 10
UTM X (Meters):	-8249783.0
UTM Y (Meters):	19198726.0

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property: 2438121-A6 JERSEY ISLAND, CA

GEOLOGIC AGE IDENTIFICATION†

Geologic Code:	Q
Era:	Cenozoic
System:	Quaternary
Series:	Quaternary

ROCK STRATIGRAPHIC UNIT†

Category: Stratifed Sequence

GROUNDWATER FLOW INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, including well data collected on nearby properties, regional groundwater flow information (from deep aquifers), or surface topography.‡

AQUIFLOW™** Search Radius: 2.000 Miles

MAP ID	DISTANCE FROM TP	DIRECTION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported			

General Topographic Gradient at Target Property: General North
General Hydrogeologic Gradient at Target Property: No hydrogeologic data available.
Site-Specific Hydrogeological Data*:
Search Radius: 2.0 miles
Status: Not found

FEDERAL DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	LITHOLOGY	DEPTH TO WATER TABLE
Northern	1 - 2 Miles	Not Reported	5 ft.
Eastern	1/2 - 1 Mile	Not Reported	Not Reported
Southern	1/8 - 1/4 Mile	Not Reported	Not Reported
Western	1 - 2 Miles	Not Reported	48 ft.

STATE DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP
Northern	1 - 2 Miles
Eastern	1 - 2 Miles
Southern	1 - 2 Miles
Western	1 - 2 Miles

† Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).
‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a,Chapter 4, page 78, September 1990.
** EDR AQUIFLOW™ information System of hydrogeologically determined groundwater flow directions at specific locations. See the date pages at the end of this report for a complete description.

GEOCHECK VERSION 2.1
SUMMARY

STATE OIL/GAS WELL INFORMATION

API #	DISTANCE FROM TP
NO WELLS FOUND	

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.
NOTE: PWS System location is not always the same as well location.

PWS Name: BRIDGEHEAD RENTALS SWS
MAURICE AND GENEVA LODGE
5540 HIGHWAY
OAKLEY, CA 94561

Location Relative to TP: >2 Miles West
PWS currently has or has had major violation(s): Yes

AREA RADON INFORMATION

EPA Radon Zone for CONTRA COSTA County: 2

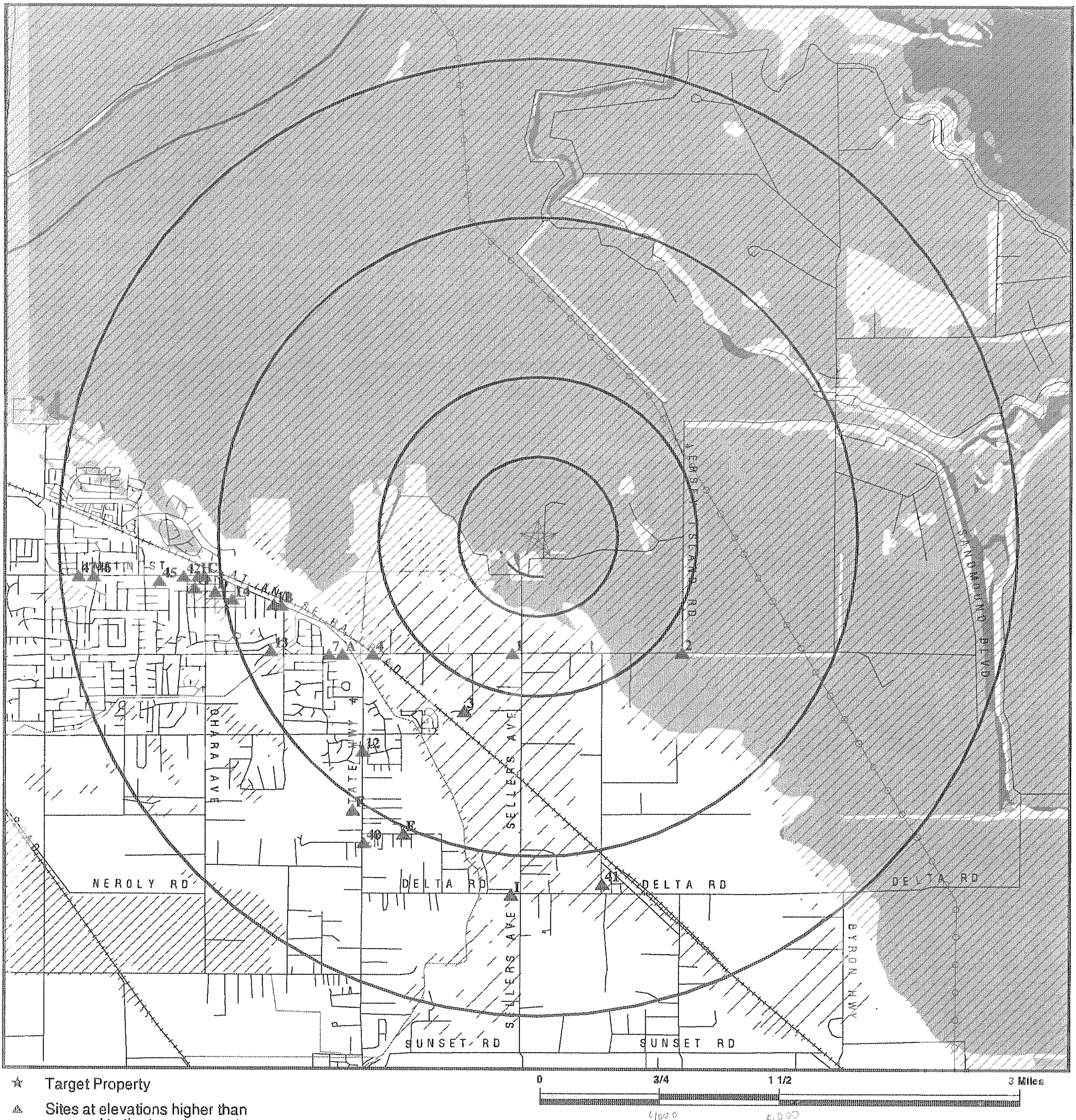
Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

CONTRA COSTA COUNTY, CA

Number of sites tested: 55

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.760 pCi/L	100%	0%	0%
Living Area - 2nd Floor	0.300 pCi/L	100%	0%	0%
Basement	0.525 pCi/L	100%	0%	0%

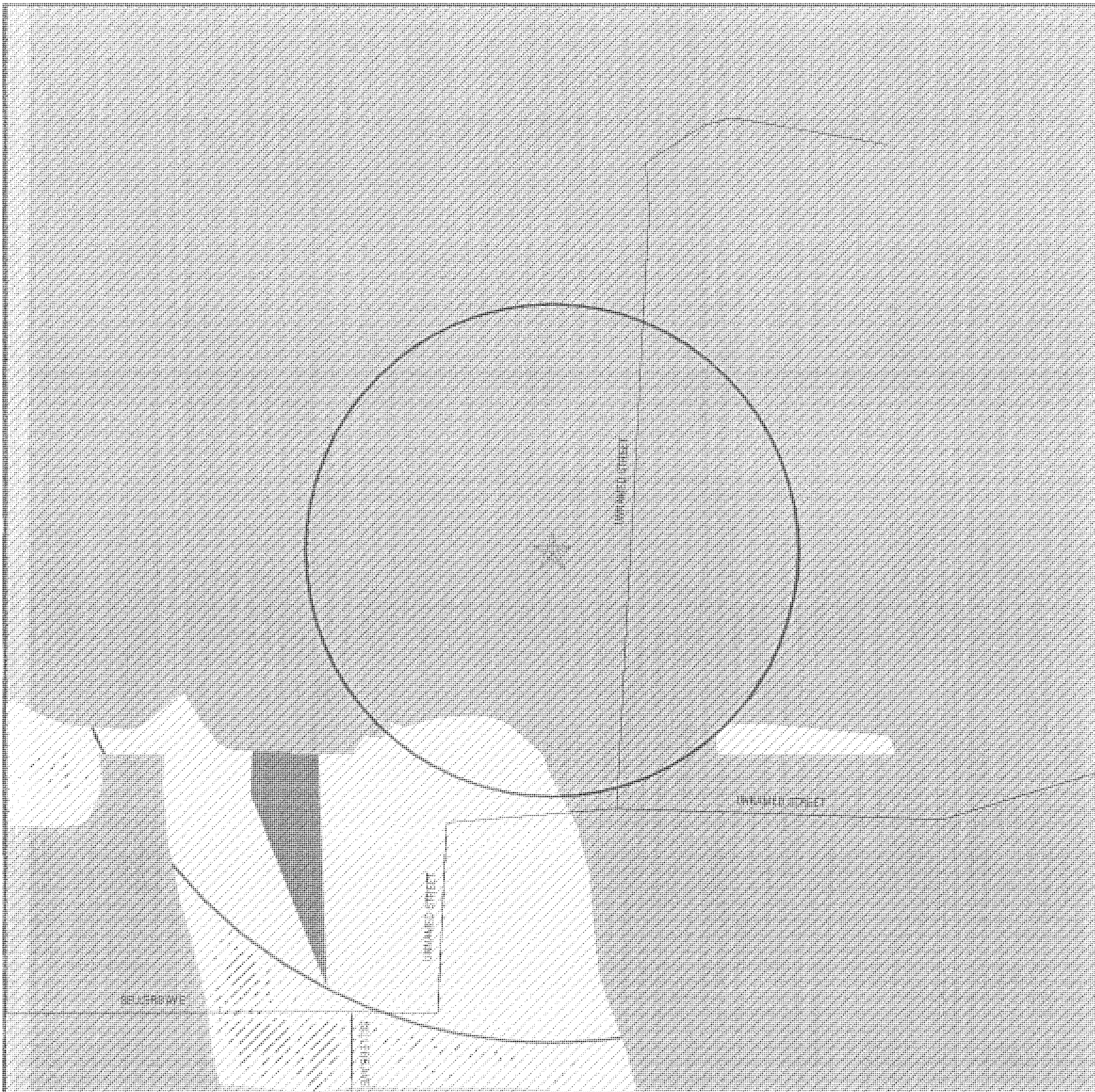
OVERVIEW MAP - 0312391.1r - ENGEO Inc.



- ☆ Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Wetlands per National Wetlands Inventory (1994)

TARGET PROPERTY:	Cypress Corridor	CUSTOMER:	ENGEO Inc.
ADDRESS:	Cypress Avenue	CONTACT:	Shawn Munger
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	0312391.1r
LAT/LONG:	38.0015 / 121.6749	DATE:	November 17, 1998 4:06 pm

DETAIL MAP - 0312391.1r - ENGEO Inc.



0 1/16 1/8 1/4 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- Sensitive Receptors
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Wetlands per National Wetlands Inventory (1994)

TARGET PROPERTY:	Cypress Corridor	CUSTOMER:	ENGEO Inc.
ADDRESS:	Cypress Avenue	CONTACT:	Shawn Munger
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	0312391.1r
LAT/LONG:	38.0015 / 121.6749	DATE:	November 17, 1998 4:08 pm

MAP FINDINGS SUMMARY SHOWING ALL SITES

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		3.000	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		2.500	0	0	0	0	0	0
AWP		3.000	0	0	0	0	1	1
Cal-Sites		3.000	0	0	0	0	1	1
Notify 65		3.000	0	0	0	0	0	0
CHMIRS		3.000	0	0	0	0	3	3
Cortese		3.000	0	0	0	0	3	3
Toxic Pits		3.000	0	0	0	0	0	0
CERCLIS		2.500	0	0	0	0	1	1
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		3.000	0	0	0	0	0	0
State Landfill		2.500	0	0	0	0	0	0
LUST		2.500	0	0	0	0	3	3
UST		2.250	0	0	0	0	8	8
CA FID		2.250	0	0	0	0	1	1
AST		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
WMUDS/SWAT		2.500	0	0	0	0	0	0
HAZNET		2.250	0	0	0	0	6	6
RCRIS Sm. Quan. Gen.		2.250	0	0	0	0	1	1
RCRIS Lg. Quan. Gen.		2.250	0	0	0	0	0	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
CA SLIC		2.500	0	0	0	0	1	1
CA Bond Exp. Plan		3.000	0	0	0	0	1	1
ROD		3.000	0	0	0	0	0	0
CONSENT		3.000	0	0	0	0	0	0
CA WDS		TP	NR	NR	NR	NR	NR	0
Site List		2.250	0	0	0	1	22	23
South Bay Region 2		TP	NR	NR	NR	NR	NR	0
Coal Gas		2.000	0	0	0	0	0	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

MAP FINDINGS SUMMARY SHOWING
ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		3.000	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		2.500	0	0	0	0	0	0
AWP		3.000	0	0	0	0	1	1
Cal-Sites		3.000	0	0	0	0	1	1
Notify 65		3.000	0	0	0	0	0	0
CHMIRS		3.000	0	0	0	0	3	3
Cortese		3.000	0	0	0	0	3	3
Toxic Pits		3.000	0	0	0	0	0	0
CERCLIS		2.500	0	0	0	0	1	1
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		3.000	0	0	0	0	0	0
State Landfill		2.500	0	0	0	0	0	0
LUST		2.500	0	0	0	0	3	3
UST		2.250	0	0	0	0	8	8
CA FID		2.250	0	0	0	0	1	1
AST		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
WMUDS/SWAT		2.500	0	0	0	0	0	0
HAZNET		2.250	0	0	0	0	6	6
RCRIS Sm. Quan. Gen.		2.250	0	0	0	0	1	1
RCRIS Lg. Quan. Gen.		2.250	0	0	0	0	0	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
CA SLIC		2.500	0	0	0	0	1	1
CA Bond Exp. Plan		3.000	0	0	0	0	1	1
ROD		3.000	0	0	0	0	0	0
CONSENT		3.000	0	0	0	0	0	0
CA WDS		TP	NR	NR	NR	NR	NR	0
Site List		2.250	0	0	0	1	22	23
South Bay Region 2		TP	NR	NR	NR	NR	NR	0
Coal Gas		2.000	0	0	0	0	0	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

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1 **SSW** **1/2-1** **Higher**	**CCC PUBLIC WORKS DEPT** **CYPRESS RD AT SELLERS** **OAKLEY, CA**	**Ca. SL**	**S102261382** **N/A**

Contra Costa SL:
Facility ID: 71982
Telephone: (510) 313-2323
Region: CNTRACSTA
Program Status:
UST: Inactive
HWG: Not reported
BUSP: Not reported

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2 **SE** **> 1** **Higher**	**TEXACO INC** **JERSEY ISLAND RD/CYPRESS** **OAKLEY, CA**	**Ca. SL**	**S103172295** **N/A**

Contra Costa SL:
Facility ID: 72103
Telephone: (805) 392-2478
Region: CNTRACSTA
Program Status:
UST: Not reported
HWG: Not reported
BUSP: Active

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3 **SSW** **> 1** **Higher**	**BENNETT RESIDENCE** **MACHADO LANE 4253** **OAKLEY, CA**	**Ca. SL**	**S102261395** **N/A**

Contra Costa SL:
Facility ID: 71792
Telephone: Not reported
Region: CNTRACSTA
Program Status:
UST: Inactive
HWG: Not reported
BUSP: Not reported

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4 **SW** **> 1** **Higher**	**S & S GAS FOOD & LIQUOR** **CYPRESS RD E 101** **OAKLEY, CA**	**Ca. SL**	**S102261383** **N/A**

Contra Costa SL:
Facility ID: 70155
Telephone: (510) 625-1126
Region: CNTRACSTA
Program Status:
UST: Active
HWG: Not reported
BUSP: Active

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A5 **WSW** **> 1** **Higher**	**FOOD & LIQUOR #86** **HWY 4/CYPRESS** **OAKLEY, CA 94561**	**LUST**	**S102430092** **N/A**

LUST Region 5:

Respble Party:	CUSTOMER COMPANY	Substance:	GASOLINE
Case Type:	Soil only		
Pilot Program:	No		
Staff Initials:	EAT	Case Number:	070041
Status:	Case Closed by Regional Board		
MTBE:	Not reported	Lead Agency:	Regional

A6 **WSW** **> 1** **Higher**	**HIGHWAY 4 / CYPRESS RD.** **OAKLEY, CA 94561**	**CHMIRS**	**S100218535** **N/A**

CHMIRS:

OES Control Number:	8910409	DOT ID:	Not reported
DOT Hazard Class:	Not Reported		
Chemical Name:	UNKNOWN		
Extent of Release:	Not reported		
CAS Number:	Not reported	Quantity Released:	Not reported
Environmental Contamination:	None Reported	Property Use:	Lake/Pond/River
Incident Date:	20-MAY-89	Date Completed:	20-MAY-89

7 **WSW** **> 1** **Higher**	**CELONI SERVICE STATION** **CYPRESS RD W 440** **OAKLEY, CA**	**Ca. SL**	**S102261385** **N/A**

Contra Costa SL:

Facility ID:	71028
Telephone:	(415) 625-3798
Region:	CNTRACSTA
Program Status:	
UST:	Inactive
HWG:	Not reported
BUSP:	Not reported

B8 **WSW** **> 1** **Higher**	**A & A AUTO PARTS & SALES** **BRENTWOOD BLVD 6240** **BRENTWOOD, CA**	**Ca. SL**	**S102260041** **N/A**

Contra Costa SL:

Facility ID:	38127
Telephone:	(925) 634-1188
Region:	CNTRACSTA
Program Status:	
UST:	Inactive
HWG:	Active
BUSP:	Active

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
B9 WSW > 1 Higher	**DISCO BAY DETAIL/DELTA BRENTWOOD BLVD 6330 BRENTWOOD, CA**	**Ca. SL**	**S102260042 N/A**

Contra Costa SL:
- Facility ID: 72236
- Telephone: (510) 634-1883
- Region: CNTRACSTA
- Program Status:
  - UST: Not reported
  - HWG: Inactive
  - BUSP: Inactive

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
B10 WSW > 1 Higher	**H & M AUTO DISMANTLERS MAIN ST 5740 OAKLEY, CA**	**Ca. SL**	**S102261409 N/A**

Contra Costa SL:
- Facility ID: 71309
- Telephone: (510) 625-2100
- Region: CNTRACSTA
- Program Status:
  - UST: Inactive
  - HWG: Active
  - BUSP: Active

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
11 WSW > 1 Higher	**WAPA/CC SUBSTATION #1 HWY 4 / ROSE AVE OAKLEY, CA**	**Ca. SL**	**S102261388 N/A**

Contra Costa SL:
- Facility ID: 71810
- Telephone: (916) 649-4416
- Region: CNTRACSTA
- Program Status:
  - UST: Not reported
  - HWG: Not reported
  - BUSP: Active

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
12 SW > 1 Higher	**BRENTWOOD CHIROPRACTIC 3440 BRENTWOOD BLVD BRENTWOOD, CA**	**HAZNET**	**S100931097 N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

BRENTWOOD CHIROPRACTIC (Continued) **S100931097**

HAZNET:

Year:	1993		
Gepaid:	CAL921763657	Tepaid:	CAD070148432
Contact:	LOPEZ, LARRY	Telephone:	(510) 634-1101
Gen County:	Contra Costa	Tons:	Not reported
Tsd Name:	Not reported		
Tsd Address	Not reported		
	Not reported		
	Not reported		
Tsd County	Alameda		
Mailing Address:	3440 BRENTWOOD BLVD		
	SUITE C		
	BRENTWOOD, CA 94513		
Category:	Photochemicals/photoprocessing waste		
Disposal Method:	Not reported		

Year:	Not reported		
Gepaid:	CAL921763657	Tepaid:	CAD070148432
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	8
Tsd Name:	DREW RESOURCE CORP		
Tsd Address	1717 4TH ST		
	Not reported		
	BERKELEY		
Tsd County	Alameda		
Mailing Address:	Not reported		
	Not reported		
	Not reported		
Category:	Photochemicals/photoprocessing waste		
Disposal Method:	Disposal, other		

---

13 **DELBARBA RANCH** **UST** **U001597802**
WSW **RT. 4 BOX 351 ROSE AVE.** **N/A**
> 1 **OAKLEY, CA 94561**
Higher

State UST:

Facility ID:	37590		
Tank Num:	1	Container Num:	1
Tank Capacity:	550	Year Installed:	1955
Tank Used for:	PRODUCT		
Type of Fuel:	UNLEADED	Tank Constrctn:	Not reported
Leak Detection:			
Contact Name:	OWNER, PARTNER	Telephone:	(415) 625-3837
Total Tanks:	2	Region:	Not reported
Facility Type:	2	Other Type:	FARMING

Facility ID:	37590		
Tank Num:	2	Container Num:	2
Tank Capacity:	325	Year Installed:	1979
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	Not reported
Leak Detection:	None		
Contact Name:	OWNER, PARTNER	Telephone:	(415) 625-3837
Total Tanks:	2	Region:	Not reported
Facility Type:	2	Other Type:	FARMING

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
14 WSW > 1 Higher	**PACIFIC BELL/OAKLEY STAR ST 301 OAKLEY, CA**	**Ca. SL**	**S102261447 N/A**

Contra Costa SL:
Facility ID: 57570
Telephone: (510) 867-6869
Region: CNTRACSTA
Program Status:
UST: Active
HWG: Not reported
BUSP: Active

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
C15 West > 1 Higher	**OAKLEY SPORTS MAIN 3903 OAKLEY, CA**	**Ca. SL**	**S102261396 N/A**

Contra Costa SL:
Facility ID: 72045
Telephone: (510) 625-4390
Region: CNTRACSTA
Program Status:
UST: Not reported
HWG: Active
BUSP: Not reported

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
D16 West > 1 Higher	**PACIFIC BELL 232 STAR ST OAKLEY, CA 94561**	**FINDS RCRIS-SQG UST**	**1000251192 CAT080020258**

RCRIS:
Owner: THE PACIFIC TELEPHONE AND TELEGRAPH CO
(415) 555-1212

Contact: ENVIRONMENTAL MANAGER
(408) 491-6029

Record Date: 09/01/1996

Classification: Small Quantity Generator

Used Oil Recyc: No

Violation Status: No violations found

State UST:

Facility ID:	57570		
Tank Num:	1	Container Num:	1
Tank Capacity:	550	Year Installed:	1983
Tank Used for:	PRODUCT		
Type of Fuel:	DIESEL	Tank Constrctn:	Not reported
Leak Detection:	None		
Contact Name:	E.J. KOEHLER	Telephone:	(415) 542-6758
Total Tanks:	1	Region:	Not reported
Facility Type:	2	Other Type:	SIC 4800

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
C17 **West** **> 1** **Higher**	**LARRY'S AUTO & ELECTRIC** **2ND ST 120** **OAKLEY, CA**	**Ca. SL**	**S102261370** **N/A**

Contra Costa SL:
Facility ID: 72047
Telephone: (510) 625-0325
Region: CNTRACSTA
Program Status:
UST: Not reported
HWG: Active
BUSP: Not reported

E18 **SSW** **> 1** **Higher**	**COOKS BATTERY RECLAMATION SITE**** **139 HILL AVENUE, OAKLEY** **OAKLEY, CA**	**CA SLIC**	**S102680595** **N/A**

E19 **SSW** **> 1** **Higher**	**COOK BATTERY (OAKLEY BATTERY)** **139 HILL AVE** **OAKLEY, CA 94561**	**AWP** **Cal-Sites**	**S101272690** **N/A**

CAL-SITES:
Facility ID 07360035
Status: AWP
Status Date: 05/01/1986
Lead: DTSC
Region: 2 - BERKELEY
Branch: NC - NORTH COAST
File Name: Not reported
Status Name: ANNUAL WORKPLAN - ACTIVE SITE
Lead Agancy: DEPT OF TOXIC SUBSTANCES CONTROL
NPL: Not Listed
SIC: 36 MANU - ELECTRONIC & OTHER ELECTRIC EQUIP
Facility Type: STATE
Facility Type Name: STATE FUNDED SITE
Staff Member Responsible for Site: TTSE
Supervisor Responsible for Site: KTOTH
Region Water Control Board: CV - CENTRAL VALLEY
Access: Controlled
Cortese: C
Hazardous Ranking Score: 37.50
Date Site Hazard Ranked: 06221988
Groundwater Contamination: Suspected
No. of Contamintion Sources: 1
Lat/Long: 37° 58′ 27″ / 121° 41′ 19″
Lat/long Method: TEALE ADDRESS MATCH
State Assembly District Code: 15
State Senate District: 7
Activity: OPERATION & MAINTENANCE
Activity Status: ANNUAL WORKPLAN - ACTIVE SITE
Activity: CERTIFICATION
Activity Status: ANNUAL WORKPLAN - ACTIVE SITE
Activity: REMOVAL ACTION
Activity Status: ANNUAL WORKPLAN - ACTIVE SITE
Activity: DESIGN
Activity Status: ANNUAL WORKPLAN - ACTIVE SITE

COOK BATTERY (OAKLEY BATTERY) (Continued) **S101272690**

Activity:	REMOVAL ACTION WORKPLAN
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	CEQA INCLUDING NEGATIVE DECS
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	POTENTIAL RESPONSIBLE PARTY SEARCH
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	LONG-TERM SITE STABILIZATION CERTIFICATION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	POTENTIAL RESPONSIBLE PARTY SEARCH
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	FOCUSED REMEDIAL INVESTIGATION/FEASIBILITY STUDY
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	FOCUSED REMEDIAL INVESTIGATION/FEASIBILITY STUDY
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	REMOVAL ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	I/SE, IORSE, FFA, FFSRA, VCA, EA
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	FINAL DETERMINATION OF NON-COMPLIANCE
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	I/SE, IORSE, FFA, FFSRA, VCA, EA
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	EXPEDITED RESPONSE ACTION
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	I/SE, IORSE, FFA, FFSRA, VCA, EA
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	PRELIMINARY ASSESSMENT
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	SITE SCREENING
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Activity:	DISCOVERY
Activity Status:	ANNUAL WORKPLAN - ACTIVE SITE
Background:	The Cook Battery Reclamation site is located on 139 Hill Ave., Oakley and was used for a battery reclamation business in the 1950s and 1960s. Salvageable lead was removed from discarded automobile batteries. The site is a residential property located in a neighborhood with many families. High concentrations of lead are present in surface soils. Buried Battery casings have been found on and near the site. In June 1987, a preliminary assessment was completed. On September 1988, DHS issued fence and post order to the responsible parties (RPs). DHS fenced and posted the site in January 1989 after finding the RPs in non-compliance with the Fence and Post Order. On December 15, 1988, DHS issued an I/SE determination and in May 1989 issued Remedial Action Order to the RPs. None of the RPs complied with the orders. DHS conducted removal actions to reduce the human health risk that may result from the contamination on

COOK BATTERY (OAKLEY BATTERY) (Continued) S101272690

site. Between 1989 and 1991, DTSC excavated and disposed of the contaminated soil from the site and neighboring properties. In 1989, the highly contaminated soil from the Site and neighboring properties was excavated and disposed. In 1991, the contaminated soil was excavated, consolidated and covered with a chip-seal cap on the Cook property and Cook Court.
In May 1992, a ground penetrating radar investigation was conducted on Cook Court located next to the 139 Hill Ave. property. Battery casing was found buried beneath one house. DTSC removed most of the battery casing without damaging the foundation of the house. The remaining battery casing was covered with a concrete pad. Confirmation soil samples collected during the excavation indicated that the soil containing battery casing is below the cleanup level. Between December 1992 and June 1993, DTSC investigated and removed soil containing battery casings from a neighboring property. The soil including the battery casing was disposed of offsite.
In February 1994, DTSC working with the Contra Costa County building department demolished the abandoned house at 139 Hill Avenue. The debris was disposed of offsite. In August 1995, DTSC approved removal action workplan (RAW). Acidic soil on the 139 Hill Avenue property was neutralized with limestone, contaminated soil from the Cook Court was excavated and moved onto the site for consolidation, and the entire 139 Hill Avenue property was covered with an asphalt cap.
DTSC will implement operations and maintenance activities. Groundwater will be monitored and the asphalt cap will be inspected yearly for deterioration.

Alternative Name: OOK BATTERY (OAKLEY BATTERY)
Alternative Addr: 139 HILL AVENUE
OAKLEY, CA 94561
Alternative Name: OOK BATTERY RECLAMATION
Alternative Addr: 139 HILL AVENUE
OAKLEY, CA 94561
Alternative Name: AKLEY BATTERY YARD
Alternative Addr: 139 HILL AVENUE
OAKLEY, CA 94561
Alternative Name: ATTERY RECLAMATION BUSINESS
Alternative Addr: 139 HILL AVENUE
OAKLEY, CA 94561
Comment Date: 12/08/1980
Comment: Facility Identified: Phone tip. Facility shut down by Air Board in 1977.
Berkeley Environmental Health Dept visited site in response to complaint.
Sample results show high levels of lead.
Site Screening Done: Mitre model required. Preliminary Assessment required.
Preliminary Assessment Done: Operations included recovery of lead from discarded automobile batteries. Empty batteries disposed at Antioch Dump. Battery acids disposed to ground.
ERA (F&P): Fence & Post.
Removal Action (BTTRY): Removal and redisposal of 315 cubic yards of highly contaminated soil including large pieces of battery casings. 140 cubic yards of clean fill brought in to backfill excavated area.
Removal Action (FENCE): Adjacent property, Cooks Court

COOK BATTERY (OAKLEY BATTERY) (Continued) **S101272690**

(located at 115/125 Hill Ave, Oakley), fenced and posted. This property is contiguous with the Cook Battery Site. Removal action started 04/24/91 and ended 04/26/91. Work remaining: The horizontal and vertical extent of contamination needs to be defined. In June 1991, DTSC toox approx 1,000 soil samples from the surrounding adjacent properties and analyzed for lead. Also, four monitoring wells were installed on the site. The soil was tested for lead and PH at each well boring as deep as 30 feet. The unconfined aquifer below the site was tested for lead and PH. Some unidentified remedial action will need to be done depending on the results of the soil and water analyses.
Records Search: Residential property used as battery reclaiming site in the 1950s & 60s. Contaminants include high levels of lead.
RA 41ROG/STAB 41 ROG: 40-50 cubic yards of lead contaminated soil was removed from 41 Rogers Lane put into containers and transferred for holding to the fenced property at 139 Hill Avenue. The field work was completed on June 25, 1993. This action resulted in all necessary work being completed at 41 Rogers Lane--thus the 41 Rogers Lane portion of the site has been stabilized and no additional work is required at that parcel.
A concrete pad was placed behind and beside the rear six feet to the Tobar house in order to cover and isolate the battery casings which were left behind when removal actions were done in November 1991. The action was taken to remove the threat if contact with lead contaminated soil.
In coordination with the County, DTSC had its contractor demolish the house and dispose of the debris in a local landfill.
Removal Action Workplan approved proposes to consolidate soil from the Cook's Court property onto the main Cook site at 139 Hill Avenue, neutralize acid impacted soils and place an asphalt cap over the entire 139 Hill Avenue site.
Removal Action (RA):onsite neutralization, consolidation and encapsulation of contaminated soil. About 250 tons of debris were removed from the site and sent to a municipal Class III landfill. Asbestos containing materials (transite siding from the shed and a 8-inch diameter transite pipe, approx 60 feet long) found onsite were removed and sent to Altamont landfill. Approx 592 cubic yards of lead contaminated soils from the back portion of the Cooks Court Area (McArthur Property) and 15 cu yds from the front of the Cook Property were excavated and moved onsite.
About 796 cu yds of low pH soils on the Cook Property were neutralized with limestone onsite before being capped onsite. The entire Cook Property is capped with an asphaltic concrete cover. All contaminated soils above the cleanup levels have been excavated, consolidated and capped on the Cook Property.
RA began 10/30/95 with the closing of the domestic well on the Cook Property. Soil remediation activities began 11/29/95. Contractor mobilized onto the site and began clearing and grubbing activities. Vegetation and trees were removed and disposed of at a municipal landfill. The garage and shed were demolished, and debris was removed either for

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

COOK BATTERY (OAKLEY BATTERY) (Continued) S101272690

recycling or off site disposal. The soil in front of the Cook Property, County right-of-way, was excavated down to 6 inches beneath the gravel driveway materials on 12/8/95. The area of excavation was 18'x45' resulting in 15 cu yds of soil removed for consolidation. Confirmation soil sampling results showed all lead contaminated soil above the clean-up levels was removed from this area. Between 12/4/95 - 12/19/95, contaminated soil on the back portion of the McArthur Property was excavated and moved to the Cook Property for consolidation. Approx 592 cu yds of lead affected soil was excavated. Confirmation sampling results showed that all lead comtaminated soils above the cleanup levels have been removed. This area was backfilled with clean soil from the Cook Property. From 12/7/95 to 12/8/95 low pH soil behind the garage on the Cook Property was neutralized with agricultural-grade lime. Approx 797 cu yds of low pH soils were treated with lime. Field sampling results showed that the treated soil has a pH between 6 & 8. Field activities were held from 12/21/95 to 2/13/96 because soils were too saturated to work with for compaction and grading due to heavy rains. To complete compaction and grading activities, the wet soils were stabilized with fly ash and lime on 2/13/95. Between 2/14/96 - 4/12/96 the soil were compacted, and the placing, grading and compacting of aggregate base were implemented at the site. 4/17/96 - 4/18/96, the entire Cook Property was paved with 2 inch asphalt.
Cost of RA: approx $310,000.00

AWP Facility ID: 07360035 Facility Type: STATE

E20 **SSW** **> 1** **Higher**	**COOK BATTERY RECLAMATION (OAKLEY BATTERY)** **139 HILL AVENUE** **OAKLEY, CA 94561**	**Ca. BEP**	**S100833369** **N/A**

D21 **West** **> 1** **Higher**	**OAKLEY FIRE DEPARTMENT** **2ND & RUBY STREET** **OAKLEY, CA 94561**	**UST**	**U001597818** **N/A**

State UST:

Facility ID:	58130		
Tank Num:	1	Container Num:	1
Tank Capacity:	560	Year Installed:	1981
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	12 gauge
Leak Detection:	Visual		
Contact Name:	CHIEF-JOE TOVAR	Telephone:	(415) 625-2102
Total Tanks:	1	Region:	Not reported
Facility Type:	2	Other Type:	FIRE DEPARTMENT

D22 **West** **> 1** **Higher**	**CONTRA COSTA FIRE STA #93** **2ND ST 215** **OAKLEY, CA**	**Ca. SL**	**S102261371** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

CONTRA COSTA FIRE STA #93 (Continued) **S102261371**

Contra Costa SL:
Facility ID: 58130
Telephone: (510) 625-2102
Region: CNTRACSTA
Program Status:
UST: Inactive
HWG: Not reported
BUSP: Inactive

C23 West > 1 Higher	**CRAFTSMAN'S AUTO BODY 3850 MAIN ST OAKLEY, CA 94561**	**HAZNET**	**S100859593 N/A**

HAZNET:

Year:	1993		
Gepaid:	CAL000113876	Tepaid:	CAT000613893
Contact:	Not reported	Telephone:	(000) 000-0000
Gen County:	Contra Costa	Tons:	Not reported
Tsd Name:	Not reported		
Tsd Address	Not reported Not reported Not reported		
Tsd County	Los Angeles		
Mailing Address:	3850 MAIN ST Not reported OAKLEY, CA 94561		
Category:	Oxygenated solvents (acetone, butanol, ethyl acetate, etc.)		
Disposal Method:	Transfer station		

Year:	Not reported		
Gepaid:	CAL000113876	Tepaid:	CAT000613893
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	2
Tsd Name:	SAFETY-KLEEN CORP (7-088-06)		
Tsd Address	10625 HICKSON ST#A Not reported EL MONTE		
Tsd County	Los Angeles		
Mailing Address:	Not reported Not reported Not reported		
Category:	Oxygenated solvents (acetone, butanol, ethyl acetate, etc.)		
Disposal Method:	Transfer station		

C24 West > 1 Higher	**OAKLEY VETERINARY HOSPITAL 3807 MAIN ST OAKLEY, CA 94561**	**HAZNET**	**S100869341 N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

OAKLEY VETERINARY HOSPITAL (Continued) **S100869341**

HAZNET:

Year:	1993		
Gepaid:	CAL000089851	Tepaid:	CAL922955281
Contact:	Not reported	Telephone:	(000) 000-0000
Gen County:	Contra Costa	Tons:	Not reported
Tsd Name:	Not reported		
Tsd Address	Not reported Not reported Not reported		
Tsd County	Santa Clara		
Mailing Address:	PO BOX 1015 Not reported OAKLEY, CA 94561		
Category:	Photochemicals/photoprocessing waste		
Disposal Method:	Not reported		

Year:	Not reported		
Gepaid:	CAL000089851	Tepaid:	CAL922955281
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	12
Tsd Name:	DIAGNOSTIC X RAY IMAGING INC		
Tsd Address	636 NEWHALL STREET Not reported SAN JOSE		
Tsd County	Santa Clara		
Mailing Address:	Not reported Not reported Not reported		
Category:	Photochemicals/photoprocessing waste		
Disposal Method:	Disposal, other		

F25 **SW** **> 1** **Higher**	**HWY 4/MALICOAT AVE** **OAKLEY, CA 94561**	**CHMIRS**	**S100218980** **N/A**

CHMIRS:

OES Control Number:	8910859	DOT ID:	1789
DOT Hazard Class:	Not Reported		
Chemical Name:	ACID, MURIATIC		
Extent of Release:	Not reported		
CAS Number:	Not reported	Quantity Released:	1
Environmental Contamination:	None Reported	Property Use:	Not reported
Incident Date:	03-NOV-89	Date Completed:	03-NOV-89

C26 **West** **> 1** **Higher**	**LOYD ENGINEERING** **3780 MAIN STREET** **OAKLEY, CA 94561**	**HAZNET**	**S100867074** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

LOYD ENGINEERING (Continued) **S100867074**

HAZNET:

Year:	1993		
Gepaid:	CAL000082168	Tepaid:	CAD042345884
Contact:	MIKE LOYD	Telephone:	(510) 625-0100
Gen County:	Contra Costa	Tons:	Not reported
Tsd Name:	Not reported		
Tsd Address	Not reported		
	Not reported		
	Not reported		
Tsd County	Santa Clara		
Mailing Address:	4420 LIVE OAK AVE		
	Not reported		
	OAKLEY, CA 94561		
Category:	Unspecified oil-containing waste		
Disposal Method:	Not reported		

Year:	Not reported		
Gepaid:	CAL000082168	Tepaid:	CAD042345884
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	29
Tsd Name:	SAFE-WAY CHEMICAL CO		
Tsd Address	909 STOCKTON AVE		
	Not reported		
	SAN JOSE		
Tsd County	Santa Clara		
Mailing Address:	Not reported		
	Not reported		
	Not reported		
Category:	Unspecified oil-containing waste		
Disposal Method:	Not specified		

C27 **West** **> 1** **Higher**	**PACIFIC BELL MOBILE** **MAIN ST 3775** **OAKLEY, CA**	**Ca. SL**	**S102445789** **N/A**

Contra Costa SL:

Facility ID:	72324
Telephone:	Not reported
Region:	CNTRACSTA
Program Status:	
UST:	Not reported
HWG:	Active
BUSP:	Inactive

C28 **West** **> 1** **Higher**	**P G & E** **3765 MAIN ST** **OAKLEY, CA 94561**	**HAZNET**	**S100869767** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

P G & E (Continued) **S100869767**

HAZNET:

Year:	1993		
Gepaid:	CAC000949824	Tepaid:	CAD980887418
Contact:	Not reported	Telephone:	(000) 000-0000
Gen County:	Contra Costa	Tons:	Not reported
Tsd Name:	Not reported		
Tsd Address	Not reported Not reported Not reported		
Tsd County	Alameda		
Mailing Address:	1919 WEBSTER ST Not reported OAKLAND, CA 94612		
Category:	Waste oil and mixed oil		
Disposal Method:	Recycler		

Year:	Not reported		
Gepaid:	CAC000949824	Tepaid:	CAD980887418
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	33
Tsd Name:	EVERGREEN OIL INC		
Tsd Address	6880 SMITH ST Not reported NEWARK		
Tsd County	Alameda		
Mailing Address:	Not reported Not reported Not reported		
Category:	Waste oil and mixed oil		
Disposal Method:	Recycler		

E29
SSW
> 1
Higher

COOKS BATTERY SITE
138 HILL AVE
OAKLEY, CA 94561

CERCLIS **1000486442**
FINDS **CAD983613910**

CERCLIS Classification Data:

Site Incident Category:	Not reported	Federal Facility:	Not a Federal Facility
Ownership Status:	Private	NPL Status:	Not on the NPL

CERCLIS Assessment History:

Assessment:	DISCOVERY	Completed:	02-NOV-91

CERCLIS Site Status:
Not reported

C30
West
> 1
Higher

WEIL PROPERTY
ACME ST E 115
OAKLEY, CA

Ca. SL **S102261372**
N/A

Contra Costa SL:

Facility ID:	71022
Telephone:	(415) 530-1423
Region:	CNTRACSTA
Program Status:	
UST:	Inactive
HWG:	Not reported
BUSP:	Not reported

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

C31 West > 1 Higher — **OAKLEY 1 HOUR CLEANERS, MAIN ST 3647, OAKLEY, CA** — Ca. SL — S102261407 N/A

Contra Costa SL:
- Facility ID: 70773
- Telephone: (510) 625-2267
- Region: CNTRACSTA
- Program Status:
  - UST: Not reported
  - HWG: Active
  - BUSP: Not reported

G32 West > 1 Higher — **OAKLEY FIRE DEPARTMENT STATION, 2ND AND RUBY STREET, OAKLEY, CA 94561** — UST — U001597819 N/A

State UST:

Facility ID:	32961		
Tank Num:	1	Container Num:	NO 2
Tank Capacity:	560	Year Installed:	1982
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	12 gauge
Leak Detection:	Stock Inventor, None		
Contact Name:	CHIEF JOSEPH TOVAR	Telephone:	(415) 625-3660
Total Tanks:	1	Region:	Not reported
Facility Type:	1	Other Type:	Not reported

F33 SSW > 1 Higher — **70AA RT 4 DOUGLAS ROAD, OAKLEY, CA 94561** — CHMIRS — S100279488 N/A

CHMIRS:

OES Control Number:	8910158	DOT ID:	1814
DOT Hazard Class:	Not Reported		
Chemical Name:	DRUG LAB WASTE		
Extent of Release:	Not reported		
CAS Number:	Not reported	Quantity Released:	Not reported
Environmental Contamination:	None Reported	Property Use:	Residential
Incident Date:	26-FEB-89	Date Completed:	26-FEB-89

H34 West > 1 Higher — **LENA'S ANTIQUES, MAIN ST 3530, OAKLEY, CA** — Ca. SL — S102261406 N/A

Contra Costa SL:
- Facility ID: 70975
- Telephone: (415) 625-4878
- Region: CNTRACSTA
- Program Status:
  - UST: Not reported
  - HWG: Inactive
  - BUSP: Not reported

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
H35 West > 1 Higher	**OAKLEY CHIROPRACTIC CLINIC 3478 MAIN ST OAKLEY, CA 94561**	**HAZNET**	**S100940976 N/A**

HAZNET:

Year:	Not reported		
Gepaid:	CAL000083007	Tepaid:	CAD070148432
Contact:	Not reported	Telephone:	Not reported
Gen County:	Not reported	Tons:	16
Tsd Name:	DREW RESOURCE CORP		
Tsd Address	1717 4TH ST Not reported BERKELEY		
Tsd County	Alameda		
Mailing Address:	Not reported Not reported Not reported		
Category:	Photochemicals/photoprocessing waste		
Disposal Method:	Treatment, incineration		

H36 West > 1 Higher	**CHEAPER #169 MAIN ST 3475 OAKLEY, CA**	**Ca. SL**	**S102261405 N/A**

Contra Costa SL:

Facility ID:	70074
Telephone:	(510) 625-9966
Region:	CNTRACSTA
Program Status:	
UST:	Active
HWG:	Not reported
BUSP:	Active

G37 West > 1 Higher	**CHARLES & GLADY PETERSON 213 O'HARA AVE. P.O. BOX 91 OAKLEY, CA 94561**	**UST**	**U001597800 N/A**

State UST:

Facility ID:	54144		
Tank Num:	1	Container Num:	1
Tank Capacity:	345	Year Installed:	Not reported
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	Not reported
Leak Detection:	Stock Inventor		
Contact Name:	Not reported	Telephone:	(415) 625-2203
Total Tanks:	1	Region:	Not reported
Facility Type:	Not reported	Other Type:	HOME OWNER

H38 West > 1 Higher	**CUTINOS FEED & TIRE CENTER MAIN ST (HWY 4) 500 OAKLEY, CA**	**Ca. SL**	**S102261411 N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

CUTINOS FEED & TIRE CENTER (Continued) **S102261411**

Contra Costa SL:
- Facility ID: 07615
- Telephone: 625-2200
- Region: CNTRACSTA
- Program Status:
  - UST: Not reported
  - HWG: Not reported
  - BUSP: Inactive

H39 **West** **> 1** **Higher**	**NORMAN'S BRENTWOOD NURSERY** **RR 3 BOX 526HWY4** **BRENTWOOD, CA 94513**	**Ca. FID** **Ca. SL**	**S101580870** **N/A**

FID:

Facility ID:	07000897	Regulate ID:	Not reported
Reg By:	Inactive Underground Storage Tank Location		
Cortese Code:	Not reported	SIC Code:	Not reported
Status:	Inactive	Facility Tel:	(415) 634-2784
Mail To:	Not reported RR 3 BOX 526 HWY 4 BRENTWOOD, CA 94513		
Contact:	Not reported	Contact Tel:	Not reported
DUNs No:	Not reported	NPDES No:	Not reported
Creation:	10/22/93	Modified:	00/00/00
EPA ID:	Not reported		
Comments:	Not reported		

Contra Costa SL:
- Facility ID: 45344
- Telephone: (510) 634-2784
- Region: CNTRACSTA
- Program Status:
  - UST: Inactive
  - HWG: Not reported
  - BUSP: Not reported

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40 **SSW** **> 1** **Higher**	**B & N AUTOMOTIVE SERVICE** **BOLTON RD E 23** **OAKLEY, CA**	**Ca. SL**	**S102261379** **N/A**

Contra Costa SL:
- Facility ID: 46135
- Telephone: (510) 625-1880
- Region: CNTRACSTA
- Program Status:
  - UST: Inactive
  - HWG: Active
  - BUSP: Inactive

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41 **South** **> 1** **Higher**	**KNIGHTSEN FIRE STATION 94** **2ND AND A STREET** **KNIGHTSEN, CA 94561**	**UST**	**U001597815** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

KNIGHTSEN FIRE STATION 94 (Continued) **U001597815**

State UST:

Facility ID:	32715		
Tank Num:	1	Container Num:	1
Tank Capacity:	560	Year Installed:	1981
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	12 gauge
Leak Detection:	Stock Inventor		
Contact Name:	CHIEF - JOSEPH TOVAR	Telephone:	(415) 625-2102
Total Tanks:	1	Region:	Not reported
Facility Type:	1	Other Type:	Not reported

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42 **West** **> 1** **Higher**	**OAKLEY BUILDERS SUPPLY** **800 MAIN ST. HWY #4** **OAKLEY, CA 94561**	**UST** **LUST** **Ca. SL**	**U001597817** **N/A**

LUST Region 5:

Respble Party:	OAKLEY BUILDERS SUPPLY	Substance:	GASOLINE
Case Type:	Soil only		
Pilot Program:	No		
Staff Initials:	EAT	Case Number:	070024
Status:	Case Closed by Regional Board		
MTBE:	8	Lead Agency:	Regional

Contra Costa SL:

Facility ID:	44676
Telephone:	(415) 625-2358
Region:	CNTRACSTA
Program Status:	
UST:	Inactive
HWG:	Not reported
BUSP:	Not reported

State UST:

Facility ID:	44676		
Tank Num:	1	Container Num:	1
Tank Capacity:	10000	Year Installed:	1976
Tank Used for:	PRODUCT		
Type of Fuel:	DIESEL	Tank Constrctn:	1/8 inches
Leak Detection:			
Contact Name:	Not reported	Telephone:	(415) 625-2358
Total Tanks:	2	Region:	Not reported
Facility Type:	2	Other Type:	BUILDING SUPPLY

Facility ID:	44676		
Tank Num:	2	Container Num:	2
Tank Capacity:	500	Year Installed:	1966
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	1/8 inches
Leak Detection:	None		
Contact Name:	Not reported	Telephone:	(415) 625-2358
Total Tanks:	2	Region:	Not reported
Facility Type:	2	Other Type:	BUILDING SUPPLY

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143 **South** **> 1** **Higher**	**DE FREMERY RANCH** **SELLERS AVE 1/4 MI. SO DELTA R** **KNIGHTSEN, CA 94548**	**UST**	**U001597228** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

DE FREMERY RANCH (Continued) **U001597228**

State UST:

Facility ID:	36459		
Tank Num:	1	Container Num:	#2
Tank Capacity:	500	Year Installed:	Not reported
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	Not reported
Leak Detection:	Visual		
Contact Name:	JIM DE FREMERY	Telephone:	(415) 625-3728
Total Tanks:	0	Region:	Not reported
Facility Type:	2	Other Type:	RANCH

Facility ID:	36459		
Tank Num:	2	Container Num:	#1
Tank Capacity:	500	Year Installed:	Not reported
Tank Used for:	PRODUCT		
Type of Fuel:	REGULAR	Tank Constrctn:	Not reported
Leak Detection:	Visual		
Contact Name:	JIM DE FREMERY	Telephone:	(415) 625-3728
Total Tanks:	0	Region:	Not reported
Facility Type:	2	Other Type:	RANCH

I44 **South** **> 1** **Higher**	**QUINTANA PETROLEUM CORP** **SELLERS / DELTA RD** **KNIGHTSEN, CA**	**Ca. SL**	**S102261021** **N/A**

Contra Costa SL:

Facility ID:	07552
Telephone:	(510) 934-5345
Region:	CNTRACSTA
Program Status:	
UST:	Not reported
HWG:	Not reported
BUSP:	Inactive

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45 **West** **> 1** **Higher**	**SAVER'S SS** **4 HWY (2323)** **BRENTWOOD, CA 94513**	**Cortese** **LUST**	**S101294066** **N/A**

State LUST:

Facility Type	INACTIVE	Cross Street:	Not reported
Reg Board:	Central Valley Region	Qty Leaked:	Not reported
Chemical:	Gasoline		
Lead Agency:	Regional Board		
Case Type:	Soil only		
Status:	Signed off, remedial action completed or deemed unnecessary		
Review Date:	12/02/1997	Confirm Leak:	09/18/1987
Workplan:	Not reported	Prelim Assess:	Not reported
Pollution Char:	Not reported	Remed Plan:	Not reported
Remed Action:	Not reported	Monitoring:	Not reported
Close Date:	12/02/1997	Release Date:	09/17/1987

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
	SAVER'S SS (Continued)		**S101294066**

LUST Region 5:

Respble Party:	SAVER'S GAS	Substance:	GASOLINE
Case Type:	Soil only		
Pilot Program:	No		
Staff Initials:	EAT	Case Number:	070018
Status:	Case Closed by Regional Board		
MTBE:	Not reported	Lead Agency:	Regional

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
46 **West** **> 1** **Higher**	**OAKLEY BUILDERS SUPPLY** **MAIN ST (800)** **OAKLEY, CA 94561**	**Cortese**	**S101294139** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
47 **West** **> 1** **Higher**	**A & A MARKET (PREVIOUSLY)** **MAIN ST (407)** **OAKLEY, CA 94561**	**Cortese** **LUST**	**S100223761** **N/A**

LUST Region 5:

Respble Party:	BRAZ, LUCY	Substance:	GASOLINE
Case Type:	Soil only		
Pilot Program:	No		
Staff Initials:	EAT	Case Number:	070035
Status:	Case Closed by Regional Board		
MTBE:	8	Lead Agency:	Regional

CORTESE:

Reg By:	LTNKA
Reg Id:	070035
Region:	CORTESE

City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
KNIGHTSEN	S102261011	CONTRA COSTA FIRE STA #94	2ND ST 15	94548	Ca. SL	58129
KNIGHTSEN	U001597225	BELLO RANCH	P.O. BOX 63 KNIGHTSEN AVE.	94548	UST	00000043315
KNIGHTSEN	S102261012	PG&E 9-1 GAS WELL	CYPRESS RD	94548	Ca. SL	24886
KNIGHTSEN	U001597224	9-1 GAS WELL	CYPRESS ROAD	94548	UST	00000024886
KNIGHTSEN	S102261016	SOMERHALDER, PAUL	KNIGHTSEN AVE	94548	Ca. SL	28831
KNIGHTSEN	S102261017	BELLO RANCH	KNIGHTSEN AVE	94548	Ca. SL	43315
KNIGHTSEN	S102261018	SOMERHALDER, BRUCE	KNIGHTSEN AVE	94548	Ca. SL	47825
KNIGHTSEN	S102261019	KNIGHTSEN POST OFFICE	KNIGHTSEN AVE 3019	94548	Ca. SL	71367
KNIGHTSEN	S102261020	KNIGHTSEN BOAT WORKS	KNIGHTSEN RD 3011	94548	Ca. SL	72048
KNIGHTSEN	U001596405	PAUL SOMERHALDER	KNIGHTSEN AVE.	94548	UST	00000028831
KNIGHTSEN	U001597226	BRUCE SOMERHALDER	KNIGHTSEN AV.	94548	UST	00000047825
KNIGHTSEN	U001597229	KNIGHTSEN FIRE STATION	2ND STREET	94548	UST	00000058129
KNIGHTSEN	S102261023	MASSONI, DANTE	TULE LN	94548	Ca. SL	30707
KNIGHTSEN	U001597227	DANTE MASSONI	TULE LANE P.O. BOX 195	94548	UST	00000030707
MIDDLETOWN	1000409170	GEOTHERMAL INDUSTRIES INC	BUTTS CANYON RD	94561	RCRIS-SQG, FINDS, CORRACTS, CERC-NFRAP	
OAKLEY	S100849527	1X BRIDGEHEAD INC	5540 HWY 4	94561	HAZNET	
OAKLEY	S102261390	NGC-CESA #1	HWY 4/SUNSET AVE	94561	Ca. SL	07731
OAKLEY	S103172293	OAKLEY MUFFLER	ACME ST E 150	94561	Ca. SL	72491
OAKLEY	U001597821	OAKLEY TRUCK & TRACTOR REPAIR	ACME STREET	94561	UST, Ca. SL	00000058946
OAKLEY	S102261373	DAL PORTO, ROBERT	BETHEL ISLAND RD	94561	Ca. SL	43314
OAKLEY	U001597822	ROBERT DAL PORTO	BETHEL ISLAND ROAD	94561	UST	00000043314
OAKLEY	S102261378	KENNEDY, HOOVER E.	BOLTON RD	94561	Ca. SL	21859
OAKLEY	S103172294	BLUE STAR GAS MART	CYPRESS RD E 1541	94561	Ca. SL	71132
OAKLEY	U001597820	OAKLEY RANCH	CYPRESS AVENUE	94561	UST, Ca. SL	00000049287
OAKLEY	S102260011	DOC'S MARINA	DUTCH SLOUGH RD 3212	94561	Ca. SL	70123
OAKLEY	U001597804	EMERSON DAIRY	NORTH END OF SELLERS RD	94561	UST	00000024330
OAKLEY	1000182487	STACY TRUCKING	LIVE OAK AVE	94561	RCRIS-SQG, FINDS, UST	00000048289
OAKLEY	S103172296	RICH LADEIRA TRUCKING INC	LIVE OAK AVE 5300	94561	Ca. SL	72278
OAKLEY	S102261397	OAKLEY HOTEL	MAIN ST 123	94561	Ca. SL	70919
OAKLEY	S103172297	G & E SALES AND RENTAL	MAIN ST 1371	94561	Ca. SL	72395
OAKLEY	S102261425	SHOSHONE OIL CORPORATION	OAKLEY GAS FIELD-HWY 4	94561	Ca. SL	07523
OAKLEY	S102261428	COUNTRY INVESTORS	OHARA AVE	94561	Ca. SL	71841
OAKLEY	S102261429	DELBARBA RANCH	ROSE AVE	94561	Ca. SL	37590
OAKLEY	U001597825	SILVIO DELL'ANTICO	ROSE AVE.	94561	UST, Ca. SL	00000028880
OAKLEY	S102261444	DEJESUS, JOHN V.	SELLERS AVE	94561	Ca. SL	30076
OAKLEY	S102261445	BACCHINI RANCH	SELLERS AVE	94561	Ca. SL	48254
OAKLEY	S102261446	EMERSON DAIRY	SELLERS AVE 7101	94561	Ca. SL	24330
OAKLEY	S103172300	SUNSET EXPL NGC-NUNN 1&2	SELLERS / SUNSET RD	94561	Ca. SL	07724
OAKLEY	U001597798	ALFRED OR DARLENE DEJESUS	SELLERS AVE.-RT2, BOX 182-C	94561	UST	00000045727
OAKLEY	S102261448	WESTERN CONT'L NGC-KYSH-1	SUNSET/HWY 4	94561	Ca. SL	07604
OAKLEY	S103172302	MIKE BOYD TRANSPORT	YULA WAY 40	94561	Ca. SL	72394

GEOCHECK VERSION 2.1 ADDENDUM
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Northern Quadrant)

BASIC WELL DATA

Site ID:	380122121390101	Distance from TP:	1 - 2 Miles
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1975	County:	Contra Costa
Altitude:	.00 ft.	State:	California
Well Depth:	50.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	5.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	08131975	Prim. Use of Water:	Domestic

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Eastern Quadrant)

BASIC WELL DATA

Site ID:	380005121394501	Distance from TP:	1/2 - 1 Mile
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1961	County:	Contra Costa
Altitude:	5.00 ft.	State:	California
Well Depth:	350.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	Not Reported	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Irrigation

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Southern Quadrant)

BASIC WELL DATA

Site ID:	375956121403201	Distance from TP:	1/8 - 1/4 Mile
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1959	County:	Contra Costa
Altitude:	.00 ft.	State:	California
Well Depth:	333.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	Not Reported	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Stock

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Western Quadrant)

BASIC WELL DATA

Site ID:	375904121420801	Distance from TP:	1 - 2 Miles
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1973	County:	Contra Costa
Altitude:	47.00 ft.	State:	California
Well Depth:	90.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	48.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	11161973	Prim. Use of Water:	Domestic

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

Water Wells:

Well Within 1 - 2 Miles of Target Property (Northern Quadrant)

Water System Information:

Prime Station Code:	02N/03E-17A01 M	User ID:	07C
FRDS Number Number:	0707569001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380140.0 1213940.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707569		
System Name:	ANGLER'S RANCH SUBDIVISION #4		
Organization That Operates System:	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		

Well Within 1 - 2 Miles of Target Property (Eastern Quadrant)

Water System Information:

Prime Station Code:	02N/03E-21D01 M	User ID:	07C
FRDS Number Number:	0707593001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380036.0 1213915.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707593		
System Name:	VIKING HARBOR		
Organization That Operates System:	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		

Well Within 1 - 2 Miles of Target Property (Southern Quadrant)

Water System Information:

Prime Station Code:	02N/03E-32L01 M	User ID:	07C
FRDS Number Number:	0707514001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	375830.0 1214008.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707514		
System Name:	MONARCH ENTERPRISES SWS		
Organization That Operates System:	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		

Well Within 1 - 2 Miles of Target Property (Western Quadrant)

Water System Information:

Prime Station Code:	02N/02E-25B01 M	User ID:	ENG
FRDS Number Number:	0710007002	County:	Contra Costa
District Number:	04	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	375950.0 1214200.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0710007		
System Name:	DIABLO WATER DISTRICT		
Organization That Operates System:	PO BOX 127 OAKLEY, CA 94561		
Pop Served:	18000	Connections:	6236
Area Served:	OAKLEY		

Sample Information: * Only Findings Above Detection Level Are Listed

Sample Collected:	09/14/1990	Findings:	5.000 UG/L
Chemical:	DICHLOROMETHANE		
Sample Collected:	04/18/1991	Findings:	9.000 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	04/18/1991	Findings:	3.000 PCI/L
Chemical:	GROSS ALPHA COUNTING ERROR		
Sample Collected:	04/18/1991	Findings:	6.000 PCI/L
Chemical:	GROSS BETA		
Sample Collected:	04/18/1991	Findings:	2.000 PCI/L
Chemical:	GROSS BETA COUNTING ERROR		
Sample Collected:	01/07/1992	Findings:	6.000 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	01/07/1992	Findings:	2.000 PCI/L
Chemical:	GROSS ALPHA COUNTING ERROR		
Sample Collected:	01/07/1992	Findings:	1.000 PCI/L
Chemical:	GROSS BETA COUNTING ERROR		
Sample Collected:	01/07/1992	Findings:	1012.000 PCI/L
Chemical:	TRITIUM		
Sample Collected:	01/07/1992	Findings:	96.000 PCI/L
Chemical:	TRITIUM COUNTING ERROR		
Sample Collected:	01/07/1992	Findings:	5.000 PCI/L
Chemical:	URANIUM		
Sample Collected:	01/07/1992	Findings:	329.000 PCI/L
Chemical:	TOTAL RADON 222 COUNTING ERROR		
Sample Collected:	01/07/1992	Findings:	17.300 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	01/07/1992	Findings:	20.000 UNITS
Chemical:	COLOR		
Sample Collected:	01/07/1992	Findings:	1400.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	01/07/1992	Findings:	7.400
Chemical:	FIELD PH		

Sample Collected:	01/07/1992	Findings:	7.700
Chemical:	PH (LABORATORY)		
Sample Collected:	01/07/1992	Findings:	240.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	01/07/1992	Findings:	240.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	01/07/1992	Findings:	1.000 MG/L
Chemical:	CARBONATE ALKALINITY		
Sample Collected:	01/07/1992	Findings:	.200 MG/L
Chemical:	AMMONIA (NH3-N)		
Sample Collected:	01/07/1992	Findings:	.200 UG/L
Chemical:	PHOSPHATE		
Sample Collected:	01/07/1992	Findings:	420.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	01/07/1992	Findings:	70.000 MG/L
Chemical:	CALCIUM		
Sample Collected:	01/07/1992	Findings:	43.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	01/07/1992	Findings:	140.000 MG/L
Chemical:	SODIUM		
Sample Collected:	01/07/1992	Findings:	4.400 MG/L
Chemical:	POTASSIUM		
Sample Collected:	01/07/1992	Findings:	130.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	01/07/1992	Findings:	1.100 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		
Sample Collected:	01/07/1992	Findings:	33.000 MG/L
Chemical:	SILICA		
Sample Collected:	01/07/1992	Findings:	2.200 UG/L
Chemical:	ARSENIC		
Sample Collected:	01/07/1992	Findings:	.800 UG/L
Chemical:	BORON		
Sample Collected:	01/07/1992	Findings:	145.400 UG/L
Chemical:	MANGANESE		
Sample Collected:	01/07/1992	Findings:	940.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	01/07/1992	Findings:	1.000 MG/L
Chemical:	HYDROXIDE ALKALINITY		
Sample Collected:	01/07/1992	Findings:	4.500 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	01/07/1992	Findings:	6.000 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	01/07/1992	Findings:	1012.000 PCI/L
Chemical:	TRITIUM		
Sample Collected:	07/13/1992	Findings:	19.300 C
Chemical:	SOURCE TEMPERATURE C		

Sample Collected:	07/13/1992	Findings:	1750.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	07/13/1992	Findings:	7.480
Chemical:	FIELD PH		
Sample Collected:	07/13/1992	Findings:	7.800
Chemical:	PH (LABORATORY)		
Sample Collected:	07/13/1992	Findings:	240.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	07/13/1992	Findings:	240.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	07/13/1992	Findings:	530.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	07/13/1992	Findings:	110.000 MG/L
Chemical:	CALCIUM		
Sample Collected:	07/13/1992	Findings:	57.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	07/13/1992	Findings:	170.000 MG/L
Chemical:	SODIUM		
Sample Collected:	07/13/1992	Findings:	5.100 MG/L
Chemical:	POTASSIUM		
Sample Collected:	07/13/1992	Findings:	160.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	07/13/1992	Findings:	.300 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		
Sample Collected:	07/13/1992	Findings:	37.000 MG/L
Chemical:	SILICA		
Sample Collected:	07/13/1992	Findings:	.900 UG/L
Chemical:	BORON		
Sample Collected:	07/13/1992	Findings:	76.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	07/13/1992	Findings:	1090.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	07/13/1992	Findings:	15.000 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	07/13/1992	Findings:	.500 MG/L
Chemical:	BROMIDE		
Sample Collected:	10/06/1992	Findings:	20.100 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	10/06/1992	Findings:	7.500
Chemical:	FIELD PH		
Sample Collected:	10/06/1992	Findings:	7.600
Chemical:	PH (LABORATORY)		
Sample Collected:	10/06/1992	Findings:	243.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	10/06/1992	Findings:	243.000 MG/L
Chemical:	BICARBONATE ALKALINITY		

Sample Collected:	10/06/1992	Findings:	508.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	10/06/1992	Findings:	69.000 MG/L
Chemical:	CALCIUM		
Sample Collected:	10/06/1992	Findings:	51.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	10/06/1992	Findings:	180.000 MG/L
Chemical:	SODIUM		
Sample Collected:	10/06/1992	Findings:	5.200 MG/L
Chemical:	POTASSIUM		
Sample Collected:	10/06/1992	Findings:	150.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	10/06/1992	Findings:	.320 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		
Sample Collected:	10/06/1992	Findings:	36.000 MG/L
Chemical:	SILICA		
Sample Collected:	10/06/1992	Findings:	3.300 UG/L
Chemical:	ARSENIC		
Sample Collected:	10/06/1992	Findings:	.900 UG/L
Chemical:	BORON		
Sample Collected:	10/06/1992	Findings:	58.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	10/06/1992	Findings:	1040.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	10/06/1992	Findings:	14.000 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	10/06/1992	Findings:	10000.000 MFL
Chemical:	ASBESTOS		
Sample Collected:	10/06/1992	Findings:	.600 MG/L
Chemical:	BROMIDE		
Sample Collected:	04/05/1993	Findings:	20.000 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	04/05/1993	Findings:	1440.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	04/05/1993	Findings:	7.800
Chemical:	FIELD PH		
Sample Collected:	04/05/1993	Findings:	7.800
Chemical:	PH (LABORATORY)		
Sample Collected:	04/05/1993	Findings:	230.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	04/05/1993	Findings:	230.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	04/05/1993	Findings:	444.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	04/05/1993	Findings:	88.000 MG/L
Chemical:	CALCIUM		

Sample Collected:	04/05/1993	Findings:	43.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	04/05/1993	Findings:	140.000 MG/L
Chemical:	SODIUM		
Sample Collected:	04/05/1993	Findings:	4.700 MG/L
Chemical:	POTASSIUM		
Sample Collected:	04/05/1993	Findings:	140.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	04/05/1993	Findings:	37.000 MG/L
Chemical:	SILICA		
Sample Collected:	04/05/1993	Findings:	2.100 UG/L
Chemical:	ARSENIC		
Sample Collected:	04/05/1993	Findings:	71.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	04/05/1993	Findings:	920.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	04/05/1993	Findings:	7.210
Chemical:	LANGELIER INDEX @ 60 C		
Sample Collected:	04/05/1993	Findings:	6.500 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	04/05/1993	Findings:	4.000 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	04/05/1993	Findings:	7.000 PCI/L
Chemical:	GROSS BETA		
Sample Collected:	04/05/1993	Findings:	186.000 PCI/L
Chemical:	TRITIUM		
Sample Collected:	04/05/1993	Findings:	6.000 PCI/L
Chemical:	URANIUM		
Sample Collected:	04/05/1993	Findings:	8.000 UG/L
Chemical:	HEXACHLOROCYCLOPENTADIENE		
Sample Collected:	07/20/1993	Findings:	20.100 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	07/20/1993	Findings:	1550.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	07/20/1993	Findings:	7.570
Chemical:	FIELD PH		
Sample Collected:	07/20/1993	Findings:	7.700
Chemical:	PH (LABORATORY)		
Sample Collected:	07/20/1993	Findings:	247.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	07/20/1993	Findings:	247.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	07/20/1993	Findings:	478.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	07/20/1993	Findings:	74.000 MG/L
Chemical:	CALCIUM		

Sample Collected:	07/20/1993	Findings:	46.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	07/20/1993	Findings:	178.000 MG/L
Chemical:	SODIUM		
Sample Collected:	07/20/1993	Findings:	4.800 MG/L
Chemical:	POTASSIUM		
Sample Collected:	07/20/1993	Findings:	150.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	07/20/1993	Findings:	33.000 MG/L
Chemical:	SILICA		
Sample Collected:	07/20/1993	Findings:	3.900 UG/L
Chemical:	ARSENIC		
Sample Collected:	07/20/1993	Findings:	700.000 UG/L
Chemical:	BORON		
Sample Collected:	07/20/1993	Findings:	180.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	07/20/1993	Findings:	1030.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	07/20/1993	Findings:	7.260
Chemical:	LANGELIER INDEX @ 60 C		
Sample Collected:	07/20/1993	Findings:	6.800 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	07/20/1993	Findings:	1600.000 UG/L
Chemical:	NITRATE + NITRITE (AS N)		
Sample Collected:	07/20/1993	Findings:	4.000 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	07/20/1993	Findings:	8.000 PCI/L
Chemical:	GROSS BETA		
Sample Collected:	07/20/1993	Findings:	7.000 PCI/L
Chemical:	URANIUM		
Sample Collected:	10/05/1993	Findings:	19.800 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	10/05/1993	Findings:	1490.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	10/05/1993	Findings:	7.620
Chemical:	FIELD PH		
Sample Collected:	10/05/1993	Findings:	7.800
Chemical:	PH (LABORATORY)		
Sample Collected:	10/05/1993	Findings:	239.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	10/05/1993	Findings:	239.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	10/05/1993	Findings:	460.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	10/05/1993	Findings:	85.000 MG/L
Chemical:	CALCIUM		

Sample Collected:	10/05/1993	Findings:	60.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	10/05/1993	Findings:	140.000 MG/L
Chemical:	SODIUM		
Sample Collected:	10/05/1993	Findings:	4.600 MG/L
Chemical:	POTASSIUM		
Sample Collected:	10/05/1993	Findings:	140.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	10/05/1993	Findings:	38.000 MG/L
Chemical:	SILICA		
Sample Collected:	10/05/1993	Findings:	3.100 UG/L
Chemical:	ARSENIC		
Sample Collected:	10/05/1993	Findings:	740.000 UG/L
Chemical:	BORON		
Sample Collected:	10/05/1993	Findings:	150.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	10/05/1993	Findings:	970.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	10/05/1993	Findings:	7.210
Chemical:	LANGELIER INDEX @ 60 C		
Sample Collected:	10/05/1993	Findings:	5.800 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	10/05/1993	Findings:	.410
Chemical:	AGGRSSIVE INDEX (CORROSIVITY)		
Sample Collected:	01/04/1994	Findings:	14.700 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	01/04/1994	Findings:	1460.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	01/04/1994	Findings:	7.680
Chemical:	FIELD PH		
Sample Collected:	01/04/1994	Findings:	7.700
Chemical:	PH (LABORATORY)		
Sample Collected:	01/04/1994	Findings:	236.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	01/04/1994	Findings:	236.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	01/04/1994	Findings:	.300 UG/L
Chemical:	PHOSPHATE		
Sample Collected:	01/04/1994	Findings:	460.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	01/04/1994	Findings:	82.000 MG/L
Chemical:	CALCIUM		
Sample Collected:	01/04/1994	Findings:	37.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	01/04/1994	Findings:	160.000 MG/L
Chemical:	SODIUM		

Sample Collected:	01/04/1994	Findings:	4.700 MG/L
Chemical:	POTASSIUM		
Sample Collected:	01/04/1994	Findings:	140.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	01/04/1994	Findings:	.210 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		
Sample Collected:	01/04/1994	Findings:	37.000 MG/L
Chemical:	SILICA		
Sample Collected:	01/04/1994	Findings:	5.200 UG/L
Chemical:	ARSENIC		
Sample Collected:	01/04/1994	Findings:	860.000 UG/L
Chemical:	BORON		
Sample Collected:	01/04/1994	Findings:	270.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	01/04/1994	Findings:	930.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	01/04/1994	Findings:	7.300
Chemical:	LANGELIER INDEX @ 60 C		
Sample Collected:	01/04/1994	Findings:	3.300 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	01/04/1994	Findings:	.320 MG/L
Chemical:	BROMIDE		
Sample Collected:	01/04/1994	Findings:	.380
Chemical:	AGGRSSIVE INDEX (CORROSIVITY)		
Sample Collected:	04/05/1994	Findings:	20.200 C
Chemical:	SOURCE TEMPERATURE C		
Sample Collected:	04/05/1994	Findings:	1470.000 UMHO
Chemical:	SPECIFIC CONDUCTANCE		
Sample Collected:	04/05/1994	Findings:	7.720
Chemical:	FIELD PH		
Sample Collected:	04/05/1994	Findings:	7.800
Chemical:	PH (LABORATORY)		
Sample Collected:	04/05/1994	Findings:	240.000 MG/L
Chemical:	TOTAL ALKALINITY (AS CACO3)		
Sample Collected:	04/05/1994	Findings:	240.000 MG/L
Chemical:	BICARBONATE ALKALINITY		
Sample Collected:	04/05/1994	Findings:	.820 UG/L
Chemical:	PHOSPHATE		
Sample Collected:	04/05/1994	Findings:	448.000 MG/L
Chemical:	TOTAL HARDNESS (AS CACO3)		
Sample Collected:	04/05/1994	Findings:	81.000 MG/L
Chemical:	CALCIUM		
Sample Collected:	04/05/1994	Findings:	48.000 MG/L
Chemical:	MAGNESIUM		
Sample Collected:	04/05/1994	Findings:	150.000 MG/L
Chemical:	SODIUM		

Sample Collected:	04/05/1994	Findings:	4.400 MG/L
Chemical:	POTASSIUM		
Sample Collected:	04/05/1994	Findings:	140.000 MG/L
Chemical:	CHLORIDE		
Sample Collected:	04/05/1994	Findings:	.260 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		
Sample Collected:	04/05/1994	Findings:	38.000 MG/L
Chemical:	SILICA		
Sample Collected:	04/05/1994	Findings:	3.700 UG/L
Chemical:	ARSENIC		
Sample Collected:	04/05/1994	Findings:	650.000 UG/L
Chemical:	BORON		
Sample Collected:	04/05/1994	Findings:	240.000 UG/L
Chemical:	MANGANESE		
Sample Collected:	04/05/1994	Findings:	890.000 MG/L
Chemical:	TOTAL DISSOLVED SOLIDS		
Sample Collected:	04/05/1994	Findings:	7.220
Chemical:	LANGELIER INDEX @ 60 C		
Sample Collected:	04/05/1994	Findings:	5.400 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	04/05/1994	Findings:	.200 NTU
Chemical:	FIELD TURBIDITY		
Sample Collected:	04/05/1994	Findings:	.500
Chemical:	AGGRSSIVE INDEX (CORROSIVITY)		
Sample Collected:	07/11/1995	Findings:	9.600 PCI/L
Chemical:	GROSS ALPHA		
Sample Collected:	07/11/1995	Findings:	3.800 PCI/L
Chemical:	GROSS ALPHA COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	6.500 PCI/L
Chemical:	GROSS BETA		
Sample Collected:	07/11/1995	Findings:	1.700 PCI/L
Chemical:	GROSS BETA COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	190.000 PCI/L
Chemical:	TRITIUM		
Sample Collected:	07/11/1995	Findings:	38.000 PCI/L
Chemical:	TRITIUM COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	2.600 PCI/L
Chemical:	RADIUM 226		
Sample Collected:	07/11/1995	Findings:	1.000 PCI/L
Chemical:	RADIUM 226 COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	6.700 PCI/L
Chemical:	RADIUM 228		
Sample Collected:	07/11/1995	Findings:	1.600 PCI/L
Chemical:	RADIUM 228 COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	.200 PCI/L
Chemical:	STRONTIUM-90 COUNTING ERROR		

Sample Collected:	07/11/1995	Findings:	8.500 PCI/L
Chemical:	URANIUM		
Sample Collected:	07/11/1995	Findings:	142.000 PCI/L
Chemical:	TOTAL RADON 222 COUNTING ERROR		
Sample Collected:	07/11/1995	Findings:	2023.000 PCI/L
Chemical:	TOTAL RADON 222		
Sample Collected:	07/11/1995	Findings:	2.700 PCI/L
Chemical:	URANIUM COUNTING ERROR		

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

PWS ID:	CA0707548	PWS Status:	Active	Distance from TP:	>2 Miles
Date Initiated:	June / 1977	Date Deactivated:	Not Reported	Dir relative to TP:	West
PWS Name:	BRIDGEHEAD RENTALS SWS MAURICE AND GENEVA LODGE 5540 HIGHWAY OAKLEY, CA 94561				

Addressee / Facility: System Owner/Responsible Party
MAURICE AND GENEVA LODGE
2743 G STREET
ANTIOCH, CA 94509

Facility Latitude:	37 59 51	Facility Longitude:	121 42 41
City Served:	Not Reported		
Treatment Class:	Untreated	Population Served:	Under 101 Persons

PWS currently has or has had major violation(s): Yes

Violations information not reported.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM RECORDS:

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 08/27/98
Date Made Active at EDR: 10/06/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 09/03/98
Elapsed ASTM days: 33
Date of Last EDR Contact: 08/27/98

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 06/30/98
Date Made Active at EDR: 07/20/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 07/14/98
Elapsed ASTM days: 6
Date of Last EDR Contact: 07/10/98

NPL: National Priority List
Source: EPA
Telephone: 703-603-8852
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC).

Date of Government Version: 03/06/98
Date Made Active at EDR: 07/09/98
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 06/09/98
Elapsed ASTM days: 30
Date of Last EDR Contact: 09/21/98

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 07/01/98
Date Made Active at EDR: 10/06/98
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 08/27/98
Elapsed ASTM days: 40
Date of Last EDR Contact: 08/14/98

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 12/15/97
Date Made Active at EDR: 02/02/98
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 01/05/98
Elapsed ASTM days: 28
Date of Last EDR Contact: 08/14/98

FEDERAL NON-ASTM RECORDS:

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/95
Database Release Frequency: Biennially
Date of Last EDR Contact: 09/22/98
Date of Next Scheduled EDR Contact: 12/21/98

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: Varies
Database Release Frequency: Varies
Date of Last EDR Contact: Varies
Date of Next Scheduled EDR Contact: N/A

FINDS: Facility Index System
Source: EPA/NTIS
Telephone: 703-908-2493
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 09/30/97
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/23/98
Date of Next Scheduled EDR Contact: 12/21/98

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4526
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/97
Database Release Frequency: Annually
Date of Last EDR Contact: 07/22/98
Date of Next Scheduled EDR Contact: 10/26/98

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/28/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/13/98
Date of Next Scheduled EDR Contact: 10/12/98

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 205-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 08/28/98
Date of Next Scheduled EDR Contact: 11/23/98

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/22/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/18/98
Date of Next Scheduled EDR Contact: 11/16/98

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 03/31/95
Database Release Frequency: Annually
Date of Last EDR Contact: 10/09/98
Date of Next Scheduled EDR Contact: 01/18/99

TRIS: Toxic Chemical Release Inventory System
Source: EPA/NTIS
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/95
Database Release Frequency: Annually
Date of Last EDR Contact: 09/28/98
Date of Next Scheduled EDR Contact: 12/28/98

TSCA: Toxic Substances Control Act
Source: EPA/NTIS
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site. USEPA has no current plan to update and/or re-issue this database.

Date of Government Version: 12/31/94
Database Release Frequency: Annually
Date of Last EDR Contact: 07/22/98
Date of Next Scheduled EDR Contact: 10/26/98

STATE OF CALIFORNIA ASTM RECORDS:

BEP: Bond Expenditure Plan
Source: Department of Health Services
Telephone: 916-255-2118
Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/89
Date Made Active at EDR: 08/02/94
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 07/27/94
Elapsed ASTM days: 6
Date of Last EDR Contact: 05/31/94

CAL-SITES (AWP): Annual Workplan
Source: California Environmental Protection Agency
Telephone: 916-323-3400
Known Hazardous Waste Sites. California DTSC's Annual Workplan (AWP), formerly BEP, identifies known hazardous substance sites targeted for cleanup.

Date of Government Version: 11/04/97
Date Made Active at EDR: 12/20/97
Database Release Frequency: Annually
Date of Data Arrival at EDR: 11/21/97
Elapsed ASTM days: 29
Date of Last EDR Contact: 07/27/98

CAL-SITES (ASPIS): Calsites
Source: Department of Toxic Substance Control
Telephone: 916-323-3400
The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database.

Date of Government Version: 07/23/98
Date Made Active at EDR: 09/23/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/24/98
Elapsed ASTM days: 30
Date of Last EDR Contact: 06/08/98

CHMIRS: California Hazardous Material Incident Report System
Source: Office of Emergency Services
Telephone: 916-464-3277
California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 12/31/94
Date Made Active at EDR: 04/24/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 03/13/95
Elapsed ASTM days: 42
Date of Last EDR Contact: 09/03/98

CORTESE: Cortese
Source: CAL EPA/Office of Emergency Information
Telephone: 916-327-1848
The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 04/01/98
Date Made Active at EDR: 09/23/98
Database Release Frequency: Annually
Date of Data Arrival at EDR: 08/26/98
Elapsed ASTM days: 28
Date of Last EDR Contact: 07/27/98

LUST: Leaking Underground Storage Tank Information System
Source: State Water Resources Control Board
Telephone: 916-445-6532
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/01/98
Date Made Active at EDR: 09/23/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/27/98
Elapsed ASTM days: 27
Date of Last EDR Contact: 08/12/98

NOTIFY 65: Proposition 65
Source: State Water Resources Control Board
Telephone: 916-657-0696
Proposition 65 Notification Records. NOTIFY 65 contains facility notifications about any release which could impact drinking water and thereby expose the public to a potential health risk.

Date of Government Version: 10/21/93
Date Made Active at EDR: 11/19/93
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 11/01/93
Elapsed ASTM days: 18
Date of Last EDR Contact: 07/22/98

SWF/LF (SWIS): Solid Waste Information System
Source: Integrated Waste Management Board
Telephone: 916-255-4035
Active, Closed and Inactive Landfills. SWF/LF records typically contain an inventory of solid waste disposal facilities or landfills. These may be active or inactive facilities or open dumps that failed to meet RCRA Section 2004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 01/01/98
Date Made Active at EDR: 04/13/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/17/98
Elapsed ASTM days: 27
Date of Last EDR Contact: 09/22/98

TOXIC PITS: Toxic Pits
Source: State Water Resources Control Board
Telephone: 916-227-4364
Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/95
Date Made Active at EDR: 09/26/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 08/30/95
Elapsed ASTM days: 27
Date of Last EDR Contact: 08/12/98

CA UST:

UST: Hazardous Substance Storage Container Database
Source: State Water Resources Control Board
Telephone: 916-227-4408
The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/90
Date Made Active at EDR: 02/12/91
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 01/25/91
Elapsed ASTM days: 18
Date of Last EDR Contact: 10/19/98

FID: Facility Inventory Database
Source: California Environmental Protection Agency
Telephone: 916-445-6532
The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/94
Date Made Active at EDR: 09/29/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 09/05/95
Elapsed ASTM days: 24
Date of Last EDR Contact: 09/28/98

WMUDS/SWAT: Waste Management Unit Database
Source: State Water Resources Control Board
Telephone: 916-227-4448
Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 06/11/98
Date Made Active at EDR: 11/16/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 09/14/98
Elapsed ASTM days: 63
Date of Last EDR Contact: 09/08/98

STATE OF CALIFORNIA NON-ASTM RECORDS:

AST: Aboveground Petroleum Storage Tank Facilities
Source: State Water Resources Control Board
Telephone: 916-227-4382
Registered Aboveground Storage Tanks.

Date of Government Version: 08/01/97
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/12/98
Date of Next Scheduled EDR Contact: 11/09/98

HAZMAT: Hazmat Facilities
Source: City of San Jose Fire Department
Telephone: 408-277-4659

Date of Government Version: 04/17/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/24/98
Date of Next Scheduled EDR Contact: 11/23/98

HAZNET: Hazardous Waste Information System
Source: California Environmental Protection Agency
Telephone: 916-324-1781
Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method.

Date of Government Version: 12/31/95
Database Release Frequency: Annually
Date of Last EDR Contact: 10/05/98
Date of Next Scheduled EDR Contact: 01/18/99

SOUTH BAY: South Bay Site Management System
Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Groundwater pollution cases in the Santa Clara Valley where the regulatory lead is the San Francisco Bay Regional Water Quality Control Board.

Date of Government Version: 09/01/96
Database Release Frequency: Annually
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

WDS: Waste Discharge System
Source: State Water Resources Control Board
Telephone: 916-657-1571
Sites which have been issued waste discharge requirements.

Date of Government Version: 12/01/97
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/24/98
Date of Next Scheduled EDR Contact: 11/23/98

CALIFORNIA COUNTY RECORDS

ALAMEDA COUNTY:

Underground Tanks
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 04/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 07/27/98
Date of Next Scheduled EDR Contact: 11/02/98

Local Oversight Program Listing of UGT Cleanup Sites
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 10/01/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 07/27/98
Date of Next Scheduled EDR Contact: 11/02/98

CONTRA COSTA COUNTY:

SL: Site List
Source: Contra Costa Health Services Department
Telephone: 925-646-2286
List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 05/21/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/12/98
Date of Next Scheduled EDR Contact: 11/09/98

KERN COUNTY:

UST: Sites & Tanks Listing
Source: Kern County Environment Health Services Department
Telephone: 805-862-8700
Kern County Sites and Tanks Listing.

Date of Government Version: 04/21/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/13/98
Date of Next Scheduled EDR Contact: 12/07/98

LOS ANGELES COUNTY:

HMS: Street Number List
Source: Department of Public Works
Telephone: 626-458-3517
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 03/31/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 07/13/98
Date of Next Scheduled EDR Contact: 10/12/98

SWF/LF: List of Solid Waste Facilities
Source: La County Department of Public Works
Telephone: 818-458-5185

Date of Government Version: 01/31/96
Database Release Frequency: Annually
Date of Last EDR Contact: 09/03/98
Date of Next Scheduled EDR Contact: 11/24/98

Site Mitigation List
Source: Community Health Services
Telephone: 213-890-7806
Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 01/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/24/98
Date of Next Scheduled EDR Contact: 11/23/98

MARIN COUNTY:

UST Sites
Source: Public Works Department Waste Management
Telephone: 415-499-6647
Currently permitted USTs in Marin County.

Date of Government Version: 12/01/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/12/98
Date of Next Scheduled EDR Contact: 11/09/98

NAPA COUNTY:

LUST: Sites With Reported Contamination
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 10/27/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/21/98
Date of Next Scheduled EDR Contact: 12/21/98

UST: Closed and Operating Underground Storage Tank Sites
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 02/17/98
Database Release Frequency: Annually
Date of Last EDR Contact: 09/21/98
Date of Next Scheduled EDR Contact: 12/21/98

ORANGE COUNTY:

List of Industrial Site Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Petroleum and non-petroleum spills.

Date of Government Version: 03/13/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

LUST: List of Underground Storage Tank Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 03/02/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

UST: List of Underground Storage Tank Facilities
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 02/24/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

PLACER COUNTY:

MS: Master List of Facilities
Source: Placer County Health and Human Services
Telephone: 530-889-7335
List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 06/30/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/28/98
Date of Next Scheduled EDR Contact: 12/28/98

RIVERSIDE COUNTY:

LUST: Listing of Underground Tank Cleanup Sites
Source: Department of Public Health
Telephone: 909-358-5055
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 01/21/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/22/98
Date of Next Scheduled EDR Contact: 10/26/98

UST: Tank List
Source: Health Services Agency
Telephone: 909-358-5055

Date of Government Version: 01/14/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/22/98
Date of Next Scheduled EDR Contact: 10/26/98

SACRAMENTO COUNTY:

Toxisite List
Source: Sacramento County Environmental Management
Telephone: 916-875-8450

Date of Government Version: 02/02/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/21/98
Date of Next Scheduled EDR Contact: 11/09/98

ML: Regulatory Compliance Master List
Source: Sacramento County Environmental Management
Telephone: 916-875-8450
Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 01/06/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/21/98
Date of Next Scheduled EDR Contact: 11/09/98

SAN BERNARDINO COUNTY:

DEHS Permit System Print-Out By Location
Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 07/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/14/98
Date of Next Scheduled EDR Contact: 12/14/98

SAN DIEGO COUNTY:

SWF/LF: Solid Waste Facilities
Source: Department of Health Services
Telephone: 619-338-2209
San Diego County Solid Waste Facilities.

Date of Government Version: 11/08/95
Database Release Frequency: Annually
Date of Last EDR Contact: 09/03/98
Date of Next Scheduled EDR Contact: 11/30/98

HMMD: Hazardous Materials Management Division Database
Source: Hazardous Materials Management Division
Telephone: 619-338-2268
The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 07/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 01/11/99

SAN FRANCISCO COUNTY:

LUST: Local Oversite Facilities
Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920

Date of Government Version: 03/19/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/19/98
Date of Next Scheduled EDR Contact: 11/16/98

Underground Storage Tank Information
Source: Department of Public Health
Telephone: 415-252-3920

Date of Government Version: 03/19/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/16/98
Date of Next Scheduled EDR Contact: 11/16/98

SAN MATEO COUNTY:

Business Inventory
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 04/01/98
Database Release Frequency: Annually
Date of Last EDR Contact: 08/17/98
Date of Next Scheduled EDR Contact: 11/16/98

LUST: Fuel Leak List
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921

Date of Government Version: 07/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/09/98
Date of Next Scheduled EDR Contact: 01/04/99

SANTA CLARA COUNTY:

LUST: Fuel Leak Site Activity Report
Source: Santa Clara Valley Water District
Telephone: 408-927-0710

Date of Government Version: 07/01/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/06/98
Date of Next Scheduled EDR Contact: 01/04/99

SOLANO COUNTY:

LUST: Leaking Undergroung Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 04/16/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/24/98
Date of Next Scheduled EDR Contact: 11/23/98

UST: Underground Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 04/16/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/24/98
Date of Next Scheduled EDR Contact: 11/23/98

SONOMA COUNTY:

LUST Sites
Source: Department of Health Services
Telephone: 707-525-6565

Date of Government Version: 07/07/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/05/98
Date of Next Scheduled EDR Contact: 01/05/99

SUTTER COUNTY:

UST: Underground Storage Tanks
Source: Sutter County Department of Agriculture
Telephone: 530-741-7504

Date of Government Version: 09/18/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 01/11/99

VENTURA COUNTY:

BWT: Business Plan, Hazardous Waste Producers, and Operating Underground Tanks
Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 06/29/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/21/98
Date of Next Scheduled EDR Contact: 12/21/98

LUST: Listing of Underground Tank Cleanup Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 06/26/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/21/98
Date of Next Scheduled EDR Contact: 12/21/98

UST: Underground Tank Closed Sites List
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 06/29/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/21/98
Date of Next Scheduled EDR Contact: 12/21/98

SWF/LF: Inventory of Illegal Abandoned and Inactive Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 06/01/97
Database Release Frequency: Annually
Date of Last EDR Contact: 08/31/98
Date of Next Scheduled EDR Contact: 11/30/98

California Regional Water Quality Control Board (RWQCB) LUST Records

LUST REG 1: Active Toxic Site Investigation
Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-576-2220

Date of Government Version: 06/30/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 11/30/98

LUST REG 2: Fuel Leak List
Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457

Date of Government Version: 05/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/19/98
Date of Next Scheduled EDR Contact: 10/19/98

LUST REG 3: LUSTIS Database
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147

Date of Government Version: 03/12/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/25/98
Date of Next Scheduled EDR Contact: 11/23/98

LUST REG 4: Underground Storage Tank Leak List
Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-266-7544

Date of Government Version: 04/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/05/98
Date of Next Scheduled EDR Contact: 01/04/99

LUST REG 5: Leaking Underground Storage Tank Database
Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-255-3125

Date of Government Version: 07/22/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 01/11/99

LUST REG 6L: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 916-542-5424

Date of Government Version: 07/14/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/14/98
Date of Next Scheduled EDR Contact: 01/11/99

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-346-7491

Date of Government Version: 11/12/97
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/27/98
Date of Next Scheduled EDR Contact: 11/02/98

LUST REG 7: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-346-7491

Date of Government Version: 11/12/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/31/98
Date of Next Scheduled EDR Contact: 11/30/98

LUST REG 8: (LUSTIS) Leaking Underground Storage Tanks
Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4498

Date of Government Version: 04/08/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/14/98
Date of Next Scheduled EDR Contact: 10/12/98

LUST REG 9: Leaking Underground Storage Tank Report
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 619-467-2952

Date of Government Version: 12/23/97
Database Release Frequency: Quarterly

Date of Last EDR Contact: 07/15/98
Date of Next Scheduled EDR Contact: 11/03/98

California Regional Water Quality Control Board (RWQCB) SLIC Records

SLIC REG 1: Active Toxic Site Investigations
Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220

Date of Government Version: 06/30/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 11/30/98

SLIC REG 2: North and South Bay Slic Report
Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 05/20/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/19/98
Date of Next Scheduled EDR Contact: 10/19/98

SLIC REG 3: SLIC Data
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 12/12/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/25/98
Date of Next Scheduled EDR Contact: 11/23/98

SLIC REG 4: SLIC Sites
Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-266-7544
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 07/01/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/05/98
Date of Next Scheduled EDR Contact: 01/04/99

SLIC REG 5: SLIC List
Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-855-3075
Unregulated sites that impact groundwater or have the potential to impact groundwater.

Date of Government Version: 04/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/14/98
Date of Next Scheduled EDR Contact: 01/11/99

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583

Date of Government Version: 09/23/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/16/98
Date of Next Scheduled EDR Contact: 01/11/99

SLIC REG 8: SLIC List
Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-3298

Date of Government Version: 10/31/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/13/98
Date of Next Scheduled EDR Contact: 01/11/99

SLIC REG 9: WDS NURD List
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 619-467-2980

Date of Government Version: 11/21/96
Database Release Frequency: Annually
Date of Last EDR Contact: 09/10/98
Date of Next Scheduled EDR Contact: 12/07/98

Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

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DELISTED NPL: NPL Deletions
Source: EPA
Telephone: 703-603-8769
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/06/98
Date Made Active at EDR: 07/09/98
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 06/09/98
Elapsed ASTM days: 30
Date of Last EDR Contact: 09/28/98

NFRAP: No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 08/27/98
Date Made Active at EDR: 10/03/98
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 09/03/98
Elapsed ASTM days: 30
Date of Last EDR Contact: 08/27/98

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SWDIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1996 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in March 1997 from the U.S. Fish and Wildlife Service.

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Water Dams: National Inventory of Dams
Source: Federal Emergency Management Agency
Telephone: 202-646-2801
National computer database of more than 74,000 dams maintained by the Federal Emergency Management Agency.

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

California Drinking Water Quality Database
Source: Department of Health Services
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

California Oil and Gas Well Locations for District 2 and 6
Source: Department of Conservation
Telephone: 916-323-1779

ENVIRONMENTAL SITE ASSESSMENT UPDATE

SOUTHERN 140 ACRES, EMERSON PROPERTY

OAKLEY, CALIFORNIA

SUBMITTED

TO

PONDEROSA HOMES

PLEASANTON, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 4603.1.011.01

JUNE 21, 2004

Project No.
4603.1.011.01

June 21, 2004

Mr. Jeff Schroeder
Ponderosa Homes
6671 Owens Drive
Pleasanton, CA 94588

Subject: Emerson Property – Southern 140 Acres
Oakley, California

ENVIRONMENTAL SITE ASSESSMENT UPDATE

Reference: ENGEO Inc.; Phase One Environmental Site Assessment, Emerson and Burroughs Properties, Cypress Corridor, Oakley, California; August 23, 1999; Project No. 4603.3.001.01.

Dear Mr. Schroeder:

As requested, this letter presents an update and review of the referenced environmental assessment report for the southern 140 acres of the Emerson property (APN 037-192-015 and 037-192-016).

The scope of work included a review of the referenced document, a site reconnaissance, a supplemental regulatory records search, and preparation of this report with our conclusions.

SITE LOCATION AND DESCRIPTION

The Emerson parcels comprise approximately 140 acres, located in Oakley, California. Sellers Avenue and Cypress Road bound the Emerson properties on the east and south, respectively and a Contra Costa County canal borders the site to the north. The Emerson property consists of pasture, single-family homes, and appurtenant structures for farming/equipment maintenance.

PREVIOUS STUDIES

Phase One Environmental Site Assessment

A phase one environmental site assessment was performed in 1999 for the 1,100 acre Emerson and Burroughs properties that included the current 140 acre subject site. The scope of services provided by ENGEO Incorporated to prepare the referenced phase one site assessment consisted of the following:

- A review of publicly available and practically reviewable standard local, state, and federal environmental record sources.

- A review of several publicly available and practically reviewable standard historical sources, aerial photographs, fire insurance maps, and physical setting sources.

- A reconnaissance of the property.

- Interviews with the property owners and government officials.

- Preparation of the phase one environmental site assessment report.

The 1999 assessment describes the 140 acre subject site conditions as follows:

- APN 037-192-015

Development of the parcel is limited to a single mobile home.

- APN 037-192-016

Improvements on the parcel include two single-family residences and a historical barn structure. The majority of the parcel consists of undeveloped pasture. A private water supply well and septic systems service the residences.

Historical Information Review (Emerson and Burroughs 1,100 acre site)

A review of regulatory databases maintained by county, state, and federal agencies found no documentation of hazardous materials violations or discharge on the property. The review of regulatory databases identified one leaking underground storage tank site within ½ mile of the subject property; however, given the distance of this site and the available database information, this site would not be expected to impact the subject properties. Four registered underground storage tank (UST) facilities were documented within ¼ mile of the subject property. Two of these facilities have had the USTs removed, with no evidence of significant soil impacts. The remaining two facilities have active USTs.

The review of aerial photographs and available historical records found that the subject property has remained relatively unchanged from at least 1953 to present, with the exception of minor site improvements. The 1999 site reconnaissance and records research did not find documentation or physical evidence of soil or groundwater impairments associated with the use of the property, with the exception of surface soil impacts related to above ground petroleum product storage tanks on both the Burroughs and Emerson properties.

Based on the findings of the 1999 assessment, ENGEO identified the following potential environmental concerns:

Burroughs Parcels

- Existing/Preexisting Natural Gas Well Sites

  Potential impacts associated with the existing/preexisting well sites could include the following:

  - Hydrocarbon impacts to soil/groundwater as a result of spillage from condensate storage tanks.
  - Spillage from above-ground diesel and motor oil storage tanks.
  - Hydrocarbon impacts within the area of compressor units.
  - Mercury impacts adjacent/beneath meter sheds.
  - Hydrocarbon/barium impacts associated with former drill sumps.
  - Hydrocarbon impacts around wellheads.

- Nitrate Impacts

  Given the current and historical dairy activities, it is possible that site soils and groundwater may exhibit elevated nitrate levels.

- Above-Ground Fuel Tanks

  The AGTs located north of the maintenance shed are currently empty; however, some soil staining was observed beneath the tanks. It is likely that some localized impact to site soils may have occurred as a result of past leakage/spills from the AGTs.

- Car Port/Garage

  A possible maintenance pit/sump, covered by wooden planks, was observed within the garage unit. Potential soil impacts may have occurred if motor oil, fuels, or solvents were discharged to the pit.

- Asbestos-Containing Materials

  An asbestos survey was not conducted as part of the site assessment. Given the age of the structures, it is conceivable that asbestos-containing materials may have been used in construction.

Emerson Parcels

- Nitrate Impacts

  Given the current and historical dairy activities, it is possible that site soils and groundwater may exhibit elevated nitrate levels.

- Above-Ground Fuel Tanks

  The AGTs are currently located within a concrete vault; however, we understand the tanks were previously stored above the ground surface. It is possible that some impact to soil and/or groundwater may have occurred as a result of product use.

- Waste Oil Tank

  Some soil staining was noted beneath the above-ground waste oil tank. It appears that spillage of motor oil has impacted near-surface soil.

- Oil House

  No obvious indication of soil impacts was noted in association with the petroleum product storage, with the exception of some discoloration of soil at the eastern side of the shed. It is conceivable some impact to soil may have occurred as a result of past product spills.

- Pesticide Shed

  No indication of a substance release or soil impacts was noted within the area of the pesticide shed. It is possible that soils may have been impacted as a result of past product spillage.

- Former Underground Fuel Tank

  Mr. Emerson indicated there was no evidence of fuel releases at the time of the UST removal. Based on this observation, it is unlikely that significant impacts exist.

- Asbestos-Containing Materials

  An asbestos survey was not conducted as part of the site assessment. Given the age of structures, it is conceivable that asbestos-containing materials may have been used in construction.

SUPPLEMENTAL SITE RECONNAISSANCE

An ENGEO Environmental Geologist conducted a supplemental site reconnaissance on June 17, 2004. The subject site parcels were viewed for hazardous materials storage, surficial staining or discoloration, debris, stressed vegetation, on-site dumping or other conditions which may be indicative of potential sources of soil or groundwater contamination.

The condition of the property at the time of the site reconnaissance was similar to that described in the referenced report.

SUPPLEMENTAL RECORDS RESEARCH

For the purpose of this update, an additional records research report was performed by Environmental Data Resources, Inc. (EDR) (Appendix A). A review of regulatory databases maintained by county, state and federal agencies found no documentation of hazardous materials violations or discharge on the property. Based on a review of the updated EDR report, no sites were documented that could adversely impact the subject property. There were no Sanborn Fire Insurance Maps available for the coverage area of the property.

CONCLUSIONS

ENGEO has performed a Phase One Environmental Site Assessment of the subject property in accordance with the outlined scope of services. Based on the findings of this assessment, ENGEO provides the following recommendations:

- Demolition/Pre-Grading Observation

  An environmental professional should view the property at the time of demolition and pre-grading activities, to observe areas that may have been obscured by structures or debris. In particular, the areas around the residences and barns should be observed for possible buried structures and stained/odoriferous soil. Additional recommendations for subsurface assessments may be provided at the time of demolition.

- Asbestos Survey

  An asbestos survey of the existing structures should be undertaken prior to any future demolition work.

- Septic Systems/Water Wells

  Existing septic systems and domestic/irrigation wells should be removed/abandoned in accordance with county/state regulations.

If you have any questions regarding this report, please contact us.

Very truly yours,

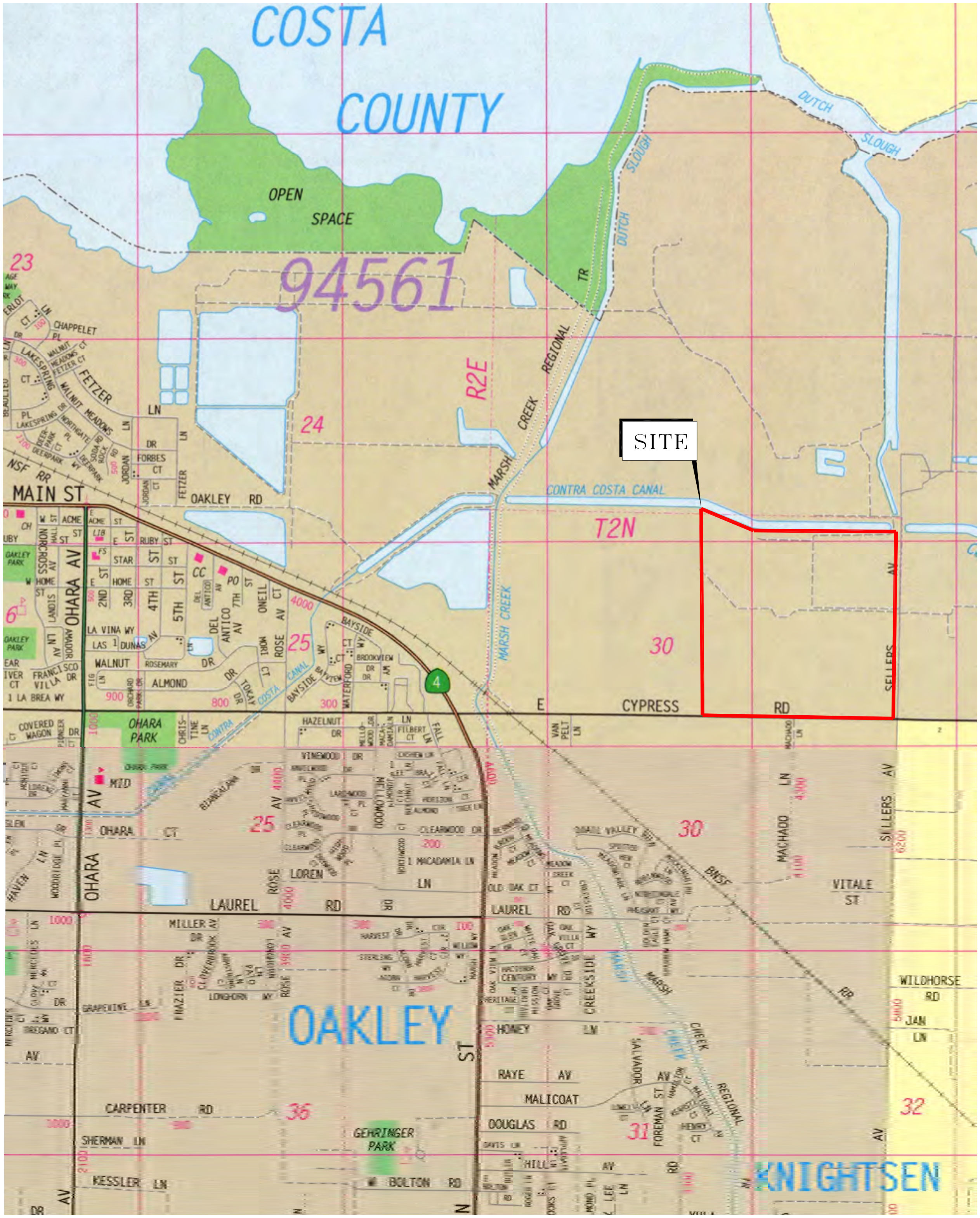
ENGEO INCORPORATED

for Casey Lee Jensen
Geologist
clj/bf/cc:esaupdate

Reviewed by:

Brian Flaherty
REA 923

Attachments: Figure 1 – Site Location Map
Figure 2 – Topographic Map
Figure 3 – Record Boundary
Appendix A - Environmental Data Resources, Inc., Radius Map Report



N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: THOMAS BROTHERS

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE LOCATION MAP
SOUTHERN 140 ACRES, EMERSON PROPERTY
OAKLEY, CALIFORNIA

PROJECT NO.: 4603.1.011.01	
DATE: JUNE 2004	
DRAWN BY: SRP	CHECKED BY: DEB

FIGURE NO.
1

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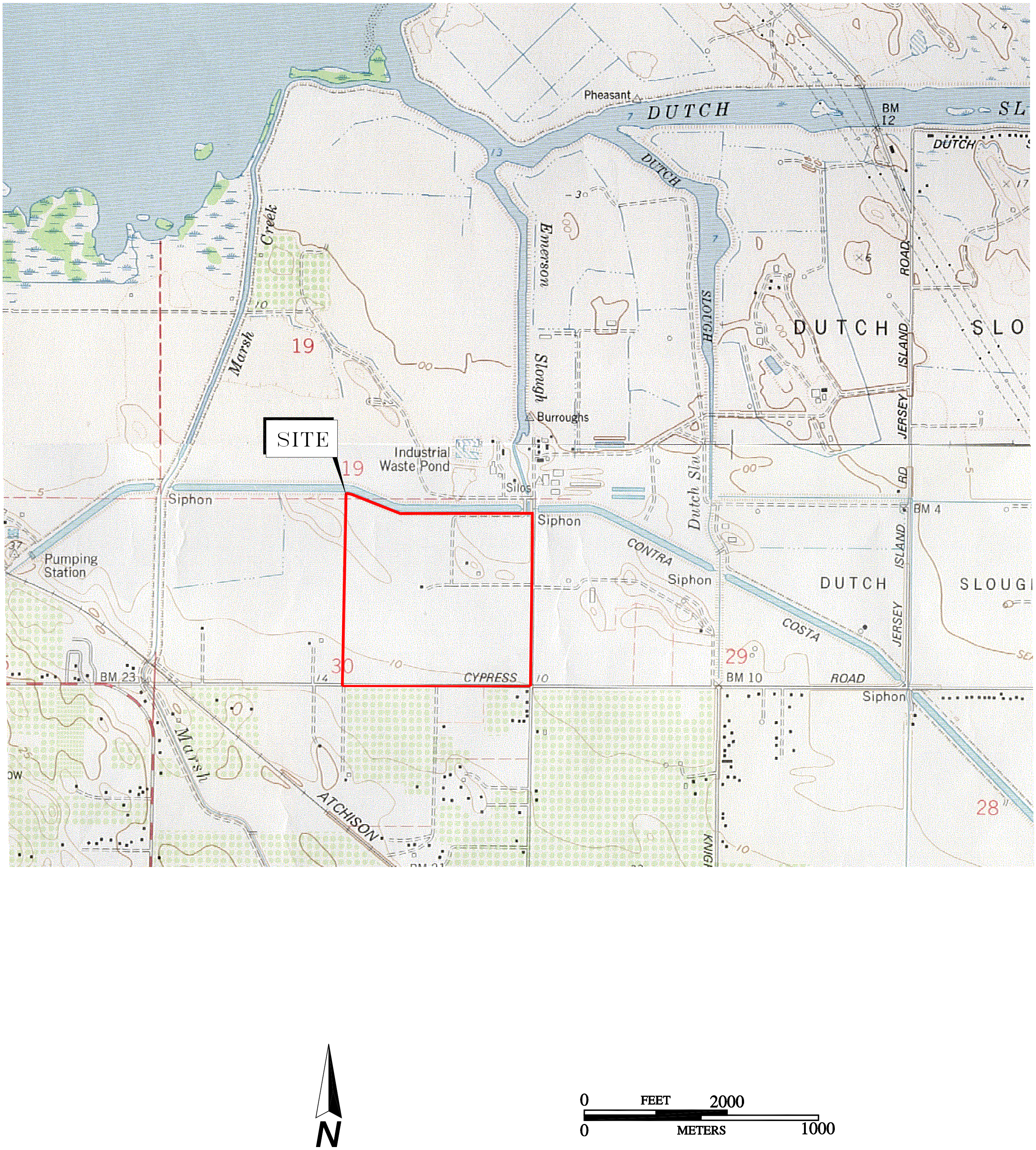

BASE MAP SOURCE: USGS

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

TOPOGRAPHIC MAP

SOUTHERN 140 ACRES, EMERSON PROPERTY

OAKLEY, CALIFORNIA

PROJECT NO.: 4603.1.011.01	
DATE: JUNE 2004	
DRAWN BY: SRP	CHECKED BY: DEB

FIGURE NO. 2

ORIGINAL FIGURE PRINTED IN COLOR

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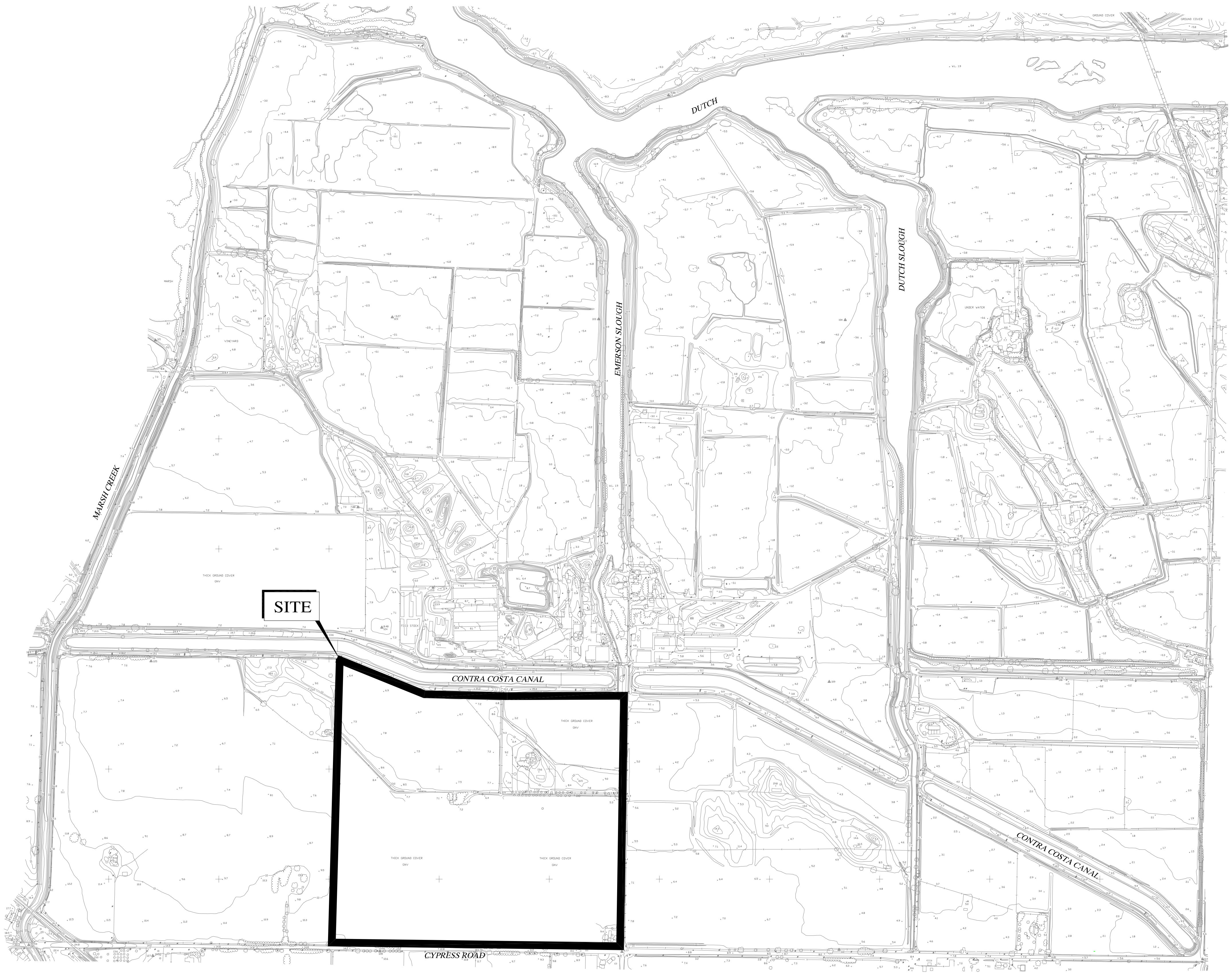

BASE MAP SOURCE: CARLSON, BARBEE AND GIBSON, INC.

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	RECORD BOUNDRY SOUTHERN 140 ACRES, EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.1.011.01 DATE: JUNE 2004 DRAWN BY: SRP CHECKED BY: DEB	FIGURE NO. 3

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APPENDIX A

ENVIRONMENTAL DATA RESOURCES, INC.

Radius Map Report

4603.1.011.01
June 21, 2004

The EDR Radius Map
with GeoCheck®

EDR™ Environmental Data Resources Inc

140 Acre South Emmerson Property
NWC of Sellers Ave
Oakley, CA 94561

Inquiry Number: 01212613.1r

June 15, 2004

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06460

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

FORM-MOR

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-00. Search distances are per ASTM standard or custom distances requested by the user.

TARGET PROPERTY INFORMATION

ADDRESS

NWC OF SELLERS AVE
OAKLEY, CA 94561

COORDINATES

Latitude (North):	37.994300 - 37˚ 59’ 39.5’’
Longitude (West):	121.682300 - 121˚ 40’ 56.3’’
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	615704.9
UTM Y (Meters):	4205796.0
Elevation:	12 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	37121-H6 BRENTWOOD, CA
Source:	USGS 7.5 min quad index

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR’s search of available ("reasonably ascertainable ") government records either on the target property or within the ASTM E 1527-00 search radius around the target property for the following databases:

FEDERAL ASTM STANDARD

NPL - National Priority List
Proposed NPL - Proposed National Priority List Sites
CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP - CERCLIS No Further Remedial Action Planned
CORRACTS - Corrective Action Report
RCRIS-TSD - Resource Conservation and Recovery Information System
RCRIS-LQG - Resource Conservation and Recovery Information System
RCRIS-SQG - Resource Conservation and Recovery Information System
ERNS - Emergency Response Notification System

STATE ASTM STANDARD

CHMIRS - California Hazardous Material Incident Report System

EXECUTIVE SUMMARY

Toxic Pits Toxic Pits Cleanup Act Sites
SWF/LF Solid Waste Information System
WMUDS/SWAT Waste Management Unit Database
UST List of Underground Storage Tank Facilities
VCP Voluntary Cleanup Program Properties
INDIAN LUST Leaking Underground Storage Tanks on Indian Land
INDIAN UST Underground Storage Tanks on Indian Land
CA FID UST Facility Inventory Database

FEDERAL ASTM SUPPLEMENTAL

CONSENT Superfund (CERCLA) Consent Decrees
ROD Records Of Decision
Delisted NPL National Priority List Deletions
FINDS Facility Index System/Facility Identification Initiative Program Summary Report
HMIRS Hazardous Materials Information Reporting System
MLTS Material Licensing Tracking System
MINES Mines Master Index File
NPL Liens Federal Superfund Liens
PADS PCB Activity Database System
DOD Department of Defense Sites
US BROWNFIELDS A Listing of Brownfields Sites
FUDS Formerly Used Defense Sites
INDIAN RESERV Indian Reservations
RAATS RCRA Administrative Action Tracking System
TRIS Toxic Chemical Release Inventory System
TSCA Toxic Substances Control Act
SSTS Section 7 Tracking Systems
FTTS INSP FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

STATE OR LOCAL ASTM SUPPLEMENTAL

AST Aboveground Petroleum Storage Tank Facilities
CLEANERS Cleaner Facilities
DEED List of Deed Restrictions
SCH School Property Evaluation Program
EMI Emissions Inventory Data
REF Unconfirmed Properties Referred to Another Agency
NFA No Further Action Determination
NFE Properties Needing Further Evaluation
CA SLIC Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
HAZNET Hazardous Waste Information System

EDR PROPRIETARY HISTORICAL DATABASES

Coal Gas Former Manufactured Gas (Coal Gas) Sites

BROWNFIELDS DATABASES

US BROWNFIELDS A Listing of Brownfields Sites
VCP Voluntary Cleanup Program Properties

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

EXECUTIVE SUMMARY

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STATE ASTM STANDARD

AWP: California DTSC's Annual Workplan, formerly known as BEP, identifies known hazardous substance sites targeted for cleanup. The source is the California Environmental Protection Agency.

A review of the AWP list, as provided by EDR, and dated 03/02/2004 has revealed that there is 1 AWP site within approximately 1.5 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
COOK BATTERY (OAKLEY BATT	***139 HILL***	***1 - 2 SSW***	***C10***	***10***

CAL-SITES: Formerly known as ASPIS, this database contains both known and potential hazardous substance sites. The source is the California Department of Toxic Substance Control.

A review of the Cal-Sites list, as provided by EDR, has revealed that there is 1 Cal-Sites site within approximately 1.5 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
COOK BATTERY (OAKLEY BATT	***139 HILL***	***1 - 2 SSW***	***C10***	***10***

CORTESE: This database identifies public drinking water wells with detectable levels of contamination, hazardous substance sites selected for remedial action, sites with known toxic material identified through the abandoned site assessment program, sites with USTs having a reportable release and all solid waste disposal facilities from which there is known migration. The source is the California Environmental Protection Agency/Office of Emergency Information.

A review of the Cortese list, as provided by EDR, has revealed that there is 1 Cortese site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
FOOD & LIQUOR #86	***HWY 4 / CYPRESS***	***1/2 - 1 WSW***	***B8***	***8***

NOTIFY 65: Notify 65 records contain facility notifications about any release that could impact drinking water and thereby expose the public to a potential health risk. The data come from the State Water Resources Control Board's Proposition 65 database.

A review of the Notify 65 list, as provided by EDR, has revealed that there is 1 Notify 65 site within approximately 1.5 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
FOOD & LIQUOR #86	HWY 4 / CYPRESS AVENU	1/2 - 1 WSW	B7	8

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the State Water Resources Control Board Leaking Underground Storage Tank Information System.

A review of the LUST list, as provided by EDR, and dated 04/13/2004 has revealed that there is 1 LUST site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
FOOD & LIQUOR #86	***HWY 4 / CYPRESS***	***1/2 - 1 WSW***	***B8***	***8***

BEP: Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

A review of the CA BOND EXP. PLAN list, as provided by EDR, has revealed that there is 1 CA BOND EXP. PLAN site within approximately 1.5 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
COOK BATTERY RECLAMATION (OAKL	139 HILL AVENUE	1 - 2 SSW	C9	10

HIST UST: Historical UST Registered Database.

A review of the HIST UST list, as provided by EDR, and dated 10/15/1990 has revealed that there is 1 HIST UST site within approximately 0.75 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
OAKLEY RANCH	CYPRESS AVENUE	1/2 - 1 WSW	A3	7

STATE OR LOCAL ASTM SUPPLEMENTAL

WDS: California Water Resources Control Board - Waste Discharge System.

A review of the CA WDS list, as provided by EDR, and dated 04/05/2004 has revealed that there is 1 CA WDS site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
EMERSON DAIRY INC	7101 SELLERS AVE	1/4 - 1/2 NE	1	6

EXECUTIVE SUMMARY

SL: Lists includes sites from the Underground Tank Program, Hazardous Waste Generator Program & Business Plan 12185 Program

A review of the CONTRA COSTA CO. SITE LIST list, as provided by EDR, has revealed that there are 4 CONTRA COSTA CO. SITE LIST sites within approximately 0.75 miles of the target property.

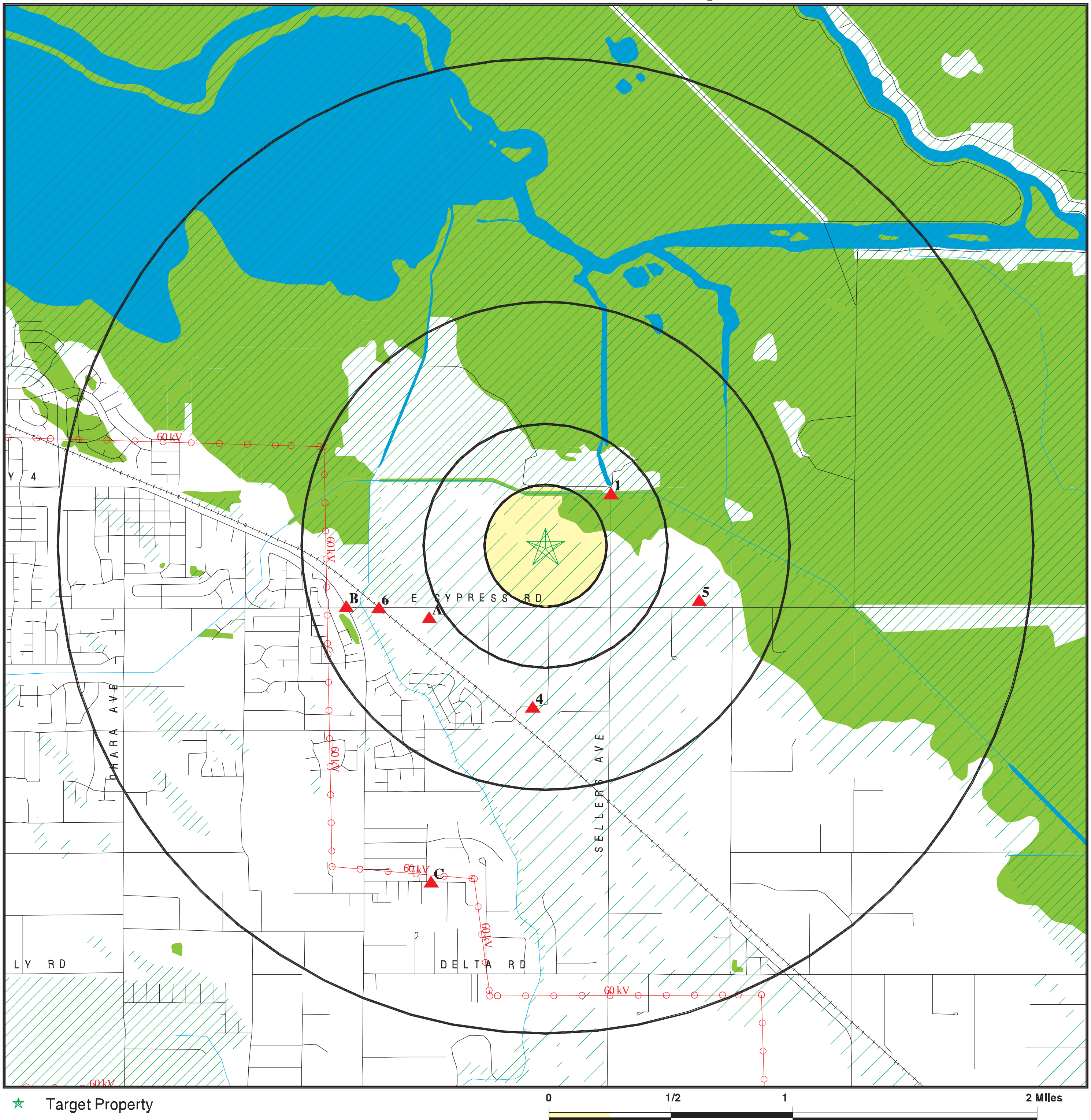
Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
OAKLEY RANCH	CYPRESS AVE	1/2 - 1 WSW	A2	6
BENNETT RESIDENCE	4253 MACHADO LN	1/2 - 1 S	4	7
CCC PUBLIC WORKS	CYPRESS RD @ SELLERS AV	1/2 - 1 ESE	5	7
M & L ACE HARDWARE	100 CYPRESS RD E	1/2 - 1 WSW	6	8

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
CAMINO DIABLO RD. WEST OF VASCO RD. NEAR BYRON.	CHMIRS, EMI
BLUE STAR GAS	LUST
S & S GAS FOOD & LIQUOR	UST
7-ELEVEN STORE #32787	UST
. . LEWIS RANCH	HIST UST
EMERSON DAIRY	HIST UST
ALFRED OR DARLENE DE ESUS	HIST UST
PUMPING PLANT 1	AST
VALUE PLUMBING CO INC	AST
MAURICE LODGE	HAZNET
EAGLE CITY MOBILE HOME PARK	HAZNET
CHEAPER #169	HAZNET
DELTA TOP SOIL	HAZNET
P G AND E DUTCH SLOUGH DEHYDRATOR	RCRIS-SQG, FINDS, HAZNET
CYPRESS RD YARD	RCRIS-SQG, FINDS
CHEVRON STATION NO 93801	RCRIS-SQG, FINDS
SHOSHONE OIL CORPORATION	FINDS, EMI
IRONHOUSE SANITARY DISTRICT	FINDS, EMI
TONKA ENERGY INC	FINDS, EMI
NGC CESA NO 1	CA WDS
CYPRESS ROAD NEW ELEMENTARY SCHOOL	SCH
BRADLEY EQUIPMENT SERVICES	CONTRA COSTA CO. SITE LIST
MCKINNEY, EMILE E	CONTRA COSTA CO. SITE LIST
LUCCHESI, ROY & RAPLH	CONTRA COSTA CO. SITE LIST
STONEBARGER RANCH	CONTRA COSTA CO. SITE LIST
LUCCHESI, GUIDO	CONTRA COSTA CO. SITE LIST
OHNSON, ELMER	CONTRA COSTA CO. SITE LIST
BALDOCCHI, EVO	CONTRA COSTA CO. SITE LIST
WINDSWEPT LIVESTOCK CO	CONTRA COSTA CO. SITE LIST
GOTLAND OIL, INC	CONTRA COSTA CO. SITE LIST
SHOSHONE OIL CORPORATION	CONTRA COSTA CO. SITE LIST
DE ESUS, OHN V	CONTRA COSTA CO. SITE LIST
BACCHINI RANCH	CONTRA COSTA CO. SITE LIST
WESTERN CONT’L NGC-KYSH-1	CONTRA COSTA CO. SITE LIST

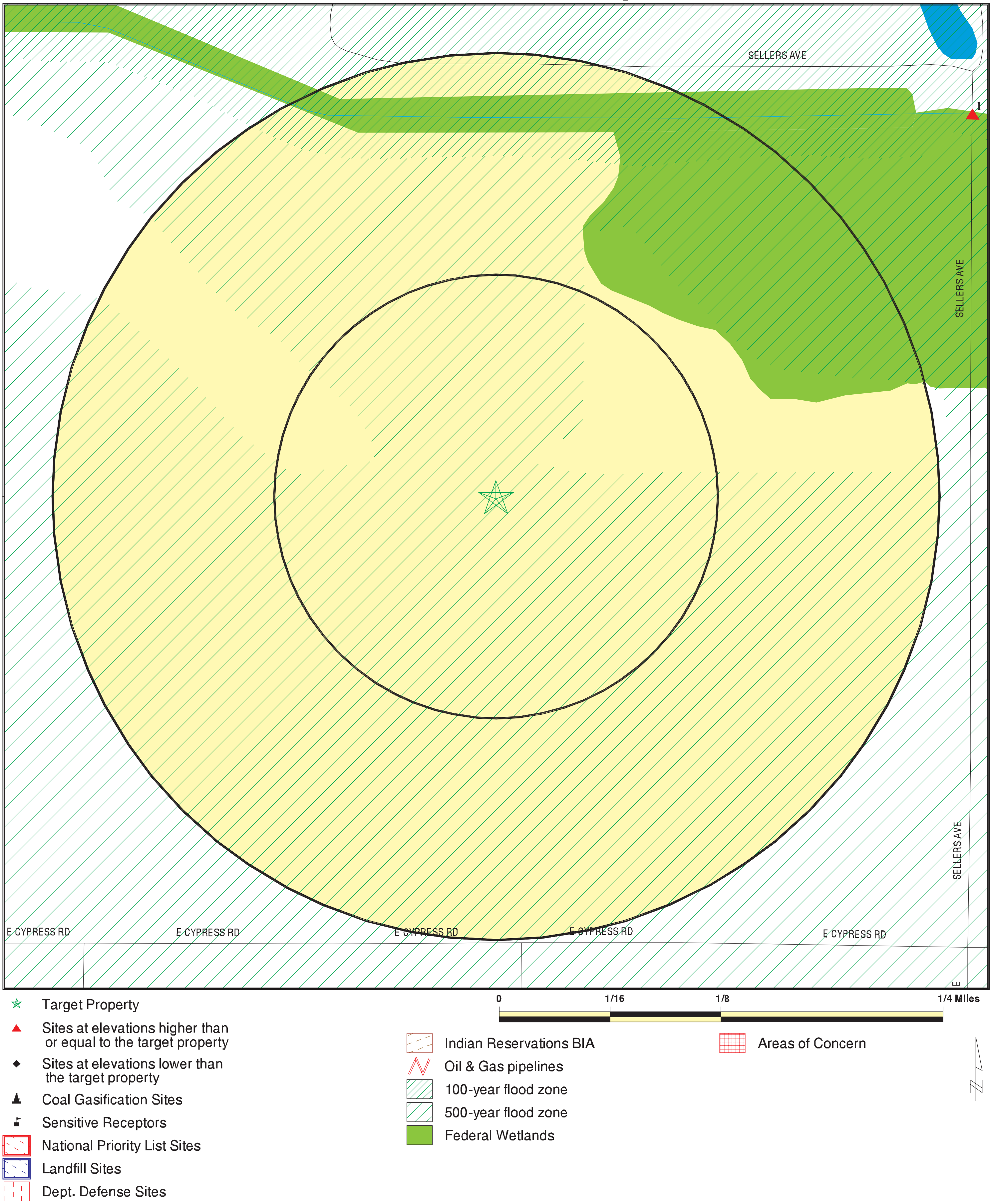
OVERVIEW MAP - 01212613.1r - Engeo Inc.



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Federal Wetlands
- Areas of Concern

TARGET PROPERTY:	140 Acre South Emmerson Property	CUSTOMER:	Engeo Inc.
ADDRESS:	NWC of Sellers Ave	CONTACT:	Casey Lee Jensen
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	01212613.1r
LAT/LONG:	37.9943 / 121.6823	DATE:	June 15, 2004 1:39 pm

DETAIL MAP - 01212613.1r - Engeo Inc.



TARGET PROPERTY:	140 Acre South Emmerson Property	CUSTOMER:	Engeo Inc.
ADDRESS:	NWC of Sellers Ave	CONTACT:	Casey Lee Jensen
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	01212613.1r
LAT/LONG:	37.9943 / 121.6823	DATE:	June 15, 2004 1:39 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL ASTM STANDARD								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		0.750	0	0	0	0	NR	0
CORRACTS		1.500	0	0	0	0	0	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
ERNS		0.500	0	0	0	NR	NR	0
STATE ASTM STANDARD								
AWP		1.500	0	0	0	0	1	1
Cal-Sites		1.500	0	0	0	0	1	1
CHMIRS		0.500	0	0	0	NR	NR	0
Cortese		1.000	0	0	0	1	NR	1
Notify 65		1.500	0	0	0	1	0	1
Toxic Pits		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
WMUDS/SWAT		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	1	NR	1
CA Bond Exp. Plan		1.500	0	0	0	0	1	1
UST		0.750	0	0	0	0	NR	0
VCP		1.000	0	0	0	0	NR	0
INDIAN LUST		1.000	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
CA FID UST		0.750	0	0	0	0	NR	0
HIST UST		0.750	0	0	0	1	NR	1
FEDERAL ASTM SUPPLEMENTAL								
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
Delisted NPL		1.500	0	0	0	0	0	0
FINDS		0.500	0	0	0	NR	NR	0
HMIRS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
MINES		0.750	0	0	0	0	NR	0
NPL Liens		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
DOD		1.500	0	0	0	0	0	0
US BROWNFIELDS		1.000	0	0	0	0	NR	0
FUDS		1.500	0	0	0	0	0	0
INDIAN RESERV		1.500	0	0	0	0	0	0
RAATS		0.500	0	0	0	NR	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SSTS		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
STATE OR LOCAL ASTM SUPPLEMENTAL								
AST		0.500	0	0	0	NR	NR	0
CLEANERS		0.750	0	0	0	0	NR	0
CA WDS		0.500	0	0	1	NR	NR	1
DEED		0.500	0	0	0	NR	NR	0
SCH		0.750	0	0	0	0	NR	0
EMI		0.500	0	0	0	NR	NR	0
REF		0.750	0	0	0	0	NR	0
NFA		0.750	0	0	0	0	NR	0
NFE		0.750	0	0	0	0	NR	0
CA SLIC		1.000	0	0	0	0	NR	0
HAZNET		0.500	0	0	0	NR	NR	0
Contra Costa Co. Site List		0.750	0	0	0	4	NR	4
EDR PROPRIETARY HISTORICAL DATABASES								
Coal Gas		1.500	0	0	0	0	0	0
BROWNFIELDS DATABASES								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
VCP		1.000	0	0	0	0	NR	0

NOTES:

AQUIFLOW - see EDR Physical Setting Source Addendum

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

---

1 **EMERSON DAIRY INC** **CA WDS** **S106104163**
NE **7101 SELLERS AVE** **N/A**
1/4-1/2 **OAKLEY, CA 94561**
1818 ft.

Relative:
Equal

Actual:
12 ft.

WDS:

Facility ID:	5S 07I014993		
Facility Contact	STAN EMERSON	Facility Telephone	(925) 625-3656
SIC Code:	Not reported	SIC Code 2:	Not reported
Agency Name:	EMERSON, STAN EMERSON DALE		
Agency Address:	7101 Sellers Ave Oakley 94561 - 4400		
Agency Contact:	STAN EMERSON	Agency Phone:	(925) 625-3656
Design Flow:	Not reported	Baseline Flow:	Not reported
Facility Type:	Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.		
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.		
Agency Type:	Private		
Waste Type:	Not reported		
Threat to Water:	Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.		
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.		
Reclamation:	Not reported		
POTW:	Not reported		
NPDES Number:	CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board		
Subregion:	0		

A2 **OAKLEY RANCH** **CONTRA COSTA CO. SITE LIST** **S104164039**
WSW **CYPRESS AVE** **N/A**
1/2-1 **OAKLEY, CA 94561**
2959 ft.

Site 1 of 2 in cluster A

Relative:
Higher

Actual:
19 ft.

Contra Costa SL:

Facility ID:	749287
Region:	CONTRA COSTA
Facility Status:	INACTIVE
Inactive Date:	08/24/2000
Tier:	Not reported
# Of ASTs On Property:	Not reported
Program Status:	
UST:	X
HWG:	Not reported
HMMP:	Not reported
AGT:	Not reported
ARP:	Not reported

Map ID Direction Distance Distance (ft.) Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A3 **WSW** **1/2-1** **2959 ft.**	**OAKLEY RANCH** **CYPRESS AVENUE** **OAKLEY, CA 94561**	**HIST UST**	**U001597820** **N/A**

Site 2 of 2 in cluster A

Relative: **Higher**

Actual: **19 ft.**

UST HIST:

Facility ID:	49287	Owner Name:	PORTER ESTATE COMPANY OAKLEY R
Total Tanks:	1	Region:	STATE
Owner Address:	100 BUSH ST., #800 SAN FRANCISCO, CA 94104		
Tank Used for:	PRODUCT		
Tank Num:	1	Container Num:	1
Tank Capacity:	00000600	Year Installed:	Not reported
Type of Fuel:	REGULAR	Tank Construction:	Not Reported
Leak Detection:	Not reported		
Contact Name:	JAMES MAHONEY, FOREMAN	Telephone:	(415) 625-2068
Facility Type:	Other	Other Type:	FARMING

4 **South** **1/2-1** **3497 ft.**	**BENNETT RESIDENCE** **4253 MACHADO LN** **OAKLEY, CA 94561**	**CONTRA COSTA CO. SITE LIST**	**S102261395** **N/A**

Relative: **Higher**

Actual: **22 ft.**

Contra Costa SL:

Facility ID:	771792
Region:	CONTRA COSTA
Facility Status:	INACTIVE
Inactive Date:	08/25/2000
Tier:	Not reported
# Of ASTs On Property:	Not reported
Program Status:	
UST:	X
HWG:	Not reported
HMMP:	Not reported
AGT:	Not reported
ARP:	Not reported

5 **ESE** **1/2-1** **3526 ft.**	**CCC PUBLIC WORKS** **CYPRESS RD @ SELLERS AVE** **OAKLEY, CA 94561**	**CONTRA COSTA CO. SITE LIST**	**S102261382** **N/A**

Relative: **Equal**

Actual: **12 ft.**

Contra Costa SL:

Facility ID:	771982
Region:	CONTRA COSTA
Facility Status:	INACTIVE
Inactive Date:	09/20/1994
Tier:	Not reported
# Of ASTs On Property:	Not reported
Program Status:	
UST:	X
HWG:	Not reported
HMMP:	Not reported
AGT:	Not reported
ARP:	Not reported

6
WSW
1/2-1
3849 ft.

M & L ACE HARDWARE
100 CYPRESS RD E
OAKLEY, CA 94561

CONTRA COSTA CO. SITE LIST — **S105455312** **N/A**

Relative: **Higher**

Actual: **21 ft.**

Contra Costa SL:

Facility ID:	772864
Region:	CONTRA COSTA
Facility Status:	ACTIVE
Inactive Date:	Not reported
Tier:	Not reported
# Of ASTs On Property:	Not reported
Program Status:	
UST:	Not reported
HWG:	Not reported
HMMP:	Yes
AGT:	Not reported
ARP:	Not reported

B7
WSW
1/2-1
4506 ft.

FOOD & LIQUOR #86
HWY 4 / CYPRESS AVENUE
OAKLEY, CA 92546

Notify 65 — **S100178935** **N/A**

Site 1 of 2 in cluster B

Relative: **Higher**

Actual: **32 ft.**

NOTIFY 65:

Date Reported:	Not reported	Staff Initials: Not reported
Board File Number:	Not reported	
Facility Type:	Not reported	
Discharge Date:	Not reported	
Incident Description:	92546	

B8
WSW
1/2-1
4506 ft.

FOOD & LIQUOR #86
HWY 4 / CYPRESS
OAKLEY, CA 94561

LUST
Cortese — **S105025334** **N/A**

Site 2 of 2 in cluster B

Relative: **Higher**

Actual: **32 ft.**

State LUST:

Cross Street:	CYPRESS		
Qty Leaked:	0		
Case Number	70041		
Reg Board:	0		
Chemical:	Gasoline		
Lead Agency:	Regional Board		
Local Agency :	7000		
Case Type:	Soil only		
Status:	Case Closed		
Abate Method:	Excavate and Treat - remove contaminated soil and treat (includes spreading or land farming)		
Review Date:	Not reported	Confirm Leak:	Not reported
Workplan:	2/17/89 0:00	Prelim Assess:	2/17/89 0:00
Pollution Char:	Not reported	Remed Plan:	Not reported
Remed Action:	Not reported		
Monitoring:	Not reported		
Close Date:	8/14/95 0:00		
Release Date:	02/17/1989		
Cleanup Fund Id :	Not reported		
Discover Date :	01/16/1989		
Enforcement Dt :	1/1/65 0:00		

FOOD & LIQUOR #86 (Continued) **S105025334**

Enf Type: None Taken
Enter Date : 7/29/89 0:00
Funding: Not reported
Staff Initials: BRU
How Discovered: Tank Closure
How Stopped: Not reported
Interim : Not reported
Leak Cause: UNK
Leak Source: UNK
MTBE Date : Not reported
Max MTBE GW : Not reported
MTBE Tested: Site NOT Tested for MTBE.Includes Unknown and Not Analyzed.
Priority: Medium priority
Local Case # : 0
Beneficial: Not reported
Staff : PMV
GW Qualifier : Not reported
Max MTBE Soil : Not reported
Soil Qualifier : Not reported
Hydr Basin #: SAN JOAQUIN VALLEY (
Operator : THE CUSTOMER COMPANY
Oversight Prgm: LUST
Review Date : 8/14/95 0:00
Stop Date : / /
Work Suspended :No
Responsible PartyCUSTOMER COMPANY
RP Address: P.O. BOX 886 4457 PARK ROAD, BENICIA, CA 94510
Global Id: T0601300767
Org Name: Not reported
Contact Person: Not reported
MTBE Conc: Not reported
Mtbe Fuel: Not reported
Water System Name: Not reported
Well Name: Not reported
Distance To Lust: 0
Waste Discharge Global ID: Not reported
Waste Disch Assigned Name: Not reported

LUST Region 5:
Substance: GASOLINE
Case Type: Soil only
Program: LUST
Staff Initials: PMV Case Number: 070041
Status: Case Closed
MTBE Code: N/A
Lead Agency: Regional

CORTESE:
Region: CORTESE
Fac Address 2: HWY 4 & CYPRESS

C9 **SSW** **> 1** **7681 ft.**

COOK BATTERY RECLAMATION (OAKLEY BATTERY)
139 HILL AVENUE
OAKLEY, CA 94561

CA BOND EXP. PLAN **S100833369** **N/A**

Site 1 of 2 in cluster C

Relative: **Higher**

Actual: **38 ft.**

BEP:

Site Description : The Cook Battery Reclamation site is a residential property which was the location of a battery reclamation operation in the 1950s and 1960s. Salvageable lead was removed from discarded automobile batteries. Battery casings and possibly other wasteswere buried onsite.

Hazardous Waste Desc : High concentrations of lead are present in surface soils. Battery casings and possibly other wastes are buried onsite.

Threat To Public Health & Env : The site is a residential property located in a neighborhood with many families. Sampling data indicates contamination of offsite properties. Potential exposure may result from ingestion of contaminated soil, drinking lead-contaminated water or inhalation of wind-blown dust.

Site Activity Status : In June of 1987, a preliminary assessment was completed. DHS will order the responsible parties to fence and post the site and perform site remediation activities. At this time, it appears that the responsible parties will be unable to comply with the order. If the RPs are unable or unwilling to perform remediation activities, DHS will find them in noncompliance with the order and perform the site remediation activities. DHS is working with the Contra Costa County Environmental Health Departmentto assess health risks and conduct community relations activities.

Project Revenue Source Co. : Not Reported

PRS Company Address : Not reported
Not reported

Project Revenue Source Desc : At this time it appears that Bond funds will be necessary to remediate this site. If Bond funds are used to investigate and remediate the site, DHS will undertake appropriate cost recovery action.

Responsible Party : DETAILED SITE EXPENDITURE PLAN

C10 **SSW** **> 1** **7681 ft.**

COOK BATTERY (OAKLEY BATT
139 HILL
OAKLEY, CA 94561

Cal-Sites **Cortese** **AWP** **S101272690** **N/A**

Site 2 of 2 in cluster C

Relative: **Higher**

Actual: **38 ft.**

CAL-SITES:

Facility ID	07360035
Status:	AWP - ANNUAL WORKPLAN (AWP) - ACTIVE SITE
Status Date:	05/01/1986
Lead:	DTSC
Region:	2 - BERKELEY
Branch:	NC - NORTH COAST
File Name:	Not reported
Status Name:	ANNUAL WORKPLAN - ACTIVE SITE
Lead Agency:	DEPT OF TOXIC SUBSTANCES CONTROL Not reported
NPL:	Not Listed
SIC:	36 MANU - ELECTRONIC & OTHER ELECTRIC EQUIP
Facility Type:	STATE
Type Name:	STATE FUNDED SITE
Staff Member Responsible for Site:	BBROWN
Supervisor Responsible for Site:	Not reported
Region Water Control Board:	CV - CENTRAL VALLEY
Access:	Controlled
Cortese:	C
Hazardous Ranking Score:	Not reported
Date Site Hazard Ranked:	Not reported
Groundwater Contamination:	Suspected

COOK BATTERY (OAKLEY BATT (Continued) **S101272690**

No. of Contamination Sources:	1.00000
Lat/Long:	0.00000˚ 0.00000´ 0.00000˝ / 0.00000˚ 0.00000´ 0.00000˝
Lat/long Method:	Not reported
State Assembly District Code:	15
State Senate District:	07

Click this hyperlink while viewing on your computer to access additional CAL-SITES detail in the EDR Site Report.

AWP Facility ID:	07360035
Facility Type:	State orphan site
Site Access Controlled :	Controlled
Region :	BERKELEY
SMBR Branch Unit:	NORTH COAST
SMBR Branch Code :	NC
Site Name. :	Not reported
Current Status Date :	19/86/0501
Current Status :	ANNUAL WORKPLAN - ACTIVE SITE
Lead Agency Code :	DTSC
Lead Agency :	DEPT OF TOXIC SUBSTANCES CONTROL
Awp Site Type:	STATE FUNDED SITE
NPL :	No
Tier Of AWP Site :	Not reported
Source Of Funding :	Not reported
Responsible Staff Member :	BBROWN
Supervisor Responsible :	Not reported
Facility SIC :	MANU - ELECTRONIC & OTHER ELECTRIC EQUIP
SIC Code :	36
RWQCB Associated With Site :	CENTRAL VALLEY
RWQCB Code :	CV
Site Listed HWS List :	Not reported
Hazard Ranking Score :	Not reported
Date Site Hazard Ranked :	Not reported
Groundwater Contamination :	Suspected
# Of Contamination Sources :	1.00000
Lat/long Method :	Not reported
Description Of Entity :	Not reported
State Assembly Distt Code :	15
State Senate District :	07
Lat/long :	0.00000˚ 0.00000´ 0.00000˝ / 0.00000˚ 0.00000´ 0.00000˝

CORTESE:

Region:	CORTESE
Fac Address 2:	Not reported

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
CONTRA COSTA COUNTY	S105631151		CAMINO DIABLO RD. WEST OF VASCO RD. NEAR BYRON.		CHMIRS, EMI
KNIGHTSEN	S103464320	BRADLEY EQUIPMENT SERVICES	9180 SELLERS AVE	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	U001597812	. . LEWIS RANCH	RT. #1 RFD BOX 145 NEROLY RD.	94561	HIST UST
OAKLEY	S102261431	MCKINNEY, EMILE E	RT 1, BOX 172	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S102261432	LUCCHESI, ROY & RAPLH	RT 1, BOX 253	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S102261435	STONEBARGER RANCH	RT 1, BOX 339	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S103464381	LUCCHESI, GUIDO	RT 1, BOX 298	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S103172299	OHNSON, ELMER	RT 2, BOX 181	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S103894558	BALDOCCHI, EVO	RT 2, BOX 187	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S104162235	WINDSWEPT LIVESTOCK CO	RT 2, BOX 481A	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	1005496366	SHOSHONE OIL CORPORATION	HWY 4 & RAYE AVE	94561	FINDS, EMI
OAKLEY	1006249937	IRONHOUSE SANITARY DISTRICT	HIGHWAY 4	94561	FINDS, EMI
OAKLEY	A100184497	PUMPING PLANT 1	HWY 4 & ROSE AVE	94561	AST
OAKLEY	S103976753	MAURICE LODGE	5540 HWY 4 @ BRIDGEHEAD RD	94561	HAZNET
OAKLEY	S104571067	EAGLE CITY MOBILE HOME PARK	2333 HWY 4	94561	HAZNET
OAKLEY	S104578255	CHEAPER #169	HIGHWAY 4 / O'HARA	94561	HAZNET
OAKLEY	S105850336	GOTLAND OIL, INC	HWY 4 / SUNSET AVE	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S106104165	NGC CESA NO 1	HWY 4 / SUNSET AVE	94561	CA WDS
OAKLEY	1000356575	CYPRESS RD YARD	CYPRESS RD 7MI E JERSEY IS RD	94561	RCRIS-SQG, FINDS
OAKLEY	1006249924	TONKA ENERGY INC	CYPRESS AVE & KNIGHTSEN	94561	FINDS, EMI
OAKLEY	A100226704	VALUE PLUMBING CO INC	1571 E CYPRESS	94561	AST
OAKLEY	U003941438	S & S GAS FOOD & LIQUOR	101 E CYPRESS RD	94561	UST
OAKLEY	S105628393	CYPRESS ROAD NEW ELEMENTARY SCHOOL	CYPRESS ROAD/HIGHWAY 4	94561	SCH
OAKLEY	S106229770	BLUE STAR GAS	1541 CYPRESS ROAD, E	94561	LUST
OAKLEY	U003937357	7-ELEVEN STORE #32787	EMPIRE RD/HWY 4	94561	UST
OAKLEY	U001597804	EMERSON DAIRY	NORTH END OF SELLERS RD	94561	HIST UST
OAKLEY	S103678682	DELTA TOP SOIL	END OF ROSE AVE AT LAUREL / HWY 4	94561	HAZNET
OAKLEY	1005904279	CHEVRON STATION NO 93801	5433 NEROLY RD AND HWY 4	94561	RCRIS-SQG, FINDS
OAKLEY	1001459705	P G AND E DUTCH SLOUGH DEHYDRATOR	OAKLEY RD AND HWY 4	94561	RCRIS-SQG, FINDS, HAZNET
OAKLEY	S102261425	SHOSHONE OIL CORPORATION	OAKLEY GAS FIELD-HWY 4	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S102261444	DE ESUS, OHN V	SELLERS AVE	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	S102261445	BACCHINI RANCH	SELLERS AVE	94561	CONTRA COSTA CO. SITE LIST
OAKLEY	U001597798	ALFRED OR DARLENE DE ESUS	SELLERS AVE.-RT2, BOX 182-C	94561	HIST UST
OAKLEY	S102261448	WESTERN CONT'L NGC-KYSH-1	SUNSET/HWY 4	94561	CONTRA COSTA CO. SITE LIST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM STANDARD RECORDS

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/27/04
Date Made Active at EDR: 05/21/04
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/04/04
Elapsed ASTM days: 17
Date of Last EDR Contact: 05/04/04

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 6
Telephone: 214-655-6659

EPA Region 8
Telephone: 303-312-6774

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: N/A

Date of Government Version: 04/27/04
Date Made Active at EDR: 05/21/04
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/04/04
Elapsed ASTM days: 17
Date of Last EDR Contact: 05/04/04

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 02/26/04
Date Made Active at EDR: 04/02/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/22/04
Elapsed ASTM days: 11
Date of Last EDR Contact: 03/22/04

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 02/26/04
Date Made Active at EDR: 04/02/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/22/04
Elapsed ASTM days: 11
Date of Last EDR Contact: 03/22/04

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/04
Date Made Active at EDR: 04/15/04
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 03/25/04
Elapsed ASTM days: 21
Date of Last EDR Contact: 03/08/04

RCRIS: Resource Conservation and Recovery Information System
Source: EPA
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs): generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs): generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs): generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 04/13/04
Date Made Active at EDR: 05/13/04
Database Release Frequency: Varies
Date of Data Arrival at EDR: 04/20/04
Elapsed ASTM days: 23
Date of Last EDR Contact: 04/20/04

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/03
Date Made Active at EDR: 03/12/04
Database Release Frequency: Annually
Date of Data Arrival at EDR: 01/26/04
Elapsed ASTM days: 46
Date of Last EDR Contact: 04/26/04

FEDERAL ASTM SUPPLEMENTAL RECORDS

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/01/01
Database Release Frequency: Biennially
Date of Last EDR Contact: 03/16/04
Date of Next Scheduled EDR Contact: 06/14/04

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: N/A
Database Release Frequency: Varies
Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ROD: Records Of Decision
Source: EPA
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/08/04
Database Release Frequency: Annually
Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/27/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/04/04
Date of Next Scheduled EDR Contact: 08/02/04

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/08/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 02/17/04
Database Release Frequency: Annually
Date of Last EDR Contact: 04/20/04
Date of Next Scheduled EDR Contact: 07/19/04

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/19/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 03/05/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 03/30/04
Date of Next Scheduled EDR Contact: 06/28/04

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 202-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/12/04
Date of Next Scheduled EDR Contact: 05/24/04

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-564-3887
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 03/30/04
Database Release Frequency: Annually

Date of Last EDR Contact: 05/12/04
Date of Next Scheduled EDR Contact: 08/09/04

DOD: Department of Defense Sites
Source: USGS
Telephone: 703-692-8801
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 10/01/03
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 02/02/04
Date of Next Scheduled EDR Contact: 05/10/04

STORMWATER: Storm Water General Permits
Source: Environmental Protection Agency
Telephone: 202 564-0746
A listing of all facilities with Storm Water General Permits.

Date of Government Version: N/A
Database Release Frequency: Quarterly

Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

INDIAN RESERV: Indian Reservations
Source: USGS
Telephone: 202-208-3710
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 10/01/03
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 02/02/04
Date of Next Scheduled EDR Contact: 05/10/04

US BROWNFIELDS: A Listing of Brownfields Sites
Source: Environmental Protection Agency
Telephone: 202-566-2777
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become BCRLF cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 04/14/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 03/15/04
Date of Next Scheduled EDR Contact: 06/14/04

RMP: Risk Management Plans
Source: Environmental Protection Agency
Telephone: 202-564-8600
When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: N/A
Database Release Frequency: N/A
Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

FUDS: Formerly Used Defense Sites
Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 10/01/03
Database Release Frequency: Varies
Date of Last EDR Contact: 04/26/04
Date of Next Scheduled EDR Contact: 07/05/04

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-566-0250
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/01
Database Release Frequency: Annually
Date of Last EDR Contact: 03/23/04
Date of Next Scheduled EDR Contact: 06/21/04

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/02
Database Release Frequency: Every 4 Years
Date of Last EDR Contact: 03/05/04
Date of Next Scheduled EDR Contact: 06/07/04

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-564-2501

Date of Government Version: 04/13/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/22/04
Date of Next Scheduled EDR Contact: 06/21/04

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-5008
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/01
Database Release Frequency: Annually
Date of Last EDR Contact: 04/19/04
Date of Next Scheduled EDR Contact: 07/19/04

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-564-2501
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/13/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/22/04
Date of Next Scheduled EDR Contact: 06/21/04

STATE OF CALIFORNIA ASTM STANDARD RECORDS

AWP: Annual Workplan Sites
Source: California Environmental Protection Agency
Telephone: 916-323-3400
Known Hazardous Waste Sites. California DTSC's Annual Workplan (AWP), formerly BEP, identifies known hazardous substance sites targeted for cleanup.

Date of Government Version: 03/02/04
Date Made Active at EDR: 03/24/04
Database Release Frequency: Annually
Date of Data Arrival at EDR: 03/03/04
Elapsed ASTM days: 21
Date of Last EDR Contact: 03/03/04

CAL-SITES: Calsites Database
Source: Department of Toxic Substance Control
Telephone: 916-323-3400
The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database.

Date of Government Version: 03/02/04
Date Made Active at EDR: 03/24/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/03/04
Elapsed ASTM days: 21
Date of Last EDR Contact: 03/03/04

CHMIRS: California Hazardous Material Incident Report System
Source: Office of Emergency Services
Telephone: 916-845-8400
California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 12/31/02
Date Made Active at EDR: 08/07/03
Database Release Frequency: Varies
Date of Data Arrival at EDR: 07/11/03
Elapsed ASTM days: 27
Date of Last EDR Contact: 02/23/04

CORTESE: "Cortese" Hazardous Waste & Substances Sites List
Source: CAL EPA/Office of Emergency Information
Telephone: 916-323-9100
The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 04/01/01
Date Made Active at EDR: 07/26/01
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 05/29/01
Elapsed ASTM days: 58
Date of Last EDR Contact: 04/28/04

NOTIFY 65: Proposition 65 Records
Source: State Water Resources Control Board
Telephone: 916-445-3846
Proposition 65 Notification Records. NOTIFY 65 contains facility notifications about any release which could impact drinking water and thereby expose the public to a potential health risk.

Date of Government Version: 10/21/93
Date Made Active at EDR: 11/19/93
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 11/01/93
Elapsed ASTM days: 18
Date of Last EDR Contact: 04/19/04

TOXIC PITS: Toxic Pits Cleanup Act Sites
Source: State Water Resources Control Board
Telephone: 916-227-4364
Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/95
Date Made Active at EDR: 09/26/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 08/30/95
Elapsed ASTM days: 27
Date of Last EDR Contact: 05/03/04

SWF/LF (SWIS): Solid Waste Information System
Source: Integrated Waste Management Board
Telephone: 916-341-6320
Active, Closed and Inactive Landfills. SWF/LF records typically contain an inve ntory of solid waste disposal facilities or landfills. These may be active or i nactive facilities or open dumps that failed to meet RCRA Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 03/15/04
Date Made Active at EDR: 04/14/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/17/04
Elapsed ASTM days: 28
Date of Last EDR Contact: 03/16/04

WMUDS/SWAT: Waste Management Unit Database
Source: State Water Resources Control Board
Telephone: 916-227-4448
Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 04/01/00
Date Made Active at EDR: 05/10/00
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 04/10/00
Elapsed ASTM days: 30
Date of Last EDR Contact: 03/11/04

LUST: Leaking Underground Storage Tank Information System
Source: State Water Resources Control Board
Telephone: 916-341-5740
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/13/04
Date Made Active at EDR: 04/29/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 04/13/04
Elapsed ASTM days: 16
Date of Last EDR Contact: 04/13/04

CA BOND EXP. PLAN: Bond Expenditure Plan
Source: Department of Health Services
Telephone: 916-255-2118
Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/89
Date Made Active at EDR: 08/02/94
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 07/27/94
Elapsed ASTM days: 6
Date of Last EDR Contact: 05/31/94

CA UST:

UST: Active UST Facilities
Source: SWRCB
Telephone: 916-341-5700
Active UST facilities gathered from the local regulatory agencies

Date of Government Version: 04/13/04
Date Made Active at EDR: 04/29/04
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 04/13/04
Elapsed ASTM days: 16
Date of Last EDR Contact: 04/13/04

VCP: Voluntary Cleanup Program Properties
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 03/02/04
Date Made Active at EDR: 03/24/04
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/03/04
Elapsed ASTM days: 21
Date of Last EDR Contact: 03/03/04

INDIAN LUST: Leaking Underground Storage Tanks on Indian Land
Source: Environmental Protection Agency
Telephone: 415-972-3372
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 02/09/04
Date Made Active at EDR: 03/01/04
Database Release Frequency: Varies
Date of Data Arrival at EDR: 02/10/04
Elapsed ASTM days: 20
Date of Last EDR Contact: 01/27/04

INDIAN LUST: Leaking Underground Storage Tanks on Indian Land
Source: EPA Region 10
Telephone: 206-553-2857
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 03/11/04
Date Made Active at EDR: 03/31/04
Database Release Frequency: Varies
Date of Data Arrival at EDR: 03/12/04
Elapsed ASTM days: 19
Date of Last EDR Contact: 01/27/04

INDIAN UST: Underground Storage Tanks on Indian Land
Source: EPA Region 9
Telephone: 415-972-3368

Date of Government Version: 02/25/04
Date Made Active at EDR: 03/24/04
Database Release Frequency: Varies
Date of Data Arrival at EDR: 03/01/04
Elapsed ASTM days: 23
Date of Last EDR Contact: 02/23/04

CA FID UST: Facility Inventory Database
Source: California Environmental Protection Agency
Telephone: 916-445-6532
The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/94
Date Made Active at EDR: 09/29/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 09/05/95
Elapsed ASTM days: 24
Date of Last EDR Contact: 12/28/98

HIST UST: Hazardous Substance Storage Container Database
Source: State Water Resources Control Board
Telephone: 916-341-5700
The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/90
Date Made Active at EDR: 02/12/91
Database Release Frequency: No Update Planned

Date of Data Arrival at EDR: 01/25/91
Elapsed ASTM days: 18
Date of Last EDR Contact: 07/26/01

STATE OF CALIFORNIA ASTM SUPPLEMENTAL RECORDS

AST: Aboveground Petroleum Storage Tank Facilities
Source: State Water Resources Control Board
Telephone: 916-341-5712
Registered Aboveground Storage Tanks.

Date of Government Version: 12/01/03
Database Release Frequency: Quarterly

Date of Last EDR Contact: 05/03/04
Date of Next Scheduled EDR Contact: 08/02/04

CLEANERS: Cleaner Facilities
Source: Department of Toxic Substance Control
Telephone: 916-225-0873
A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaner's agents; linen supply; coin-operated laundries and cleaning; drycleaning plants, except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

Date of Government Version: 04/21/04
Database Release Frequency: Annually

Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

CA WDS: Waste Discharge System
Source: State Water Resources Control Board
Telephone: 916-341-5227
Sites which have been issued waste discharge requirements.

Date of Government Version: 04/05/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/22/04
Date of Next Scheduled EDR Contact: 06/21/04

DEED: List of Deed Restrictions
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
The use of recorded land use restrictions is one of the methods the DTSC uses to protect the public from unsafe exposures to hazardous substances and wastes.

Date of Government Version: 04/06/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/06/04
Date of Next Scheduled EDR Contact: 07/05/04

NFA: No Further Action Determination
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
This category contains properties at which DTSC has made a clear determination that the property does not pose a problem to the environment or to public health.

Date of Government Version: 03/02/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/03/04
Date of Next Scheduled EDR Contact: 05/31/04

EMI: Emissions Inventory Data
Source: California Air Resources Board
Telephone: 916-322-2990
Toxics and criteria pollutant emissions data collected by the ARB and local air pollution agencies.

Date of Government Version: 12/31/02
Database Release Frequency: Varies

Date of Last EDR Contact: 04/20/04
Date of Next Scheduled EDR Contact: 07/19/04

REF: Unconfirmed Properties Referred to Another Agency
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
This category contains properties where contamination has not been confirmed and which were determined as not requiring direct DTSC Site Mitigation Program action or oversight. Accordingly, these sites have been referred to another state or local regulatory agency.

Date of Government Version: 03/02/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/03/04
Date of Next Scheduled EDR Contact: 05/31/04

SCH: School Property Evaluation Program
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
This category contains proposed and existing school sites that are being evaluated by DTSC for possible hazardous materials contamination. In some cases, these properties may be listed in the CalSites category depending on the level of threat to public health and safety or the environment they pose.

Date of Government Version: 03/02/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/03/04
Date of Next Scheduled EDR Contact: 05/31/04

NFE: Properties Needing Further Evaluation
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
This category contains properties that are suspected of being contaminated. These are unconfirmed contaminated properties that need to be assessed using the PEA process. PEA in Progress indicates properties where DTSC is currently conducting a PEA. PEA Required indicates properties where DTSC has determined a PEA is required, but not currently underway.

Date of Government Version: 03/02/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/03/04
Date of Next Scheduled EDR Contact: 05/31/04

HAZNET: Hazardous Waste Information System
Source: California Environmental Protection Agency
Telephone: 916-255-1136
Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method.

Date of Government Version: 12/31/02
Database Release Frequency: Annually
Date of Last EDR Contact: 05/10/04
Date of Next Scheduled EDR Contact: 08/09/04

LOCAL RECORDS

ALAMEDA COUNTY:

Local Oversight Program Listing of UGT Cleanup Sites
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 12/09/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/26/04
Date of Next Scheduled EDR Contact: 07/26/04

Underground Tanks
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 12/09/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/26/04
Date of Next Scheduled EDR Contact: 07/26/04

CONTRA COSTA COUNTY:

Site List
Source: Contra Costa Health Services Department
Telephone: 925-646-2286
List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 03/05/04 | Date of Last EDR Contact: 03/01/04
Database Release Frequency: Semi-Annually | Date of Next Scheduled EDR Contact: 05/31/04

FRESNO COUNTY:

CUPA Resources List
Source: Dept. of Community Health
Telephone: 559-445-3271
Certified Unified Program Agency. CUPA's are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.

Date of Government Version: 01/14/04 | Date of Last EDR Contact: 05/10/04
Database Release Frequency: Semi-Annually | Date of Next Scheduled EDR Contact: 08/09/04

KERN COUNTY:

Underground Storage Tank Sites & Tank Listing
Source: Kern County Environment Health Services Department
Telephone: 661-862-8700
Kern County Sites and Tanks Listing.

Date of Government Version: 01/27/04 | Date of Last EDR Contact: 03/08/04
Database Release Frequency: Quarterly | Date of Next Scheduled EDR Contact: 06/07/04

LOS ANGELES COUNTY:

List of Solid Waste Facilities
Source: La County Department of Public Works
Telephone: 818-458-5185

Date of Government Version: 06/03/03 | Date of Last EDR Contact: 02/20/04
Database Release Frequency: Varies | Date of Next Scheduled EDR Contact: 05/17/04

City of El Segundo Underground Storage Tank
Source: City of El Segundo Fire Department
Telephone: 310-524-2236

Date of Government Version: 03/01/04 | Date of Last EDR Contact: 02/16/04
Database Release Frequency: Semi-Annually | Date of Next Scheduled EDR Contact: 05/17/04

City of Long Beach Underground Storage Tank
Source: City of Long Beach Fire Department
Telephone: 562-570-2543

Date of Government Version: 03/28/03 | Date of Last EDR Contact: 02/23/04
Database Release Frequency: Annually | Date of Next Scheduled EDR Contact: 05/24/04

City of Torrance Underground Storage Tank
Source: City of Torrance Fire Department
Telephone: 310-618-2973

Date of Government Version: 02/17/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 02/16/04
Date of Next Scheduled EDR Contact: 05/17/04

City of Los Angeles Landfills
Source: Engineering & Construction Division
Telephone: 213-473-7869

Date of Government Version: 03/01/04
Database Release Frequency: Varies
Date of Last EDR Contact: 03/16/04
Date of Next Scheduled EDR Contact: 06/14/04

HMS: Street Number List
Source: Department of Public Works
Telephone: 626-458-3517
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 09/30/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 05/17/04

Site Mitigation List
Source: Community Health Services
Telephone: 323-890-7806
Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 02/26/04
Database Release Frequency: Annually
Date of Last EDR Contact: 02/16/04
Date of Next Scheduled EDR Contact: 05/17/04

San Gabriel Valley Areas of Concern
Source: EPA Region 9
Telephone: 415-972-3178
San Gabriel Valley areas where VOC contamination is at or above the MCL as designated by region 9 EPA office.

Date of Government Version: 12/31/98
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 07/06/99
Date of Next Scheduled EDR Contact: N/A

MARIN COUNTY:

Underground Storage Tank Sites
Source: Public Works Department Waste Management
Telephone: 415-499-6647
Currently permitted USTs in Marin County.

Date of Government Version: 02/10/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/03/04
Date of Next Scheduled EDR Contact: 08/02/04

NAPA COUNTY:

Sites With Reported Contamination
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 03/29/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 03/29/04
Date of Next Scheduled EDR Contact: 06/28/04

Closed and Operating Underground Storage Tank Sites
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 03/29/04
Database Release Frequency: Annually

Date of Last EDR Contact: 03/29/04
Date of Next Scheduled EDR Contact: 06/28/04

ORANGE COUNTY:

List of Underground Storage Tank Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 03/01/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

List of Underground Storage Tank Facilities
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 03/01/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

List of Industrial Site Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Petroleum and non-petroleum spills.

Date of Government Version: 03/01/04
Database Release Frequency: Annually

Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

PLACER COUNTY:

Master List of Facilities
Source: Placer County Health and Human Services
Telephone: 530-889-7312
List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 02/17/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 02/17/04
Date of Next Scheduled EDR Contact: 06/21/04

RIVERSIDE COUNTY:

Listing of Underground Tank Cleanup Sites
Source: Department of Public Health
Telephone: 909-358-5055
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 12/23/03
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/19/04
Date of Next Scheduled EDR Contact: 07/19/04

Underground Storage Tank Tank List
Source: Health Services Agency
Telephone: 909-358-5055

Date of Government Version: 12/01/03
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/19/04
Date of Next Scheduled EDR Contact: 07/19/04

SACRAMENTO COUNTY:

CS - Contaminated Sites
Source: Sacramento County Environmental Management
Telephone: 916-875-8406

Date of Government Version: 04/16/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/07/04
Date of Next Scheduled EDR Contact: 08/02/04

ML - Regulatory Compliance Master List
Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 02/03/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/07/04
Date of Next Scheduled EDR Contact: 08/02/04

SAN BERNARDINO COUNTY:

Hazardous Material Permits
Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 04/15/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

SAN DIEGO COUNTY:

Solid Waste Facilities
Source: Department of Health Services
Telephone: 619-338-2209
San Diego County Solid Waste Facilities.

Date of Government Version: 08/01/00
Database Release Frequency: Varies
Date of Last EDR Contact: 02/23/04
Date of Next Scheduled EDR Contact: 05/24/04

Hazardous Materials Management Division Database
Source: Hazardous Materials Management Division
Telephone: 619-338-2268
The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 10/31/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/08/04
Date of Next Scheduled EDR Contact: 07/05/04

SAN FRANCISCO COUNTY:

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Local Oversite Facilities
Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920

Date of Government Version: 03/08/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

Underground Storage Tank Information
Source: Department of Public Health
Telephone: 415-252-3920

Date of Government Version: 03/08/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

SAN MATEO COUNTY:

Fuel Leak List
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921

Date of Government Version: 01/29/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/12/04
Date of Next Scheduled EDR Contact: 07/12/04

Business Inventory
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 04/07/04
Database Release Frequency: Annually
Date of Last EDR Contact: 03/02/04
Date of Next Scheduled EDR Contact: 07/12/04

SANTA CLARA COUNTY:

Fuel Leak Site Activity Report
Source: Santa Clara Valley Water District
Telephone: 408-265-2600

Date of Government Version: 12/31/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 03/30/04
Date of Next Scheduled EDR Contact: 06/28/04

Hazardous Material Facilities
Source: City of San Jose Fire Department
Telephone: 408-277-4659

Date of Government Version: 10/01/03
Database Release Frequency: Annually
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

SOLANO COUNTY:

Leaking Underground Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 03/18/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/15/04
Date of Next Scheduled EDR Contact: 06/14/04

Underground Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 03/18/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/15/04
Date of Next Scheduled EDR Contact: 06/14/04

SONOMA COUNTY:

Leaking Underground Storage Tank Sites
Source: Department of Health Services
Telephone: 707-565-6565

Date of Government Version: 04/26/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/26/04
Date of Next Scheduled EDR Contact: 07/26/04

SUTTER COUNTY:

Underground Storage Tanks
Source: Sutter County Department of Agriculture
Telephone: 530-822-7500

Date of Government Version: 01/29/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

VENTURA COUNTY:

Inventory of Illegal Abandoned and Inactive Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 09/01/02
Database Release Frequency: Annually

Date of Last EDR Contact: 02/23/04
Date of Next Scheduled EDR Contact: 05/24/04

Listing of Underground Tank Cleanup Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 02/26/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/16/04
Date of Next Scheduled EDR Contact: 06/14/04

Underground Tank Closed Sites List
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 12/01/03
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/15/04
Date of Next Scheduled EDR Contact: 07/12/04

Business Plan, Hazardous Waste Producers, and Operating Underground Tanks
Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 02/26/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/16/04
Date of Next Scheduled EDR Contact: 06/14/04

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

YOLO COUNTY:

Underground Storage Tank Comprehensive Facility Report
Source: Yolo County Department of Health
Telephone: 530-666-8646

Date of Government Version: 01/27/04
Database Release Frequency: Annually
Date of Last EDR Contact: 04/19/04
Date of Next Scheduled EDR Contact: 07/19/04

California Regional Water Quality Control Board (RWQCB) LUST Records

LUST REG 1: Active Toxic Site Investigation
Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-576-2220
Del Norte, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/01/01
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 02/23/04
Date of Next Scheduled EDR Contact: 05/24/04

LUST REG 2: Fuel Leak List
Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457

Date of Government Version: 03/31/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/04
Date of Next Scheduled EDR Contact: 07/12/04

LUST REG 3: Leaking Underground Storage Tank Database
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147

Date of Government Version: 05/19/03
Database Release Frequency: Varies
Date of Last EDR Contact: 02/16/04
Date of Next Scheduled EDR Contact: 05/17/04

LUST REG 4: Underground Storage Tank Leak List
Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Los Angeles, Ventura counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/10/04
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

LUST REG 5: Leaking Underground Storage Tank Database
Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-3291

Date of Government Version: 04/01/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/08/04
Date of Next Scheduled EDR Contact: 07/05/04

LUST REG 6L: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 916-542-5424
For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/09/03
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-346-7491

Date of Government Version: 01/21/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

LUST REG 7: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-346-7491

Date of Government Version: 02/26/04
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 02/26/04
Date of Next Scheduled EDR Contact: 06/28/04

LUST REG 8: Leaking Underground Storage Tanks
Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4498
California Regional Water Quality Control Board Santa Ana Region (8). For more current information, please refer to the State Water Resources Control Board’s LUST database.

Date of Government Version: 01/12/04
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 05/12/04
Date of Next Scheduled EDR Contact: 08/09/04

LUST REG 9: Leaking Underground Storage Tank Report
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-467-2980
Orange, Riverside, San Diego counties. For more current information, please refer to the State Water Resources Control Board’s LUST database.

Date of Government Version: 03/01/01
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 04/19/04
Date of Next Scheduled EDR Contact: 07/19/04

California Regional Water Quality Control Board (RWQCB) SLIC Records

SLIC REG 1: Active Toxic Site Investigations
Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220

Date of Government Version: 04/03/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 02/23/04
Date of Next Scheduled EDR Contact: 05/24/04

SLIC REG 2: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 03/31/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/04
Date of Next Scheduled EDR Contact: 07/12/04

SLIC REG 3: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 09/16/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 02/16/04
Date of Next Scheduled EDR Contact: 05/17/04

SLIC REG 4: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 01/28/04
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/26/04
Date of Next Scheduled EDR Contact: 07/26/04

SLIC REG 5: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-855-3075
Unregulated sites that impact groundwater or have the potential to impact groundwater.

Date of Government Version: 04/01/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

SLIC REG 6L: SLIC Sites
Source: California Regional Water Quality Control Board, Lahontan Region
Telephone: 530-542-5574

Date of Government Version: 03/09/04
Database Release Frequency: Varies

Date of Last EDR Contact: 03/08/04
Date of Next Scheduled EDR Contact: 06/07/04

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583

Date of Government Version: 04/01/04
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/05/04
Date of Next Scheduled EDR Contact: 07/05/04

SLIC REG 7: SLIC List
Source: California Regional Quality Control Board, Colorado River Basin Region
Telephone: 760-346-7491

Date of Government Version: 02/27/04
Database Release Frequency: Varies

Date of Last EDR Contact: 02/23/04
Date of Next Scheduled EDR Contact: 05/24/04

SLIC REG 8: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-3298

Date of Government Version: 04/01/03
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/08/04
Date of Next Scheduled EDR Contact: 07/05/04

SLIC REG 9: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-467-2980

Date of Government Version: 04/29/04
Database Release Frequency: Annually

Date of Last EDR Contact: 04/29/04
Date of Next Scheduled EDR Contact: 05/31/04

EDR PROPRIETARY HISTORICAL DATABASES

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

Disclaimer Provided by Real Property Scan, Inc.

The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

BROWNFIELDS DATABASES

VCP: Voluntary Cleanup Program Properties
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 03/02/04
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/03/04
Date of Next Scheduled EDR Contact: 05/31/04

US BROWNFIELDS: A Listing of Brownfields Sites
Source: Environmental Protection Agency
Telephone: 202-566-2777
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become BCRLF cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: N/A
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: PennWell Corporation
Telephone: (800) 823-6277
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Facilities
Source: Department of Social Services
Telephone: 916-657-4041

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

140 ACRE SOUTH EMMERSON PROPERTY
NWC OF SELLERS AVE
OAKLEY, CA 94561

TARGET PROPERTY COORDINATES

Latitude (North):	37.994301 - 37˚ 59’ 39.5’’
Longitude (West):	121.682297 - 121˚ 40’ 56.3’’
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	615704.9
UTM Y (Meters):	4205796.0
Elevation:	12 ft. above sea level

EDR’s GeoCheck Physical Setting Source Addendum has been developed to assist the environmental professional with the collection of physical setting source information in accordance with ASTM 1527-00, Section 7.2.3. Section 7.2.3 requires that a current USGS 7.5 Minute Topographic Map (or equivalent, such as the USGS Digital Elevation Model) be reviewed. It also requires that one or more additional physical setting sources be sought when (1) conditions have been identified in which hazardous substances or petroleum products are likely to migrate to or from the property, and (2) more information than is provided in the current USGS 7.5 Minute Topographic Map (or equivalent) is generally obtained, pursuant to local good commercial or customary practice, to assess the impact of migration of recognized environmental conditions in connection with the property. Such additional physical setting sources generally include information about the topographic, hydrologic, hydrogeologic, and geologic characteristics of a site, and wells in the area.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata. EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

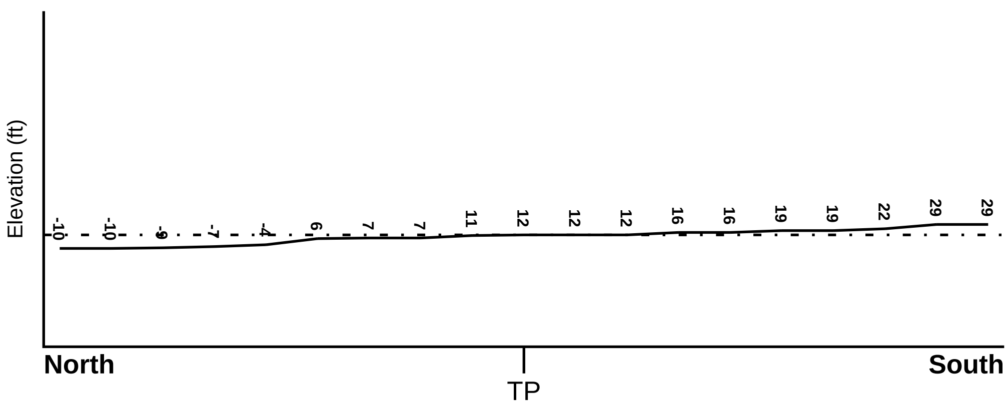
TOPOGRAPHIC INFORMATION

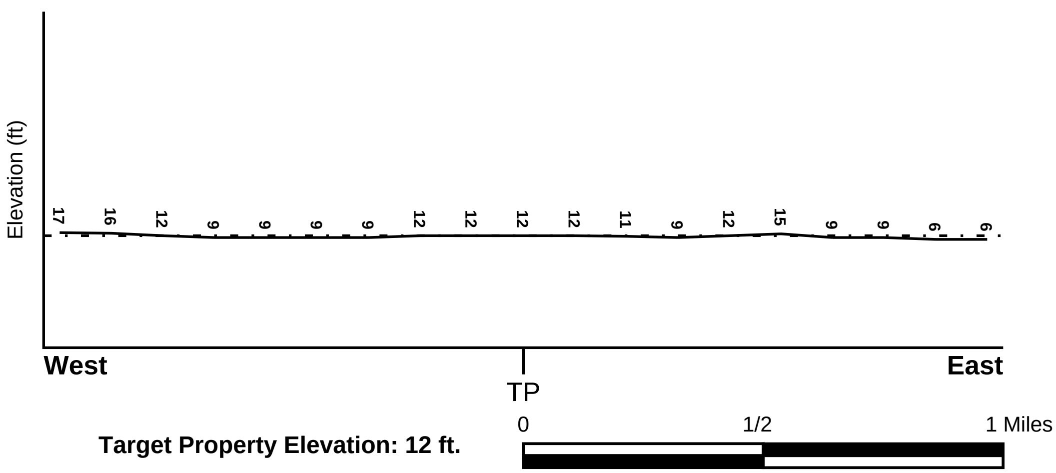
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

USGS Topographic Map:	37121-H6 BRENTWOOD, CA
General Topographic Gradient:	General NNE
Source:	USGS 7.5 min quad index

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 12 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
CONTRA COSTA, CA	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 0600250360B

Additional Panels in search area: 0600250175B
0600250355B

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
BRENTWOOD	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era:	Cenozoic
System:	Quaternary
Series:	Quaternary
Code:	Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	CAPAY
Soil Surface Texture:	clay
Hydrologic Group:	Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.
Soil Drainage Class:	Moderately well drained. Soils have a layer of low hydraulic conductivity, wet state high in the profile. Depth to water table is 3 to 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	HIGH
Depth to Bedrock Min:	> 60 inches
Depth to Bedrock Max:	> 60 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**	**Permeability Rate (in/hr)**	**Soil Reaction (pH)**
1	0 inches	32 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.20 Min: 0.06	Max: 8.40 Min: 5.60
2	32 inches	50 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 0.20 Min: 0.06	Max: 8.40 Min: 6.60
3	50 inches	62 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 0.20 Min: 0.06	Max: 8.40 Min: 6.60

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: clay loam
silt loam
silty clay loam
sand
loam

Surficial Soil Types: clay loam
silt loam
silty clay loam
sand
loam

Shallow Soil Types: silty clay loam
sand
clay
stratified

Deeper Soil Types: clay loam
stratified
gravelly - loam
sand
clay

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

According to ASTM E 1527-00, Section 7.2.2, "one or more additional state or local sources of environmental records may be checked, in the discretion of the environmental professional, to enhance and supplement federal and state sources... Factors to consider in determining which local or additional state records, if any, should be checked include (1) whether they are reasonably ascertainable, (2) whether they are sufficiently useful, accurate, and complete in light of the objective of the records review (see 7.1.1), and (3) whether they are obtained, pursuant to local, good commercial or customary practice." One of the record sources listed in Section 7.2.2 is water well information. Water well information can be used to assist the environmental professional in assessing sources that may impact groundwater flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS0120539	1/4 - 1/2 Mile NE
2	USGS0120601	1/2 - 1 Mile SSE
4	USGS0120602	1/2 - 1 Mile ESE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
3	1685	1/2 - 1 Mile WSW

STATE OIL/GAS WELL INFORMATION

DISTANCE FROM TP (Miles)
1 - 2 Miles NE
1/2 - 1 Mile North
1 - 2 Miles NE
1 - 2 Miles NW
1 - 2 Miles WNW
1/4 - 1/2 Mile NNE
1 - 2 Miles WNW
1 - 2 Miles WNW
1/2 - 1 Mile ENE

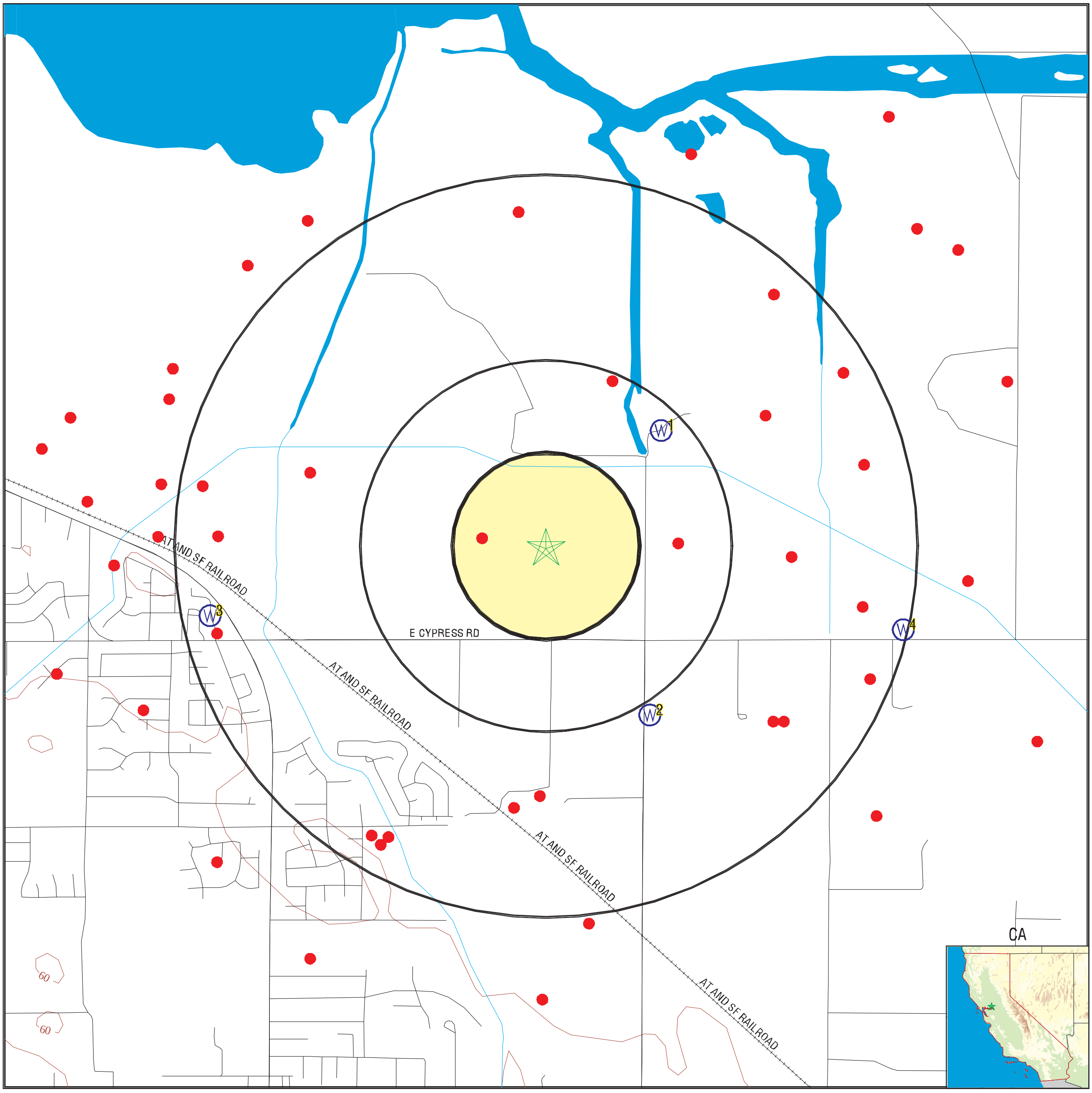
DISTANCE FROM TP (Miles)
1 - 2 Miles NNE
1 - 2 Miles NW
1 - 2 Miles NE
1/2 - 1 Mile NE
1/2 - 1 Mile ENE
1 - 2 Miles ENE
1/2 - 1 Mile ENE
1 - 2 Miles West
1/2 - 1 Mile WNW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE OIL/GAS WELL INFORMATION

DISTANCE FROM TP (Miles)	DISTANCE FROM TP (Miles)
1 - 2 Miles West	1/2 - 1 Mile West
1 - 2 Miles West	1/2 - 1 Mile West
1 - 2 Miles West	1/8 - 1/4 Mile West
1/4 - 1/2 Mile East	1/2 - 1 Mile East
1 - 2 Miles West	1 - 2 Miles East
1/2 - 1 Mile East	1/2 - 1 Mile WSW
1 - 2 Miles WSW	1/2 - 1 Mile ESE
1 - 2 Miles WSW	1/2 - 1 Mile SE
1/2 - 1 Mile SE	1 - 2 Miles ESE
1/2 - 1 Mile South	1/2 - 1 Mile South
1 - 2 Miles SE	1/2 - 1 Mile SSW
1/2 - 1 Mile SSW	1/2 - 1 Mile SSW
1 - 2 Miles SW	1 - 2 Miles South
1 - 2 Miles SSW	1 - 2 Miles South

PHYSICAL SETTING SOURCE MAP - 01212613.1r



County Boundary
Major Roads
Contour Lines
Earthquake Fault Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Closest Hydrogeological Data
Oil, gas or related wells

TARGET PROPERTY:	140 Acre South Emmerson Property	CUSTOMER:	Engeo Inc.
ADDRESS:	NWC of Sellers Ave	CONTACT:	Casey Lee Jensen
CITY/STATE/ZIP:	Oakley CA 94561	INQUIRY #:	01212613.1r
LAT/LONG:	37.9943 / 121.6823	DATE:	June 15, 2004 1:39 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **NE** **1/4 - 1/2 Mile** **Lower**	**FED USGS**	**USGS0120539**

Agency:	USGS	Site ID:	375956121403201
Site Name:	002N003E20N001M		
Dec. Latitude:	37.99881		
Dec. Longitude:	-121.67662		
Coord Sys:	NAD83		
State:	CA		
County:	Contra Costa County		
Altitude:	Not Reported		
Hydrologic code:	18040003		
Topographic:	Valley flat		
Site Type:	Ground-water other than Spring		
Const Date:	19591219	Inven Date:	Not Reported
Well Type:	Single well, other than collector or Ranney type		
Primary Aquifer:	Not Reported		
Aquifer type:	Not Reported		
Well depth:	333		
Hole depth:	610	Source:	Not Reported
Project no:	Not Reported		

Ground-water levels, Number of Measurements: 0

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2 **SSE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS0120601**

Agency:	USGS	Site ID:	375916121403401
Site Name:	002N003E29M001M		
Dec. Latitude:	37.9877		
Dec. Longitude:	-121.67718		
Coord Sys:	NAD83		
State:	CA		
County:	Contra Costa County		
Altitude:	12.00		
Hydrologic code:	18040003		
Topographic:	Valley flat		
Site Type:	Ground-water other than Spring		
Const Date:	19760526	Inven Date:	Not Reported
Well Type:	Single well, other than collector or Ranney type		
Primary Aquifer:	111ALVF		
Aquifer type:	Not Reported		
Well depth:	88.0		
Hole depth:	100	Source:	Not Reported
Project no:	Not Reported		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1976-05-26	12.00	

Map ID Direction Distance Elevation	Database	EDR ID Number
3 **WSW** **1/2 - 1 Mile** **Higher**	**CA WELLS**	**1685**

Water System Information:

Prime Station Code:	02N/02E-25H01 M	User ID:	07C
FRDS Number:	0707588001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	375930.0 1214152.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707588		
System Name:	BIG OAK TRAILER COURT		
Organization That Operates System:	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		

4 **ESE** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS0120602**

Agency:	USGS	Site ID:	375928121394901
Site Name:	002N003E29G001M		
Dec. Latitude:	37.99103		
Dec. Longitude:	-121.66468		
Coord Sys:	NAD83		
State:	CA		
County:	Contra Costa County		
Altitude:	5.00		
Hydrologic code:	18040003		
Topographic:	Valley flat		
Site Type:	Ground-water other than Spring		
Const Date:	19760622	Inven Date:	Not Reported
Well Type:	Single well, other than collector or Ranney type		
Primary Aquifer:	Not Reported		
Aquifer type:	Not Reported		
Well depth:	237		
Hole depth:	245	Source:	Not Reported
Project no:	Not Reported		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1976-06-22	15.00	

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Direction Distance	Database	EDR ID Number

NE
1 - 2 Miles | **OIL_GAS** | **CA00004826**

Well Number:	3-1	Status:	Completed gas
API Number:	01300117	Operator:	Tonka Energy, Inc.
Latitude:	38.01114	Longitude:	-121.66433
Region:	6	Lease:	Tract 3
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9090.00000
Spud Date:	9/11/1963	Abandonment Date:	Not Reported

NNE
1 - 2 Miles | **OIL_GAS** | **CA00004821**

Well Number:	4-2	Status:	Completed gas-directional
API Number:	01300112	Operator:	Tonka Energy, Inc.
Latitude:	38.00968	Longitude:	-121.67408
Region:	6	Lease:	Tract 4
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7900.00000
Spud Date:	10/29/1964	Abandonment Date:	Not Reported

North
1/2 - 1 Mile | **OIL_GAS** | **CA00004648**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01300293	Operator:	Occidental Petroleum Corp.
Latitude:	38.00742	Longitude:	-121.68259
Region:	6	Lease:	Emerson
Section:	19	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8053.00000
Spud Date:	11/15/1964	Abandonment Date:	11/25/1964

NW
1 - 2 Miles | **OIL_GAS** | **CA00004647**

Well Number:	2	Status:	Plugged and abandoned-dry hole-directional
API Number:	01300292	Operator:	Chevron U.S.A. Inc.
Latitude:	38.00708	Longitude:	-121.69299
Region:	6	Lease:	Porter Sesnon
Section:	19	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9103.00000
Spud Date:	7/11/1964	Abandonment Date:	8/3/1964

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Direction Distance	Database	EDR ID Number

NE
1 - 2 Miles **OIL_GAS** **CA00004827**

Well Number:	3-2	Status:	Completed gas
API Number:	01300118	Operator:	Tonka Energy, Inc.
Latitude:	38.00677	Longitude:	-121.66294
Region:	6	Lease:	Tract 3
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8250.00000
Spud Date:	11/1/1963	Abandonment Date:	Not Reported

NE
1 - 2 Miles **OIL_GAS** **CA00004825**

Well Number:	6-1	Status:	Completed gas
API Number:	01300116	Operator:	Tonka Energy, Inc.
Latitude:	38.00594	Longitude:	-121.66091
Region:	6	Lease:	Tract 6
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7680.00000
Spud Date:	10/11/1966	Abandonment Date:	Not Reported

NW
1 - 2 Miles **OIL_GAS** **CA00004569**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320058	Operator:	Ferguson & Bosworth
Latitude:	38.00533	Longitude:	-121.69595
Region:	6	Lease:	Sesnon
Section:	24	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8491.00000
Spud Date:	11/11/1969	Abandonment Date:	11/24/1969

NE
1/2 - 1 Mile **OIL_GAS** **CA00004820**

Well Number:	4-1	Status:	Completed gas
API Number:	01300111	Operator:	Tonka Energy, Inc.
Latitude:	38.00420	Longitude:	-121.67000
Region:	6	Lease:	Tract 4
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7591.00000
Spud Date:	9/8/1964	Abandonment Date:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Direction Distance	Database	EDR ID Number
WNW 1 - 2 Miles	**OIL_GAS**	**CA00004764**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01300173	Operator:	Porter Sesnon, et al
Latitude:	38.00130	Longitude:	-121.69964
Region:	6	Lease:	Sesnon
Section:	24	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	6951.00000
Spud Date:	12/30/1949	Abandonment Date:	2/3/1950

Direction Distance	Database	EDR ID Number
ENE 1/2 - 1 Mile	**OIL_GAS**	**CA00004828**

Well Number:	3-3	Status:	Completed gas
API Number:	01300119	Operator:	Tonka Energy, Inc.
Latitude:	38.00114	Longitude:	-121.66657
Region:	6	Lease:	Tract 3
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7600.00000
Spud Date:	9/8/1964	Abandonment Date:	Not Reported

Direction Distance	Database	EDR ID Number
NNE 1/4 - 1/2 Mile	**OIL_GAS**	**CA00004410**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320233	Operator:	Shoshone Oil Corp.
Latitude:	38.00082	Longitude:	-121.67796
Region:	6	Lease:	Emerson Dairy
Section:	19	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7773.00000
Spud Date:	6/13/1984	Abandonment Date:	7/10/1984

Direction Distance	Database	EDR ID Number
ENE 1 - 2 Miles	**OIL_GAS**	**CA00004332**

Well Number:	6-2	Status:	Plugged and abandoned-dry hole
API Number:	01320330	Operator:	St. Croix Resources
Latitude:	38.00080	Longitude:	-121.65849
Region:	6	Lease:	Burroughs
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8488.00000
Spud Date:	5/26/1995	Abandonment Date:	6/8/1995

Direction
Distance | Database | EDR ID Number

WNW
1 - 2 Miles **OIL_GAS** **CA00004358**

Well Number:	1-24	Status:	Plugged and abandoned-dry hole
API Number:	01320294	Operator:	Nahama & Weagant Energy Co.
Latitude:	38.00011	Longitude:	-121.69982
Region:	6	Lease:	Big Break
Section:	24	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7304.00000
Spud Date:	9/28/1989	Abandonment Date:	10/19/1989

ENE
1/2 - 1 Mile **OIL_GAS** **CA00004822**

Well Number:	4-3	Status:	Completed gas
API Number:	01300113	Operator:	Tonka Energy, Inc.
Latitude:	37.99947	Longitude:	-121.67041
Region:	6	Lease:	Tract 4
Section:	20	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7580.00000
Spud Date:	3/10/1965	Abandonment Date:	Not Reported

WNW
1 - 2 Miles **OIL_GAS** **CA00004774**

Well Number:	3	Status:	Plugged and abandoned-dry hole
API Number:	01300172	Operator:	Chevron U.S.A. Inc.
Latitude:	37.99939	Longitude:	-121.70469
Region:	6	Lease:	Sesnon-Gulf
Section:	24	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	6600.00000
Spud Date:	6/2/1966	Abandonment Date:	6/10/1966

West
1 - 2 Miles **OIL_GAS** **CA00004349**

Well Number:	2-24	Status:	Completed gas
API Number:	01320306	Operator:	Enerfin Resources NLP
Latitude:	37.99817	Longitude:	-121.70610
Region:	6	Lease:	Big Break
Section:	24	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	5952.00000
Spud Date:	2/16/1991	Abandonment Date:	4/12/1997

Direction Distance	Database	EDR ID Number

ENE
1/2 - 1 Mile **OIL_GAS** **CA00004823**

Well Number:	5-4	Status:	Completed gas
API Number:	01300114	Operator:	Tonka Energy, Inc.
Latitude:	37.99755	Longitude:	-121.66555
Region:	6	Lease:	Tract 5
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7651.00000
Spud Date:	6/19/1964	Abandonment Date:	Not Reported

WNW
1/2 - 1 Mile **OIL_GAS** **CA00004453**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320191	Operator:	Atlantic Oil Co.
Latitude:	37.99724	Longitude:	-121.69287
Region:	6	Lease:	Williamson
Section:	30	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8200.00000
Spud Date:	6/10/1983	Abandonment Date:	8/29/1983

West
1 - 2 Miles **OIL_GAS** **CA00004637**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01300303	Operator:	Chevron U.S.A. Inc.
Latitude:	37.99679	Longitude:	-121.70021
Region:	6	Lease:	Porter Sesnon
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9018.00000
Spud Date:	7/20/1963	Abandonment Date:	6/19/1980

West
1/2 - 1 Mile **OIL_GAS** **CA00004369**

Well Number:	3-25	Status:	Completed oil
API Number:	01320283	Operator:	Enerfin Resources NLP
Latitude:	37.99672	Longitude:	-121.69817
Region:	6	Lease:	Big Break
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7490.00000
Spud Date:	7/27/1988	Abandonment Date:	4/8/1997

Direction Distance			Database	EDR ID Number

West
1 - 2 Miles — **OIL_GAS** **CA00004437**

Well Number:	25-1	Status:	Plugged and abandoned-dry hole
API Number:	01320218	Operator:	TXO Production Corp.
Latitude:	37.99611	Longitude:	-121.70386
Region:	6	Lease:	Porter Estates
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7409.00000
Spud Date:	12/30/1983	Abandonment Date:	1/4/1984

West
1/2 - 1 Mile — **OIL_GAS** **CA00004403**

Well Number:	2-25	Status:	Completed oil
API Number:	01320249	Operator:	Enerfin Resources NLP
Latitude:	37.99476	Longitude:	-121.69741
Region:	6	Lease:	Big Break
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7486.00000
Spud Date:	3/9/1987	Abandonment Date:	4/3/1997

West
1 - 2 Miles — **OIL_GAS** **CA00004397**

Well Number:	1-25	Status:	Plugged and abandoned gas-directional
API Number:	01320243	Operator:	Nahama & Weagant Energy Co.
Latitude:	37.99474	Longitude:	-121.70037
Region:	6	Lease:	Big Break
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7422.00000
Spud Date:	3/29/1985	Abandonment Date:	2/26/1987

West
1/8 - 1/4 Mile — **OIL_GAS** **CA00004795**

Well Number:	2	Status:	Plugged and abandoned-dry hole
API Number:	01300151	Operator:	Occidental Petroleum Corp.
Latitude:	37.99468	Longitude:	-121.68439
Region:	6	Lease:	Oakley Unit One
Section:	30	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8434.00000
Spud Date:	8/18/1964	Abandonment Date:	8/30/1964

Direction
Distance | Database | EDR ID Number

East
1/4 - 1/2 Mile | **OIL_GAS** | **CA00004819**

Well Number:	8-3	Status:	Plugged and abandoned gas
API Number:	01300110	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.99448	Longitude:	-121.67472
Region:	6	Lease:	Tract 8
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7700.00000
Spud Date:	9/28/1964	Abandonment Date:	4/27/1978

East
1/2 - 1 Mile | **OIL_GAS** | **CA00004835**

Well Number:	8-1	Status:	Plugged and abandoned gas
API Number:	01300105	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.99395	Longitude:	-121.66913
Region:	6	Lease:	Tract 8
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8328.00000
Spud Date:	7/16/1964	Abandonment Date:	12/4/1994

West
1 - 2 Miles | **OIL_GAS** | **CA00004443**

Well Number:	1	Status:	Plugged and abandoned gas
API Number:	01320202	Operator:	Western Continental Oper. Co.
Latitude:	37.99362	Longitude:	-121.70254
Region:	6	Lease:	NGC-Dell@Antico
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7387.00000
Spud Date:	4/9/1983	Abandonment Date:	1/20/1988

East
1 - 2 Miles | **OIL_GAS** | **CA00004920**

Well Number:	7-1	Status:	Completed gas
API Number:	01300011	Operator:	Tonka Energy, Inc.
Latitude:	37.99301	Longitude:	-121.66043
Region:	6	Lease:	Tract 7
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7700.00000
Spud Date:	9/22/1966	Abandonment Date:	Not Reported

Direction Distance	Database	EDR ID Number

East
1/2 - 1 Mile **OIL_GAS** **CA00004824**

Well Number:	5-5	Status:	Completed gas
API Number:	01300115	Operator:	Tonka Energy, Inc.
Latitude:	37.99200	Longitude:	-121.66562
Region:	6	Lease:	Tract 5
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7700.00000
Spud Date:	10/22/1964	Abandonment Date:	Not Reported

WSW
1/2 - 1 Mile **OIL_GAS** **CA00004389**

Well Number:	25-1	Status:	Plugged and abandoned-dry hole
API Number:	01320260	Operator:	Arkoma Production Co. of Calif.
Latitude:	37.99096	Longitude:	-121.69746
Region:	6	Lease:	Domingo
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7395.00000
Spud Date:	1/20/1986	Abandonment Date:	8/8/1986

WSW
1 - 2 Miles **OIL_GAS** **CA00004922**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01300013	Operator:	Sumpf-Williams
Latitude:	37.98938	Longitude:	-121.70536
Region:	6	Lease:	Biancalana
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	6069.00000
Spud Date:	8/8/1966	Abandonment Date:	8/20/1966

ESE
1/2 - 1 Mile **OIL_GAS** **CA00004834**

Well Number:	9-1	Status:	Plugged and abandoned gas
API Number:	01300104	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.98918	Longitude:	-121.66525
Region:	6	Lease:	Tract 9
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7701.00000
Spud Date:	9/5/1965	Abandonment Date:	11/24/1992

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Direction Distance	Database	EDR ID Number

WSW
1 - 2 Miles **OIL_GAS** **CA00004565**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320077	Operator:	Neaves Petroleum Developments
Latitude:	37.98796	Longitude:	-121.70109
Region:	6	Lease:	J.P. Mori
Section:	25	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7409.00000
Spud Date:	10/9/1972	Abandonment Date:	4/24/1973

SE
1/2 - 1 Mile **OIL_GAS** **CA00004836**

Well Number:	8-2	Status:	Plugged and abandoned gas
API Number:	01300106	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.98752	Longitude:	-121.66951
Region:	6	Lease:	Tract 8
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8298.00000
Spud Date:	8/11/1964	Abandonment Date:	12/16/1992

SE
1/2 - 1 Mile **OIL_GAS** **CA00004935**

Well Number:	8-4	Status:	Plugged and abandoned gas-directional
API Number:	01300005	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.98752	Longitude:	-121.67003
Region:	6	Lease:	Tract 8
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	7360.00000
Spud Date:	1/10/1967	Abandonment Date:	8/1/1984

ESE
1 - 2 Miles **OIL_GAS** **CA00004833**

Well Number:	28-1	Status:	Plugged and abandoned-dry hole
API Number:	01300103	Operator:	Occidental Petroleum Corp.
Latitude:	37.98674	Longitude:	-121.65701
Region:	6	Lease:	Transamerica
Section:	28	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8540.00000
Spud Date:	4/2/1964	Abandonment Date:	5/14/1964

Direction
Distance | Database | EDR ID Number

South
1/2 - 1 Mile **OIL_GAS** **CA00004570**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320059	Operator:	Prudential Minerals Expl. Corp.
Latitude:	37.98461	Longitude:	-121.68154
Region:	6	Lease:	Machado
Section:	30	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8179.00000
Spud Date:	12/19/1969	Abandonment Date:	1/6/1970

South
1/2 - 1 Mile **OIL_GAS** **CA00004793**

Well Number:	1	Status:	Plugged and abandoned gas
API Number:	01300149	Operator:	Occidental Petroleum Corp.
Latitude:	37.98415	Longitude:	-121.68282
Region:	6	Lease:	Machado
Section:	30	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	11607.00000
Spud Date:	8/19/1962	Abandonment Date:	6/21/1968

SE
1 - 2 Miles **OIL_GAS** **CA00004837**

Well Number:	10-1	Status:	Plugged and abandoned gas
API Number:	01300107	Operator:	Phillips Petroleum Co., Unit Op
Latitude:	37.98383	Longitude:	-121.66494
Region:	6	Lease:	Tract 10
Section:	29	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8170.00000
Spud Date:	9/22/1964	Abandonment Date:	12/29/1977

SSW
1/2 - 1 Mile **OIL_GAS** **CA00004431**

Well Number:	2	Status:	Plugged and abandoned gas
API Number:	01320210	Operator:	Atlantic Oil Co.
Latitude:	37.98307	Longitude:	-121.68984
Region:	6	Lease:	Loo
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8018.00000
Spud Date:	7/22/1983	Abandonment Date:	4/20/1987

Direction Distance	Database	EDR ID Number

SSW
1/2 - 1 Mile **OIL_GAS** **CA00004476**

Well Number:	1	Status:	Plugged and abandoned gas
API Number:	01320169	Operator:	Atlantic Oil Co.
Latitude:	37.98301	Longitude:	-121.68901
Region:	6	Lease:	Loo
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9409.00000
Spud Date:	2/19/1981	Abandonment Date:	4/21/1987

SSW
1/2 - 1 Mile **OIL_GAS** **CA00004386**

Well Number:	3	Status:	Plugged and abandoned-dry hole-directional
API Number:	01320257	Operator:	Atlantic Oil Co.
Latitude:	37.98271	Longitude:	-121.68939
Region:	6	Lease:	Loo
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8321.00000
Spud Date:	11/22/1985	Abandonment Date:	12/26/1985

SW
1 - 2 Miles **OIL_GAS** **CA00004540**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320096	Operator:	Ladd Petroleum Corp.
Latitude:	37.98203	Longitude:	-121.69746
Region:	6	Lease:	Honegger
Section:	36	Township:	02N
Range:	02E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8356.00000
Spud Date:	10/1/1973	Abandonment Date:	10/24/1973

South
1 - 2 Miles **OIL_GAS** **CA00004794**

Well Number:	1	Status:	Plugged and abandoned-dry hole-directional
API Number:	01300150	Operator:	Occidental Petroleum Corp.
Latitude:	37.97963	Longitude:	-121.67912
Region:	6	Lease:	Oakley Unit B
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9065.00000
Spud Date:	9/19/1962	Abandonment Date:	11/8/1962

Direction Distance	Database	EDR ID Number

SSW
1 - 2 Miles **OIL_GAS** **CA00004452**

Well Number:	1	Status:	Completed gas
API Number:	01320190	Operator:	Shoshone Oil Corp.
Latitude:	37.97826	Longitude:	-121.69287
Region:	6	Lease:	Nunnally
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	8279.00000
Spud Date:	1/4/1983	Abandonment Date:	Not Reported

South
1 - 2 Miles **OIL_GAS** **CA00004399**

Well Number:	1	Status:	Plugged and abandoned-dry hole
API Number:	01320245	Operator:	Channel Exploration Co.
Latitude:	37.97666	Longitude:	-121.68142
Region:	6	Lease:	Bacchini
Section:	31	Township:	02N
Range:	03E	Map Number:	608
Base and Meridian:	Mount Diablo	Total Depth:	9185.00000
Spud Date:	4/3/1985	Abandonment Date:	4/29/1985

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: CA Radon

Radon Test Results

Zip	Total Sites	> 4 Pci/L	Pct. > 4 Pci/L
94561	2	0	0.00

Federal EPA Radon Zone for CONTRA COSTA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for CONTRA COSTA COUNTY, CA

Number of sites tested: 55

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.760 pCi/L	100%	0%	0%
Living Area - 2nd Floor	0.300 pCi/L	100%	0%	0%
Basement	0.525 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002. 7.5-Minute DEMs correspond to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STATE RECORDS

California Drinking Water Quality Database
Source: Department of Health Services
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

California Oil and Gas Well Locations for District 2, 3, 5 and 6
Source: Department of Conservation
Telephone: 916-323-1779

RADON

State Database: CA Radon
Source: Department of Health Services
Telephone: 916-324-2208
Radon Database for California

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

ENGEO
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
4603.4.102.01

July 5, 2007

Mr. Bob Weiss
DeNova Homes, Inc.
333 Civic Drive
Pleasant Hill, CA 94523

Subject: Emerson Property – Southern 140 Acres
Assessor Parcel Numbers 037-192-015 and 037-192-032
Oakley, California

CLARIFICATION REGARDING ENVIRONMENTAL SITE ASSESSMENT UPDATE FINDINGS

Reference: ENGEO Incorporated; Environmental Site Assessment Update, Southern 140 Acres – Emerson Property, Oakley, California; June 21, 2004; Project No. 4603.1.011.01.

Dear Mr. Weiss:

ENGEO Incorporated has prepared this letter of clarification regarding our referenced Environmental Site Assessment (ESA) Update of the southern 140-acre Emerson parcel located at 6701 and 6501 Sellers Avenue in Oakley, California (Assessor Parcel Numbers 037-192-015 and 037-192-032). The primary intent of the letter is to clarify that the Environmental Site Assessment Update determined no recognized environmental conditions exist on the subject 140-acre property.

References made in the "Previous Studies" section of the referenced document, which regard stained soil, petroleum storage tanks (above ground and underground), nitrates and pesticide storage, concern off-site, adjacent parcels to the north of the subject property. Because the ESA Update utilized a previous ESA that covered 1,100 acres (Emerson and Burroughs properties combined) and the subject of the ESA Update only concerned a portion of these sites (i.e., southern 140 acres of the Emerson property), references to these environmental concerns were made. Since these environmental concerns are located off-site with respect to the 140-acre property, it is our opinion that the potential environmental impact associated with these conditions can be considered less than significant with respect to proposed development on the subject property.

We are pleased to be of continued service to you with regard to this project. If you have further questions, please contact us.

Very truly yours,

ENGEO INCORPORATED

Jason Preece

Jason Preece
Senior Engineering Geologist
jp/jb

Josef J. Tootle
Principal

cc: 1 – Mr. Rod Stinson (e-mail only)

4.8 BIOLOGICAL RESOURCES

INTRODUCTION

This section evaluates the biological resources known to occur and potentially occurring on the 124-acre Gilbert project site; existing plant communities, wetlands, wildlife habitats, and the likelihood of occurrence of special-status species and communities are discussed for the project site. This section also describes potential impacts to those resources and identifies measures, where practicable, to eliminate or substantially reduce those impacts to less-than-significant levels.

METHODS OF ANALYSIS

The information contained in this analysis is primarily based upon the *Biological Resources Section* prepared by Zentner and Zentner whose biological analysis is based on studies conducted on-site and in the site vicinity, including a review of the documents listed below; review of regional biological resource databases, examination of aerial photography, biological resources, and vegetation maps; and focused habitat assessments, biological surveys according to accepted protocols and guidelines, and field investigations. Biologists from other professional firms conducted field surveys on the property, in the adjacent properties and in the vicinity and region of the property.

The evaluation of whether or not an impact on biological resources would be significant considers CEQA Guidelines as well as the resource itself and how that resource fits into a regional or local context. Significant impacts would be those that would diminish, or result in the loss of, an important biological resource, or those that would conflict with local, State, or federal resource conservation plans, goals, or regulations.

The following information pertaining to biological resources was reviewed in the preparation of this section:

- Atlas Tree Service, Inc. *Tree Survey: Subdivision: cypress Road, Oakley, CA.* March 7, 2006.
- Entomological Consulting Services, Ltd. *Habitat Assessment for Special-Status Invertebrates for the Cypress Grove Project, Oakley, Contra Costa County, California.* September 19, 2002.
- Entomological Consulting Services, Ltd. *Habitat Assessment for Special-Status Insects and Invertebrates for the Cypress Grove Project, Oakley, Contra Costa County, California.* October 7, 2002.
- Entomological Consulting Services, Ltd. *Western Pacific 19A – Cypress Grove Property in Oakley (Contra Costa County), CA WA# 135 – Presence-Absence*

Surveys for Three Beetles. June 27, 2004.

- H.T. Harvey & Associates. *Site Assessment for Special-Status Bats for the Cypress Grove Project, Oakley, Contra Costa County, California.* August 8, 2002

- Monk & Associates. *Shea Homes Summer Lakes Development - Water Pipeline Project – Tree Removal - Swainson's Hawk Avoidance Measures in Coordination with CDFG*. November 14, 2005.

- Raney Planning & Management Inc. *Cypress Grove Draft Environmental Impact Report.* May 2003.

- Raney Planning & Management Inc. *Dutch Slough Properties Draft Environmental Impact Report.* July 2006. *(Withdrawn)*

- Sycamore Associates LLC. *Preliminary Wetlands Delineation and Jurisdictional Determination of the Emerson and Burroughs Properties, Oakley, California. Addendum letter report.* June 28, 1998.

- Sycamore Associates LLC. *Biological Assessment of the Emerson and Burroughs Properties, Oakley, Contra Costa County, California.* 1999.

- Sycamore Associates LLC. *Wetland Delineation and Preliminary Jurisdictional Determination for the Cypress Grove Project, Oakley, California.* August 23, 2001.

- Sycamore Associates LLC. *Protocol-level Habitat Assessment and Focused Breeding Season Burrowing Owl Surveys for the Cypress Grove Project, Oakley, Contra Costa County, California.* August 12, 2002.

- Sycamore Associates LLC. *Botanical Assessment for the Cypress Grove Project, Oakley, Contra Costa County, California.* September 20, 2002.

- Sycamore Associates LLC. *Revised Biological Assessment for the Cypress Grove Property, Oakley, California.* January 30, 2003.

- Sycamore Associates LLC. *Focused Winter Burrowing Owl and Pre-construction Bird Surveys for the Cypress Grove Project, Oakley, Contra Costa County, California.* February 6, 2003.

- Sycamore Associates LLC. *Cypress Grove Project – Swainson's Hawk Foraging Habitat Analysis for the Cypress Grove Project, Oakley, Contra Costa County, California.* June 2003.

- Sycamore Associates LLC. *Site Assessment for the California Red-legged Frog for the Cypress Grove Project, Oakley, California.* March 20, 2003.
- Sycamore Associates LLC. *Supplemental Botanical Assessment for the Cypress Grove Residential Development, Oakley, Contra Costa County, California.* July 25, 2003.

- Sycamore, Hanson Environmental, and Balance Hydrologics. *Essential Fish Habitat Assessment for the Cypress Grove Project, Oakley, Contra Costa County, California.* August 10, 2004.
- Sycamore Associates LLC. *Letter to David Ivester Re: Summary of Silvery Legless Lizard Sightings on the Cypress Grove Residential Development, City of Oakley, Contra Costa County*. May 4, 2004.
- Sycamore Associates LLC. *Silvery Legless Lizard Survey Results and Mitigation Plan for the Cypress Grove Residential Project, City of Oakley, Contra Costa County, California.* July 13, 2004.
- Sycamore Associates LLC. *Focused Special-Status Reptile Surveys for the Cypress Grove Project, Oakley, Contra Costa County, California.* August 23, 2004.
- Sycamore Associates LLC. *Biological Assessment for the 150-acre Emerson Property South of the Contra Costa Canal, Oakley, Contra Costa County, California.* January 14, 2005.
- Sycamore Associates, LLC. *Tree Survey Report for the 150-acre Emerson Property and Off-Site Areas Along Cypress Road and Sellers Avenue, Oakley, Contra Costa County, California.* March 24, 2005.
- Sycamore Associates, LLC. *Burrowing Owl winter Season Habitat Assessment and Focused Surveys 150-acre Emerson Property South of the Contra Costa Canal, Oakley, Contra Costa County, California.* June 6, 2005.
- Sycamore Associates, LLC. *Botanical Assessment for the 150-Acre Emerson Property South of the Contra Costa Canal, Oakley, California*. July 25, 2005.
- Sycamore Associates, LLC. *Swainson's Hawk Foraging Habitat Analysis the 150-Acre Emerson Property South of the Contra Costa Canal, Oakley, Contra Costa County, California*. July 31, 2005.
- Swaim Biological Consulting. *Survey Results for the Giant Garter Snake (Thamnophis gigas) at the Gilbert and Burroughs Properties in Contra Costa County, California.* February 27, 2006.
- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) in Marsh Creek and the Contra Costa Canal, Northeast Contra Costa County, California.* January 22, 2004.
- Swaim Biological Consulting. *Site Assessment for Special Status Reptiles and Amphibians at the Proposed Cypress Grove Site in Oakley, Contra Costa County, California.* September 15, 2002.
- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) in Marsh Creek and the Contra Costa Canal, Northeast Contra Costa County, California.* January 22, 2004.

- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) at the Dal Porto North Property in Oakley, Contra Costa County, California.* October 1, 2005.
- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) at the Dal Porto South Property in Oakley, Contra Costa County, California.* October 3, 2005.
- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) at the Lesher Property in Oakley, Contra Costa County, California.* October 3, 2005.
- Swaim Biological Consulting. *Results of Surveys for the Giant Garter Snake (Thamnophis gigas) at the Biggs Property in Oakley, Contra Costa County, California*. October 3, 2005.
- Townsend, S. E. *San Joaquin Kit Fox Regional Analysis for the Cypress Grove Project, Oakley, Contra Costa County, California.* September 9, 2002.
- Zentner and Zentner. *Gilbert Property Oakley, Contra Costa County, Special Status Species Assessment*. January 6, 2005.
- Zentner and Zentner. *Burroughs Property, Oakley, Contra Costa County, Biotic Assessment.* May 2005.
- Zentner and Zentner. *Gilbert Property, Oakley, Section 404 Jurisdictional Delineation.* July 6, 2005.
- Zentner and Zentner. *South Cypress Road Environmental Assessment*. November 2005.
- Zentner and Zentner. *Special Status Species Surveys at the Gilbert's Property including Silvery Legless Lizard, Western Pond Turtle, Tri-colored Blackbird, Nesting Raptors and Vegetation.* October 2005.
- Zentner and Zentner. *Annual Report: Gilbert Property Surveys, Oakley, CA.* April 2006.

Nomenclature used throughout this report conforms to Hickman (1993) for plants except where noted. Nomenclature for special-status plant species conforms to the CDFG (2004c,e) and CNPS (2001); nomenclature for special-status animals conforms to the CDFG (2004b,d); nomenclature for special-status natural communities conforms to the California Department of Fish and Game (2003). Nomenclature for wildlife conforms to Sibley (2000) for birds, Stebbins (2003) for reptiles and amphibians, and Jameson Jr. and Peeters (2004) for mammals.

ENVIRONMENTAL SETTING

The Gilbert property is an approximately 124-acre farmed and grazed field. Dutch Slough marks the site's eastern boundary, while the Contra Costa Canal abuts the northern. The site is predominantly the level plain of a formerly irrigated pasture and has been frequently disked for farm uses. A vegetated sand mound rises near the center of the site, a remnant of the sand dunes that once occupied this region. Several drainage ditches have been constructed through the site to control the flow of water during irrigation. Annual grassland weeds dominate the majority of the site.

The site is bordered to the north by the Contra Costa Canal, to the west by the Emerson property, which is open agricultural land proposed for residential development, to the south by rural residential properties south of Cypress Road and to the east by rural residential and agricultural lands, most of which are part of the East Cypress Specific Plan area and are likely to be developed in the near future (see Figure 3-2 in Chapter 3 of this Draft EIR).

Environs

The lands around the project site are currently being used for various forms of farming. Adjacent land uses to the north, south, and east, including farming and livestock grazing. These areas have been farmed in irrigated pasture, oat and wheat hay and similar endeavors for the past several decades and, occasionally, longer periods. To the north are the lands of the Delta; typically including farmland, marsh and open waters, as well as canals and similar features.

Regional and local ecology

The western edge of the Sacramento-San Joaquin Delta's freshwater tidelands is located only 0.4 miles east of the Gilbert site. The Delta was created 10,000 years ago when a warmer climate following the Pleistocene Ice Age melted continental ice sheets. The addition of their melt water then caused worldwide sea levels to rise. Rising seas first breached California's Golden Gate at this time to flood interior valleys and create the San Francisco Bay Estuary. During the Ice Age the Sacramento-San Joaquin river system had flowed through the Golden Gate to a shoreline near the present Farallon Islands, but the estuary's subsequent rising waters hydraulically dammed the river system's outflow to permanently flood the center of California's Central Valley and create the freshwater tidal wetland we know today as the Delta. An unusual Delta feature is the failure of rivers flowing into to fill it with sediment during the 10,000 years it developed. Instead its vast new emergent marsh was dominated by tules (*Scirpus acutus*), which used the supportive substrate formed by their own past generations' dead stems and rhizomes to synchronously follow the gradually rising waters upward. The many generations of dead tules beneath each living generation formed the Delta's peat soils.

While Ice Age glaciers covered vast continental lowlands in northern North America, others farther south carved deep valleys like Yosemite in the Sierra Nevada's granite spine. Such glacial erosion produced enormous quantities of sand that major rivers carried down to the Central Valley, where it accumulated in large dune fields as the rivers left the mountains. One of the largest valley dune fields, fed by sand from the Stanislaus, Mokelumne, and other rivers to the north and south, once occupied much of the Delta area, where peat now largely covers it, and the northern part of the San Francisco Bay estuary, where it now mostly lies beneath bay mud. Edges of the old estuary-delta dune field too high for inundation by rising waterways and wetlands can still be seen, however. One example is Oakland, which is largely built on low hills around Lake Merritt formed by Ice Age Merritt sand. A second is Oakley, which is surrounded by Delhi sand of the same age and origin. Oakland and Oakley's similar names are not coincidental since the old estuary-delta dune field is particularly good substrate for coast live oak (*Quercus agrifolia*). Both communities are named for forests of this tree that once covered surrounding sand deposits and stopped at their edge.

A sand hill located at the site's center is a remnant of the old dune field that rises 15 feet above a surrounding level plain formed by more recent sediments deposited by Coast Range creeks over dunes that were lower. One mile southwest of the site, however, the dune field is continuously exposed in a 1.5 mile wide band extending southeastward for 9 miles through Oakley from the San Joaquin River near Antioch. Sand hills are continuous in this belt, but to its northeast several hills like the one on the site are isolated amidst an otherwise continuous mantle of more recent sediments. East of the site in the Delta several sand islands even rise above surrounding peat. All delta sand islands have not been continuously exposed above peat, however, since some were revealed only when peat oxidized and deflated after it was farmed. Others like sands on Brannan Island are dredge spoils produced when sand underlying much of the Delta was excavated to deepen shipping channels.

Most natural vegetation on exposures of the old estuary-delta dune field in Contra Costa County has long been removed since Delhi sand is highly desirable for orchards and vineyards. More recently rapid urbanization around Oakley has removed even more of the few remaining examples of natural vegetation on nearby sand hills. Enough currently remains, however, to demonstrate original coverage of the dune field area by a forest or woodland that ended abruptly at the edge of the sands and was exclusively dominated by coast live oak (*Quercus agrifolia*). The nature of the woodland's understory is less certain, but California croton (*Croton californicus*), a native forb with an isolated population on northeastern Contra County's sands disjunct from its otherwise largely coastal dune associated populations, was certainly important. Telegraph weed (*Heterotheca grandiflora*) is another native forb now common on sands around Oakley, but its population may currently be unnaturally high since it thrives in the disturbed habitats now general in the area. The native shrub silver lupine (*Lupinus albifrons*) is a particularly common understory associate of oaks on sands around Oakley. Other native shrubs of the area's sands are dune lupine (*Lupinus chamissonis*), which is reported from the region but was not seen on this site, and golden-fleece (*Ericameria arborescens*), which was seen but is not otherwise reported for the area. A currently declining native forb of the Oakley sands that was probably once much more common is birdcage evening primrose (*Oenothera deltoides* ssp. *cognata*), a close relative of endangered Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*), which is essentially confined to the least stabilized areas of the dune field along the San Joaquin River near Antioch.

Other native forbs recently reported from the Oakley sand hills are slender buckwheat (*Eriogonum gracile*) and valley lessingia (*Lessingia glandulifera*). An attractive but non-native forb that has recently colonized the Oakley sand hills but is scarce elsewhere in central California is golden crownbeard (*Verbesina encelioides*). No evidence of native grasses was seen in the dune field, but some probably at least once occurred there. Purple needlegrass (*Nassella pulchra*) is the most likely native grass among those that might once have occurred on the Oakley sands. Trees were apparently scarce on recent non-sandy sediments deposited over the dune field by Marsh Creek. The most widespread natural vegetation on these sediments was probably grassland dominated by creeping wild-rye (*Leymus triticoides*).

Vegetation Communities and Wildlife Habitats

The following is a discussion of existing habitats found within the project site and the plant and wildlife species it supports. These habitats include: formerly irrigated pasturelands, non-native annual grasslands including the vegetated sand mound, seasonal wetlands, sloughs, and drainage ditches. These various habitats are used by a variety of wildlife and the potential for occurrence of special-status species within the on-site habitats described below in the subsequent section.

Figure 4.8-1, Habitat Map, identifies the locations of the various habitat types on the Dutch Slough Properties.

Figure 4.8-1
Habitat Map

Irrigated Pasture

Most of the Gilbert property consists of formerly irrigated pasture, which is dominated by non-native forage species that include Bermuda grass, (*Paspalum dilatatum*), Italian ryegrass, curly dock (*Rumex crispus*), English plantain (*Plantago lanceolata*), fiddle dock (*Rumes pulcher*), white clover (*Trifolium repens*), meadow fescue (*Festuca pratensis*), bird's foot trefoil (*Lotus carniculatus)*, Mediterranean barley (*Hordeum marinum*), and dallis grass (*Paspalum dilatatum*). Small portions of the pasture had supported hydrophytes in the past during irrigation but these are now shifting to upland dominance. These areas generally occur alongside drainage ditches or other low areas where overflow from the irrigation has accumulated. Typical wildlife in this habitat includes a variety of small mammals, occasional raptors that prey on the small mammals, and larger, farm-adapted mammals such as skunks and raccoons. Squirrels are notably absent on-site, presumably due to efforts by the farming community n this area to reduce their populations on farm land.

Non-Native Annual Grassland

Near the center of the site, the degraded, vegetated sand mound is dominated by non-native annual grassland. The sand mound, which has been highly disturbed by grazing, is dominated by common non-native annual grassland vegetation, especially ripgut brome (*Bromus diandrus*), and hare barley (*Hordeum murinum*). Various artifacts from past cattle operations, as well as an abandoned house, are also present. Weedy non-native forbs that include Russian thistle, yellow star-thistle, and bull thistle (*Cirsium vulgare*) are common on the sand mound. Other dominant species include stinging nettle (*Urtica urens*), summer mustard, wild radish (*Raphamus sativa*), and broad-leaved pepper weed (*Lepidum latifolium*). The only relatively common native is foxtail barley (*Hordeum jubatum*), which is found scattered around areas with sandy soils.

Non-native annual grasses are also commonly found along the site edges and as well as berms located adjacent to drainage ditches that are artifacts of ditch construction. These areas contain more ruderal grassland vegetation including: wild oats, brome grasses (*Bromus* spp.), wild barley (*Hordeum* spp.), quaking grass (*Briza* spp.), Italian ryegrass (*Lolium multiflorum*), and fescue (*Vulpia* spp.). Common non-native forbs include yellow star thistle (*Centaurea solstitialis*), field bindweed (*Convovulus arvensis*), cut-leaved geranium (*Geranium dissectum*), sheep sorrel (*Rumex acetosella*), bur-clover (*Medicago polymorpha*), black mustard (*Brassica nigra*), and filaree (*Erodium* spp.), among others. Wildlife in these areas are similar to those found in the irrigated pasture.

Wetlands

The seasonal wetlands on the property are dominated by annual and perennial native and non-native wetland species. This plant association typically resembles a wetland community only following the wet season; it dries up rapidly with the onset of summer. During the dry season, such sites may not be readily recognizable as wetlands.

Several small, low-lying areas totaling 1.29 acres are found alongside the edge of the sand mound. These areas are either irrigated pasture artifacts or seasonal wetland habitats that occupy the low areas of the level plain within the irrigated pasture. These more mesic areas contain more native species than the drier habitats on the site. These areas are dominated by knot grass (*Paspalum distichum,* a native species), common nut-sedge or umbrella grass (*Cyperus eragrostis,* a native species), curly dock, Bermuda grass, Italian ryegrass, dallis grass (*Paspalum dilatatum*), and creeping spikerush (*Eleocharis marcrostachya*, a native species).

A drainage ditch found along the northern border of the property supports perennial wetland. This wetland is 1.21 acres in extent and is dominated primarily by perennial species that are adapted to ponded or saturated conditions year round. The perennial wet conditions in the ditch is supplemented by a culverted connected to Dutch Slough and seepage from the adjacent Contra Costa Canal. This wetland is dominated by cattail (*Typha sp.*) and bulrush (*Scirpus sp.)*.

Wildlife in these wetlands can be varied and includes amphibians such as tree- and bullfrogs, waterfowl, and wading birds such as egrets.

Constructed Drainage Ditch

A network of abandoned ditches are located on the Gilbert property, which formerly carried irrigation water onto or drained tailwater from summer irrigated pastures. Vegetation within the pastures is dominated by ruderal (weedy) seasonal wetland species, including non-native species such as curly dock and dallis grass, and native species such as common nut-sedge, annual marsh aster (*Aster subulatus* var. *subulatus*), and knot grass. Five drainage ditches totaling 1.04 acres are located on the Gilbert property; these were all constructed in upland. The largest ditch runs at the base of the Contra Costa Canal levee along the northern border of the site; this ditch is dominated by common tule and California bulrush. This ditch may also be receiving subsurface seepage from the canal, which at this location consists of an unlined earthen conveyance. The remaining ditches do not support wetland vegetation. Wildlife using these ditches are similar to those described above for the wetlands.

Slough

A portion of Dutch Slough (0.52 acre) is located on the Gilbert property. The slough consists of a linear channel that runs along approximately 1,500 feet of the eastern edge of the site. Dutch Slough at this location is dominated by native species including California bulrush (*Scirpus californicus*), common tule (*Scirpus acutus v. occidentalis*), three-square (*Scirpus americanus*), willow (*Salix* spp.), and bugleweed (*Lycopus americanus*). Dutch Slough also includes areas of open water covered by water hyacinth (*Eichornia crassipes*). Dutch Slough at the site has been realigned into a linear artificial channel, but it is directly connected to the system of delta waterways north of the site, and is tidally influenced at this location. The Slough's use by wildlife is constant and relatively significant, including both the wetland species noted above and a variety of Delta fish.

Trees

There are 14 black cottonwood trees (*Populus balsamifera ssp. trichocarpa*) located on-site in the southeastern portion of the sand mound near an old residence; these are the only trees on the project site. A number of trees that once existed north of Cypress Road adjacent to the site were cut down for a pipeline project by another developer after approval of a City Tree Removal Permit and consultation with the California Department of Fish and Game (CDFG) staff.

SPECIAL STATUS HABITATS AND SPECIES

Wetlands and Jurisdictional Areas

Methods

The wetland delineation was completed by Zentner and Zentner over the winter and spring of 2005. Boundaries between jurisdictional areas and uplands were first investigated using the routine on-site assessment procedure, Section D, Subsection 2, page 57 of the 1987 "Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory 1987; hereafter the "Delineation Manual"). Dominant plant species, soil characteristics, and hydrology indicators were noted within a 10-foot by 10-foot plot at each sample point Wetlands were distinguished from uplands on this site by the presence of: 1) hydrophytic vegetation, 2) wetland hydrology, and 3) hydric soils.

Hydrophytic vegetation is dominated by plant species that can tolerate prolonged inundation or soil saturation during the growing season. More than 50% of the dominant species must be wetland indicators of FAC, FACW and OBL for the vegetation to be considered hydrophytic. These wetland indicators, or hydrophytes, are listed in the Delineation Manual as OBL, FACW, and FAC. Other plants are listed as FACU or NI, and unlisted plants are considered as UPL.

Hydric soils develop under the low oxygen conditions typical of prolonged inundation or saturation, and generally show visible indications of chemical reduction. The hydric nature of a soil is most often indicated by low matrix chromas of 0 to 1, or 2 with mottles, and is determined by comparing the wetted soil with Munsell Soil Color Charts. The hydric nature of a soil may also be indicated by the presence of manganese or iron nodules, or other more subtle characteristics.

Common wetland hydrology indicators demonstrate inundation or saturation and include observations of standing water, saturated soils, algal mats, water-matted detritus, and water stains on rocks or other objects. In evaluating these hydrology indicators some attention must be given to the frequency and duration of inundation, and the effects of recent weather, unusual flooding and climatic fluctuations.

The Corps also regulates "other waters tributary to waters of the U.S." Boundaries between uplands and other waters are determined based on water elevations and geomorphic features. In freshwater conditions, the boundary between uplands and other waters is the ordinary high water mark, which is roughly equivalent to the mean annual flood line. In tidal conditions, the boundary is set by the high tide line, roughly equivalent to mean high water.

In addition to the routine on-site assessment procedure, a hydrology-based wetland assessment was conducted because the site had been irrigated and thus hydrophytic vegetation was present on the site that would probably not be sustained under normal circumstances.

For a site or portion of a site to exhibit wetland hydrology, it must have continuous inundation or saturation for at least 5% of growing season in most (<50% of) years (Environmental Laboratory, 2005). With a growing season of 365 days, as listed for this area (National Water and Climate Center, 2002), at least 18.25 days of continuous inundation or saturation would be required to meet this parameter. The hydrology and soils criteria (NRCS, 2005) further require the prolonged saturation to be at the surface, or as a water table, within: (a) 1.0 ft of the surface during the growing season for soils with permeability less than 6.0 in/h in any layer within 20 in of the surface (the Marcuse and Sycamore soils of the site are within this range); or (b) 0.5 ft of the surface for soils with permeability equal to or greater than 6.0 in/hour in all layers within 20 in of the surface (the Piper and Delhi soils of the site are in this range).

10 sampling stations were placed in low areas, marked with wire flags, where the previous irrigation had sustained a mix of FAC, FACW and OBL species. The hydrology monitoring entailed recording the depth of inundation or saturation in a freshly dug hole to < -18 inches at each station, with photography, during eight visits from early November though January.

Daily rainfall for this season was extracted and compiled from a State database (Calif. Dept. of Water Resources, 2005) for Brentwood (the nearest station with current data) for correlation with site hydrology.

Areas with inundation or with saturation within 12"of the surface were mapped in the field during each of the eight hydrology monitoring visits. Sample points were examined at each location as noted above. Areas with wetland hydrology (i.e. sustained shallow saturation or inundation) were then identified from the field maps, in conjunction with the monitoring described above.

Hydrologic conditions were also observed in two areas near the site for comparison to on-site hydrology. One area is located just over a quarter mile east from the southeast corner of the site in a field just south of Cypress Road and east of the project site. The other area is located immediately west across Sellars Road from the northwest side of the site.

Results

The Zentner and Zentner delineation was verified by the US Army Corps of Engineers (USACE) in August 2006. A total of 2.50 acres of USACE jurisdictional wetlands are located on the Gilbert property. This includes 1.21 acres of adjacent perennial wetland, 0.63 of adjacent seasonal wetland, 0.52 acres of Dutch Slough and 0.14 acres of former tidal wetland altered during farming. The bulk of these wetlands are located within an agricultural ditch along the northern edge of the project site, just below the Contra Costa Canal.

There are also 1.56 acres of non-jurisdictional wetlands including 0.52 acres of isolated seasonal wetlands, and 1.04 acres of agricultural ditches constructed in uplands. Figure

4.8-2, Wetlands/Section 404 Jurisdictional Delineation Map, identifies the jurisdictional and non-jurisdictional waters on the project site.

Figure 4.8-2
Wetlands/Section 404 Jurisdictional Delineation Map

Special-Status Species

Federal and State designations

Special status taxa (species) are those plant and animal species that, in the judgment of the resource agencies, trustee agencies, and, certain non-governmental organizations warrant special consideration in CEQA documents. This can be a very broad definition as it includes the following taxa:

- Officially designated as "threatened" (FT), "endangered" (FE) or "candidate" (FC) species federally listed by the US Fish and Wildlife Service (USFWS) and protected under the Federal Endangered Species Act (FESA). USFWS also maintains a list of species that are "Species of Concern" (FSC) that are also generally included as special status species under CEQA.

- Officially designated as "rare" (SR), "threatened" (ST), or "endangered" (SE) or "candidate" (SC) species state listed by the CDFG and protected under the California Endangered Species Act (CESA). CDFG also maintains a list of "Fully Protected" (SFP) species as well as "California Special Concern" (CSC) species that are also generally included as special status species under CEQA.

- Taxa considered rare, threatened, or endangered under the conditions of Section 15380 of the California Environmental Quality Act ("CEQA") Guidelines, such as the plant taxa identified on lists 1A, 1B, and 2 in the California Native Plant Society ("CNPS") Inventory of Rare and Endangered Vascular Plants of California.

  Other taxa considered sensitive such as the nests of birds listed in the Federal Migratory Bird Treaty Act (which includes most native birds) and plants included on lists 3 and 4 in the CNPS Inventory. Taxa may also be designated as of special concern at the local level due to limited data regarding distribution preventing threatened or endangered at the state or federal level.

Special-Status Species Results

For the special-status species discussion and tables below, we use the following definitions of the likelihood of species occurrence:

- **Present**: Species known to occur on the site, based on the actual observations or observation records as contained in the California Natural Diversity Database (CNDDB) records or other, verified observations.
- **High**: Species known to occur recently (within past 5 years) near the site (within 5 mi although this distance may vary depending on the species) based on CNDDB or other records, highly suitable habitat exists on-site or, based on professional expertise specific to the site or species, the plant or animal is considered highly likely to occur.
- **Moderate:** Species known to occur recently in the vicinity of the site (greater than 5 miles) and suitable nesting, foraging or other required habitat is present on-site.
- **Low**: Species known to occur in the vicinity of the site but only marginal habitat exists on the site or, suitable habitat exists on-site but the species has not been observed in the vicinity for more than 5 years.
- **Not Expected**: Species are not known to occur on or in the vicinity of the site and/or required habitat for the species does not exist on the site. Or, species were surveyed for during the appropriate season with negative results.

Special-Status Plant Species Results

A total of 52 special status species plants were reviewed for the Gilbert project. Of these, 10 plants have at least a low likelihood of occurrence, including; round-leaved filaree (*Erodium macrophyllum*; CNPS 2), Antioch Dunes evening-primrose *(Oenothera deltoides ssp. Howellii*; CNPS 1B, FE), Hoover's cryptantha (*Cryptantha hooveri*; CNPS 1B), rose-mallow (*Hibiscus lasiocarpus*; CNPS 2); Delta tule pea (*Lathyrus jepsonii var. jepsonii*; CNPS 1B, FSC), Mason's lilaeopsis (*Lilaeopsis masonii*; CNPS 1B, FSC), Delta mudwort (*Limosella subulata*; CNPS 2), eelgrass pondweed (*Potamogeton zosteriformis*; CNPS 2), blue skullcap (*Scutellaria lateriflora*; CNPS 2), and Suisun Marsh aster (*Aster lentus*; CNPS 1B, FSC). Of these, none were found on-site despite directed surveys in late spring of 2005 and summer 2005. Figure 4.8-3, Special-Status Vegetation Occurrence Map, shows the locations of these species where they occur within a 5-mile radius of the project area.

Figure 4.8-3
Special Status Plant Occurrence Map

Table 4.8-1 shows the special-status plant species that were evaluated for occurrence on the project site.

Table 4.8-1

Special-Status Plant Species with some Likelihood of Occurrence

Based on the negative survey results, no special status plant species are expected to occur on the project site.

Special-Status Wildlife Species Results

Based on a review of the extant literature, State and Federal data base searches, and a familiarity with the fauna within the project region, a total of 75 special-status wildlife species could possibly or do occur within the region of the project site. Of these, 32 species are not expected to occur on-site due to the lack of suitable habitat, isolation from known habitats, and the site being out of the species' known range. For example, special-status wildlife species that are strictly associated with the northern coastal salt marsh habitat present in the Bay-Delta were not included as part of this assessment because salt marsh habitat is not present on the study site or immediately adjacent to the site. These species include California clapper rail (*Rallus longirostris obsoletus*), saltmarsh yellowthroat (*Geothlypis trichas sinuosa*), Suisun song sparrow (*Melospiza melodia maxillaris*), San Pablo song sparrow (*Melospiza melodia samuelis*), Suisun shrew (*Sorex ornatus sinuosus*), salt marsh vagrant shrew (*Sorex vagrans halicoetes*), ornate salt marsh shrew (*Sorex ornatus salicornicus*), and salt marsh harvest mouse (*Reithrodontomys raviventris*).

The remaining 43 species have at least some potential to occur on-site and are discussed in more detail below.

Figure 4.8-4, Special-Status Wildlife Occurrence Map, shows the locations of special-status wildlife occurrence within a 5-mile radius of the project area.

Figure 4.8-4
Special Status Wildlife Occurrence Map

Table 4.8-2 identifies a full listing of all species considered as part of this project.

Table 4.8-2
Potentially Occurring Special-Status Wildlife Species

Of the 43 species with at least some potential to occur, 5 were observed on the property during the course of the surveys. These include loggerhead shrike (FSC and CSC), white-tailed kite (CFP), western burrowing owl (FSC and CSC), tricolored blackbird (FSC and

CSC), and Swainson's hawk (FSC and ST). Western pond turtle (*Clemmys marmorata*; FSC and CSC) and northern harrier (CSC) have a moderate potential to occur on-site given the presence of suitable habitat.

Invertebrates

Lange's Metalmark Butterfly

The Lange's metalmark butterfly (*Apodemia mormo langei*) is federally-listed as Endangered. This butterfly is associated only with the larval host plant naked-stem buckwheat (*Eriogonum nudum* var. *auriculatum*) and is known only from the Antioch dunes in Contra Costa County, approximately seven miles west of the project area. Although sandy soils occur on-site that could support the naked-stem buckwheat, this plant species was not seen during the site visits despite directed surveys. Based on an absence of the larval host plant, the restricted range of the butterfly, and the entomological report for the Cypress Grove site (Entomological Consulting Services 2002), which suggested that the butterfly was not likely to occur, the Lange's metalmark butterfly is not expected to occur on-site.

Valley Elderberry Longhorn Beetle

The Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), federally-listed Threatened, is restricted to the Central Valley wherever its food plant, blue elderberry shrub (*Sambucus mexicana*) occurs, primarily along riparian areas. The historical range of the beetle may have included the entire Sacramento and San Joaquin Valley riparian zone. Today less than four percent of the historical 400,000 acres of riparian forest remain (Barr 1991).

Elderberry trees do not occur on-site. Accordingly, the Valley elderberry longhorn beetle is not expected to occur.

Vernal Pool Fairy Shrimp (five species)

Fairy shrimp are aquatic crustaceans associated with vernal pools, grassy swales, and other temporarily ponded bodies of water in California, such as seasonal wetlands. As a taxonomic group, they are referred to as branchiopods. Most branchiopods are small freshwater organisms with limited specialization of their appendages as compared to other crustacean groups.

Vernal pools and seasonal wetlands form in regions with Mediterranean climates where shallow depressions fill with water during fall and winter rains, which evaporate in the spring. Fairy shrimp are ecologically dependent upon these seasonal fluctuations in their environment. After pools become inundated with water, these crustaceans hatch from eggs that have been dormant in the soil from previous wet seasons. The eggs are highly tolerant of heat, cold, and prolonged desiccation. In general, two to three weeks of inundation are required for eggs to hatch and for completion of development, although this time period varies by species. When the pool dries, the eggs survive as cysts among the soil and detritus at the bottom of the pool. Generally, one generation occurs per rainy season, but in some locations and in some years, depending on weather patterns and rainfall amounts, conditions may permit two or more generations to complete their development. Egg cysts are dispersed from one pool to another via wind, water, or animals such as birds that may ingest them, or cattle that may pick them up on their feet.

Vernal pool fairy shrimp (*Branchinecta lynchi*), a federally threatened species, is a small (0.5 to 1 inches long) aquatic crustacean. The shrimp can be found in a variety of vernal pool habitats, including: small, clear, sandstone rock pools and large, turbid, alkaline, grassland valley floor pools (USFWS 2003). The species tends to occur in smaller pools and is most commonly found in pools that are less than 0.05 acre in grass or mud bottomed swales or basalt flow depression pools in unplowed grasslands (USFWS 2003). Vernal pool fairy shrimp have been collected from early December to early May. On average it takes vernal pool fairy shrimp 41 days to mature but in warmer pools it can take as little as 18 days (Eriksen and Belk 1999).

The population is widespread but not abundant. The species has been recorded from Stillwater Plain in Shasta County through most of the length of the Central Valley to Pixley in Tulare County. Along the central coast, they range from northern Solano County to Pinnacles National Monument in San Benito County. Four additional populations exist one near Soda Lake in San Luis Obispo County, one in the mountain grasslands of northern Santa Barbara County, one on the Santa Rosa Plateau in Riverside County, and one near Rancho California in Riverside County (USFWS 2003).

Vernal pool fairy shrimp have a low likelihood of occurrence on-site. The closest CNDDB records for this species are over seven miles away from the site at various locations west, southwest and south of the site. Wet season surveys for branchiopods were conducted in the winter of 2004 to 2005 by Zentner and Zentner staff and no fairy shrimp were observed during these surveys (Zentner, 2006). USFWS protocols require two wet season surveys to determine presence/absence and the second season of surveys are currently being conducted. The difference between “not expected to occur” and “low likelihood” in this, and the following cases, is that although almost all indicators are that this species does not occur here, potentially suitable habitat exists on-site in the form of seasonal wetlands and the second season of protocol-level surveys have not been completed.

Midvalley fairy shrimp

Midvalley fairy shrimp (*Branchinecta mesovallensis*), a federal Species of Concern, is a small (0.28 to 0.79 inches long) freshwater crustacean. This species is found in shallow ephemeral pools, shallow vernal pools, vernal swales and artificial ephemeral wetland habitats. Midvalley fairy shrimp has also been observed in puddles, scrapes, and ditches (Belk and Fugate 2000) and is found in the mid portion of the Central Valley in

Sacramento, Solano, Contra Costa, San Joaquin, Madera, Merced and Fresno counties (Belk and Fugate 2000). Because this species is normally found in quick drying pools, it can mature within about eight days when hatching in small pools. However, average maturing is approximately 26 days or longer in larger pools.

Midvalley fairy shrimp have a low likelihood of occurrence on the Gilbert property. The nearest CNDDB records for the midvalley fairy shrimp are more than five miles away. Also, as noted above, wet season surveys were conducted for special status branchiopods at the Gilbert site during the winter of 2004 to 2005 with negative results.

California linderiella fairy shrimp

California fairy shrimp (*Linderiella occidentalis*), a federal Species of Concern, is a small (approximately 0.4 inches long) aquatic crustacean. This shrimp is most commonly found in large, moderately clear vernal pools and lakes, although it has been found in very small pools and in clear to turbid water with pH from 6.1 to 8.5. California fairy shrimp can live in water temperatures ranging between 41° to 85° F. On average they mature in 45 days. Adult linderiella shrimp have been collected from late December to early May. Linderiella fairy shrimp are the most common fairy shrimp in the Central Valley and have been observed in most locations that support vernal pools (USFWS 2003).

California linderiella fairy shrimp have a low likelihood of occurrence on the Gilbert property. The nearest CNDDB records for the California linderiella fairy shrimp are more than five miles away. Also, wet season surveys were conducted in the winter of 2004 and 2005 and no fairy shrimp were observed.

Longhorn fairy shrimp

Longhorn fairy shrimp (*Branchinecta longiantenna*), a federally-listed Endangered species, is a small (0.5 to 0.8 inches long) aquatic crustacean. The longhorn fairy shrimp occupies clear to turbid vernal pools including clear-water depressions in sandstone outcroppings near Tracy, grass-bottomed pools in Merced County and claypan pools around Soda Lake in San Luis Obispo County (USFWS 2003). This species has been collected from late December to late April. (Eriksen and Belk 1999). On average, longhorn fairy shrimp take 43 days to mature. This species has been recorded in scattered populations along the eastern margin of the Central Coast Range from Concord in Contra Costa County south to Soda Lake in San Luis Obispo County (USFWS 2003).

As with the previously mentioned branchiopods, longhorn fairy shrimp have a low likelihood of occurrence on the Gilbert property. The closest known population of longhorn fairy shrimp is near Tracy, which is over 20 miles southeast of the project site. Also, no shrimp were found during the protocol level surveys conducted in the winter of 2004 to 2005.

Vernal pool tadpole shrimp

Vernal pool tadpole shrimp (*Lepidurus packardi*), a federally-listed Endangered species, is a small (up to 2 inches long) aquatic crustacean. This shrimp is found in vernal pools with clear to highly turbid water. Vernal pool tadpole shrimp has been observed in pools ranging in size from 54 square feet to 89 acres. Eighteen known populations exist in the Central Valley, ranging from east of Redding south to the San Luis National Wildlife Refuge in Merced County. This species is also known from a single vernal pool complex in the San Francisco Bay National Wildlife Refuge in Alameda County (USFWS 2003).

As with the fairy shrimp discussed above, this species has a low likelihood of occurrence within the seasonal wetlands located on the Gilbert property. The closest vernal pool tadpole shrimp observation was made in 2003 over seven miles southwest of the site in a small claypan vernal pool surrounded by grazed grassland. Also, the vernal pool tadpole shrimp was not observed during the wet season surveys in the winter of 2004 to 2005.

Antioch Dune insects (4 species)

Several special-status invertebrate species are known from sandy substrates at the Antioch Dunes, situated approximately seven miles northwest of the project site, including: yellow-banded andrenid bee (*Perdita hirticeps luteocincta*), a federal Species of Concern; Antioch andrenid bee (*Perdita scituta antiochensis*) a federal Species of Concern; Antioch dunes anthicid beetle (*Anthicus antiochensis*), a federal Species of Concern; and Sacramento anthicid beetle (*Anthicus sacramento*), a federal Species of Concern.

The yellow-banded andrenid bee and Antioch andrenid bee are native bees found in sand dunes and are known to visit the flowers of California matchweed (*Gutierrezia californica*). The Antioch andrenid bee is also known to visit the flowers of buckwheat (*Eriogonum* sp.), telegraph weed, and lessingia (*Lessingia* sp.).

California matchweed does not occur on-site and the yellow-banded andrenid bee, therefore, is not expected to occur on-site. Potential habitat for the Antioch andrenid bee exists on the Gilbert property in the vegetated sand mound due to the presence of telegraph weed; however, this plant is fairly common in the Oakley area as it thrives in disturbed habitats. The dune habitat on-site is also degraded and the habitat value is marginal (Zentner and Zentner 2005d). These species were also not observed during site surveys on the Gilbert property in September and November 2004 when they should have been visible.

Entomologist Dick Arnold conducted a habitat assessment for special-status invertebrates on the Cypress Grove residential development site, located approximately one-half mile west of the project site (Entomological Consulting Services 2002), a portion of which is contiguous with the sand mound on the adjacent Emerson property, which is adjacent and similar to the Gilbert site sand mound. He found that current land use practices have converted native plant communities to grazing lands or substantially degraded their habitat value. He concluded that no special-status insect or invertebrate species were observed and the Antioch dunes anthicid beetle, yellow-banded andrenid bee, and Sacramento anthicid beetle were not expected to occur there.

Due to the degraded quality of the habitat and negative findings from this and nearby sites, these four insects are not expected to occur on the project site.

Fish

Central Valley steelhead

The Central Valley steelhead (*Oncorhynchus mykiss*) is an anadromous rainbow trout. The Central Valley evolutionarily significant unit (ESU) of steelhead includes the Sacramento and San Joaquin Rivers, along with all of their tributaries. Their numbers have declined drastically in the past several decades due to habitat loss, over-fishing, predation, and other factors.

Steelhead spawn from January to March and then do not die like salmon but return to the ocean. The young stay in freshwater for one to four years and then migrate downstream, typically during spring and early summer. Steelhead depend upon suitable water temperature and substrate (no larger than 10 centimeters) for successful spawning and incubation.

The Central Valley steelhead has not been observed in either the vicinity of the project or this portion of Dutch Slough. Also, the channelized extension of Dutch Slough on-site does not contain suitable habitat for salmon. It is at the extreme end of Dutch Slough, has been modified into a channel and does not receive enough water, even during high tides, to support large spawning fish. Therefore, this species is not likely to occur on-site.

Winter-run Chinook salmon

Winter-run Chinook salmon (*Oncorhynchus tshawytscha*) are on average one meter in length. The fish spends the majority of its life in the open ocean but migrates through estuaries and then upstream to spawn in the upper reaches of its home river. Spawning reaches its peak from May to August after which the salmon dies. These fish require cold (6°-13°C), fast-flowing, clean rivers with gravel bottoms to lay their eggs in order to reproduce successfully. Adults mainly eat other fish and juveniles mainly feed on invertebrates.

Historically, the species was found in most coastal streams along western North America but the population was greatly reduced. The breeding population is currently restricted to the Sacramento River and its tributaries. After breeding, salmon migrate through the Sacramento/San Joaquin Drainage where they continue past the Red Bluff Diversion Dam to spawn in the upper reaches of the Sacramento River.

Chinook salmon have not been observed in either the vicinity of the project or this portion of Dutch Slough. Also, the channelized extension of Dutch Slough on-site does not contain suitable habitat for this species. It is at the extreme end of Dutch Slough, has been modified into a channel and does not receive enough water, even during high tides, to support large spawning salmon. Chinook salmon are not likely to occur on-site.

Central Valley spring run and fall/late run Chinook salmon

Chinook salmon are the largest of all salmon and adults often exceed 40 pounds. They use a variety of freshwater habitats and spawn more commonly in larger main-stem rivers than other salmon species. The species requires deep pools, cover and gravel for spawning. Their "run" is determined by when they leave the ocean and enter freshwater to begin their migration.

As stated above, Chinook salmon have not been observed within the vicinity of the project site. Also, the on-site channelized portion of Dutch Slough does not contain adequate habitat for this species. Therefore, Chinook salmon are not expected to occur on-site.

Delta smelt

Delta smelt (*Hypomesus transpacificus*) is a small, native fish that is 2 to 3 inches at adult size. It is found only in the Sacramento-San Joaquin Estuary and has been observed as far upstream as the mouth of the American River on the Sacramento River and Mossdale on the San Joaquin River. The species used to be one of the most common species in the estuary but due to varying outflow from the Estuary from year to year, reductions in outflow from the Estuary, water diversions, and changes in food organisms, the population has been greatly reduced (CDFG 2002).

This euryhaline species lives at the interface of fresh and salt water for most of the year before spawning upstream in brackish streams and sloughs where the eggs attach to tules, cattails, and tree roots. The spawning period is from late winter to early summer. Delta smelt are found in brackish water (usually in salinity ranges of less than 2 parts per thousand (ppt) and rarely at salinities greater than 14 ppt).

Dutch Slough waterway is within critical habitat for the delta smelt and they have been documented within the waters of Big Break, just over two miles from the project site, as recently as 1994 (Hanson personal communication 2001, Urquhart personal communication 2001, CDFG 2004a). Also, recent fish sampling (2004-2005) conducted along the Contra Costa Canal, adjacent to the project site and in Rock Slough, approximately 1.5 miles to the east, positively identified Delta smelt (Tenera Environmental 2005). However, Dutch Slough on the project site has been significantly modified and its connection with tidal waters is poor. Accordingly, there is a moderate likelihood that Delta smelt occur on the property but Dutch Slough is outside the boundaries of the development project and will not be affected by home development. Accordingly, Delta smelt are not expected to occur on-site.

Longfin smelt

The longfin smelt (*Spirinchus thaleichthys*) is a small, native species once thought to be the most abundant fish in the Bay-Delta Estuary. This species is found from Monterey Bay north to Alaska. Adult smelts reach a maximum size of 150 mm. They have been found in fresh water and seawater but prefer salinities of 15-30 ppm. The smelt spawn in dead-end sloughs, larger sloughs such as Montezuma Slough, the lower reaches of rivers, and bypasses used for flood management. Spawning sites are in the shallow, weedy areas inshore and the smelt move into the deeper offshore habitat as they mature.

Longfin smelt were positively identified during fish sampling conducted along the adjacent Contra Costa Canal and in Rock Slough in 1994 and 1995 (Tenera Environmental 2005). However, as noted above, Dutch Slough on-site has been heavily modified. Additionally, although there is moderate likelihood that this fish occurs in the Slough, no work will occur in the Slough. Longfin smelt are therefore unlikely to occur on-site.

Sacramento splittail

The Sacramento splittail (*Pogonichthys macrolepidotus*) is a large (adults grow to more than 1 foot), relatively long-lived (5 yrs) native minnow. This species historically occurred within all the lower portions of the streams and rivers that fed the Delta and portions of the Bay (*e.g.* the Petaluma River) but is presently most common in brackish waters of the Delta, Suisun Marsh and Suisun Bay. They are predominantly freshwater fish but can tolerate moderate salinity and are found mainly in slow moving waters in sloughs and streams. They are one of the native fishes that are highly dependent on flooding of low-lying terrace lands adjacent to the Delta; they spawn, rear young and feed in submerged floodplains. They also spawn on shallowly flooded vegetation (Goals Project 2000).

Sacramento splittail have been documented within the waters of Big Break in 1994 (Hanson personal communication 2001, Urquhart personal communication 2001, CDFG 2004a) and recently in the Contra Costa Canal, adjacent to the project site and in Rock Slough (Tenera Environmental 2005). However, as noted above, Dutch Slough on-site has been heavily modified. Additionally, although there is moderate likelihood that this fish occurs in the Slough, no work will occur in the Slough. Sacramento splittail are therefore not expected to occur on-site.

Sacramento Perch

The Sacramento perch (*Archoplites interruptus*) is a deep-bodied, laterally compressed perch. Its lifespan is approximately 4 to 5 years but 9-year-old Sacramento Perch have been recorded. At year 4 the average length of the species is 30 cm, but growth is dependant on both biotic and abiotic factors (Mathews 1962, McCarraher and Gregory 1970, Moyle et al. 1974). They feed mainly on benthic insect larvae, nails, mid-water insects, zooplankton and fish (Moyle et. al 1974).

Historically, Sacramento perch inhabited sloughs, sluggish rivers, and lakes in the Central Valley, but currently they are found mainly in reservoirs and farm ponds. Currently the native range of the species is restricted to Clear Lake but the species has been introduced to reservoirs and ponds outside of this range.

Only marginal habitat exists in the channelized extension of Dutch Slough on-site and the species has not been observed in either the vicinity of the project or this portion of Dutch Slough. There is a record, however, of the species from 1986 within 5 miles of the site. The perch were found in the intake screens at the Contra Costa power plant on the south shore of the San Joaquin River in Antioch (CDFG 2004). In any case, although there is a low likelihood that this fish occurs in the Slough, no work will occur in the Slough.

Green sturgeon

The green sturgeon (*Acipenser medirostris*) is a large (up to 7 feet long) anadromous fish. The species is slow growing and slow to mature and only spawns every 4 to 11 years. It spends most of its life in salt water and returns to spawn in fresh water in the spring and summer months. Adults feed mainly on benthic invertebrates and small fish. They prefer to spawn in lower reaches of large rivers with swift currents and large cobble. They have been documented to travel up to 600 miles between freshwater and estuary environments.

No green sturgeon have been observed in the vicinity of the project site. Some suitable habitat exists for spawning in adjacent deeper waters of Big Break; however the species is too large to use the on-site portion of Dutch Slough due to lack of sufficient water. It is therefore unlikely to occur on-site.

River lamprey

The river lamprey (*Lampetra ayresi*) is a small (average adult length is 17 cm) anadromous lamprey. Lampreys feed on a variety of fish, most commonly salmon, and normally attach themselves to host fish to feed on muscle tissue. It is found in large coastal streams from Alaska south to San Francisco Bay. Most records from California are from the lower Sacramento and San Joaquin Rivers and the Russian River where they exist in isolated and scattered populations (Lee et al. 1980). Adults spawn in April and May in small tributary streams (Vladykov 1958).

No observations of river lamprey have been made within the vicinity of the project site.

And, the channelized extension of Dutch Slough on-site does not contain suitable habitat for this species. It is at the extreme end of Dutch Slough and has been highly modified into a channel. Therefore river lampreys are not expected to occur on-site.

Pacific Lamprey

The Pacific lamprey (*Lampetra tridentate*) is a parasitic, anadromous lamprey. They spawn in the spring when the water temperature is between 50 and 60 degrees Fahrenheit. Spawning occurs in low gradient sections of water with a gravel and sand substrates. In California the species was historically found only in the upper drainages of the Sacramento-San Joaquin system. Recently, this species has been observed in San Francisco Bay (Aplin 1967), San Pablo Bay (Ganssle 1966), and Carquinez Strait (Messersmith 1969) along with Cache Slough, Lindsey Slough, Suisun Bay, American River (up to Nimbus Dam), the Sacramento River (up to Red Bluff Dam), Napa River, Sonoma Creek, and Walnut Creek.

Pacific lamprey were positively identified during fish sampling in Rock Slough 1994, 1995, and 1996 (Tenera Environmental 2005). However, as noted above, Dutch Slough on-site has been heavily modified. Additionally, although there is moderate likelihood that this fish occurs in the Slough, no work will occur in the Slough. Therefore, Pacific lamprey are not expected to occur on-site.

Amphibians

Red-legged frog

The California red-legged frog (*Rana aurora draytonii*; RLF) is a relatively large frog, native to lowland California. The RLF historically ranged from, in the north, Redding and Marin County, south to northern Baja California, essentially throughout lowland California (Jennings and Hayes 1994). Due to a variety of factors, including loss and modification of habitat, predation by the non-native bullfrog, and possibly water quality impacts, its range has been reduced to mostly isolated drainages within coastal ranges and near-coastal foothills. The USFWS notes that while the RLF once occupied 46 counties, it is now known from only 22, with the greatest concentrations in Monterey, San Luis Obispo and Santa Barbara Counties (USFWS 1999).

Young RLF (eggs, larvae, and tadpoles) are found almost exclusively in ponds (such as stockponds) or very slowly moving water in creeks, ditches or similar habitat. Typically, these ponds or creeks are well-vegetated (Zeiner et al 1988) but habitat may also consist of well-grazed stockponds with little marsh vegetation (McCasland, Curt, FWS. pers. comm.). Young RLF generally do not occur in aquatic habitats that also contain bullfrogs or game fish (Jennings and Hayes 1989).

Adult RLF are typically found in or near breeding habitat, which consists of perennial or near-perennial, deep (greater than 2 ft) ponds, pools or similar habitats associated with dense riparian or marsh vegetation (Hayes and Jennings 1989, 1994, Jennings 1988) from late-November to late-April. During rainy nights during this time, however, they may also be found up to 200-300 feet away from the aquatic habitat (Zeiner et al 1988; Tatarian, pers. comm.).

From late-spring through fall, RLF will typically stay near aquatic habitat but during the latter part of this period they may move away from the breeding locale into nearby moist locations. RLF have been found “up to 30 m (98 ft) from water in adjacent dense riparian vegetation” (USFWS, final rule on listing of the RLF, p. 25814; hereafter simply “USFWS”) during foraging or estivation. The USFWS states that “estivation habitat for the California red-legged frog is potentially all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area” (USFWS 1999).

Determining the location of RLF habitat is complicated by RLF movement away from relatively easily identified riparian and wetland habitats. Much of the movement ecology of RLF is still poorly understood (Jennings and Hayes 1994), but they appear to move significant distances at two times during a year. First, adults move between winter oviposition sites and spring and summer foraging habitat (Jennings and Hayes 1989). Frogs observed in upland habitat at night during winter rains may represent such movement, but new aquatic habitat may also be found and colonized during such periods of reduced water stress. Movement into upland riparian habitat at such time may also protect frogs from catastrophic injury and transport by floodwaters (Jennings and Hayes 1994). Second, RLF move into the shelter of riparian thickets during fall, when stream habitat is often much reduced (Rathbun et al. 1993). Such behavior appears to resemble estivation of amphibians like California tiger salamanders and spadefoots (Jameson 1981) but these amphibians also then exhibit distinct seasonal dormancy, which the RLF, especially the coastal populations, do not exhibit. Their fall movement into shady habitats may simply represent retraherence (Porter 1972), the generalized shelter-seeking behavior of most amphibians that does not involve distinct seasonal dormancy.

This species is not expected to occur on this site. The closest records for the RLF are approximately 6.5 miles from the project site in a tributary to Sand Creek in Horse Valley and in Sand Creek in Lone Tree Valley. These known populations are separated from the project area by extensive urbanization and habitat modification. The Gilbert site is also outside of the designated Critical Habitat for RLF.

The only potential breeding habitat for the RLF on-site is in the perennial wetlands south of the Contra Costa Canal, at the north and east ends of the site. These marshes are dominated by a dense stand of common tule (*Scirpus sp*.) and cattails (*Typha sp*.). Due to the dense vegetation and lack of open water, it is unlikely that RLF would use this habitat for breeding.

USFWS personnel agreed during discussions with Sycamore Associates and during site visits on the Cypress Grove property, located approximately ½ mile to the west, that RLFs were very unlikely to occur (Sycamore 2003c). Furthermore, as part of the formal

Section 7 Endangered Species Act consultation for the Cypress Grove project, which resulted in issuance of a Biological Opinion dated July 2, 2004, the USFWS determined that the proposed Cypress Grove project, which contains similar habitats to those found at Gilbert, was not likely to adversely affect the RLF due to a lack of suitable habitat and distance to known sightings.

Due to the lack of reported occurrences in the vicinity, lack of connectivity to known populations in the region, and USFWS concurrence with these assertions for the Cypress Grove property, RLFs are not expected to occur on the project site.

California tiger salamander

The California tiger salamander (*Ambystoma californiense;* CTS) is a relatively large, mostly terrestrial salamander. Its status has been subject to some change recently but it is generally acknowledged to be rare due to habitat loss, predation by non-native species, and interbreeding with introduced salamanders (Fisher and Shaffer 1996).

This species is relatively secretive and difficult to find and they are rarely seen outside of their nocturnal breeding migrations, which begin with the first rains of the season in November or December. Sexually mature adults move at night from underground refugia, e.g. squirrel burrows, to breeding ponds from late November to early March and they may move significant distances, as much as 1.6 km. Vernal pools or seasonal ponds are required for breeding, which occurs from late winter into early spring. The species also breeds in man-made ponds including stock ponds, reservoirs, and small lakes but there they are often subject to introduced predatory fish species.

After breeding, the adults then return to their underground burrows. The eggs then hatch and the resulting gilled aquatic larvae metamorphose into juveniles that also move at night into terrestrial habitats (Zeiner et al 1988). Beginning in late spring and early summer, juveniles migrate from the ponds into underground burrows created by ground squirrels (*Spermophilus* spp) and other rodent or man-made structures where they estivate until the dry season ends. Juveniles can travel up to one mile from their breeding site to upland refuge site. This distance is normally less when there are large numbers of refuge sites in close proximity to breeding sites. Barriers including road berms, buildings, or walls can impede migration and roads with high levels of traffic are both a major barrier to the species and a major source of mortality. At the end of the dry season, juveniles return to the breeding pond.

This species once ranged from Petaluma east to the Dunnigan Hills and south to Tulare and Santa Barbara Counties. This species is restricted to relatively deep vernal pools, stockponds or similar habitats as, compared to other amphibians, its larvae take a significant amount of time to transform into juvenile adults and require relatively lengthy hydroperiods. Currently the species is only found in the Central Valley from southern Colusa County to northern Kern County, coastal valleys and foothills in Sonoma and Santa Barbara County, and in the Coast Ranges from Suisun Bay south to the Temblor range.

This species is not expected to occur on-site. The closest records for the species are located approximately six and eight miles away, in the Sand Creek and Cowell Ranch State Park areas to the southwest and south respectively (CNDDB 2004). These known populations are separated from the project area by extensive urbanization and habitat modification. Although some seasonal ponding occurs on-site, the hydroperiod of these seasonal pools is too short for CTS breeding and no ponds with suitable hydroperiods occur in the vicinity. The larval forms were also not observed during the fairy shrimp surveys. There is suitable habitat on-site for aestivation in the ground squirrel burrows but due to the history of flooding and disturbance on-site it is unlikely that the species aestivates here. Finally, Karen Swaim, a noted herpetologist, concluded that CTS did not occur at the Cypress Grove site, a similar nearby site, for the same reasons (Swaim 2002).

Western spadefoot toad

Western spadefoot toads (*Scaphiopus hammondii*), a Federal Species of Concern and a California Species of Special Concern, are medium-sized native toads once found from Redding south to Northwestern Baja, California and from San Francisco Bay south to Mexico in the Coast Ranges and coastal lowlands. The toad prefers habitats with short grasses and open vegetation in sandy or gravelly soils. The species is normally found in lowland habitats including alluvial fans, floodplains, playas, and alluvial flats, but are also found in foothill and mountain valleys below 3,000 feet (Stebbins, 1985).

Western spadefoot toads are nocturnal and hide in deep burrows during the day and during extended dry periods. Some toads use mammal burrows but the majority dig their own burrows by using the spades on their feet. The species emerge to feed during warm summer nights. Insects, worms, and invertebrates including grasshoppers, moths, ground beetles, flies, ants, and earthworms make up the majority of their diet (CDFG, 1988).

Adult movement is minimal except during the breeding period. The toads breed in vernal pools between late winter and the end of March. Females can deposit more than 500 eggs in two days on detritus, small, submerged rocks, or around plant stems in the temporary pools. Eggs Hatch rapidly, usually within two weeks (CDFG, 1988). Tadpoles feed on plankton and organic material from the bottom of the pool, which they filter out of the water.

This species is not expected to occur on the project site. There are no records of this species in the vicinity of the project site; the deeper seasonal pools required by this species are not present on-site; and no western spadefoot toads were observed during site surveys for the fairy shrimp.

Reptiles

Giant garter snake

The giant garter snake (*Thamnophis gigas*; GGS) is a relatively large, aquatic snake endemic to the Central Valley of California. It is a federal- and state- listed threatened species.

Historically, the snake was present from Butte County south to Kern County in flooded basins, freshwater marshes, small lakes, ponds, sloughs, and tributaries (Stebbins 1985). Due to habitat destruction and fragmentation, changes in water management, predation by and competition with non-native species including bullfrogs and large mouthed bass, and pesticide contamination, the species is currently only found sporadically from Butte County south to Fresno County (CDFG 2000). This snake is now found mainly in rice fields, remnant wetlands, and drainage and irrigation channels where it feeds on small fish, frogs, tadpoles, and other small vertebrates. The GGS often feeds in receding wet areas where prey is concentrated.

During the winter dormant season (October 31 to March 1), GGS stay in small burrows, normally on sunny south- and west-facing slopes or in riprap. When they emerge in April to forage and breed, males quickly seek out a mate. Females give birth to young from late July until early September and brood size varies from 10 to 46 young.

Individual giant garter snakes have been observed approximately four miles northwest and six miles north of the project site, within the main waterways of the Delta (CDFG 2004a, Swaim Biological Consulting 2002) in 2002 and 1998 respectively. These recent occurrences in the region suggest that individual giant garter snakes may use these main Delta waterways, if only occasionally. The site's proximity to the more natural portions of Dutch Slough and the Contra Costa Canal, as well as the presence of suitable escape and refugia habitat on-site in the form California ground squirrel burrows, also indicates that the site could be used by giant garter snakes. The perennial irrigation ditches within the properties and the adjacent Contra Costa Canal were determined by Zentner and Zentner (2005) to contain suitable habitat given that giant garter snakes have been known to use similar ditches as movement corridors when they are inundated with water. Accordingly, they determined that giant garter snake may occur on-site and focused surveys were recommended.

Karen Swaim conducted field surveys and trapping in the summer of 2005 on the Gilbert project site including the perennial ditch on the north part of the site and Dutch Slough; the only suitable habitats on-site (Swaim Biological Consulting 2006). Surveys for giant garter snake were also conducted by Swaim on the adjacent Burroughs property at the same time. Finally, surveys for giant garter snake were also conducted on the E. Cypress Specific Plan area, located just over ½ mile east of the project site concurrently with the Gilbert and Burroughs surveys (Swaim Biological Consulting 2005). Findings for all of these surveys, both on- and off-site were negative.

Swaim also completed trapping and field surveys during 2003 for the neighboring Emerson property and the Cypress Grove project, and included the stretch of the Contra Costa Canal that runs adjacent to the Emerson project site (Swaim Biological Consulting 2004a). These protocol-level surveys found no evidence of giant garter snake within the Contra Costa Canal or on the adjacent Cypress Grove site. Furthermore, as part of the formal Section 7 Endangered Species Act consultation for the Cypress Grove project, the

USFWS determined that the proposed Cypress Grove project was not likely to adversely affect the giant garter snake due to negative findings from protocol trapping surveys.

Accordingly, giant garter snakes are not expected to occur on-site at the present time. They have not been observed during surveys both on the project site and in the neighboring areas. Also, the disturbed nature of the site and the presence of predatory game fish within the Contra Costa Canal that have been known to prey upon giant garter snakes as well as compete with them for food, make the occurrence of this snake unlikely. However, this species could move through site waterways in the future.

Western pond turtle

The western pond turtle, a Federal Species of Concern and a California Species of Special Concern, frequents slow-moving rivers and streams (*e.g.* in oxbows), lakes, reservoirs, permanent and ephemeral wetlands, and stock ponds. Western pond turtles regularly utilize upland terrestrial habitat for nesting (females), mate seeking (males), overwintering, a seasonal terrestrial habitat use, and overland dispersal (Reese 1996, Holland 1994). Female western pond turtles have been reported ranging as far as 500 m (1,640 ft) from a watercourse to find suitable nesting habitat (Reese and Welsh 1997). Nest sites are most often situated on south or west-facing slopes, are sparsely vegetated with short grasses or forbs, have no overstory, and are scraped in hard-packed, dry silt or clay soils (Holland 1994, Rathbun *et al.* 1992, Reese and Welsh 1997), typically on low slopes of less than 25 degrees, but ranging from slopes of 0 to 60 degrees (Holte 1994). Western pond turtles exhibit high site fidelity, returning in sequential years to the same terrestrial site to nest or overwinter (Reese 1996). Most hatchlings appear to overwinter in the nest (Holland 1992, Jennings and Hayes 1994), and placing nests away from watercourses makes young less susceptible to death by flood events that commonly occur during the winter weather year (Rathbun *et al.* 1992). Additional explanations for placing nests away from watercourses include avoidance of predators such as raccoon and sex determination, which may be affected by temperature (Rathbun *et al.* 1992).

This medium-sized turtle ranges in size to just over eight inches (21cm) with a low carapace that is generally olive, brownish or blackish (Stebbins 2003, Jennings and Hayes 1994). Western pond turtles may live for 40 years or more (Jennings and Hayes 1994), and are therefore sometimes found in degraded areas. Adults appear to be able to persist for several years in poor aquatic habitat without any successful recruitment. This failure in recruitment is presumably due to introduced predators or unsuitable conditions for egg deposition.

A review of recent data (CDFG 2004a, Swaim Biological Consulting 2002) identified four occurrences of western pond turtles within a five-mile radius of the project area and several others within the extended vicinity. Karen Swaim also observed a western pond turtle on the northwest portion of the adjacent Emerson property within the Contra Costa Canal during a site visit to the adjacent Cypress Grove residential development site (Swaim Biological Consulting 2002). Suitable aquatic habitat for the western pond turtle exists on or near the project site within the Contra Costa Canal, Dutch Slough and the perennial wetland which runs along the northern boundary of the project site.

Dutch Slough and the other aquatic habitats of the Gilbert and adjacent Burroughs property were specifically surveyed for the presence of western pond turtle and turtle nests with negative results (Zentner and Zentner 2005d, 2005e). However, because the turtle is a mobile species and suitable habitat does exist, western pond turtles may move onto the site. Accordingly, this species is judged to have a moderate likelihood to occur on-site.

Silvery legless lizard

The silvery legless lizard, a federal Species of Concern and a California Species of Special Concern, is a limbless lizard approximately 4 to 7 inches long with a seemingly polished skin typically silvery gray or beige in color and a yellow belly. This species is differentiated from snakes by its smaller size and the presence of eyelids and ears. The silvery legless lizard ranges from San Francisco to Baja, Mexico along coastal mountains and foothills. The Central Coast dunes, interior dunes and coastal scrub provide favorable habitat, which is typically characterized by shrubby vegetation and loose soils. This species is also associated with streamside growths of sycamores, cottonwoods, and oaks with plenty of ground litter. This species uses burrows it creates in loose soil near the base of slopes and near temporary or permanent streams. A diurnal species (active during the day), the silvery legless lizard forages leaf litter under the overhang of trees and bushes on sunny slopes and under rocks and logs. Bush lupine (*Lupinus arboreus*) and mock heather (*Ericameria ericoides*) often grow in areas that are suitable for this lizard. A highly fragmented distribution and widespread threats, mainly habitat conversion, have made them vulnerable to localized extirpations.

A population of silvery legless lizards is known to occur approximately 1.5 miles west of the project site within the East Bay Regional Park Legless Lizard Preserve as recently as May 2000 (CDFG 2004a, Swaim Biological Consulting 2002). Silvery legless lizard was positively identified in a remnant dune area located on the far south portion of the Cypress Grove project in January and June 2004 during pre-construction surveys (Sycamore 2004a). Silvery legless lizard was also found just off site of the Cypress Grove property on a remnant dune located along the Burlington Northern Santa Fe (BSNF) Railroad tracks.

Moderately suitable silvery legless lizard habitat is present within the sand dune habitat located on-site. Surveys for silvery legless lizard were conducted in April and May 2005 but did not identify any silvery legless lizard on the Gilbert property (Zentner and Zentner 2005d). Therefore, there is a low likelihood that this species will occur on-site.

California horned lizard

The California horned lizard (*Phrynosoma coronatum frontale*), a California Species of

Special Concern, occupies a variety of open habitats including coastal scrub, oak savanna and grasslands. Historically, the species ranged throughout the Central Valley and Coast Range from Sonoma County south to Santa Barbara, Kern and Los Angeles Counties where it likely intergrades with the San Diego horned lizard (*Phrynosoma coronatum blainvillei*). Despite a wide-ranging distribution, the species appears to be restricted to localized populations because of its close association with loose soils that have a high sand content (Jennings and Hayes 1994); however, local abundance and geographic distribution are poorly understood for this region. Horned lizards require open areas to forage and feed primarily on native harvester ants (*Pogonomyrmex barbatus*) species. The spread of introduced Argentine ants (*Linepithema humile*), which eliminate native ants, has probably contributed significantly to localized extirpations in urban and semi-rural areas (Jennings personal communication 2000). The species cannot exist in areas that have been converted to agriculture, so its current distribution throughout the Central Valley is highly restricted.

According to Jennings and Hayes (1994) this species is extirpated from the Oakley area. Also, a review of recent data (CDFG 2004a, Swaim Biological Consulting 2002), did not reveal recent or historic occurrences within the region. Suitable habitat does exist within the remnant sand dune. Finally, the presence of the non-native Argentine ant, which tends to preclude the horned lizard, was noted on-site during surveys conducted by Zentner and Zentner. Given these factors, California horned lizards are not expected to occur on-site.

Birds

<u>Raptors </u>*(five species)*

Raptors potentially nesting within the project area include white-tailed kite, northern harrier, Swainson's hawk, short-eared owl, and burrowing owl. Most raptors such as Swainson's hawk nest in mature, large trees and use twigs or branches as nesting material. Smaller raptors may nest in cavities in anthropogenic structures and trees. Short-eared owls and northern harriers nest on the ground with moderate ground cover. Burrowing owls typically nest in small mammal burrows in open dry lands, but have been known to utilize any ground cavity of similar size as well as anthropogenic structures. The nesting period for raptors generally occurs between December 15 and August 31.

Suitable nesting and foraging habitat exists on the project site for many raptor species, especially those that can withstand high levels of disturbance such as red-tailed hawks, American kestrels, and burrowing owls. Agricultural lands can provide a rich source of food for a wide range of species such as rodents, which in turn can be utilized as a prey base by raptors. Several mature trees occur within the project site that provide highly suitable nesting and foraging habitat for raptors. In addition, several species of raptors have been observed foraging on-site.

Special-status raptor species that have potential to occur on-site and those that are prominent in today's regulatory environment are addressed in further detail below.

Western burrowing owl

In California, the western burrowing owl, a California Species of Special Concern and a federal Species of Concern, occurs in the Central Valley, inner and outer Coastal region, the San Francisco Bay Area, southern California Coast, from southern California to the Mexican Border, the Imperial Valley and in portions of the desert and high desert habitats in southeastern and northeastern California. Burrowing owl is a small, ground dwelling owl that inhabits available burrows in flat, open areas characterized by dry vegetation that is typical of heavily grazed grasslands, low stature grasslands, or desert vegetation (Johnsgard 1988). Burrowing owl occurs in deserts, plains and open grasslands, and in some cases, urban and agricultural landscapes. Burrowing owl requires underground burrows or artificial, man-made structures for shelter and nesting, and is often associated with fossorial animals such as prairie dogs, ground squirrels, badgers and some canids. In the Bay Area, burrowing owl typically utilizes burrows of California ground squirrel for denning. Burrows are used year-round and are an essential component to the life history of burrowing owl.

The species is an opportunistic feeder and is most active at dawn and dusk foraging primarily in areas of short grass or bare ground. In general, burrowing owl primarily consumes insects, amphibians, reptiles, and small mammals (Zarn 1974, Collins 1979) but they also feed on reptiles, young cottontails, amphibians, scorpions, bats and birds (Haug et al 1993). The breeding season for burrowing owl begins in the late winter and extends through late summer. Courtship is evident when males decorate burrow entrances with dung, feathers, shiny objects, and/or desiccated skins of various animals. In California, egg-laying may begin as early as March in some areas (Zarn 1974) but typically begins in late April and early May (Thomsen 1971). Once eggs are laid, the female does the majority of incubating (although there are conflicting reports; see Coulombe 1971), which lasts approximately three to four weeks.

A single wintering (non-breeding) burrowing owl was observed on the Gilbert property during the biotic survey conducted in November 2004. Protocol-level breeding and wintering season surveys conducted in 2005 and 2006 by Zentner and Zentner resulted in negative findings for burrowing owl or sign of burrowing owl, although ground squirrel burrows were present on the Gilbert property within the remnant sand mound area. A wintering burrowing owl was also observed during the winter 2006 survey approximately 250 feet south of the southern extent of the project site on a property south of Cypress Road. Because of the presence of squirrel burrows, the number of recent observations in the region, and the sighting of an individual owl in November 2004, burrowing owls are likely to occur on the Gilbert property. Because more than 2 years will have passed since the breeding season surveys before construction is set to begin and because the burrowing owl is a highly mobile species, prior to breeding season burrowing owl surveys should be conducted within 1 year of project construction.

Swainson's hawk

The Swainson's hawk, State-listed Threatened, occurs in open habitats throughout much of the western United States, Canada, and northern Mexico. Swainson's hawk breeds in North America and winters in the open grassland areas of southern South America (pampas), as well as parts of Mexico. In the Central Valley, Swainson's hawk arrives at nesting areas in late February and early March, four to six weeks earlier than it arrives at nesting sites in northeastern California. The species begins to depart for wintering areas in early September. In California, Swainson's hawk breeds in desert, shrub steppe, agricultural, and grassland habitats. Swainson's hawk constructs its nests in a variety of tree species in existing riparian forests, remnant riparian trees, shade trees at residences and alongside roads, planted windbreaks, and solitary upland oaks; however, it typically does not nest in large continuous patches of woodland other than along edges next to open habitats (England *et al.* 1997). The diet of Swainson's hawk varies considerably during breeding and non-breeding seasons. The species depends largely on small mammals during the breeding season and shift to feeding on insects during the non-breeding season, particularly crickets and grasshoppers. During the breeding season, Swainson's hawk travels long distances (up to 18 miles) in search of suitable foraging habitat that provides abundant prey (Estep 1989). The vegetation types/agricultural crops considered suitable foraging habitat for Swainson's hawk due to the availability of small mammals and insects include alfalfa, fallow fields, beet, tomato, and other low-growing row or field crops, dry land and irrigated pasture, rice land (when not flooded), and cereal grain crops (including corn after harvest) (CDFG 1994).

A Swainson's hawk nest was positively identified on Cypress Road approximately 50 meters west of Dutch Slough in the summer of 2005. This tree was removed, in consultation with the CDFG, for the construction of a pipeline constructed as part of the Summer Lakes residential development east of the project site (Monk & Associates, 2005). Additionally, a pair of Swainson's hawks successfully nested less than 3,000 feet south of the project area in 2004 (CDFG 2005a). Suitable nesting habitat for Swainson's hawk is present within the large trees within the project site. The Gilbert site is often cultivated in hay, which is a suitable foraging habitat type for Swainson's hawk. Swainson's hawks have been observed during field surveys conducted by Zentner and Zentner on the project site. Swainson's hawks are highly likely to nest on-site.

White-tailed kite

White-tailed kite, a California Fully Protected species, is a medium-sized raptor that is distributed across much of the western part of California. The species underwent a dramatic reduction in numbers during the last century due to habitat loss and hunting. Between the 1940s and early 1980s, the population recovered and its range expanded. More recently, population declines have again been noted, possibly as a result of the conversion of agricultural lands to urban uses (Allsop 2001). The white-tailed kite occupies low-elevation grassland, agricultural, wetland, oak woodland and savanna habitats and nests in a wide variety of trees and shrubs, either isolated or in larger stands. Nearby open areas are required for foraging, including certain types of agricultural fields. Food habit studies have demonstrated that voles make up a large proportion of its diet, although other small mammals, birds and insects are also preyed upon (Allsop 2001). The species hunts during the day primarily by hovering and searching for prey. White-tailed kite in California is generally resident, although it may occupy different areas during the non-breeding and breeding seasons. Typically, four eggs are laid in February and March and chicks hatch after 30 to 32 days. Juvenile kites are dependent on parents for two to three months before they fledge. During the non-breeding season, the species roosts communally.

White-tailed kites have been observed roosting and foraging on the project site. In addition a pair successfully bred on the Cypress Grove property approximately 1 mile west of the site during the spring of 2004. Suitable breeding and foraging habitat exists on-site. Therefore, white-tailed kites are highly likely to nest on-site.

Short-eared owl

Short-eared owl, a California Species of Special Concern, is a large owl that inhabits coastal areas of California. The species is a winter resident of the Central Valley of California and occupies open habitats including annual and perennial grasslands, meadows, irrigated lands, and saline and fresh emergent marshes. Short-eared owl feeds primarily on voles and other small mammals, as well as small birds, amphibians and arthropods. Nests are built on the ground in a shallow depression among dense vegetation. Eggs are laid in April and May. The male feeds the female while she incubates eggs. The young fledge at 31 to 36 days (Sibley 2000). Raptor species such as northern harrier and short-eared owl are well suited to foraging in tall grasses and often nest in agricultural fields cultivated in grain crops.

No observations of this species have been recorded in the vicinity and it was not seen during site reviews. Although hay fields such as those found on-site can provide suitable foraging and nesting habitat, it is not expected to occur on-site.

Northern harrier

Northern harrier, a California Species of Special Concern, inhabits grasslands, agricultural fields, scrub habitats, and marshes. Breeding typically occurs in tall vegetation near marshes and in grasslands and agricultural fields from March to July. Northern harrier feeds primarily on voles and other small mammals, birds, frogs, and insects (Sibley 2000). Raptors such as northern harrier are well suited to foraging in tall grasses and often nest in agricultural fields cultivated in grain crops.

Northern harrier has been observed in the immediate vicinity of the site. Hay fields such as those found on-site provide suitable foraging and nesting habitat may be found in short trees on- or near the site. Therefore, harriers have a moderate likelihood of occurring on-site.

<u>Passerines and non-passerine land birds</u> (three species)

Passerines (perching birds) are a taxonomic grouping that consists of several families including swallows (*Hirundinidae*), larks (*Alaudidae*), crows, ravens and jays (*Corvidae*), shrikes (*Laniidae*), vireos (*Vireonidae*), finches (*Fringillidae*) and Emberizids (*Emberizidae*, warblers, sparrows, blackbirds, *etc.*), among others. Non-passerine land birds are a non-taxonomic based grouping typically used by ornithologists to categorize a loose assemblage of birds. Families grouped into this category include kingfishers (*Alcedinidae*), woodpeckers (*Picidae*), swifts (*Apodidae*), hummingbirds (*Trochilidae*) and pigeons and doves (*Columbidae*), among others. Habitat, nesting and foraging requirements for these species are wide ranging; therefore, outlining generic habitat requirements for this grouping is difficult. These species typically use most habitat types and are known to nest on the ground, in shrubs and trees, on buildings, under bridges, and within cavities, crevices and manmade structures. Many of these species migrate long distances and all species except starlings, English house sparrows, and rock doves (pigeons), are protected under the federal Migratory Bird Treaty Act. The nesting period for passerines and non-passerine land birds occurs between February 1 and August 31.

Most of the project site provides suitable nesting habitat for many ground-nesting passerine and non-passerine land bird species. Additionally, trees around home sites provide suitable nesting habitat for many other passerine and non-passerine land bird species.

These special-status passerine species have the potential to occur on-site; California horned lark, loggerhead shrike, and tri-colored blackbird. These species are discussed in more detail below.

California horned lark

The California horned lark, a California Species of Special Concern, breeds in open grasslands throughout the Central Valley and adjacent foothills and along the central and southern California coast region. Feeding on insects and seeds, this bird is a ground nesting species that prefers shorter, less dense grasses and areas with some bare ground. The California horned lark forms flocks in the summer and winter months that are often observed foraging and roosting in cultivated fields and along dirt roads.

Although this species was not observed, the presence of suitable nesting and foraging habitat give the California horned lark a low likelihood for occurrence.

Loggerhead shrike

The loggerhead shrike, a California Species of Special Concern, is a wide-ranging species that occupies open habitats including grassland, scrub and open woodland communities. The species typically nests in densely vegetated, isolated trees and shrubs and occasionally man-made structures, and at the margins of open grasslands. Loggerhead shrike feeds on a variety of small prey including arthropods, mammals, amphibians, reptiles and birds (Alsop 2002). Because it lacks talons, the loggerhead shrike often impales prey on thorns or barbed wire. In California, the species does not migrate and is resident year-round. Loggerhead shrike is highly territorial, with pairs maintaining territories during the breeding season and individuals maintaining territories during the winter (Alsop 2002). Declines in numbers have been noted across a broad geographical range in the eastern United States. However, the shrike is treated on a national basis as a single unit and though its decline is in the east, but not in California, where it is common and abundant in virtually all habitats that are suitable.

Suitable foraging and nesting habitat is present on-site. The loggerhead shrike has been observed foraging on the project site and has a moderate potential to nest on-site.

Tricolored blackbird

Tricolored blackbird (*Agelaius tricolor*), a California Species of Special Concern, inhabits coastal areas of central and southern California and the Central Valley. The species typically requires freshwater marshes with emergent vegetation surrounded by water for nesting, although thorny brambles, nettles, dense willows or grain fields near water are also used. The foraging area must be large enough to support a colony of about 50 pairs (Grinnell and Miller 1944) for survival. The microhabitats selected for nesting must provide protection from numerous avian, mammalian, and reptilian predators. The species is highly colonial. Historically, tricolored blackbirds congregated in large colonies during the breeding season.

Breeding is highly synchronous. The species is nomadic and smaller colonies will often nest in different areas from year to year. Juveniles are not likely to return to the sites where they were born (DeHaven *et al.* 1975). Tricolored blackbird is regularly observed foraging and roosting in mixed flocks with other blackbird species, especially during the non-breeding season. Tricolored blackbird forages on seeds and insects in grassland and cropland, the latter primarily during the breeding season (Skorupa *et al.* 1980). Nesting colonies can be highly susceptible to human disturbance; in extreme cases, disturbances can result in entire colonies abandoning their nests. Agricultural activities in particular can threaten entire colonies.

Although the exact occurrence locations for tricolored blackbird are listed as sensitive by the CNDDB, occurrences have been reported in the Union Island, Byron Hot Springs, Brentwood, and Clifton Court Forebay quads, but none are reported within five miles of the site. Suitable nesting habitat for the tricolored blackbird is present on the project site along the sloughs and irrigation and drainage canals, and irrigated pastures provide foraging opportunities. Tricolored blackbird nesting colonies are readily observable but none have been seen during surveys of the project site although a non-nesting tricolored blackbird was observed on the Gilbert property during a September 2004 survey and a few non-nesting tricolored blackbirds were observed on June 6, 2005 (Zentner and Zentner 2005d). Sycamore Associates biologists observed tricolored blackbirds foraging on the East Cypress Corridor Specific Plan Area, approximately 1.5 miles to the east in

2004 (Sycamore 2005e). However, no nesting birds or colonies have been noted on the project site or any areas adjacent to the site. Therefore, tricolored blackbird is not expected to nest on the project site within Dutch Slough or the perennial irrigation and drainage canals due to negative survey results.

Mammals

San Joaquin kit fox

The San Joaquin kit fox (*Vulpes macrotis mutica*), federally-listed Endangered and State-listed Threatened, is one of seven subspecies of kit fox and is considered the most genetically distinct (Mercure *et al*. 1993). The San Joaquin kit fox is the smallest North American canid (member of the dog family, Canidae). Adult males weigh approximately 2.3 kilograms (approximately 5 lbs.) and adult females weigh 2.1 kilograms (about 4.6 lbs.), on average (Morrell 1972). Historically, the San Joaquin kit fox occurred extensively throughout California's Central Valley and parts of the Salinas and Santa Clara valleys. Kit fox currently inhabit some areas of suitable habitat on the San Joaquin Valley floor and in the surrounding foothills of the coastal ranges, Sierra Nevada, and Tehachapi Mountains, from southern Kern County north to Contra Costa, Alameda, and San Joaquin Counties on the west, and near La Grange, Stanislaus County on the east side of the Valley and some of the larger scattered islands of natural land on the Valley floor in Kern, Tulare, Kings, Fresno, Madera, and Merced Counties (taken from the Recovery Plan for Upland Species of the San Joaquin Valley, California, USFWS 1998).

A number of reviews of the distribution of kit fox in the northern portion of their range have been prepared (Laughrin 1970, Swick 1973, Morrell 1975, USFWS 1983, Orloff *et al*. 1986, Wesler 1987, Bell 1994, H.T. Harvey and Associates 1997, USFWS 1998). Detection of kit fox in the past decade in the Black Diamond Mines East Bay Regional Park have extended the kit fox range farther north than earlier descriptions. Kit fox prefers habitats of open or low vegetation with loose soils. In the northern portion of their range, it occupies grazed grasslands and to a lesser extent valley oak woodlands. In the southern and central portion of the Central Valley, kit fox is found in valley sink scrub, valley saltbrush scrub, upper Sonoran subshrub scrub and annual grassland (USFWS 1998). Kit fox is also found in grazed grasslands, urban settings and in areas adjacent to tilled or fallow fields (USFWS 1998). Kit fox requires underground dens to raise pups in order to avoid predators (Golightly and Ohmart 1984), and to regulate temperature and avoid other adverse environmental conditions. In the northern portion of their range, burrowing mammals, primarily ground squirrels, usually provide these holes. Dens are usually located on loose-textured soils on slopes less than 40 degrees (O'Farrell 1980).

Kit fox have a low likelihood of occurrence for a number of reasons. First, the site is well north of the historic range of the kit fox. The entire project area was historically part of the Delta with its marshes and wet meadows while the kit fox was known from the more xeric lands to the south. The distribution of the kit fox in this region has also been reviewed recently and extensively (cf. Orloff et al 1986, Wesler 1987, Bell 1994, HT Harvey & Associates 1997, USFWS 1998) and, while kit fox are now known to range further north than once thought, they still are not known from as far north into the margins of the Delta as this site.

Second, the population of kit fox south of Byron and the observed kit fox in Black Diamond Mines Park are separated from this site by extensive residential development in Antioch, Brentwood and Oakley and development along Highway 4. Townsend (2002) reviewed potential kit fox habitat in the region for the Cypress Grove project site, a similar site just to the west with a similar mix of pasture and remnant sand dune. She concluded that kit foxes were highly unlikely to visit that site due to the lack of potential movement corridor or habitat connectivity between that site and known kit fox habitat to the south. This assessment was reviewed by the USFWS during their analysis of other species use of the Cypress Grove site and Sycamore Associates states that the USFWS concluded that the project would have no effect on kit fox (Sycamore Associates 2005; also see Attachment A, which contains the Section 7 Consultation). The project site reviewed in this assessment is even further removed from potential kit fox habitat than the Cypress Grove site.

Finally, although the remnant sand mounds on the project site are potentially suitable habitat for kit fox, none have been observed, nor have the characteristic kit fox burrows been observed; the landowners have done a good deal of small mammal eradication work on the project site as well as relatively frequent farming, including tilling—all factors that would tend to militate against kit fox use.

Special-status bats (eight species)

California has 24 known species of bats (CDFG 2000a). Of those, 11 are classified as California Species of Special Concern (CDFG 2000a). Eight special-status bat species have at least some potential to occur within the project area, including pallid bat (*Antrozous pallidus*), a California Species of Special Concern, Townsend's big-eared bat (*Corynorhinus towsendii townsendii*), a California Species of Special Concern, greater western mastiff bat (*Eumops perotis californicus*) a Federal and California Species of Special Concern, the small-footed myotis bat (*Myotis ciliolabrum*) a Federal Species of Special Concern, long eared myotis bat (*Myotis evotis*) a Federal Species of Special Concern, fringed myotis bat (*Myotis thysanodes*) a Federal Species of Special Concern, long-legged myotis bat (*Myotis volans*) a Federal Species of Special Concern and the Yuma myotis bat (*Myotis yumanensis*) a Federal and California Species of Special Concern.

These species use caves, mature trees, snags, crevices and man-made structures (such as buildings) for roosting, either for winter roosting (hibernacula) or for forming nursery colonies. Bats are generally site faithful and will not abandon an established roosting area unless disturbed.

These bat species are not likely to occur on-site. Marginal potential roosting habitat exists on-site in an abandoned building on the edge of the remnant sand dune. Zentner and Zentner biologists conducted a survey of the building for the presence, or signs, of bat use in November 2004. No evidence of bats or use by bats was observed. Additionally, with one exception, there are no records for any of these species within 5 miles of the site

However, bats could begin to use this building if dispersed from other sites. Therefore, maternity season surveys should be completed for the presence or signs of bat use if the abandoned building is not demolished before mid-April. If no indications of bat use are observed, then no further action would be necessary and the building could be demolished without further surveys. A qualified bat biologist (i.e., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG which allows the biologist to handle and collect bats) should conduct these surveys. However, if an active bat maternity roost is found, CDFG should be notified and the building should not be razed until after bats are excluded as determined by the bat biologist. Bat exclusion should be performed only during two time windows; from approximately mid-February through mid-April and from late August through mid-October (Tatarian, pers. comm.).

Wildlife Movement Corridors and Habitat Fragmentation

Wildlife movement includes migration (usually one direction per season), inter-population movement (long-term genetic exchange, dispersal) and small travel pathways (daily movement corridors within an animal's territory). While small travel pathways primarily function as movement corridors for daily home range activities such as foraging or escape from predators, they can also provide a connection between outlying populations and the main corridor, thereby facilitating dispersal and leading to an increase in gene flow between populations.

These connections between habitat types can extend for miles between primary habitat areas, and occur on a large scale throughout California. Habitat linkages facilitate movement between otherwise isolated populations and those within larger habitat areas. The mosaic of habitats found within a larger-scale landscape results in a meta-population structure, a large single population made up of multiple discrete sub-populations. Where patches of pristine habitat are fragmented, such as occurs with coastal scrub, movement between these sub-populations is facilitated by habitat linkages in the form of migration or movement corridors.

Depending upon the condition of the corridor, dispersal and subsequent gene flow between populations may be either high or low in frequency. A high frequency of dispersal can allow for an increased genetic diversity within the population, whereas a lower frequency of dispersal may lead to decreased genetic diversity, and increased susceptibility to environmental pressures such as disease. If dispersal frequency is very low, sub-populations may become completely isolated from the rest of the meta-population, and eventually could be subject to local extinction (McCullough 1996, Whittaker 1998).

Habitat fragmentation, by definition, is an event that creates a greater number of habitat patches that are smaller in size than the original contiguous habitat. Fragmentation of primary habitat types can hinder regional wildlife movements. The resulting reduced interaction between individuals changes the long-term dynamics of populations distributed among fragments, reducing the ability of these isolated populations to persist in the face of adverse environmental pressures such as disease or stochastic events and increasing the probability of extinction (Kupfer et al. 1997, Zuidema et al. 1996). The effects of habitat fragmentation on the movement and dispersal of organisms, within a landscape, play an important role in determining the genetic composition and diversity of a population (Opdam 1990, Tiebout III & Anderson 1997). As such, it is imperative to consider the impacts of potential habitat fragmentation and the subsequent loss of valuable dispersal corridors when assessing the biological impacts of a project.

As it currently exists the Gilbert project site does not serve as a significant movement corridor for terrestrial animals. It is immediately bordered by recent housing developments to the west, Contra Costa Canal on the north, and agricultural lands with rural residential units to the east and south. The housing developments prevent wildlife from being able to easily move through the project site to the west.

The Contra Costa Canal and Dutch Slough most likely serve as wildlife movement corridors for some aquatic and terrestrial animals. However, both the canal and the Slough adjacent to the site are relatively degraded waterways with poor connections to other waterways. Accordingly, these systems are probably used by wildlife adapted to human intrusion. The proposed project will not directly impact the Contra Costa Canal or Dutch Slough but it will increase the proximity of development to portions of the canal and the Slough but the increase is likely to be relatively minor, compared to existing conditions.

REGULATORY CONTEXT

A number of federal, State and local policies provide the regulatory framework that guides the protection of biological resources. The following discussion summarizes those laws that are most relevant to biological resources in the vicinity of the project site.

Riparian areas, wetlands, waters of the U.S., and special-status species and communities are considered sensitive biological resources and fall under the jurisdiction of several regulatory agencies. Impacts to these areas often require federal, State, and/or local permits or agreements. The permits required vary depending upon the location of the project and the type and extent of impacts. However, prior to the issuance of any permit for actions that would result in impacts to wetlands, waters, or special-status species or communities, notification to all or some of the following agencies may be required:

- U.S. Army Corps of Engineers (USACE), Sacramento District
- California Department of Fish and Game (CDFG)
- California Regional Water Quality Control Board (RWQCB)
- U.S. Fish and Wildlife Service (USFWS)
- National Oceanic and Atmospheric Administration – Fisheries (NOAA

Fisheries)

An overview of the jurisdiction, application requirements and required permits for each of the above-listed agencies is provided in the following sections.

Federal Regulations

United States Army Corps of Engineers, Sacramento District

Section 404 of the Clean Water Act (CWA) of 1972 regulates activities that result in the discharge of dredged or fill material into waters of the United States, including wetlands. The USACE has the principal authority to regulate discharges of dredged or fill material into waters of the United States. However, the EPA has oversight authority over the USACE and retains veto power over the USACE's decision to issue permits.

Waters of the United States include the following:

1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide;
2) All interstate waters including interstate wetlands;
3) All other waters such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, vernal pools, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce;
4) Tributaries of the above; and
5) Territorial seas.

Any discharge of dredged or fill material into waters of the United States must be approved by the USACE pursuant to Section 404 of the CWA. Two permit types are possible:

1) Individual Permits; or
2) Nationwide Permits (NWPs) which are generally less time-consuming than the Individual Permit.

A standard Individual Permit for residential development such as this project is required if either of the following would occur:

1) Discharges that will result in the fill of any tidal waters or wetlands; or
2) Impacts to more than one-half acre of non-tidal waters or wetlands, and/or impacts to greater than 300 linear feet of non-tidal waters or wetlands, including creeks (either perennial or ephemeral and generally intermittent as well), arroyos or vegetated and unvegetated tributaries.

As the Gilbert project will result in the fill of more than ½ acre of jurisdictional wetlands, an Individual Permit from the Corps will be required.

United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries

The Federal Endangered Species Act (FESA) prohibits "take" of federally-listed Threatened or Endangered wildlife species. The FESA defines "take" to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or attempt to engage in any such conduct" 16 U.S.C. Section1532(19). The FESA requires that actions authorized, funded or carried out by federal agencies do not jeopardize the continued existence of a federally-listed species or adversely modify designated Critical Habitat for such species. If a federal agency determines that a proposed federal action (i.e., issuance of a Clean Water Act Section 404 permit for wetland fill) "may affect" a listed species and/or designated Critical Habitat, the agency must consult with the USFWS and/or NOAA Fisheries under Section 7 of the FESA. If take of a federally-listed species may occur, the applicant may be required to obtain an Incidental Take Permit. The Incidental Take Permit allows "incidental" taking of federally-listed species if the take is "incidental to and not the purpose of, the carrying out of an otherwise lawful activity" 16 U.S.C. Section1539(a)(1)(B). An Incidental Take Permit is issued only if the applicant, to the maximum extent possible, has minimized and mitigated for the impacts of the taking, provided adequate funding for the mitigation plan, and if the taking would not appreciably reduce the likelihood of the survival and recovery of the species in the wild 16 U.S.C. Section1539(a)(2)(B).

Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) prohibits the killing, possessing, or trading of migratory birds (most birds commonly observed) except in accordance with regulations prescribed by the Secretary of Interior.

State Regulations

California Endangered Species Act

The State of California enacted the California Endangered Species Act (CESA) in 1984. The CESA is similar to the FESA but pertains to state-listed endangered and threatened species. CESA requires state agencies to consult with the California Department of Fish and Game (CDFG) when preparing California Environmental Quality Act (CEQA) documents to ensure that the state lead agency actions do not jeopardize the existence of listed species. CESA directs agencies to consult with CDFG on projects or actions that could affect listed species, directs CDFG to determine whether jeopardy would occur, and allows CDFG to identify "reasonable and prudent alternatives" to the project consistent with conserving the species. Agencies can approve a project that affects a listed species if they determine that "overriding considerations" exist; however, the agencies are prohibited from approving projects that would result in the extinction of a listed species.

The CESA prohibits the taking of state-listed endangered or threatened plant and wildlife species. CDFG exercises authority over mitigation projects involving state-listed species, including those resulting from CEQA mitigation requirements. CDFG may authorize taking if an approved habitat management plan or management agreement that avoids or compensates for possible jeopardy is implemented. CDFG requires preparation of mitigation plans in accordance with published guidelines.

California Department of Fish and Game (CDFG)

The CDFG exercises jurisdiction over wetland and riparian resources associated with rivers, streams, and lakes under CDFG Code Section 1600 to 1607. The CDFG has the authority to regulate work that will do any one or more of the following:

1) Divert, obstruct, or change the natural flow of a river, stream, or lake;
2) Change the bed, channel, or bank of a river, stream, or lake; or
3) Use material from a streambed.

CDFG asserts that its jurisdictional area along a river, stream or creek is usually bounded by the top-of-bank or the outermost edges of riparian vegetation. Typical activities regulated by CDFG under Section 1600-1607 authority include installing outfalls, stabilization of banks, creek restoration, implementing flood control projects, constructing river and stream crossings, diverting water, damming streams, gravel mining, logging operations and jack-and-boring.

CDFG Species of Special Concern

In addition to formal listing under FESA and CESA, plant and wildlife species receive additional consideration during the CEQA process. Species that may be considered for review are included on a list of "Species of Special Concern" developed by the CDFG. CDFG tracks species in California whose numbers, reproductive success, or habitat may be threatened.

CDFG Birds of Prey Protection

Birds of prey are also protected in California under provisions of the State Fish and Game Code, Section 3503.5, (1992), which states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered “taking” by the CDFG.

Regional Water Quality Control Board

Pursuant to Section 401 of the Clean Water Act and EPA 404(b)(1) guidelines, in order for a USACE federal permit applicant to conduct any activity which may result in discharge into navigable waters, they must provide a certification from the RWQCB that such discharge will comply with the state water quality standards. The RWQCB has a policy of no-net-loss of wetlands in effect and typically requires mitigation for all impacts to wetlands before it will issue water quality certification.

Under the Porter-Cologne Water Quality Control Act (Cal. Water Code Section 13000-14920), the RWQCB is also authorized to regulate the discharge of waste that could affect the quality of the State’s waters. When reviewing applications, the RWQCB focuses on ensuring that projects do not adversely affect the “beneficial uses” associated with waters of the State. Generally, the RWQCB defines beneficial uses to include all of the resources, services and qualities of aquatic ecosystems and underground aquifers that benefit the State. In most cases, the RWQCB seeks to protect these beneficial uses by requiring the integration of water quality control measures into projects that will result in discharge into waters of the State. For most construction projects, RWQCB requires the use of construction and post-construction Best Management Practices (BMPs). In many cases, proper use of BMPs, including bioengineering detention ponds, grassy swales, sand filters, modified roof techniques, drains, and other features, will speed project approval from RWQCB. Development setbacks from creeks are also requested by RWQCB as they often lead to less creek-related impacts in the future.

Local Regulations

East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan

On January 25, 2000, the Contra Costa County Board of Supervisors declared its intent to participate in the development of a Habitat Conservation Plan (HCP) for East Contra Costa County. On June 30, 2000, the East Contra Costa County Habitat Conservation Plan Association Agreement went into effect. This agreement established the East Contra Costa Habitat Conservation Plan Association (HCPA) as the lead agency in drafting the Habitat Conservation Plan for submittal to the governing boards and councils of member agencies, oversee compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), and would serve as the lead agency under CEQA for developing the HCP. In addition, the City of Oakley has declared its intent to participate in the development of the HCP and is a member of the HCPA. A Draft of the East Contra Costa Count Habitat Conservation Plan and Natural Community Conservation Plan (Draft HCP) was issued in June 2005 for public review and comment. Comments on the Draft HCP were due December 1, 2005. The Draft HCP is intended to address potential impacts to many listed species and their habitats within East Contra

Costa County. The Draft HCP provides avoidance and minimization measures for several special-status species as well as mitigation via an in-lieu fee program for unavoidable impacts to Draft HCP covered species. The City of Oakley is a participant in the Draft HCP and mitigation according to its guidelines and programs may be available and utilized by the project proponents.

City of Oakley General Plan

The following applicable goals and policies are from the Oakley 2020 General Plan Land Use Element:

General Land Use

Goal 2.1 Guide development in a manner that creates a balanced and desirable community, maintains and enhances the character and best qualities of the community, and ensures that Oakley remains an economically viable City.

Policies

2.1.5 Preserve open space areas, of varying scales and uses, both within development projects and at the City's boundary.

2.1.6 Ensure a strong physical connection to the Delta and the waterfront, including convenient public access and recreational opportunities.

2.1.10 When considering large-scale development projects, the City may, at its discretion, authorize a Specific Plan (SP) or Planned Unit Development (PUD) approach that allows flexibility within a project area. Under this approach, the distribution of land uses may vary from the land uses as designated on the Land Use Diagram. The SP/PUD approach shall not allow either an overall greater development density than allowed under the Land Use Diagram, or a combination of uses that undermines the overall intent of the project area as established under the General Plan policies and Land Use Diagram.

Implementation Programs

2.1.F Provide public access to the Delta and the Oakley waterfront through discretionary approvals of development projects, coordinated efforts with involved agencies and organizations, and the improvement of City public facilities.

The following applicable goals and policies are from the Oakley 2020 General Plan Open Space and Conservation Element:

Open Space

Goal 2.6 Ensure that open space areas are properly managed and designed to conserve natural resources and enhance the community's character and provide passive recreational activities.

Policies

2.6.2 Preserve, enhance and/or restore selected existing natural habitat areas, as feasible.

2.6.3 Create new wildlife habitat areas in appropriate locations, which may serve multiple purposes of natural resource preservation and passive recreation, as feasible.

Biological Resources

Goal 6.3 Encourage preservation of important ecological and biological resources.

Policies

6.3.1 Encourage preservation of important ecological and biological resources as open space.

6.3.2 Develop open space uses in an ecologically sensitive manner.

6.3.3 Use land use planning to reduce the impact of urban development on important ecological and biological resources identified during application review and analysis.

6.3.4 Encourage preservation and enhancement of the natural characteristics of the San Joaquin Delta and Dutch Slough in a manner that encourages public access.

6.3.5 Encourage preservation and enhancement of Delta wetlands, significant trees, natural vegetation, and wildlife populations.

6.3.6 Encourage preservation of portions of important wildlife habitats that would be disturbed by major development, particularly adjacent to the Delta.

6.3.7 Preserve and expand stream corridors in Oakley, restoring natural vegetation where feasible.

Implementation Programs

6.3.A Prior to development within identified sensitive habitat areas, the area shall be surveyed for special status plant and/or animal species. If any special status plant or animal species are found in areas proposed for development, the appropriate resource agencies shall be contacted and species-specific management strategies established to ensure the protection of the particular species. Development in sensitive habitat areas should be avoided or mitigated to the maximum extent possible.

6.3.B Participate with regional, state, and federal agencies and organizations to establish and preserve open space that provides habitat for locally present wildlife.

Tree Protection and Preservation Ordinance

The tree protection and preservation ordinances for the City of Oakley are presented in Appendix A.

IMPACTS AND MITIGATION MEASURES

Standards of Significance

For the purposes of this EIR, impacts are considered significant if implementation of the proposed project would do any one or more of the following:

- Adversely affect, either directly or through habitat modification, any endangered, threatened or rare species, as listed in Title 14 of the California Code of Regulations (Section 670.5) or in Title 50, Code of Regulations (Section 17.11 or 17.12) or their habitats (including but not limited to plants, fish, insects, animals, and birds);
- Have a substantial adverse impact, either directly or through habitat modification, on any species identified as a candidate, sensitive or special-status species in local or regional plans, policies, or regulations or by the CDFG or USFWS, including CNPS plants listed as 1B;
- Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulation or by the CDFG or USFWS;
- Allow development that would be inconsistent with the City's General Plan;
- Allow development that would be inconsistent with other City plans, policies, or ordinances;
- Adversely affect federally protected wetlands (including but not limited to, marsh, vernal pool, coastal, etc.) either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means;
- Have a substantial adverse effect on significant ecological resources including:
    - Wetland areas including vernal pools;
    - Large areas of non-fragmented natural communities that support endangered, threatened or rare species;
    - Wildlife movement zones, including but not limited to, non-fragmented stream environment zones, avian and mammalian routes, and known concentration areas of waterfowl within the Pacific Flyway;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or

impede the use of wildlife nursery sites;

- Conflict with any local or regional policies or ordinances designed to protect or enhance biological resources, such as a tree preservation policy or ordinance;
- Substantially fragment, eliminate or otherwise disrupt foraging areas, access to food sources, range and/or movement;
- Disrupt critical time periods (i.e., nesting and breeding) for fish and other wildlife species;
- Conflict with local, state, or federal resource conservation plans, goals, or regulations that would result in a physical impact on the environment; or,
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

An evaluation of whether or not an impact on biological resources would be substantial must consider both the resource itself and how that resource fits into a regional or local context. Substantial impacts would be those that would diminish or result in the loss of an important biological resource, or those that would obviously conflict with local, state, or federal resource conservation plans, goals, or regulations.

Project-Specific Impacts and Mitigation Measures

The following discussion of impacts is based on the implementation of the proposed project as shown in current plans.

4.8-1 Impacts to jurisdictional waters of the U.S. and waters of the State.

The project site contains 2.50 acres of Section 404 jurisdictional wetlands that were confirmed by the USACOE in August, 2006. The jurisdictional areas include a perennial wetland (1.21 acres), Dutch Slough (0.52 acres), Seasonal wetlands adjacent to the Slough (0.63 acres), and a former tidal wetland (0.14 acres).

Grading for the residential development and other infrastructure improvements will require the fill of 1.98 acres of jurisdictional area. This includes all of the perennial, seasonal, and former tidal wetlands on the site. The development project will not impact Dutch Slough.

Mitigation Measure(s)
Implementation of the following mitigation measure would reduce the impact to a *less-than-significant* level.

4.8-1(a) To the extent feasible implementation of the project shall be designed *and constructed to avoid and minimize adverse effects to waters of the United States or jurisdictional waters of the State of California within the project area.*

4.8-1(b) A Section 404 permit for fill of jurisdictional wetlands shall be sought, and mitigation for impacts to jurisdictional waters that cannot be avoided shall conform with the USACE "no-net-loss" policy and the USACE Regulatory Guidance Letter No. 02-2 establishing policies and guidance on appropriate mitigation for impacts to jurisdictional waters. Mitigation for impacts to both federal and State jurisdictional waters shall be addressed using these guidelines.

4.8-1(c) Mitigation shall include creation of wetlands at a minimum 1:1 ratio and all temporarily impacted areas resulting from construction access or similar activities shall be revegetated and restored.

Or,

Alternatively, the applicant shall provide the required mitigation either through an in-lieu fee program, purchase of the required acreage in an approved mitigation bank, or an approved Habitat Conservation Plan (HCP) or similar mechanism.

4.8-1 (d) A mitigation plan shall be prepared for mitigation and implemented that provides guidance on managing and monitoring the wetland mitigation habitat. The mitigation plan shall include jurisdictional and non-jurisdictional wetland mitigation. The mitigation plan shall include standards deemed acceptable by the City of Oakley, USACE, RWQCB, and CDFG. Annual reports of the monitoring activities and results shall be provided to the City of Oakley, USACE, USFWS, CDFG and RWQCB.

4.8-2 Impacts to Protected and Heritage Trees.

The City of Oakley recently approved a new Zoning Code, which includes Section 5-D-3A on Heritage Tree Preservation, and Section 5-D-3B on Tree Preservation (which includes preservation of "protected trees"). This ordinance supercedes the Contra Costa County Tree Protection and Heritage Tree Ordinances cited above. The Oakley Heritage Tree Preservation Ordinance (Section 5-D-2-3A) states that a heritage tree is a tree either 50 or more inches diameter at breast height (dbh, or 4½ feet above the natural grade); or any tree or trees "worthy of protection" because they have historical or ecological interest or significance, is dependent upon other trees for health or survival, or is considered an outstanding specimen due to location, size, age, rarity, shape, or health.

The Tree Preservation Ordinance (5-D-3B), which applies to any protected tree, indicates that proposed development shall consider tree alteration or removal as part of the project application, and if necessary, a tree survey shall be submitted. Protected trees are those trees which are adjacent to or part of a riparian, foothill woodland, or oak savannah area, or part of a stand of four or more trees, measure 20 inches or larger dbh, and are one or more of the following native species: bigleaf maple, box elder, California buckeye, white alder, madrone, toyon, California black walnut, California juniper, tanoak or tanbark oak, knobcone pine, digger pine, California Sycamore, Fremont cottonwood, black cottonwood, California or coast live oak, canyon live oak, blue oak, California black oak, Valley oak, interior live oak, and California bay or laurel. Protected trees can also include any tree that is shown in an approved tentative map, development, or site plan that is required to be retained as a condition of approval, or any tree required to be planted as a replacement for an unlawfully removed tree.

Heritage and protected trees as defined by this Section 5-D-3 of the Oakley Zoning Ordinance are protected from destruction or removal, and construction activities are limited around the dripline of heritage and protected trees. If heritage or protected trees are damaged, the contractor, developer, or owner must repair or replace the damaged tree according to the fees noted in the ordinance.

A tree survey was conducted on the Gilbert property on March 10, 2006. The survey indicated that 15 black cottonwood (*Populus balsamifera spp. Trichocarpa*) are located within the property. All 15 of these trees measure 20” dbh or greater and thus would be subject to the Tree Preservation Ordinance (5-D-3B). Removal of the protected trees would have a potentially significant impact.

Mitigation Measure(s)
Implementation of the following mitigation measure would reduce the impact to a *less-than-significant* level.

4.8-2(a) Building structure and yard design, along with construction activities, shall attempt to retain existing protected trees on the project site to the maximum extent practicable. Prior to the issuance of grading permits, the project developer shall have a tree preservation plan prepared by an ISA-certified arborist to minimize damage to on-site protected trees during the *construction of the project, replace any protected trees damaged or killed by development of the project, and plant additional trees as determined by the Community Development Department. The plan shall be reviewed and approved by the Community Development Department prior to issuance of a grading permit, and the plan shall be in compliance with Sections 5-D-3A and 5-D-2-3B of the City of Oakley Zoning Ordinance. The tree preservation plan shall include but not be limited to the following elements:*

- *The preservation element of the plan shall include but not be limited to installation of protective fencing during construction, appropriate irrigation practices, and inclusion of appropriate tree preservation notes on grading and construction plans. The replacement and new plantings portion of the plan shall include a map showing where the replacement and new trees will be located.*
- *Where mitigation is determined to be necessary, tree removal shall be mitigated at a minimum 3:1 ratio or other ratio acceptable to the City of Oakley, or an in-lieu fee shall be paid on a per-inch basis as determined by the Community Development Department. The mitigation trees shall be established with appropriate maintenance to ensure long-term self-sustaining survivorship.*
- *In the event that any protected or heritage tree is damaged during the construction process, the applicant shall comply with subsection 5-D-3A.5(E) and/or 5-D-3B.6(D) and 5.-D-3B.6 (E) of the Oakley Zoning Ordinance as applicable, including but not limited to notification of the Community Development Director.*

4.8-2(b) Per the Tree Preservation Ordinance Section 5-D-3B.6(B) and (C), prior to the issuance of any grading or building permit for a property where trees will be removed, the applicant shall deposit cash or other acceptable security with the Community Development Department on a per-tree basis in the amount established by the involved development's conditions of approval of approved applications. As required, the City may hold the deposit for a two-year period to guarantee the health of the trees for a two-year period upon completion of construction. In addition, the applicant may be required to enter into a tree maintenance agreement secured by said deposit/bond by which the applicant agrees to maintain said trees in a living and viable condition throughout the term of agreement. This agreement may be transferred to any new *owner of the property for the remaining length of the agreement.*

4.8-2(c) The applicant shall obtain the necessary permit for the removal and/or destruction of heritage trees that cannot be avoided during project construction for the review and approval of the Community Development Department.

4.8-3 Impacts to special-status brachiopods.

The potential for occurrence of special-status brachiopod species is considered low based on a lack of occurrences in the vicinity. However, due to the presence of potentially suitable habitat within the Gilbert property for the protected vernal pool fairy shrimp (federally-listed Threatened); midvalley fairy shrimp (federal Species of Concern); Longhorn fairy shrimp(federally-listed Endangered); California linderiella, (federal Species of Concern); and vernal pool tadpole shrimp (federally-listed Endangered) focused surveys should be conducted according to USFWS protocol guidelines (USFWS 1996b). One wet season survey was completed in 2005 with negative result, however the second and last wet season survey is being conducted this year. If these special-status brachiopods occur within the project site, the project could have a ***potentially significant*** impact.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-3 (a) Prior to issuance of a grading permit, the applicant shall conduct wet season surveys per the 1996 USFWS Interim Survey Guidelines for Vernal Pool Branchiopods within potentially suitable habitat on the Gilbert property during the appropriate season. Because protected brachiopods were not found during the 2005 wet season surveys, a second wet season will be conducted this year. If federally protected branchiopods are not found after completion of protocol-level surveys, then no further mitigation shall be required. If federally protected branchiopods are found during one or more of the surveys, then the following measures shall be implemented.

4.8-3 (b) If protected brachiopods are found to occur during protocol surveys on the Gilbert property, properties that are connected biologically and hydrologically (via ground or surface water) shall also be considered as potentially occupied habitat. Assessment of presence or absence shall be determined for each wetland, taking into account connectivity of the wetland areas. Project impacts shall be evaluated and mitigation shall *be based on an analysis of the following:*

- *Connectivity of aquatic habitats (both ground and surface water);*
- *Habitat quality measured as potential to support listed shrimp species;*
- *Potential for cyst (egg) dispersal;*
- *Adjacent land uses, current and anticipated, and resulting effects on the hydrology of aquatic habitats;*
- *Threats and encroachment on populations of listed species, including edge effects and associated buffers, and habitat fragmentation;*
- *If protected brachiopods are found within the boundary of the project site, impacts to occupied or potentially occupied aquatic habitats and an associated upland buffer, to be determined according to the criteria above, shall be avoided to the extent feasible. If avoidance is not feasible, aquatic habitat and the amount of watershed associated with the preserved pools necessary to sustain the existing hydrology of the pool habitat shall be replaced at a 1:1 ratio at a location approved by the City and USFWS. The habitat in the amount specified above shall be acquired, permanently protected, and enhanced through management for the benefit of the species, to compensate for the loss of aquatic habitat on the project site. A plan describing the mitigation and monitoring requirements and performance standards shall be prepared if habitat is preserved or acquired for special-status fairy shrimp species. This mitigation measure shall be coordinated with the plan in Mitigation Measure 4.8-1 (d). Alternatively, the applicant can provide the required mitigation either through an in-lieu fee program, purchase of the required acreage in an approved mitigation bank, or an approved Habitat Conservation Plan (HCP). Take authorization shall be obtained from the USFWS if federally-listed branchiopods are present on-site.*

4.8-3(c) If presence of protected brachiopods is confirmed during protocol surveys, the uppermost layer of soil in seasonally inundated habitat may contain cysts of listed crustaceans as well as seeds of vernal pool plants. Therefore, before these wetlands are filled, the top layer of soil shall be made available prior to the start of project grading to any vernal pool creation bank that requests it, with USFWS approval, for inoculating newly created pools. Soil stockpiled for this purpose shall be shielded *from rain with a waterproof cover to ensure that it remains completely dry.*

4.8-4 Impacts to special-status sand dune insects.

Special-status insect species, including but not limited to andrenid bee and anthicid beetle are not expected to occur within the sand mound habitats on the project site (see Table 4.8-1 for a full list of special-status insect species with a low potential to occur on the site). These invertebrate species are federal Species of Concern and are not afforded any formal protection under the federal or State Endangered Species Acts. Given the degraded quality of the sand dune habitat and the lack of suitable plant species to act as host plants, the sand mound is not likely to support these species. In addition, the remnant sand dune on the adjacent Emerson property was surveyed with negative findings for these species in 2004 by entomologist Dr. Dick Arnold. Given these negative findings, the degraded quality of the habitat, the implementation of the project is expected to have a ***less-than-significant*** impact on these species.

Mitigation Measure(s)
None required.

4.8-5 Impacts to special-status fish species.

Potential special-status fish species that may be present in Dutch Slough include Sacramento perch, a federal Species of Concern and a California Species of Special Concern; delta smelt, federally- and state-listed as Threatened; and Sacramento splittail, a California Species of Special Concern; Chinook salmon, winter-run, federally- and state-listed Endangered; Central Valley fall/late run, a federal Candidate species; Central Valley spring-run, federally- and State-listed Threatened; and steelhead, Central Valley ESU, federally-listed Threatened. However, no work will be conducted within Dutch Slough and therefore no impacts are anticipated by the project and no mitigation measures will be required.

4.8-6 Impacts to silvery legless lizard.

Silvery legless lizard was positively identified in a remnant dune area located on the far south portion of the Cypress Grove project approximately one mile west of the Gilbert project site in similar but less disturbed habitat in January and June 2004 during pre-construction surveys (Sycamore 2004a). Silvery legless lizard was also found just off site of the Cypress Grove property on a remnant dune located along the Burlington Northern Santa Fe (BSNF) Railroad tracks. Additionally, a population of silvery legless lizards is known to occur approximately 1.5 miles west of the project site within the East Bay Regional Park Legless Lizard Preserve as recently as May 2000 (CDFG 2004a, Swaim Biological Consulting 2002).

The biological assessment for the Gilbert property (Zentner and Zentner 200?) indicated that silvery legless lizards had a moderate potential to occur within the vegetated mound habitat on the site. Therefore a silvery legless lizard survey was conducted within the mound, but with negative results. Accordingly, the silvery legless lizard is considered to have a low likelihood of occurrence on the project site. Therefore, the implementation of the project is expected to have a ***less-than-significant*** impact on these species.

Mitigation Measure(s)
None required.

4.8-7 Impacts to giant garter snake.

Potential aquatic habitat for the giant garter snake, federally-listed Threatened, is present within Dutch Slough, perennially inundated irrigation/drainage ditches, and the Contra Costa Canal adjacent to the project site. Adjacent upland habitats contain ground squirrel burrows that provide dispersal, refugia, and winter retreat opportunities. Focused surveys for giant garter snake in the Contra Costa Canal in 2003 resulted in negative findings as did focused surveys conducted in 2005 on the Gilbert and the adjacent Burroughs properties to the east. However, individual giant garter snakes have been observed approximately four miles northwest and six miles north of the project site, within the waterways of the Delta (CDFG 2004a, Swaim Biological Consulting 2002) in 2002 and 1998 respectively. These recent occurrences in the region suggest that individual giant garter snakes may make occasional use the main Delta waterways north of the project. Given occurrences in the region, and the presence of limited potential habitat in Dutch Slough, irrigation/drainage ditches and the Contra Costa Canal, giant garter snake have a very limited potential to move through the site although they are not expected to occur on-site at the present. Therefore, the project could have a ***potentially significant*** impact if construction begins at the time a snake is moving through the site.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-7(a) The following measures shall be implemented to avoid potential take of individual garter snakes during construction:

- *All construction activity within potential giant garter snake aquatic habitat shall be conducted between May 1 and*

October 1. This is the active period for giant garter snakes and if present, potential effects are lessened because snakes are actively moving and can avoid danger.

- *A qualified biologist shall provide project contractors and construction crews with a worker-awareness program appropriate for giant garter snakes before any work within aquatic habitats or adjacent upland habitats is initiated. This program shall be used to describe the species, its habits and habitats, its legal status and required protection, all applicable mitigation measures, and conditions of any state or federal permits as they relate to giant garter snake. Proof of this instruction shall be submitted to the City.*

- *During project activities and following construction, all trash shall be properly contained, removed from the work site, and disposed of properly.*

- *24-hours prior to construction activities, the project area shall be surveyed for giant garter snake. Survey of the project area shall be repeated if a lapse in construction activity of two weeks or greater has occurred. If a giant garter snake is encountered during construction, activities shall not begin until appropriate corrective measures have been completed or it has been determined that the snake shall not be harmed. Any sightings and any incidental take shall be reported immediately to the USFWS at (916) 414-6600.*

- *Movement of heavy equipment to and from the project site shall be restricted to established roadways to minimize disturbance.*

- *After completion of construction activities, any temporary fill and construction debris shall be removed and, wherever feasible, disturbed areas shall be restored to pre-project conditions. Restoration work shall include replanting emergent vegetation.*

- *All fueling and maintenance of vehicles or other equipment and staging areas shall occur at least 66 feet from any water body that could be potentially used by the snake. Prior to the onset of work, the applicant shall prepare a plan to allow prompt and effective response to any accidental spills. All workers shall be informed of the importance of preventing spills and of the appropriate* *measures to take should a spill occur.*

- *To control erosion during and after project implementation, the applicant shall implement best management practices, as identified by the Regional Water Quality Control Board. Drainage banks shall be stabilized by compacting additional soil after sediment and vegetation removal to minimize the potential for erosion. Additionally, during sediment and vegetation removal in a channel that still contains flowing water during August, September, and October, a silt fence shall be installed directly downstream of the project site. This will help to prevent silt accumulation downstream of the project site.*

4.8-8 Impacts to western pond turtle.

Western pond turtle, a California Species of Special Concern, has been documented in the Contra Costa Canal and on the Cypress Grove property approximately one mile to the west and a nest was observed in the adjacent Emerson project site just west of the project. This species has the potential to occur in Dutch Slough and perennial irrigation/drainage ditches on the project site and to nest and over-winter in upland habitats such as the grassland habitats adjacent to aquatic habitats on the property. Temporary construction impacts that may affect this species include presence of heavy equipment and earthmoving activities and fill of irrigation/drainage canals as part of residential and levee alignment or modification construction. The proposed project may result in impacts to upland habitat for western pond turtle. Loss of habitat and potential loss of individuals and nests if this species is present within construction areas could have a ***potentially significant*** impact.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-8(a) A qualified biologist shall conduct pre-construction surveys for western pond turtles in all construction areas identified as potential nesting or dispersal habitat located within 1,000 feet of potential aquatic habitat 48 hours prior to initiation of construction activities. If western pond turtle is found during pre-construction surveys, it shall be relocated as necessary to a location deemed suitable by the biologist and CDFG (i.e., at a location which is a sufficient distance from construction activities). This survey shall include looking for turtle nests within the construction area. If a nest is found within the construction area, construction shall not take place within 100 *feet of the nest until the turtles have hatched and have left the nest or can be safely relocated with assistance from CDFG.*

4.8-8 (b) Because attempting to locate pond turtle nests will not result in a realistic probability of detection, after completion of pre-construction surveys, and relocation as necessary, exclusion fencing shall be placed around all construction-sites adjacent to aquatic habitats to eliminate the possibility of nest establishment in uplands adjacent to aquatic areas.

4.8-8 (c) If construction activities occur in aquatic areas where turtles have been identified during pre-construction or other surveys, a biological monitor shall be present during disturbance of those aquatic habitats. If any turtle is found, it shall be relocated as necessary to a location deemed suitable by the biologist and CDFG (i.e., at a location which is a sufficient distance from construction activities).

4.8-8 (d) A qualified biologist shall provide project contractors and construction crews with a worker-awareness program before any work within aquatic habitats or adjacent upland habitats that are appropriate for western pond turtles. This program shall be used to describe the species, its habits and habitats, its legal status and required protection, and all applicable mitigation measures.

4.8-9 Impacts to western burrowing owl.

Burrowing owl is a California and federal Species of Concern. Despite negative focused breeding and non-breeding season surveys suitable habitat is present on the Gilbert property. A burrowing owl was noted on the site in November, 2004 and burrowing owls have been observed during wintering surveys approximately 250 feet south of the southern property boundary and approximately ½ mile east of the site. Disturbance of over-wintering or nesting owls and habitat loss could have a ***potentially significant*** impact on burrowing owls.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-9(a) Prior to issuance of a grading permit, pre-construction surveys of all potential burrowing owl habitat shall be conducted by a qualified biologist within the project area and within 250 feet of the project boundary. Presence or sign of burrowing owl and all potentially occupied burrows shall be recorded and *monitored according to CDFG and California Burrowing Owl Consortium guidelines. If burrowing owls are not detected by sign or direct observation, construction may proceed.*

4.8-9(b) Because more than two years will have passed since breeding season surveys were conducted before project construction is set to begin, and because the burrowing owl is a mobile species, prior to issuance of a grading permit, focused breeding season surveys of all potential burrowing owl habitat shall be conducted by a qualified biologist within the Gilbert property within 1 year prior to development. Presence or sign of burrowing owl shall be recorded and monitored according to CDFG and California Burrowing Owl Consortium guidelines.

4.8-9(c) If potentially nesting burrowing owls are present during pre-construction surveys conducted between February 1 and August 31, grading shall not be allowed within 250 feet of any nest burrow during the nesting season (February-August), unless approved by the CDFG.

4.8-9(d) If burrowing owl is detected during pre-construction surveys outside the nesting season (September 1-January31), passive relocation and monitoring may be undertaken by a qualified biologist following CDFG and California Burrowing Owl Consortium guidelines, which involve the placement of one-way exclusion doors on occupied and potentially occupied burrowing owl burrows. Owls shall be excluded from all suitable burrows within the project area and within a 160-foot buffer zone of the impact area. A minimum of a week shall be allowed to accomplish this task and allow for owls to acclimate to alternate burrows. These mitigation actions shall be carried out prior to the burrowing owl breeding season (February 1-August 31) and, until construction begins, the site shall be monitored weekly by a qualified biologist to ensure that burrowing owls do not re-inhabit the site.

4.8-9(e) If nesting or wintering burrowing owl or sign of nesting or wintering burrowing owl is detected at any time on the project site, a minimum of 6.5 acres of foraging habitat per pair or individual resident bird, shall be acquired and permanently protected to compensate for the loss of burrowing owl habitat. The acreage shall be based on the maximum number of owls observed inhabiting the property for any given observation period, pre-construction survey, or other field visit. The protected lands shall be occupied burrowing owl habitat and at a location acceptable to CDFG and the City of Oakley. The habitat in the *amount specified above shall be acquired, permanently protected, and enhanced through management for the benefit of the species, to compensate for the loss of burrowing owl habitat on the project site. Alternatively, the applicant shall provide the required mitigation either through an in-lieu fee program, purchase of the required acreage in an approved mitigation bank, or an approved Habitat Conservation Plan (HCP).*

4.8-9(f) Before construction activities begin, all construction personnel shall receive training that includes photos of burrowing owl for identification purposes, habitat description, limits of construction activities in the project area, and guidance regarding general measures being implemented to conserve burrowing owl as they relate to the project.

4.8-9(g) A monitoring report of all activities associated with pre-construction surveys, avoidance measures, and passive relocation of burrowing owls shall be submitted to the City and CDFG no later than two weeks before initiation of grading.

4.8-10 Impacts to raptors and migratory birds.

Several special-status and common bird species have the potential to nest in existing vegetation, including trees, shrubs and grasslands within the project area although the have not been seen on-site recently, including the following: raptors such as white-tailed kite, northern harrier and short-eared owl; and birds such as California horned lark, loggerhead shrike, and tri-colored blackbird. Any removal of buildings, trees or shrubs, grading, or construction activities in the vicinity of active passerine or non-passerine land bird nests, or active raptor nests, could result in nest abandonment, nest failure, or premature fledging. Destruction or disturbance of active nests would be in violation of the Migratory Bird Treaty Act (MBTA) and California Department of Fish and Game (CDFG) Code. Such disturbance would be considered a ***potentially significant*** impact.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-10(a) The removal of any buildings, trees, emergent aquatic vegetation, or shrubs shall occur from September 1 through December 15, outside of the avian nesting season. If removal of buildings, trees, emergent aquatic vegetation, or shrubs occurs, or construction begins between February 1 and August 31 (nesting season for passerine or non-passerine land birds) or

December 15 and August 31 (nesting season for raptors), a nesting bird survey shall be performed by a qualified biologist within 14 days prior to the removal or disturbance of a potential nesting structure, trees, emergent aquatic vegetation, or shrubs, or the initiation of other construction activities during the early part of the breeding season (late December through April) and no more than 30 days prior to the initiation of these activities during the late part of the breeding season (May through August). During this survey, a qualified biologist shall inspect all potential nesting habitat (trees, shrubs, structures, grasslands, pastures, emergent aquatic vegetation, etc.) in and immediately adjacent to the impact areas for nests.

4.8-10(b) All vegetation and structures with active nests shall be flagged and an appropriate non-disturbance buffer zone shall be established around the nesting tree. The size of the buffer zone shall be determined by the project biologist in consultation with CDFG and will depend on the species involved, site conditions, and type of work to be conducted in the area. Typically, if active nests are found, construction activities shall not take place within 500 feet of the raptor nests and within 100 feet of other migratory birds until the young have fledged. A qualified biologist shall monitor active nests to determine when the young have fledged and are feeding on their own. The project biologist and CDFG shall be consulted for clearance before construction activities resume in the vicinity.

4.8-11 Impacts to Swainson's hawk.

Mature trees provide suitable nesting habitat on the project site for Swainson's hawk, state-listed Threatened. At least two Swainson's hawk nests are known to occur within approximately 3,000 feet of the project area, one active and one removed (CDFG 2004a, Monk 2005).

The grassland on the project site provide suitable foraging habitat for Swainson's hawks, and they have been observed foraging over these areas. Dryland pasture, irrigated pasture, grasslands, and other suitable foraging habitats such as row crops, in particular alfalfa fields, are abundant in the vicinity of the project area. CDFG identifies whether or not a project will adversely affect suitable foraging habitat within a ten-mile radius of an active Swainson's hawks nest (used during one or more of the last 5 years). The ten-mile radius standard is the flight distance between active nest sites and suitable foraging habitats as documented in telemetry studies by Estep (1989) and Babcock (1993, 1995). Telemetered Swainson's hawks have been documented by Babcock (1993) utilizing foraging areas of up to 19,000 acres surrounding nest sites. According to calculations that were completed for the adjacent Emerson property and documented in the *Revised Swainson's Hawk Foraging Habitat Analysis the 150-Acre Emerson Property South of the Contra Costa Canal, Oakley, Contra Costa County, California* (Sycamore 2005), presently between 65,181 and 120,078 acres of foraging habitat exist within the ten-mile radius of the nest sites, depending upon individual nest. Development of the proposed project would remove approximately 120 acres of foraging habitat for Swainson's hawk within the above-described area presently available. Based on this analysis, the currently proposed project will not substantially affect Swainson's hawk foraging habitat.

Loss of an occupied Swainson's hawk nest, however, would be considered a significant impact. If during the pre-construction surveys, Swainson's hawks are found nesting on or adjacent to the site, the project could have a ***potentially significant*** impact on Swainson's hawks.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-11(a) In order to ensure that nesting Swainson's hawks shall not be affected by construction on the project site or off-site improvement locations, a qualified biologist shall conduct pre-construction surveys according to CDFG and Swainson's Hawk Technical Advisory Committee guidelines (2000). Survey Period I occurs from January 1 – March 20, Period II from March 20 – April 5, Period III from April 5 – April 20, Period IV from April 21 – June 10, and Period V is from June 10 – July 30. Three surveys shall be completed in at least each of the two survey periods immediately prior to a project's initiation and encompass the area within ½ mile of the project site. If a nest site is found, then either of the following measures shall be implemented:

4.8-11(b) Trees containing known or potential raptor nest sites that must be removed as a result of project implementation shall be removed during the non-breeding season (September 1 to January 31) to discourage future nesting attempts, on the condition that no Swainson's hawk pair is currently utilizing the nest site. Monitoring evidence that any nests in trees planned for early removal are unattended by reproductive-aged birds must be provided; or

4.8-11(c) If an active Swainson's hawk nest is found sufficiently close (as determined by the qualified biologist and CDFG) to the construction area to be affected by construction activities, a qualified biologist shall determine the extent of a construction-

free buffer zone to be established around the nest. Intensive new disturbances (e.g., heavy equipment activities associated with construction) that may cause nest abandonment or forced fledging shall not be initiated within this buffer zone between March 1 and September 1 until it is determined by a qualified biologist in coordination with CDFG that the young have fledged and are feeding on their own.

4.8-12 Impacts to special-status bat species.

Several mature trees exist on the project site which provide suitable bat roosting habitat. In addition, the old residence located on the project site provide potentially suitable roosting habitat for bats. Special-status bat species that have the potential to occur on-site including pallid bat, a California Species of Special Concern; Townsend's big-eared bat, a California Species of Special Concern; greater western mastiff bat, a Federal and California Species of Special Concern; the small-footed myotis bat, a Federal Species of Special Concern; long eared myotis bat, a Federal Species of Special Concern; fringed myotis bat, a Federal Species of Special Concern; long-legged myotis bat, a Federal Species of Special Concern and the Yuma myotis bat, a Federal and California Species of Special Concern. Although these species are not expected to occur on-site presently, existing buildings and mature trees located within the project site provide potential roosting habitat for these special-status bat species if they reach this site after leaving another site. If special-status bats are found roosting on-site, the project could have a ***potentially significant*** impact.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce the impact to a *less-than-significant* level.

4.8-12(a) A pre-construction survey for roosting bats shall be performed by a qualified biologist within 30 days prior to any removal of trees or structures on the site. If no active roosts are found, then no further action shall be required. If either a maternity roost or hibernacula (structures used by bats for hibernation) is present, the following mitigation measures shall be implemented.

4.8-12(b) If active maternity roosts or hibernacula are found in trees or structures which are to be removed as part of project construction, the project shall be redesigned to avoid the loss of the tree or structure occupied by the roost to the extent feasible as determined by the City. If an active maternity roost is located and the project cannot be redesigned to avoid removal of the occupied tree or structure, demolition shall *commence before maternity colonies form (i.e., prior to March 1) or after young are volant (flying) (i.e., after July 31). Disturbance-free buffer zones as determined by a qualified biologist in coordination with CDFG shall be observed during the maternity roost season (March 1 - July 31).*

4.8-12(c) If a non-breeding bat hibernacula is found in a tree or structure scheduled for removal, the individuals shall be safely evicted, under the direction of a qualified biologist (as determined by a Memorandum of Understanding with CDFG), by opening the roosting area to allow airflow through the cavity. Demolition shall then follow at least one night after initial disturbance for airflow. This action shall allow bats to leave during darkness, thus increasing their chance of finding new roosts with a minimum of potential predation during daylight. Trees or structures with roosts that need to be removed shall first be disturbed at dusk, just prior to removal that same evening, to allow bats to escape during the darker hours.

4.8-13 Impacts to wildlife corridors.

Dutch Slough and the Contra Costa Canal, are potential wildlife movement corridors, which may facilitate the movement of animals to and from the project area and may provide safe refuge for species that may forage within the project area during various times of the year, including the fish and western pond turtle (if present). However, lands and hydrologic features surrounding the site are not suitable to facilitate movement and dispersal of many other special-status species as described in the above section due to agricultural practices, the isolated nature of habitats (*i.e.,* sand mounds), introduction of exotic predators, and suburban development. Additionally, the project site does not provide a key movement corridor for wildlife in the region given the present agricultural practices and surrounding land uses. Therefore, project impacts to wildlife corridors are expected to be ***less-than-significant***.

Mitigation Measure(s)
None required.

Cumulative Impacts and Mitigation Measures

The following discussion of impacts is based on the implementation of the proposed project in combination with other proposed and pending projects in the region. Unless otherwise indicated, mitigation measures apply to all three of the subject properties.

4.8-14 Contribution to cumulative impacts to biological resources in the project area.

The Oakley area, like many other communities in the San Francisco Bay Area, is experiencing a great deal of urban growth. Many housing developments are already approved in the surrounding areas. In the immediate vicinity of the project site are several projects in various stages of the entitlement and development process. Adjacent to the west is the 155-acre Cypress Grove development, which resulted in the removal of 155 acres that were previously under cultivation. Approximately 1.5 miles to the east is the East Cypress Corridor Specific Plan area, an approximate 2,500-acre area that has been used historically for irrigated pasture and row crops and which is planned for urban development. Although the 1,166-acre Dutch Slough restoration project located immediately north of the project area will provide valuable habitat for native plant and wildlife species in the region, cumulatively, these projects could affect common as well as special-status plant and animal species with the reduction of available habitat and the potential loss of individuals.

The Oakley 2020 General Plan EIR (Impact 3.9-F) states that a potentially significant impact to biological resources would result from the cumulative conversion of habitat; however, implementation of applicable General Plan policies and programs would reduce the impact to a less-than-significant level. One of the programs that the Oakley General Plan EIR lists under Impact 3.9-A is Program 6.3.A, which is in the Open Space and Conservation element of the Oakley 2020 Genera Plan. Program 6.3.A states that prior to development within identified sensitive habitat areas, the area shall be surveyed for special status plant and/or animal species. If any special status species are found, the program requires consultation with the appropriate resource agency to establish management strategies to ensure the protection of the particular species. The mitigation measures pertaining to special status plant and animal species included in this EIR would be consistent with program 6.3.A. The project could contribute to the cumulative loss of these special-status species, their habitat, and special-status natural communities and common wildlife communities, resulting in ***potentially significant*** cumulative impacts.

Mitigation Measure(s)
Implementation of the following mitigation measures would reduce cumulative impacts to biological resources to a *less-than-significant* level.

4.8-14 Implement Mitigation Measures 4.8-1 through 4.8-12.

Appendix A

Tree Ordinance

The City of Oakley Zoning Ordinance for Heritage Tree Preservation and Tree Preservation was adopted by the City Council in October 2005. Section D-3A Heritage Tree Preservation and Section D-3B Tree Preservation of Chapter 5: Additional Requirements for Development, in Zoning Ordinances, serve as an overview for protected trees within the project site.

Section D-3A Heritage Tree Preservation

5-D-3A.3 Definition and Designation

A. *Heritage tree definition.*

"Heritage tree" means:

1. A tree fifty inches or more in circumference measured four and one-half feet above the natural grade; or

2. Any tree or a group of trees particularly worthy of protection, and specifically designated as a heritage tree by the City Council pursuant to the provisions of this chapter, because of:

a. Having historical or ecological interest or significance, or
b. Being dependent upon each other for health or survival, or
c. Being considered an outstanding specimen of its species as to such factors as location, size, age, rarity, shape, or health.

5-D-3A.4 Destruction or Removal.

A. Prohibition. No person shall destroy or remove any designated heritage tree unless a permit has been obtained therefore. This chapter does not require a permit for nor prevent trimming, pruning, or maintenance of a heritage tree where such does not result in destruction nor substantially change the tree's form or shape.

5-D-3A.5 Preservation.

A. Encroachment, construction or excavation. When proposed developments or construction encroach into the drip line or a radius of twelve feet from the trunk of any designated heritage tree, whichever is greater, special construction to allow the roots to breathe, obtain water and nutrients shall be required, as determined necessary by the Community Development Department to minimize damage to such tree visible above ground level. Excavation, cuts, fills or compaction of the existing ground surface within the drip line or a radius of twelve feet from the trunk of a designated heritage tree, whichever is greater, shall minimize such damage to the root system so as to result in least damage to such tree. Permission is required prior to back filling. Tree wells may be used where approved by the building inspection department. The cost of required pruning or other treatment to compensate for root damage and/or cost of removal shall be at the expense of the involved developer and/or contractor but may be shared by the owner. Such pruning as is done shall not cause permanent injury or destroy any designated heritage tree;

B. Storage and dumping. No person shall store or dump any oil, gas, or chemicals that may be harmful to trees, nor place heavy construction machinery or construction materials in the open within the drip line of any designated heritage tree or within a radius of twelve feet from the trunk of such tree, whichever is greater;

C. Burning. Burning of any material within or near the drip line of any designated heritage tree shall not be done where such will injure the tree;

D. Attachments. No person shall attach any wire (except as needed for support) or sign (other than approved tree identification signs) to any heritage tree where such wire or sign may damage such designated heritage tree;

E. Damage notification. The contractor, developer or owner or any agent thereof shall notify the Community Development Department without undue delay of any damage that occurs to any heritage tree during construction. The cost of repair of the damage or tree replacement shall be at the expense of the responsible party and the repair work done according to standards approved by the Community Development Department. The cost of repair or replacement is to be determined by the following method, pending adoption by the City Council by resolution:

1. The applicant shall secure an appraisal of the condition and value of the damaged tree(s). The appraisal shall be done in accordance with the then current edition of the Guide for Establishing Values of Trees and Other Plants by the Council of Tree and Landscape Appraisers under the auspices of the International Society of Arboriculture. The appraisal shall be done at the applicant's sole expense, and the appraiser shall be subject to the City's approval, which it shall not unreasonably withhold. The appraisal shall be performed by a certified arborist, as that term is defined by the Western Chapter of the International Society of Arboriculture; a consulting arborist who satisfies the requirements of the American Society of Consulting Arborists; or such other arborist who, after review by the Community Development Department, is determined to meet the standards established for certified or consulting arborists.

2. If the appraised value of the tree(s) is $25,000 dollars or less, the responsible party shall deposit with the Community Development Department, in cash or such other security as may be acceptable to the director, an amount equal to the value of each tree within the development area of the site. If the appraised value of the tree(s) is over $25,000 dollars, the responsible party shall deposit with the Community Development Department in cash or such other security as may be acceptable to the director an amount equal to $25,000 dollars plus an additional amount as a percentage of the total appraised value, as defined in the table below:

Appraised Value	Deposit
$25,001--$50,000	50 percent
50,001--100,000	25 percent
100,001 and up	10 percent

5-D-3A.6 Permits.

A. Application.

1. Any application for a permit to destroy, cut down or remove a designated heritage tree shall be submitted to the Community Development Department by the owner or his authorized agent (satisfactory evidence of such authorization to be submitted with the application) on the form provided by the Community Development Department together with any specified fee;

2. The application shall contain the location, number, species, size, and heritage designation of the tree to be destroyed, cut down or removed and a statement of reasons for the proposed action, together with such other information as may be required by the Community Development Department, including an Arborist Report.

Section D-3B Tree Preservation

A. 5-D-3B.2 Definitions.

B. Definitions, as used in this section:

a. "Arborist" shall mean a person currently certified by the Western Chapter of the International Society of Arboriculture, as an expert on the care of woody trees, shrubs and vines in the landscape, a consulting arborist who satisfies the requirements of the American Society of Consulting Arborists or such other arborist who, after review by the director, is determined to meet the standards established for certified or consulting arborists hereinabove described.

b. "Arborist Report" shall mean a report prepared by an arborist on:

i. The possible impact of development on trees or existing tree condition;
ii. The impact of any alteration; and/or
iii. Restorative or other remedial action that might be feasible to address tree alterations.

c. “Department” means the Community Development Department;

d. “Development” means any modification of land for human use from its existing state which requires a discretionary entitlement for its establishment or a building and/or grading permit involving a protected tree or trees;

e. “Development Application” shall mean an application for development (as defined in this article) requiring either ministerial or discretionary approvals including design review, use permits, subdivisions, rezoning applications, building and/or grading permits;

f. “Director” means the Director of Community Development or his/her designee;

g. “Riparian Vegetation” shall mean vegetation that is found along creeks and streams. Runoff streams that only carry runoff during the rain seasons in this area are known to support significant riparian vegetation;

h. “Routine Pruning” shall mean the removal of dead or dying, diseased, weak or objectionable branches of a tree in a reasonable and scientific manner which does not structurally harm the tree;

i. “Topping” shall mean the removal of the upper twenty-five percent or more of a tree’s trunk(s) or primary leader;

j. “Tree” shall mean a large woody perennial plant with one or more trunks, branches and leaves, not including shrubs shaped to tree forms;

k. “Tree removal” shall mean the destruction of any protected tree by cutting, regrading, girdling, interfering with water supply, applying chemicals or by other means;

l. “Undeveloped property” shall mean:

   a. A parcel of private land which is vacant or a developed parcel which has remaining development potential;
   b. A parcel of land that can be further divided in accordance with zoning regulations of the City;
   c. A parcel of land on which the structures are proposed to be demolished or relocated.

5-D-3B.3 Protected Trees.

A. Prohibition. No person shall trench, grade or fill within the dripline of any protected tree or cut down, destroy, trim by topping or remove any protected tree on private property within the City without a tree permit, except as provided for in Section 5-D-3A.6, subsection A;

B. Protected Trees.

1. On all properties within the City of Oakley, a protected tree is any one of the following (See also Section 5-D-3A, *Heritage Tree Preservation*, for definition of a Heritage Tree):

   a. Where the tree to be cut down, destroyed or trimmed by topping is adjacent to or part of a riparian, foothill woodland or oak savanna area, or part of a stand of four or more trees, measures twenty inches or larger in circumference (approximately 6.5 inches in diameter) as measured four and one-half feet from ground level, or multi-stemmed tree with the sum of the circumferences measuring forty inches or larger, measured four and one-half feet from ground level, and is included in the following list of indigenous trees: Acer macrophyllum (Bigleaf Maple), Acer negundo (Box Elder), Aesculus califonica (California Buckeye), Alnus Rhombifolia (White Alder), Arbutus menziesii (Madrone), Heteromeles arbutifolia (Toyon), Juglans Hindsii (California Black Walnut), Juniperus californica (California Juniper), Lithocarpus densiflora (Tanoak or Tanbark Oak), Pinus attenuata (Knobcone Pine), Pinus sabiniana (Digger Pine), Platanus Racemosa (California Sycamore), Populus fremontii (Fremont Cottonwood), Populus trichocarpa (Black Cottonwood), Quercus agrifolia (California or Coast Live Oak), Quercus chrysolepis (Canyon Live Oak), Quercus douglasii (Blue Oak), Quercus kelloggii (California Black Oak), Quercus lobata (Valley Oak), Quercus wislizenii (Interior Live Oak) Umbellularia californica (California Bay or Laurel);

   b. Any tree shown to be preserved on an approved tentative map, development or site plan or required to be retained as a condition of approval;

   c. Any tree required to be planted as a replacement for an unlawfully removed tree.

5-D-3B.4 Applications.

A. Permit requirement. Any person proposing to trench, grade or fill within the dripline of any protected tree or cut down, destroy, trim by topping or remove any protected tree shall apply to the department for a tree permit, not less than ten days prior to the proposed tree removal or tree alterations. Persons who would be eligible to apply for three or more individual tree permits under provisions of this chapter may apply for a collective tree permit for the site.

5-D-3B.6 Tree Protection.

A. Tree protection. Except where otherwise provided by the involved development's conditions of approval or approved permit application, on all properties where trees are required to be saved during the course of development, the developer shall follow the following tree preservation standards:

1. Prior to the start of any clearing, stockpiling, trenching, grading, compaction, paving or change in ground elevation on a site with trees to be preserved, the applicant shall install fencing at the dripline or other area as determined by an arborist report of all trees adjacent to or in the area to be altered. Prior to grading or issuance of any permits, the fences may be inspected and the location thereof approved by appropriate City staff.
2. No grading, compaction, stockpiling, trenching, paving or change in ground elevation shall be permitted within the dripline unless indicated on the grading plans approved by the City and addressed in any required report prepared by an arborist. If grading or construction is approved within the dripline, an arborist may be required to be present during grading operations. The arborist shall have the authority to require protective measures to protect the roots. Upon completion of grading and construction, an involved arborist shall prepare a report outlining further methods required for tree protection if any are required. All arborist expense shall be borne by the developer and applicant unless otherwise provided by the development's conditions of approval.

3. No parking or storing vehicles, equipment, machinery or construction materials, construction trailers and no dumping of oils or chemicals shall be permitted within the dripline of any tree to be saved.

B. Construction tree damage. A development's property owner or developer shall notify the department of any damage that occurs to any tree during the construction process. As determined by a director-approved arborist, the owner or developer shall be responsible for securing an appraisal of and repairing the damage. If the tree is damaged beyond repair or dies as a result of development activities, subsection 5-D-3B.6(E) shall be applicable.

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March 24, 2005

TREE SURVEY REPORT FOR THE 150-ACRE EMERSON PROPERTY AND OFF-SITE AREAS ALONG CYPRESS ROAD AND SELLERS AVENUE, OAKLEY, CONTRA COSTA COUNTY, CALIFORNIA

The information provided in this document is intended solely for the use and benefit of Centex Homes and Ponderosa Homes.

No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided herein, without the express written consent of Sycamore Associates LLC, 2099 Mt. Diablo Boulevard, Suite 205, Walnut Creek, CA 94596.

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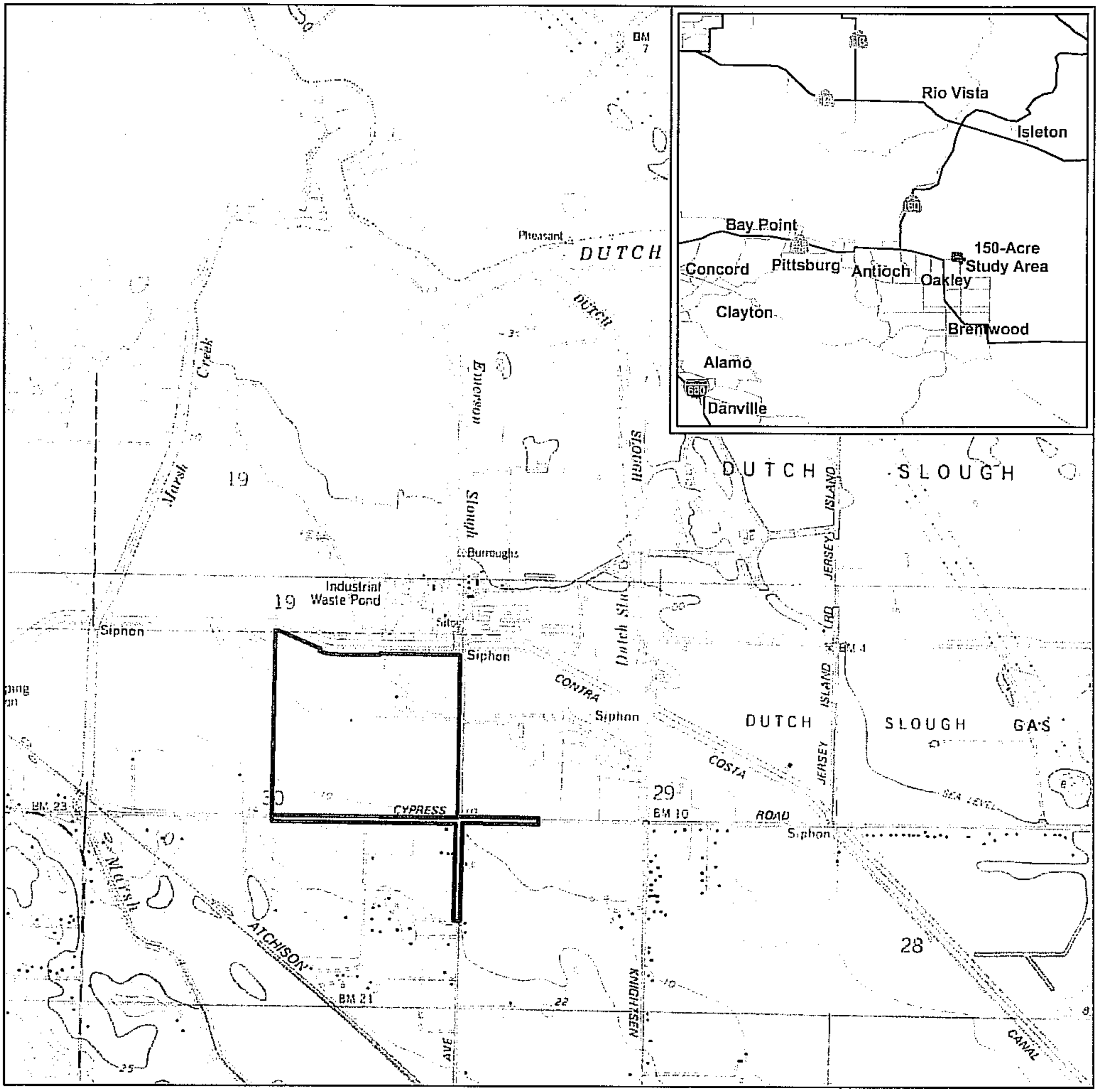
1.0 INTRODUCTION AND SETTING

Sycamore Associates LLC (Sycamore) was contracted to provide a tree survey report for a 150-acre portion of the Emerson property south of Contra Costa Canal and off-site project areas along Cypress Road and Sellers Avenue in Oakley, Contra Costa County, California (Figure 1). This report presents the results of the tree survey.

The subject portion of the Emerson property consists of low-lying, relatively level land situated on the north side of Cypress Road, and the west side of Sellers Avenue, east of State Highway 4. The approximate 150-acre property is bordered to the north by the Contra Costa Canal, to the west by the Cypress Grove residential development, which is currently under construction, and to the south and east by rural residential, agricultural lands, and a portion of Emerson Slough. Current land use practices within the study area include rural residential and agricultural. The homesites are located in the central portion of the property. Adjacent land uses consist of agricultural activities to the north, south, and east, including farming and livestock grazing, and construction activities to the west.

The Emerson property consists predominately of disturbed lands ranging in elevation from 5 to 29 feet above sea level, in which most of the naturally-occurring vegetation has been removed. Cultivated and disturbed lands represent the dominant habitat present on the property. Other vegetation communities identified on site include sand mounds, and a very small amount of valley freshwater marsh vegetation associated with an irrigation ditch and Emerson Slough. Several native and non-native trees are located adjacent to homesites and associated roads on the property, and are assumed to be either ornamentally planted or remnants of previous landscaping. Additionally, there are several trees bordering the property along Cypress Road.

The off-site project area consists of the Sellers and Cypress roadways approximately ½ mile from their intersection in each direction and approximately 35 feet from the roadway's edge. The off-site study area is based upon measurements taken from the Cypress Grove Property Road Improvement Plans prepared by Carlson, Barbee, and Gibson, dated November 22, 2004. Ruderal vegetation, debris, agricultural fields and orchards characterize the area bordering Sellers Road. The off-site area bordering Cypress Road is characterized by agricultural fields, a roadside ditch, and irrigated pasture. There are native and non-native trees lining stretches of both the north and south sides of Cypress Road, and associated with private properties on both the east and west sides of Sellers Avenue.



Legend

150-Acre Study Area

Off-Site Study Area

Figure 1

Location of the Project Site

Emerson Property

Centex Homes

Ponderosa Homes

Oakley, Contra Costa County, California

This document provided for the sole use of Centex Homes. This document not intended for detail design work. USGS quadrangles from MapTech Terrain Professional (1998).

1:24,000 3/23/05

1 inch equals 2,000 feet

0 2,000 4,000 Feet

N

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2.0 METHODS

Sycamore conducted the tree survey of the 150-acre Emerson Property on February 25 and 28 and the Off-site areas on February 28, 2005. All trees in the study area with a diameter at breast height (dbh, 54 inches above grade) greater than 6.5 inches were identified to species, tagged, and the location recorded on a map. A few trees were inaccessible and were only assigned a tag number. The trees were visually assessed from the ground and assigned a condition rating on a scale of 0 to 5 as follows:

- 0 - dead;
- 1 - declining; majority of new growth epicormic, dieback in scaffold branches and/or trunk, extensive structural defects not correctable with proper care;
- 2 - poor; significant epicormic growth, dieback in large branches, significant structural defects not correctable with proper care;
- 3 - fair; average vigor, some dieback of twigs and/or small branches, structural defects that may be corrected or alleviated with proper care;
- 4 - good; good vigor and leaf color, some twig dieback may be present, minor structural defects correctable with proper care;
- 5 - excellent; healthy, vigorous tree with good structure and form typical of the species; reasonably free of signs and symptoms of disease.

Any areas of structural weakness such as decay, cracks, poor crown formation or branch structure, and signs of disease were noted. Each tree's suitability for preservation was then rated as "good", "moderate", or "poor" based upon the tree's health, age, structural condition, and its potential to remain an asset to the site.

3.0 RESULTS

3.1 Emerson Property

Ninety-seven trees were identified representing 20 species (Table 1 and Map Pocket). The most common species were black walnut lining Cypress Road on the southern property boundary and purple-leaf cherry plum which lines both sides of the driveway leading to the homesites midway along the eastern boundary of the property. The remaining trees were surrounding the two central homesites and the homesite in the southeast corner of the property. Three of the 20 species (15 percent) and 35 of the 97 trees (36 percent) are listed as indigenous.

Table 1. Summary of Trees Surveyed for Emerson Property

Species	Common Name	Number of Trees	Listed as Indigenous
Cedrus atlantica	Atlas cedar	1	N
Cinnamomum camphora	camphor tree	1	N
Cupressus sempervirens	Italian cypress	2	N
Eucalyptus globulus	blue gum	5	N
Eucalyptus sp.	gum	2	N
Grevillea noel	silkoak	2	N
Juglans hindsii	black walnut	27	Y
Morus alba	white mulberry	9	N
Phoenix canariensis	Canary Island date palm	1	N
Pinus radiata	Monterey pine	1	N
Pinus sp.	pine	1	N
Platanus racemosa	California sycamore	6	Y
Populus nigra 'Italica'	Lombardy poplar	2	N
Populus tomentosa	Chinese poplar	2	N
Prunus cerasifera 'Atropurpurea'	purple-leaf plum	25	N
Pyrus sp.	pear	1	N
Quercus agrifolia	Coast live oak	2	Y
Schinus molle	Peruvian pepper	1	N
Ulmus parvifolia	Siberian elm	3	N
Washingtonia filifera	California fan palm	3	N
	Grand Total	**97**	

3.2 Off-site Areas Along Cypress Road and Sellers Avenue

Seventy-seven trees were identified representing eight species (Table 2 and Map Pocket). The most common species was black walnut found along Cypress road (63 of the 77 trees are black walnut). Two of the eight species (25 percent) and 64 of the 77 trees (83 percent) are listed as indigenous.

Table 2. Summary of Trees Surveyed for Off-site Areas Along Cypress Road and Sellers Avenue

Species	Common Name	Number of Trees	Listed as Indigenous
Juglans hindsii	black walnut	63	Y
Juglans regia	English walnut	1	N
Morus alba	white mulberry	1	N
Pinus muricata	Bishop pine	3	N
Prunus amygdalus	almond	2	N
Salix laevigata	red willow	1	Y
Ulmus parvifolia	Siberian elm	3	N
Unknown sp.		3	N
	Grand Total	77	

3.3 Heritage and Protected Trees

Contra Costa County Municipal Code contains two chapters pertaining to trees: Chapter 816-4 Heritage Tree Preservation (HTP) District and Chapter 816-6 Tree Protection and Preservation. Heritage trees are defined as all trees greater than 72 inches in circumference (23 inches dbh). All trees greater than 20 inches in circumference (6.5 inches dbh) on any property within the unincorporated area of the county that are included in the list of indigenous species are protected trees, as are all trees greater than 20 inches in circumference on undeveloped property in any district of the county.

3.3.1 Emerson Property

There were 40 heritage trees identified representing 15 species and 41 percent (40 out of 97) of the total population (Table 3). Three of the 15 species (20 percent) are included in the list of indigenous trees, § 816-6.6004. Of the 40 total heritage trees, 18 (45 percent) are listed as indigenous and 22 are not listed.

There were 57 protected trees identified representing 15 species and 59 percent (57 out of 97) of the total population (Table 4). Three of the 15 species (20 percent) are included in the list of indigenous trees. Of the 57 total protected trees, 17 (30 percent) are listed as indigenous and 40 are not listed.

Table 3. Heritage Trees

LISTED AS INDIGENOUS			
Species	**Common Name**	**Emerson Property**	**Off-site Areas**
Juglans hindsii	black walnut	13	17
Platanus racemosa	California sycamore	4	
Salix laevigata	red willow		1
Quercus agrifolia	Coast live oak	1	
	TOTALS	**18**	**18**

NOT LISTED AS INDIGENOUS			
Cedrus atlantica	Atlas cedar	1	
Cupressus sempervirens	Italian cypress	1	
Eucalyptus globulus	blue gum	5	
Eucalyptus sp.	gum	2	
Morus alba	white mulberry	4	1
Phoenix canariensis	Canary Island date palm	1	
Pinus muricata	Bishop pine		3
Populus nigra 'Italica'	Lombardy poplar	1	
Populus tomentosa	Chinese poplar	1	
Prunus cerasifera 'Atropurpurea'	purple-leaf plum	1	
Schinus molle	Peruvian pepper	1	
Ulmus parvifolia	Siberian elm	2	
Washingtonia filifera	California fan palm	2	
	TOTALS	**22**	**4**

Table 4. Protected Trees

LISTED AS INDIGENOUS			
Species	**Common Name**	**Emerson Property**	**Off-site Areas**
Juglans hindsii	black walnut	14	46
Platanus racemosa	California sycamore	2	
Quercus agrifolia	Coast live oak	1	
	TOTALS	**17**	**46**
NOT LISTED AS INDIGENOUS			
Cinnamomum camphora	camphor tree	1	
Cupressus sempervirens	Italian cypress	1	
Grevillea robusta	silkoak	2	
Juglans regia	English walnut		1
Morus alba	white mulberry	5	
Pinus radiata	Monterey pine	1	
Pinus sp.	pine	1	
Populus nigra 'Italica'	Lombardy poplar	1	
Populus tomentosa	Chinese poplar	1	
Prunus amygdalus	almond		2
Prunus cerasifera 'Atropurpurea'	purple-leaf plum	24	
Pyrus sp.	pear	1	
Ulmus parvifolia	Siberian elm	1	3
unknown species			1
Washingtonia filifera	California fan palm	1	
	TOTALS	**40**	**7**

3.3.2 Off-site Areas Along Cypress Road and Sellers Avenue

There were 22 heritage trees identified representing four species and 29 percent (22 out of 77) of the total population (Table 3). Two of the four species (50 percent) are included in the list of indigenous trees. Of the 22 total heritage trees, 18 (82 percent) are listed as indigenous and four are not listed. Of note is a group of four red willows on the south side of Cypress Road approximately one quarter-mile west of Sellers Avenue and represented by one tag number, 55. The tagged and measured individual is of heritage size and the remaining three willows are all multi-trunked with at least one trunk measuring 37.5 inches or more in circumference (12 inches dbh). These trees are growing closely together with intertwined trunks and branches and can be considered to be dependent on one another for health and survival (§ 816-4.402 2B).

There were 53 protected trees identified representing five species and 69 percent (53 out of 77) of the total population (Table 4). One of the five species (20 percent) is included in the list of indigenous trees. Of the 53 total protected trees, 46 (87 percent) are listed as indigenous and seven are not listed. Two pollarded trees (pollarding is yearly pruning of all branches back almost to the trunk) in a yard fronting the west side of Sellers Avenue approximately one-tenth of a mile south of Cypress Road were noted (110 and 111) but were estimated to be less than 20 inches in circumference (6.5 inches dbh) and are therefore not protected.

4.0 SUITABILITY FOR PRESERVATION

Trees that are preserved on development sites must be able to survive construction impacts, adapt to a new environment, and perform well in the landscape. Prior to evaluating any impacts from proposed development it is necessary to consider the tree resource itself and its ability to function well over an extended period of time. Each tree was rated for suitability for preservation based upon its species, approximate age, health, structural integrity, and ability to safely coexist within a development environment. Suitability was rated as good, moderate, or low (Appendix A).

Trees rated good have good health and structural stability, and the potential for longevity at the site. Trees rated moderate have fair health and/or structural defects that may be abated with management measures. Trees in this category may require more management and may have shorter life spans than those rated good. Trees rated low have poor health or significant structural defects that cannot be abated with treatment. Trees in this category can be expected to decline regardless of management practices.

4.1 Emerson Property

The trees are in variable condition ranging from severe decline to vigorous healthy trees (Appendix A). The trees along Cypress road on the southern boundary of the property have had little or no maintenance other than pruning for clearance. The majority are old and in decline. Lining the driveway leading to the homesites are rows of purple-leaf plum that have been largely neglected. Most of the trees surrounding the homesites have been cared for and are in good condition. Of the 97 trees on the property, 23 were rated good, 36 rated moderate, and 38 rated low suitability for preservation (Table 5).

Table 5. Summary of Suitability Ratings

AREA	SUITABILITY RATING		
	Good	**Moderate**	**Low**
Emerson Property	23	36	38
Off-site*	2	4	66
TOTALS	**25**	**40**	**104**

*Five trees are undetermined

4.2 Off-site Areas Along Cypress Road and Sellers Avenue

The trees are in variable condition ranging from dead snags to vigorous healthy trees (Appendix A). The majority of the trees have had little or no maintenance other than pruning for clearance. Many are old and in decline. The few trees that have been cared for and are in relatively good condition are those that are associated with homes along Sellers Avenue. Five of the 77 trees were inaccessible without trespassing and their condition could not be rated, therefore their suitability for preservation could not be determined. Of the remaining 72 trees on the property, 2 were rated good, 4 rated moderate, and 66 rated low suitability for preservation (Table 5).

5.0 RECOMMENDATIONS

Trees with moderate and good suitability ratings can be considered for preservation depending on the intensity of proposed site changes. Retention of trees with low suitability for preservation cannot be recommended in areas where people or property may be present.

5.1 Emerson Property

The daylight line or grading envelope of the proposed project on the Emerson property extends to the boundaries of the property; therefore impacts from development preclude the recommendation of any trees for preservation.

5.2 Off-site Areas Along Cypress Road and Sellers Avenue

The off-site areas were evaluated for a proposed street widening up to 35 feet from the edge of the existing road. Only trees approximately 35 feet from the edge of the existing road and therefore within the area of impact were surveyed. Two trees, Numbers 106 and 114, are very near to but possibly further than 35 feet from the edge of the existing road. Number 106 is young, healthy, in good condition, and has good suitability for preservation. If this tree is outside the area of impact it is recommended that it be preserved. Number 114 was clearly on private property and its condition could not be ascertained, therefore no recommendation can be made without further evaluation. Guidelines for preservation of trees during construction can be supplied as needed.

APPENDIX A

EMERSON PROPERTY, OAKLEY

Tag no.	Latin name	Common name	Condition	DBH	DBH2	DBH3	DBH4	DBH5	Total Circ.	Suitability	Comments
943	*Juglans hindsii*	black walnut	3	8.0	10.3	11.2	8.2		118.4	Low	large branches broken off, dead; 4 splits at base
944	*Juglans hindsii*	black walnut	3	18.3	9.5				87.3	Low	splits at base, codom; 1 splits again at 5', also codom
945	*Juglans hindsii*	black walnut	1	7.5	13.2				65.0	Low	split at base, 1 lead dead other has few watersrpouts
946	*Juglans hindsii*	black walnut	2	10.2					32.0	Low	leaders broken off (codom at 5'), few healthy branches on one
947	*Juglans hindsii*	black walnut	1	8.6	13.1	9.8	7.9		123.8	Low	multi-trunked at base, poor structure, old and/or severe decline
948	*Juglans hindsii*	black walnut	2	12.3	9.8				69.4	Low	codom at 5' with scaffold branches broken off; top heavy growth
949	*Juglans hindsii*	black walnut	3	17.8					55.9	Low	some large branches broken, lopsided due to 950, but o.k. structure
950	*Juglans hindsii*	black walnut	3	15.2	11.1				82.6	Low	some large branches broken, lopsided due to 949, but o.k. structure
951	*Juglans hindsii*	black walnut	2	27.3					85.8	Low	lopsided growth due to 950; hole drilled through trunk to wrap barb-wire
952	*Juglans hindsii*	black walnut	2	31.3	9.8	7.0			151.1	Low	many large branches and some major limbs broken; thin crown
953	*Juglans hindsii*	black walnut	2	12.1					38.0	Low	large hollow at 1' where codom lead broke off; major branches dead
954	*Juglans hindsii*	black walnut	2	11.2	6.4				55.3	Low	significant lean, split at base, poor structure, epicormic growth
955	*Juglans hindsii*	black walnut	2	9.2					28.9	Low	thin crown, damage at base
956	*Juglans hindsii*	black walnut	2	10.1					31.7	Low	thin crown' split at 7', one leade broken
957	*Juglans hindsii*	black walnut	3	12.1	8.7				65.3	Low	split at 3', one pruned back with no limbs, just watersprouts; top-heavy
958	*Juglans hindsii*	black walnut	2	16.8	48.5				205.1	Low	codom at 2', small lead girdled by barb-wire; major wound scar 1/4 circ of trunk of 2nd lead
959	*Juglans hindsii*	black walnut	2	15.7					49.3	Low	thin, epicormic growth, lean away from 960
960	*Juglans hindsii*	black walnut	2	11.1					34.9	Low	small, leaning away from 961
961	*Juglans hindsii*	black walnut	2	30.1					94.6	Low	codom at 4.5', included bark, some epicormic growth
962	*Juglans hindsii*	black walnut	1	27.3					85.8	Low	codom at 4.5', 1 lead dead, many basal sprouts
963	*Juglans hindsii*	black walnut	2	17.2	11.4	10.0	8.9		149.2	Low	major scaffold branches broken, dead; some epicormic growth
964	*Juglans hindsii*	black walnut	2	12.3	11.5				74.8	Low	large limbs broken, epicormic growth, watersrpouts
965	*Juglans hindsii*	black walnut	2	18.9					59.4	Low	scaffold branch, large limbs broken; thin crown
966	*Juglans hindsii*	black walnut	2	9.3					29.2	Low	broken scaffold branch, hollow at base where split
967	*Juglans hindsii*	black walnut	3	16.6	13.8				95.5	Low	codom at 2', old, but benefit from pruning - structure o.k.
968	*Juglans hindsii*	black walnut	1	18.1					56.9	Low	lead dead, severe decline
969	*Juglans hindsii*	black walnut	3	32.0					100.5	Low	girdled by 4 strands barb-wire, some major branches broken; mult-trunk at 8' with poor attachments
970	*Eucalyptus sp.*	gum	3	11.7	13.1				77.9	Low	split at base, o.k. structure
971	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	3.4	3.9	2.6	2.9	2.6	48.4	Low	o.k. structure; neglected
972	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	7.3					22.9	Moderate	o.k. structure; neglected
973	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	7.2					22.6	Moderate	o.k. structure; neglected
974	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	7.3					22.9	Moderate	o.k. structure; neglected
975	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	8.2					25.8	Moderate	o.k. structure; neglected
976	*Grevillea noel*		4	19.6					61.6	Good	good structure, balance, and vigor
977	*Grevillea noel*		4	17.2					54.0	Good	splits at 7' but good attachment; good structure overall
978	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	12.1					38.0	Moderate	o.k. structure; neglected
979	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	11.1					34.9	Moderate	o.k. structure; neglected
980	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	24.0					75.4	Moderate	o.k. structure; neglected
981	*Populus tomentosa*	Chinese poplar	4	8.7					27.3	Good	crowded by 981, but o.k. structure
982	*Populus tomentosa*	Chinese poplar	4	31.3					98.3	Good	o.k. structure, benefit from cleaning/pruning
983	*Populus nigra* 'Italica'	Lombardy poplar	2	15.0					47.1	Moderate	983 and 984 both dormant and covered with ivy - vigor hard to determine, moderate epicormic growth
984	*Populus nigra* 'Italica'	Lombardy poplar	2	56.3					176.9	Moderate	983 and 984 both dormant and covered with ivy - vigor hard to determine, moderate epicormic growth
985	*Cedrus atlantica*	Atlas cedar	4	30.9					97.1	Good	good structure, healthy tree
986	*Platanus racemosa*	California sycamore	4	21.2					66.6	Good	good structure, benefit from pruning
987	*Platanus racemosa*	California sycamore	4	23.5					73.8	Good	good structure, benefit from pruning
988	*Platanus racemosa*	California sycamore	4	25.4					79.8	Good	good structure, benefit from pruning
989	*Platanus racemosa*	California sycamore	4	23.8					74.8	Good	crown good, dormant but many buds; few small broken branches
990	*Morus alba*	white mulberry	3	21.7					68.2	Moderate	good structure for mulberry
991	*Schinus molle*	California pepper	3	42.7					134.1	Moderate	large hollows at base and at 10' but mostly healed and closed over; crown good (according to residents tree recovering ever since they moved in 12 years ago)
992	*Platanus racemosa*	California sycamore	3	18.1					56.9	Good	
993	*Quercus agrifolia*	coast live oak	4	24.3					76.3	Good	
994	*Morus alba*	white mulberry	3	10.6					33.3	Moderate	
995	*Morus alba*	white mulberry	3	10.3					32.4	Moderate	
996	*Quercus agrifolia*	coast live oak	4	12.6	8.9				67.5	Good	codom at 2'

EMERSON PROPERTY, OAKLEY

Tag no.	Latin name	Common name	Condition	DBH	DBH2	DBH3	DBH4	DBH5	Total Circ.	Suitability	Comments
997	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	11.1					34.9	Moderate	some sprouts; neglected
998	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	8.4					26.4	Moderate	neglected
999	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	11.0					34.6	Moderate	neglected
0	*Platanus racemosa*	California sycamore	2	65.0					204.2	Moderate	some epicormic growth; large wound at major branch attachment
1	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	9.3					29.2	Moderate	neglected
2	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	8.2					25.8	Moderate	neglected
3	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	13.3					41.8	Moderate	neglected
4	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	2	8.6					27.0	Moderate	neglected, die back in center of crown
5	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	14.0					44.0	Moderate	neglected
6	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	10.6					33.3	Moderate	neglected
7	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	11.6					36.4	Moderate	neglected
8	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	9.7					30.5	Moderate	neglected
9	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	11.2					35.2	Moderate	neglected
10	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	9.7					30.5	Moderate	neglected
11	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	8.9					28.0	Moderate	neglected
12	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	3	8.2					25.8	Moderate	neglected
13	*Phoenix canariensis*	Canary Island date palm	4	60.5					190.1	Good	
14	*Pinus radiata*	Monterey pine	3	11.4					35.8	Moderate	significan lean, lead splits into several smaller branches; scaffold branches dead; 25% crown dieback
15	*Pinus sp.*	pine	4	10.2					32.0	Moderate	small branches dieback
16	*Pyrus sp.*	pear	2	9.6					30.2	Low	many wound scars on trunk and scaffold branches; 6" wide trunk scar from 2.5'-4.5
17	*Morus alba*	white mulberry	3	27.3					85.8	Moderate	o.k. structure, lots of watersprouts
18	*Morus alba*	white mulberry	2	8.6	11.7				63.8	Low	trunks split at 1', then rub/fuse at 5', codom; assymetrical due to 017
19	*Morus alba*	white mulberry	2	5.7	7.3				40.8	Low	lopsided, shaded out and leaning due to 018
20	*Washingtonia filifera*	California fan palm	3	7.0					22.0	Good	sheathed to ground
21	*Washingtonia filifera*	California fan palm	3	29.8					93.6	Good	sheathed to ground
22	*Ulmus parvifolia*	Siberian elm	3	28.1					88.3	Moderate	some large branch dieback
23	*Washingtonia filifera*	California fan palm	3	56.5					177.5	Good	sheathed to ground
24	*Ulmus parvifolia*	Siberian elm	3	12.4	10.7	14.3			117.5	Low	significant lean of both leads, codom at 1'; major scaffold branches crossing
25	*Ulmus parvifolia*	Siberian elm	2	8.8					27.6	Low	laying down under 024
26	*Morus alba*	white mulberry	4	31.1					97.7	Moderate	good structure for mulberry, 2 major limbs need removal; some watersprouts
27	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	4	11.4					35.8	Good	cared for - good structure
28	*Prunus cerasifera* 'Atropurpurea'	purple-leaf plum	4	14.1					44.3	Good	cared for - good structure
29	*Cupressus sempervirens*	Italian cypress	4	24.4					76.7	Good	
30	*Cupressus sempervirens*	Italian cypress	4	11.7					36.8	Good	
31	*Morus alba*	white mulberry	3	37.2					116.9	Moderate	good structure, but possible rot at base
32	*Eucalyptus globulus*	blue gum	4	16.9	42.9				187.9	Good	sligt lean, but balanced canopy
33	*Eucalyptus globulus*	blue gum	4	37.0					116.2	Good	leaning into 032 and shaded
34	*Eucalyptus globulus*	blue gum	4	48.0					150.8	Good	slightly assymetrical canopy due to 033; codom
35	*Cinnamomum camphora*	camphor tree	3	8.1	13.8				68.8	Moderate	wound scars on trunk
36	*Eucalyptus sp.*	gum	2	16.6	20.0				115.0	Low	declining
37	*Morus alba*	white mulberry	3	24.2					76.0	Low	lots of weak branch attachments
38	*Eucalyptus globulus*	blue gum	2	55.2					173.4	Low	
39	*Eucalyptus globulus*	blue gum	2	42.0					131.9	Low	very lopsided, leaning; declining

Indigenous species / Heritage tree
Heritage tree
Indigenous species / Protected tree
Protected tree
Not protected

EMERSON PROJECT OFF-SITE AREAS, OAKLEY

Tag no.	Latin name	Common name	Condition	DBH	DBH2	DBH3	DBH4	DBH5	DBH6	DBH7	DBH8	Total Circ.	Suitability	Comments
40	*Juglans hindsii*	black walnut	1	14.0								14.0	Low	040-088 are located along south side of Cypress Road west of Sellers Ave.
41	*Juglans hindsii*	black walnut	1	10.0								10.0	Low	most of these trees are already in decline or are nearing senescence
42	*Prunus amygdalus*	almond	1	9.0								9.0	Low	none would merit preservation with the exception of the group of willows
43	*Juglans hindsii*	black walnut	1	10.0	10.0							20.0	Low	indicated by 055, though they too are in poor condition
44	*Juglans hindsii*	black walnut	1	19.0								19.0	Low	(Most dbh are estimated)
45	*Juglans hindsii*	black walnut	1	15.0								15.0	Low	
46	*Juglans hindsii*	black walnut	3	7.4								7.4	Low	o.k. structure; some basal sprouts
47	*Juglans hindsii*	black walnut	3	3.9	7.0							10.9	Low	o.k. structure; some basal sprouts
48	*Juglans hindsii*	black walnut	3	7.9								7.9	Low	o.k. structure; some basal sprouts; few big branches broken
49	*Juglans hindsii*	black walnut	1	10.0	10.0							20.0	Low	
50	*Juglans hindsii*	black walnut	1	5.0	12.0							17.0	Low	
51	*Juglans hindsii*	black walnut	1	2.0	3.0	3.0	2.0	2.0				12.0	Low	
52	*Juglans hindsii*	black walnut	1	17.0	12.0							29.0	Low	
53	*Juglans hindsii*	black walnut	1	17.0								17.0	Low	
54	*Juglans hindsii*	black walnut	1	14.0								14.0	Low	
55	*Salix laevigata*	red willow	1	24.0	24.0	24.0	18.0	18.0	12.0			120.0	Low	Group of 4, all in decline; largest was tagged and numbers recorded; others are multi-trunked with at least one trunk >12" dbh
56	*Juglans hindsii*	black walnut	2	14.0								14.0	Low	
57	*Juglans hindsii*	black walnut	2	20.0								20.0	Low	
58	*Juglans hindsii*	black walnut	2	14.0	24.0							38.0	Low	
59	*Juglans hindsii*	black walnut	2	24.0	12.0							36.0	Low	
60	*Juglans hindsii*	black walnut	2	4.0	10.0							14.0	Low	
61	*Juglans hindsii*	black walnut	2	16.0								16.0	Low	
62	*Juglans hindsii*	black walnut	2	13.0								13.0	Low	
63	*Juglans hindsii*	black walnut	2	14.0								14.0	Low	
64	*Juglans hindsii*	black walnut	2	12.0								12.0	Low	
65	*Juglans hindsii*	black walnut	2	7.0	4.0							11.0	Low	
66	*Juglans hindsii*	black walnut	2	7.8								7.8	Low	
67	*Juglans hindsii*	black walnut	2	7.0	15.0							22.0	Low	
68	*Juglans hindsii*	black walnut	2	4.0	5.0	3.0						12.0	Low	
69	*Juglans hindsii*	black walnut	2	19.1								19.1	Low	
70	*Juglans hindsii*	black walnut	2	12.0	7.0	9.0	9.0					37.0	Low	
71	*Juglans hindsii*	black walnut	2	10.0	6.0							16.0	Low	
72	*Juglans hindsii*	black walnut	2	12.0	8.0	12.0						32.0	Low	
73	*Juglans hindsii*	black walnut	2	12.0	8.0							20.0	Low	
74	*Juglans hindsii*	black walnut	2	5.0	5.0	3.0	2.0					15.0	Low	
75	*Juglans hindsii*	black walnut	2	8.0								8.0	Low	
76	*Juglans hindsii*	black walnut	2	13.0	12.0							25.0	Low	
77	*Juglans hindsii*	black walnut	2	12.0								12.0	Low	
78	*Juglans hindsii*	black walnut	2	6.4								6.4	Low	
79	*Juglans hindsii*	black walnut	2	6.0	6.0	5.0						17.0	Low	
80	*Juglans hindsii*	black walnut	2	6.0	4.0	4.0	4.0	4.0				22.0	Low	
81	*Juglans hindsii*	black walnut	2	9.0	9.0	9.0						27.0	Low	
82	*Juglans hindsii*	black walnut	2	8.0								8.0	Low	
83	*Juglans hindsii*	black walnut	2	7.0								7.0	Low	
84	*Juglans hindsii*	black walnut	2	5.0	3.0	2.0						10.0	Low	
85	*Juglans hindsii*	black walnut	2	8.0	8.0	8.0	8.0	4.0	4.0	3.0	3.0	46.0	Low	
86	*Juglans hindsii*	black walnut	2	7.0	6.0	6.0	5.0	5.0	5.0			34.0	Low	
87	*Juglans hindsii*	black walnut	2	13.0	9.0	8.0	6.0					36.0	Low	
88	*Prunus amygdalus*	almond	1	11.0								11.0	Low	
89	*Juglans hindsii*	black walnut	3	8.1								8.1	Low	089-097 are located along north side of Cypress Road east of Sellers Ave.
90	*Juglans hindsii*	black walnut	2	13.3	8.9	8.3						30.5	Low	most of these trees are already in decline or are nearing senescence
91	*Juglans hindsii*	black walnut	2	14.4	17.6							32.0	Low	none would merit preservation (most dbh are estimated)
92	*Juglans hindsii*	black walnut	0	22.8								22.8	Low	
93	*Juglans hindsii*	black walnut	2	7.5	7.6	5.6	6.5					27.2	Low	
94	*Juglans hindsii*	black walnut	2	5.1	7.1							12.2	Low	

EMERSON PROJECT OFF-SITE AREAS, OAKLEY

Tag no.	Latin name	Common name	Condition	DBH	DBH2	DBH3	DBH4	DBH5	DBH6	DBH7	DBH8	Total Circ.	Suitability	Comments
95	*Juglans hindsii*	black walnut	2	7.5	13.2	6.4	7.9					35.0	Low	
96	*Juglans hindsii*	black walnut	2	16.4	10.7	9.3						36.4	Low	
97	*Juglans regia*	English walnut	2	8.1	4.0	4.0	4.0					20.1	Low	
98	*Juglans hindsii*	black walnut	2	13.8	12.1	11.9						37.8	Low	mistletoe; lead rotted out
99	*Juglans hindsii*	black walnut	2	10.4								10.4	Low	codom lead dead
100	*Juglans hindsii*	black walnut	2	14.7								14.7	Low	2 major scaffold branches dead
101	*Juglans hindsii*	black walnut	2	13.9								13.9	Low	2 major scaffold branches dead, bad pruning cut
102	*Juglans hindsii*	black walnut	2	10.0	5.0	6.1	5.7					26.8	Low	central lead dead, rotted out
103	*Juglans hindsii*	black walnut	2	10.5								10.5	Low	huge cavity in trunk from base to 2.5'
104	*Juglans hindsii*	black walnut	2	17.5								17.5	Low	
105	*Juglans hindsii*	black walnut	2	8.5	9.9							18.4	Low	major scaffold branches dead
106	*Pinus muricata*	Bishop pine	4	12.1	12.0	8.0	8.0					40.1	Good	
107	*Pinus muricata*	Bishop pine	3	23.6								23.6	Moderate	slight lean
108	*Pinus muricata*	Bishop pine	4	23.5								23.5	Good	
109	*Morus alba*	white mulberry	3	23.0								23.0	Moderate	109-116 not tagged - access blocked on private property but fully visible
110	*unk sp.*		3	6.0								6.0	Moderate	dbh was estimated
111	*unk sp.*		3	6.0								6.0	Moderate	110 and 111 pollarded
112	*unk sp.*			6.0	6.0							12.0		112-116 not tagged - access blocked on private property; dbh was estimated
113	*Juglans hindsii*	black walnut		12.0								12.0		unable to determine condition as view was blocked by fences
114	*Ulmus parvifolia*	Siberian elm		12.0								12.0		112 pruned for clearance; no exceptional specimens
115	*Ulmus parvifolia*	Siberian elm		6.0	8.0	7.0						21.0		
116	*Ulmus parvifolia*	Siberian elm		6.0	7.0	7.0						20.0		

Indigenous species / Heritage tree
Heritage tree
Indigenous species / Protected tree
Protected tree
Not protected

GEOTECHNICAL EXPLORATION

SOUTHERN 140 ACRES, EMERSON PROPERTY

OAKLEY, CALIFORNIA

SUBMITTED

TO

PONDEROSA HOMES

PLEASANTON, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 4603.4.100.01

MARCH 4, 2005

Project No.
4603.4.100.01

March 4, 2005

Mr. Jeff Schroeder
Ponderosa Homes
6671 Owens Drive
Pleasanton, CA 94588

Subject: Emerson Property – Southern 140 Acres
Contra Costa County, California

GEOTECHNICAL EXPLORATION

Dear Mr. Schroeder:

With your authorization, we have conducted a geotechnical exploration for the subject property, located on the north side of Cypress Road in Oakley, California. The accompanying report presents the results of our site explorations and geotechnical recommendations for design of the proposed development. Based on our study, it is our opinion that the currently proposed development is feasible from a geotechnical standpoint provided the recommendations included in this report are followed.

We are pleased to provide our services to you on this project and look forward to consulting further with you and your design team.

Very truly yours,

ENGEO INCORPORATED

FOR Steve Harris, PE
sh/jf:gex

Reviewed by:

Paul C. Guerin, PGE

REGISTERED PROFESSIONAL ENGINEER
PAUL C. GUERIN
2099
Exp. 3/31/05
GEOTECHNICAL
STATE OF CALIFORNIA

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INTRODUCTION

Purpose and Scope

The purpose of this geotechnical exploration was to evaluate the feasibility of site development for residential use and to provide design-level geotechnical recommendations for the proposed development. Our scope of services included the following:

1. Review of published geologic maps and geotechnical reports of the project site and general vicinity.
2. Drilling and sampling of three exploratory borings to depths of 50 feet using rotary wash drilling methods.
3. Advancing 46 cone penetrometer test (CPT) soundings to a depth of up to 50 feet.
4. Laboratory testing of relatively undisturbed and bulk samples of site soils.
5. Engineering analyses.
6. Preparation of this report.

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

Site Location and Description

The subject property consists of approximately 140 acres, located in Oakley, California. The subject property is bound by Sellers Avenue to the east, Cypress Road to the south, a Contra Costa County canal to the north, and an agricultural field to the west as shown on Figures 1 and 2.

The site is nearly square and the topography is generally flat with some slight manmade and natural rises. Existing site elevations range from approximately 7 feet above mean sea level (MSL) to approximately 12 feet above MSL.

The northern and southern majority of the site consists of undeveloped agricultural land which was disced at the time of our exploration. The central eastern portion of the site consists of an east- to west-trending strip of land which varies up to approximately 8 feet higher in elevation than the remainder of the site. An existing driveway, trees, and several residential structures with associated buildings are located in this area. A modular home and a shed are located at the southeast corner of the property. The residences are serviced by a private water well and septic systems. There is a system of irrigation pipelines that run east-west across the southernmost portion, east-west in the central portion of the site, and another that runs north-south approximately thirty feet west of Sellers Avenue. Some abandoned cement pipes were found in the northwest corner of the site. There may be additional piping buried beneath the ground surface in this location.

The Contra Costa County Canal, which borders the property to the north, consists of an approximately 12-foot-high berm and a relatively shallow canal. At the time of our field activities, the flow line in the canal was lower than the ground surface of the subject property.

There has been minor grading on the property to construct roads, dikes, and level areas for buildings and other improvements.

Proposed Development

Although specific development plans have not been prepared as of the date of this report, it is our understanding that the proposed development will consist of single-family residential housing. We anticipate relatively light loadings for the single-family residential structures. Additional improvements will likely consist of streets and underground utility construction. It is our understanding that the site grading for this project will likely include only minor cutting and filling to establish pads and streets.

GEOLOGY

Regional Geology

The site is located at the margin of the Great Valley Geomorphic Province and the Coast Ranges Geomorphic Province. The Great Valley Geomorphic Province consists of an elongated structural trough that has been filled with a sequence of sedimentary deposits ranging from Jurassic to recent in age. In the San Joaquin/Sacramento Delta, sedimentary bedrock is up to six miles in thickness (Atwater, 1982). Geophysical evidence suggests that the Great Valley is underlain at depth with granitic rocks of the Sierra Nevada Province. The adjacent Coast Ranges Geomorphic Province is underlain at depth by Franciscan Assemblage rocks.

The San Joaquin/Sacramento Delta lies at the junction of the Sacramento and San Joaquin rivers, the two major waterways that drain the Central Valley. This area currently consists of a braided pattern of brackish to freshwater tidally-influenced channels and sloughs encircling a series of low-lying islands.

Site Geology

The near-surface sediments across the site consist of eolian (wind-blown), lacustrine (lake-deposited) and alluvial deposits. These sediments are typically irregularly-stratified, poorly consolidated deposits of clay, silt, sand, and minor gravel.

The surficial geology of the Delta has been mapped by Atwater (1982) as shown in Figure 3. The geology of the surficial deposits on the site has been largely influenced by changes in sea level during the Late Pleistocene. Most of the high-standing areas in the site vicinity are the crests of old sand dunes and are underlain by sandy eolian deposits deposited during the later part of the most recent low-stand of sea level. According to Atwater, these eolian deposits formerly extended across most of the surface of the site but are now buried in low-lying areas by younger sediments.

The alluvial fan of Marsh Creek extends across the site and Atwater's map and text imply that alluvium of Marsh creek typically overlies the sandy eolian deposits in low-lying areas. According to Atwater (1982), much of the alluvium in the site vicinity consists of gray silt and clay deposited in near sea-level flood basins and ephemeral lakes.

Soil Survey Maps

The site is mapped by the Soil Survey of Contra Costa County (1977) as shown in Figure 5. The predominant soil across the southern and western portions of the site is Sycamore Silty Clay Loam (So). Marcuse Clay (Mb), Dehli Sand (DaC), and Piper Loamy Sand (Pe) are mapped along the eastern side of the parcel.

Regional Seismicity

The site is located in an area of moderate seismicity. No faults, active or otherwise, are known to come to the ground surface within or very close to the project site (Figure 4). In addition, no portion of the site is mapped within any Seismic Special Study Zone. The closest active strike-slip fault with surface expression, as identified by the California Division of Mines and Geology, is the Concord fault located approximately 19 miles to the west. Other nearby active strike-slip faults include the Calaveras fault, 22 miles to the southwest; the Hayward fault, 32 miles to the west; and the San Andreas fault, 50 miles to the west.

The Midland fault was mapped by Jennings (1994) approximately 1.5 miles east of the site and by Bortugno (1991) approximately 3 miles east of the site. An unnamed queried fault, assumed to be the Midland fault, is also mapped by the City of Oakley (Oakley General Plan 2020 adopted December 2002) to be approximately 2 miles east of the site. Crane (1971) mapped a postulated concealed splay of the Midland fault across the subject site. There is no evidence that supports that Crane's postulated concealed splay of the Midland fault has a risk of surface rupture on the subject site. The Midland fault is thought to be a part of the Coast Ranges – Sierran Block (CRSB) fault system.

Because of the presence of active faults in the region, the area is considered seismically active. Numerous small earthquakes occur every year in the region, and large (>M7) earthquakes have been recorded and can be expected to occur in the future. Table I lists distances to known active and potentially-active strike-slip faults located within 100 kilometers of the site and summarizes their estimated earthquake magnitudes and UBC Classification. Figure 4 shows the approximate locations of these faults and significant historic earthquakes recorded within the San Francisco region.

A significant seismic source listed in Table I and shown on Figure 4 is the Coast Ranges – Sierran Block (CRSB) boundary, mapped along the west side of the Central Valley. As the name implies, it is the approximate boundary between the actively uplifting east side of the Coast Range crustal block and the west side of the Sierran crustal block. The west side of the Sierran block is covered by the thick veneer of sedimentary rock that fills the Central Valley. The boundary between the two blocks is thought to be a zone of tectonic crustal shortening and compression. The compression is structurally accommodated by a series of generally west-dipping buried or "blind" thrust faults, along which Coast Range rocks have been thrust eastward over Central Valley sediments. According to Wakabayashi and Smith (1994), the CRSB can be divided into a series of segments that are thought to be seismically independent. The local segments of the CRSB, according to the California Division of Mines and Geology (Peterson, et al., 1996) pass through the area in the approximately vicinity of the site. Since the CRSB thrust faults are thought to exist entirely in the subsurface, the exact location of the boundary, that is a "surface fault trace," can not be defined. However, it should be assumed that an earthquake on the local segment of the CRSB could occur in the subsurface below or a few miles east or west of the site.

The historic seismicity of the eastern Coast Ranges includes a number of earthquakes in the M 5.0 to M 6.8 range, including the M 6.3 1889 Antioch-Collinsville earthquake, the M 6.4-6.8 1892 Vacaville-Winters earthquakes, and the M 6.0-6.5 1983 Coalinga earthquakes. Based on historic seismicity and segment lengths, it is believed that the CRSB is generally capable of producing M 6.0-6.8 earthquakes. The actual location of a possible earthquake epicenter in the CRSB can not be easily estimated, so the maximum ground shaking levels at the site could vary as described above. However, the recurrence interval for the local segments of the CRSB is believed to be in the range of 500 to 650 years (Peterson, et al. 1996), much longer than the for the nearby strike-slip faults (commonly 150 to 250 years).

Since the CRSB faults are not known to extend to the ground surface, the State of California has not defined Earthquake Fault Hazard Zones around the postulated traces.

FIELD EXPLORATION

Previous Site Studies

A preliminary geotechnical exploration was prepared by ENGEO in 1999 for the Cypress Corridor Planning area which included the subject property. Three test borings, two cone penetrometer test soundings, four test pits, and laboratory testing on selected soil samples were conducted as part of the 1999 study. The locations of the exploratory data points are shown on the Site Plan, Figure 2, and the boring logs, CPT data, test pit logs, and associated laboratory test results are presented in Appendix C.

Field Exploration

Our field exploration was conducted between June 14 and July 16, 2004. The field exploration consisted of drilling three borings to a maximum depth of about 50 feet and advancing 46 Cone Penetration Tests (CPTs) to a maximum depth of about 50 feet at the approximate locations shown on Figure 2. The borings and CPTs were approximately located by pacing from existing features. Boring logs and CPT logs are presented in Appendix A. The borings were drilled using a CME45 drill rig using the rotary wash method of drilling. Soil samples recovered during drilling were from Standard Penetration Tests and a 3-inch O.D. California-type split-spoon sampler fitted with 6-inch-long brass liners. In addition, three shallow borings were drilled next to CPTs 8, 9, and 10 to verify that the sensitive fines/organic material encountered in the upper ten feet did not contain peat.

The Standard Penetration Test (SPT) requires a 140-pound hammer with a 30-inch drop. The drilling rig used for this sampling was equipped with a safety hammer that was raised using a rope and cathead. The penetration of the 3-inch-diameter sampler and the SPT sampler into the native materials was field recorded as the number of blows needed to drive the sampler eighteen inches in 6-inch increments. Field blow count results on the boring logs were recorded as the number of blows required for the last one foot of penetration. The blow counts recorded in the field for the last one foot of penetration are presented on the boring logs without correction factors.

Borings were logged in the field by an ENGEO Geologist. The field logs were then used to develop the boring logs as shown in Appendix A. The logs depict subsurface conditions within the borings for the date of drilling; however, subsurface conditions will vary with time.

The CPT soundings were performed utilizing a 20-ton compression-type cone with a 15-square-centimeter (cm^2) base area, an apex angle of 60 degrees, and a friction sleeve with a surface area of 225 cm^2. The cone, connected with a series of rods, is pushed into the ground at a constant rate. Cone readings are taken at approximately 5-cm intervals with a penetration rate of 2 cm per second in accordance with ASTM D-3441. Measurements include the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and pore pressure (U) (Robertson and Campanella, 1988).

Laboratory Testing

Following the exploratory drilling, the collected soil samples were reexamined in our laboratory to confirm field classifications. Representative soil samples recovered during drilling were tested for the following physical characteristics:

Characteristic	Test Method	Location of Results Within this Report
Natural Unit Weight and Moisture Content	ASTM D-2216	Boring Logs in Appendix A
Incremental Consolidation	ASTM D-2435	Appendix B
Gradation	ASTM D-422	Appendix B
Plasticity Index	ASTM D-4318	Appendix B
Sulfate Testing	EPA 300M	Appendix B

Individual test results are presented in Appendices A and B as noted above.

Subsurface Stratigraphy

In general, approximately the southern one-third of the site consists of 12 to 23 feet of medium stiff to stiff clayey material. Several CPT probes identified areas of interbedded organic material varying up to 5.5 feet thick in the upper 10 feet. Therefore, three additional borings were drilled in the location of CPTs 8, 9, and 10 and samples were collected within the zones of material identified by the CPTs as being organic material. The samples collected within the zones of material identified in the CPTs as being organic material were observed to be clayey without organic material. The clayey soils are underlain primarily by loose to very dense sandy material to a depth of approximately 30 to 45 feet, which was then underlain primarily by very stiff clayey material to the maximum depth explored of 50 feet.

The northern approximately two-thirds of the site consists primarily of 3 to 6 feet of medium stiff to stiff clayey material underlain by loose to dense sandy material with variable interbedded layers of clayey material to approximately 35 to 40 feet, then underlain primarily by clayey material with minor interbedded sand layers.

Plasticity Index (PI) determinations of the on site clayey material ranged from 24 to 42. These are indications that the native soil materials have a high to very high shrink-swell potential.

A detailed description of the subsurface stratigraphy is shown on the exploratory boring logs and CPT results presented in Appendix A at each location explored.

Existing Canal Embankment Fills

The northern portion of the site is bordered by a Contra Costa Canal which consists of a levee type of embankment on the subject property. The side slopes are typically inclined at between

1.5:1 to 2:1 (horizontal:vertical). Based on examination of exposed soils, the levees appear to have been constructed from nearby native soils consisting mainly of sands and clays. Based on experience with other levees in the delta, it should be assumed that the fill comprising the existing levees is uncompacted and relatively weak. The levees are likely founded directly on the surface of the native soils. The composition of the levee foundation soils varies across the site depending on the local conditions that existed at the time the levees were constructed in the early 1900s.

Groundwater

Groundwater was estimated in all three of our borings based on the moisture content in the samples at a depth of about 4 to 6 feet below the existing ground. Due to the method of drilling for this exploration, the exact depth to groundwater could not be determined. In 1999, the borings encountered groundwater at depths ranging from 3 to 9 feet below the existing ground surface. In addition, the groundwater elevation may fluctuate due to seasonal variation in rainfall, tidal action or other factors not in evidence at the time of our exploration.

DISCUSSION

Seismic Hazards

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, ground lurching, soil liquefaction, and lateral spreading. These hazards are discussed in the following sections.

Based on topographic and lithologic data, risk from earthquake-induced lurch cracking, regional subsidence or uplift, or tsunamis, is considered low at the site.

Ground Rupture. The site is not located within a State of California Earthquake Fault Hazard Zone and no known active faults cross the site. Therefore, it is our opinion that ground rupture is not likely to occur at the site.

Ground Shaking. A major potential seismic hazard at the site is strong ground shaking from a nearby moderate to major seismic event. The degree of shaking is dependent on the magnitude of the event, the distance to its epicenter, and the nature of the underlying soils.

For this site, a probabilistic seismic hazard evaluation has been conducted. In this analysis, a computer program (EZ-FRISK) was used to model the seismic setting of the region and is able to explicitly account for uncertainty relating to:

- Earthquake magnitude
- Rupture length
- Location of rupture
- Maximum possible earthquake magnitude
- Attenuation relationship

The program calculates, by summation from earthquake sources, the total average annual expected number of occurrences of an acceleration greater than each of several specified values. Once the annual probability is obtained, the probability of the level of ground acceleration being exceeded over a specified time period can be calculated by the following equation:

$$P = 1 - e^{-pT}$$

in which P is the probability of the level of ground acceleration being exceeded in T years and p is the annual probability of exceedence.

Using this method, a horizontal ground acceleration of 0.31g is predicted to have a 10 percent probability of exceedence in a 50-year design life, which is equivalent to an earthquake with an average return period of 475 years. This acceleration is the design level of ground shaking for liquefaction analyses.

Liquefaction. As noted in ENGEO (1999), the most significant geotechnical concern to be considered in the design of the project is the presence of liquefiable dune sand in the near subsurface across most of the site. During earthquakes, ground shaking may cause a loss of strength in cohesionless saturated soils. This process is called liquefaction, and it occurs most commonly in loose sands associated with a high water table. For this exploration, we evaluated the liquefaction potential of the silts and sands by measuring penetration resistance using the Standard Penetration Test (SPT) and the cone penetrometer. The test borings and cone penetrometer soundings typically found that the some sand found in the upper 5 to 15 feet is potentially liquefiable with some potentially liquefiable layers extending to 25 feet. Deeper layers are dense and generally not liquefiable. The data from SPT measurements and cone penetrometer soundings was evaluated based on the work of Seed and Idriss (1982) and Robertson and Wride (1997).

Ground Failure Assessment. In addition to the above analysis, we also evaluated the capping effect of overlying non-liquefiable soils. In order for liquefaction induced ground surface disruption to occur, the pore water pressure generated within the liquefied strata must exert a sufficient force to break through the overlying soil and vent to the surface resulting in sand boils or fissures.

In 1985, Ishihara presented preliminary empirical criteria to assess the potential for ground surface disruption at liquefiable sites based on the relationship between thickness of liquefiable sediments and thickness of overlying non-liquefiable soil. A more recent study by Youd and Garris (1995) expanded on the work of Ishihara to include data from over 308 exploratory borings, 15 different earthquakes, and several ranges of recorded peak ground acceleration.

The eastern central portion of the site contains potentially liquefiable soils that are relatively shallow and are not generally capped by a sufficient thickness of non-liquefiable soils to prevent venting. Therefore in our opinion, there is a relatively high probability that sands susceptible to liquefaction would be significantly vented to the surface during a design-level seismic event.

The detrimental effects of liquefaction-induced ground disruption and settlement can be reduced by densifying the loose, near-surface sands. The liquefaction potential of the loose sands can be reduced by several methods: (1) removing and recompacting, (2) in-place vibro compaction, (3) the installation of stone columns, and (4) deep dynamic densification. The viability of each of these methods depends on the consistency, depth and grain size of the liquefiable soils. If removal and replacement is selected, it may be sufficient to remove only the upper portion of the sand layer such that the liquefiable layer thickness is reduced and the upper capping layer thickness is increased. In this case, some settlement potential will remain, but the potential for damaging ground disruption will be mitigated. Based on our analyses, the required subexcavation depth varies from 6 to 12 feet.

The approximate thickness of liquefiable material, approximate liquefaction induced settlement, and approximate limit of ground rupture from liquefaction is shown on Figures 7, 8, and 9, respectively, within the Appendix A.

Liquefaction-Induced Settlement. Densification of the sandy soils above and below groundwater levels can result in settlement/densification during an earthquake. Since some of the granular materials were characterized as loose to medium dense and liquefiable, we estimate that up to 2.5 inches of settlement may occur as a result of densification. After mitigation to address liquefaction-induced ground failure, the thickness of liquefiable deposits will be reduced. Post mitigation, depending on the method selected, we estimate from zero to 2 inches of settlement may occur as a result of densification. We recommend that structures be designed to accommodate 1 inch of differential settlement over the length of the structure (SCEC, 1999).

Seiches. Tsunamis are long sea waves, generated by displacements associated with earthquakes. These waves can reach great heights when they encounter shallow water. The subject development will be located far enough from the ocean that the potential for tsunamis affecting it is remote.

Seiches are caused by seismically-induced ground motions imparted to bodies of water which cause them to oscillate from side to side. Seiches may occur in the waters within the Contra Costa Canal located adjacent to the site during strong earthquakes. However, we believe there is sufficient freeboard within the canal to contain any seiche action.

Lateral Spreading and Earthquake-Induced Landsliding. Lateral spreading and earthquake-induced landsliding involve lateral ground movements caused by earthquake vibrations. These lateral ground movements are often associated with a weakening or failure of an embankment or soil mass overlying a layer of liquefied sands. The potential for lateral spreading appears to be high where existing levees and embankments are underlain at shallow depth by liquefiable sands such as along the northern property boundary. The likelihood of damage from such an occurrence will depend on the relative grades and distance between the canal and project improvements.

Compressible Soils

Another geotechnical concern is the presence of layers of compressible clay in the near subsurface of the site. We conducted consolidation tests on three samples of the weaker clay and found them to be overconsolidated; therefore, at least at these locations, the potential for consolidation settlement of the clay soils is limited under moderate loads.

If soft or organic soils are encountered during grading, we recommend removal of soft or organic material, where practical, prior to filling.

Ground Subsidence

Ground subsidence is a widespread phenomenon throughout the Delta. Possible causes of subsidence have been categorized as related to shallow and deep phenomena. Shallow subsidence is primarily related to a reduction in the thickness of the alluvium by oxidation of the surficial organic peaty soils. Other causes of shallow subsidence or depletion are wind erosion and consolidation following the lowering of the water table. No areas of major amounts of shallow subsidence are mapped within the boundaries of the subject property.

Deep subsidence is thought to result from such factors as natural gas and groundwater withdrawal and tectonic subsidence related to movements of the earth's crust. Rates of deep subsidence have been estimated at 0.006 inch per year in the Delta (1 inch in more than 160 years).

Flooding

The site is not located within a 100-year flood plain, as shown on Figure 6. According to FEMA, the water surface elevation during peak runoff from the 100-year flood is +7.0 feet. This finding is based on the results of a 1986 study performed by the Corps of Engineers. The subject site elevations are currently between approximately +7 and +12 feet.

Corrosive Soils

Five samples of the near-surface soil were collected from the subject site and tested for sulfate content. The following table, based on the 1997 UBC (Table 19-A-4), provides guidelines to mitigate sulfate attack on concrete in contact with soil.

Sulfate Exposure	Sulfate In Soil		Cement Type	Maximum Water- Cement Ratio	Minimum Strength F'$_c$ (psi)
	mg/kg	(%)			
Negligible	0 – 1,000	0.00 – 0.10	II*	0.55*	3,000*
Moderate	1,000 – 2,000	0.10 – 0.20	II, IP(MS), IS(MS)	0.50	4,000
Severe	2,000 – 20,000	0.20 – 2.00	V	0.45	4,500
Very Severe	Over 20,000	over 2.00	V plus pozzolan	0.45	4,500

Note: * Recommended Practice to Minimize Attack on Concrete by Sulfate Soils and Water provided by the Cement Technical Committee of California.

The samples collected yielded sulfate concentrations ranging from 129 to 5,850 mg/kg. As shown in the above Table 19-A-4 of the 1997 UBC, these soils are classified in the negligible to severe sulfate exposure range. Due to the minimal amount of soil tested, it is recommended that additional samples be collected from the building pads once grading of the site is complete to determine the cement type, maximum water-cement ratio, and minimum strength for the concrete to mitigate sulfate attack. As an alternative, all foundations for the project can be designed to resist the severe sulfate-exposure condition.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on our studies, we conclude that the proposed project is feasible from a geotechnical standpoint. It is our opinion that the geotechnical concerns can be mitigated if our recommendations are incorporated in the design of the project. The primary geotechnical concern that will need to be considered in the design of the project includes the presence of liquefiable sands. Secondary geotechnical concerns include potential consolidation settlement of relatively thin clay soils, and the presence of expansive and corrosive surface soils. Liquefaction and consolidation settlement can be most effectively addressed during site grading; the detrimental effects of expansive and corrosive soils should be mitigated through proper foundation design.

We anticipate that the most economical method for mass grading is the use of conventional earth-moving equipment and dewatering. Caution must be exercised when excavations are performed near the canal levees to avoid destabilizing them.

In order to perform grading using conventional equipment, dewatering may be required when excavations extend below the level of the groundwater surface and particularly when excavations extend through the clayey cap into sandy soils below groundwater.

Liquefaction Mitigation

The test borings and CPTs typically found that generally the upper 5 to 15 feet of soil on site contains loose sands which have the potential to liquefy. Liquefaction-induced settlement and surficial ground rupture may be experienced during a large seismic event. The liquefiable sands will require mitigation prior to construction of improvements. Park areas and open space areas will not require mitigation. The approximate extent of the project that will require liquefaction mitigation is shown on Figure 9.

The liquefaction potential of the loose sands can be reduced by several methods: (1) removing and recompacting, (2) in-place vibro compaction, (3) the installation of stone columns, and (4) deep dynamic compaction. The viability of each of these methods depends on the consistency, depth and grain size of the liquefiable soils. Based on our preliminary cost evaluation, the least expensive methods will be either (1) removal and recompaction of the upper portion of the sands as described above in the Discussion section, or (2) deep dynamic compaction, which consists of dropping a 10-to 30-ton weight from 50 to 100 feet above the ground in a 7- to 20-foot grid. The actual extent of removal and recompaction or deep dynamic compaction required will be determined by ENGEO once the final grading plan is prepared.

To help minimize the extent of liquefaction mitigation, the project Civil Engineer should raise the final surface grades within the zone identified on Figure 9. Conversely, areas with significant cuts may result in insufficient capping to prevent surface manifestation of liquefiable sands.

As an alternative, the proposed residential structures could be designed to accommodate the expected liquefaction-induced settlement. However, sufficient capping of the potentially liquefiable material will be needed to prevent surface manifestation of the sand. In general, this will require site grades to be raised to approximately 5 feet above existing grades. In addition, the associated underground utilities will require flexible connections and adequate fall to accommodate the expected settlement.

Demolition and Stripping

Grading should begin with the removal of existing structures and associated foundation systems, any buried pipes, septic tanks, leach fields, irrigation lines, debris piles, designated fences, trees and associated root systems, and any other deleterious materials. Underground structures that will be abandoned or are expected to extend below proposed finished grades should be removed from the project site.

All vegetation in areas to be graded should also be removed as necessary for project requirements. The depth of removal of these materials should be determined by ENGEO at the time of grading. Evaluation of unsuitable deposits should be performed during grading and may include sampling and laboratory analyses.

Tree roots should be removed to a depth of at least 3 feet below original grades. The organically contaminated materials should not be used in proposed building pads or pavement areas. The organics should be stockpiled and may be used in landscape areas or may be off hauled. Any debris found within any areas to be graded should be removed.

The actual depth of removal should be determined in the field by a representative of ENGEO based on actual conditions encountered during the site grading. Excavations resulting from demolition and stripping below design grades should be cleaned to a firm undisturbed, non-yielding soil surface as determined by ENGEO.

As an alternative to stripping of organic material, agricultural fields and/or fallow open fields may be cut/harvested as low to the ground as possible and as close to the time of grading as practical. The organic material should be hauled off site or to landscaping areas subject to approval by the landscape architect. The remaining stubs of the crops/grass and roots then may be thoroughly disced into the underlying soil providing the organic content of the resulting soil does not exceed 3 percent organic content.

All backfilling of depressions resulting from demolition, stripping, or removal of tree root bulb excavations, should be observed by ENGEO. ENGEO should be notified prior to the backfill of any depression to observe the backfill operations. Tree removal should be monitored by ENGEO on a part-time basis, with full-time observation of the backfill operations.

Existing Fill Removal

All stockpiles and fills associated with dikes, roads, and structures should be treated as nonengineered fill. These materials should be subexcavated and reworked as engineered fill provided the materials are free of deleterious matter.

Soft and Compressible Material

As previously discussed, significant layers of compressible clay and peat were not encountered within our borings and CPTs. However, if encountered during grading, they should be removed and replaced with engineered fill.

Subgrade Preparation

After the method of liquefaction mitigation has been implemented, the site has been properly cleared, stripped and necessary excavations have been made, a minimum of the upper 12 inches should be scarified, moisture conditioned, and compacted in accordance with the recommendations presented below in the "Fill Placement" section prior to replacing and recompacted any overlying soils as engineered fill. Except for landscaping areas, the site should be underlain by a minimum thickness of 24 inches of moisture conditioned and compacted engineered fill. The compaction recommendations for the preparation of existing soil to prepare for fill placement are the same as those for engineered fill, as described in a subsequent section of this report.

Selection of Materials

With the exception of organically contaminated soil containing more than 3 percent organics, the site soils are suitable for use as engineered fill. The Geotechnical Engineer should be informed when import materials are planned for the site. Import materials should conform to Section 2.02B of Part I in the Guide Contract Specifications and must be approved by the Geotechnical Engineer. A sample of such material should be submitted to the Geotechnical Engineer for evaluation by laboratory testing prior to delivery at the site.

Treatment of Over-Optimum Soil Moisture Conditions

Subsurface material being placed as engineered fill may contain an over-optimum moisture content. Within the building pads and streets, it is recommended that the material be placed in thin lifts over large areas to allow the material to dry prior to placing additional fill. The time needed for the material to dry will be dependent on the amount of moisture in the material and weather conditions at the time of grading. Based on our experience with similar grading projects, over optimum moisture conditions should not delay the grading process.

In our opinion, highly organic (greater than 3 percent organics) and wet soils should be removed prior to placement of fill. Wet soils will require aeration before being used in filling. Soils that are not suitable for use as engineered fill may be placed in nonstructural fills such as parks.

Over-optimum moisture conditions on street subgrades can be treated by either ripping the subgrade and letting it dry out; removing the wet material and replacing it with drier material; or removing 12 inches of wet material, placing, and backfilling the excavation with Class II aggregate base rock.

Placement of Fill

Areas to receive fill should be scarified to a depth of 12 inches, moisture conditioned and recompacted to provide adequate bonding with the initial lift of fill. All fills should be placed in thin lifts. The lift thickness should not exceed 8 inches or the depth of penetration of the compaction equipment used, whichever is less. Track rolling to compact faces of slopes is not acceptable; slopes should be overfilled and cut back to design grades.

Cut-Fill Transition Lots and Cut Lots

Some lots may be traversed by a cut-fill transition. In general, cut portions of transition lots should be overexcavated to the greater of the depth of fill on the lot or 3 feet and replaced with properly compacted engineered fill. Cut lots should be overexcavated to provide a blanket of at least 24 inches of engineered fill as described above.

Lots traversed by significantly different material types, such as sand and expansive clay, should also be made more uniform. These lots should be treated in a similar manner as cut-fill transition lots by overexcavating to a depth of 3 feet and replacing the material with properly compacted engineered fill.

Monitoring and Testing

The Geotechnical Engineer's representative should be present during all phases of grading operations to observe demolition, site preparation, and grading operations. The following compaction recommendations should be used for the placement and compaction of fills:

1. Moderately to highly expansive soils (P.I. greater than 12) to be used as fill should be compacted as follows: Within the upper 5 feet of finished grade, these fill materials should be moisture conditioned to at least 5 percentage points above optimum moisture content and compacted to between 87 and 92 percent relative compaction. At depths below 5 feet of finished grade, these fill materials should be moisture conditioned to at least 3 percentage points above optimum moisture content and compacted to between 90 and 95 percent relative compaction.

2. Non- to low-expansive soil (P.I. less than or equal to 12) to be used as fill should be compacted a minimum of 92 percent of the maximum dry density at a minimum moisture content of 2 percentage points above optimum.

Relative compaction refers to in-place dry density of the fill material expressed as a percentage of the maximum dry density as determined by ASTM D-1557 (latest edition). Optimum moisture is the moisture content corresponding to the maximum dry density.

It is important that all site preparation, including demolition and stripping, is done under the observation of a Geotechnical Engineer's field representative and should be carried out according to the requirements contained in the Guide Contract Specifications in Appendix D.

Foundation Design

The major consideration in foundation design at the site is the swelling potential of the on-site soils. The effects of expansion must be minimized by the choice of a proper foundation system. In order to reduce the effects of the potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. It is recommended that the proposed residential structures be founded on a Post-Tensioned Mat Slab Foundation. The recommendations that follow are intended for construction on level pads.

Post-Tensioned Mat Design Criteria

Provided the surface soil materials are compacted as recommended in this report, a post-tensioned foundation system can be used to support the proposed residential buildings.

The following recommendations are based upon the characteristics of the expansive clayey material located at the site. If sandy material is used to establish the subgrade for the building pads, less stringent design parameters may be acceptable for the proposed mat foundations. Once the grading is complete, the building pads should be evaluated by ENGEO to determine if following recommendations are appropriate.

Post-tensioned mats should be designed according to methods recommended in the Post Tensioning Institute "Design and Construction of Post-Tensioned Slabs-on-ground, Second Edition," dated 1996. The soil design parameters are presented below. These parameters should be confirmed following the completion of mass grading.

Center Lift Condition:

Edge Moisture Variation Distance, e_m = 5.0 feet
Differential Soil Movement, y_m = 3.2 inches

Edge Lift Condition:

Edge Moisture Variation Distance, e_m = 4.0 feet
Differential Soil Movement, y_m = 1.4 inches

The post-tensioned mats should be designed to impose a maximum allowable bearing pressure of 1,000 pounds per square foot (psf) for dead-plus-live loads. This value may be increased by one-third when considering total loads including wind or seismic loads. A minimum mat thickness of 12 inches is recommended. Depending on the method of liquefaction mitigation, the foundations may need to be designed to resist up to 1 inch of differential settlement across the length of individual structures. The minimum soil backfill height against the mat at the perimeter should be 6 inches. The actual thickness of the mat should be determined by the project structural engineer using the above mentioned criteria.

Subgrade Treatment for Post-Tensioned Mat Foundations. The subgrade material under post-tensioned mats should be uniform. The top 12 inches of pad subgrade should be moisture conditioned to a moisture content of at least 5 percentage points above optimum if expansive soils are present. The subgrade should be thoroughly soaked prior to placing the concrete. The subgrade should not be allowed to dry prior to concrete placement.

Where floor coverings are anticipated, we recommend that the concrete be underlain by a tough, vapor retarder at least 10 mils thick (Section 2.05D, Part I of Guide Contract Specifications) to minimize moisture transmission through the mat. All joints and penetrations of the vapor retarder medium should be sealed. If a sand cushion is not used between the vapor retarder and the mat, the vapor retarder thickness should be increased to 20 mils through the use of a thicker single sheet or two 10-mil layers.

Foundation subgrade soils should be protected from seepage by providing impermeable plugs within utility trenches as described in the "Utilities" section of this report.

Secondary Slab-on-Grade Construction. This section provides guidelines for secondary slabs such as porch slabs, exterior patio slabs, walkways, driveways and steps. Secondary slabs-on-grade should be constructed structurally independent of the foundation system. This allows slab movement to occur with a minimum of foundation distress. Where slab-on-grade construction is anticipated, care must be exercised in attaining a near-saturation condition of the subgrade soil before concrete placement.

Slabs-on-grade should be designed specifically for their intended use and loading requirements. Some of the site soils have a high expansion potential; therefore, cracking of conventional slabs should be expected in the future. As a minimum requirement, slabs-on-grade should be reinforced and provided with frequent control joints to reduce and control the cracking. The Structural Engineer should design the reinforcement, which in our opinion, should consist of a minimum of No. 3 bars spaced 12 inches on center each way. In our experience, welded wire mesh is not sufficient to control slab cracking.

Secondary slabs-on-grade should have a minimum thickness of 4 inches. A 4-inch-thick layer of clean, crushed rock or gravel should be placed under all concrete slabs.

Retaining Walls

Unrestrained drained retaining walls, less than 10 feet in vertical height, constructed on level ground may be designed for active lateral fluid pressures determined as follows:

Backfill Slope Condition (horizontal:vertical)	Active Pressure (pound per cubic foot (pcf))
Level	50
4:1	55
3:1	60
2:1	70

Passive pressures acting on foundations and keyways may be assumed as 250 pounds per cubic foot (pcf) provided that the area in front of the retaining wall is level for a distance of at least 10 feet or three times the depth of foundation and keyway, whichever is greater. The upper one foot of soil should be excluded from passive pressure computations unless it is confined by pavement or a concrete slab.

The friction factor for sliding resistance may be assumed as 0.30. It is recommended that retaining wall footings be designed using an allowable bearing pressure of 2,000 pounds per square foot (psf) in firm native materials or fill. Appropriate safety factors against overturning and sliding should be incorporated into the design calculations.

The Geotechnical Engineer should be consulted on design values where surcharge loads, such as from automobiles, are expected or where a downhill slope exists below a proposed wall.

All retaining walls should be provided with drainage facilities to prevent the build-up of hydrostatic pressures behind the walls. Wall drainage may be provided using a 4-inch-diameter perforated pipe embedded in Class 2 permeable material (Part I of Guide Contract Specifications, Section 2.05B), or free-draining gravel surrounded by synthetic filter fabric. The width of the drain blanket should be at least 12 inches. The drain blanket should extend to about one foot below the finished grades. As an alternative, prefabricated synthetic wall drain panels can be used. The upper one foot of wall backfill should consist of on-site clayey soils. Collector perforated pipes should be directed to an outlet approved by the Civil Engineer. Subdrain pipe, drain blanket and synthetic filter fabric should meet the minimum requirement as listed in Part I of the Guide Contract Specifications.

All backfill should be placed in accordance with recommendations provided above for engineered fill. Light equipment should be used during backfill compaction to minimize possible overstressing of the walls.

Sound Walls

Sound walls should be founded on a pier-and-grade-beam foundation in accordance with the recommendations presented in the following recommendations.

Pier design and construction criteria are as follows:

Pier diameter:	Minimum 12 inches.
Pier depth:	Minimum 10 feet deep.
Maximum allowable skin friction:	500 pounds per square foot (psf). This value may be increased by one-third when considering seismic or wind loads. Exclude the upper 24 inches from pier load capacity computations.
Minimum pier spacing:	3 pier diameters, center-to-center. Where closer spacings are unavoidable, the piers should be designed with a reduced skin friction of 330 psf.

An equivalent fluid weight of 250 pounds per cubic foot acting on 1½ times the pier diameter may be used to evaluate passive resistance. The passive pressure may be increased by one-third for transient loads such as wind or seismic.

The expansive soils may exert upward pressure on the base of wall panels. The potential uplift pressure can be neglected if a 2-inch void form is utilized at the base of the panels. Otherwise, the panels should be designed for an uplift pressure of 2,000 psf. These design guidelines assume the subgrade soils are well over optimum moisture at the time of concrete placement. Under no circumstance should the grade beams be cast upon dry, desiccated soil.

The Structural Engineer should design the pier reinforcement, but, as a minimum, at least two No. 4 rebars should extend the full length of each pier.

Preliminary Pavement Design

Based on field explorations and our experience on neighboring sites, we estimate that clayey surface soils will have a resistance ("R") value of 5 and the sandy will have an R value of 20. However, additional R-value tests should be performed prior to final pavement design on the actual exposed subgrade soils at the site. The following preliminary pavement sections have been determined for Traffic Indices of 5, 6 and 7 according to the method contained in Topic 608 of Highway Design Manual by CALTRANS (revised August 5, 1988).

CLAYEY SOIL - R-VALUE 5

Traffic Index	Pavement Section	
	AC (in.)	AB (in.)
5.0	3.0	10.0
6.0	3.5	13.0
7.0	4.0	16.0

SANDY SOIL - R-VALUE 20

Traffic Index	Pavement Section	
	AC (in.)	AB (in.)
5.0	3.0	8.0
6.0	3.5	10.0
7.0	4.0	12.0

AC is asphaltic concrete
AB is aggregate base Class 2 Material with minimum R = 78

The above pavement sections are based on assumed Traffic Indices and not an equivalent wheel load analysis developed by a traffic study. The actual subgrade material should be tested for R-values at the completion of rough grading.

Pavement materials and construction should conform to the specifications and requirements of the Standard Specifications by the Division of Highways, Department of Public Works, State of

California, latest edition, and Contra Costa County requirements and the following minimum requirements.

- All clayey pavement subgrades should be scarified to a depth of 12 inches below finished subgrade elevation, moisture conditioned to at least 3 percentage points above optimum moisture, and compacted to at least 92 percent relative compaction and in accordance with City and County requirements. Granular subgrades should be compacted to at least 95 percent relative compaction, at a moisture content of at least 2 percentage points above optimum.

- Subgrade soils should be in a stable, non-pumping condition at the time aggregate base materials are placed and compacted.

- Adequate provisions must be made such that the subgrade soils and aggregate base materials are not allowed to become saturated.

- Aggregate base materials should meet current Caltrans, City and County requirements for Class 2 aggregate base and should be compacted to at least 95 percent of maximum dry density.

- Asphalt paving materials should meet current Caltrans specifications for asphalt concrete.

- All concrete curbs separating pavement and irrigated landscaped areas should extend into the subgrade and below the bottom of adjacent aggregate base materials. In addition, an edge of pavement drain or cut-off should be installed to intercept water infiltrating the aggregate base.

Due to the clayey nature of the site soils, it is our opinion that the subgrade soils for pavement areas should be tested utilizing ASTM test methods (ASTM D-1557 and ASTM D-2016). This will allow for control of moisture in the subgrade, which is critical for clayey (expansive) soils.

<u>Drainage</u>

The building pads must be positively graded at all times to provide for rapid removal of surface water runoff from the foundation systems and to prevent ponding of water under floors or seepage toward the foundation systems at any time during or after construction. Ponded water will cause undesirable soil swell and loss of strength.

Ponding of storm water must not be permitted on the building pads during prolonged periods of inclement weather. As a minimum requirement, finished grades should have slopes of at least 3 to 5 percent within 7 feet from the exterior walls at right angles to them to allow surface water to drain positively away from the structures. For paved areas, the slope gradient can be reduced to 2 percent. All surface water should be collected and discharged into the storm drain system. Landscape mounds must not interfere with this requirement. Sufficient area drains should be constructed around the residential buildings to remove excessive surface water.

All roof storm water should be collected and directed to downspouts. Storm water from roof downspouts should be directed to a solid pipe that discharges to the street or to an approved outlet.

Requirements for Landscaping Irrigation

Vegetation should not be planted immediately adjacent to structures. If planting adjacent to the buildings is desired, we recommend using plants that require very little moisture with drip irrigation systems.

Sprinkler systems should not be installed where they may cause ponding or saturation of foundation soils within 5 feet of the walls or under structures. Ponding or saturation of foundation soils may cause soil swell, consequent loss of strength, and movements of the foundation and slabs.

Irrigation of landscaped areas should be strictly limited to that necessary to sustain vegetation. Excessive irrigation could result in saturating, weakening, and possible swelling of foundation soils. The Landscape Architect and prospective owners should be informed of the surface drainage requirements included in this report.

If, at any time, the drainage or irrigation requirements cannot be followed, it is very important that the foundation soils be protected from adverse wetting caused by poor drainage. This can be accomplished by installing a perimeter subdrain.

Utilities

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

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

Care should be exercised where utility trenches are located beside foundation areas. Utility trenches constructed parallel to foundations should be located entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. Utility companies and Landscape Architects should be made aware of this information.

Utility trenches in areas to be paved should be constructed in accordance with Contra Costa County requirements. In addition, all materials used for trench backfill should be in conformance with the Standard Plans and Specifications by Contra Costa County. Compaction of trench backfill by jetting should not be allowed at this site. If there appears to be a conflict between County or other agency requirements and the recommendations contained in this report, this should be brought to the Owner's attention for resolution prior to submitting bids.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

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

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

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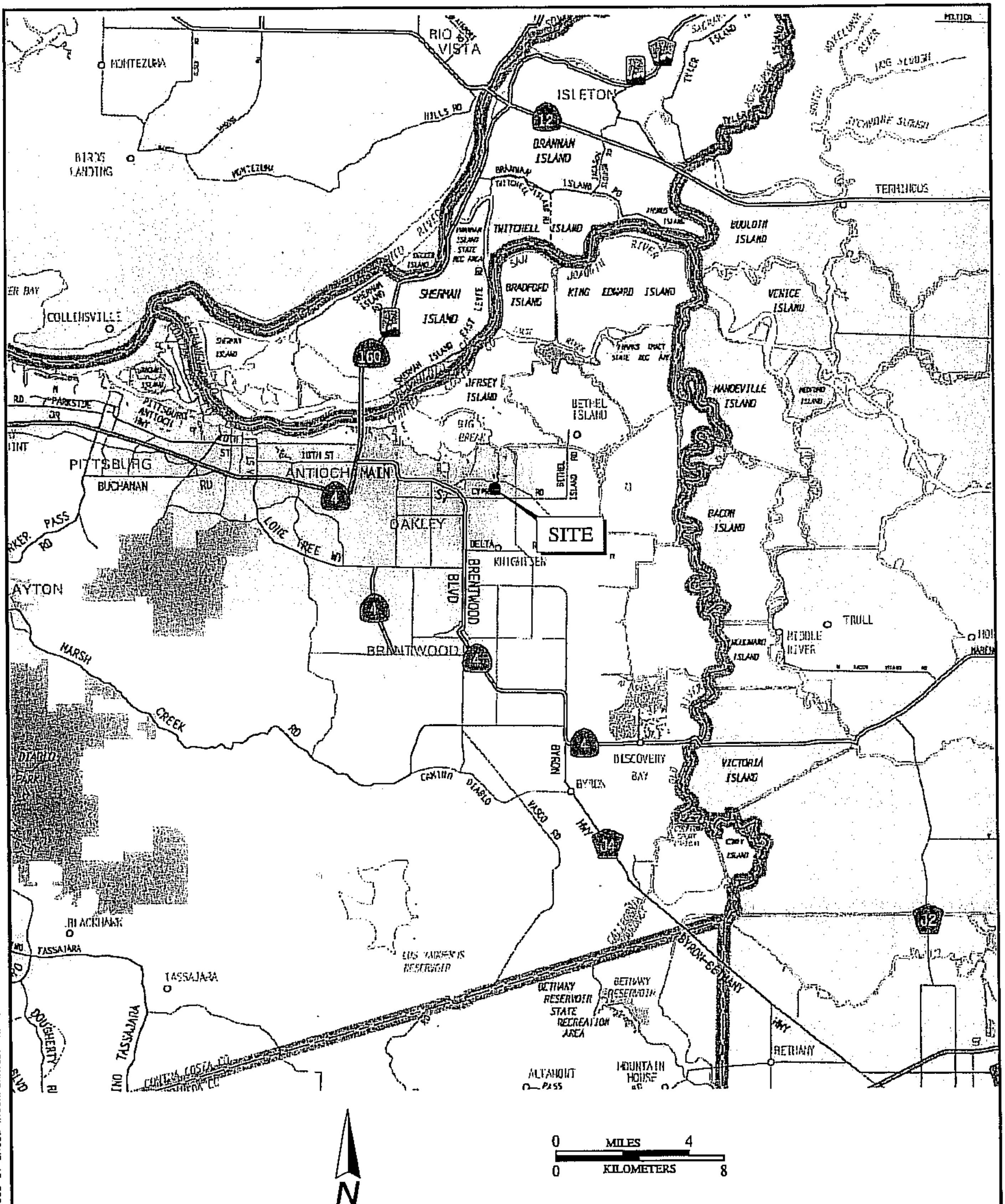
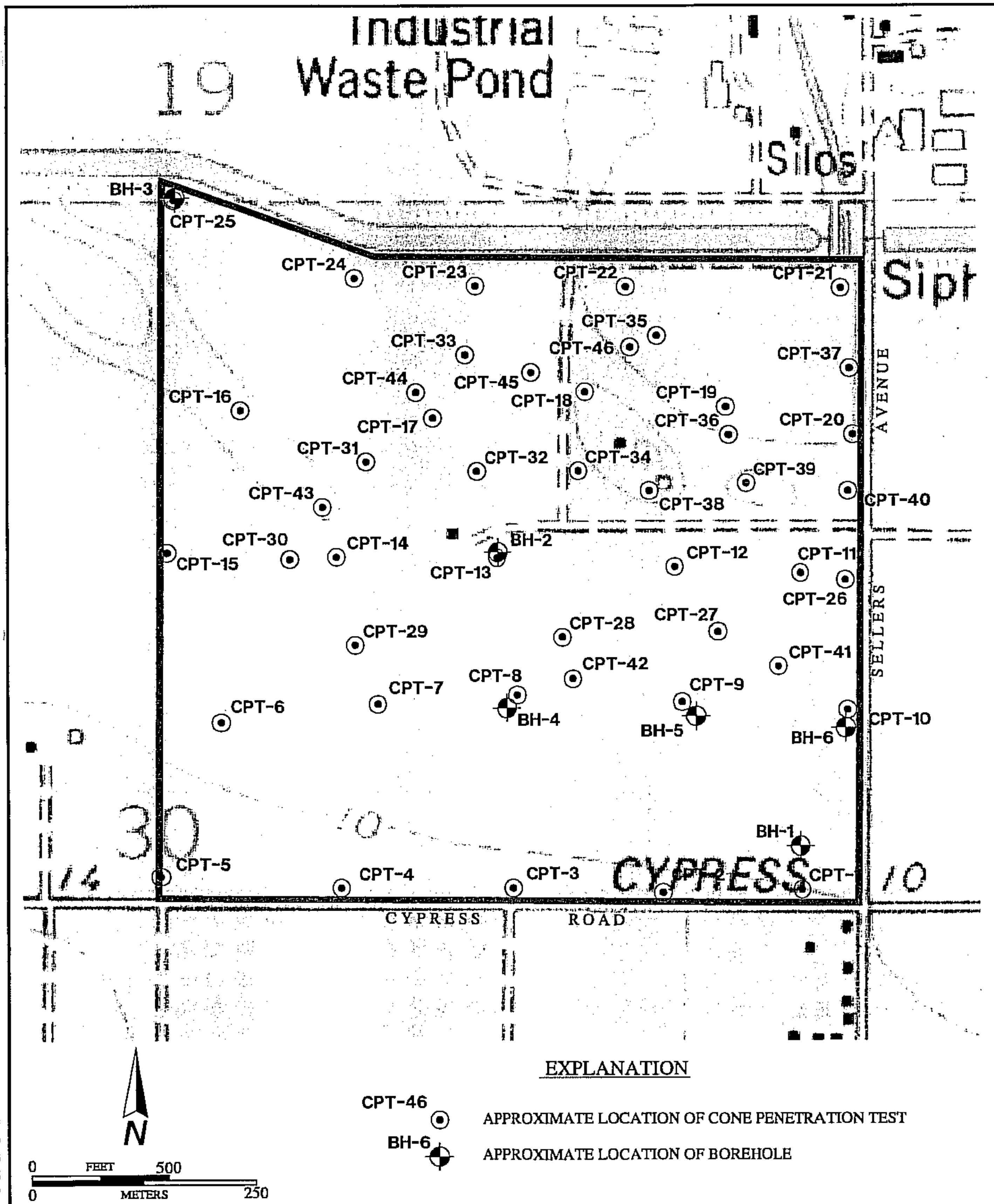
LIST OF FIGURES AND TABLE



BASE MAP SOURCE: THOMAS BROTHERS

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	SITE VICINITY MAP EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: PC / CHECKED BY: JT	FIGURE NO. 1

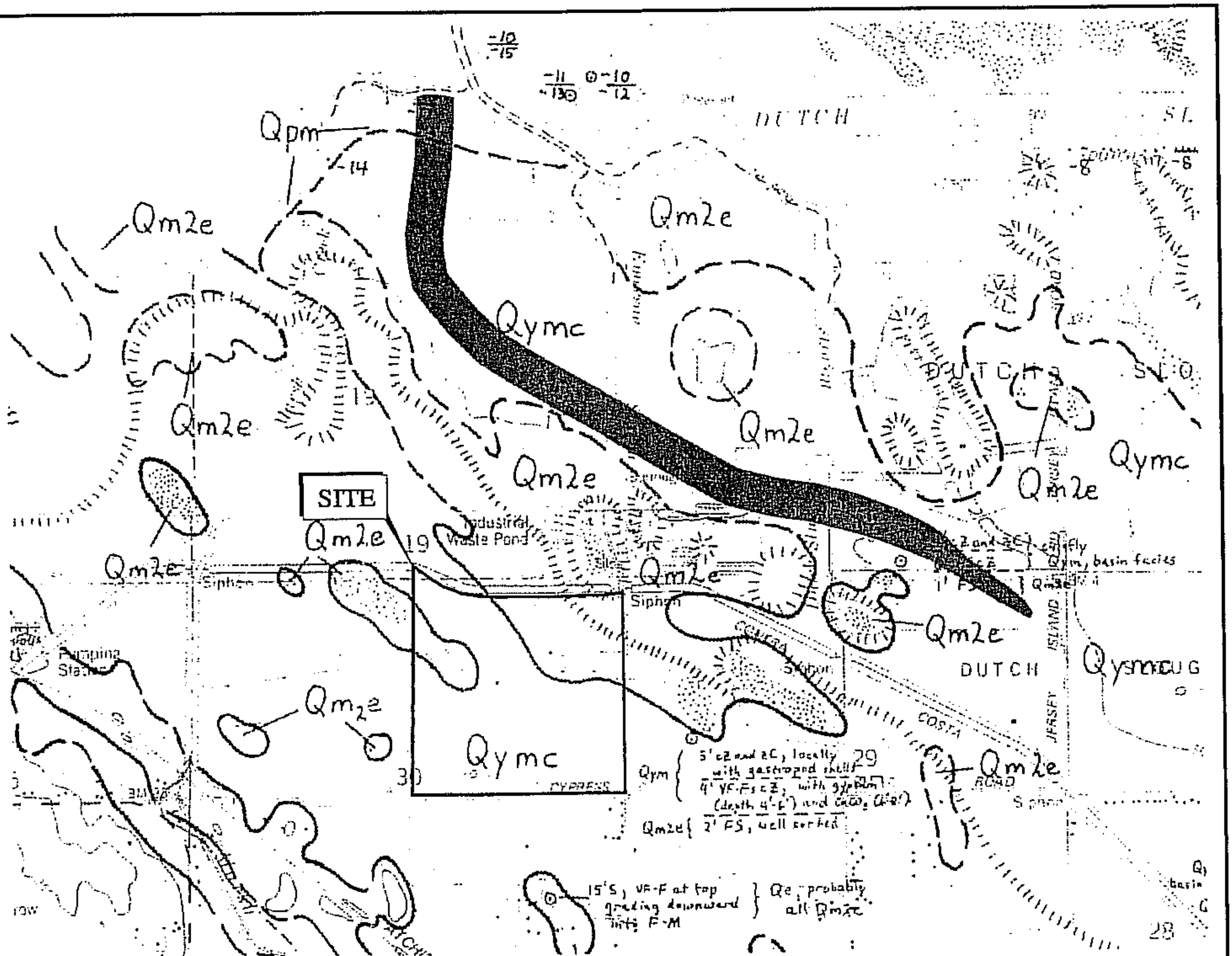
ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE: U.S.G.S.

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	SITE PLAN EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: PC CHECKED BY: JT	FIGURE NO. 2

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

Qpm PEAT AND MUD OF TIDAL WETLANDS AND WATERWAYS (HOLOCENE)

Qm2e EOLIAN DEPOSITS OF UPPER MEMBER OF THE MODESTO FORMATION (UPPER PLEISTOCENE)

Qymc YOUNGER ALLUVIUM OF MARSH CREEK AND VICINITY (HOLOCENE AND UPPER PLEISTOCENE)

IIIIIIIII LANDWARD MARGIN OF TIDAL WETLAND AT LOW RIVER STAGES CIRCA 1850, QUERIED WHERE LOCATION MAY ERR BY MORE THAN 1000 FEET

INFERRED APPROXIMATE FORMER LOCATION OF DUTCH SLOUGH

N

0 MILE .5

0 KILOMETER 1

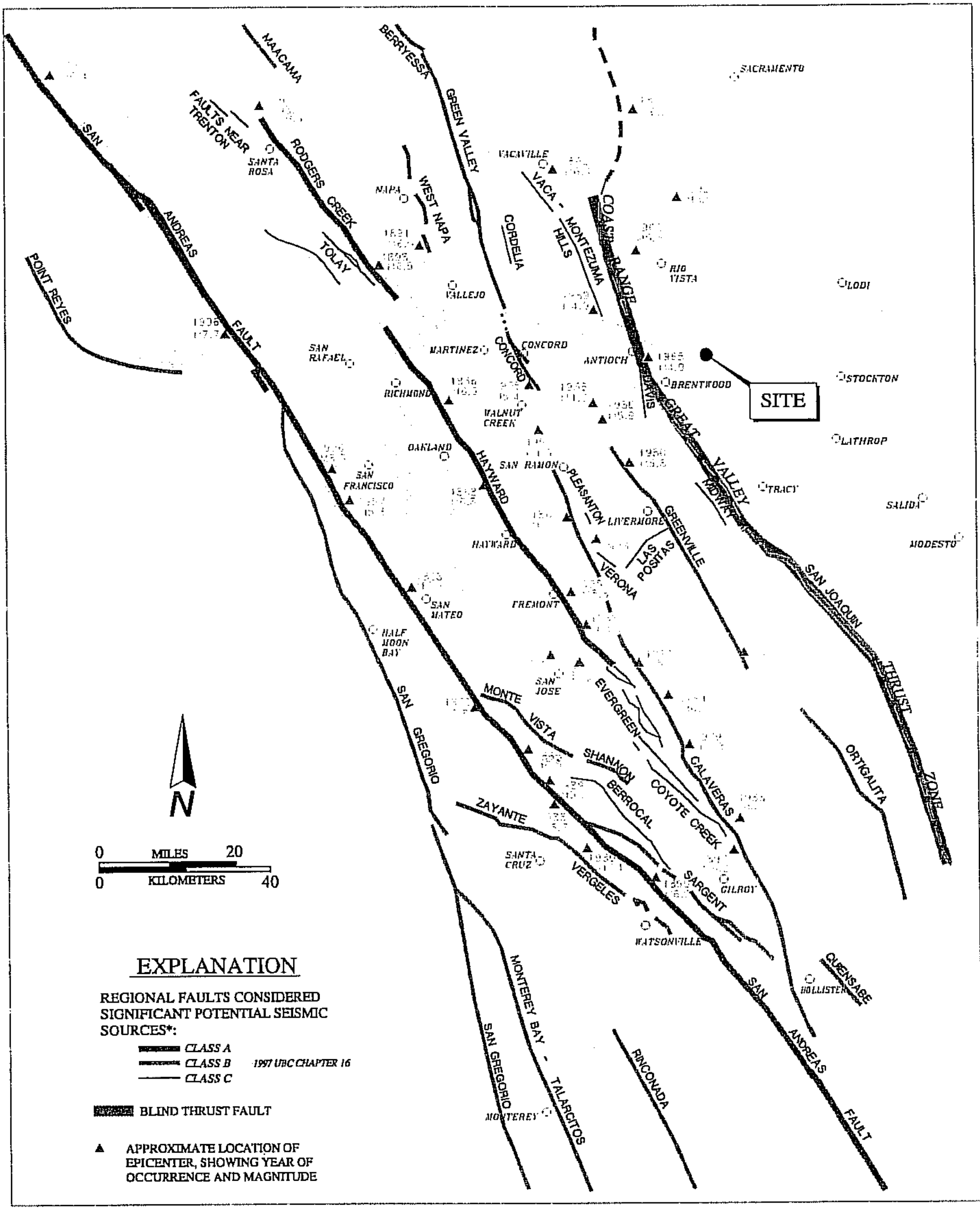
BASE MAP SOURCE: ATWATER, 1982

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

GEOLOGIC MAP
EMERSON PROPERTY
OAKLEY, CALIFORNIA

PROJECT NO.: 4603.4.100.01		FIGURE NO.
DATE: MARCH 2005		3
DRAWN BY: CLL	CHECKED BY: JT	

ORIGINAL FIGURE PRINTED IN COLOR



*BASED ON USGS OPEN FILE 96-706

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	REGIONAL FAULTING AND SEISMICITY EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: CLL / CHECKED BY: JT	FIGURE NO. 4

ORIGINAL FIGURE PRINTED IN COLOR

EXPLANATION

CbA	CAPAY CLAY, WET, 0 TO 2% SLOPES	Rd	RINDGE MUCK
DaC	DELHI SAND, 2 TO 9% SLOPES	Rh	RYDE SILT LOAM
Ea	EGBERT MUCKY CLAY LOAM	Sa	SACRAMENTO CLAY
Kb	KINGILE MUCK	Se	SHIMA CLAY
Mb	MARCUSE CLAY	So	SYCAMORE SILTY CLAY LOAM
Pe	PIPER LOAMY SAND	Sp	SYCAMORE SILTY CLAY LOAM, CLAY SUBSTRATUM
Ph	PIPER FINE SANDY LOAM		

N

0 MILES .5

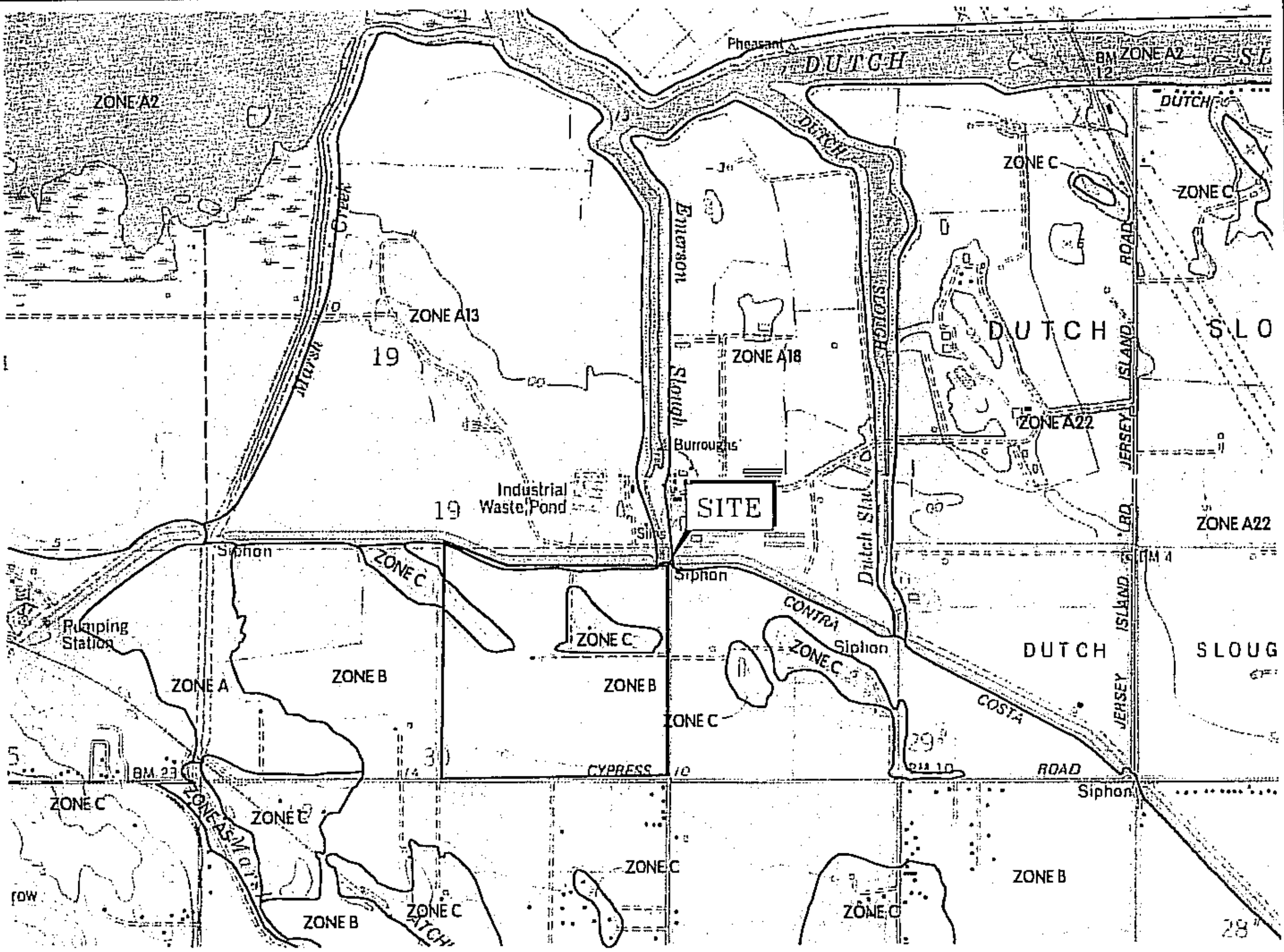
0 KILOMETERS 1

BASE MAP SOURCE: USDA

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SOIL SURVEY MAP
EMERSON PROPERTY
OAKLEY, CALIFORNIA

PROJECT NO.: 4603.4.100.01		FIGURE NO. 5
DATE: MARCH 2005		
DRAWN BY: CLL	CHECKED BY: JT	



KEY TO MAP

500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	
Zone Designations	ZONE A1 / ZONE A5
100-Year Flood Boundary	ZONE B
500-Year Flood Boundary	
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

0 MILE .5
0 KILOMETER 1

EXPLANATION OF ZONE DESIGNATIONS

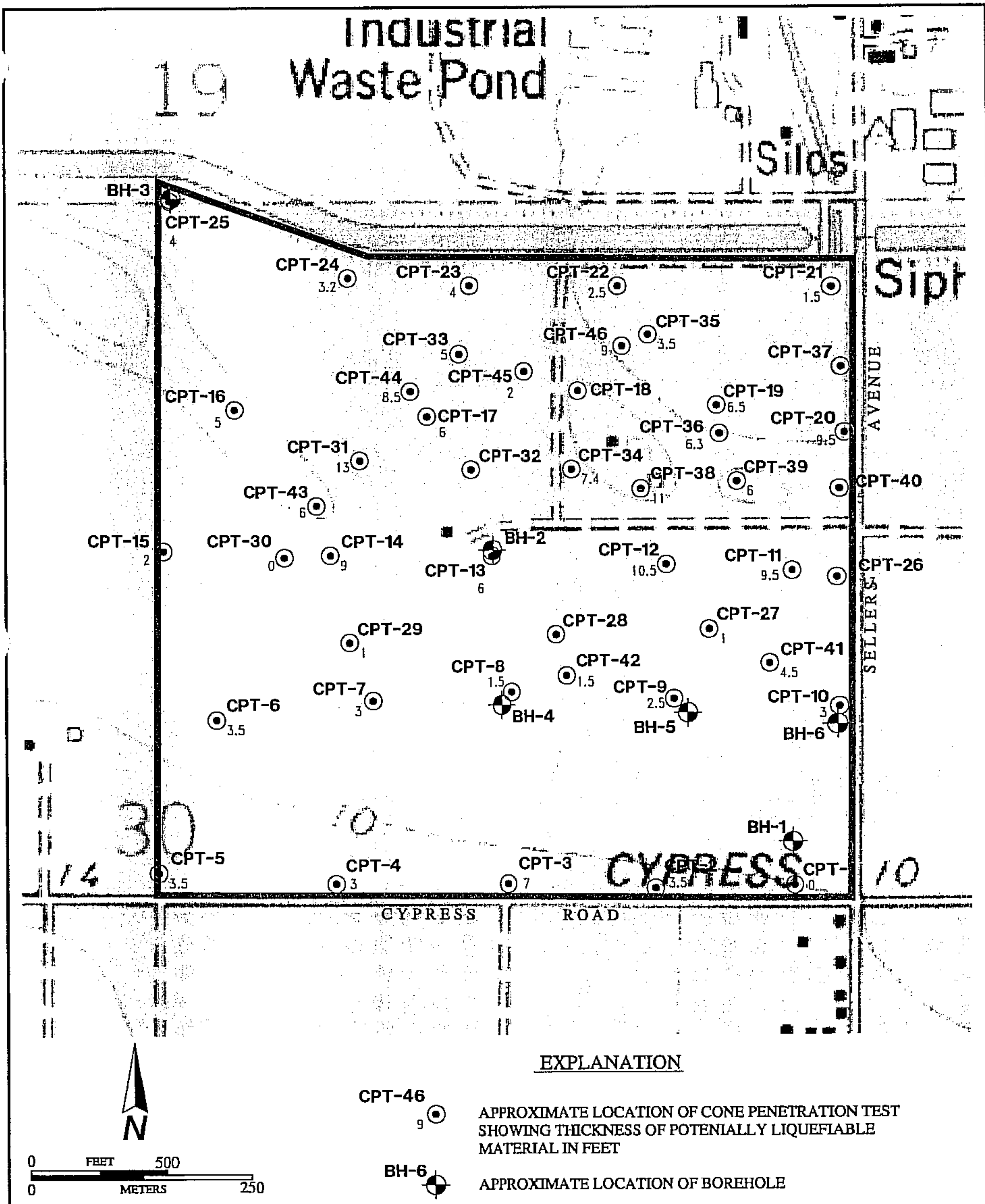
ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)

N

BASE MAP SOURCE: FEMA

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	FLOOD ZONE MAP EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: SRP CHECKED BY: JT	FIGURE NO. 6

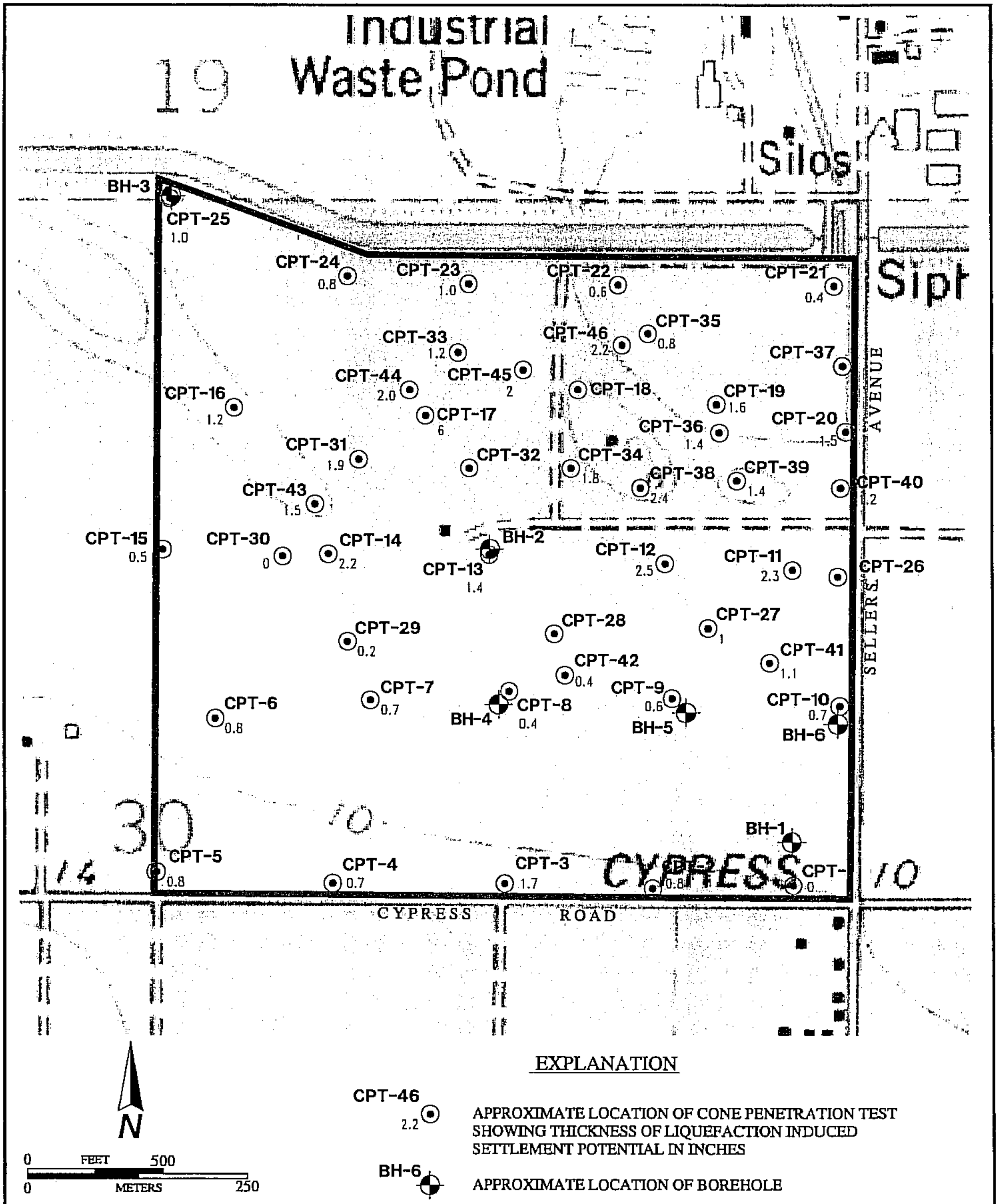
ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE: U.S.G.S.

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	APPROXIMATE THICKNESS OF LIQUEFIABLE MATERIAL EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: PC CHECKED BY: JT	FIGURE NO. 7

ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE: U.S.G.S.

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	APPROXIMATE LIQUEFACTION INDUCED SETTLEMENT EMERSON PROPERTY OAKLEY, CALIFORNIA	PROJECT NO.: 4603.4.100.01 DATE: MARCH 2005 DRAWN BY: PC CHECKED BY: JT	FIGURE NO. 8

ORIGINAL FIGURE PRINTED IN COLOR

TABLE I
REGIONAL ACTIVE AND POTENTIALLY ACTIVE FAULTS

FAULT NAME	Approximate Distance[1] mi (km)	Maximum Moment Mag.[2]	UBC Fault Type[3]
GREAT VALLEY	5.2 (8.3)	6.7	B, omitted
GREENVILLE	12.0 (19.3)	6.9	B
CONCORD – GREEN VALLEY	17.6 (28.3)	6.9	B
CALAVERAS	21.3 (34.2)	6.8	A
HAYWARD	30.3 (48.8)	7.1	A
WEST NAPA	32.8 (52.8)	6.5	B
ROGERS CREEK	36.4 (58.5)	7.0	A
HUNTING CREEK – BERRYESSA	42.4 (68.2)	6.9	B
FOOTHILLS FAULT SYSTEM	47.3 (76.1)	6.5	C
SAN ANDREAS (1906)	48.8 (78.6)	7.9	A
MONTE VISTA - SHANNON	49.3 (79.4)	6.5	B
SAN GREGORIO	53.1 (85.4)	7.3	A
ORTIGALITA	54.2 (87.2)	6.9	B
SARGENT	60.8 (97.8)	6.8	B
POINT REYES	61.8 (99.4)	6.8	B

1 – SOURCE: EQFAULT (2003)
2 – SOURCE: CDMG, OPEN-FILE REPORT 96-08.
3 – SOURCE: ICBO, 1998

16 FAULTS FOUND WITHIN THE SPECIFIED 100-KILOMETER SEARCH RADIUS

APPENDIX A

[illegible]
[illegible]
[illegible]
[illegible]

[illegible]
[illegible]

KEY TO BORING LOGS

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

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE: 200, 40, 10, 4

CLEAR SQUARE SIEVE OPENINGS: 3/4", 3", 12"

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

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

CONSISTENCY

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

MOISTURE CONDITION

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

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

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

SAMPLER SYMBOLS

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

LINE TYPES

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

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

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

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

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 14, 2004 SURFACE ELEVATION: Approx. 12 feet (4 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Disced field / loose soil.				
	1	1-1		SILTY CLAY (CL), very dark greyish brown, very stiff, moist, with sand.	22			11.1
5	2	1-2		SILTY CLAY (CL), olive brown, medium stiff, wet. ∇	7	*0.75	85	35.7
10	3	1-3		SILTY CLAY (CL), mottled, brown, grey and olive, medium stiff, saturated, trace sand.	6	*1.0	95	29.3
15	4, 5		NR	No sample recovered.	15			
20	6	1-4		SILTY SAND (SM), light olive brown, medium dense, saturated, trace clay, fine-grained sand.	19		103	22.1
25	7, 8	1-5		SILTY CLAY (CL) with sand, mottled olive grey and reddish brown, oxidation, stiff, saturated, with sand.	11			37.2
30	9			SILTY SAND (SM), light olive brown, very dense, saturated, medium- to fine-grained sand, some silt.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-1

DATE OF BORING: June 14, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		1-6		79		113	17.7
	10						
35			SAND (SP), greyish brown, very dense, saturated, medium- to fine-grained sand, some silt.				
	11	1-7		54		115	17.1
	12						
40		1-8		40			21.0
	13						
45			CLAYEY SILT(ML) with sand, olive greyish brown, very stiff, saturated, fine-grained sand.				
	14	1-9		19			26.7
	15						
50			CLAYEY SILT (ML), olive grey, hard, saturated, some oxidation.				
		1-10		31	*3.0	102	24.4
	16		Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				
55	17						
60	18						

ENGEO BORELOG 46034100001 EMERSON PROPERTY.GPJ 3/10/05

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-1

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 / SURFACE ELEVATION: Approx. 12 feet (4 meters) / DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil.				
				SAND with silt (SM), olive brown, medium dense, moist to wet, fine-grained sand.				
	1	2-1			15			7.3
5				No sample recovered.	12			
				∇				
	2			SILTY SAND (SM), light olive brown, loose, saturated, some silt, fine-grained sand.				
		2-2			7			17.2
10	3							
		2-3			6			22.0
	4							
15				SILTY SAND (SM), light olive brown, medium dense, saturated, fine-grained sand, trace clay.				
	5	2-4			15			31.4
20	6			SAND (SP) with silt, light olive brown, medium dense, saturated, fine-grained sand.				
		2-5			20			24.6
	7							
25				SILTY SAND (SM), olive brown, dense, saturated, fine-grained sand.				
	8	2-6			34		112	19.0
30	9			SILTY SAND (SM), olive brown, very dense, fine-grained sand.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-2

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 12 feet (4 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		2-7			92		112	19.1
35	10, 11	2-8		SILTY CLAY (CL) with sand, olive brown, very stiff, saturated, fine-grained sand.	27			24.7
40	12, 13	2-9		SILTY SAND (SM), olive brown, very dense, saturated, fine-grained sand.	74		112	18.6
45	14	2-10		SILTY CLAY, olive, hard, saturated.	32	*4.0	98	27.1
50	15	2-11		CLAYEY SILT (ML), olive brown, hard, saturated.	49	*4.5	105	22.6
55, 60	16, 17, 18			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				

ENGEO BORELOG 4603410001 EMERSON PROPERTY.GPJ 3/10/05

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-2

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 10 feet (3 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil, dry grass. SAND with some silt (SP), light brown, loose to very loose, dry.				
				CLAY (CH), dark grayish brown, oxidation, stiff, wet, some silt.				
	1	3-1		∇	10	*3.0	90	30.2
5	2							
10	3			SILTY SAND (SM), brown, loose, saturated, loose medium- to fine-grained sand.				
		3-2 3-3		CLAY with some silt (CL), olive brown, medium stiff to stiff, saturated, trace sand.	9	*1.5	95 107	17.7 21.4
15	4			CLAY (CL), mottled brown and gray, stiff, saturated, trace silt.				
	5	3-4			12	*2.0	85	36.3
20	6	3-5		SAND with silt (SM), yelloish brown, medium dense, saturated, fine-grained sand.	24		111	18.9
25	7 8	3-6		SAND with silt (SP), olive gray to olive brown, very dense, saturated, fine-grained sand.	66			17.0
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-3

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-3

ENGEO_BORELOG 460341000I EMERSON PROPERTY.GPJ 3/10/05

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 10 feet (3 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
	10	3-7			50			23.2
35	11	3-8		SAND with silt (SM), olive brown, medium dense, saturated, fine-grained sand.	26			22.0
40	12, 13	3-9		SILT (ML) with sand, olive brown, medium dense, saturated, fine-grained sand, trace clay.	14			31.4
45	14	3-10		SILTY CLAY (CL), light olive brown, very stiff, saturated, trace sand.	23			23.9
50	15	3-11		SILTY CLAY (CL), olive brown, hard, saturated.	52		110	20.7
55, 60	16, 17, 18			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 4 feet during drilling.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-3

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-3

ENGEO BORELOG 4603410001 EMERSON PROPERTY.GPJ 3/10/05

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated.				
5				∇				
	2	4-1 4-2		CLAY with some sand (CL), olive brown, medium stiff, saturated.	7	*1.0 *0.75		
10	3	4-3 4-4		SANDY CLAY (CL), olive brown, stiff, saturated, fine-grained sand.	9	*1.0 *1.5		
				Bottom of boring at approximately 10 feet. Groundwater encountered at 5.5 feet during drilling.				
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-4

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-4

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, stiff, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated. ▽				
5		5-1 5-2			7	*1.0 *1.0		
	2			Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15	5							
20	6							
	7							
25	8							
30	9							

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, very stiff, moist, trace sand.				
	1	6-1			7	*3.5		
5				▽CLAY with some silt (CL), dark olive brown, medium stiff, wet to saturated.				
		6-2				*0.75		
		6-3			5	*0.75		
	2			Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-6

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-6

ENGEO_BORELOG 4603.4.100.01 EMERSON.GPJ 3/10/05

LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
I	0	0.00	0	50	0	pass
2	3.5	14-17.5	0.84	14	3.5	pass
3	5	7-12	1.2	7	7	borderline
	1	13 – 14	0.24			
	1	19 – 20	0.24			
4	1	15 – 16.5	0.24	15	3	pass
	2	22 – 23.5	0.48			
5	3.5	23 – 27.5	0.84	23	3.5	pass
6	3.5	17 – 20.5	0.84	17	3.5	pass
7	3	12.5 -15.5	0.72	12.5	3	pass
8	1.5	16 – 17.5	0.36	16	1.5	pass
9	2.5	19.5 – 22	0.6	19.5	2.5	pass
10	3	15.5 -18.5	0.72	15.5	3	pass
11	9.5	6 – 15.5	2.28	6	9.5	fail
12	8	6.5 – 14.5	1.92	6.5	10.5	fail
	2.5	21 – 23.5	0.6			
13	5	6.5 – 11.5	1.2	6.5	6	fail
	1	22 – 23	0.24			
14	9	6 – 15	2.16	6	9	fail
15	2	18 – 20	0.48	18	2	pass
16	5	7 – 12	1.2	7	5	pass
17	6	6.5 – 12.5	1.44	6.5	6	fail
18		0			0	
19	5.5	5 – 10.5	1.32	5	6.5	fail
	1	11.5 -12.5	0.24			
20	0.7	5.2 – 5.9	0.17	5.2	9.5	fail
	5	6.7 – 11.7	1.2			
	0.7	12.6 – 11.3	0.17			
	3	14 – 17	0.72			
21	1.5	14.2 -15.7	0.36	14.2	1.5	pass

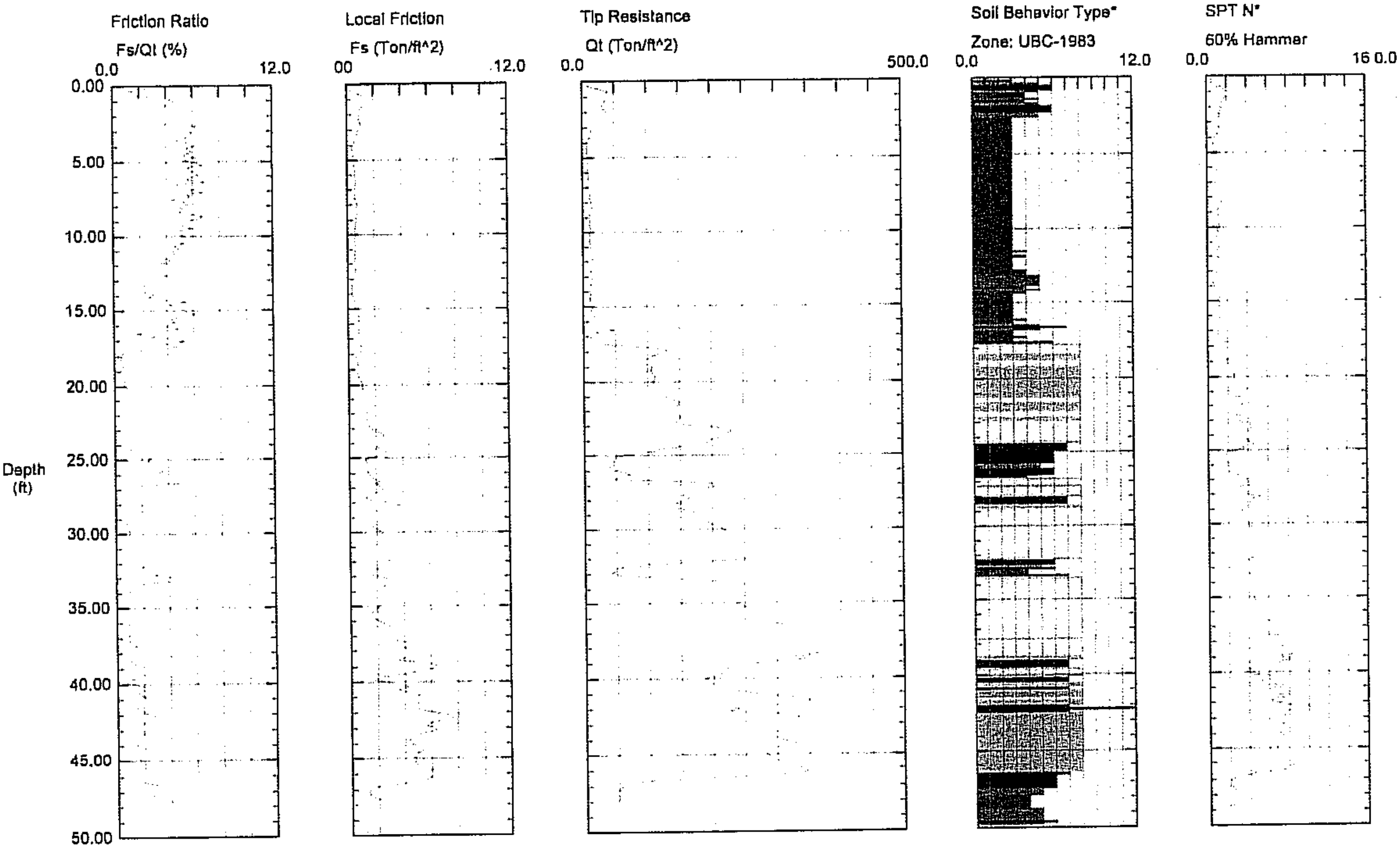
LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
22	1	6 - 7	0.24	6	2.5	pass
	1.5	9.5 - 11	0.36			
23	4	11 - 15	0.96	11	4	pass
24	3.2	5.3 - 8.5	0.77	5.3	3.2	pass
25	4	7.5 - 11.5	0.96	7.5	4	pass
26	13	6.5 - 19.5	3.12	6.5	13	fail
27	1	15-16	0.24	15	1	pass
28						
29	1	14 - 15	0.24	14	1	pass
30	0	-	0	-	0	pass
31	8	5 - 13	1.92	5	13	fail
32						
33	5	6.5 - 11.5	1.2	6.5	5	borderline
34	7.4	6.2 - 13.6	1.78	6.2	7.4	fail
35	1	5 - 6	0.24	5	3.5	pass
	1.5	10.5 - 12	0.36			
	1	13 - 14	0.24			
36	6	5.3 - 11.3	1.44	5.3	6.3	fail
37						
38	10	9 - 19	2.4	8.2	11	fail
39	3	11-14	0.72	11	6	pass
	3	15 - 18	0.72			
40	5	9 - 14	1.2	9	5	pass
41	4.5	14.5 - 19	1.08	14.5	4.5	pass
42	1.5	18 - 19.5	0.36	18	1.5	pass
43	4	9.5 - 13.5	0.96	9.5	6	pass
	2	15 - 17	0.48			
44	8.5	5.5 - 14	2.04	5.5	8.5	fail
45	2	11 - 13	0.48	11	2	pass
46	9	6.5 - 15.5	2.16	6.5	9	fail

behavior type and SP… …sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W052
Cone Used: HO738TC

CPT Date/Time: 06-14-04 09:19
Location: CPT-1
Job Number: 4803.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

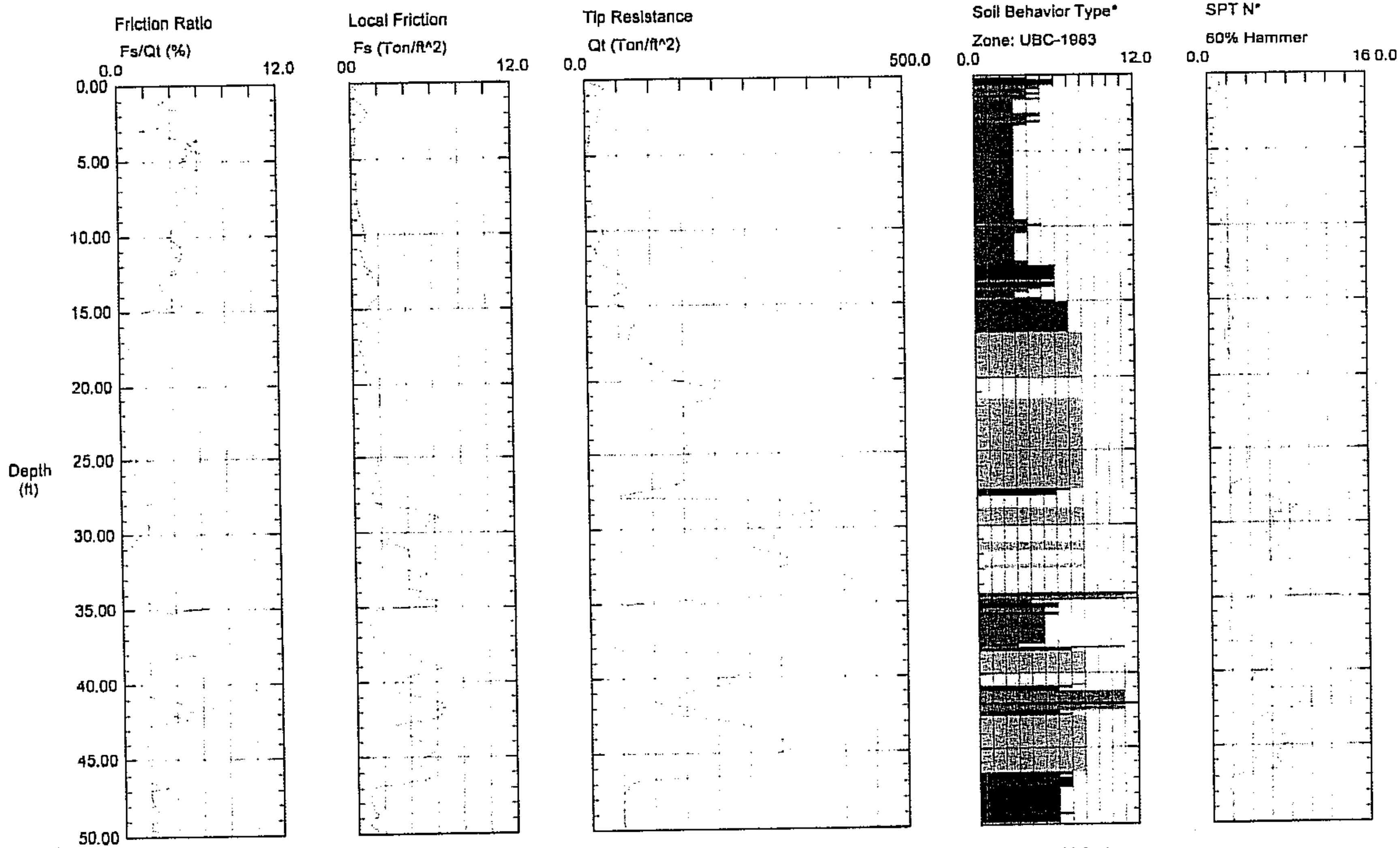
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

| behavior type and SP . .sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W053
Cone Used: HO738TC

CPT Date/Time: 06-14-04 11:03
Location: CPT-2
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

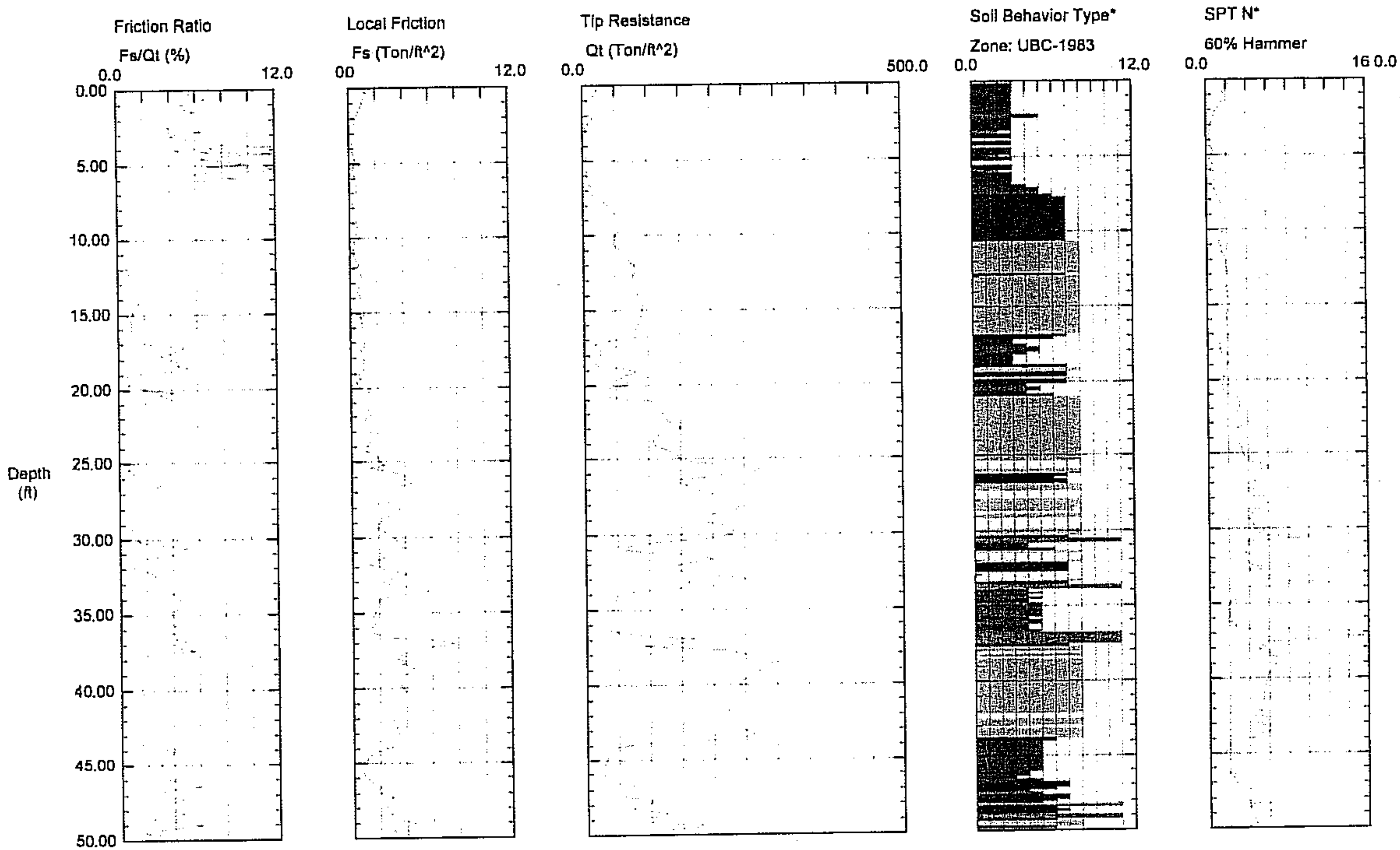
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP[illegible] ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W054
Cone Used: HO736TC

CPT Date/Time: 06-14-04 13:40
Location: CPT-3
Job Number: 4603.4100.01



Maximum Depth = 50.03 feet

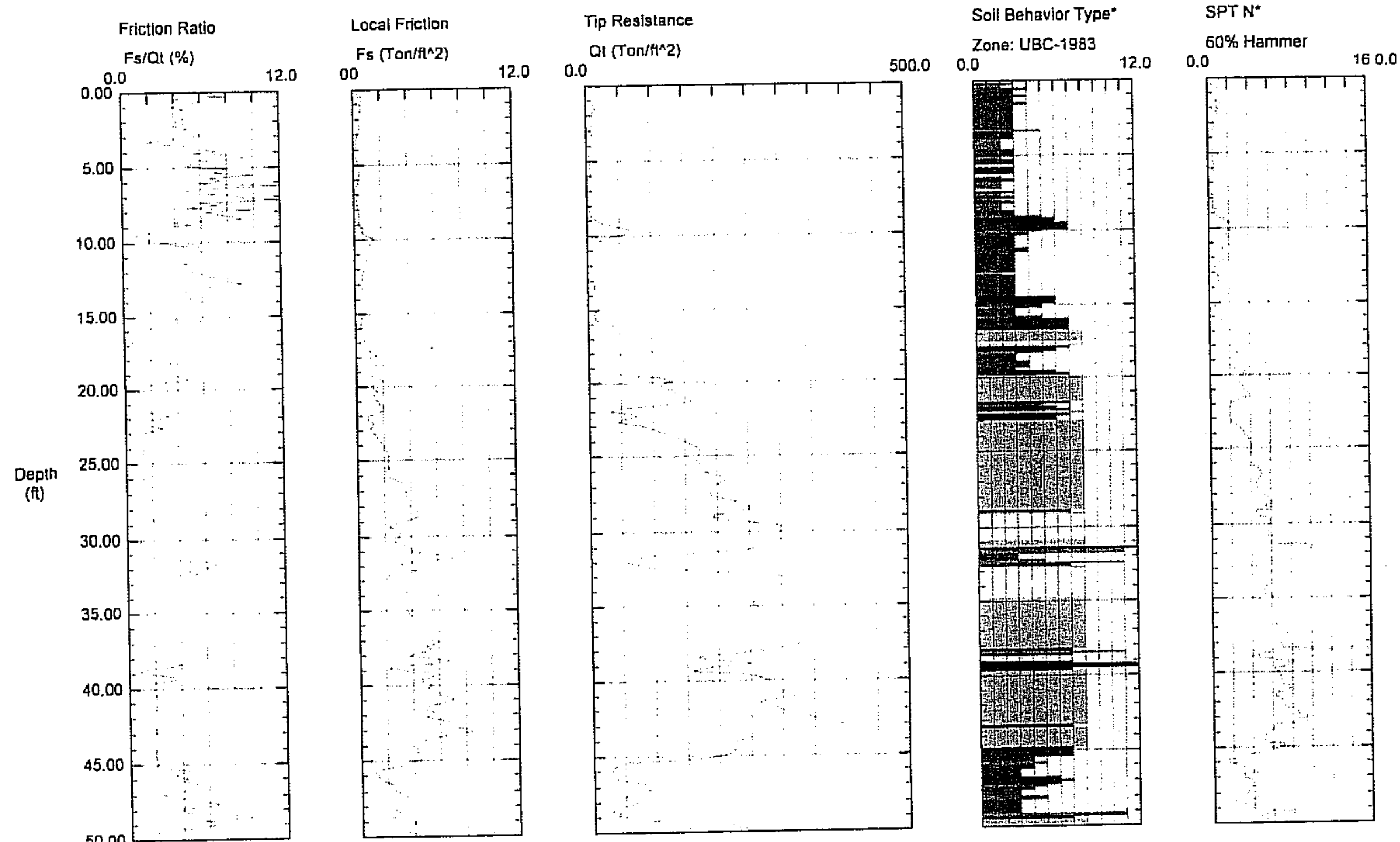
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W055
Cone Used: HO738TC

CPT Date/Time: 06-14-04 15:15
Location: CPT-4
Job Number: 4603.4100.01



Maximum Depth = 51.67 feet

Depth Increment = 0.16 feet

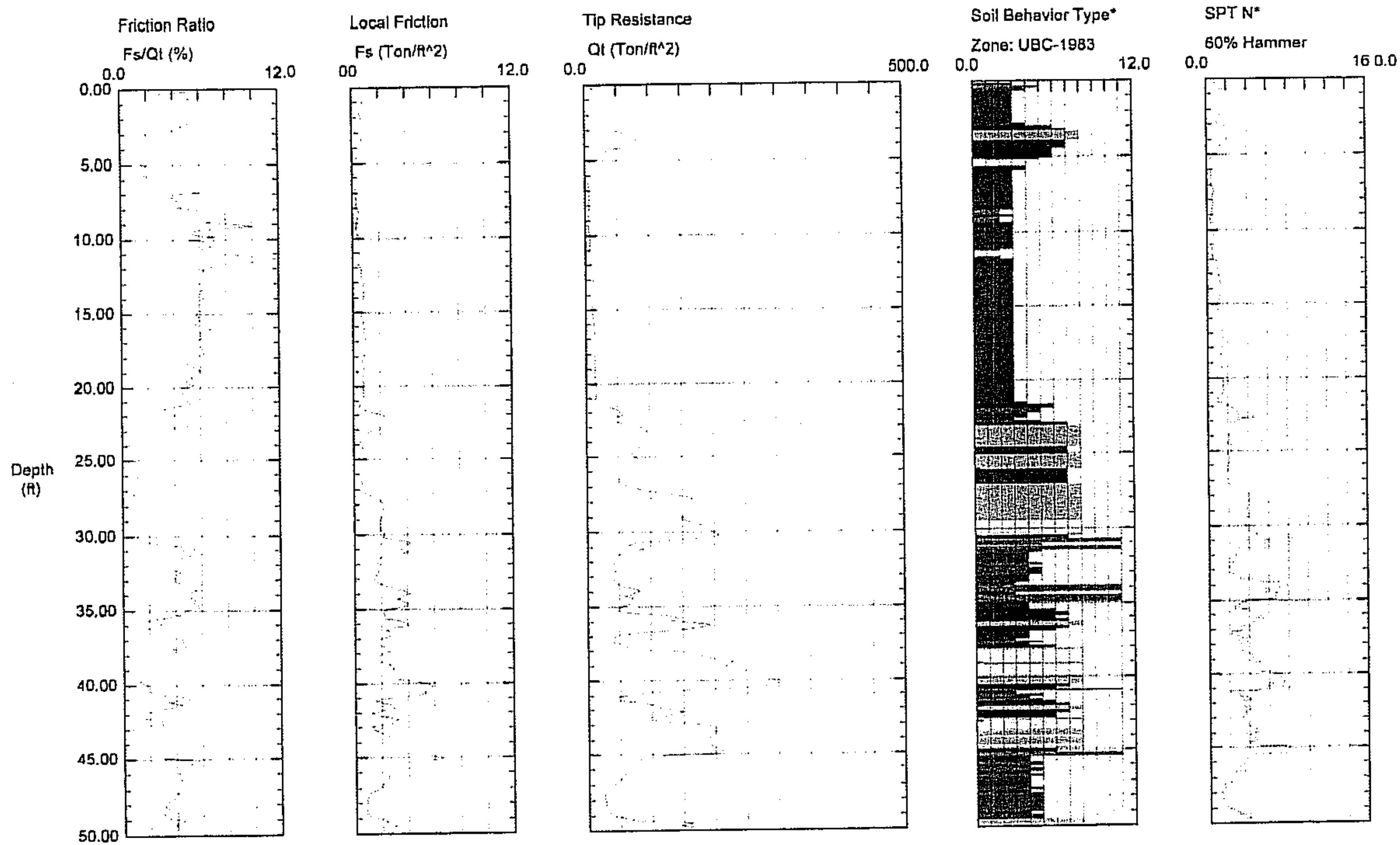
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*behavior type and SPT ... d on data from UBC-1 983 behavior type and SPT ...ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W056
Cone Used: HO738TC

CPT Date/Time: 06-15-04 07:26
Location: CPT-5
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

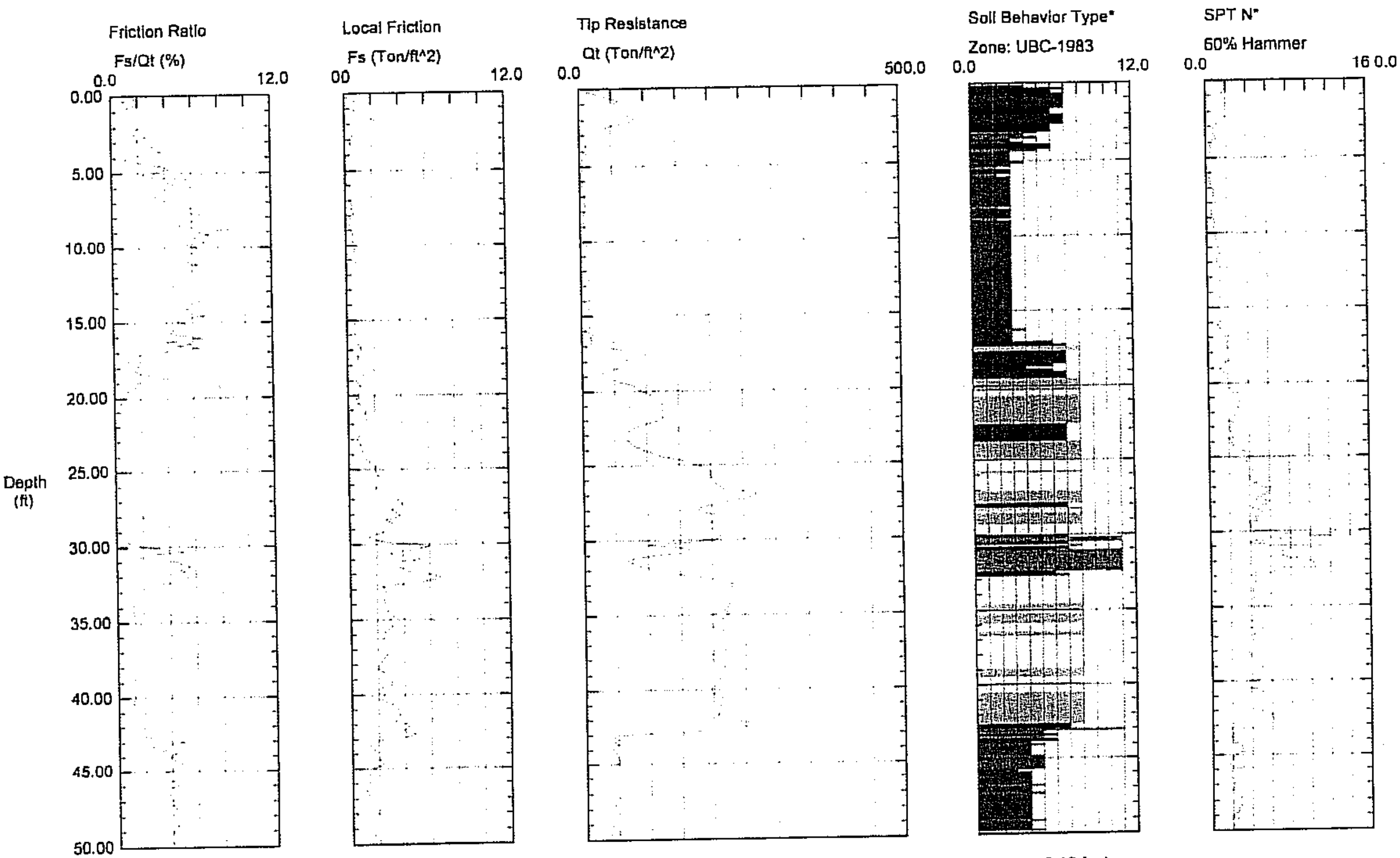
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SPT d on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W057
Cone Used: HO738TC

CPT Date/Time: 06-15-04 09:10
Location: CPT-6
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

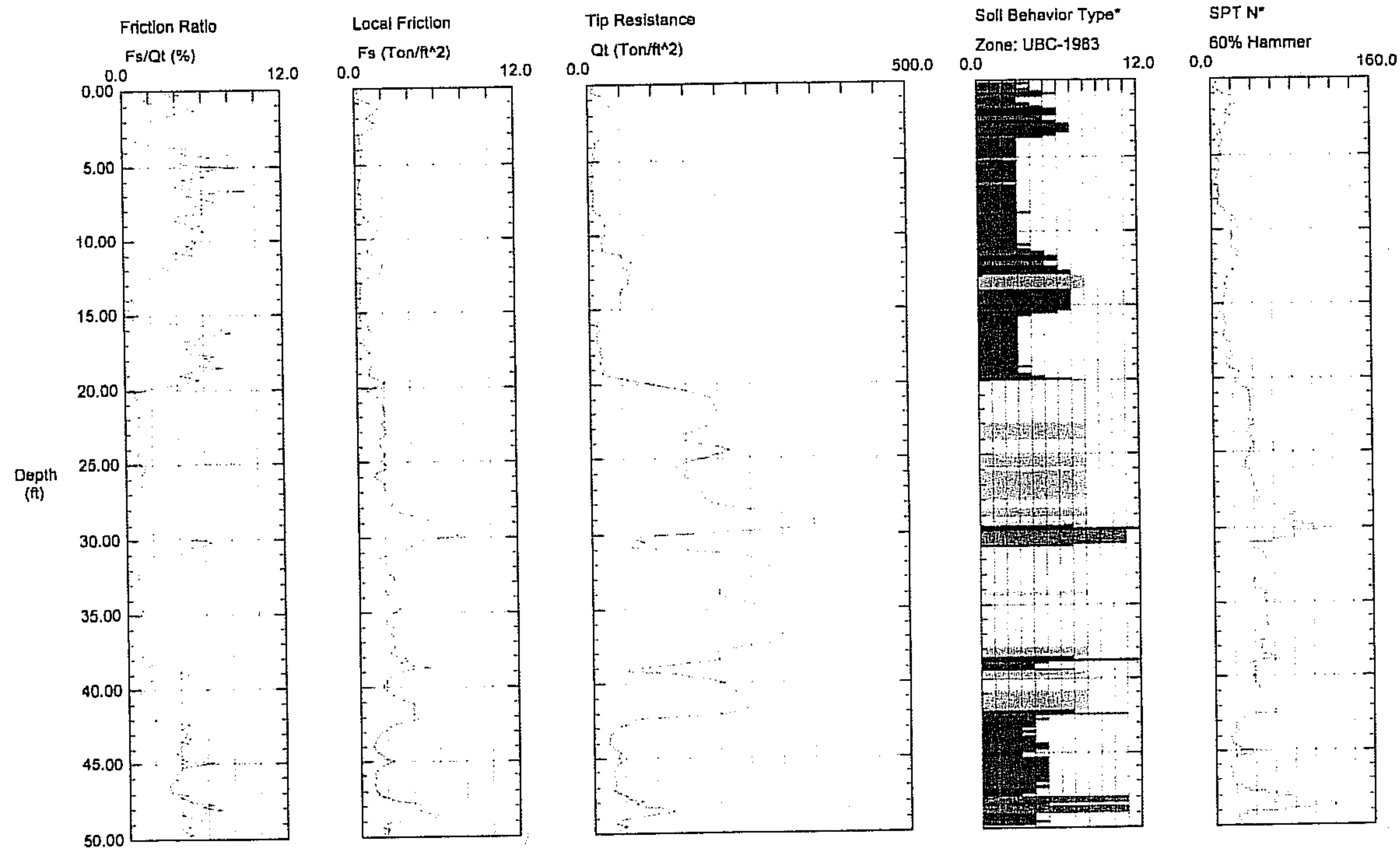
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SPT 3 on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W058
Cone Used: HO738TC

CPT Date/Time: 06-15-04 10:26
Location: CPT-7
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

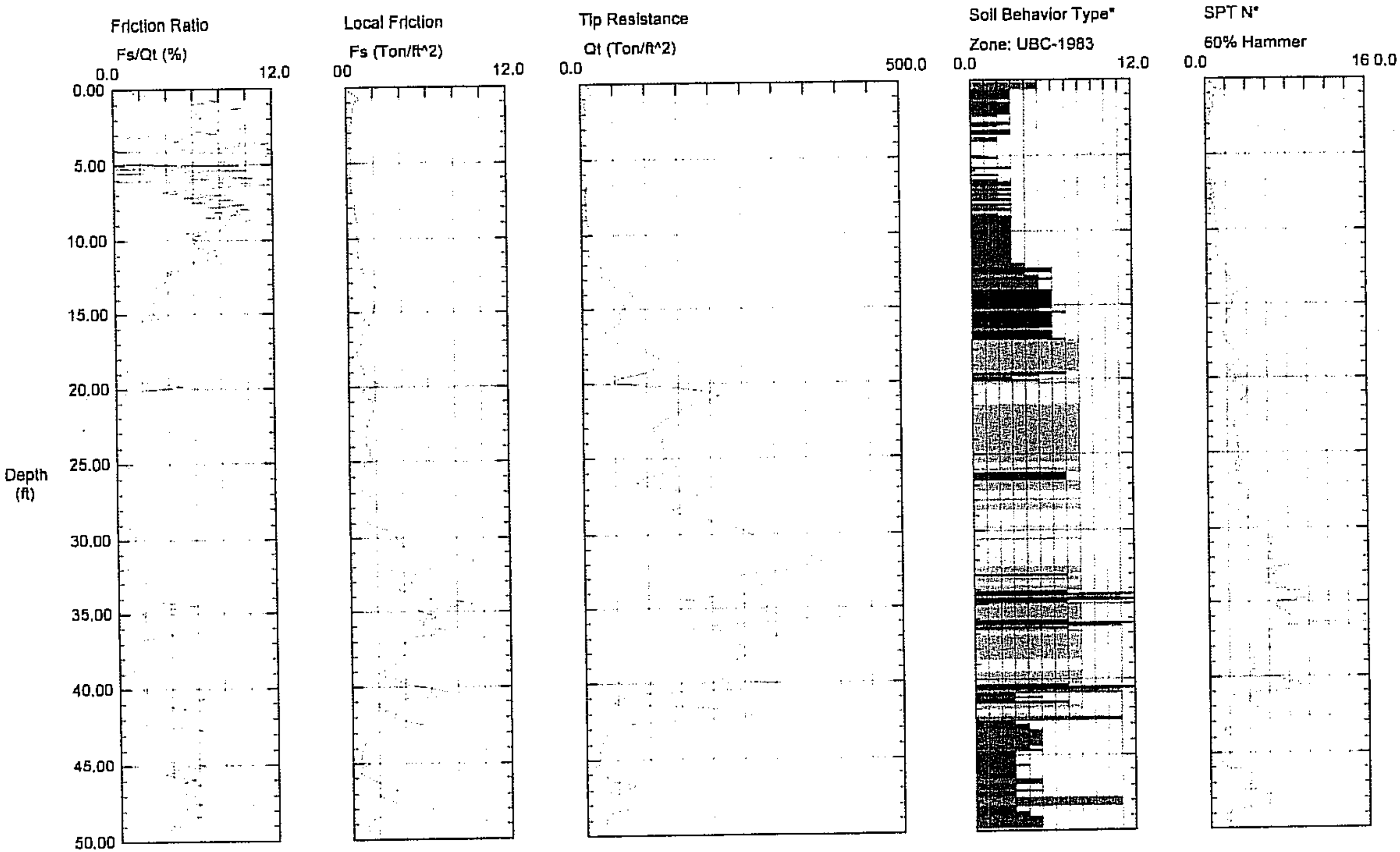
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP*   ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W059
Cone Used: HO738TC

CPT Date/Time: 06-15-04 12:04
Location: CPT-8
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

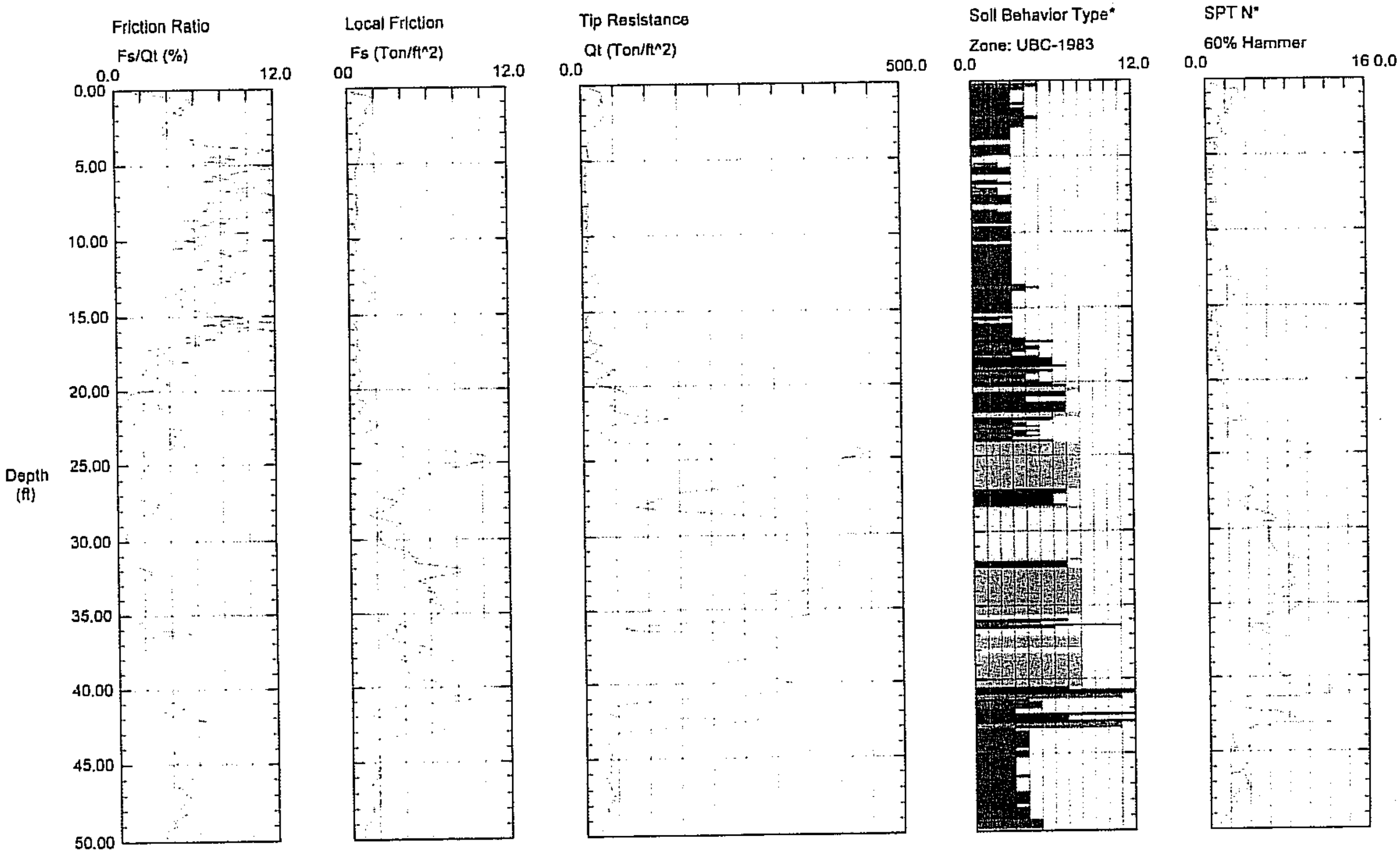
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SPT .d on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W060
Cone Used: HO738TC

CPT Date/Time: 06-15-04 13:46
Location: CPT-9
Job Number: 4603.4100.01



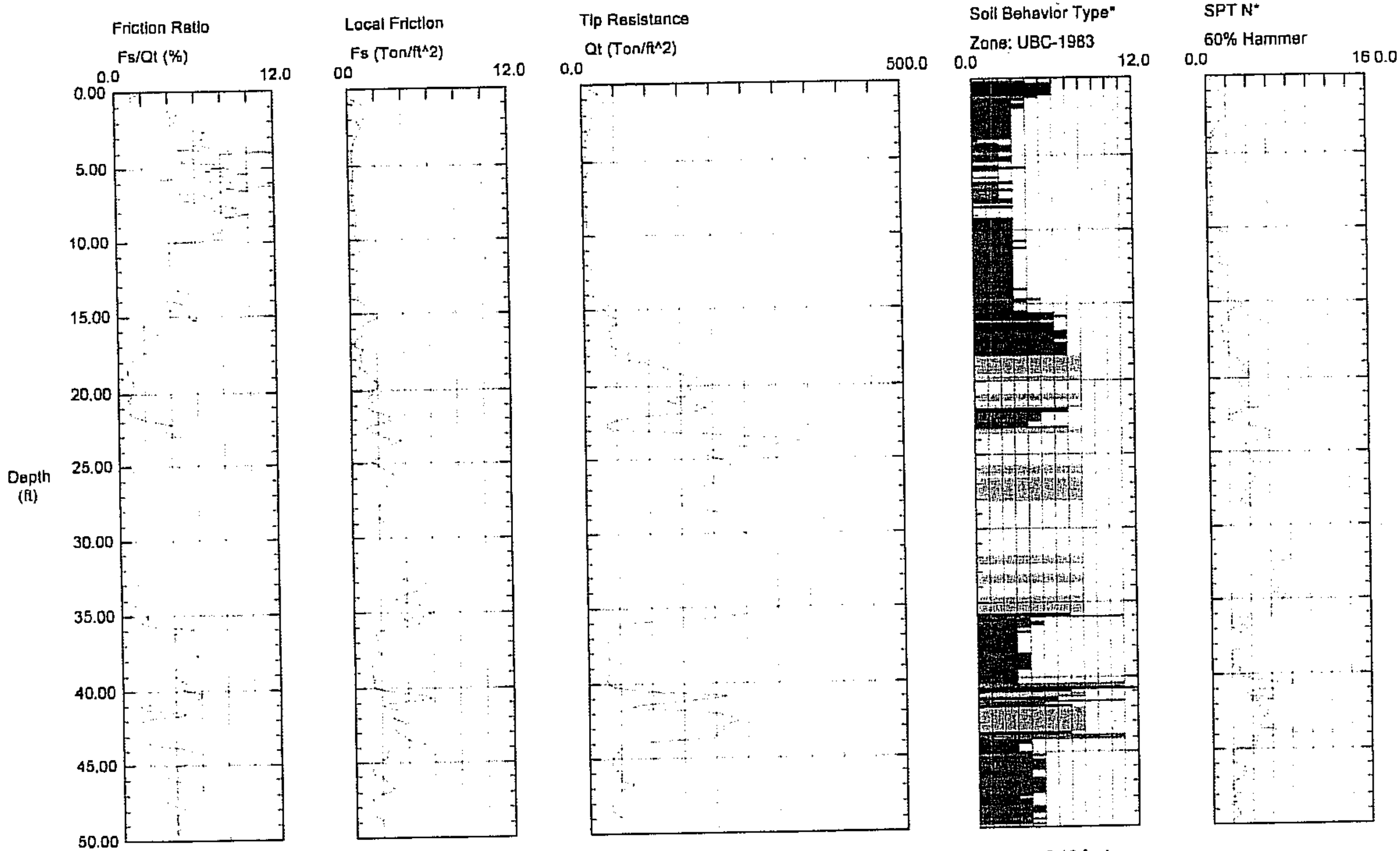
Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 - clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson	CPT Date/Time: 06-15-04 15:22
Sounding: 04W061	Location: CPT-10
Cone Used: HO738TC	Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

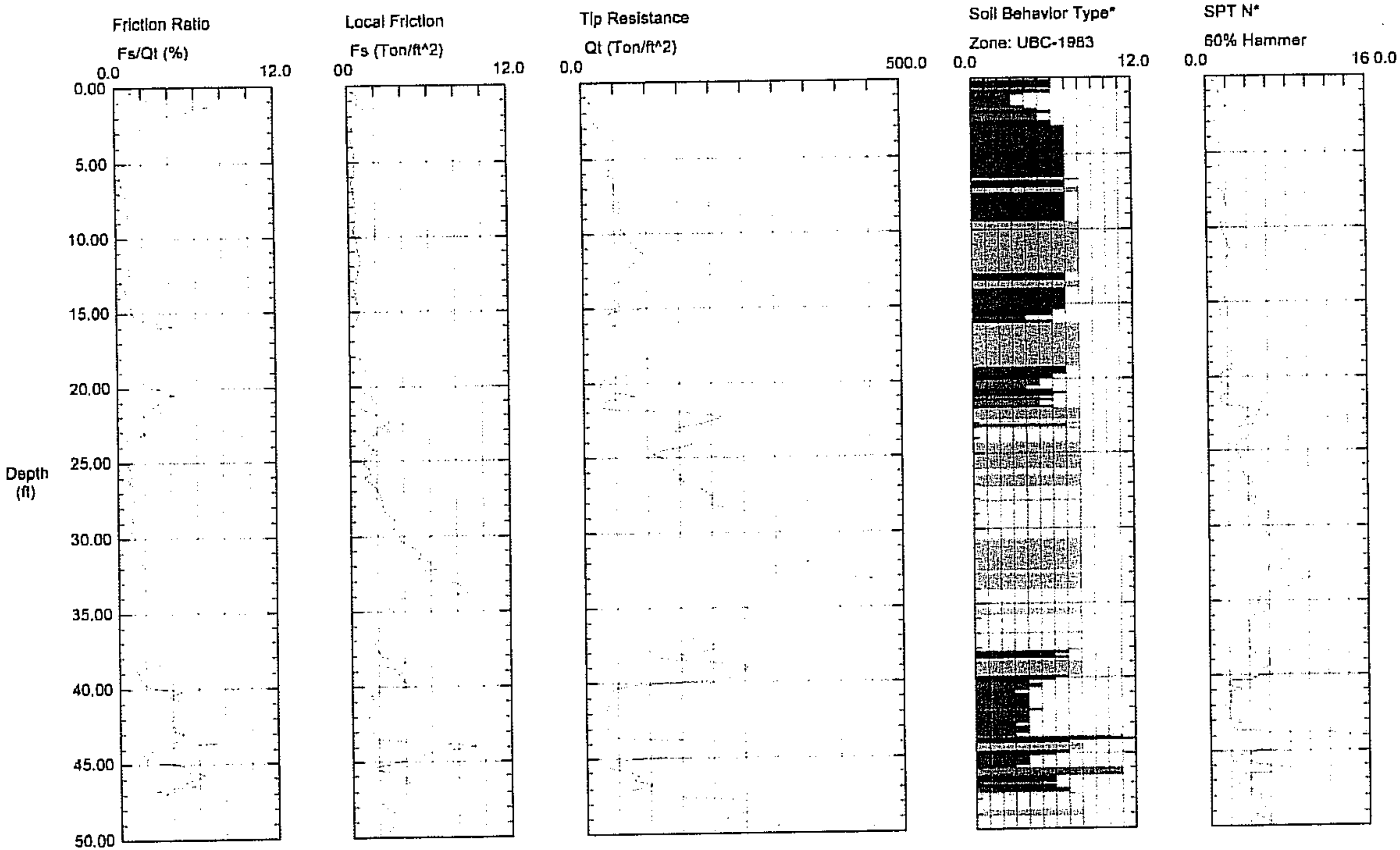
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP. .d on data from UBC-1 983 behavior type and SP ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W062
Cone Used: HO738TC

CPT Date/Time: 06-15-04 16:34
Location: CPT-11
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

Depth Increment = 0.16 feet

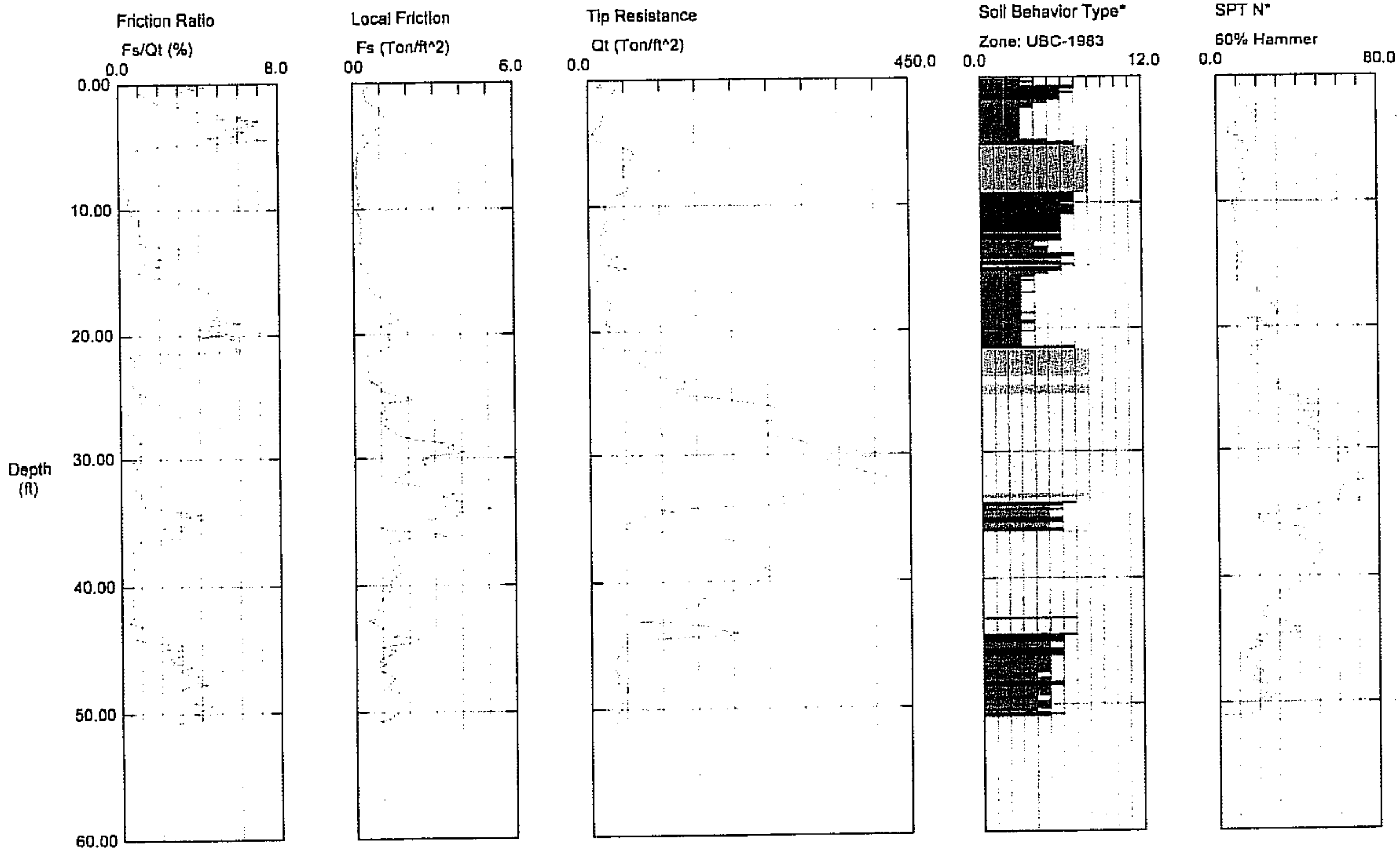
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP… …ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W063
Cone Used: HO839TC

CPT Date/Time: 06-16-04 07:27
Location: CPT-12
Job Number: 4603.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

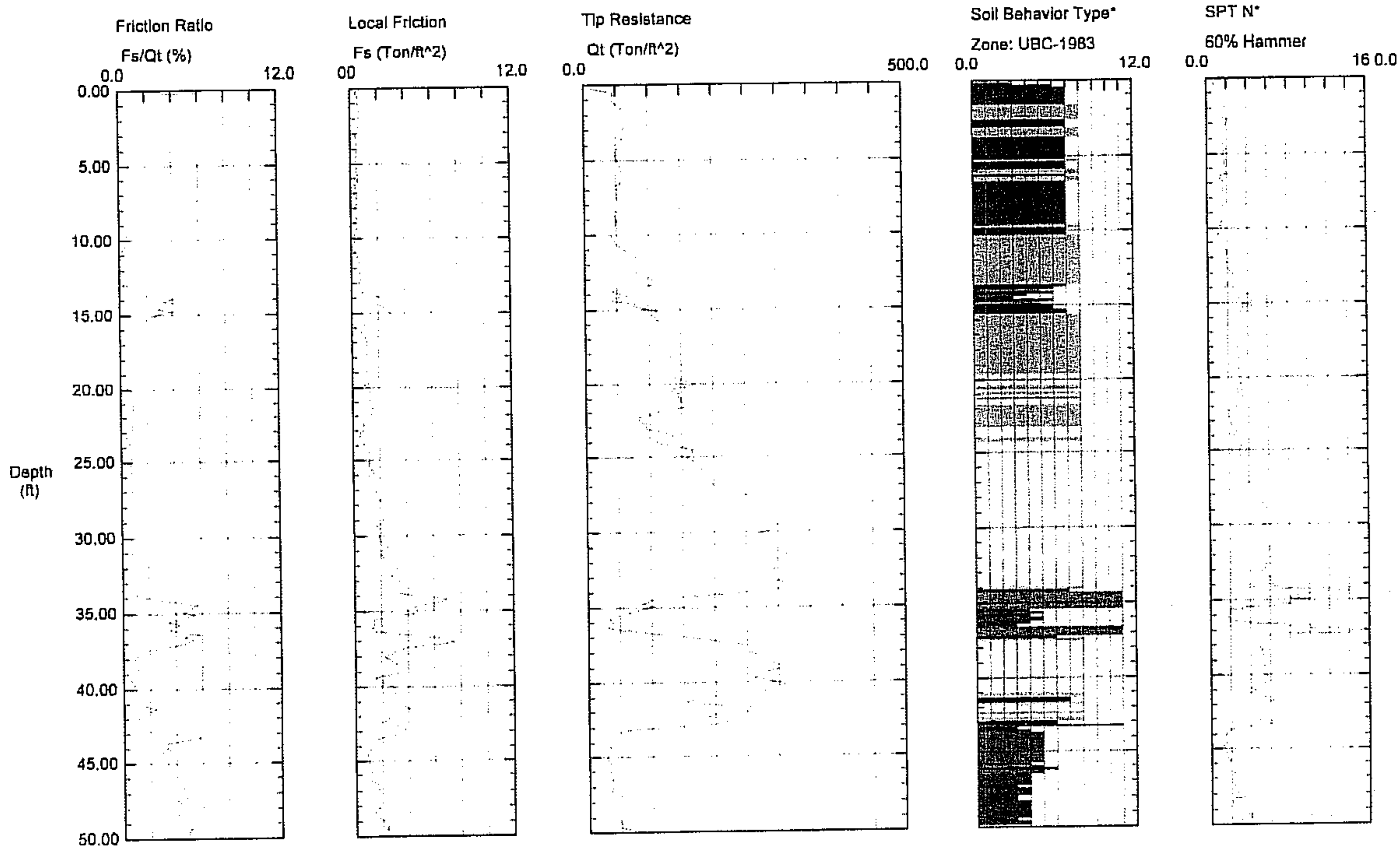
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and S... sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W064
Cone Used: HO839TC

CPT Date/Time: 06-16-04 08:45
Location: CPT-13
Job Number: 4603.4100.01



Maximum Depth = 52.49 feet

Depth Increment = 0.16 feet

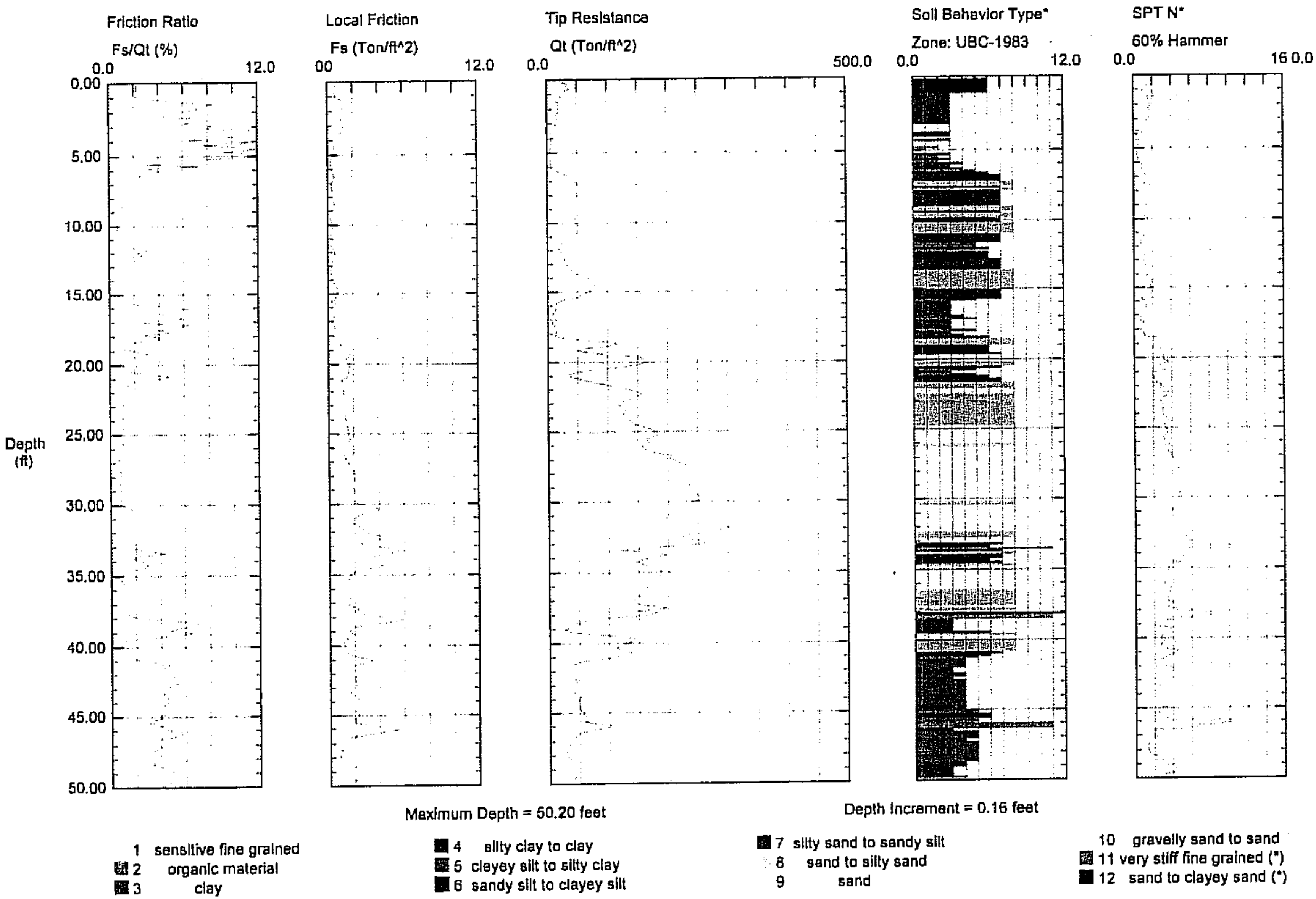
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

ɔil behavior type and S ... ɹsed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W065
Cone Used: HO839TC

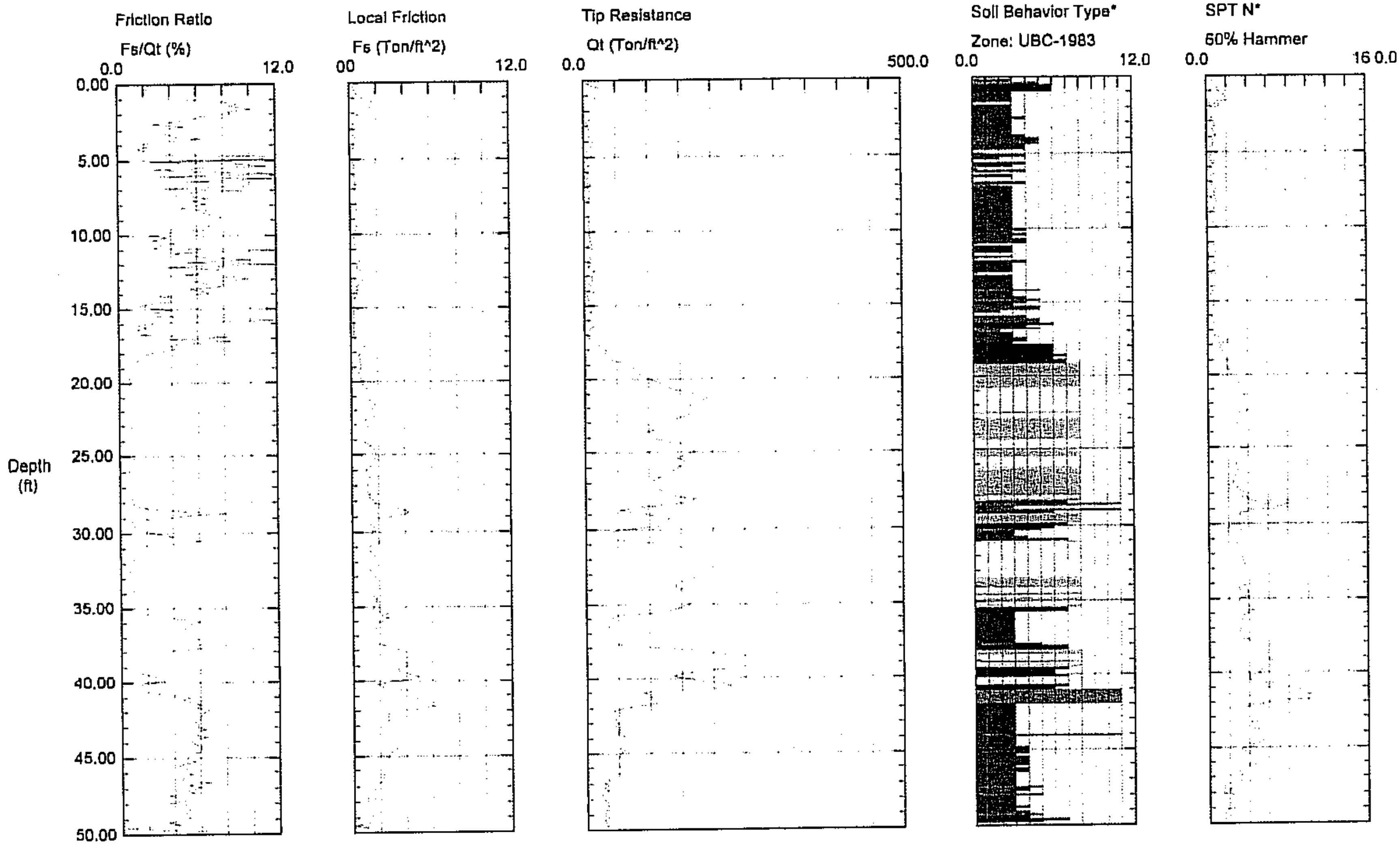
CPT Date/Time: 06-16-04 11:12
Location: CPT-14
Job Number: 4603.4100.01



VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W066
Cone Used: HO839TC

CPT Date/Time: 06-16-04 13:05
Location: CPT-15
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

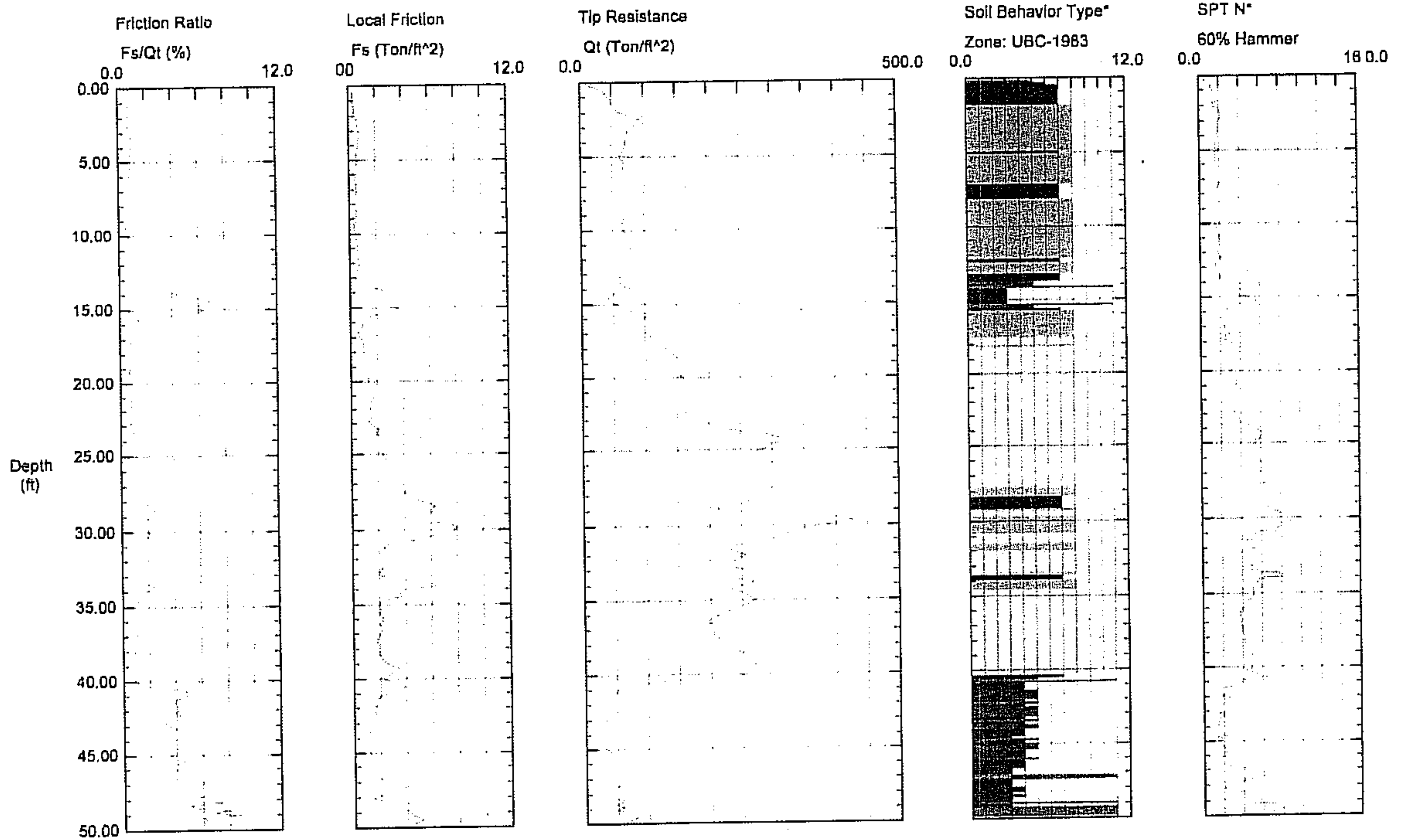
*… behavior type and S… …ed on data from UBC-1983

ll behavior type and S. sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W067
Cone Used: HO839TC

CPT Date/Time: 06-16-04 14:57
Location: CPT-16
Job Number: 4603.4100.01



Maximum Depth = 51.51 feet

Depth Increment = 0.16 feet

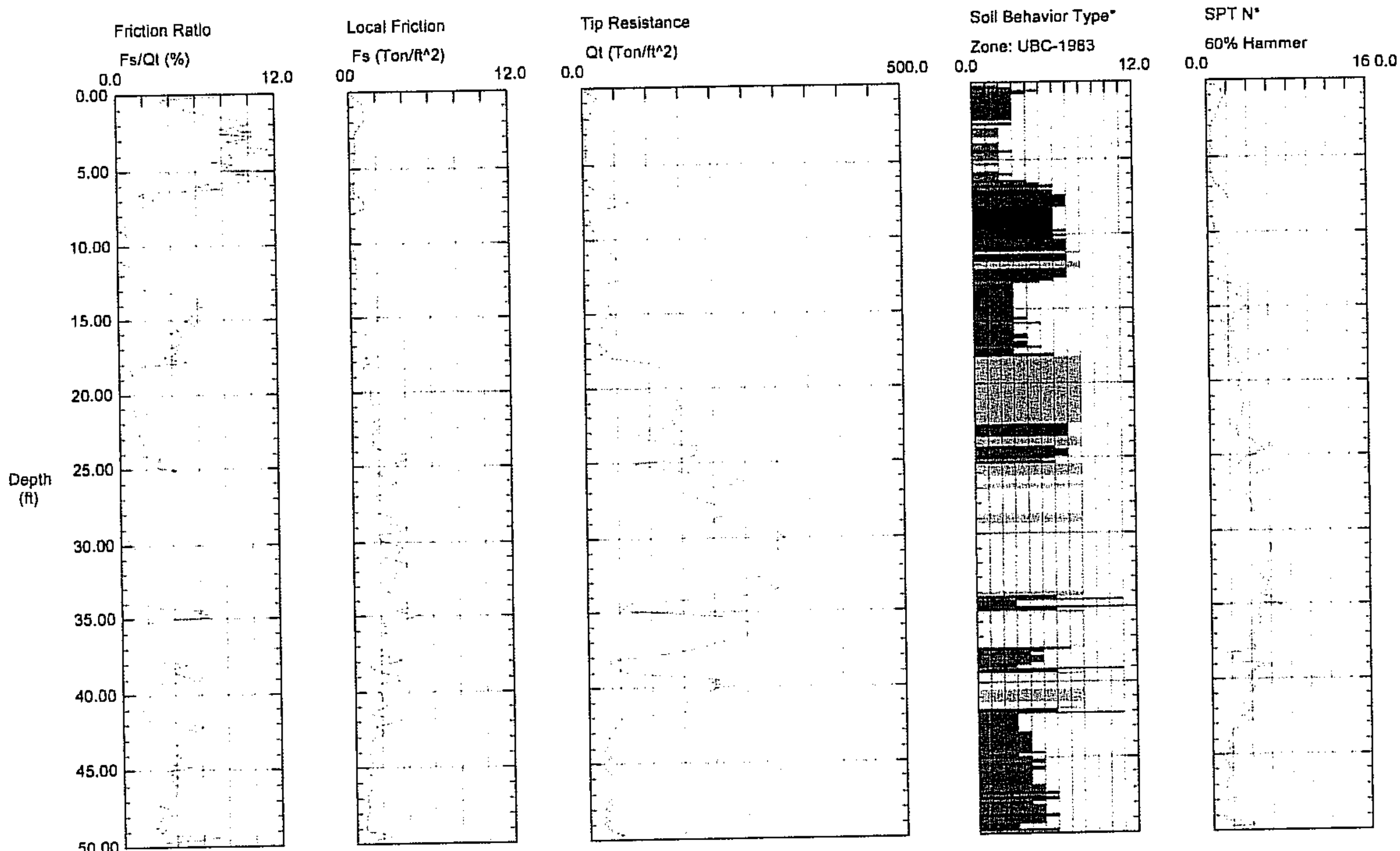
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and SPT based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W068
Cone Used: HO839TC

CPT Date/Time: 06-17-04 07:25
Location: CPT-17
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

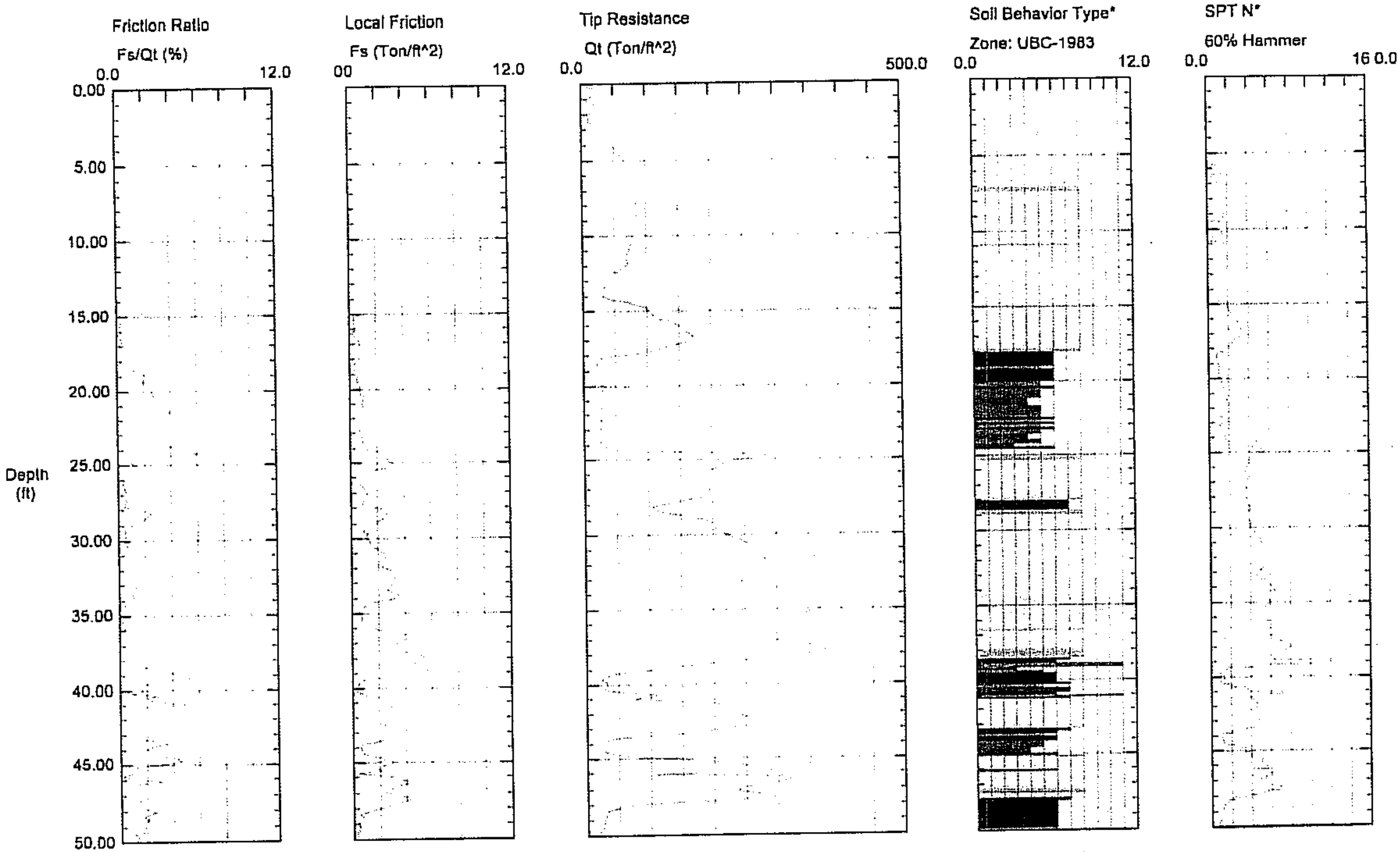
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

I behavior type and SP, ..ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W069
Cone Used: HO839TC

CPT Date/Time: 06-17-04 08:42
Location: CPT-18
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

Depth Increment = 0.16 feet

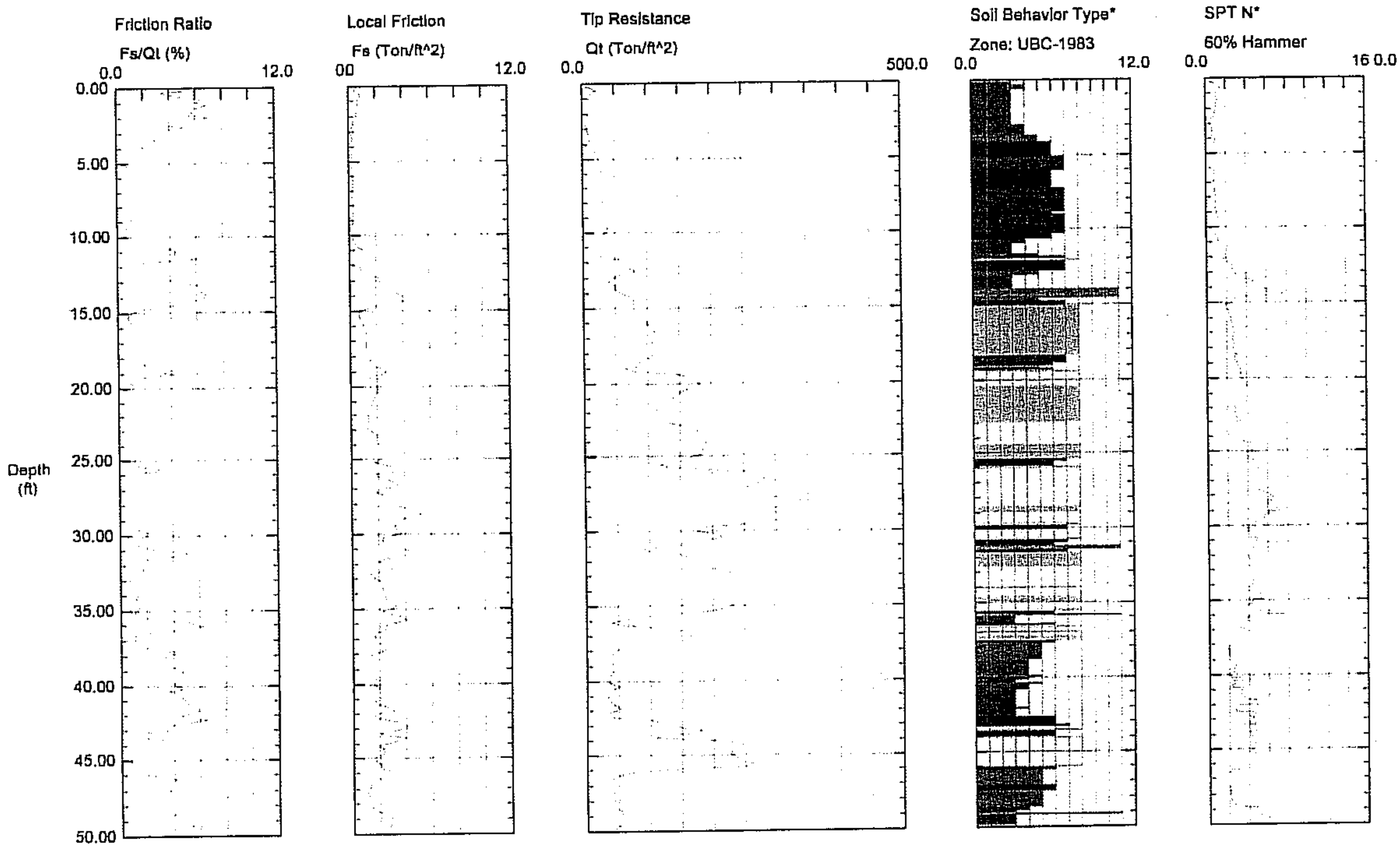
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and S… …sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W070
Cone Used: HO839TC

CPT Date/Time: 06-17-04 10:37
Location: CPT-19
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

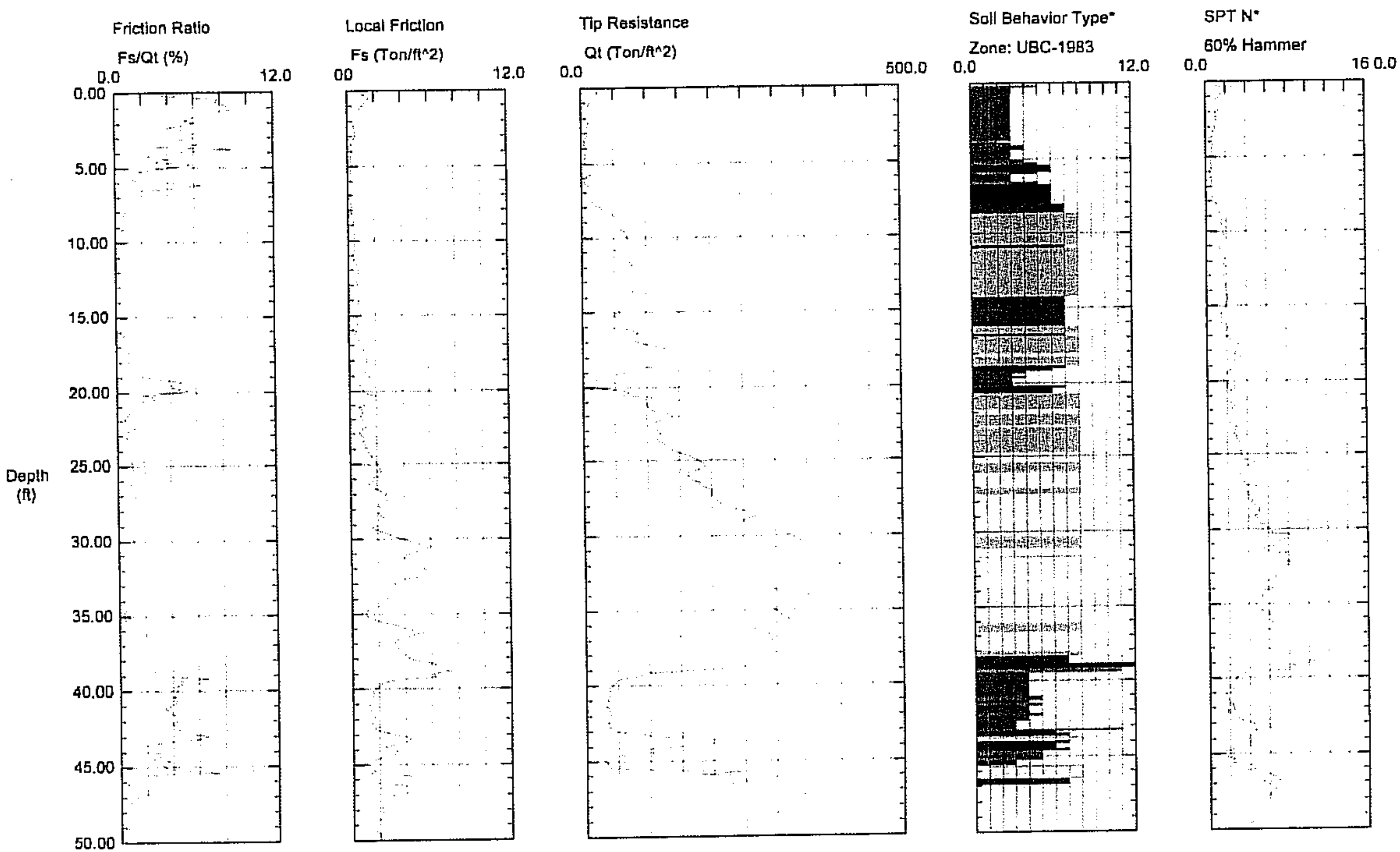
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and SF ... sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W071
Cone Used: HO839TC

CPT Date/Time: 06-17-04 11:40
Location: CPT-20
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

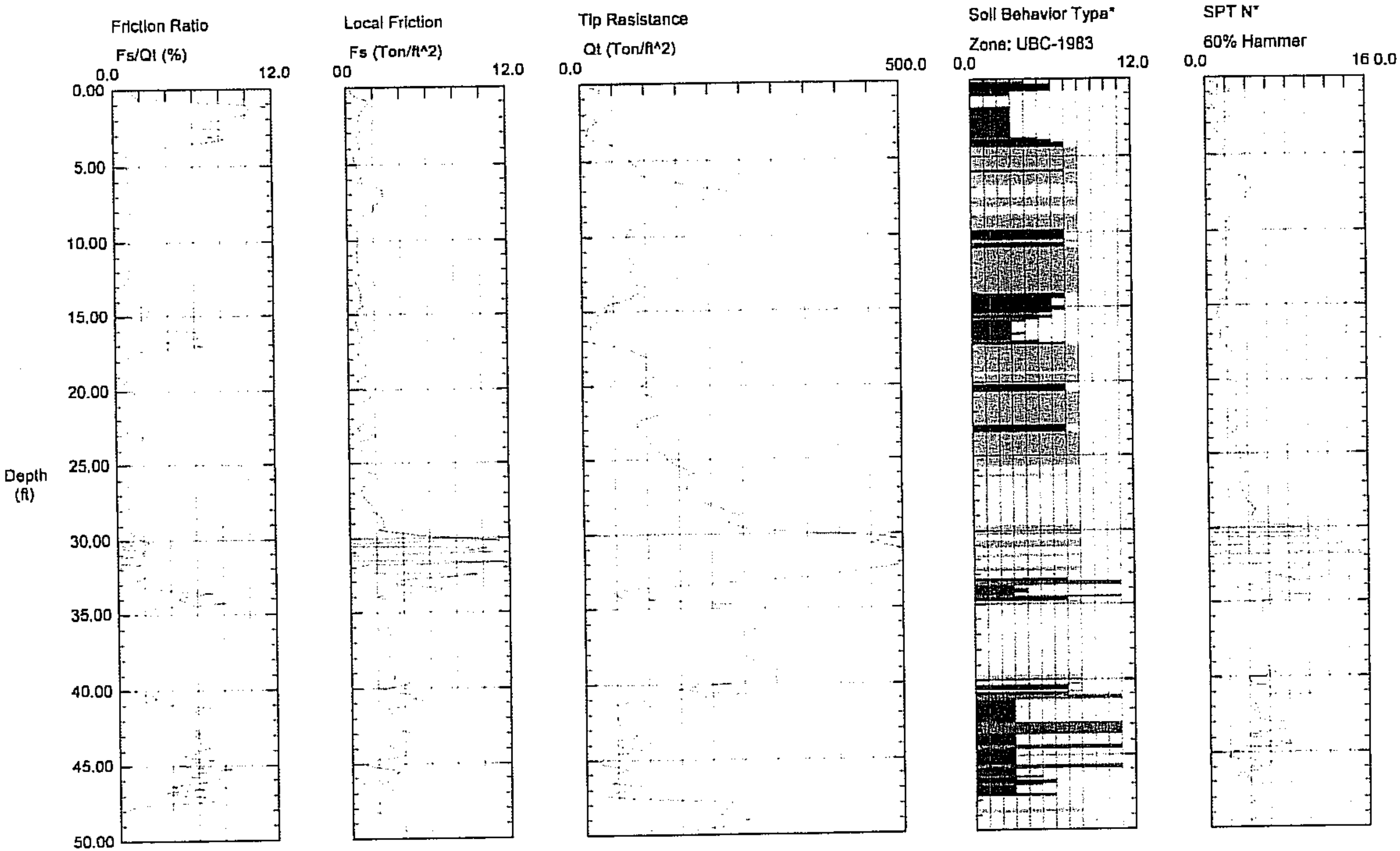
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SF ... ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W072
Cone Used: HO839TC

CPT Date/Time: 06-17-04 12:40
Location: CPT-21
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

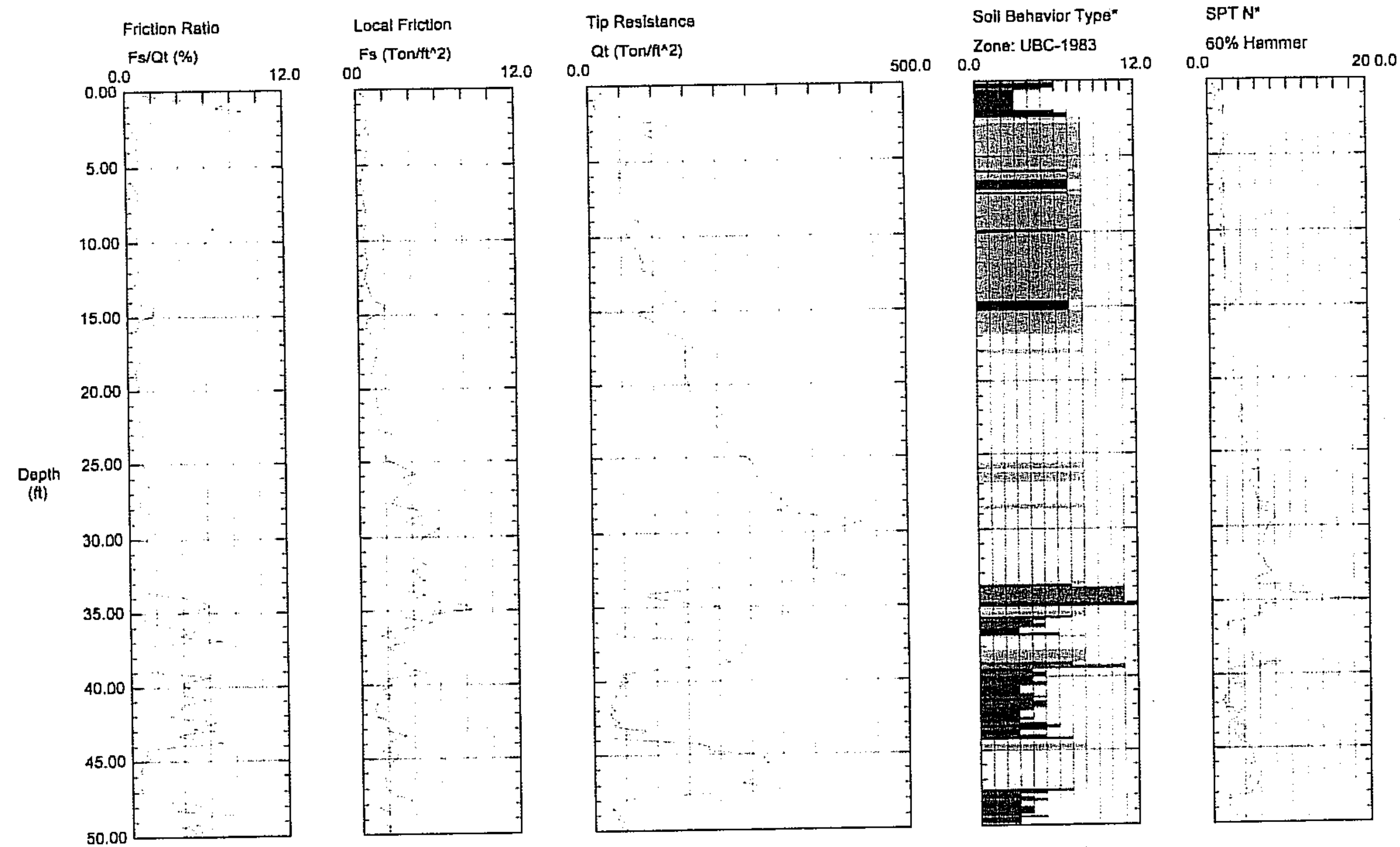
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP ... d on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W073
Cone Used: HO839TC

CPT Date/Time: 06-17-04 14:33
Location: CPT-22
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

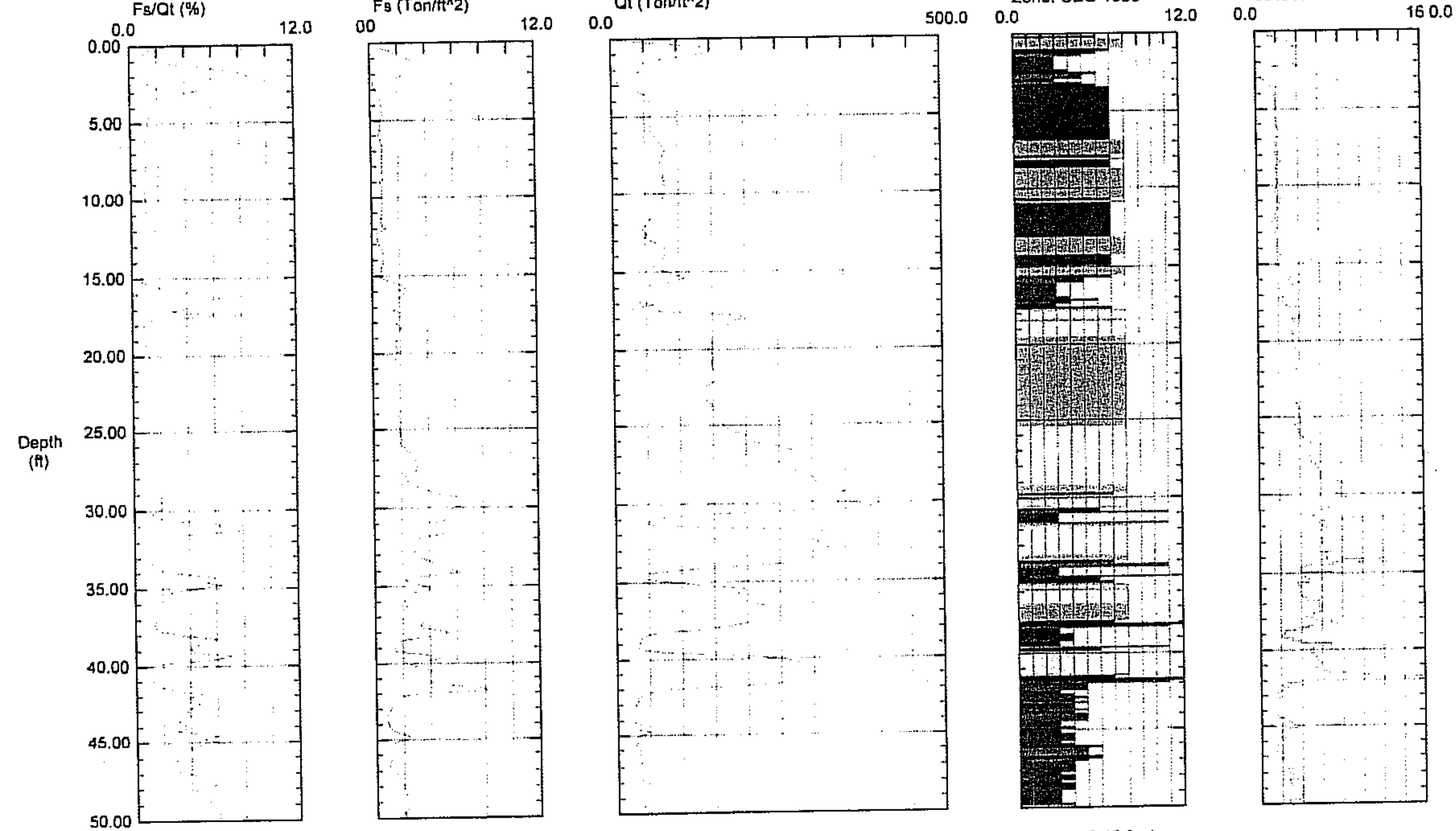
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and S+ ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W074
Cone Used: HO839TC

CPT Date/Time: 06-17-04 15:42
Location: CPT-23
Job Number: 4603.4100.01



Maximum Depth = 51.16 feet

Depth Increment = 0.16 feet

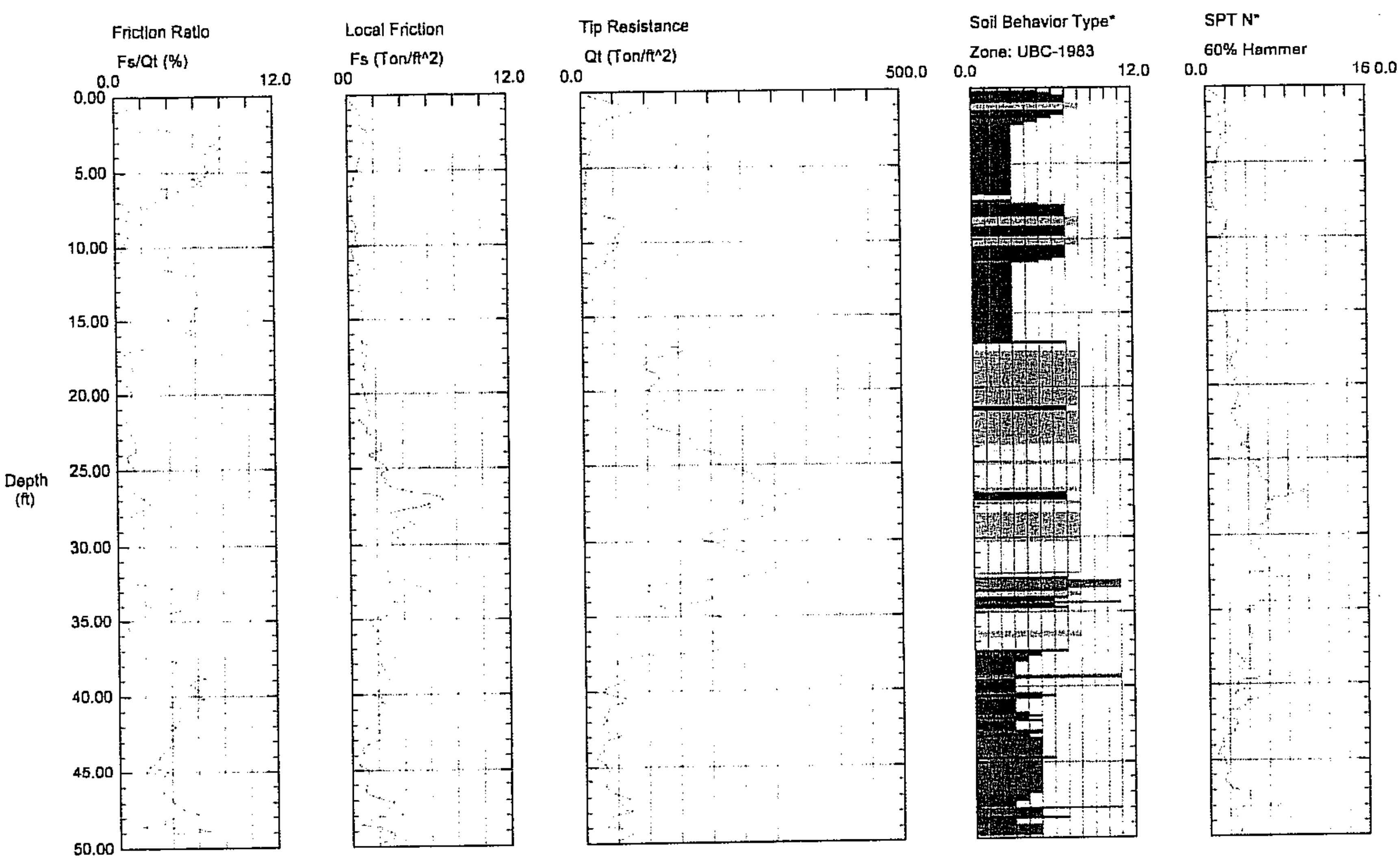
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and S[illegible] [illegible]ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W076
Cone Used: HO839TC

CPT Date/Time: 06-18-04 06:57
Location: CPT-25
Job Number: 4603.4100.01



Maximum Depth = 51.84 feet

Depth Increment = 0.16 feet

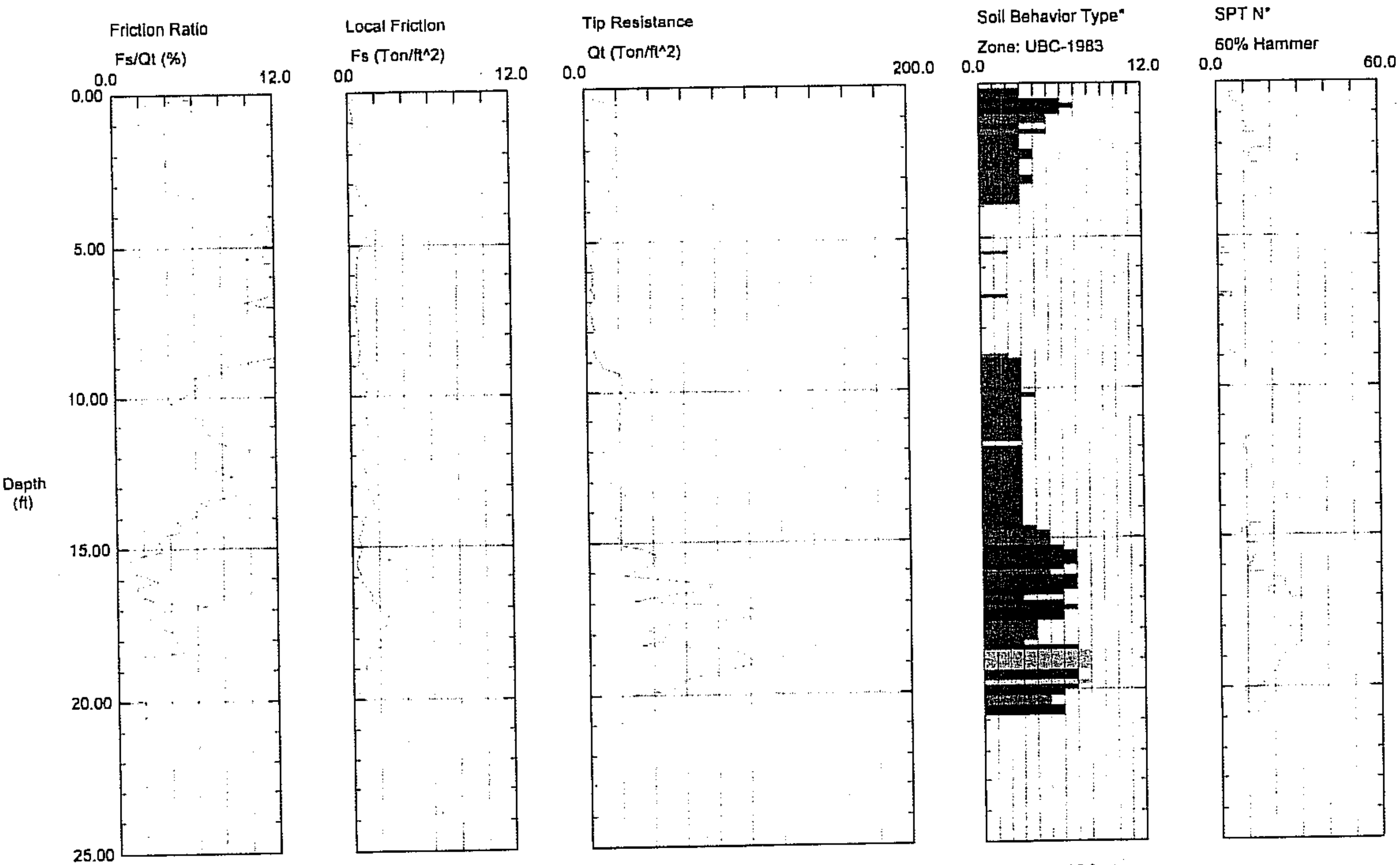
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SF ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W088
Cone Used: HO856TC

CPT Date/Time: 07-14-04 11:04
Location: CPT-27
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

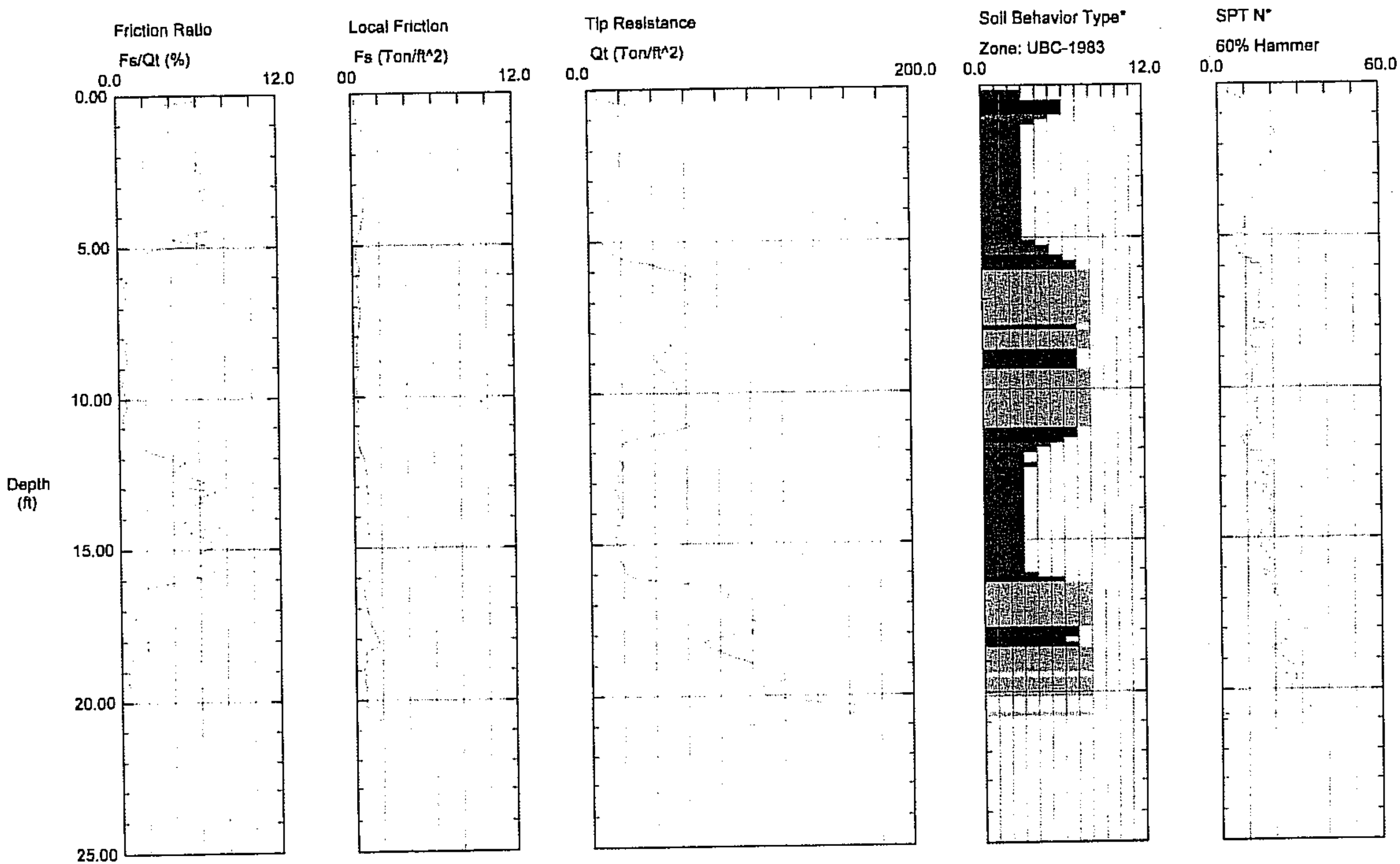
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and S… …ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w089
Cone Used: HO856TC

CPT Date/Time: 07-14-04 13:14
Location: CPT-28
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

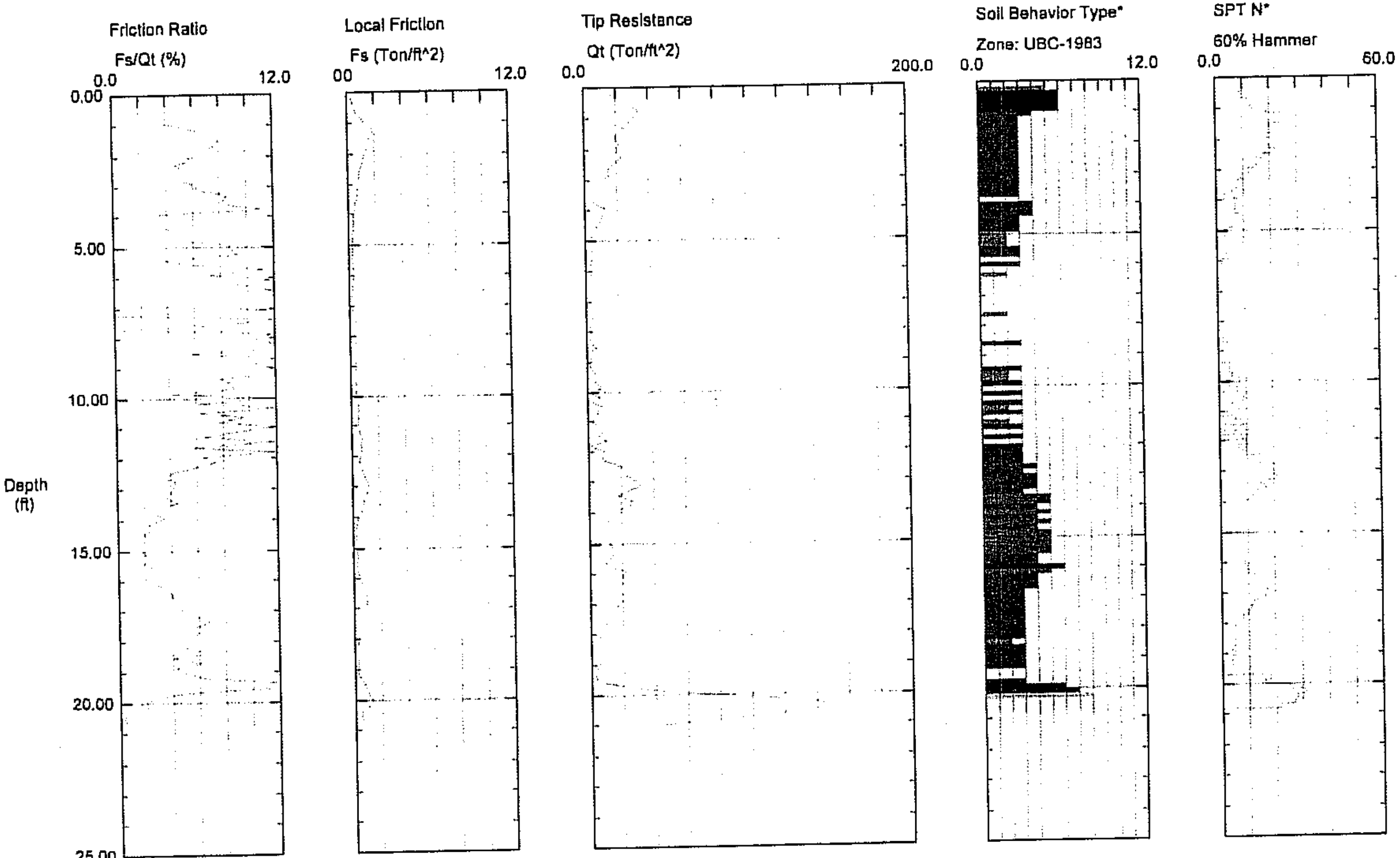
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP… …ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w091
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:10
Location: CPT-30
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

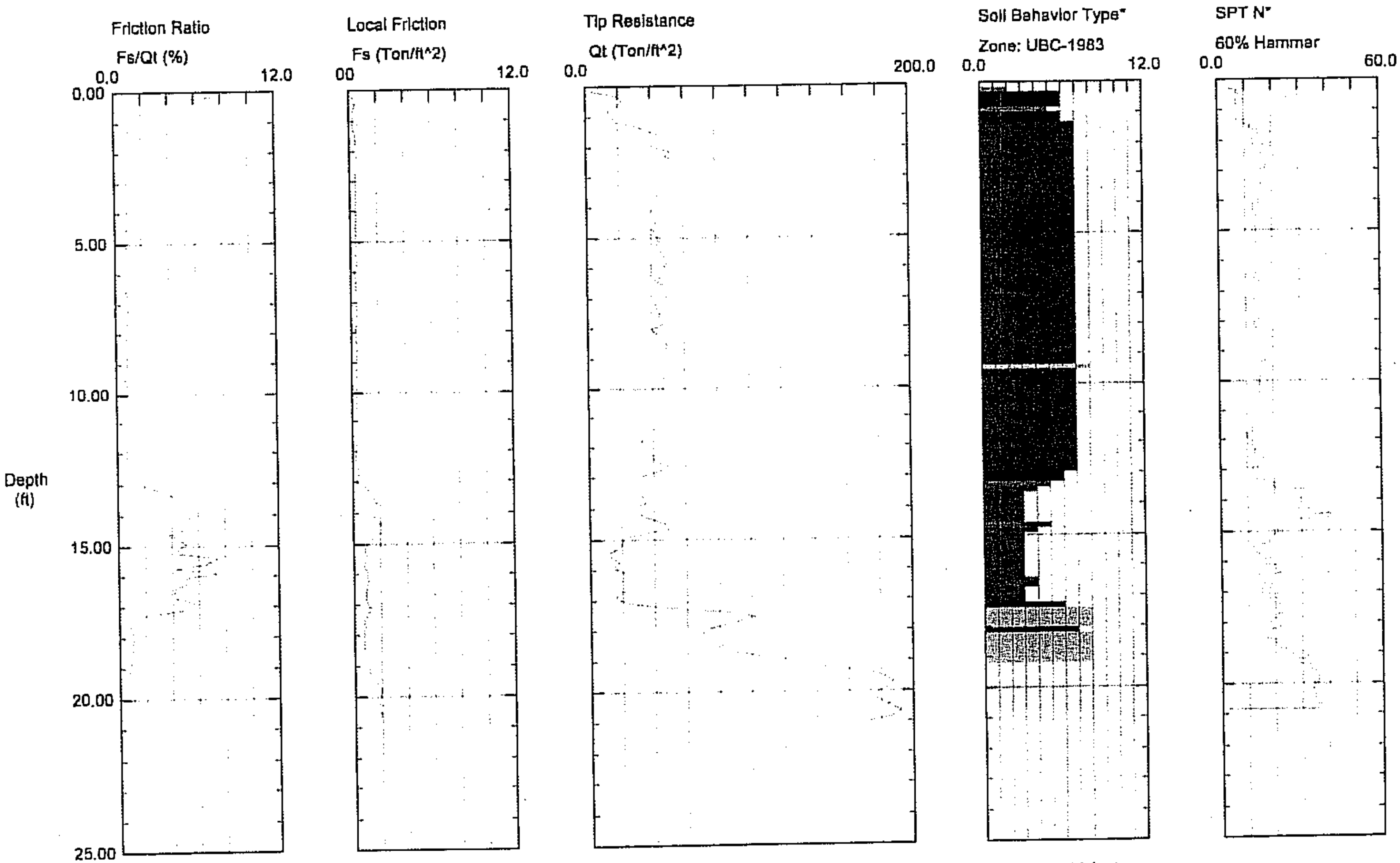
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP ...ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w092
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:59
Location: CPT-31
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

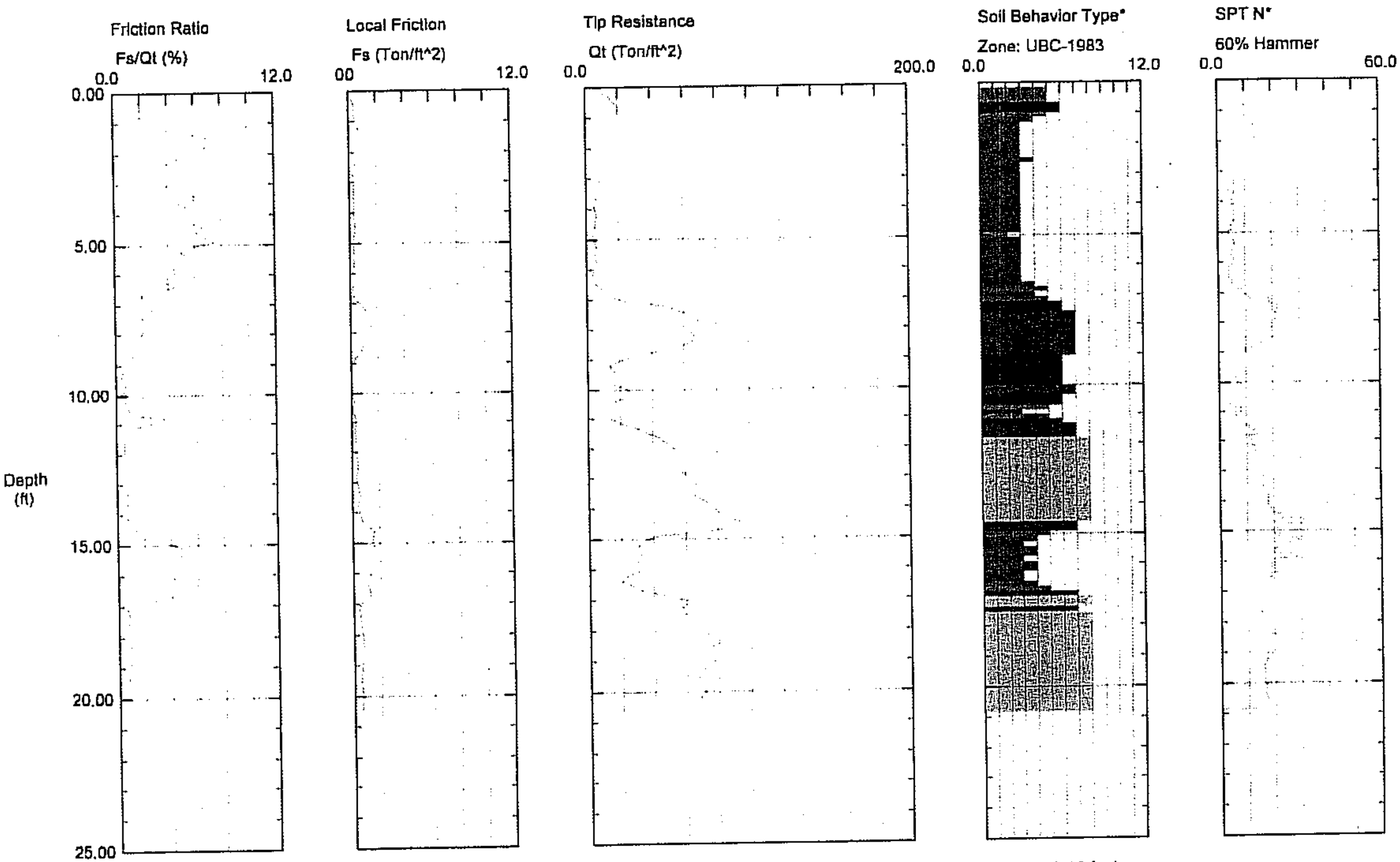
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SF ...ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w093
Cone Used: HO856TC

CPT Date/Time: 07-15-04 07:32
Location: CPT-32
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

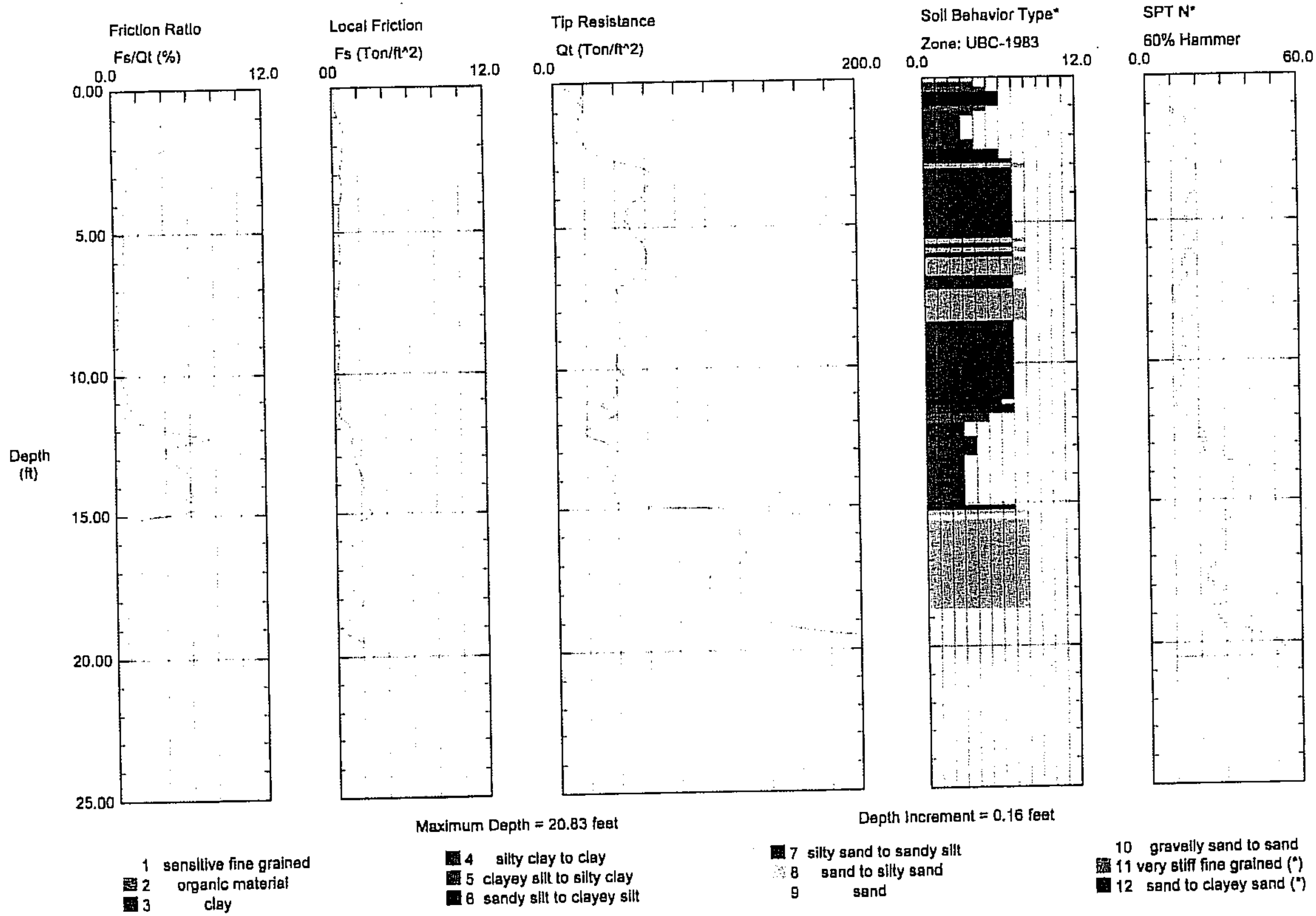
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and S. ..ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w094
Cone Used: HO856TC

CPT Date/Time: 07-15-04 08:22
Location: CPT-33
Job Number: 4603.4100.01

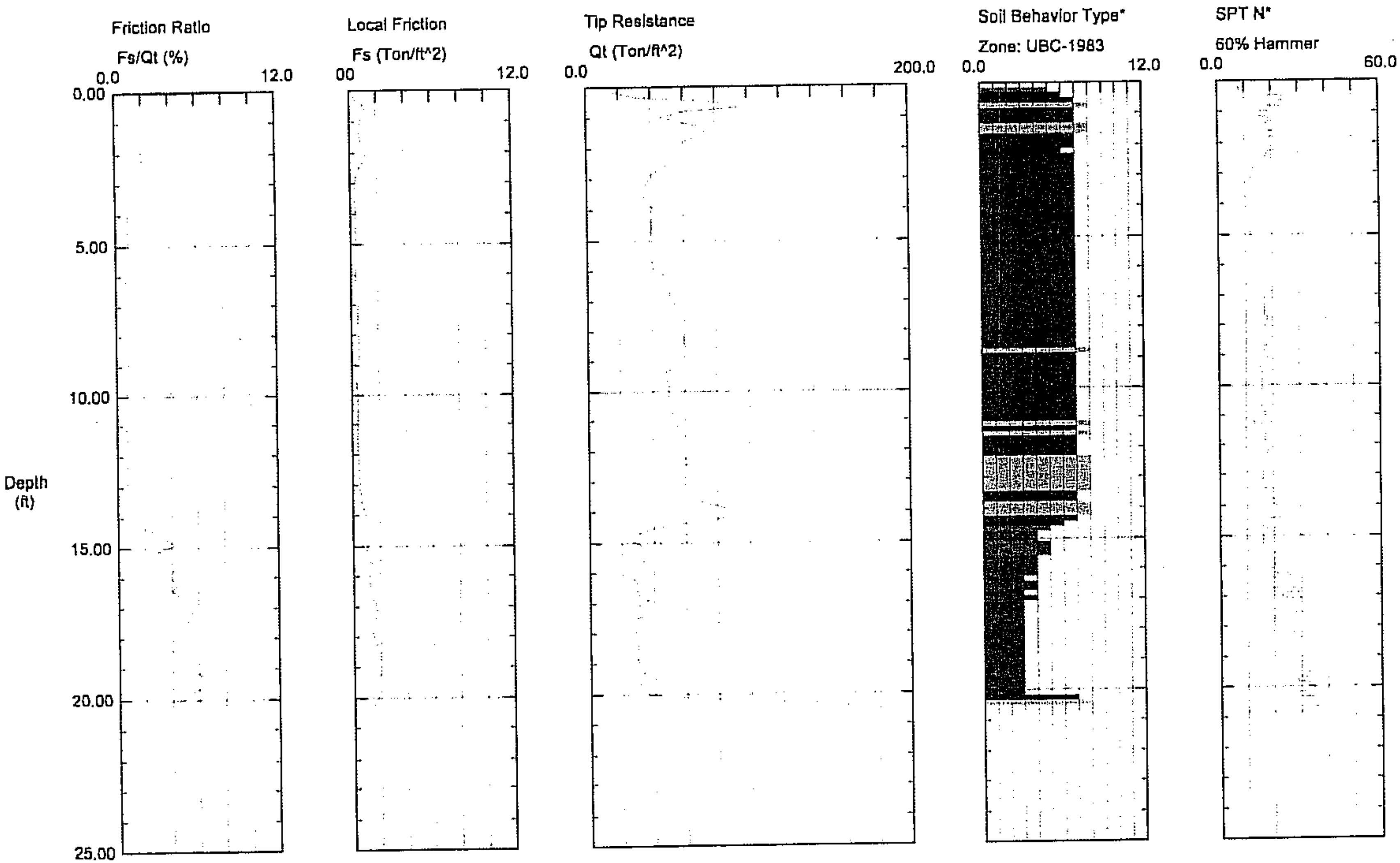


behavior type and SI ...ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w095
Cone Used: HO856TC

CPT Date/Time: 07-15-04 09:22
Location: CPT-34
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

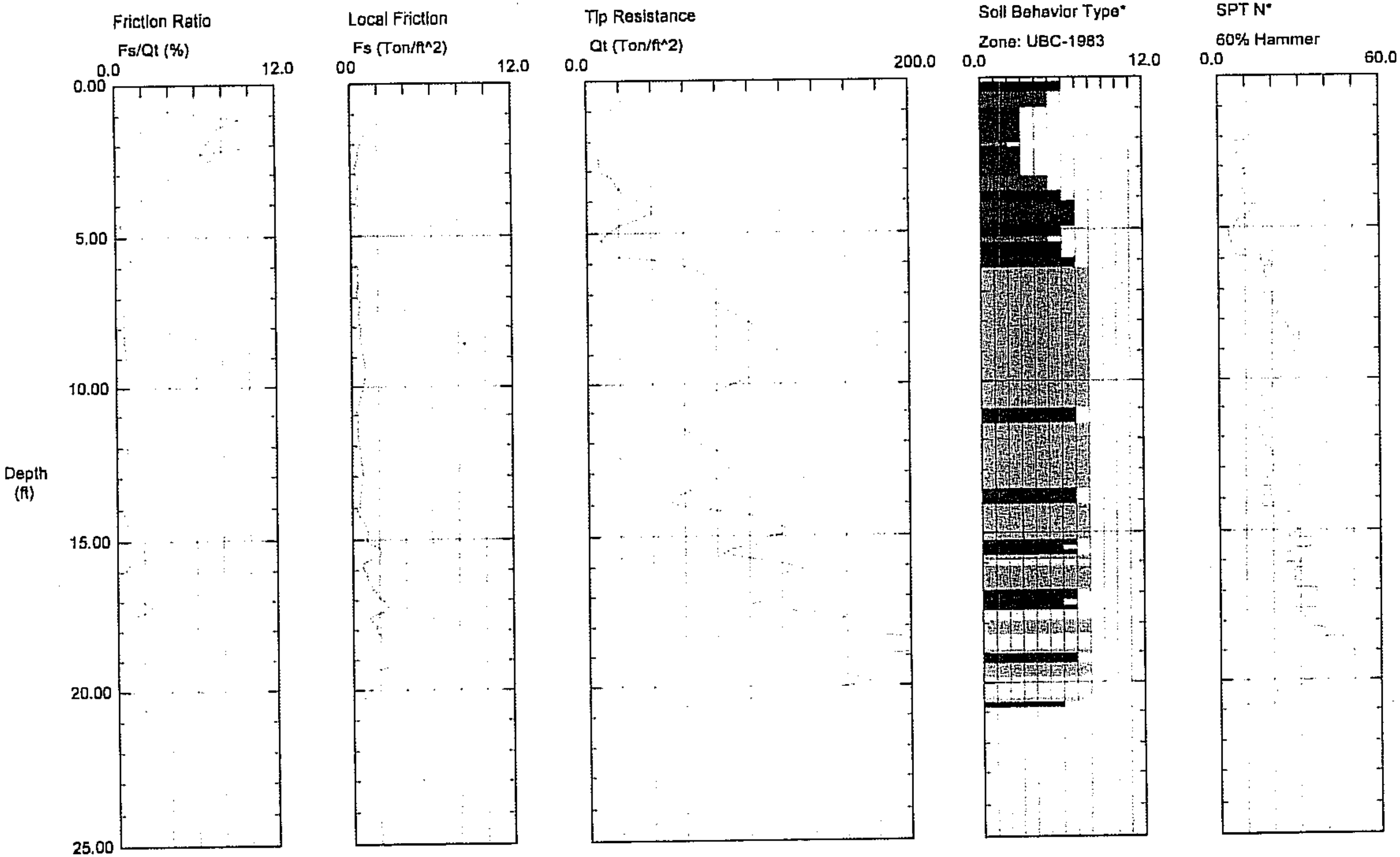
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w096
Cone Used: HO856TC

CPT Date/Time: 07-15-04 10:24
Location: CPT-35
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

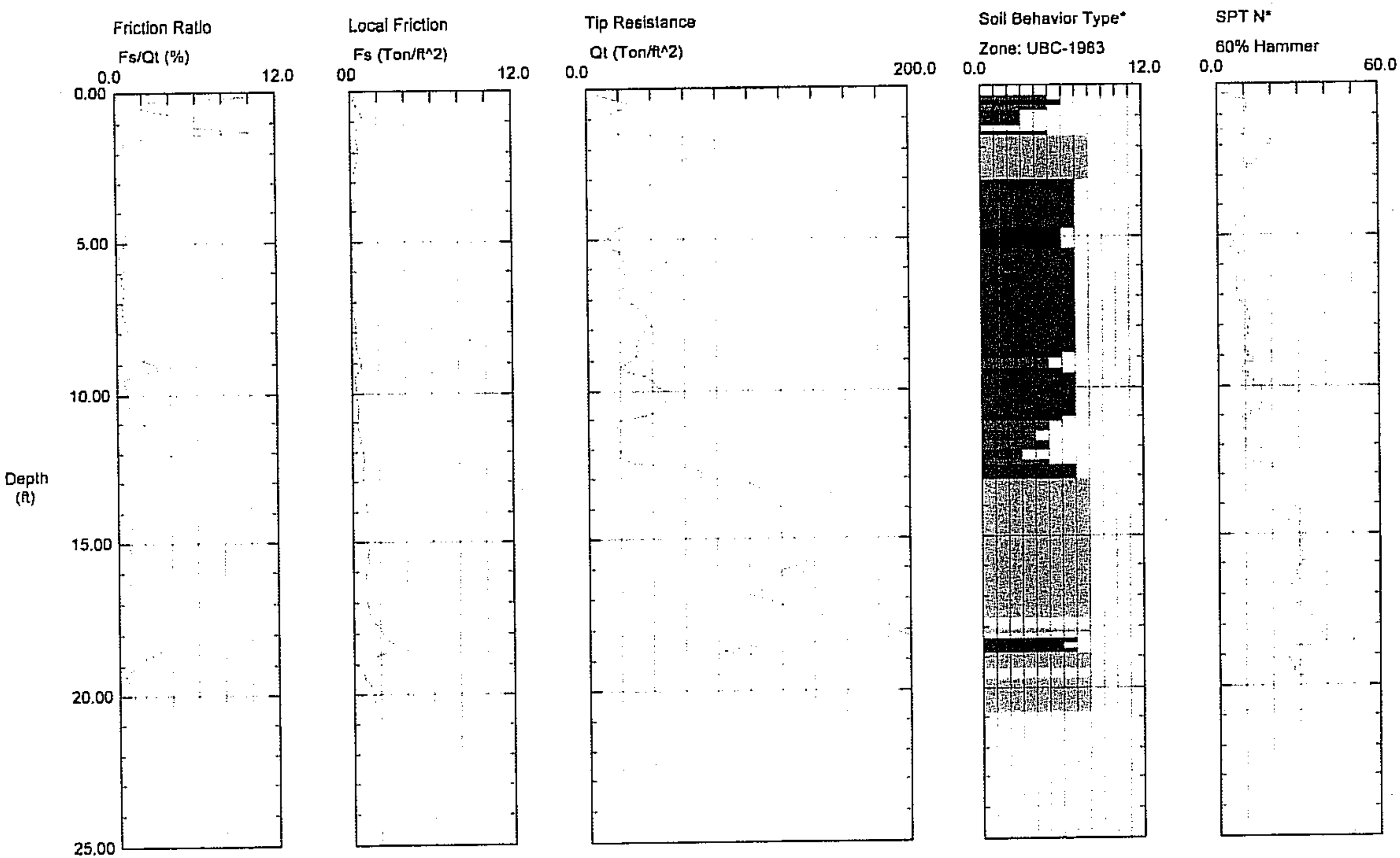
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SP... ...sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w097
Cone Used: HO856TC

CPT Date/Time: 07-15-04 12:34
Location: CPT-36
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

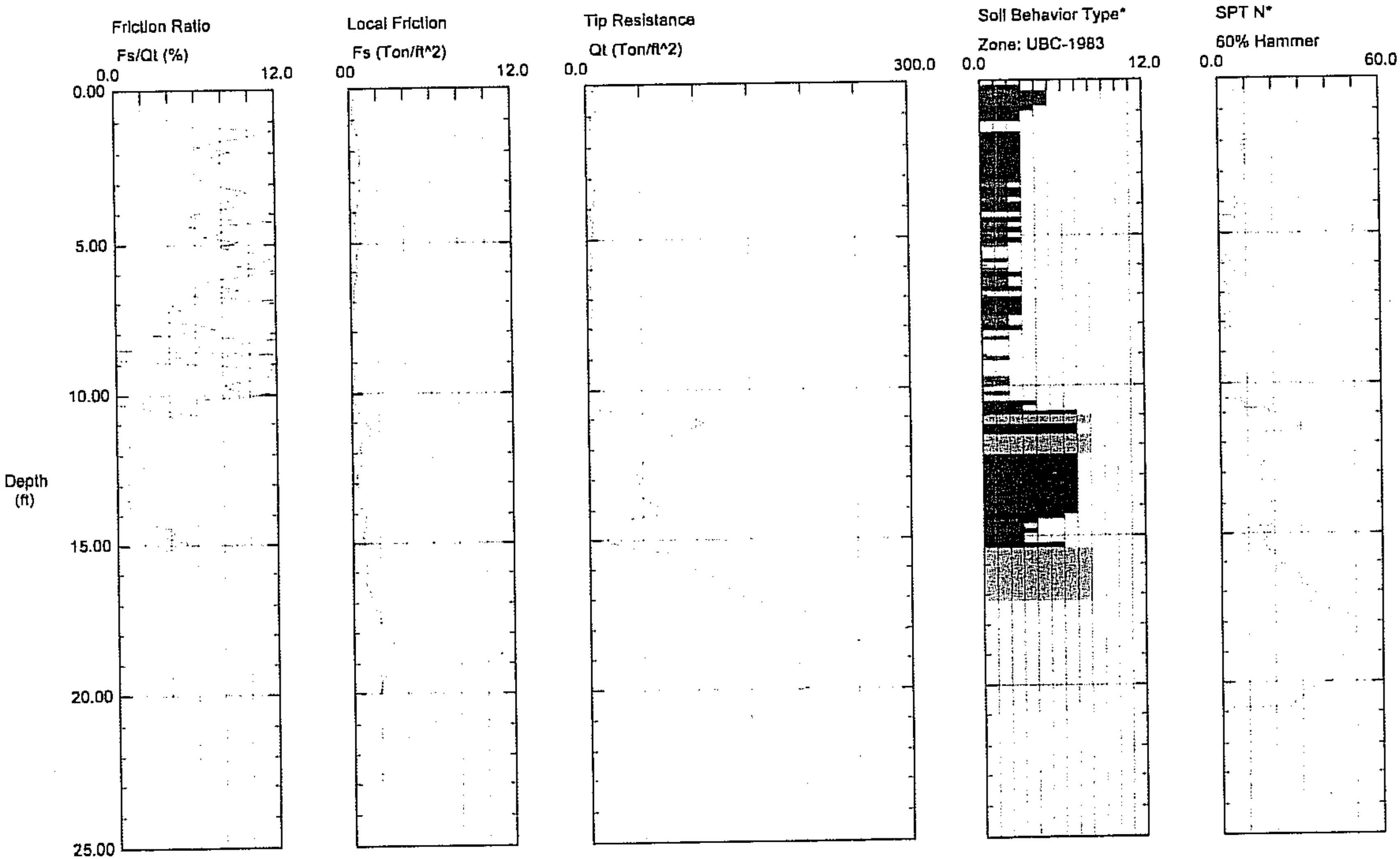
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and S. ↲ed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w098
Cone Used: HO856TC

CPT Date/Time: 07-15-04 13:27
Location: CPT-37
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

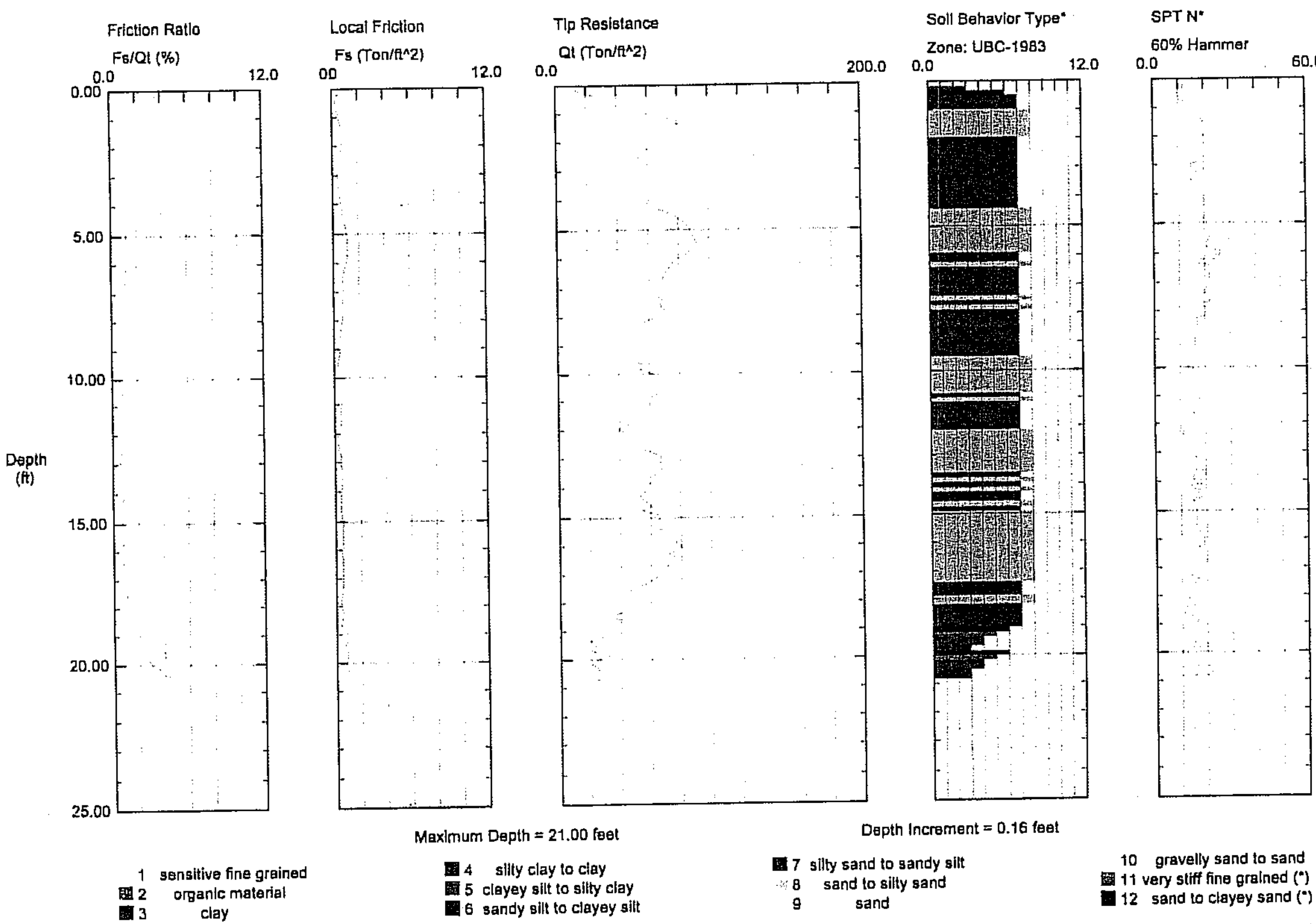
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

ll behavior type and S. ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w099
Cone Used: HO856TC

CPT Date/Time: 07-15-04 14:24
Location: CPT-38
Job Number: 4603.4100.01

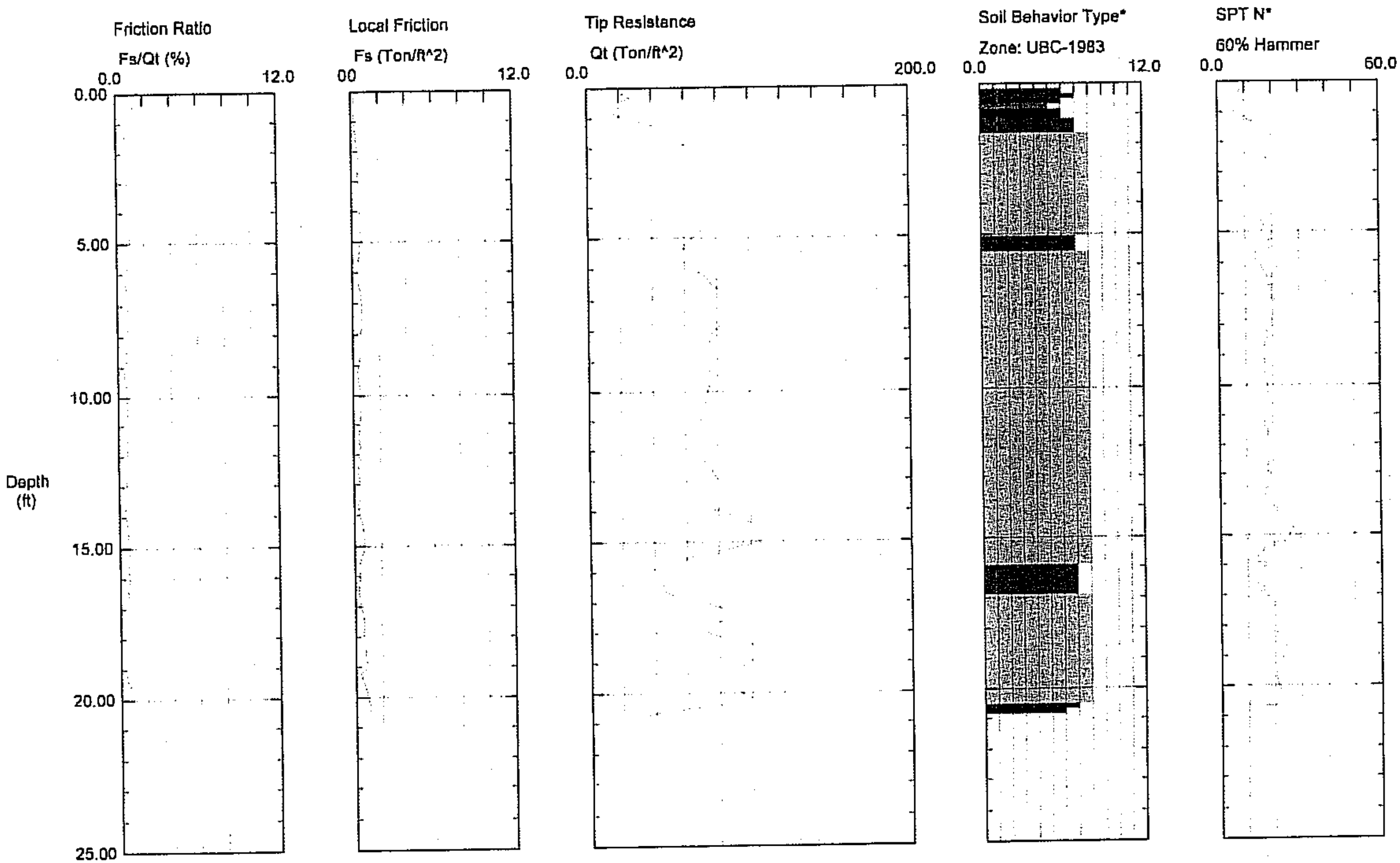


behavior type and SP... ...sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w100
Cone Used: HO856TC

CPT Date/Time: 07-15-04 15:24
Location: CPT-39
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

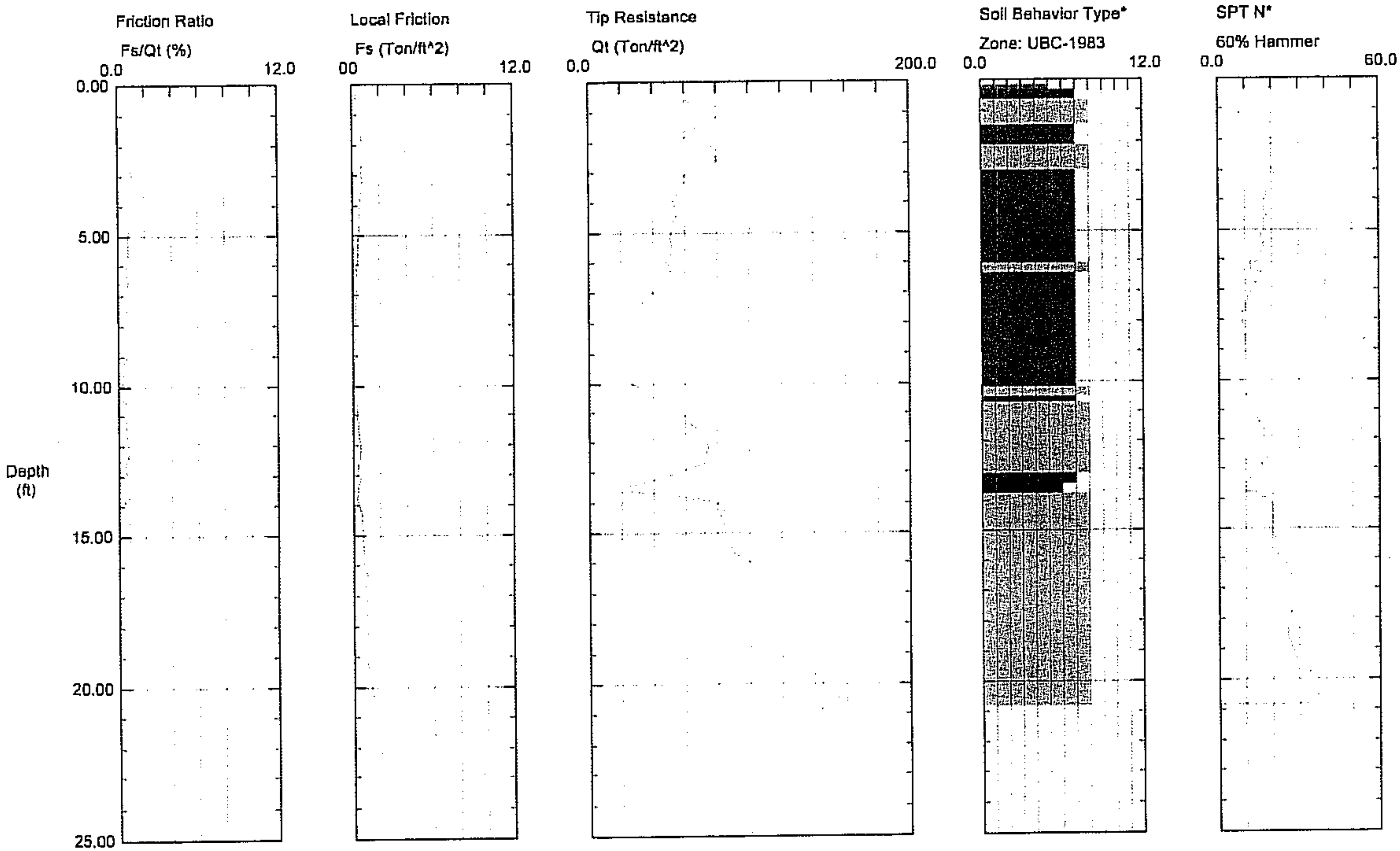
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w101
Cone Used: HO856TC

CPT Date/Time: 07-15-04 16:20
Location: CPT-40
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

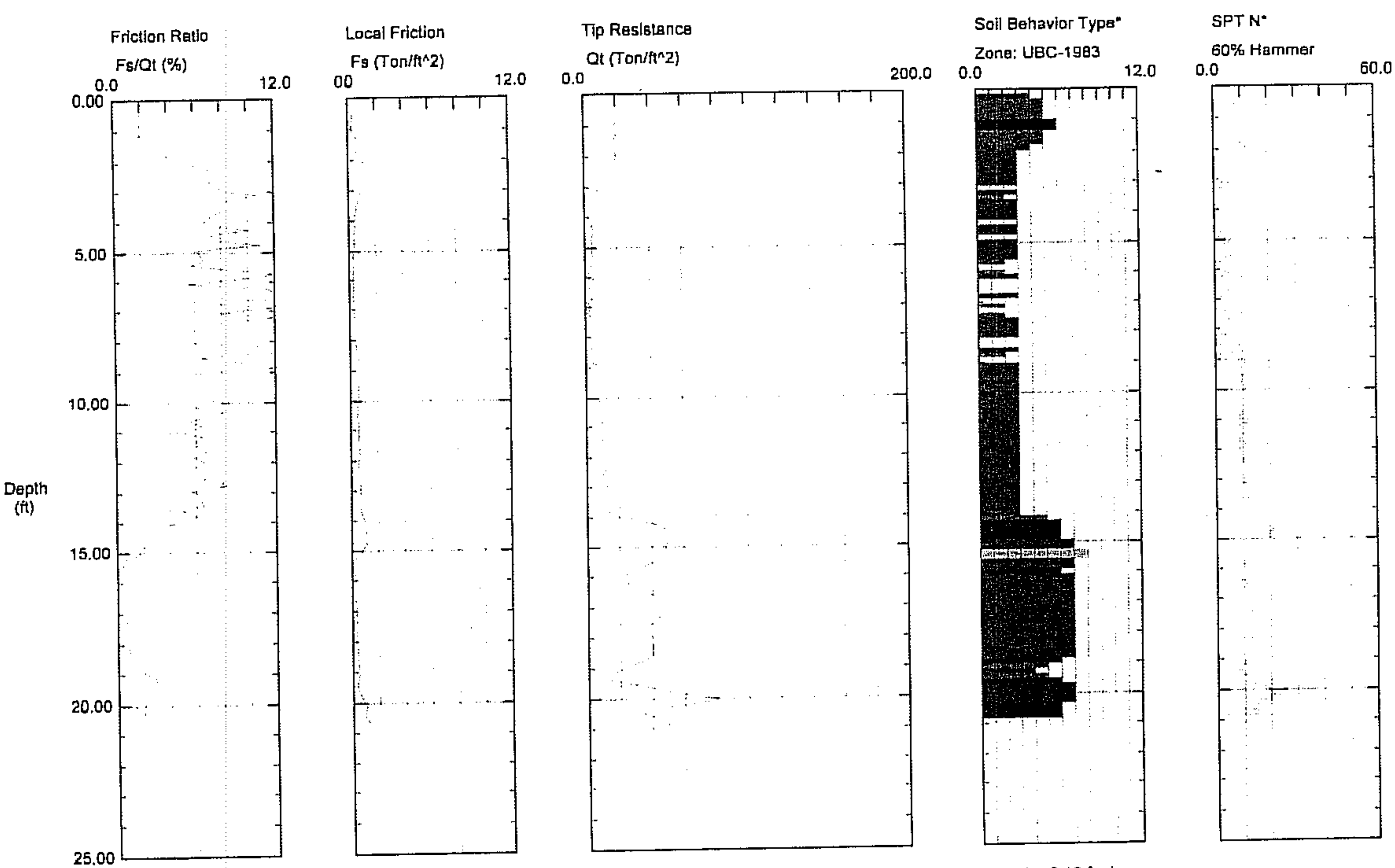
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

l behavior type and S_ _sed on data from UBC-1 983 behavior type and SP. ..sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w102
Cone Used: HO856TC

CPT Date/Time: 07-16-04 08:26
Location: CPT-41
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

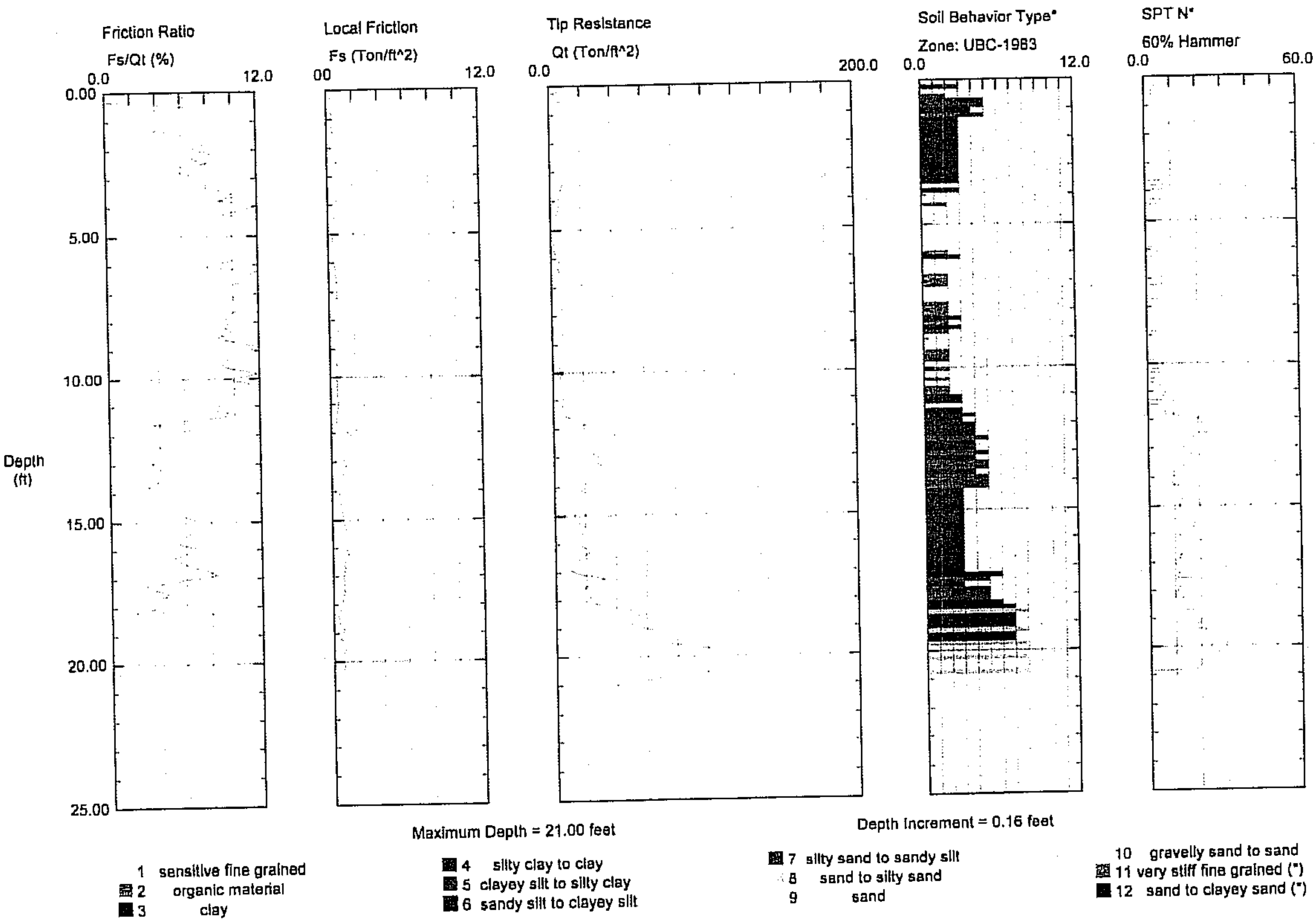
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and SPT ...sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w103
Cone Used: HO856TC

CPT Date/Time: 07-16-04 09:18
Location: CPT-42
Job Number: 4603.4100.01

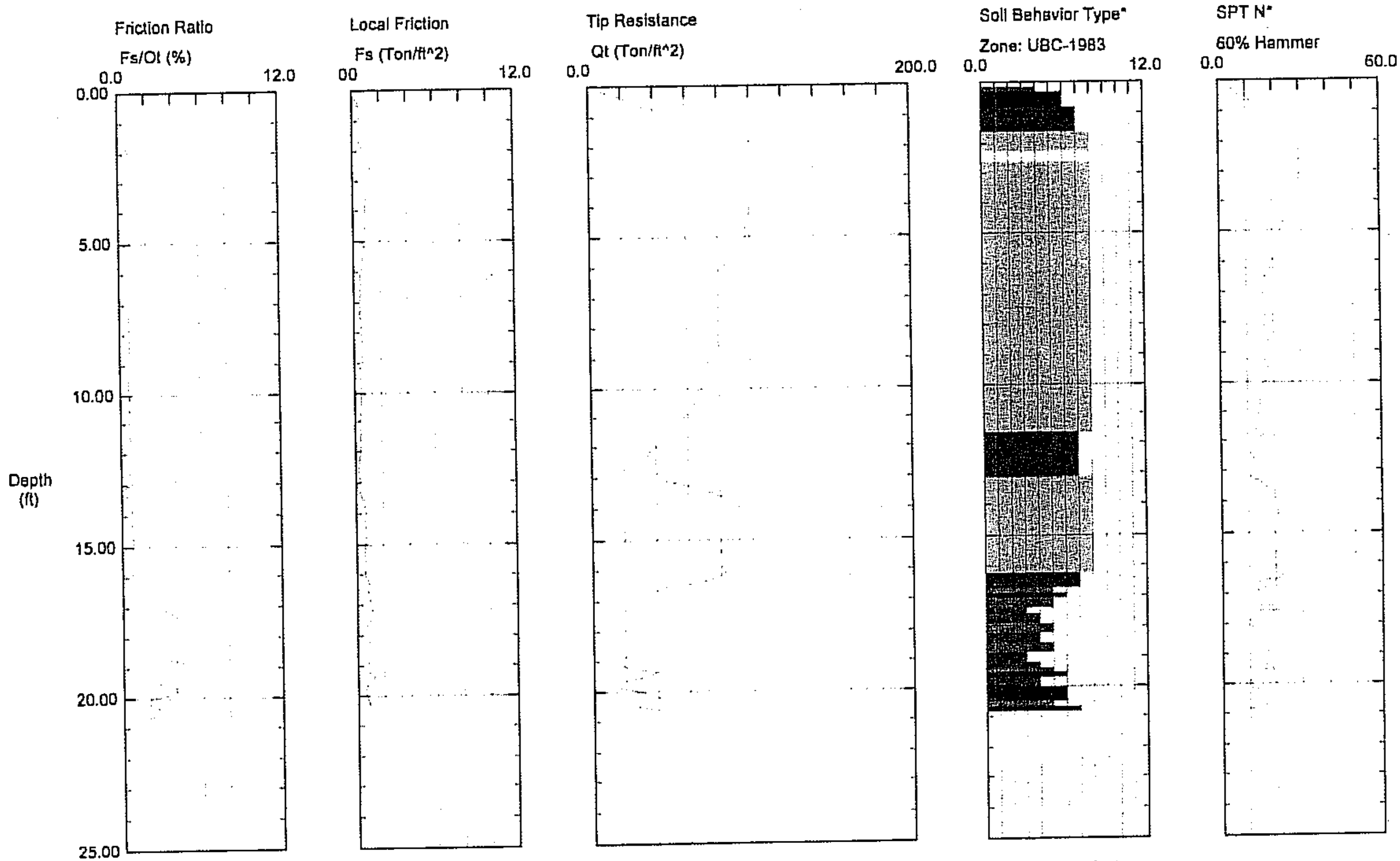


l behavior type and S... ...sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w104
Cone Used: HO856TC

CPT Date/Time: 07-16-04 10:24
Location: CPT-43
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

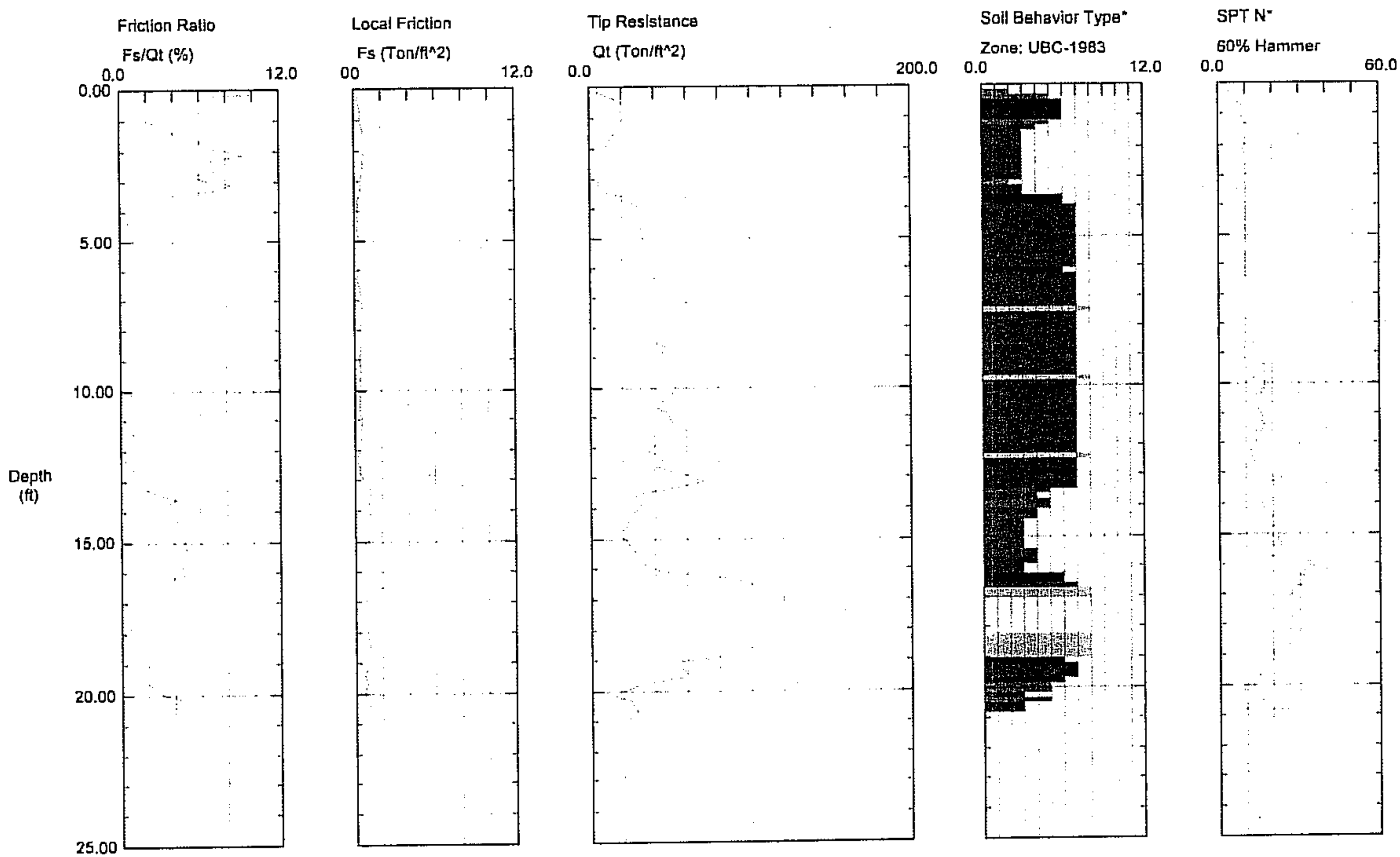
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

ll behavior type and S ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w105
Cone Used: HO856TC

CPT Date/Time: 07-16-04 11:16
Location: CPT-44
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

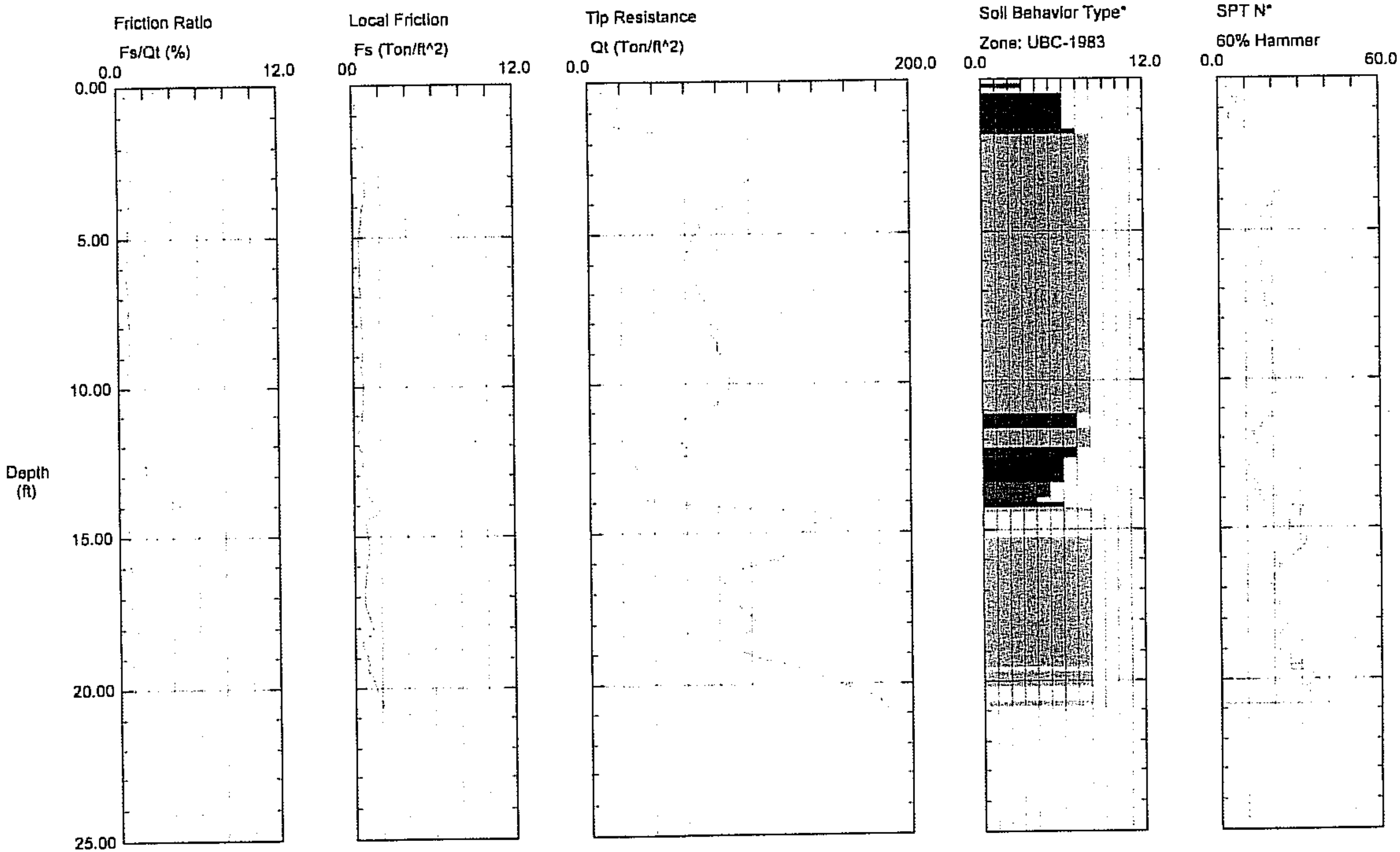
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and 5. ...sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w106
Cone Used: HO856TC

CPT Date/Time: 07-16-04 07:26
Location: CPT-45
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

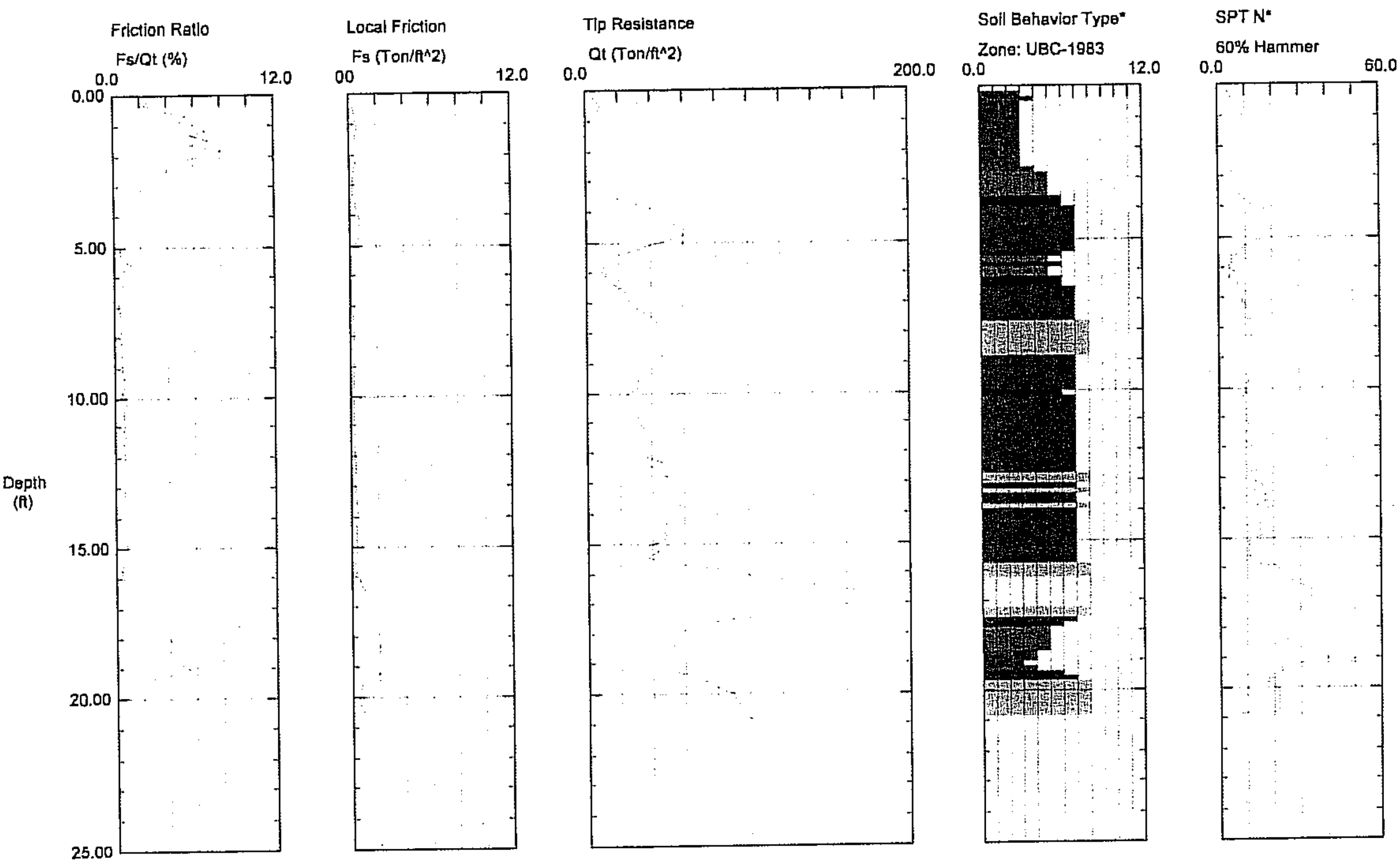
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

behavior type and S. .sed on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w107
Cone Used: HO856TC

CPT Date/Time: 07-16-04 12:09
Location: CPT-46
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

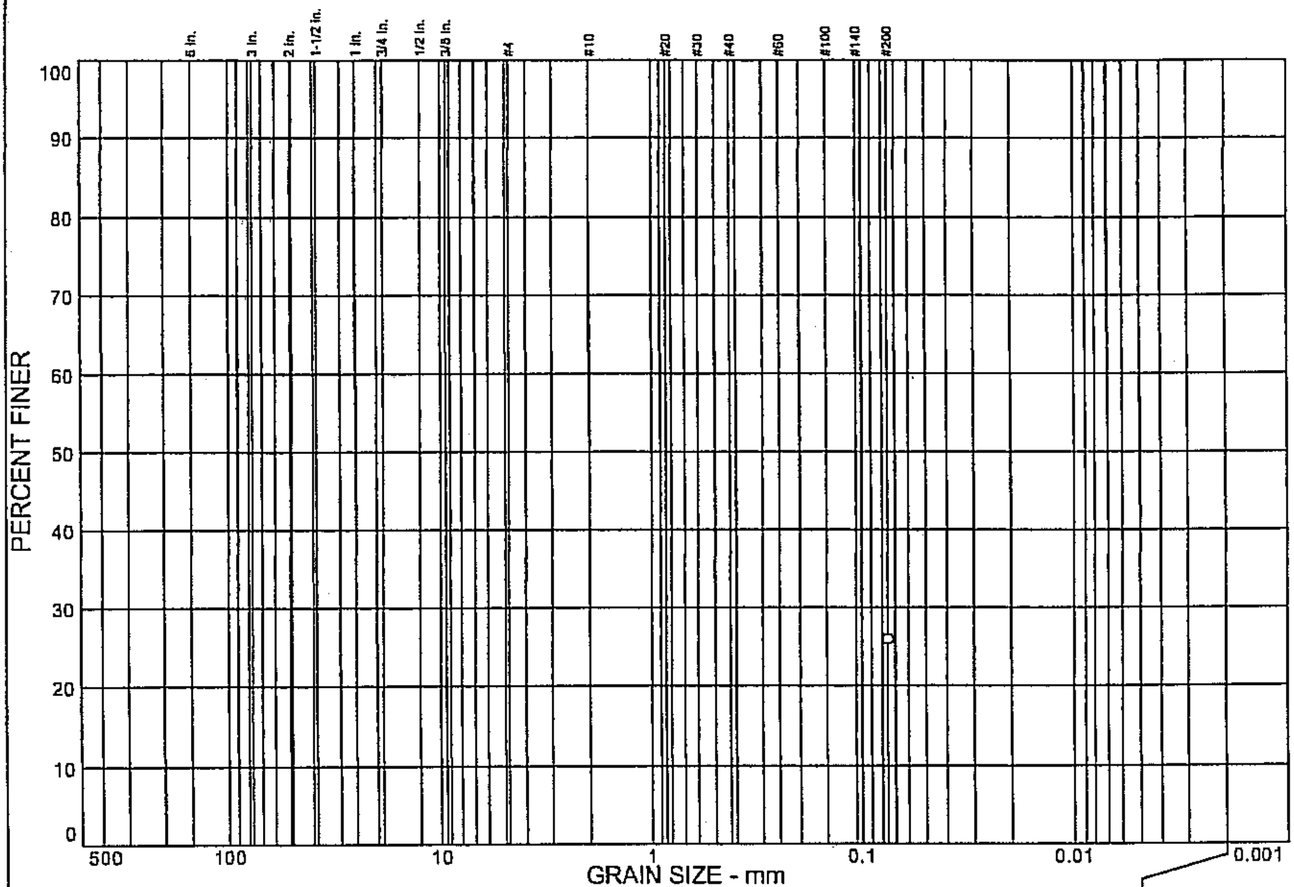
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

ENGEO

APPENDIX B

Grain Size Distribution Curves (18 pages)
[illegible]
Consolidation Tests ([illegible] pages)
Sulfate Test Results ([illegible] page)

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			25.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	25.9		

* (no specification provided)

Soil Description

Light olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= SM AASHTO=

Remarks

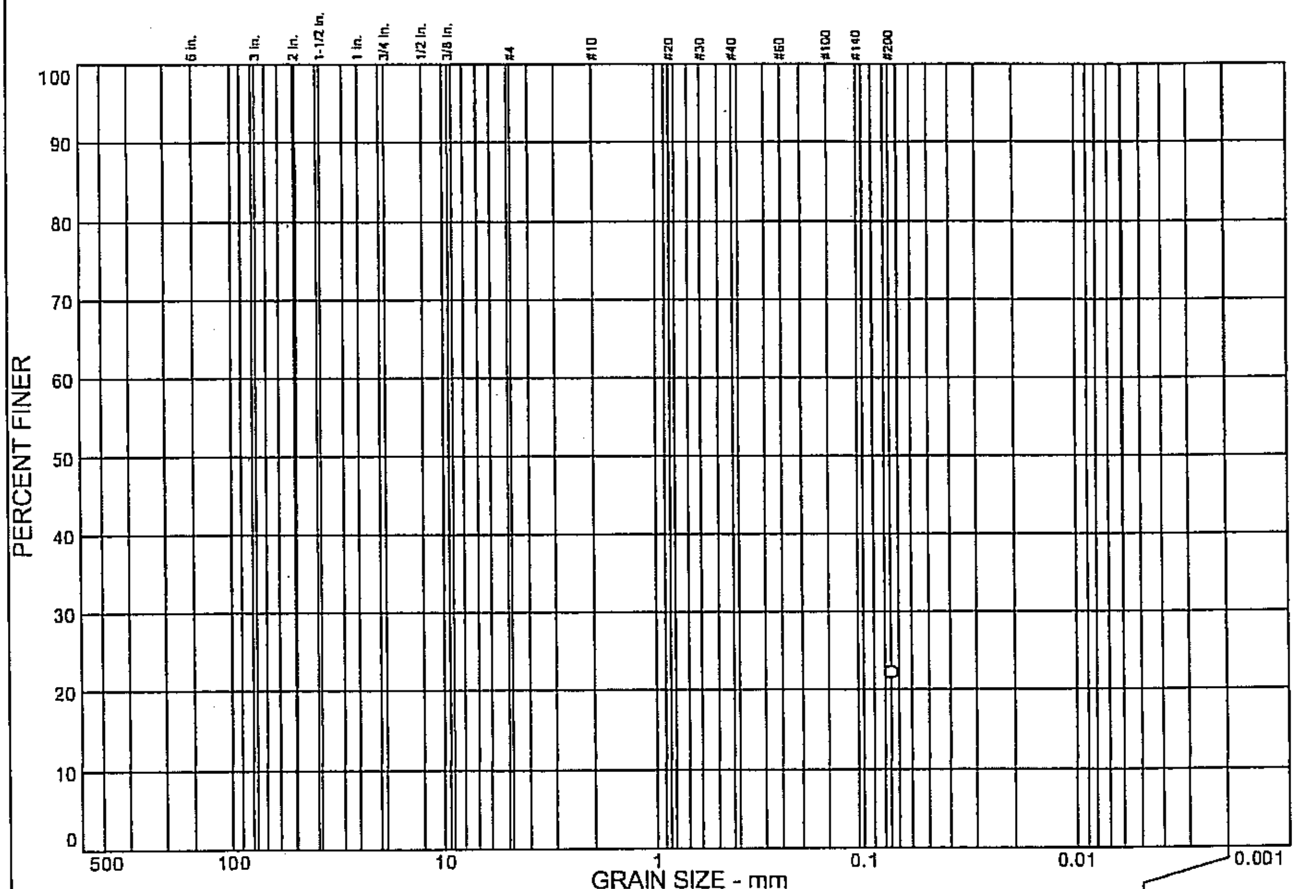
Sample No.: 1-6 **Source of Sample:** %200 **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			22.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	22.2		

* (no specification provided)

Soil Description

Olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= SM AASHTO=

Remarks

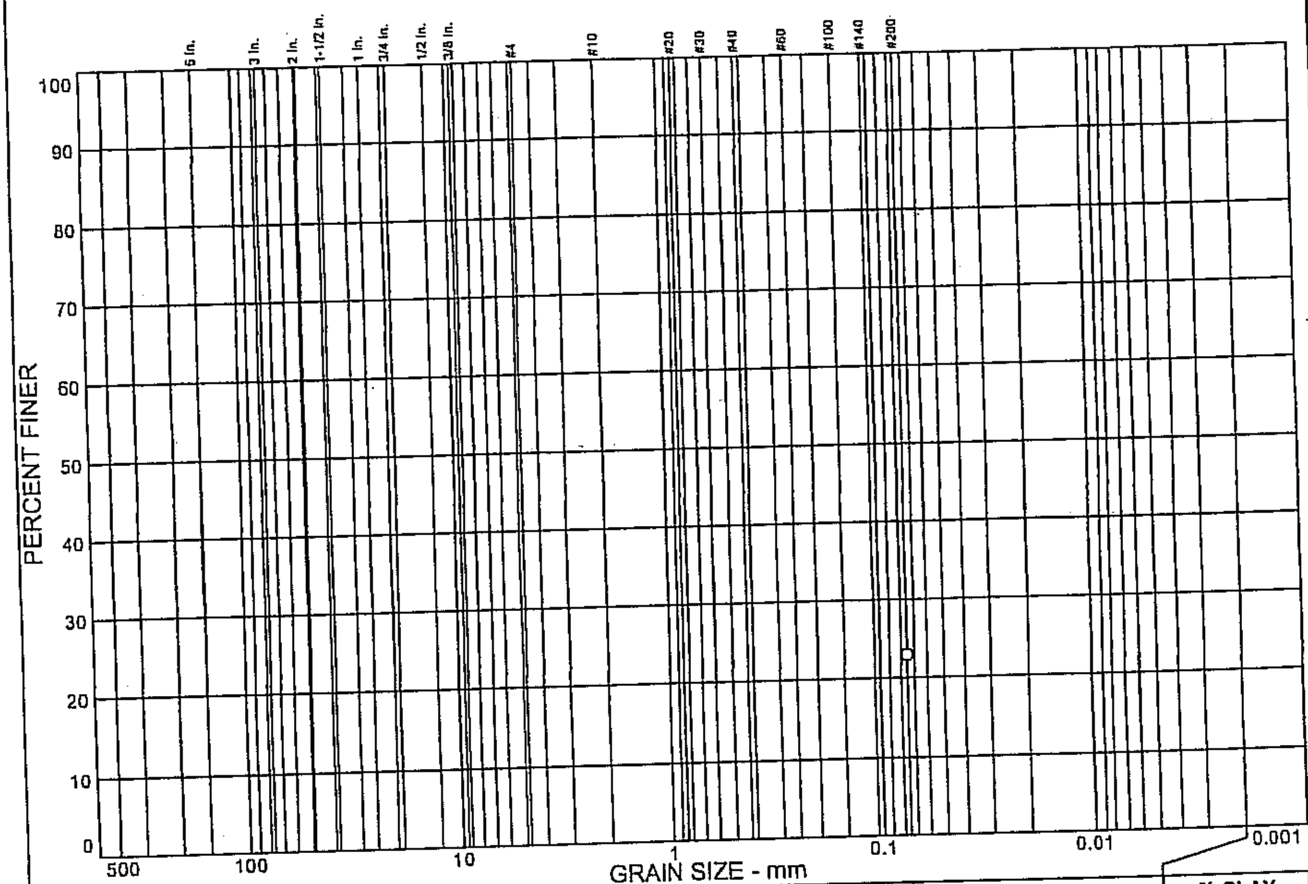
Sample No.: 2-6 **Source of Sample:** %200 **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			22.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	22.8		

* (no specification provided)

Soil Description

Olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= SM AASHTO=

Remarks

Sample No.: 2-7
Location:

Source of Sample: %200

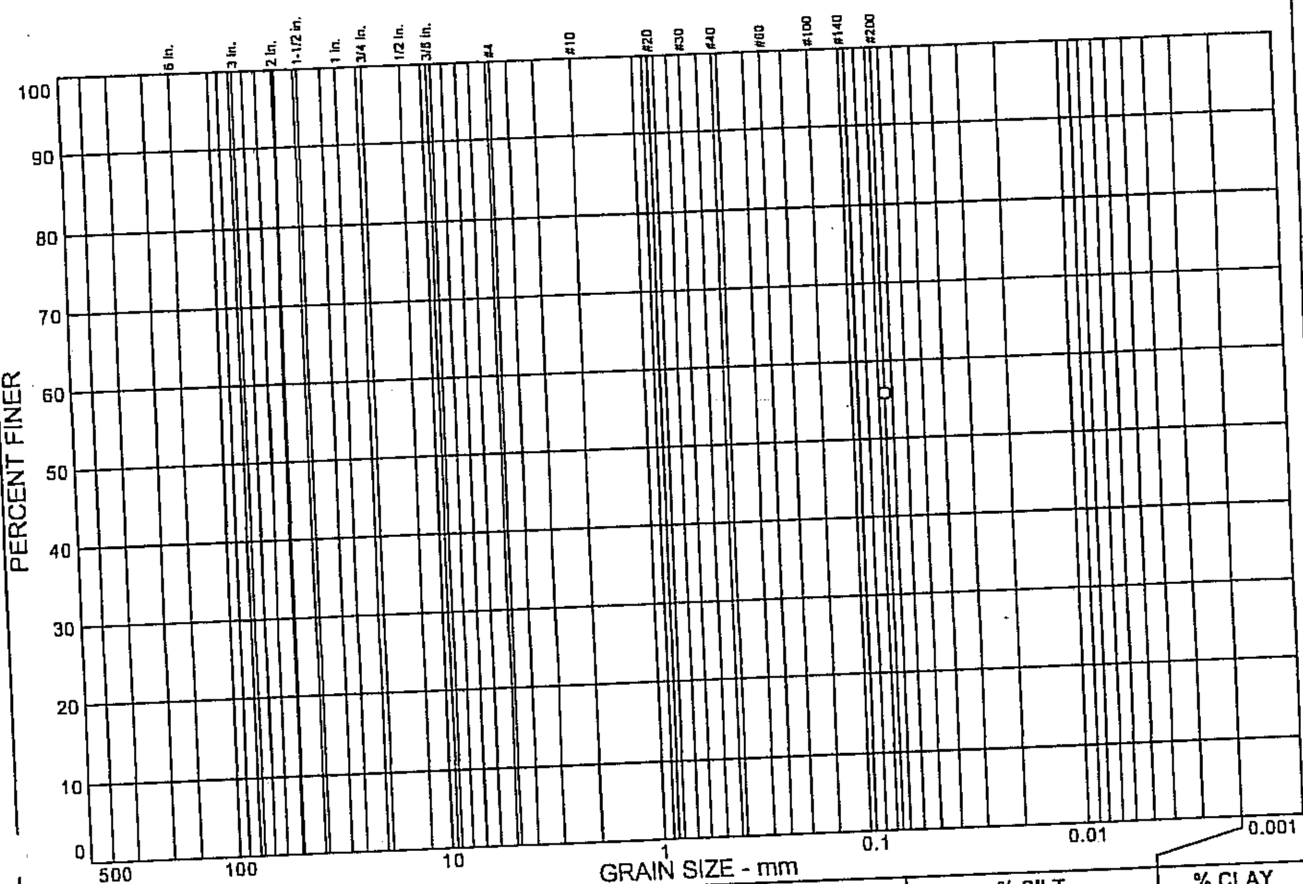
Date: 06-24-04
Elev./Depth:

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 Plate

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			55.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	55.7		

* (no specification provided)

Soil Description

Olive brown silty Clay with sand

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= CL AASHTO=

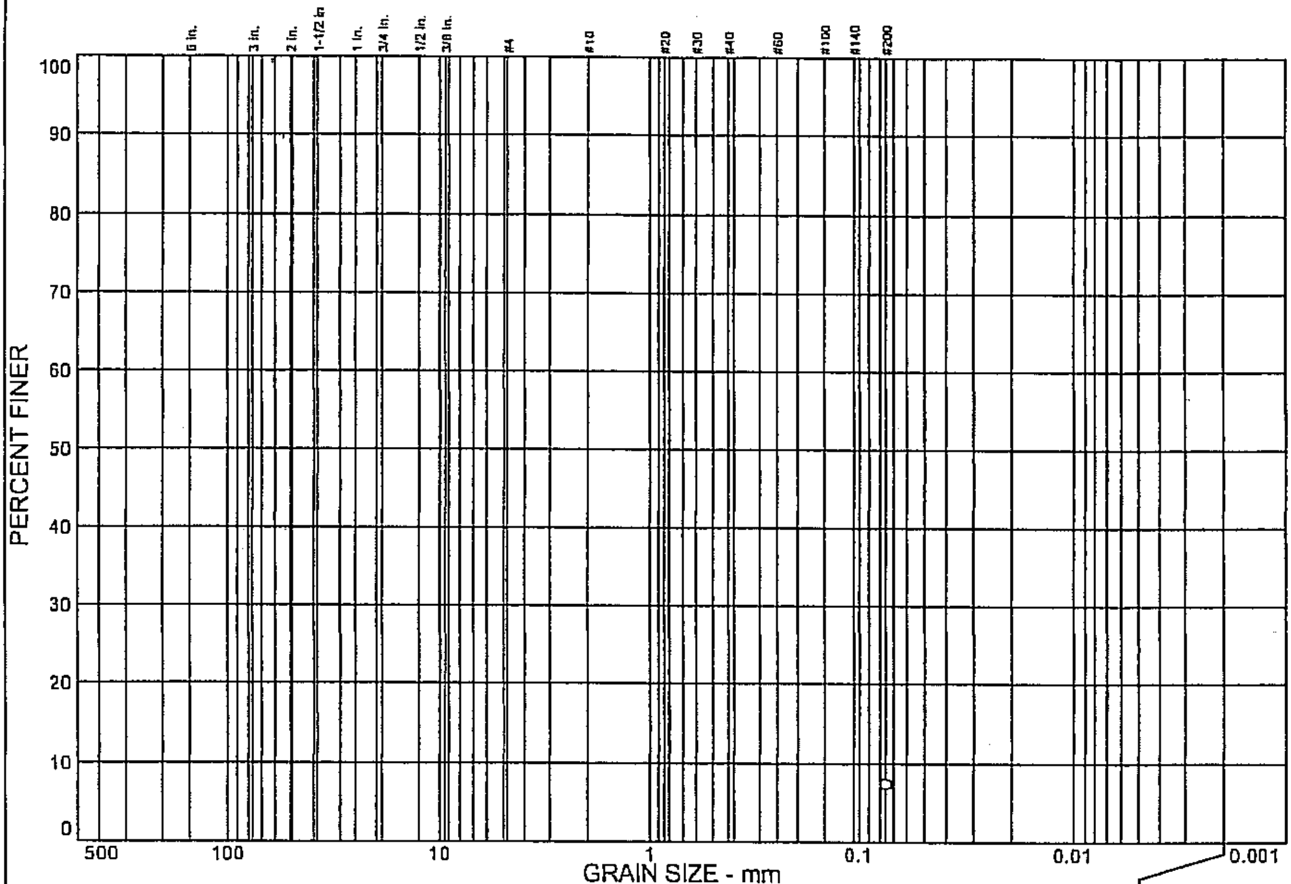
Remarks

Sample No.: 2-8 Source of Sample: %200 Date: 06-24-04
Location: Elev./Depth:

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01
Project No: 4603.4.100.01 Plate

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			7.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	7.2		

* (no specification provided)

Soil Description

Olive gray poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= SP-SM AASHTO=

Remarks

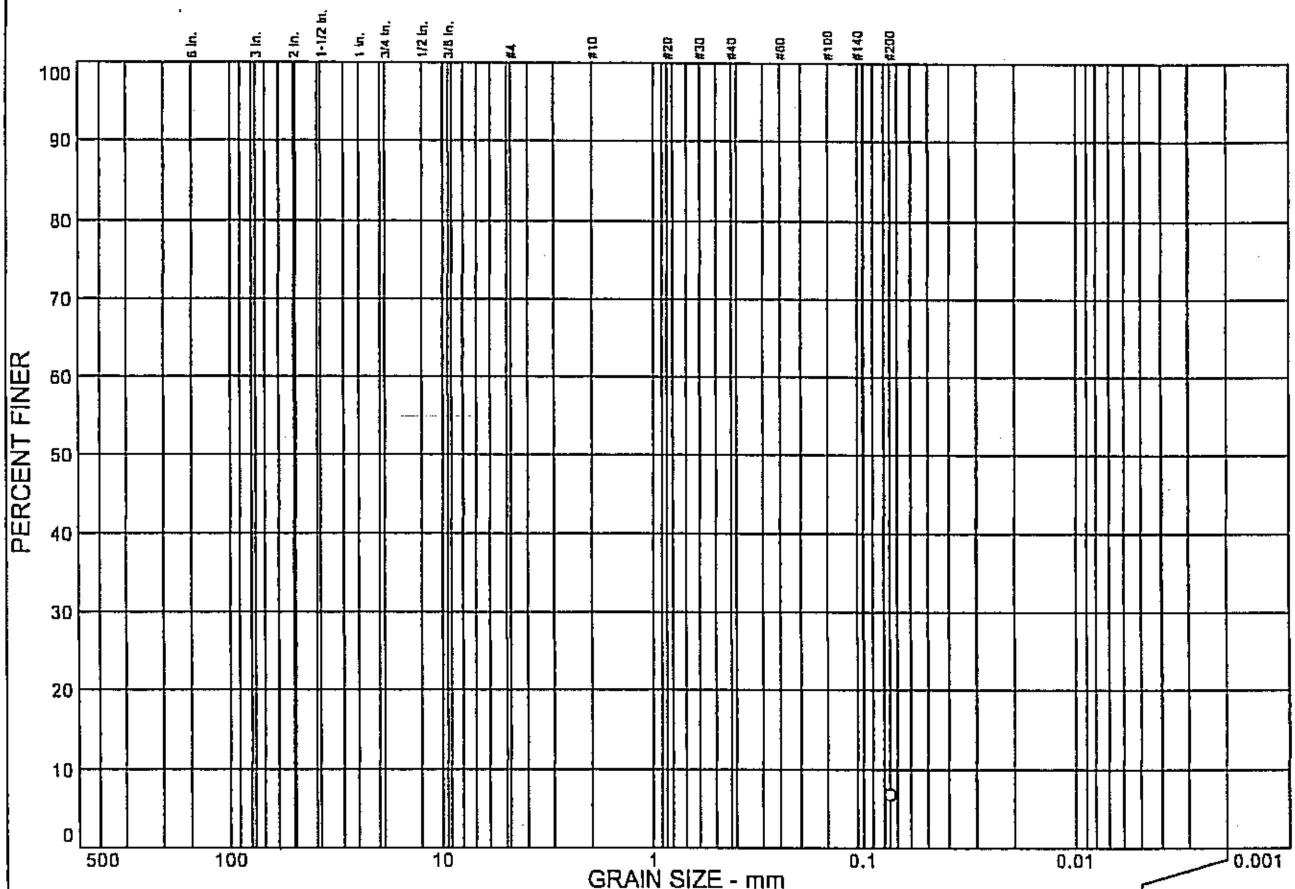
Sample No.: 3-6 **Source of Sample:** %200 **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			6.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	6.6		

* (no specification provided)

Soil Description

Light olive brown Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

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

Classification

USCS= SP AASHTO=

Remarks

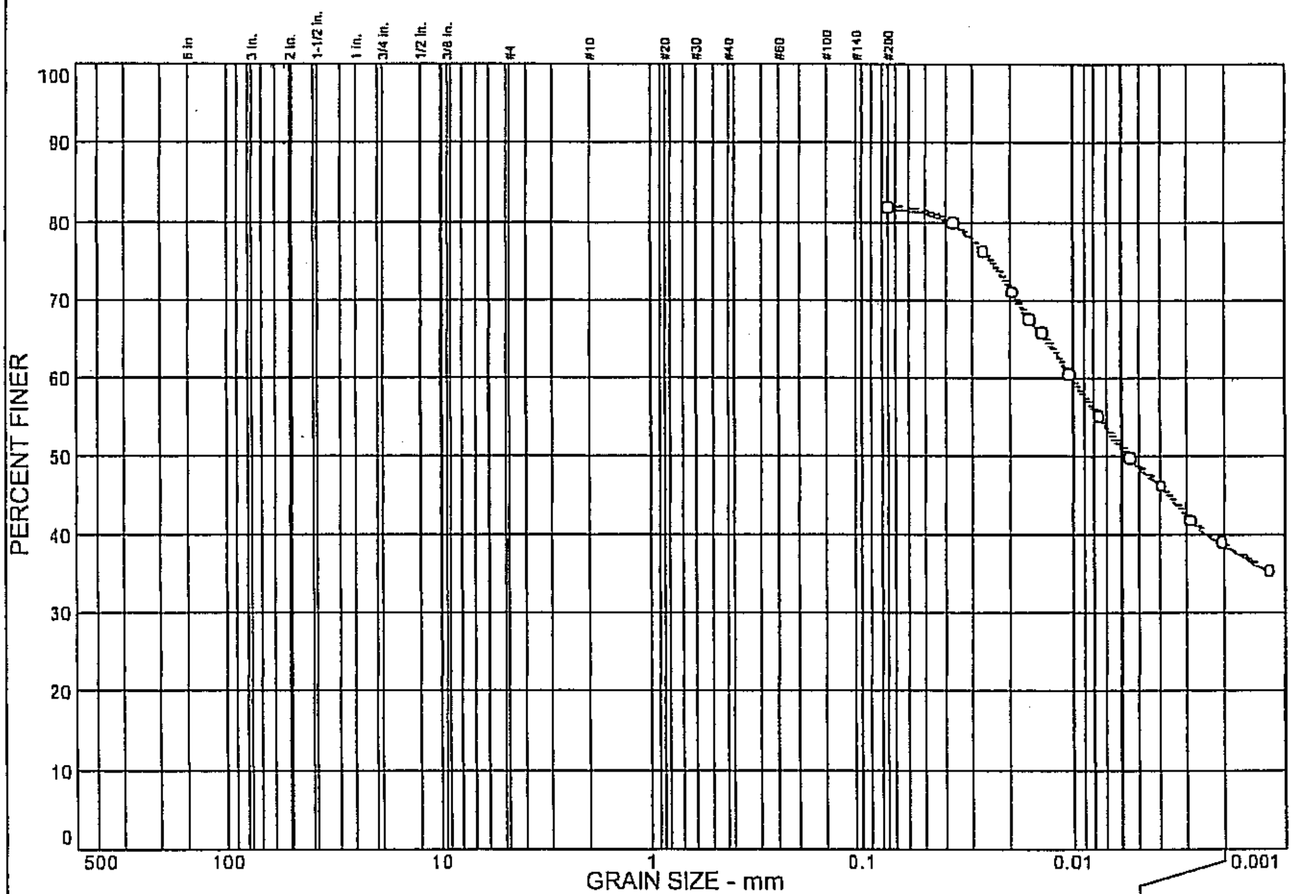
Sample No.: 3-7 **Source of Sample:** %200 **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			42.9	38.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	81.7		

* (no specification provided)

Soil Description

Very dark grey brown silty Clay with sand.

Atterberg Limits

PL= 18 LL= 47 PI= 29

Coefficients

D_{85}= D_{60}= 0.0103 D_{50}= 0.0056
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

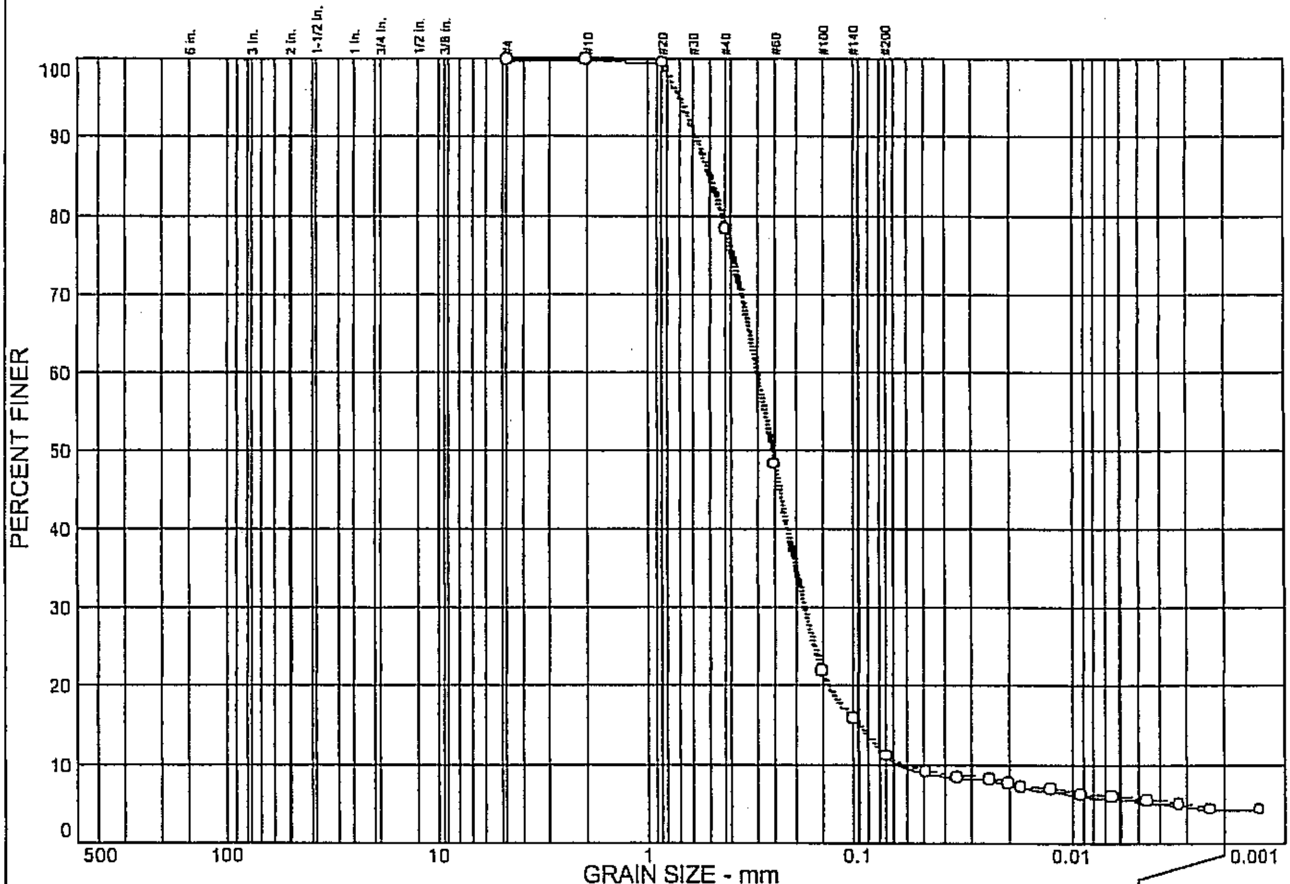
Sample No.: 1-1 **Source of Sample:** PI/Hy **Date:** 06-22-04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	88.9	6.8	4.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.6		
#40	78.3		
#60	48.3		
#100	21.9		
#140	15.9		
#200	11.1		

* (no specification provided)

Soil Description

Light olive brown silty Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.501 D_{60}= 0.302 D_{50}= 0.257
D_{30}= 0.183 D_{15}= 0.0993 D_{10}= 0.0656
C_u= 4.61 C_c= 1.68

Classification

USCS= SP-SM AASHTO=

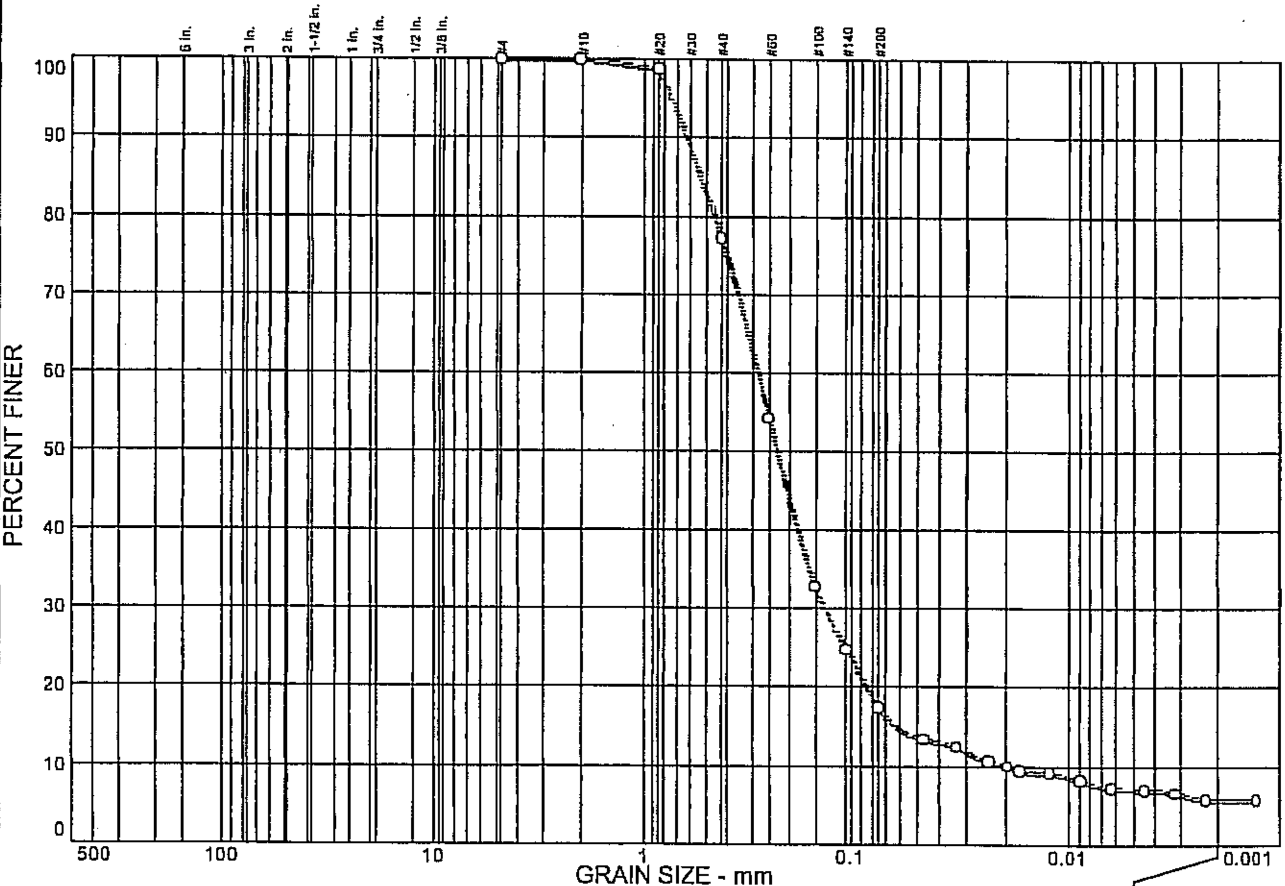
Remarks

Sample No.: 2-2 **Source of Sample:** PI/Hy **Date:** 6-22-04
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: 4603.4.100.01
Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	82.7	11.7	5.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.7		
#40	77.0		
#60	54.1		
#100	32.7		
#140	24.7		
#200	17.3		

* (no specification provided)

Soil Description

Light olive brown silty Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.535 D_{60}= 0.284 D_{50}= 0.229
D_{30}= 0.136 D_{15}= 0.0630 D_{10}= 0.0201
C_u= 14.12 C_c= 3.22

Classification

USCS= SM AASHTO=

Remarks

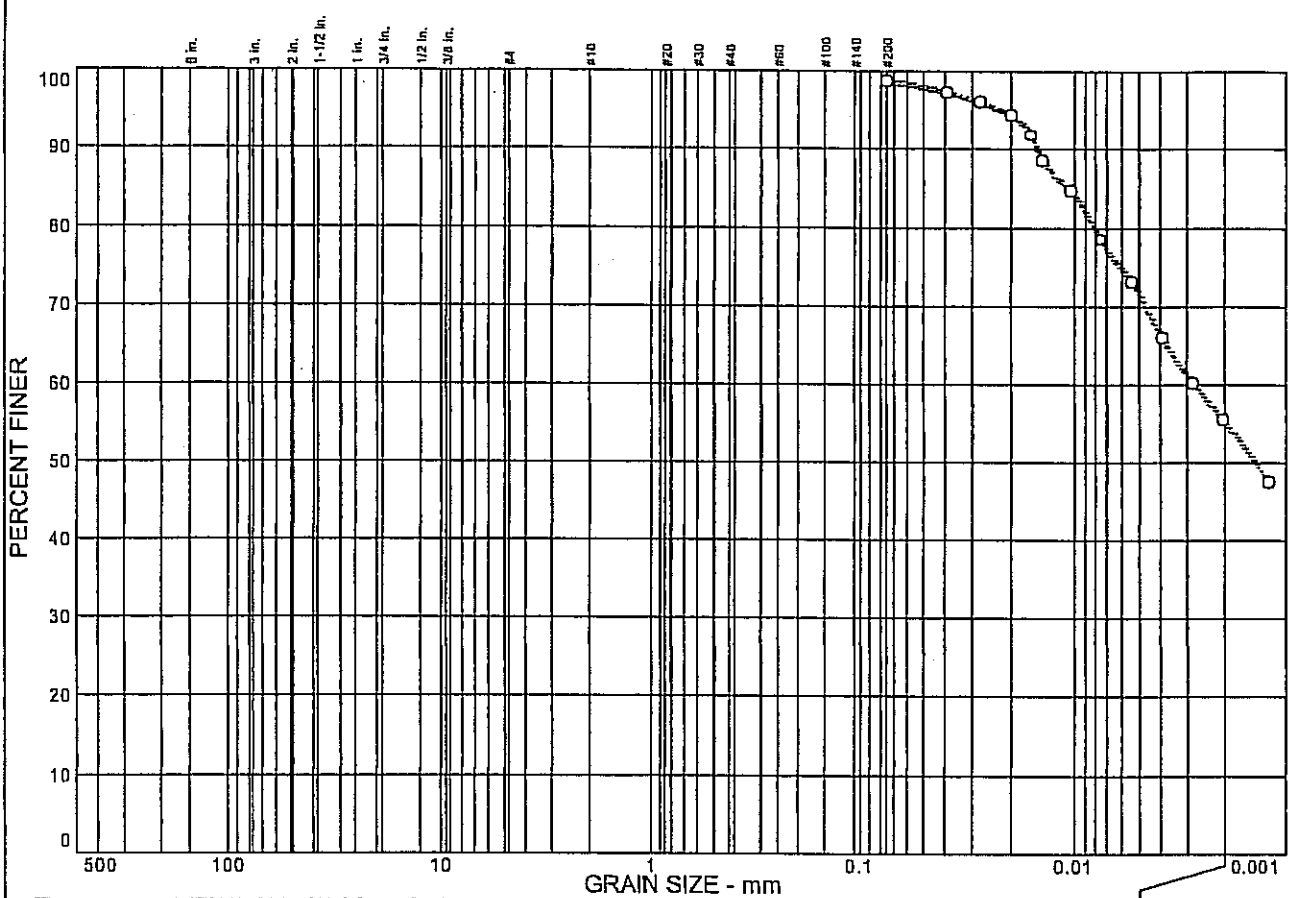
Sample No.: 2-3 **Source of Sample:** PI/Hy **Date:** 6/22/04
Location: **Elev./Depth:**

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			43.4	55.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	98.7		

* (no specification provided)

Soil Description

Dark grey brown Clay

Atterberg Limits

PL= 19 LL= 61 PI= 42

Coefficients

D_{85}= 0.0107 D_{60}= 0.0028 D_{50}= 0.0014
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

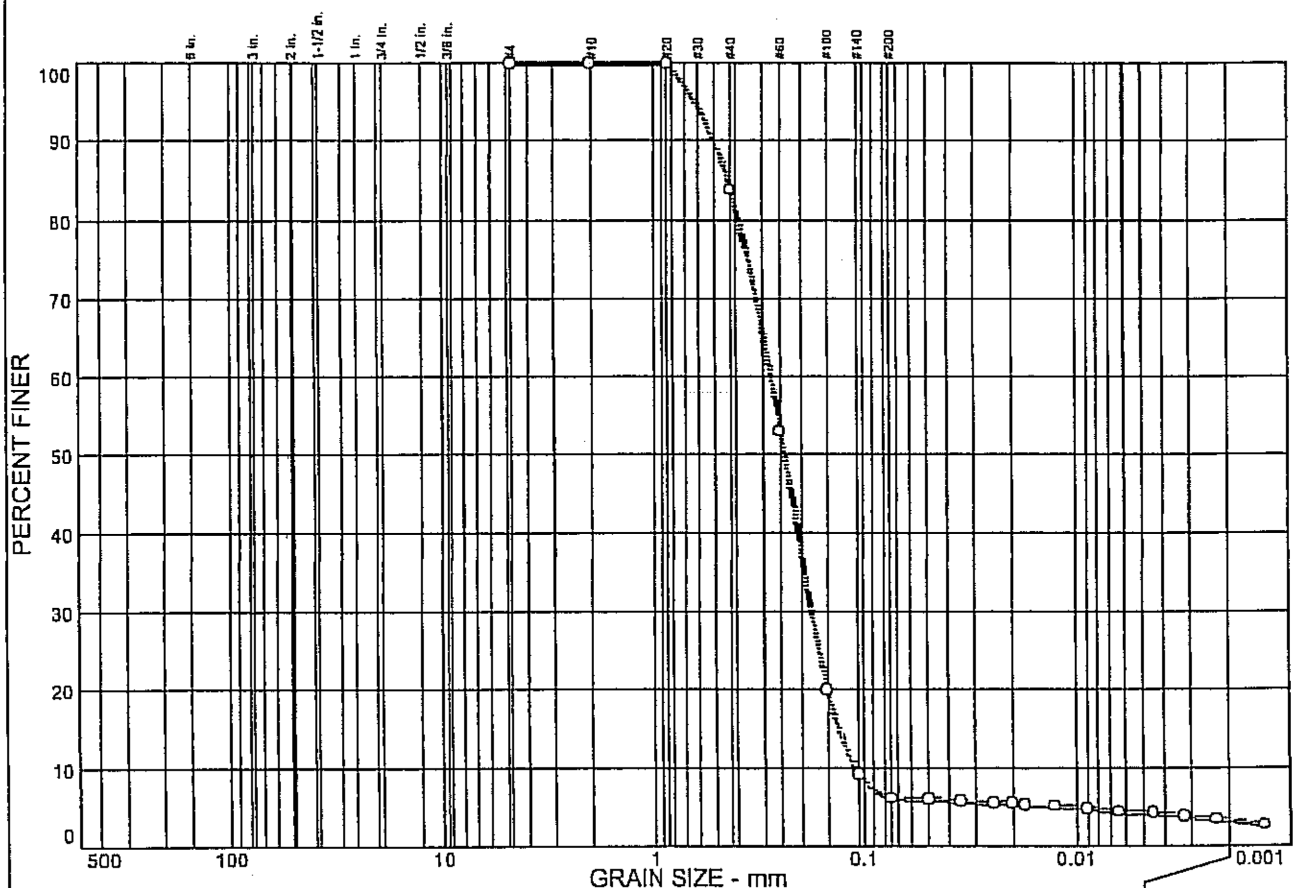
Sample No.: 3-1 **Source of Sample:** PI/Hy **Date:** 6/24/04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	94.0	2.9	3.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	83.8		
#60	52.9		
#100	19.9		
#140	9.1		
#200	6.0		

* (no specification provided)

Soil Description

Yellowish brown Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.438 D_{60}= 0.277 D_{50}= 0.240
D_{30}= 0.179 D_{15}= 0.133 D_{10}= 0.111
C_u= 2.50 C_c= 1.04

Classification

USCS= SP-SM AASHTO=

Remarks

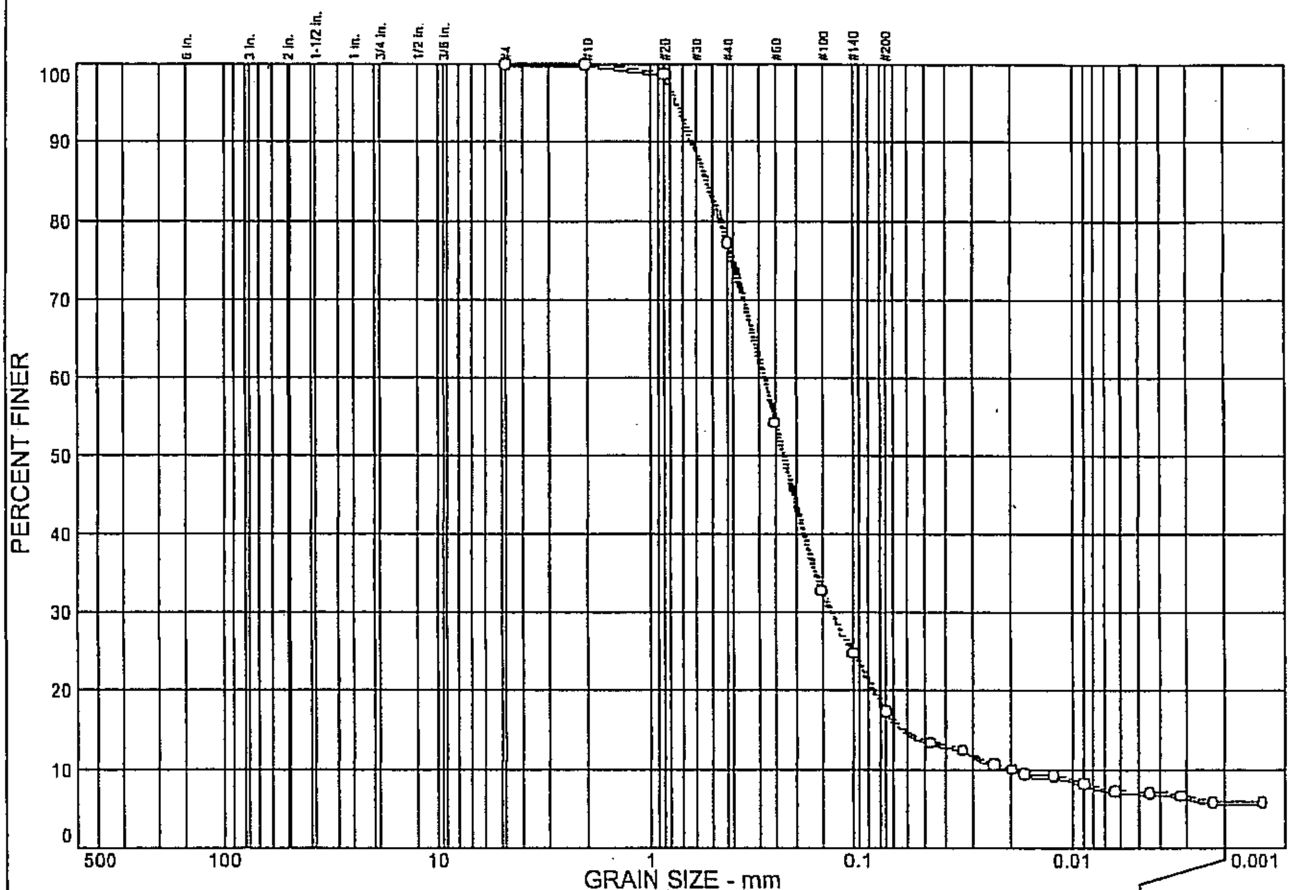
Sample No.: 3-5 Source of Sample: PI/Hy Date: 6-23-04
Location: Elev./Depth:

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 Plate

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	82.7	11.7	5.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.7		
#40	77.0		
#60	54.1		
#100	32.7		
#140	24.7		
#200	17.3		

* (no specification provided)

Soil Description

Light olive brown silty Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.535 D_{60}= 0.284 D_{50}= 0.229
D_{30}= 0.136 D_{15}= 0.0630 D_{10}= 0.0201
C_u= 14.12 C_c= 3.22

Classification

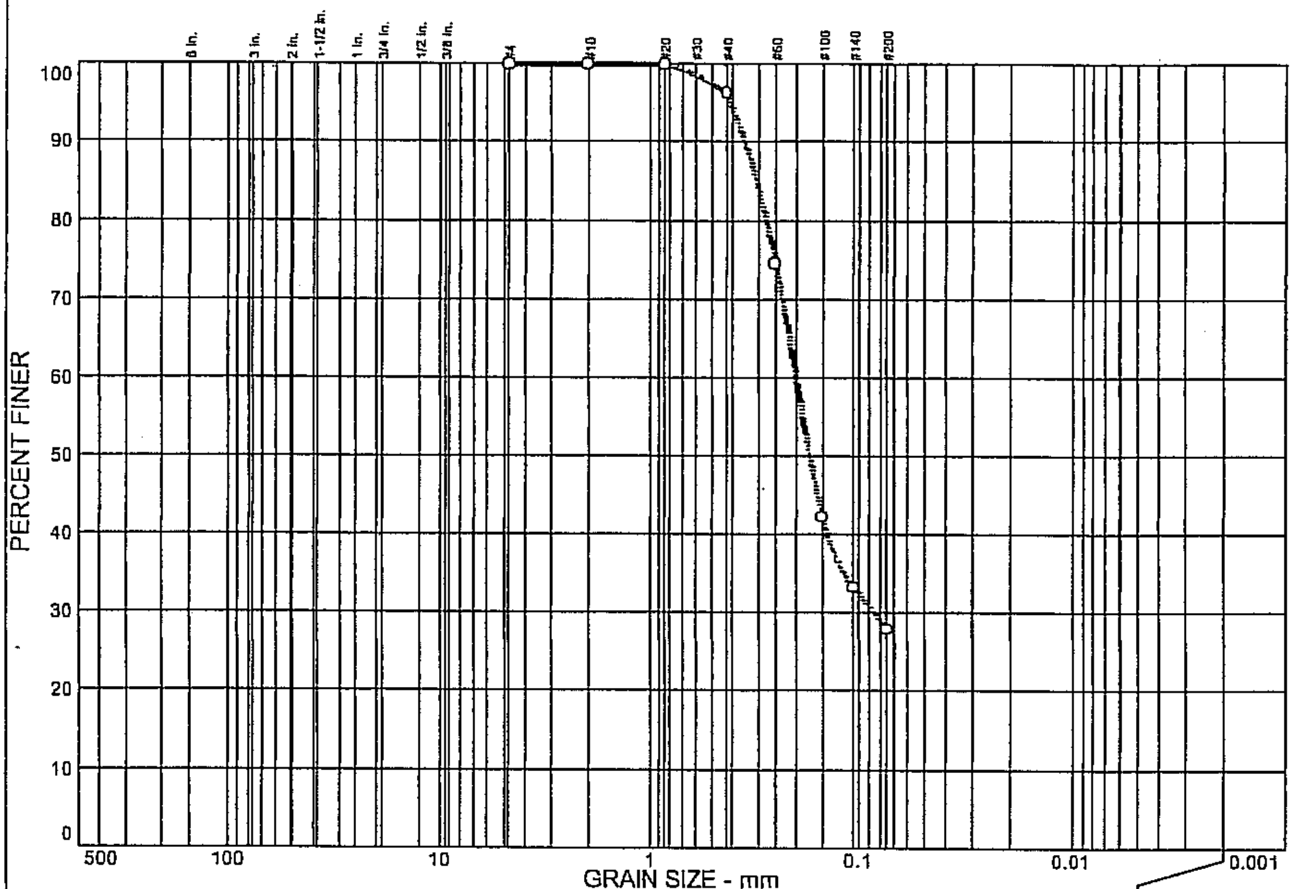
USCS= SM AASHTO=

Remarks

Sample No.: 2-3 **Source of Sample:** PI/Hy **Date:** 6/22/04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING	**Client:** **Project:** 4603.4.100.01 **Project No:** 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	72.1	27.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	96.3		
#60	74.4		
#100	42.2		
#140	33.2		
#200	27.9		

* (no specification provided)

Soil Description

Light olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.309 D_{60}= 0.201 D_{50}= 0.173
D_{30}= 0.0863 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

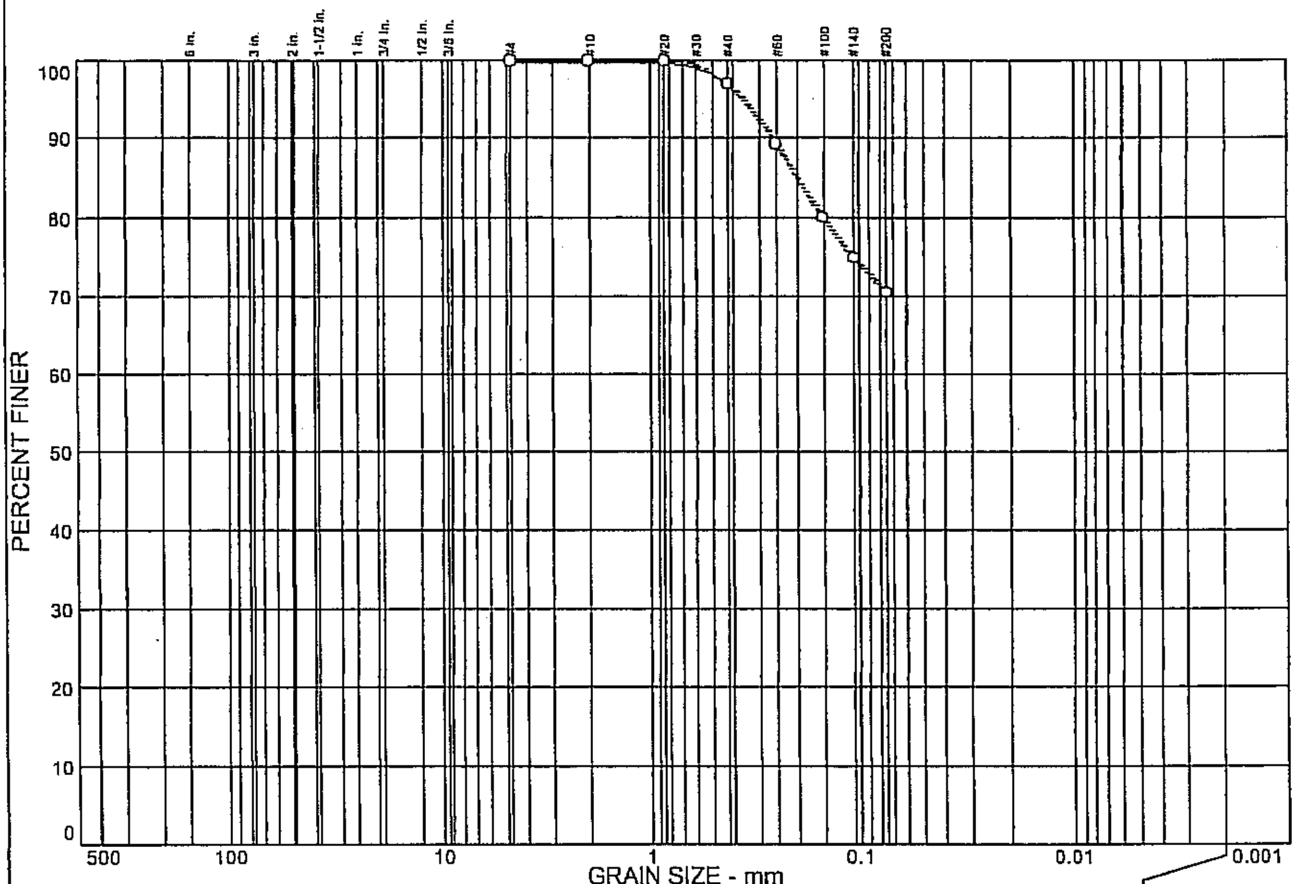
Sample No.: 1-4 **Source of Sample:** W.S **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	29.6	70.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	97.1		
#60	89.3		
#100	79.9		
#140	74.8		
#200	70.4		

* (no specification provided)

Soil Description

Light olive brown silty Clay with sand.

Atterberg Limits

PL= 16 LL= 49 PI= 33

Coefficients

D_{85}= 0.199 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

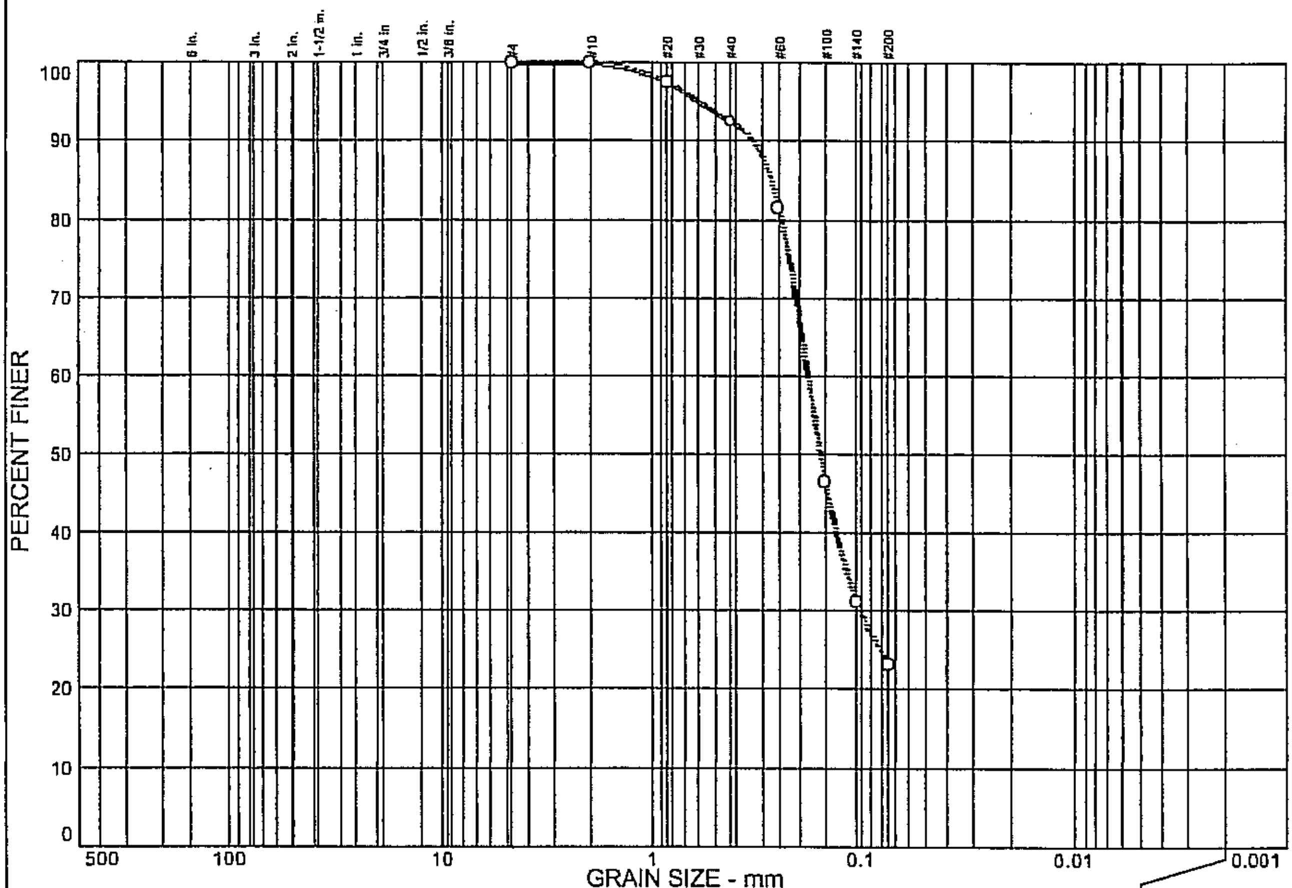
Sample No.: 1-5 **Source of Sample:** PI/W.S. **Date:** 6-22-04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	76.8	23.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	97.5		
#40	92.5		
#60	81.5		
#100	46.4		
#140	31.2		
#200	23.2		

* (no specification provided)

Soil Description

Light olive brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.271 D_{60}= 0.182 D_{50}= 0.159
D_{30}= 0.102 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

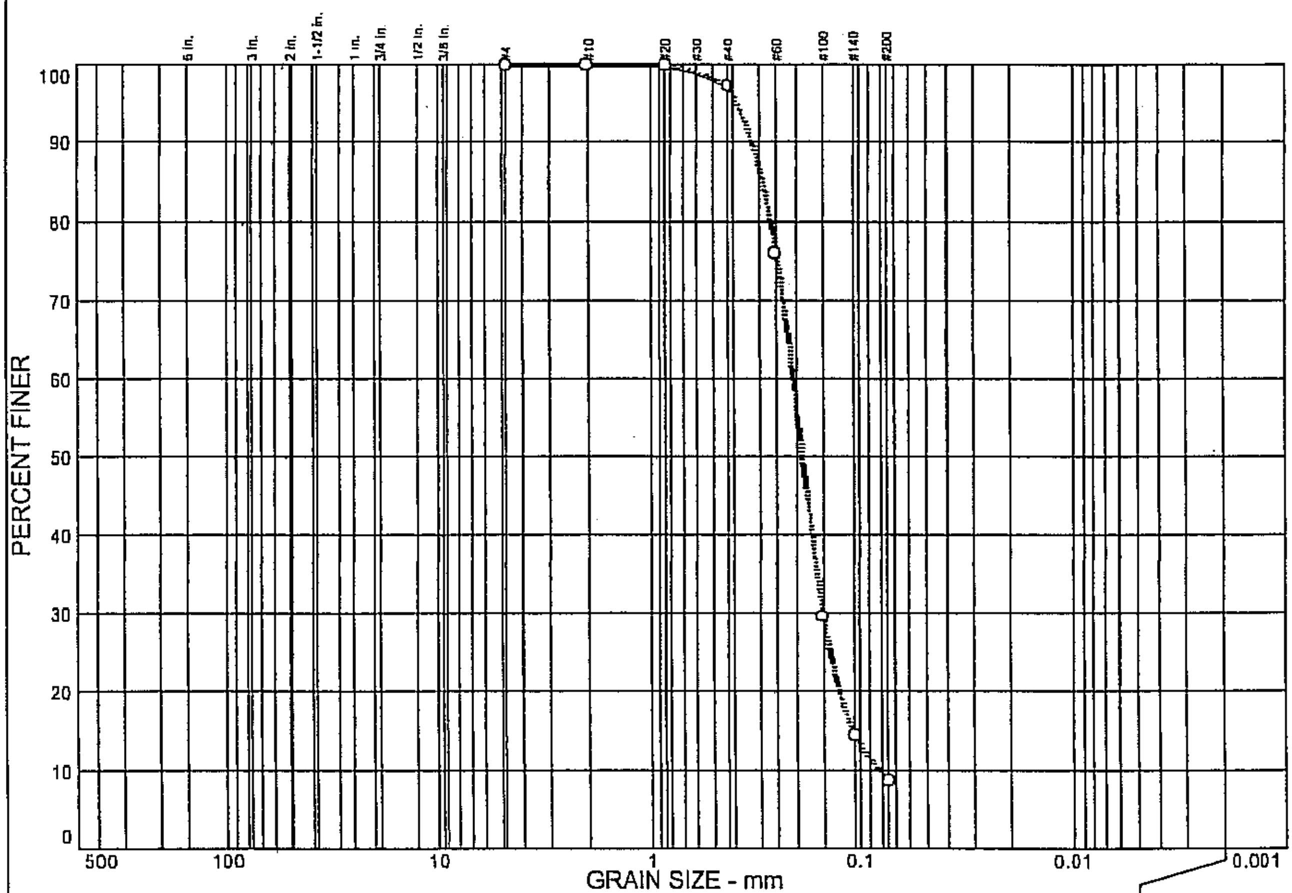
Sample No.: 2-4 **Source of Sample:** W.S **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	91.5	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	97.3		
#60	75.9		
#100	29.6		
#140	14.4		
#200	8.5		

* (no specification provided)

Soil Description

Light olive brwon poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.289 D_{60}= 0.209 D_{50}= 0.189
D_{30}= 0.151 D_{15}= 0.109 D_{10}= 0.0836
C_u= 2.50 C_c= 1.30

Classification

USCS= SP-SM AASHTO=

Remarks

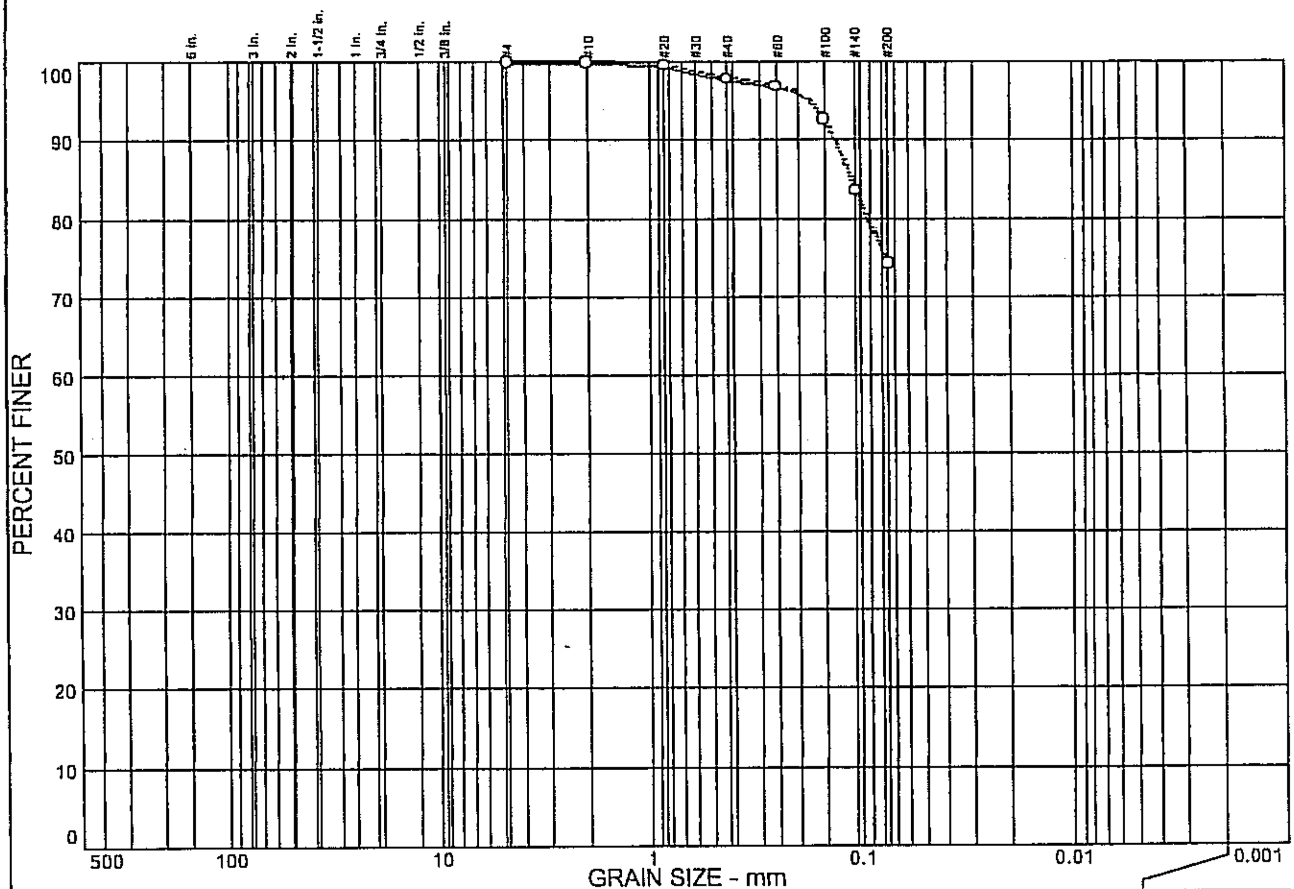
Sample No.: 2-5 **Source of Sample:** W.S **Date:** 06-24-04
Location: **Elev./Depth:**

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	25.8	74.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.6		
#40	97.9		
#60	96.9		
#100	92.7		
#140	83.5		
#200	74.2		

* (no specification provided)

Soil Description

Olive brown silt with Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.112 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

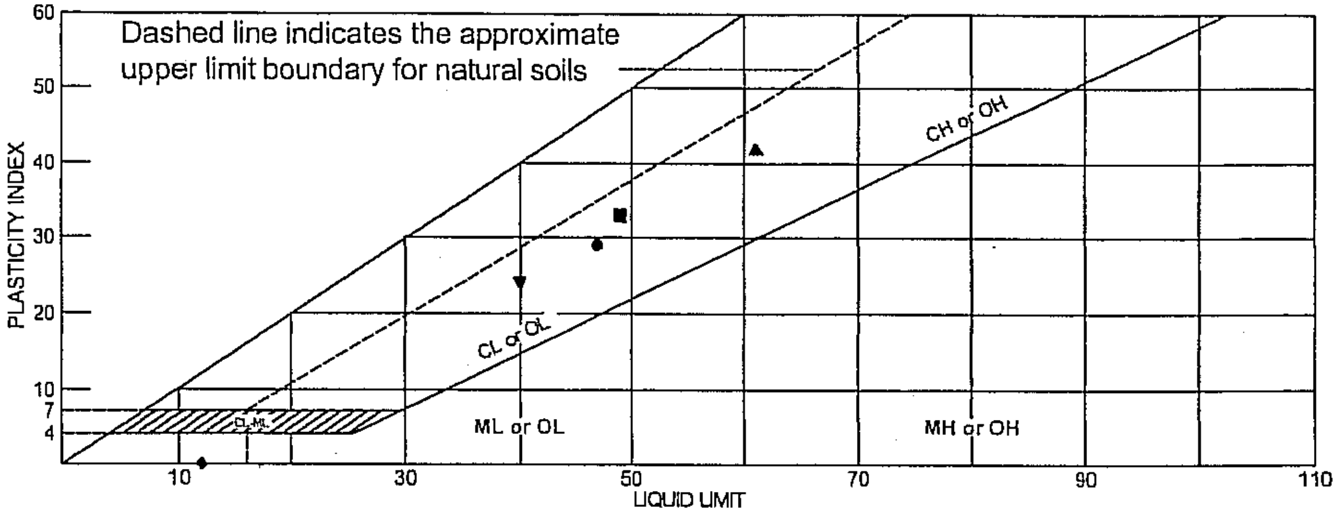
Sample No.: 3-9 **Source of Sample:** W.S **Date:** 06-24-04
Location: **Elev./Depth:**

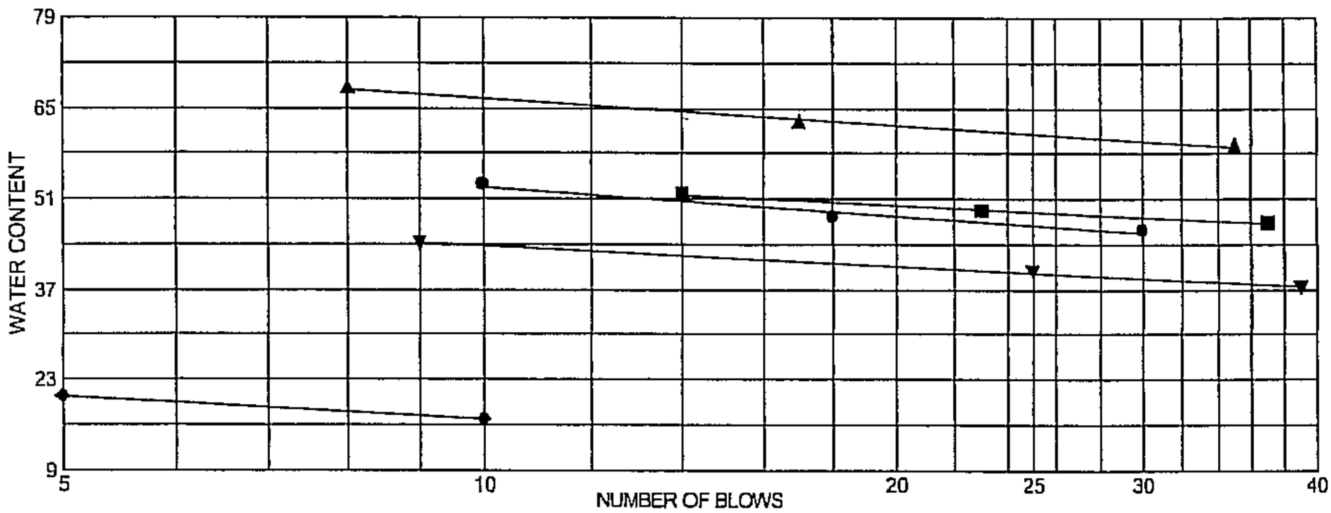
ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: 4603.4.100.01

Project No: 4603.4.100.01 **Plate**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Very dark grey brown silty Clay with sand.	47	18	29		81.7	CL
■	Light olive brown silty Clay with sand.	49	16	33	97.1	70.4	CL
▲	Dark grey brown Clay	61	19	42		98.7	CH
◆	Grey brown silty Sand.	12	21	NP	93.0	10.7	SM
▼	Light olive brown silty Clay	40	16	24			CL

Project No. 4603.4.100.01 **Client:**

Project: 4603.4.100.01

● **Source:** PI/Hy **Sample No.:** 1-1

■ **Source:** PI/W.S. **Sample No.:** 1-5

▲ **Source:** PI/Hy **Sample No.:** 3-1

◆ **Source:** PI/Hy **Sample No.:** 3-8

▼ **Source:** PI **Sample No.:** 3-10

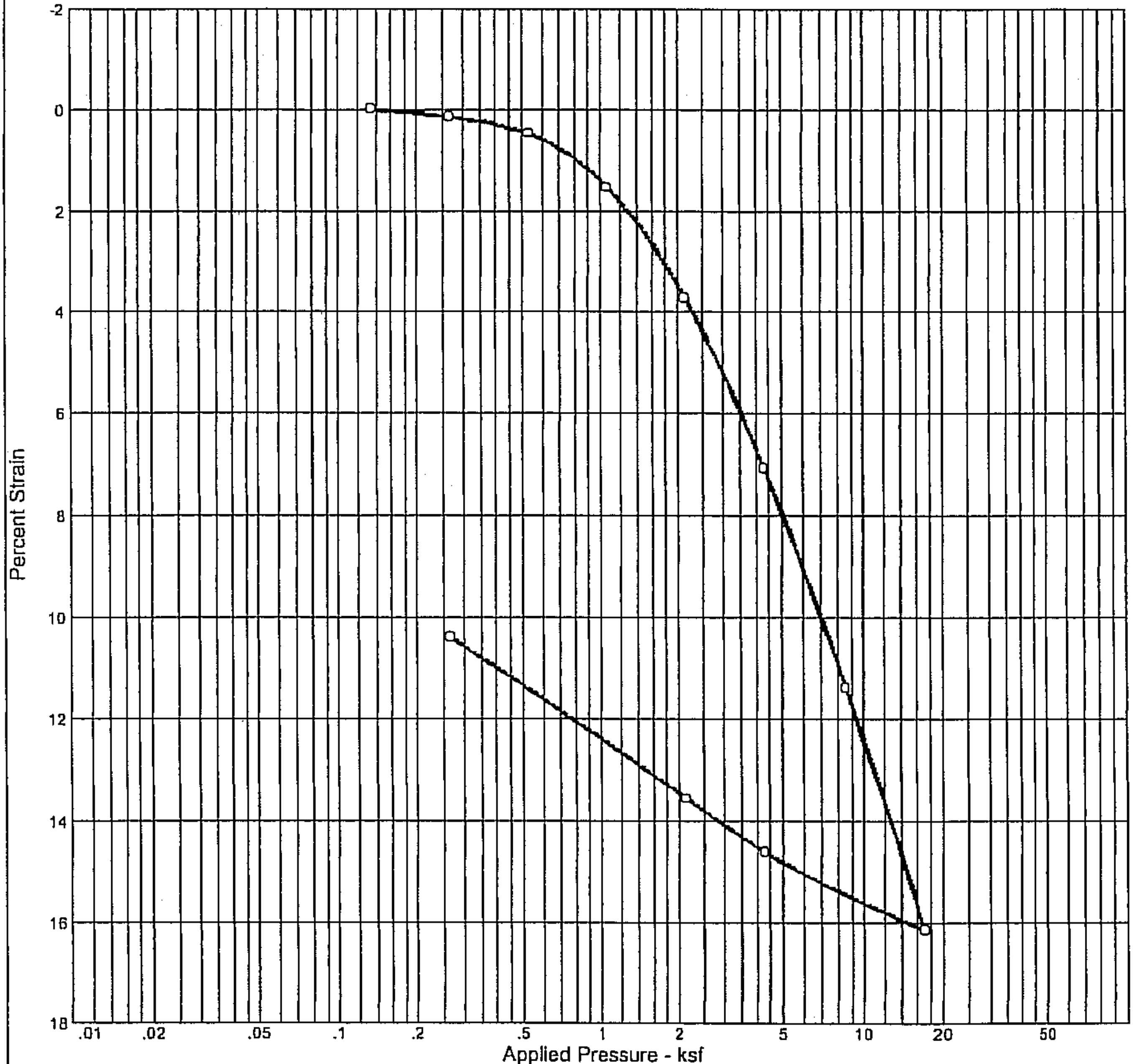
ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

● (1-1)
■ (1-5)
▲ (3-1)
◆ (3-8)
▼ (3-10)

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.5 %	35.7 %	84.2			2.61	CL		0.936

MATERIAL DESCRIPTION

Dark olive gray silty Clay

Project No. 4603.4.100.01 **Client:**

Project: 4603.4.100.01

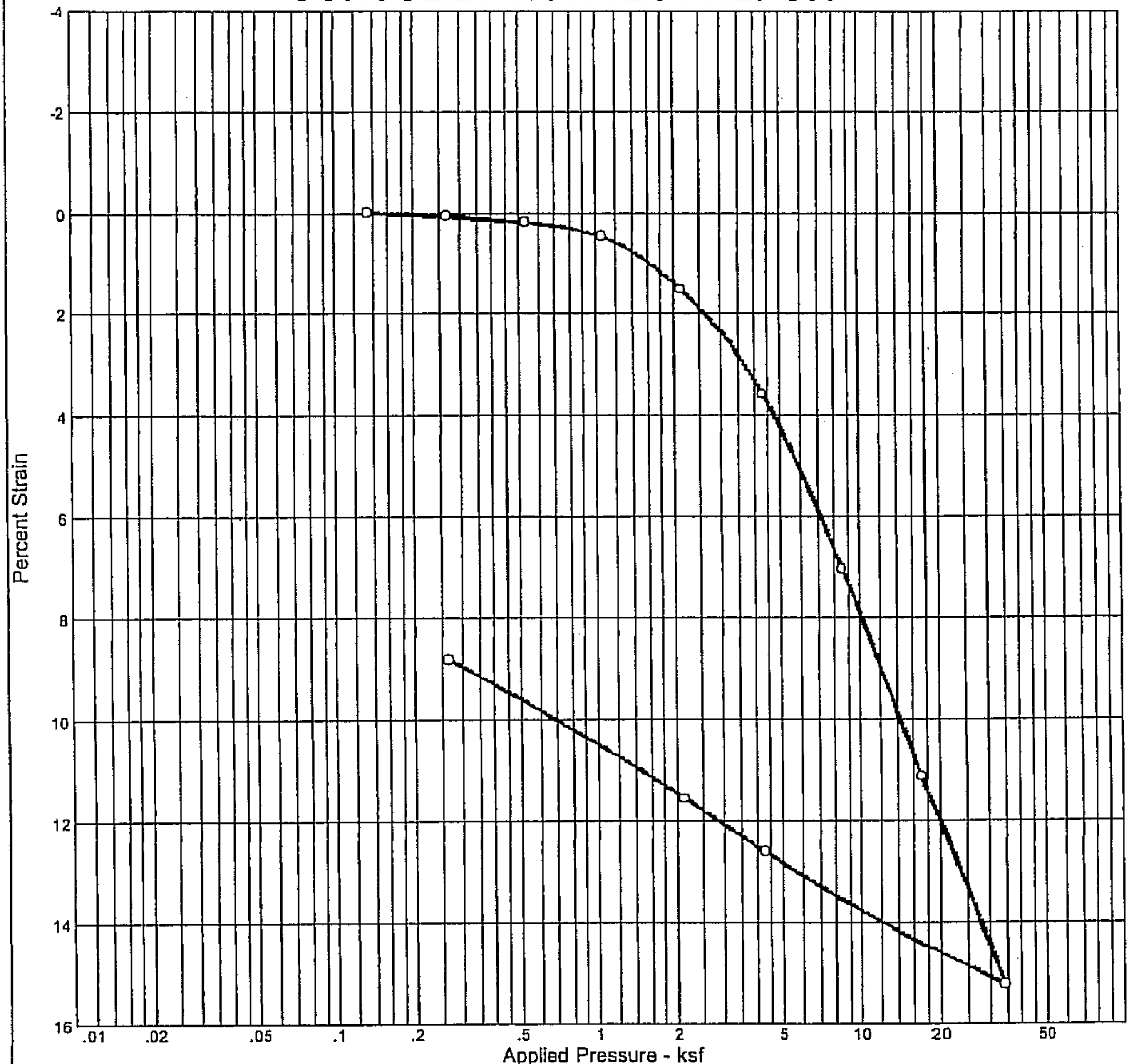
Source: Consol **Sample No.:** 1-2 **Elev./Depth:** 6 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:
Sample swelled to 268 psf loading

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.1 %	29.3 %	94.9			2.74	CL		0.802

MATERIAL DESCRIPTION

Dark yellowish brown sandy silty Clay

Project No. 4603.4.100.01 **Client:**

Project: 4603.4.100.01

Source: Consol **Sample No.:** 1-3

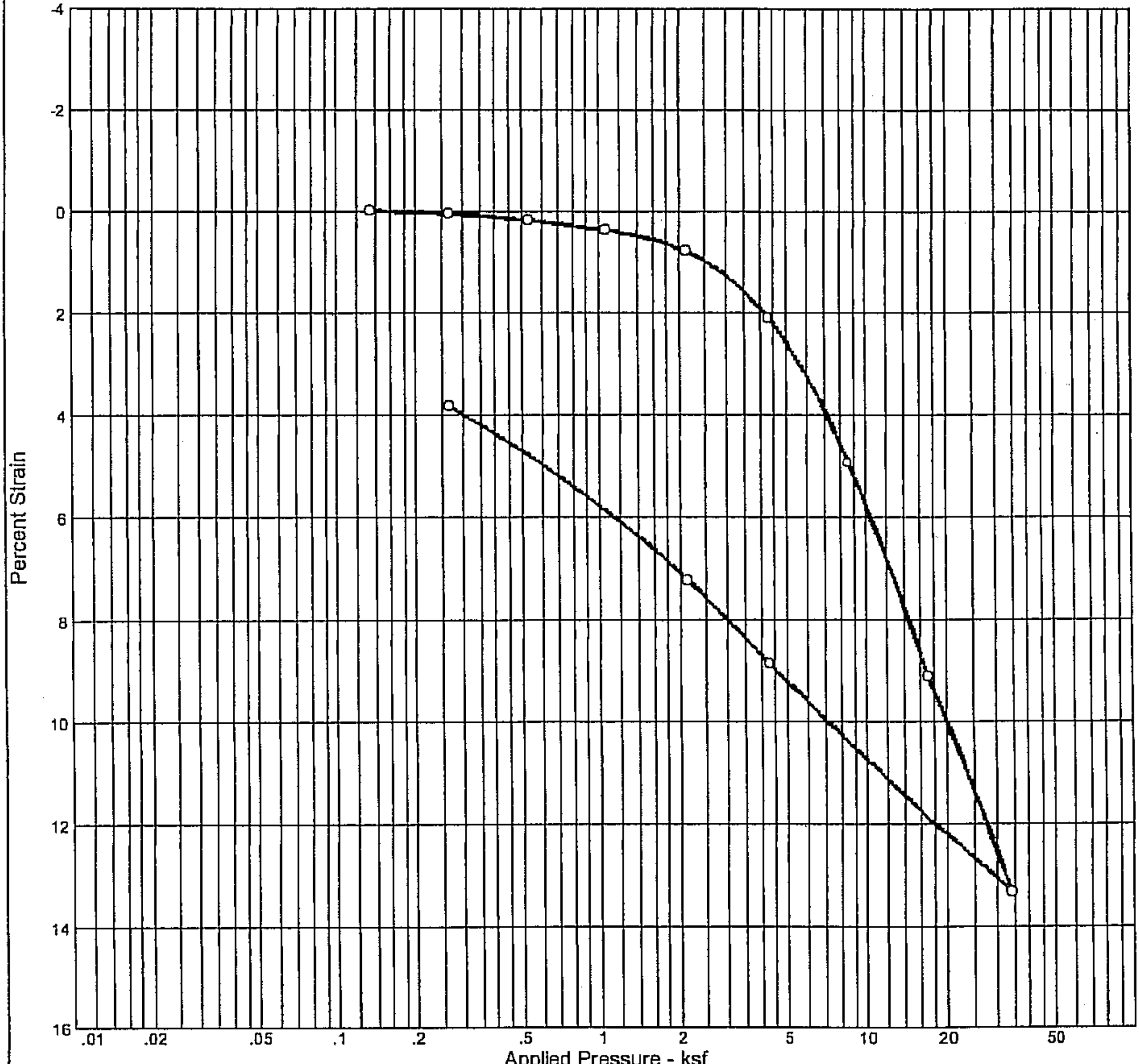
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Sample swelled to 536 psf

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.6 %	36.3 %	86.2			2.75	CL		0.992

MATERIAL DESCRIPTION

Olive brown silty Clay

Project No. 4603.4.100.01 **Client:**

Project: 4603.4.100.01

Source: Consol **Sample No.:** 3-4

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

SULFATE TEST RESULTS

Caltrans 417

Project Name: Emerson Property　　　　Date: 6-24-04

Project No. 4603.4.100.01　　　　Test by: mh

Sample	Description	Location/Source/Date	Sulfates ppm
1-1			215
1-2			5850
1-3			1578
2-1			203
2-2			129
3-2			4620

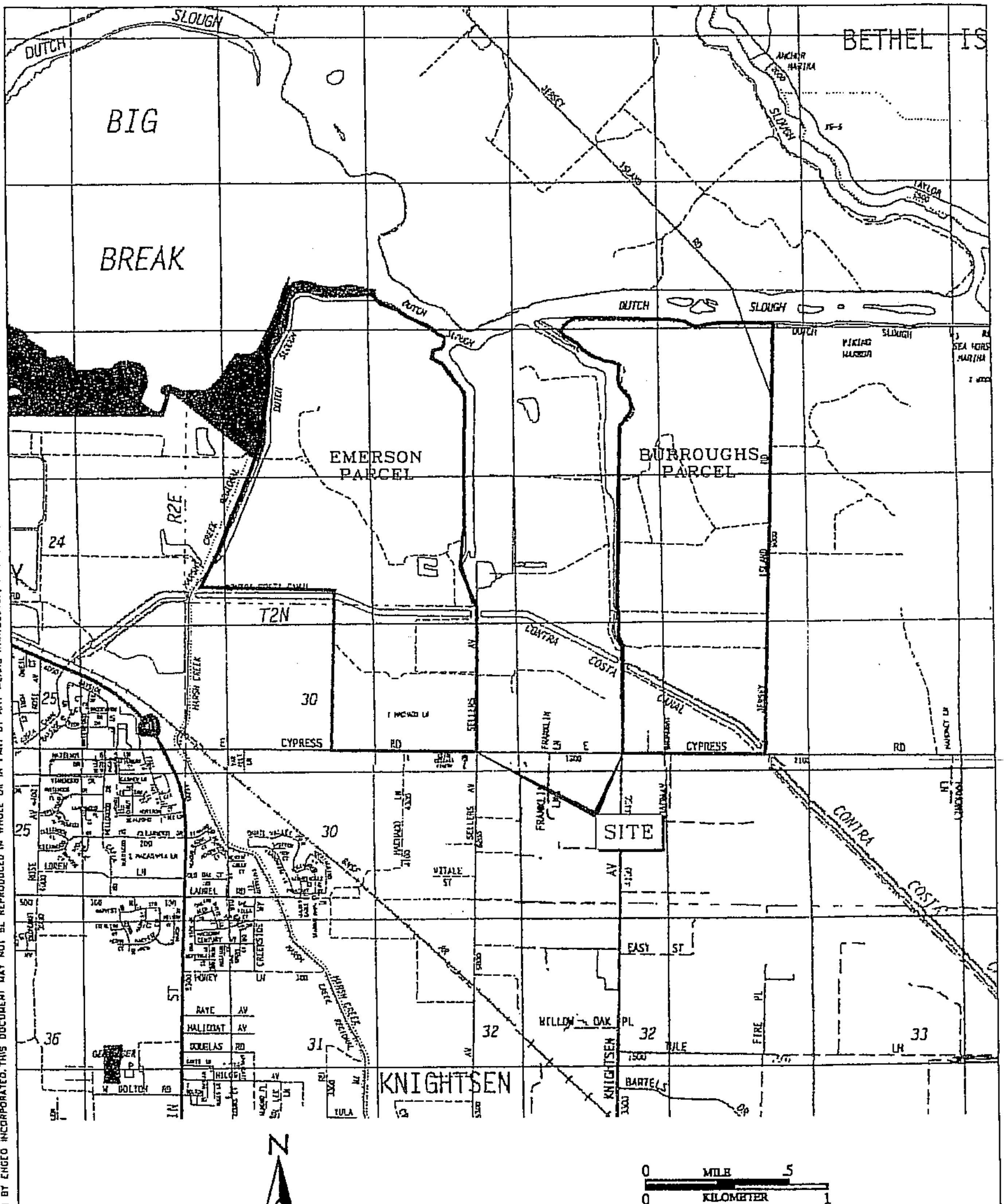
ENGEO

APPENDIX C

ENGEO INCORPORATED
Exploration Data
[illegible]

[illegible] Plan
[illegible]
Test Pit Logs [illegible]
CPT Logs [illegible]
Grain Size Distribution Curve [illegible] Sample [illegible]
Plasticity [illegible]
[illegible] Sample [illegible]

[illegible]
[illegible]



BASE: THOMAS BROTHERS

ENGEO INCORPORATED	SITE LOCATION MAP A PORTION OF THE CYPRESS CORRIDOR PLANNING AREA OAKLEY, CALIFORNIA	PROJECT NO.: 4603.5.002.01 DATE: JUNE 1999 DRAWN BY: B CHECKED BY: DH	FIGURE NO. 1

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF PROBE: March 31, 1999 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	RATE OF PENET. (SEC./FT.)	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY SAND, olive brown, wet, loose, organics.				
	1				5*			
				SILTY SAND, yellow brown, loose, saturated.				
5								
	2	5-1-1		∇ *Water level at time of drilling.*	8*			
10	3							
		5-2-1		SILTY SAND, yellow brown, saturated, medium dense.	20*			
	4							
15				Heaving sand - boring abandoned. *Boring terminated at 15 feet.*				
	5							
20	6							
	7							
25	8							
30	9							

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF PROBE: March 31, 1999 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	RATE OF PENET. (SEC./FT.)	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY, olive brown, wet, stiff, roots, organics.				
5	1	6-1-1		SILTY CLAY, mottled olive brown, wet, medium stiff, organics. PI=36	3*	0.45	89.0	32.0
	2	6-2-1		SILTY CLAY, mottled olive brown to gray, wet, stiff, organics. ∇ *Water level at time of drilling.*	7*	2.0*		
10	3							
	4	6-3-1		SILTY CLAY, mottled olive brown-gray-yellow brown, wet, stiff, organics.	10*	2.0*		35.0
15	5							
		6-4-1		SILTY SAND, yellow brown, saturated, loose				
20	6	6-5-1		SILTY SAND, yellow brown, saturated, loose (disturbed sample). *Bottom of boring at approximately 20.5 feet.*	12*			
	7							
25	8							
30	9							

METPROBE 4603.GPJ 6/22/99

ENGEO INCORPORATED

A PORTION OF THE CYPRESS CORRIDOR PLANNING AREA OAKLEY, CALIFORNIA

PROBE NO.: B6

DATE: June 1999

PROJ. NO.: 4603.5.002.01

CHECKED BY

FIGURE NO. 12

DATE OF PROBE: April 1, 1999

SURFACE ELEVATION: Approx. feet (meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	RATE OF PENET. (SEC./FT.)	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY, olive brown, wet, soft, roots, organics.				
	1	7-1-2		3 inch layer of CLAYEY SAND, olive brown, wet. ∇ SILTY CLAY, olive brown, wet, soft, organics. *Water level at time of drilling.*	3*	0.5*	88.0	33.0
5	2							
		7-2-1		SANDY CLAY, mottled gray and olive brown, wet, very stiff, organics.	9*	2.75*	112.0	18.0
10	3			SILTY SAND, gray, saturated.				
	4	7-3-1		SILTY SAND with clay, gray to yellow brown, saturated, medium dense.	18			
15	5							
	6	7-4-1		SILTY SAND to SILTY SAND with clay, olive gray to yellow brown, saturated, medium dense to dense.	28			
20				*Bottom of boring at approximately 20 feet.*				
	7							
25	8							
30	9							

ENGEO INCORPORATED

A PORTION OF THE CYPRESS CORRIDOR PLANNING AREA OAKLEY, CALIFORNIA

PROBE NO.: B7

DATE: June 1999

PROJ. NO.: 4603.5.002.01

CHECKED BY

FIGURE NO. 13

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP – 15	0 - .5	Silty SAND, black, loose, moist, with roots.
	.5 – 1	Silty SAND, mottled orange/light brown, loose, moist.
	1 – 5	Silty SAND, light brown to orange, dense, wet.
		Bottom of test pit at 5 fet.
TP – 16	0 – 2	Silty SAND, yellow brown, loose, moist, with roots.
	2 – 8	Silty SAND, light brown, dense, moist to wet, with roots to 4 feet.
		Bottom of test pit at 8 feet.
TP – 17	0 – 1	Silty CLAY, brown, medium stiff, moist, with roots.
	1 – 2	Silty CLAY, light brown, stiff, moist, with roots.
	2 – 3	Sandy silty CLAY, dark brown, stiff, moist, with roots.
	3 – 4	Silty SAND, dark brown, dense, moist.
	4 – 6	Silty SAND, brown, medium dense, wet, caving on sides.
		Bottom of test pit at 6 feet.
TP – 18	0 – 2	Silty CLAY, brown, stiff, moist, with roots.
	2 – 3	Sandy silty CLAY, brown, medium stiff, moist to wet, with roots.
	3 – 4	Silty CLAY, brown, medium stiff, wet.
	4 – 5	Clayey silty SAND, light brown, medium dense, wet, caving on sides.
	5 – 7	Silty SAND, gray, medium dense, wet, caving on sides.
		Bottom of test pit at 7 feet.

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP – 19	0 – 2	Sandy silty CLAY, brown, stiff, moist.
	2 – 3	Silty CLAY, brown/orange mottled, stiff, moist.
	3 – 5	Silty CLAY, brown, soft, wet.
	5 – 7	Silty CLAY, gray with brown mottled, stiff, moist.
	7 – 10	Silty SAND, gray, medium dense, wet.
		Bottom of test pit at 10 feet.
TP – 20	0 – 2	Sandy silty CLAY, brown, stiff to very stiff, clam shells, with roots.
	2 – 3	Sandy silty CLAY, mottled black/brown/white/calcified, very stiff, moist.
	3 – 4	Silty SAND, gray, medium dense, wet.
	4 – 7	Silty SAND, mottled light brown/gray, dense, wet.
		Bottom of test pit at 7 feet.
TP – 21	0 – 4	Silty CLAY, brown, stiff, moist, with roots to 2 feet.
	4 – 7	Silty CLAY, mottled gray/brown, very stiff, moist to wet.
	7 – 11	Silty SAND, mottled gray/brown, medium dense, wet.
	11 – 13	Silty SAND, gray, dense, wet.
		Bottom of test pit at 13 feet.

PROJECT: CYPRESS CORRIDOR PLANNING AREA
LOCATION: CONTRA COSTA COUNTY
PROJ. NO.: 4603.002.01(EGO-14)

CPT NO.: CPT-10
DATE : 03-12-1999
Groundwater estimated at 3.0 feet

DEPTH (feet)	Qc (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT (N')	TotHzStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
0.50	9.53	0.403	4.2	10	15	0.06	----	1.27	CLAY	110-120
1.00	11.19	0.365	3.3	7	12	0.12	----	1.48	Silty CLAY to CLAY	''
1.50	8.09	0.296	3.7	8	13	0.17	----	1.60	CLAY	''
2.00	10.43	0.478	4.6	10	17	0.23	----	1.38	''	120-130
2.50	9.47	0.380	4.0	9	15	0.29	----	1.24	''	110-120
3.00	6.00	0.262	4.4	6	10	0.34	----	1.17	''	100-110
3.50	4.82	0.210	4.4	5	8	0.40	----	0.92	''	''
4.00	4.64	0.065	1.4	2	4	0.44	----	0.88	Sensitive Fine Grained	85-90
4.50	10.19	0.069	0.7	5	8	0.49	----	1.33	Clayey SILT to Silty CLAY	90-100
5.00	29.66	0.012	0.0	10	16	0.54	43	----	Silty SAND to Sandy SILT	110-120
5.50	32.10	0.053	0.2	11	17	0.60	43	----	''	''
6.00	32.04	0.041	0.1	11	17	0.66	43	----	''	''
6.50	35.47	0.079	0.2	12	19	0.72	43	----	''	''
7.00	38.89	0.050	0.1	13	21	0.77	43	----	''	''
7.50	44.21	0.018	0.0	15	24	0.83	44	----	''	''
8.00	46.29	0.072	0.2	15	25	0.89	44	----	''	''
8.50	46.97	0.103	0.2	16	25	0.95	44	----	''	''
9.00	45.74	0.118	0.3	15	24	1.00	43	----	''	''
9.50	45.38	0.112	0.2	15	24	1.06	43	----	''	''
10.00	43.05	0.129	0.3	14	23	1.12	43	----	''	''
10.50	40.23	0.103	0.3	13	21	1.18	42	----	''	''
11.00	41.75	0.117	0.3	14	22	1.23	42	----	''	''
11.50	42.44	0.098	0.2	14	23	1.29	42	----	''	''
12.00	43.47	0.144	0.3	14	23	1.35	42	----	''	''
12.50	47.75	0.238	0.5	16	25	1.41	42	----	''	''
13.00	56.80	0.459	0.8	19	30	1.47	43	----	''	120-130
13.50	26.47	0.358	1.4	11	16	1.53	----	3.43	Sandy SILT to Clayey SILT	''
14.00	19.56	0.504	2.6	10	15	1.59	----	2.50	Clayey SILT to Silty CLAY	''
14.50	21.34	0.451	2.1	9	13	1.65	----	2.73	Sandy SILT to Clayey SILT	''
15.00	58.70	0.158	0.3	20	28	1.72	42	----	Silty SAND to Sandy SILT	''
15.50	66.21	0.264	0.4	17	24	1.78	43	----	SAND to Silty SAND	''
16.00	91.54	0.269	0.3	23	32	1.84	44	----	''	''
16.50	94.03	0.373	0.4	24	32	1.90	44	----	''	''
17.00	95.51	0.346	0.4	24	33	1.97	44	----	''	''
17.50	96.35	0.350	0.4	24	32	2.03	44	----	''	''
18.00	96.11	0.354	0.4	24	32	2.09	44	----	''	''
18.50	95.99	0.366	0.4	24	32	2.15	44	----	''	''
19.00	98.00	0.364	0.4	25	32	2.22	44	----	''	''
19.50	92.32	0.288	0.3	23	30	2.28	43	----	''	''
20.00	103.57	0.362	0.3	26	33	2.34	44	----	''	''
20.50	107.06	0.396	0.4	27	33	2.40	44	----	''	''
21.00	111.04	0.306	0.3	28	34	2.47	44	----	''	''
21.50	92.44	0.621	0.7	23	28	2.53	43	----	''	''
22.00	87.86	0.741	0.8	22	26	2.59	43	----	''	''
22.50	100.02	0.257	0.3	25	30	2.65	43	----	''	''
23.00	129.57	0.381	0.3	26	30	2.72	44	----	SAND	''
23.50	156.70	0.596	0.4	31	36	2.78	45	----	''	''
24.00	175.96	0.707	0.4	35	40	2.84	45	----	''	''
24.50	200.48	0.815	0.4	40	46	2.90	46	----	''	''
25.00	217.48	0.665	0.3	43	49	2.97	46	----	''	''
25.50	242.67	0.639	0.3	49	54	3.03	46	----	''	''
26.00	234.05	0.665	0.3	47	52	3.09	46	----	''	''
26.50	235.90	1.143	0.5	47	51	3.15	46	----	''	''
27.00	270.98	1.201	0.4	54	58	3.22	46	----	''	''
27.50	327.35	0.878	0.3	65	70	3.28	47	----	''	''
28.00	318.42	0.681	0.2	64	67	3.34	47	----	''	''
28.50	308.27	0.905	0.3	62	65	3.40	47	----	''	''
29.00	283.51	0.842	0.3	57	59	3.47	46	----	''	''
29.50	267.68	2.167	0.8	54	55	3.53	46	----	''	''
30.00	317.93	1.117	0.4	64	65	3.59	47	----	''	''
30.50	354.56	0.646	0.2	71	72	3.65	47	----	''	''
31.00	328.08	1.376	0.4	66	66	3.72	47	----	''	''
31.50	118.12	2.470	2.1	39	40	3.78	42	----	Silty SAND to Sandy SILT	130-140
32.00	59.18	1.262	2.1	20	20	3.85	38	----	''	''
32.50	177.55	0.865	0.5	36	35	3.91	44	----	SAND	120-130
33.00	199.99	1.603	0.8	40	40	3.98	44	----	''	''

John Sarmiento & Associates
Cone Penetration Testing Service

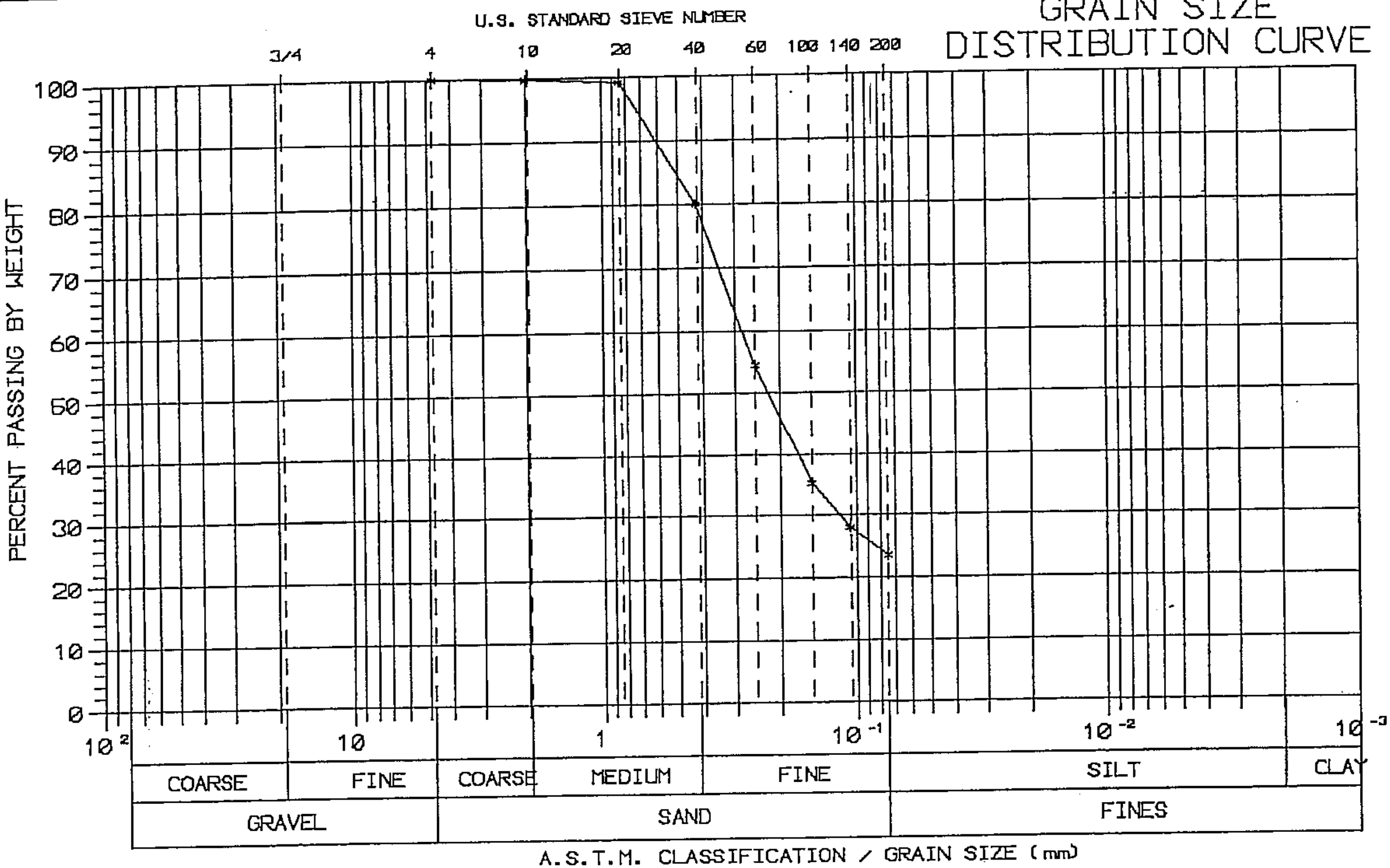
PROJECT: CYPRESS CORRIDOR PLANNING AREA
LOCATION: CONTRA COSTA COUNTY
PROJ. NO.: 4603.002.01(EGO-14)

CPT NO.: CPT-11
DATE : 03-12-1999
Groundwater estimated at 3.0 feet

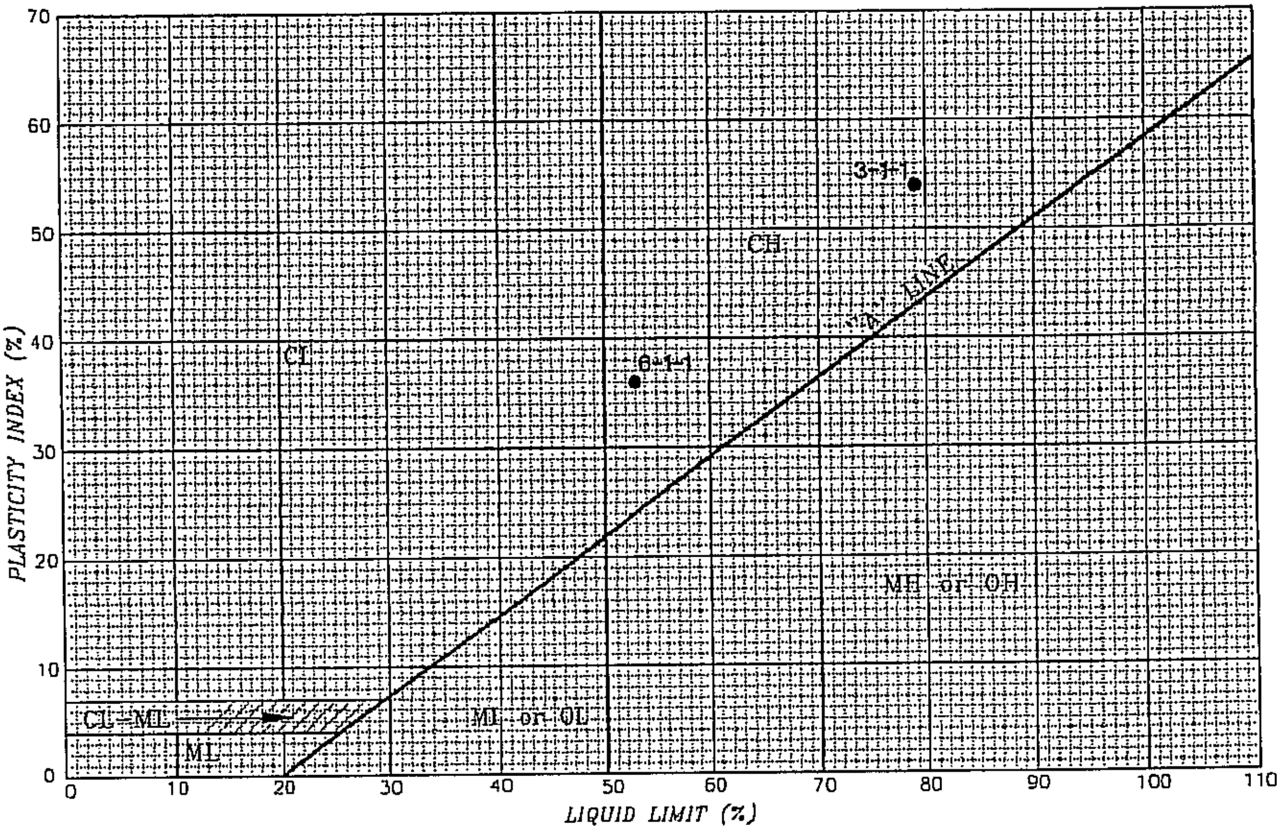
DEPTH (feet)	Qc (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT (N')	TotHzStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
0.50	7.63	0.484	6.3	8	12	0.06	----	1.52	CLAY	110-120
1.00	6.09	0.386	6.3	6	10	0.12	----	1.21	''	''
1.50	10.32	0.497	4.8	10	17	0.17	----	1.36	''	120-130
2.00	11.15	0.595	5.3	11	18	0.24	----	1.47	''	''
2.50	8.82	0.467	5.3	9	14	0.30	----	1.74	''	110-120
3.00	119.73	0.423	0.4	30	48	0.36	>48	----	SAND to Silty SAND	120-130
3.50	104.70	0.474	0.5	26	42	0.42	>48	----	''	''
4.00	70.40	0.100	0.1	18	28	0.48	47	----	''	''
4.50	63.61	0.149	0.2	16	25	0.54	46	----	''	''
5.00	64.35	0.225	0.3	16	26	0.61	46	----	''	''
5.50	72.85	0.320	0.4	18	29	0.67	46	----	''	''
6.00	42.40	0.155	0.4	14	23	0.73	44	----	Silty SAND to Sandy SILT	110-120
6.50	51.88	0.144	0.3	17	28	0.79	44	----	''	120-130
7.00	50.66	0.067	0.1	17	27	0.85	44	----	''	''
7.50	47.72	0.108	0.2	16	25	0.92	43	----	''	110-120
8.00	49.86	0.123	0.2	17	27	0.98	43	----	''	120-130
8.50	44.61	0.118	0.3	15	24	1.04	43	----	''	110-120
9.00	34.51	0.045	0.1	12	18	1.09	41	----	''	''
9.50	39.53	0.091	0.2	13	21	1.15	42	----	''	''
10.00	48.57	0.146	0.3	16	26	1.21	43	----	''	120-130
10.50	60.85	0.180	0.3	15	24	1.27	43	----	SAND to Silty SAND	''
11.00	71.13	0.179	0.3	18	28	1.34	44	----	''	''
11.50	71.86	0.200	0.3	18	28	1.40	44	----	''	''
12.00	65.25	0.218	0.3	16	25	1.46	43	----	''	''
12.50	61.59	0.090	0.1	15	23	1.52	43	----	''	''
13.00	47.05	0.275	0.6	16	23	1.58	41	----	Silty SAND to Sandy SILT	110-120
13.50	47.85	0.768	1.6	16	23	1.65	41	----	''	120-130
14.00	42.33	1.013	2.4	17	24	1.71	----	5.53	Sandy SILT to Clayey SILT	130-140
14.50	27.49	0.652	2.4	11	15	1.78	----	3.55	''	120-130
15.00	38.19	1.229	3.2	19	26	1.84	----	4.97	Clayey SILT to Silty CLAY	130-140
15.50	20.51	0.436	2.1	8	11	1.91	----	2.61	Sandy SILT to Clayey SILT	120-130
16.00	80.12	0.356	0.4	20	27	1.97	43	----	SAND to Silty SAND	''
16.50	32.32	0.590	1.8	13	17	2.03	----	4.17	Sandy SILT to Clayey SILT	''
17.00	22.04	0.199	0.9	9	11	2.09	----	2.80	''	100-110
17.50	69.73	0.272	0.4	17	22	2.15	42	----	SAND to Silty SAND	120-130
18.00	106.82	0.450	0.4	27	34	2.21	44	----	''	''
18.50	116.38	0.261	0.2	29	36	2.28	44	----	''	''
19.00	81.40	0.153	0.2	20	25	2.34	42	----	''	''
19.50	60.06	0.183	0.3	15	18	2.40	41	----	''	''
20.00	43.63	0.101	0.2	15	18	2.46	39	----	Silty SAND to Sandy SILT	110-120
20.50	64.35	0.031	0.0	16	19	2.52	41	----	SAND to Silty SAND	120-130
21.00	80.13	0.122	0.2	20	24	2.58	42	----	''	''
21.50	115.74	0.210	0.2	29	34	2.65	44	----	''	''
22.00	132.49	0.324	0.2	26	30	2.71	44	----	SAND	''
22.50	142.09	0.309	0.2	28	32	2.77	44	----	''	''
23.00	140.09	0.564	0.4	28	32	2.83	44	----	''	''
23.50	171.19	0.551	0.3	34	38	2.90	45	----	''	''
24.00	194.96	0.657	0.3	39	43	2.96	45	----	''	''
24.50	190.64	1.023	0.5	38	42	3.02	45	----	''	''
25.00	196.02	1.156	0.6	39	42	3.08	45	----	''	''
25.50	201.30	0.798	0.4	40	43	3.15	45	----	''	''
26.00	176.44	0.521	0.3	35	37	3.21	45	----	''	''
26.50	147.67	0.667	0.5	30	31	3.27	44	----	''	''
27.00	170.22	0.940	0.6	34	36	3.33	44	----	''	''
27.50	155.23	1.927	1.2	31	32	3.40	44	----	''	130-140
28.00	177.73	1.449	0.8	36	37	3.46	44	----	''	120-130
28.50	240.53	1.248	0.5	48	49	3.53	46	----	''	''
29.00	269.90	1.187	0.4	54	55	3.59	46	----	''	''
29.50	296.86	1.239	0.4	59	60	3.65	46	----	''	''
30.00	286.90	0.610	0.2	57	57	3.71	46	----	''	''
30.50	256.11	1.101	0.4	51	51	3.78	46	----	''	''
31.00	177.93	1.145	0.6	36	36	3.84	44	----	''	''
31.50	231.88	1.452	0.6	46	46	3.90	45	----	''	''
32.00	351.81	2.393	0.7	70	70	3.96	47	----	''	''
32.50	345.06	2.134	0.6	69	69	4.03	46	----	''	''

John Sarmiento & Associates
Cone Penetration Testing Service

GRAIN SIZE DISTRIBUTION CURVE



ENGEO INCORPORATED	CYPRESS Oakley, California		FIGURE NO: 31
	SAMPLE NO: 7-3-1 DATE: 04-26-1999	JOB NO: 4603.5.002.01	



NO.	SAMPLE DEPTH IN FEET (METERS)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS			PERCENT PASSING NO. 200 SIEVE	UNIFIED SOIL CLASSIFI-CATION SYMBOL
			LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)		
3-1-1	4.5 (1.4)	--	79	25	54	--	CH
6-1-1	4.0 (1.2)	--	53	17	36	--	CH

ENGEO INCORPORATED

PLASTICITY CHART

A PORTION OF THE CYPRESS CORRIDORE PLANNING AREA

OAKLEY CALIFORNIA

PROJECT NO.: 4603.5.002.01

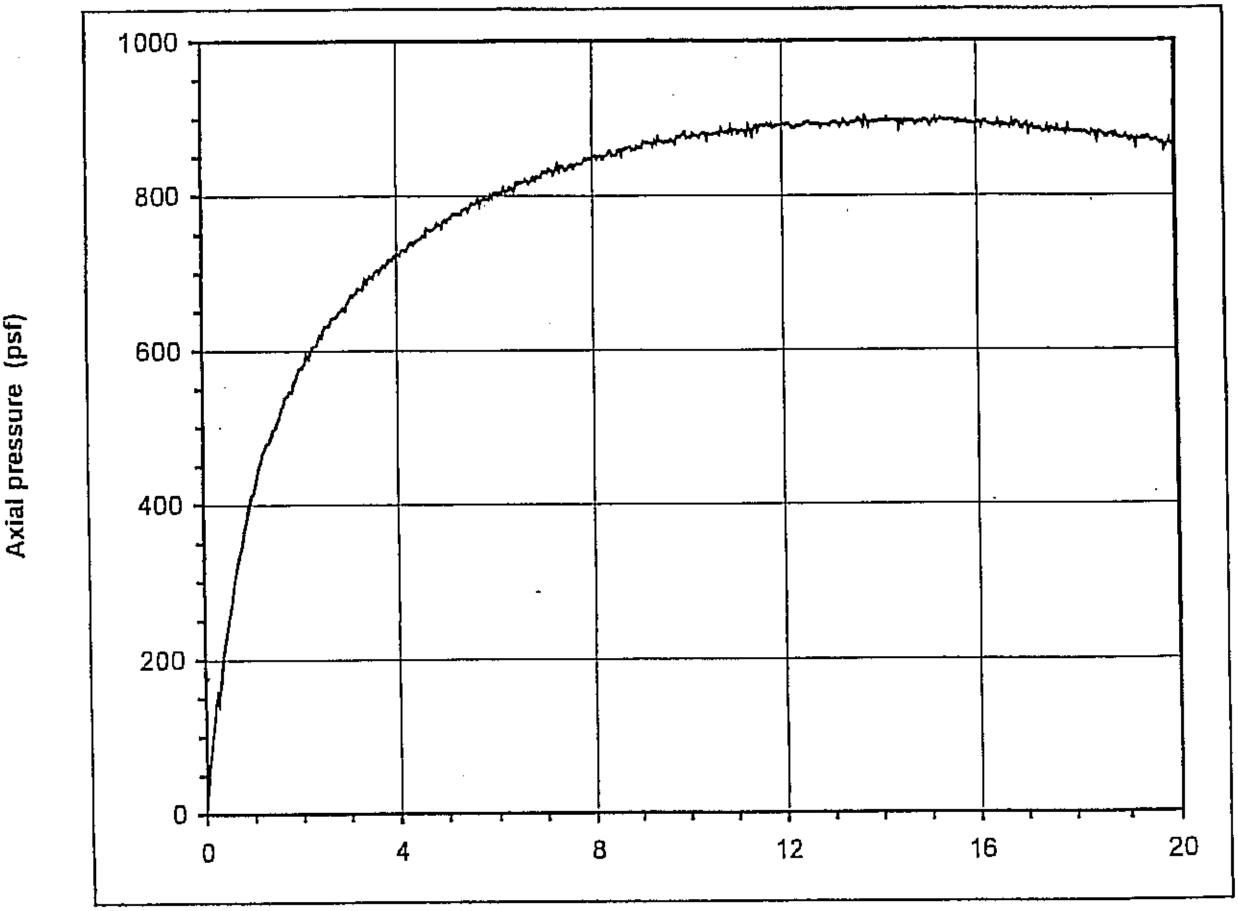
DATE: MAY 1999

DRAWN BY: CB

CHECKED BY: DH

FIGURE NO. 33

Unconfined Compression Test
ASTM Test Method D2166



Unconfined Compressive Strength: 900 psf 0.5 tsf

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

Initial Diameter:	2.375 in.		Sample Number:	1-1	
Initial Height:	4.73 in.		Boring Number:	6	
Strain Rate:	1.241 %/min		Dry Unit Weight:	89.0	pcf
Total Strain:	19.97 %		Moisture Content:	31.5	%
			Depth of Sample:		ft.

ENGEO INCORPORATED	CYPRESS Oakley, California	Job No.: 4603500201 Sample Number: 6-1-1 Date: 4/30/99	Figure No. 35

APPENDIX D

GUIDE CONTRACT SPECIFICATIONS

PART I - EARTHWORK

PREFACE

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

PART 1 - GENERAL

1.01 WORK COVERED

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

B. Subsurface drainage as indicated on the Drawings.

1.02 CODES AND STANDARDS

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

1.03 SUBSURFACE SOIL CONDITIONS

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

1.04 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

1.05 OBSERVATION AND TESTING

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

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

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

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

1.06 SITE CONDITIONS

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

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

PART 2 - PRODUCTS

2.01 GENERAL

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

2.02 SOIL MATERIALS

A. Fill

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

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

3. ENGEO shall be immediately notified if potential hazardous materials or suspect soils exhibiting staining or odor are encountered. Work activities shall be discontinued within the area of potentially hazardous materials. ENGEO environmental personnel will conduct an assessment of the suspect hazardous material to determine the appropriate response and mitigation. Regulatory agencies may also be contacted to request concurrence and oversight. *ENGEO will rely on the Owner, or a designated Owner's representative, to make necessary notices to the appropriate regulatory agencies. The Owner may request ENGEO's assistance in notifying regulatory agencies, provided ENGEO receives Owner's written authorization to expand its scope of services.*

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

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

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

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

2.03 SAND

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

2.04 AGGREGATE DRAINAGE FILL

A. Aggregate drainage fill under concrete slabs and paving shall consist of broken stone, crushed or uncrushed gravel, clean quarry waste, or a combination thereof. The aggregate shall be free from fines, vegetable matter, loam, volcanic tuff, and other deleterious substances. It shall be of such quality that the absorption of water in a saturated surface dry condition does not exceed 3 percent of the oven dry weight of the samples.

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

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

2.05 SUBDRAINS

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

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

<u>Design depths less than 30 feet</u>

- Perforated ABS Solid Wall SDR 35 (ASTM D-2751)
- Perforated PVC Solid Wall SDR 35 (ASTM D-3034)
- Perforated PVC A-2000 (ASTM F949)

- Perforated Corrugated HDPE double-wall (AASHTO M-252 or M-294, Caltrans Type S, 50 psi minimum stiffness)

Design depths less than 50 feet

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

Design depths less than 70 feet

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

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

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

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

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

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

2.06 PERMEABLE MATERIAL (Class 1; Type A)

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

Sieve Size	Percentage Passing Sieve
¾-inch	100
½-inch	95 - 100
⅜-inch	70 - 100
#4	0 - 55
#8	0 - 10
#200	0 - 3

PART 3 - EXECUTION

3.01 STAKING AND GRADES

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

3.02 EXISTING UTILITIES

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

3.03 EXCAVATION

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

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

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

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

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

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

3.04 SUBGRADE PREPARATION

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

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

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

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

3.05 ENGINEERED FILL

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

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

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

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

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

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

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

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

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

3.06 BACKFILLING

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

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

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

3.07 TRENCHING AND BACKFILLING FOR UTILITIES

A. Trenching:

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

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

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

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

B. Backfilling:

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

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

3. Backfill material shall be select material.

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

3.08 SUBDRAINS

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

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

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

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

3.09 AGGREGATE DRAINAGE FILL

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

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

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

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

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

3.10 SAND CUSHION

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

3.11 FINISH GRADING

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

3.12 DISPOSAL OF WASTE MATERIALS

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

PART II - GEOGRID SOIL REINFORCEMENT

1. DESCRIPTION:

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

2. GEOGRID MATERIAL:

2.1 The specific geogrid material shall be preapproved by ENGEO.

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

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

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

3. CONSTRUCTION:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

** Unified Soil Classifications.

PART III - GEOTEXTILE SOIL REINFORCEMENT

1. DESCRIPTION:

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

2. GEOTEXTILE MATERIAL:

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

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

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

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

3. CONSTRUCTION:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

** Unified Soil Classifications.

PART IV - EROSION CONTROL MAT OR BLANKET

1. DESCRIPTION:

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

2. EROSION CONTROL MATERIALS:

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

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

3. CONSTRUCTION:

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

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

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

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

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

PART V - GEOSYNTHETIC DRAINAGE COMPOSITE

1. DESCRIPTION:

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

2. DRAINAGE COMPOSITE MATERIALS:

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

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

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

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

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

3. CONSTRUCTION:

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

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

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

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

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

4.9 GEOLOGY AND SOILS

Introduction

This section analyzes the effects of the proposed subdivisions upon soils and geology within the project area.

Information in this chapter is drawn from a *Geotechnical Exploration Report* (Appendix _) prepared by ENGEO, Inc. (March 2005), a *Geotechnical Exploration Report* (Appendix _) Prepared by Stevens, Ferrone, & Bailey Engineering Company Inc. (Dated 8/30/04), a *Geotechnical Report* (Appendix _) prepared by Kleinfelder (Dated ___), Pertinent comments received in response to the Notice of Preparation (NOP) for the proposed projects have been integrated into the analysis.

GEOLOGIC Setting

The following background setting information focuses on the existing topography of the project sites, and site seismicity, as well as the general conditions and expansiveness of the on-site soils.

Regional Geology

The site is located at the margin of the Great Valley Geomorphic Province and the Coast Ranges Geomorphic Province. The Great Valley Geomorphic Province consists of an elongated structural trough that has been filled with a sequence of sedimentary deposits ranging from Jurassic to recent in age. In the San Joaquin/Sacramento Delta, sedimentary bedrock is up to six miles in thickness (Atwater, 1982). Geophysical evidence suggests that the Great Valley is underlain at depth with granitic rocks of the Sierra Nevada Province. The adjacent Coast Ranges Geomorphic Province is underlain at depth by Franciscan Assemblage rocks.

The San Joaquin/Sacramento Delta lies at the junction of the Sacramento and San Joaquin rivers, the two major waterways that drain the Central Valley. This area currently consists of a braided pattern of brackish to freshwater tidally-influenced channels and sloughs encircling a series of low-lying islands.

Site Geology

The near-surface sediments across the project consist of eolian (wind-blown), lacustrine (lake-deposited) and alluvial deposits. These sediments are typically irregularly-stratified, poorly consolidated deposits of clay, silt, sand, and minor gravel.

The geology of the surficial deposits on the site has been largely influenced by changes in sea level during the Late Pleistocene. Most of the high-standing areas in the site vicinity are the crests of old sand dunes and are underlain by sandy eolian deposits deposited during the later part of the most recent low-stand of sea level. According to Atwater, these eolian deposits formerly extended across most of the surface of the site but are now buried in low-lying areas by younger sediments.

The alluvial fan of Marsh Creek extends across the site and Atwater's map and text imply that alluvium of Marsh creek typically overlies the sandy eolian deposits in low-lying areas. According to Atwater (1982), much of the alluvium in the site vicinity consists of gray silt and clay deposited in near sea-level flood basins and ephemeral lakes.

Site Seismicity

The project is located in an area of moderate seismicity. No faults, active or otherwise, are known to come to the ground surface within or very close to the project site. In addition, no portion of the site is mapped within any Earthquake Fault Zone. The closest active strike-slip fault with surface expression, as identified by the California Geological Survey, is the Concord fault located approximately 19 miles to the west. Other nearby active strike-slip faults include the Calaveras fault, 22 miles to the southwest; the Hayward fault, 32 miles to the west; and the San Andreas fault, 50 miles to the west.

The Midland fault was mapped by Jennings (1994) approximately 0.5 miles east of the site and by Bortugno (1991) approximately 2 miles east of the site. An unnamed queried fault, assumed to be the Midland fault, is also mapped by the City of Oakley (Oakley General Plan 2020 adopted December 2002) to be approximately 1 mile east of the site. Crane (1971) mapped a postulated concealed splay of the Midland fault across the subject site. There is no evidence that supports that Crane's postulated concealed splay of the Midland fault has a risk of surface rupture on the subject site. The Midland fault is thought to be a part of the Coast Ranges – Sierran Block (CRSB) fault system.

Because of the presence of active faults in the region, the area is considered seismically active. Numerous small earthquakes occur every year in the region, and large (>M7) earthquakes have been recorded and can be expected to occur in the future. Table I lists distances to known active and potentially-active strike-slip faults located within 100 kilometers of the site and summarizes their estimated earthquake magnitudes and UBC Classification.

A significant seismic source listed is the Coast Ranges – Sierran Block (CRSB) boundary, mapped along the west side of the Central Valley. As the name implies, it is the approximate boundary between the actively uplifting east side of the Coast Range crustal block and the west side of the Sierran crustal block. The west side of the Sierran block is covered by the thick veneer of sedimentary rock that fills the Central Valley. The boundary between the two blocks is thought to be a zone of tectonic crustal shortening and compression. The compression is structurally accommodated by a series of generally west-dipping buried or "blind" thrust faults, along which Coast Range rocks have been thrust eastward over Central Valley sediments. According to Wakabayashi and Smith (1994), the CRSB can be divided into a series of segments that are thought to be seismically independent. The local segments of the CRSB, according to the California Geological Survey (Peterson, et al., 1996) pass through the area in the approximately vicinity of the site. Since the CRSB thrust faults are thought to exist entirely in the subsurface, the exact location of the boundary, that is a "surface fault trace," can not be defined. However, it should be assumed that an earthquake on the local segment of the CRSB could occur in the subsurface below or a few miles east or west of the site.

The historic seismicity of the eastern Coast Ranges includes a number of earthquakes in the M 5.0 to M 6.8 range, including the M 6.3 1889 Antioch-Collinsville earthquake, the M 6.4-6.8 1892 Vacaville-Winters earthquakes, and the M 6.0-6.5 1983 Coalinga earthquakes. Based on historic seismicity and segment lengths, it is believed that the CRSB is generally capable of producing M 6.0-6.8 earthquakes. The actual location of a possible earthquake epicenter in the CRSB can not be easily estimated, so the maximum ground shaking levels at the site could vary as described above. However, the recurrence interval for the local segments of the CRSB is believed to be in the range of 500 to 650 years (Peterson, et al. 1996), much longer than the for the nearby strike-slip faults (commonly 150 to 250 years).

Since the CRSB faults are not known to extend to the ground surface, the State of California has not defined Earthquake Fault Hazard Zones around the postulated traces.

Soil Conditions

The site is mapped by the Soil Survey of Contra Costa County (1977). The predominant soil across the southwestern portions of the project is Sycamore Silty Clay Loam (So). Marcuse Clay (Mb), Dehli Sand (DaC), and Piper Loamy Sand (Pe) are mapped along the eastern side of the project. {{SFB and Kleinfelder, please confirm}}

Marcuse Clay (Mb), Delhi Sand (DaC), and Piper Loamy Sand (Pe) are predominately mapped in the middle portion of the project area (Gilbert site).

In general, the project is underlain by variable layers of soft to stiff clayey material and loose to very dense sandy material to the maximum depth explored of 50 feet.

Groundwater

The depth to groundwater varies across the project from approximately 1 to 15 feet below the existing ground surface. In addition, the groundwater elevation may fluctuate due to seasonal variation in rainfall, tidal action or other factors not in evidence at this time.

Expansive Soil

The near surface soils in portions of the site consist of moderately expansive clay. Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to moisture changes in expansive soils can be reduced by re-grading the pad areas with appropriate non-expansive soils, pre-swelling the soils by moisture conditioning, stabilizing the expansive soil through lime treatment, and/or modifying or stiffing foundations to resist movement.

Weak or Compressible Clay

Some weak or compressible clays interbedded with some moderately organic clays exist within the near surface of the eastern portion of the site. This material will consolidate due to the addition of additional fill material and building loads.

Liquefaction

The most significant geotechnical concern to be considered in the design of the project is the presence of liquefiable dune sand near the ground surface across most of the project. During earthquakes, ground shaking may cause a loss of strength in cohesionless saturated soils. This process is called liquefaction, and it occurs most commonly in loose sands associated with a high water table. In general, variable layers of potentially liquefiable material were encountered in the upper 30 feet of the project. Below a depth of 30 feet, the sandy materials are dense and generally not liquefiable.

Regulatory Context

Existing policies, laws and regulations that would apply to the proposed projects are summarized below.

California Building Standards Code / Uniform Building Code

Site development and design are regulated in the State of California by the California Building Standards Code (CBC), based on the federal Uniform Building Code (UBC) and suited to the unique sensitivity of the state's geology and faultlines. CBC and UBC regulations must be complied with in consideration of expansive soils, drainage, erosion, earthquake resistance, and required safety measures during on-site development. Geologic and soils conditions would also determine the proper installation of underground communications and utility lines.

City of Oakley General Plan

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IMPACTS AND MITIGATION MEASURES

The geological impacts related to the proposed projects are analyzed and assessed in this section.

Standards of Significance

An impact on the geology of the subject site would be considered significant if any of the following conditions would potentially result from the proposed projects' implementation:

- Exposure of people, structures, or infrastructure components to increased risk of injury or damage due to the presence of expansive soils, soil settlement/compaction, or other geotechnical constraints.
- Exposure of people or structures to substantial, adverse effects as a result of strong ground shaking, seismic-related ground failure, liquefaction, lateral spreading, landslides, or lurch cracking;
- Substantial alteration of the existing topography through significant grading activities;
- Substantial erosion or unstable slope or soil conditions through alteration of topographic features, dewatering, or changes in drainage patterns; or

Method of Analysis

The analysis for the proposed project relies on from a *Geotechnical Exploration Report* (Appendix _) prepared by ENGEO, Inc. (March 2005), a *Geotechnical Exploration Report* (Appendix _) Prepared by Stevens, Ferrone, & Bailey Engineering Company Inc. (Dated 8/30/04), a *Geotechnical Report* (Appendix _) prepared by Kleinfelder (Dated ___).

Project-Specific Impacts and Mitigation Measures

4.9I-1 Impacts related to expansive soil.

Construction of the proposed roadways and future construction of the houses would require solid building surfaces. Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Therefore, expansive soil could have a ***potentially significant*** impact.

Mitigation Measure
Implementation of the following mitigation measure would mitigate potential impacts related to foundation support/expansive soil to a ***less-than-significant*** level.

1) Re-grading the pad areas with appropriate non-expansive soils, pre-swelling the soils by moisture conditioning, stabilizing the expansive soil through lime treatment, and/or modifying or stiffing foundations to resist movement.

2) A design-level geotechnical study should be completed for each proposed development before a grading permit is issued. The study should specifically address whether expansive soils are present in the development area and include measures to address these soils where they occur. Measures included in the study should be implemented as appropriate, based on the specific soil conditions and the type of facility being constructed.

4.9I-2 Impacts related to weak or compressible clay

Weak or compressible clays can consolidate under additional loads from engineered fill and buildings. This can cause settlement of pavements and structures founded on shallow foundations. Therefore, weak or compressible soil could have a ***potentially significant*** impact.

<u>Mitigation Measure</u>
Implementation of the following mitigation measure would mitigate potential impacts related to weak or compressible soil to a ***less-than-significant*** level.

1) It is estimated that a majority of the settlement would occur during earthwork operations and would be aerial in extent. Once the project grading plans are completed and the approximate building loads are determined, the project geotechnical engineer will determine if remediation measures such as removing or surcharging the compressible material will be necessary to minimize future settlement to acceptable levels.

4.9I-3 Impacts related to Liquefaction

Liquefaction is a phenomenon during which granular material (silt or sand) is transformed from a solid state into a liquid state as a result of seismic activity. The primary factors determining liquefaction potential of a soil deposit are: (1) the level and duration of seismic ground motions; (2) the type and consistency of the soil; and (3) the depth to groundwater. All of the geotechnical studies performed on the subject sites indicate that variable thicknesses of liquefiable material exist below a majority of the entire project. It is estimated that up to 4 inches of settlement could occur due to liquefaction. In addition, portions of the site do not have enough capping material to prevent the liquefiable material from venting to the surface creating sand boils, ground cracking, and other ground surface disruption. Therefore, liquefaction could have a ***potentially significant*** impact.

<u>Mitigation Measure</u>

Implementation of the following mitigation measure would mitigate potential impacts related to liquefiable soil to a ***less-than-significant*** level.

1) *Depending on the thickness of potentially liquefiable material and thickness of material capping the liquefiable material, several different methods of mitigating the effects of liquefaction can be implemented consisting of post-tensioned mat foundations, removing and recompacting the liquefiable material, deep dynamic compaction, in-place vibro compaction, gravel filled geo-piers, or other similar procedures. Once final grading plans are designed, the project geotechnical engineer will need to determine the most appropriate and effective method of mitigating the effects of liquefaction.*

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July 30, 2004

Mr. Jeffrey C. Schroeder
Vice President, Land Acquisition & Planning
PONDEROSA HOMES II, Inc.
6671 Owens Drive
Pleasanton, CA 94588

RE: *Cultural Resources Assessment* - Emerson Property, Cypress Road and Sellers Avenue (APN 037-192-015 and 037-102-016) - City of Oakley, Contra Costa County

Dear Mr. Schroeder,

Please let this letter serve as our *Cultural Resources Assessment (Archaeology)* of the Emerson Property located at Cypress Road and Sellers Avenue, City of Oakley, Contra Costa County. This assessment was requested in order to fulfill the various mandates of the California Environmental Quality Act (CEQA) and cultural resources and planning directives of the City of Oakley. The report provides the results of a records search, reviews pertinent literature, provides the results of an archaeological field inventory, and presents management recommendations.

PROJECT LOCATION

The Emerson Property (the project) is located east of State Route 4 and Frank Hengle Way in the City Oakley in the far northeast portion Contra Costa County. Marsh Creek is to the west, the Contra Costa Canal is on the north, and Emerson Slough is just north of Sellars Avenue. Big Break is to the northwest, and Dutch Slough is further north (opposite Jersey Island).

The Emerson Property is located within the "Cypress Corridor Area" a special planning area of the City of Oakley (Oakley, 2002a:General Plan, Fig. 2-3). The property consists of two parcels: a smaller, 0.97-acre parcel is at the northwest corner of Cypress Road and Sellers Avenue (APN 037-192-015); and a much larger, 140.16-acre parcel (APN 037-192-016) surrounds the smaller parcel. The latter is bounded by the Contra Costa Canal on the north, Sellars Avenue on the east, and Cypress Road on the south (Ponderosa Homes 2004; USGS Brentwood, Calif. 1978; T 2N, R 3E, most of the NE 1/4 of Section 30) [Figs. 1-3].

RESEARCH SOURCES CONSULTED AND REVIEW RESULTS

A prehistoric and historic site records and literature search was completed by the California Historical Resources Information System, Northwest Information Center, California State

University Sonoma, Rohnert Park (CHRIS/NWIC File No. 04-04).[1] Reference material from the Bancroft Library, University of California at Berkeley and Basin Research Associates, San Leandro was also consulted.[2]

RESULTS

The majority of the archaeological data available for the study area have been compiled as a result of cultural resource compliance programs undertaken for both public agencies and private entities.

The *Contra Costa County General Plan* appears to assign a "low" archaeological sensitivity rating to the project area and near vicinity (Contra Costa County Community Development Department (CCC/CDD) 1996:9-11 to 9-18, Figure 9-2).

There are no recorded or formally reported archaeological sites located in or adjacent to the project.

A historic building, the former Iron House School, was originally located within the northwest corner of Cypress Avenue and Sellars Road but has since been remodeled as a private residence and moved from its original location to the main parcel. The *Historic Properties Directory* (HPD) has assigned Primary Number P-07-000903 to the building (CAL/OHP 2004:3). The resource is listed on the HPD as on Cypress Road in Brentwood [*sic*] as a "code 7", not evaluated for inclusion on the National Register of Historic Places or the California Register of Historical Resources or needs reevaluation.

Cultural Resources Compliance Reports

Four cultural resources compliance reports on file at the CHRIS/NWIC include part of the project area or adjacent areas along Cypress Road.

> The *Cultural Resources Survey East/Central Contra Costa County Wastewater Management Plan* provides the results of a review of recorded sites, various historical listings, a general background review, and a field survey which included a pipeline along Cypress Road and a segment (#12) along the east-west unpaved road off of Sellars Avenue within the Emerson Property. Iron House School was identified as 150 yards away from the proposed pipeline route #12. No other cultural resources were observed in or adjacent to the Emerson Property (Busby 1976/S-18352).[3]

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1. Dated July 23, 2004.

2. Specialized listings consulted include the *Historic Properties Directory* for Contra Costa County (CAL/OHP 2004) with the most recent updates of the National Register of Historic Places; California Historical Landmarks; and, California Points of Historical Interest as well as other evaluations of properties reviewed by the State of California Office of Historic Preservation. Other sources consulted include: *California History Plan* (CAL/OHP 1973); *California Inventory of Historic Resources* (CAL/OHP 1976); *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988); and, *Historic Civil Engineering Landmarks of San Francisco and Northern California* (ASCE 1977); as well as local inventories, lists, and historic maps.

3. S-# assigned by the CHRIS/NWIC.

A *Class II Archeological Survey of the Contra Costa Canal* includes the results of a records search, historical context, and windshield survey of most of the canal system, reservoirs, and other facilities and lands. Existing conditions were described, noting that all portions of the canal right-of-way have been modified and that canals are/were cleaned twice each year with sediments dried within the canal right-of-way and then hauled away. No historic properties eligible for listing on the National Register of Historic Places were identified (West and Welch 1996/S-18440).

A Cultural Resources Inventory and Evaluation Report for the City of Brentwood Wastewater Facilities Expansion Project includes a records search, environmental setting, archaeological survey and review of architectural properties. This survey was negative for the area along Cypress Road adjacent to the project (Jones & Stokes Associates 1998/S-20808).

Report S-25276, which includes a project located adjacent to the west side of the Emerson Property, was not available for review.

NATIVE AMERICAN RESOURCES
PREHISTORIC

The general study area appears to have been favored by Native Americans for both occupation and hunting and collecting activities. The area would have provided a favorable environment during the prehistoric period with riparian and inland resources readily available and the bayshore in relative close proximity. Native American occupation and use of the general area appears to extend over 5000-7000 years and may be longer. Archaeological information suggests an increase in the prehistoric population over time with an increasing focus on permanent settlements with large populations in later periods. This change from hunter-collectors to an increased sedentary lifestyle is due to more efficient resource procurement but with a focus on staple food exploitation, the increased ability to store food at village locations, and the development of increasing complex social and political systems including long-distance trade networks. General overviews and perspectives on the regional prehistory can be found in Moratto (1984), Elsasser (1978), and Rice et al. (1994).

ETHNOGRAPHIC

The proposed project appears to have been within the *Julpun* and/or *Volvon* tribelet area of the *Bay Miwok* or *Eastern Miwok*. The *Julpun* territory appears to have extended along the Old River of the San Joaquin River and lower Marsh Creek while the *Volvon* held Mount Diablo and upper Marsh Creek drainage on the eastern side of Mount Diablo (Milliken 1995:229, Map 5, 246, 259). They may have been subject to some Northern Yokuts influence, a group clustered along the San Joaquin River and its main tributaries. Following Bennyhoff (1977) and Levy (1978), *Chupcan* is the closest known ethnographic village[4] and the tribelet center appears to

4. Note researchers differ as to group names and locations, sometimes reflecting new and/or differing interpretations of research sources. *Arguello stated that the Sacramento and San Joaquin Rivers joined to form the "bays of the Julpunes, Ompines, and Chupcanes"* (Bennyhoff 1977:161, #68 after Cook 1960:287, May 21). Bennyhoff refers to the group and village as *Chupcan* and places the *Julpun* to the southeast, east of Marsh Creek. Milliken places the *Chupcan* further west holding the lower Diablo Valley with the *Julpun* in the Marsh

have been located at present-day Antioch[5] (Kroeber 1925; Davis 1961; Bennyhoff 1977; Levy 1978; Wallace 1978; Elsasser 1986).

The Bay Miwok were the first of the Eastern Miwok to be missionized and the largest group of *Julpun* went to Mission San Jose in present-day Fremont. *Julpunes* is identified as a Christian village on a 1824 Topographic map of the Mission San Jose. At the time, this village is shown on an island on the north bank of the San Joaquin River suggesting the Julpun moved as a result of missionization (Anonymous 1824 in Bennyhoff 1977:144, 166-167, Maps 4a-b; Levy 1978:401).

In 1838, Dr. John Marsh, the namesake of Marsh Creek, found a few Native Americans when he settled on his *Rancho Los Meganos* (the sand-banks or sand dunes), a rancho located south of the project.[6] They appear to have returned to the area at the end of 1836 after the secularization[7] of Mission San Jose. Marsh was noted for his good relations with local Native Americans, whom he referred to as the *Pulpunes* and placed his adobe dwelling[8] on the bank opposite their *rancheria* (Hoover et al. 1966; Bennyhoff 1977; Milliken 1995).

Extensive ethnographic data for the San Francisco Bay Region are lacking, and the aboriginal lifeway apparently disappeared by approximately 1810 due to introduced diseases, a declining birthrate, the cataclysmic impact of the mission system and the later secularization of the missions by the Mexican government (Levy 1978).

No Native American villages or known trails are situated within or near the project area.

For additional information on the Native Americans in the study area see Kroeber (1925), Bennyhoff (1977), Levy (1978), and Milliken (1995).

HISTORIC ERA RESOURCES

HISPANIC PERIOD

Between 1769 and 1776 a number of Spanish expeditions passed through the San Francisco Bay region, including those led by Portola, Fages, Fages and Crespi, Anza, Rivera, and Moraga. Even though the routes of the early explorers cannot be determined with total accuracy, none are

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Creek vicinity (e.g., Schenck 1926:133, Fig. 1 after Spanish Reports).

5. CA-CCo-138, located on the Hotchkiss Tract near Cypress and Bethel Island Roads may have functioned as a main pre-contact village for the *Julpun* tribelet (Bennyhoff 1977:144).

6. This rancho is located south of Lone Tree Way and includes present-day Brentwood.

7. The program which involved the release of Indian neophytes from mission jurisdiction and the conversion of Mission property. The 1826 decree in California was ineffective and followed by proclamation in 1834 (Hart 1987:322, 464).

8. Replaced by a stone house located nearby on Marsh Creek Road two and a half miles south of Brentwood. He called his estate the Farm of *Pulpones* (Hoover et al. 1966:60-61). The stone house is probably the most notable cultural resource in the general study area. It is listed on the National Register of Historic Places, the *California Inventory of Historic Resources*, designated a Contra Costa County *Structure of Historical Significant/Architectural Specimen*, and on the *Contra Costa County Map of Historical Points of Interest* (Hoover et al. 1966:60; CAL/OHP 1976:229; CCC/CDD 1989; CCCoHS 1994:#143; CAL/OHP 2004).

known to have traveled near the project area (Schenck 1926; Cook 1957; Beck and Haase 1974:#17; Milliken 1995:33, Map 3). The closest known historic trail corridor, the 1776 Juan Bautista de Anza National Historic Trail, passed just west and south of the Emerson Property (USNPS 1995).[9]

The Spanish philosophy of government in northwestern New Spain was directed at the founding of presidios, missions, and secular towns with the land held by the Crown (1769-1821), while the later Mexican policy (1822-1848) stressed individual ownership of the land. After the secularization of the missions was declared by Mexico in 1833, vast tracts of the mission lands were granted to individual citizens (Hart 1987).

During the Mexican Period (1822 to 1846) and into the American Period, the project was situated in ungranted/patented lands north of the *Rancho Los Meganos* (sand hills). Governor Jose Castro granted the rancho to Jose Noriega in October 1835. He sold it to John Marsh in 1837. Marsh moved to the rancho in April 1838 and was murdered in 1856 by three Mexican Vaqueros. His daughter patented the rancho in August 1867.

No known Hispanic Period features, dwellings, roads, corrals, etc. appear to have been present within or near the project (Hendry and Bowman 1940:484-486; Collier 1983).

AMERICAN PERIOD

In the mid-19th century, most of the rancho and pueblo lands in California were subdivided as the result of population growth and the American takeover. This American ascendancy was the result of the confirmation of property titles throughout California, prior to which the transfer of real estate had been extremely risky. The initial explosion in population was associated with the Gold Rush (1848), followed later by the construction of the transcontinental railroad (1869). Still later, the development of the refrigerator railroad car (ca. 1880s), used for the transport of agricultural produce to distant markets, had a major impact on population growth (Hart 1987).

Contra Costa County is among the 27 initial California counties. Growth in the general study area has been linked with agriculture, a coal mining boom from the 1850s-1880s, and the development of transportation networks to service both industry and agriculture with market links. The towns of Crockett, Port Costa, Vallejo Junction, Martinez, former Bay Point/Port Chicago, Bay Point, Pittsburg, Antioch, and later Oakley were important focal points for services and the transport of coal, fish, lumber, and wheat to San Francisco and Sacramento and beyond by water and, later, by rail.

Project Study Area

The project is located in the eastern part of present-day Oakley. Prior to reclamation, Marsh's Landing at the edge of the extensive tule area opposite Sherman Island and Iron House/Babbe's Landing (both dating to the 1850s) along Dutch Slough were the most important features in the study area.

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9. A proposed recreational trail with the potential to be marked as the Anza Trail has been placed just south of Cypress Road (USNPS 1995).

By 1873 the San Pablo and Tulare Railroad ran through the study area skirting the northeastern portion of *Rancho Los Meganos* (e.g., Geological Survey of California 1873). By 1878, the San Pablo and Tulare Railroad was complete and ran south of the future Oakley vicinity, from Tracy through Byron, Brentwood, Antioch,[10] Pittsburg/Cornwall, and Bay Point and on to Martinez to connect with the Central Pacific Railroad. In 1899, a parallel line was constructed between Seal Bluff and Antioch by the San Francisco & San Joaquin Valley Railroad Company. This line was conveyed to the Santa Fe Railroad Company in 1901 which was a 1897 reorganization of the Atchison Topeka & Santa Fe Railway Company (AT&SF).

Late 19th century Oakley was/is located on the south side of Atchison Topeka and Santa Fe (AT&SF) railroad line[11] 1.5 mile east and slightly south of the Emerson Property. The town is situated about 6.0 miles east of Antioch and about 1.5 mile northwest of Knightsen (on the Atchison Topeka & Santa Fe Railway Company rail line).[12] Oakley was named for the abundant native oak trees by R.C. Marsh and was noted for apricot, almond and grapes. R.C. Marsh, farmer and first postmaster of the Oakley post office which opened October 7, 1878, negotiated the right-of-way across the northwest quarter of Section 25 for at least a half mile of side-track and a small station "room" . . . to be followed by a station dependent on business.

The land for "Oakley" was provided by James O'Hara who had purchased government-grant land in 1887. The town was founded in 1897, initially subdivided by R.C. Marsh with O'Hara Avenue as the main north-south street followed to the east to the tracks by Second, Third, and Fifth streets. East-west streets from Main Street (present-day State Route 4) south consisted of Acme, Ruby, Star, and Home streets. By 1902 Oakley had a general merchandise store, blacksmith shop, a post office, and a "pigeon industry" and the first hotel opened in 1908 by Mr. and Mrs. S. Dal Porto who also built a town hall. In 1910 A.G. Ramos opened a store specializing in harnesses, whips, lap robes, and blankets and in 1911 M.A. Ferrell opened another grocery store and also sold feed and hardware.

Fruit and vegetable wholesalers built packing sheds along the north side of the half-mile long railroad spur to ship almonds, celery, asparagus and wine grapes to the eastern markets. Reportedly the field workers in the area were "mostly Oriental" [Chinese and Japanese] but also included Hindus and later, Mexicans provided labor (Smith and Elliot 1879:map; Collier 1983:141-142; Emanuels 1986:209-211; Patera 1991:154; Fickewirth 1992:13, 129, 137; Metcalfe 1994 [1902]:not paginated; Walker 1994:Map CA-13; Gudde 1998:266; Oakley 2002b:EIR, 3-2)).

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10. Antioch Station was south of Antioch. Smith's Landing, dating to the 1850s at Fulton Shipyard Road, was the first landing in Antioch and on land purchased from Dr. John Marsh. This landing is on the *California Inventory of Historic Resources* under the theme of Economic/Industrial and *Revised Preliminary Historic Resources Inventory* of Contra Costa County (CAL/OHP 1976:111, 230; Emanuels 1986:213; CCC/CDD 1989:Antioch area).

11. in the northeast 1/4 of the 1/4 NW of Section 25 T2N R3E (USGS 1916 Byron [surveyed 1911])

12. This line, incorporated in December 1895 was the successor of the Atchison, Topeka & Santa Fe Railroad Company incorporated in 1859 (Fickewirth 1992:13).

Project Specific Historic Map Review

Goddard's 1857 *Map of the State of California* shows major points of interest in the general study area: Antioch and New York of the Pacific (present-day Pittsburg) are mapped north of the project and the name "Marsh" is mapped south of the project while the project area is shown as marshy.

The 1862 *Government Land Office* (GLO) survey plat for Township 2 North, Range 3 East shows a markedly different shoreline. Iron House Landing is located north of the project in the N 1/2 of the NE 1/4 of Section 19. Two roads lead to the Landing, one of which would have proceed through the Emerson Property west of Sellars Avenue and not along the present-day alignment between Sections.[13]

The 1872 *Plat showing the subdivision of the Two Bodies of land "Notoriously Swampy & Overflowed"* (United States Surveyor General (USSG) 1872) shows Dutch Slough and the zig-zaging boundary of the swampy & overflowed lands thorough the SW 1/2 of T2N R3E north and east the project's. Chan's (1986:166-167, Map 7) reconstruction of the sequence of reclamation in the study area between 1860-1930 shows the Emerson Property as not reclaimed in contrast to the area on the east side of Sellars Avenue which was reclaimed 1890-1900.

The 1873 *Geological Survey of California* map shows Iron House Landing on Dutch Slough and two roads leading to it. None of the farmsteads shown were located in or near the project.

The 1914 USGS Brentwood and 1916 USGS Byron [surveyed 1911] topographic maps include Oakley, the Atchison Topeka and Santa Fe tracks, and Knightsen in the vicinity of the project. Both present-day Cypress Road and Sellars Avenue were extant. Two paved roads proceeded about a third west into the larger Emerson Parcel (APN 037-102-016) from Sellars Avenue and connected to a paved road north through the parcel. The northernmost paved road was parallel to the boundary of T2N R3E Sections 19 and 30 and the southernmost paved road was situated about midpoint of the NE 1/4 of Section 30. In addition, an unpaved road proceeded north from Cypress Road at the midpoint of the NE 1/4 of Section 30 and connected to southernmost paved road off of Sellars Avenue. Iron House School, the only structure in the project area, is labeled and shown in the northwest corner of the intersection of Cypress Road and Sellars Avenue (e.g., APN 037-192-015).[14]

A 1938 *Map of Contra Costa County, California* shows the project by "Emerson" as well as property on the north side of the Contra Costa Canal north to Dutch Slough (Anonymous 1938).

The 1943 US War Dept [photography 1937] quadrangle also shows and labels Iron House School in the northwest corner of the intersection of Cypress Road and Sellars Avenue. Part of unpaved road at a diagonal is shown about mid-property connecting to a north unpaved road to the Contra Costa Canal and also east to Sellars Avenue. Three structures are located in the vicinity of these unpaved roads on the Emerson Property.

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13. Sellars Avenue follows the section line between Sections 19-20, 30-29, and 31-32 on the T2N R3E survey plat.

14. Neither Cypress or Sellars is labeled.

The 1978 USGS show two unpaved roads, one north/south and the other trending east-west, off of Sellars Avenue which appear to conform to the alignment of earlier roads. Iron House School at the corner of Cypress Road and Sellars Avenue is not shown or labeled.[15] Two structures are shown in the vicinity of the unpaved roads: one in the northeast quadrant of the property [the location of the moved School as observed during the field survey] and another at about project mid-point slightly south of the slightly extended east-west unpaved road. The third structure present in the late 1930s/early 1940s situated near Sellars Avenue just north of the unpaved mid-point east-west road had been removed by 1978 [Fig. 2].

Historic Resources In/Near the Project

No Historic Era sites have been recorded or formally reported in the project area or adjacent (CHRIS/NWIC File No. 04-4).

Two historic Era cultural resources are located in/adjacent to the Emerson Property: **Iron House School**, and part of the **Contra Costa Canal** (adjacent). No other local, state or federal historically or architecturally significant structures, landmarks, or points of interest have been identified within or adjacent to the project. One historic Era cultural resource, Iron House Landing (later known as Babbe's Landing), is located just north of the project.

<u>Iron House School</u>

The former Iron House School was originally located at the northwest corner of Cypress Road and Sellars Avenue (e.g., USGS 1916 Bryon [surveyed 1911]).[16] *"School house built in 1850s. Structure now used as a private home and dairy, quarter-mile north of Cypress, west side of Sellars Road."* (CCCoHS 1994:#148).[17] By 1882, the Iron House School District was one of 39 in Contra Costa County (Slocum 1882:207). This school has been described as a 1852 single story wood frame building with shiplap siding capped with a double pitched roof. In 1976, the school was located about 150 yards from a proposed pipeline along Cypress Road and had been modified and modernized for use as a private residence (Busby 1976).

The former school is on the *California History Plan* (CAL/OHP 1973:55) and *California Inventory of Historic Resources* under the theme of Social/Educational (CAL/OHP 1976:209, 229), is listed on the *Revised Preliminary Historic Resources Inventory* of Contra Costa County as a "Structure of Historical Significance" (CCCo/CDD 1989:East Contra Costa County area), and is on the *Contra Costa County Map of Historical Points of Interest* places (Contra Costa County Historical Society (CCCoHS) 1994:#148). Iron House School is listed on the *Historic Properties Directory* (HPD) on Cypress Road in Brentwood [sic] as a "code 7", not evaluated for inclusion on the National Register of Historic Places or the California Register of Historical

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15. Note Busby (1976:Segment #12/S-18352) places the school 150 yards from unpaved east-west road.

16. Anonymous/Source Unknown (1976?:#324) maps the school near the corner [likely in small corner parcel, APN 037-192-015).

17. The text places it on the northwest corner of Cypress Avenue and Sellars Avenue in Brentwood. The accompanying map shows the "Iron Horse [sic] School" (site)" straddling the Contra Costa Canal.

Resources or needs reevaluation. The HPD assigns Primary Number P-07-000903 to the school.

Contra Costa Canal

The Contra Costa Canal, the first canal built as part of the Central Valley Project, is located adjacent to the northern boundary of the larger Emerson Property project parcel (APN 037-102-016). The United States Bureau of Reclamation opened an office in Antioch in 1936. Construction on the canal began in late 1937 and was completed in 1948 (after work was suspended during World War II). The 46-mile long Contra Costa Canal has been evaluated as not eligible for inclusion on the National Register of Historic Places (Craigo 1992; West and Welch 1996/S-18440; JRP 2000:73-77, Appendix A, p. 5 as code 6Y1, determined ineligible by consensus with no potential for any listing).

Iron House Landing

One historic Era cultural resource, Iron House Landing (later known as Babbe's Landing), is described as located at the foot of Sellers Avenue on Dutch Slough (e.g., CAL/OHP 1976:228).[18] Iron House Landing, as mapped on the 1862 *Government Land Office* (GLO) survey plat for Township 2 North, Range 3 East, is north of the project in the N 1/2 of the NE 1/4 of Section 19. The landing dates to the 1850s and appears on a number of historic maps. Reportedly the name "Iron House" is associated with a store owned by Larrabee and Henderson, on the landing who replaced a their make-shift pole and tule structure with a house built of sheet iron.[19] The Iron House was later bought by the Halstead family." (Hohlmayer 1991:239-240). The landing was on a channel cut to high land and was the central point for horse and hay transport to San Francisco in the Iron House and Eden Plains districts. It also included the store of Martin Hamburg[20] until he moved to Antioch (Smith and Elliott 1879:30, ff22 [illustrated]; Slocum 1882:484; Baker 1985:2-4/S-7639). Research conducted by Baker at the Bancroft Library, University of California, Berkeley located some material on Frederick Babbe, but not for Martin Hamburg at the Landing site. Baker posits, given the lack of data[21], that the Martin Hamburg store at the landing may be "a mistake".[22]

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18. Anonymous/Source Unknown (1976?:#325) maps the Landing mostly on the east side of Sellars Avenue on the south side of the Contra Costa Canal.

19. Reportedly, a cargo of 24 x 36 and 24 x 72 inch iron sheets arrived in San Francisco via the "Delia Chapin" out of Massachusetts in 1849 and were traded for firewood up and down the San Joaquin River.

20. *It* [Hamburg's store] *was first situated about five miles above Marsh Landing, on the bank of a sheet of water that had acquired the name of Dutch slough, whence there had been cut a channel to the high land, and saving the expense of a road and wharf on the tule lands, thus making a central point for the residents of the Iron House and Eden Plains districts.* (Solcum 1882:484).

21. Including the Contra Costa County Community Development Department.

22. The surveys of the Burroughs property opposite Sellars Avenue and northeast of the Emerson Property [the Ponderosa Homes Project] were negative for prehistoric and historic era sites including evidence of Babbe's Landing (Baker 1985a/S-7639; Baker 1985b/S-7666).

Babbe's Landing [*sic*] is listed on the *California History Plan* under the theme of Exploration/Settlement (CAL/OHP 1973:53), *California Inventory of Historic Resources* under the theme of Economic/Industrial (CAL/OHP 1976:68, 228), and the *Revised Preliminary Historic Resources Inventory* of Contra Costa County (CCC/CDD 1989:East Contra Costa County area) as a "Site of Historic Event".

FIELD INVENTORY

PREVIOUS SURVEYS

Three previous archaeological field surveys for water projects have included Cypress Road adjacent to the southern boundary of the Emerson Property (Busby 1976/S-18352; West and Welch 1996/S-18440; Jones & Stokes Associates 1998/S-20808). No cultural resources were identified along Cypress Road in/adjacent to the project. Busby (1976/S-18352) also conducted a pipeline survey along the east-west unpaved road off of Sellars Avenue within the larger APN 037-192-016 Emerson property parcel. At that time, the Iron House School was identified as 150 yards away from the proposed pipeline route #12.

PROJECT SURVEY

A field inventory of the Emerson Property was undertaken by Ms. Christine Marshall, MSc (Archaeologist and Physical Anthropologist), on July 13-14, 2004 in accordance with standard archaeological practice for central California. The Emerson Property consists of two parcels, a small 0.97 acre parcel at the northwest corner of Sellars Avenue and Cypress Road (APN 037-192-015) and the larger 140.16 acre parcel (APN 037-192-016).

APN 037-192-015: Access was limited by two large and aggressive dogs. The property was visible from both Cypress Road and Sellers Road. A large double-wide mobile home and nearby metal outbuilding with two garage bays currently occupy this corner lot.

APN 037-192-016: The larger parcel is subdivided into four fields separated by either fencing or a modern linear berm. The inventory was conducted in transects spaced at 30 meter intervals. The property had been recently plowed resulting in excellent ground surface visibility. Four structures, a large farmhouse with an associated barn and outbuilding, and smaller one-story farmhouse, are present on the property. The large house consists of the former "Iron Horse School" distinguished by the cupola. The school has been converted into a private residence and enlarged. Landscaping around the residence includes two tall cypress visible from a distance. The smaller residence, a one-story ca. 1940s? farmhouse, is located to the southwest and is also surrounded by landscaping.

No evidence of prehistoric or historically significant archaeological materials was observed during the field inventory. No indications of the Iron House/Babbe's Landing and/or buildings and features at the foot of Seller's Road were observed. A loose, dark blackish gray silty loam with unmodified complete and fragmented fresh water clam shell is present in the northeast quadrant of the Emerson property. This approximately 20 cm deep loam stratum overlays a compact layer of dark yellowish brown silty clay. The upper loam layer may have been imported or the residue from dredging operations of the adjoining Contra Costa Canal (e.g., *Corbicula* (clam) valves after West and Welch 1996:6/S-18440).[23] Other parcel soils vary from a firm medium yellowish gray sandy silts with rounded and subrounded gravel to loose yellowish brown fine sand. Occasional cement rubble is also scattered throughout the property.

FINDINGS

The intent of this report was to identify cultural properties including prehistoric and historic archaeological sites, historic features and standing structures which may be potentially eligible for inclusion on the California Register of Historical Resources (CRHR)[24] using available archival data and a field inventory of the Emerson Property.

ARCHAEOLOGICAL SENSITIVITY

- The *Contra Costa County General Plan* appears to assign a "low" archaeological sensitivity rating to the project area and near vicinity (Contra Costa County Community Development Department (CCC/CDD) 1996:9-11 to 9-18, Figure 9-2).

RECORDS SEARCH RESULTS

- No archaeological resources have been recorded or formally reported in or adjacent to the project (CHRIS/NWIC File No. 04-04)

- Four cultural resources compliance reports on file at the CHRIS/NWIC include either the project area or adjacent areas (Busby 1976/S-18352; West and Welch 1996/S-18440; Jones & Stokes Associates 1998/S-20808; Author/date?/S-25276). No cultural resources have been identified along Cypress Road in/adjacent to the project.

IDENTIFIED CULTURAL RESOURCES

- No prehistoric, ethnographic settlements or traditional Native American use areas have been recorded or identified in or adjacent to property.

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23. Likely *Corbicula* (clam) valves from dredged canal sediments (e.g., West and Welch 1996:6/S-18440).

24. A historical resource may be listed in the California Register of Historical Resources (CRHR) if it meets one or more of the following criteria: "(1) it is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; (2) it is associated with the lives of persons important to local, California or national history; (3) it embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or (4) it has yielded or has the potential to yield information important in the prehistory or history of the local area, California or the nation." Automatic listings include properties listed in the National Register of Historic Places, determined eligible for the National Register either by the Keeper of the National Register or through a consensus determination on a project review, or State Historical Landmarks from number 770 onward. In addition Points of Interest nominated from January 1998 onward will be jointly listed as Points and in the California Register. Landmarks prior to 770 and Points of Historical Interest may be listed through an action of the State Historical Resources Commission (CAL/OHP ca. 1999, 2001a-c).

- No Hispanic Period archaeological resources have been recorded or identified in or adjacent to the property.

- Two American Era cultural resources have been noted in/adjacent to the Emerson Property. The location of the former Iron House School site is at the northwest corner of Sellars Avenue and Cypress Road (APN 037-192-015). Archaeological deposits may be associated with the original building site. The school (building) was relocated to the northeast quadrant of the Emerson Property and has been modified/expanded (APN 037-192-016). The available USGS map series indicate that the structure was moved after ca. 1940 (US War Dept 1943 [labeled]; USGS 1980). The structure has been described as ".. *now used as a private home and dairy, quarter-mile north of Cypress, west side of Sellars Road."* (CCCoHS 1994:#148)." The former school, P-07-000903, is listed on the *Historic Properties Directory* (HPD) as a "code 7", not evaluated for inclusion on the National Register of Historic Places or the California Register of Historical Resources or needs reevaluation.

- The other identified American Era cultural resource, part of the **Contra Costa Canal**, is situated adjacent to the north side of the project (APN 037-192-016). The canal has been evaluated as not eligible for inclusion on the National Register of Historic Places (code 6Y1).

- No other local, state or federal historically or architecturally significant structures, landmarks, or points of interest have been recorded or identified in or adjacent to the project.

FIELD SURVEY – Archaeological Resources

No prehistoric or historically significant archaeological resources were observed during previous surveys or during the survey conducted for the current project. No evidence of the former Iron House/Babbe's Landing were observed during the survey. Any remnants were likely destroyed by the construction of Contra Costa Canal (completed in 1948) along the northern boundary of the Emerson property.

FIELD SURVEY – Built Resources

The former Iron House School previously located at the northwest corner of Cypress Road and Sellars Avenue has been moved to the northeast quadrant of the Emerson Property (APN 037-192-016). The building has been modified/expanded and is currently a private residence. Three other buildings that could be over 50 years in age on the property include: a small one-story farm house, a barn, and an outbuilding. The small house definitely post dates the 1914 USGS topographic map and appears to be one of structures on the 1943 US War Department quadrangle. None of the buildings have been evaluated for inclusion on the California Register of Historical Resources or National Register of Historic Resources.

A large double-wide mobile home and metal outbuilding with two garage bays currently occupy this corner lot (APN 037-192-015). The buildings and structures appear to be less than 50 years in age.

MANAGEMENT RECOMMENDATIONS

Management recommendations are provided in accordance with the Oakley 2020 General Plan provisions for cultural and historic resources (Oakley 2002a:General Plan, 6-5, 6-6).

ARCHAEOLOGICAL RESOURCES

It is the considered opinion of Basin Research Associates, based on a review of pertinent records, maps and other documents, and a field inventory that the proposed project can proceed as planned in regard to prehistoric and historic archaeological resources. However, future development of the Emerson Property could impact potentially significant historic era archaeological materials associated with the former location of the Iron House School at the northwest corner of Sellars Avenue and Cypress Road. Avoidance of the this area is recommended in accordance with the Oakley 2020 General Plan (Oakley 2002a:General Plan, 6-5, 6-6) which encourages preservation of cultural resources within the Plan Area (e.g., Policy 6.4.1 *Preserve areas that have identifiable and important archaeological or paleontological significance*). If avoidance is not possible, archaeological monitoring during ground disturbing construction is recommended in the vicinity of the former school. Subsurface testing to determine the presence/absence of buried archaeological resources does not appear necessary.

If any significant cultural materials[25] are exposed or discovered during site clearing or during subsurface construction, operations should stop within 25 feet of the find and a qualified professional archaeologist contacted for further review and recommendations.

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25. Significant prehistoric cultural resources may include:

a. Human bone - either isolated or intact burials.
b. Habitation (occupation or ceremonial structures as interpreted from rock rings/features, distinct ground depressions, differences in compaction (e.g., house floors).
c. Artifacts including chipped stone objects such as projectile points and bifaces; groundstone artifacts such as manos, metates, mortars, pestles, grinding stones, pitted hammerstones; and, shell and bone artifacts including ornaments and beads.
d. Various features and samples including hearths (fire-cracked rock; baked and vitrified clay), artifact caches, faunal and shellfish remains (which permit dietary reconstruction), distinctive changes in soil stratigraphy indicative of prehistoric activities.
e. Isolated artifacts

Historic cultural materials may include finds from the late 19th through early 20th centuries. Objects and features associated with the Historic Period can include.

a. Structural remains or portions of foundations (bricks, cobbles/boulders, stacked field stone, postholes, etc.).
b. Trash pits, privies, wells and associated artifacts.
c. Isolated artifacts or isolated clusters of manufactured artifacts (e.g., glass bottles, metal cans, manufactured wood items, etc.).
d. Human remains.

In addition, cultural materials including both artifacts and structures that can be attributed to Hispanic, Asian and other ethnic or racial groups are potentially significant. Such features or clusters of artifacts and samples include remains of structures, trash pits, and privies.

BUILT RESOURCES

The former Iron House School previously located at the northwest corner of Cypress Road and Sellars Avenue has been moved to the northeast quadrant of the Emerson Property (APN 037-192-016). This property will be moved to another location as part of the proposed project. The three other buildings on APN 037-192-016 that could be over 50 years in age - a small one-story farm house, a barn, and an outbuilding – should be reviewed and evaluated by a qualified architectural historian to determine if they can be considered historic resources under the California Environmental Quality Act.

The Oakley 2020 General Plan Goal 6.5 (Oakley 2002a:General Plan, 6-5, 6-6) encourages preservation and enhancement of selected historic structures and features within the community. Policy 6.5.6 mandates working with property owners to preserve historic features within the community. Program 6.5C requires assessing development proposals for potential impacts to significance historic resources pursuant to Section 15064.5 of the CEQA Guidelines.

The double-wide mobile home and metal outbuilding with two garage bays on APN 037-192-015 appear to less than 50 years in age and no further management is recommended.

CLOSING REMARKS

If I can provide any additional information or be of further service please don't hesitate to contact me. Thank you for retaining our firm for the project.

Sincerely,
BASIN RESEARCH ASSOCIATES, INC.

Colin I. Busby Ph.D., R.P.A.
Principal

CIB/j
Enclosures

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1996 Class II Archeological Survey of the Contra Costa Canal, Contra Costa County, California. MS on file, S-18440, CHRIS/NWIC, CSU Sonoma, Rohnert Park.

Abbreviations

n.d. no date
v.d. various dates
N.P. no publisher noted
n.p. no place of publisher noted

Note: "CHRIS/NWIC, CSU Sonoma, Rohnert Park" is used for material assigned S-# on file at the California Historical Resources Information System, Northwest Information Center, California State University Sonoma, Rohnert Park.

ATTACHMENTS

FIGURES

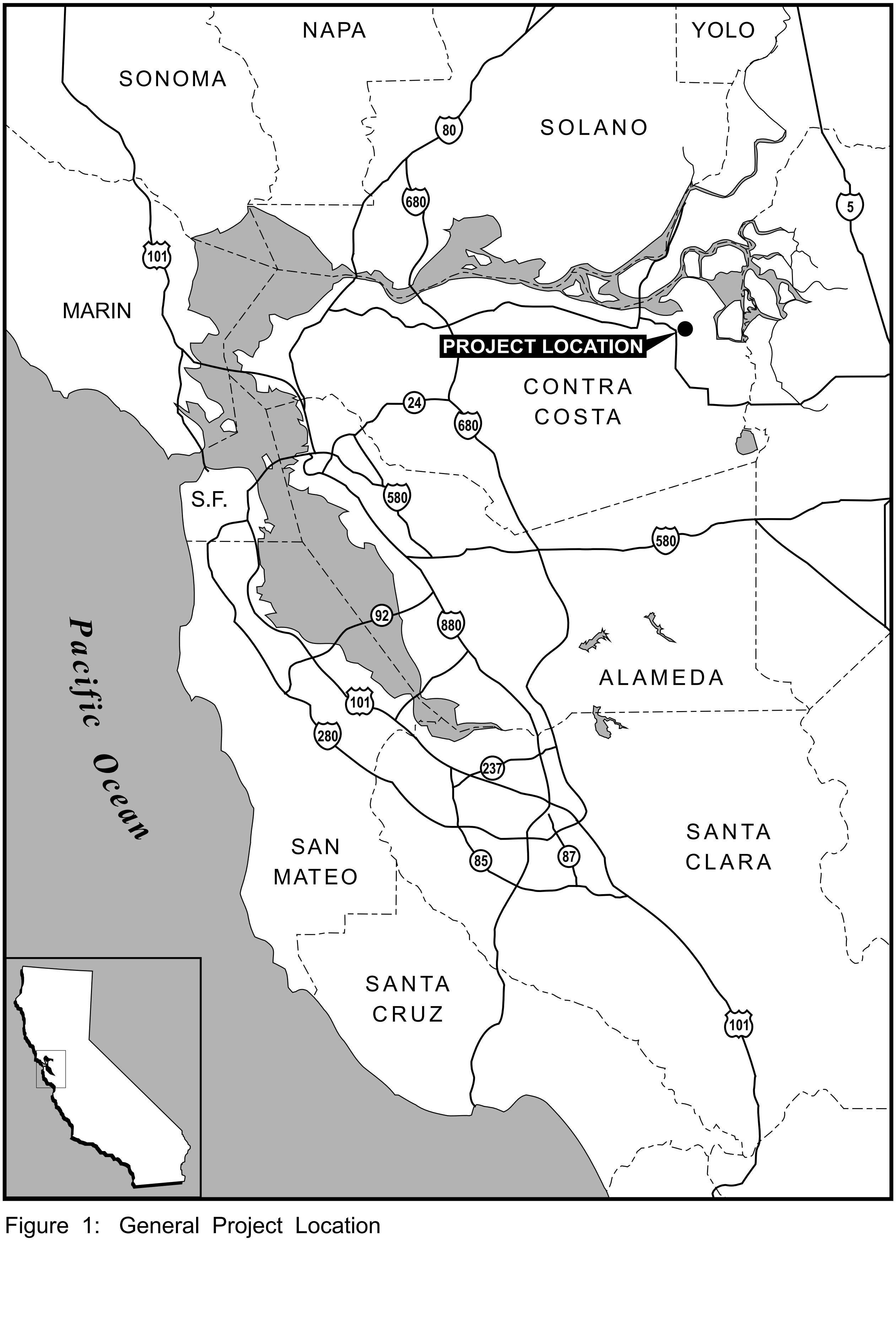

Figure 1: General Project Location

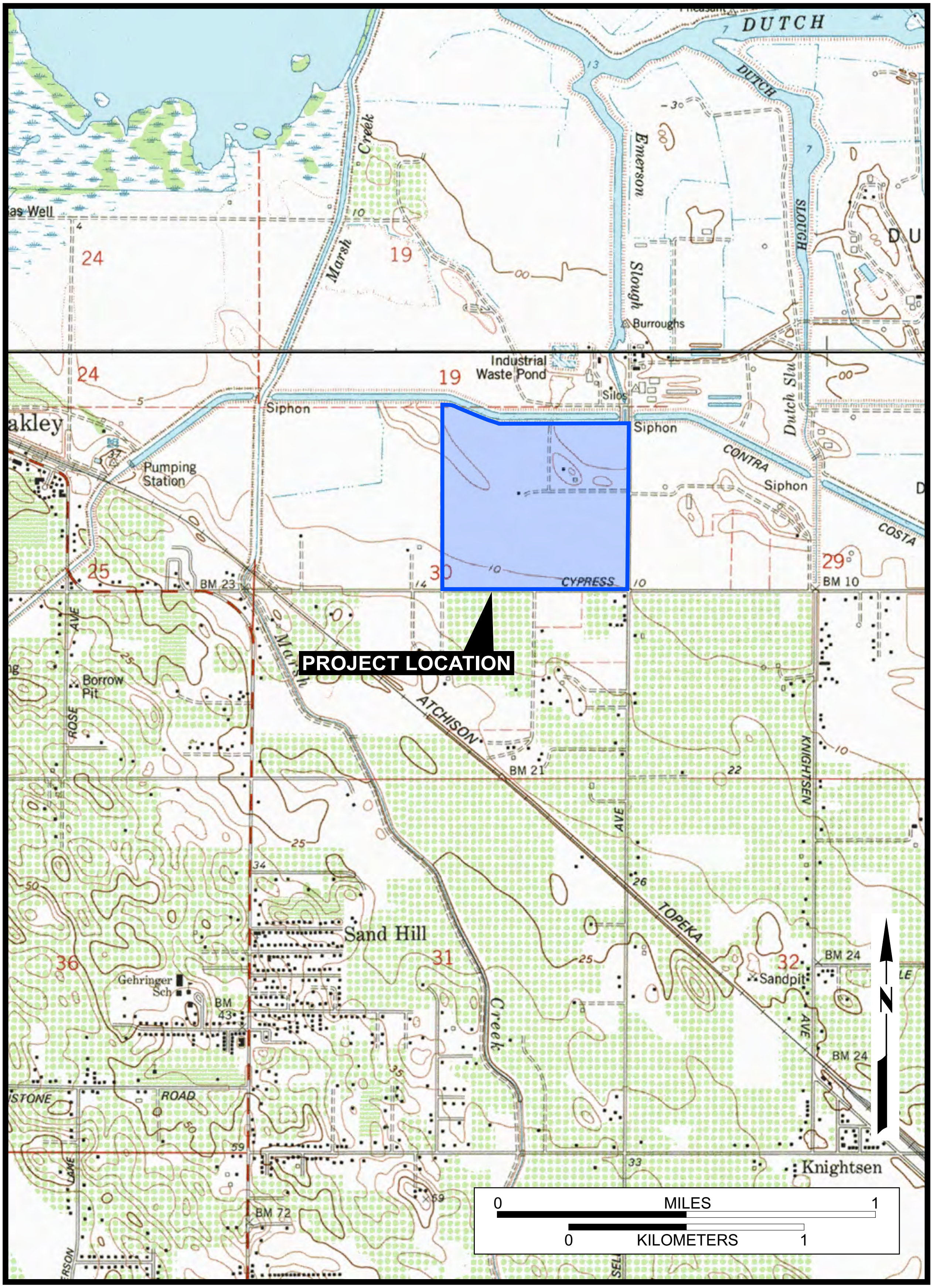

Figure 2: Project Location (USGS Jersey Island, Calif. 1978 and Brentwood, Calif. 1978)

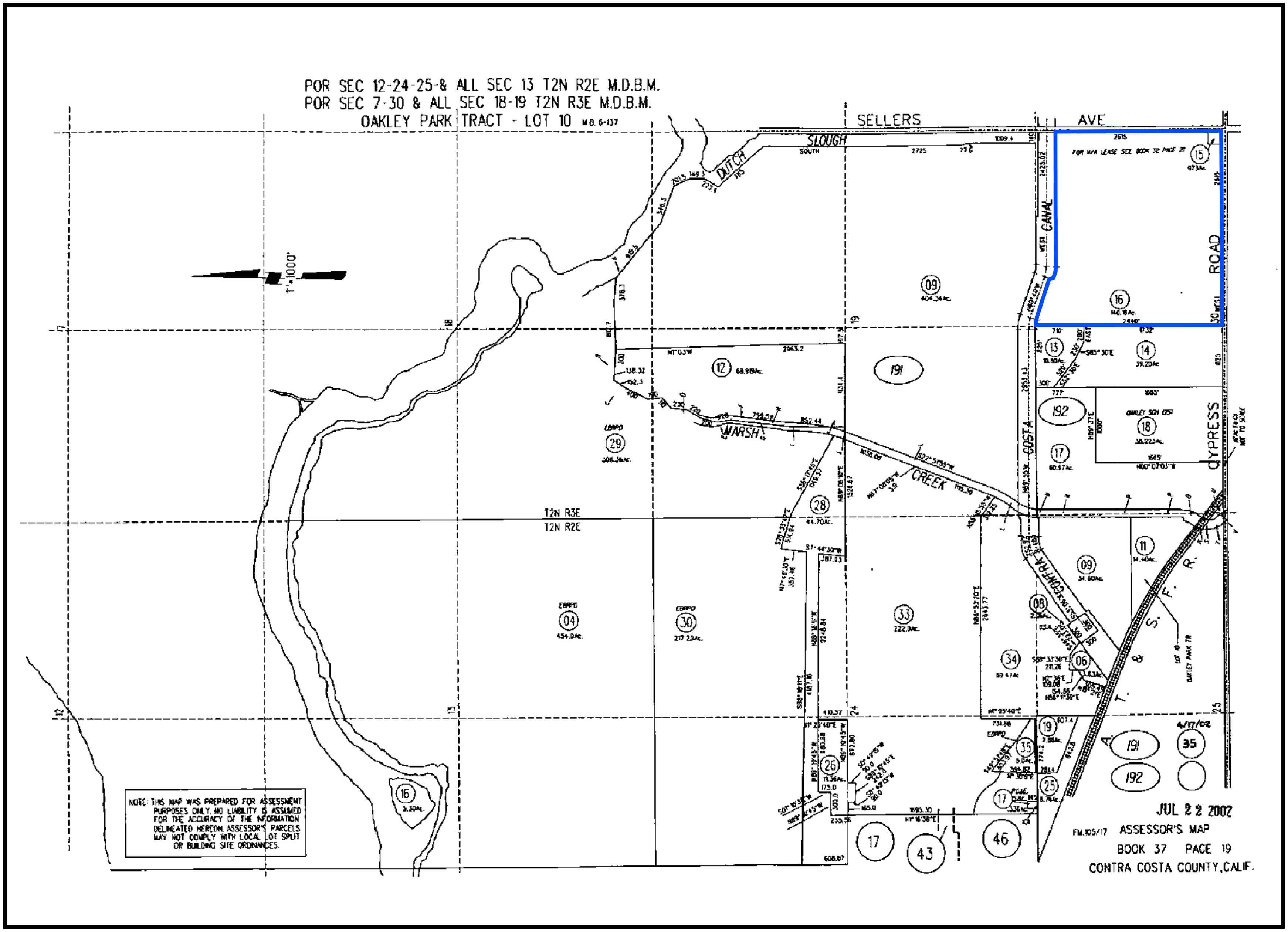

Figure 3: Assessor's Parcel Map

GROUNDWATER STUDY

EMERSON AND BURROUGHS PROPERTIES

CONTRA COSTA COUNTY, CALIFORNIA

SUBMITTED

TO

PONDEROSA HOMES

PLEASANTON, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 4603.4.101.02

OCTOBER 27, 2005

ENGEO
INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Project No.
4603.4.101.02

October 27, 2005

Mr. Jeff Schroeder
Ponderosa Homes
6671 Owens Drive
Pleasanton, CA 94588

Subject: Emerson and Burroughs Properties
Contra Costa County, California

GROUNDWATER STUDY

Dear Mr. Schroeder:

With your authorization, we have conducted a groundwater study for the subject property, located on the north side of Cypress Road in Contra Costa County, California. The accompanying report presents the results of our study of hydrogeologic conditions beneath the proposed development. Based on our study, it is our opinion that groundwater can be used for evaporation make up requirements of the currently proposed lakes within the development from a hydrogeologic standpoint; provided the recommendations included in this report are followed.

We are pleased to provide our services to you on this project and look forward to consulting further with you and your design team.

Very truly yours,

ENGEO INCORPORATED

Jason Preece, CEG
jp/jb:gw

Reviewed by:

Dennis B. Nakamoto, CEG

cc: 1 – Mr. Steve Garrett, Castle Companies, Inc.
1 – Alexandra Barry, Centex Homes
1 – Reed Onate, Trumark Companies
2 – Sandra Pellegrino, Carlson Barbee & Gibson
1 – Cindy Gnos, Raney Planning and Management

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Letter of Transmittal

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EXECUTIVE SUMMARY

Development is planned on the southern portions of the Emerson and Burroughs Properties (Assessor's Parcel Numbers [APN] 032-270-809, 032-081-016 and 032-270-801 totaling 305 acres) that includes construction of two lakes that would be supplied by stormwater runoff and groundwater resources for the purpose of establishing storage capacity. Groundwater resources would be utilized to maintain the water level of the lakes and also supply turf irrigation water for perimeter green spaces. This report is intended to provide an assessment of groundwater conditions in light of future land use changes. This assessment considers the cumulative affects on groundwater supply and demand contributed from other nearby planned developments for which additional lakes and community park and turf space are planned. This assessment has included research of available data on groundwater quantity and quality, site reconnaissance and interviews, development of a conceptual site model, and a comparison of historical to anticipated future groundwater needs.

The site is irregularly shaped and generally flat with some slight manmade and natural rises. Existing site elevations range from approximately 14 to 4 feet above mean sea level (msl). The northern and southern majority of the site consists of undeveloped agricultural land. Existing driveway, trees, irrigation pipelines and several residential structures with associated buildings are located on the site. Several canals and sloughs exist adjacent to and in the vicinity of the site.

It has been necessary to evaluate groundwater conditions over a much broader area than the site (approximately 12 square miles herein referred to as the "study area") to provide an adequate and cumulative assessment of the potential for impacts to result from land use changes. The groundwater flow direction is northeast at an estimated rate of approximately one (1) gallon per day per square foot based on a hydraulic gradient of 0.1. The primary aquifers in the area are within the upper 500 feet of unconsolidated alluvial sediments of the Great Valley comprised of interlayered sequences of sand, silt and clay. While aquifer characteristics are best determined by aquifer pumping test data, for the purposes of assessing potential environmental impacts, a pumping test may be omitted in favor of theoretical modeling of aquifer performance. Specific recommendations are presented at the end of this report to conduct pumping tests for well design purposes.

In general, this assessment concludes that planned land use changes for the site and surrounding area should not have significant impacts to groundwater conditions. While significant amounts of groundwater recharge, such as infiltration from rainfall and irrigation, may be reduced due to the affects of urbanization, the reduction appears to be greatly counteracted by a reduction in historical groundwater pumpage rates and a potential increase in streambed recharge, such that an overall change in the groundwater budget is not expected. A balanced groundwater budget is expected with the assumption that groundwater resources will meet the future water demands created by the cumulative amount of evaporation from surface water in the lakes and from irrigation water applied to common area parks and street landscape planned in the study area that is estimated to be 540 and 290 acre-feet per year, respectively.

This study has also concluded that groundwater in the site and study area is of sufficient quality for the purpose of landscape irrigation and lake evaporation loss makeup. In addition, it appears plausible for the quality of groundwater in the area to improve due to urbanization primarily due to less infiltration of nitrate-laden irrigation water from agricultural activities and a greater component of recharge from streams and sloughs having lower concentrations of total dissolved solids (TDS) than either recharge of irrigation water or the lateral flow of higher TDS groundwater sourced from the Coast Ranges located to the west of the study area.

1.0 INTRODUCTION

1.1 Background

Proposed development on the southern portions of the Emerson and Burroughs Properties (Assessor's Parcel Numbers [APN] 032-270-809, 032-081-016 and 032-270-801 totaling 305 acres) includes planned construction of lakes (two are planned at approximately 5 acres each in size) that would be supplied by stormwater runoff and groundwater resources for the purpose of establishing storage capacity. Groundwater resources would be utilized to maintain the lakes' water level (i.e. account for make up losses due to evaporation) and also supply turf irrigation water for perimeter green spaces (total of approximately 16 acres). A CEQA study of the proposed lakes currently in progress recently revealed a need to complete an assessment of potential hydrogeologic impacts resulting from incorporating lake operations into the planned development. This report is intended to provide the needed assessment. This assessment also includes the cumulative affects on groundwater supply and demand contributed from other nearby planned developments for which additional lakes (approximately 167 total acres) and community park and turf space (up to 58 acres) are planned that would also utilize groundwater resources.

1.2 Purpose

This groundwater study is being conducted to assess current and historical groundwater conditions at the site, and in the general vicinity, to provide background data useful in assessing the affects, if any, of planned groundwater use at the property.

1.3 Scope

The scope of the study consists of:

- Review of existing surface and groundwater databases.

- Field reconnaissance to identify wells and locations where more detailed groundwater data can be collected in the future.

- Compiling information that will allow for modeling of the current groundwater use rates.

- Evaluation of the hydrogeologic cycle under current agricultural-use in the site's low-lying delta setting.

- Research and evaluation of regional water resource critical issues such as, Total Maximum Daily Load (TMDL) goals for adjacent surface water bodies to assess the potential for contributing to brackish water intrusion that could result from groundwater removal.

- Constructing a groundwater balance for the site vicinity that will assist in determining estimates of current and future groundwater use.

- Develop a conceptual site groundwater model including the following data types:

  - Quantity and quality of applied water (evaluation of changes in salt concentrations in storage pond due to evaporation).

  - Quantity and quality of percolating water (comparison to leaching factor available from similarly situated projects in the vicinity of the subject site).

- Develop data to assist with modeling the aquifer conditions and predicting the effects of operation of the proposed lakes.

- Identify any accessible well suitable for conducting a short-duration pump test with water quality testing.

- Compare water demand with historical groundwater pumping.

Aquifer characteristics are, in the long term, determined by aquifer pumping test data. Such data are best collected from a pumping well that is screened across the entire shallow aquifer thickness and monitoring wells that are screened at the same depths as the pumping well and that are constructed at specific distances and directions from the pumping well. However, for the purposes of assessing potential environmental impacts, a pumping test may be omitted in favor of theoretical modeling of aquifer performance. Additionally, pumping tests for the purpose of establishing a sustainable aquifer yield must be conducted on the actual well to be used and in the late Fall, when groundwater levels are lowest due to low precipitation, low stream levels and high pumping demands. Specific recommendations are presented at the end of this report to conduct pumping tests for well design purposes.

1.4 Site Location and Description

The site consists of approximately 305 acres, located in Contra Costa County, California east of Oakley. The site is generally bound by the Contra Costa Canal to the north and east, Cypress Road to the south and the Emerson Property boundary to the west (north-south trending line approximately one-half mile west of Sellers Avenue as shown on Figures 1 and 2. The site consists collectively of portions of properties also referred to as the Emerson and Burroughs properties. Figure 2 also shows the area covered by this study.

The site is irregularly shaped and generally flat with some slight manmade and natural rises. Existing site elevations range from approximately 14 to 4 feet above mean sea level (msl).

The northern and southern majority of the site consists of undeveloped agricultural land which was fallow or disced at the time of our exploration. The central eastern portion of the site consists of an east-to-west-trending strip of land which varies up to approximately 8 feet higher in elevation than the remainder of the site. An existing driveway, trees, and several residential structures with associated buildings are located in this area. There is a system of irrigation pipelines that run east-west across the southernmost portion, east-west in the central portion of the site, and another that runs north-south approximately thirty feet west of Sellers Avenue.

The Contra Costa County Canal, which borders the property to the north, consists of an approximately 12-foot-high berm and a relatively shallow canal. At the time of our field activities, the flow line in the canal was lower than the ground surface of the subject property.

There has been minor grading on the property to construct roads, dikes, and level areas for buildings and other improvements.

1.5 Proposed Development

Although specific development plans have not been prepared as of the date of this report, it is our understanding that the proposed development will consist of single-family residential housing. Two surface water impoundments (lakes) are proposed in the central portions of the site. Approximately 10 acres of lakes are proposed on the site and an additional 167.3 acres of lakes are proposed within the rest of the study area of this report. Therefore, a total of approximately 177.3 acres of lakes are planned within the study area. Additional site improvements will likely consist of streets and underground utility construction. It is our understanding that the site grading for this project will likely include minor cutting and filling to establish building pads and streets. To improve ground stability, geotechnical recommendations call for over-excavation and recompaction of compressible soils to depths of six to ten feet below existing grade (based on final site elevations of 3 feet below seal level). Excavation for the lakes may involve cuts up to 15 feet deep and will likely require dewatering to that depth for construction purposes due to shallow groundwater conditions. A perimeter dike system surrounding the site is also proposed that will involve substantial thickness of fill placement (up to at least 10 feet thick).

2.0 GEOLOGY, BASIN AND SUBBASIN BOUNDARIES, AND HYDROGEOLOGY

2.1 Geology

The site is located at the margin of the Great Valley Geomorphic Province and the Coast Ranges Geomorphic Province. The Great Valley Geomorphic Province consists of an elongated structural trough that has been filled with a sequence of sedimentary deposits ranging from Jurassic to recent in age. In the San Joaquin/Sacramento Delta, sedimentary deposits are up to six miles in thickness (Atwater, 1982) and consist of marine and non-marine deposits. Based on generalized geologic cross sections prepared by the California Division of Oil and Gas from oil and gas well logs, it is estimated that undifferentiated non-marine sedimentary deposits, which are of primary importance with respect to the freshwater aquifer systems, extend to depths of approximately 1,000 to 3,000 feet in the study area and beneath the San Joaquin River (DOG, 1982). These deposits rise to the west and pinch out as they meet the flank of the Coast Ranges geomorphic province. Geophysical evidence suggests that the Great Valley is underlain at depth with granitic rocks of similar origin to those of the Sierra Nevada Province. The adjacent Coast Ranges Geomorphic Province consists of the Franciscan Assemblage rocks which also likely underlie a portion of the Great Valley and the study area.

The San Joaquin/Sacramento Delta lies at the junction of the Sacramento and San Joaquin rivers, the two major waterways that drain the Central Valley. The Delta area currently consists of a braided pattern of brackish to freshwater tidally-influenced channels and sloughs encircling a series of low-lying islands.

2.1.1 Site Geology

The near-surface sediments across the site consist of eolian (wind-blown), lacustrine (lake-deposited) and alluvial deposits. These sediments are typically irregularly-stratified, poorly consolidated deposits of clay, silt, sand, and minor gravel.

The surficial geology of the Delta has been mapped by Atwater (1982) (Figure 3) which shows that the surficial deposits on the site have been largely influenced by changes in sea level during the Late Pleistocene. Most of the high-standing areas in the site vicinity are the crests of old sand dunes and are underlain by sandy eolian deposits deposited during later stages of the most recent low-stand of sea level. According to Atwater, these eolian deposits formerly extended across most of the surface of the site but are now buried in low-lying areas by younger sediments.

The alluvial fan of Marsh Creek extends across the site and Atwater's map and text imply that alluvium of Marsh Creek typically overlies the sandy eolian deposits in low-lying areas. According to Atwater (1982), much of the alluvium in the site vicinity consists of gray silt and clay deposited in near sea-level flood basins and ephemeral lakes.

2.1.2 Soil Survey Maps

The site and study area is mapped by the Soil Survey of Contra Costa County (1977). The predominant soil types across the site are the Marcuse Clay (Mb) and Delhi Sand (DaC) with lesser amounts of Piper Loamy Sands (Pe). Sycamore Silty Clay Loam (So) appears south and southwest of the site. Sacramento Clays (Sa and Sb) and Egbert Mucky Clay Loam (Ea) along with some other muck soils appear east of the site but within the study area boundary delineated on Figure 2.

2.2 Groundwater Basin and Subbasin

The site is located within the jurisdictional boundaries of the Central District of the California Department of Water Resources (DWR) as shown on Figure 4. According to DWR classification, the site is situated in the northernmost portion of the Tracy Subbasin (No. 5-22.15) of the San Joaquin River Hydrologic Region as shown on Figure 5 (DWR, 2003). Groundwater aquifers at the site and surrounding area have subsurface recharge from converging sources that included the western alluvial plain deposits of the Central Valley, chiefly the Marsh Creek alluvial fan deposits, and the San Joaquin Valley interbasin deposits that are more prevalent to the southeast. According to DWR, the Tracy Subbasin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Diablo Range on the west; the Mokelumne and San Joaquin Rivers on the north; the San Joaquin River to the east; and the San Joaquin-Stanislaus County line on the south. The Tracy Subbasin is located adjacent to the Eastern San Joaquin Subbasin on the east and the Delta-Mendota Subbasin on the south. All of the above-mentioned subbasins are located within the larger San Joaquin Valley Groundwater Basin. The Tracy Subbasin also lies to the south of the Solano Subbasin that is within the Sacramento Valley Groundwater Basin (DWR, 2004).

The basin boundaries shown in Figure 5 are approximately the same as those used in previous groundwater investigations. These boundaries generally follow the edge of the relatively young alluvial deposits that comprise the valley floor areas. However, the young sedimentary formations exposed in hills adjacent to some of the valley floor areas to the west also extend beneath the site, where they may contribute to some of the thickness of the groundwater basin. The young sedimentary formations exposed in the hills are thought to be fault displaced to their positions beneath the valley floor. In those areas, the true boundaries of the groundwater flow system are defined by faults (for example, the Midland fault and other faults thought to be a part of the Coast Ranges – Sierran Block fault system).

2.3 Regional Hydrogeology

In 1999, Luhdorff and Scalmanini Consulting Engineers (LSCE) completed an investigation of the groundwater conditions in the east Contra Costa County area for the East County Water Management Association, a collection of the major water and irrigation districts in the area (LSCE, 1999). In this study, LSCE characterized four general hydrogeologic regions based on a deposition model of alluvium in the study area and surrounding region as follows:

- Fluvial Plain – An area east and south of the study area along the floor of the San Joaquin Valley comprised of several thick beds (20 to 30 feet) of sands and gravels at distinct levels separated by intervening clay to silt beds.

- Delta Islands – An area within the northeast portion of the study area and to the northeast comprised of sand and gravel beds correlated to the sand and gravel beds of the Fluvial Plain region but with greater thickness and increased net sand thickness to the north. Sand is reportedly finer with lesser occurrences of gravels.

- Marginal Delta Dunes – An area mostly within the study area but also to the west of the study area comprised of numerous thin to thick sand beds having net sand thicknesses of generally greater than 30 feet per 100 feet. The sand beds are generally finer grained than the Delta Islands region and have areas of locally thick (greater than 30 feet) beds.

- Alluvial Plain – An area generally south of the study area that includes the Brentwood area comprised of discontinuous thin sand and gravel with generally low net sand thickness of less than 20 feet per 100 feet. The Alluvial Plain deposits thin westward to pinch-out against the Coastal Range foothills and thicken eastward where they probably interbed with the flood plain deposits of the Fluvial Plain deposits.

To further evaluate the hydrogeology specific to the study area, available Water Well Drillers Reports (WWDRs) were obtained from DWR for a 12-square-mile area surrounding the site (primarily to the south and east of the site). In addition, a reconnaissance of the area was conducted to identify groundwater wells for which WWDRs were not on file. Figure 6 presents a graphical summary of the groundwater wells identified through both research activities. Table 1 presents a summary of some of the data presented on the WWDRs reviewed. Most of the wells in the study area were screened between 100 and 250 feet below the ground surface (bgs), while some of the boreholes extended as deep as 610 feet bgs.

Based on the information contained in the WWDRs, several simplified geologic cross sections were constructed and are presented in Figure 7. These cross sections are in general agreement with the cross section presented in the LSCE study, although the LSCE cross section covers a much larger area. Since the sediment descriptions on lithologic logs of the WWDRs generally only made the distinction as to whether the sediment was "clay", "sand" or "gravel", these cross sections are equally simplified and only generally represent the depth and thickness of more permeable sediments relative to less permeable sediments. In general, the cross sections indicate that the deposits beneath the site and surrounding area consist of discontinuous, interlayered deposits of varying thickness that have highly contrasting permeabilities. This characterization is supported by more detailed subsurface information contained in previous geotechnical studies for the site (ENGEO, 2005 and 1993; data excerpts in Appendix A) which indicated a high degree of variability up to depths of 50 feet. The degree of variability can be interpolated to also extend to greater depths.

Recent work conducted by LSCE in 2005 involved the installation of two wells within the study area and included detailed lithologic logging of samples collected from depths as much as 460 feet bgs, as well as down-hole geophysical surveys to depths as much as 250 feet bgs (Appendix B). These two test holes are an appreciable distance apart; the northern test hole is located approximately ½ mile east of the intersection of Cypress and Bethel Island Roads and the southern test hole is located approximately 2,000 feet further south. Logs for these two test holes indicated some larger-scale similarities at both sites with moderate to high permeable sediments encountered at the depth intervals of 140 to 180, 210 to 260 and 270 to 295 feet bgs. This level of similarity between the two test holes suggests that aquifer boundaries are defined, on a larger scale, by the generalized occurrences of mostly sand beds versus mostly clay and silt beds. In other words, sequences of predominantly sand beds (higher permeable layers) can represent an aquifer while sequences of predominantly clay and silt beds (lower permeable layers) can represent boundaries to vertical groundwater flow. Based on the WWDRs, work by Luhdorff and Scalmanini, and the geologic cross sections, the subsurface hydrogeologic conditions can be characterized as semi-confined aquifers having moderate to high water yield.

3.0 GROUNDWATER USE

3.1 Sources of Water

The site and near vicinity have a rural setting and, as such, rely strictly on groundwater for a source of domestic water. Groundwater use also includes some industrial and agricultural water supply uses. However, these uses appear limited. The vast majority of agricultural irrigation water is supplied to the area by the surrounding sloughs via lift pumps and sluice gates. Some irrigation water in the south and southwestern portions of the study area is also supplied by the East Contra Costa Irrigation District (ECCID) that conveys surface water from the south through a series of concrete-lined open ditches and buried concrete pipes. The main source of ECCID's water is surface water diverted from Indian Slough and groundwater pumped regionally and introduced into the irrigation system. ECCID does not appear to operate groundwater wells in the study area. In general, ECCID irrigation water from Indian Slough does not reach the study area. Instead, irrigation water is delivered to a large portion of the northern half of the study area via gravity feed from Little Dutch Slough (slough aligned with Knightsen Avenue).

In 1994, the City of Brentwood commissioned the Lawrence Livermore National Laboratory (LLNL) to conduct a groundwater isotope study in the Brentwood area (Davisson and Campell, 1994). The study cites that 50 years of historical water table maps compiled by ECCID indicate that the change in groundwater storage in the region is essentially zero as there have been no substantial changes in the water table elevation and slope. This appears to be generally true even based on limited information on depth to groundwater recorded in WWDRs for the area which usually indicated a very shallow depth to groundwater of between 5 and 10 feet. Major points regarding sources of water that are presented in the LLNL study include:

- ECCID's irrigation water is chiefly sourced from surface water diverted at Indian, Little Dutch and Rock Sloughs, but is also supplied from groundwater on demand.

- Most of the groundwater extracted by ECCID is related to drainage tile water removal in the low-lying areas east of the site and is exported from the basin.
- Irrigation water delivered to the area has averaged approximately 37,550 acre-feet (ac-ft) per year for the service area of at least 17,000 acres (approximately 26.5 square miles).
- Recharge to the groundwater basin from ECCID agricultural irrigation water is estimated to be approximately 11,265 ac-ft per year (30 percent of applied water).
- Recharge to the groundwater basin from stream beds is approximately 550 ac-ft per year.
- Recharge to the groundwater basin from rainfall is approximately 2,550 ac-ft per year.
- ECCID's average groundwater pumpage is 3,750 ac-ft per year.
- Domestic pumpage in the region (includes Brentwood, Knightsen and rural sites) was estimated to be approximately 950 ac-ft per year using population figures and an assumed consumption rate of 164 gallons per capita per day.
- Safe yield from groundwater for the Brentwood area was estimated by the LLNL study to be 300 to 1,800 ac-ft per year. This safe yield is based on the assumption that 90 percent of available recharge from over irrigation and rainfall is lost due to urbanization, which makes the estimate conservatively low.
- Elevated nitrate levels in groundwater are primarily located in shallow groundwater (less than 100 feet bgs) in the Brentwood area located to the south of the site.

It is reasonable to assume that available groundwater recharge from irrigation in the subject Oakley study area is less than that for the Brentwood area due to the study area being about one-half of that used for the Brentwood area study (12 square miles compared to 26 square miles) and due to the differences in agricultural practices (cattle feed versus orchard and row crops). For a 12-square-mile (7,680 acre) study area, the irrigation water applied to the study area would amount to approximately 17,000 ac-ft per year (based on 2.21 ac-ft applied per year per acre). If it is assumed that the differences in agricultural practices between the two areas reduce the amount of irrigation water applied by 33 percent, recharge to the study area groundwater basin would be 20 percent (30 percent x 67 percent) of the applied irrigation water or approximately 3,400 ac-ft per year (0.4 ac-ft per year per acre). Water used for irrigation in the study area is primarily delivered by gravity flow from Little Dutch and Emerson Sloughs and, to a lesser extent, from Rock Slough. Lift pumps also help deliver water from the sloughs to the area. Assuming 10 square miles are agricultural land use and about 30 percent of irrigated water reaches the groundwater table, irrigation rates would be approximately 1.8 feet per year[1] which is about 50 percent the average rate for California of 3.6 feet per year. The 1.8 feet per year rate is reasonable given that the vast majority of agricultural land in the study area is farmed for cattle feed or pasture that is irrigated much less than conventional crops (usually only irrigated during the peak hot weather season). Shallow groundwater conditions also lessen the amount of crop water demand.

Assuming rainfall of 1 foot per year over a 7,680-acre area (very little of the study area is urbanized) and an infiltration rate to groundwater of 20 percent (same as used in the LLNL study), recharge from rainfall would amount to approximately 1,550 ac-ft per year.

Stream recharge for the study area is generally not that significant because streams do not cross the area. However, major waterways do include the Contra Costa Canal and Emerson, Sand Mound and Dutch Sloughs. It is reasonable to estimate that the Sloughs do not currently contribute to significant groundwater recharge in the study area because drainage tiles and lift pumps used to dewater the lands below sea level exist adjacent to these sloughs that provide a point of hydraulic control with a zero net effect. In other words, the amount of water recharges from the sloughs equals, or is less than, the amount of water being removed by the drainage tiles and drainage lift pumps. Conversely, the Contra Costa Canal likely provides groundwater recharge because it is unlined and typically has a water level greater than the groundwater table. Using Darcy's Law governing hydraulic flow in the subsurface and assuming the water level in the canal is 10 feet above the underlying groundwater table, the distance between bottom of the canal and the water table is 5 feet, the intervening sediments are primarily silty sand having an approximate hydraulic conductivity of 0.1 gpd per square foot (gpd/sf) (Freeze and Cherry, 1979,

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[1] 3,400 ac-ft per year / 10 square miles / 640 acres per square mile / 0.3 infiltration rate

Table 2.2), and the areal extent of the canal affecting the study area is 1.5 million sf (20,000 feet long by 75 feet wide), the amount of recharge available from the canal is approximately 335 ac-ft per year[2].

Domestic and agricultural pumping in the study area is quite different than in the Brentwood area primarily because the City of Oakley uses very little groundwater for domestic water and agricultural groundwater pumping is significantly less in the study area (based on area reconnaissance and observed agricultural practices). In general, agricultural groundwater wells were not identified in the area. WWDRs only identified 7 agricultural supply wells and 62 domestic supply wells in the study area. Reconnaissance of the study area identified at least 150 additional domestic water supply wells. Applying a similar ratio of WWDR-identified to reconnaissance-identified domestic water wells to the WWDR-identified agricultural wells, it is estimated that approximately 25 agricultural wells exist in the study area.

Assuming that the daily use for all private domestic water supply wells is approximately 700 gallons[3], private domestic water pumping in the area is approximately 166 ac-ft per year[4].

The aforementioned amount of domestic water pumpage does not include pumpage from several community well supplies identified by the area reconnaissance and records review (e.g. Knightsen Community Water System, Sandmound Mutual, Riverview Water Association, Pleasant Times Mutual Water Company, Dutch Slough Water Works, Angler's Ranch, Bethel Island Mutual Water Company, Delta Mutual Water Company, Big Oak Mobile Park, Belle Vista Trailer Court and Island Park Trailer Court). Except for the Knightsen Community Water System, these community water supply systems service recreational developments that would be expected to consume much less (conservatively, about half of full-time residences) the amount of

[2] 1.5 million sf x 10 feet / 5 feet x 0.1 gpd/sf / 325,851 gallons per ac-ft x 365 days per year
[3] (4.3 residents per well or household x 164 gallons per day (gpd) per person
[4] 212 wells x 700 gpd x 365 days per year / 325,851 gallons per ac-ft

water private non-recreational development domestic water wells produce. Each of the 11 community supply systems likely averages not more than 25 connections or 150 people for half the year because the wells primarily serve vacation homes. The Knightsen water system is reported to serve a population of 150 with 21 service connections that serve full-time residences. Based on the aforementioned information, it is estimated that the community water systems in the study area result in approximately 165 ac-ft per year of additional domestic water pumpage[5]. Including the pumpage from other identified wells in the area, total domestic water pumpage in the study area is estimated to be approximately 330 ac-ft per year.

Estimating agricultural pumpage in the study area requires much more generalized assumptions because irrigation practices appear to vary greatly from farm to farm without accurate flow measurements being collected and it is uncertain how much of the irrigation demand is supplied by groundwater. A reasonable approach to estimating agricultural pumpage would be to estimate the average use for each well. Assuming each agricultural well (25 are estimated to exist) only operates one-third the time during the two months of July and August to supplement irrigation water or improve water quality when irrigation demand is the highest and that each well produces, on average, a 1,000 gallons per minute (gpm), an estimation of agricultural pumpage in the study area is approximately 2,260 ac-ft per year[6]. This amount seems reasonable given that the LLNL study estimated 4,500 ac-ft per year of agricultural pumpage for the Brentwood area. It appears that much of the difference in agricultural pumpage in the study area compared to the Brentwood area is attributable to the fact that the subject study area is about half of the Brentwood study area and irrigating fields for pasture or cattle feed (predominant in the study area) with pumped groundwater is generally discouraged due to higher operating costs and the availability of slough water.

[5] (1,500 residents x 164 gallons per day x 365 days per year x 0.5 occupancy rate / 325, 851 gallons per ac-ft) + (150 residents in Knightsen x 164 gallons per day x 365 gallons per year / 325, 851 gallons per ac-ft)

[6] 25 wells x 1,000 gpm x 60 minutes per hour x 24 hours per day x 62 days x 0.33 rate of operation / 325, 851 gallons per ac-ft

Another approach to estimating agricultural pumpage is to estimate crop demand and make an assumption on how much of that demand is met by groundwater pumpage. Alfalfa is a common crop used for dairy cattle feed that appears to be the primary agricultural activity in the study area covering approximately 6 square miles. Orchards do exist in the southwest quadrant of the study area and cover about 4 square miles, but it is believed that the water demands for these orchards are chiefly supplied by ECCID ditch water and groundwater pumpage in this area can be ignored. Alfalfa requires approximately 60 inches of water per year while corn, another common cattle feed crop, requires much less, about 34 inches per year. As mentioned above, agricultural pumpage in the study area likely only occurs during the summer months of July and August when water demand is highest. During these two months, alfalfa could demand as much as 16 inches of water. Assuming that groundwater supplies as much as 50 percent of the crop demand and a cultivated area of approximately 6 square miles, agricultural pumpage for the two months (and year) is estimated to be 2,560 ac-ft per year[7]. This estimate (2,560 ac-ft per year) agrees well with the estimate derived from the estimated number of wells (2,260 ac-ft per year) such that, a reasonable estimate of groundwater agricultural pumpage in the area is set at 2,500 ac-ft per year.

Other types of water uses in the study area included limited industrial uses (e.g. commercial, dairy operations, light industrial, etc.). While these uses are incrementally minor in terms of the overall groundwater balance in the region, their local affects on groundwater flow and supply can not be overlooked, especially in light of major land use changes.

Based on site reconnaissance and interviews with property owners, the Emerson Dairy operated just north of the site (within the study area) up until September 2003 and used significant amounts of groundwater for continuous washdown of the milking parlor. Based on discussions with Mr. Stan Emerson who managed the dairy for many years and grew up in the study area, the dairy started in about 1970 and significantly increased the size of its operation with the

[7] 16 inches / 12 inches per foot x 6 square miles x 640 acres per square mile x 0.5 for groundwater share

In summary, groundwater uses in the study area are given below.

Study Area Groundwater Recharge	Study Area Groundwater Pumpage
Rainfall Infiltration = 1,550 ac-ft per year	Domestic Water = 330 ac-ft per year
Irrigation Infiltration = 3,400 ac-ft per year	Agricultural Water = 2,500 ac-ft per year
Waterway Infiltration = 335 ac-ft per year	Industrial Water = 750 ac-ft per year
	Commercial Water = 250 ac-ft per year

The above listing indicates that groundwater recharge exceeds the groundwater pumpage by 1,455 ac-ft per year.

3.2 Types of Groundwater Use

Based on the findings of the LLNL study, review of the WWDRs, area surveillance, and planned future needs, groundwater uses in the region include:

- Domestic
- Agricultural
- Industrial
- Commercial
- Environmental (i.e. wetland and tidal marsh preservation, slough and river water quality, lake water levels, green space irrigation etc.)

3.3 Water Use Patterns and Trends

According to the City of Oakley's September 13, 2002, General Plan Draft EIR, groundwater is a source of water in the East Contra Costa County, mostly in rural areas. Several small public and private water companies extract underground water through wells and convey it to nearby customers[8]. These include Bethel Island, Knightsen, Byron, and Discovery Bay. Whereas the City of Oakley does not significantly use groundwater for its municipal water supply, there are many private wells in the area as the review of WWDRs and area surveillance suggest (Figure 6). Sources not served by Diablo Water District (DWD) that use water wells are located primarily south of Laurel Road and east of Main Street. Wells are primary water sources in some rural areas, and could be a source of water for Oakley and its sphere-of-influence areas. However, the feasibility of utilizing well water is dependent on the quality and quantity of the groundwater supplies. The City of Oakley has suggested in its General Plan that a major problem with groundwater quality is the concentration of nitrates in the water supply.

Limited groundwater quality data available from DWR's online Water Data Library[9] (Appendix C) does not suggest prevalent nitrate groundwater impact, particularly to the east of Oakley and along Dutch and Sand Mound Sloughs. However, a certain percentage of the wells in the area (e.g. around Knightsen and Brentwood) have nitrate levels at or just above drinking water standards. Also, according to the LLNL study, the elevated nitrate levels are attributed to groundwater recharge on agricultural land. The highest nitrate levels are found in water less than 100 feet deep in the area southeast of Brentwood where row crop farming and orchards are predominant.

In contrast to the City of Oakley that does not currently depend on groundwater as a municipal water source, the City of Brentwood operates entirely on groundwater. Data for fourteen wells owned by the City of Brentwood were reviewed on Geotracker (Appendix C) that indicated that, of the 14 groundwater supply wells, five have been abandoned. The data included historical water quality data as far back as 1988 for some of the wells. The data indicated recent total dissolved solids (TDS) levels ranging from 490 to 1,230 milligrams per liter (mg/l). Historical TDS trends have generally increased over the last 10 to 15 years. Some of the City of Brentwood wells have had elevated nitrate levels that have approached or exceeded the drinking

[8] Geotracker (http://www.geotracker.swrcb.ca.gov)
[9] DWR Water Data Library, Historical Data Map Interface

water standard for Nitrate as NO_3 of 45 mg/l, including a few that have been abandoned. However, most of the newer wells have recent nitrate levels ranging from 4.5 to 11.1 mg/l, suggesting they are either screened deeper or are located in areas less impacted with nitrates from agricultural practices.

Water use trends in the area are expected to change from agricultural to domestic as urban development moves into predominantly agricultural areas. With this change, it is anticipated that groundwater recharge from irrigation will be reduced while recharge from yard and green space landscape irrigation will increase. Estimating the overall affect of this change would be speculative. However, one expectation is that the there will be a net reduction of groundwater recharge. Another expectation is that the quality of the recharge water should be improved as the use of agrichemicals (added nutrients that are the primary source of elevated nitrate levels in the area) is reduced.

3.4 Groundwater Levels and Trends

Groundwater level data compiled by ECCID and contained on WWDRs strongly support the idea that groundwater levels in the area have remained shallow and constant for a long period. Groundwater occurs beneath the site at depths of approximately 4 to 6 feet bgs (elevations of 10 to -2 feet NGVD). Within the study area boundaries, groundwater levels are between approximately 10 and -10 feet NGVD. Throughout the region, groundwater generally is encountered at depths of less than 20 feet. The study area does not appear to be in a state of overdraft as demonstrated by the shallow groundwater levels.

One of the better records of historic groundwater levels in the area exists for a well (State ID NO. 01N03E17E001M) located approximately one mile east of Brentwood and approximately 2.5 miles south of the southern study area boundary and 3 miles south of the site. A graph of the

(http://well.water.ca.gov/gw/gw_data/hyd/Rpt_Bas_Well_AllCal.asp) data from this well is presented on Figure 8 and shows a moderately stable history of water levels (water surface elevations vary less than 10 feet over 8 years) and shows a slight upward trend (from season high elevations of 42 feet NGVD in 1976 to 45 feet in 1983). The increasing groundwater table elevations are more likely attributable to changes in climatic patterns (i.e. period of increased rainfall) versus an increase in ECCID irrigation water deliveries to the area (ECCID deliveries are assumed to have reached capacity by 1972 when 100 percent of available land was being irrigated). Additionally, the rising water table levels do not appear to be attributable to a reduction of groundwater pumpage in the area (ECCID pumpage was significantly reduced by 1970 and was chiefly comprised of drainage tile pumpage, the degree of which is not expected to have changed since that time).

In general, the overall groundwater levels have been very stable and are expected to remain that way irrespective of whether recharge from irrigation or rainfall increase or decreases over the area due to urbanization. It appears that the stability of groundwater levels in the study area are due to influences of the San Joaquin and Sacramento Rivers Delta. Groundwater levels have the potential to be lowered only a relatively small amount as a result of urbanization for the following reasons:

- The surface water levels in the adjoining sloughs and river will remain constant, thereby providing a significant recharge source for the area.
- While urbanization has the potential of reducing available groundwater recharge from irrigation and rainfall by up to 90 percent (from 3,400 to 340 ac-ft per year), an increase in available recharge from slough and river course stream beds would occur. The potential end result could be a lowering of the groundwater table by as much as 10 feet in the northeastern portion of the study area and 30 feet in the southwestern portions of study areas.
- A removal of groundwater pumpage in the study area due to land use changes (e.g. removal of industrial groundwater use like that which formerly existed at the Emerson Dairy, located north of the site, the Lesher Property, east of the site, and other agricultural irrigation pumping in surrounding areas) would counteract the affects of lost recharge from urbanization. The amount of gain in the groundwater budget by stopping industrial and commercial groundwater pumpage is conservatively estimated at 1,000 ac-ft per year.

- The 90 percent recharge loss rate due to urbanization used in the LLNL study appears overly conservative given the layout of the planned development which will have significant park and street landscaping areas. The lakes are planned to be lined and would not contribute significant quantities to recharge. A more accurate estimate of the recharge loss rate might be 60 percent based on the current planned development for the area. However, for this study, 90 percent is used as a more conservative estimate.

- Planned increases in groundwater demand as a result of completion of the planned developments in the study area only consist of providing makeup water due to evaporation losses off the planned lakes and turf irrigation of certain common spaces. Groundwater is not intended to be used for domestic-use water supplies. Some of the groundwater wells in the study area may also provide emergency municipal water supply to the developments in the event of a failure of the transmission line that will be providing municipal water for the developments from the Randall-Bold Water Treatment Plant located in Oakley. However, groundwater use for emergency water supply should be considered temporary, not affecting the long-term groundwater budget, and therefore can be ignored. The estimated water demand for evaporation makeup for the lakes (total area of 177.3 acres in the study area) is estimated to be approximately 540 ac-ft per year[10]. Of this amount, the direct site demands are only 30 ac-ft per year since only 10 acres of lakes are planned on the site.

  The amount of irrigation demand for the site parks and street landscape on the Emerson portion of the site has been estimated by vanderToolen Associates Inc. (vTA), the project landscape design professionals, to be approximately 40 ac-ft per year. According to vTA, this is a conservative estimate. It is reasonable to assume that a similar amount of irrigation demand is planned for the remaining Burroughs portion of the site. Therefore, a total site irrigation demand is estimated to be 80 ac-ft per year.

  The amount of turf irrigation demand in other portions of the study area is conservatively estimated to be approximately 210 ac-ft per year[11] based on planting cool season turf over approximately 72 percent of the approximate 58 acres available for the large community parks planned at the intersection of East Cypress and Bethel Island Roads. This is a very conservative, worse-case scenario that considers poor irrigation efficiency of 75 percent and planting turf over a vast majority of the available space. For comparison purposes, a more realistic assumption would result in only 30 percent of the available space being planted with cool season turf and an irrigation efficiency of 90 percent; thus yielding a turf irrigation

[10] 177.3 acres x 36.5 inches per year / 12 inches per foot = 539 ac-ft per year

[11] 72 percent x 58 acres x 45 inches per year (based on quarterly values for Brentwood area ETo and cool season turf crop coefficients) / 12 inches per foot / 75 percent irrigation efficiency = 208.8 ac-ft per year

demand of approximately 72 ac-ft per year. If warm season turf was to be planted, the irrigation demand would be further reduced to 58 ac-ft per year, an overall reduction of 150 ac-ft per year over the worse-case scenario.

The lake evaporation makeup water and turf irrigation demand (540 and 290 ac-ft per year, respectively) therefore conservatively totals approximately 830 ac-ft per year which is a little more than half of the overall current excess flux of groundwater through the study area estimated to be approximately 1,455 ac-ft per year (based on current recharge amounts less the pumpage amounts given in Section 3.1). It is important to recognize that an additional amount of groundwater flows into the study area from the southwest. The total amount of groundwater flux into the study area from the southwest is conservatively estimated to be approximately 1,600 ac-ft per year[12].

It is uncertain how much water DWD will pump from the two groundwater wells that have recently been constructed at a location east of the site near the intersection of Cypress and Bethel Island Roads. In addition to lake makeup water and turf irrigation demands, the wells are also planned to supply groundwater for initial filling of the lakes. However, filling of the lakes should be considered to only have a temporal affect and to not affect the long-term groundwater budget. Each well appears capable of producing up to 1,200 gallons per minute or 1.73 million gallons per day on a continuous basis. If both wells were run continuously, approximately 3,900 ac-ft per year of groundwater could be pumped. It is not unreasonable to expect DWD to utilize the wells to the greatest capacity should they be able to demonstrate no adverse impacts in doing so. However, for the purposes of this study, groundwater demands are assumed to only consist of lake makeup and irrigation water demands.

[12] 22,000 feet of cross sectional length along the Atchison Topeka and Santa Fe railroad alignment x 350 feet of saturated thickness x 30 feet per 100 feet of net sand thickness x a hydraulic conductivity of 1,000 gallons per day per square foot [average for clean sand] x 365 days per year / 325,851 gallons per acre-foot x an average hydraulic gradient of 4 feet per 6,300 feet = 1,640 ac-ft per year

4.0 GROUNDWATER BUDGETS

4.1 Regional Groundwater Budgets

It is our opinion that the data presented in the LLNL study provides an adequate characterization of groundwater budgets in the adjacent area and can be used as a basis for the current study. The LLNL study concluded that the groundwater storage in the area is in a steady state. The LLNL study estimated groundwater flow exiting the Brentwood area to the east to be approximately 7,400 ac-ft per year. For comparison purposes, in Section 3.4 of this study, it is estimated that 1,600 ac-ft per year are entering the study area. The differences can be attributed to the smaller size of the study area compared to the LLNL Brentwood study area. The LLNL study indicates their estimate is based solely on comparison of groundwater recharge occurring within their studied area to groundwater pumpage within the same area. The excess groundwater is the result of recharge from irrigation, streams and rainfall, totaling approximately 12,100 ac-ft per year, exceeding agricultural and domestic pumping of approximately 4,700 ac-ft per year. On this basis, it is estimated the study area has groundwater recharge exceeding pumpage by 1,455 ac-ft per year (see Section 3.1 of this report).

The excess groundwater quantified for the Brentwood area by LLNL suggests that up to 7,400 ac-ft per year of groundwater could be pumped from the Brentwood area before an overdraft condition would occur. However, the study concluded that only 300 to 1,800 ac-ft per year could be safely pumped from the area primarily due to perceived future affects of retiring agricultural land, estimated to provide 67 to 84 percent of the available groundwater recharge in the area, and replacing it with urbanized areas that have limited availability for sources of recharge. The reduction in groundwater recharge amounts are attributed to urbanization causing increases of impervious areas (e.g. more rooftops and pavement) and creating landscape areas that utilize more water efficient vegetation than orchards and row crops that otherwise cause a significant amount of irrigation water infiltration to the groundwater table. As previously mentioned, the LLNL study cites that it is estimated that the urbanization of agricultural land causes over a 90 percent reduction in groundwater recharge. A similar scenario for the study area is presented in Sections 4.2 and 4.3 to estimate the affect to groundwater resources from cumulative land use changes.

4.2 Study Area Groundwater Budgets

The high percent reduction in groundwater recharge postulated in the LLNL study is suspect and is not necessarily applicable to the site and surrounding area where irrigation practices are not necessarily similar to that in the Brentwood area. The study area has historically been primarily used to grow cattle feed and the majority of the land has been irrigated less than in the Brentwood area where row crops or orchards have been cultivated. In addition, cultivation in the study area relies heavily on rainfall (i.e. is often dry-farmed and is not irrigated land). In the case of "pasture" land that is not heavily irrigated, urbanization may actually contribute greater amounts of recharge to groundwater due to a significant increase in yard landscape and green space watering. In addition, much of the areas inclusive of the study area historically have not been irrigated with ECCID water from outside the study area, but rather with water from nearby sloughs. The LLNL study did not account for the irrigation water captured from Emerson, Little Dutch and Sand Mound Sloughs because these water sources were consider outside of the LLNL study area. It has not been determined to what degree historic irrigation water locally derived from the sloughs will continue to be a contributing factor to groundwater recharge.

If, in fact, recharge to groundwater from irrigation and rainfall in the study area is reduced due to urbanization, groundwater levels will likely experience only a relatively small change. Reduced recharge may cause the direction of groundwater flow to change from flowing northeast to flowing southwest, particularly in the northeastern portion of the study area. This change results from loss of available groundwater recharge and the onset of groundwater pumping for lake makeup water and community park irrigation which could cause the groundwater table to become lower in the southwest than in the northeast. It can be expected that if, at some point, the water table is lowered, a reduction in pumpage would arise as the need for drainage tile pumping along the sloughs is reduced due to a lower water table. However, to be conservative, the reduction in drainage tile pumping (that essentially removes groundwater) is ignored in the assessment of future changes in the groundwater budget.

Based on the amount of available streambed recharge along Dutch and Sand Mound Sloughs (approximately 5 miles of wetted perimeter having an approximate width of 60 feet), a hydraulic gradient of 10 feet of head over a 100-foot flow path, and an assumed hydraulic conductivity of 10 gallons per day, per square-foot (typical for silty sand considered to be the limiting aquifer material type), it is estimated stream bed recharge from the sloughs and river could increase to 1,700 ac-ft per year[13]. This estimate is based on very crude assumptions and only provides a rough estimate of the potential increase in available streambed recharge that could result from depression of the water table in the study area. However, keep in mind that if the water table were to depress further, say 20 feet, due to a greater imbalance in the groundwater budget, the hydraulic head and groundwater flow velocity at the stream bed boundary would increase, streambed recharge would increase and a steady state in the groundwater table would ultimately be achieved (e.g. a hydraulic head difference of 20 feet versus 10 feet would increase the streambed recharge amount by a factor of 2 to 3,400 ac-ft per year). The considerations listed below should mitigate concerns over impacts from increased stream bed recharge in the form of changes in groundwater quality, a potential loss of available water to the sloughs or a change in slough water quality:

- In general, the quality of slough water is better than groundwater (lower total dissolved solids and nitrate levels).

[13] Length of 5 miles x 5,280 feet per mile x a width of 60 feet x a hydraulic gradient of 10 feet per 100 feet x a hydraulic conductivity of 10 gallons per day per square-foot x 365 days per year / 325,851 gallons per acre-foot = 1,774 ac-ft per year

- The rate of potential stream bed recharge (estimated above to potentially be 1,700 ac-ft per year), and therefore, lost from the sloughs, would be much less than the historic rate of irrigation water withdrawal from the sloughs and applied on land (estimated in footnote #15 to be 9,650 ac-ft per year). Therefore, salinity in the sloughs should not be expected to increase under a future urbanized land use scenario because much less water will be removed from the sloughs causing a lower propensity for upstream migration of more brackish downstream water (in other words, there will be greater amounts of flushing with fresh water from upstream thus improving the slough water quality).

- The sloughs would not experience less flushing with high quality river water or changes in water levels for the same reason as stated in the second bullet above. The main slough affected, Dutch Slough, receives water upstream from the San Joaquin River.

4.3 Groundwater Available for Lake Makeup Water and Community Park Turf Irrigation

The planned developments within the study area include a total of 177.3 acres of surface water lakes to provide recreational and aesthetic amenities, stormwater quality management and storage for irrigation during the dry season. It is our understanding that the ponds will have a synthetic liner to eliminate water loss due to infiltration at the base of the ponds. Even if the lakes were to have a clay liner that had some component of leakage, the leakage would return to the groundwater table and would not affect the overall groundwater budget since the volume of water introduced by leakage would be equaled by groundwater removed by pumpage to maintain the lake water levels. Because of the synthetic lining proposed for the surface water lakes, supplemental water requirements are only comprised of free-surface evaporation. Work being conducted by Balance Hydrologics, Inc. for design of the lakes has estimated their annual makeup requirements based on pan evaporation rates, coefficients for lake evaporation precipitation, runoff and runoff to the lakes. Based on this work, Balance Hydrologics have estimated an annual makeup requirement for the lakes of 36.5 inches per year. The 36.5-inch-per-year rate is reasonable based on review of a generalized map of evapotranspiration rates for California which indicates a evapotranspiration rate of 57 inches per year for the study area (CIMIS, 1999) and the fact that the transpiration component of evapotranspiration is absent of free-surface evaporation. Based on a total surface area of the lakes of 177.3 acres, it is estimated that the amount of water needed for the makeup requirement is approximately 540 ac-ft per year (see footnote #10). Again, for the site irrigation demands, lake make up water is on approximately 30 ac-ft per year.

It is currently planned that groundwater will provide 100 percent of the water losses for the lakes due to evaporation (i.e. makeup requirement of 540 ac-ft per year) and the irrigation demand for the site parks, site street landscaping and the large planned community parks east of the site. In addition, the peak lake makeup requirement occurs during the month of August when evaporation is greatest and there is no runoff to the lakes. During this peak month, approximately 95 ac-ft of groundwater will be needed or approximately 690 gpm[14] collectively for all the lakes.

As previously mentioned in Sections 2.3 and 3.4, two groundwater supply wells have been recently installed by LSCE for the Shea Homes development within the study area in anticipation of using groundwater to provide lake makeup water and community park turf irrigation demands, emergency backup domestic-use water and initial filling of the lakes. Upon completion of the wells, short-duration, step-drawdown pump tests were conducted for the purpose of sizing pumps for the wells. The pumping flow rates for each well were 800, 1,200 and 1,500 gpm for the north well; and 1,000, 1,500 and 1,800 gpm for the south well. After each well's step-drawdown tests, 8-hour pump tests were conducted at 1,200 gpm for each well. The pump test durations were limited to eight hours due to restrictions on construction noise and do not necessarily represent sustainable well yields. At the end of the 8-hour pump tests, maximum drawdowns were 36.99 feet (pumping water level went from 11.26 to 48.25 feet bgs) and 40.50 feet (from 11.85 to 52.35 feet bgs) for the north and south wells, respectively. At the end of each test, the rate of drawdown was approximately 0.40 and 0.37 foot per hour for the north and south wells, respectively. Based on the information from these pump tests, it appears that the installed wells

[14] 95 ac-ft per month x 325,851 gallons per ac-ft / 31 days in August / 24 hours per day / 60 minutes per hour = 693 gpm

are be capable of producing the high flow rates required for lake free-surface evaporation during the peak demand month of August.

With respect to the sustainability of these flow rates and the affects of loss recharge and pumpage due to urbanization, the following points indicate that the groundwater basin is capable of providing groundwater for lake makeup and turf irrigation requirements. The total loss of irrigation and rainfall recharge due to urbanization is estimated to be approximately 4,455 ac-ft per year (90 percent of the total recharge of 4,950 ac-ft per year available from irrigation and rainfall). This amount needs to be further reduced because only about 75 percent of the agricultural land use will be urbanized. Therefore, 4,455 ac-ft per year is reduced to approximately 3,340 ac-ft per year of lost recharge. In conjunction with this lost recharge, irrigation pumpage of 2,500 ac-ft per year and industrial use pumpage of 750 ac-ft per year would likely also be reduced by 75 percent. Therefore, groundwater pumpage for agricultural and industrial uses will be reduced by approximately 2,440 ac-ft per year due to urbanization. This leaves a net loss of groundwater supply of approximately 900 ac-ft per year (3,340 ac-ft per year lost recharge; 2,440 ac-ft per year lost pumpage). Along with urbanization and the availability of municipal water from outside of the area, comes the opportunity of providing higher quality treated water to existing private and commercial domestic water users. Combined private and commercial domestic water use in the study area is estimated to be approximately 580 ac-ft per year. It is reasonable to assume that 50 percent (290 ac-ft per year) of these users will switch from their own private groundwater wells to a municipal water supply that imports water from outside the area. This still leaves a net loss to the existing groundwater supply due to urbanization of 610 ac-ft per year (900 ac-ft less 290 ac-ft per year). This amount should be coupled with the 830 ac-ft per year required for the lake makeup water and turf irrigation demands to yield a net negative change in the groundwater budget of 1,440 ac-ft per year. It is important to consider that this net negative difference can be partially or entirely offset by utilizing surface water (e.g., water from the sloughs) to provide lake makeup water and turf irrigation requirements.

As previous discussed, the probable net affect of lost recharge due to urbanization and future groundwater pumpage for lake makeup water and turf irrigation requirements is a shift of groundwater flow from northeastward to southwestward in the northeastern portion of the study area as the loss recharge is replaced by stream bed infiltration along Emerson, Sand Mound, Little Dutch and Dutch Sloughs. The potential available rate of infiltration from the sloughs to groundwater is estimated to be between 1,700 to 3,400 ac-ft per year depending on the degree of hydraulic gradient reversal that may occur. The net negative difference of 1,440 ac-ft per year due to urbanization is less than the minimum 1,700 ac-ft per year potentially available from infiltration of slough water. Under this hypothetical scenario, it is very important to keep in mind that much of the land in the study area is currently irrigated through lift pumps or sluice gates that take water from the sloughs and disperse it on the land. The amount of irrigation water sourced from the sloughs is conservatively estimated to be approximately 9,650 ac-ft per year[15]. Under an urbanization scenario, 75 percent of the 9,650 ac-ft per year of water pumped from the sloughs will cease and that water will become available for indirect recharge to the groundwater basin through slough bed recharge. Given that 1,440 ac-ft per year is relatively small compared to approximately 7,240 ac-ft per year (75 percent of the estimated 9,650 ac-ft per year historically derived from the sloughs for irrigation purposes), it appears that there will be a net beneficial affect of increased amounts of water in the sloughs once the area is urbanized.

[15] (50 inches per year average cattle fodder crop demand - 12 inches rainfall per year / 12 inches per foot x 6 square miles of land of cultivated land x 640 acres per square mile) - 2,500 ac-ft per year supplied by groundwater) = 9,650 ac-ft per year

5.0 GROUNDWATER QUALITY

Whereas groundwater quality data is very limited for the site and surrounding area, sufficient groundwater quality information exists to provide a general sense of the water quality and what changes to water quality may arise from changes in land use. Sources of groundwater quality data include DWR's Water Data Library, Geotracker and site-specific studies (Appendix C).

5.1 Groundwater Quality

The study area has a generally low occurrence of chemical release sites because of its rural agricultural setting. Previous phase one environmental site assessments by ENGEO for the site did not reveal significant contaminated sites that would indicate potential to impact deep groundwater.

5.1.1 Nitrates

Groundwater in the some areas within the study area and to the south contain elevated nitrate levels. The LLNL study conducted for the Brentwood area to the south of the study area indicated that high nitrate levels in groundwater less than 100 feet deep are due to agricultural practices (i.e. infiltration of irrigation water laden with agrichemicals). LSCE (1999) also noted differences in groundwater quality with respect to high nitrate levels being limited to the upper sequence of aquifer materials and that nitrate levels decreased appreciably in wells screened below 200 feet. Review of a map of the aerial distribution of nitrate concentrations at selected wells shows pronounced differences between the Brentwood, Discovery Bay, Oakley and Delta areas. In general, nitrate concentrations were low to below detection limits for wells within the study area.

Additional data available from GeoTracker and the USGS Water Data Library (WDL) websites (Appendix C) suggests that some conditions similar to the Brentwood area exist in the southwestern quadrant of the study area, but, in general, do not exist elsewhere in the study area. Generally, detectable nitrate levels trend lower across the study area from the southwest to the northwest. In the northeastern and eastern portions of the study area, closer to Emerson, Little Dutch, Dutch and Rock Sloughs, nitrate is generally not detectable in groundwater. This pattern of lower nitrate levels in the northeast may be attributable to the local groundwater recharge conditions that are comprised of significant amounts of irrigation with higher quality river water and without much use of agrichemicals (fertilizers and pesticides). The river water is expected to have non-detectable nitrate levels. Nitrate was not detected in groundwater that services the communities located on Sandmound Road, Bethel Island, and Holland Tract.

An example of the localized and sporadic occurrence of elevated nitrate levels occurs in the vicinity of Delta Road and State Highway 4. A groundwater well at the Bethel Mission Baptist Church located just west of Highway 4 had a nitrate as NO_3 level of 46 mg/l while the groundwater well at Delta Kids Center located less than a 1,000 feet to the east of the church on Delta Road does not have detectable levels of nitrate. One well, located at the intersection of Sellers Avenue and Cypress Road is only 90 feet deep and had a nitrate as NO_3 level of 93 mg/l. A large area of orchards is shown on aerial photographs of the study area (USGS, 1998) in the immediate vicinity and upgradient of this well that may have a localized affect on the groundwater quality less than 100 feet deep.

In contrast, in the vicinity of the City of Oakley where less farming occurs, nitrate as NO_3 levels are low, ranging from less than 4 mg/l at Diablo Water District's Contra Costa Canal Pumping Station (well likely greater than 100 feet deep) to 12 mg/l at State Well Number 002N002E036M001M (a well that is 130 feet deep) located approximately ½ mile further west of the Bethel Mission Baptist Church.

In July 2003, ENGEO conducted a focused investigation on shallow groundwater in the immediate vicinity of the Emerson Dairy north of the site that indicated nitrate as NO_3 levels were below analytical detection levels in six of the seven samples collected. One sample had a nitrate as NO_3 concentration of 320 mg/l that was in close proximity to the wash water disposal pond for the dairy operation and was considered a localized affect since nitrate levels were below detection levels at locations less than 500 feet away.

5.1.2 Total Dissolved Solids

Review of the available data regarding total dissolved solids (TDS) concentrations in groundwater presented in the LSCE report and online at Geotracker and the USGS WDL sites indicate a slightly different trend in the distribution of concentrations in the study area with respect to surrounding areas like Brentwood and Discovery Bay. Higher concentrations (generally above 1,000 mg/l) are evident in the Brentwood compared to the study area and Discovery Bay (generally between 500 and 1,000 mg/l). It can not be concluded that TDS concentrations show the same trend with depth as nitrate concentrations. It appears that the groundwater beneath Brentwood has a higher component of groundwater recharge from the Coast Ranges geomorphic providence (notorious for having high TDS concentrations) than the Great Valley or Sierra Nevada providences to the east that may have a stronger influence on groundwater beneath the study area than in Brentwood. Another plausible explanation for the lower TDS concentrations beneath the study area and the Discovery Bay area is their closer proximity to the San Joaquin River and Delta resulting in a greater component of stream bed recharge of higher quality surface water, generally having low TDS concentrations, to their underlying aquifers than recharge from the Coast Ranges. The lithologic profile in the study area indicates generally thicker and shallower sequences of sand that would increase the chances for surface water infiltration to reach the underlying aquifer.

5.1.3 Chloride

Review of the available data regarding chloride concentrations in groundwater presented in the LSCE report and online at Geotracker and the USGS WDL sites again indicate lower chloride concentrations in the study area compared to the areas to the south and west (e.g., the Brentwood and central Oakley areas). However, in general, chloride concentrations are below 200 mg/l, well below concentrations considered brackish (e.g., 500 mg/l).

The data collected in and surrounding the study area suggest that, in general, groundwater in the study area is less impacted with nitrates than in the Brentwood area where farming of row crops that use agrichemicals more heavily appears to have contributed significantly to nitrate in groundwater. The study area has primarily been used to raise cattle feed and, in general, application of fertilizers, pesticides and herbicides is not done, and therefore, irrigation infiltration in the study area has a lower propensity to cause nitrate contamination in the groundwater.

Finally, water quality in the sloughs appears to be of higher quality (i.e. lower TDS and no nitrates) than agricultural runoff water that also infiltrates to the groundwater table (high TDS and nitrates). Figure 9 provides graphs of river stage and electrical conductivity (EC) for a monitoring station on Rock Slough (available from the California Data Exchange Center [CDEC]) located upstream of the intake for the Contra Costa Canal. The EC values essentially represent water quality at the mixing point between: (1) agricultural runoff and groundwater base flow into the slough from the heavily farmed upland areas to the south and west with (2) the San Joaquin River water that flows to the slough from the southern Central Valley of California. A key observation of the charts is that EC drops as the river stage rises during higher flows of the San Joaquin River, which represents an improvement in water quality. Parallels in water quality can be drawn between the surface water at this location and groundwater under a future urbanized scenario. With the onset of urbanization and a reversal of the groundwater flow direction, water quality is expected to improve as a result of slough water recharge, much like the water quality improves at the Rock Slough CDEC monitoring station when the river stage is high and there is an influx of river water to the area.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General Conclusions

Based on information gathered for this study, the following conclusions regarding current groundwater conditions can be made:

- The study area groundwater conditions are static with a current excess flux of 1,455 ac-ft per year through the area exiting to the north and east due to recharge amounts exceeding pumpage amounts.
- Groundwater quality in the area is generally suitable for domestic water supplies but has been marginally impacted with nitrates to depths of up to 100 feet bgs in the southwest portions due to agricultural practices in that area.
- Significant differences in groundwater quantity and quality exist between the study area and the Brentwood area to the south.

The planned development on the site is part of an overall urbanization in the entire study area. The combined affects of this urbanization will result in a change in the sources of recharge and pumpage within the overall groundwater budget. While these changes are appreciable in quantity, they have a tendency to counteract each other and will not result in a significant overall loss of groundwater supply or a significant drop in the groundwater table elevation. In addition, the changes in sources of recharge and pumpage in the groundwater beneath the study area has the potential to improve the general quality of the groundwater by changing the groundwater flow direction. The following points support these conclusions:

- Urbanization can cause significant loss of available recharge, in some cases up to 90 percent, but this affect is not expected to reach that rate in the study area due to the nature of the planned development (e.g. extensive green spaces will continue to be irrigated and large parcels [25 percent of the overall land developed] will remain as agricultural land use). However, for the purpose of this study and to be conservative, a 90 percent recharge loss rate was used.

- It is estimated that urbanization will have an overall affect of removing 1,455 ac-ft per year of current excess inflow to groundwater in the area (i.e. current recharge minus current pumpage in the area) and creating a groundwater deficit of 1,440 ac-ft per year (i.e. future recharge minus future pumpage). However, at the same time, up to 7,240 less ac-ft per year of irrigation water will be diverted from the sloughs adjacent to the study area while the deficit of 1,440 ac-ft per year may be replaced by recharge from the base of the sloughs as a result of lower groundwater table conditions.

- With the onset of a potential change in the groundwater flow direction due to urbanization in the study area (from northeastward to southwestward in the area adjacent to the sloughs), a potential beneficial effect of improving groundwater quality in the region may be realized. This is because future slough water that is capable of recharging the groundwater is of higher quality than a substantial portion of the irrigation water currently recharging groundwater. The poorer quality irrigation water that appears to currently affect groundwater is limited to a four-square-mile region around the communities of Knightsen and Sand Hill in the southwest portion of the study area.

6.2 Recommendations

As stated in Section 1 of this report, a specific need exists to perform one or more pumping tests to determine the aquifer characteristics for the site for the purpose of designing water supply wells. Based on pervious ENGEO studies and site reconnaissance observations, a high-production well exists at the Emerson Dairy (Well I-1 on Figure 6) that would be suitable for conducting a long-term pump test. WWDRs exist for other nearby wells and well lithology and geophysical logs are available for the DWD wells to the east (LSCE, 2005) (DWD-North and DWD-South on Figure 6) that adequately characterize the lithologic conditions at the proposed pump test well site. Construction characteristics of the proposed pump test well can be investigated prior to the pump test to determine the well's water bearing depth for correlation to the available logs. Therefore, it is recommended that a one- to two-week pump test be conducted on the well. The actual duration of the pump test is dependent on the changes in the rate of drawdown and should be determined during the pump test. Prior to conducting the pump test, short-duration, step-drawdown tests need to be conducted to determine a suitable pumping rate for the well that will provide for adequate stress to the aquifer while not exceeding the sustainable well yield during the test. In addition, four observation monitoring wells, two at approximately 100 and 250 feet downgradient of the pumping well and two at approximately 50 and 100 feet in a cross gradient direction, should be installed in the same production zone of the pumping well (150 to 180 feet bgs). These observation wells, as well as the pumping well, should be outfitted with automated water level data recorders to measure the changes in water levels during the pump test and recovery period. An accurate flow meter and flow control valve also may need to be installed on the discharge line to the pumping well and monitored to maintain a constant flow rate during the pump test. A water level transducer should also be installed at the end of Little Dutch Slough lateral to determine if the slough is hydraulically connected with the groundwater table and affected by the pumping well.

Alternatively, a new well could be constructed with a design based on existing well designs in the area that would be sited adjacent to infrastructure planned to have future groundwater demands (i.e., adjacent to surface water lakes and street landscaping) with the intention of serving the future groundwater demands for the site. Once installed, a long-duration pump test, similar to the one described above could be conducted to determine this well's safe yield. In any event, a pump test must be performed on the actual wells to be used to establish their sustainable aquifer yield.

Multiple groundwater quality samples should also be collected at set intervals during the test to determine if changes in water quality are experienced as a result of changes in the flow field during the test. The samples should be analyzed for general minerals and nitrates. It does not appear to be necessary at this time to assess surface water quality from adjacent sloughs during the test.

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

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

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

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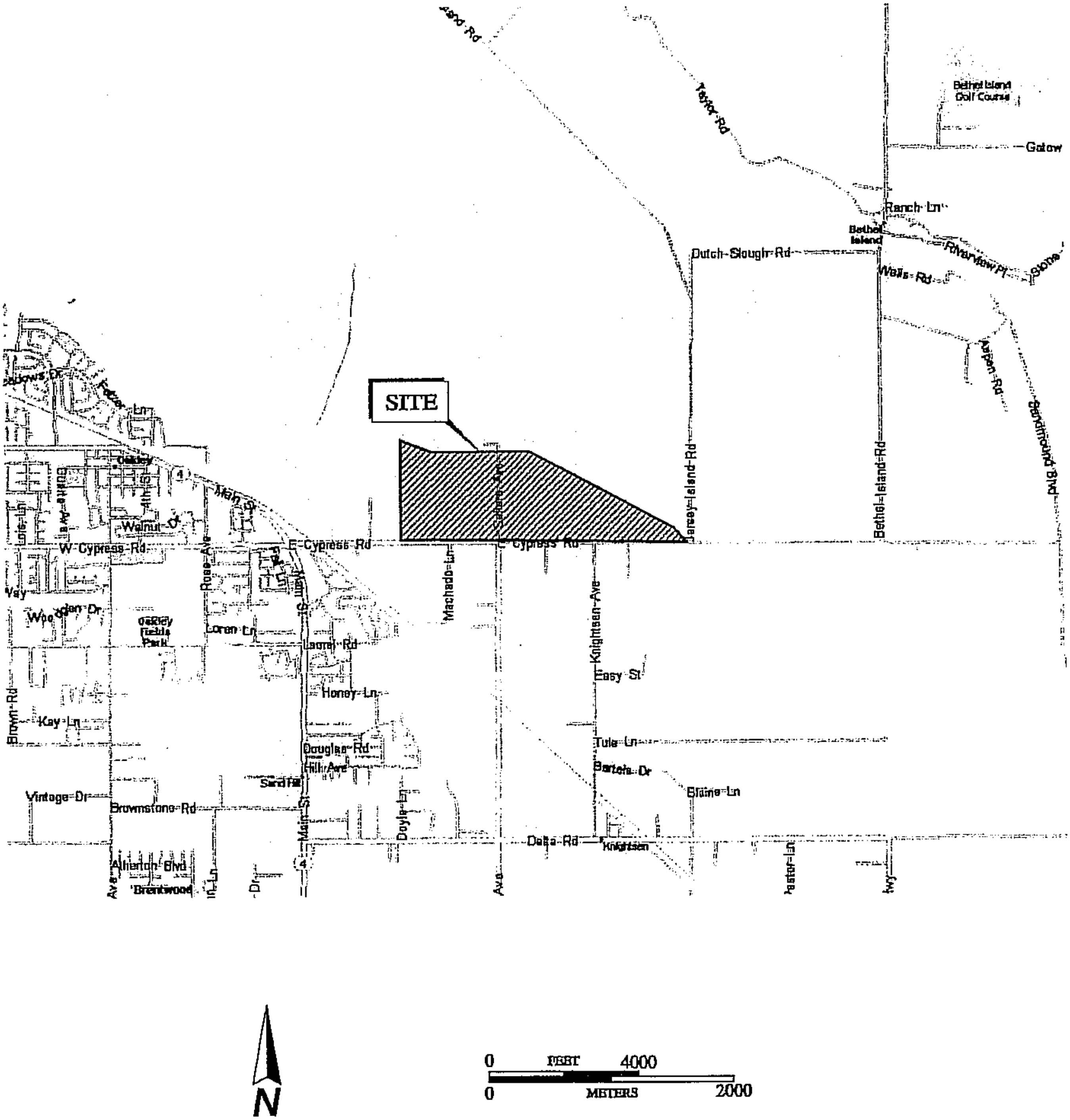
LIST OF FIGURES AND TABLE



BASE MAP SOURCE: MS STREETS AND TRIPS

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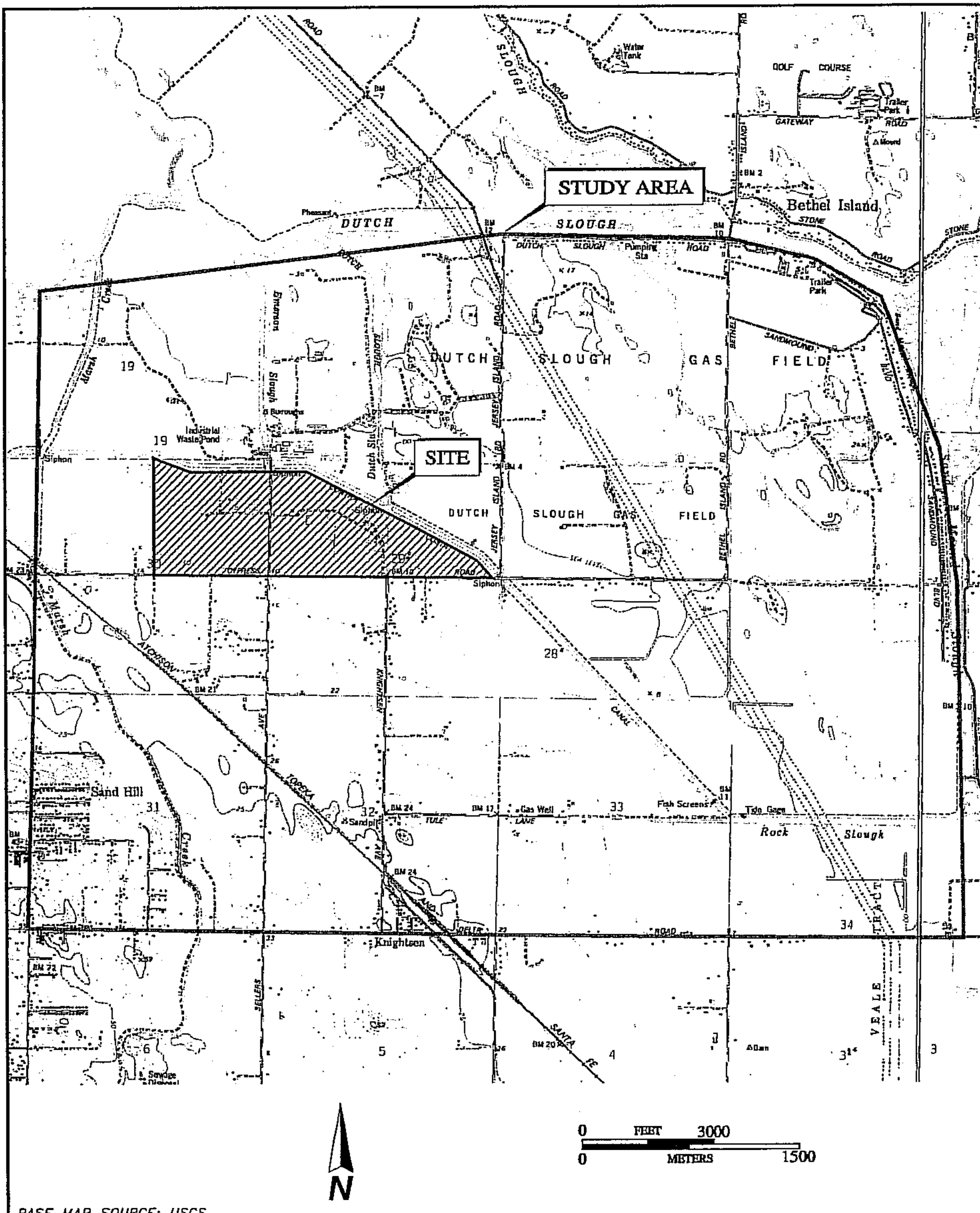

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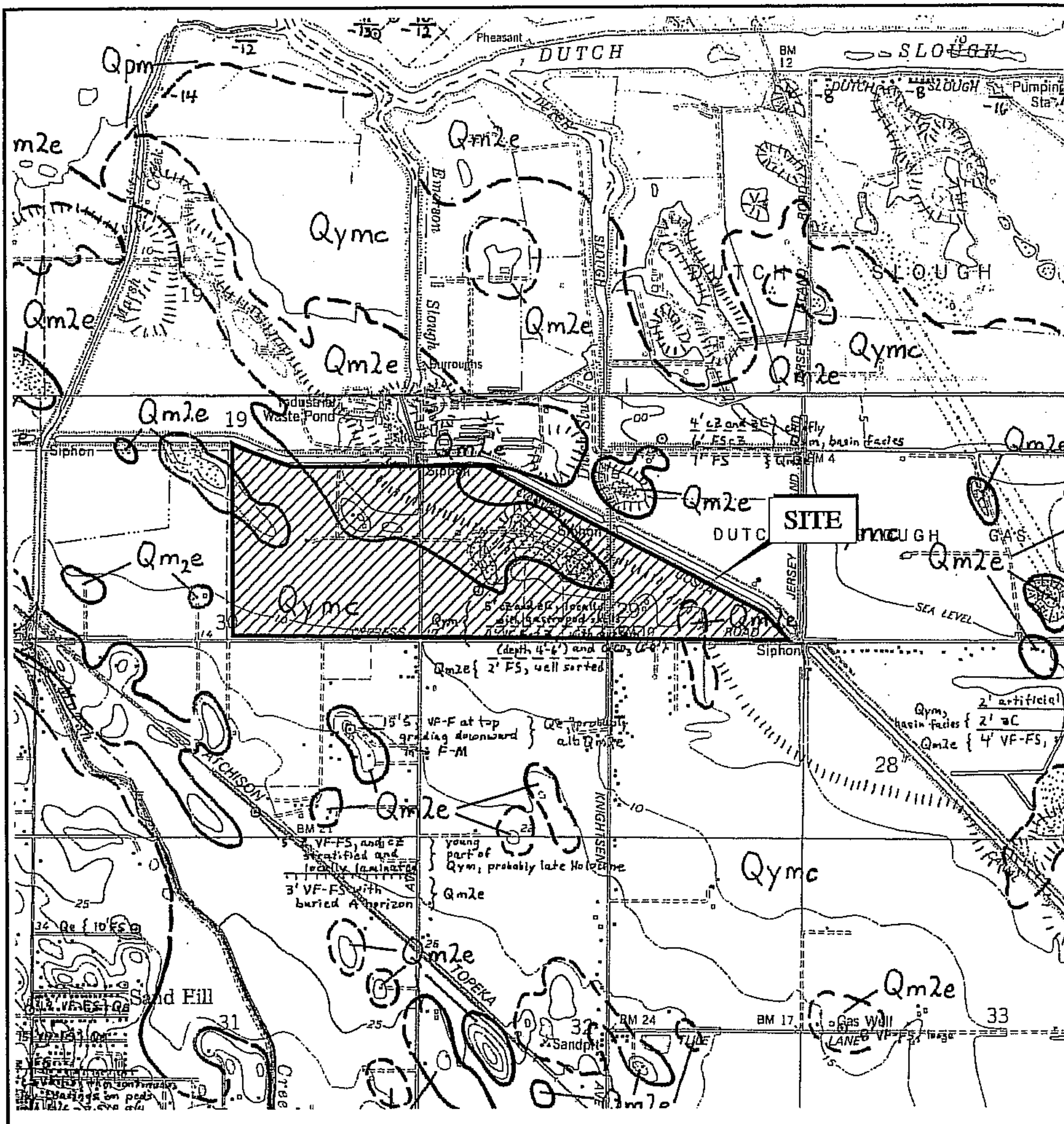

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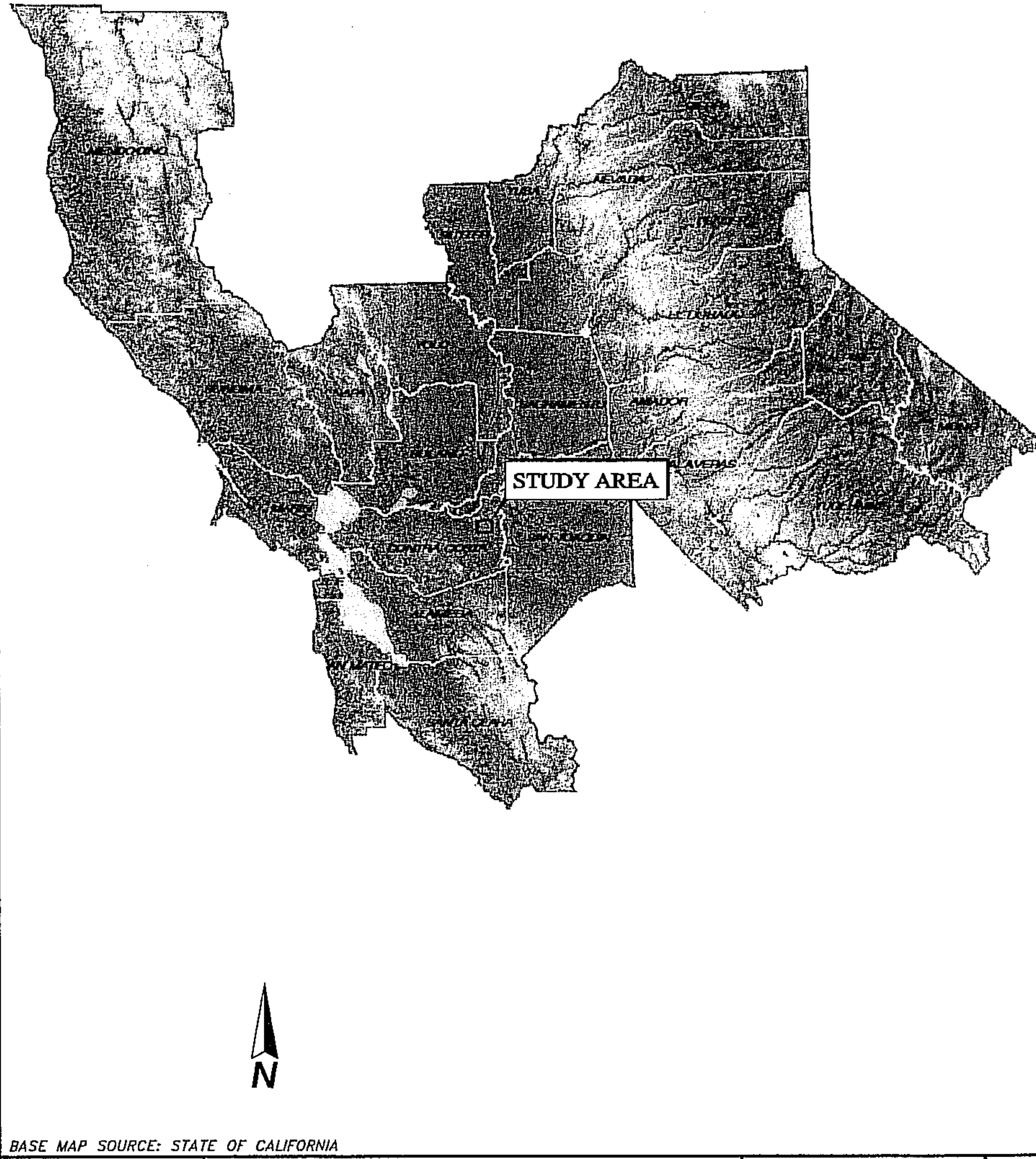

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ENGEO INCORPORATED
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DWR CENTRAL DISTRICT BOUNDARY
EMERSON AND BURROUGHS PROPERTIES
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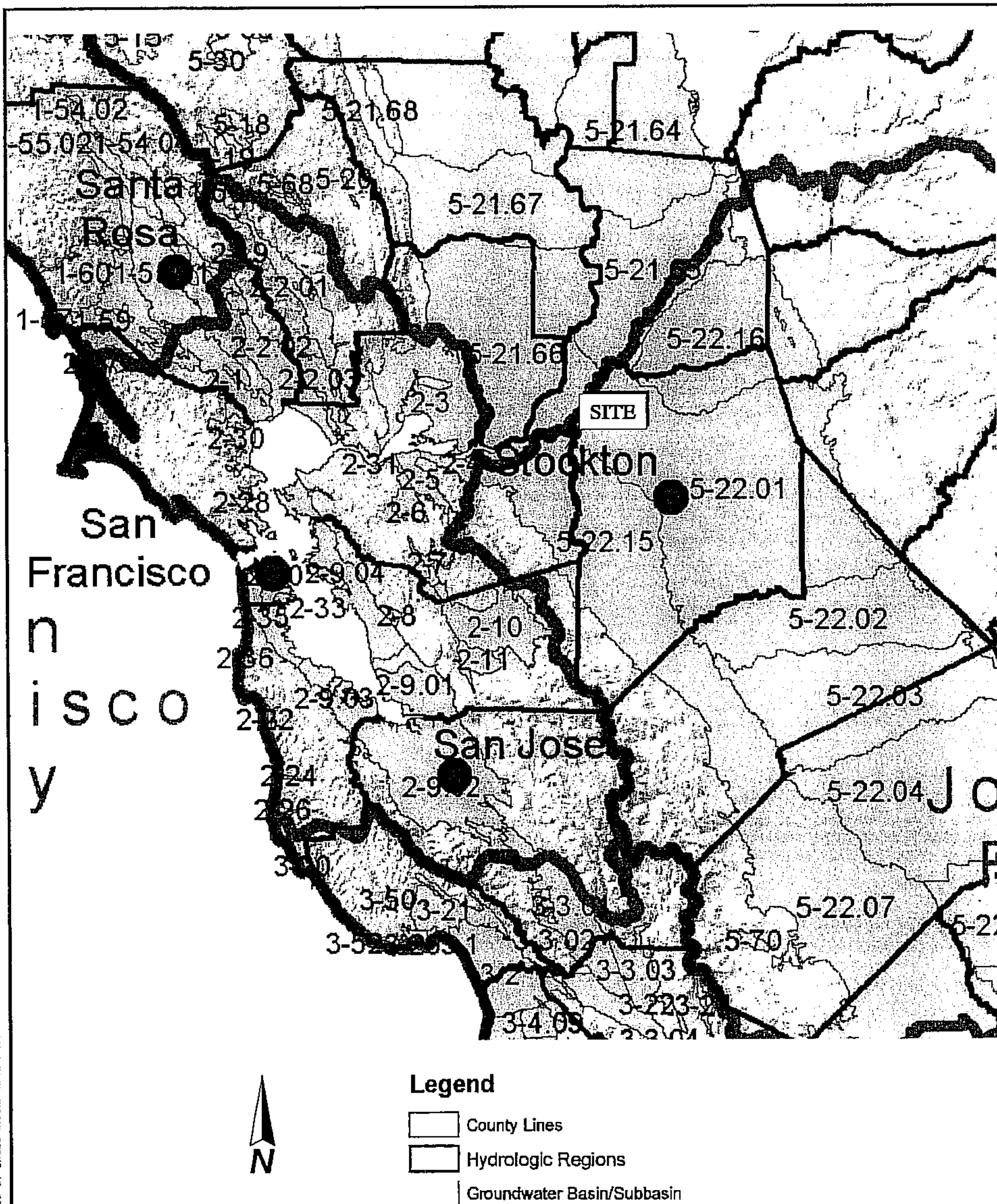

BASE MAP SOURCE: STATE OF CALIFORNIA

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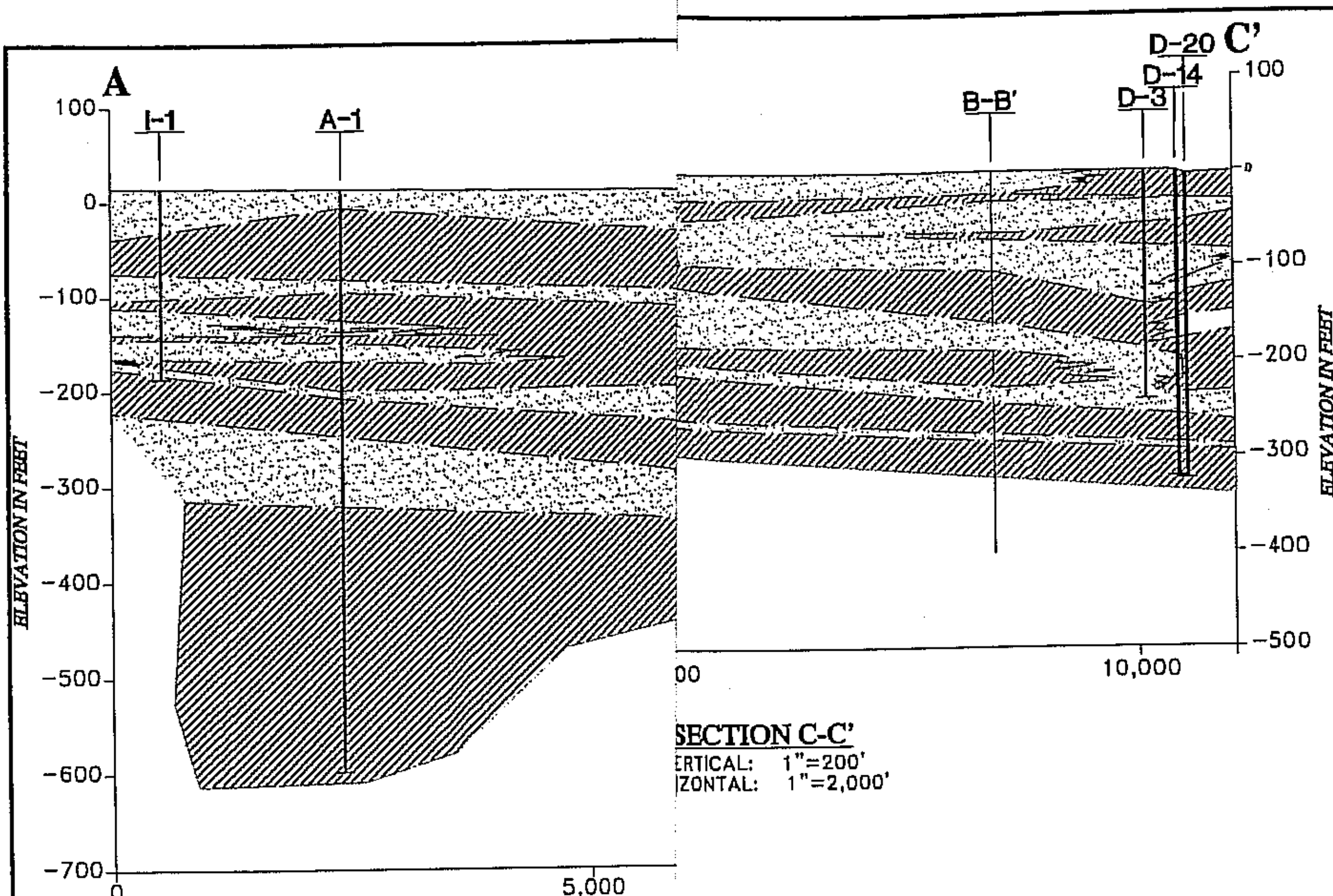

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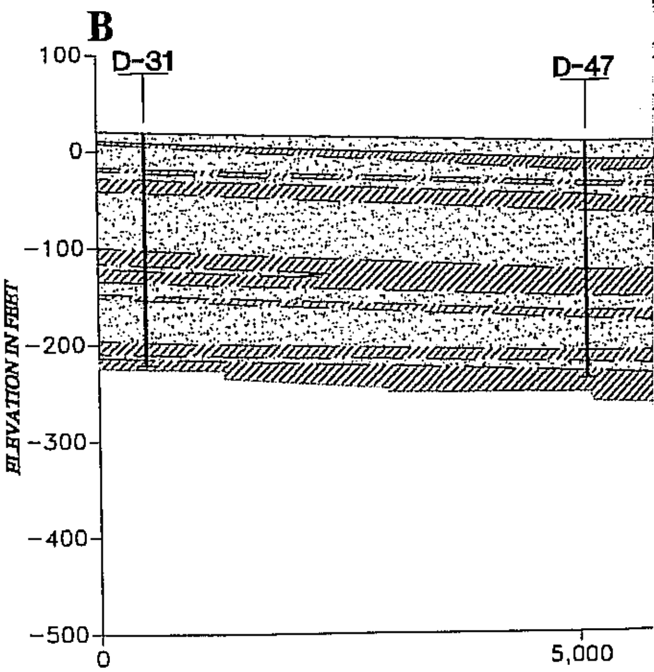

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SS SECTIONS S PROPERTIES CALIFORNIA	PROJECT NO.: 4603.4.101.02		FIGURE NO.
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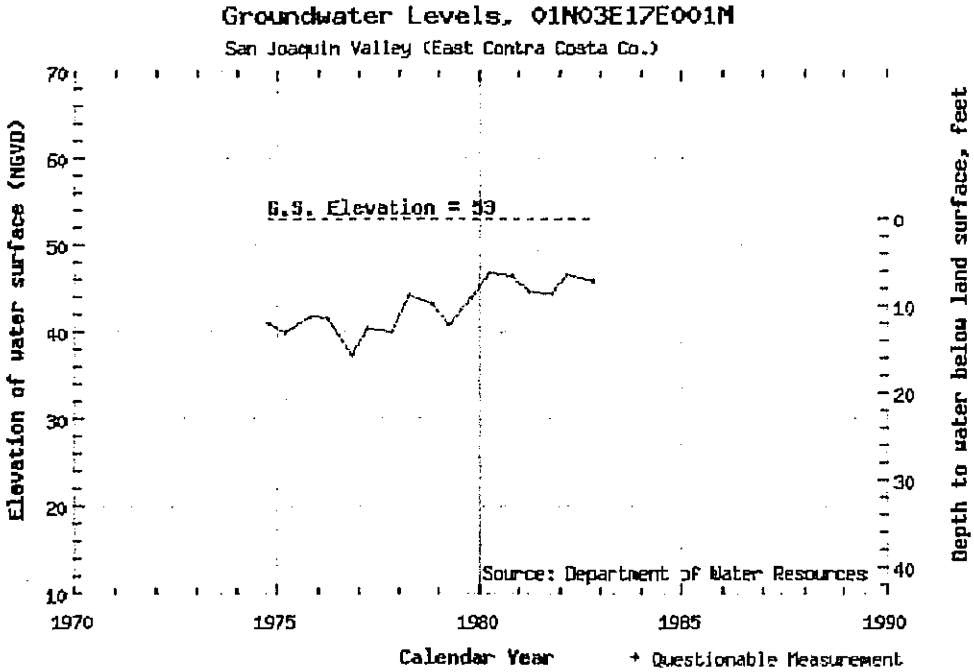

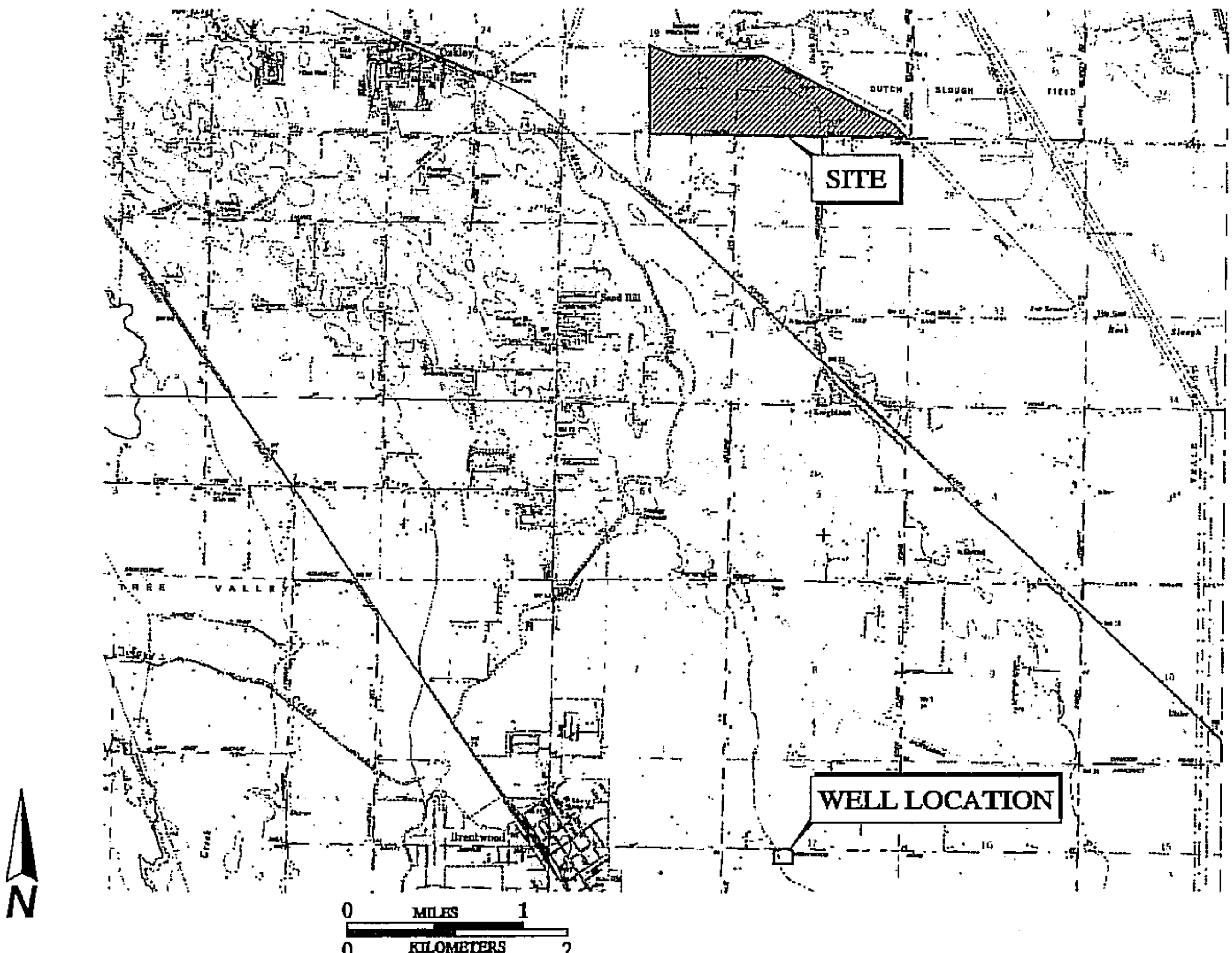

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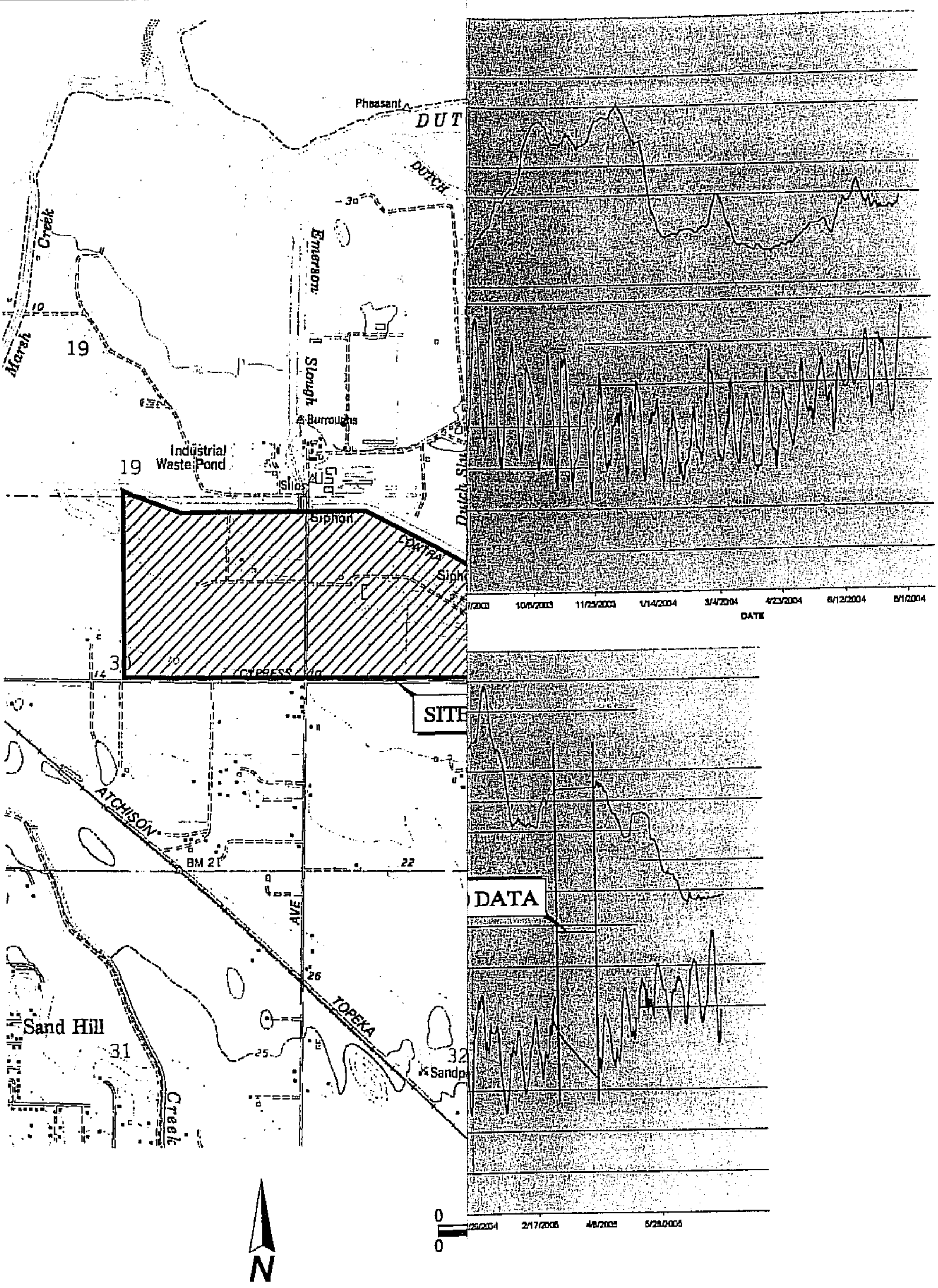

ROCK SLOUGH
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GROUNDWATER STUDY

EMERSON PROPERTY

Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
I-1	9/5/1980	South side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	200	Y	180	10	153	Slot (0.45")	155 - 180	#3-16	20	9/5/1980		80-160	E
I-2D	1/11/1982	North side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	198	Y	190	10	153	Slot (1/32")	160 - 190	#3-16	22	1/12/1982			D; 6/21/1993
I-3	6/23/1993	North side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	191	Y	190	10	153	Slot (1/32")	160 - 190	1/4" Gravel	30	6/24/1993		20	E
I-4D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	85	N	85	8									D; 3/6/1998
I-5D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	170	N	170	3									D; 3/6/1998
I-6D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	160	N	160	3									D; 3/6/1998
D-1	1/1/1905	Emerson Residence west of Sellers Ave	Stan Emerson		N											E
D-2	4/15/1984	West of Jersey Island Road north of Cypress Rd	Vaughn Hummel	240	Y	235	6	210	Slot (0.45")	215 - 235	#3-16	11	4/15/1984			E?
A-1	8/10/1959 to 12/19/1959	5/8 mi N and 100 ft E of Cypress and Sellers Ave	Burroughs Brothers	610	Y	333	18	31	Torch (1/4")	161 - 185; 209 - 233; 257-333	3/4" gravel					
A-2	10/13/1961 to 11/16/1961	1 mi N and 1/4 mi W from Cypress and Jersey Island Roads	Burroughs Brothers	428	Y	350	22	200	Torch (1/4")	206 - 254; 302 - 305	3/4" gravel					
M-1	7/6/1985	On Dutch Slough Road (south side) 3/4 mi E of Jersey Island	Dutch Slough Water Works	300	Y	245	6	215	Slot (0.45")	225 - 245	#3-16	22	7/6/1985			
D-3	10/4/1979	4220 Sand Mound Road	Morgan Fong	240	Y	240	2	50	Slot (1/16")	180 - 220	1/8"	11	10/4/1979			
D-4	2/13/1981	5372 Tule Tree Lane	B. Adams	200	Y	200	2.5	40	Saw (1/8")	160 - 180	1/8"	12	2/13/1981			
D-5	7/7/1985	Sand Mound Road (southwest side)	Ellis Sidney	220	Y	210	6	175	Slot (0.45")	190 - 210	#3-16	18	7/7/1985			

GROUNDWATER STUDY

EMERSON PROPERTY

Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-61	1/10/1977	3600 Stone Road	Sand Mound Mutual Water Co.	201	Y	155	8	50	Screen	145 - 155	pea gravel	2	1/10/1977			
D-62	8/1/1983	2566 Taylor Road	Farrar Park Water Co.	520	Y	265	6	230	Slot (0.45")	245 - 265	#3-16	5	8/1/1983			
M-4	9/1/1983	3600 Stone Road	Sand Mound Mutual Water Co.	240	Y	152	6	120	Slot (0.45")	220 - 240	3/8" gravel	10	9/1/1983			
D-6	9/26/1983	Sandmound Road 1/2 mi east of Bethel Island Road	John Dunn	300	Y	300	6	240	Slot (0.45")	280 - 300	3/8" gravel	10	9/26/1983			
D-7	6/23/1986	3460 Sandmound Road	Monroe Long	252	Y	252	2.5	60	Saw (1/8")	232 - 252	1/8"	3	6/23/1986			
D-8D		5332 Tule Tree Lane	Diane Maybee	80	N		6									D; 1/31/1990
D-9	3/9/1989	West side of Aspen Road	Betty Bunting	270	Y	220	6	190	Slot (1/16")	200 - 220	1/4"	5	3/9/1989			
D-10	7/3/1989	3500 Sandmound Road (south side)	Greg Nordine	320	Y	300	4.5	260	Slot (1/16")	280 - 300	1/4"	4	7/3/1989			
D-11D		Wells Road at Mariner	Willow Park Marina H.O.A.	167	N		3									D; 12/1/89
D-12D		Wells Road at Mariner	Willow Park Marina H.O.A.	190	N		3									D; 12/1/89
M-5	9/24/1996	5998 Bethel Island Road (200 yds ln to east)	Mark Gilbert	320	Y	300	6	240	Screen (0.40")	240 - 300	1/4" gravel	10	9/26/1997			
M-6	2/3/1972	3600 Stone Road (1/2 mi SW of Betheyl Island Road)	Sand Mound Mutual Water Co.	197	Y	161	8 5/8	50	Slot (3"x1/8")	140 - 161	pea gravel	5	2/3/1972			
D-13	6/11/1973	Tule Tree Lane	Carl Jackson	180	Y	170	6.5	0	Slot (3"x1/8")	156 - 170	pea gravel	10	6/11/1973			
D-14	5/7/1986	End of Sandmound Road	Darrell Edwards	320	Y	312	6	230	Slot (1/16")	282 - 312	#3-16	8	5/7/1986			
D-61	7/18/1984	Cypress Road 1 mi East of Kightson Road	Pacific Water Systems	260	Y	260	6	70	Screen	240 - 260	Sand & Gravel	8	7/18/1984			
D-62	7/23/1984	Cypress Road 1 mi East of Kightson Road	Pacific Water Systems	187	Y	187	4	40	Screen	169 - 187	Sand & Gravel	8	7/23/1984			
D-15	6/17/1986	Bethel Island Road	Manuel Bonilla	113	Y	113	5	50	Slot (0.05")	93 - 113	1/8"	8	6/19/1986			
D-16	7/3/1989	3761 Cypress Rd.	Charles Pringle	260	Y	250	6	195	Slot (1/16")	230-250	1/4" gravel	8				
D-17	3/30/1981	Bethel Island Road	E&C Gorgas/Bruce Their	215	Y	215	8	175	Slot (1/8x6")	175-215	3/8" pea gravel	8	4/15/1981		30 after 4 hours	
D-18	10/9/1989	1751 Tule Lane	Robert Lloyd	160	Y	140	6	55		120-160	Sand		10/9/1989			

GROUNDWATER STUDY

EMERSON PROPERTY

Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-19	12/12/1989	Sellars Ave	Fred & Jan Grexton	180	Y	120	6	80	Slot (1/16")	100-120	1/4" Gravel	20	12/13/1989			
D-20	11/30/1989	End of Sandmound Road	James Aberer Jr.	320	Y	255	4.5"	200	Slot (1/16")	235-255	1/4" Gravel	5	12/2/1989			
A-3	10/19/1984	Delta Road in Contra Costa County	Rich Fuller	260	Y	245	8	70	45th	225-245	#3-16	11	10/19/1984			
D-21	4/11/1978	Third Lot on east side of Crismore Rd., Parcel C	Travis Crismore	139	Y	135	6	20	Slot (1/16")	115-135	#3-16	15	4/17/1978		250	
D-22	1/27/1978	5 miles south of Bethel Island on Sandmound Rd.	EJ Brown	160	Y	180	3	20	Slot (1/16")	162-182		5	1/27/1978			
D-23	8/11/1981	Delta Road in Contra Costa County	Al Fuller	240	Y	240	6	70	45th	220-240	#3-16	10	8/11/1981			
D-24	8/12/1981	Delta Road in Contra Costa County	Rich Fuller	260	Y	245	6	70	45th	225-245	#3-16	12	8/12/1981			
D-25	2/21/1973	Delta and Eden Plains Rd., past school	Carl Jackson	110	Y	75	6.5		Slot (1/8x3")	65-75	pea gravel	17	2/21/1973			
D-26	12/12/1997	2800 Delta Rd.	Zenaida Ramirez	160	Y	140	6	115	slot (40/1000")	115-140	1/4" Gravel	7	12/12/1997			
A-4	4/16/1987	Tule Lane	Dante Massoni	180	Y	141	6	80	Slot (1/16")	121-141	1/4" Gravel	18	4/16/1987			
D-27	7/19/1989	4019 Meadows Lane Oakley	Mr. Showaker	160	Y	155	6	125	Slot (1/16")	135-155	1/4" Gravel	30	7/20/1989			
A-5	11/24/1987	North end of sellers Ave on West side down road	Emerson Dairy	180	Y	180	10	155	Slot (1/16")	155-185	1/4" Gravel	20	11/28/1987			
D-28	11/6/1985	Machado Ln., Oakley	L.H. Bennet	113	Y	113	5	30	0.04	103-113	1/8" Gravel	19	11/6/1985			
D-29	Jun-83	Machado Ln., Oakley	Paulino Hajas	100	Y	90	6	46	45th	70-90	#3-16	27	Jun-83			
D-30	Aug-82	Sellars Ave., 1/2 mi. south of Cypress, west side	D.C. Ellison	180	Y	165	6	60	45th	145-165	#3-16	15	Aug-82			
D-31	9/28/1984	Sellars Ave.	Gary Frost	240	Y	235	6	175	45th	195-235	#3-16	17	9/28/1984			
D-32	5/1/1987	300 Yards South of Cypress Rd. on West side of Sellars Ave.	Juan Nodal	122	Y	122	4.5	50	0.02	102-122	pea gravel	18	5/1/1987			
D-33	7/25/1985	North Sellars Ave	Manuel Gansalves	175	Y	163	6	130	0.045	143-163	#3-16	18	7/25/1985			
D-34	6/26/1985	Laurel Rd.	Jim Nabas	140	Y	134	6	112	0.045	114-134	#3-16	26	6/27/1985			
D-35	1/24/1978	Cypress Road 2 mi south of bethel island	Floyd Duegon	230	Y		6	20	Slot (1/16")	212-232	pea gravel	10	2/9/1978			
D-36	12/26/1984	Rt 2 Box 210-a Oakley CA	Donald Durst	230	Y	210	6	150	0.045	190-210	#3-16	5	12/26/1985			
D-37	12/23/1996	2901 E Cypress Road	Milan Petrovich	240	Y	200	5	165	Slot (1/32")	180-200	1/4" Gravel	8	12/23/1996			

GROUNDWATER STUDY
EMERSON PROPERTY
Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-38	12/1/1997	2521 E Cypress Road	Pam Boyce	240	Y	217	6	195	0.04	197-217	1/4" Gravel	4	12/28/1997			
D-39	9/28/1980	South side of cypress, between sellers & knightsen	George Ferreira	140	Y	120	6	45	45th	100-120	#3-16	8	9/28/1980			
D-40	11/2/1981	Knightsen Ave 1/2 mile south of cypress rd.	James Baca	140	Y	135	6	50	45th	115-135	#3-16	13	11/2/1981			
D-41	7/12/1978	Sellars Rd 1000' south of cypress rd, east side	John Moore	100	Y	100	6	20	"screen"	80-100	Birdseye	11	7/12/1978			
D-42	3/14/1979	Knightsen Ave one mile south of Cypress on West side of road	Don Kirkpatrick	138	Y		6	37	45th	118-138	1/4" Gravel	20	3/14/1979			
D-43	4/18/1979	East side of Knightsen Ave 0.3 miles south of Cypress Ave	Bill Parkhurst	146	Y	125	6	38	45th	105-125	#3-16	6	4/18/1979			
D-44	7/10/1979	1/4 mile south of Cypress Ave on E side of Broadway st.	Louis Hernandez	240	Y	215	6	155	45th	195-215	#3-16	12	7/11/1979			
D-45	8/3/1979	100 Yds W of Jersey Island Rd. on N side of Cypress Rd	Arley Reeves	240	Y	210	6	140	45th	190-210	#3-16	10	8/3/1979			
D-46	5/26/1976	Sellars Ave, 1/4 mile S of Cypress Ave, E side	Charles Marin	100	Y	88	6	20		78-88	pea gravel	12	5/26/1976			
D-47	6/22/1976	Cypress Rd between Jersey Island & Knightsen Rd.	Ernest Burroughs	245	Y	237	6-5/8"	20	Slot (3"x1/8")	205-215, 222-237	Birdseye	15	6/22/1976			
D-48	4/25/1986	Cypress Rd. Oakley	Russel Hooper	260	Y	245	6	216	Slot (1/16")	225-245	#3-16	5	4/26/1986			
D-49	Sep-84	South of Cypress Rd.	Jim Owens	140	Y	118	6	50	45th	118-198	#3-16	10	Sep-84			
A-6	12/29/1982	1/4 mile S of Cypress Rd on Knightsen Ave	Wayne West	139	Y	138	8	70	45th	119-139	#3-16	15	12/29/1982			
D-50	10/3/1989	Cypress Rd/Broadway	Bill Koenig	220	Y	200	6-3/4"	50	0.02	200-220	1/8" pea		10/9/1989			
D-51	10/6/1973	Broadway St. off Cypress Ave, Oakley	Gelasia Velez	212	Y	212	6.5		Slot (3"x1/8")	202-212	pea gravel	10	10/6/1973			
D-52	5/8/1979	4002 Creekside Dr., Oakley	Bob Buchanan	100	Y		6	30	Slot (2x1/16")	50-100	1/4" Gravel	15	5/9/1979	150+		
D-53	9/13/1978	Oakley	Ken Grunstad	152	Y	152	6-5/8"	40	Slot (3"x1/8")	122-142	1/4" Gravel	25	9/15/1978			
D-54	7/25/1980	North of Meadow Ln.	Edward Rogers	160	Y	154	6	50	45th	134-154	#3-16	25	7/25/1980			
D-55	7/25/1981	North of Creekside Way	Wm Bankson	160	Y	154	6	50	45th	134-154	#3-16	25	7/25/1981			

GROUNDWATER STUDY

EMERSON PROPERTY

Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

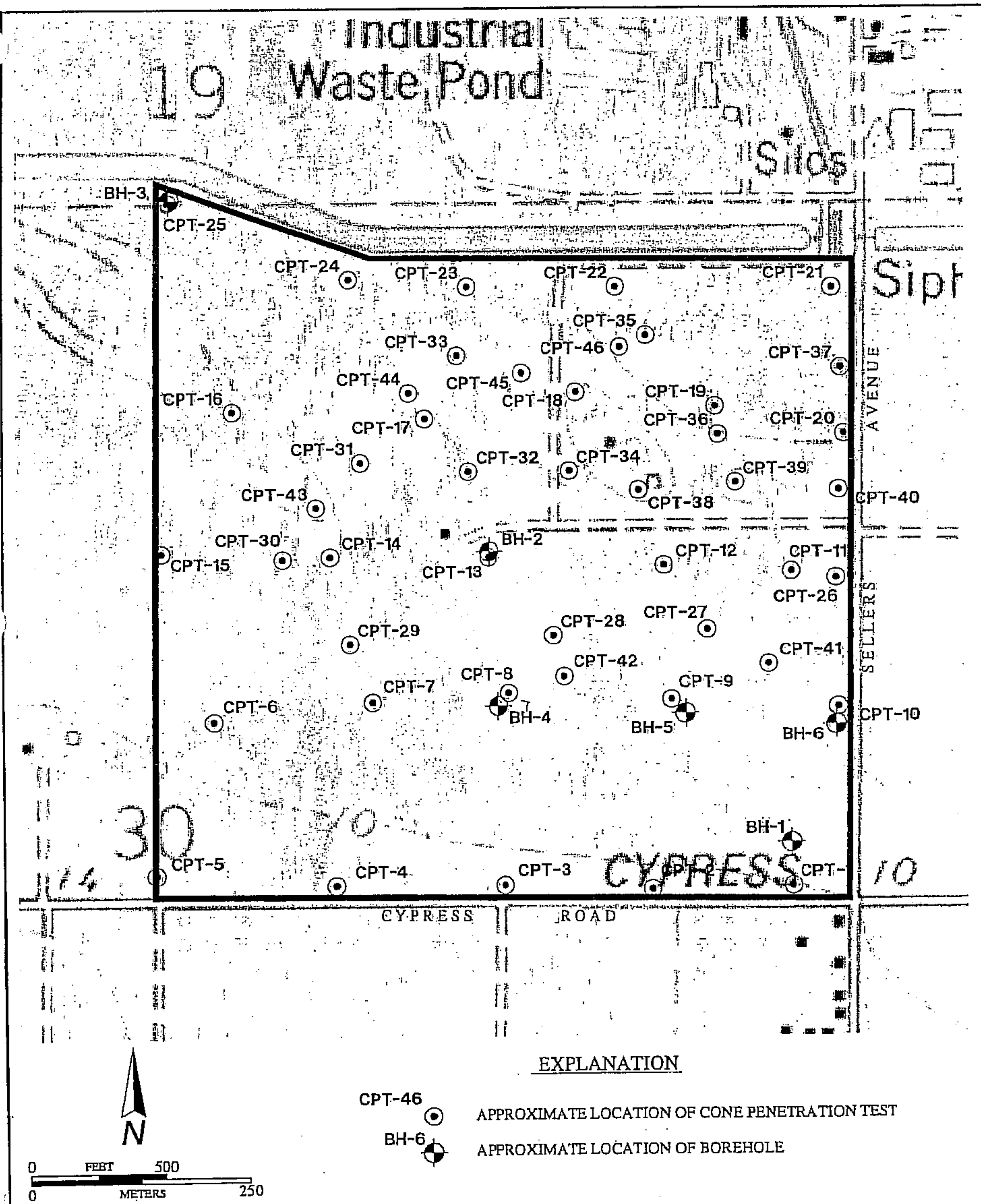
Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-56	4/25/1979	End of Laurel Rd., 1/2 mile east of Hwy 4	Steve Watty	145	Y	145	6	20	Slot (2x1/16")	115-145	3/8" gravel	19	4/27/1979	60+		
A-7	6/21/1978	Cypress Rd South 100 ft from W Machado Ln.	Frank Stonebarger	68	Y	65	3		Slot (3/16")			15	6/21/1978	100		
D-57	7/23/1979	S side of Cypress Rd 200 yards west of Sellars Ave	Steve Hinman	180	Y	159	6	50	45th	139-159	#3-16	13	7/23/1979			
D-58	3/27/1980	100ft E of Meadows Ln	Edward Rogers	155	Y	155	6	60	45th	135-155	#3-16	18	3/27/1980			
D-59	4/10/1980	NW corner of Creekside Ct	Ruben Quesada	152	Y	152	6	45	45th	132-152	#3-16	17	4/10/1980			
D-60	11/24/1986	Off Cypress Rd	Hogas Paulino	155	Y	120	8	50	45th	100-120	Sand & Gravel	15	11/24/1986			

APPENDIX A

ENGEO INCORPORATED

[illegible]

[illegible]



BASE MAP SOURCE: U.S.G.S.

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE PLAN
EMERSON PROPERTY
OAKLEY, CALIFORNIA

PROJECT NO.: 4603.4.100.01		FIGURE NO.
DATE: MARCH 2005		2
DRAWN BY: PC	CHECKED BY: JT	

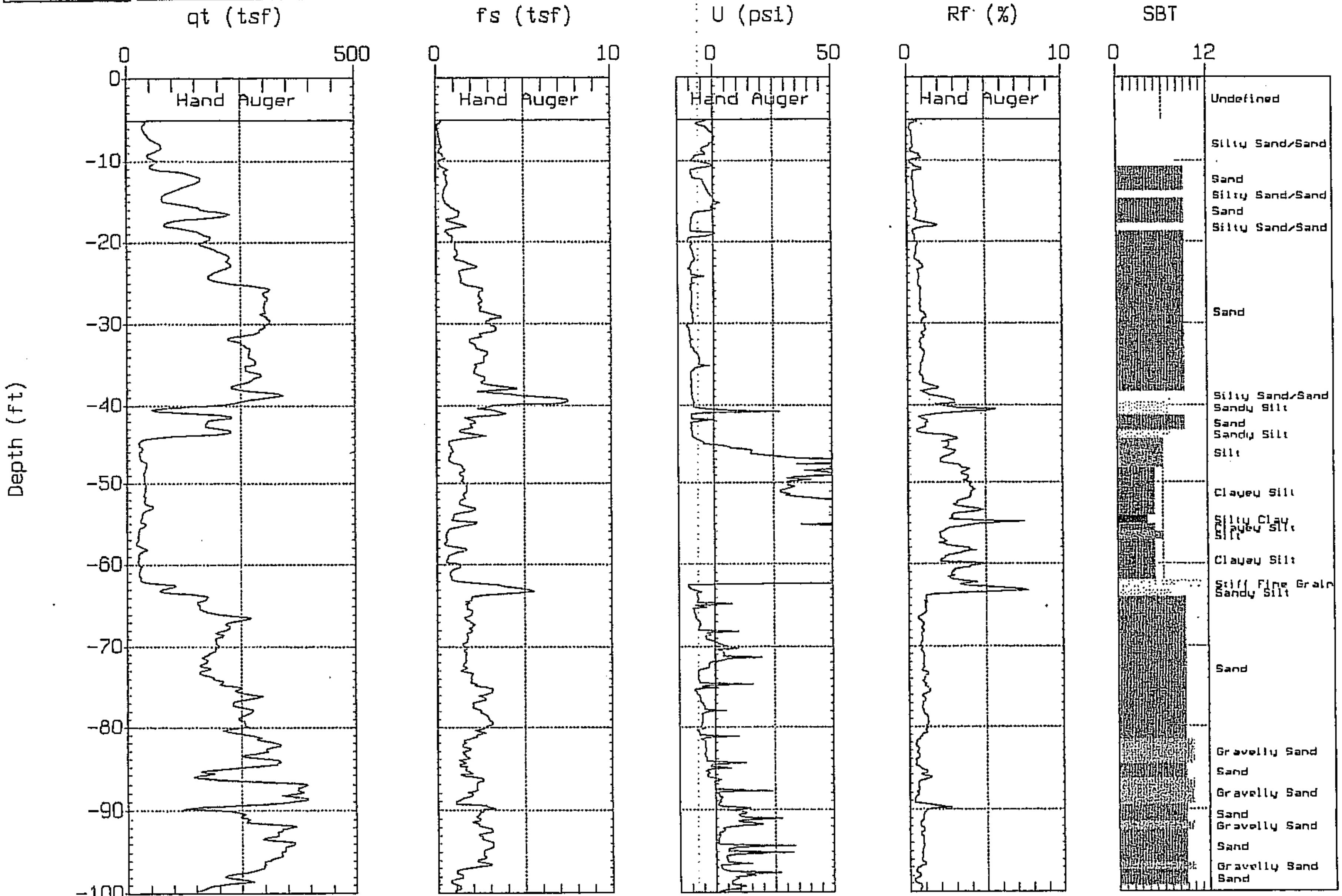
C:\Drafting\DRAFTING2_Dwg\4603\100\460341000 1-2-SITE-0305.dwg 3-08-05 07:46:42 AM

ORIGINAL FIGURE PRINTED IN COLOR

ENGEO

Site: KB HOMES
Location: SCPT-51

Engineer: S.HARRIS
Date: 08:05:05 08:09



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

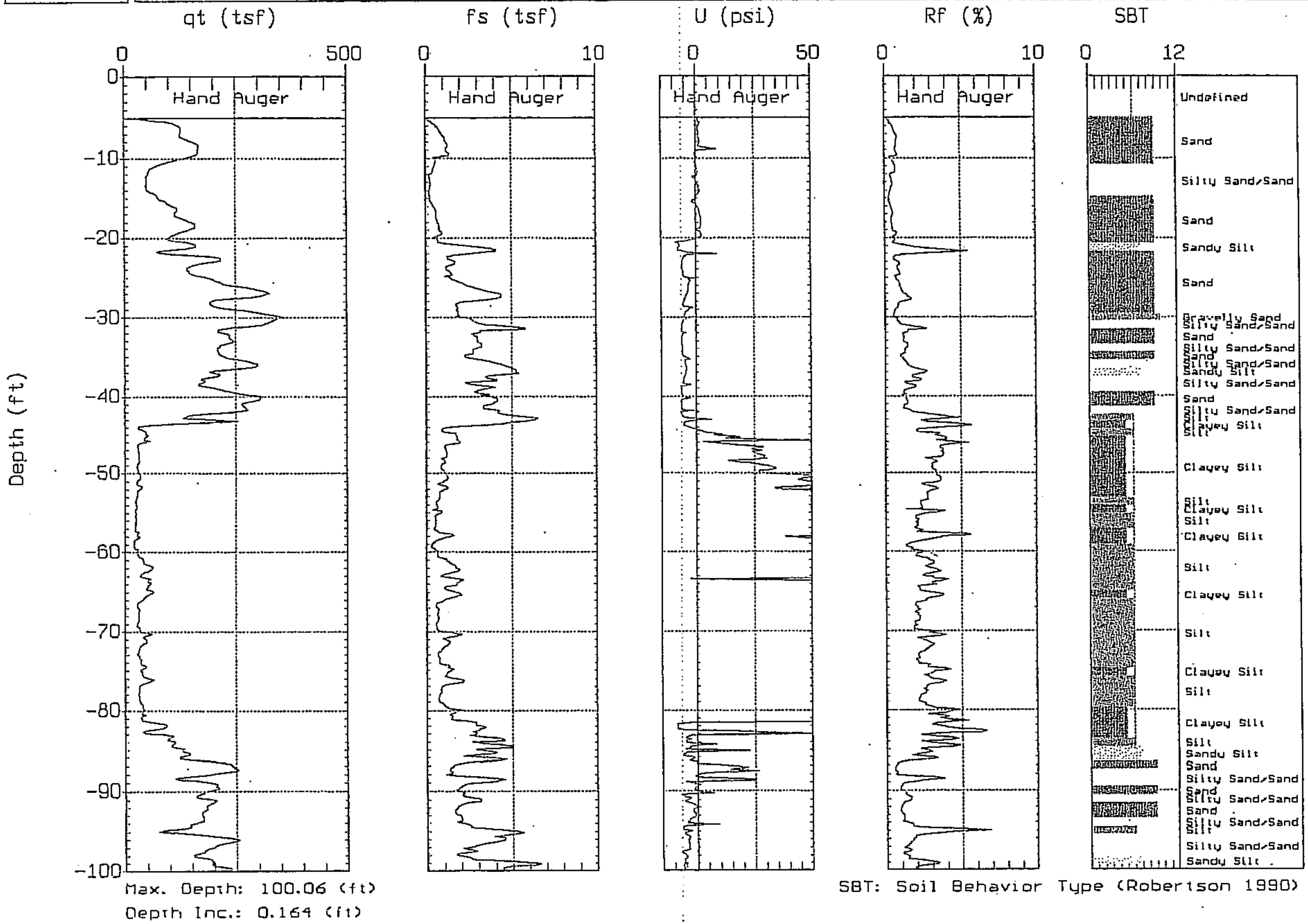
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: SCPT-52

Engineer: S.HARRIS
Date: 08:05:05 11:36



KEY TO BORING LOGS

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

GRAIN SIZES

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

RELATIVE DENSITY

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

CONSISTENCY

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

MOISTURE CONDITION

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

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

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

SAMPLER SYMBOLS

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

LINE TYPES

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

GROUND-WATER SYMBOLS

- ∇ Groundwater level during drilling
- ▼ Stabilized groundwater level

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

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

DATE OF BORING: June 14, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Disced field / loose soil.				
	1	1-1		SILTY CLAY (CL), very dark greyish brown, very stiff, moist, with sand.	22			11.1
5	2	1-2		SILTY CLAY (CL), olive brown, medium stiff, wet. ▽	7	*0.75	85	35.7
10	3	1-3		SILTY CLAY (CL), mottled, brown, grey and olive, medium stiff, saturated, trace sand.	6	*1.0	95	29.3
15	4, 5			No sample recovered.	15			
20	6	1-4		SILTY SAND (SM), light olive brown, medium dense, saturated, trace clay, fine-grained sand.	19		103	22.1
25	7, 8	1-5		SILTY CLAY (CL) with sand, mottled olive grey and reddish brown, oxidation, stiff, saturated, with sand.	11			37.2
30	9			SILTY SAND (SM), light olive brown, very dense, saturated, medium- to fine-grained sand, some silt.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-1

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 14, 2004 SURFACE ELEVATION: Approx. 12 feet (4 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		1-6		SAND (SP), greyish brown, very dense, saturated, medium- to fine-grained sand, some silt.	79		113	17.7
	10							
35	11	1-7			54		115	17.1
40	12	1-8			40			21.0
	13							
45	14	1-9		CLAYEY SILT(ML) with sand, olive greyish brown, very stiff, saturated, fine-grained sand.	19			26.7
50	15	1-10		CLAYEY SILT (ML), olive grey, hard, saturated, some oxidation.	31	*3.0	102	24.4
	16			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				
55	17							
60	18							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-1

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 12 feet (4 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil.				
				SAND with silt (SM), olive brown, medium dense, moist to wet, fine-grained sand.				
	1	2-1			15			7.3
5				No sample recovered. ▽	12			
	2			SILTY SAND (SM), light olive brown, loose, saturated, some silt, fine-grained sand.				
		2-2			7			17.2
10	3	2-3			6			22.0
	4							
15				SILTY SAND (SM), light olive brown, medium dense, saturated, fine-grained sand, trace clay.				
	5	2-4			15			31.4
20	6			SAND (SP) with silt, light olive brown, medium dense, saturated, fine-grained sand.				
		2-5			20			24.6
	7							
25				SILTY SAND (SM), olive brown, dense, saturated, fine-grained sand.				
	8	2-6			34		112	19.0
30	9			SILTY SAND (SM), olive brown, very dense, fine-grained sand.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES
OAKLEY, CALIFORNIA

BORING NO.: B-2
LOGGED BY: Z. Crawford
PROJ. NO.: 4603.4.100.01
CHECKED BY
FIGURE NO. A-2

DATE OF BORING: June 15, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
	10	2-7			92		112	19.1
35	11	2-8		SILTY CLAY (CL) with sand, olive brown, very stiff, saturated, fine-grained sand.	27			24.7
40	12, 13	2-9		SILTY SAND (SM), olive brown, very dense, saturated, fine-grained sand.	74		112	18.6
45	14	2-10		SILTY CLAY, olive, hard, saturated.	32	*4.0	98	27.1
50	15	2-11		CLAYEY SILT (ML), olive brown, hard, saturated.	49	*4.5	105	22.6
55, 60	16, 17, 18			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-2

ENGEO BOREL 460341000I EMERSON PROPERTY.GPJ 3/10/05

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 10 feet (3 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil, dry grass. SAND with some silt (SP), light brown, loose to very loose, dry.				
	1	3-1		CLAY (CH), dark grayish brown, oxidation, stiff, wet, some silt. ∇	10	*3.0	90	30.2
5	2							
10	3	3-2		SILTY SAND (SM), brown, loose, saturated, loose medium- to fine-grained sand.			95	17.7
		3-3		CLAY with some silt (CL), olive brown, medium stiff to stiff, saturated, trace sand.	9	*1.5	107	21.4
15	4, 5	3-4		CLAY (CL), mottled brown and gray, stiff, saturated, trace silt.	12	*2.0	85	36.3
20	6	3-5		SAND with silt (SM), yelloish brown, medium dense, saturated, fine-grained sand.	24		111	18.9
25	7, 8	3-6		SAND with silt (SP), olive gray to olive brown, very dense, saturated, fine-grained sand.	66			17.0
30	9							

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 15, 2004 SURFACE ELEVATION: Approx. 10 feet (3 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		3-7			50			23.2
35	10, 11	3-8		SAND with silt (SM), olive brown, medium dense, saturated, fine-grained sand.	26			22.0
40	12, 13	3-9		SILT (ML) with sand, olive brown, medium dense, saturated, fine-grained sand, trace clay.	14			31.4
45	14	3-10		SILTY CLAY (CL), light olive brown, very stiff, saturated, trace sand.	23			23.9
50	15	3-11		SILTY CLAY (CL), olive brown, hard, saturated.	52		110	20.7
55, 60	16, 17, 18			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 4 feet during drilling.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES
OAKLEY, CALIFORNIA

BORING NO.: B-3
LOGGED BY: Z. Crawford
PROJ. NO.: 4603.4.100.01
CHECKED BY

FIGURE NO. A-3

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated.				
5				∇				
	2	4-1 4-2		CLAY with some sand (CL), olive brown, medium stiff, saturated.	7	*1.0 *0.75		
10	3	4-3 4-4		SANDY CLAY (CL), olive brown, stiff, saturated, fine-grained sand.	9	*1.0 *1.5		
				Bottom of boring at approximately 10 feet. Groundwater encountered at 5.5 feet during drilling.				
	4							
15	5							
20	6							
	7							
25	8							
30	9							

603.4.100.01 EMERSON.GPJ 3/10/05

ENGEO BOREL

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-4

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO.

A-4

DATE OF BORING: July 2, 2004

SURFACE ELEVATION: Approx. feet (meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, stiff, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated. ▽				
5		5-1				*1.0		
		5-2			7	*1.0		
	2			Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15								
	5							
20	6							
	7							
25								
	8							
30	9							

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-5

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-5

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, very stiff, moist, trace sand.				
	1	6-1			7	*3.5		
5				∇CLAY with some silt (CL), dark olive brown, medium stiff, wet to saturated.				
		6-2				*0.75		
	2	6-3			5	*0.75		
				Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-6

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-6

ENGEO_BOREL 4603.4.100.01 EMERSON.GPJ 3/10/05

LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
1	0	0.00	0	50	0	pass
2	3.5	14-17.5	0.84	14	3.5	pass
3	5	7-12	1.2	7	7	borderline
	1	13 – 14	0.24			
	1	19 – 20	0.24			
4	1	15 – 16.5	0.24	15	3	pass
	2	22 – 23.5	0.48			
5	3.5	23 – 27.5	0.84	23	3.5	pass
6	3.5	17 – 20.5	0.84	17	3.5	pass
7	3	12.5 -15.5	0.72	12.5	3	pass
8	1.5	16 – 17.5	0.36	16	1.5	pass
9	2.5	19.5 – 22	0.6	19.5	2.5	pass
10	3	15.5 -18.5	0.72	15.5	3	pass
11	9.5	6 – 15.5	2.28	6	9.5	fail
12	8	6.5 – 14.5	1.92	6.5	10.5	fail
	2.5	21 – 23.5	0.6			
13	5	6.5 – 11.5	1.2	6.5	6	fail
	1	22 – 23	0.24			
14	9	6 – 15	2.16	6	9	fail
15	2	18 – 20	0.48	18	2	pass
16	5	7 – 12	1.2	7	5	pass
17	6	6.5 – 12.5	1.44	6.5	6	fail
18		0			0	
19	5.5	5 – 10.5	1.32	5	6.5	fail
	1	11.5 -12.5	0.24			
20	0.7	5.2 – 5.9	0.17	5.2	9.5	fail
	5	6.7 – 11.7	1.2			
	0.7	12.6 – 11.3	0.17			
	3	14 – 17	0.72			
21	1.5	14.2 -15.7	0.36	14.2	1.5	pass

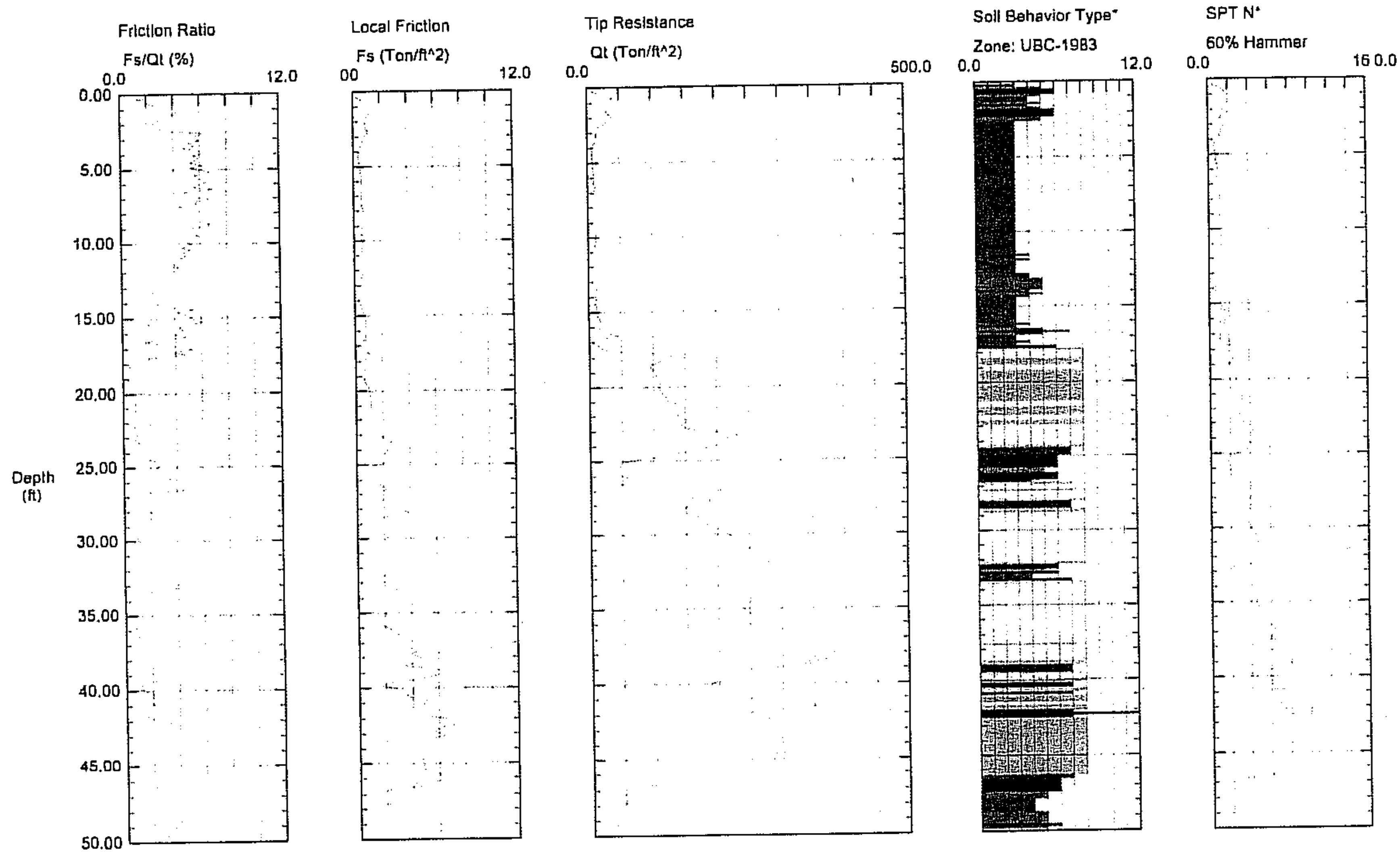
LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
22	1	6 - 7	0.24	6	2.5	pass
	1.5	9.5 - 11	0.36			
23	4	11 - 15	0.96	11	4	pass
24	3.2	5.3 - 8.5	0.77	5.3	3.2	pass
25	4	7.5 - 11.5	0.96	7.5	4	pass
26	13	6.5 - 19.5	3.12	6.5	13	fail
27	1	15-16	0.24	15	1	pass
28						
29	1	14 - 15	0.24	14	1	pass
30	0	-	0	-	0	pass
31	8	5 - 13	1.92	5	13	fail
32						
33	5	6.5 - 11.5	1.2	6.5	5	borderline
34	7.4	6.2 - 13.6	1.78	6.2	7.4	fail
35	1	5 - 6	0.24	5	3.5	pass
	1.5	10.5 - 12	0.36			
	1	13 - 14	0.24			
36	6	5.3 - 11.3	1.44	5.3	6.3	fail
37						
38	10	9 - 19	2.4	8.2	11	fail
39	3	11-14	0.72	11	6	pass
	3	15 - 18	0.72			
40	5	9 - 14	1.2	9	5	pass
41	4.5	14.5 - 19	1.08	14.5	4.5	pass
42	1.5	18 - 19.5	0.36	18	1.5	pass
43	4	9.5 - 13.5	0.96	9.5	6	pass
	2	15 - 17	0.48			
44	8.5	5.5 - 14	2.04	5.5	8.5	fail
45	2	11 - 13	0.48	11	2	pass
46	9	6.5 - 15.5	2.16	6.5	9	fail

*Soil behavior type and ›ased on data from UBC-1 983

VBI In-Situ 'resting

Operator: Mike Robertson
Sounding: 04W052
Cone Used: HO738TC

CPT Date/Time: 06-14-04 09:19
Location: CPT-1
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

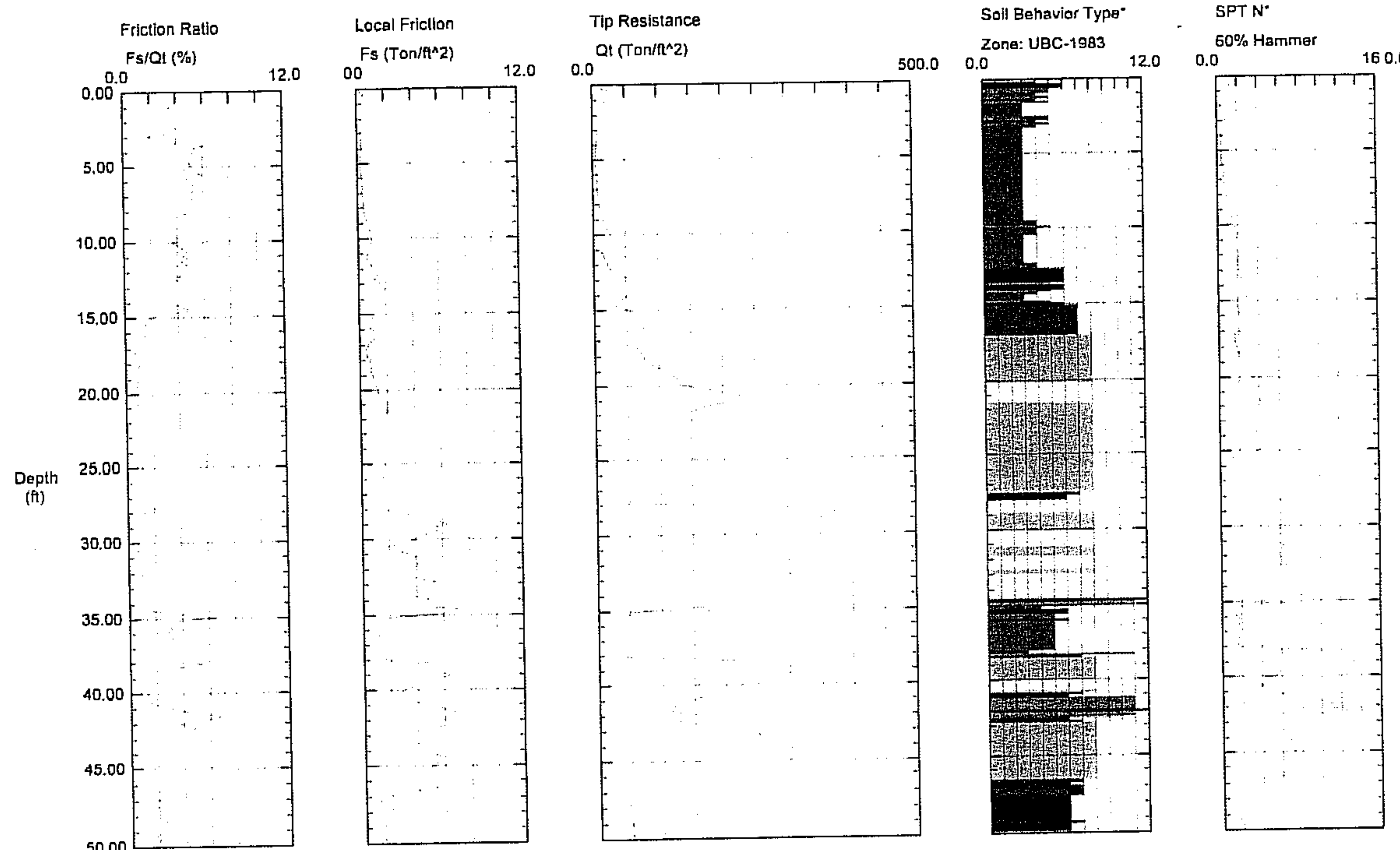
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and ... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W053
Cone Used: HO738TC

CPT Date/Time: 06-14-04 11:03
Location: CPT-2
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

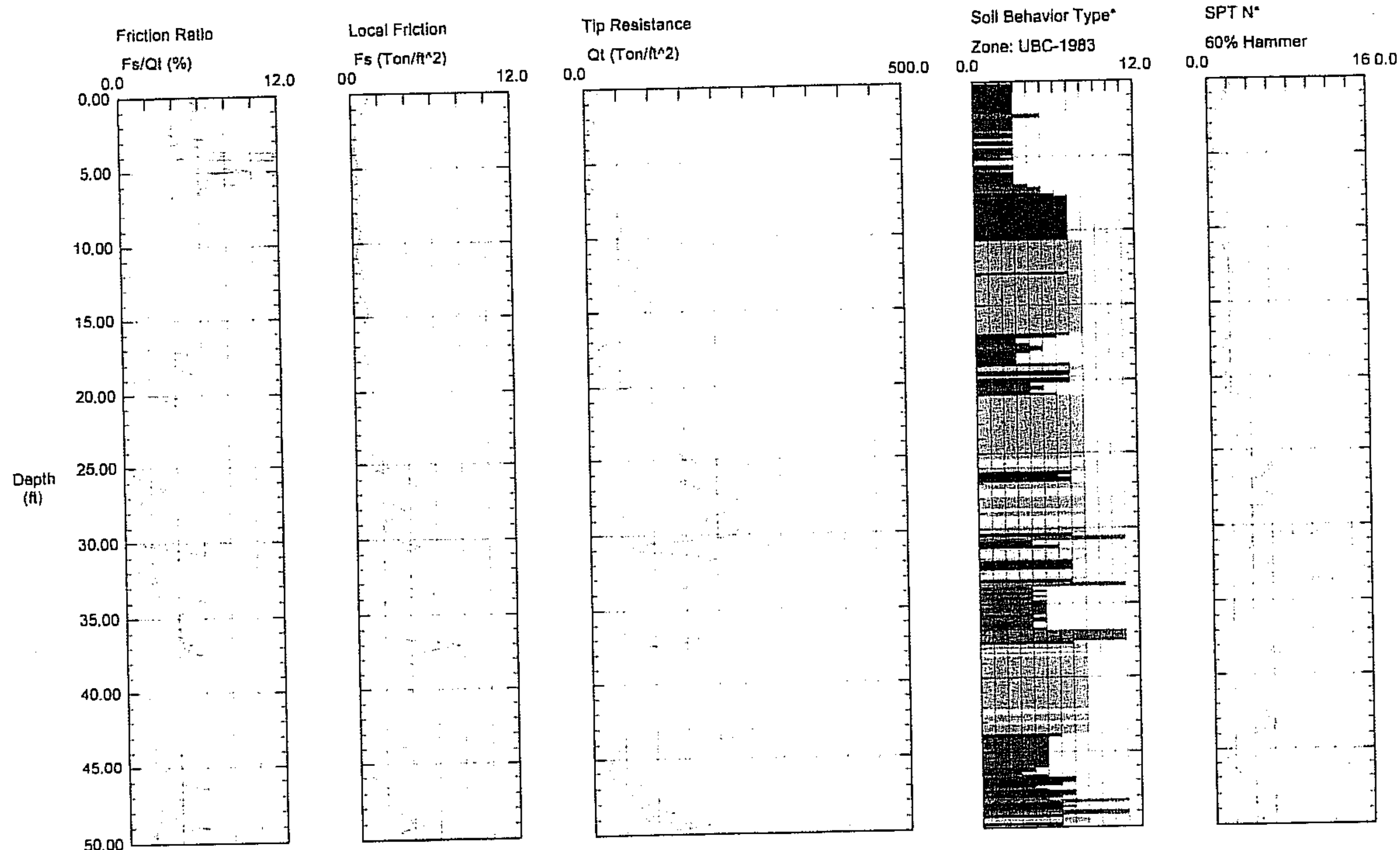
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W054
Cone Used: HO738TC

CPT Date/Time: 06-14-04 13:40
Location: CPT-3
Job Number: 4603.4100.01



Maximum Depth = 50.03 feet

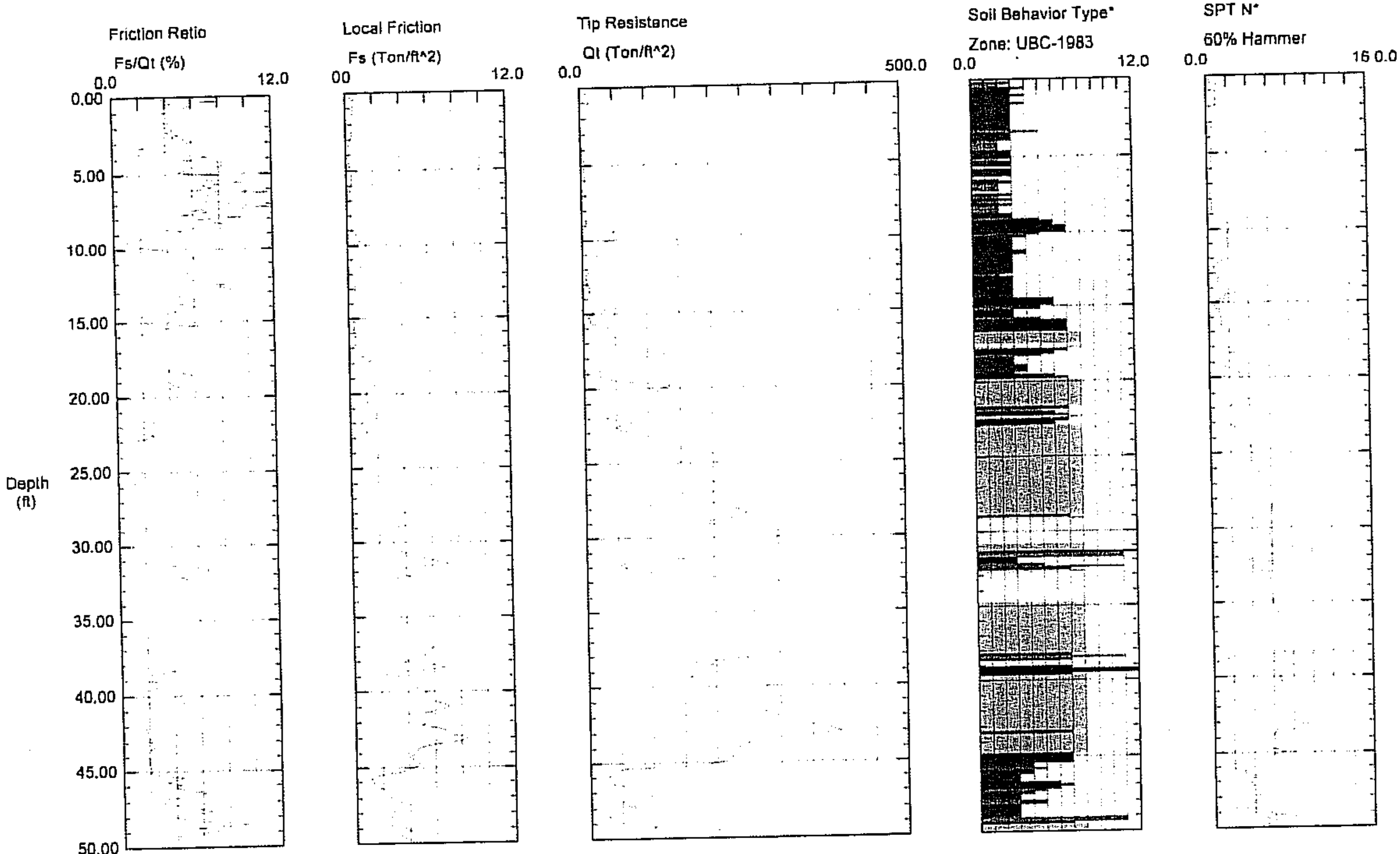
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W055
Cone Used: HO738TC

CPT Date/Time: 06-14-04 15:15
Location: CPT-4
Job Number: 4603.4100.01



Maximum Depth = 51.67 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

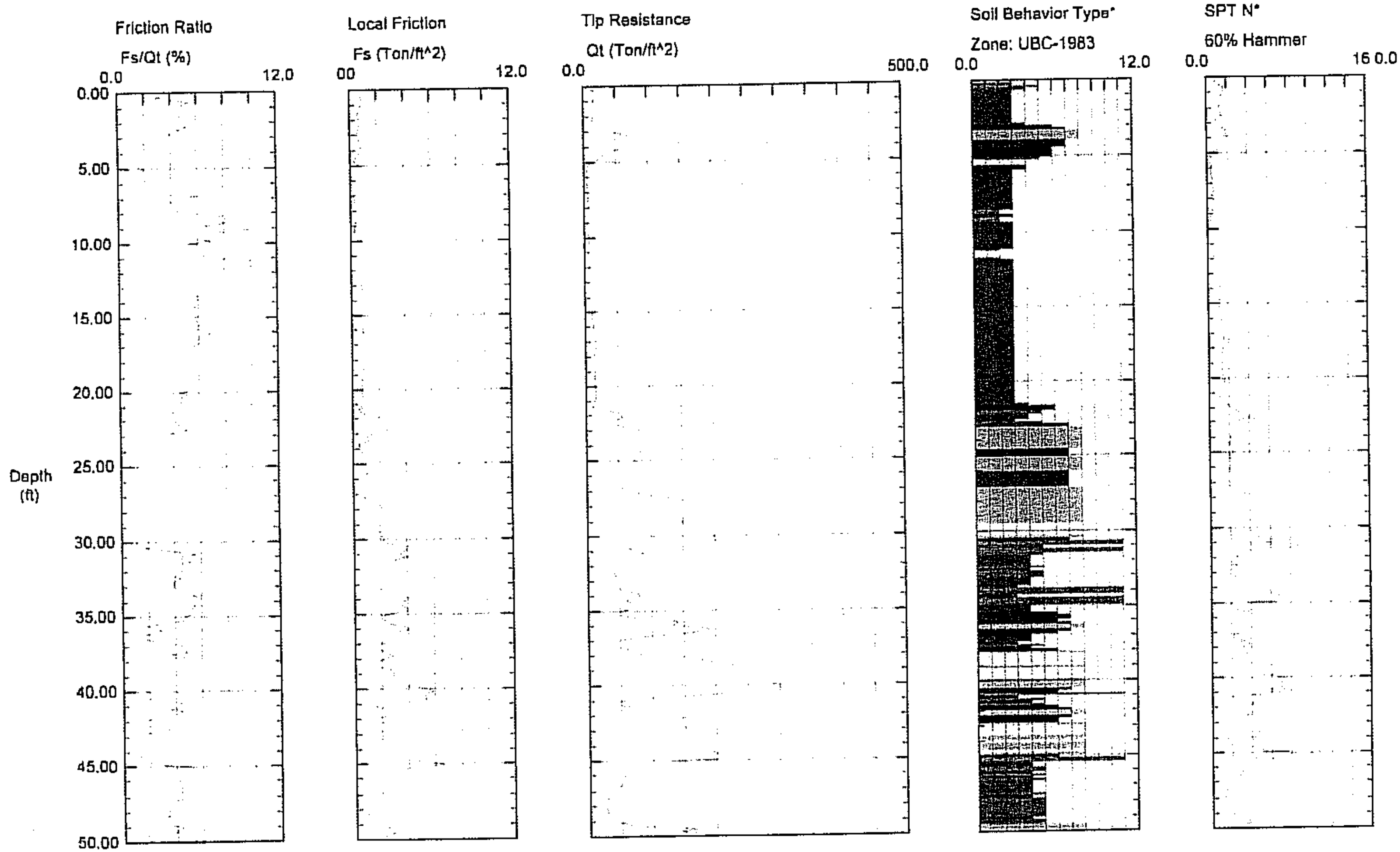
*oil behavior type and *ased on data from UBC-1 983

Soil behavior type anc ɔased on data from UBC-1 983

VBI In-Situ ˈesting

Operator: Mike Robertson
Sounding: 04W056
Cone Used: HO738TC

CPT Date/Time: 06-15-04 07:26
Location: CPT-5
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

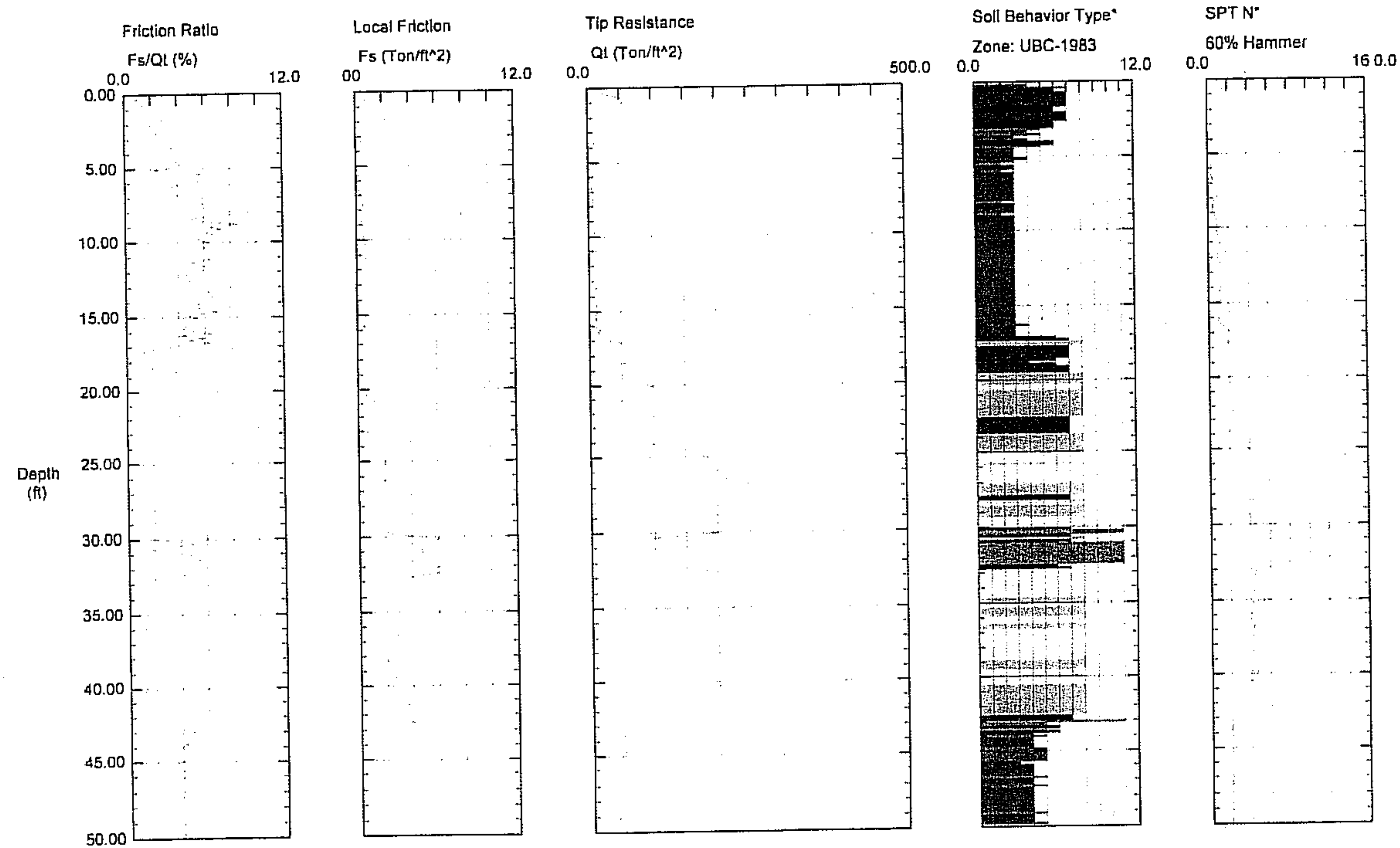
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   oased on data from UBC-1 983

VBI In-Situ 'resting

Operator: Mike Robertson
Sounding: 04W057
Cone Used: HO738TC

CPT Date/Time: 06-15-04 09:10
Location: CPT-6
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

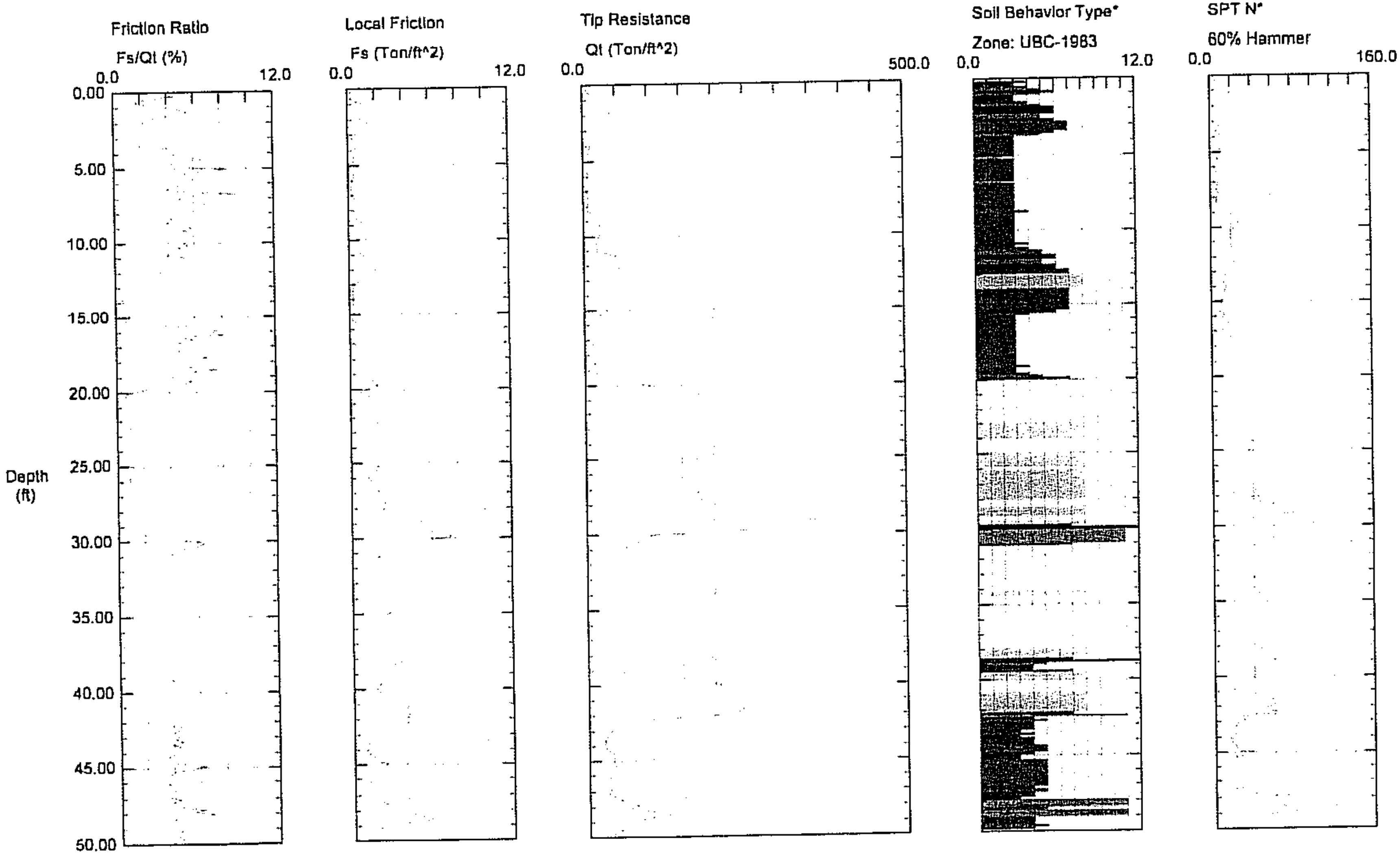
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W058
Cone Used: HO738TC

CPT Date/Time: 06-15-04 10:26
Location: CPT-7
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

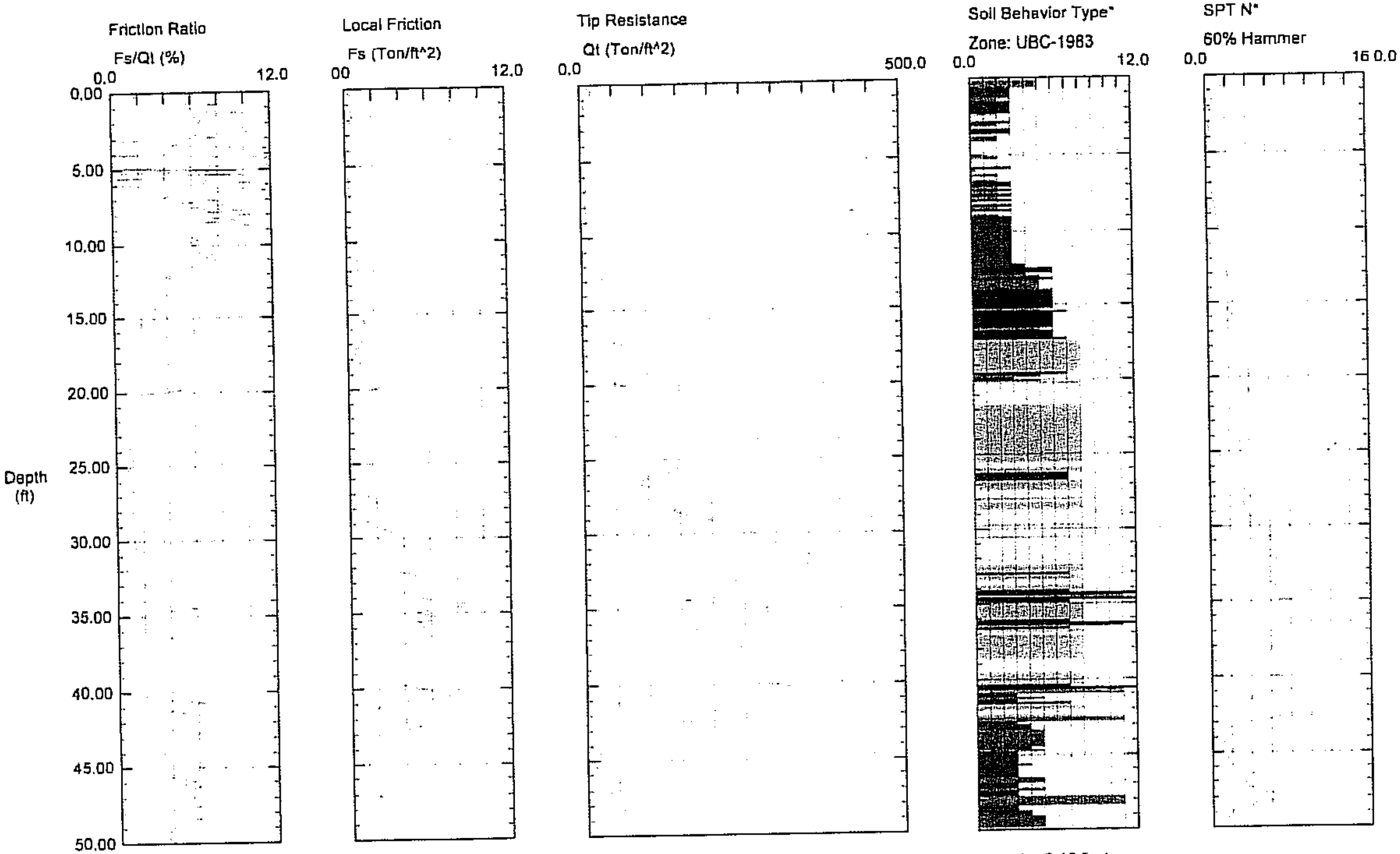
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an. based on data from UBC-1 983

VBI In-Situ esting

Operator: Mike Robertson
Sounding: 04W059
Cone Used: HO738TC

CPT Date/Time: 06-15-04 12:04
Location: CPT-8
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

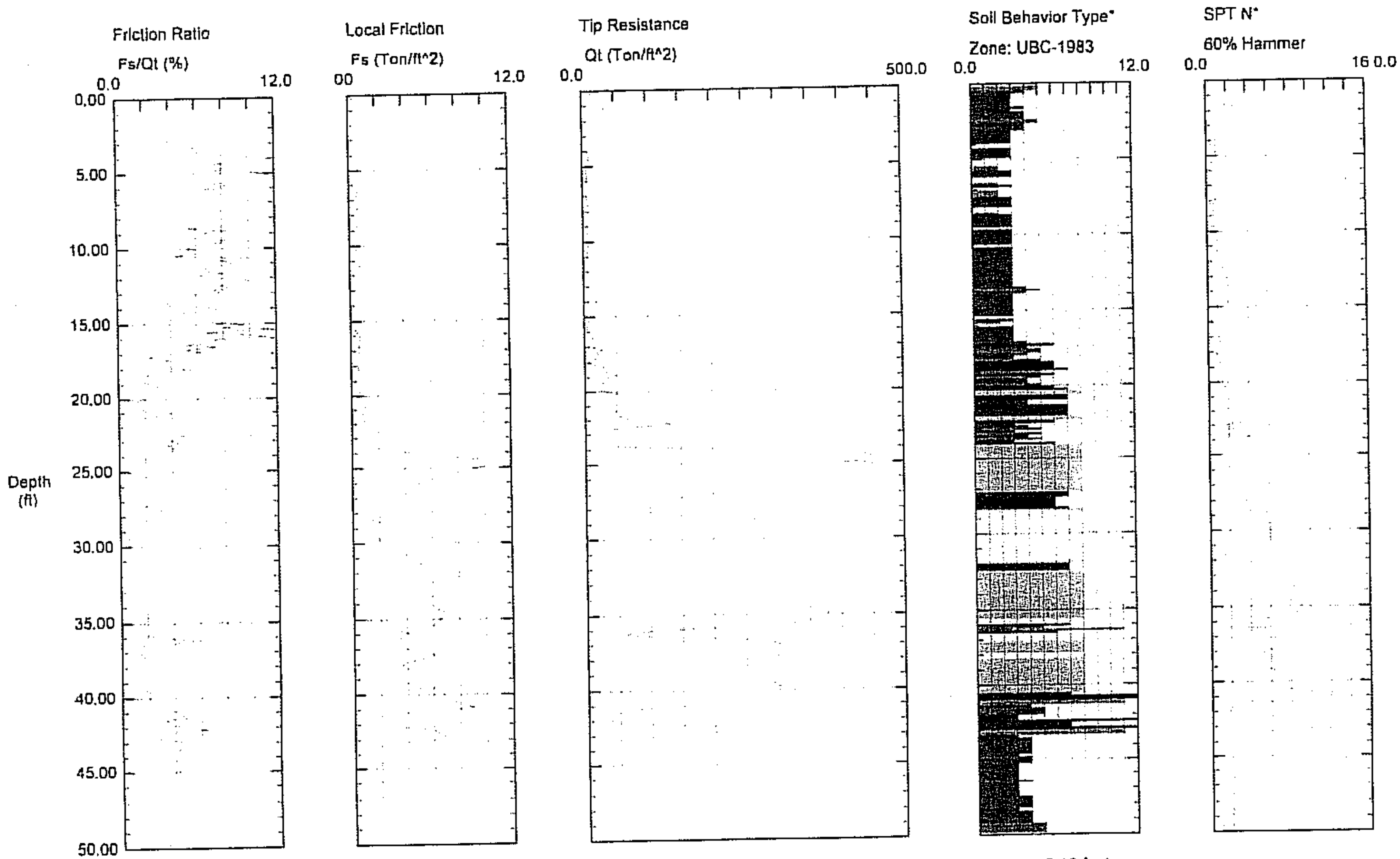
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   oased on data from UBC-1 983

VBI In-Situ ᵣesting

Operator: Mike Robertson
Sounding: 04W060
Cone Used: HO738TC

CPT Date/Time: 06-15-04 13:46
Location: CPT-9
Job Number: 4603.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

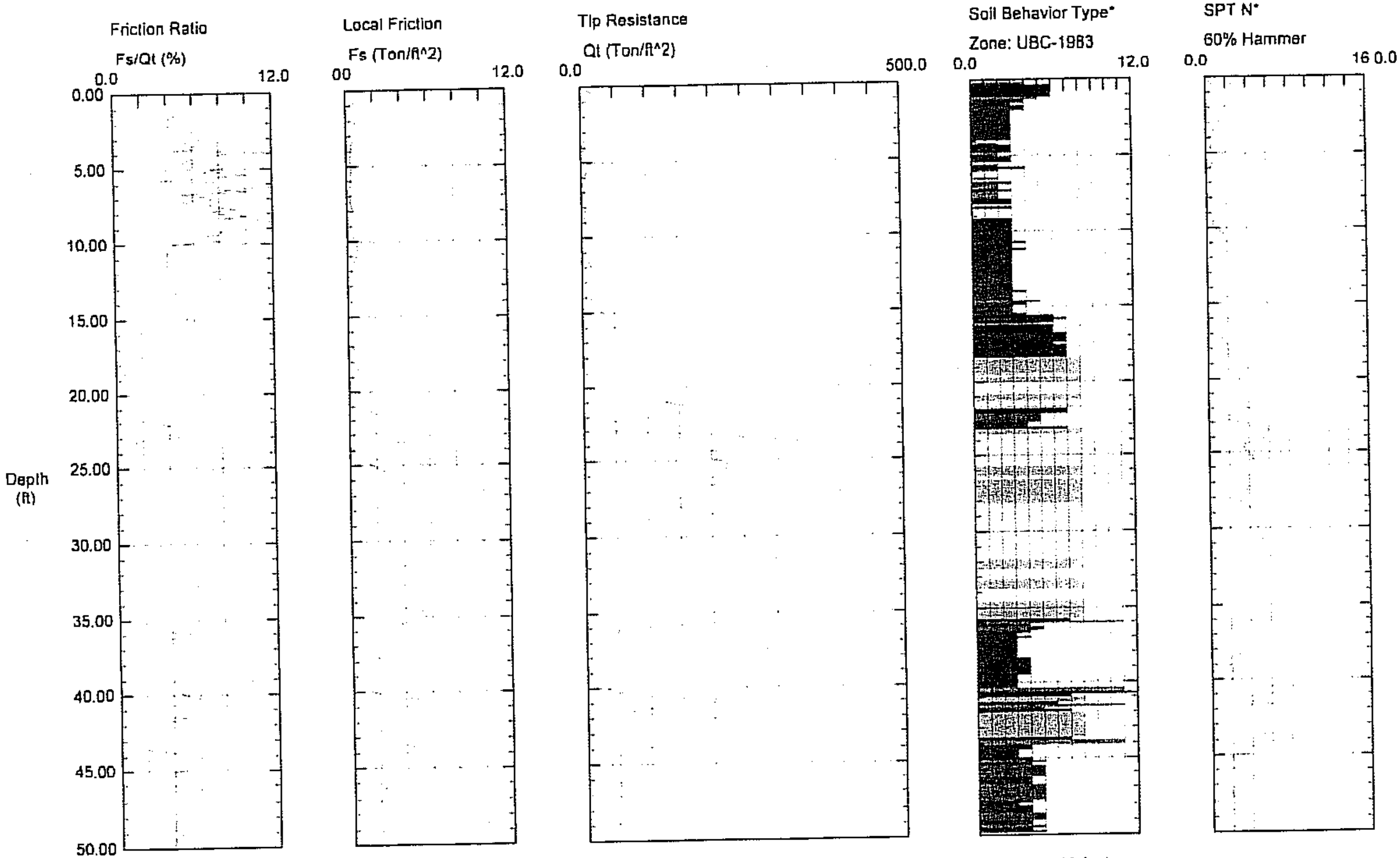
1 sensitive fine grained
2 organic material
3 - clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Soil behavior type and ased on data from UBC-1 983

Operator: Mike Robertson
Sounding: 04W061
Cone Used: HO738TC

CPT Date/Time: 06-15-04 15:22
Location: CPT-10
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

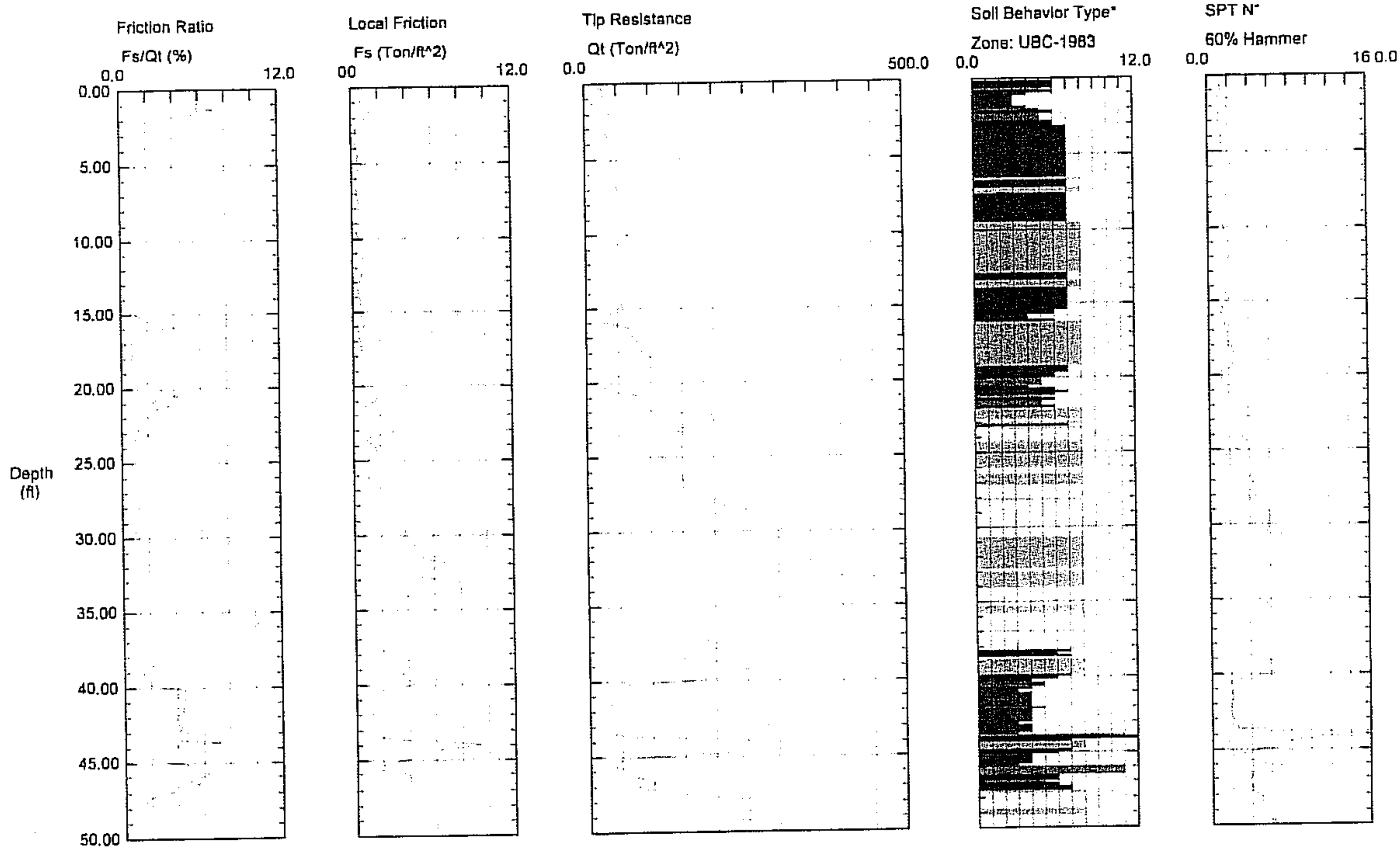
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W062
Cone Used: HO738TC

CPT Date/Time: 06-15-04 16:34
Location: CPT-11
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

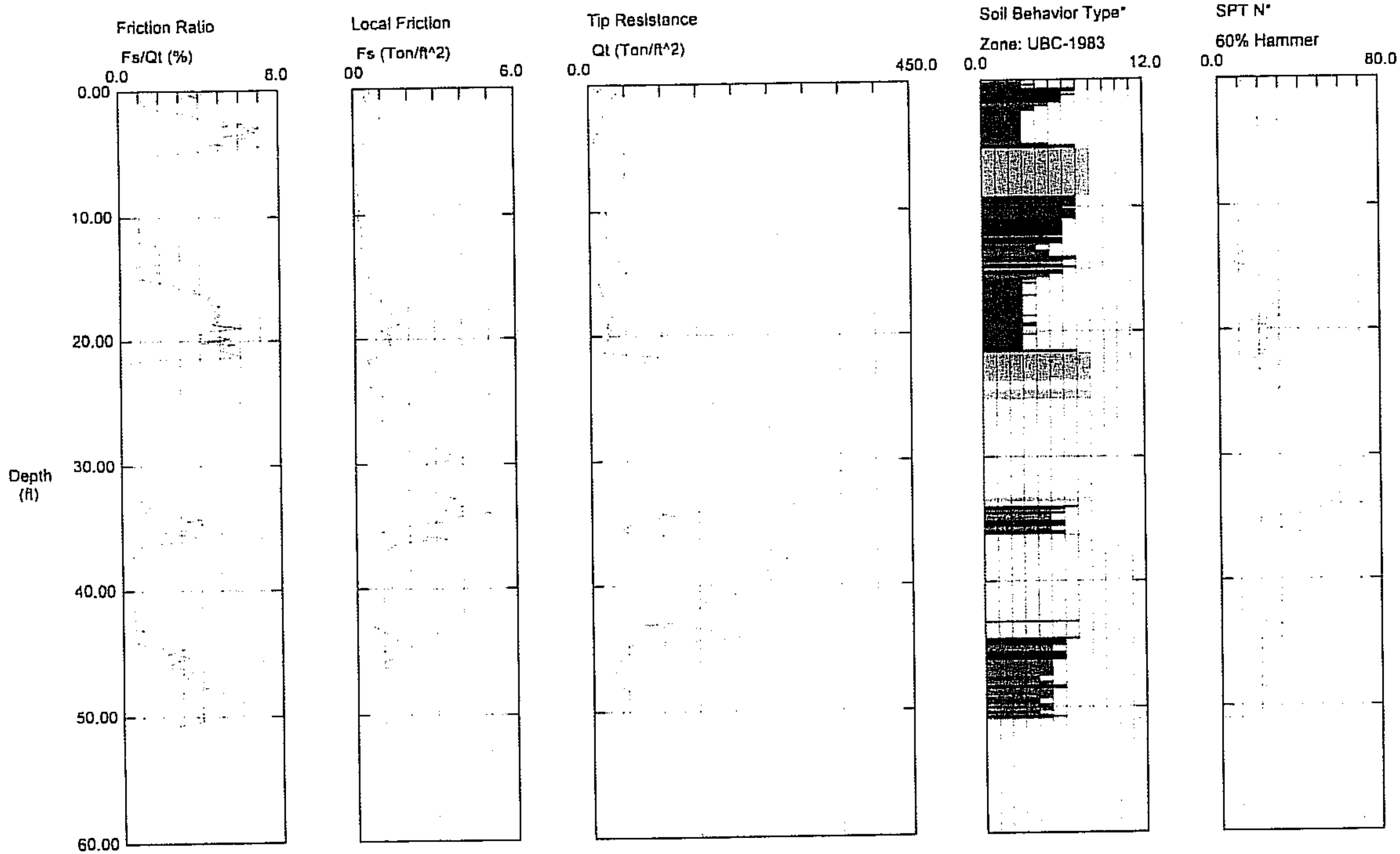
Soil behavior type and ... based on data from UBC-1983

Soil behavior type anc   ɹased on data from UBC-1 983

VBI In-Situ ˈɾesting

Operator: Mike Robertson
Sounding: 04W063
Cone Used: HO839TC

CPT Date/Time: 06-16-04 07:27
Location: CPT-12
Job Number: 4603.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

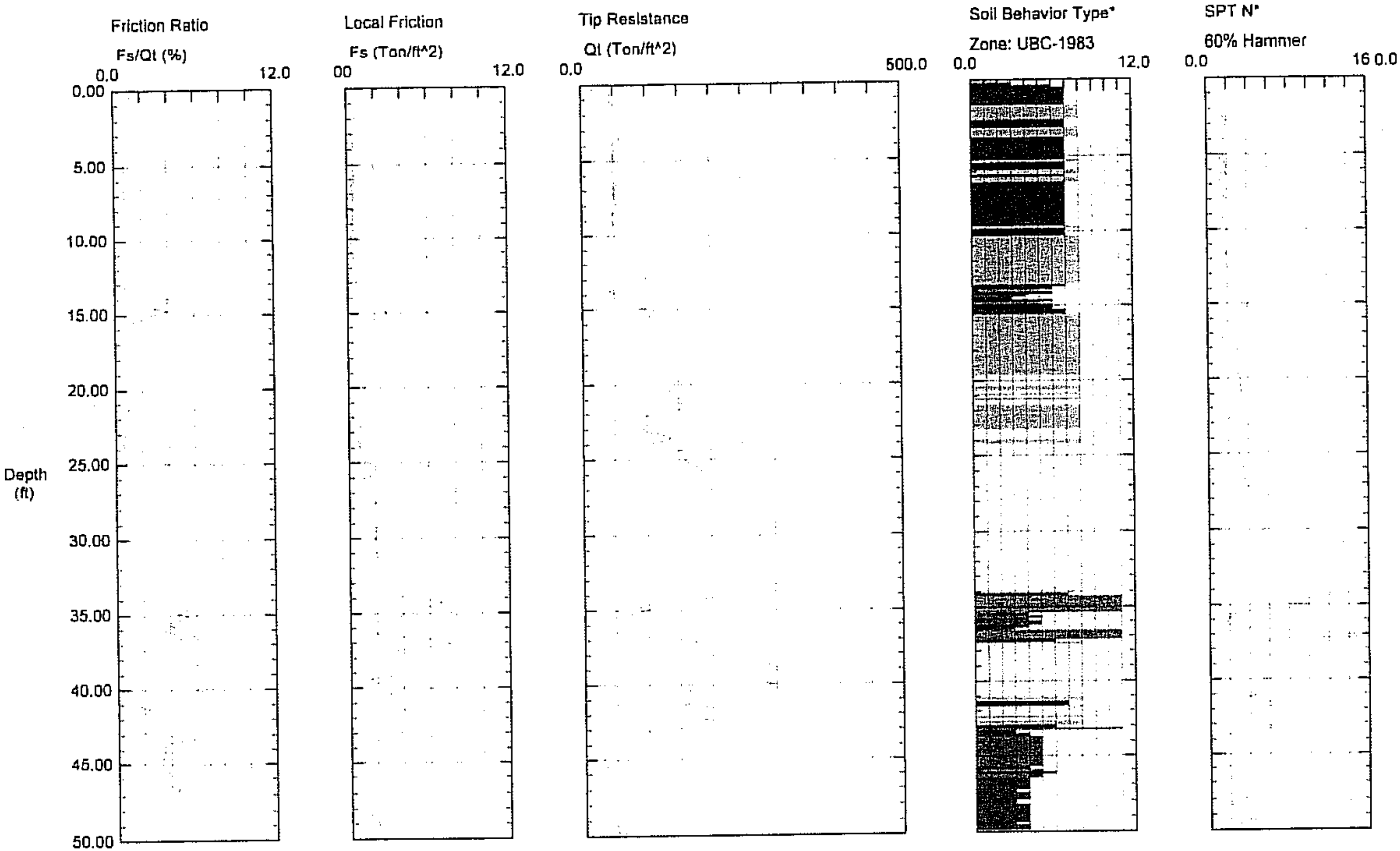
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type an. based on data from UBC-1 983

VBI In-Situ ſesting

Operator: Mike Robertson
Sounding: 04W064
Cone Used: HO839TC

CPT Date/Time: 06-16-04 08:45
Location: CPT-13
Job Number: 4603.4100.01



Maximum Depth = 52.49 feet

Depth Increment = 0.16 feet

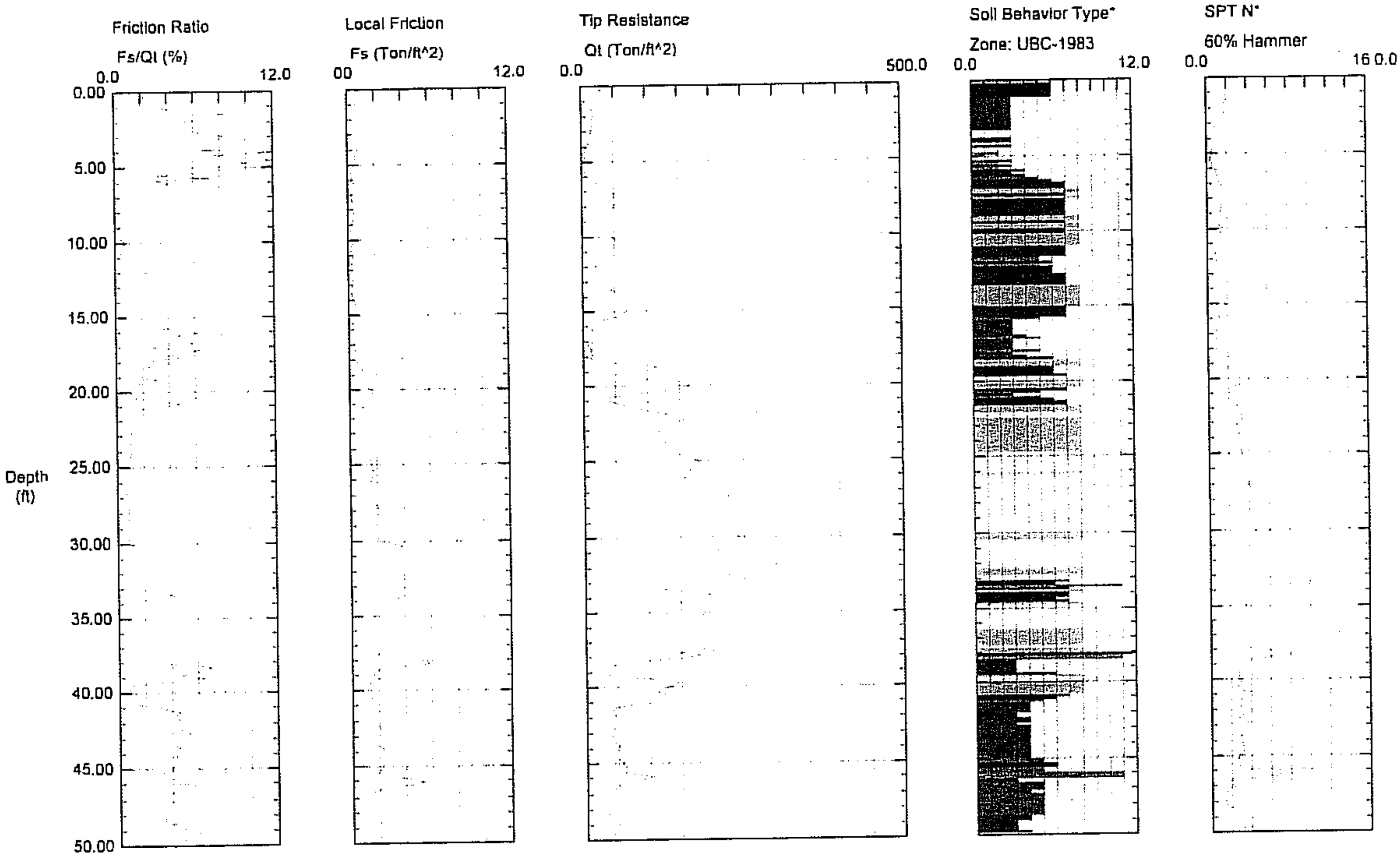
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type at based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W065
Cone Used: HO839TC

CPT Date/Time: 06-16-04 11:12
Location: CPT-14
Job Number: 4603.4100.01



Maximum Depth = 50.20 feet

Depth Increment = 0.16 feet

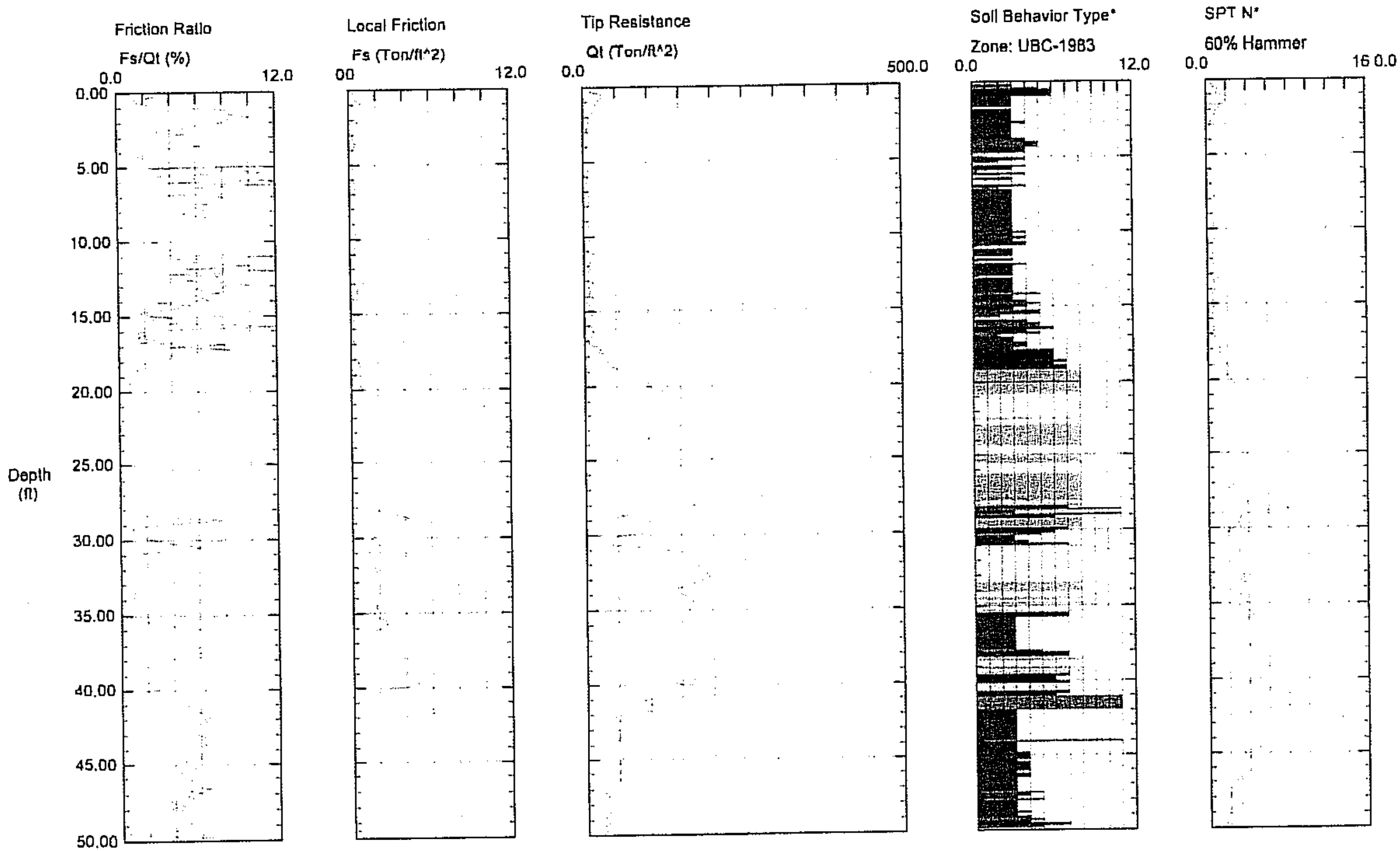
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type an based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W066
Cone Used: HO839TC

CPT Date/Time: 06-16-04 13:05
Location: CPT-15
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

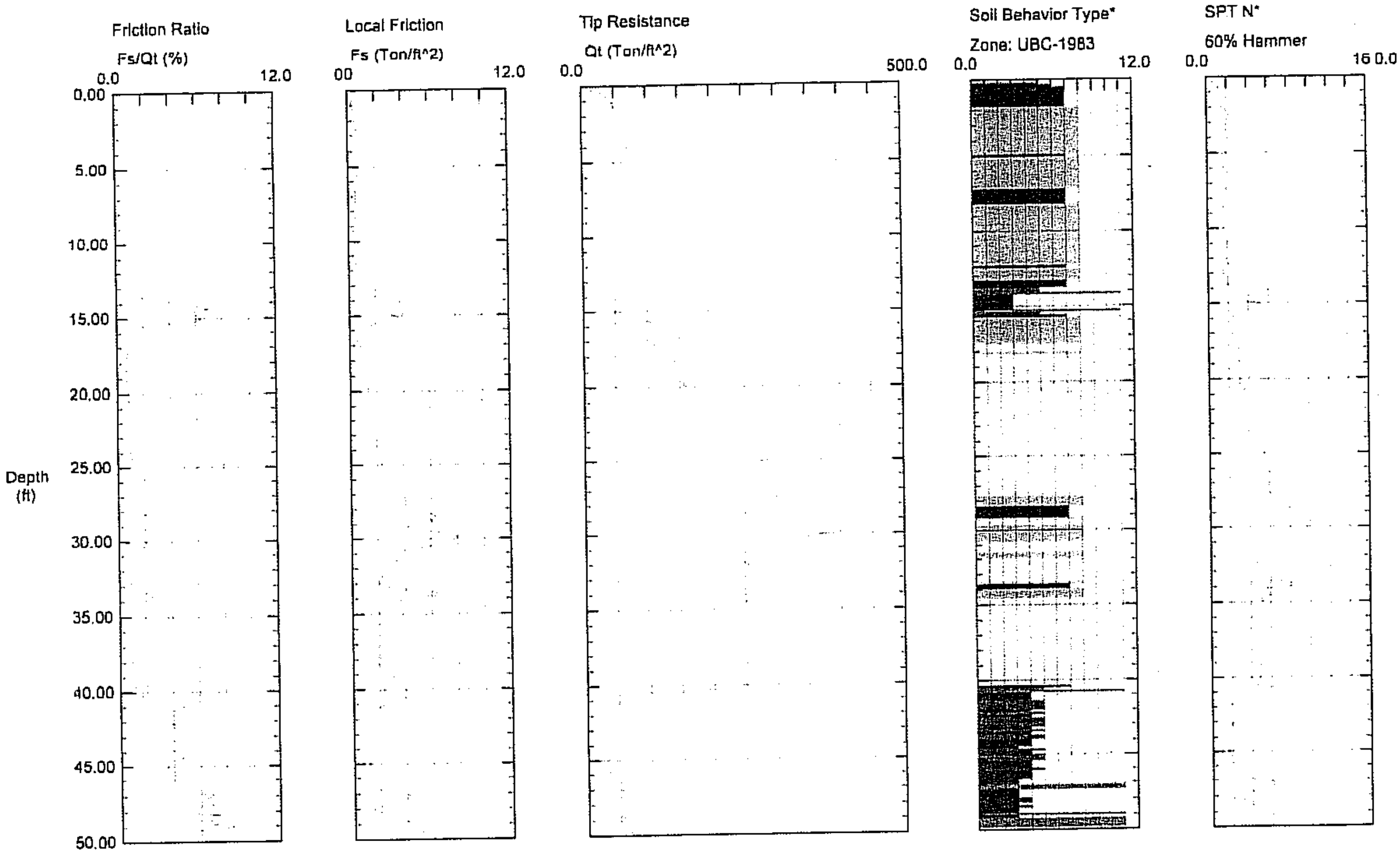
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type ar. based on data from UBC-1 983

VBI In-Situ esting

Operator: Mike Robertson
Sounding: 04W067
Cone Used: HO839TC

CPT Date/Time: 06-16-04 14:57
Location: CPT-16
Job Number: 4603.4100.01



Maximum Depth = 51.51 feet

Depth Increment = 0.16 feet

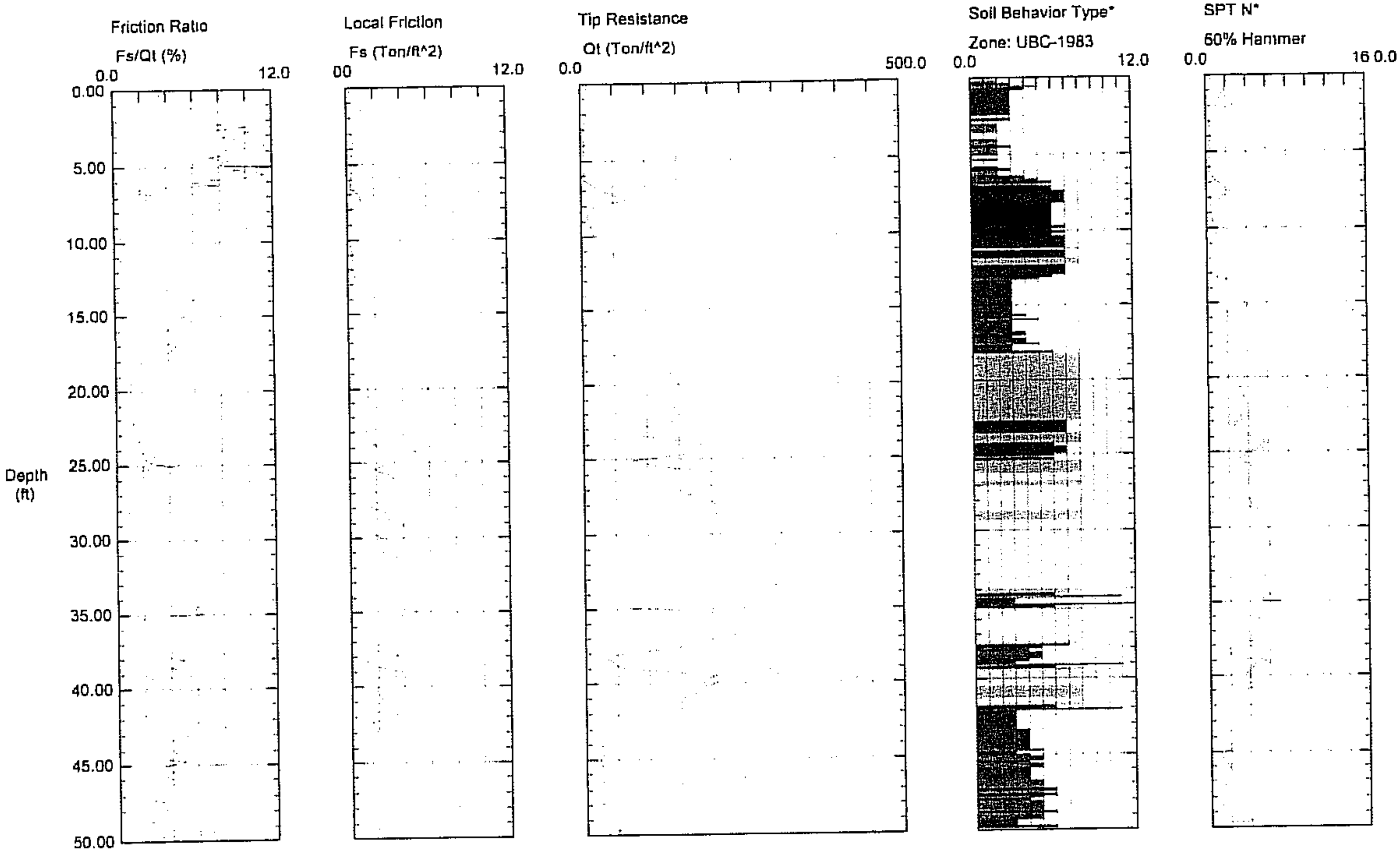
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   ɔased on data from UBC-1 983

VBI In-Situ ꞅesting

Operator: Mike Robertson
Sounding: 04W068
Cone Used: HO839TC

CPT Date/Time: 06-17-04 07:25
Location: CPT-17
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

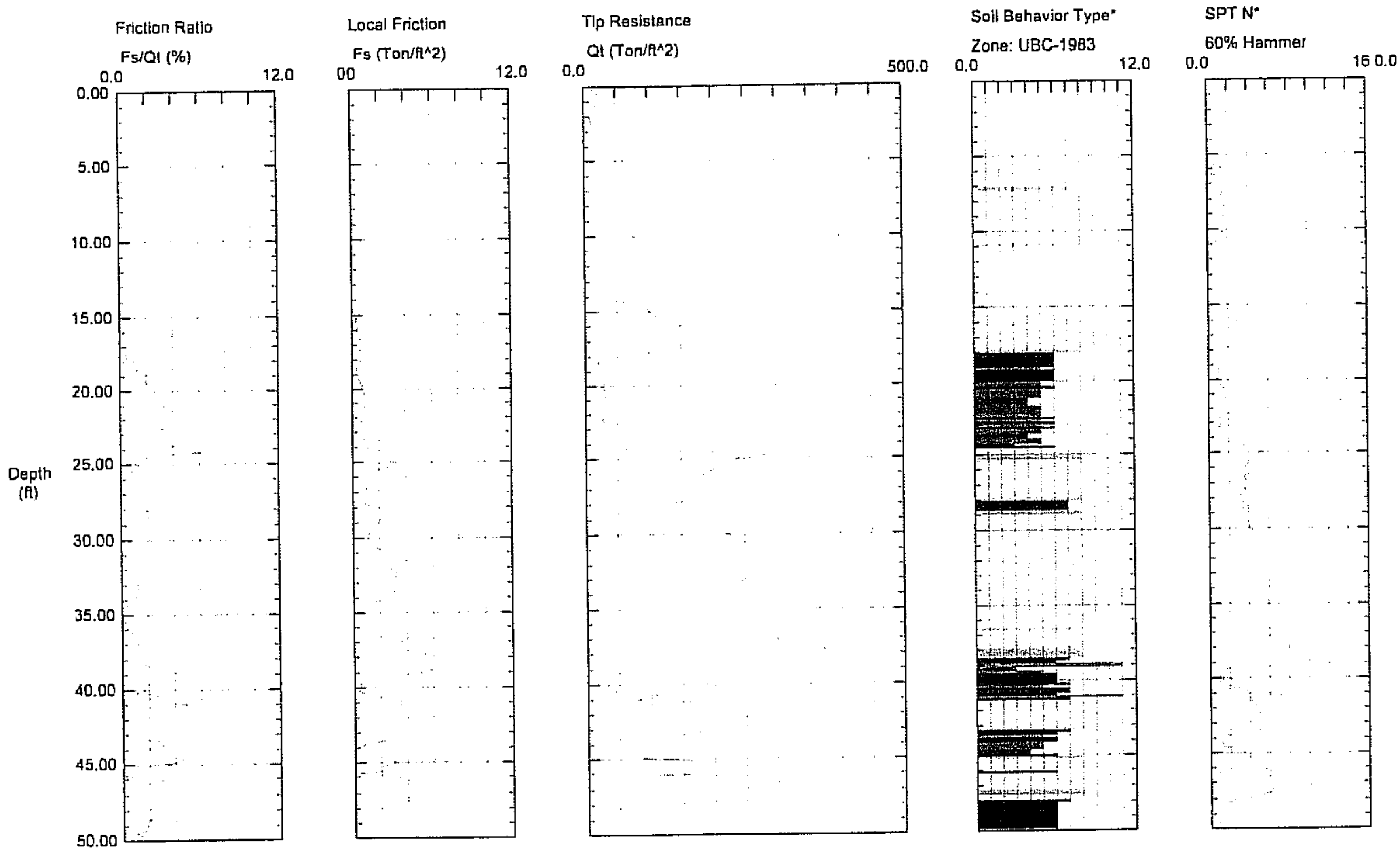
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type an based on data from UBC-1 983

VBI In-Situ ı esting

Operator: Mike Robertson
Sounding: 04W069
Cone Used: HO839TC

CPT Date/Time: 06-17-04 08:42
Location: CPT-18
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

Depth Increment = 0.16 feet

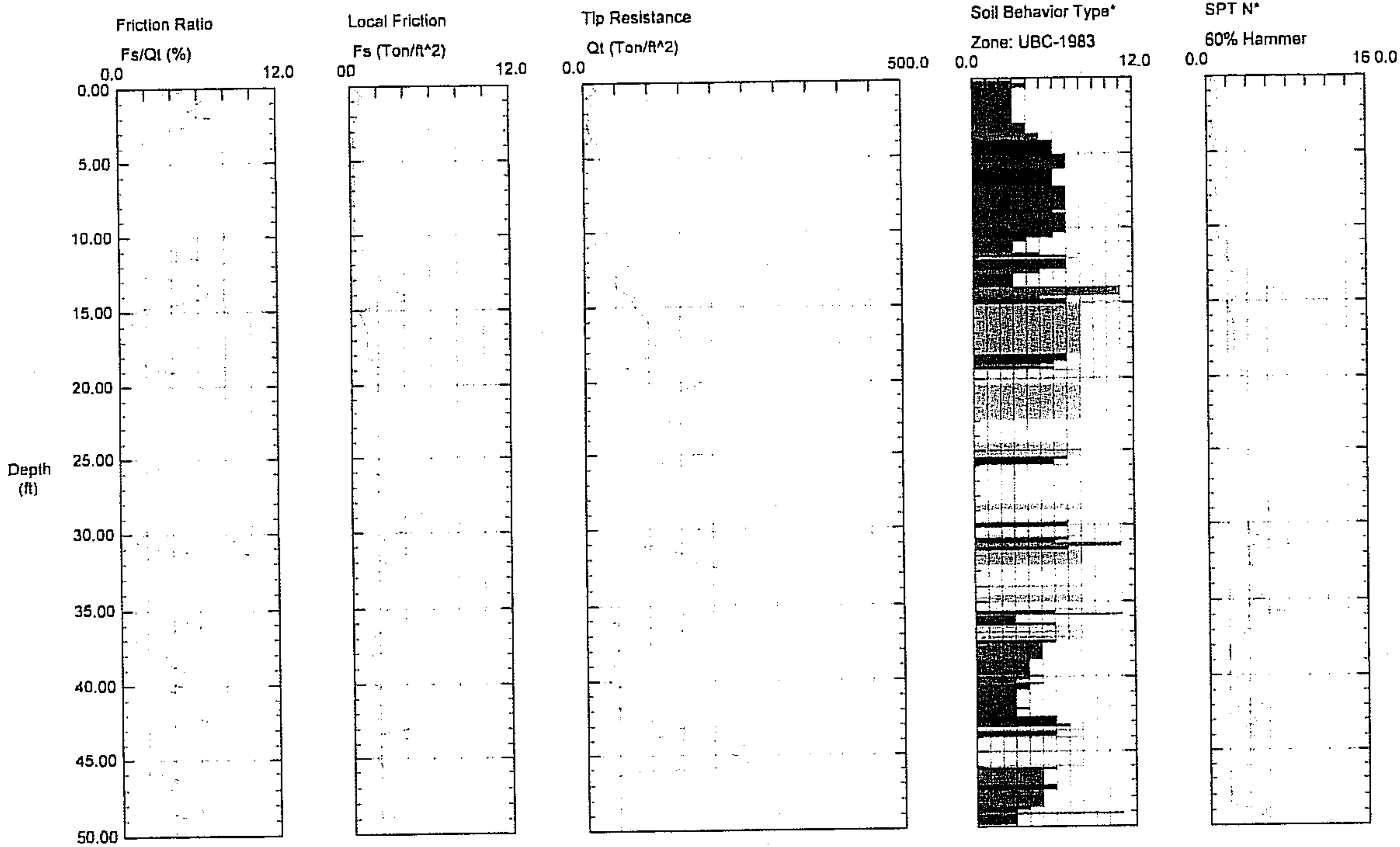
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an ɔased on data from UBC-1 983

VBI In-Situ ⌐esting

Operator: Mike Robertson
Sounding: 04W070
Cone Used: HO839TC

CPT Date/Time: 06-17-04 10:37
Location: CPT-19
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

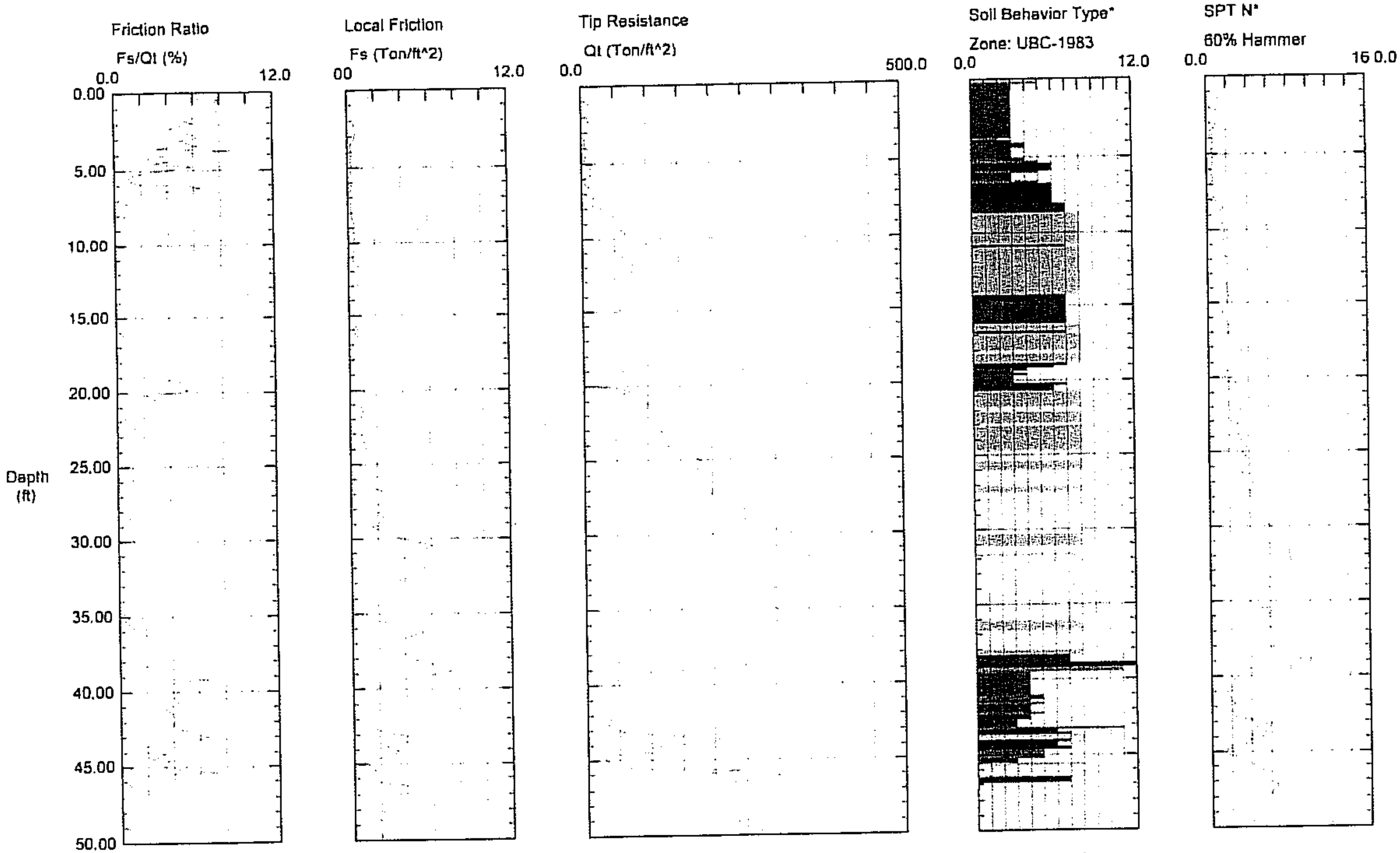
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   Jased on data from UBC-1 983

VBI In-Situ ı esting

Operator: Mike Robertson
Sounding: 04W071
Cone Used: HO839TC

CPT Date/Time: 06-17-04 11:40
Location: CPT-20
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

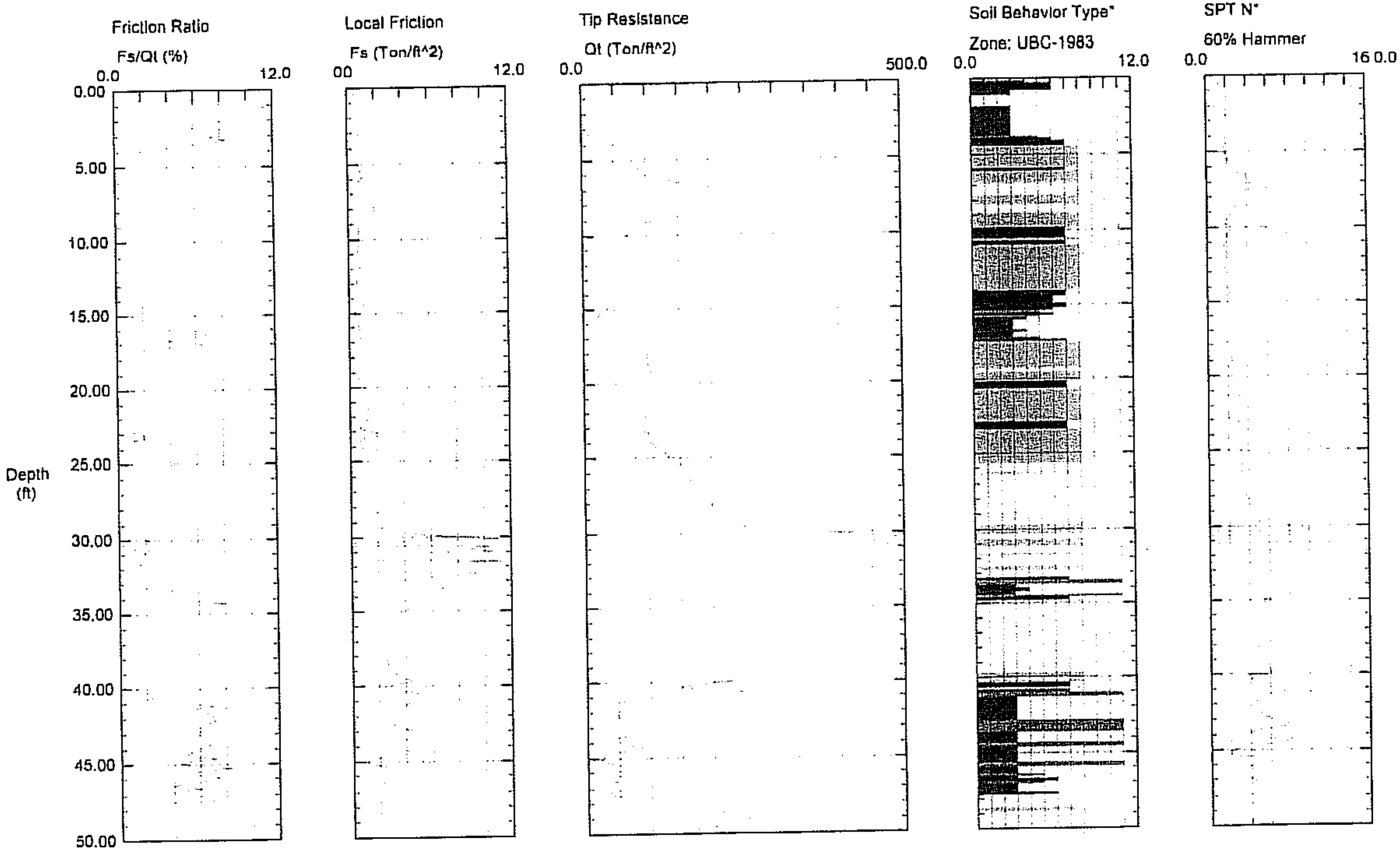
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ esting

Operator: Mike Robertson
Sounding: 04W072
Cone Used: HO839TC

CPT Date/Time: 06-17-04 12:40
Location: CPT-21
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

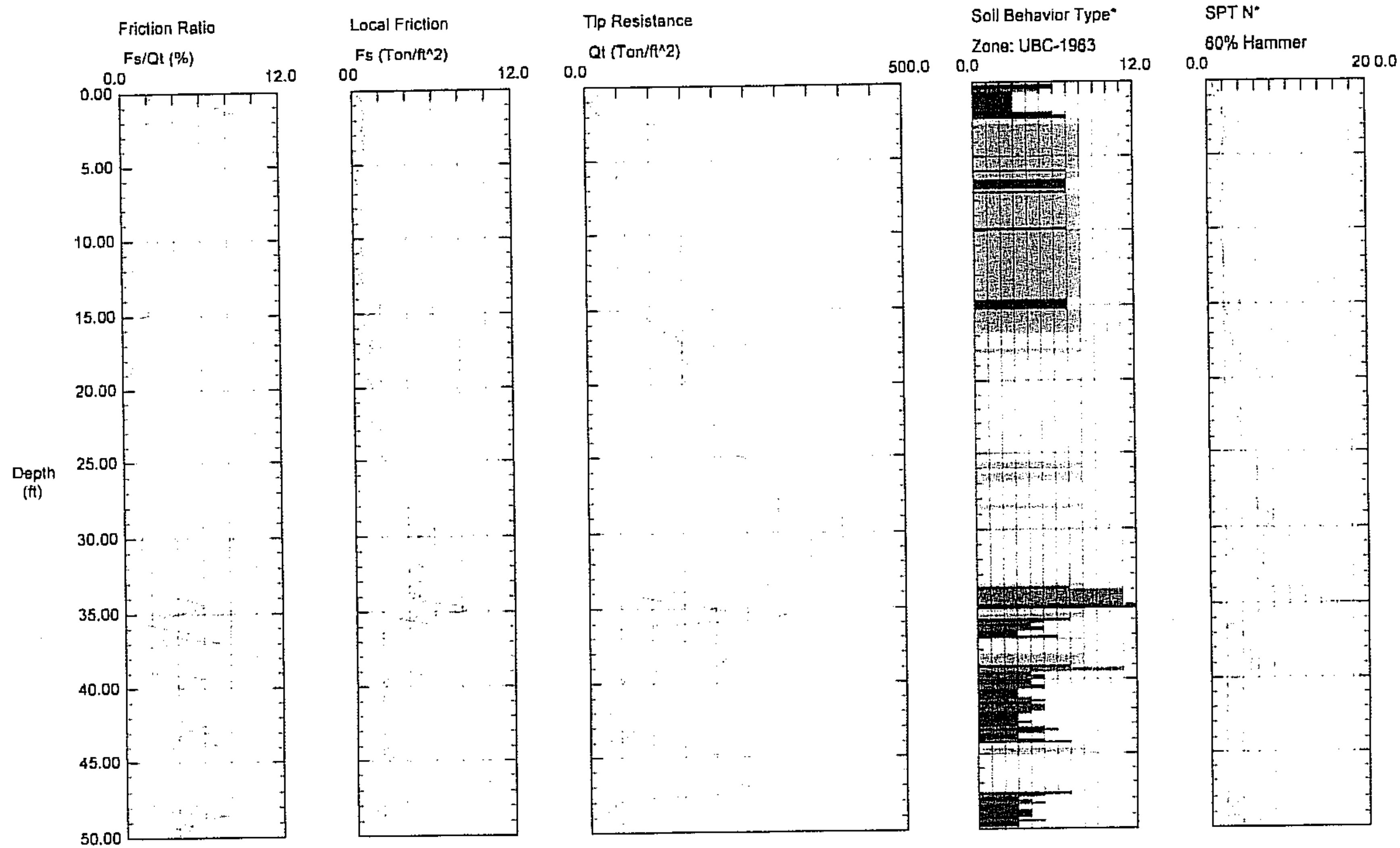
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W073
Cone Used: HO839TC

CPT Date/Time: 06-17-04 14:33
Location: CPT-22
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

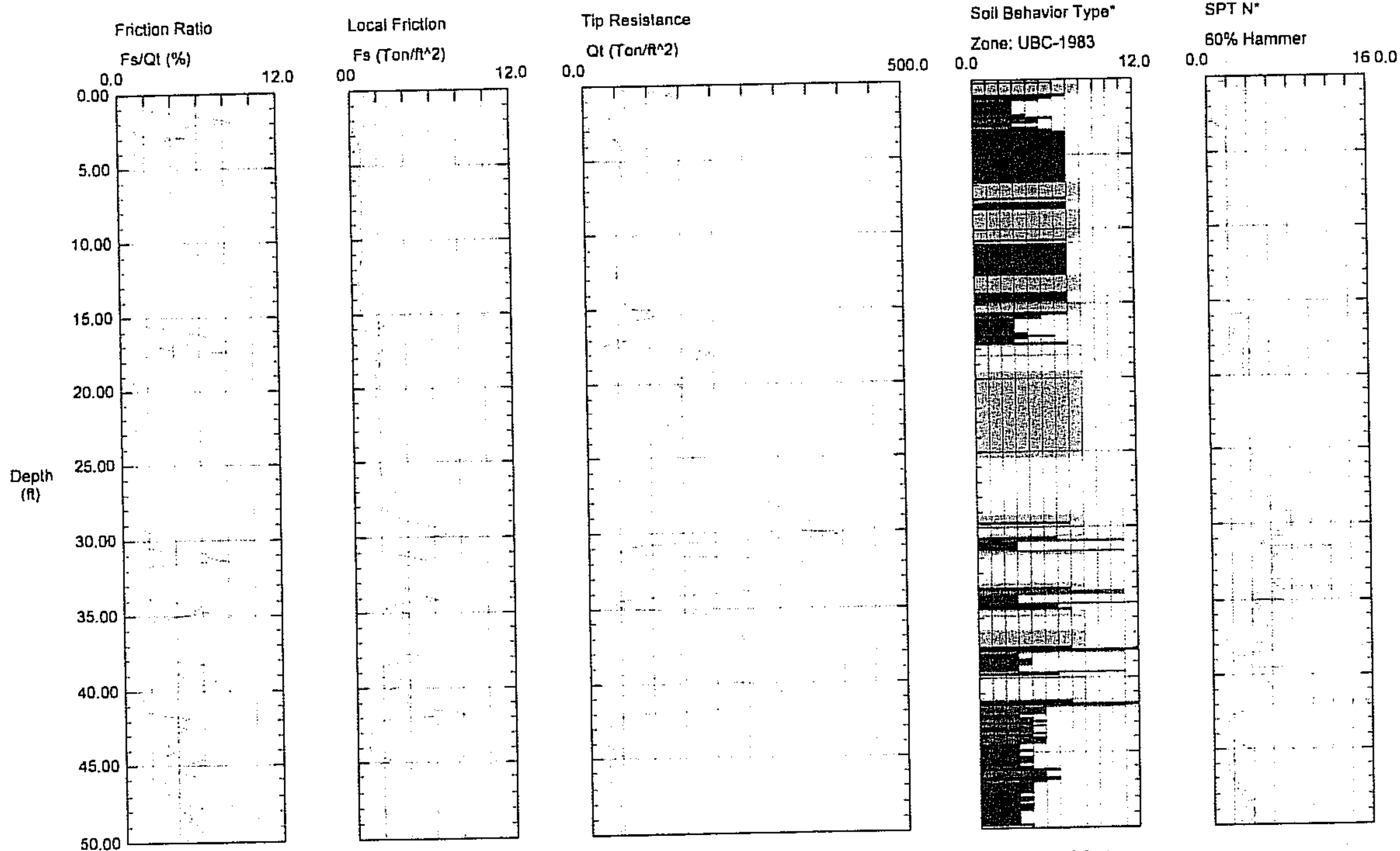
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W074
Cone Used: HO839TC

CPT Date/Time: 06-17-04 15:42
Location: CPT-23
Job Number: 4803.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

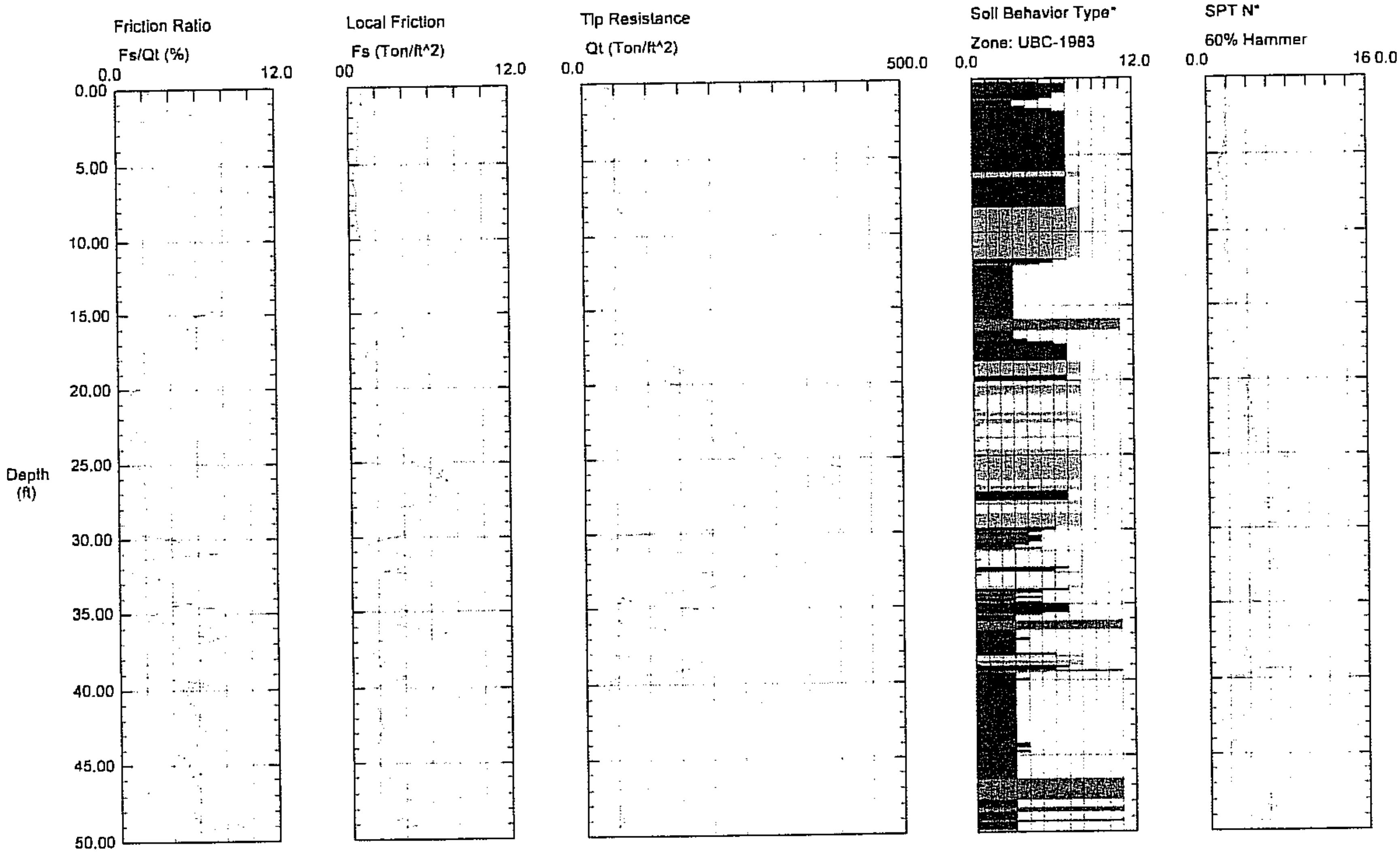
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W075
Cone Used: HO839TC

CPT Date/Time: 06-17-04 16:56
Location: CPT-24
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

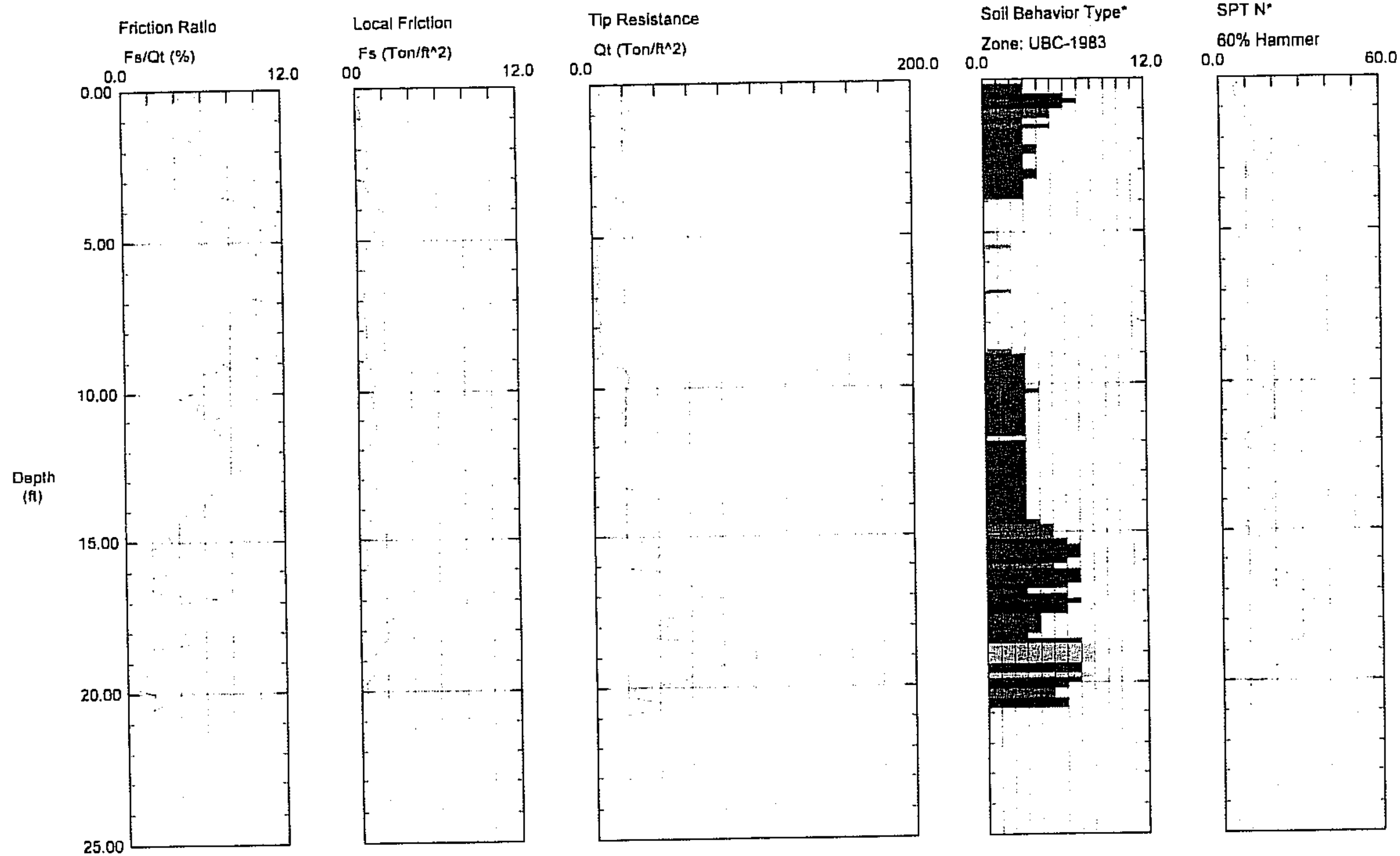
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   ɔased on data from UBC-1 983

VBI In-Situ ɾesting

Operator: Mike Robertson
Sounding: 04W088
Cone Used: HO856TC

CPT Date/Time: 07-14-04 11:04
Location: CPT-27
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

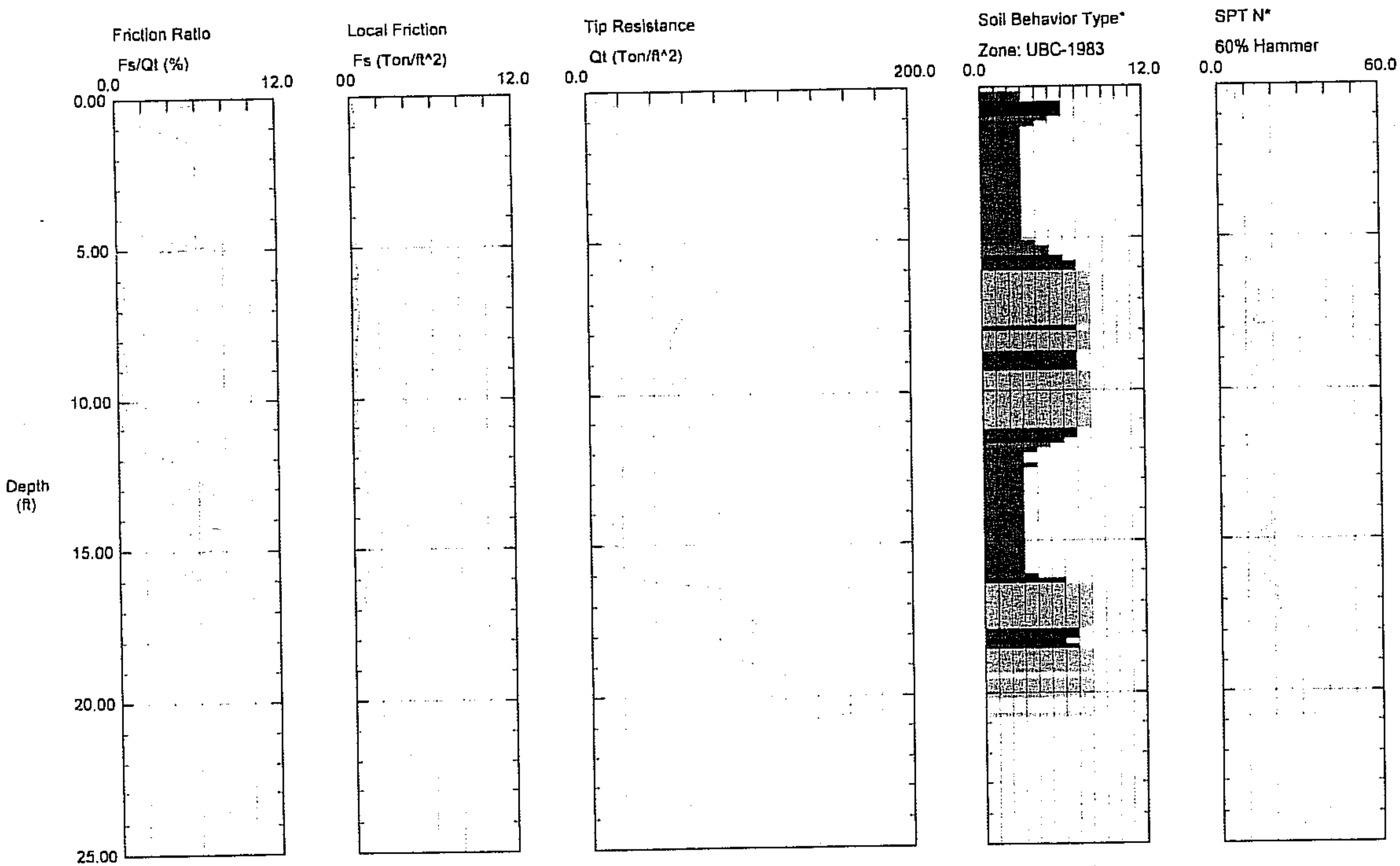
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type ar.   based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w089
Cone Used: HO856TC

CPT Date/Time: 07-14-04 13:14
Location: CPT-28
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

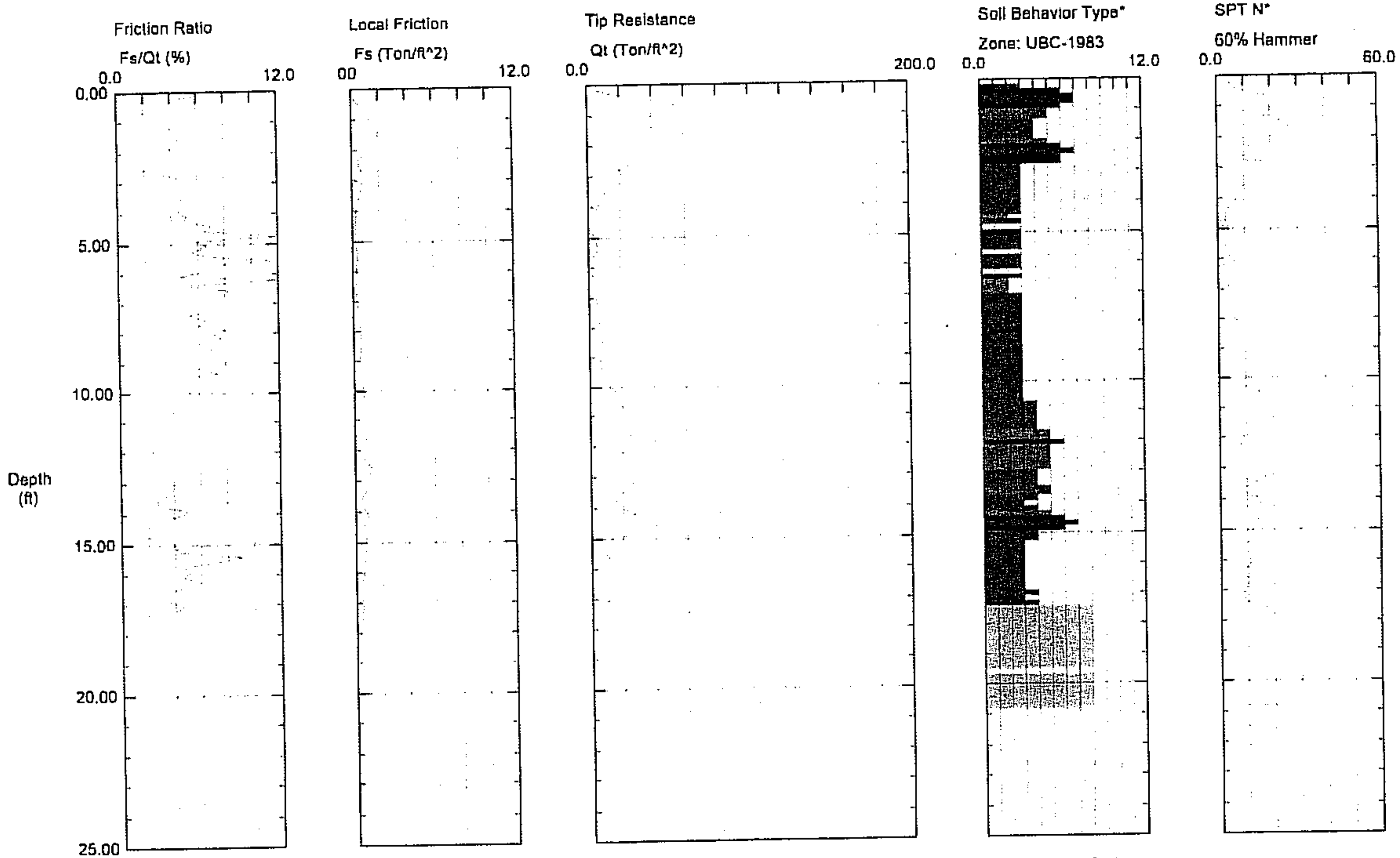
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an. based on data from UBC-1 983

VBI In-Situ ı esting

Operator: Mike Robertson
Sounding: 04w090
Cone Used: HO856TC

CPT Date/Time: 07-14-04 14:17
Location: CPT-29
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

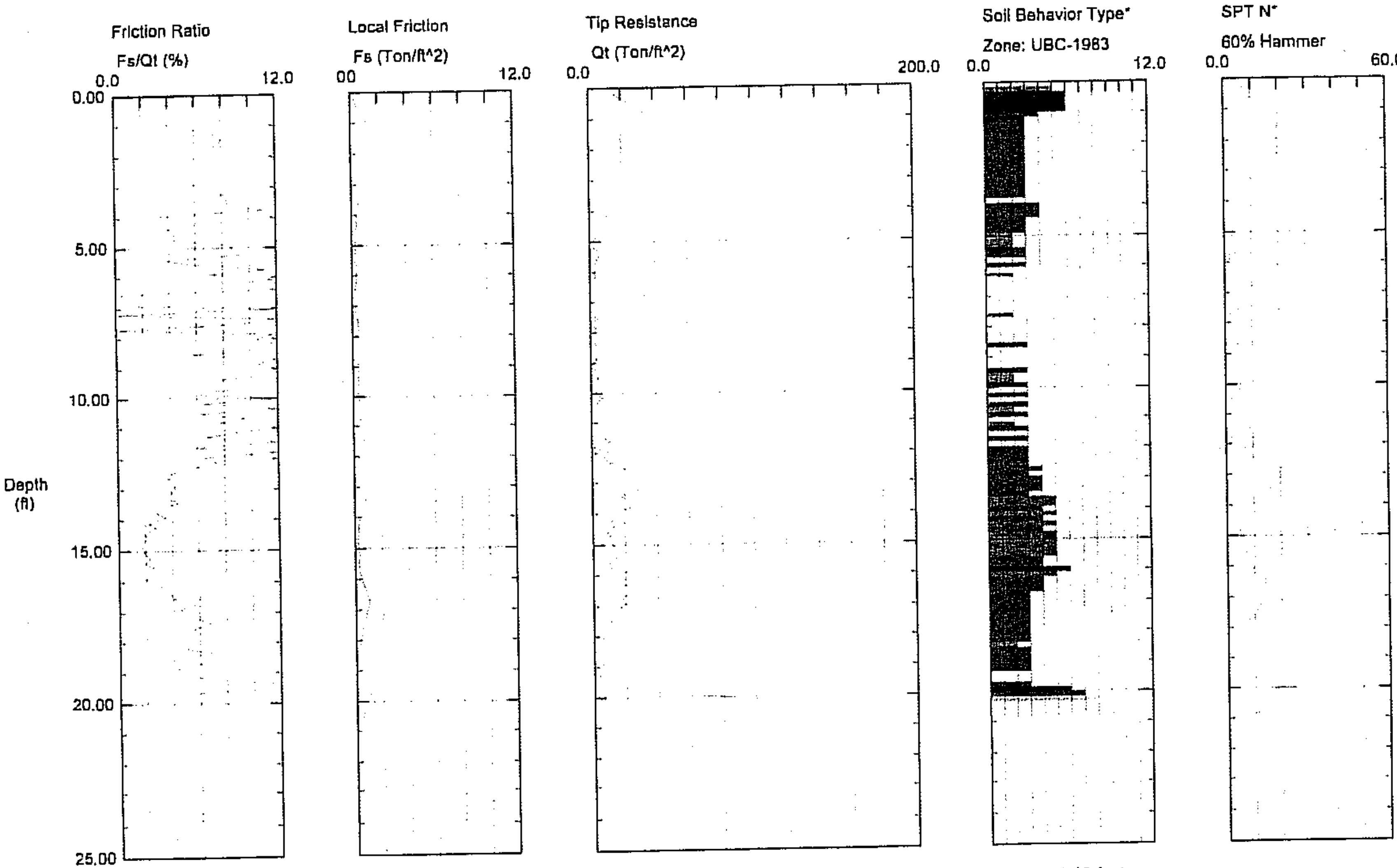
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc based on data from UBC-1 983

VBI In-Situ resting

Operator: Mike Robertson
Sounding: 04w091
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:10
Location: CPT-30
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

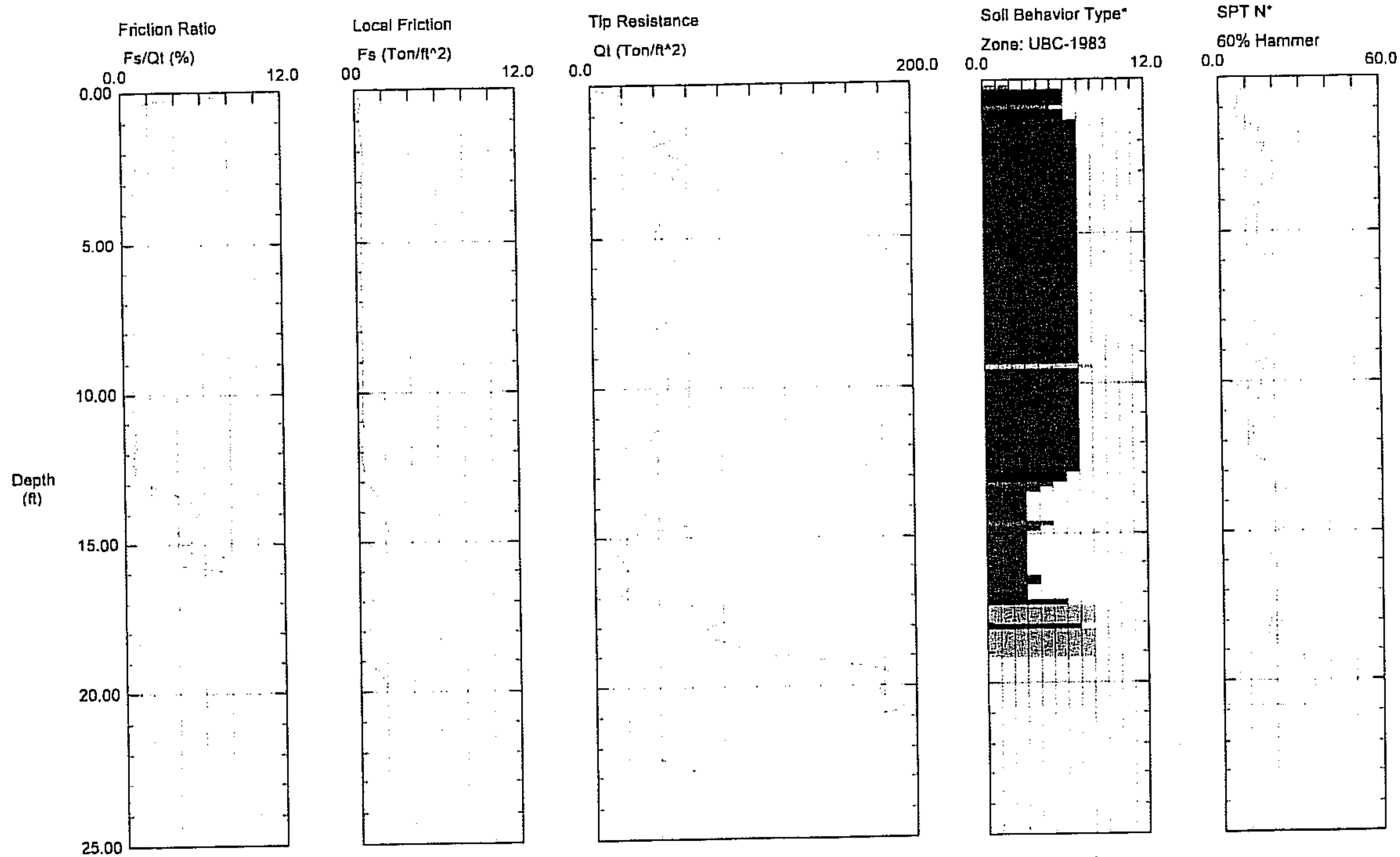
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anı based on data from UBC-1 983

VBI In-Situ ׀esting

Operator: Mike Robertson
Sounding: 04w092
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:59
Location: CPT-31
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

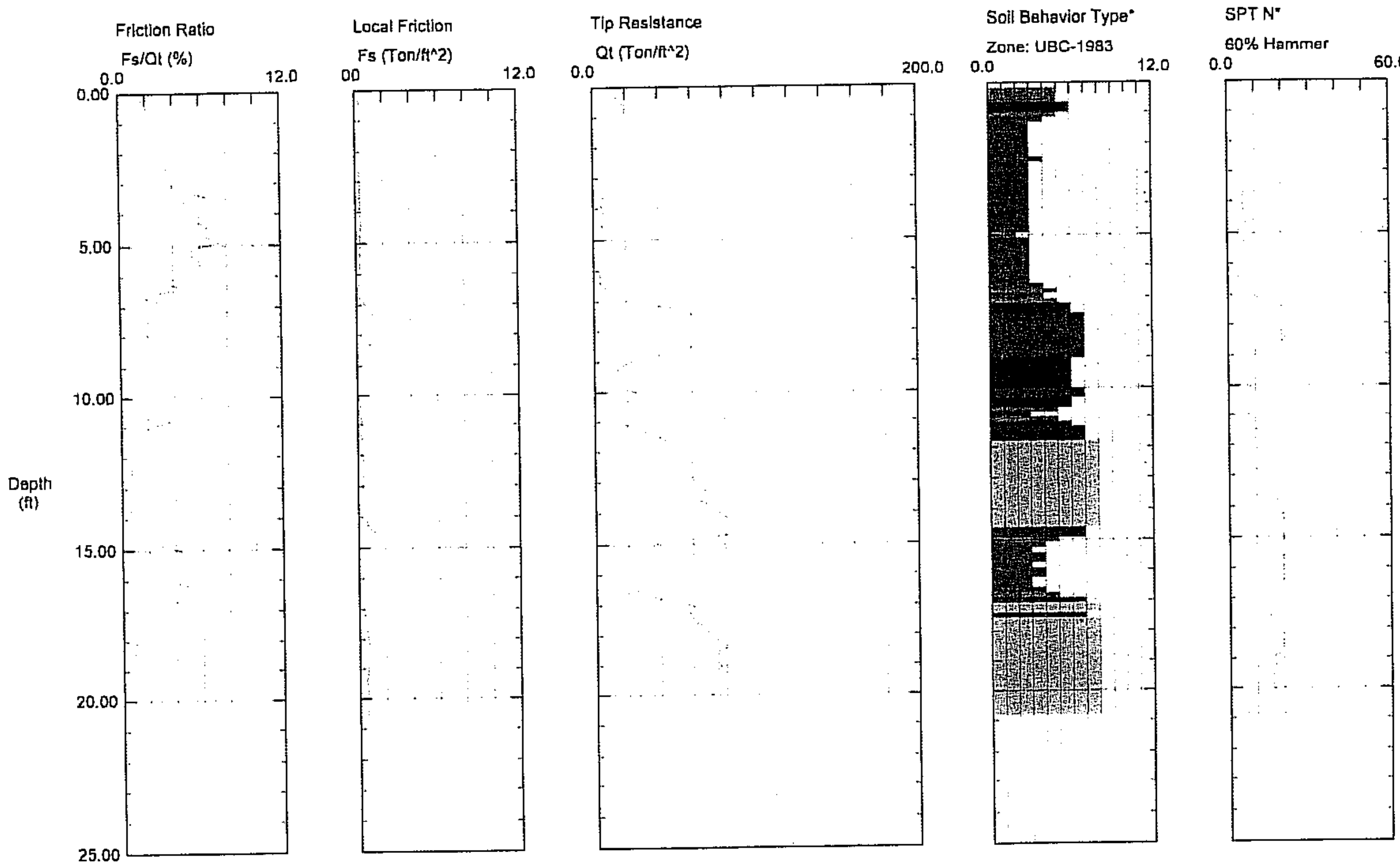
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type a. ' based on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w093
Cone Used: HO856TC

CPT Date/Time: 07-15-04 07:32
Location: CPT-32
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

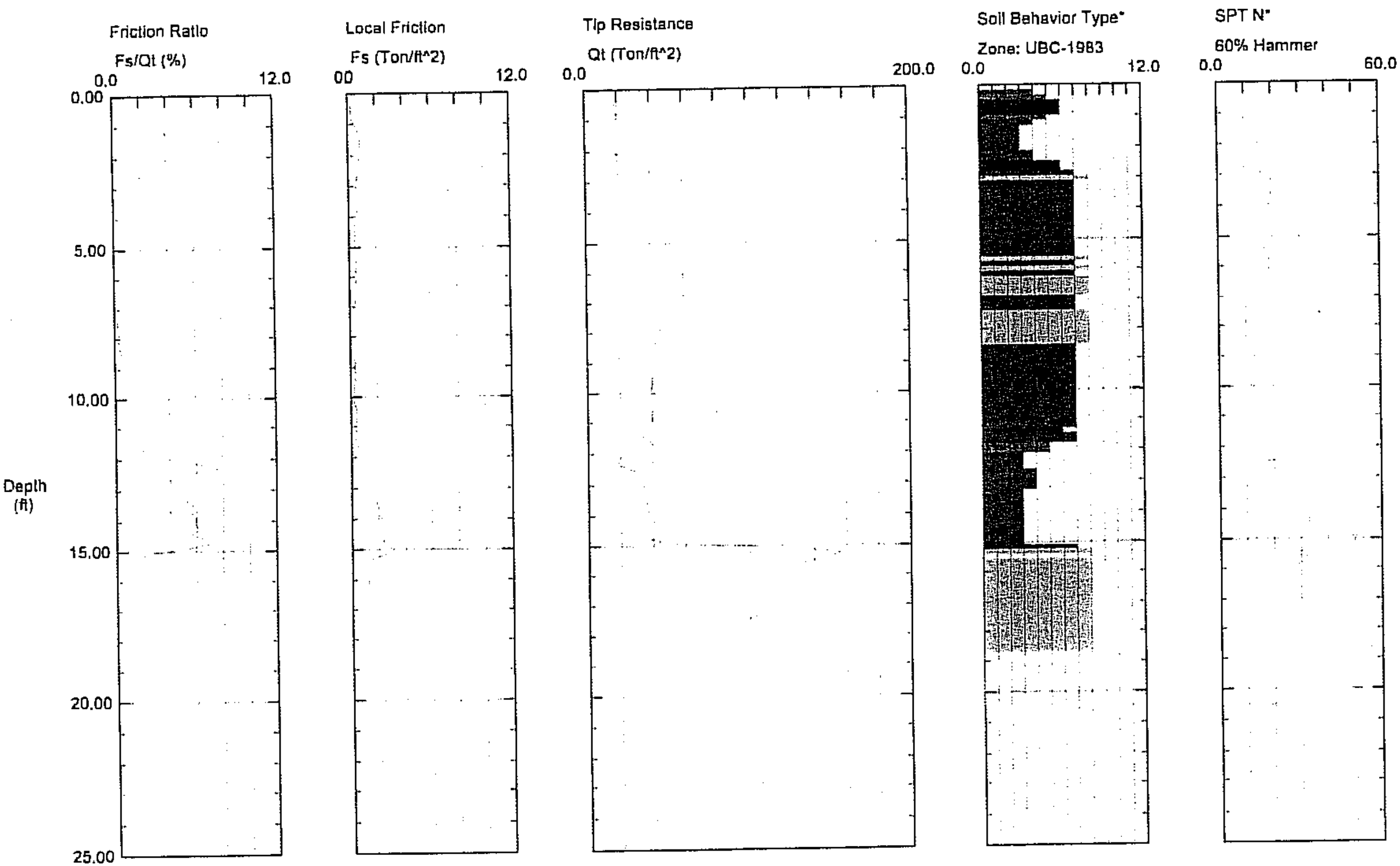
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and ... ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Roberison
Sounding: 04w094
Cone Used: HO856TC

CPT Date/Time: 07-15-04 08:22
Location: CPT-33
Job Number: 4603.4100.01



Maximum Depth = 20.83 feet

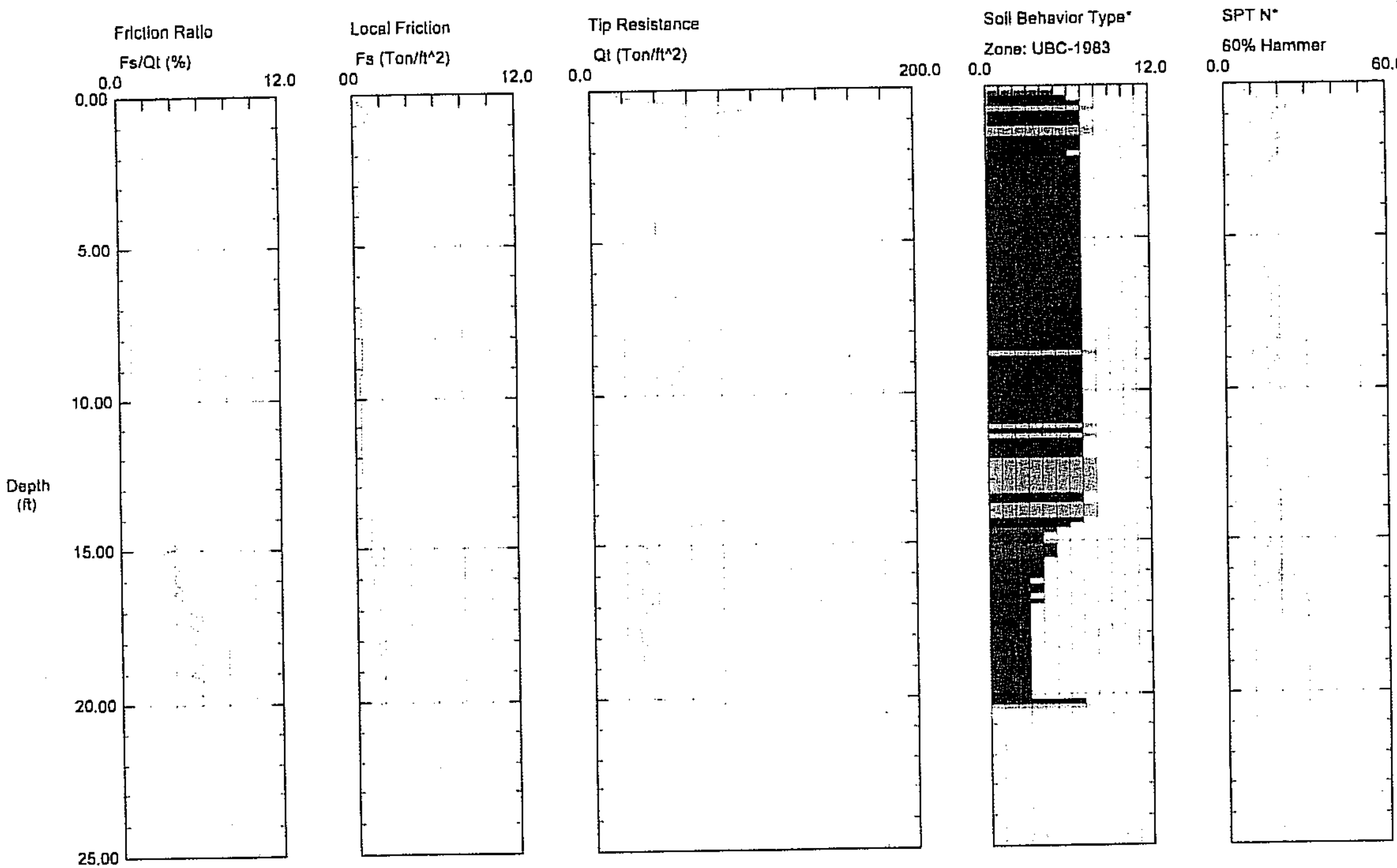
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w095
Cone Used: HO856TC

CPT Date/Time: 07-15-04 09:22
Location: CPT-34
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

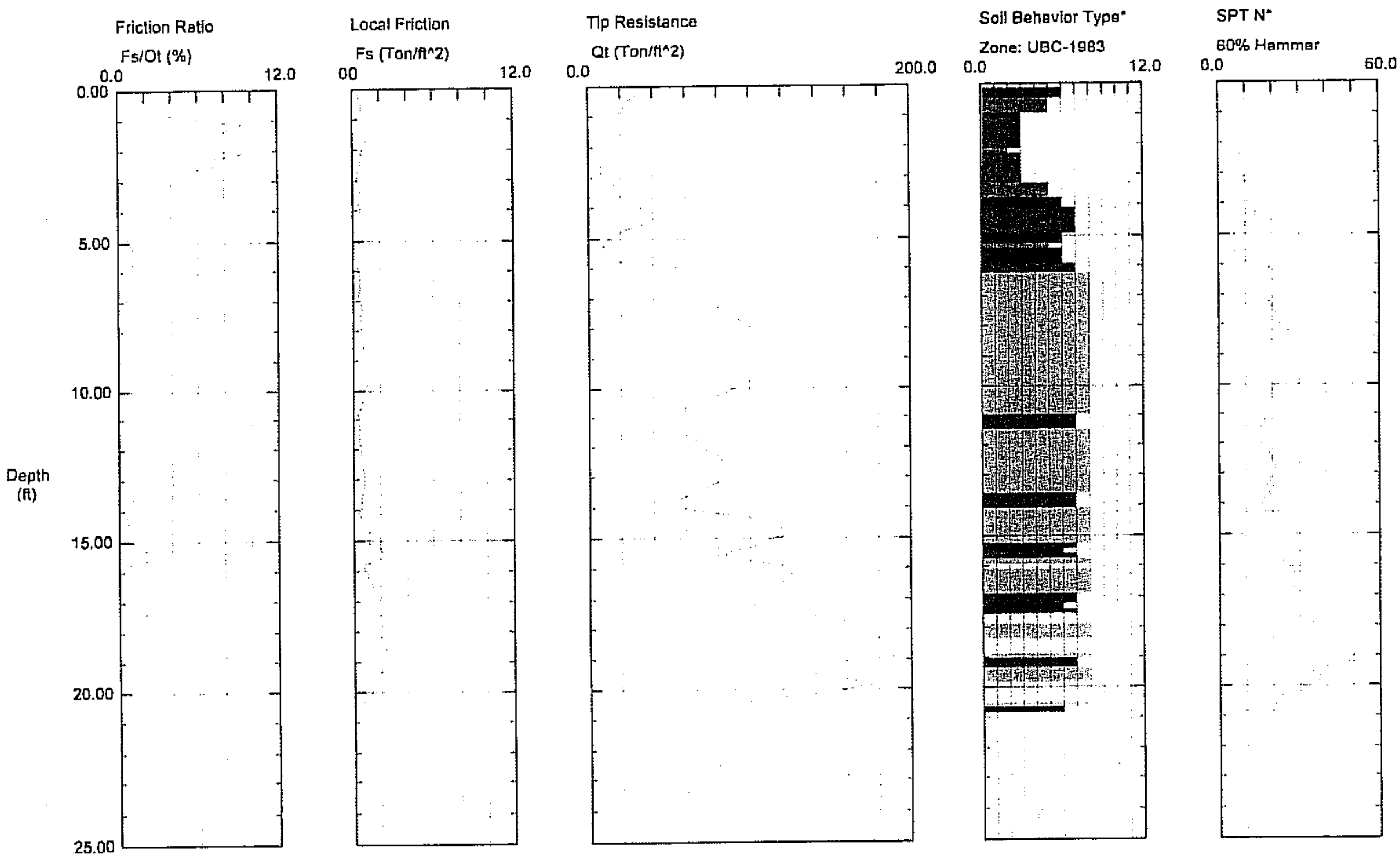
Soil behavior type and S. ... ased on data from UBC-1 983

*Soil behavior type and ... based on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w096
Cone Used: HO856TC

CPT Date/Time: 07-15-04 10:24
Location: CPT-35
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

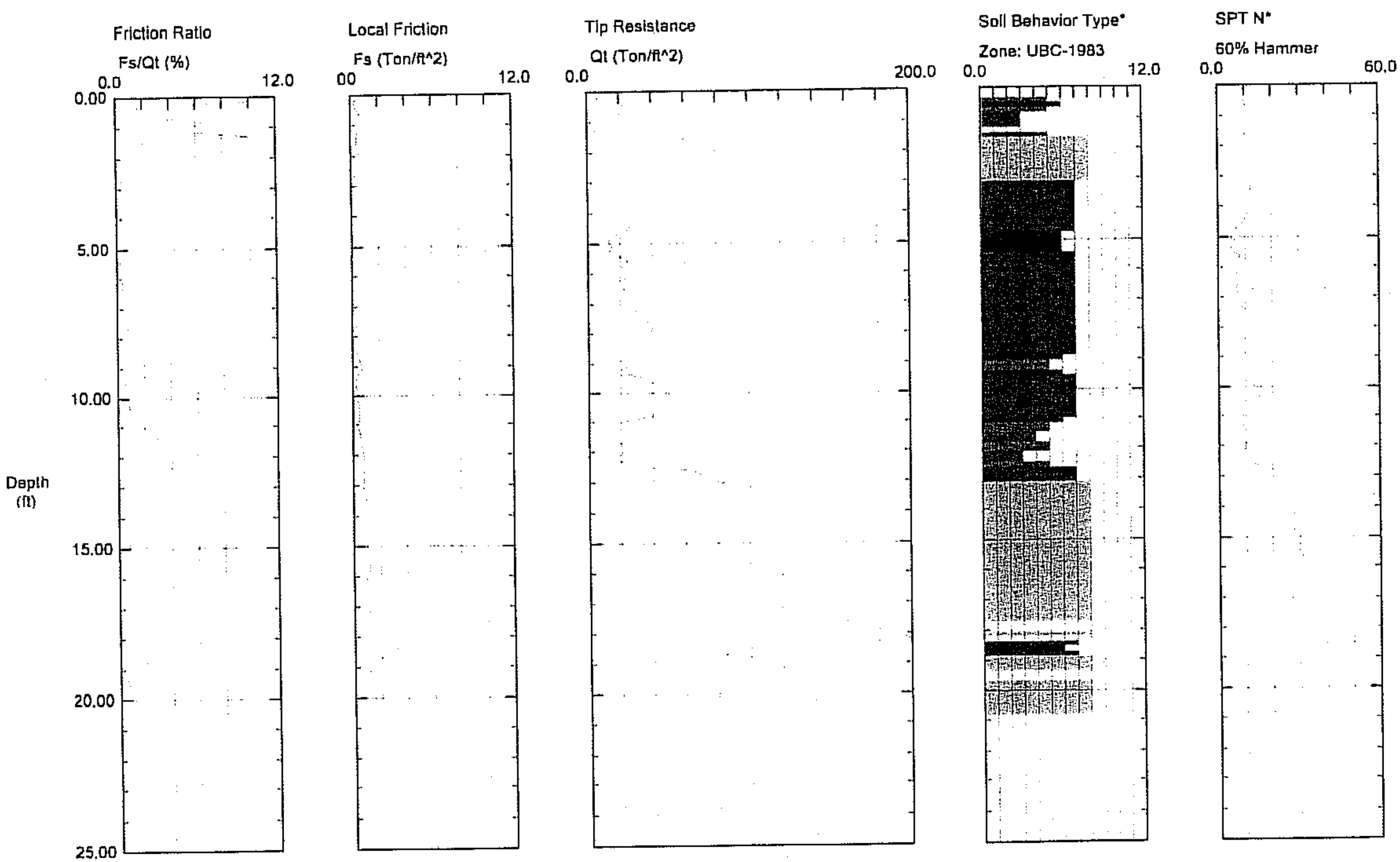
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w097
Cone Used: HO856TC

CPT Date/Time: 07-15-04 12:34
Location: CPT-36
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

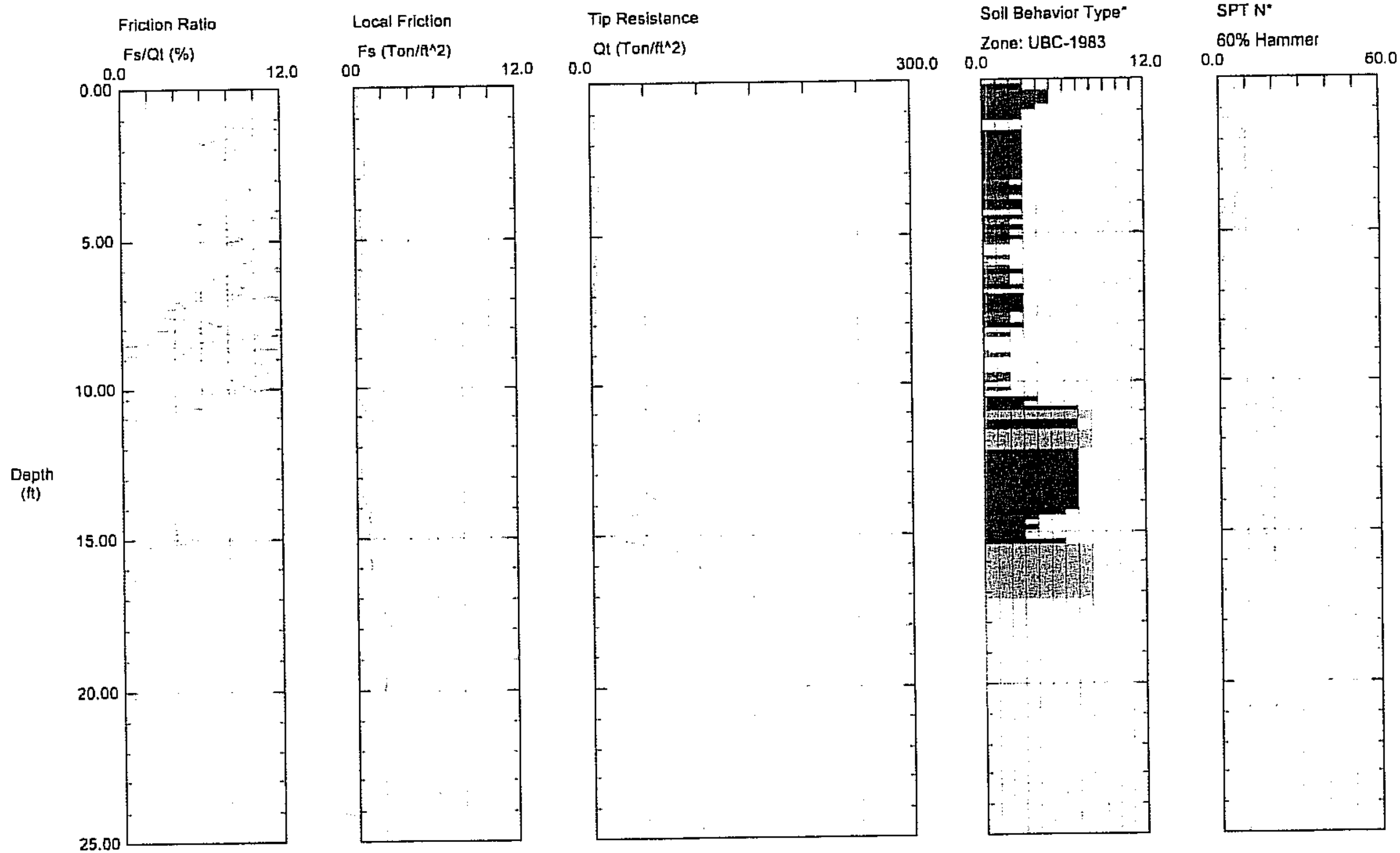
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ɔased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w098
Cone Used: HO856TC

CPT Date/Time: 07-15-04 13:27
Location: CPT-37
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

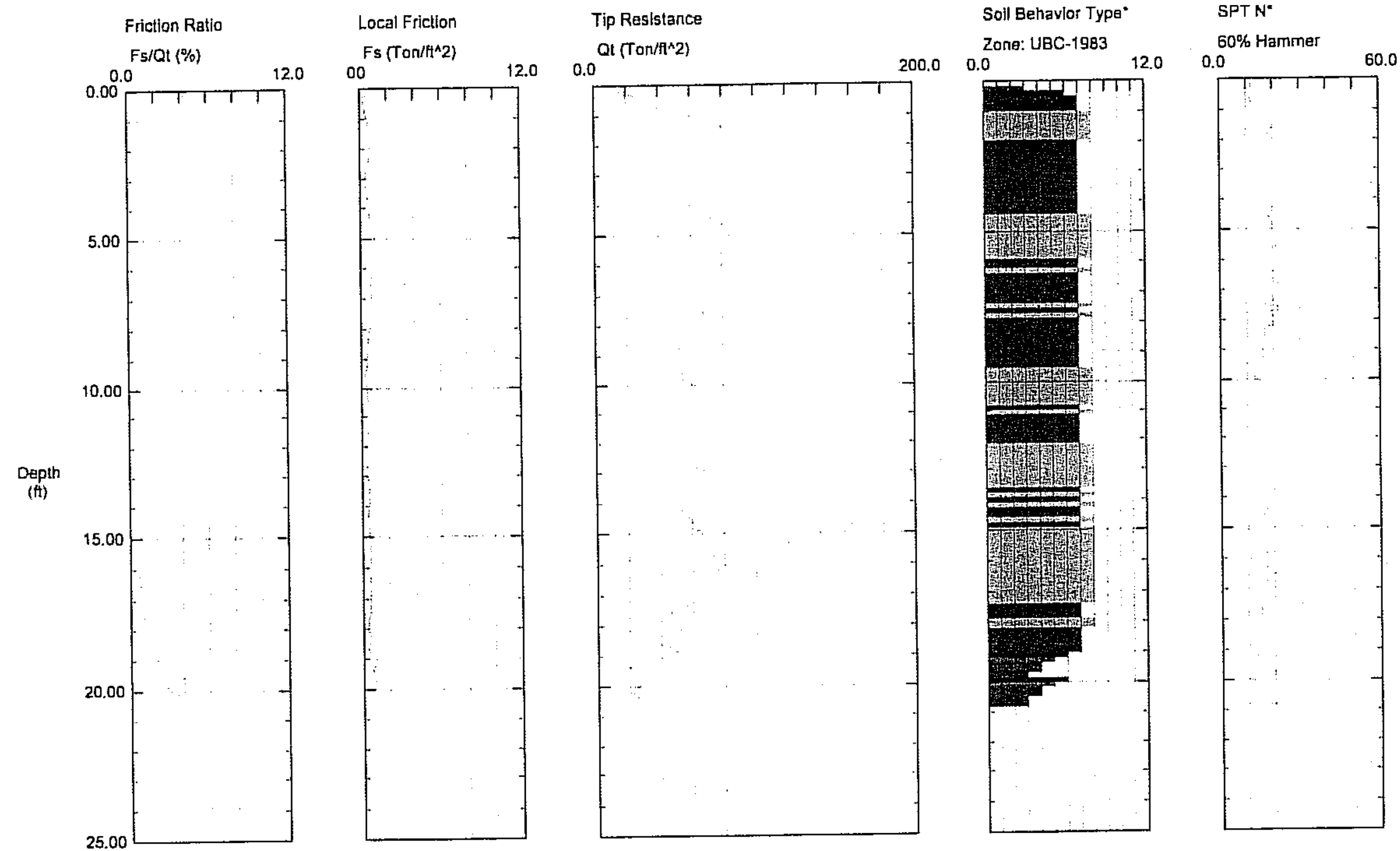
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type anc oased on data from UBC-1 983

VBI In-Situ resting

Operator: Mike Robertson
Sounding: 04w099
Cone Used: HO856TC

CPT Date/Time: 07-15-04 14:24
Location: CPT-38
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

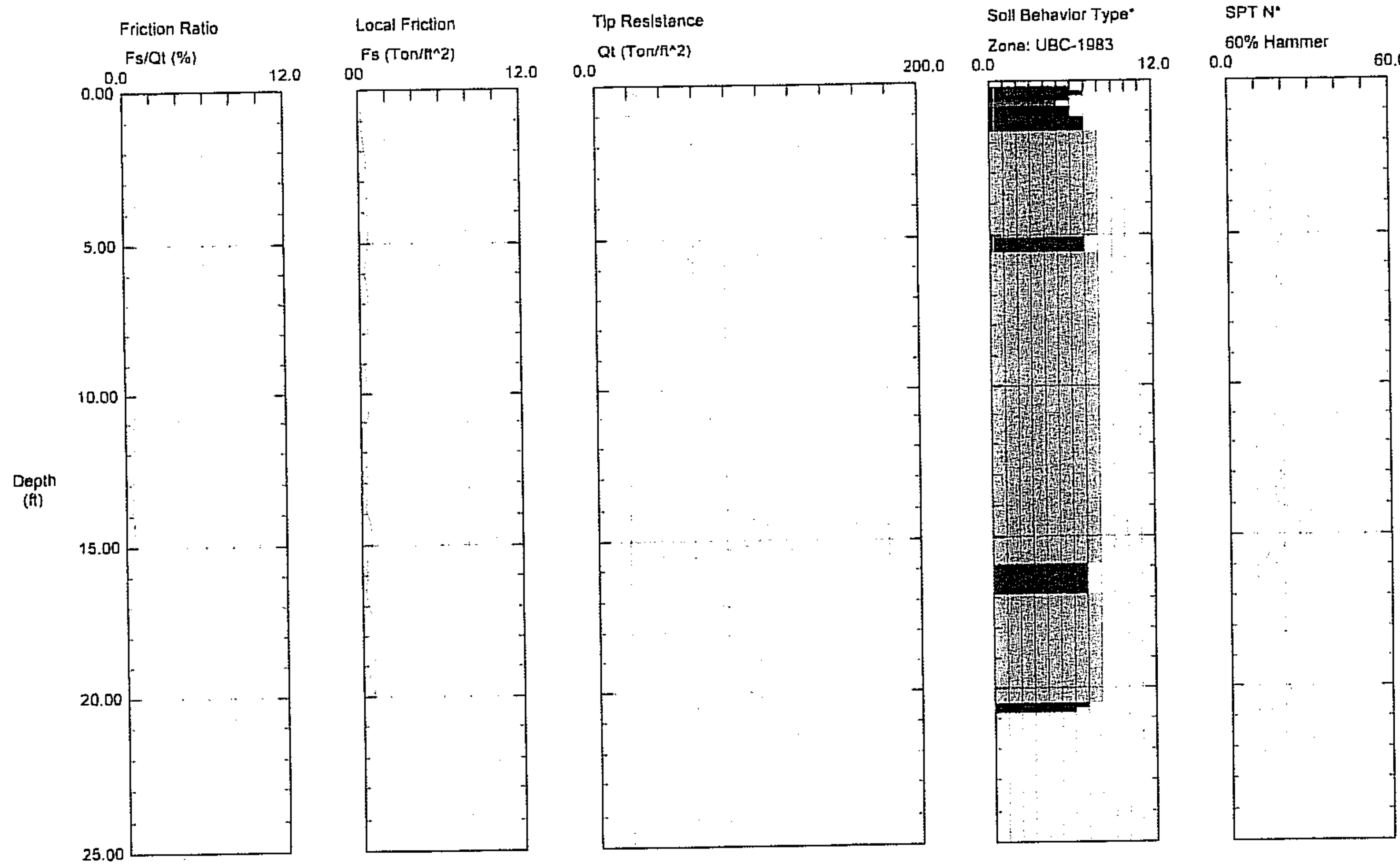
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w100
Cone Used: HO856TC

CPT Date/Time: 07-15-04 15:24
Location: CPT-39
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

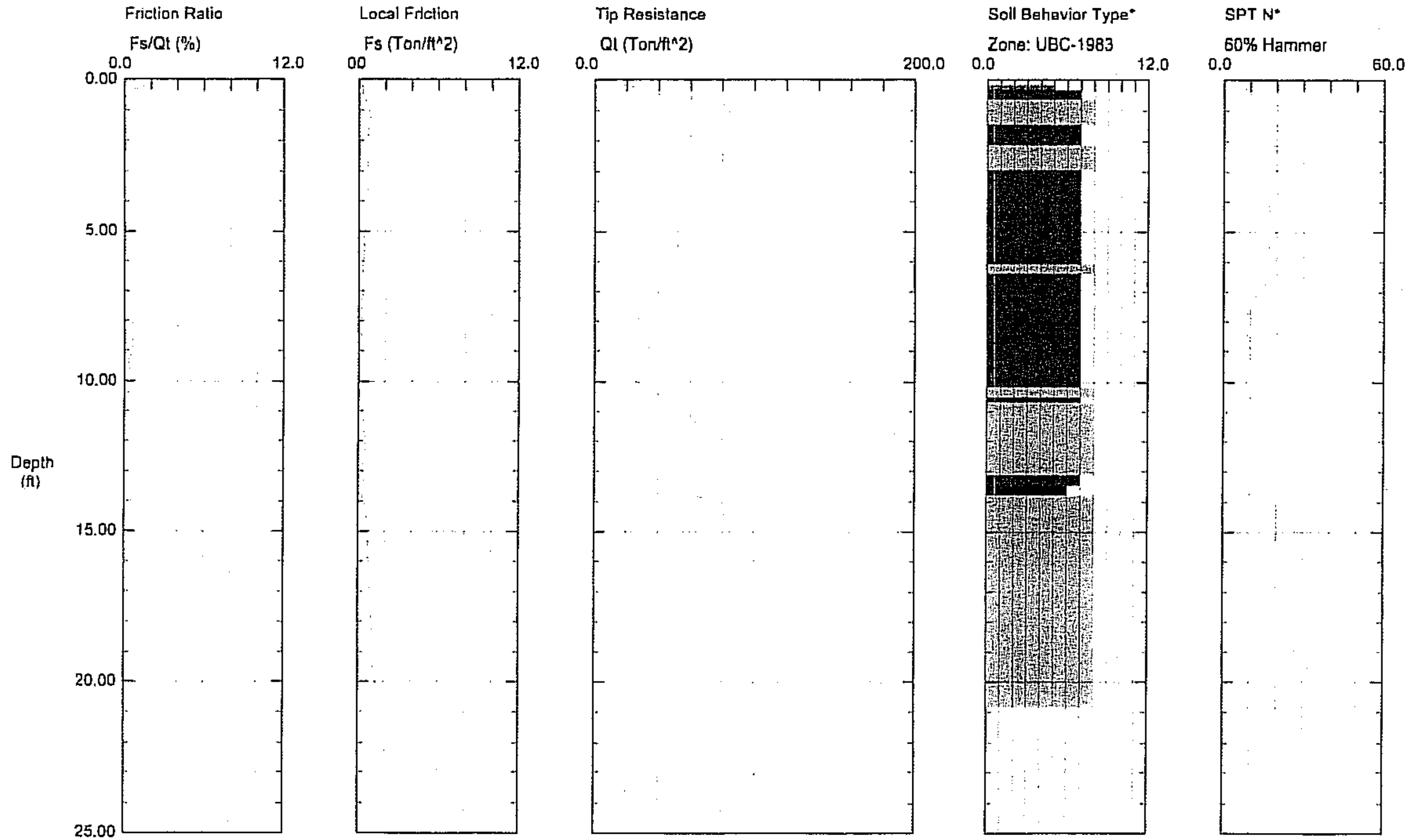
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w101
Cone Used: HO856TC

CPT Date/Time: 07-15-04 16:20
Location: CPT-40
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

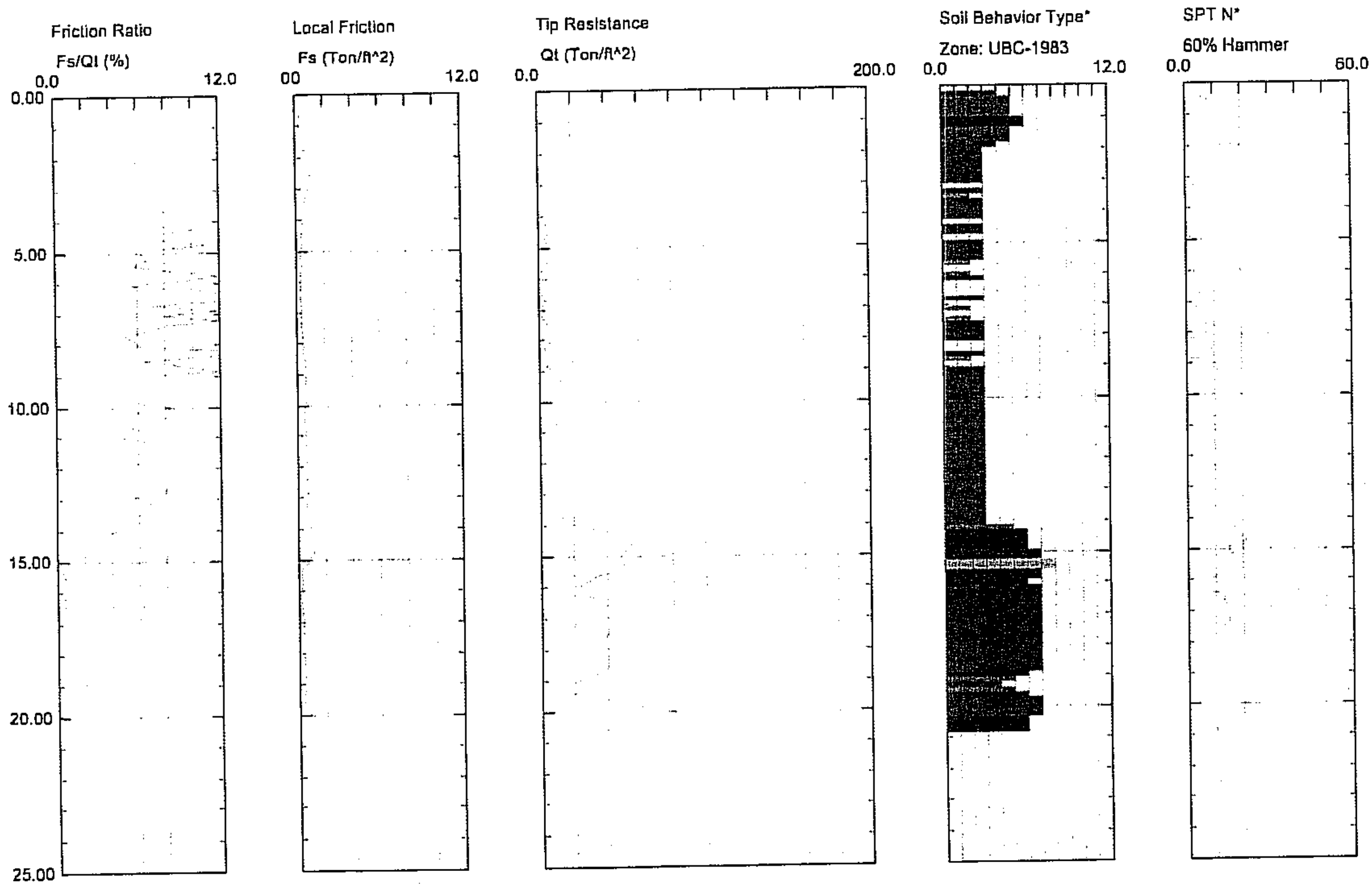
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ 'resting

Operator: Mike Robertson
Sounding: 04w102
Cone Used: HO856TC

CPT Date/Time: 07-16-04 08:26
Location: CPT-41
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

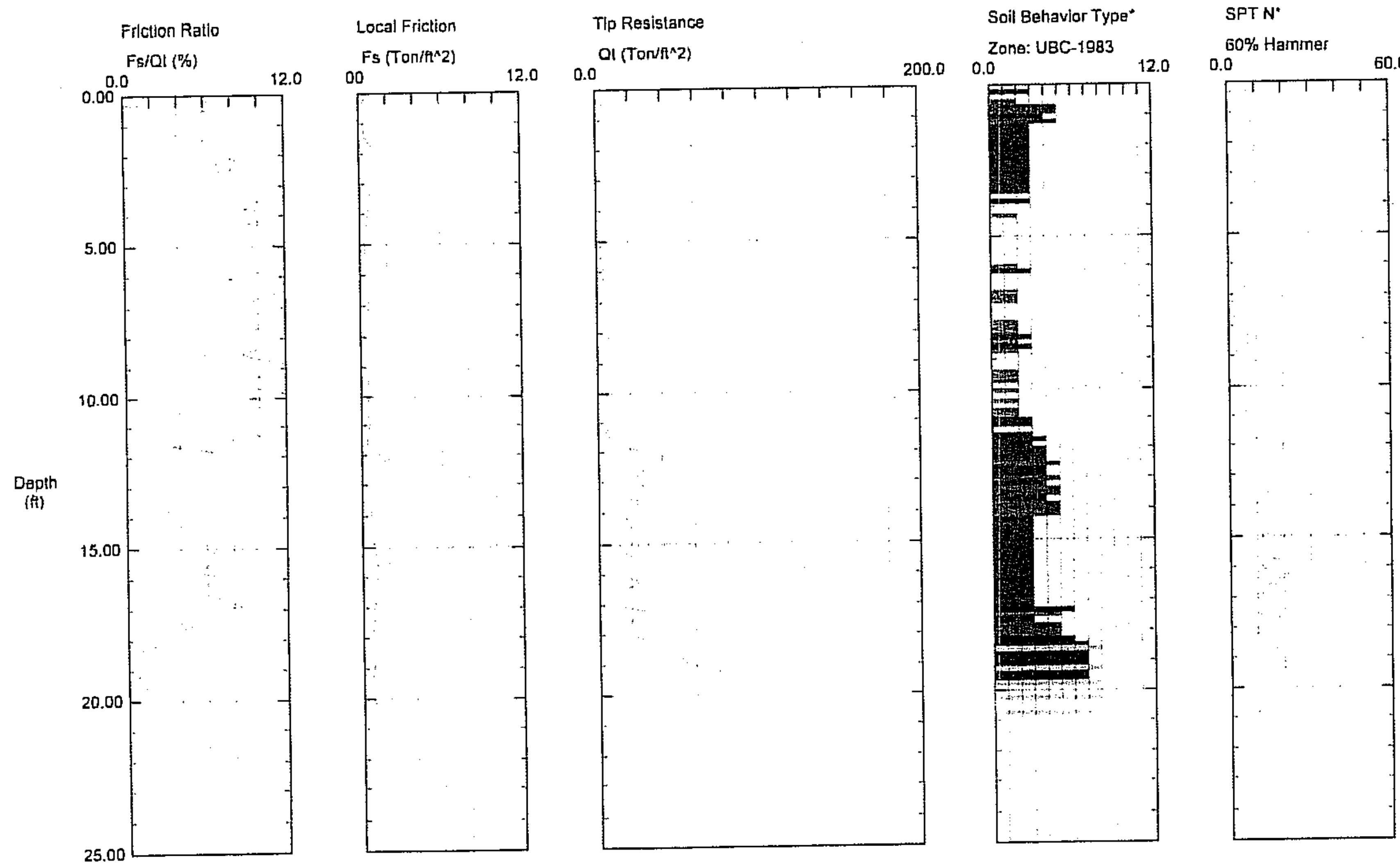
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

oil behavior type and . ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w103
Cone Used: HO856TC

CPT Date/Time: 07-16-04 09:18
Location: CPT-42
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

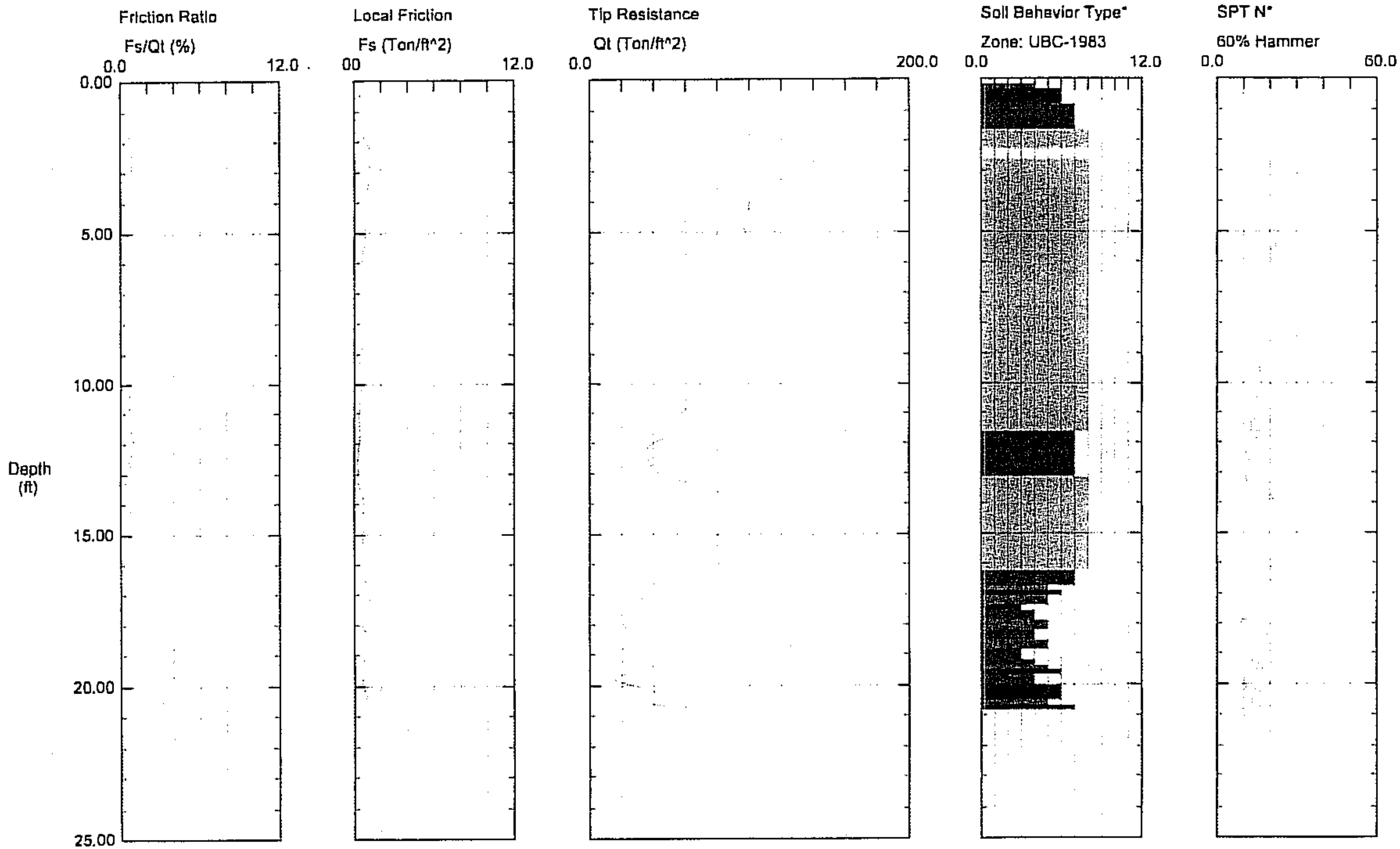
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc	 based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w104
Cone Used: HO856TC

CPT Date/Time: 07-16-04 10:24
Location: CPT-43
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

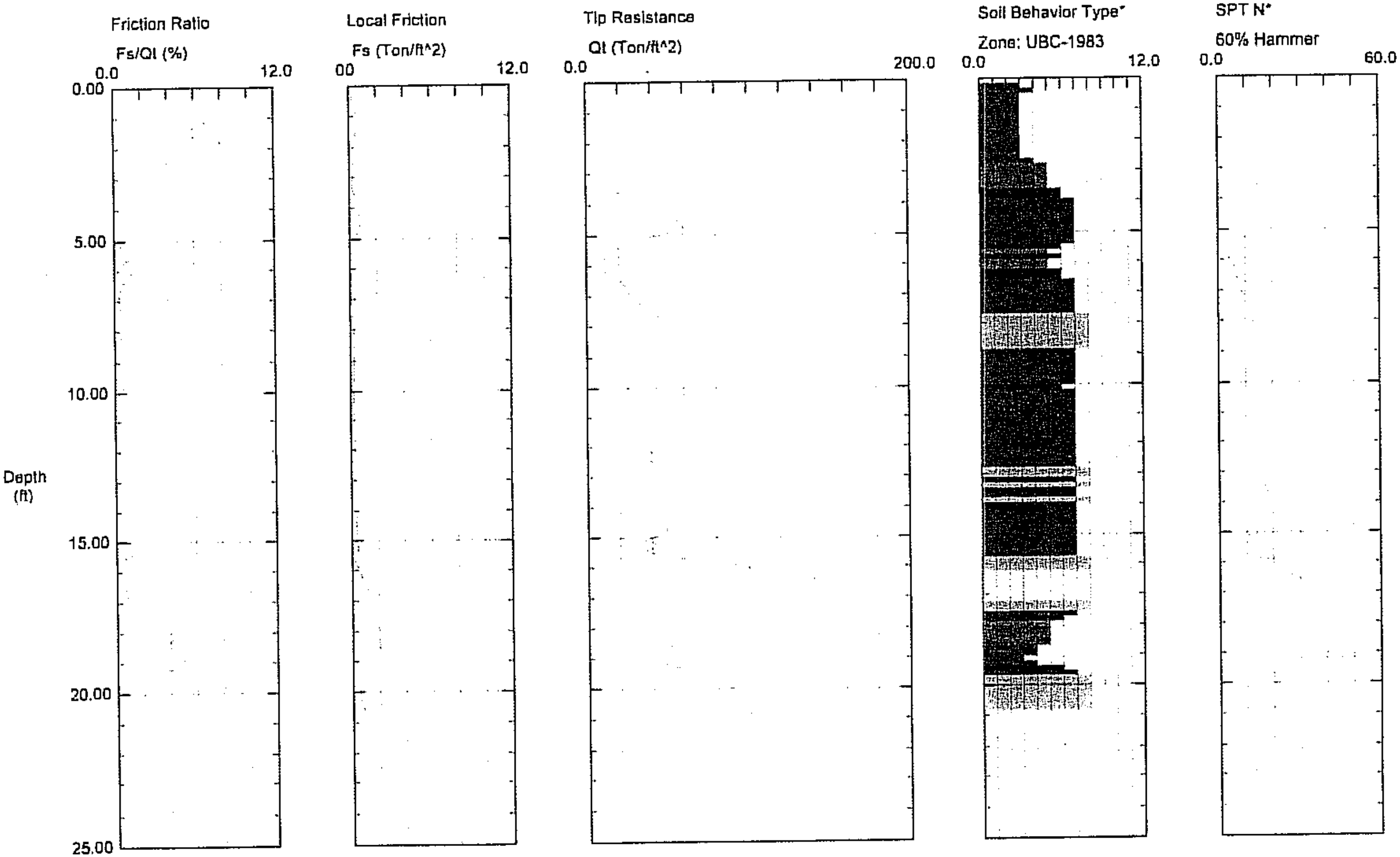
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w107
Cone Used: HO856TC

CPT Date/Time: 07-16-04 12:09
Location: CPT-46
Job Number: 4603.4100.01

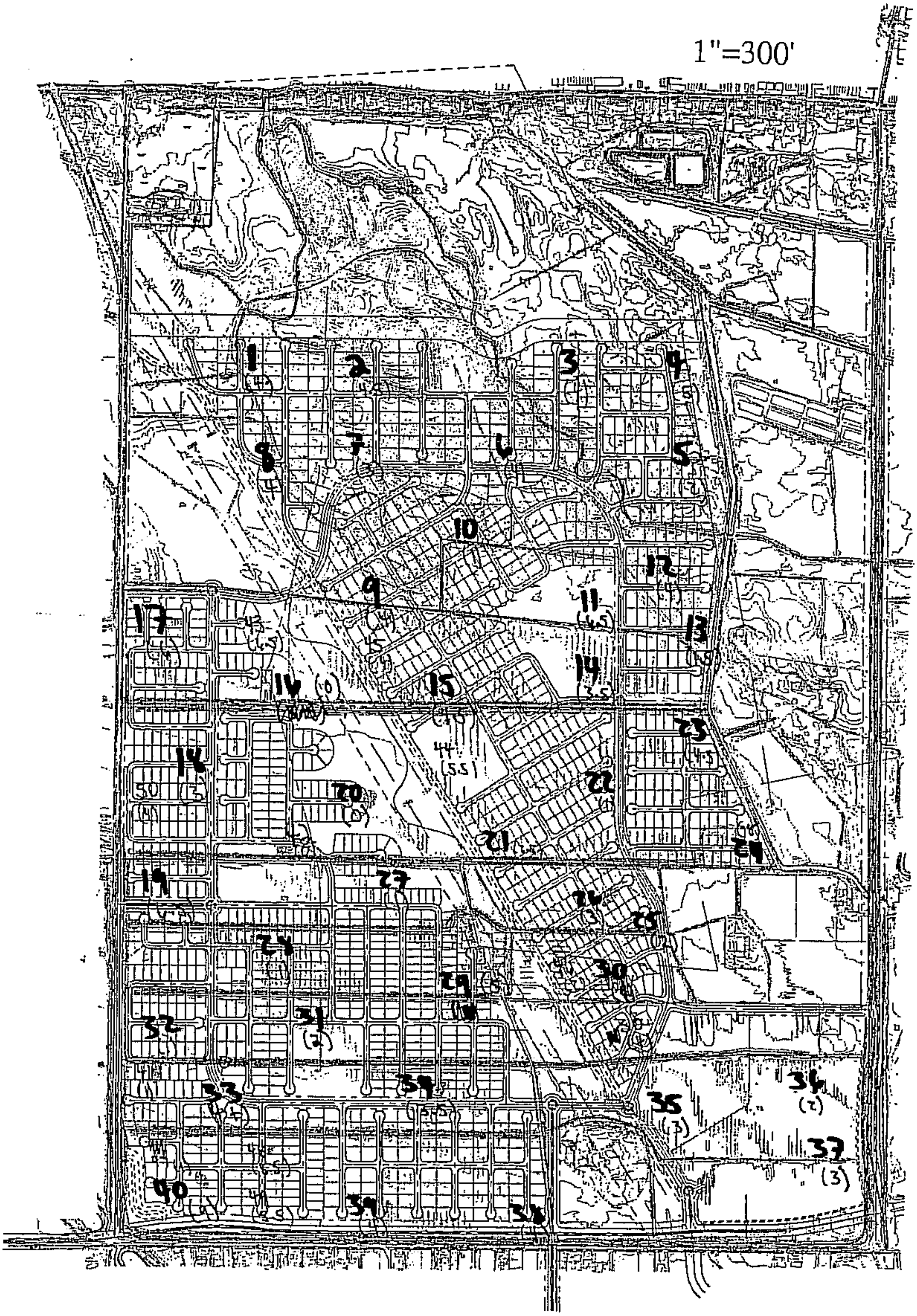


Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

1"=300'


1
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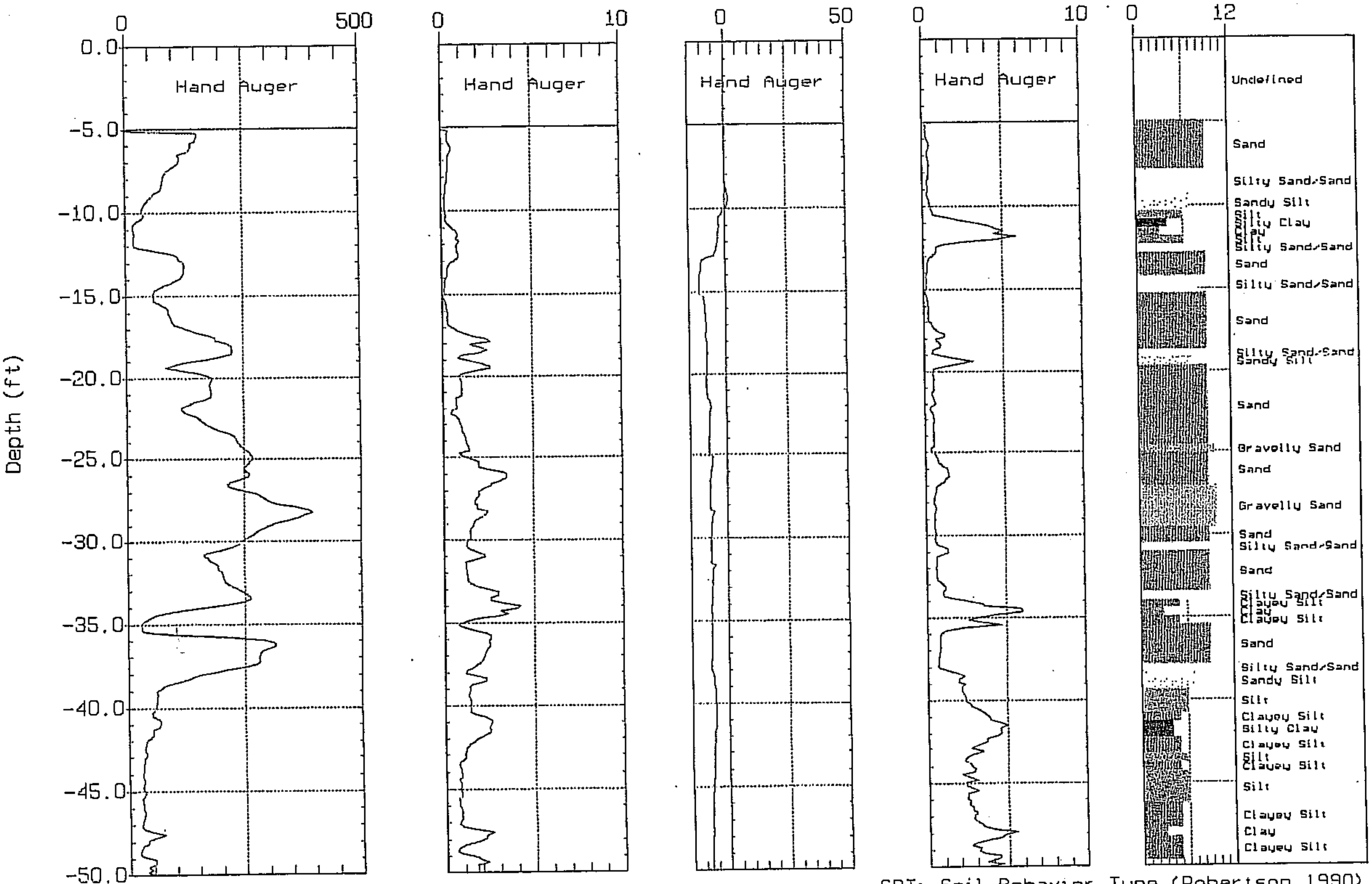
GREGG

ENGEO

Site: KB HOMES
Location: CPT-1

Engineer: S.HARRIS
Date: 07:15:05 10:24



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

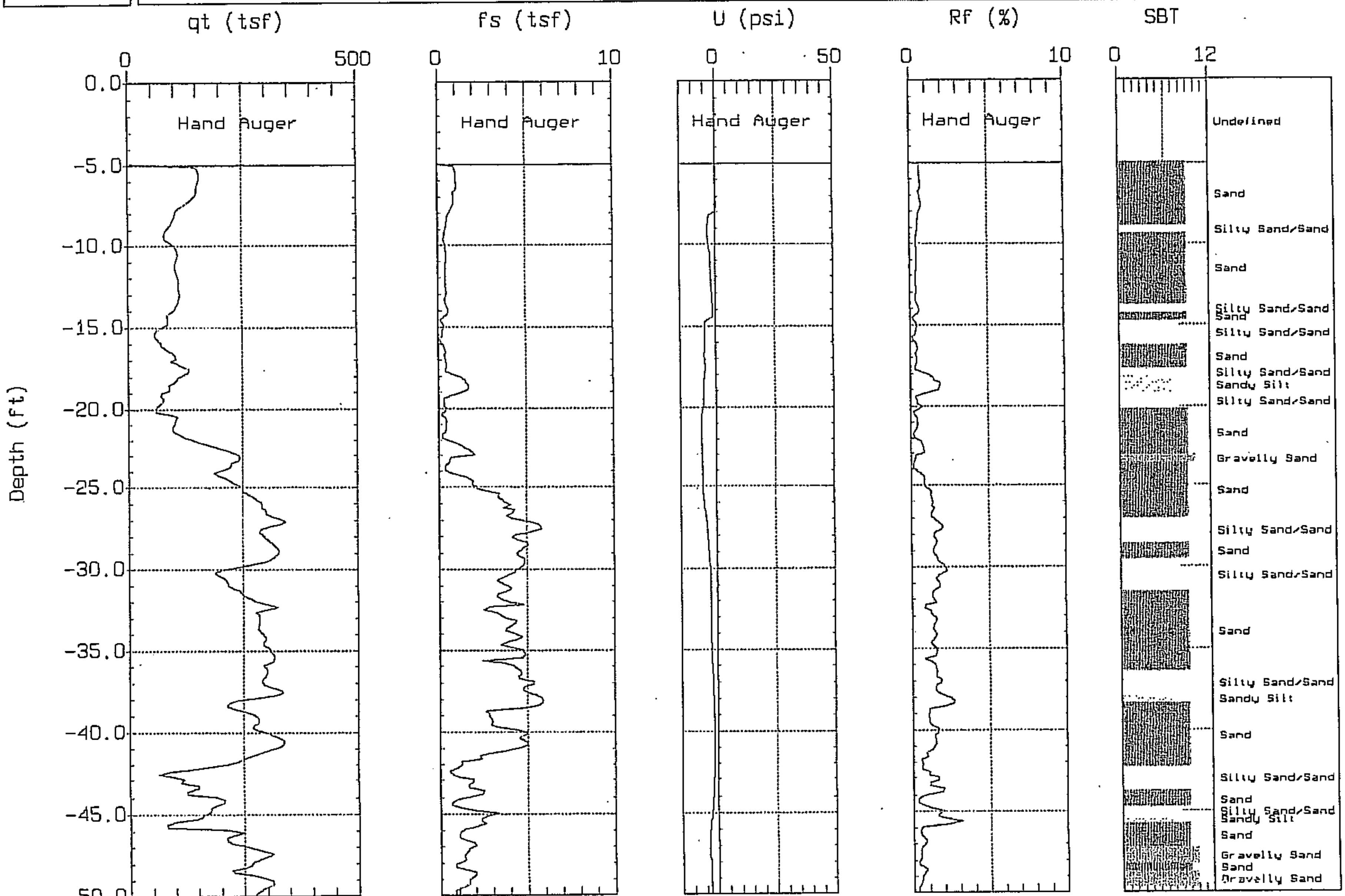
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-2

Engineer: S.HARRIS
Date: 07:15:05 11:06



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

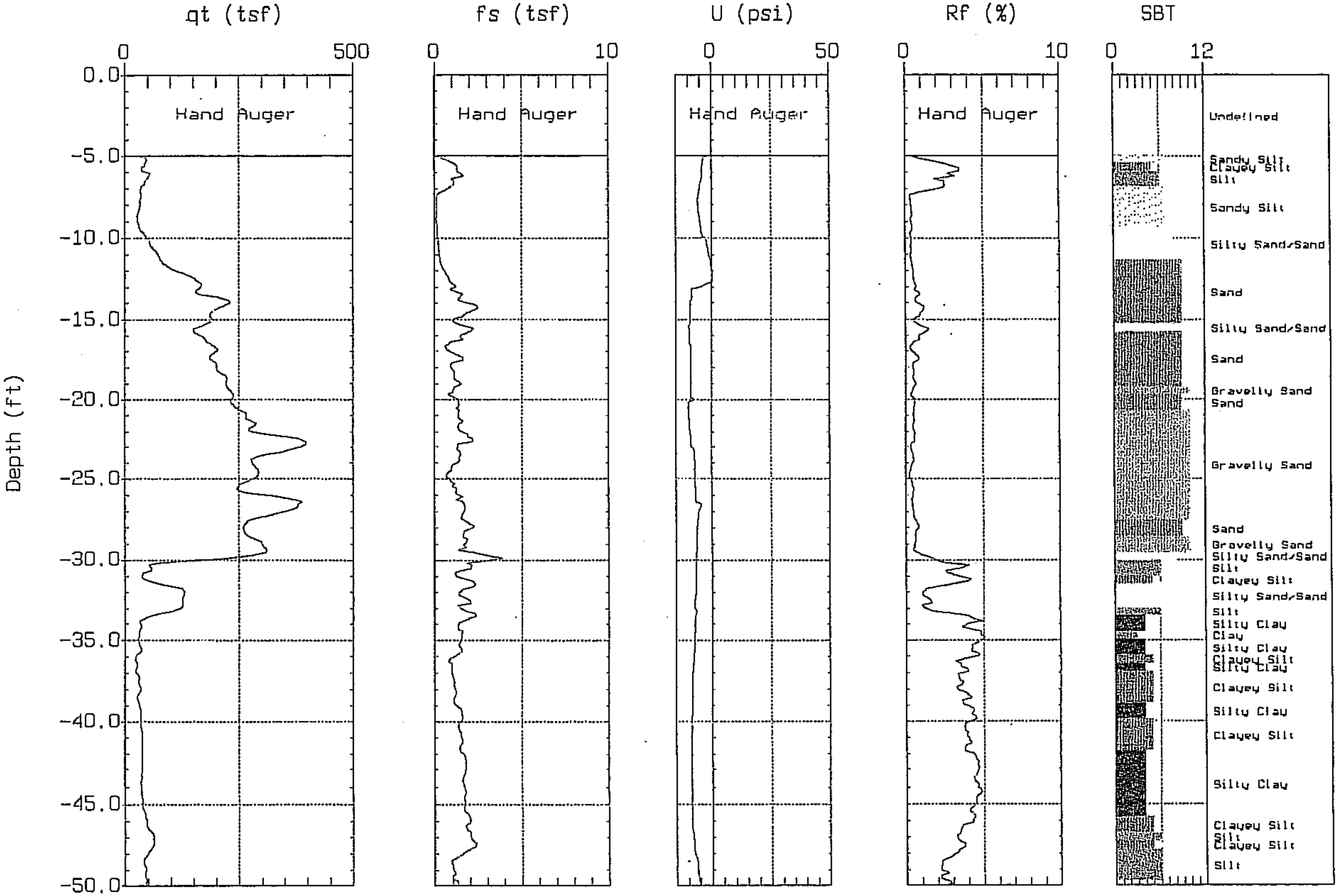
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-3

Engineer: S.HARRIS
Date: 07:18:05 15:25



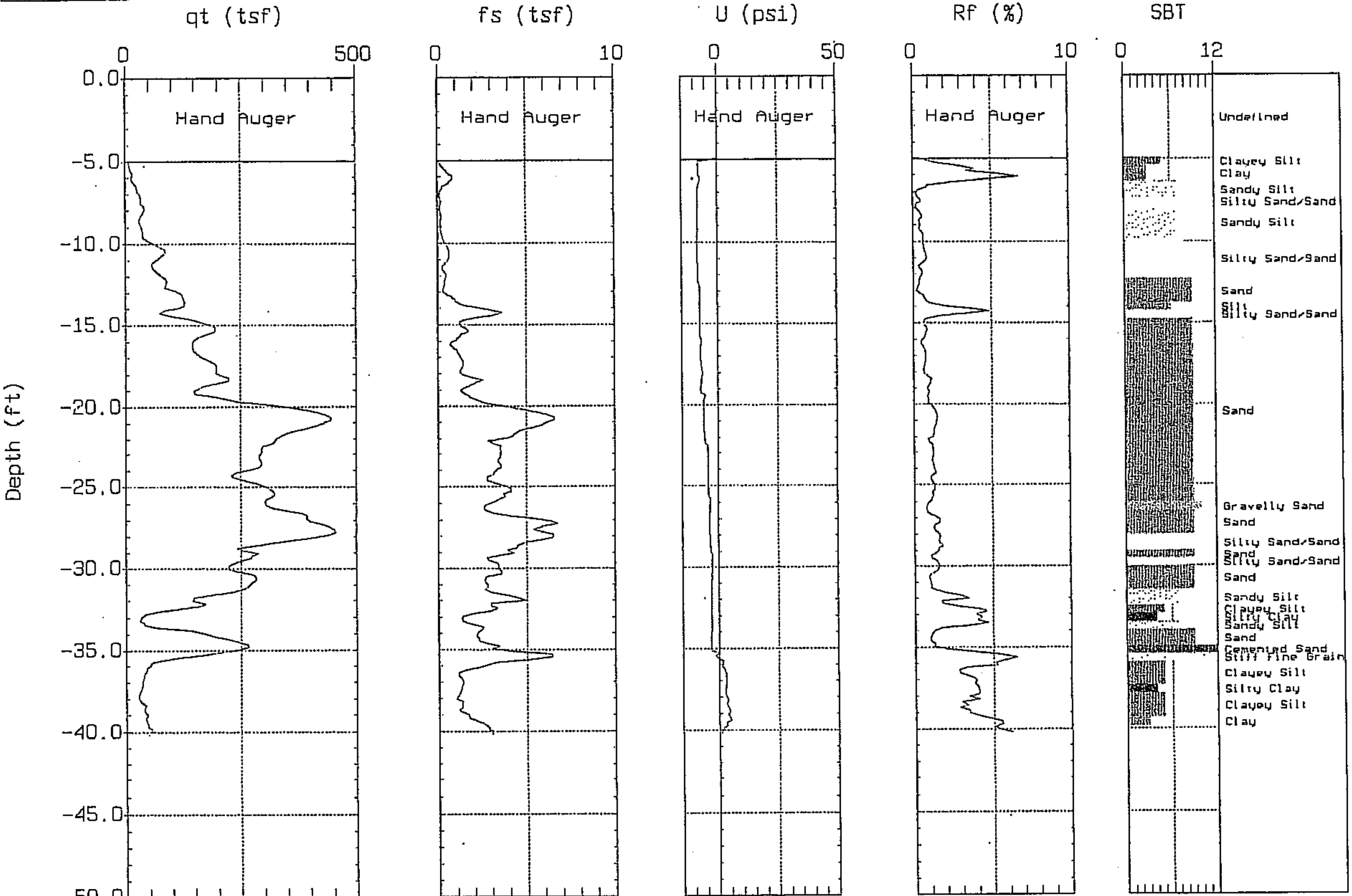
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-4

Engineer: S.HARRIS
Date: 07:18:05 14:41



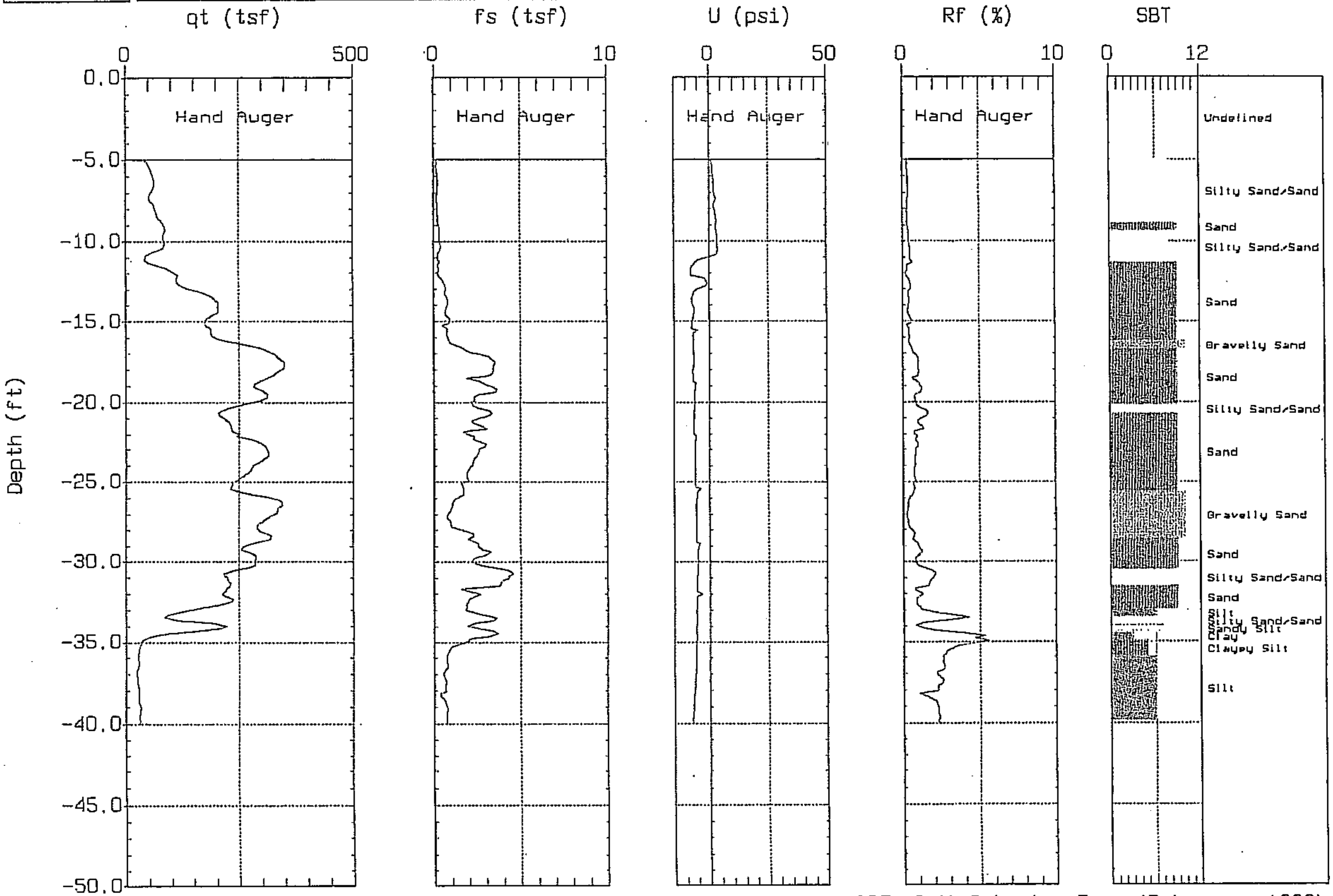
Max. Depth: 40.19 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: KB HOMES
Location: CPT-5

Engineer: S.HARRIS
Date: 07:19:05 07:46



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

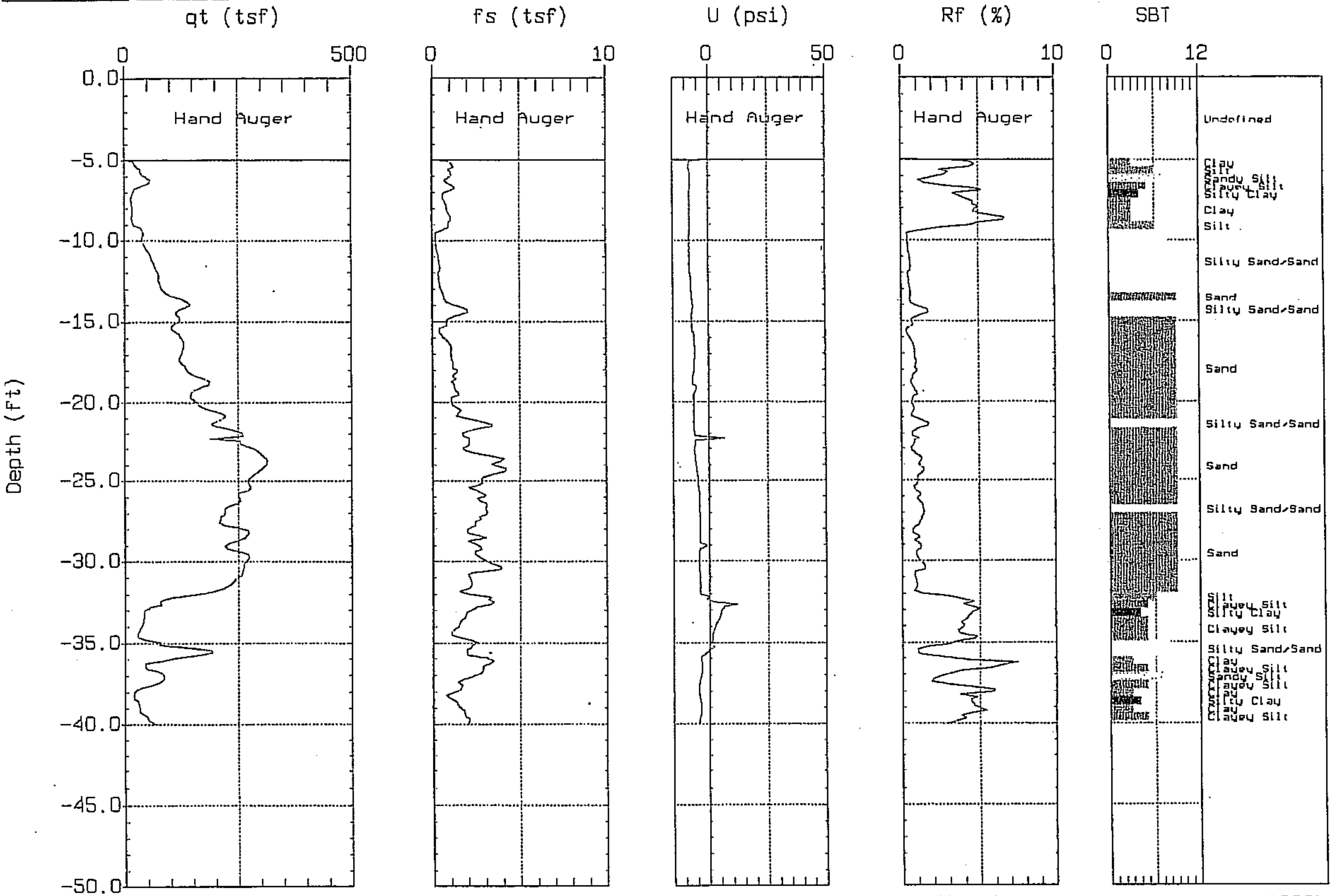
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-6

Engineer: S.HARRIS
Date: 07:18:05 11:49



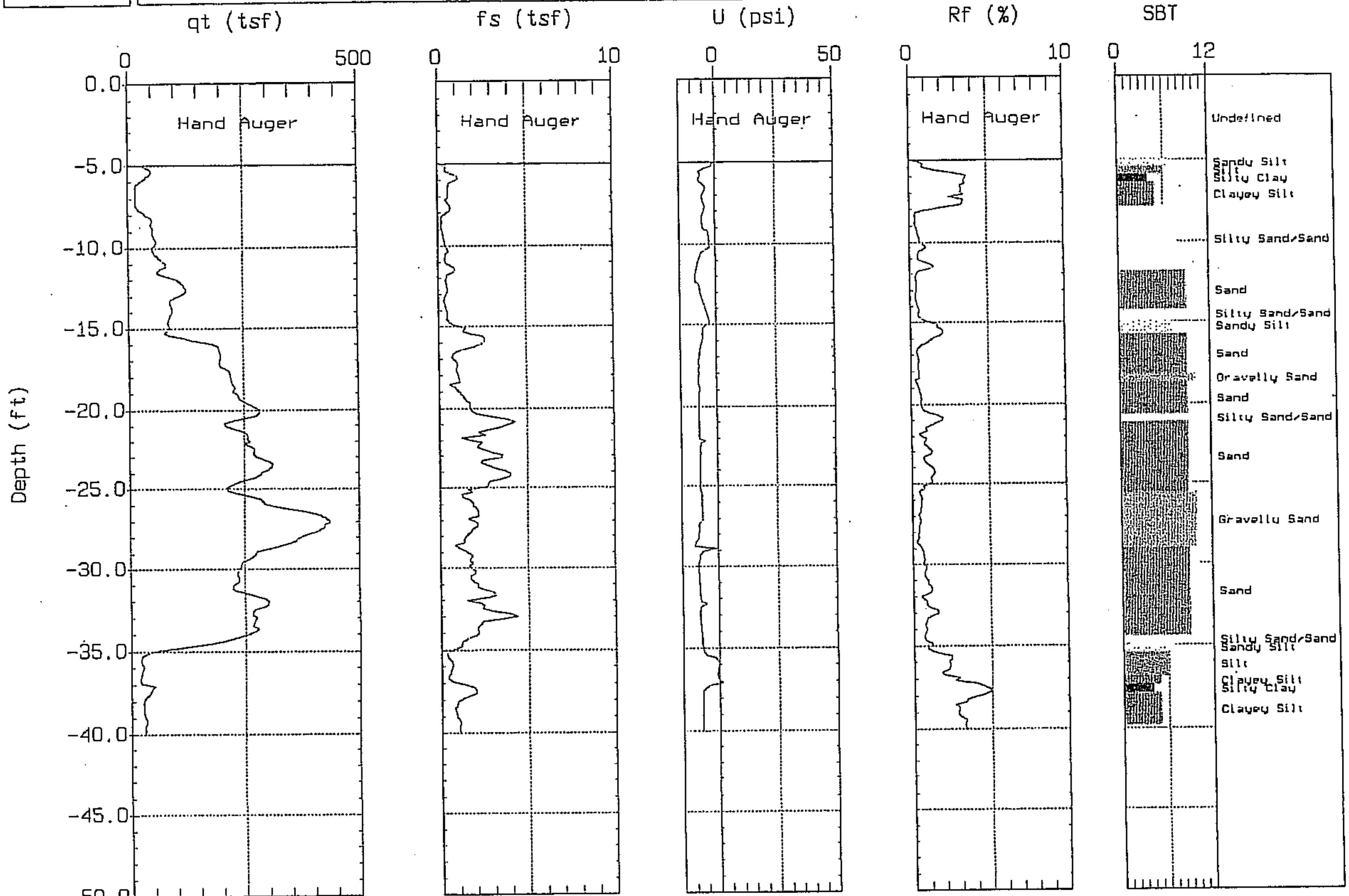
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-7

Engineer: S.HARRIS
Date: 07:18:05 10:47



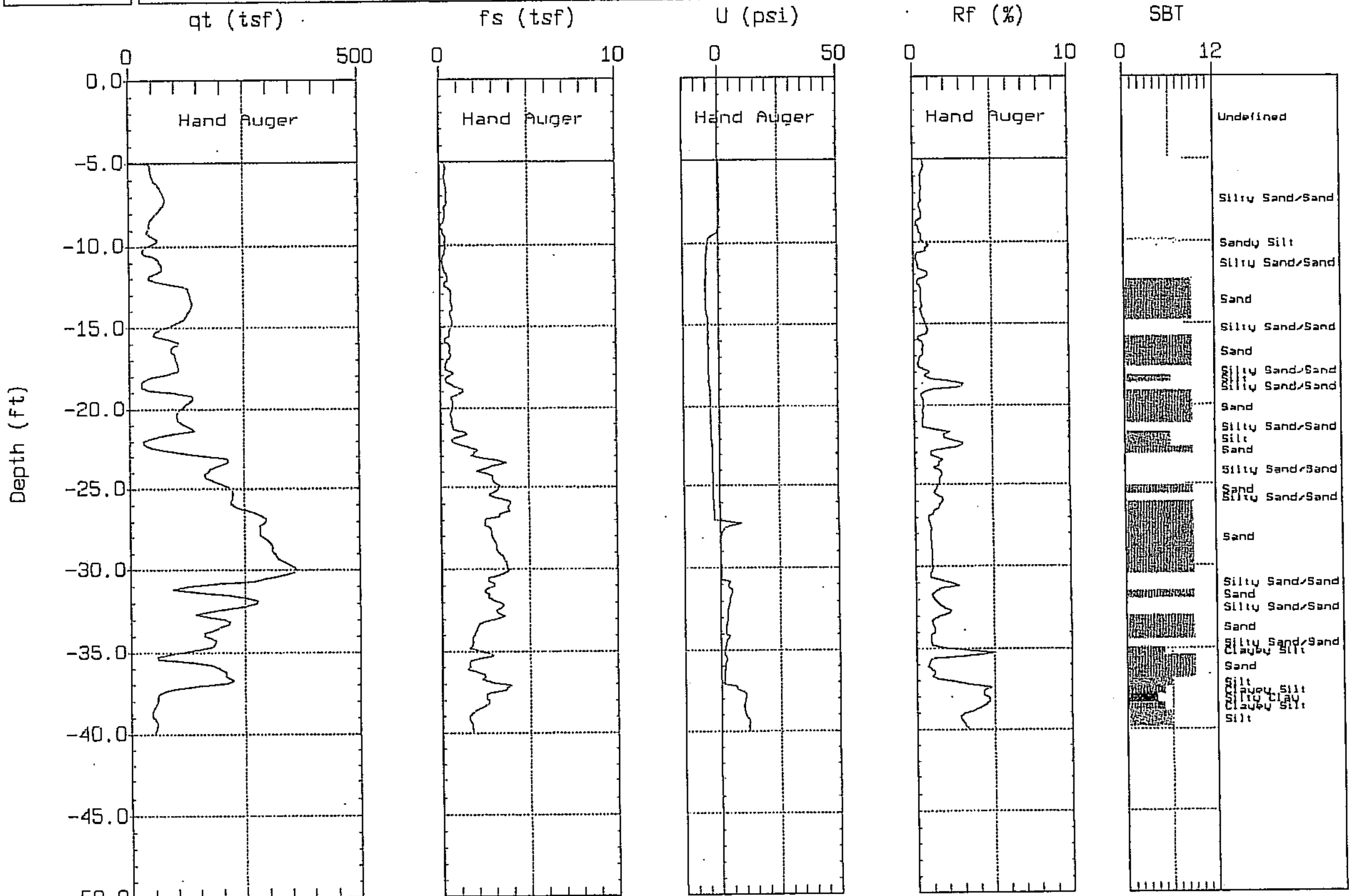
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-8

Engineer: S.HARRIS
Date: 07:15:05 09:53



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

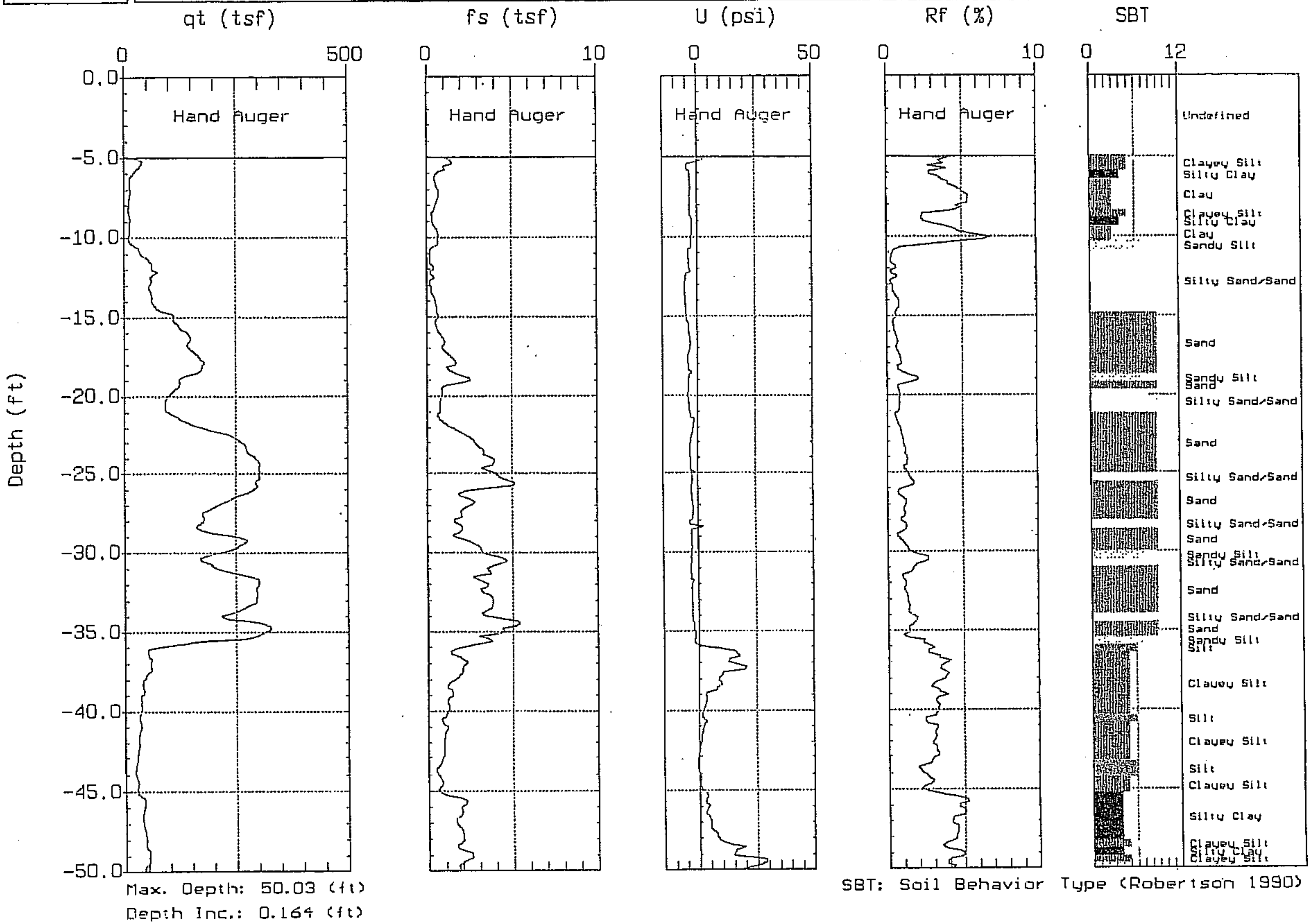
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-9

Engineer: S.HARRIS
Date: 07:15:05 08:34

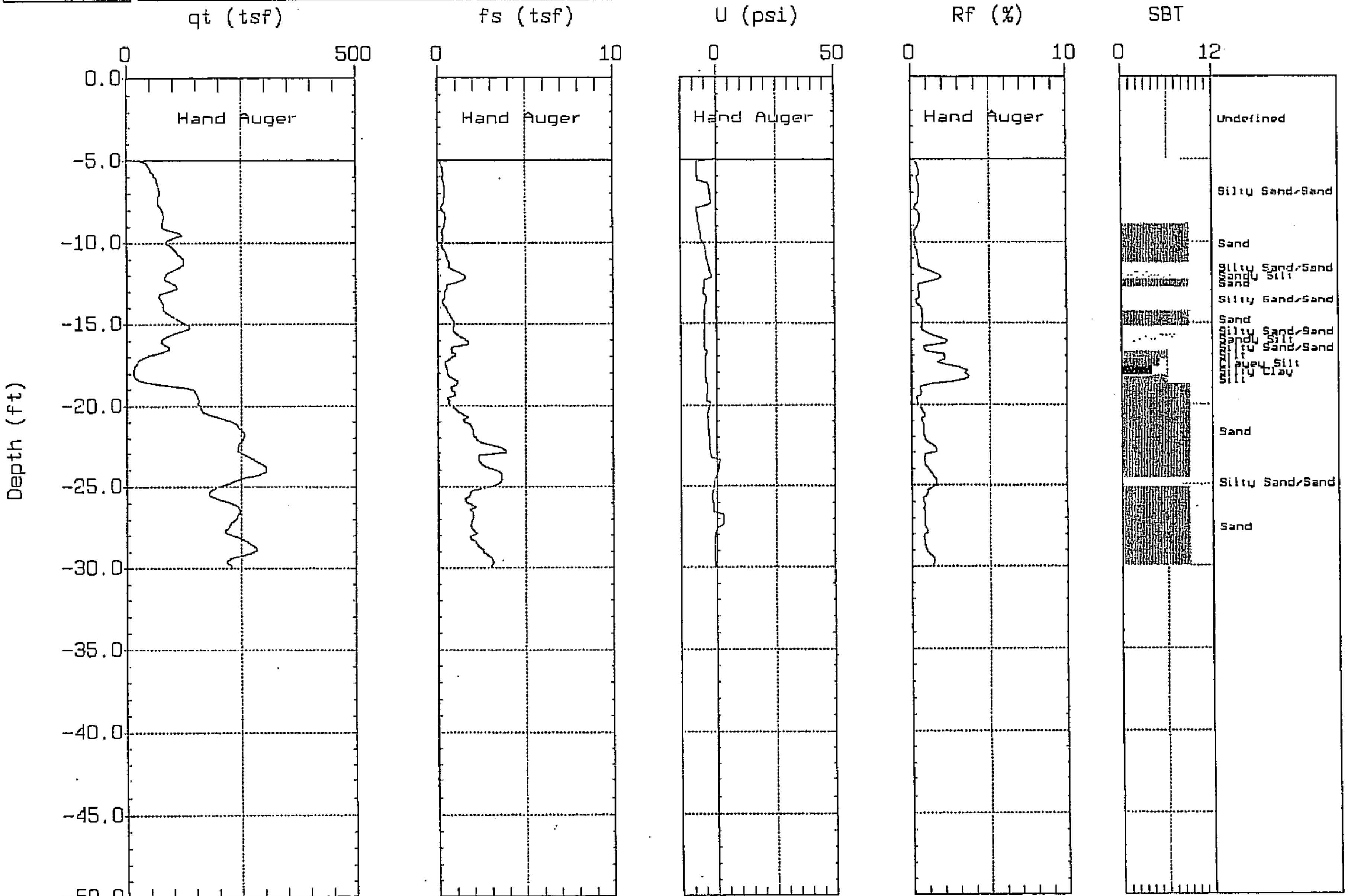


GREGG

ENGEO

Site: KB HOMES
Location: CPT-10

Engineer: S.HARRIS
Date: 07:18:05 11:27



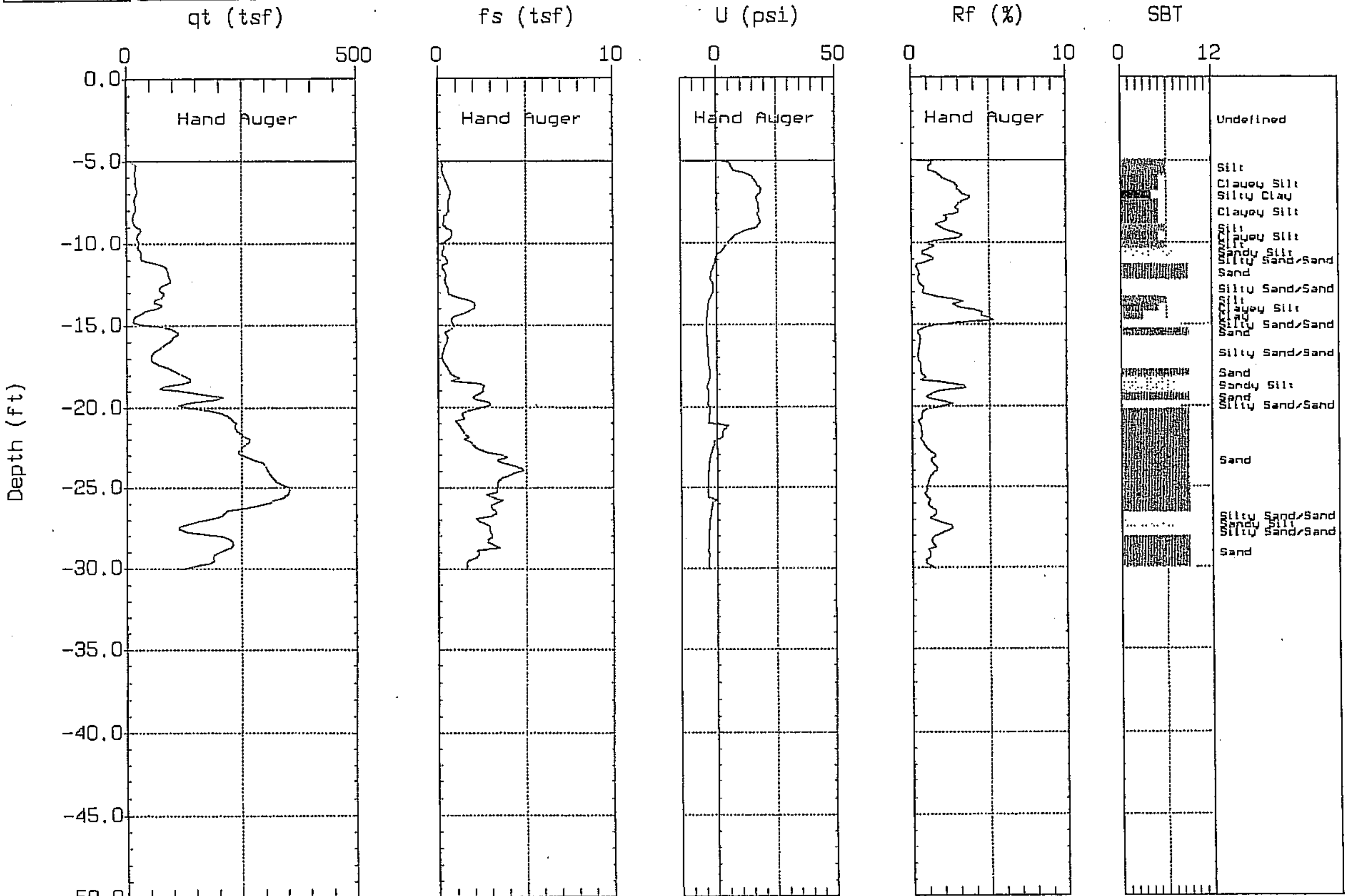
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-11

Engineer: S.HARRIS
Date: 07:15:05 09:07



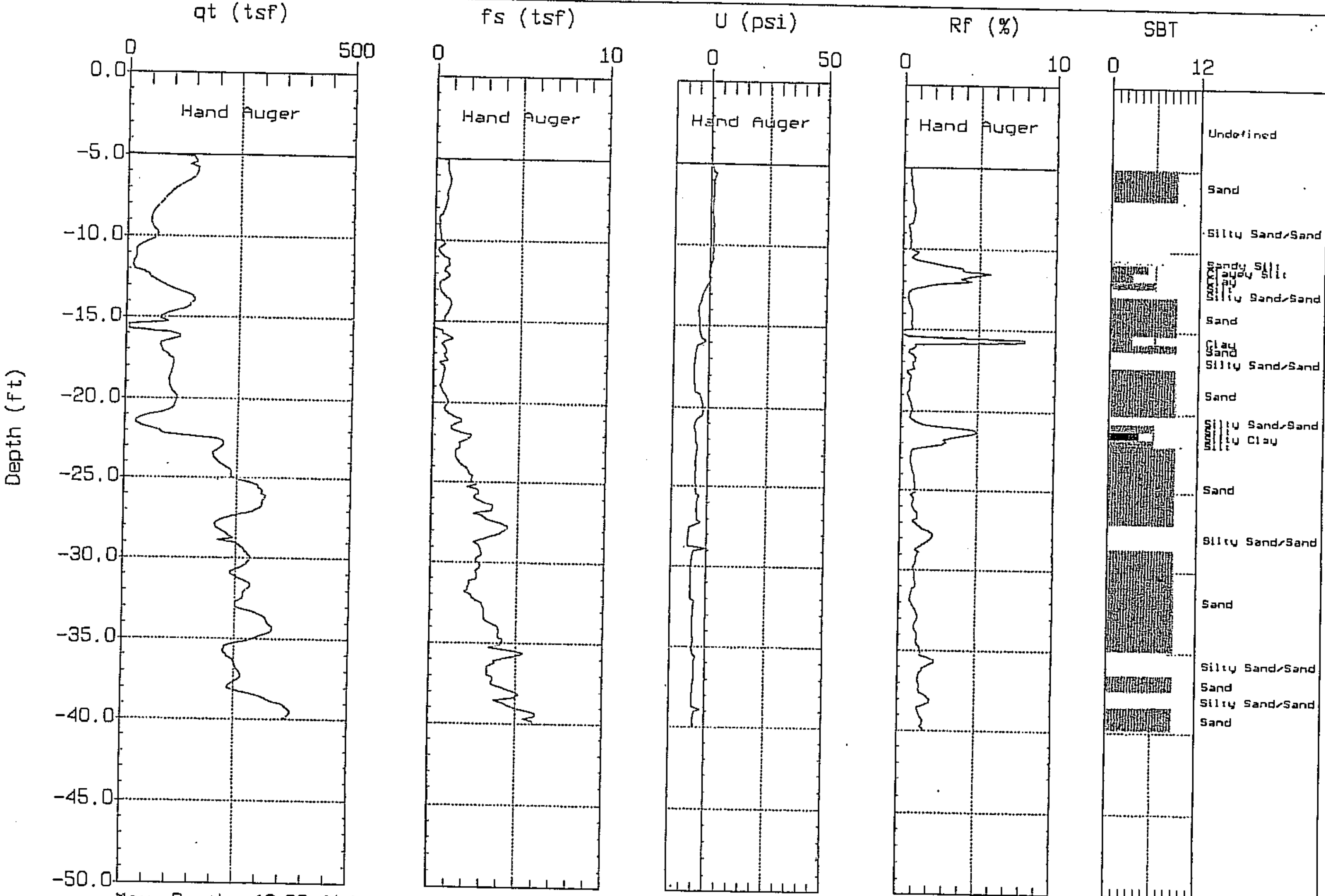
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREG ENGEO

Site: KB HOMES
Location: CPT-12

Engineer: S.HARRIS
Date: 07:18:05 12:29



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

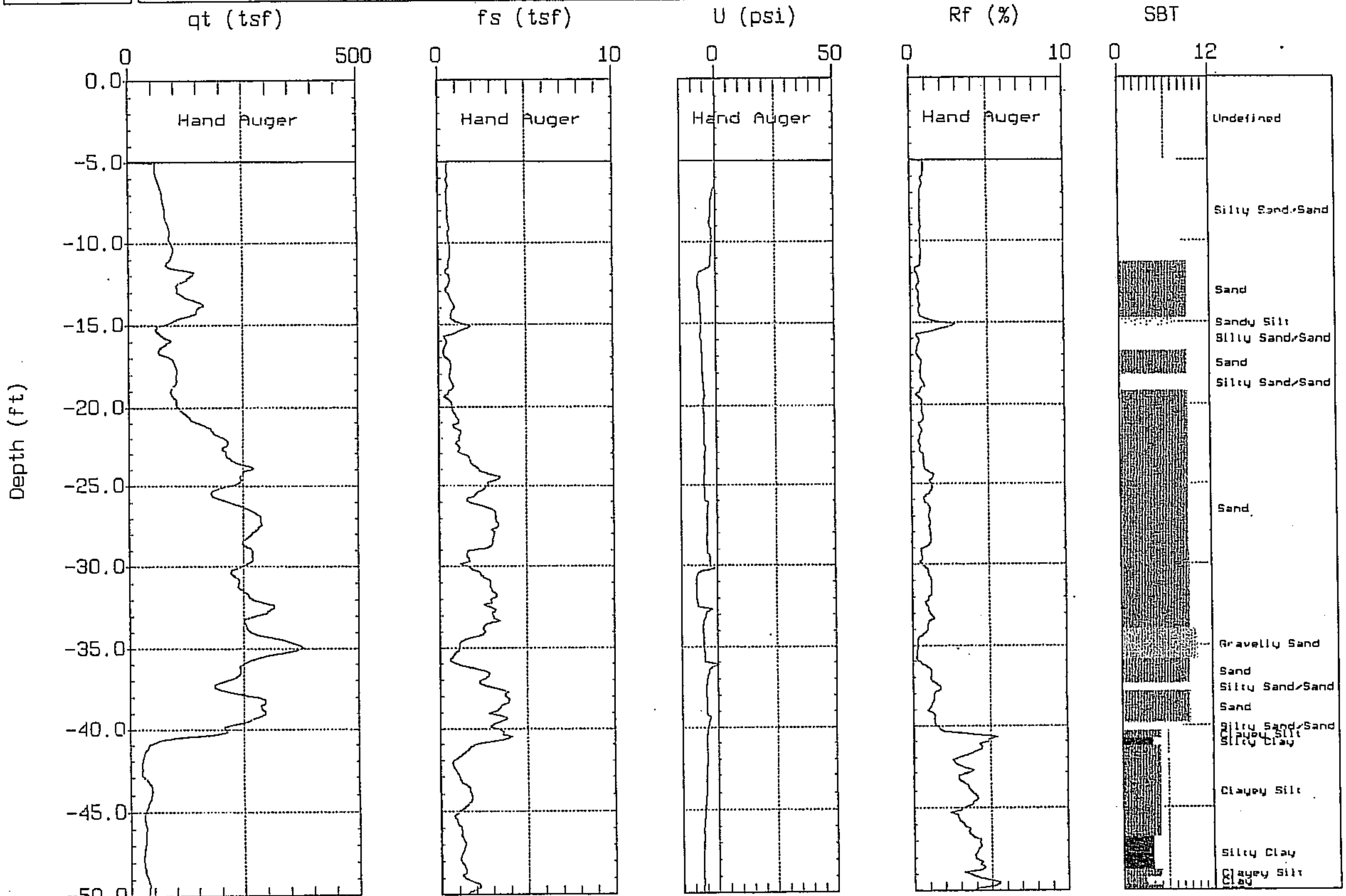
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KG HOMES
Location: CPT-13

Engineer: S.HARRIS
Date: 07:18:05 13:04



Max. Depth: 50.36 (ft)
Depth Inc.: 0.164 (ft)

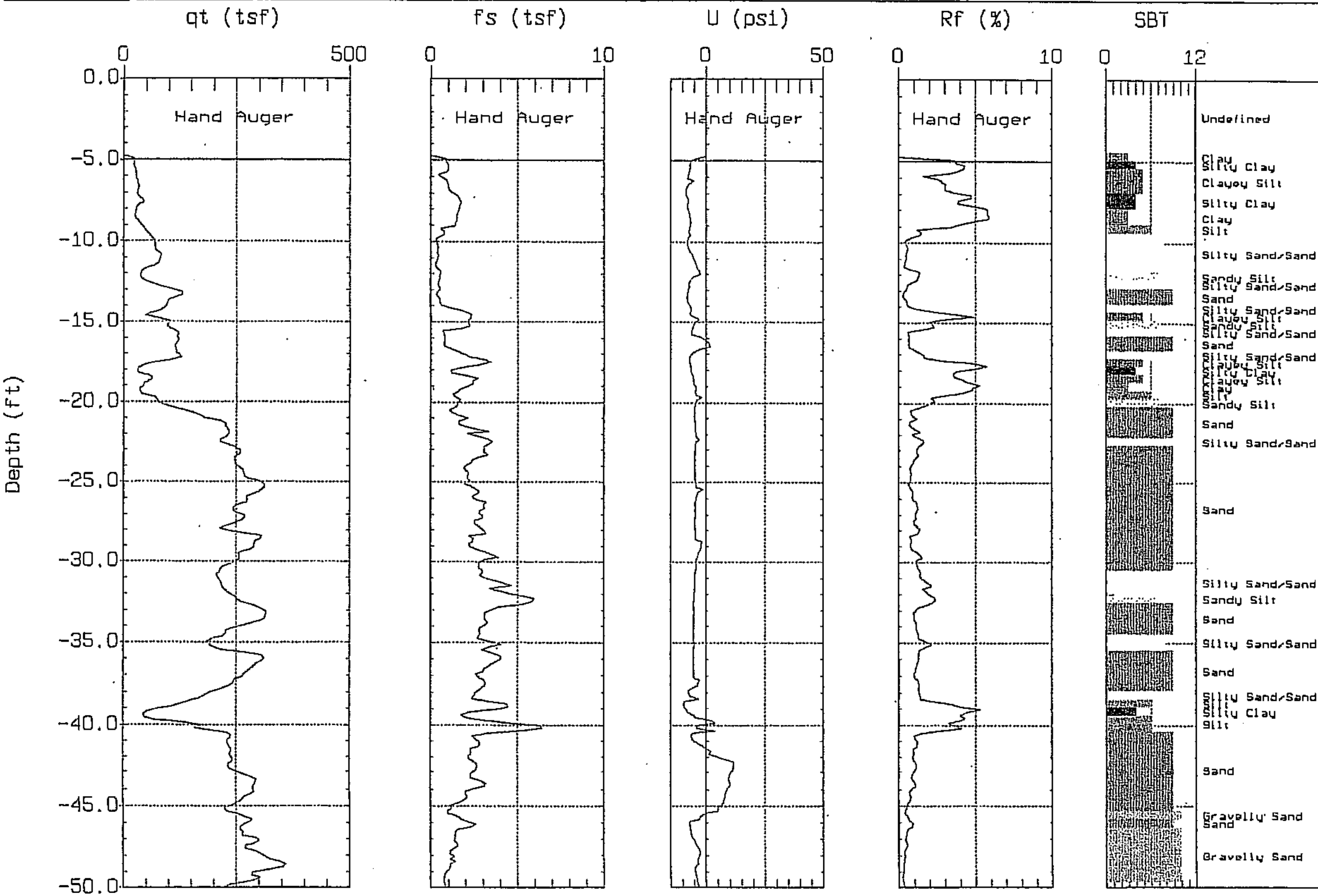
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-14

Engineer: S.HARRIS
Date: 07:15:05 07:39



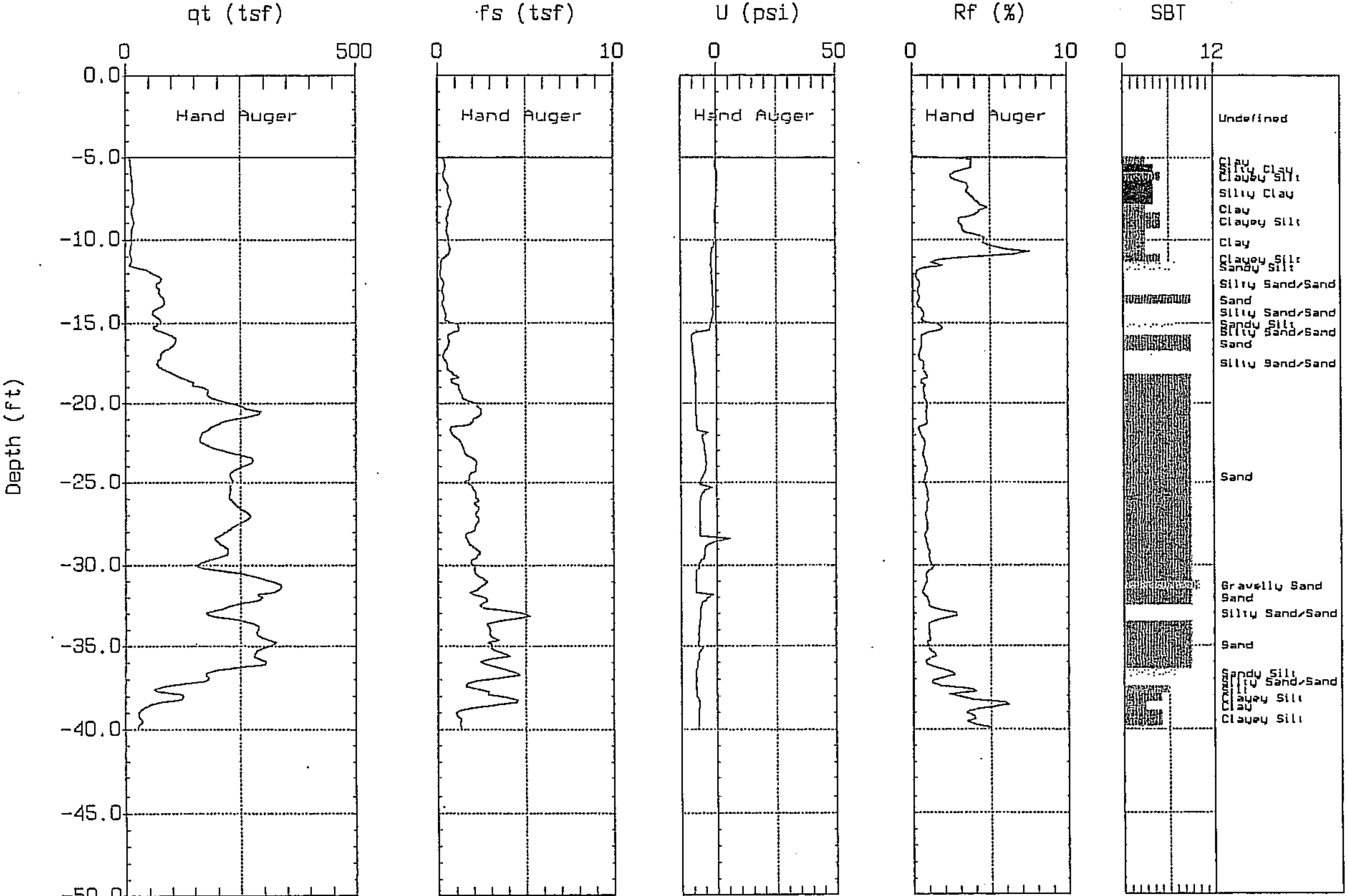
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-15

Engineer: S.HARRIS
Date: 07:14:05 15:31



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

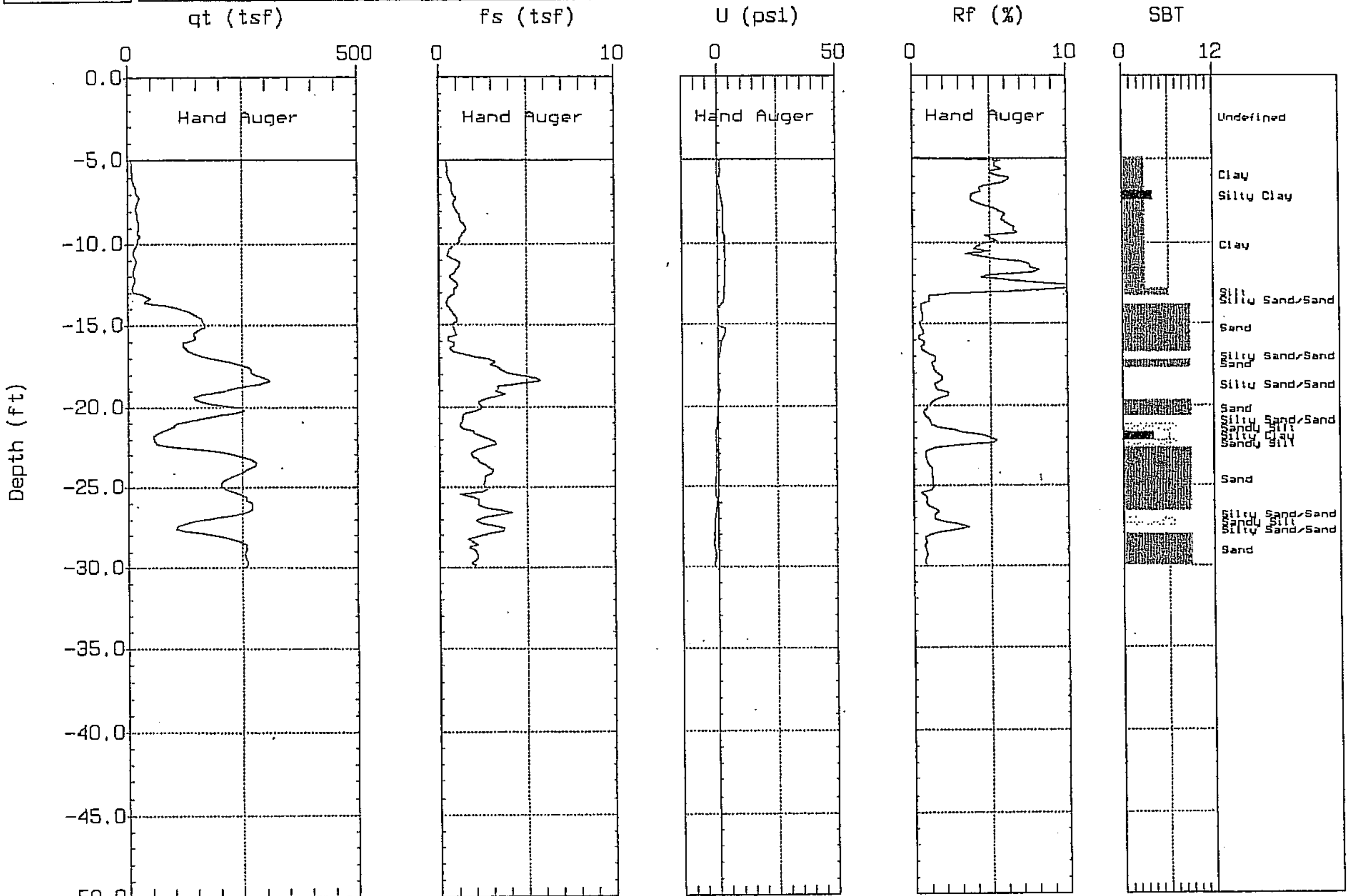
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-16

Engineer: S.HARRIS
Date: 07:14:05 14:18



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

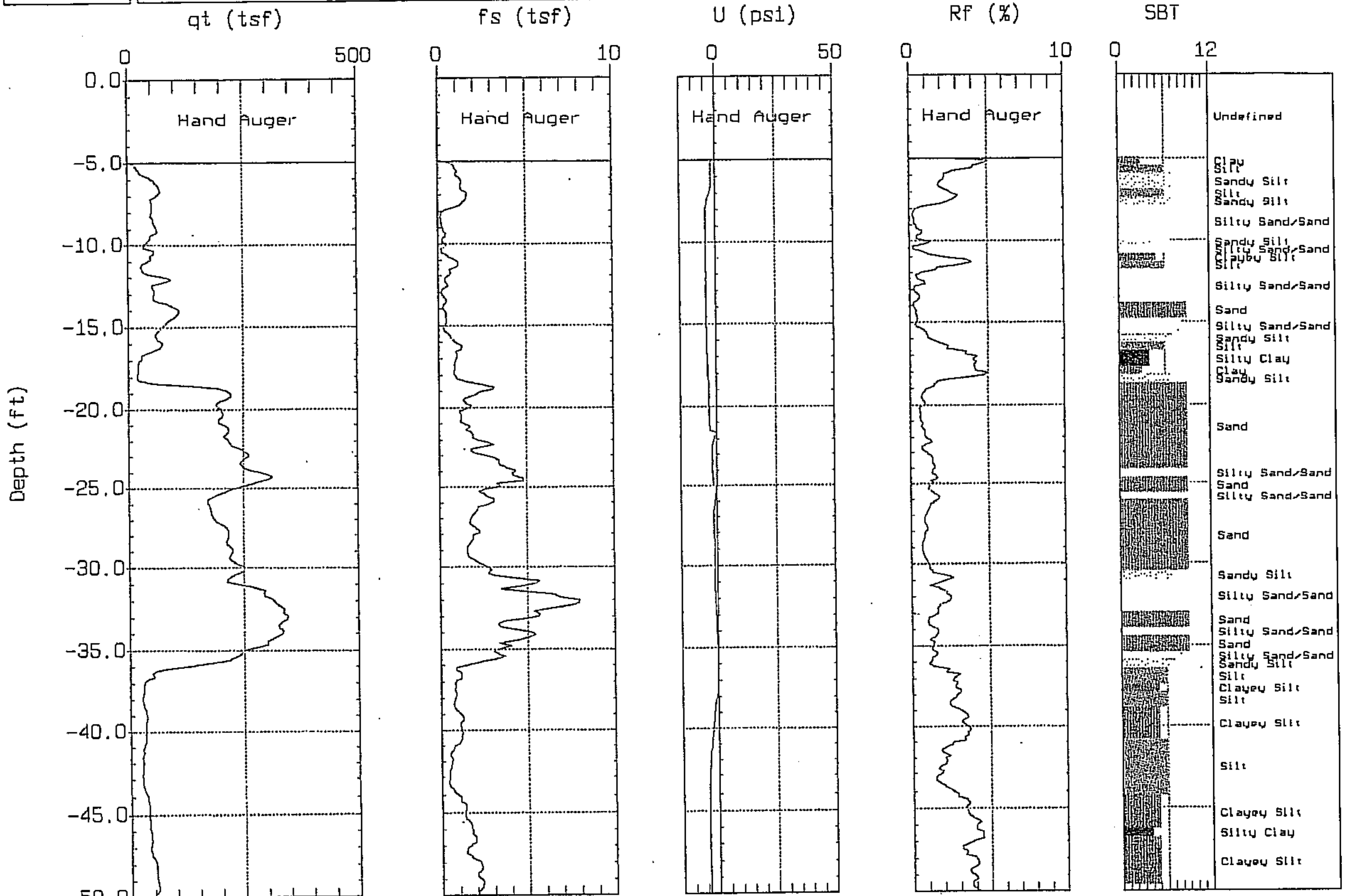
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-17

Engineer: S.HARRIS
Date: 07:14:05 14:57



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

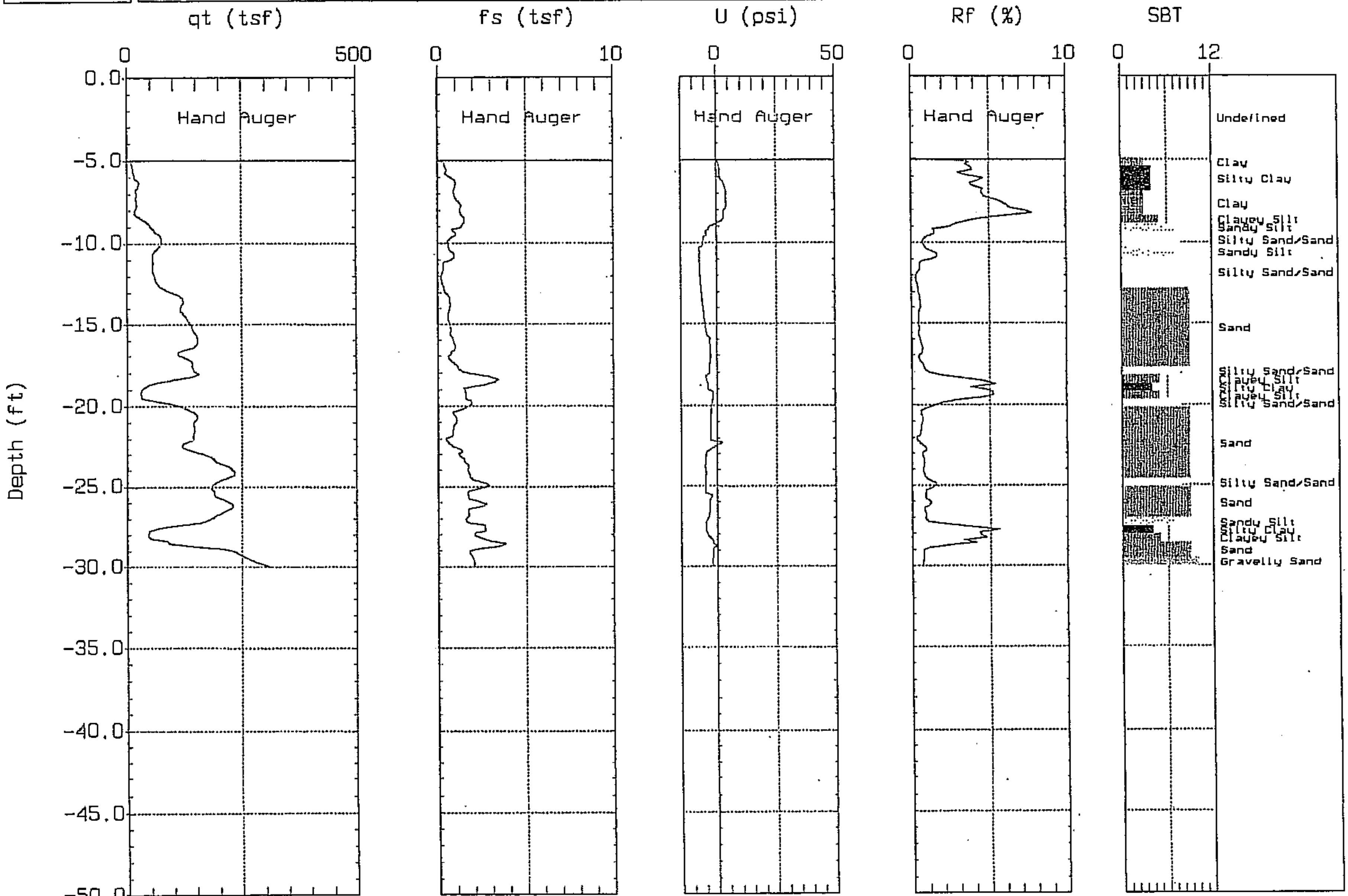
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-18

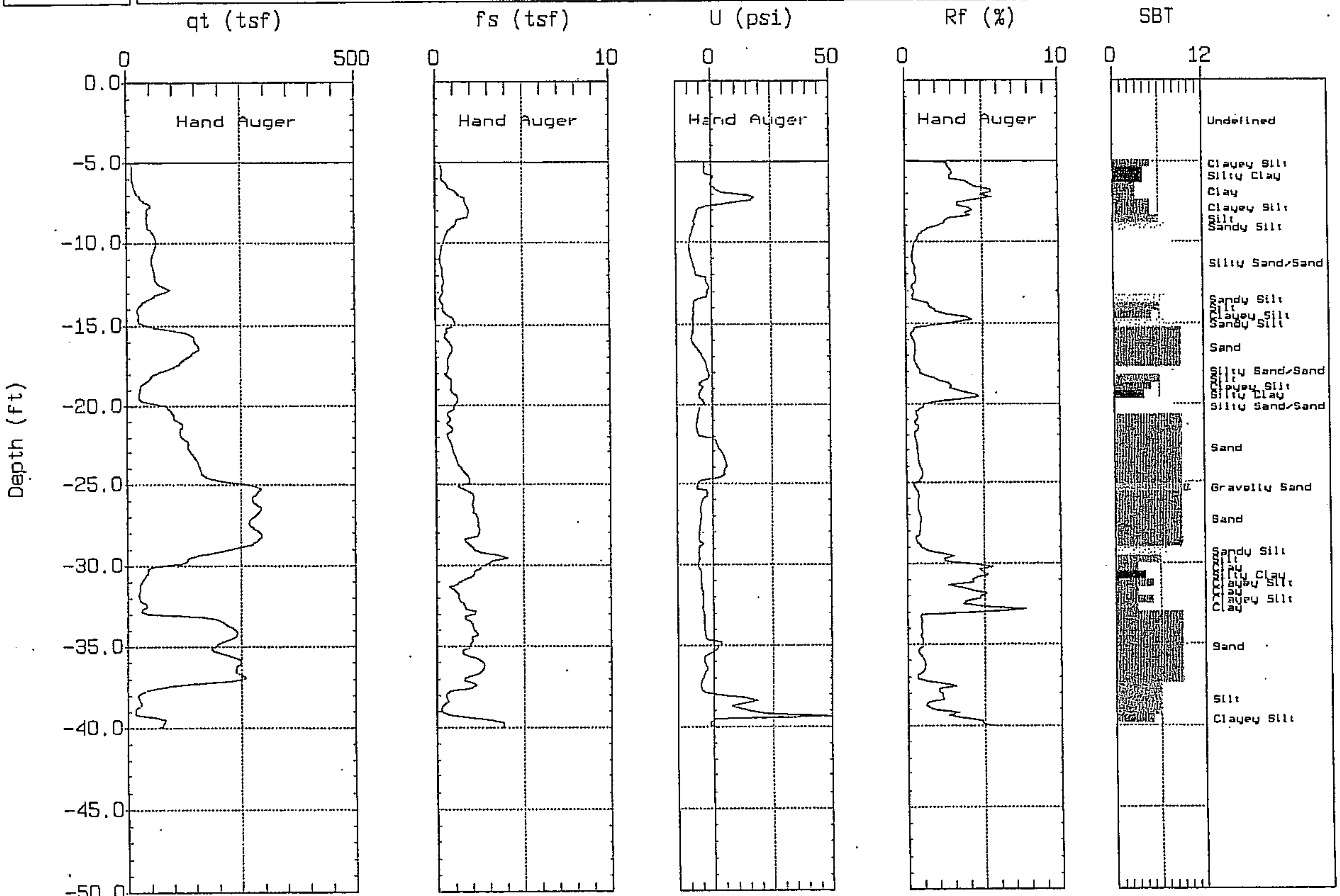
Engineer: S.HARRIS
Date: 07:19:05 08:41



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES | Engineer: S.HARRIS
Location: CPT-19 | Date: 07:14:05 07:52



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

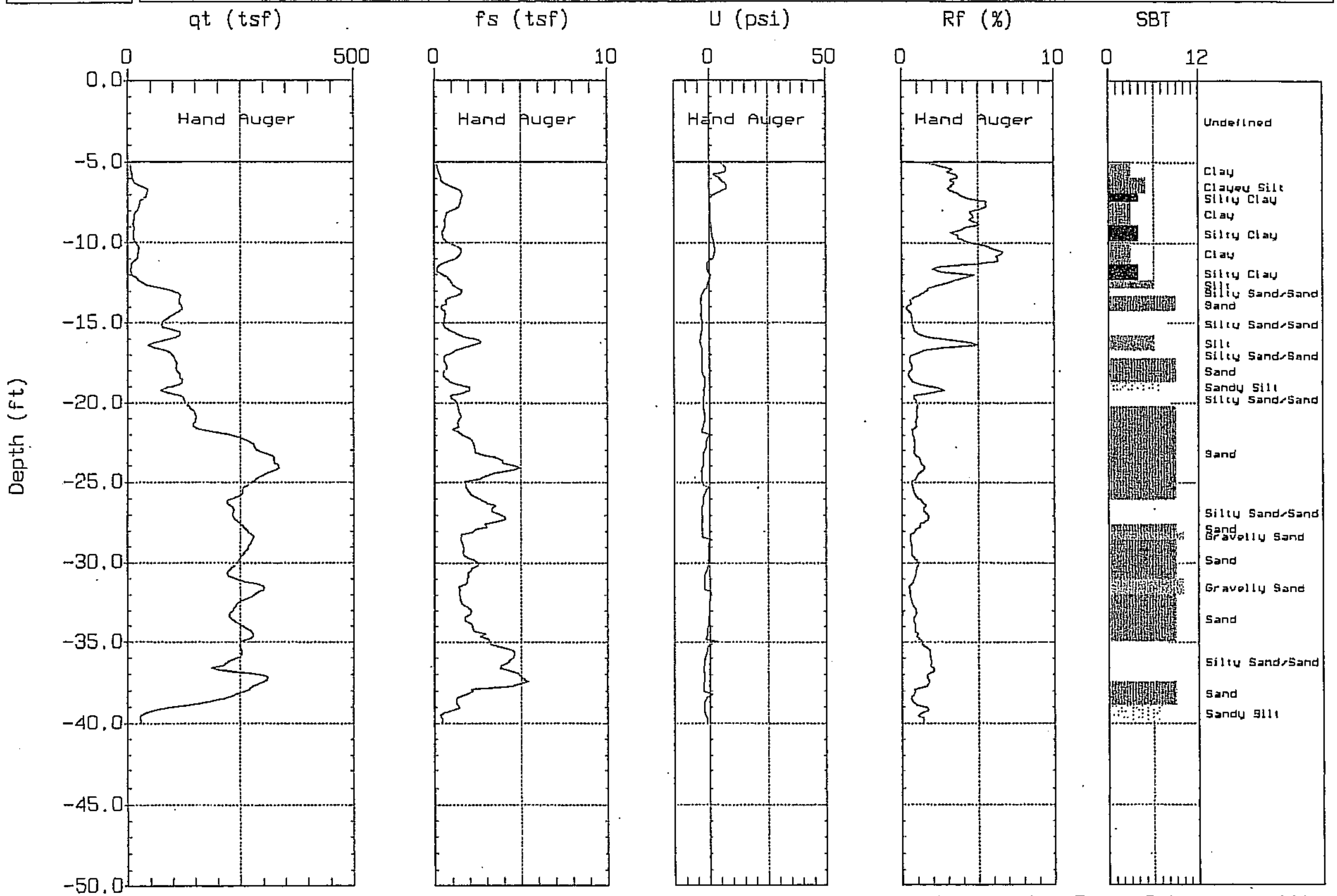
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-20

Engineer: S.HARRIS
Date: 07:19:05 09:36



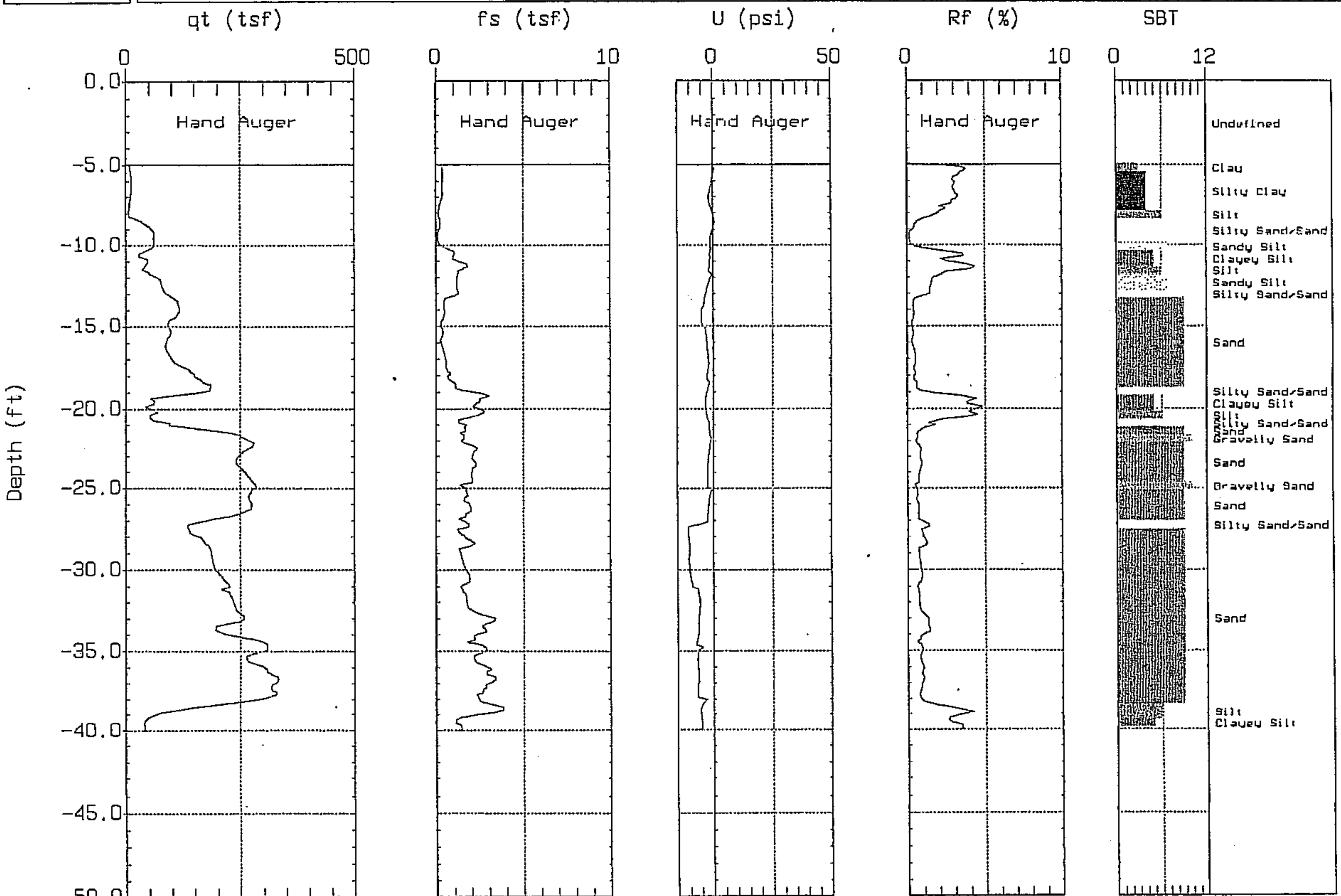
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-21

Engineer: S.HARRIS
Date: 07:19:05 10:35



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

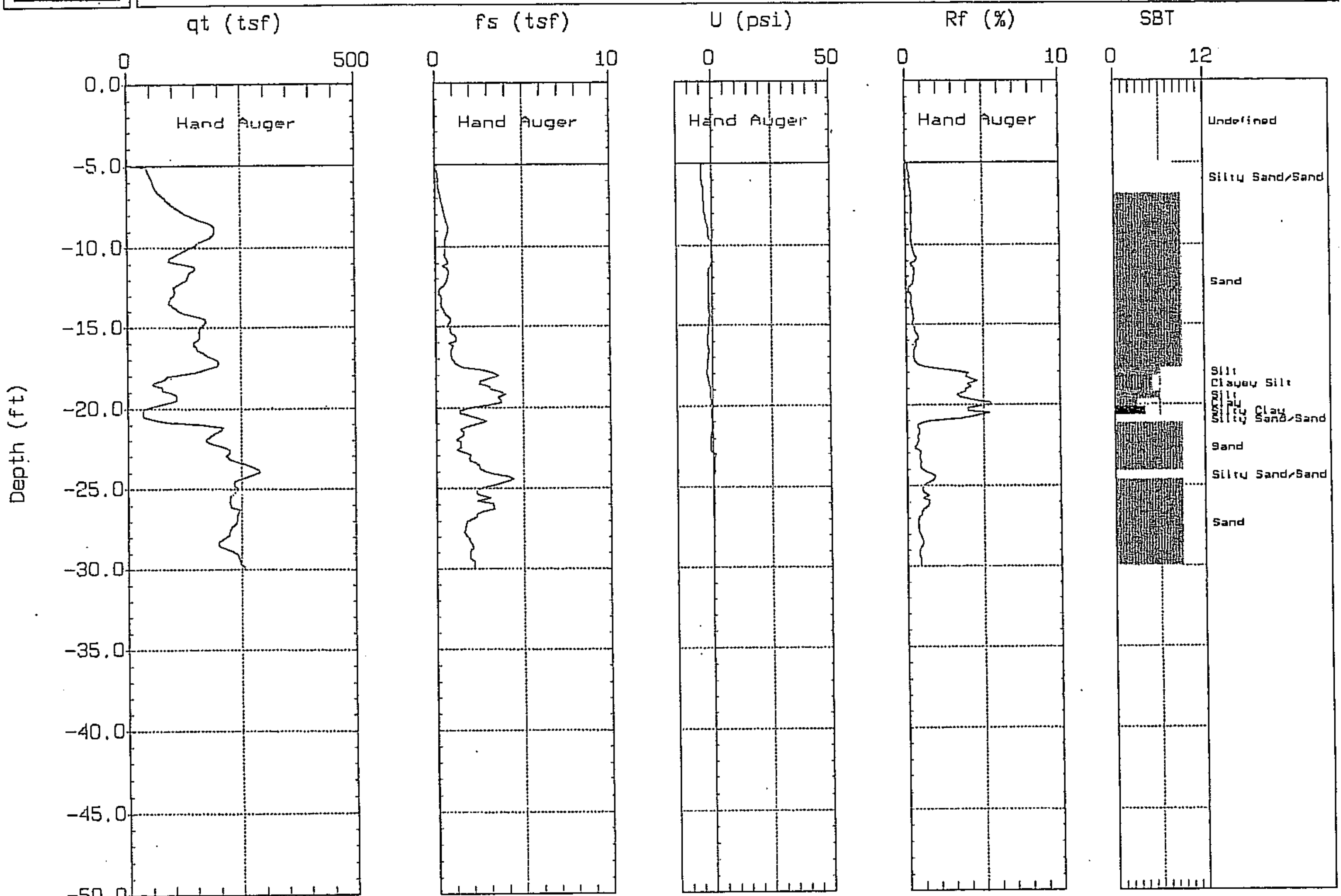
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-22

Engineer: S.HARRIS
Date: 07:19:05 11:14



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

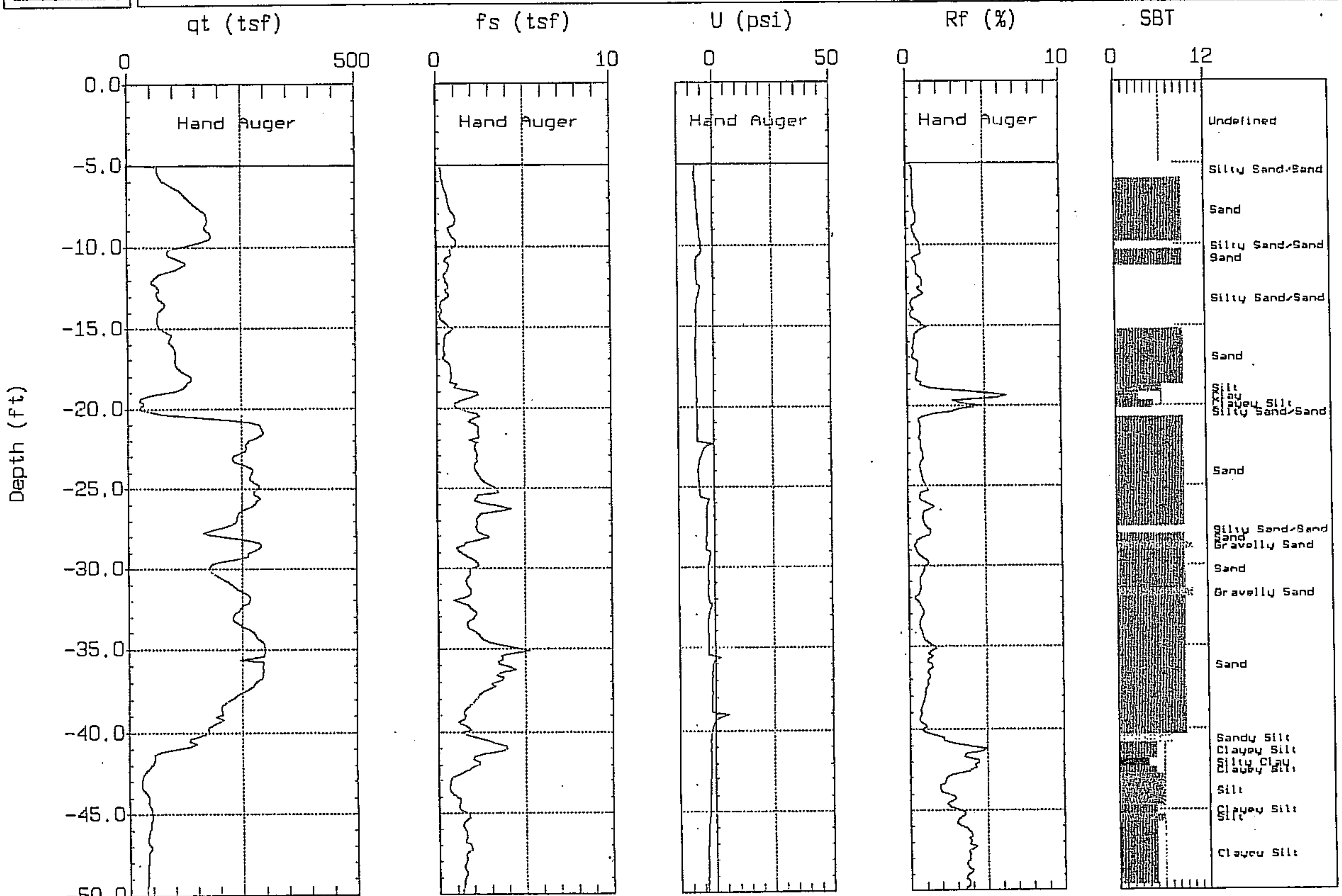
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-23

Engineer: S.HARRIS
Date: 07:19:05 12:56



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

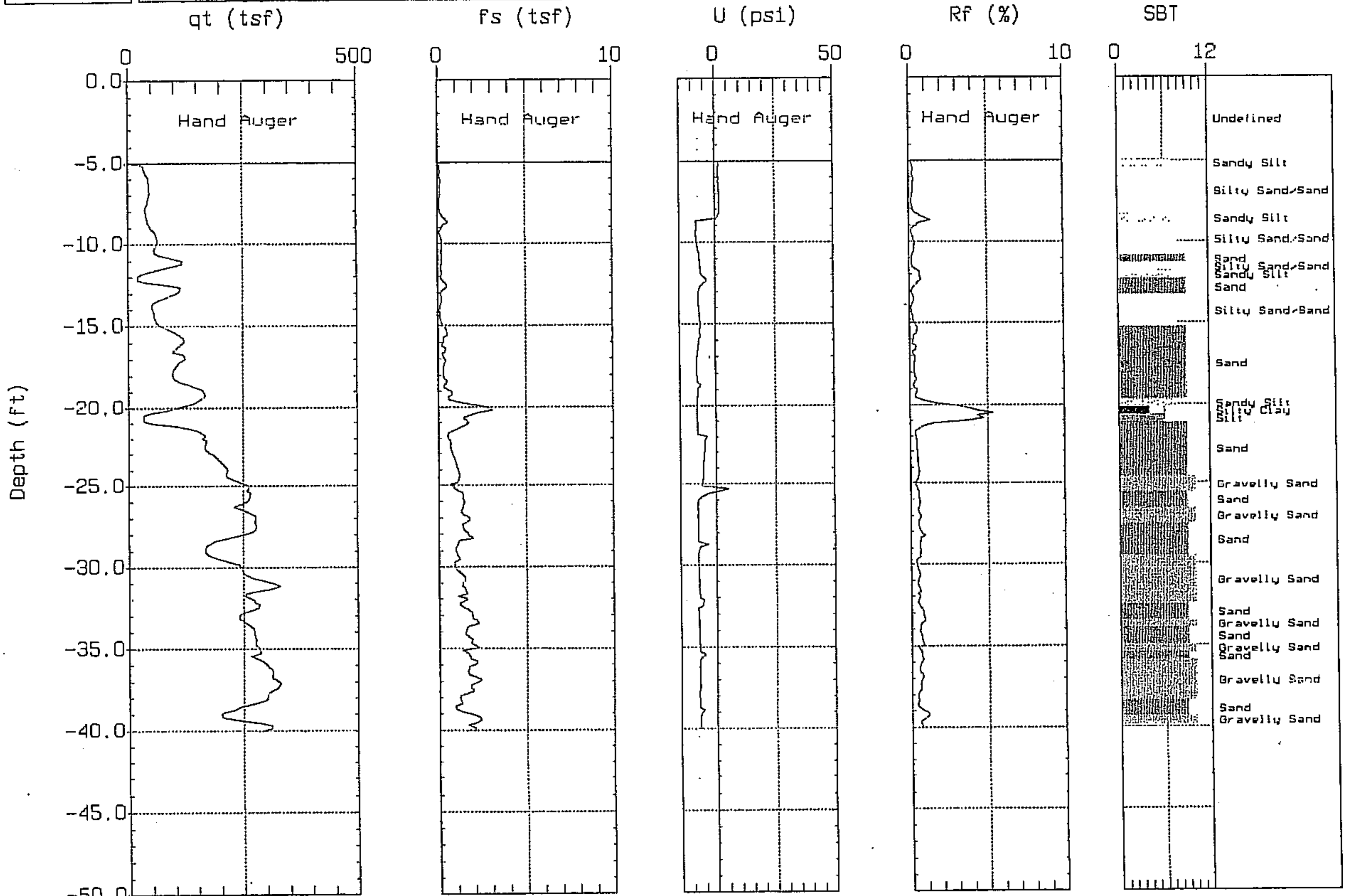
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-24

Engineer: S.HARRIS
Date: 07:19:05 13:35



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

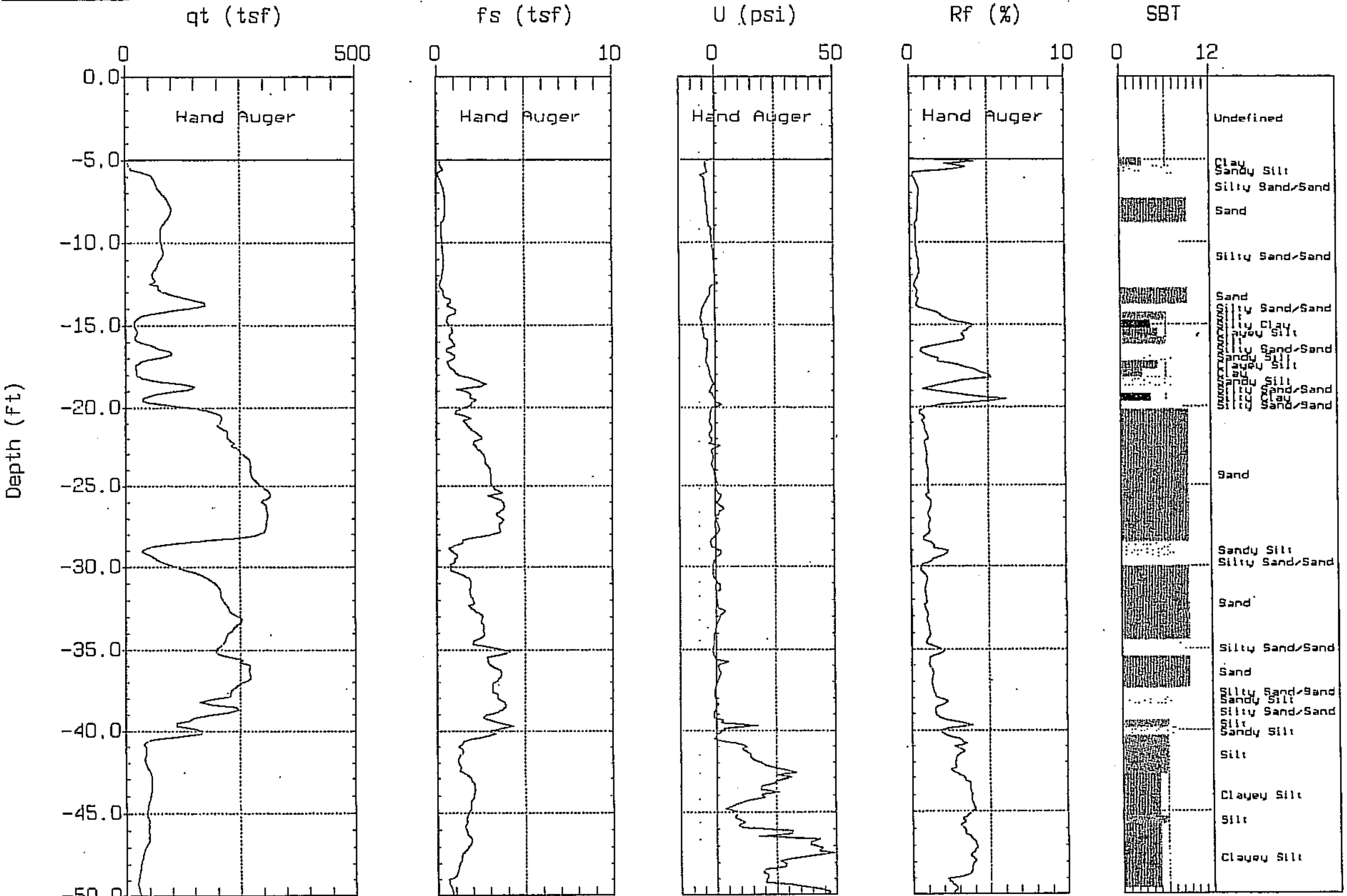
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-25

Engineer: S.HARRIS
Date: 07:14:05 08:34



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

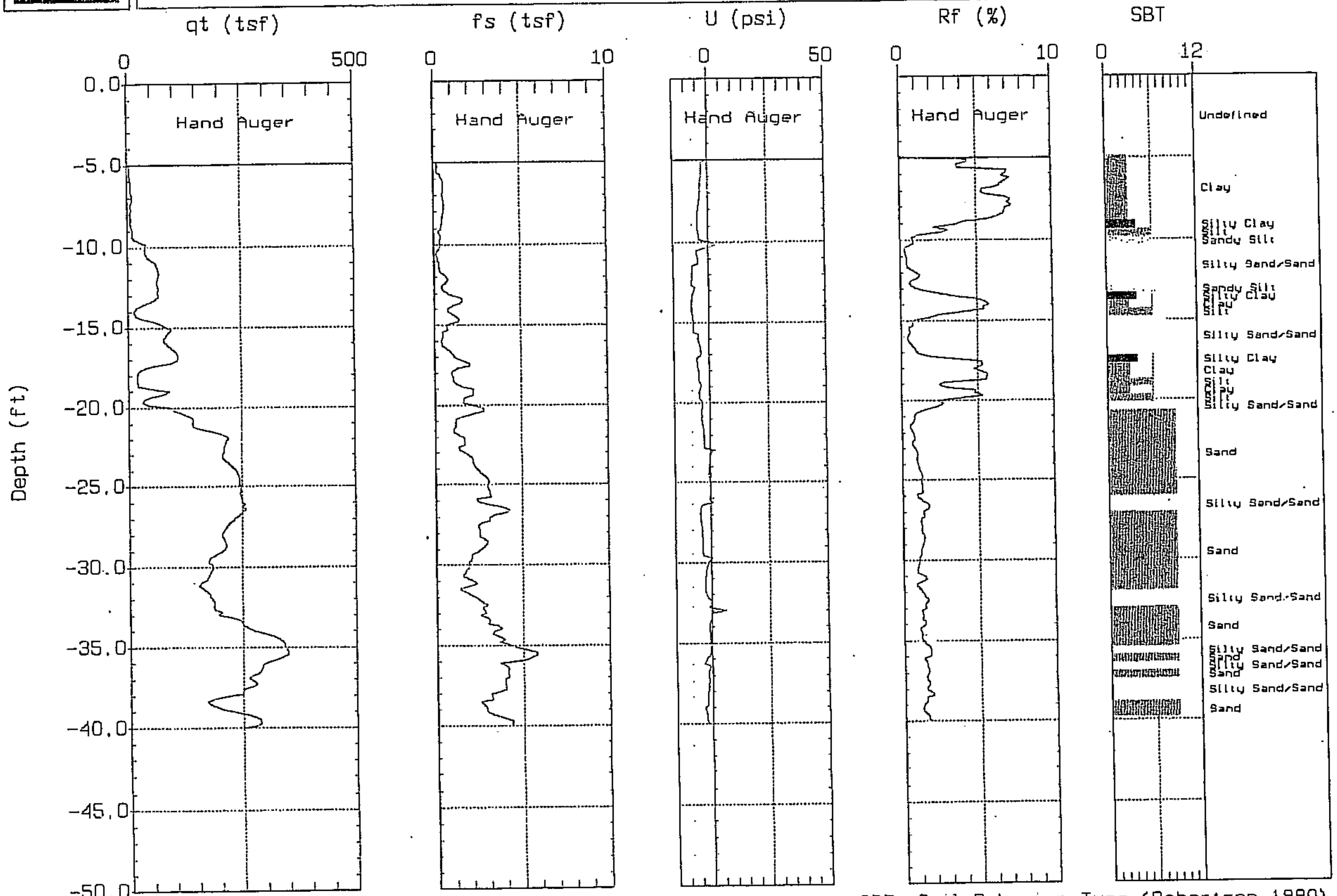
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-26

Engineer: S.HARRIS
Date: 07:14:05 09:13



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

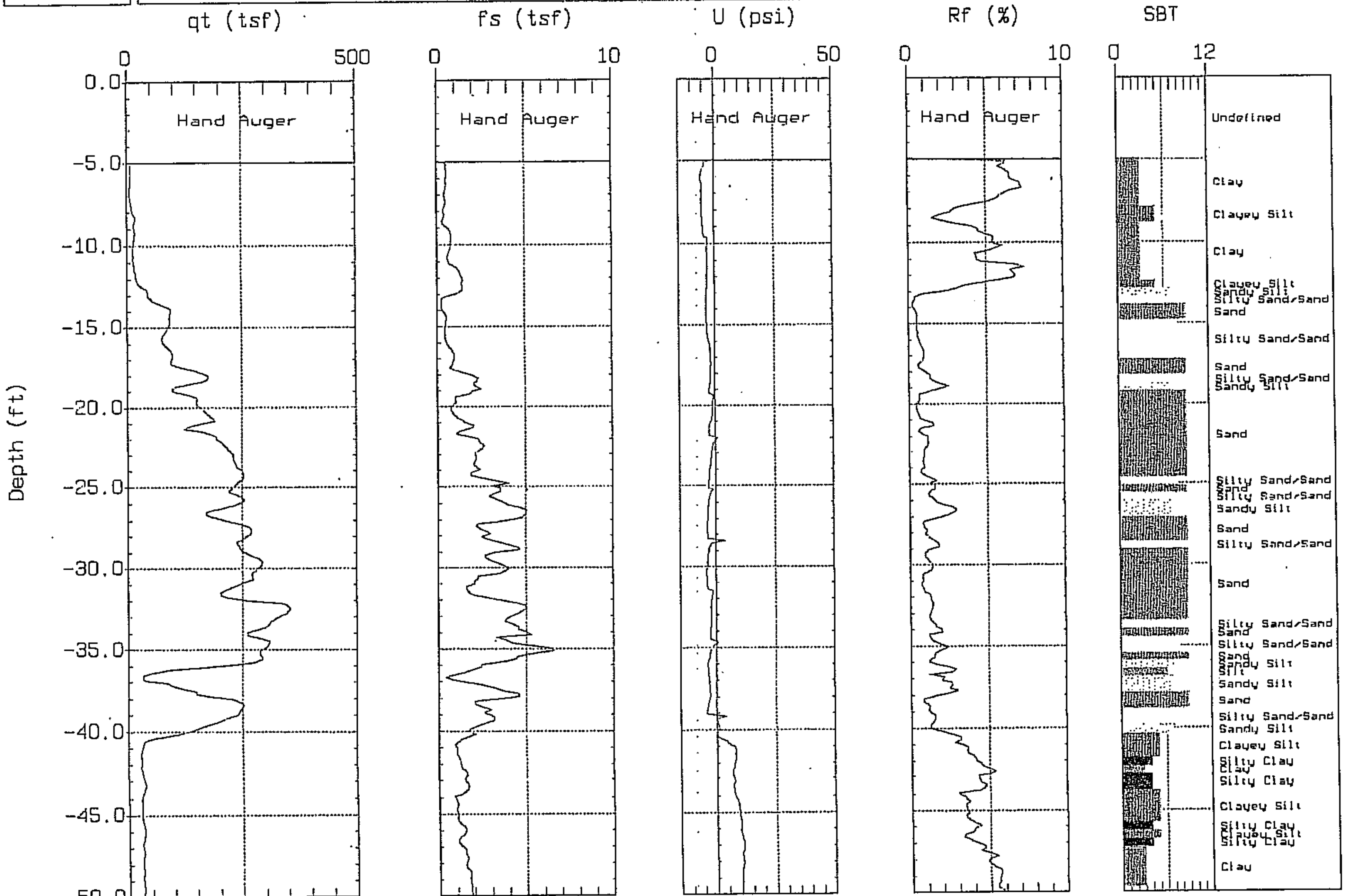
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-27

Engineer: S.HARRIS
Date: 07:13:05 16:01



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

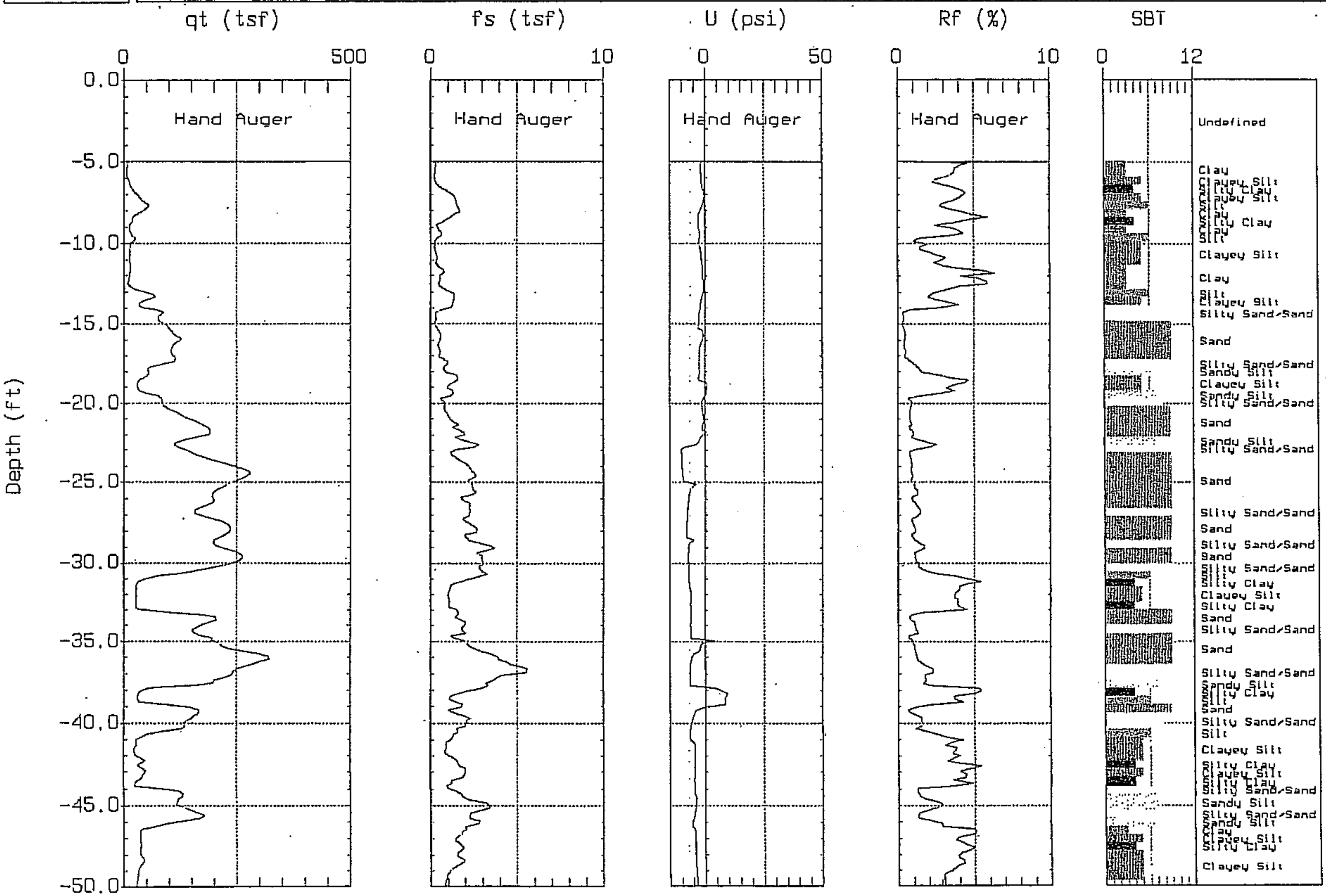
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-28

Engineer: S.HARRIS
Date: 07:13:05 15:28



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

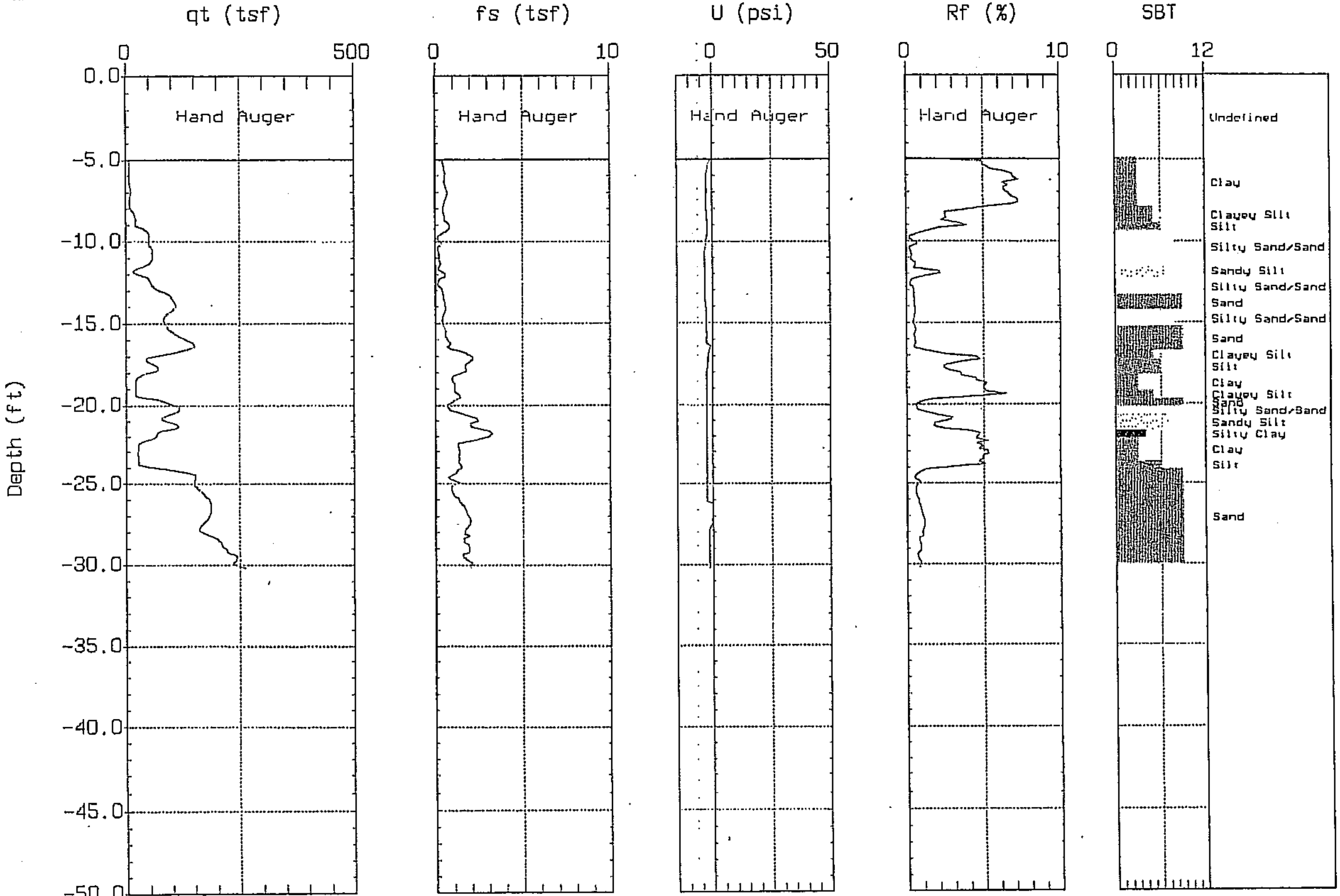
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-29

Engineer: S.HARRIS
Date: 07:13:05 15:06



Max. Depth: 30.19 (ft)
Depth Inc.: 0.164 (ft)

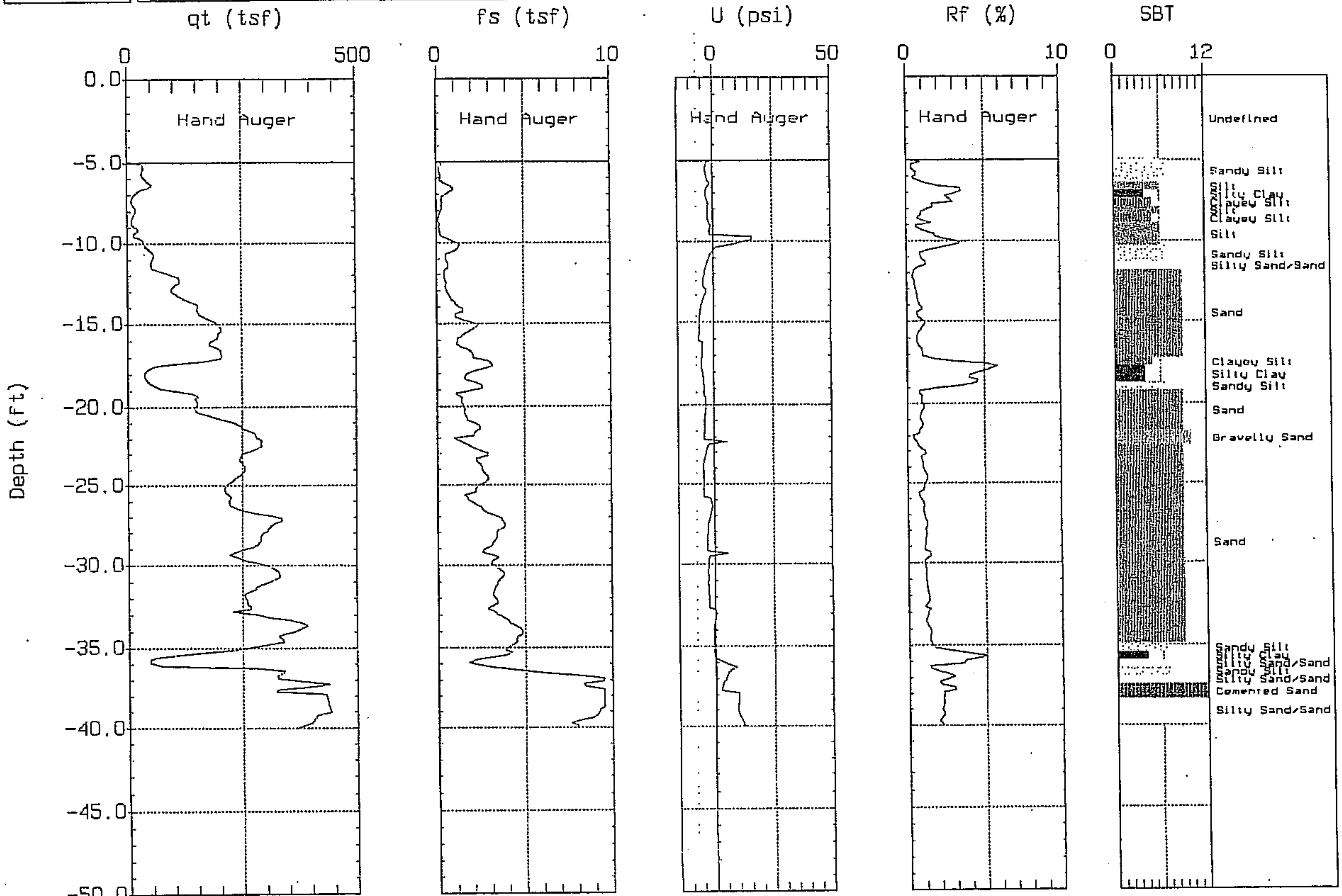
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-30

Engineer: S.HARRIS
Date: 07:14:05 09:53



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

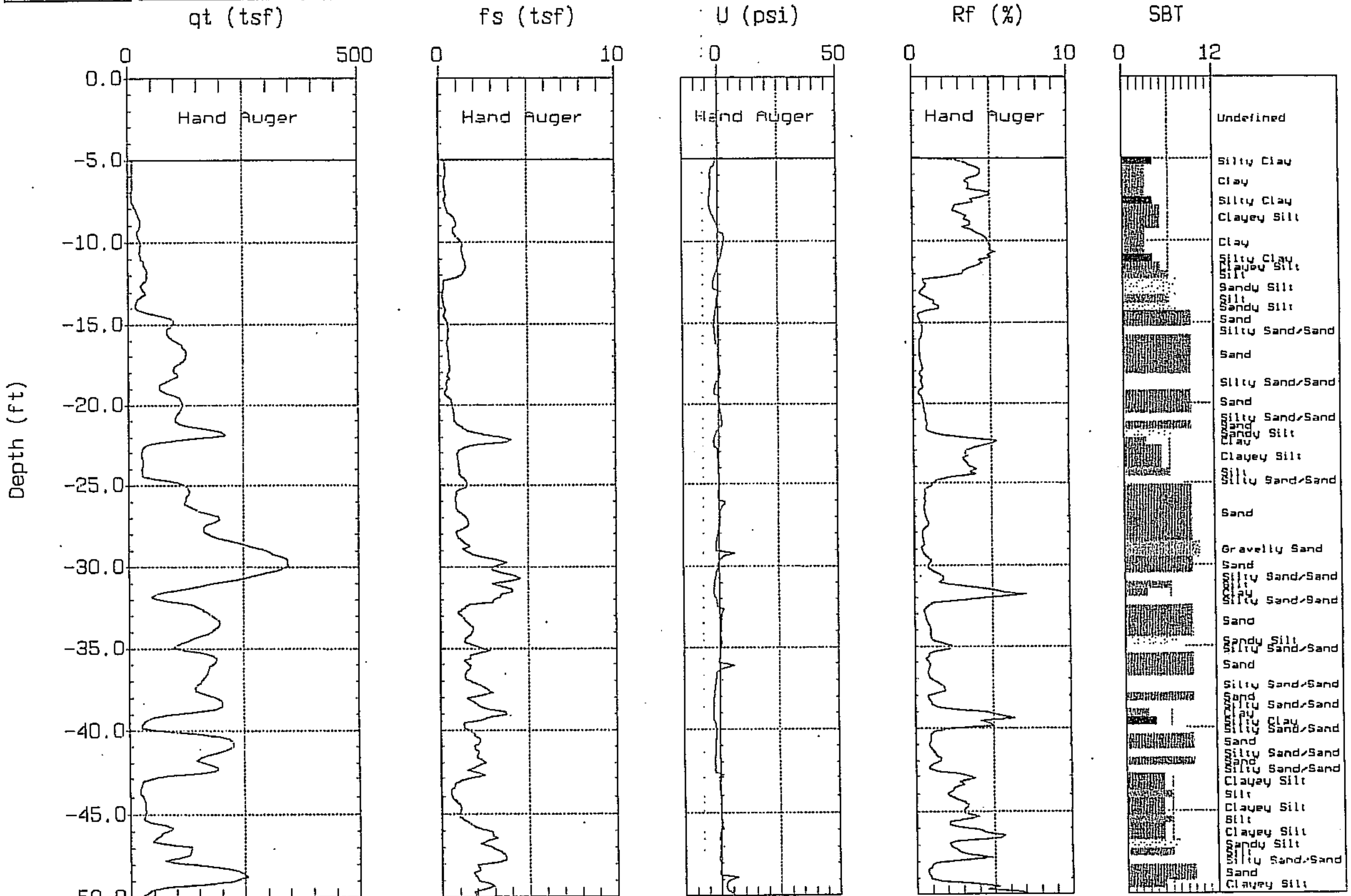
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-31

Engineer: S.HARRIS
Date: 07:13:05 14:22



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

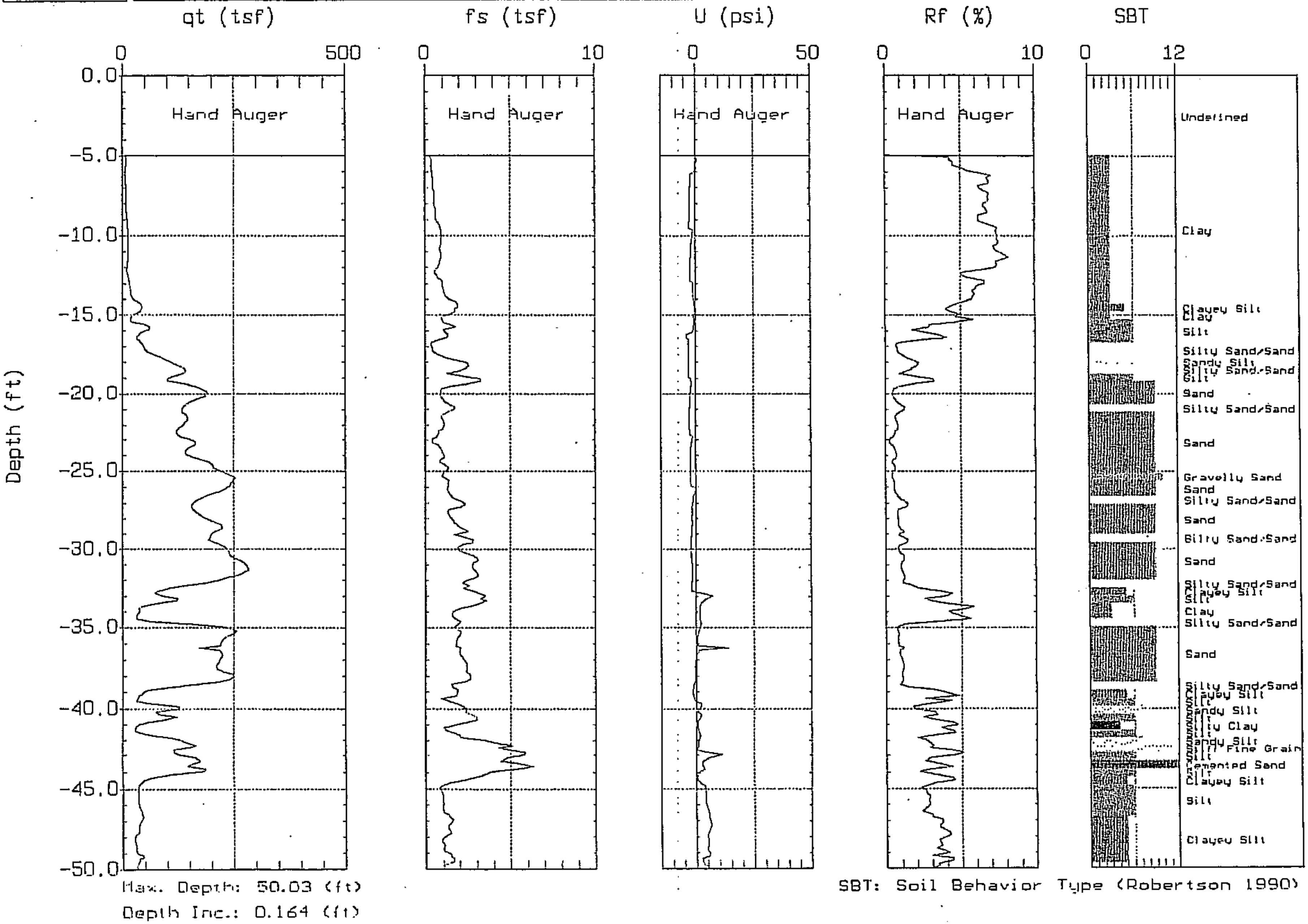
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-32

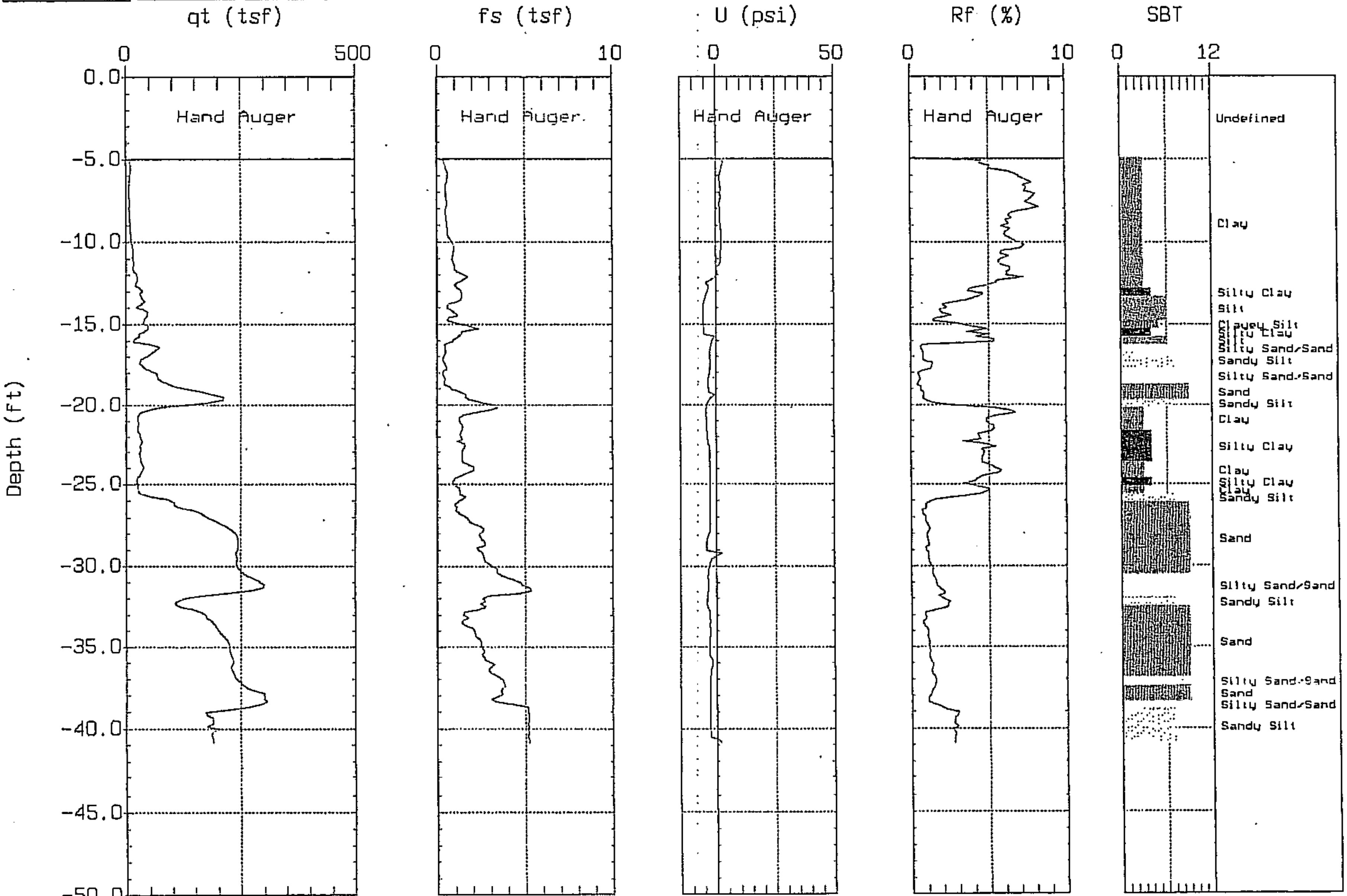
Engineer: S.HARRIS
Date: 07:20:05 09:19



ENGEO

Site: KB HOMES
Location: CPT-33

Engineer: S.HARRIS
Date: 07:13:105 13:26



Max. Depth: 40.85 (ft)
Depth Inc.: 0.164 (ft)

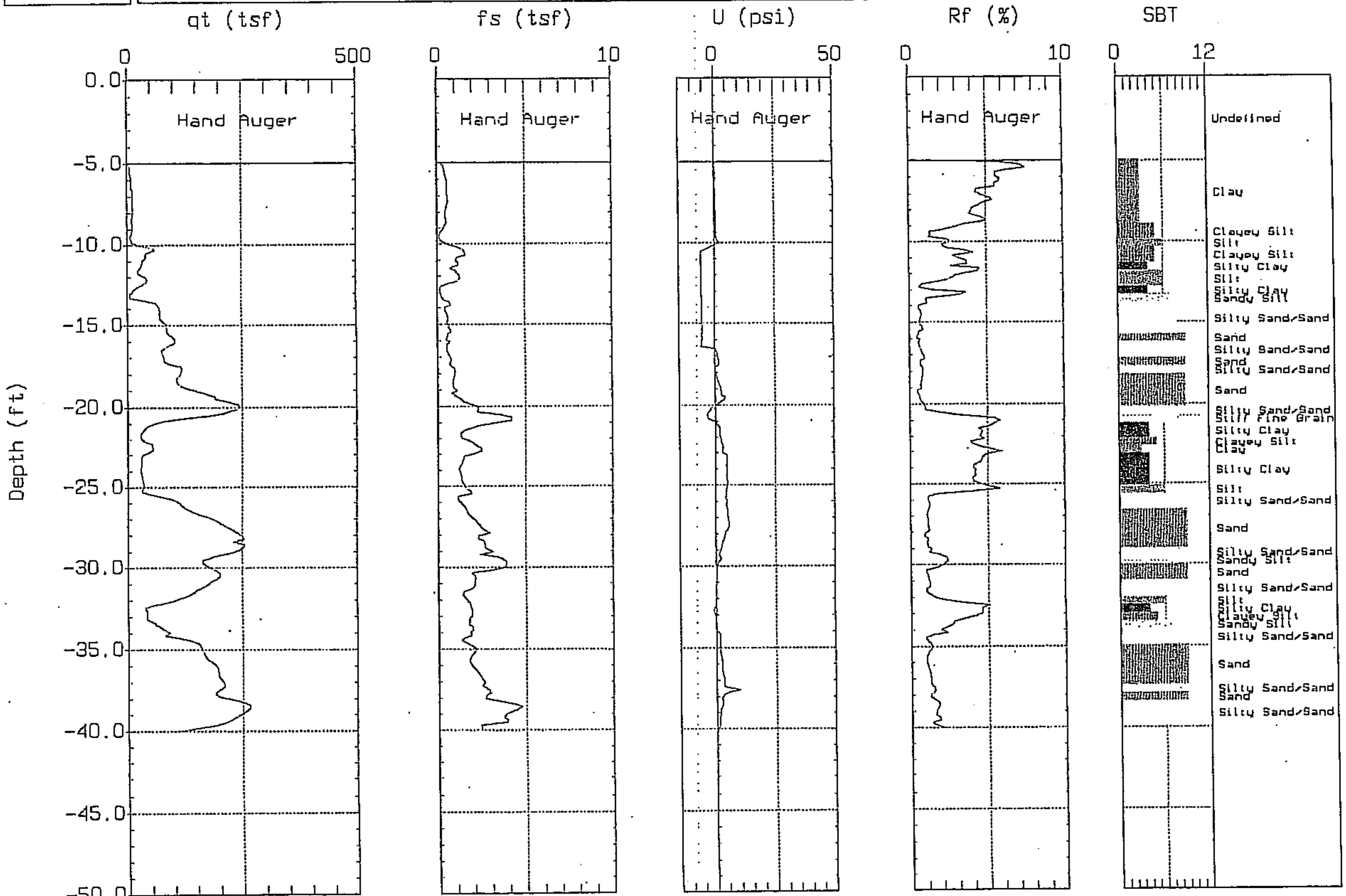
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-34

Engineer: S.HARRIS
Date: 07:13:05 11:13



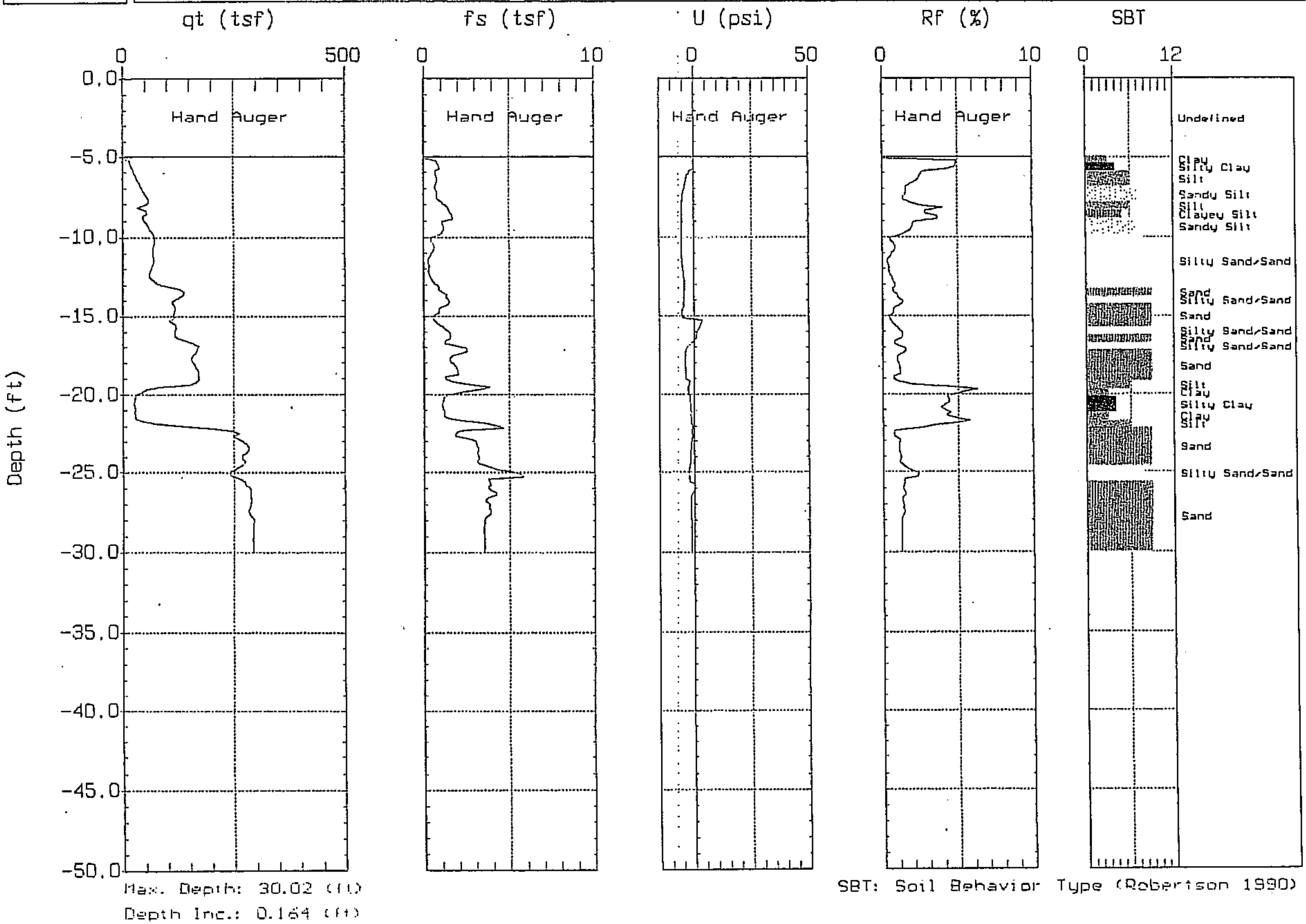
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-35

Engineer: S.HARRIS
Date: 07:14:05 10:32

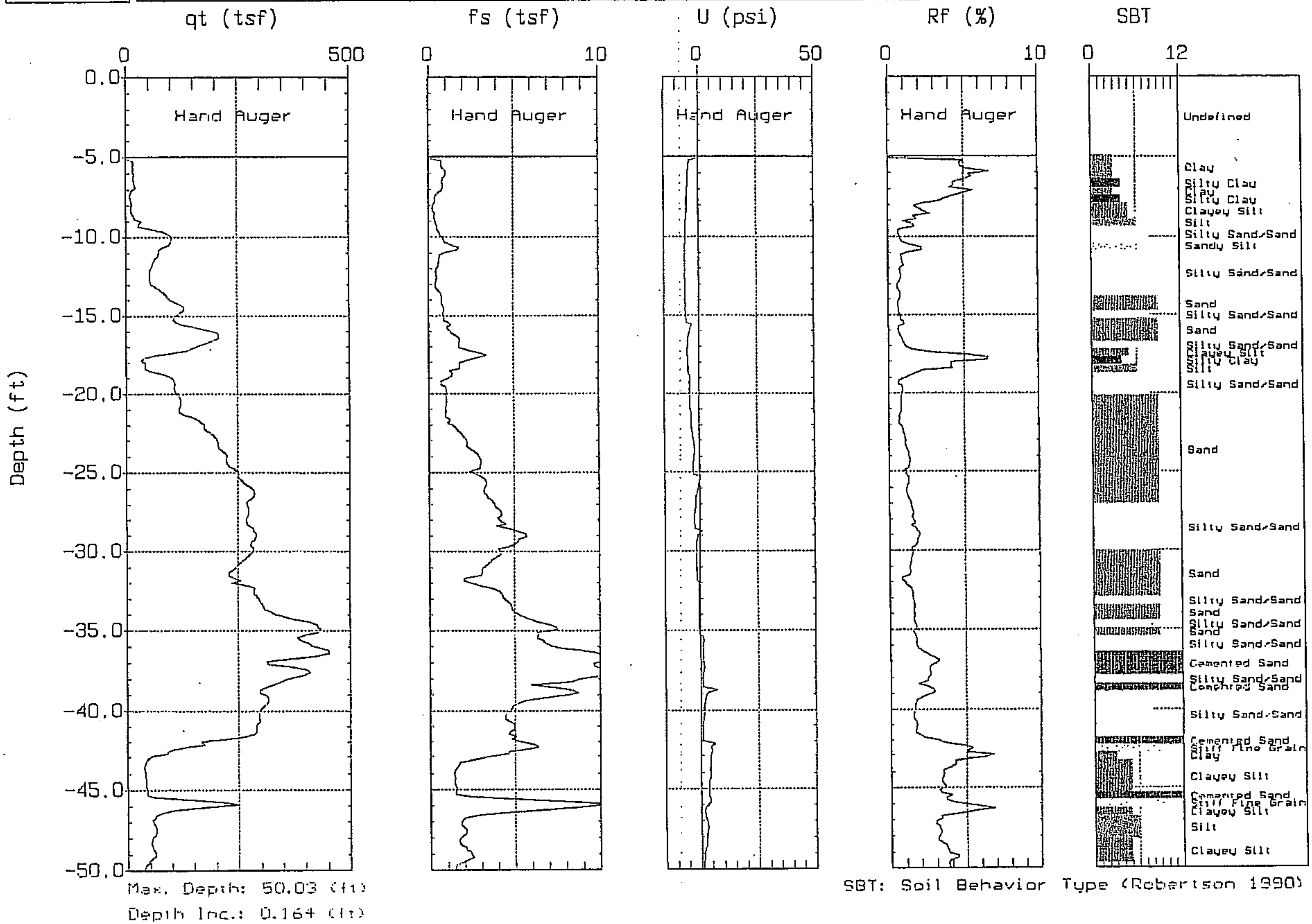


GREGG

ENGEO

Site: KB HOMES
Location: CPT-36

Engineer: S.HARRIS
Date: 07:14:05 12:41

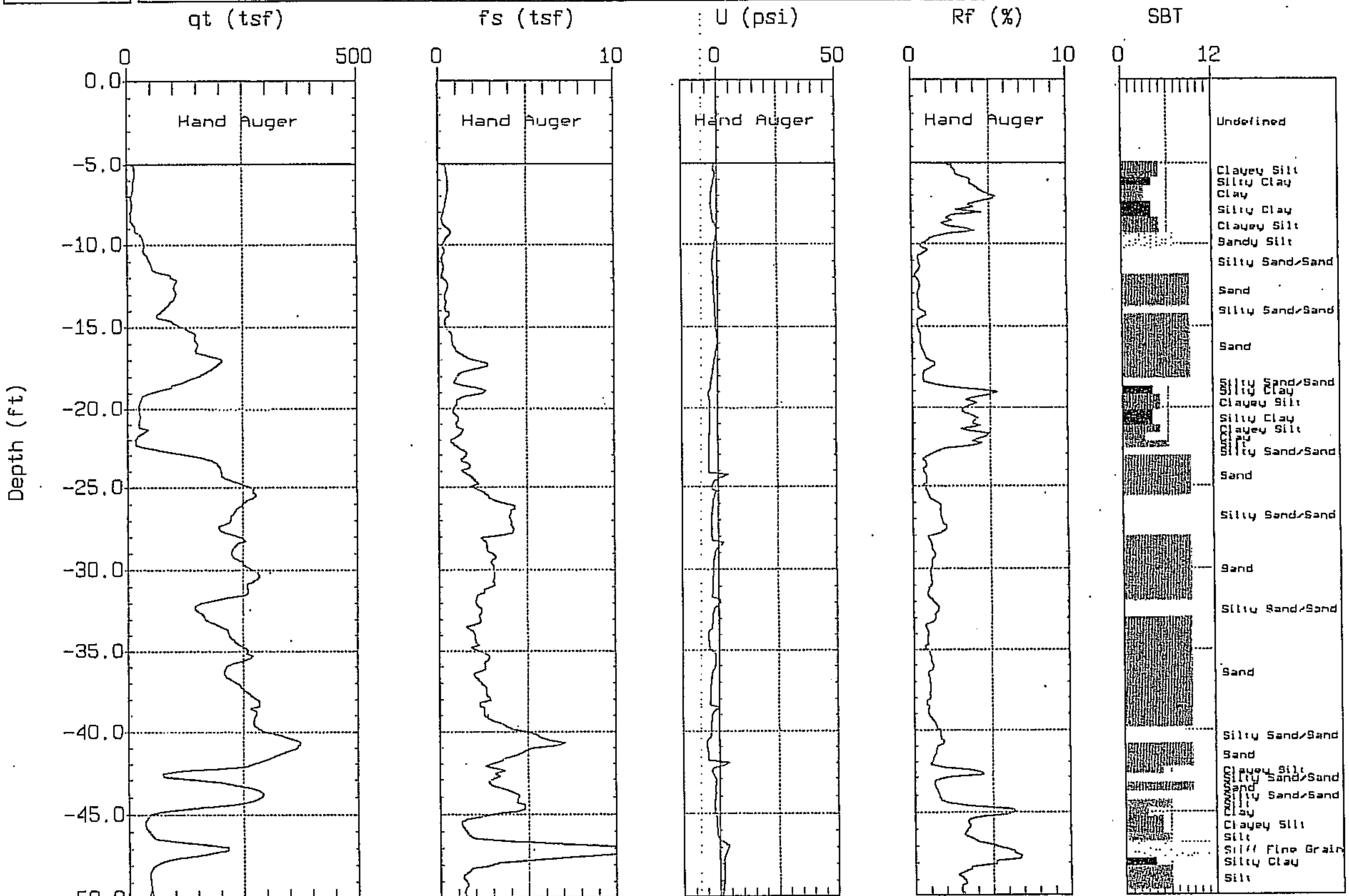


GREGG

ENGEO

Site: KB HOMES
Location: CPT-37

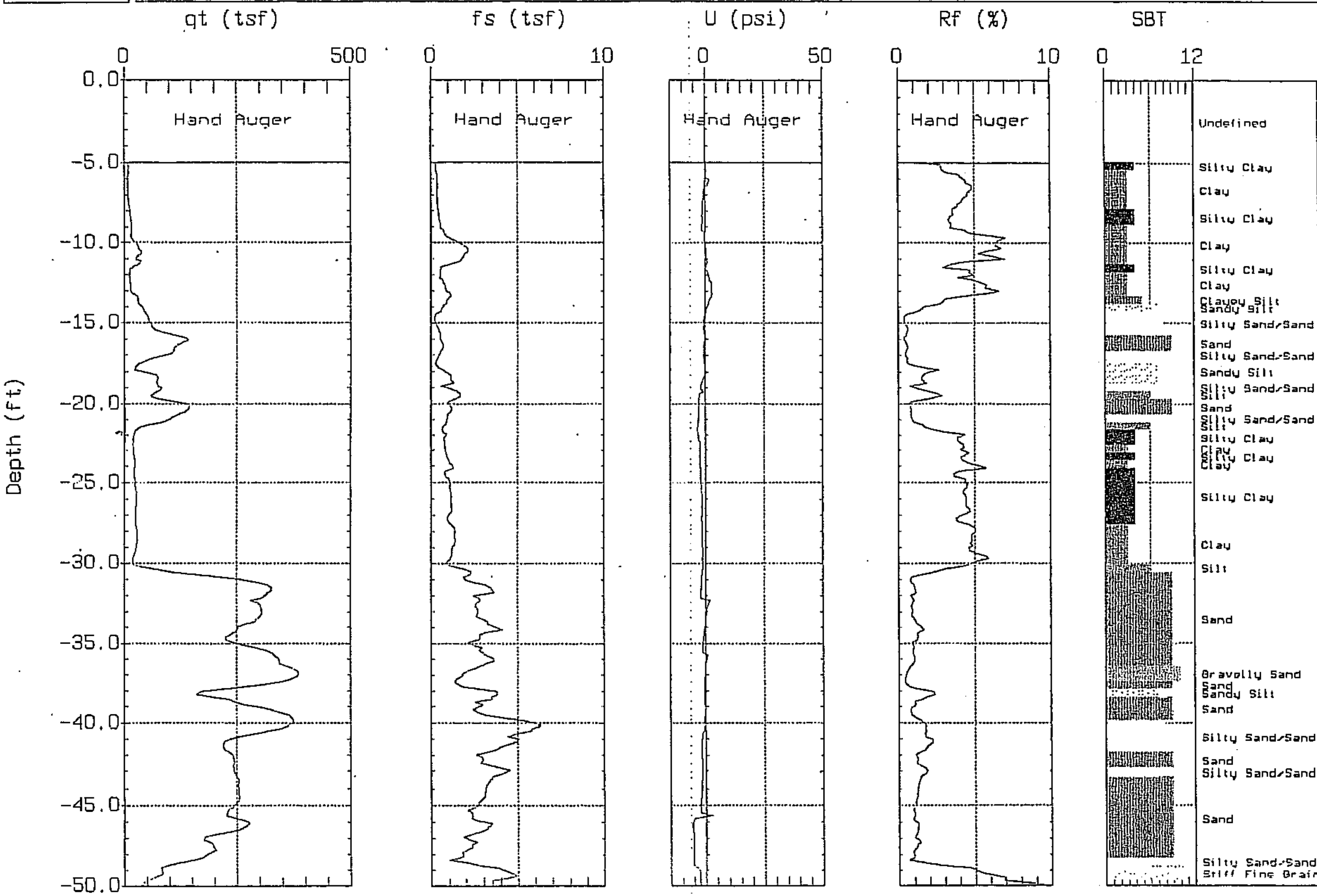
Engineer: S.HARRIS
Date: 07:14:05 13:10



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES | Engineer: S.HARRIS
Location: CPT-38 | Date: 07:13:05 10:19



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

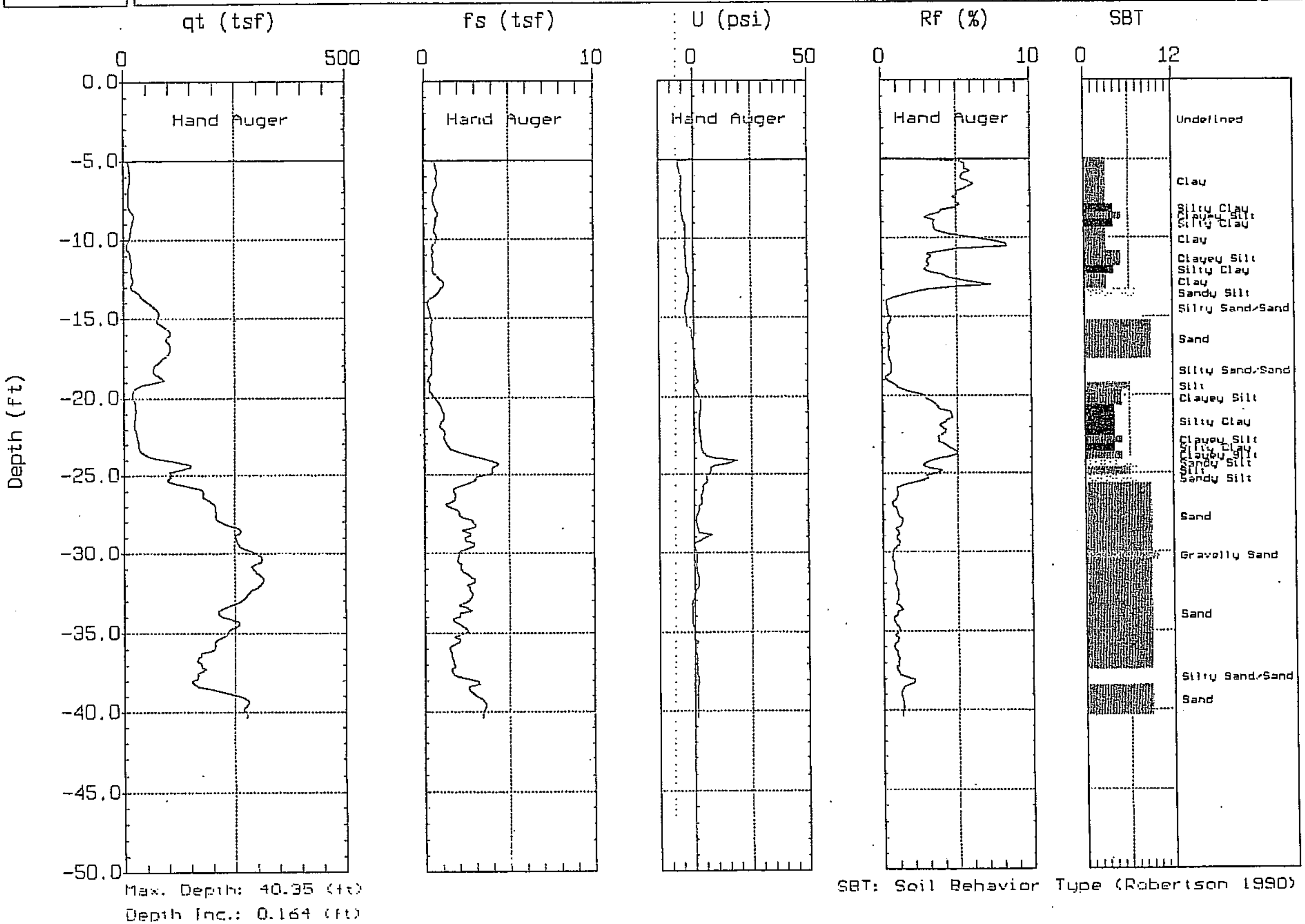
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-39

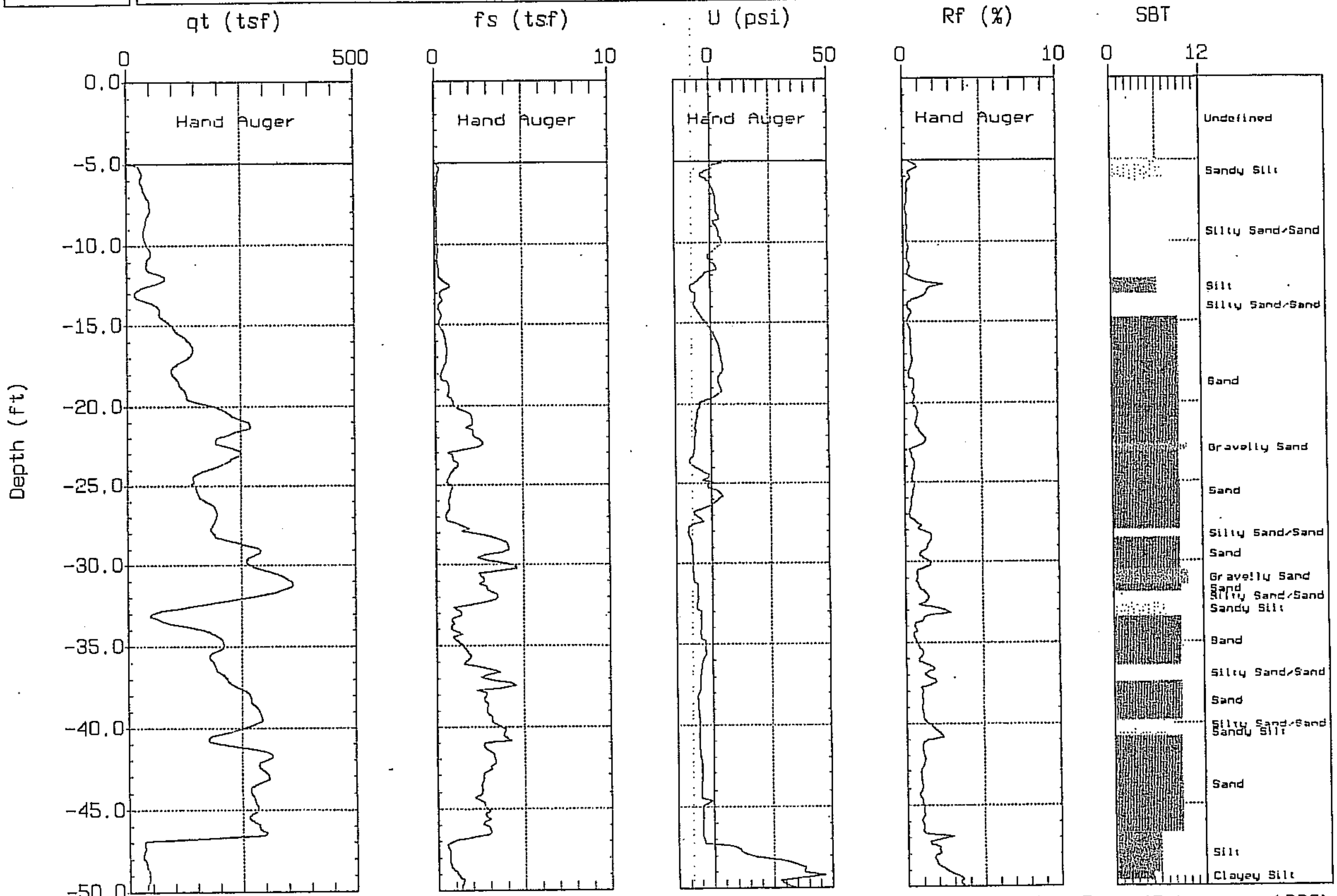
Engineer: S.HARRIS
Date: 07:13:05 09:34



ENGEO

Site: KB HOMES
Location: CPT-40

Engineer: S.HARRIS
Date: 07:13:05 08:42



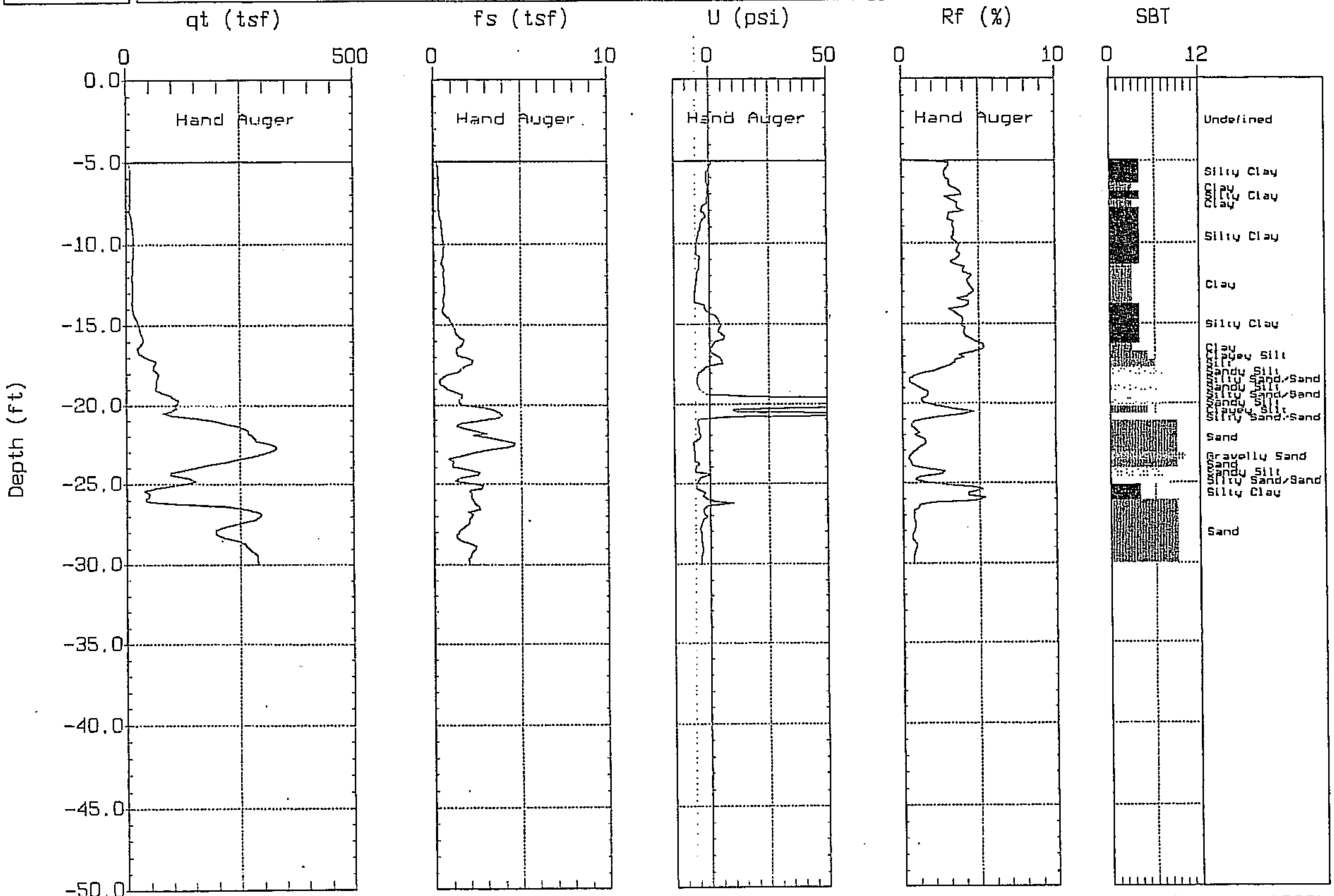
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-41

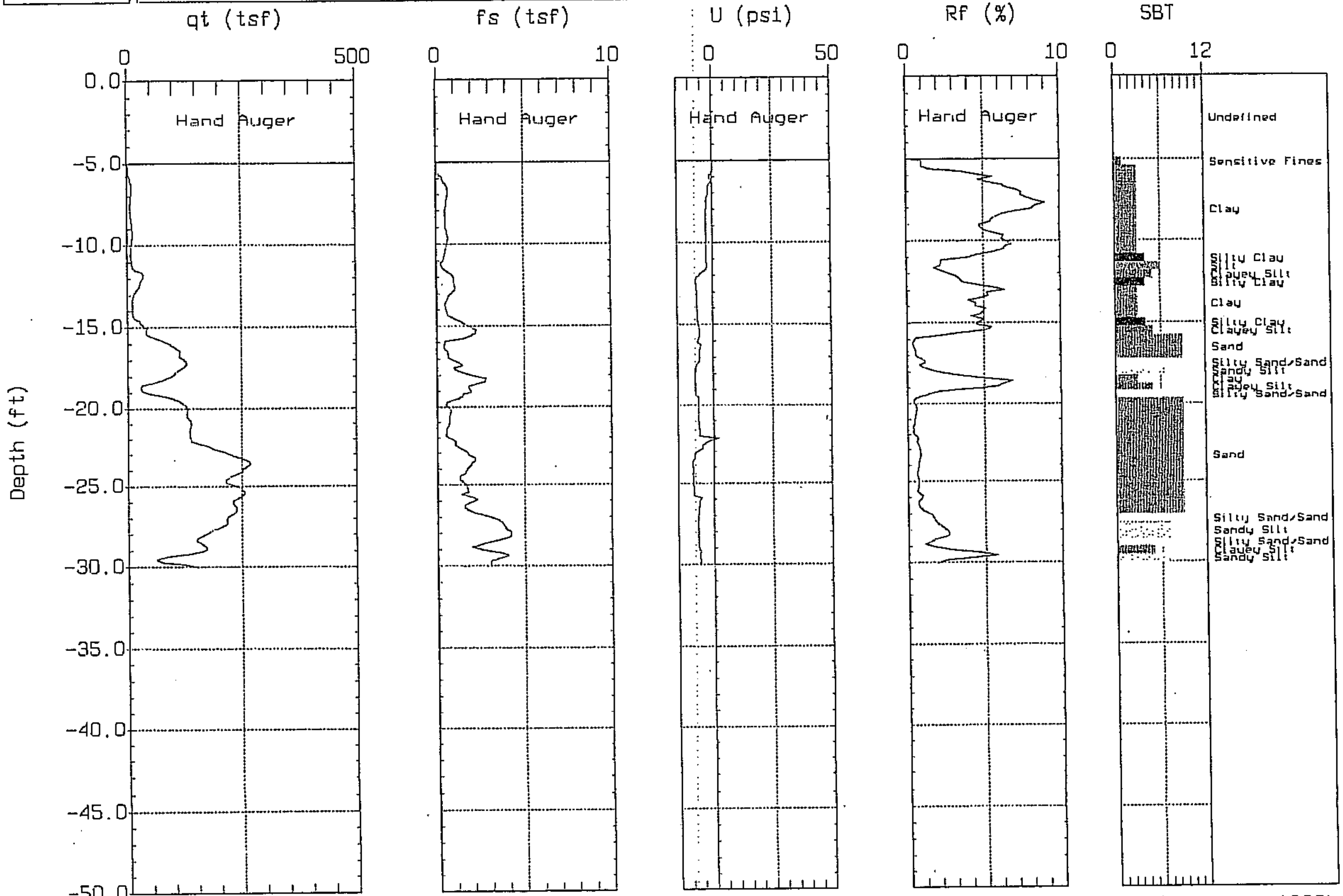
Engineer: S.HARRIS
Date: 07:20:05 07:46



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES
Location: CPT-42 | Engineer: S.HARRIS
Date: 07:20:05 12:33



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

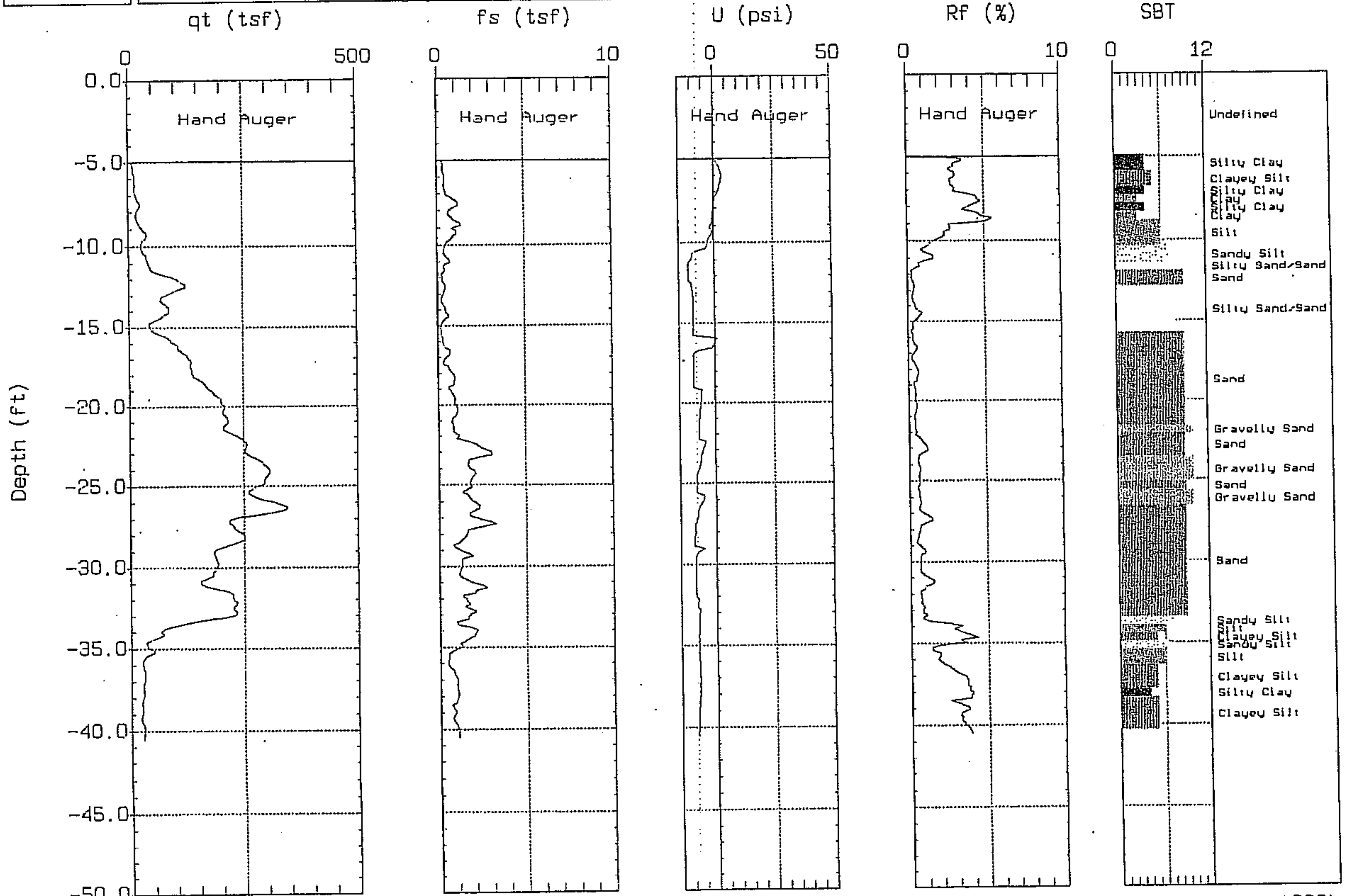
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-43

Engineer: S.HARRIS
Date: 07:20:05 14:06



Max. Depth: 40.52 (ft)
Depth Inc.: 0.164 (ft)

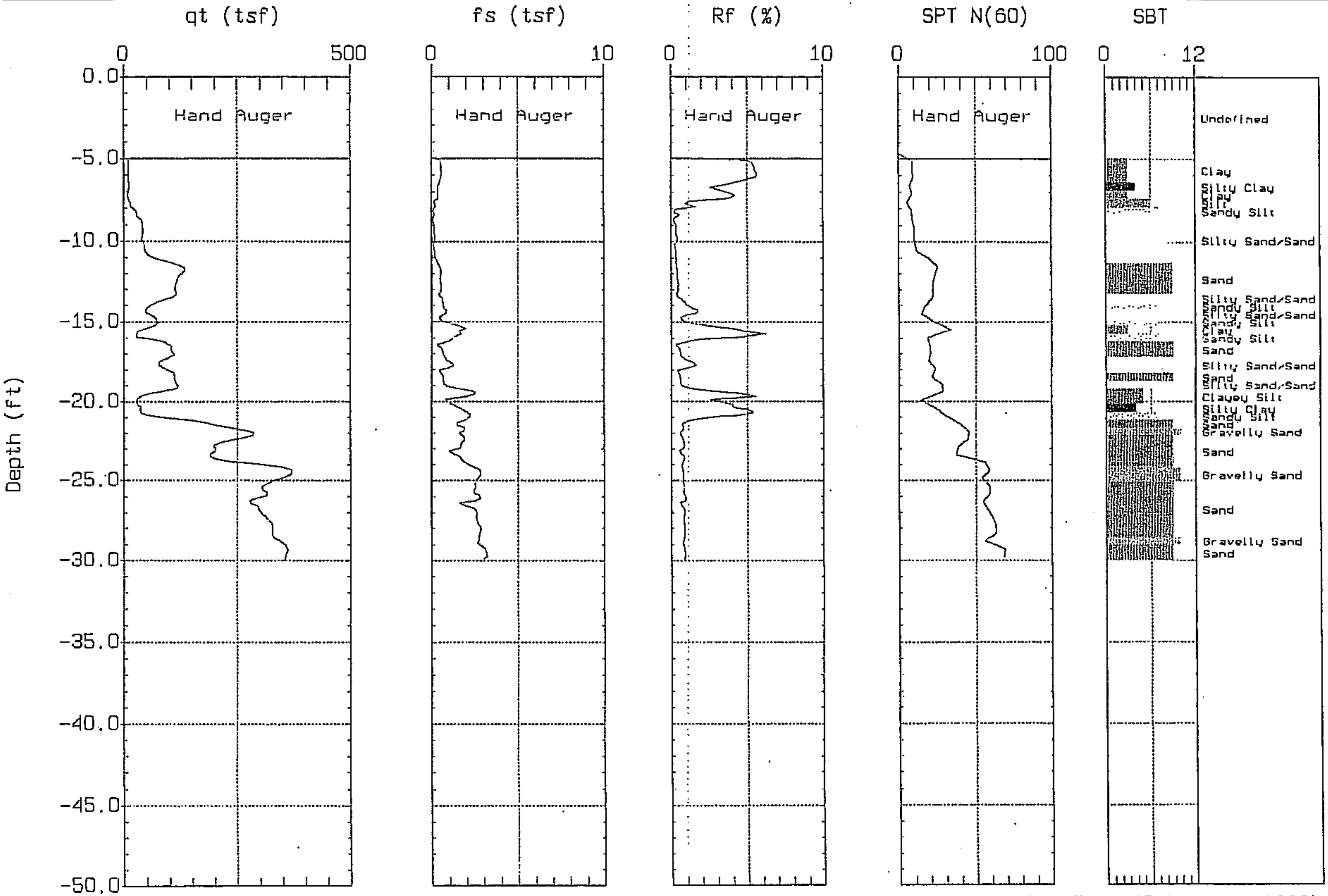
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-44

Engineer: S.HARRIS
Date: 07:20:05 13:24



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

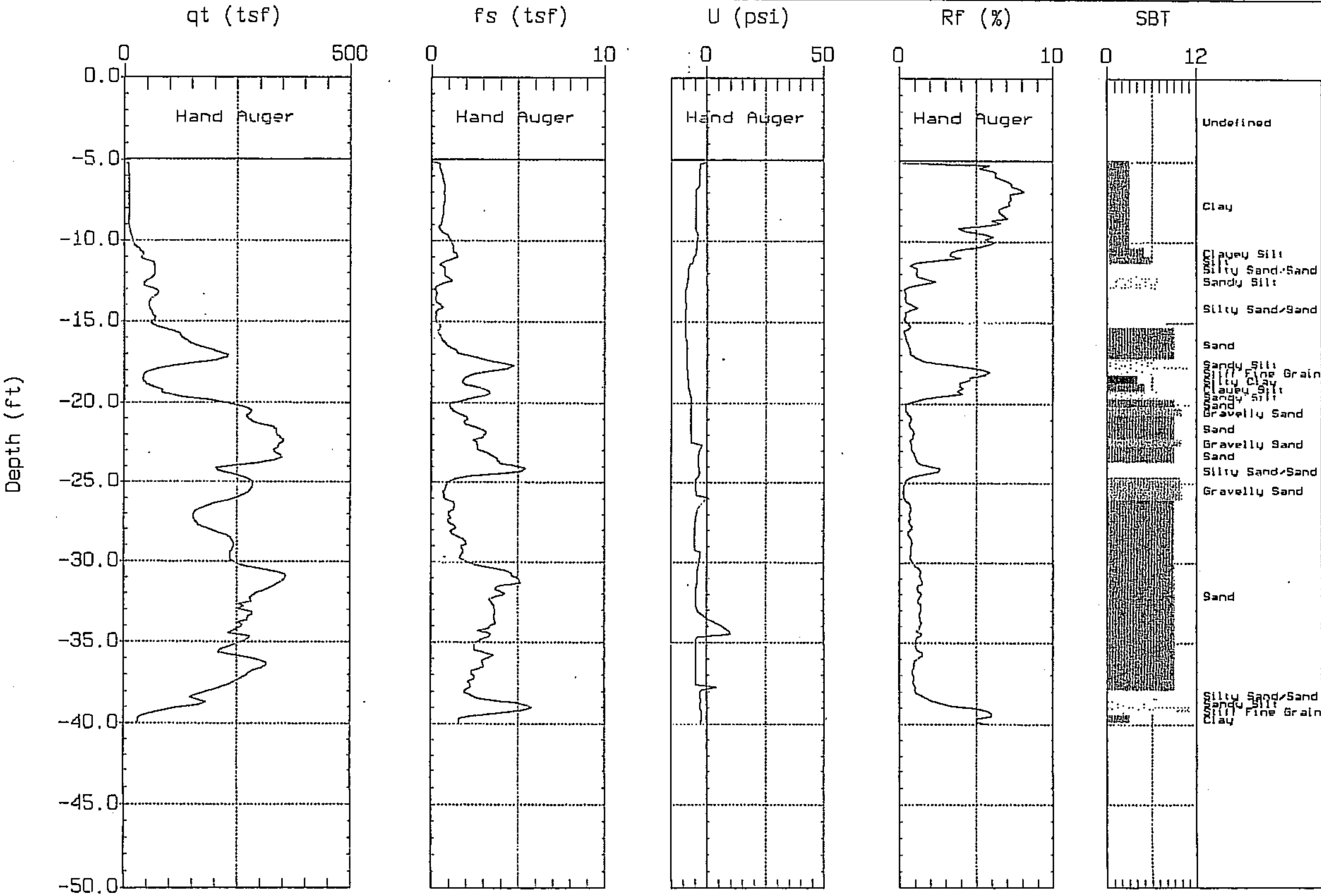
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-45

Engineer: S.HARRIS
Date: 07:20:05 14:32



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

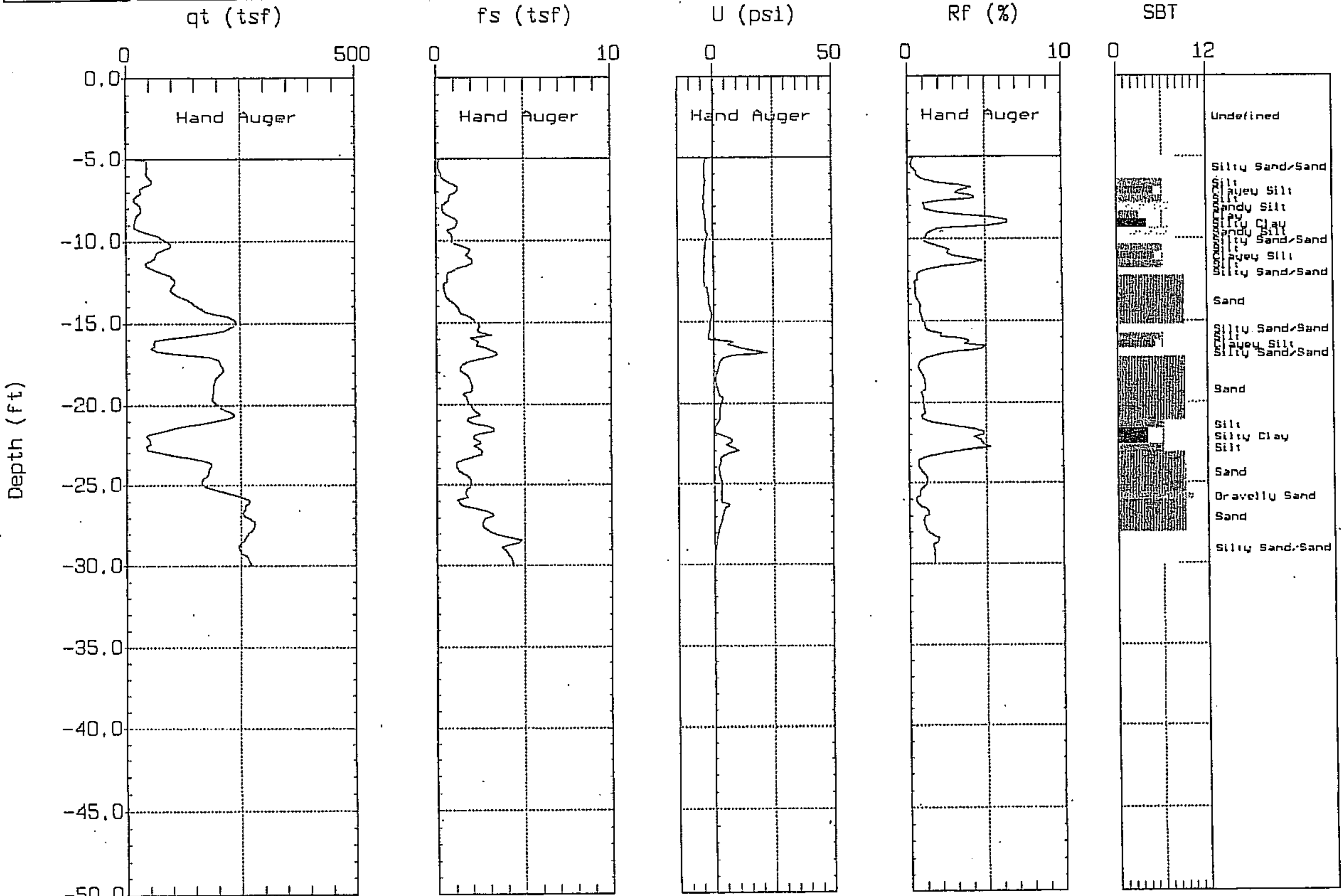
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-46

Engineer: S.HARRIS
Date: 07:20:05 08:29



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

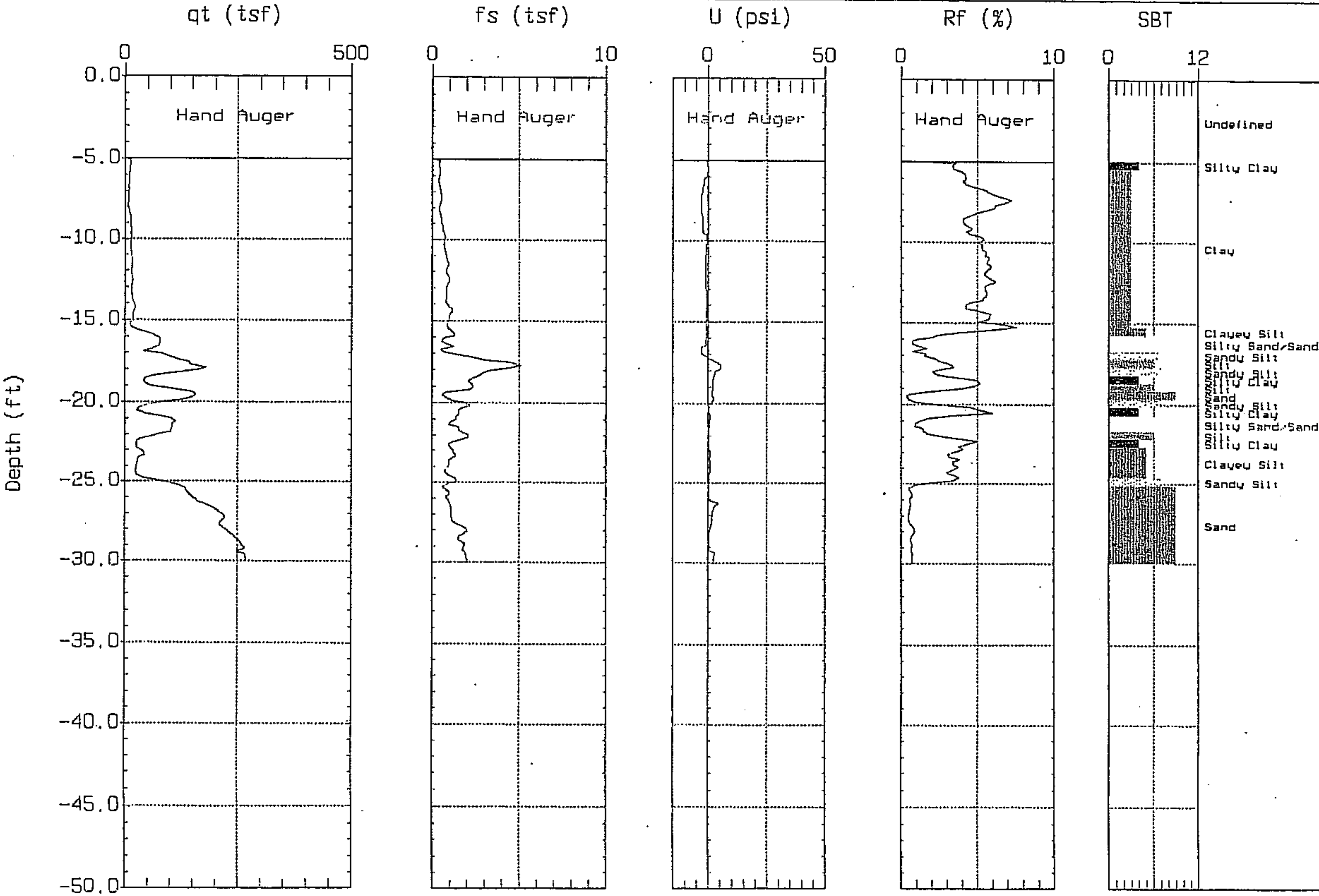
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-47

Engineer: S.HARRIS
Date: 07:19:05 15:55



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

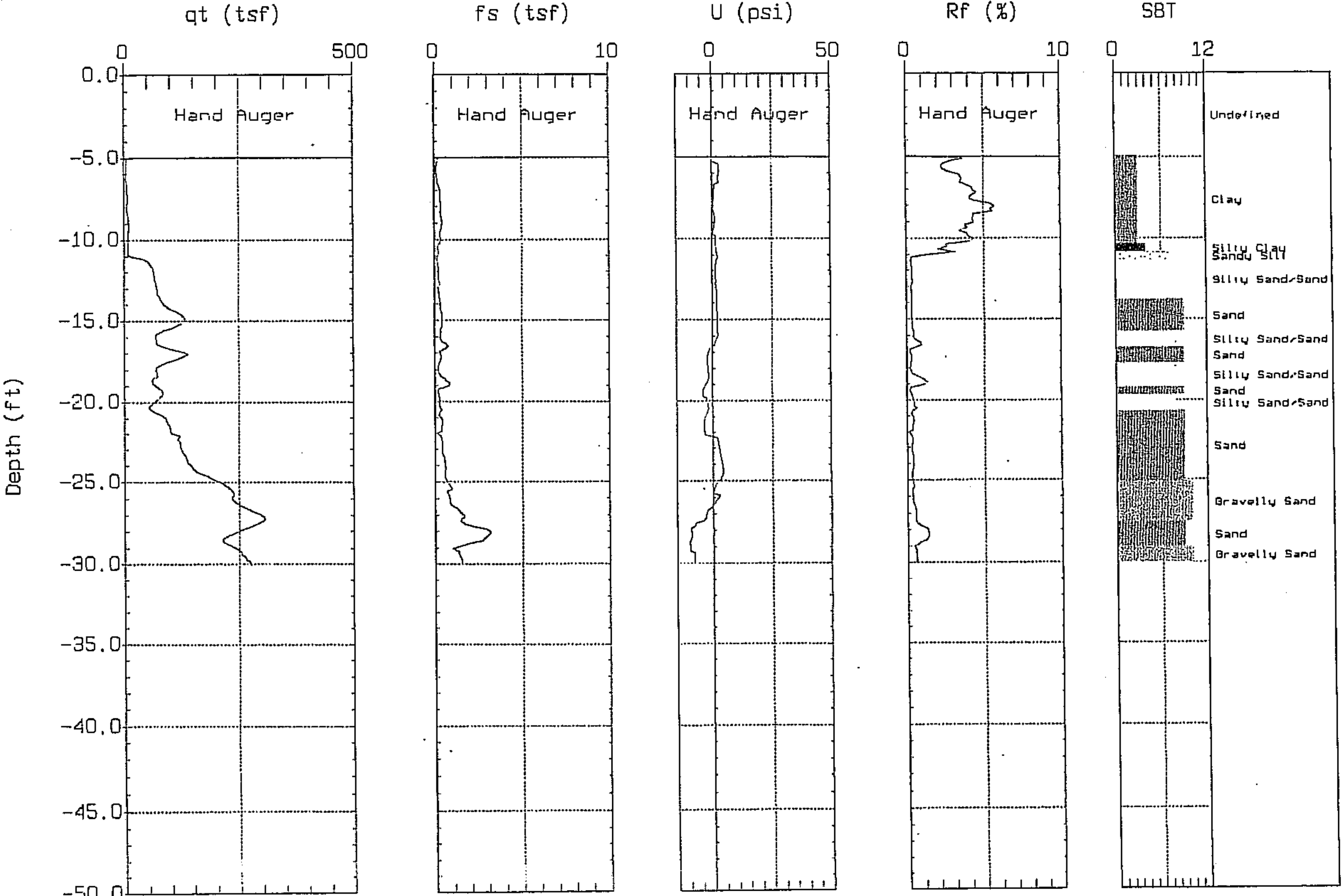
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-48

Engineer: S.HARRIS
Date: 07:19:05 15:24



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

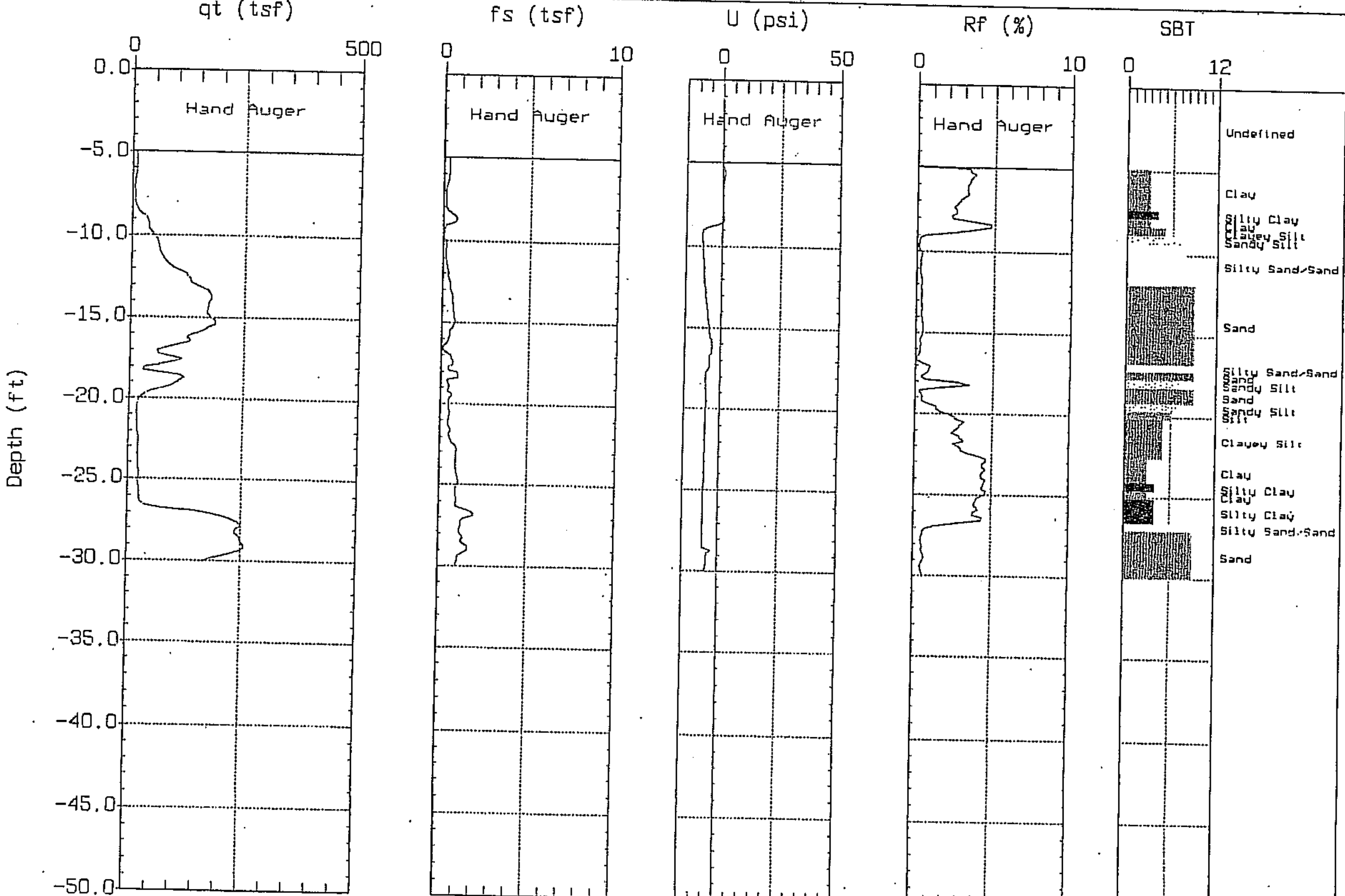
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-49

Engineer: S.HARRIS
Date: 07:19:05 15:04



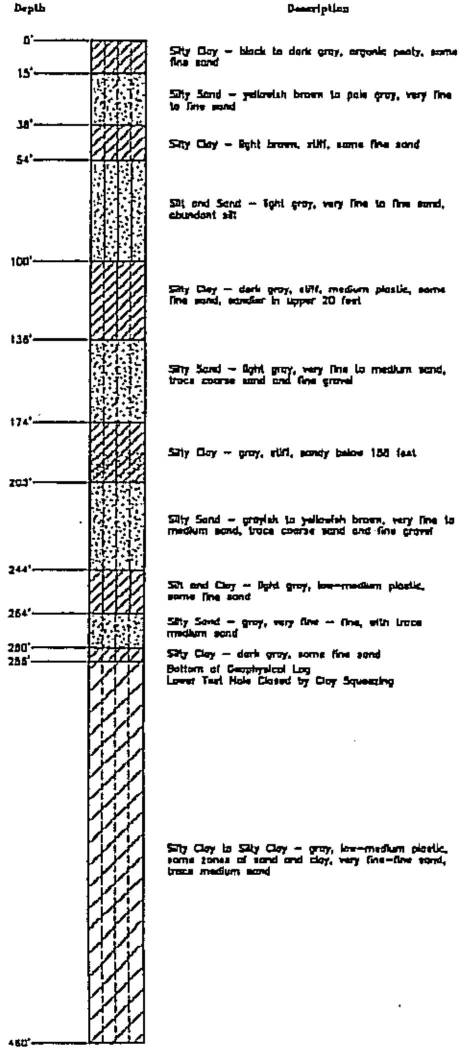
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

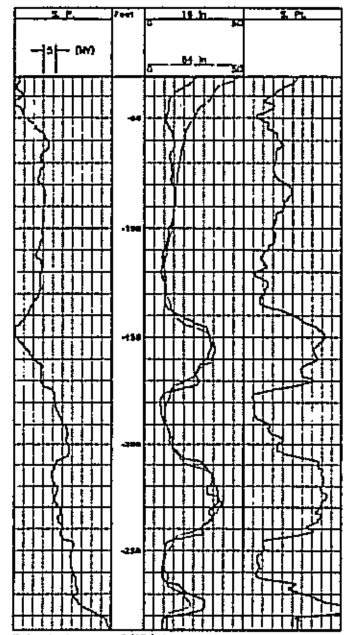
APPENDIX B

LUHDORFF AND SCALMANINI CONSULTING ENGINEERS

CYPRESS LAKES NORTH SITE
TEST HOLE
LITHOLOGY

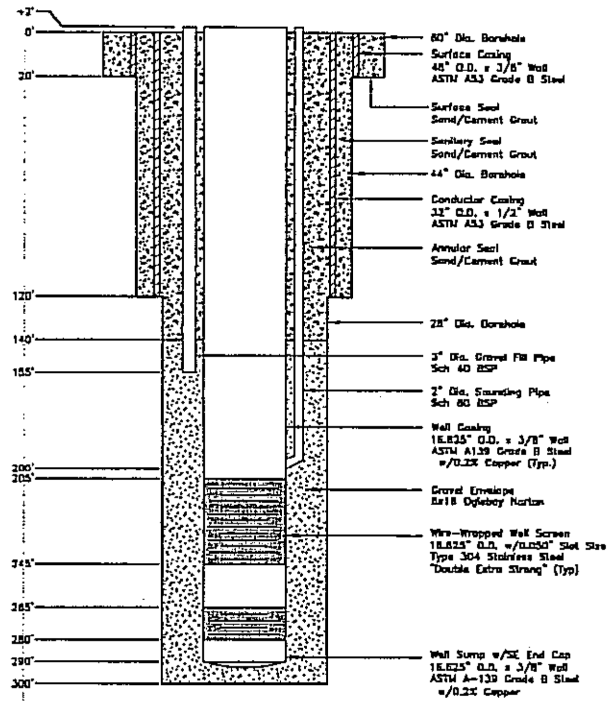


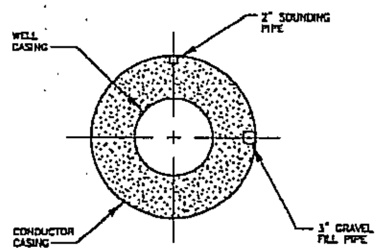
CYPRESS LAKES NORTH SITE
MONITORING WELL
ELECTRIC LOG



E-log by Welenco 03/17/04

CYPRESS LAKES NORTH SITE
PRODUCTION WELL
PROFILE





ACCESSORY PIPE ORIENTATION
(TO BE DETERMINED IN THE FIELD)

CASING CENTRALIZER SCHEDULE
50'
125'
203'
247'
282'

PRODUCTION WELL PROFILE–NORTH
North & South Water Supply Wells
Cypress Lakes Development
Contra Costa County, California

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

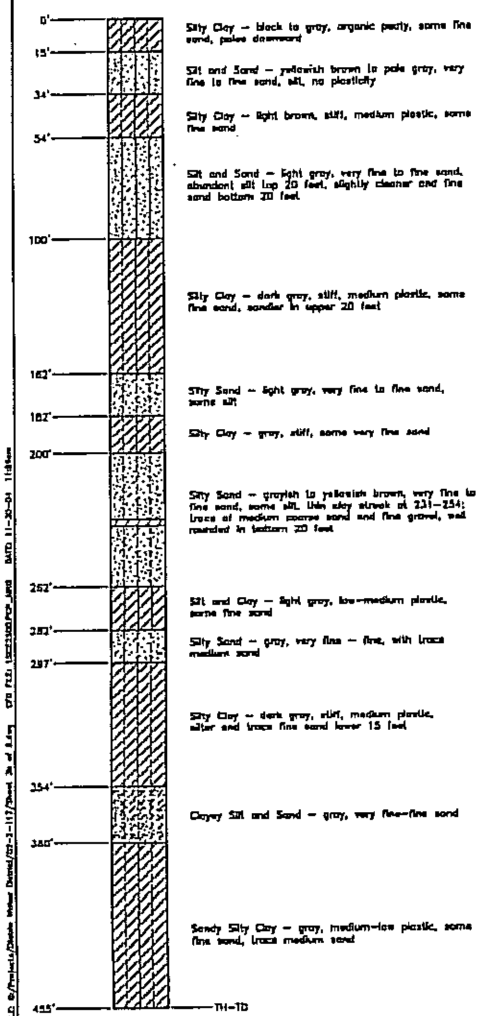
REVISIONS		
NO.	DATE	REVISION

DATE: SEPTEMBER 2004
JOB NO. 102-2-117
DESIGN BY: TDE
DRAWN BY: DWT
CHECKED BY: LHE
FILE: Sheet 3a of 5.dwg

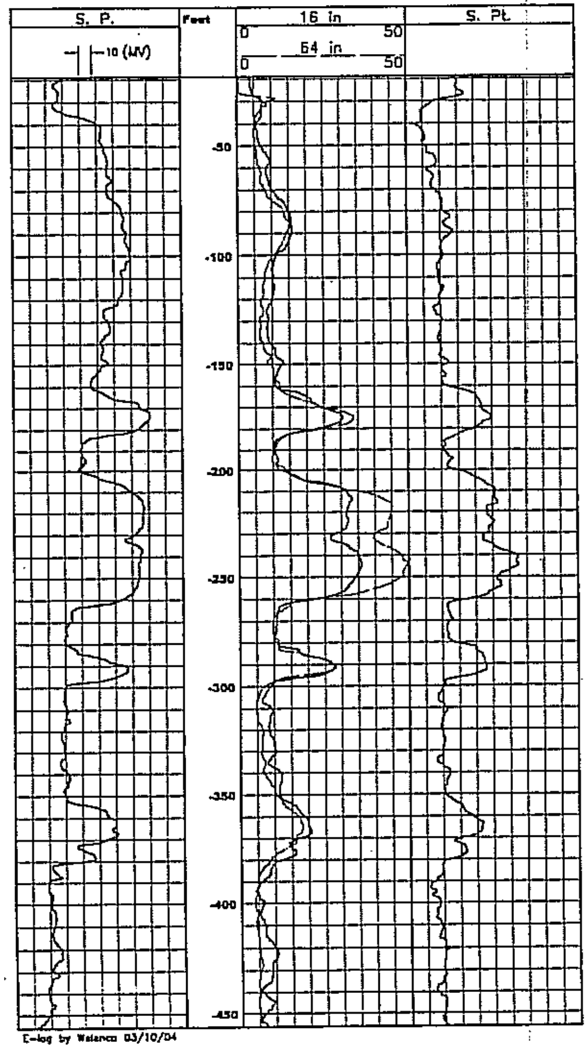
SHEET: 3a
OF: 5

CAD FILE: Q:/Projects/Cypress Water District/02-2-117/Sheet 3a of 5.dwg CFG FILE: LSECONDPCP.DWG DATE: 11-28-04 12:30pm

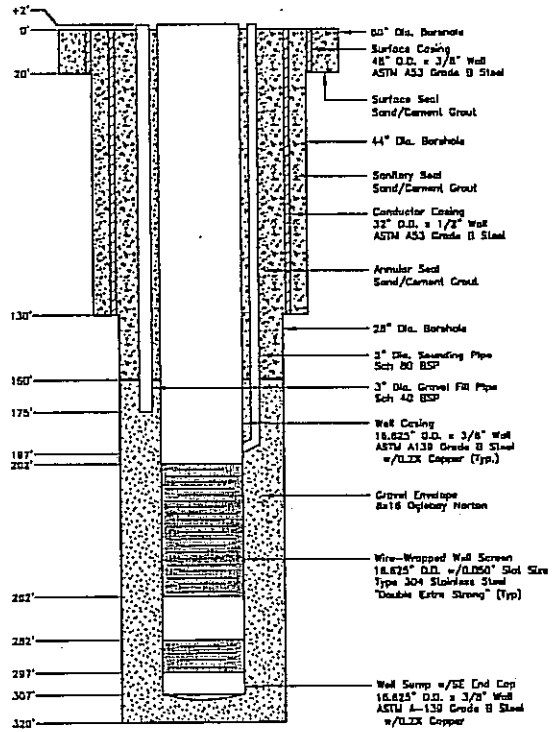
CYPRESS LAKES SOUTH SITE
TEST HOLE
LITHOLOGY

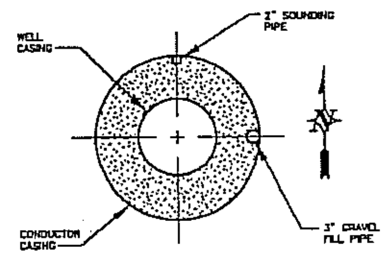


CYPRESS LAKES SOUTH SITE
TEST HOLE
ELECTRIC LOG



CYPRESS LAKES SOUTH SITE
PRODUCTION WELL
PROFILE





ACCESSORY PIPE ORIENTATION

CASING CENTRALIZER SCHEDULE
50'
125'
200'
264'
299'

PRODUCTION WELL PROFILE–SOUTH

North & South Water Supply Wells
Cypress Lakes Development
Contra Costa County, California

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

REVISIONS		
NO.	DATE	REVISION

DATE: SEPTEMBER 2004
JOB NO. 102-2-117
DESIGN BY: TDC
DRAWN BY: DMT
CHECKED BY: LHK
FILE: Sheet 3b of 5.dwg

SHEET: 3b OF: 5

CAD FILE: G:/Projects/Diablo Water District/02-2-117/Sheet 3b of 5.dwg CFG FILE: LSCE2500PCP_.SHD DATE: 11-30-04 11:16am

APPENDIX C

Groundwater Quality and Quantity Data
from Federal, State and Local Sources

Water Resources

Data Category: Ground Water | Geographic Area: California | go

Ground-water Site Inventory for California

Site Selection Results -- 282 sites found

Site type = Spring, Ground Water
County = Contra Costa

Save file of selected sites to local disk for future upload

Data for individual sites can be obtained by selecting the site number below

Agency	Site Number	Site Name
USGS	363659119221801	015S024E20A001M
USGS	374242121533101	002S001E32N001M
USGS	374304121505801	001S001E34K002M
USGS	374357121543701	002S001E30E001M
USGS	374357121543702	002S001E30E002M
USGS	374418121563201	002S001W26C002M
USGS	374422121545001	002S001W24R001M
USGS	374430121521201	002S001E21P001M
USGS	374436121561401	002S001W23K001M
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USGS	374545121515801	002S001E16G002M
USGS	374546121520101	002S001E16G001M
Agency	Site Number	Site Name
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USGS	374600121493101	002S001E11R001M
USGS	374614121473701	002S002E18B001M
USGS	374616121552601	002S001W12L001M
USGS	374617121483201	002S001E12K001M
USGS	374627121505801	002S001E10L001M
USGS	374631121480101	002S001E12G001M

USGS	374632121482801	002S002E12H001M
USGS	374635121492401	002S001E11H001M
USGS	374635121494501	002S001E11G001M
USGS	374638121513801	002S001E09H001M
USGS	374649121514501	002S001E09A001M
USGS	374655121534201	002S001E06R002M
USGS	374659121534501	002S001E06J006M
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USGS	374712121514001	002S001E04J006M
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USGS	374713121533601	002S001E05M001M
USGS	374719121510301	002S001E03F004M
USGS	374722121510001	002S001E03L001M
USGS	374726121535001	002S001E06H008M
USGS	374727121513001	002S001E03E001M
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USGS	374727121532701	002S001E05E001M
USGS	374727121535001	002S001E06H006M
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USGS	374735121532401	002S001E05F001M
USGS	374735121534801	002S001E06A001M
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USGS	374801121510201	001S001E34L001M
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USGS	380138121552501	002N001W12P003M
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USGS	380207121372902	002N003E10H005M
USGS	380207121372903	002N003E10H006M
USGS	380208121372901	002N003E10H001M
USGS	380208121372902	002N003E10H002M

USGS	380208121372903	002N003E10H003M
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USGS	380218121380901	002N003E10D001M
USGS	380221121590801	002N001W09D002M
USGS	380226121591201	002N001W09D001M
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Agency	**Site Number**	**Site Name**
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USGS	380817121520101	003N001E14B002M
USGS	380917121582601	004N001W33A001M
USGS	381129122075001	004N002W18M001M
USGS	381230122045601	004N002W09H001M
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USGS	381342122055701	004N002W04D001M
USGS	381348122041402	005N002W34P004M
USGS	381438121585501	005N001W28P001M
USGS	381443121550301	005N001W25R001M

Questions about data California NWISWeb Data Inquiries
Feedback on this website California NWISWeb Maintainer

Top
Explanation of terms

Ground-water Site Inventory -- 282 sites found
http://waterdata.usgs.gov/ca/nwis/gwsi?

Retrieved on 2005-07-29 15:11:59 EDT
Department of the Interior, U.S. Geological Survey
USGS Water Resources of California
Privacy Statement || Disclaimer || Accessibility || FOIA
0.99 0.93 ca

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

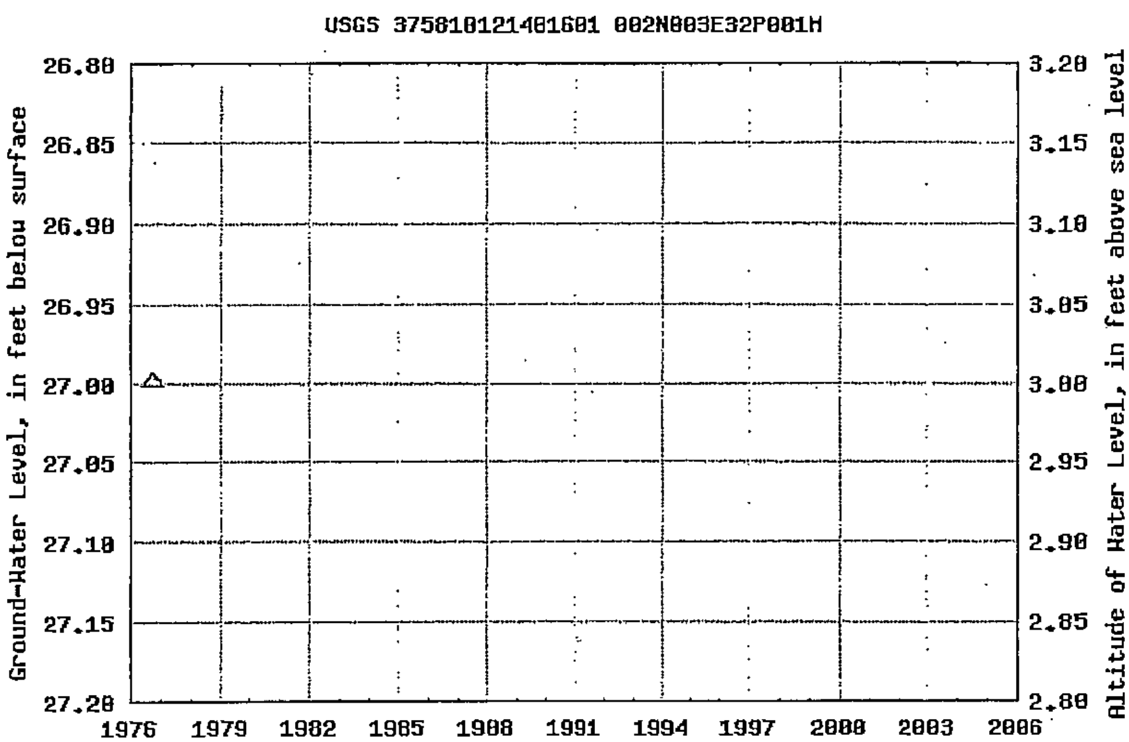
site_no list =	• 375810121401601

Save file of selected sites to local disk for future upload

USGS 375810121401601 002N003E32P001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California	Table of data
Hydrologic Unit Code 18040003	Tab-separated data
Latitude 37°58'10", Longitude 121°40'16" NAD27	Graph of data
Gage datum 30.00 feet above sea level NGVD29	Reselect period
The depth of the well is 113 feet below land surface.	
The depth of the hole is 126 feet below land surface.	



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

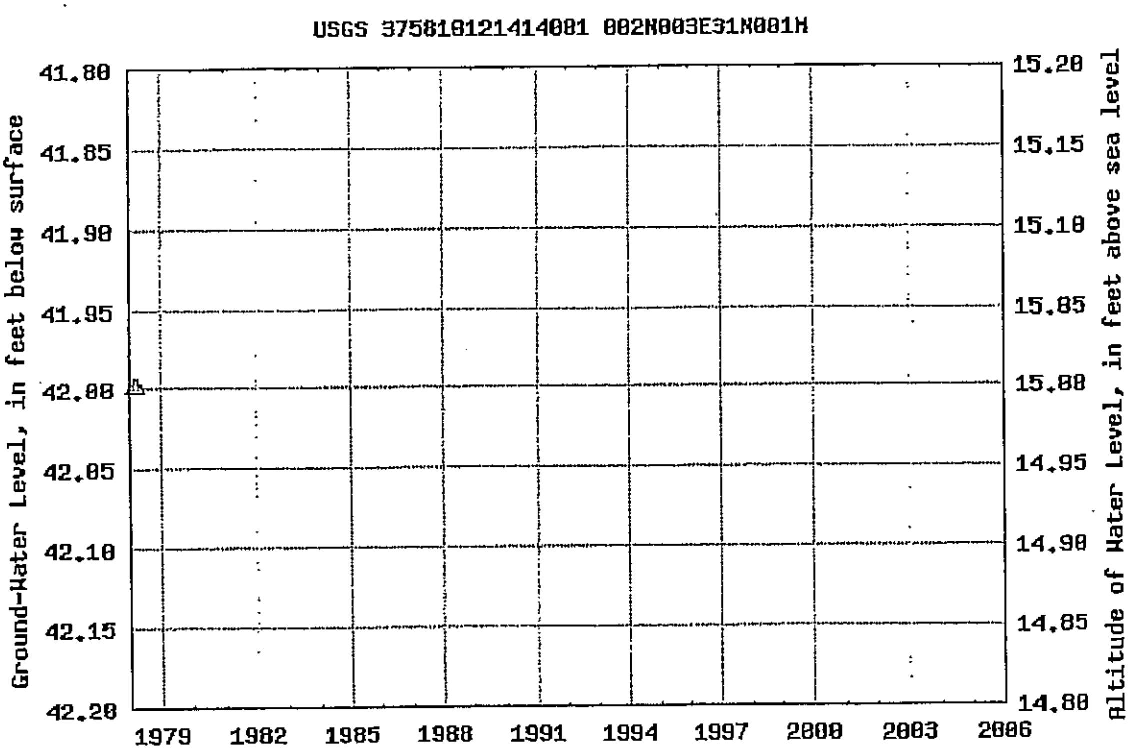
site_no list =	• 375810121414001

Save file of selected sites to local disk for future upload

USGS 375810121414001 002N003E31N001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°58'10", Longitude 121°41'40" NAD27 Gage datum 57.00 feet above sea level NGVD29 The depth of the well is 93.0 feet below land surface. The depth of the hole is 132 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

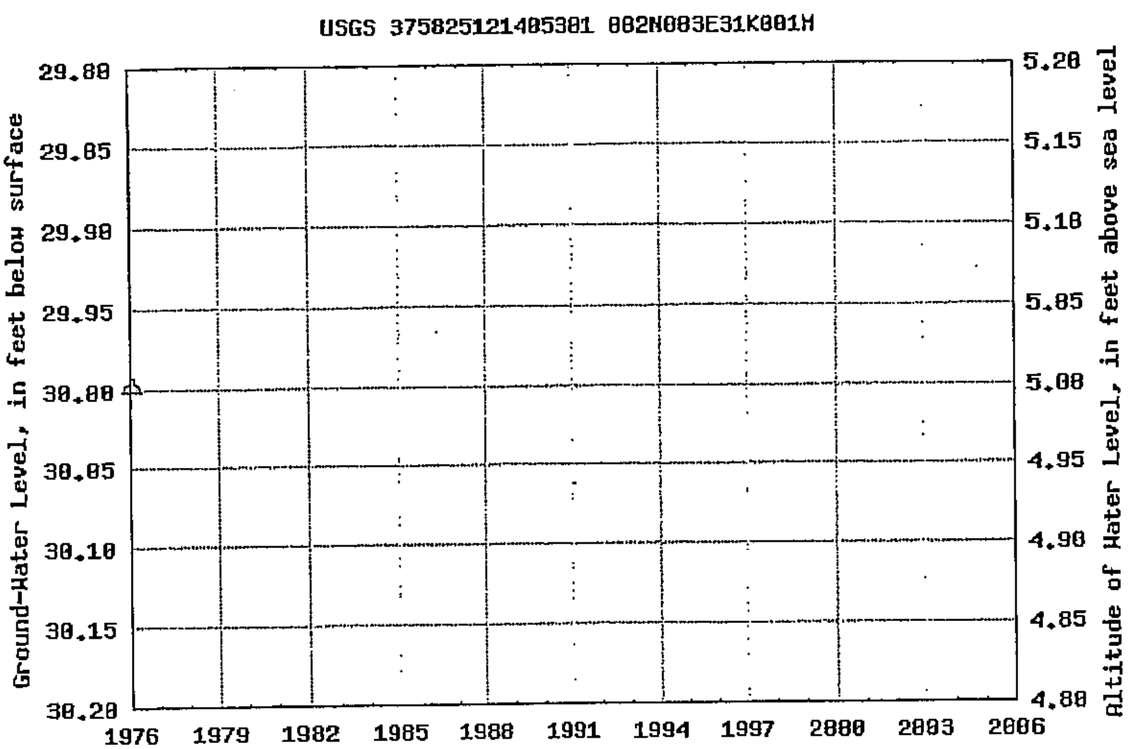
site_no list =	• 375825121405301

Save file of selected sites to local disk for future upload

USGS 375825121405301 002N003E31K001M

Available data for this site Ground-water: Levels GO

	Output formats
~~Contra Costa County, California~~ Hydrologic Unit Code 18040003 Latitude 37°58'25", Longitude 121°40'53" NAD27 Gage datum 35.00 feet above sea level NGVD29 The depth of the well is 150 feet below land surface. The depth of the hole is 155 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

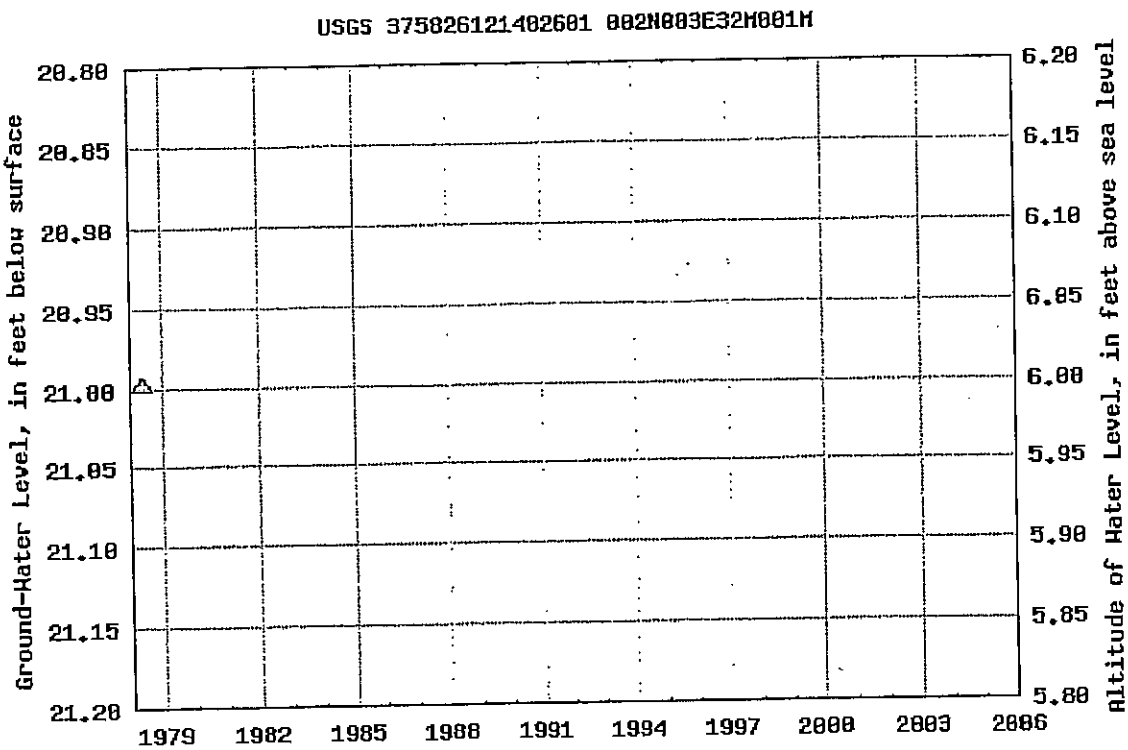
site_no list =	• 375826121402601

Save file of selected sites to local disk for future upload

USGS 375826121402601 002N003E32M001M

Available data for this site Ground-water: Levels GO

	Output formats
~~Contra Costa County, California~~ Hydrologic Unit Code 18040003 Latitude 37°58'26", Longitude 121°40'26" NAD27 Gage datum 27.00 feet above sea level NGVD29 The depth of the well is 105 feet below land surface. The depth of the hole is 125 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375858121394601

Save file of selected sites to local disk for future upload

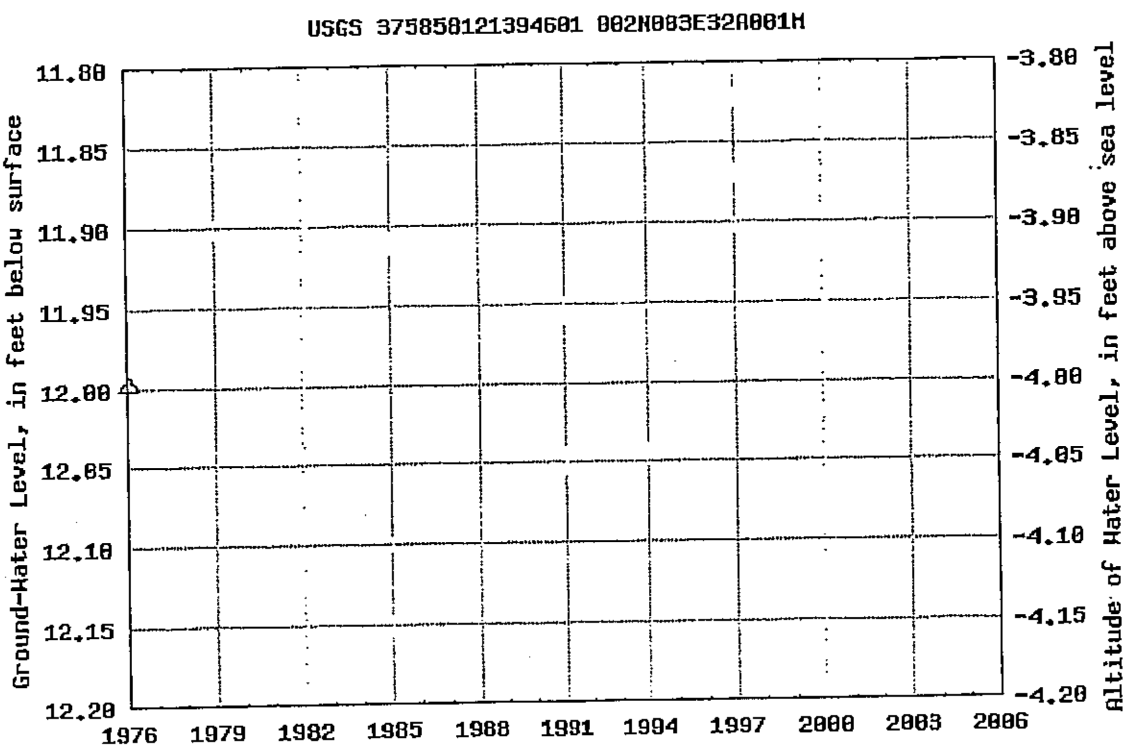
USGS 375858121394601 002N003E32A001M

Available data for this site Ground-water: Levels GO

~~Contra Costa County, California~~
Hydrologic Unit Code 18040003
Latitude 37°58'58", Longitude 121°39'46" NAD27
Gage datum 8.00 feet above sea level NGVD29
The depth of the well is 105 feet below land surface.
The depth of the hole is 110 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

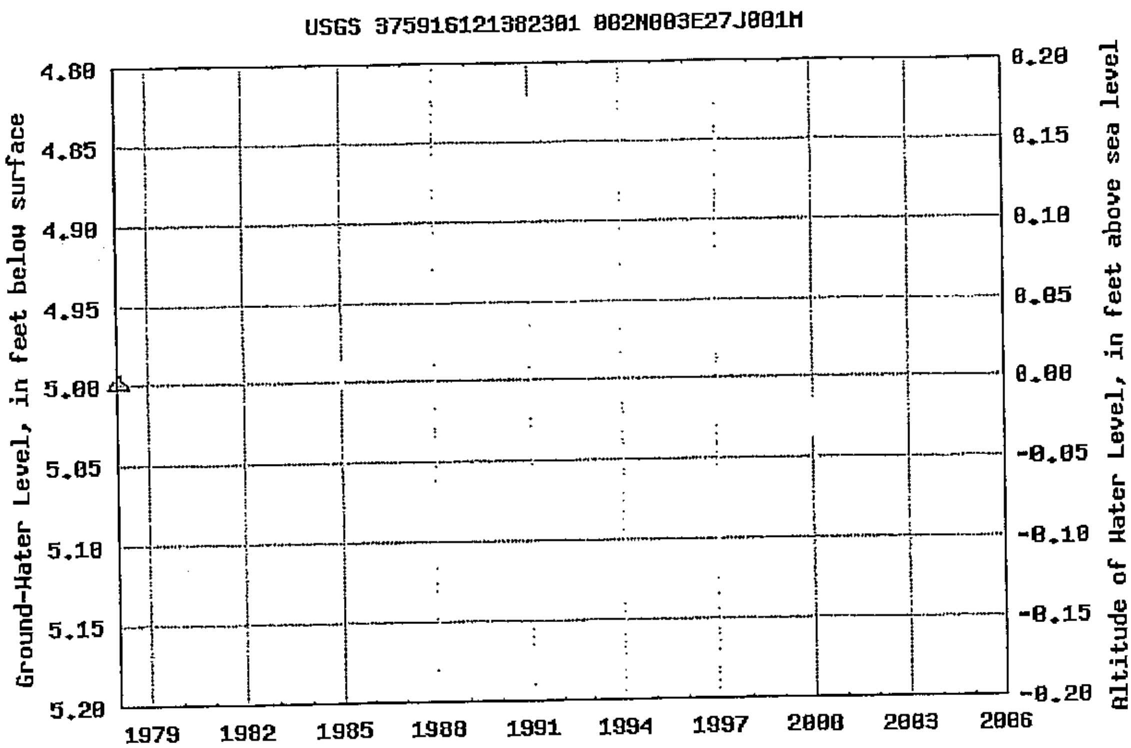
site_no list =	• 375916121382301

Save file of selected sites to local disk for future upload

USGS 375916121382301 002N003E27J001M

Available data for this site: Ground-water: Levels — GO

	Output formats
~~Contra Costa County, California~~ Hydrologic Unit Code 18040003 Latitude 37°59'16", Longitude 121°38'23" NAD27 Gage datum 5.00 feet above sea level NGVD29 The depth of the well is 162 feet below land surface. The depth of the hole is 182 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

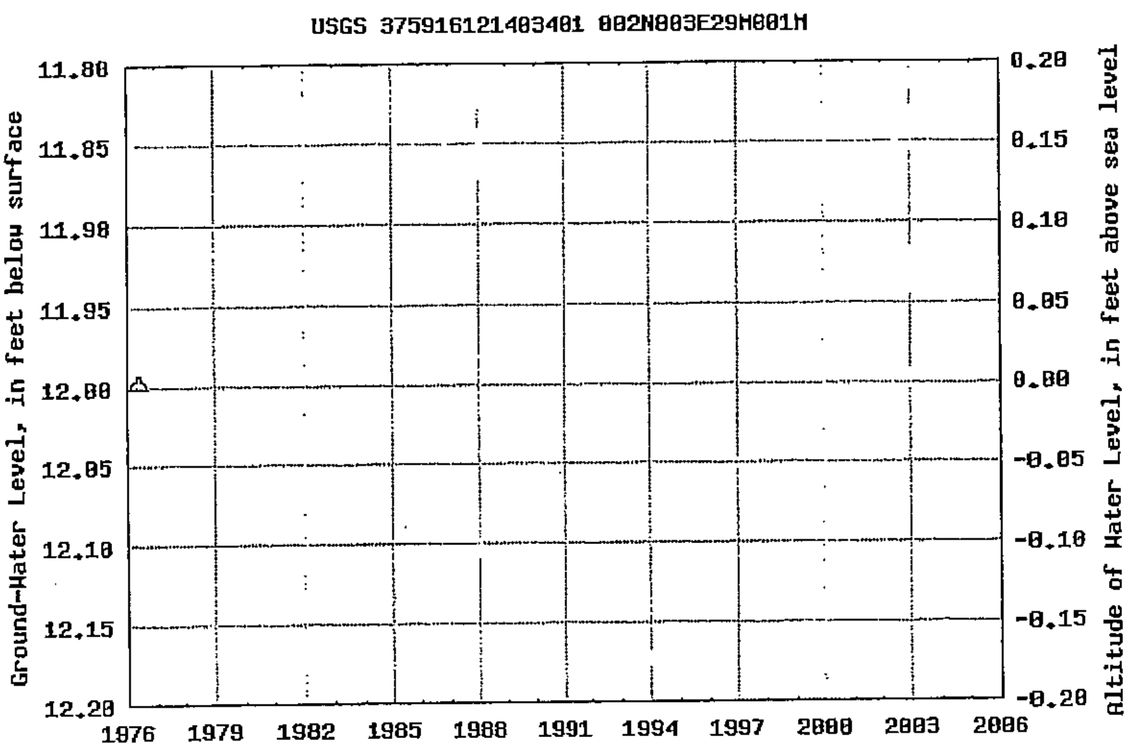
site_no list =	• 375916121403401

Save file of selected sites to local disk for future upload

USGS 375916121403401 002N003E29M001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°59'16", Longitude 121°40'34" NAD27 Gage datum 12.00 feet above sea level NGVD29 The depth of the well is 88.0 feet below land surface. The depth of the hole is 100 feet below land surface. This well is completed in ALLUVIAL-FAN DEPOSITS (111ALVF)	**Output formats** Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd      - Agency Code
#  site_no        - USGS site number
#  sample_dt      - Date of sample
#  sample_tm      - Time of sample
#  parameter_cd   - Parameter Code
#  result_va      - Value
#  remark_cd      - Remark Code
#  qw_method_cd   - Quality Assurance Method Code
#  anl_stat_cd    - Analysis Stat Code
#  anl_src_cd     - Analysis Source Code
#  hyd_cond_cd    - Hydrologic Cond Code
#  samp_type_cd   - Sample Type Code
#  hyd_event_cd   - Hydrologic Event Code
#  medium_cd      - Sample medium code
#
# Data for the following sites are included:
#  USGS 375916121403401 002N003E29M001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00028  - Agency analyzing sample, code
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00660  - Orthophosphate, water, filtered, milligrams per liter
#  00671  - Orthophosphate, water, filtered, milligrams per liter as phosphorus
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01000  - Arsenic, water, filtered, micrograms per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  01046  - Iron, water, filtered, micrograms per liter
#  01056  - Manganese, water, filtered, micrograms per liter
#  01106  - Aluminum, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
```

N - Presumptive evidence of presence of material
S - Most probable value
U - Material specifically analyzed for but not detected
V - Value affected by contamination
#
#

agency_cd		site_no	sample_dt		sample_tm		parameter_cd		result_va	
5s	15s	10d	4d	5s	12n	1s	1s	1s	1s	1s
USGS	375916121403401		1979-06-05			00010	22.0			7
USGS	375916121403401		1979-06-05			00028	80020			7
USGS	375916121403401		1979-06-05			00095	1860			7
USGS	375916121403401		1979-06-05			00400	7.4			7
USGS	375916121403401		1979-06-05			00410	360			7
USGS	375916121403401		1979-06-05			00618	21.0			7
USGS	375916121403401		1979-06-05			00660	.250			7
USGS	375916121403401		1979-06-05			00671	.080			7
USGS	375916121403401		1979-06-05			00900	690			7
USGS	375916121403401		1979-06-05			00915	140			7
USGS	375916121403401		1979-06-05			00925	82.0			7
USGS	375916121403401		1979-06-05			00930	150			7
USGS	375916121403401		1979-06-05			00931	2			7
USGS	375916121403401		1979-06-05			00932	32			7
USGS	375916121403401		1979-06-05			00935	3.20			7
USGS	375916121403401		1979-06-05			00940	170			7
USGS	375916121403401		1979-06-05			00945	310			7
USGS	375916121403401		1979-06-05			00950	.10			7
USGS	375916121403401		1979-06-05			00955	35.0			7
USGS	375916121403401		1979-06-05			01000	3.0			7
USGS	375916121403401		1979-06-05			01020	1700			7
USGS	375916121403401		1979-06-05			01046	10	<		7
USGS	375916121403401		1979-06-05			01056	300			7
USGS	375916121403401		1979-06-05			01106	100	<		7
USGS	375916121403401		1979-06-05			70300	1260			7
USGS	375916121403401		1979-06-05			71851	93.0			7

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375928121394901

Save file of selected sites to local disk for future upload

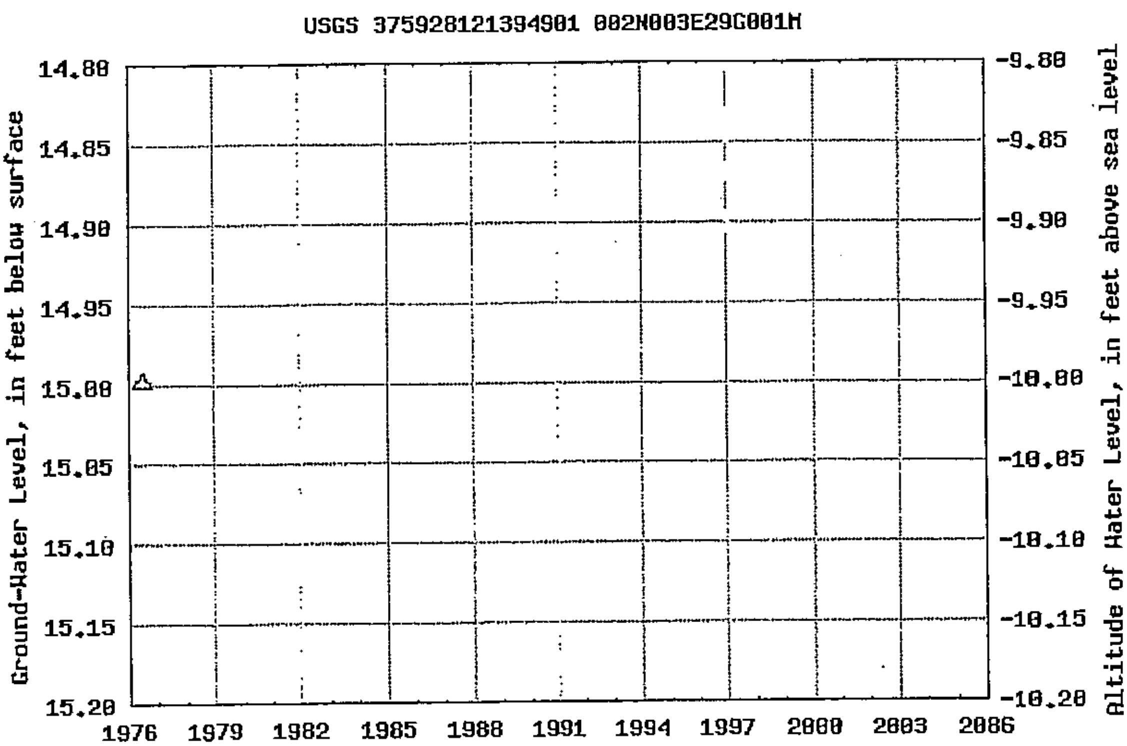
USGS 375928121394901 002N003E29G001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°59'28", Longitude 121°39'49" NAD27
Gage datum 5.00 feet above sea level NGVD29
The depth of the well is 237 feet below land surface.
The depth of the hole is 245 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

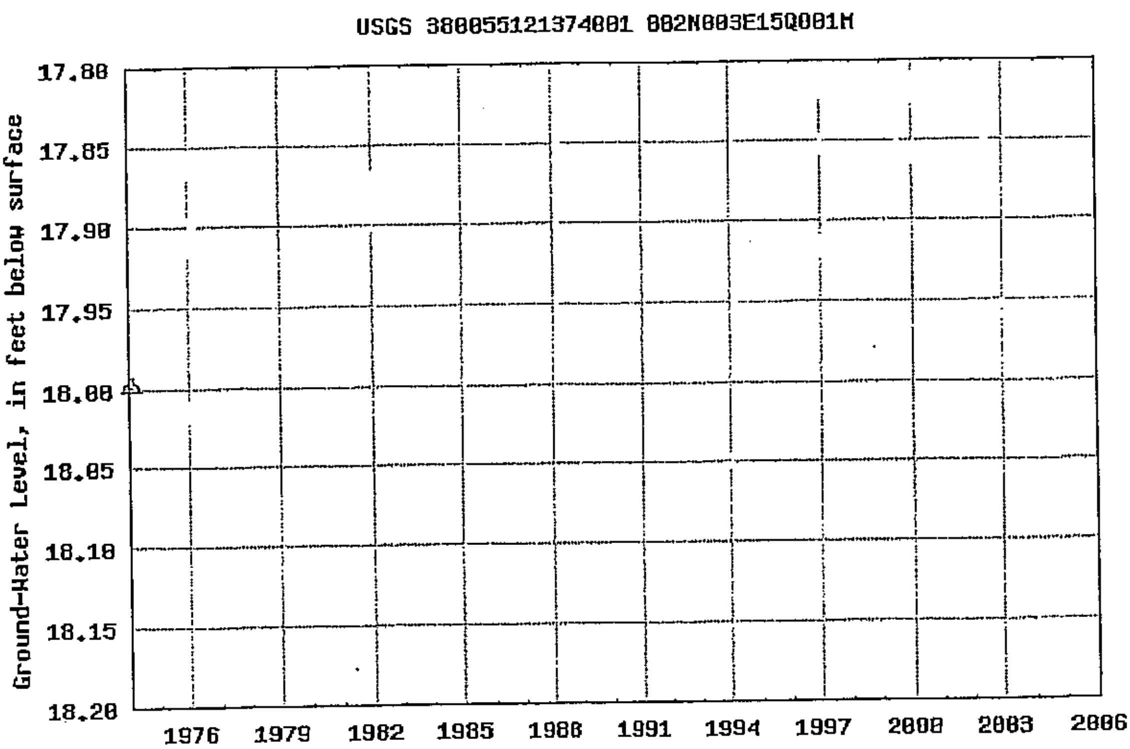
site_no list =	• 380055121374001

Save file of selected sites to local disk for future upload

USGS 380055121374001 002N003E15Q001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°00'55", Longitude 121°37'40" NAD27 The depth of the well is 165 feet below land surface. The depth of the hole is 236 feet below land surface. This well is completed in FLOOD-BASIN DEPOSITS (111FLDB)	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

5s	15s	10d	4d	5s	12n	1s	1s	1s	1s	1s
USGS	380055121374001	1979-06-05				00010	25.0			7
USGS	380055121374001	1979-06-05				00095	1330			7
USGS	380055121374001	1979-06-05				00400	8.1			7
USGS	380055121374001	1979-06-05				00410	270			7
USGS	380055121374001	1979-06-05				00618	.02			7
USGS	380055121374001	1979-06-05				00900	300			7
USGS	380055121374001	1979-06-05				00915	63.0			7
USGS	380055121374001	1979-06-05				00925	35.0			7
USGS	380055121374001	1979-06-05				00930	140			7
USGS	380055121374001	1979-06-05				00931	4			7
USGS	380055121374001	1979-06-05				00932	50			7
USGS	380055121374001	1979-06-05				00935	3.80			7
USGS	380055121374001	1979-06-05				00940	200			7
USGS	380055121374001	1979-06-05				00945	73.0			7
USGS	380055121374001	1979-06-05				00950	.10	<		7
USGS	380055121374001	1979-06-05				00955	34.0			7
USGS	380055121374001	1979-06-05				01020	500			7
USGS	380055121374001	1979-06-05				70300	768			7
USGS	380055121374001	1979-06-05				71851	.100			7

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd      - Agency Code
#  site_no        - USGS site number
#  sample_dt      - Date of sample
#  sample_tm      - Time of sample
#  parameter_cd   - Parameter Code
#  result_va      - Value
#  remark_cd      - Remark Code
#  qw_method_cd   - Quality Assurance Method Code
#  anl_stat_cd    - Analysis Stat Code
#  anl_src_cd     - Analysis Source Code
#  hyd_cond_cd    - Hydrologic Cond Code
#  samp_type_cd   - Sample Type Code
#  hyd_event_cd   - Hydrologic Event Code
#  medium_cd      - Sample medium code
#
# Data for the following sites are included:
#  USGS 380055121374001 002N003E15Q001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
# N  - Presumptive evidence of presence of material
# S  - Most probable value
# U  - Material specifically analyzed for but not detected
# V  - Value affected by contamination
#
#
agency_cd       site_no sample_dt       sample_tm       parameter_cd    result_va
```

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 380108121391001

Save file of selected sites to local disk for future upload

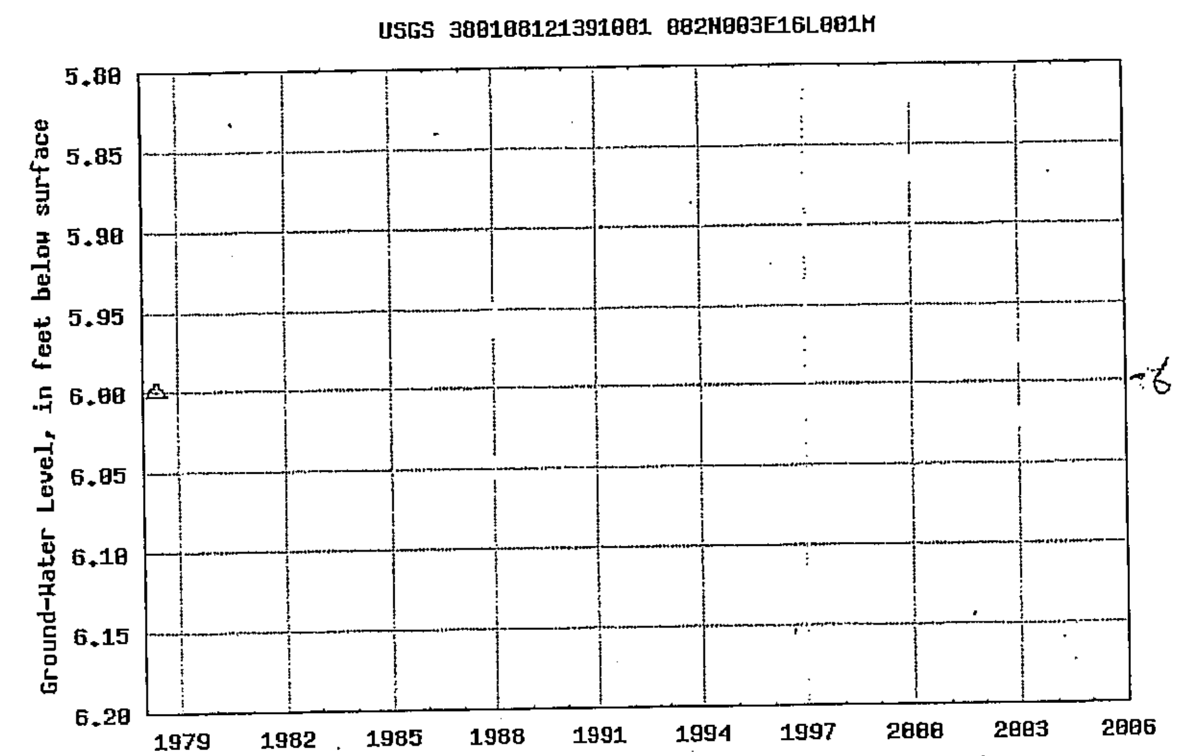
USGS 380108121391001 002N003E16L001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 38°01'08", Longitude 121°39'10" NAD27
The depth of the well is 255 feet below land surface.
The depth of the hole is 270 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

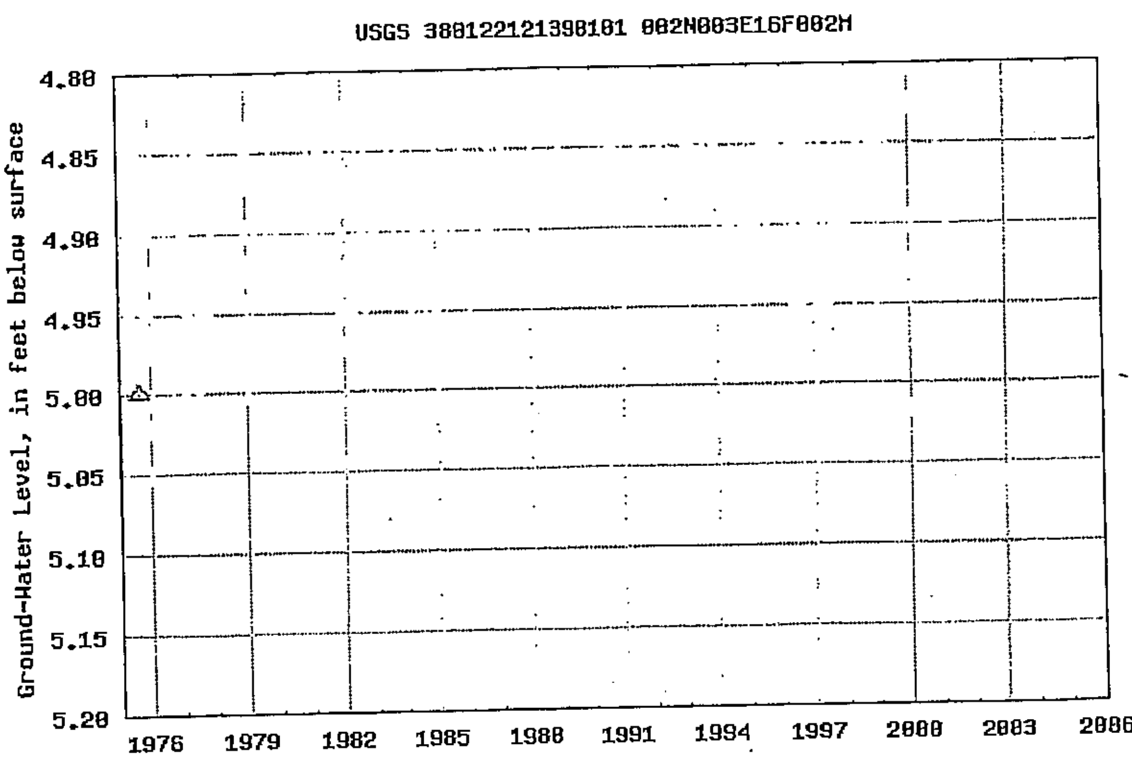
Agency code = usgs	
site_no list =	• 380122121390101

Save file of selected sites to local disk for future upload

USGS 380122121390101 002N003E16F002M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°01'22", Longitude 121°39'01" NAD27 The depth of the well is 50.0 feet below land surface. The depth of the hole is 61.0 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



-9

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375728121400901

Save file of selected sites to local disk for future upload

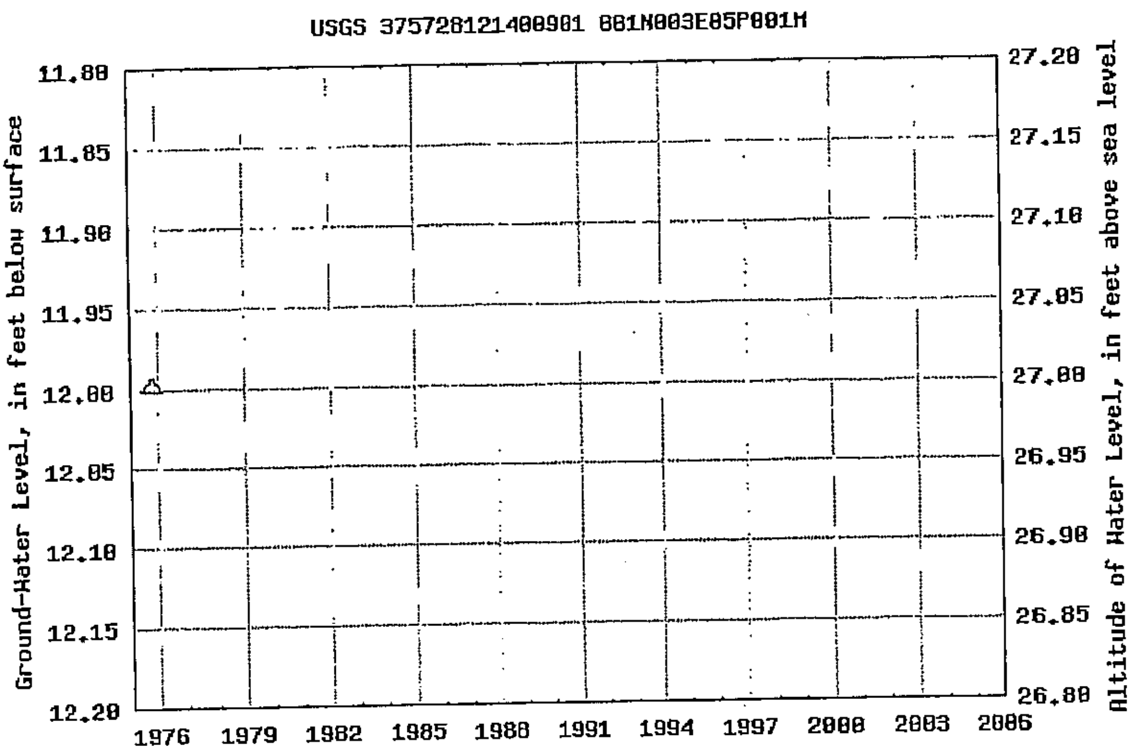
USGS 375728121400901 001N003E05P001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°57'28", Longitude 121°40'09" NAD27
Gage datum 39.00 feet above sea level NGVD29
The depth of the well is 65.0 feet below land surface.
The depth of the hole is 95.0 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

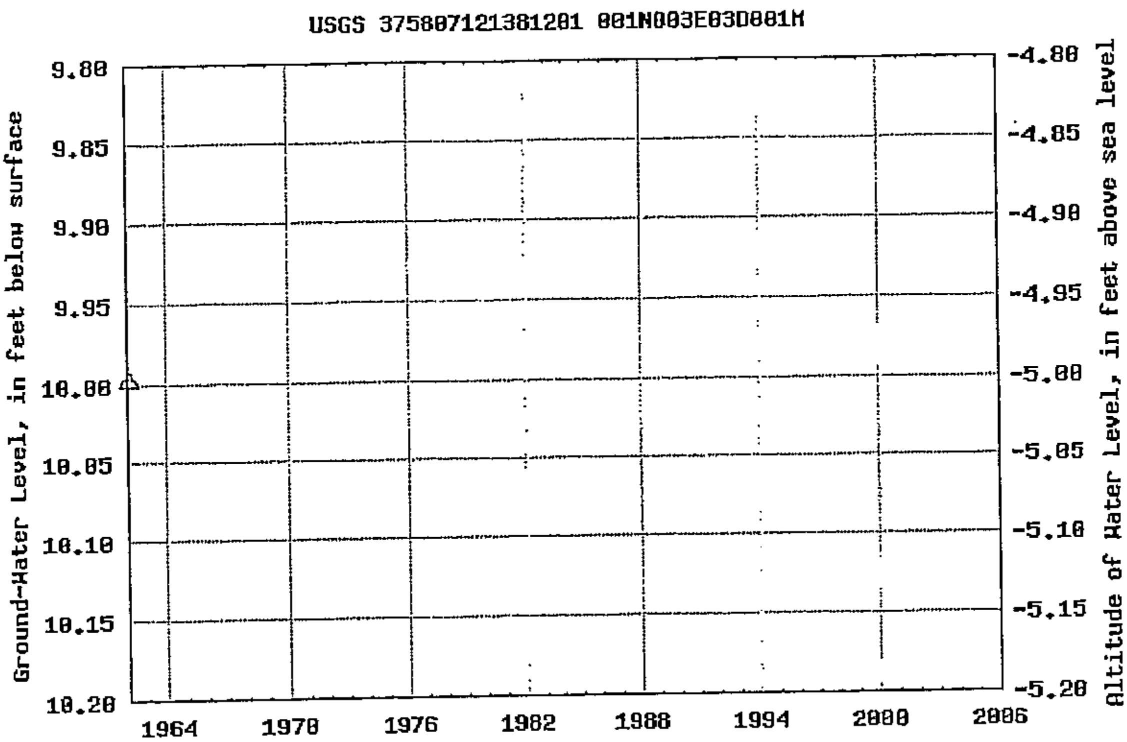
site_no list =	• 375807121381201

Save file of selected sites to local disk for future upload

USGS 375807121381201 001N003E03D001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°58'07", Longitude 121°38'12" NAD27 Gage datum 5.00 feet above sea level NGVD29 The depth of the well is 147 feet below land surface. The depth of the hole is 255 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

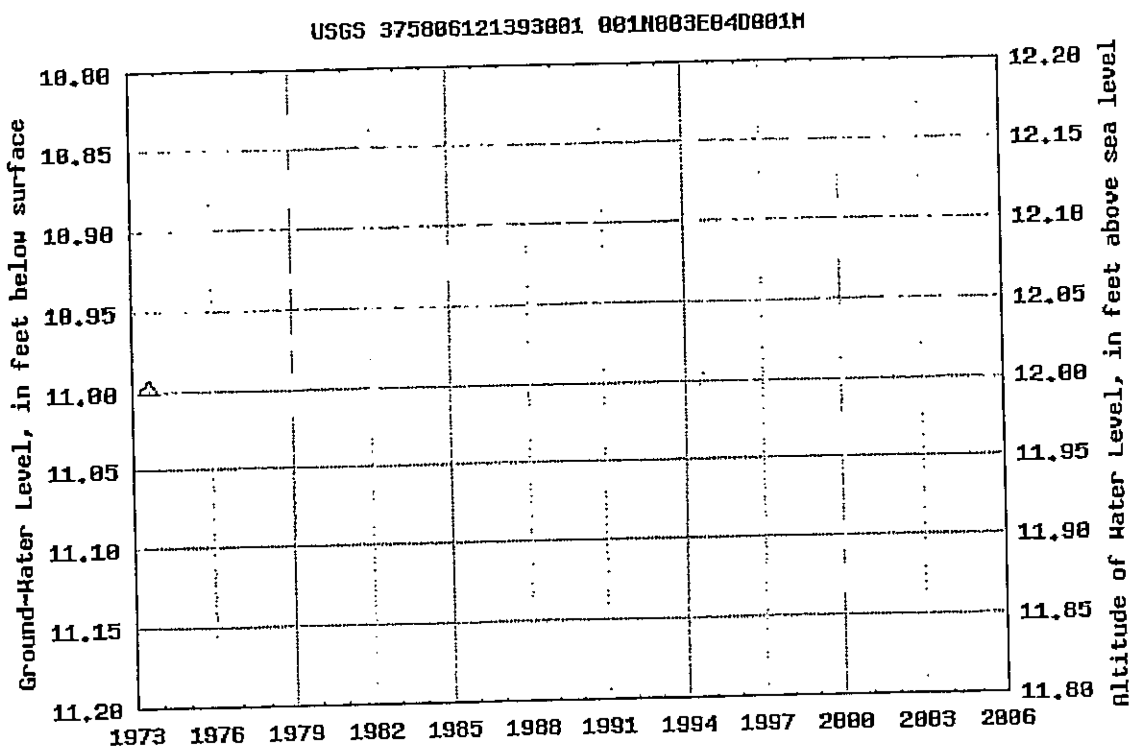
site_no list =	• 375806121393001

Save file of selected sites to local disk for future upload

USGS 375806121393001 001N003E04D001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°58'06", Longitude 121°39'30" NAD27 Gage datum 23.00 feet above sea level NGVD29 The depth of the well is 75.0 feet below land surface. The depth of the hole is 90.0 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

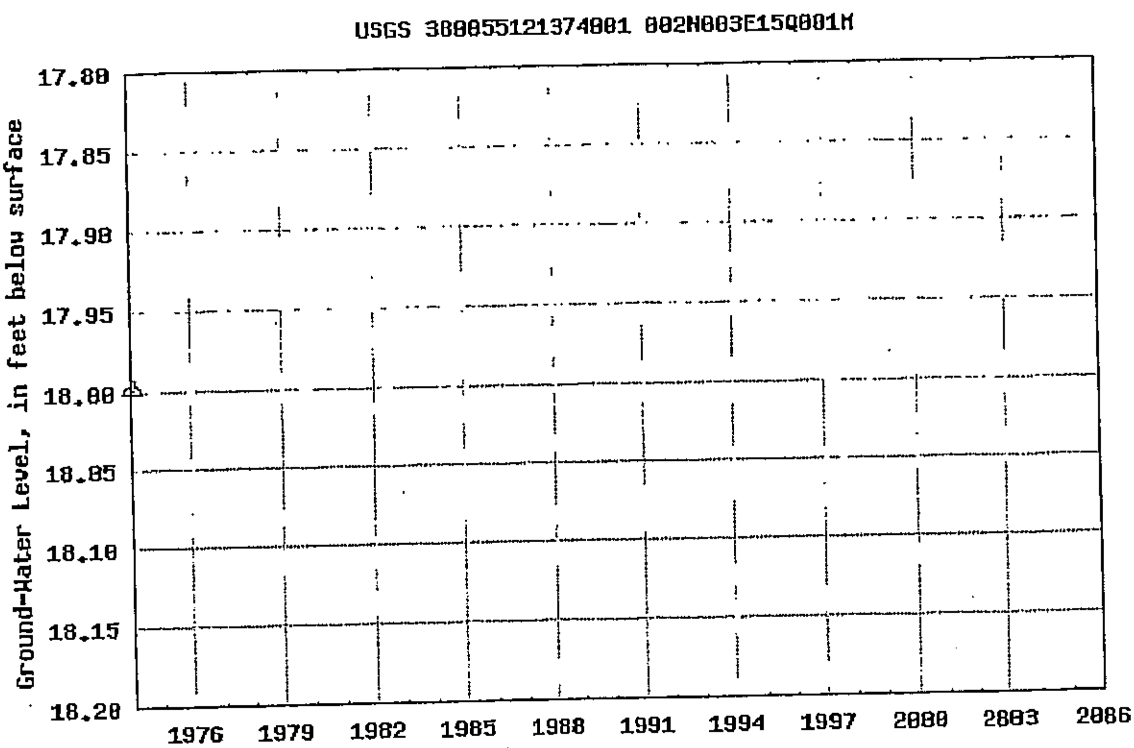
site_no list =	• 380055121374001

Save file of selected sites to local disk for future upload

USGS 380055121374001 002N003E15Q001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°00'55", Longitude 121°37'40" NAD27 The depth of the well is 165 feet below land surface. The depth of the hole is 236 feet below land surface. This well is completed in FLOOD-BASIN DEPOSITS (111FLDB)	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375809121383401

Save file of selected sites to local disk for future upload

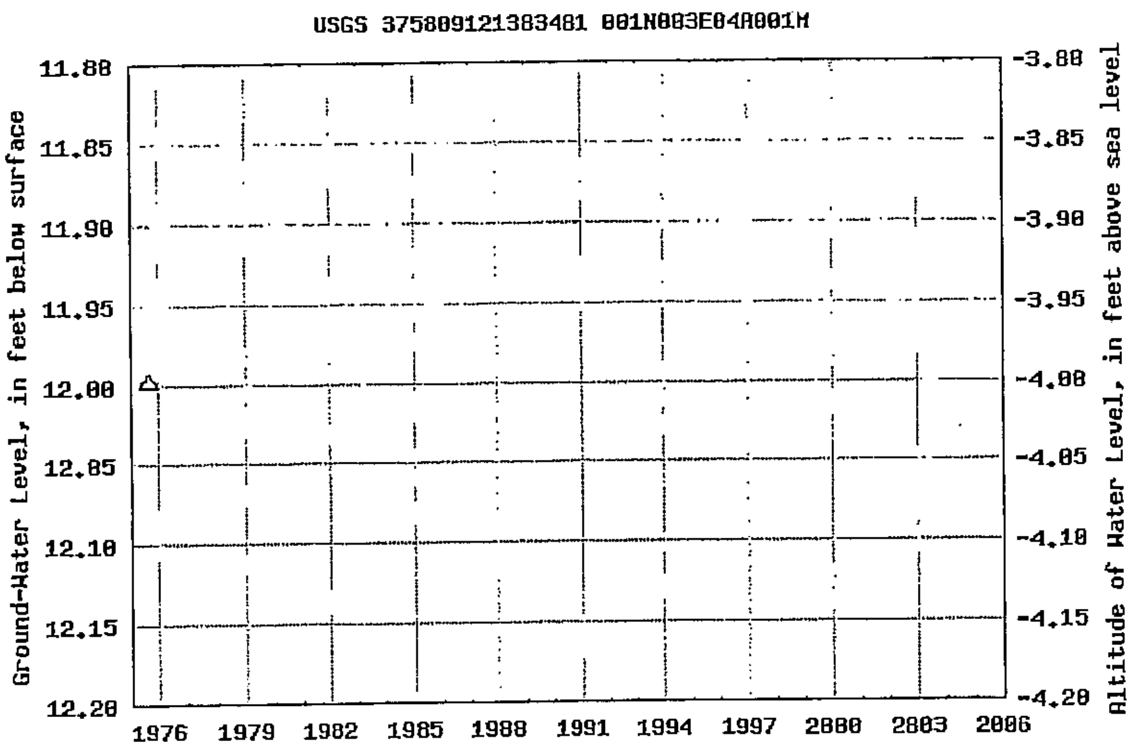
USGS 375809121383401 001N003E04A001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°58'09", Longitude 121°38'34" NAD27
Gage datum 8.00 feet above sea level NGVD29
The depth of the well is 65.0 feet below land surface.
The depth of the hole is 80.0 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd     - Agency Code
#  site_no       - USGS site number
#  sample_dt     - Date of sample
#  sample_tm     - Time of sample
#  parameter_cd  - Parameter Code
#  result_va     - Value
#  remark_cd     - Remark Code
#  qw_method_cd  - Quality Assurance Method Code
#  anl_stat_cd   - Analysis Stat Code
#  anl_src_cd    - Analysis Source Code
#  hyd_cond_cd   - Hydrologic Cond Code
#  samp_type_cd  - Sample Type Code
#  hyd_event_cd  - Hydrologic Event Code
#  medium_cd     - Sample medium code
#
# Data for the following sites are included:
#  USGS 380055121374001 002N003E15Q001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
# N  - Presumptive evidence of presence of material
# S  - Most probable value
# U  - Material specifically analyzed for but not detected
# V  - Value affected by contamination
#
#
agency_cd       site_no sample_dt       sample_tm       parameter_cd    result_va
```

5s	15s	10d	4d	5s	12n	1s	1s	1s	1s	1s
USGS	380055121374001	1979-06-05				00010	25.0			7
USGS	380055121374001	1979-06-05				00095	1330			7
USGS	380055121374001	1979-06-05				00400	8.1			7
USGS	380055121374001	1979-06-05				00410	270			7
USGS	380055121374001	1979-06-05				00618	.02			7
USGS	380055121374001	1979-06-05				00900	300			7
USGS	380055121374001	1979-06-05				00915	63.0			7
USGS	380055121374001	1979-06-05				00925	35.0			7
USGS	380055121374001	1979-06-05				00930	140			7
USGS	380055121374001	1979-06-05				00931	4			7
USGS	380055121374001	1979-06-05				00932	50			7
USGS	380055121374001	1979-06-05				00935	3.80			7
USGS	380055121374001	1979-06-05				00940	200			7
USGS	380055121374001	1979-06-05				00945	73.0			7
USGS	380055121374001	1979-06-05				00950	.10	<		7
USGS	380055121374001	1979-06-05				00955	34.0			7
USGS	380055121374001	1979-06-05				01020	500			7
USGS	380055121374001	1979-06-05				70300	768			7
USGS	380055121374001	1979-06-05				71851	.100			7

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 380011121375501

Save file of selected sites to local disk for future upload

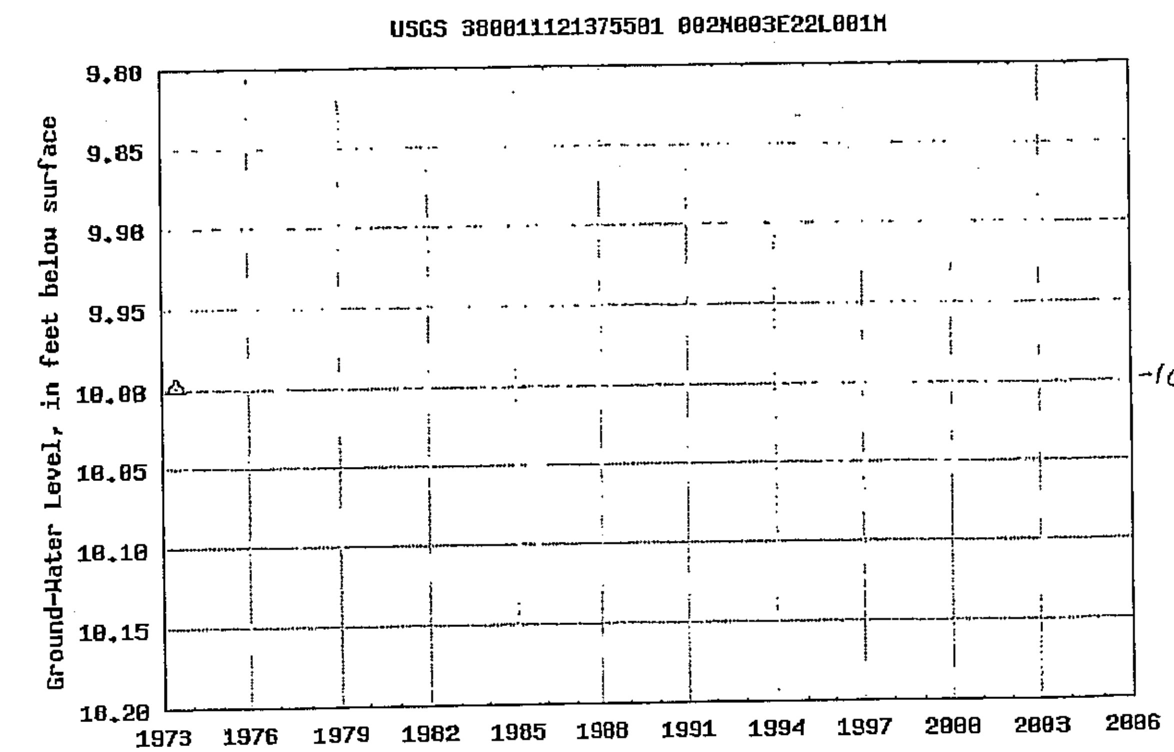
USGS 380011121375501 002N003E22L001M D-13

Available data for this site: Ground-water: Levels | GO

San Joaquin County, California
Hydrologic Unit Code 18040003
Latitude 38°00'11", Longitude 121°37'55" NAD27
The depth of the well is 170 feet below land surface.
The depth of the hole is 180 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period

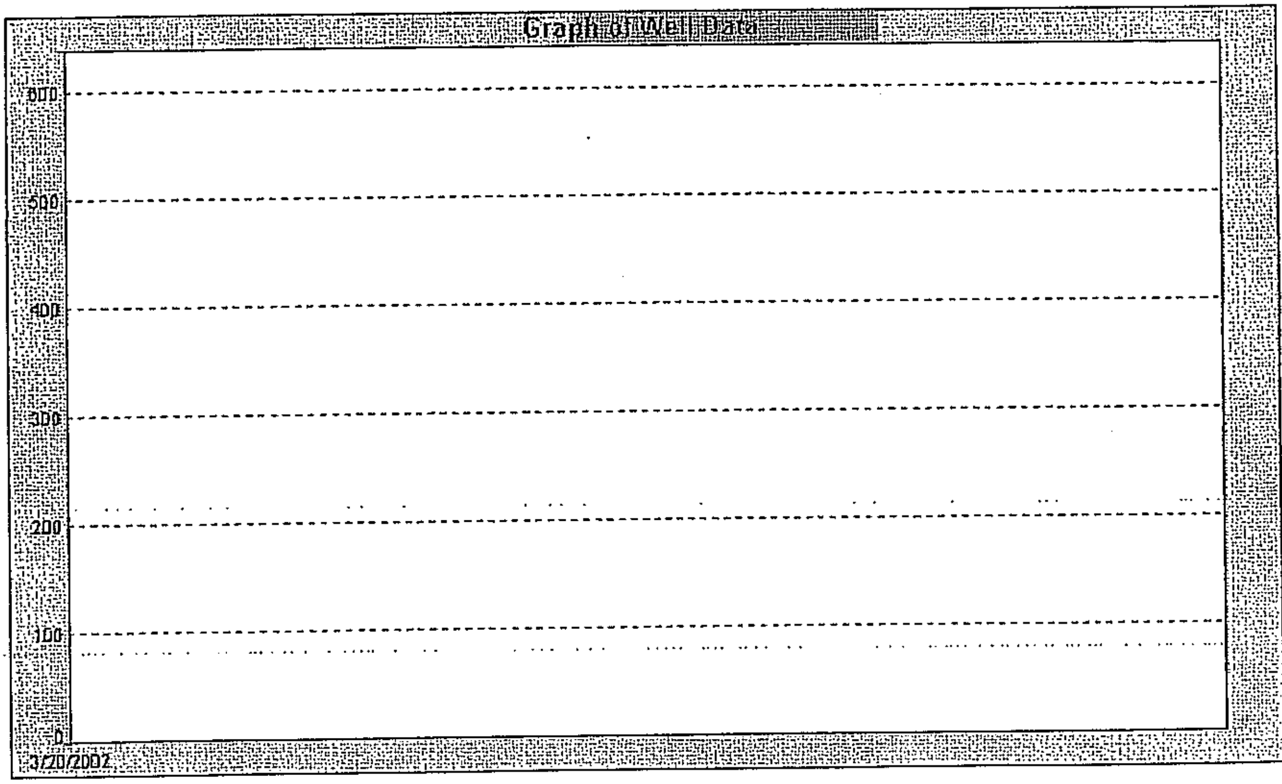


Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

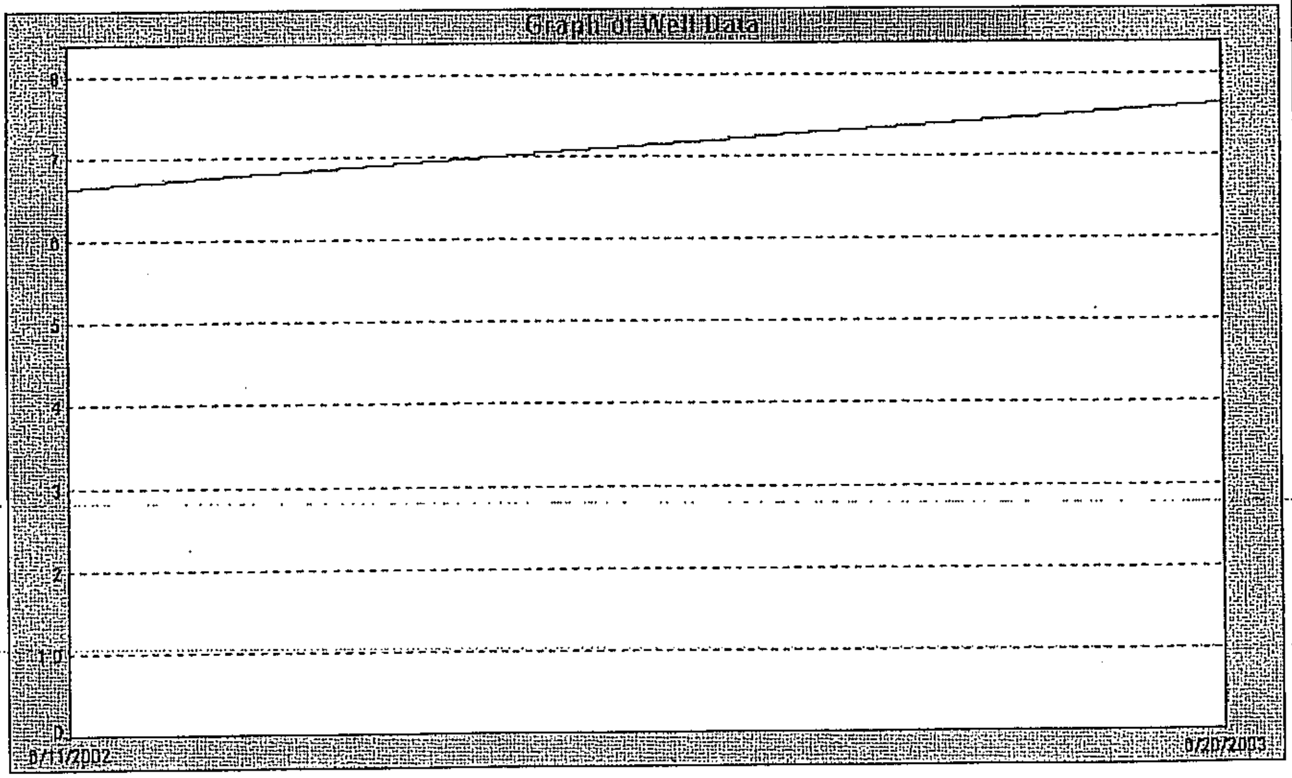
Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

4-24

DELTA KIDS CENTER (OAKLEY)
WELL HEAD
State Well Number: 0706048-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/20/2003	NITRATE (AS NO3)		7.6	mg/L	45
6/11/2002	NITRATE (AS NO3)		6.6	mg/L	45

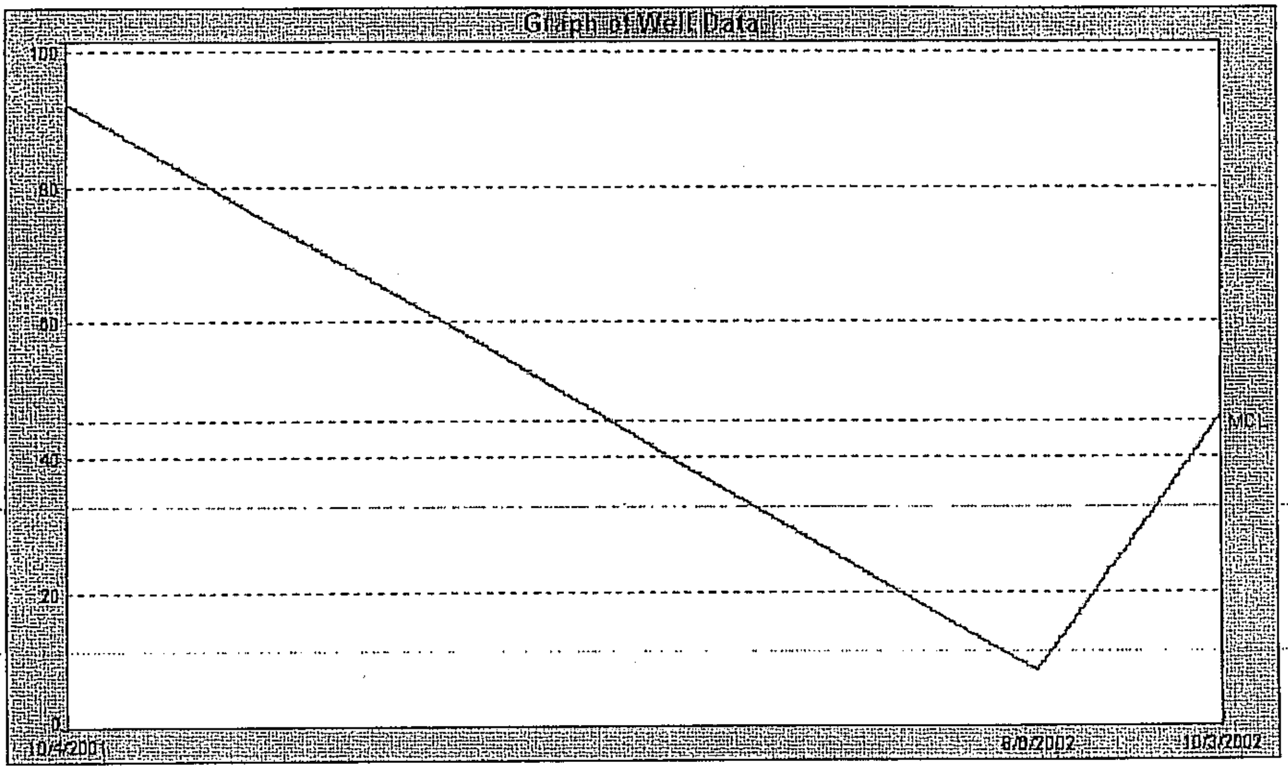
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

BETHEL MISSIONARY BAPTIST (OAKLEY)
WELL HEAD
State Well Number: 0706032-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
10/3/2002	NITRATE (AS NO3)		46	mg/L	45
8/6/2002	NITRATE (AS NO3)		8	mg/L	45
10/4/2001	NITRATE (AS NO3)		92	mg/L	45

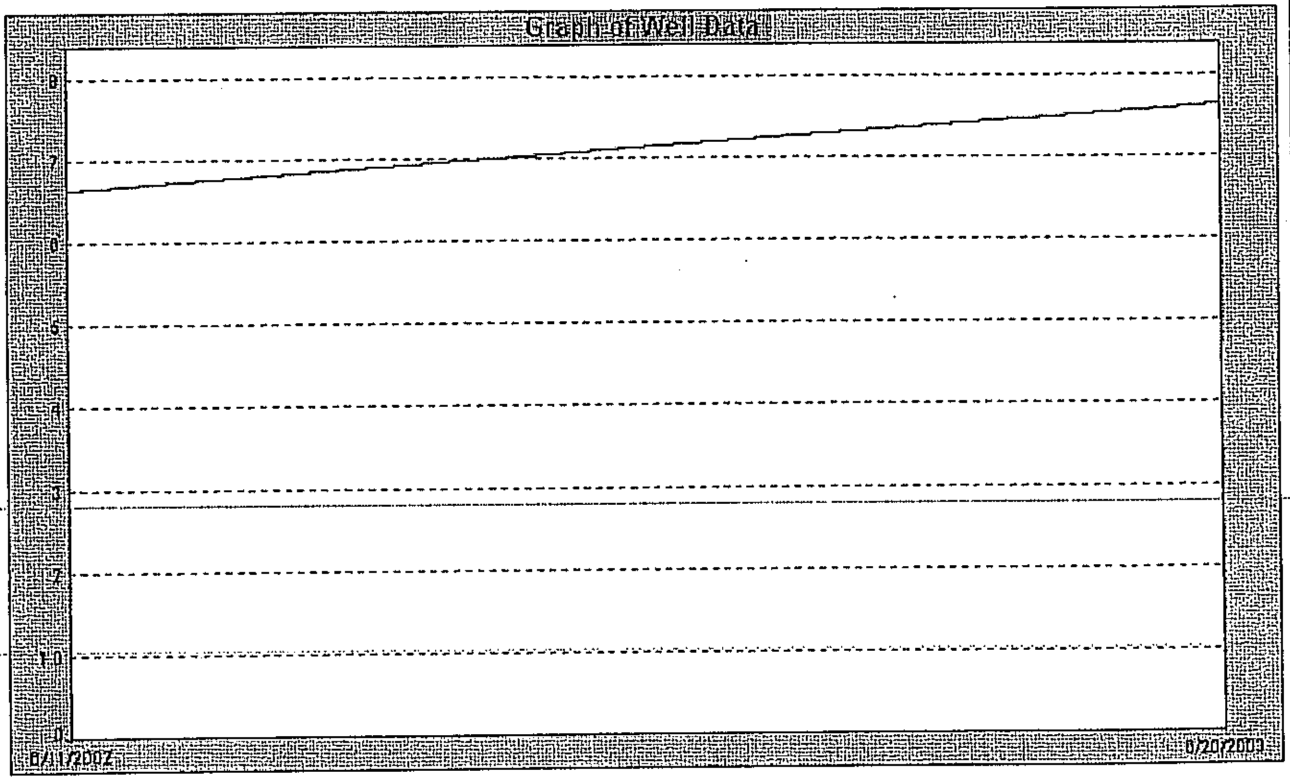
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DELTA KIDS CENTER (OAKLEY)
WELL HEAD
State Well Number: 0706048-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/20/2003	NITRATE (AS NO3)		7.6	mg/L	45
6/11/2002	NITRATE (AS NO3)		6.6	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

DHS Water Quality

BETHEL MISSIONARY BAPTIST (OAKLEY)
WELL HEAD
State Well Number: 0706032-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals   Reset Boxes   **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/3/2002	NITRATE (AS NO3)		46	mg/L	45	

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

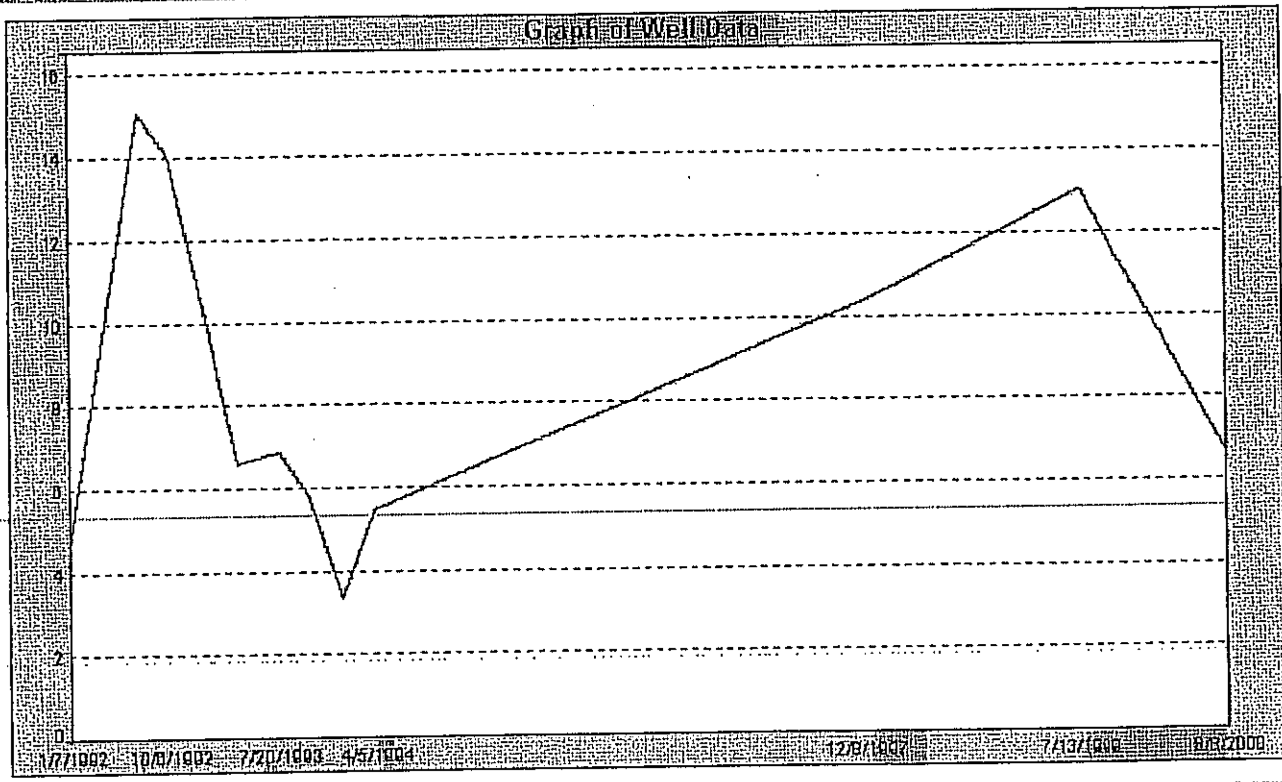
Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
WELL 01 - STANDBY
State Well Number: 0710007-002

Near Oakley Builder's Supply

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Graph of Well Data



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	NITRATE (AS NO3)		6.6	mg/L	45
7/13/1999	NITRATE (AS NO3)		13	mg/L	45
12/8/1997	NITRATE (AS NO3)		10.3	mg/L	45
4/5/1994	NITRATE (AS NO3)		5.4	mg/L	45
1/4/1994	NITRATE (AS NO3)		3.3	mg/L	45
10/5/1993	NITRATE (AS NO3)		5.8	mg/L	45
7/20/1993	NITRATE (AS NO3)		6.8	mg/L	45
4/5/1993	NITRATE (AS NO3)		6.5	mg/L	45
10/6/1992	NITRATE (AS NO3)		14	mg/L	45
7/13/1992	NITRATE (AS NO3)		15	mg/L	45
1/7/1992	NITRATE (AS NO3)		4.5	mg/L	45

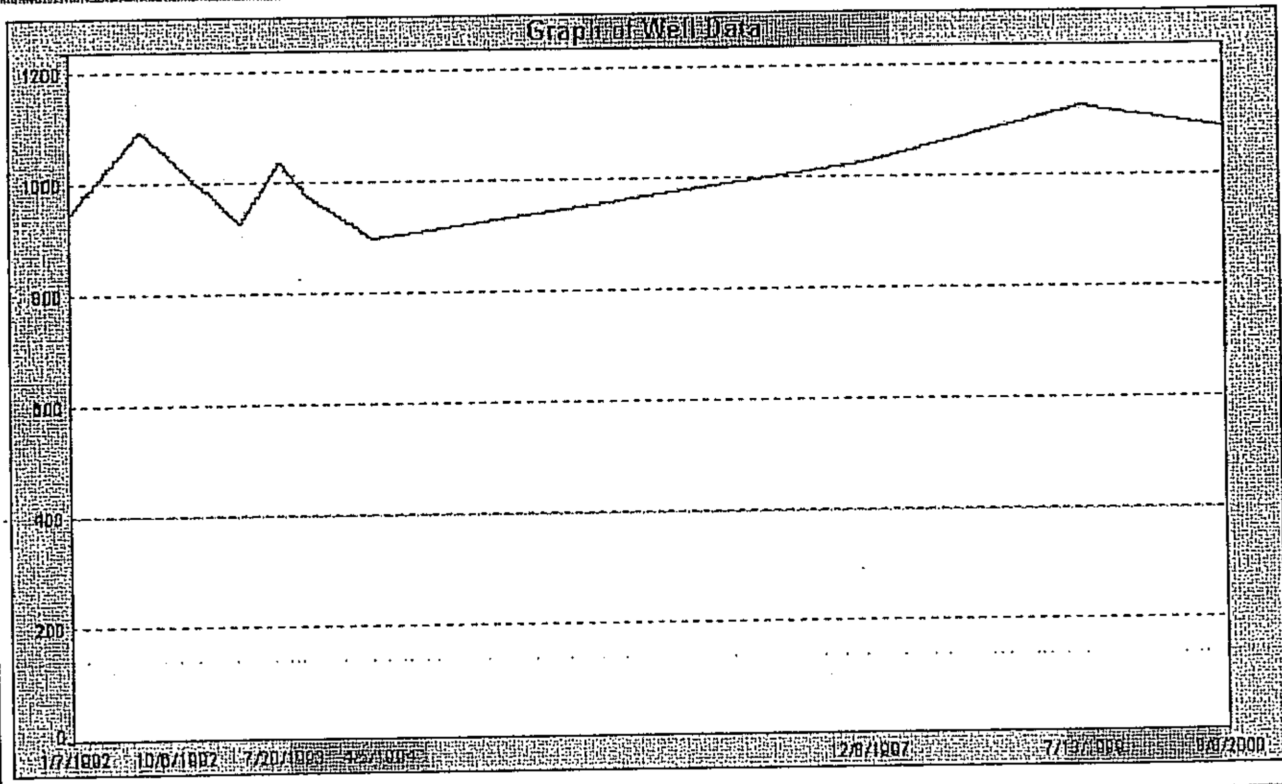
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
WELL 01 - STANDBY
State Well Number: 0710007-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	TOTAL DISSOLVED SOLIDS		1080	mg/L	1500
7/13/1999	TOTAL DISSOLVED SOLIDS		1120	mg/L	1500
12/8/1997	TOTAL DISSOLVED SOLIDS		1020	mg/L	1500
4/5/1994	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
1/4/1994	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
10/5/1993	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
7/20/1993	TOTAL DISSOLVED SOLIDS		1030	mg/L	1500
4/5/1993	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
10/6/1992	TOTAL DISSOLVED SOLIDS		1040	mg/L	1500
7/13/1992	TOTAL DISSOLVED SOLIDS		1090	mg/L	1500
1/7/1992	TOTAL DISSOLVED SOLIDS		940	mg/L	1500

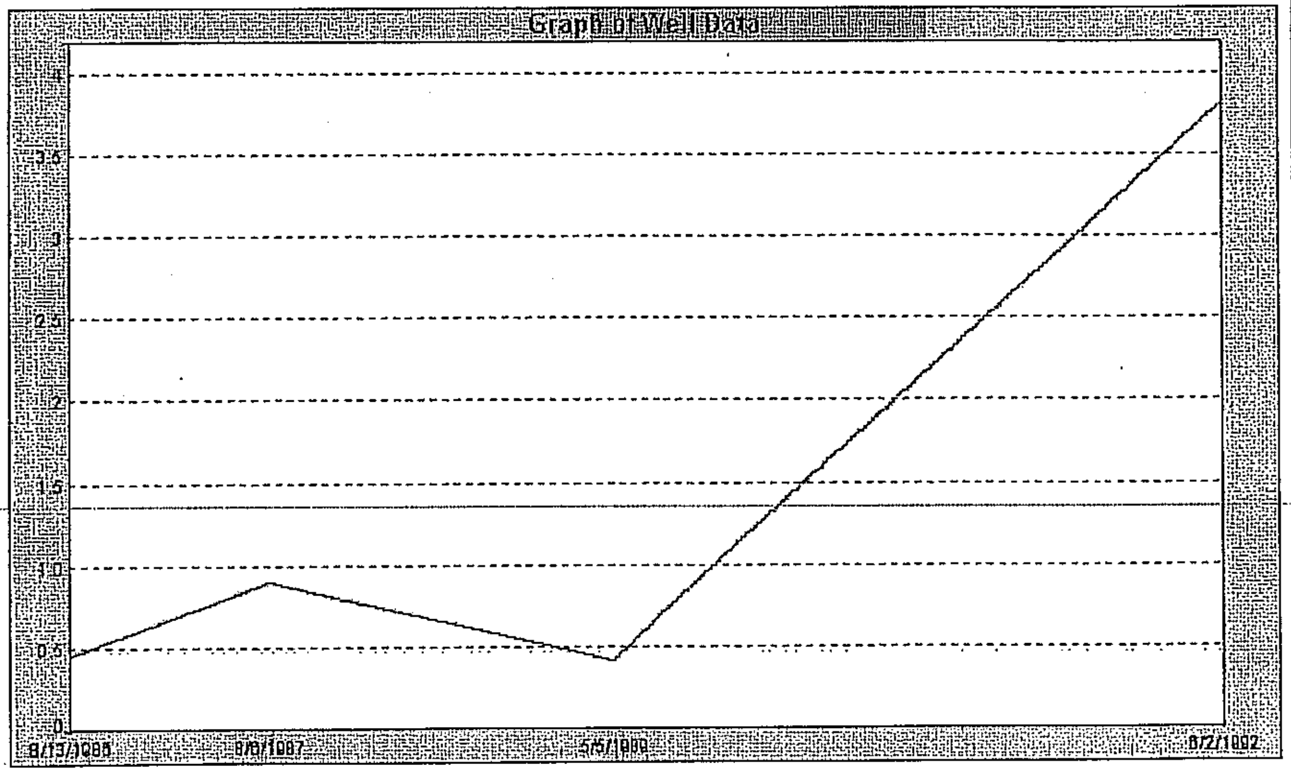
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	NITRATE (AS NO3)		3.8	mg/L	45
5/5/1989	NITRATE (AS NO3)	<	0.4	mg/L	45
8/6/1987	NITRATE (AS NO3)		0.89	mg/L	45
8/13/1986	NITRATE (AS NO3)	<	0.44	mg/L	45

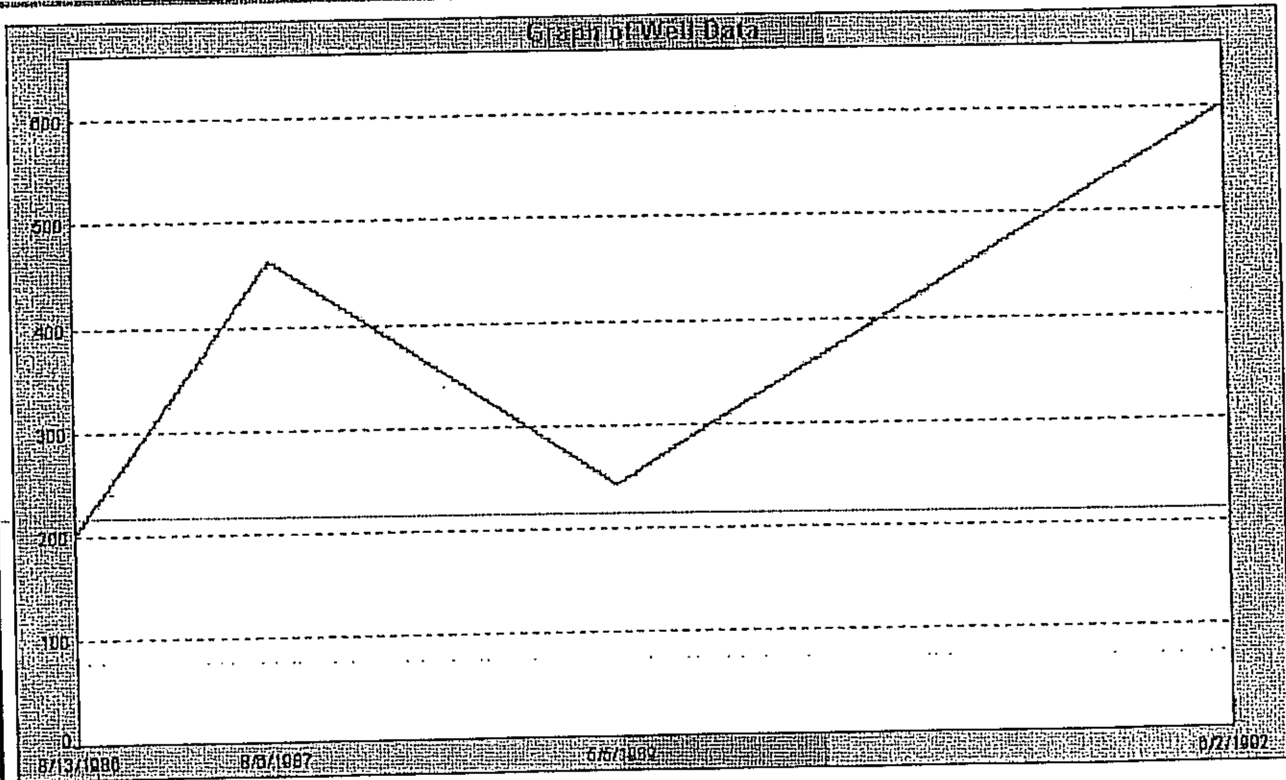
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	TOTAL DISSOLVED SOLIDS		600	mg/L	1500
5/5/1989	TOTAL DISSOLVED SOLIDS		240	mg/L	1500
8/6/1987	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
8/13/1986	TOTAL DISSOLVED SOLIDS		199	mg/L	1500

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

GREG'S MOTEL & HARBOR (OAKLEY)
WELL HEAD
State Well Number: 0707526-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

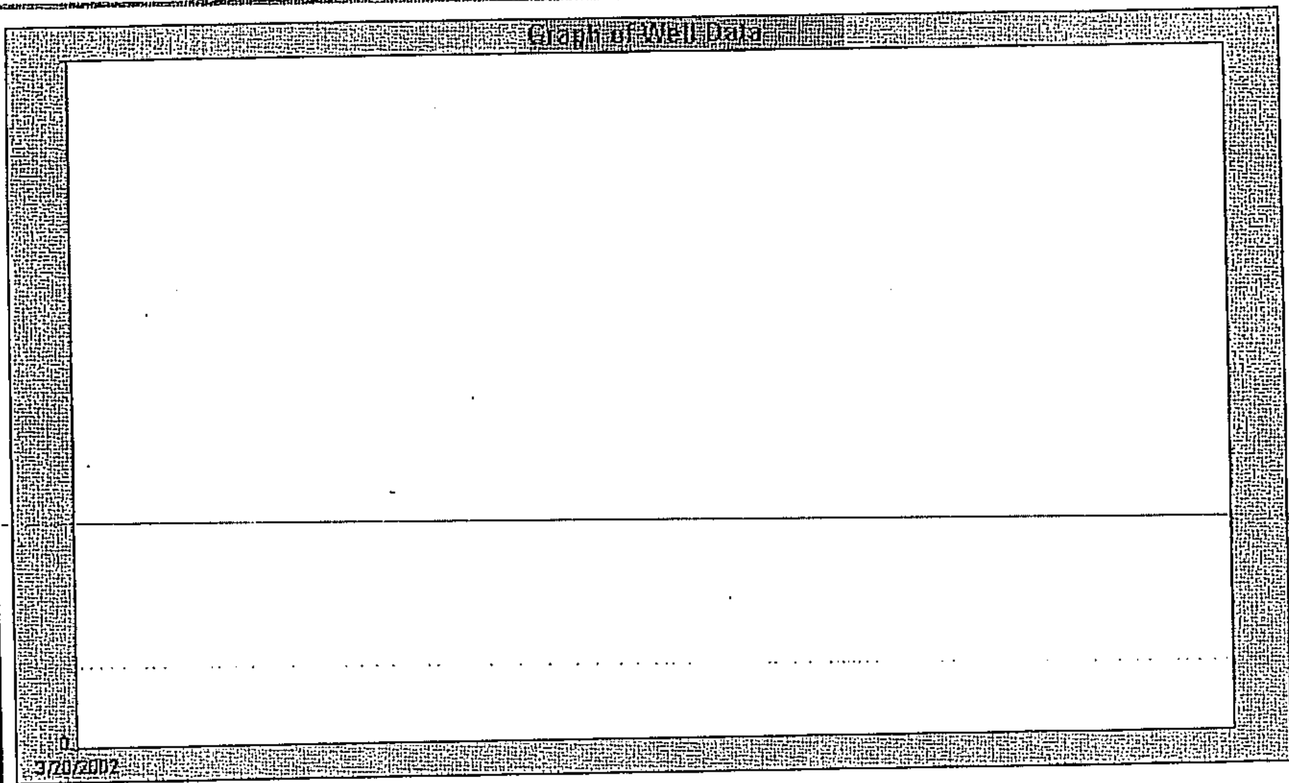
Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/15/2002	NITRATE (AS NO3)		0	mg/L	45	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
EAST WELL
State Well Number: 0706004-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	NITRITE (AS N)		0	ug/L	1000

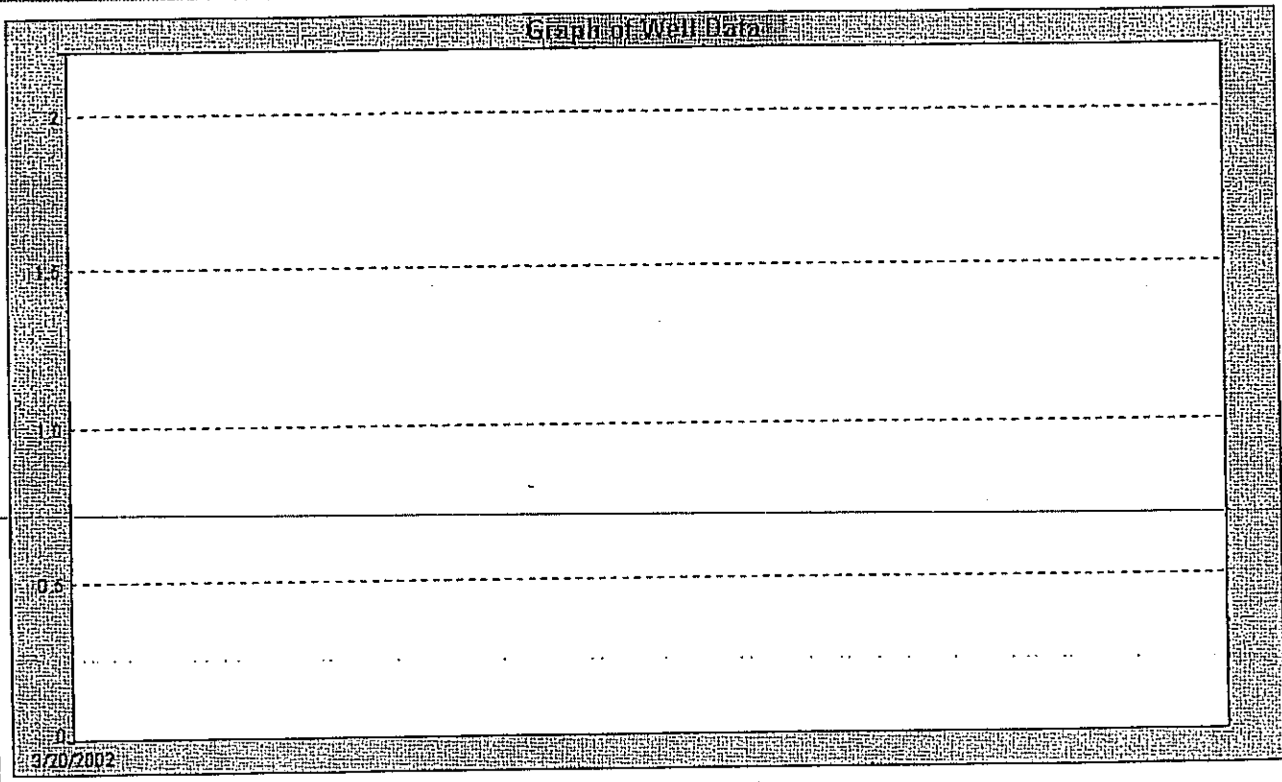
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45

From Date: To Date: Graph Size Normalized

Small Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
3/20/2002	ALKALINITY (TOTAL) AS CACO3		290	mg/L	NA	
3/20/2002	ALUMINUM		0	ug/L	1000	
3/20/2002	ARSENIC		0	ug/L	50	
3/20/2002	BARIUM		0	ug/L	1000	
3/20/2002	CADMIUM		0	ug/L	5	
3/20/2002	CALCIUM		60	mg/L	NA	
3/20/2002	CHLORIDE		85	mg/L	600	
3/20/2002	CHROMIUM (TOTAL)		0	ug/L	50	
3/20/2002	COLOR		7	UNITS	15	
3/20/2002	COPPER		0	ug/L	1000	
3/20/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	
3/20/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	
3/20/2002	HARDNESS (TOTAL) AS CACO3		260	mg/L	NA	
3/20/2002	IRON		140	ug/L	300	
3/20/2002	LEAD		0	ug/L	NA	
3/20/2002	MAGNESIUM		28	mg/L	NA	
3/20/2002	MANGANESE		170	ug/L	50	
3/20/2002	MERCURY		0	ug/L	2	
6/19/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45	
3/20/2002	NITRITE (AS N)		0	ug/L	1000	
3/20/2002	ODOR THRESHOLD @ 60 C		2	TON	3	
3/20/2002	PH, LABORATORY		7.9		NA	
3/20/2002	POTASSIUM		2	mg/L	NA	
3/20/2002	SELENIUM		0	ug/L	50	
3/20/2002	SILVER		0	ug/L	100	
3/20/2002	SODIUM		110	mg/L	NA	
3/20/2002	SOURCE TEMPERATURE C		19.5	C	NA	

3/20/2002	SPECIFIC CONDUCTANCE		960	US	2200
3/20/2002	SULFATE		100	mg/L	600
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500
3/20/2002	TURBIDITY, LABORATORY		0.46	NTU	5
3/20/2002	ZINC	<	50	ug/L	5000

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
LINDQUIST LANDING MARINA SWS

Water System Address:
LINDQUIST LANDING MARINA SWS
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
23

Population Served:
20

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
4/29/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	
4/29/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	
4/29/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	
4/29/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	
4/29/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	
4/29/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	
~~4/29/1986~~	~~1,2-DICHLOROETHANE~~	~~<~~	~~0.5~~	~~ug/L~~	~~0.5~~	
4/29/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	
4/29/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	
4/29/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	
4/29/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	
5/7/1986	BENOMYL	<	100	ug/L	NA	
4/29/1986	BENZENE	<	0.5	ug/L	1	
4/29/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	
4/29/1986	BROMOFORM (THM)	<	0.5	ug/L	100	
4/29/1986	BROMOMETHANE	<	0.5	ug/L	NA	
4/29/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	
4/29/1986	CHLOROETHANE	<	0.5	ug/L	NA	
4/29/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	
4/29/1986	CHLOROMETHANE	<	0.5	ug/L	NA	
4/29/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	
4/29/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	
4/29/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	
4/29/1986	DICHLOROMETHANE	<	0.5	ug/L	5	
4/29/1986	ETHYLBENZENE	<	0.5	ug/L	700	
4/29/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	
4/29/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	
4/29/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	

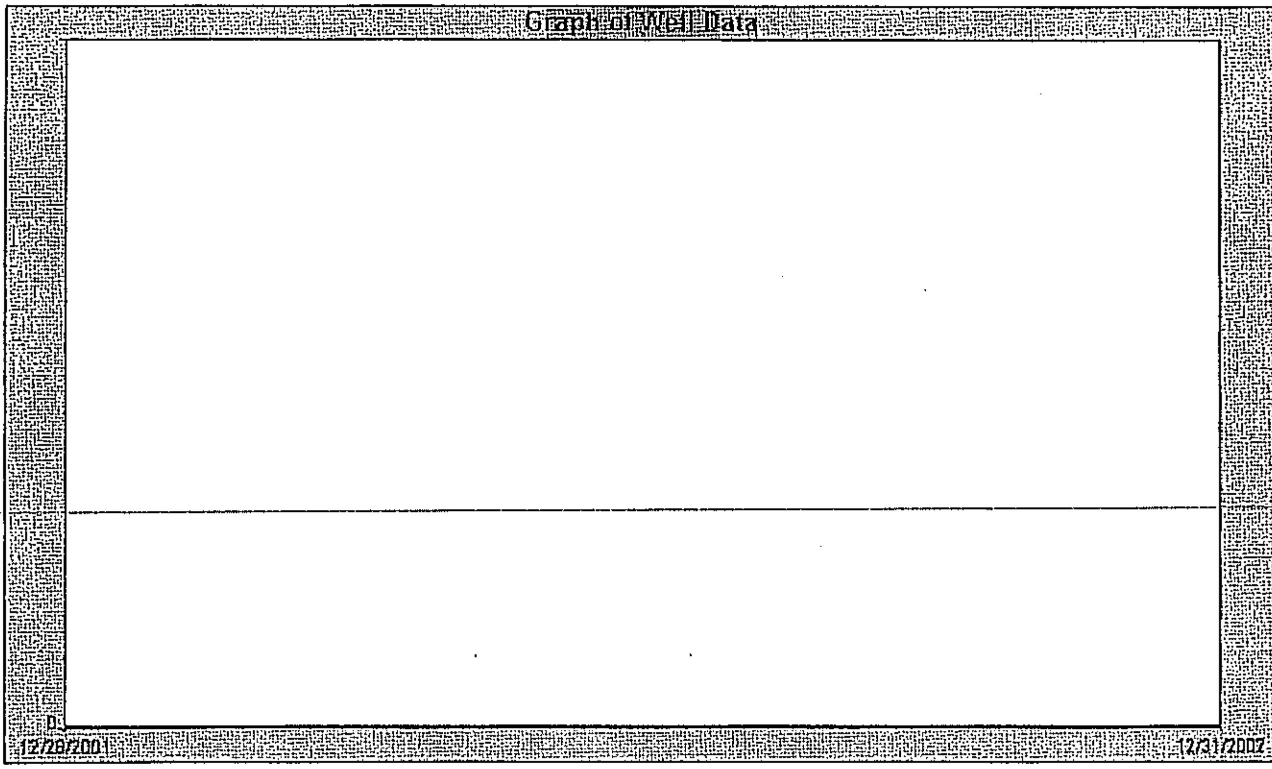
12/31/2002	NITRATE (AS NO3)		0	mg/L	45	
4/29/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	5	
4/29/1986	TOLUENE	<	0.5	ug/L	150	
4/29/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	10	
4/29/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	
4/29/1986	TRICHLOROETHYLENE	<	0.5	ug/L	5	
4/29/1986	TRICHLOROFLUOROMETHANE	<	0.5	ug/L	150	
4/29/1986	VINYL CHLORIDE	<	1	ug/L	0.5	
4/29/1986	XYLENES (TOTAL)	<	0.5	ug/L	1750	

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

RED COACH DELI (KNIGHTSEN)
LPA REPORTED PRIMARY SOURCE
State Well Number: 0706043-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
RED COACH DELI

Water System Address:
_ PO BOX 2
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
1

Population Served:
25

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

RED COACH DELI (KNIGHTSEN)
LPA REPORTED PRIMARY SOURCE
State Well Number: 0706043-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot

No water quality data for this well has been reported to Department of Health Services.

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Wells Owned By W0600707556

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND MUTUAL
BETHEL ISLAND , CA 94511

State Well No.	Well Common Name		
0707556-001	SANDMOUND RD WELL	Show on Map	Report
0707556-002	STONE ROAD WELL	Show on Map	Report
PWS MAIN FAC	0707556	Show on Map	Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND RD WELL
State Well Number: 0707556-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
SANDMOUND MUTUAL

Water System Address:
SANDMOUND MUTUAL
BETHEL ISLAND, CA 94511

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections: 30

Population Served: 175

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND RD WELL
State Well Number: 0707556-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
2/26/2003	ALUMINUM		0	ug/L	1000	☐
2/26/2003	ANTIMONY		0	ug/L	6	☐
2/26/2003	ARSENIC		0	ug/L	50	☐
2/26/2003	ASBESTOS		0	MFL	7	☐
2/26/2003	BARIUM		172	ug/L	1000	☐
2/26/2003	BERYLLIUM		0	ug/L	4	☐
2/26/2003	CADMIUM		0	ug/L	5	☐
2/26/2003	CHROMIUM (TOTAL)		0	ug/L	50	☐
2/26/2003	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	☐
2/26/2003	GROSS ALPHA		2.79	PCI/L	15	☐
2/26/2003	GROSS ALPHA COUNTING ERROR		1.54	PCI/L	NA	☐
11/4/1997	GROSS BETA		2.55	PCI/L	50	☐
11/4/1997	GROSS BETA COUNTING ERROR		0.56	PCI/L	NA	☐
2/26/2003	LEAD		0	ug/L	NA	☐
2/26/2003	MERCURY		0	ug/L	2	☐
2/26/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
2/26/2003	NICKEL		0	ug/L	100	☐
2/26/2003	NITRATE (AS NO3)		0	mg/L	45	☐
2/26/2003	NITRITE (AS N)		0	ug/L	1000	☐
2/26/2003	SELENIUM		0	ug/L	50	☐
2/26/2003	THALLIUM		0	ug/L	2	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

SANDMOUND MUTUAL (BETHEL ISLAND)
STONE ROAD WELL
State Well Number: 0707556-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
SANDMOUND MUTUAL

Water System Address:
SANDMOUND MUTUAL
BETHEL ISLAND, CA 94511

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:	Population Served:
30	175

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

SANDMOUND MUTUAL (BETHEL ISLAND)
STONE ROAD WELL
State Well Number: 0707556-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

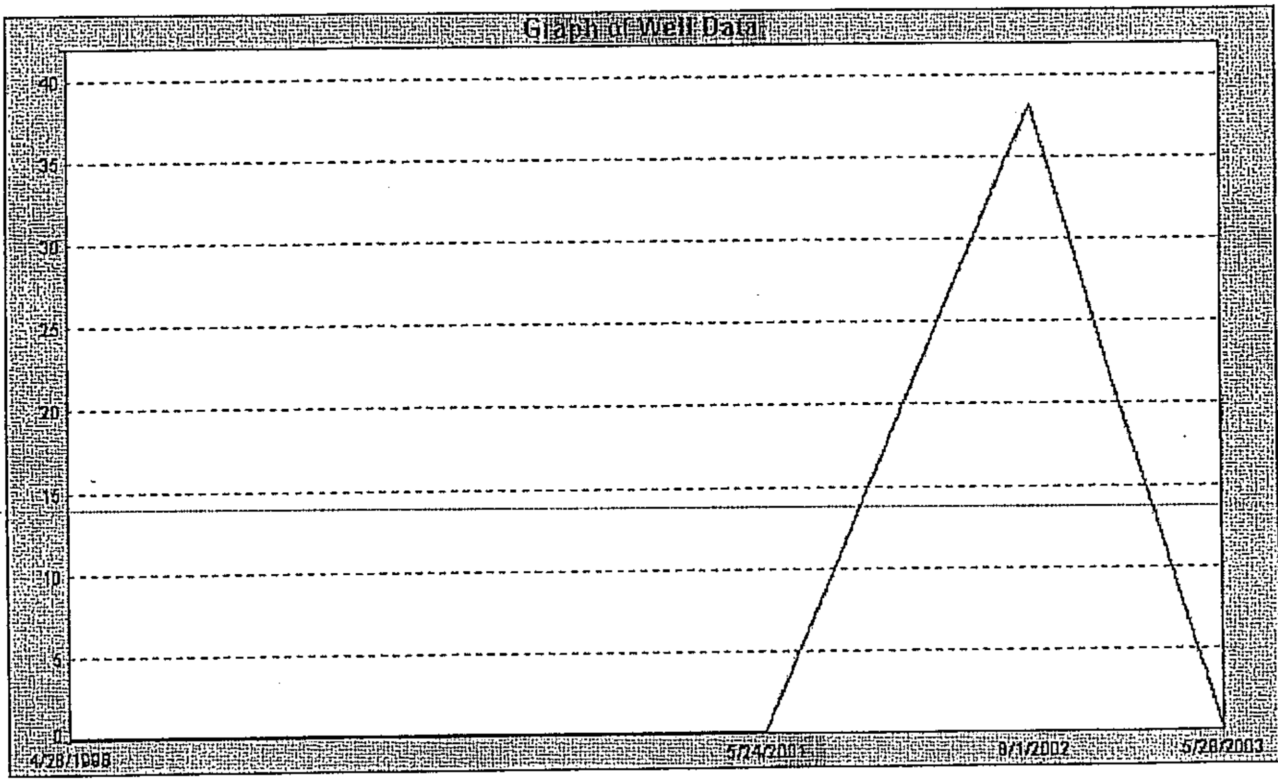
Date	Parameter	Qualifier	Result	Units	MCL	Plot
2/26/2003	ALUMINUM		0	ug/L	1000	☐
2/26/2003	ANTIMONY		0	ug/L	6	☐
2/26/2003	ARSENIC		15	ug/L	50	☐
2/26/2003	ASBESTOS		0	MFL	7	☐
2/26/2003	BARIUM	<	160	ug/L	1000	☐
2/26/2003	BERYLLIUM		0	ug/L	4	☐
2/26/2003	CADMIUM		0	ug/L	5	☐
2/26/2003	CHROMIUM (TOTAL)		0	ug/L	50	☐
2/26/2003	FLUORIDE (TEMPERATURE DEPENDENT)		0	mg/L	1.7	☐
2/26/2003	GROSS ALPHA		1.04	PCI/L	15	☐
2/26/2003	GROSS ALPHA COUNTING ERROR		2.05	PCI/L	NA	☐
2/26/2003	LEAD		0	ug/L	NA	☐
2/26/2003	MERCURY		0	ug/L	2	☐
2/26/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
2/26/2003	NICKEL		0	ug/L	100	☐
2/26/2003	NITRATE (AS NO3)		0	mg/L	45	☐
2/26/2003	NITRITE (AS N)		0	ug/L	1000	☐
2/26/2003	SELENIUM		0	ug/L	50	☐
2/26/2003	THALLIUM		0	ug/L	2	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

ISLAND PARK TRAILER COURT (BETHEL ISLAND)
WELL 01
State Well Number: 0707574-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
5/28/2003	NITRATE (AS NO3)		0	mg/L	45
8/1/2002	NITRATE (AS NO3)		38	mg/L	45
5/24/2001	NITRATE (AS NO3)		0	mg/L	45
4/28/1998	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Wells Owned By W0600710004

CITY OF BRENTWOOD (BRENTWOOD)
161 Sycamore Avenue
BRENTWOOD , CA 94516

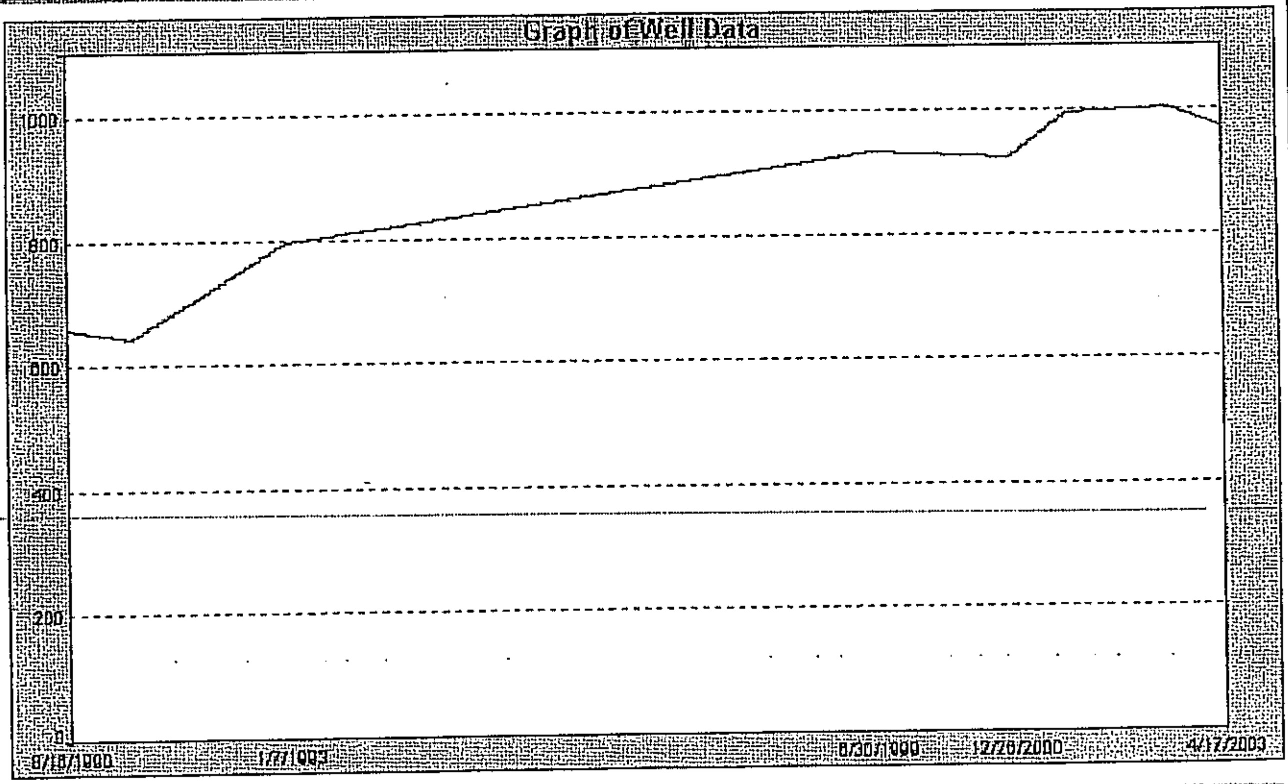
3	TDS	State Well No.	Well Common Name	
7.5	1166	0710004-001	WELL 01 - ABANDONED	Show on Map Report
2.2	934	0710004-002	WELL 02 - ABANDONED	Show on Map Report
NA	NA	0710004-003	WELL 03 - ABANDONED	Show on Map Report
10.5	939	0710004-004	WELL 04 - ABANDONED	Show on Map Report
NA	NA	0710004-005	WELL 05 - ABANDONED	Show on Map Report
17.8	970	0710004-006	WELL 06 8.9-17.8	Show on Map Report
8.2	760	0710004-007	WELL 07	Show on Map Report
4.5	890	0710004-008	WELL 08	Show on Map Report
25.	1230	0710004-009	WELL 10A - IRRIGATION - AGRICULTURAL	Show on Map Report
41.	960	0710004-010	WELL 11	Show on Map Report
7.5	530	0710004-011	WELL 12	Show on Map Report
6.4	490	0710004-012	WELL 13	Show on Map Report
NA	NA	0710004-013	DIABLO WD PS/RANDALL BOLD WTP	Show on Map Report
11.1	930	0710004-014	WELL 14	Show on Map Report
		0710004-015	WELL 10A - IRRIGATION - TREATED-INACTIVE	Show on Map Report
		0710004-016	WELL 11 - TREATED	Show on Map Report
		0710004-017	WELL 12 - TREATED	Show on Map Report
		0710004-018	WELL 14 - TREATED	Show on Map Report
		0710004-019	WELL 06 - TREATED	Show on Map Report
		0710004-020	WELL 07 - TREATED	Show on Map Report
		0710004-021	WELL 08 - TREATED	Show on Map Report
		0710004-022	WELL 13 - TREATED	Show on Map Report
		0710004-023	DIABLO WD/RANDALL-BOLD - TREATED	Show on Map Report
		0710004-024		Show on Map Report
		0710004-025		Show on Map Report
		PWS MAIN FAC 0710004		Show on Map Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 06
State Well Number: 0710004-006

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		1000	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		990	mg/L	1500
12/26/2000	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
1/7/1993	TOTAL DISSOLVED SOLIDS		793	mg/L	1500
4/30/1991	TOTAL DISSOLVED SOLIDS		640	mg/L	1500
8/16/1990	TOTAL DISSOLVED SOLIDS		657	mg/L	1500

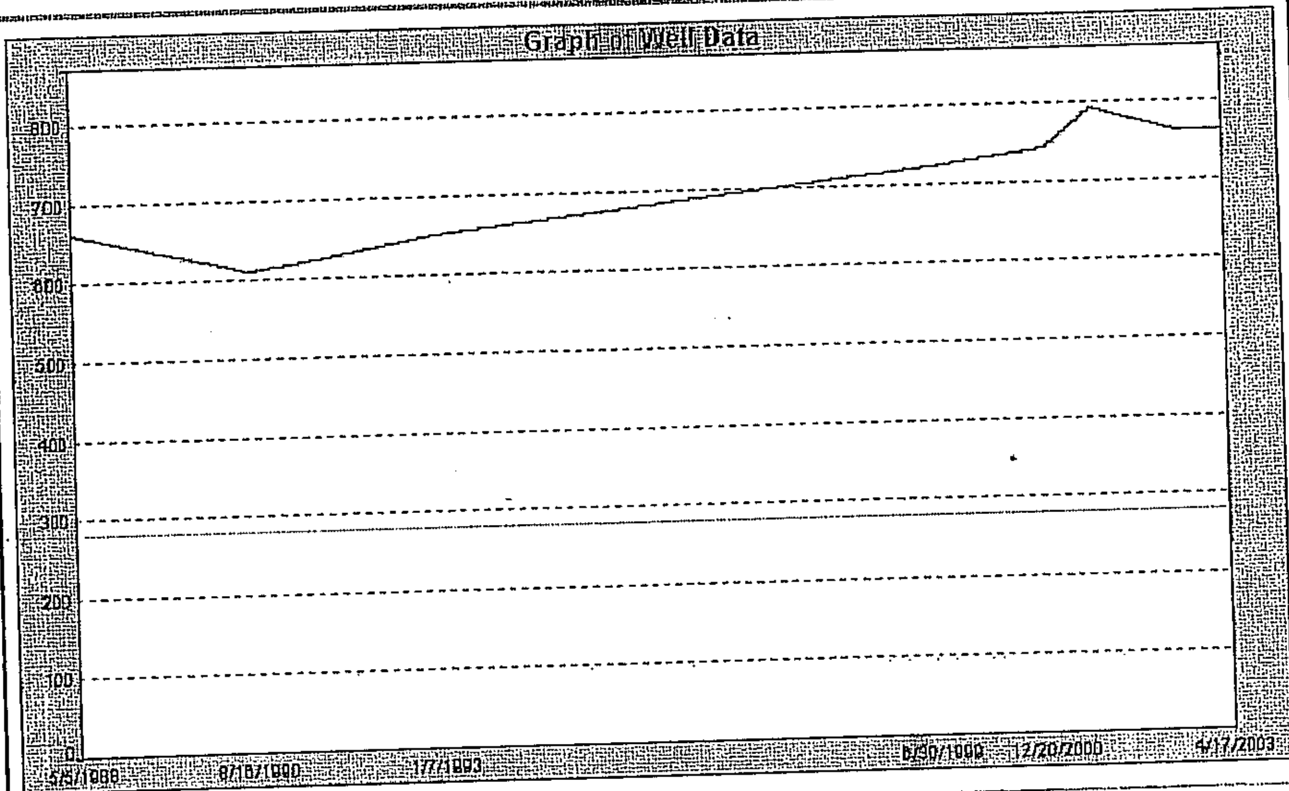
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 07
State Well Number: 0710004-007

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		760	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		760	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		790	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		740	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		720	mg/L	1500
1/7/1993	TOTAL DISSOLVED SOLIDS		650	mg/L	1500
4/30/1991	TOTAL DISSOLVED SOLIDS		620	mg/L	1500
8/16/1990	TOTAL DISSOLVED SOLIDS		608	mg/L	1500
5/5/1988	TOTAL DISSOLVED SOLIDS		660	mg/L	1500

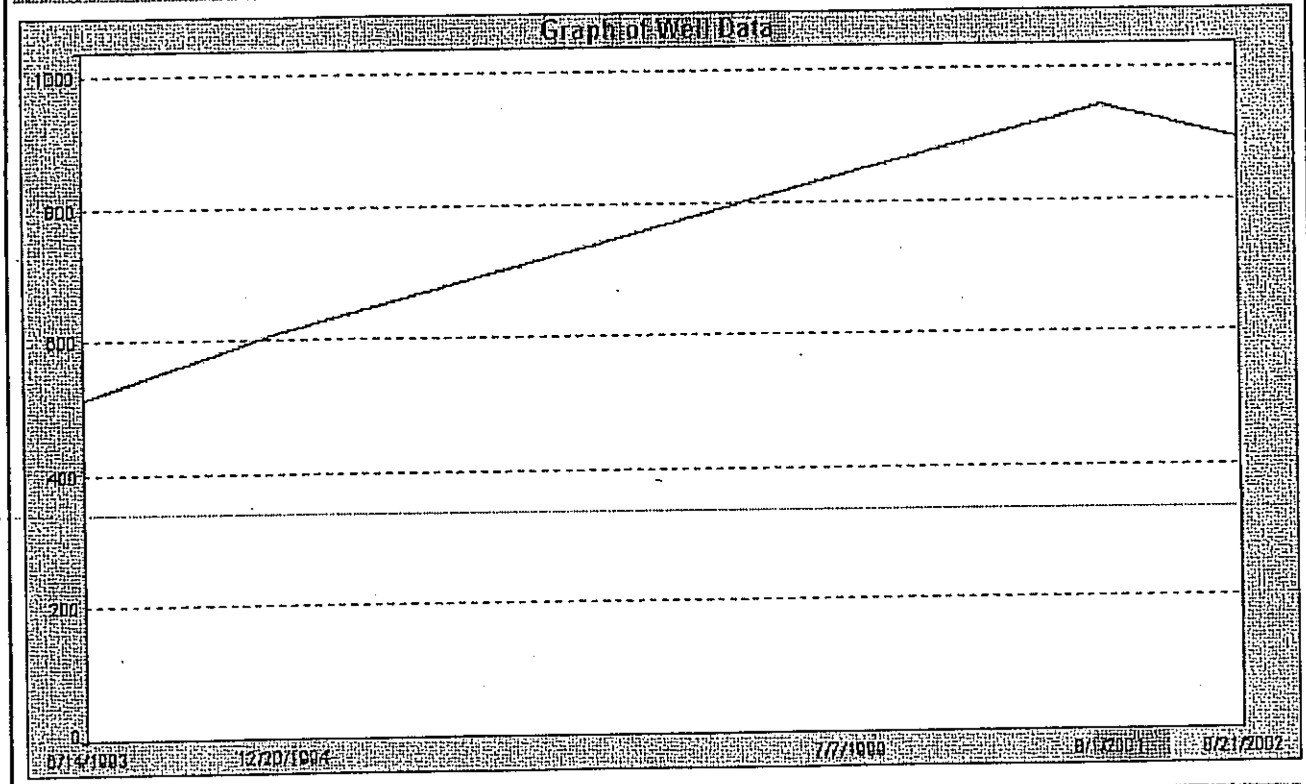
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 08
State Well Number: 0710004-008

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



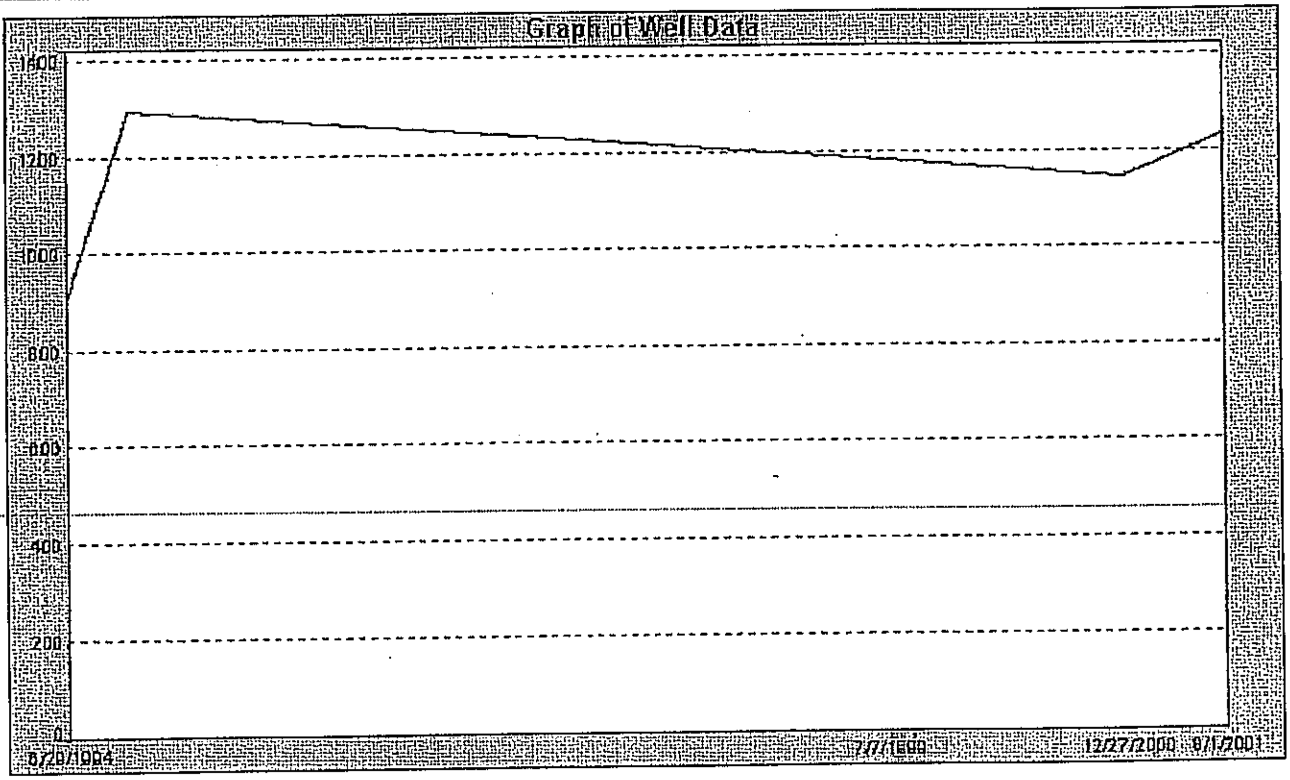
Date	Parameter	Qualifier	Result	Units	MCL
8/21/2002	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		940	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		840	mg/L	1500
12/20/1994	TOTAL DISSOLVED SOLIDS	<	606	mg/L	1500
6/14/1993	TOTAL DISSOLVED SOLIDS		510	mg/L	1500

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 10A - IRRIGATION - AGRICULTURAL
State Well Number: 0710004-009

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/1/2001	TOTAL DISSOLVED SOLIDS		1230	mg/L	1500
12/27/2000	TOTAL DISSOLVED SOLIDS		1140	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		1180	mg/L	1500
11/10/1994	TOTAL DISSOLVED SOLIDS		1289	mg/L	1500
6/29/1994	TOTAL DISSOLVED SOLIDS		900	mg/L	1500

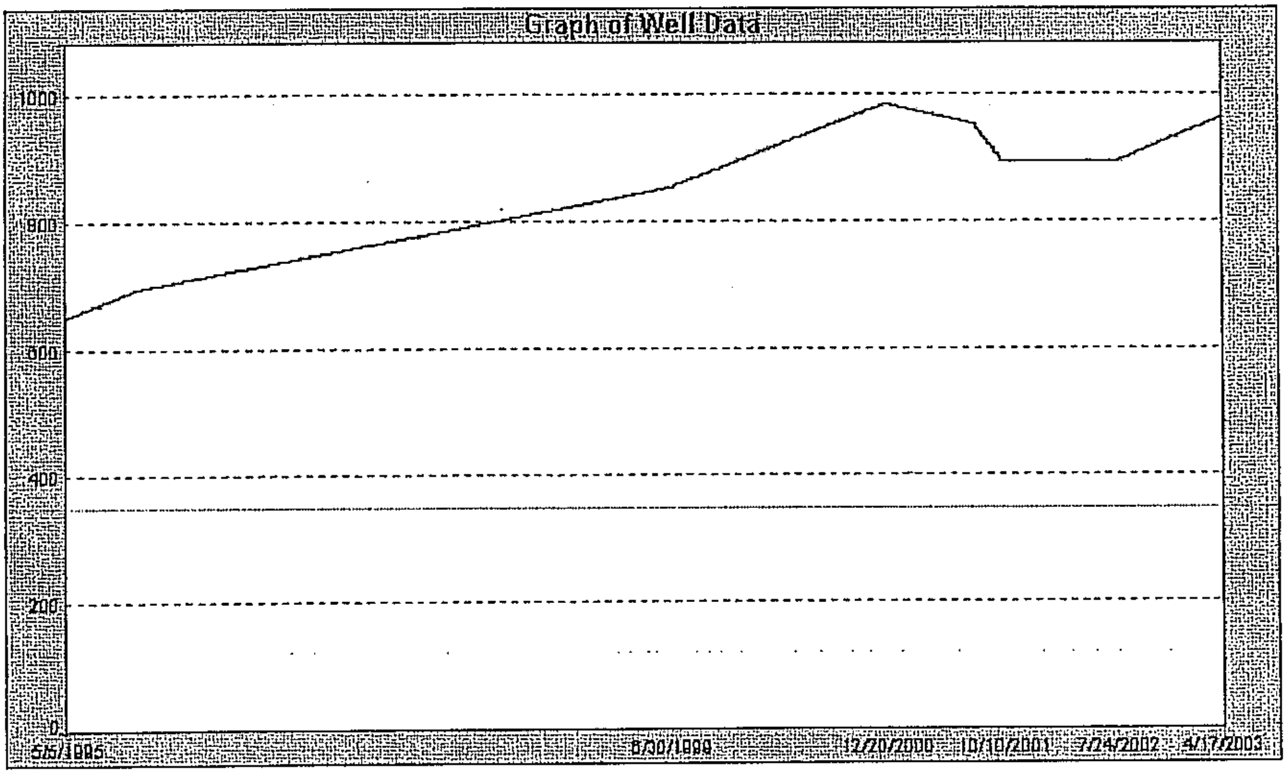
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 11
State Well Number: 0710004-010

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		960	mg/L	1500
7/24/2002	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
10/10/2001	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		950	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		980	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		850	mg/L	1500
10/26/1995	TOTAL DISSOLVED SOLIDS		688	mg/L	1500
5/5/1995	TOTAL DISSOLVED SOLIDS		645	mg/L	1500

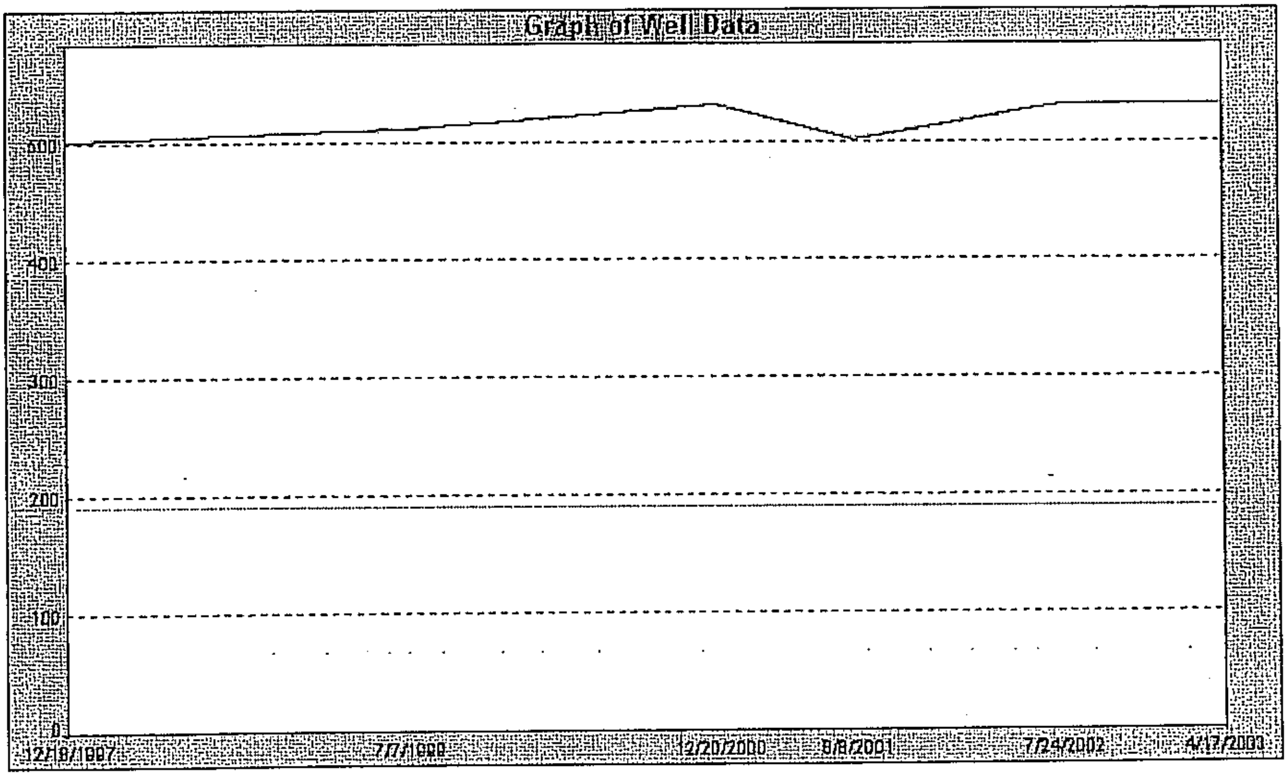
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 12
State Well Number: 0710004-011

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
7/24/2002	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
8/8/2001	TOTAL DISSOLVED SOLIDS		500	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		510	mg/L	1500
12/18/1997	TOTAL DISSOLVED SOLIDS		500	mg/L	1500

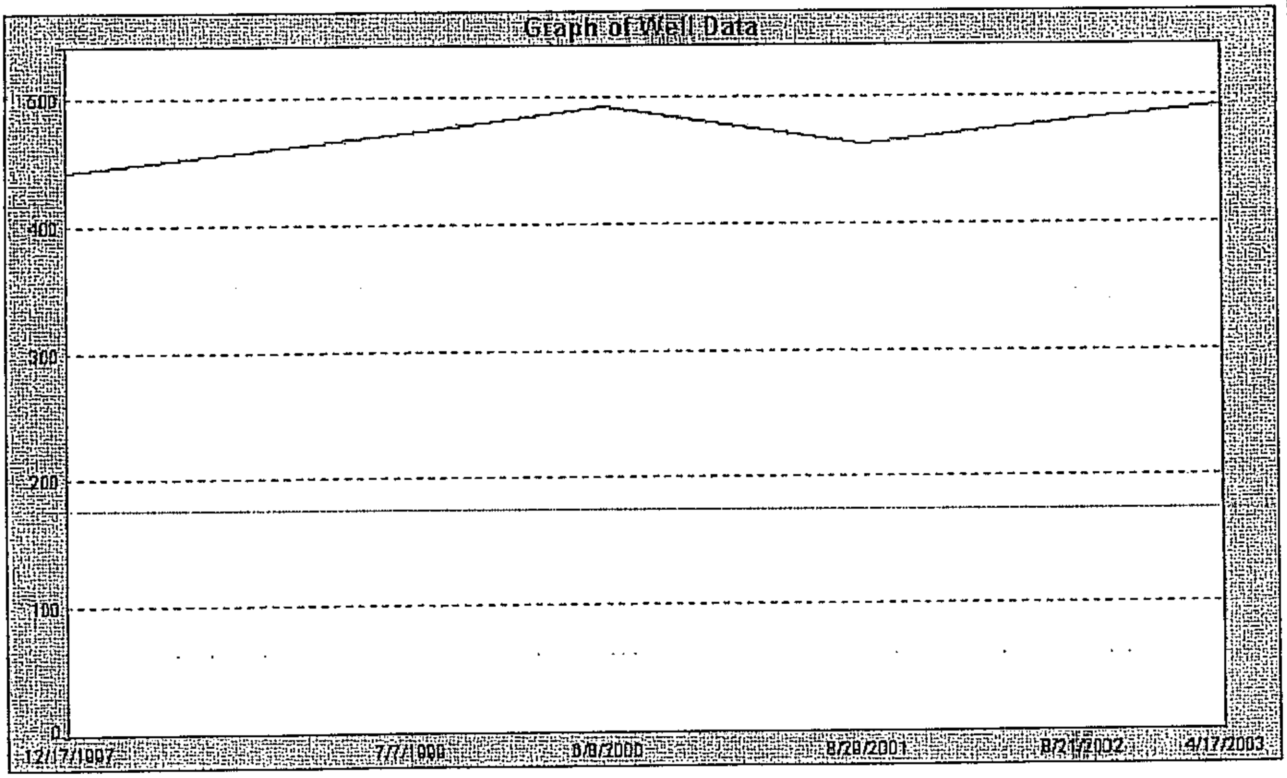
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 13
State Well Number: 0710004-012

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		490	mg/L	1500
8/21/2002	TOTAL DISSOLVED SOLIDS		480	mg/L	1500
8/29/2001	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
6/8/2000	TOTAL DISSOLVED SOLIDS		490	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		470	mg/L	1500
12/17/1997	TOTAL DISSOLVED SOLIDS		440	mg/L	1500

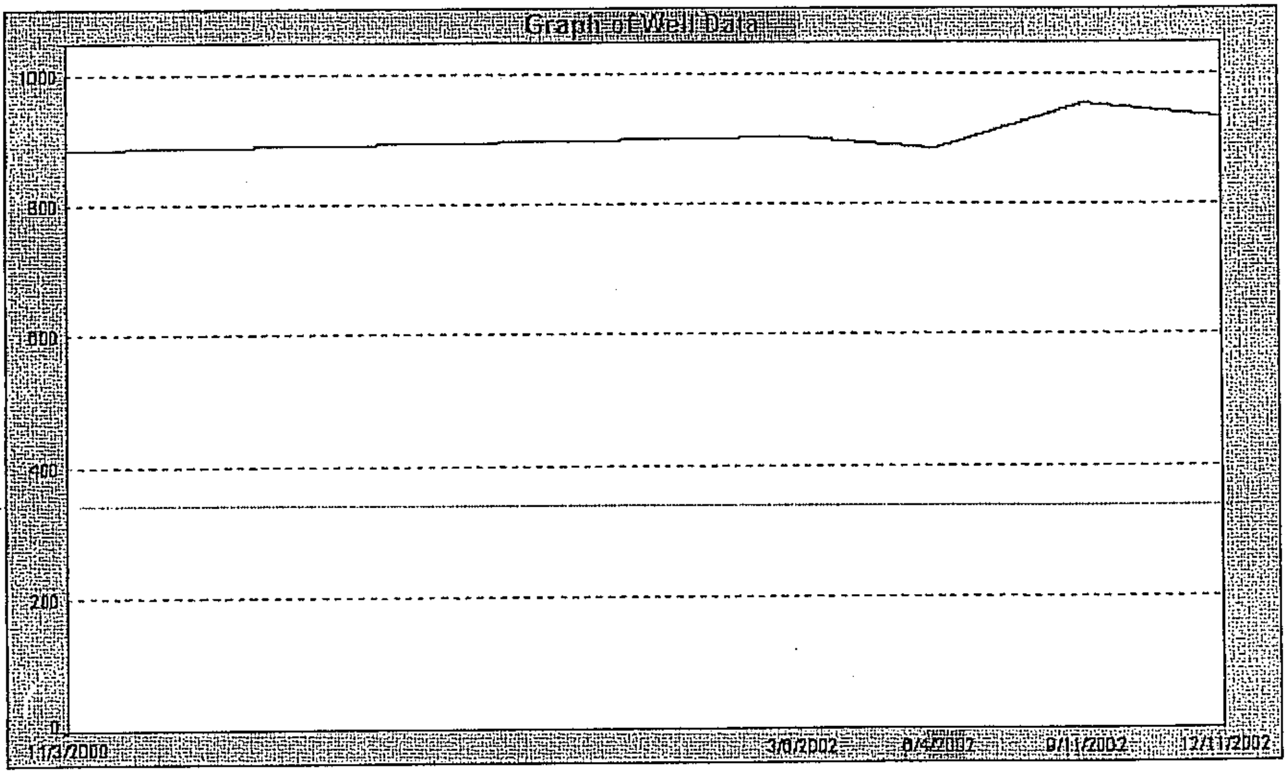
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 14
State Well Number: 0710004-014

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/11/2002	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		950	mg/L	1500
6/4/2002	TOTAL DISSOLVED SOLIDS		880	mg/L	1500
3/6/2002	TOTAL DISSOLVED SOLIDS		900	mg/L	1500
11/3/2000	TOTAL DISSOLVED SOLIDS		880	mg/L	1500

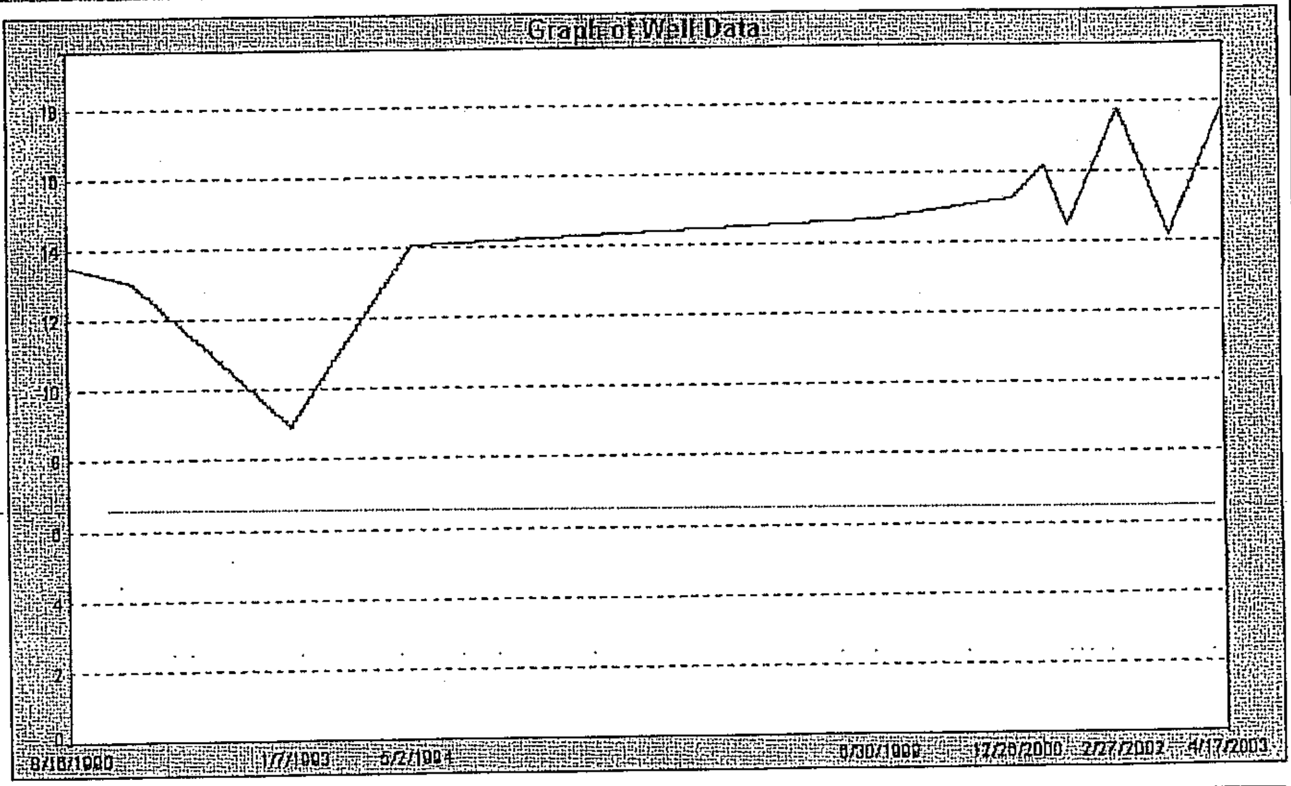
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 06
State Well Number: 0710004-006

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		17.8	mg/L	45
9/11/2002	NITRATE (AS NO3)		14.1	mg/L	45
2/27/2002	NITRATE (AS NO3)		17.7	mg/L	45
8/1/2001	NITRATE (AS NO3)		14.4	mg/L	45
5/2/2001	NITRATE (AS NO3)		16.1	mg/L	45
12/26/2000	NITRATE (AS NO3)		15.2	mg/L	45
6/30/1999	NITRATE (AS NO3)		14.6	mg/L	45
5/2/1994	NITRATE (AS NO3)		14	mg/L	45
1/7/1993	NITRATE (AS NO3)		8.9	mg/L	45
4/30/1991	NITRATE (AS NO3)		13	mg/L	45
8/16/1990	NITRATE (AS NO3)		13.5	mg/L	45

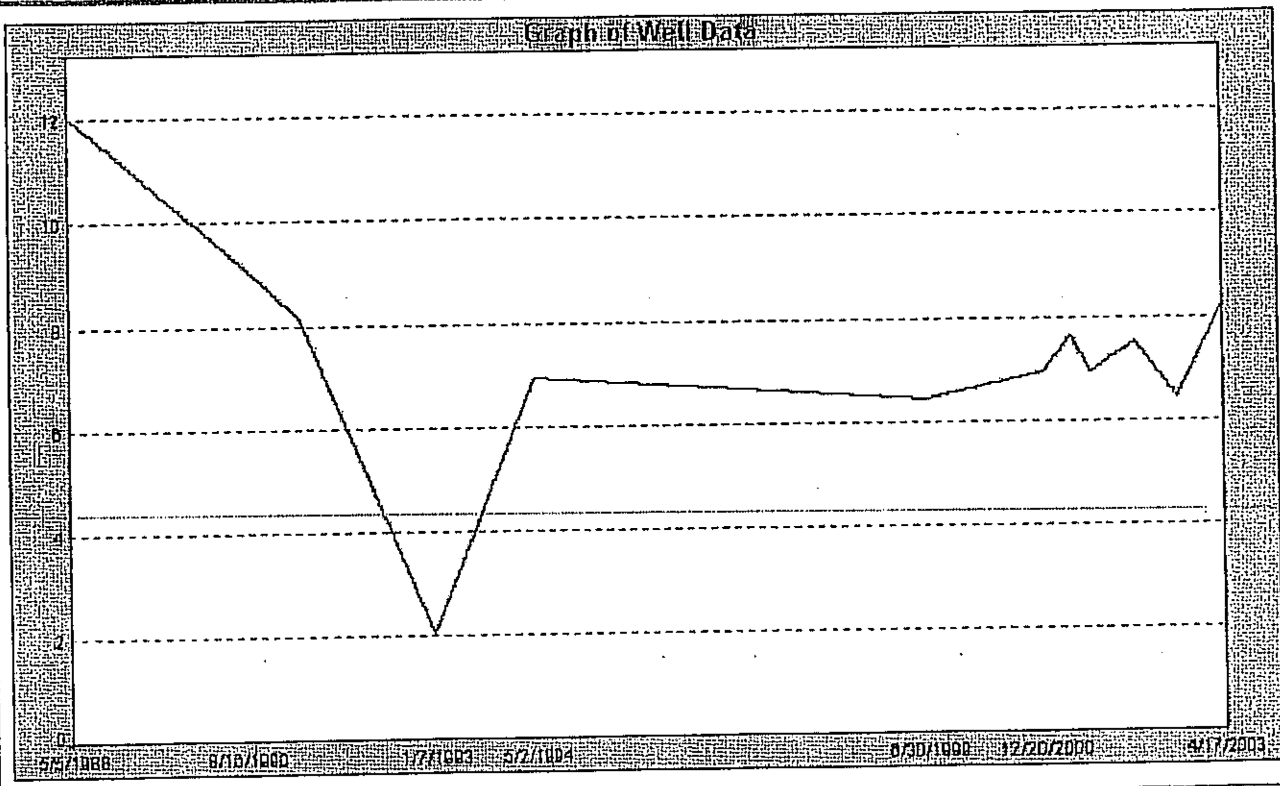
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 07
State Well Number: 0710004-007

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		8.2	mg/L	45
9/11/2002	NITRATE (AS NO3)		6.4	mg/L	45
2/27/2002	NITRATE (AS NO3)		7.5	mg/L	45
8/1/2001	NITRATE (AS NO3)		6.9	mg/L	45
5/2/2001	NITRATE (AS NO3)		7.6	mg/L	45
12/20/2000	NITRATE (AS NO3)		6.9	mg/L	45
6/30/1999	NITRATE (AS NO3)		6.4	mg/L	45
5/2/1994	NITRATE (AS NO3)		6.9	mg/L	45
1/7/1993	NITRATE (AS NO3)		2	mg/L	45
4/30/1991	NITRATE (AS NO3)		8.1	mg/L	45
8/16/1990	NITRATE (AS NO3)		9.1	mg/L	45
5/5/1988	NITRATE (AS NO3)		12	mg/L	45

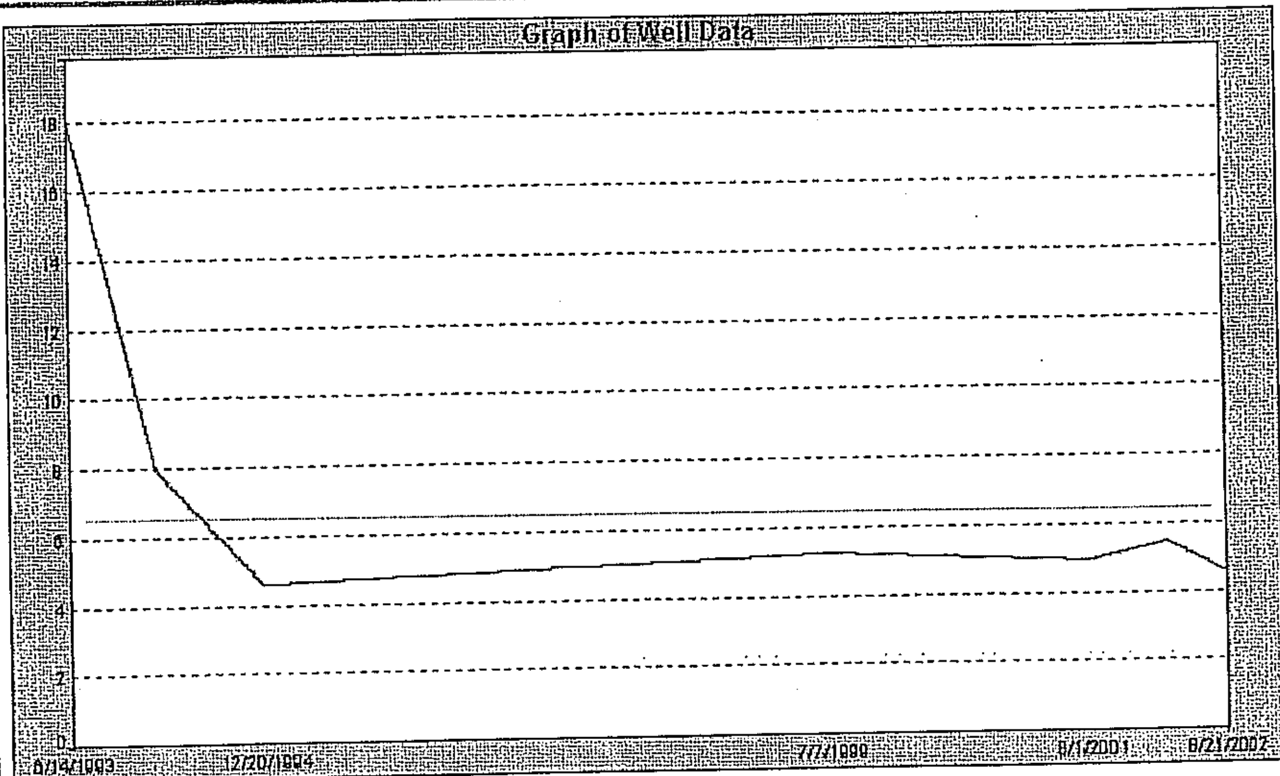
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 08
State Well Number: 0710004-008

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/21/2002	NITRATE (AS NO3)		4.5	mg/L	45
3/6/2002	NITRATE (AS NO3)		5.4	mg/L	45
8/1/2001	NITRATE (AS NO3)		4.9	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.2	mg/L	45
12/20/1994	NITRATE (AS NO3)	<	4.52	mg/L	45
2/15/1994	NITRATE (AS NO3)		7.9	mg/L	45
6/14/1993	NITRATE (AS NO3)		18	mg/L	45

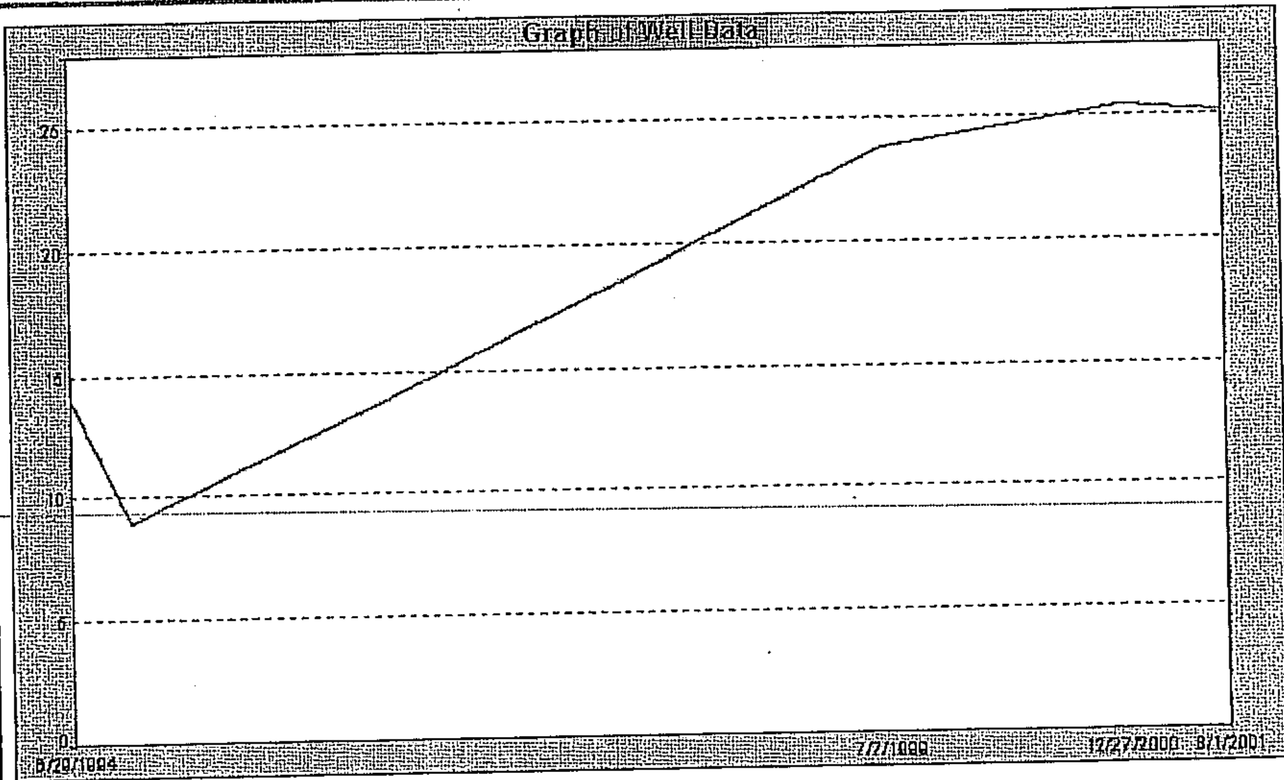
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 10A - IRRIGATION - AGRICULTURAL
State Well Number: 0710004-009

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/1/2001	NITRATE (AS NO3)		25.1	mg/L	45
12/27/2000	NITRATE (AS NO3)		25.3	mg/L	45
7/7/1999	NITRATE (AS NO3)		23.7	mg/L	45
11/10/1994	NITRATE (AS NO3)		8.82	mg/L	45
6/29/1994	NITRATE (AS NO3)		14	mg/L	45

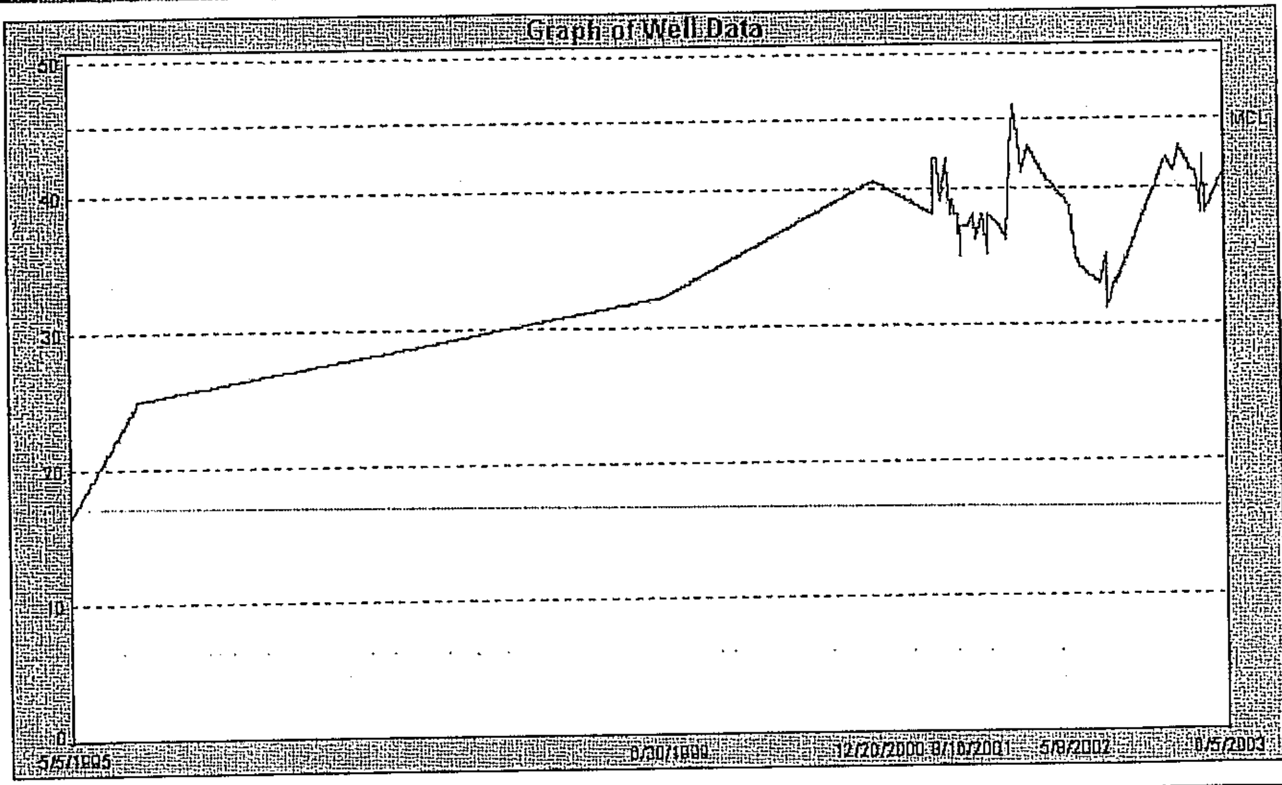
From Date: To Date: Graph Size: Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 11
State Well Number: 0710004-010

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/5/2003	NITRATE (AS NO3)		41	mg/L	45
4/22/2003	NITRATE (AS NO3)		38	mg/L	45
4/17/2003	NITRATE (AS NO3)		42.2	mg/L	45
4/8/2003	NITRATE (AS NO3)		38	mg/L	45
3/27/2003	NITRATE (AS NO3)		41	mg/L	45
3/13/2003	NITRATE (AS NO3)		41	mg/L	45
2/27/2003	NITRATE (AS NO3)		42	mg/L	45
2/11/2003	NITRATE (AS NO3)		43	mg/L	45
1/28/2003	NITRATE (AS NO3)		41	mg/L	45
1/9/2003	NITRATE (AS NO3)		42	mg/L	45
8/14/2002	NITRATE (AS NO3)		31	mg/L	45
8/13/2002	NITRATE (AS NO3)		35	mg/L	45
7/24/2002	NITRATE (AS NO3)		32.8	mg/L	45
6/11/2002	NITRATE (AS NO3)		34	mg/L	45
5/22/2002	NITRATE (AS NO3)		34.7	mg/L	45
5/8/2002	NITRATE (AS NO3)		38.6	mg/L	45
2/26/2002	NITRATE (AS NO3)		41	mg/L	45
2/12/2002	NITRATE (AS NO3)		42	mg/L	45
1/22/2002	NITRATE (AS NO3)		43	mg/L	45
1/8/2002	NITRATE (AS NO3)		41	mg/L	45
12/18/2001	NITRATE (AS NO3)		46	mg/L	45

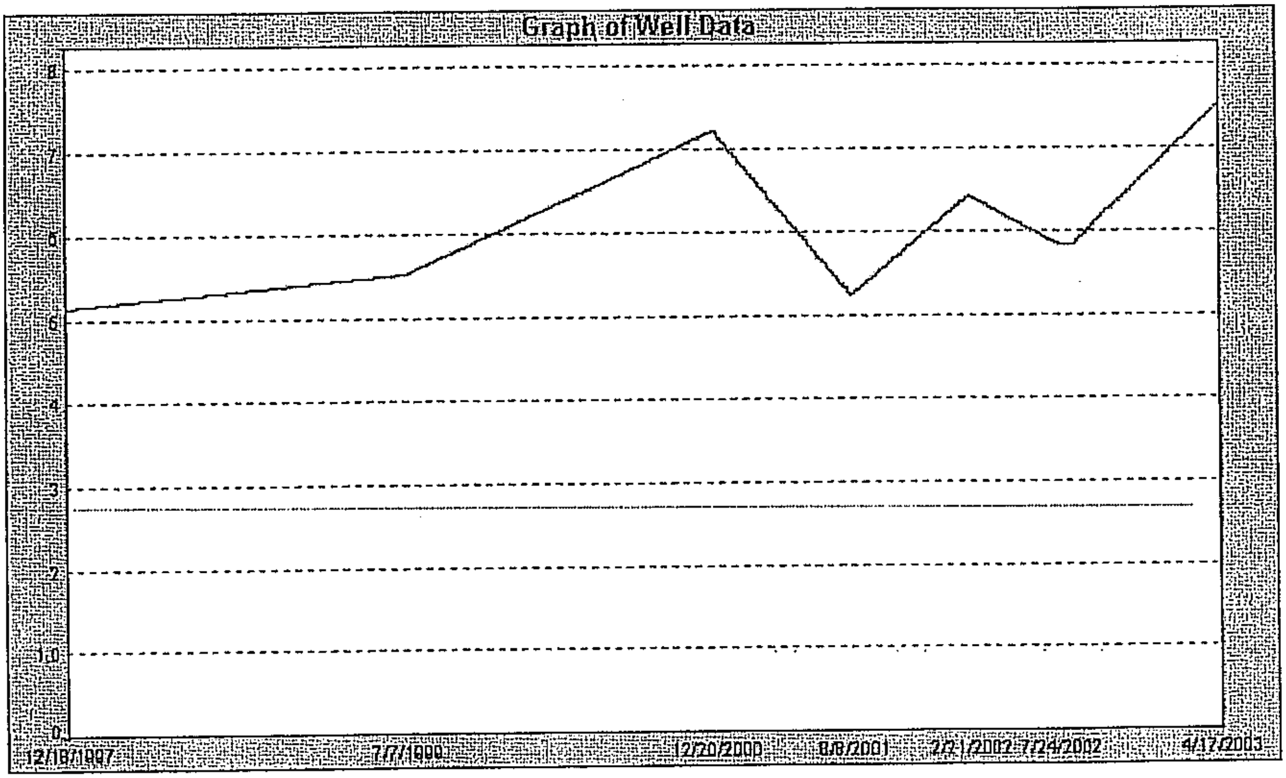
12/13/2001	NITRATE (AS NO3)	44	mg/L	45
12/11/2001	NITRATE (AS NO3)	45	mg/L	45
11/27/2001	NITRATE (AS NO3)	36	mg/L	45
11/13/2001	NITRATE (AS NO3)	37	mg/L	45
10/12/2001	NITRATE (AS NO3)	38	mg/L	45
10/10/2001	NITRATE (AS NO3)	35	mg/L	45
9/28/2001	NITRATE (AS NO3)	38	mg/L	45
9/13/2001	NITRATE (AS NO3)	36	mg/L	45
9/5/2001	NITRATE (AS NO3)	38	mg/L	45
8/24/2001	NITRATE (AS NO3)	37	mg/L	45
8/16/2001	NITRATE (AS NO3)	37	mg/L	45
8/2/2001	NITRATE (AS NO3)	37	mg/L	45
8/1/2001	NITRATE (AS NO3)	34.8	mg/L	45
7/26/2001	NITRATE (AS NO3)	38	mg/L	45
7/19/2001	NITRATE (AS NO3)	38	mg/L	45
7/12/2001	NITRATE (AS NO3)	39	mg/L	45
7/6/2001	NITRATE (AS NO3)	38	mg/L	45
6/28/2001	NITRATE (AS NO3)	42	mg/L	45
6/13/2001	NITRATE (AS NO3)	39	mg/L	45
6/6/2001	NITRATE (AS NO3)	40	mg/L	45
6/1/2001	NITRATE (AS NO3)	42	mg/L	45
5/25/2001	NITRATE (AS NO3)	42	mg/L	45
5/21/2001	NITRATE (AS NO3)	38	mg/L	45
12/20/2000	NITRATE (AS NO3)	40.4	mg/L	45
6/30/1999	NITRATE (AS NO3)	32.1	mg/L	45
10/26/1995	NITRATE (AS NO3)	24.8	mg/L	45
5/5/1995	NITRATE (AS NO3)	16.2	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 12
State Well Number: 0710004-011

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		7.5	mg/L	45
8/14/2002	NITRATE (AS NO3)		5.8	mg/L	45
7/24/2002	NITRATE (AS NO3)		5.8	mg/L	45
2/21/2002	NITRATE (AS NO3)		6.4	mg/L	45
8/8/2001	NITRATE (AS NO3)		5.2	mg/L	45
12/20/2000	NITRATE (AS NO3)		7.2	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.5	mg/L	45
12/18/1997	NITRATE (AS NO3)		5.1	mg/L	45

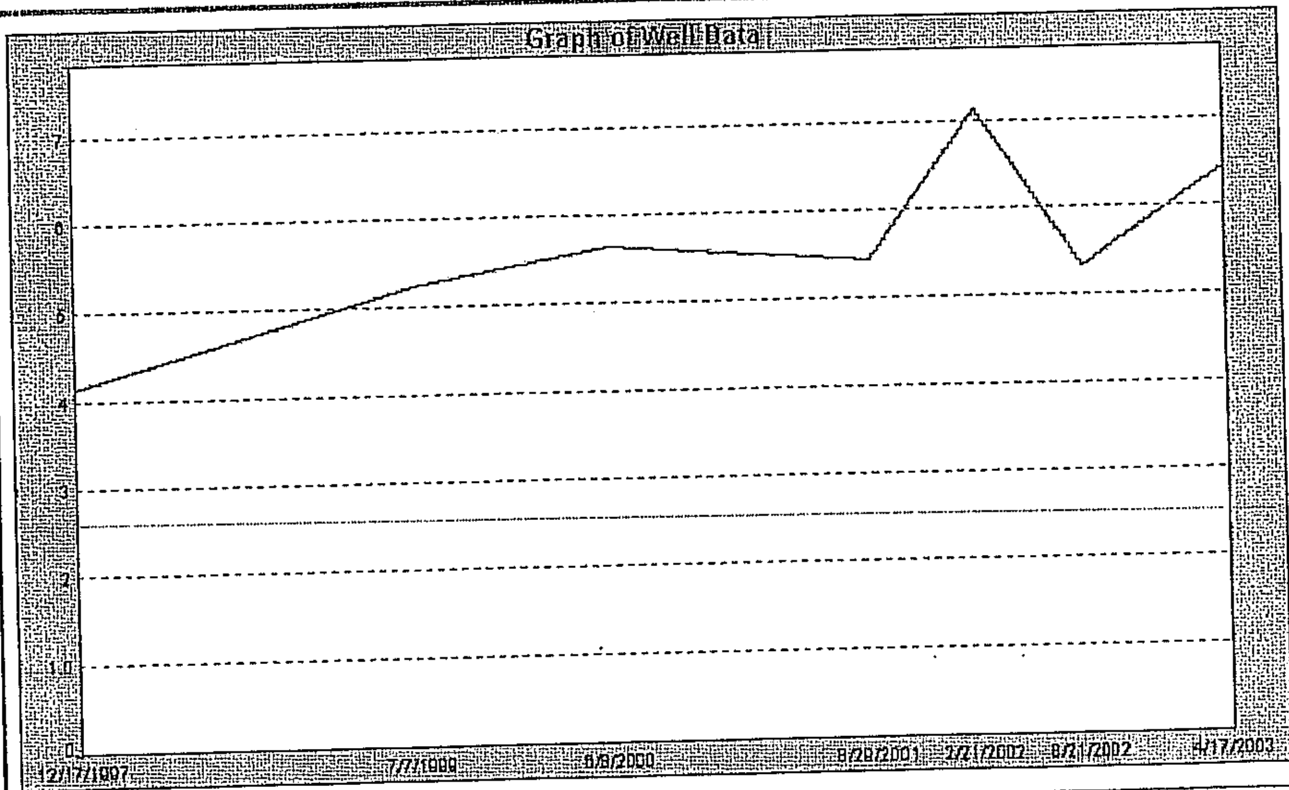
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 13
State Well Number: 0710004-012

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		6.4	mg/L	45
8/21/2002	NITRATE (AS NO3)		5.3	mg/L	45
2/21/2002	NITRATE (AS NO3)		7.1	mg/L	45
8/29/2001	NITRATE (AS NO3)		5.4	mg/L	45
6/8/2000	NITRATE (AS NO3)		5.6	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.2	mg/L	45
12/17/1997	NITRATE (AS NO3)		4.1	mg/L	45

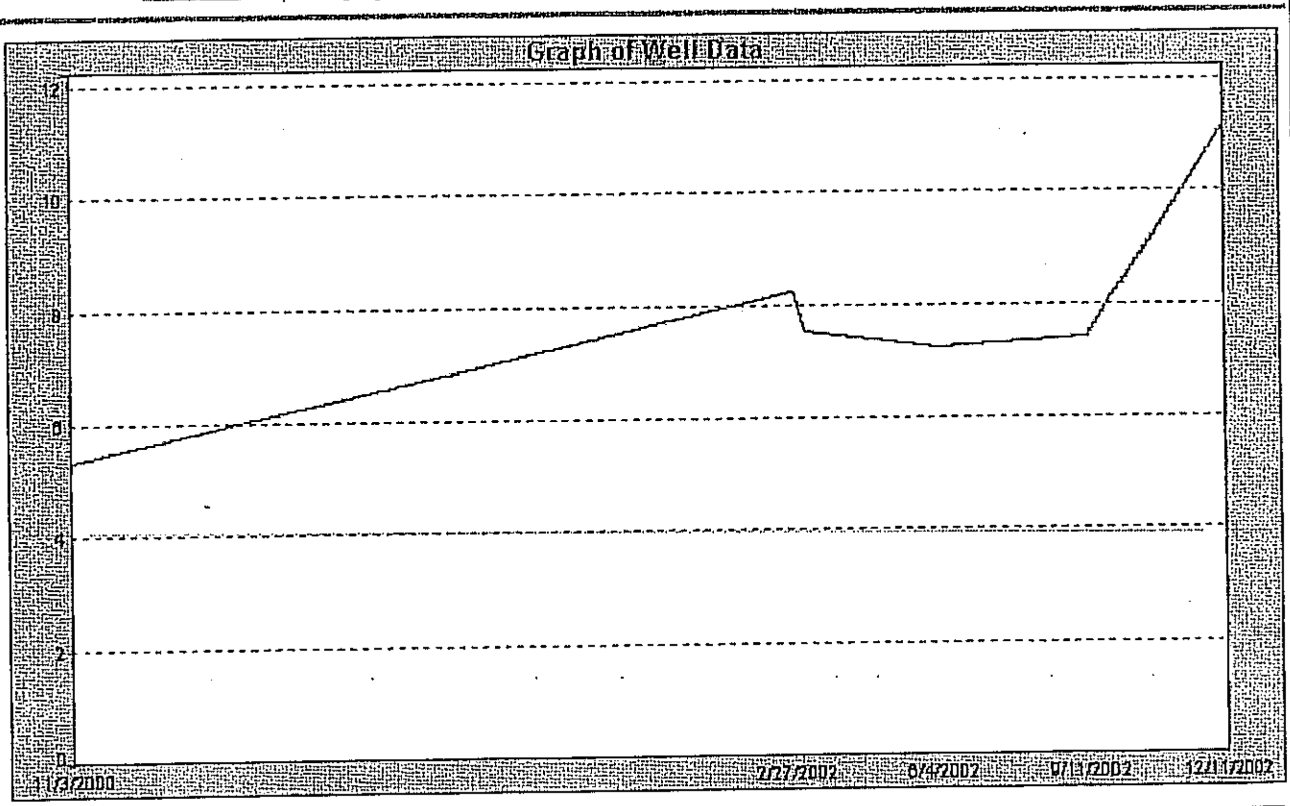
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 14
State Well Number: 0710004-014

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/11/2002	NITRATE (AS NO3)		11.1	mg/L	45
9/11/2002	NITRATE (AS NO3)		7.4	mg/L	45
6/4/2002	NITRATE (AS NO3)		7.2	mg/L	45
3/6/2002	NITRATE (AS NO3)		7.5	mg/L	45
2/27/2002	NITRATE (AS NO3)		8.2	mg/L	45
11/3/2000	NITRATE (AS NO3)		5.3	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

GREG'S MOTEL & HARBOR (OAKLEY)
WELL HEAD
State Well Number: 0707526-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/15/2002	NITRATE (AS NO3)		0	mg/L	45	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

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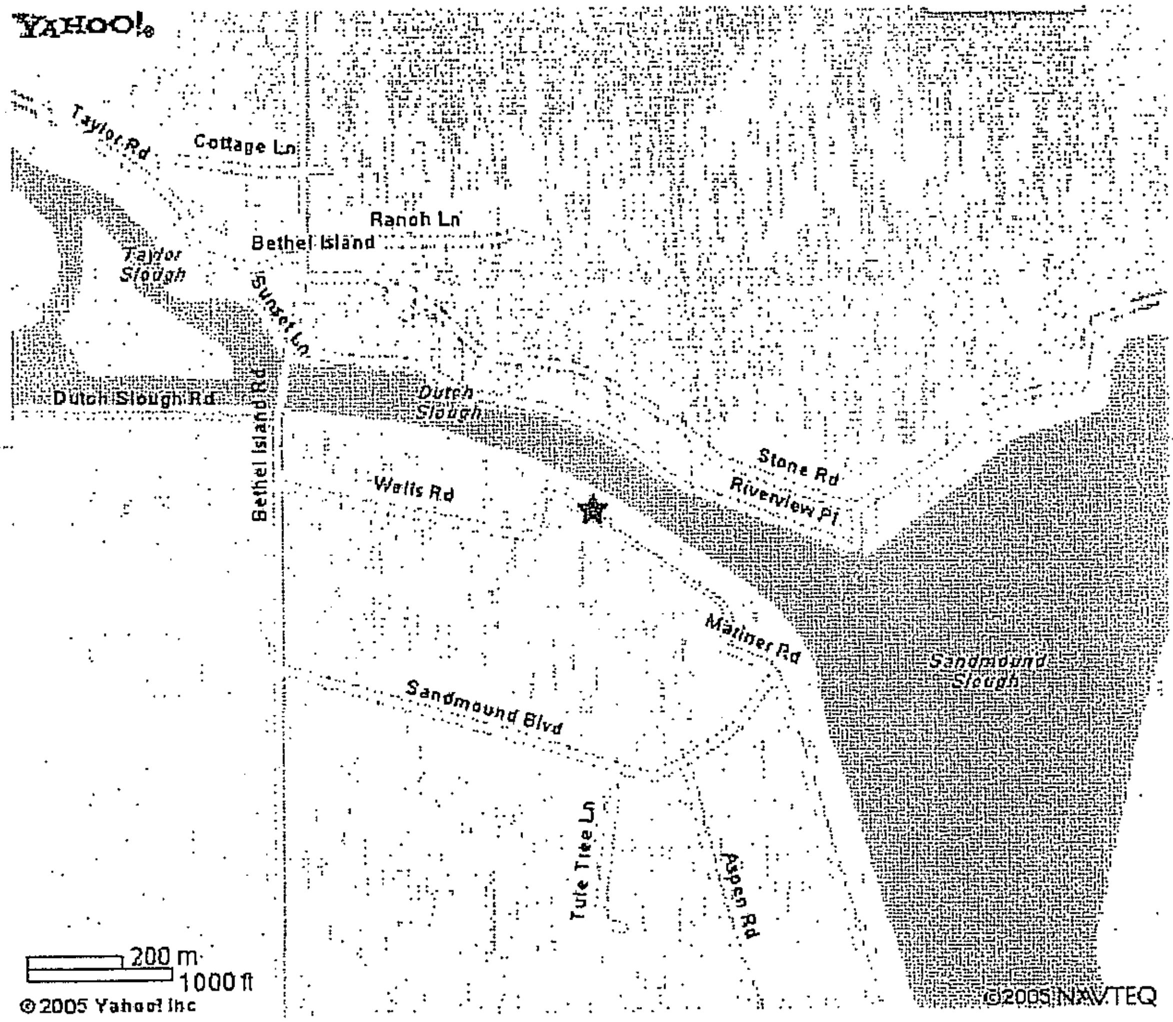
Yahoo! Maps - Oakley, CA 94561-5085

« Back to Map

★ Casa del Rio Motel & Marina, 3295 Wells Rd Oakley, CA 94561-5085 (925) 684-2242



When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

DHS Water Quality

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
3/20/2002	ALKALINITY (TOTAL) AS CACO3		290	mg/L	NA	☐
3/20/2002	ALUMINUM		0	ug/L	1000	☐
3/20/2002	ARSENIC		0	ug/L	50	☐
3/20/2002	BARIUM		0	ug/L	1000	☐
3/20/2002	CADMIUM		0	ug/L	5	☐
3/20/2002	CALCIUM		60	mg/L	NA	☐
3/20/2002	CHLORIDE		85	mg/L	600	☐
3/20/2002	CHROMIUM (TOTAL)		0	ug/L	50	☐
3/20/2002	COLOR		7	UNITS	15	☐
3/20/2002	COPPER		0	ug/L	1000	☐
3/20/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	☐
3/20/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	☐
3/20/2002	HARDNESS (TOTAL) AS CACO3		260	mg/L	NA	☐
3/20/2002	IRON		140	ug/L	300	☐
3/20/2002	LEAD		0	ug/L	NA	☐
3/20/2002	MAGNESIUM		28	mg/L	NA	☐
3/20/2002	MANGANESE		170	ug/L	50	☐
3/20/2002	MERCURY		0	ug/L	2	☐
6/19/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45	☐
3/20/2002	NITRITE (AS N)		0	ug/L	1000	☐
3/20/2002	ODOR THRESHOLD @ 60 C		2	TON	3	☐
3/20/2002	PH, LABORATORY		7.9		NA	☐
3/20/2002	POTASSIUM		2	mg/L	NA	☐
3/20/2002	SELENIUM		0	ug/L	50	☐
3/20/2002	SILVER		0	ug/L	100	☐
3/20/2002	SODIUM		110	mg/L	NA	☐
3/20/2002	SOURCE TEMPERATURE C		19.5	C	NA	☐

3/20/2002	SPECIFIC CONDUCTANCE		960	US	2200	☐
3/20/2002	SULFATE		100	mg/L	600	☐
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500	☑
3/20/2002	TURBIDITY, LABORATORY		0.46	NTU	5	☐
3/20/2002	ZINC	<	50	ug/L	5000	☐

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Well Search Results

42 records found Page 1 of 2

SITE NAME	ADDRESS	CITY	COUNTY	
ANGEL MARINE CENTER	P.O. BOX 1870	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ANGLER'S RANCH #3	ANGLER'S RANCH #3	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ANGLER'S SUBDIVISION #4	ANGLER'S SUBDIVISION 4	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL BAPTIST CHURCH	BETHEL BAPTIST CHURCH	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL HARBOR	BETHEL HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND GOLF & RESORT	BETHEL ISLAND GOLF & RESORT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND LODGE	BETHEL ISLAND LODGE **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND MUTUAL WATER CO.	BETHEL ISLAND MUTUAL WATER CO	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL MARKET **	BETHEL MARKET **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BILLECI'S	_ PO BOX	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BOAT HOUSE LOUNGE	BOAT HOUSE LOUNGE **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BONNIE & CLYDE SALOON	BONNIE & CLYDE SALOON	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
CALIENTE ISLE	CALIENTE ISLE	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DELTA MUTUAL WATER COMPANY	DELTA MUTUAL WATER COMPANY	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DELTA SPORTSMAN	DELTA SPORTSMAN	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DOC'S MARINA	DOC'S MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DUTCH SLOUGH WATER WORKS	DUTCH SLOUGH WATER WORKS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FARRAR PARK PROPERTY OWNERS	FARRAR PARK PROPERTY OWNERS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FLAMINGO MOBILE MANOR	FLAMINGO MOBILE MANOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FRANK'S MARINA INC	FRANK'S MARINA INC	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
HARRIS MARINA	HARRIS MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
HENNIS MARINA - INACTIVE	_ P O BOX	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ISLAND PARK TRAILER COURT 3505 Gateway Rd	ISLAND PARK TRAILER COURT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
KELLER LIQUORS	_ P O BOX 5	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
LEISURE LANDING MARINA	LEISURE LANDING MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
LUNDBORG LANDING	LUNDBORG LANDING	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
MARINA MOBILE MANOR	MARINA MOBILE MANOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
MARINE EMPORIUM RICHARDS YACHT	MARINE EMPORIUM RICHARDS YACHT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

MARS HARBOR	MARS HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
NEW ANCHOR MARINA	NEW ANCHOR MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

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Well Search Results

42 records found

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SITE NAME	ADDRESS	CITY	COUNTY	
PARK MARINA	PARK MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
PLEASANTIMES MUTUAL WATER CO.	PLEASANTIMES MUTUAL WATER CO	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RIVERVIEW MARINA SWS	RIVERVIEW MARINA SWS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RIVERVIEW WATER ASSN	RIVERVIEW WATER ASSN	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RUSSO'S MOBILE PARK	_ P O BOX 4	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
-164 SANDMOUND MUTUAL	SANDMOUND MUTUAL	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SANDY POINT MOBILE HOME PARK	SANDY POINT MOBILE HOME PARK 5625 Sandmound	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SUGAR BARGE RV PARK & MARINA	SUGAR BARGE RV PARK & MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SUNSET HARBOR	SUNSET HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
TONY'S FAMILY RESTAURANT	TONY'S FAMILY RESTAURANT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
WALLY'S RESTAURANT & DELI **	WALLY'S RESTAURANT & DELI **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
WILLOW PARK MARINA	WILLOW PARK MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

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DHS Water Quality

ISLAND PARK TRAILER COURT (BETHEL ISLAND)
WELL 01
State Well Number: 0707574-001

3505 Gateway Rd
Bethel Island, CA
(925) 684-2144

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
8/1/2002	1,1,1,2-TETRACHLORETHANE		0	ug/L	NA	☐
8/1/2002	1,1,1-TRICHLOROETHANE		0	ug/L	200	☐
8/1/2002	1,1,2,2-TETRACHLOROETHANE		0	ug/L	1	☐
8/1/2002	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE		0	ug/L	1200	☐
8/1/2002	1,1,2-TRICHLOROETHANE		0	ug/L	5	☐
8/1/2002	1,1-DICHLOROETHANE		0	ug/L	5	☐
8/1/2002	1,1-DICHLOROETHYLENE		0	ug/L	6	☐
8/1/2002	1,1-DICHLOROPROPENE		0	ug/L	NA	☐
8/1/2002	1,2,3-TRICHLOROBENZENE		0	ug/L	NA	☐
8/1/2002	1,2,3-TRICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	1,2,4-TRICHLOROBENZENE		0	ug/L	70	☐
8/1/2002	1,2,4-TRIMETHYLBENZENE		0	ug/L	NA	☐
8/1/2002	1,2-DICHLOROBENZENE		0	ug/L	600	☐
8/1/2002	1,2-DICHLOROETHANE		0	ug/L	0.5	☐
8/1/2002	1,2-DICHLOROPROPANE		0	ug/L	5	☐
8/1/2002	1,3,5-TRIMETHYLBENZENE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROBENZENE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROPROPENE (TOTAL)		0	ug/L	0.5	☐
8/1/2002	1,4-DICHLOROBENZENE		0	ug/L	5	☐
8/1/2002	1-PHENYLPROPANE (N-PROPYLBENZENE)		0	ug/L	NA	☐
8/1/2002	2,2-DICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	2-CHLOROTOLUENE		0	ug/L	NA	☐
8/1/2002	4-CHLOROTOLUENE		0	ug/L	NA	☐
8/1/2002	ALKALINITY (TOTAL) AS CACO3		620	mg/L	NA	☐
8/1/2002	ALUMINUM		0	ug/L	1000	☐
10/21/2002	ANTIMONY		0	ug/L	6	☐
8/1/2002	ARSENIC		7	ug/L	50	☐

4/28/1998	ATRAZINE	0	ug/L	3	☐
8/1/2002	BARIUM	0	ug/L	1000	☐
8/1/2002	BENZENE	0	ug/L	1	☐
8/1/2002	BERYLLIUM	0	ug/L	4	☐
8/1/2002	BICARBONATE ALKALINITY	760	mg/L	NA	☐
4/28/1998	BROMACIL	0	ug/L	NA	☐
8/1/2002	BROMOBENZENE	0	ug/L	NA	☐
8/1/2002	BROMOCHLOROMETHANE	0	ug/L	NA	☐
8/1/2002	BROMODICHLORMETHANE (THM)	0	ug/L	100	☐
8/1/2002	BROMOFORM (THM)	0	ug/L	100	☐
8/1/2002	BROMOMETHANE	0	ug/L	NA	☐
4/28/1998	BUTACHLOR	0	ug/L	NA	☐
8/1/2002	CADMIUM	0	ug/L	5	☐
8/1/2002	CALCIUM	24	mg/L	NA	☐
8/1/2002	CARBON TETRACHLORIDE	0	ug/L	0.5	☐
8/1/2002	CARBONATE ALKALINITY	0	mg/L	NA	☐
8/1/2002	CHLORIDE	220	mg/L	600	☐
8/1/2002	CHLOROETHANE	0	ug/L	NA	☐
8/1/2002	CHLOROFORM (THM)	0.72	ug/L	100	☐
8/1/2002	CHLOROMETHANE	0	ug/L	NA	☐
8/1/2002	CHROMIUM (TOTAL)	0	ug/L	50	☐
8/1/2002	CIS-1,2-DICHLOROETHYLENE	0	ug/L	6	☐
8/1/2002	COLOR	1	UNITS	15	☐
8/1/2002	COPPER	0	ug/L	1000	☐
4/28/1998	DIAZINON	0	ug/L	NA	☐
8/1/2002	DIBROMOCHLOROMETHANE (THM)	0	ug/L	100	☐
8/1/2002	DIBROMOMETHANE	0	ug/L	NA	☐
8/1/2002	DICHLORODIFLUOROMETHANE	0	ug/L	NA	☐
8/1/2002	DICHLOROMETHANE	0	ug/L	5	☐
8/1/2002	DIISOPROPYL ETHER	0	ug/L	NA	☐
4/28/1998	DIMETHOATE	0	ug/L	NA	☐
8/1/2002	ETHYL-TERT-BUTYL ETHER	0	ug/L	NA	☐
8/1/2002	ETHYLBENZENE	0	ug/L	700	☐
8/1/2002	FLUORIDE (TEMPERATURE DEPENDENT)	2.4	mg/L	1.7	☐
8/1/2002	FOAMING AGENTS (MBAS)	0	ug/L	500	☐
8/1/2002	HARDNESS (TOTAL) AS CACO3	180	mg/L	NA	☐
8/1/2002	HEXACHLOROBUTADIENE	0	ug/L	NA	☐

8/1/2002	HYDROXIDE ALKALINITY		0	mg/L	NA	☐
8/1/2002	IRON	<	100	ug/L	300	☐
8/1/2002	ISOPROPYLBENZENE		0	ug/L	NA	☐
8/1/2002	LEAD		0	ug/L	NA	☐
8/1/2002	M,P-XYLENE		0	ug/L	1750	☐
8/1/2002	MAGNESIUM		28	mg/L	NA	☐
8/1/2002	MANGANESE		0	ug/L	50	☐
8/1/2002	MERCURY		0	ug/L	2	☐
8/1/2002	METHYL ISOBUTYL KETONE		0	ug/L	NA	☐
8/1/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
4/28/1998	METOLACHLOR	<	0.5	ug/L	NA	☐
4/28/1998	METRIBUZIN	<	0.25	ug/L	NA	☐
4/28/1998	MOLINATE		0	ug/L	20	☐
8/1/2002	MONOCHLOROBENZENE		0	ug/L	70	☐
8/1/2002	N-BUTYLBENZENE		0	ug/L	NA	☐
8/1/2002	NAPHTHALENE		0	ug/L	NA	☐
8/1/2002	NICKEL		20	ug/L	100	☐
5/28/2003	NITRATE (AS NO3)		0	mg/L	45	☐
8/1/2002	NITRITE (AS N)		0	ug/L	1000	☐
8/1/2002	O-XYLENE		0	ug/L	1750	☐
8/1/2002	ODOR THRESHOLD @ 60 C		1	TON	3	☐
8/1/2002	P-ISOPROPYLTOLUENE		0	ug/L	NA	☐
8/1/2002	PH, LABORATORY		7.8		NA	☐
8/1/2002	POTASSIUM		1.9	mg/L	NA	☐
4/28/1998	PROMETRYN		0	ug/L	NA	☐
4/28/1998	PROPACHLOR		0	ug/L	NA	☐
8/1/2002	SEC-BUTYLBENZENE		0	ug/L	NA	☐
8/1/2002	SELENIUM		0	ug/L	50	☐
8/1/2002	SILVER		0	ug/L	100	☐
4/28/1998	SIMAZINE		0	ug/L	4	☐
8/1/2002	SODIUM		430	mg/L	NA	☑
8/1/2002	SPECIFIC CONDUCTANCE		2000	US	2200	☐
8/1/2002	STYRENE		0	ug/L	100	☐
8/1/2002	SULFATE		160	mg/L	600	☐
8/1/2002	TERT-AMYL-METHYL ETHER		0	ug/L	NA	☐
8/1/2002	TERT-BUTYL ALCOHOL		0	ug/L	NA	☐
8/1/2002	TERT-BUTYLBENZENE		0	ug/L	NA	☐

8/1/2002	TETRACHLOROETHYLENE		0	ug/L	5	☐
8/1/2002	THALLIUM		0	ug/L	2	☐
4/28/1998	THIOBENCARB		0	ug/L	70	☐
8/1/2002	TOLUENE		0	ug/L	150	☐
8/1/2002	TOTAL DISSOLVED SOLIDS		1300	mg/L	1500	☑
8/1/2002	TOTAL TRIHALOMETHANES		0.72	ug/L	100	☐
8/1/2002	TRANS-1,2-DICHLOROETHYLENE		0	ug/L	10	☐
8/1/2002	TRICHLOROETHYLENE		0	ug/L	5	☐
8/1/2002	TRICHLOROFLUOROMETHANE		0	ug/L	150	☐
8/1/2002	TURBIDITY, LABORATORY		0	NTU	5	☐
8/1/2002	VINYL CHLORIDE		0	ug/L	0.5	☐
8/1/2002	XYLENES (TOTAL)		0	ug/L	1750	☐
8/1/2002	ZINC	<	50	ug/L	5000	☐

Wells Owned By W0600707569

ANGLER'S SUBDIVISION #4 (BETHEL ISLAND)
ANGLER'S SUBDIVISION 4
BETHEL ISLAND , CA 94511

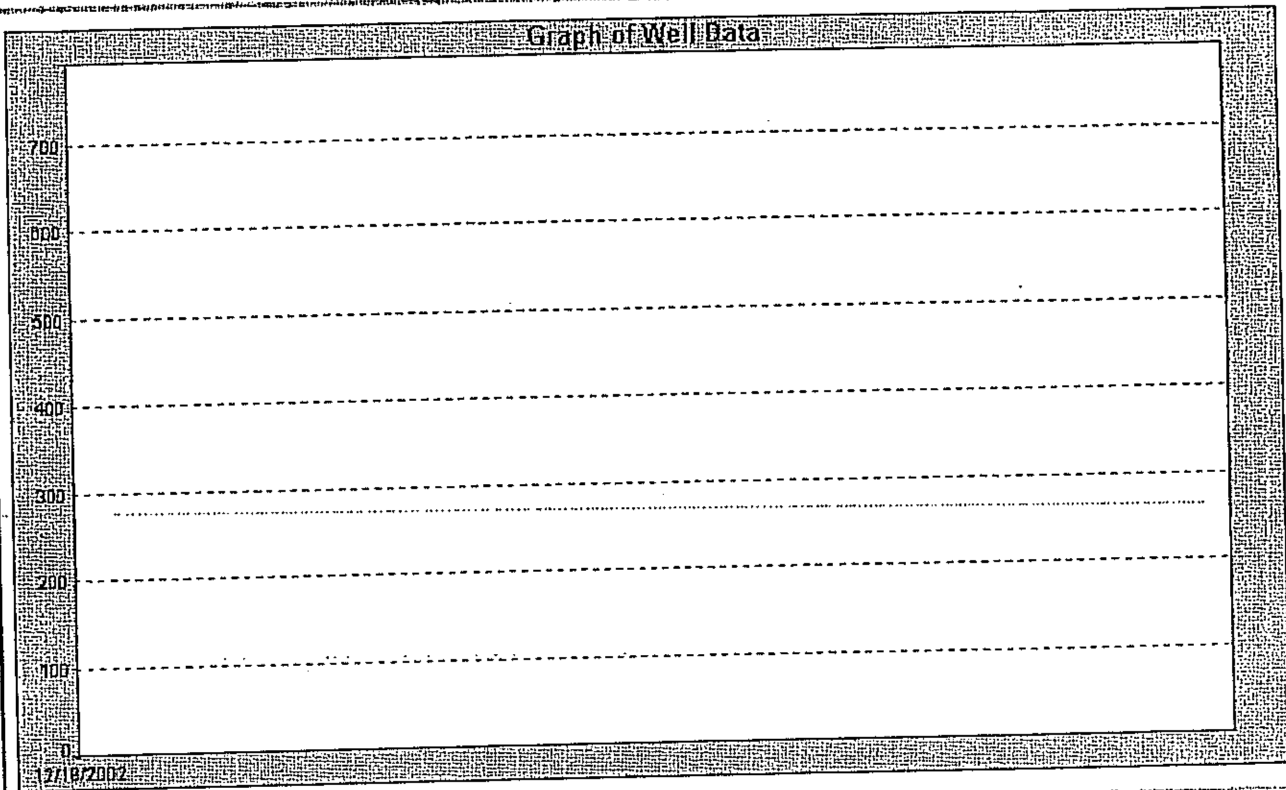
State Well No.	Well Common Name		
0707569-001	WELL 1 - 1696 TAYLOR	Show on Map	Report
0707569-002	WELL 2 - 1398 TAYLOR	Show on Map	Report
0707569-003	WELL 3 - 1698 TAYLOR	Show on Map	Report
PWS MAIN FAC	0707569	Show on Map	Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

FRANK'S MARINA INC (BETHEL ISLAND) on Piper Slough
WELL HEAD
State Well Number: 0707575-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/18/2002	TOTAL DISSOLVED SOLIDS		720	mg/L	1500

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

FRANK'S MARINA INC (BETHEL ISLAND)
WELL HEAD
State Well Number: 0707575-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
12/18/2002	1,1,1,2-TETRACHLORETHANE		0	ug/L	NA	☐
12/18/2002	1,1,1-TRICHLOROETHANE		0	ug/L	200	☐
12/18/2002	1,1,2,2-TETRACHLOROETHANE		0	ug/L	1	☐
12/18/2002	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE		0	ug/L	1200	☐
12/18/2002	1,1,2-TRICHLOROETHANE		0	ug/L	5	☐
12/18/2002	1,1-DICHLOROETHANE		0	ug/L	5	☐
12/18/2002	1,1-DICHLOROETHYLENE		0	ug/L	6	☐
12/18/2002	1,1-DICHLOROPROPENE		0	ug/L	NA	☐
12/18/2002	1,2,3-TRICHLOROBENZENE		0	ug/L	NA	☐
12/18/2002	1,2,3-TRICHLOROPROPANE		0	ug/L	NA	☐
12/18/2002	1,2,4-TRICHLOROBENZENE		0	ug/L	70	☐
12/18/2002	1,2,4-TRIMETHYLBENZENE		0	ug/L	NA	☐
12/18/2002	1,2-DICHLOROBENZENE		0	ug/L	600	☐
12/18/2002	1,2-DICHLOROETHANE		0	ug/L	0.5	☐
12/18/2002	1,2-DICHLOROPROPANE		0	ug/L	5	☐
12/18/2002	1,3,5-TRIMETHYLBENZENE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROBENZENE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROPROPANE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROPROPENE (TOTAL)		0	ug/L	0.5	☐
12/18/2002	1,4-DICHLOROBENZENE		0	ug/L	5	☐
12/18/2002	1-PHENYLPROPANE (N-PROPYLBENZENE)		0	ug/L	NA	☐
12/18/2002	2,2-DICHLOROPROPANE		0	ug/L	NA	☐
2/27/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
12/18/2002	2-CHLOROTOLUENE		0	ug/L	NA	☐
12/18/2002	4-CHLOROTOLUENE		0	ug/L	NA	☐
12/18/2002	ALKALINITY (TOTAL) AS CACO3		200	mg/L	NA	☐
12/18/2002	ALUMINUM		0	ug/L	1000	☐
12/18/2002	ANTIMONY		0	ug/L	6	☐

12/18/2002	ARSENIC		0	ug/L	50	☐
12/18/2002	ASBESTOS		0	MFL	7	☐
12/18/2002	BARIUM		130	ug/L	1000	☐
12/18/2002	BENZENE		0	ug/L	1	☐
12/18/2002	BERYLLIUM		0	ug/L	4	☐
12/18/2002	BICARBONATE ALKALINITY		250	mg/L	NA	☐
12/18/2002	BROMOBENZENE		0	ug/L	NA	☐
12/18/2002	BROMOCHLOROMETHANE		0	ug/L	NA	☐
12/18/2002	BROMODICHLORMETHANE (THM)		0	ug/L	100	☐
12/18/2002	BROMOFORM (THM)		0	ug/L	100	☐
12/18/2002	BROMOMETHANE		0	ug/L	NA	☐
12/18/2002	CADMIUM		0	ug/L	5	☐
12/18/2002	CALCIUM		28	mg/L	NA	☐
12/18/2002	CARBON TETRACHLORIDE		0	ug/L	0.5	☐
12/18/2002	CARBONATE ALKALINITY		0	mg/L	NA	☐
12/18/2002	CHLORIDE		180	mg/L	600	☐
12/18/2002	CHLOROETHANE		0	ug/L	NA	☐
12/18/2002	CHLOROFORM (THM)		0	ug/L	100	☐
12/18/2002	CHLOROMETHANE		0	ug/L	NA	☐
12/18/2002	CHROMIUM (TOTAL CR-CRVI SCREEN)		1.3	UG/L	NA	☐
12/18/2002	CHROMIUM (TOTAL)		0	ug/L	50	☐
12/18/2002	CIS-1,2-DICHLOROETHYLENE		0	ug/L	6	☐
2/27/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
12/18/2002	COLOR		1	UNITS	15	☐
12/18/2002	COPPER		0	ug/L	1000	☐
12/18/2002	DIBROMOCHLOROMETHANE (THM)		0	ug/L	100	☐
12/18/2002	DIBROMOMETHANE		0	ug/L	NA	☐
12/18/2002	DICHLORODIFLUOROMETHANE		0	ug/L	NA	☐
12/18/2002	DICHLOROMETHANE		0	ug/L	5	☐
12/18/2002	DIISOPROPYL ETHER		0	ug/L	NA	☐
12/18/2002	ETHYL-TERT-BUTYL ETHER		0	ug/L	NA	☐
12/18/2002	ETHYLBENZENE		0	ug/L	700	☐
12/18/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0	mg/L	1.7	☐
12/18/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	☐
12/18/2002	HARDNESS (TOTAL) AS CACO3		130	mg/L	NA	☐
12/18/2002	HEXACHLOROBUTADIENE		0	ug/L	NA	☐
12/18/2002	HYDROXIDE ALKALINITY		0	mg/L	NA	☐

12/18/2002	IRON		0	ug/L	300	☐
12/18/2002	ISOPROPYLBENZENE		0	ug/L	NA	☐
12/18/2002	LEAD		0	ug/L	NA	☐
12/18/2002	M,P-XYLENE		0	ug/L	1750	☐
12/18/2002	MAGNESIUM		15	mg/L	NA	☐
12/18/2002	MANGANESE		140	ug/L	50	☐
12/18/2002	MERCURY		0	ug/L	2	☐
2/27/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
12/18/2002	METHYL ISOBUTYL KETONE		0	ug/L	NA	☐
12/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
12/18/2002	MONOCHLOROBENZENE		0	ug/L	70	☐
12/18/2002	N-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	NAPHTHALENE		0	ug/L	NA	☐
12/18/2002	NICKEL		20	ug/L	100	☐
12/18/2002	NITRATE (AS NO3)		0	mg/L	45	☐
12/18/2002	NITRITE (AS N)		0	ug/L	1000	☐
12/18/2002	O-XYLENE		0	ug/L	1750	☐
12/18/2002	ODOR THRESHOLD @ 60 C		1	TON	3	☐
12/18/2002	P-ISOPROPYLTOLUENE		0	ug/L	NA	☐
12/18/2002	PH, LABORATORY		8.1		NA	☐
12/18/2002	POTASSIUM		2.3	mg/L	NA	☐
12/18/2002	SEC-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	SELENIUM		0	ug/L	50	☐
12/18/2002	SILVER		0	ug/L	100	☐
12/18/2002	SODIUM		230	mg/L	NA	☐
12/18/2002	SPECIFIC CONDUCTANCE		1200	US	2200	☐
12/18/2002	STYRENE		0	ug/L	100	☐
12/18/2002	SULFATE		130	mg/L	600	☐
12/18/2002	TERT-AMYL-METHYL ETHER		0	ug/L	NA	☐
12/18/2002	TERT-BUTYL ALCOHOL		0	ug/L	NA	☐
12/18/2002	TERT-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	TETRACHLOROETHYLENE		0	ug/L	5	☐
12/18/2002	THALLIUM		0	ug/L	2	☐
12/18/2002	TOLUENE		0	ug/L	150	☐
12/18/2002	TOTAL DISSOLVED SOLIDS		720	mg/L	1500	☑
12/18/2002	TOTAL TRIHALOMETHANES		0	ug/L	100	☐
12/18/2002	TRANS-1,2-DICHLOROETHYLENE		0	ug/L	10	☐

2/27/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
12/18/2002	TRICHLOROETHYLENE		0	ug/L	5	☐
12/18/2002	TRICHLOROFLUOROMETHANE		0	ug/L	150	☐
12/18/2002	TURBIDITY, LABORATORY		0.12	NTU	5	☐
12/18/2002	VINYL CHLORIDE		0	ug/L	0.5	☐
12/18/2002	XYLENES (TOTAL)		0	ug/L	1750	☐
12/18/2002	ZINC	<	50	ug/L	5000	☐

Public Water System Information

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Way east on Middle River

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
HOLLAND RIVERSIDE MARINA

Water System Address:
HOLLAND RIVERSIDE MARINA
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Date Entered System:

Deactivation Date:

Service Area:

System Status:

Last Revised:

Connection Information

Number of Service Connections:
255

Population Served:
25

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

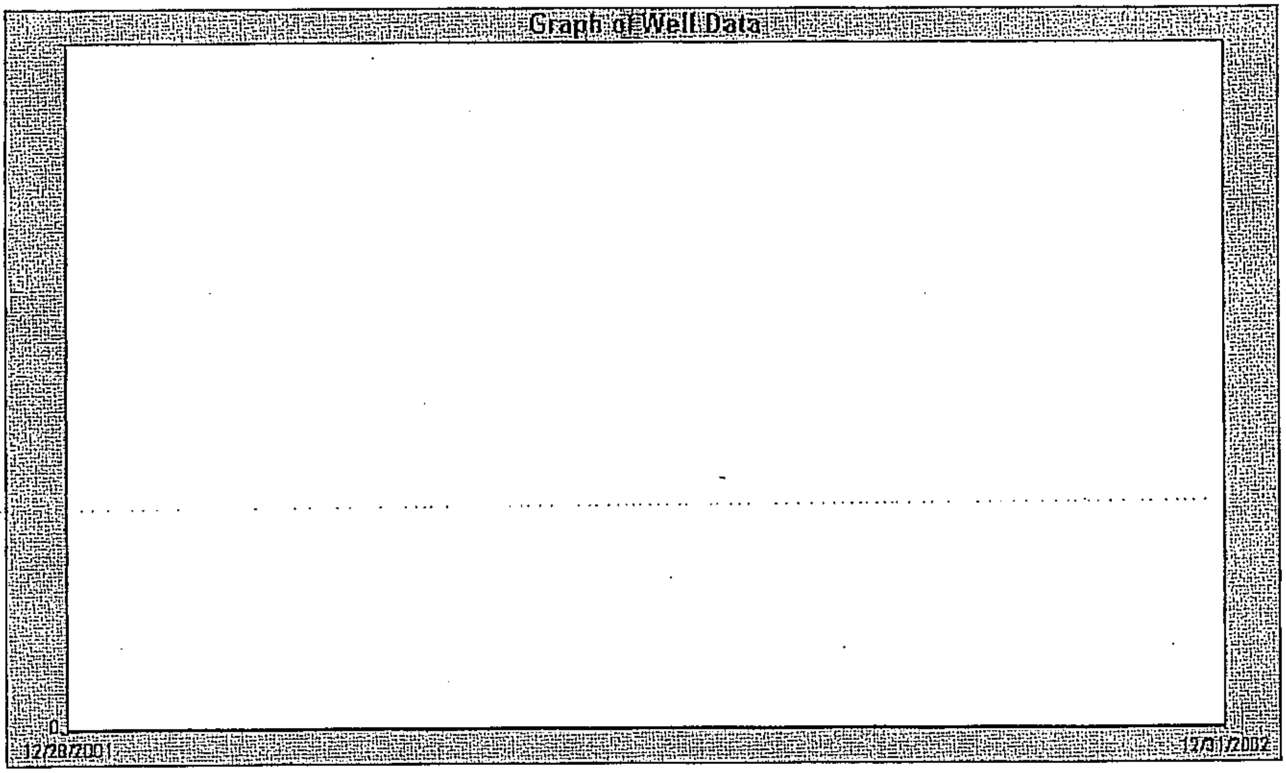
Date	Parameter	Qualifier	Result	Units	MCL	Plot
5/7/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	☐
5/7/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	☐
5/7/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	☐
5/7/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	☐
5/7/1986	1,2-DICHLOROETHANE	<	0.5	ug/L	0.5	☐
5/7/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	☐
5/7/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	☐
5/7/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	☐
5/7/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
5/7/1986	BENZENE	<	0.5	ug/L	1	☐
5/7/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	☐
5/7/1986	CHLOROETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	CHLOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	DICHLOROMETHANE	<	0.5	ug/L	5	☐
5/7/1986	ETHYLBENZENE	<	0.5	ug/L	700	☐
5/7/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
5/7/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	☐
5/7/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	☐
12/31/2002	NITRATE (AS NO3)		0	mg/L	45	☑

5/7/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	5	☐
5/7/1986	TOLUENE	<	0.5	ug/L	150	☐
5/7/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	10	☐
5/7/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	TRICHLOROETHYLENE	<	0.5	ug/L	5	☐
5/7/1986	TRICHLOROFLUOROMETHANE	<	0.5	ug/L	150	☐
5/7/1986	VINYL CHLORIDE	<	1	ug/L	0.5	☐
5/7/1986	XYLENES (TOTAL)	<	0.5	ug/L	1750	☐

Well Data Graph

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: To Date: Graph Size Small Normalized ☐ Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL 2
State Well Number: 0706034-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
HOLLAND RIVERSIDE MARINA

Water System Address:
HOLLAND RIVERSIDE MARINA
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
255

Population Served:
25

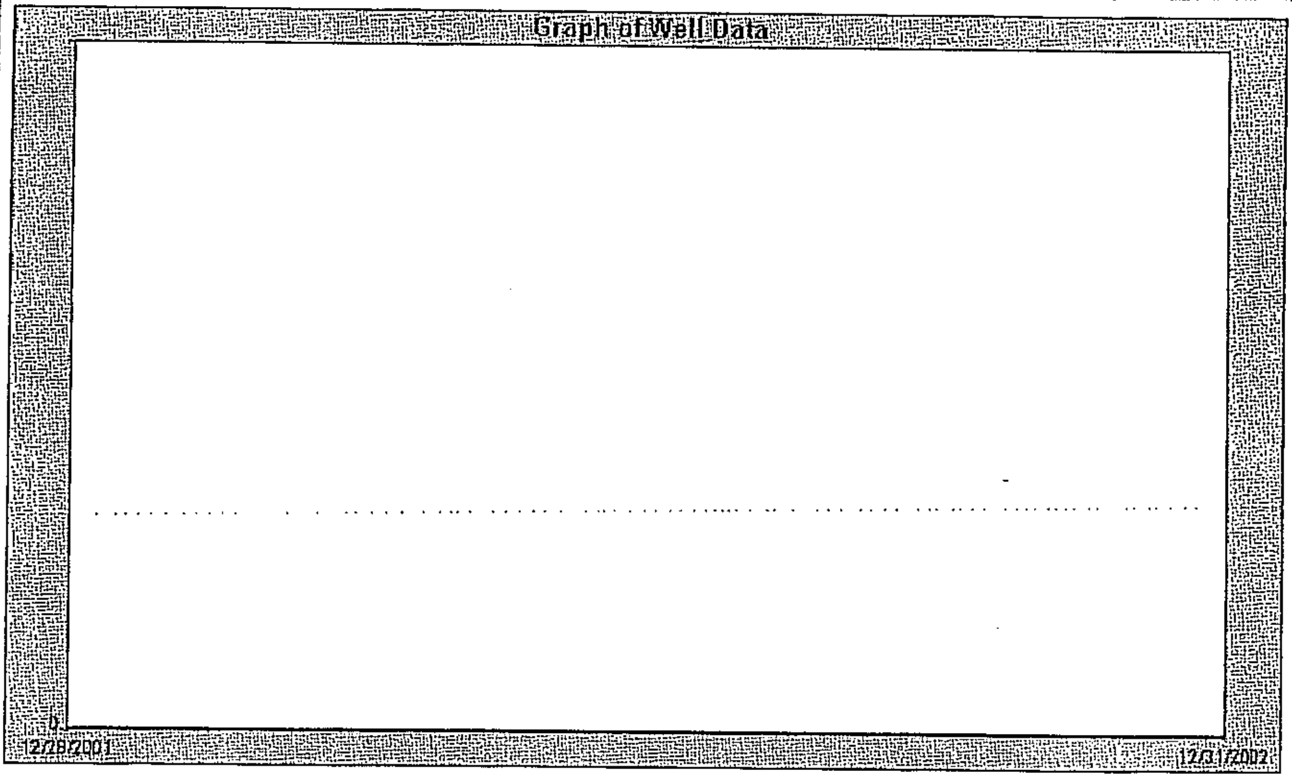
- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL 2
State Well Number: 0706034-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** ☐ Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
KNIGHTSEN ELEMENTARY SCHOOL

Water System Address:
KNIGHTSEN ELEMENTARY SCHOOL
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
5

Population Served:
324

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

1-74
68

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
5/7/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	☐
5/7/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	☐
5/7/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	☐
5/7/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	☐
5/7/1986	1,2-DICHLOROETHANE	<	0.5	ug/L	0.5	☐
5/7/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	☐
5/7/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	☐
5/7/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	☐
5/7/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
5/7/1986	BENZENE	<	0.5	ug/L	1	☐
5/7/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	☐
5/7/1986	CHLOROETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	CHLOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	DICHLOROMETHANE	<	0.5	ug/L	5	☐
5/7/1986	ETHYLBENZENE	<	0.5	ug/L	700	☐
5/7/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
5/7/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	☐
1/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
5/7/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	☐

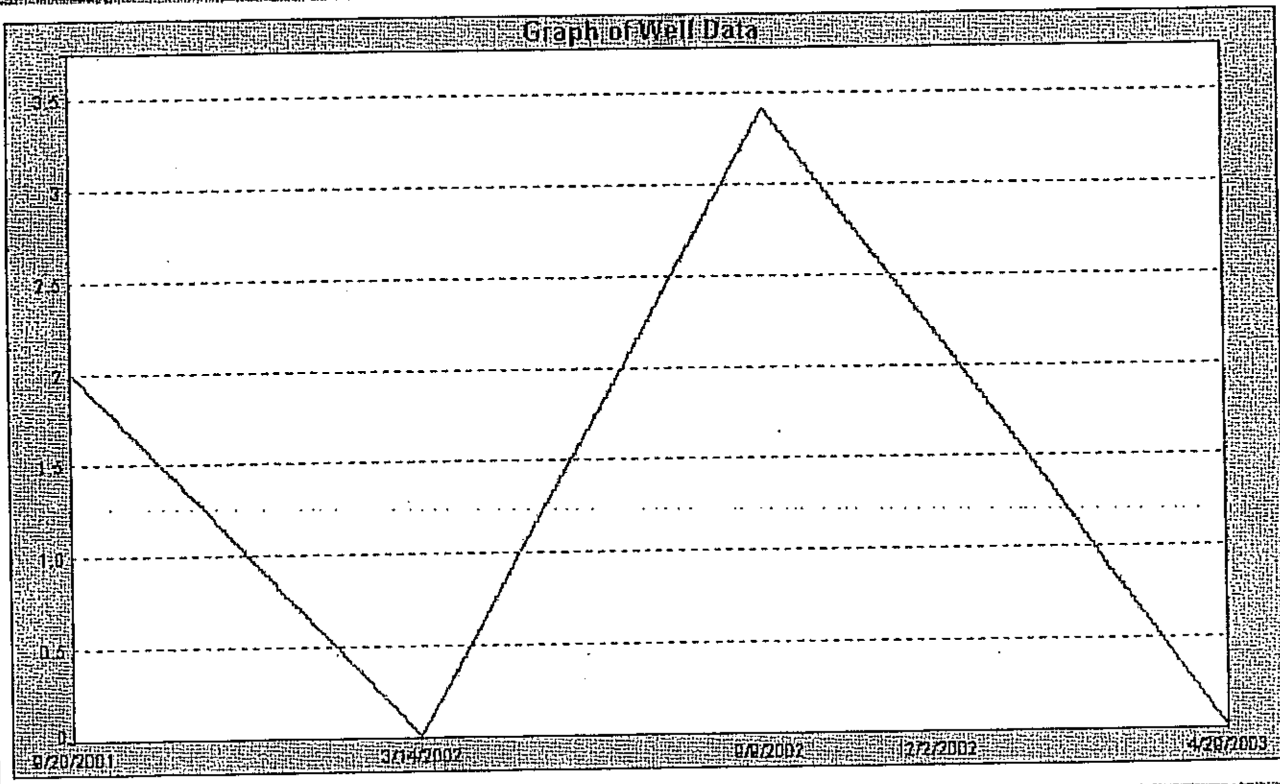
			0	mg/L	45	☑
29' 3	NITRATE (AS NO3)	<	0.5	ug/L	5	☐
7/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	150	☐
7/1986	TOLUENE	<	0.5	ug/L	10	☐
/7/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	0.5	☐
/7/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	5	☐
/7/1986	TRICHLOROETHYLENE	<	0.5	ug/L	150	☐
/7/1986	TRICHLOROFLUOROMETHANE	<	1	ug/L	0.5	☐
/7/1986	VINYL CHLORIDE	<	0.5	ug/L	1750	☐
/7/1986	XYLENES (TOTAL)					

Well Data Graph

1=74
68

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/29/2003	NITRATE (AS NO3)		0	mg/L	45
12/2/2002	NITRATE (AS NO3)		2.2	mg/L	45
9/9/2002	NITRATE (AS NO3)		3.4	mg/L	45
3/14/2002	NITRATE (AS NO3)		0	mg/L	45
9/20/2001	NITRATE (AS NO3)		2	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

2-69

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
SOUTH WELL
State Well Number: 0706028-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals   Reset Boxes   **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
1/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
4/29/2003	NITRATE (AS NO3)		25	mg/L	45	☐

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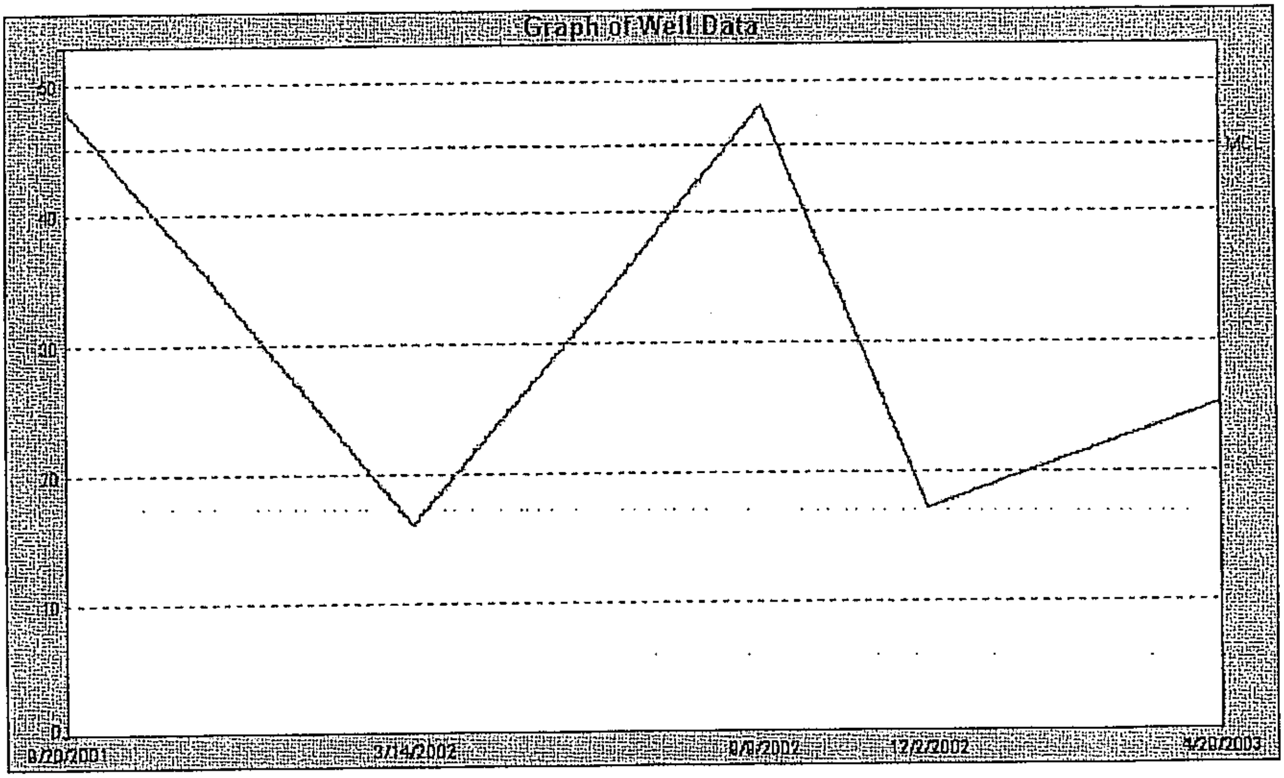
Well Data Graph

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
1-69 SOUTH WELL
State Well Number: 0706028-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/29/2003	NITRATE (AS NO3)		25	mg/L	45
12/2/2002	NITRATE (AS NO3)		17	mg/L	45
9/9/2002	NITRATE (AS NO3)		48	mg/L	45
3/14/2002	NITRATE (AS NO3)		16	mg/L	45
9/20/2001	NITRATE (AS NO3)		48	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

iL-10

KNIGHTSEN COMMUNITY WATER SYS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707547-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

MTBE only

Public Water System
KNIGHTSEN COMMUNITY WATER SYS

Water System Address:
KNIGHTSEN COMMUNITY WATER SYS
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
21

Population Served:
150

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

No data

Nitrate only

BACK TO SEARCH | GEOTRACKER HOME

Well Search Results

8 records found Page 1 of 1

SITE NAME	ADDRESS	CITY	COUNTY	
BELLA VISTA TRAILER COURT	4253_MACHADO LN	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BETHEL MISSIONARY BAPTIST	BETHEL MISSIONARY BAPTIST	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BIG OAK MOBILE PARK	BIG OAK MOBILE PARK	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BLUE STAR GAS MART	BLUE STAR GAS MART	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
DELTA KIDS CENTER	DELTA KIDS CENTER	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
DIABLO WATER DISTRICT	5325 P.O. BOX 127	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
GREG'S MOTEL & HARBOR	GREG'S MOTEL & HARBOR	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
OAKLEY MUTUAL WATER CO.	OAKLEY MUTUAL WATER CO	OAKLEY	CONTRA COSTA	VIEW PWS WELLS

925-[illegible] 2242

Wood's Marina

M

[illegible] Marina
3215 Wells Rd

NWIS

Wells Owned By W0600710007

DIABLO WATER DISTRICT (OAKLEY)
5325 P.O. Box 127
OAKLEY , CA 94513

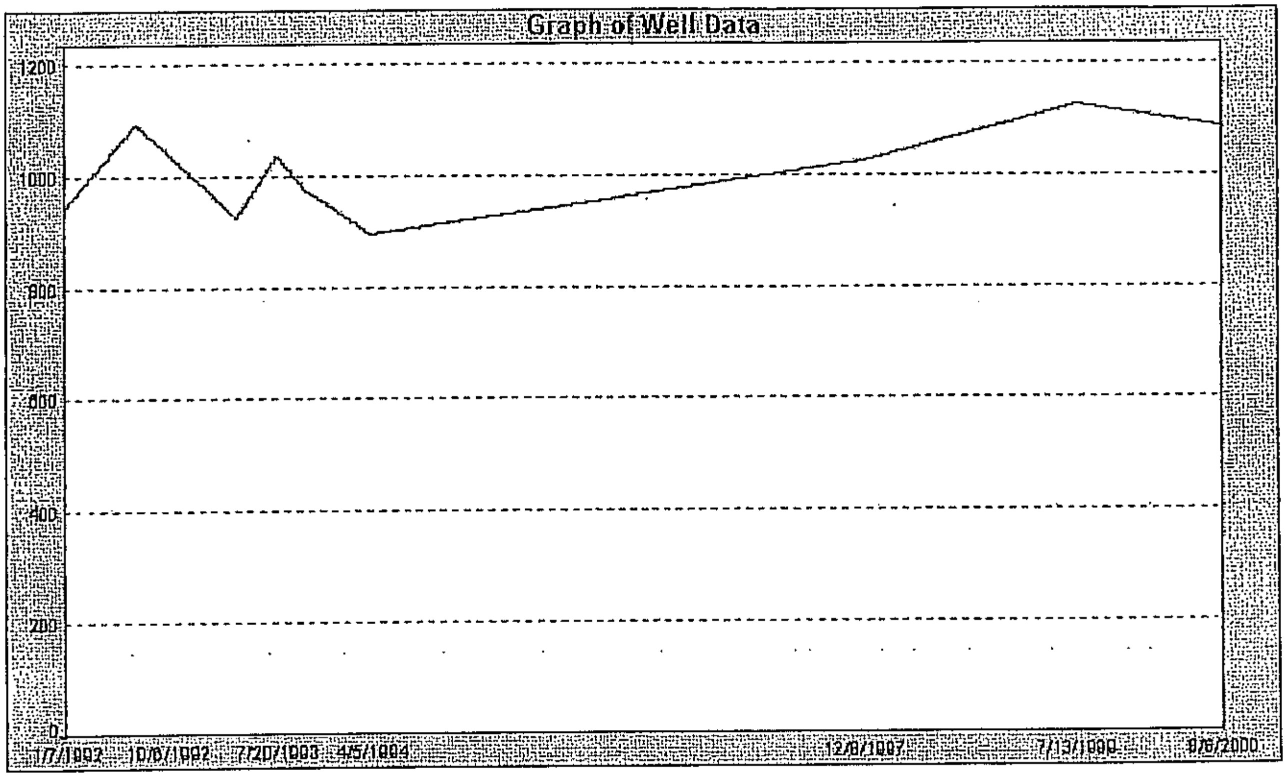
State Well No.	Well Common Name		
0710007-001	CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND	Show on Map	Report
0710007-002	WELL 01 - STANDBY	Show on Map	Report
0710007-003	RANDALL-BOLD WTP - TREATED	Show on Map	Report
0710007-004	WELL 01 - TREATED - STANDBY	Show on Map	Report
PWS MAIN FAC	0710007	Show on Map	Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
WELL 01 - STANDBY
State Well Number: 0710007-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	TOTAL DISSOLVED SOLIDS		1080	mg/L	1500
7/13/1999	TOTAL DISSOLVED SOLIDS		1120	mg/L	1500
12/8/1997	TOTAL DISSOLVED SOLIDS		1020	mg/L	1500
4/5/1994	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
1/4/1994	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
10/5/1993	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
7/20/1993	TOTAL DISSOLVED SOLIDS		1030	mg/L	1500
4/5/1993	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
10/6/1992	TOTAL DISSOLVED SOLIDS		1040	mg/L	1500
7/13/1992	TOTAL DISSOLVED SOLIDS		1090	mg/L	1500
1/7/1992	TOTAL DISSOLVED SOLIDS		940	mg/L	1500

From Date: To Date: Graph Size Small Normalized Redraw

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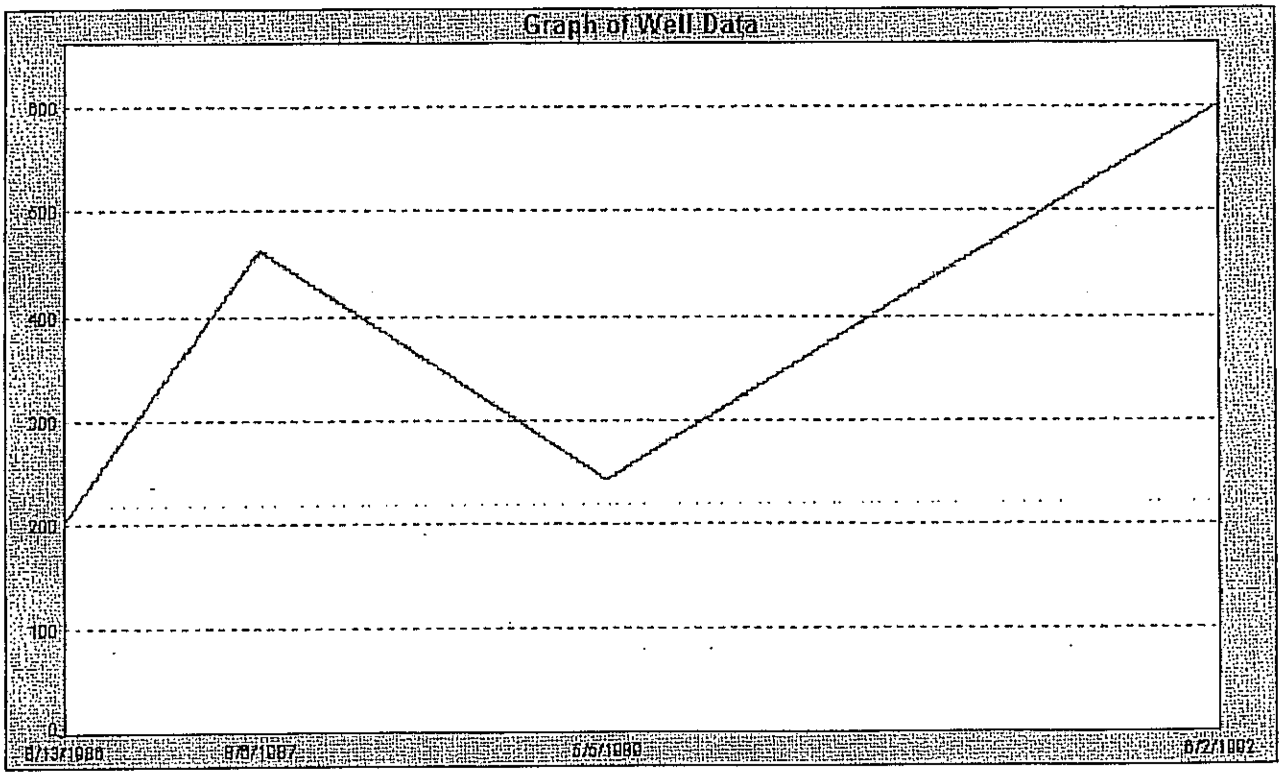
Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	TOTAL DISSOLVED SOLIDS		600	mg/L	1500
5/5/1989	TOTAL DISSOLVED SOLIDS		240	mg/L	1500
8/6/1987	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
8/13/1986	TOTAL DISSOLVED SOLIDS		199	mg/L	1500

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

GROUNDWATER STUDY
EMERSON AND BURROUGHS PROPERTIES
CONTRA COSTA COUNTY, CALIFORNIA

SUBMITTED

TO

PONDEROSA HOMES

PLEASANTON, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 4603.4.101.02

OCTOBER 27, 2005

Project No.
4603.4.101.02

October 27, 2005

Mr. Jeff Schroeder
Ponderosa Homes
6671 Owens Drive
Pleasanton, CA 94588

Subject: Emerson and Burroughs Properties
Contra Costa County, California

GROUNDWATER STUDY

Dear Mr. Schroeder:

With your authorization, we have conducted a groundwater study for the subject property, located on the north side of Cypress Road in Contra Costa County, California. The accompanying report presents the results of our study of hydrogeologic conditions beneath the proposed development. Based on our study, it is our opinion that groundwater can be used for evaporation make up requirements of the currently proposed lakes within the development from a hydrogeologic standpoint; provided the recommendations included in this report are followed.

We are pleased to provide our services to you on this project and look forward to consulting further with you and your design team.

Very truly yours,

ENGEO INCORPORATED

Jason Preece, CEG
jp/jb:gw

Reviewed by:

Dennis B. Nakamoto, CEG

cc: 1 – Mr. Steve Garrett, Castle Companies, Inc.
1 – Alexandra Barry, Centex Homes
1 – Reed Onate, Trumark Companies
2 – Sandra Pellegrino, Carlson Barbee & Gibson
1 – Cindy Gnos, Raney Planning and Management

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Letter of Transmittal

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EXECUTIVE SUMMARY

Development is planned on the southern portions of the Emerson and Burroughs Properties (Assessor's Parcel Numbers [APN] 032-270-809, 032-081-016 and 032-270-801 totaling 305 acres) that includes construction of two lakes that would be supplied by stormwater runoff and groundwater resources for the purpose of establishing storage capacity. Groundwater resources would be utilized to maintain the water level of the lakes and also supply turf irrigation water for perimeter green spaces. This report is intended to provide an assessment of groundwater conditions in light of future land use changes. This assessment considers the cumulative affects on groundwater supply and demand contributed from other nearby planned developments for which additional lakes and community park and turf space are planned. This assessment has included research of available data on groundwater quantity and quality, site reconnaissance and interviews, development of a conceptual site model, and a comparison of historical to anticipated future groundwater needs.

The site is irregularly shaped and generally flat with some slight manmade and natural rises. Existing site elevations range from approximately 14 to 4 feet above mean sea level (msl). The northern and southern majority of the site consists of undeveloped agricultural land. Existing driveway, trees, irrigation pipelines and several residential structures with associated buildings are located on the site. Several canals and sloughs exist adjacent to and in the vicinity of the site.

It has been necessary to evaluate groundwater conditions over a much broader area than the site (approximately 12 square miles herein referred to as the "study area") to provide an adequate and cumulative assessment of the potential for impacts to result from land use changes. The groundwater flow direction is northeast at an estimated rate of approximately one (1) gallon per day per square foot based on a hydraulic gradient of 0.1. The primary aquifers in the area are within the upper 500 feet of unconsolidated alluvial sediments of the Great Valley comprised of interlayered sequences of sand, silt and clay. While aquifer characteristics are best determined by aquifer pumping test data, for the purposes of assessing potential environmental impacts, a pumping test may be omitted in favor of theoretical modeling of aquifer performance. Specific recommendations are presented at the end of this report to conduct pumping tests for well design purposes.

In general, this assessment concludes that planned land use changes for the site and surrounding area should not have significant impacts to groundwater conditions. While significant amounts of groundwater recharge, such as infiltration from rainfall and irrigation, may be reduced due to the affects of urbanization, the reduction appears to be greatly counteracted by a reduction in historical groundwater pumpage rates and a potential increase in streambed recharge, such that an overall change in the groundwater budget is not expected. A balanced groundwater budget is expected with the assumption that groundwater resources will meet the future water demands created by the cumulative amount of evaporation from surface water in the lakes and from irrigation water applied to common area parks and street landscape planned in the study area that is estimated to be 540 and 290 acre-feet per year, respectively.

This study has also concluded that groundwater in the site and study area is of sufficient quality for the purpose of landscape irrigation and lake evaporation loss makeup. In addition, it appears plausible for the quality of groundwater in the area to improve due to urbanization primarily due to less infiltration of nitrate-laden irrigation water from agricultural activities and a greater component of recharge from streams and sloughs having lower concentrations of total dissolved solids (TDS) than either recharge of irrigation water or the lateral flow of higher TDS groundwater sourced from the Coast Ranges located to the west of the study area.

1.0 INTRODUCTION

1.1 Background

Proposed development on the southern portions of the Emerson and Burroughs Properties (Assessor's Parcel Numbers [APN] 032-270-809, 032-081-016 and 032-270-801 totaling 305 acres) includes planned construction of lakes (two are planned at approximately 5 acres each in size) that would be supplied by stormwater runoff and groundwater resources for the purpose of establishing storage capacity. Groundwater resources would be utilized to maintain the lakes' water level (i.e. account for make up losses due to evaporation) and also supply turf irrigation water for perimeter green spaces (total of approximately 16 acres). A CEQA study of the proposed lakes currently in progress recently revealed a need to complete an assessment of potential hydrogeologic impacts resulting from incorporating lake operations into the planned development. This report is intended to provide the needed assessment. This assessment also includes the cumulative affects on groundwater supply and demand contributed from other nearby planned developments for which additional lakes (approximately 167 total acres) and community park and turf space (up to 58 acres) are planned that would also utilize groundwater resources.

1.2 Purpose

This groundwater study is being conducted to assess current and historical groundwater conditions at the site, and in the general vicinity, to provide background data useful in assessing the affects, if any, of planned groundwater use at the property.

1.3 Scope

The scope of the study consists of:

- Review of existing surface and groundwater databases.

- Field reconnaissance to identify wells and locations where more detailed groundwater data can be collected in the future.
- Compiling information that will allow for modeling of the current groundwater use rates.
- Evaluation of the hydrogeologic cycle under current agricultural-use in the site's low-lying delta setting.
- Research and evaluation of regional water resource critical issues such as, Total Maximum Daily Load (TMDL) goals for adjacent surface water bodies to assess the potential for contributing to brackish water intrusion that could result from groundwater removal.
- Constructing a groundwater balance for the site vicinity that will assist in determining estimates of current and future groundwater use.
- Develop a conceptual site groundwater model including the following data types:
  - Quantity and quality of applied water (evaluation of changes in salt concentrations in storage pond due to evaporation).
  - Quantity and quality of percolating water (comparison to leaching factor available from similarly situated projects in the vicinity of the subject site).
- Develop data to assist with modeling the aquifer conditions and predicting the effects of operation of the proposed lakes.
- Identify any accessible well suitable for conducting a short-duration pump test with water quality testing.
- Compare water demand with historical groundwater pumping.

Aquifer characteristics are, in the long term, determined by aquifer pumping test data. Such data are best collected from a pumping well that is screened across the entire shallow aquifer thickness and monitoring wells that are screened at the same depths as the pumping well and that are constructed at specific distances and directions from the pumping well. However, for the purposes of assessing potential environmental impacts, a pumping test may be omitted in favor of theoretical modeling of aquifer performance. Additionally, pumping tests for the purpose of establishing a sustainable aquifer yield must be conducted on the actual well to be used and in the late Fall, when groundwater levels are lowest due to low precipitation, low stream levels and high pumping demands. Specific recommendations are presented at the end of this report to conduct pumping tests for well design purposes.

1.4 Site Location and Description

The site consists of approximately 305 acres, located in Contra Costa County, California east of Oakley. The site is generally bound by the Contra Costa Canal to the north and east, Cypress Road to the south and the Emerson Property boundary to the west (north-south trending line approximately one-half mile west of Sellers Avenue as shown on Figures 1 and 2. The site consists collectively of portions of properties also referred to as the Emerson and Burroughs properties. Figure 2 also shows the area covered by this study.

The site is irregularly shaped and generally flat with some slight manmade and natural rises. Existing site elevations range from approximately 14 to 4 feet above mean sea level (msl).

The northern and southern majority of the site consists of undeveloped agricultural land which was fallow or disced at the time of our exploration. The central eastern portion of the site consists of an east-to-west-trending strip of land which varies up to approximately 8 feet higher in elevation than the remainder of the site. An existing driveway, trees, and several residential structures with associated buildings are located in this area. There is a system of irrigation pipelines that run east-west across the southernmost portion, east-west in the central portion of the site, and another that runs north-south approximately thirty feet west of Sellers Avenue.

The Contra Costa County Canal, which borders the property to the north, consists of an approximately 12-foot-high berm and a relatively shallow canal. At the time of our field activities, the flow line in the canal was lower than the ground surface of the subject property.

There has been minor grading on the property to construct roads, dikes, and level areas for buildings and other improvements.

1.5 Proposed Development

Although specific development plans have not been prepared as of the date of this report, it is our understanding that the proposed development will consist of single-family residential housing. Two surface water impoundments (lakes) are proposed in the central portions of the site. Approximately 10 acres of lakes are proposed on the site and an additional 167.3 acres of lakes are proposed within the rest of the study area of this report. Therefore, a total of approximately 177.3 acres of lakes are planned within the study area. Additional site improvements will likely consist of streets and underground utility construction. It is our understanding that the site grading for this project will likely include minor cutting and filling to establish building pads and streets. To improve ground stability, geotechnical recommendations call for over-excavation and recompaction of compressible soils to depths of six to ten feet below existing grade (based on final site elevations of 3 feet below seal level). Excavation for the lakes may involve cuts up to 15 feet deep and will likely require dewatering to that depth for construction purposes due to shallow groundwater conditions. A perimeter dike system surrounding the site is also proposed that will involve substantial thickness of fill placement (up to at least 10 feet thick).

2.0 GEOLOGY, BASIN AND SUBBASIN BOUNDARIES, AND HYDROGEOLOGY

2.1 Geology

The site is located at the margin of the Great Valley Geomorphic Province and the Coast Ranges Geomorphic Province. The Great Valley Geomorphic Province consists of an elongated structural trough that has been filled with a sequence of sedimentary deposits ranging from Jurassic to recent in age. In the San Joaquin/Sacramento Delta, sedimentary deposits are up to six miles in thickness (Atwater, 1982) and consist of marine and non-marine deposits. Based on generalized geologic cross sections prepared by the California Division of Oil and Gas from oil and gas well logs, it is estimated that undifferentiated non-marine sedimentary deposits, which are of primary importance with respect to the freshwater aquifer systems, extend to depths of approximately 1,000 to 3,000 feet in the study area and beneath the San Joaquin River (DOG, 1982). These deposits rise to the west and pinch out as they meet the flank of the Coast Ranges geomorphic province. Geophysical evidence suggests that the Great Valley is underlain at depth with granitic rocks of similar origin to those of the Sierra Nevada Province. The adjacent Coast Ranges Geomorphic Province consists of the Franciscan Assemblage rocks which also likely underlie a portion of the Great Valley and the study area.

The San Joaquin/Sacramento Delta lies at the junction of the Sacramento and San Joaquin rivers, the two major waterways that drain the Central Valley. The Delta area currently consists of a braided pattern of brackish to freshwater tidally-influenced channels and sloughs encircling a series of low-lying islands.

2.1.1 Site Geology

The near-surface sediments across the site consist of eolian (wind-blown), lacustrine (lake-deposited) and alluvial deposits. These sediments are typically irregularly-stratified, poorly consolidated deposits of clay, silt, sand, and minor gravel.

The surficial geology of the Delta has been mapped by Atwater (1982) (Figure 3) which shows that the surficial deposits on the site have been largely influenced by changes in sea level during the Late Pleistocene. Most of the high-standing areas in the site vicinity are the crests of old sand dunes and are underlain by sandy eolian deposits deposited during later stages of the most recent low-stand of sea level. According to Atwater, these eolian deposits formerly extended across most of the surface of the site but are now buried in low-lying areas by younger sediments.

The alluvial fan of Marsh Creek extends across the site and Atwater's map and text imply that alluvium of Marsh Creek typically overlies the sandy eolian deposits in low-lying areas. According to Atwater (1982), much of the alluvium in the site vicinity consists of gray silt and clay deposited in near sea-level flood basins and ephemeral lakes.

2.1.2 Soil Survey Maps

The site and study area is mapped by the Soil Survey of Contra Costa County (1977). The predominant soil types across the site are the Marcuse Clay (Mb) and Delhi Sand (DaC) with lesser amounts of Piper Loamy Sands (Pe). Sycamore Silty Clay Loam (So) appears south and southwest of the site. Sacramento Clays (Sa and Sb) and Egbert Mucky Clay Loam (Ea) along with some other muck soils appear east of the site but within the study area boundary delineated on Figure 2.

2.2 Groundwater Basin and Subbasin

The site is located within the jurisdictional boundaries of the Central District of the California Department of Water Resources (DWR) as shown on Figure 4. According to DWR classification, the site is situated in the northernmost portion of the Tracy Subbasin (No. 5-22.15) of the San Joaquin River Hydrologic Region as shown on Figure 5 (DWR, 2003). Groundwater aquifers at the site and surrounding area have subsurface recharge from converging sources that included the western alluvial plain deposits of the Central Valley, chiefly the Marsh Creek alluvial fan deposits, and the San Joaquin Valley interbasin deposits that are more prevalent to the southeast. According to DWR, the Tracy Subbasin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Diablo Range on the west; the Mokelumne and San Joaquin Rivers on the north; the San Joaquin River to the east; and the San Joaquin-Stanislaus County line on the south. The Tracy Subbasin is located adjacent to the Eastern San Joaquin Subbasin on the east and the Delta-Mendota Subbasin on the south. All of the above-mentioned subbasins are located within the larger San Joaquin Valley Groundwater Basin. The Tracy Subbasin also lies to the south of the Solano Subbasin that is within the Sacramento Valley Groundwater Basin (DWR, 2004).

The basin boundaries shown in Figure 5 are approximately the same as those used in previous groundwater investigations. These boundaries generally follow the edge of the relatively young alluvial deposits that comprise the valley floor areas. However, the young sedimentary formations exposed in hills adjacent to some of the valley floor areas to the west also extend beneath the site, where they may contribute to some of the thickness of the groundwater basin. The young sedimentary formations exposed in the hills are thought to be fault displaced to their positions beneath the valley floor. In those areas, the true boundaries of the groundwater flow system are defined by faults (for example, the Midland fault and other faults thought to be a part of the Coast Ranges – Sierran Block fault system).

2.3 Regional Hydrogeology

In 1999, Luhdorff and Scalmanini Consulting Engineers (LSCE) completed an investigation of the groundwater conditions in the east Contra Costa County area for the East County Water Management Association, a collection of the major water and irrigation districts in the area (LSCE, 1999). In this study, LSCE characterized four general hydrogeologic regions based on a deposition model of alluvium in the study area and surrounding region as follows:

- Fluvial Plain – An area east and south of the study area along the floor of the San Joaquin Valley comprised of several thick beds (20 to 30 feet) of sands and gravels at distinct levels separated by intervening clay to silt beds.
- Delta Islands – An area within the northeast portion of the study area and to the northeast comprised of sand and gravel beds correlated to the sand and gravel beds of the Fluvial Plain region but with greater thickness and increased net sand thickness to the north. Sand is reportedly finer with lesser occurrences of gravels.
- Marginal Delta Dunes – An area mostly within the study area but also to the west of the study area comprised of numerous thin to thick sand beds having net sand thicknesses of generally greater than 30 feet per 100 feet. The sand beds are generally finer grained than the Delta Islands region and have areas of locally thick (greater than 30 feet) beds.
- Alluvial Plain – An area generally south of the study area that includes the Brentwood area comprised of discontinuous thin sand and gravel with generally low net sand thickness of less than 20 feet per 100 feet. The Alluvial Plain deposits thin westward to pinch-out against the Coastal Range foothills and thicken eastward where they probably interbed with the flood plain deposits of the Fluvial Plain deposits.

To further evaluate the hydrogeology specific to the study area, available Water Well Drillers Reports (WWDRs) were obtained from DWR for a 12-square-mile area surrounding the site (primarily to the south and east of the site). In addition, a reconnaissance of the area was conducted to identify groundwater wells for which WWDRs were not on file. Figure 6 presents a graphical summary of the groundwater wells identified through both research activities. Table 1 presents a summary of some of the data presented on the WWDRs reviewed. Most of the wells in the study area were screened between 100 and 250 feet below the ground surface (bgs), while some of the boreholes extended as deep as 610 feet bgs.

Based on the information contained in the WWDRs, several simplified geologic cross sections were constructed and are presented in Figure 7. These cross sections are in general agreement with the cross section presented in the LSCE study, although the LSCE cross section covers a much larger area. Since the sediment descriptions on lithologic logs of the WWDRs generally only made the distinction as to whether the sediment was "clay", "sand" or "gravel", these cross sections are equally simplified and only generally represent the depth and thickness of more permeable sediments relative to less permeable sediments. In general, the cross sections indicate that the deposits beneath the site and surrounding area consist of discontinuous, interlayered deposits of varying thickness that have highly contrasting permeabilities. This characterization is supported by more detailed subsurface information contained in previous geotechnical studies for the site (ENGEO, 2005 and 1993; data excerpts in Appendix A) which indicated a high degree of variability up to depths of 50 feet. The degree of variability can be interpolated to also extend to greater depths.

Recent work conducted by LSCE in 2005 involved the installation of two wells within the study area and included detailed lithologic logging of samples collected from depths as much as 460 feet bgs, as well as down-hole geophysical surveys to depths as much as 250 feet bgs (Appendix B). These two test holes are an appreciable distance apart; the northern test hole is located approximately ½ mile east of the intersection of Cypress and Bethel Island Roads and the southern test hole is located approximately 2,000 feet further south. Logs for these two test holes indicated some larger-scale similarities at both sites with moderate to high permeable sediments encountered at the depth intervals of 140 to 180, 210 to 260 and 270 to 295 feet bgs. This level of similarity between the two test holes suggests that aquifer boundaries are defined, on a larger scale, by the generalized occurrences of mostly sand beds versus mostly clay and silt beds. In other words, sequences of predominantly sand beds (higher permeable layers) can represent an aquifer while sequences of predominantly clay and silt beds (lower permeable layers) can represent boundaries to vertical groundwater flow. Based on the WWDRs, work by Luhdorff and Scalmanini, and the geologic cross sections, the subsurface hydrogeologic conditions can be characterized as semi-confined aquifers having moderate to high water yield.

3.0 GROUNDWATER USE

3.1 Sources of Water

The site and near vicinity have a rural setting and, as such, rely strictly on groundwater for a source of domestic water. Groundwater use also includes some industrial and agricultural water supply uses. However, these uses appear limited. The vast majority of agricultural irrigation water is supplied to the area by the surrounding sloughs via lift pumps and sluice gates. Some irrigation water in the south and southwestern portions of the study area is also supplied by the East Contra Costa Irrigation District (ECCID) that conveys surface water from the south through a series of concrete-lined open ditches and buried concrete pipes. The main source of ECCID's water is surface water diverted from Indian Slough and groundwater pumped regionally and introduced into the irrigation system. ECCID does not appear to operate groundwater wells in the study area. In general, ECCID irrigation water from Indian Slough does not reach the study area. Instead, irrigation water is delivered to a large portion of the northern half of the study area via gravity feed from Little Dutch Slough (slough aligned with Knightsen Avenue).

In 1994, the City of Brentwood commissioned the Lawrence Livermore National Laboratory (LLNL) to conduct a groundwater isotope study in the Brentwood area (Davisson and Campell, 1994). The study cites that 50 years of historical water table maps compiled by ECCID indicate that the change in groundwater storage in the region is essentially zero as there have been no substantial changes in the water table elevation and slope. This appears to be generally true even based on limited information on depth to groundwater recorded in WWDRs for the area which usually indicated a very shallow depth to groundwater of between 5 and 10 feet. Major points regarding sources of water that are presented in the LLNL study include:

- ECCID's irrigation water is chiefly sourced from surface water diverted at Indian, Little Dutch and Rock Sloughs, but is also supplied from groundwater on demand.

- Most of the groundwater extracted by ECCID is related to drainage tile water removal in the low-lying areas east of the site and is exported from the basin.

- Irrigation water delivered to the area has averaged approximately 37,550 acre-feet (ac-ft) per year for the service area of at least 17,000 acres (approximately 26.5 square miles).

- Recharge to the groundwater basin from ECCID agricultural irrigation water is estimated to be approximately 11,265 ac-ft per year (30 percent of applied water).

- Recharge to the groundwater basin from stream beds is approximately 550 ac-ft per year.

- Recharge to the groundwater basin from rainfall is approximately 2,550 ac-ft per year.

- ECCID's average groundwater pumpage is 3,750 ac-ft per year.

- Domestic pumpage in the region (includes Brentwood, Knightsen and rural sites) was estimated to be approximately 950 ac-ft per year using population figures and an assumed consumption rate of 164 gallons per capita per day.

- Safe yield from groundwater for the Brentwood area was estimated by the LLNL study to be 300 to 1,800 ac-ft per year. This safe yield is based on the assumption that 90 percent of available recharge from over irrigation and rainfall is lost due to urbanization, which makes the estimate conservatively low.

- Elevated nitrate levels in groundwater are primarily located in shallow groundwater (less than 100 feet bgs) in the Brentwood area located to the south of the site.

It is reasonable to assume that available groundwater recharge from irrigation in the subject Oakley study area is less than that for the Brentwood area due to the study area being about one-half of that used for the Brentwood area study (12 square miles compared to 26 square miles) and due to the differences in agricultural practices (cattle feed versus orchard and row crops). For a 12-square-mile (7,680 acre) study area, the irrigation water applied to the study area would amount to approximately 17,000 ac-ft per year (based on 2.21 ac-ft applied per year per acre). If it is assumed that the differences in agricultural practices between the two areas reduce the amount of irrigation water applied by 33 percent, recharge to the study area groundwater basin would be 20 percent (30 percent x 67 percent) of the applied irrigation water or approximately 3,400 ac-ft per year (0.4 ac-ft per year per acre). Water used for irrigation in the study area is primarily delivered by gravity flow from Little Dutch and Emerson Sloughs and, to a lesser extent, from Rock Slough. Lift pumps also help deliver water from the sloughs to the area. Assuming 10 square miles are agricultural land use and about 30 percent of irrigated water reaches the groundwater table, irrigation rates would be approximately 1.8 feet per year[1] which is about 50 percent the average rate for California of 3.6 feet per year. The 1.8 feet per year rate is reasonable given that the vast majority of agricultural land in the study area is farmed for cattle feed or pasture that is irrigated much less than conventional crops (usually only irrigated during the peak hot weather season). Shallow groundwater conditions also lessen the amount of crop water demand.

Assuming rainfall of 1 foot per year over a 7,680-acre area (very little of the study area is urbanized) and an infiltration rate to groundwater of 20 percent (same as used in the LLNL study), recharge from rainfall would amount to approximately 1,550 ac-ft per year.

Stream recharge for the study area is generally not that significant because streams do not cross the area. However, major waterways do include the Contra Costa Canal and Emerson, Sand Mound and Dutch Sloughs. It is reasonable to estimate that the Sloughs do not currently contribute to significant groundwater recharge in the study area because drainage tiles and lift pumps used to dewater the lands below sea level exist adjacent to these sloughs that provide a point of hydraulic control with a zero net effect. In other words, the amount of water recharges from the sloughs equals, or is less than, the amount of water being removed by the drainage tiles and drainage lift pumps. Conversely, the Contra Costa Canal likely provides groundwater recharge because it is unlined and typically has a water level greater than the groundwater table. Using Darcy's Law governing hydraulic flow in the subsurface and assuming the water level in the canal is 10 feet above the underlying groundwater table, the distance between bottom of the canal and the water table is 5 feet, the intervening sediments are primarily silty sand having an approximate hydraulic conductivity of 0.1 gpd per square foot (gpd/sf) (Freeze and Cherry, 1979,

[1] 3,400 ac-ft per year / 10 square miles / 640 acres per square mile / 0.3 infiltration rate

Table 2.2), and the areal extent of the canal affecting the study area is 1.5 million sf (20,000 feet long by 75 feet wide), the amount of recharge available from the canal is approximately 335 ac-ft per year[2].

Domestic and agricultural pumping in the study area is quite different than in the Brentwood area primarily because the City of Oakley uses very little groundwater for domestic water and agricultural groundwater pumping is significantly less in the study area (based on area reconnaissance and observed agricultural practices). In general, agricultural groundwater wells were not identified in the area. WWDRs only identified 7 agricultural supply wells and 62 domestic supply wells in the study area. Reconnaissance of the study area identified at least 150 additional domestic water supply wells. Applying a similar ratio of WWDR-identified to reconnaissance-identified domestic water wells to the WWDR-identified agricultural wells, it is estimated that approximately 25 agricultural wells exist in the study area.

Assuming that the daily use for all private domestic water supply wells is approximately 700 gallons[3], private domestic water pumping in the area is approximately 166 ac-ft per year[4].

The aforementioned amount of domestic water pumpage does not include pumpage from several community well supplies identified by the area reconnaissance and records review (e.g. Knightsen Community Water System, Sandmound Mutual, Riverview Water Association, Pleasant Times Mutual Water Company, Dutch Slough Water Works, Angler's Ranch, Bethel Island Mutual Water Company, Delta Mutual Water Company, Big Oak Mobile Park, Belle Vista Trailer Court and Island Park Trailer Court). Except for the Knightsen Community Water System, these community water supply systems service recreational developments that would be expected to consume much less (conservatively, about half of full-time residences) the amount of

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[2] 1.5 million sf x 10 feet / 5 feet x 0.1 gpd/sf / 325,851 gallons per ac-ft x 365 days per year

[3] (4.3 residents per well or household x 164 gallons per day (gpd) per person

[4] 212 wells x 700 gpd x 365 days per year / 325,851 gallons per ac-ft

water private non-recreational development domestic water wells produce. Each of the 11 community supply systems likely averages not more than 25 connections or 150 people for half the year because the wells primarily serve vacation homes. The Knightsen water system is reported to serve a population of 150 with 21 service connections that serve full-time residences. Based on the aforementioned information, it is estimated that the community water systems in the study area result in approximately 165 ac-ft per year of additional domestic water pumpage[5]. Including the pumpage from other identified wells in the area, total domestic water pumpage in the study area is estimated to be approximately 330 ac-ft per year.

Estimating agricultural pumpage in the study area requires much more generalized assumptions because irrigation practices appear to vary greatly from farm to farm without accurate flow measurements being collected and it is uncertain how much of the irrigation demand is supplied by groundwater. A reasonable approach to estimating agricultural pumpage would be to estimate the average use for each well. Assuming each agricultural well (25 are estimated to exist) only operates one-third the time during the two months of July and August to supplement irrigation water or improve water quality when irrigation demand is the highest and that each well produces, on average, a 1,000 gallons per minute (gpm), an estimation of agricultural pumpage in the study area is approximately 2,260 ac-ft per year[6]. This amount seems reasonable given that the LLNL study estimated 4,500 ac-ft per year of agricultural pumpage for the Brentwood area. It appears that much of the difference in agricultural pumpage in the study area compared to the Brentwood area is attributable to the fact that the subject study area is about half of the Brentwood study area and irrigating fields for pasture or cattle feed (predominant in the study area) with pumped groundwater is generally discouraged due to higher operating costs and the availability of slough water.

[5] (1,500 residents x 164 gallons per day x 365 days per year x 0.5 occupancy rate / 325, 851 gallons per ac-ft) + (150 residents in Knightsen x 164 gallons per day x 365 gallons per year / 325, 851 gallons per ac-ft)

[6] 25 wells x 1,000 gpm x 60 minutes per hour x 24 hours per day x 62 days x 0.33 rate of operation / 325, 851 gallons per ac-ft

Another approach to estimating agricultural pumpage is to estimate crop demand and make an assumption on how much of that demand is met by groundwater pumpage. Alfalfa is a common crop used for dairy cattle feed that appears to be the primary agricultural activity in the study area covering approximately 6 square miles. Orchards do exist in the southwest quadrant of the study area and cover about 4 square miles, but it is believed that the water demands for these orchards are chiefly supplied by ECCID ditch water and groundwater pumpage in this area can be ignored. Alfalfa requires approximately 60 inches of water per year while corn, another common cattle feed crop, requires much less, about 34 inches per year. As mentioned above, agricultural pumpage in the study area likely only occurs during the summer months of July and August when water demand is highest. During these two months, alfalfa could demand as much as 16 inches of water. Assuming that groundwater supplies as much as 50 percent of the crop demand and a cultivated area of approximately 6 square miles, agricultural pumpage for the two months (and year) is estimated to be 2,560 ac-ft per year[7]. This estimate (2,560 ac-ft per year) agrees well with the estimate derived from the estimated number of wells (2,260 ac-ft per year) such that, a reasonable estimate of groundwater agricultural pumpage in the area is set at 2,500 ac-ft per year.

Other types of water uses in the study area included limited industrial uses (e.g. commercial, dairy operations, light industrial, etc.). While these uses are incrementally minor in terms of the overall groundwater balance in the region, their local affects on groundwater flow and supply can not be overlooked, especially in light of major land use changes.

Based on site reconnaissance and interviews with property owners, the Emerson Dairy operated just north of the site (within the study area) up until September 2003 and used significant amounts of groundwater for continuous washdown of the milking parlor. Based on discussions with Mr. Stan Emerson who managed the dairy for many years and grew up in the study area, the dairy started in about 1970 and significantly increased the size of its operation with the

[7] 16 inches / 12 inches per foot x 6 square miles x 640 acres per square mile x 0.5 for groundwater share

In summary, groundwater uses in the study area are given below.

Study Area Groundwater Recharge

Rainfall Infiltration = 1,550 ac-ft per year
Irrigation Infiltration = 3,400 ac-ft per year
Waterway Infiltration = 335 ac-ft per year

Study Area Groundwater Pumpage

Domestic Water = 330 ac-ft per year
Agricultural Water = 2,500 ac-ft per year
Industrial Water = 750 ac-ft per year
Commercial Water = 250 ac-ft per year

The above listing indicates that groundwater recharge exceeds the groundwater pumpage by 1,455 ac-ft per year.

3.2 Types of Groundwater Use

Based on the findings of the LLNL study, review of the WWDRs, area surveillance, and planned future needs, groundwater uses in the region include:

- Domestic
- Agricultural
- Industrial
- Commercial
- Environmental (i.e. wetland and tidal marsh preservation, slough and river water quality, lake water levels, green space irrigation etc.)

3.3 Water Use Patterns and Trends

According to the City of Oakley's September 13, 2002, General Plan Draft EIR, groundwater is a source of water in the East Contra Costa County, mostly in rural areas. Several small public and private water companies extract underground water through wells and convey it to nearby customers[8]. These include Bethel Island, Knightsen, Byron, and Discovery Bay. Whereas the City of Oakley does not significantly use groundwater for its municipal water supply, there are many private wells in the area as the review of WWDRs and area surveillance suggest (Figure 6). Sources not served by Diablo Water District (DWD) that use water wells are located primarily south of Laurel Road and east of Main Street. Wells are primary water sources in some rural areas, and could be a source of water for Oakley and its sphere-of-influence areas. However, the feasibility of utilizing well water is dependent on the quality and quantity of the groundwater supplies. The City of Oakley has suggested in its General Plan that a major problem with groundwater quality is the concentration of nitrates in the water supply.

Limited groundwater quality data available from DWR's online Water Data Library[9] (Appendix C) does not suggest prevalent nitrate groundwater impact, particularly to the east of Oakley and along Dutch and Sand Mound Sloughs. However, a certain percentage of the wells in the area (e.g. around Knightsen and Brentwood) have nitrate levels at or just above drinking water standards. Also, according to the LLNL study, the elevated nitrate levels are attributed to groundwater recharge on agricultural land. The highest nitrate levels are found in water less than 100 feet deep in the area southeast of Brentwood where row crop farming and orchards are predominant.

In contrast to the City of Oakley that does not currently depend on groundwater as a municipal water source, the City of Brentwood operates entirely on groundwater. Data for fourteen wells owned by the City of Brentwood were reviewed on Geotracker (Appendix C) that indicated that, of the 14 groundwater supply wells, five have been abandoned. The data included historical water quality data as far back as 1988 for some of the wells. The data indicated recent total dissolved solids (TDS) levels ranging from 490 to 1,230 milligrams per liter (mg/l). Historical TDS trends have generally increased over the last 10 to 15 years. Some of the City of Brentwood wells have had elevated nitrate levels that have approached or exceeded the drinking

[8] Geotracker (http://www.geotracker.swrcb.ca.gov)
[9] DWR Water Data Library, Historical Data Map Interface

water standard for Nitrate as NO_3 of 45 mg/l, including a few that have been abandoned. However, most of the newer wells have recent nitrate levels ranging from 4.5 to 11.1 mg/l, suggesting they are either screened deeper or are located in areas less impacted with nitrates from agricultural practices.

Water use trends in the area are expected to change from agricultural to domestic as urban development moves into predominantly agricultural areas. With this change, it is anticipated that groundwater recharge from irrigation will be reduced while recharge from yard and green space landscape irrigation will increase. Estimating the overall affect of this change would be speculative. However, one expectation is that the there will be a net reduction of groundwater recharge. Another expectation is that the quality of the recharge water should be improved as the use of agrichemicals (added nutrients that are the primary source of elevated nitrate levels in the area) is reduced.

3.4 Groundwater Levels and Trends

Groundwater level data compiled by ECCID and contained on WWDRs strongly support the idea that groundwater levels in the area have remained shallow and constant for a long period. Groundwater occurs beneath the site at depths of approximately 4 to 6 feet bgs (elevations of 10 to -2 feet NGVD). Within the study area boundaries, groundwater levels are between approximately 10 and -10 feet NGVD. Throughout the region, groundwater generally is encountered at depths of less than 20 feet. The study area does not appear to be in a state of overdraft as demonstrated by the shallow groundwater levels.

One of the better records of historic groundwater levels in the area exists for a well (State ID NO. 01N03E17E001M) located approximately one mile east of Brentwood and approximately 2.5 miles south of the southern study area boundary and 3 miles south of the site. A graph of the

(http://well.water.ca.gov/gw/gw_data/hyd/Rpt_Bas_Well_AllCal.asp) data from this well is presented on Figure 8 and shows a moderately stable history of water levels (water surface elevations vary less than 10 feet over 8 years) and shows a slight upward trend (from season high elevations of 42 feet NGVD in 1976 to 45 feet in 1983). The increasing groundwater table elevations are more likely attributable to changes in climatic patterns (i.e. period of increased rainfall) versus an increase in ECCID irrigation water deliveries to the area (ECCID deliveries are assumed to have reached capacity by 1972 when 100 percent of available land was being irrigated). Additionally, the rising water table levels do not appear to be attributable to a reduction of groundwater pumpage in the area (ECCID pumpage was significantly reduced by 1970 and was chiefly comprised of drainage tile pumpage, the degree of which is not expected to have changed since that time).

In general, the overall groundwater levels have been very stable and are expected to remain that way irrespective of whether recharge from irrigation or rainfall increase or decreases over the area due to urbanization. It appears that the stability of groundwater levels in the study area are due to influences of the San Joaquin and Sacramento Rivers Delta. Groundwater levels have the potential to be lowered only a relatively small amount as a result of urbanization for the following reasons:

- The surface water levels in the adjoining sloughs and river will remain constant, thereby providing a significant recharge source for the area.
- While urbanization has the potential of reducing available groundwater recharge from irrigation and rainfall by up to 90 percent (from 3,400 to 340 ac-ft per year), an increase in available recharge from slough and river course stream beds would occur. The potential end result could be a lowering of the groundwater table by as much as 10 feet in the northeastern portion of the study area and 30 feet in the southwestern portions of study areas.
- A removal of groundwater pumpage in the study area due to land use changes (e.g. removal of industrial groundwater use like that which formerly existed at the Emerson Dairy, located north of the site, the Lesher Property, east of the site, and other agricultural irrigation pumping in surrounding areas) would counteract the affects of lost recharge from urbanization. The amount of gain in the groundwater budget by stopping industrial and commercial groundwater pumpage is conservatively estimated at 1,000 ac-ft per year.

- The 90 percent recharge loss rate due to urbanization used in the LLNL study appears overly conservative given the layout of the planned development which will have significant park and street landscaping areas. The lakes are planned to be lined and would not contribute significant quantities to recharge. A more accurate estimate of the recharge loss rate might be 60 percent based on the current planned development for the area. However, for this study, 90 percent is used as a more conservative estimate.

- Planned increases in groundwater demand as a result of completion of the planned developments in the study area only consist of providing makeup water due to evaporation losses off the planned lakes and turf irrigation of certain common spaces. Groundwater is not intended to be used for domestic-use water supplies. Some of the groundwater wells in the study area may also provide emergency municipal water supply to the developments in the event of a failure of the transmission line that will be providing municipal water for the developments from the Randall-Bold Water Treatment Plant located in Oakley. However, groundwater use for emergency water supply should be considered temporary, not affecting the long-term groundwater budget, and therefore can be ignored. The estimated water demand for evaporation makeup for the lakes (total area of 177.3 acres in the study area) is estimated to be approximately 540 ac-ft per year[10]. Of this amount, the direct site demands are only 30 ac-ft per year since only 10 acres of lakes are planned on the site.

  The amount of irrigation demand for the site parks and street landscape on the Emerson portion of the site has been estimated by vanderToolen Associates Inc. (vTA), the project landscape design professionals, to be approximately 40 ac-ft per year. According to vTA, this is a conservative estimate. It is reasonable to assume that a similar amount of irrigation demand is planned for the remaining Burroughs portion of the site. Therefore, a total site irrigation demand is estimated to be 80 ac-ft per year.

  The amount of turf irrigation demand in other portions of the study area is conservatively estimated to be approximately 210 ac-ft per year[11] based on planting cool season turf over approximately 72 percent of the approximate 58 acres available for the large community parks planned at the intersection of East Cypress and Bethel Island Roads. This is a very conservative, worse-case scenario that considers poor irrigation efficiency of 75 percent and planting turf over a vast majority of the available space. For comparison purposes, a more realistic assumption would result in only 30 percent of the available space being planted with cool season turf and an irrigation efficiency of 90 percent; thus yielding a turf irrigation

[10] 177.3 acres x 36.5 inches per year / 12 inches per foot = 539 ac-ft per year

[11] 72 percent x 58 acres x 45 inches per year (based on quarterly values for Brentwood area ETo and cool season turf crop coefficients) / 12 inches per foot / 75 percent irrigation efficiency = 208.8 ac-ft per year

demand of approximately 72 ac-ft per year. If warm season turf was to be planted, the irrigation demand would be further reduced to 58 ac-ft per year, an overall reduction of 150 ac-ft per year over the worse-case scenario.

The lake evaporation makeup water and turf irrigation demand (540 and 290 ac-ft per year, respectively) therefore conservatively totals approximately 830 ac-ft per year which is a little more than half of the overall current excess flux of groundwater through the study area estimated to be approximately 1,455 ac-ft per year (based on current recharge amounts less the pumpage amounts given in Section 3.1). It is important to recognize that an additional amount of groundwater flows into the study area from the southwest. The total amount of groundwater flux into the study area from the southwest is conservatively estimated to be approximately 1,600 ac-ft per year[12].

It is uncertain how much water DWD will pump from the two groundwater wells that have recently been constructed at a location east of the site near the intersection of Cypress and Bethel Island Roads. In addition to lake makeup water and turf irrigation demands, the wells are also planned to supply groundwater for initial filling of the lakes. However, filling of the lakes should be considered to only have a temporal affect and to not affect the long-term groundwater budget. Each well appears capable of producing up to 1,200 gallons per minute or 1.73 million gallons per day on a continuous basis. If both wells were run continuously, approximately 3,900 ac-ft per year of groundwater could be pumped. It is not unreasonable to expect DWD to utilize the wells to the greatest capacity should they be able to demonstrate no adverse impacts in doing so. However, for the purposes of this study, groundwater demands are assumed to only consist of lake makeup and irrigation water demands.

[12] 22,000 feet of cross sectional length along the Atchison Topeka and Santa Fe railroad alignment x 350 feet of saturated thickness x 30 feet per 100 feet of net sand thickness x a hydraulic conductivity of 1,000 gallons per day per square foot [average for clean sand] x 365 days per year / 325,851 gallons per acre-foot x an average hydraulic gradient of 4 feet per 6,300 feet = 1,640 ac-ft per year

4.0 GROUNDWATER BUDGETS

4.1 Regional Groundwater Budgets

It is our opinion that the data presented in the LLNL study provides an adequate characterization of groundwater budgets in the adjacent area and can be used as a basis for the current study. The LLNL study concluded that the groundwater storage in the area is in a steady state. The LLNL study estimated groundwater flow exiting the Brentwood area to the east to be approximately 7,400 ac-ft per year. For comparison purposes, in Section 3.4 of this study, it is estimated that 1,600 ac-ft per year are entering the study area. The differences can be attributed to the smaller size of the study area compared to the LLNL Brentwood study area. The LLNL study indicates their estimate is based solely on comparison of groundwater recharge occurring within their studied area to groundwater pumpage within the same area. The excess groundwater is the result of recharge from irrigation, streams and rainfall, totaling approximately 12,100 ac-ft per year, exceeding agricultural and domestic pumping of approximately 4,700 ac-ft per year. On this basis, it is estimated the study area has groundwater recharge exceeding pumpage by 1,455 ac-ft per year (see Section 3.1 of this report).

The excess groundwater quantified for the Brentwood area by LLNL suggests that up to 7,400 ac-ft per year of groundwater could be pumped from the Brentwood area before an overdraft condition would occur. However, the study concluded that only 300 to 1,800 ac-ft per year could be safely pumped from the area primarily due to perceived future affects of retiring agricultural land, estimated to provide 67 to 84 percent of the available groundwater recharge in the area, and replacing it with urbanized areas that have limited availability for sources of recharge. The reduction in groundwater recharge amounts are attributed to urbanization causing increases of impervious areas (e.g. more rooftops and pavement) and creating landscape areas that utilize more water efficient vegetation than orchards and row crops that otherwise cause a significant amount of irrigation water infiltration to the groundwater table. As previously mentioned, the LLNL study cites that it is estimated that the urbanization of agricultural land causes over a 90 percent reduction in groundwater recharge. A similar scenario for the study area is presented in Sections 4.2 and 4.3 to estimate the affect to groundwater resources from cumulative land use changes.

4.2 Study Area Groundwater Budgets

The high percent reduction in groundwater recharge postulated in the LLNL study is suspect and is not necessarily applicable to the site and surrounding area where irrigation practices are not necessarily similar to that in the Brentwood area. The study area has historically been primarily used to grow cattle feed and the majority of the land has been irrigated less than in the Brentwood area where row crops or orchards have been cultivated. In addition, cultivation in the study area relies heavily on rainfall (i.e. is often dry-farmed and is not irrigated land). In the case of "pasture" land that is not heavily irrigated, urbanization may actually contribute greater amounts of recharge to groundwater due to a significant increase in yard landscape and green space watering. In addition, much of the areas inclusive of the study area historically have not been irrigated with ECCID water from outside the study area, but rather with water from nearby sloughs. The LLNL study did not account for the irrigation water captured from Emerson, Little Dutch and Sand Mound Sloughs because these water sources were consider outside of the LLNL study area. It has not been determined to what degree historic irrigation water locally derived from the sloughs will continue to be a contributing factor to groundwater recharge.

If, in fact, recharge to groundwater from irrigation and rainfall in the study area is reduced due to urbanization, groundwater levels will likely experience only a relatively small change. Reduced recharge may cause the direction of groundwater flow to change from flowing northeast to flowing southwest, particularly in the northeastern portion of the study area. This change results from loss of available groundwater recharge and the onset of groundwater pumping for lake makeup water and community park irrigation which could cause the groundwater table to become lower in the southwest than in the northeast. It can be expected that if, at some point, the water table is lowered, a reduction in pumpage would arise as the need for drainage tile pumping along the sloughs is reduced due to a lower water table. However, to be conservative, the reduction in drainage tile pumping (that essentially removes groundwater) is ignored in the assessment of future changes in the groundwater budget.

Based on the amount of available streambed recharge along Dutch and Sand Mound Sloughs (approximately 5 miles of wetted perimeter having an approximate width of 60 feet), a hydraulic gradient of 10 feet of head over a 100-foot flow path, and an assumed hydraulic conductivity of 10 gallons per day, per square-foot (typical for silty sand considered to be the limiting aquifer material type), it is estimated stream bed recharge from the sloughs and river could increase to 1,700 ac-ft per year[13]. This estimate is based on very crude assumptions and only provides a rough estimate of the potential increase in available streambed recharge that could result from depression of the water table in the study area. However, keep in mind that if the water table were to depress further, say 20 feet, due to a greater imbalance in the groundwater budget, the hydraulic head and groundwater flow velocity at the stream bed boundary would increase, streambed recharge would increase and a steady state in the groundwater table would ultimately be achieved (e.g. a hydraulic head difference of 20 feet versus 10 feet would increase the streambed recharge amount by a factor of 2 to 3,400 ac-ft per year). The considerations listed below should mitigate concerns over impacts from increased stream bed recharge in the form of changes in groundwater quality, a potential loss of available water to the sloughs or a change in slough water quality:

- In general, the quality of slough water is better than groundwater (lower total dissolved solids and nitrate levels).

[13] Length of 5 miles x 5,280 feet per mile x a width of 60 feet x a hydraulic gradient of 10 feet per 100 feet x a hydraulic conductivity of 10 gallons per day per square-foot x 365 days per year / 325,851 gallons per acre-foot = 1,774 ac-ft per year

- The rate of potential stream bed recharge (estimated above to potentially be 1,700 ac-ft per year), and therefore, lost from the sloughs, would be much less than the historic rate of irrigation water withdrawal from the sloughs and applied on land (estimated in footnote #15 to be 9,650 ac-ft per year). Therefore, salinity in the sloughs should not be expected to increase under a future urbanized land use scenario because much less water will be removed from the sloughs causing a lower propensity for upstream migration of more brackish downstream water (in other words, there will be greater amounts of flushing with fresh water from upstream thus improving the slough water quality).
- The sloughs would not experience less flushing with high quality river water or changes in water levels for the same reason as stated in the second bullet above. The main slough affected, Dutch Slough, receives water upstream from the San Joaquin River.

4.3 Groundwater Available for Lake Makeup Water and Community Park Turf Irrigation

The planned developments within the study area include a total of 177.3 acres of surface water lakes to provide recreational and aesthetic amenities, stormwater quality management and storage for irrigation during the dry season. It is our understanding that the ponds will have a synthetic liner to eliminate water loss due to infiltration at the base of the ponds. Even if the lakes were to have a clay liner that had some component of leakage, the leakage would return to the groundwater table and would not affect the overall groundwater budget since the volume of water introduced by leakage would be equaled by groundwater removed by pumpage to maintain the lake water levels. Because of the synthetic lining proposed for the surface water lakes, supplemental water requirements are only comprised of free-surface evaporation. Work being conducted by Balance Hydrologics, Inc. for design of the lakes has estimated their annual makeup requirements based on pan evaporation rates, coefficients for lake evaporation precipitation, runoff and runoff to the lakes. Based on this work, Balance Hydrologics have estimated an annual makeup requirement for the lakes of 36.5 inches per year. The 36.5-inch-per-year rate is reasonable based on review of a generalized map of evapotranspiration rates for California which indicates a evapotranspiration rate of 57 inches per year for the study area (CIMIS, 1999) and the fact that the transpiration component of evapotranspiration is absent of free-surface evaporation. Based on a total surface area of the lakes of 177.3 acres, it is estimated that the amount of water needed for the makeup requirement is approximately 540 ac-ft per year (see footnote #10). Again, for the site irrigation demands, lake make up water is on approximately 30 ac-ft per year.

It is currently planned that groundwater will provide 100 percent of the water losses for the lakes due to evaporation (i.e. makeup requirement of 540 ac-ft per year) and the irrigation demand for the site parks, site street landscaping and the large planned community parks east of the site. In addition, the peak lake makeup requirement occurs during the month of August when evaporation is greatest and there is no runoff to the lakes. During this peak month, approximately 95 ac-ft of groundwater will be needed or approximately 690 gpm[14] collectively for all the lakes.

As previously mentioned in Sections 2.3 and 3.4, two groundwater supply wells have been recently installed by LSCE for the Shea Homes development within the study area in anticipation of using groundwater to provide lake makeup water and community park turf irrigation demands, emergency backup domestic-use water and initial filling of the lakes. Upon completion of the wells, short-duration, step-drawdown pump tests were conducted for the purpose of sizing pumps for the wells. The pumping flow rates for each well were 800, 1,200 and 1,500 gpm for the north well; and 1,000, 1,500 and 1,800 gpm for the south well. After each well's step-drawdown tests, 8-hour pump tests were conducted at 1,200 gpm for each well. The pump test durations were limited to eight hours due to restrictions on construction noise and do not necessarily represent sustainable well yields. At the end of the 8-hour pump tests, maximum drawdowns were 36.99 feet (pumping water level went from 11.26 to 48.25 feet bgs) and 40.50 feet (from 11.85 to 52.35 feet bgs) for the north and south wells, respectively. At the end of each test, the rate of drawdown was approximately 0.40 and 0.37 foot per hour for the north and south wells, respectively. Based on the information from these pump tests, it appears that the installed wells

[14] 95 ac-ft per month x 325,851 gallons per ac-ft / 31 days in August / 24 hours per day / 60 minutes per hour = 693 gpm

are be capable of producing the high flow rates required for lake free-surface evaporation during the peak demand month of August.

With respect to the sustainability of these flow rates and the affects of loss recharge and pumpage due to urbanization, the following points indicate that the groundwater basin is capable of providing groundwater for lake makeup and turf irrigation requirements. The total loss of irrigation and rainfall recharge due to urbanization is estimated to be approximately 4,455 ac-ft per year (90 percent of the total recharge of 4,950 ac-ft per year available from irrigation and rainfall). This amount needs to be further reduced because only about 75 percent of the agricultural land use will be urbanized. Therefore, 4,455 ac-ft per year is reduced to approximately 3,340 ac-ft per year of lost recharge. In conjunction with this lost recharge, irrigation pumpage of 2,500 ac-ft per year and industrial use pumpage of 750 ac-ft per year would likely also be reduced by 75 percent. Therefore, groundwater pumpage for agricultural and industrial uses will be reduced by approximately 2,440 ac-ft per year due to urbanization. This leaves a net loss of groundwater supply of approximately 900 ac-ft per year (3,340 ac-ft per year lost recharge; 2,440 ac-ft per year lost pumpage). Along with urbanization and the availability of municipal water from outside of the area, comes the opportunity of providing higher quality treated water to existing private and commercial domestic water users. Combined private and commercial domestic water use in the study area is estimated to be approximately 580 ac-ft per year. It is reasonable to assume that 50 percent (290 ac-ft per year) of these users will switch from their own private groundwater wells to a municipal water supply that imports water from outside the area. This still leaves a net loss to the existing groundwater supply due to urbanization of 610 ac-ft per year (900 ac-ft less 290 ac-ft per year). This amount should be coupled with the 830 ac-ft per year required for the lake makeup water and turf irrigation demands to yield a net negative change in the groundwater budget of 1,440 ac-ft per year. It is important to consider that this net negative difference can be partially or entirely offset by utilizing surface water (e.g., water from the sloughs) to provide lake makeup water and turf irrigation requirements.

As previous discussed, the probable net affect of lost recharge due to urbanization and future groundwater pumpage for lake makeup water and turf irrigation requirements is a shift of groundwater flow from northeastward to southwestward in the northeastern portion of the study area as the loss recharge is replaced by stream bed infiltration along Emerson, Sand Mound, Little Dutch and Dutch Sloughs. The potential available rate of infiltration from the sloughs to groundwater is estimated to be between 1,700 to 3,400 ac-ft per year depending on the degree of hydraulic gradient reversal that may occur. The net negative difference of 1,440 ac-ft per year due to urbanization is less than the minimum 1,700 ac-ft per year potentially available from infiltration of slough water. Under this hypothetical scenario, it is very important to keep in mind that much of the land in the study area is currently irrigated through lift pumps or sluice gates that take water from the sloughs and disperse it on the land. The amount of irrigation water sourced from the sloughs is conservatively estimated to be approximately 9,650 ac-ft per year[15]. Under an urbanization scenario, 75 percent of the 9,650 ac-ft per year of water pumped from the sloughs will cease and that water will become available for indirect recharge to the groundwater basin through slough bed recharge. Given that 1,440 ac-ft per year is relatively small compared to approximately 7,240 ac-ft per year (75 percent of the estimated 9,650 ac-ft per year historically derived from the sloughs for irrigation purposes), it appears that there will be a net beneficial affect of increased amounts of water in the sloughs once the area is urbanized.

[15] (50 inches per year average cattle fodder crop demand - 12 inches rainfall per year / 12 inches per foot x 6 square miles of land of cultivated land x 640 acres per square mile) - 2,500 ac-ft per year supplied by groundwater) = 9,650 ac-ft per year

5.0 GROUNDWATER QUALITY

Whereas groundwater quality data is very limited for the site and surrounding area, sufficient groundwater quality information exists to provide a general sense of the water quality and what changes to water quality may arise from changes in land use. Sources of groundwater quality data include DWR's Water Data Library, Geotracker and site-specific studies (Appendix C).

5.1 Groundwater Quality

The study area has a generally low occurrence of chemical release sites because of its rural agricultural setting. Previous phase one environmental site assessments by ENGEO for the site did not reveal significant contaminated sites that would indicate potential to impact deep groundwater.

5.1.1 Nitrates

Groundwater in the some areas within the study area and to the south contain elevated nitrate levels. The LLNL study conducted for the Brentwood area to the south of the study area indicated that high nitrate levels in groundwater less than 100 feet deep are due to agricultural practices (i.e. infiltration of irrigation water laden with agrichemicals). LSCE (1999) also noted differences in groundwater quality with respect to high nitrate levels being limited to the upper sequence of aquifer materials and that nitrate levels decreased appreciably in wells screened below 200 feet. Review of a map of the aerial distribution of nitrate concentrations at selected wells shows pronounced differences between the Brentwood, Discovery Bay, Oakley and Delta areas. In general, nitrate concentrations were low to below detection limits for wells within the study area.

Additional data available from GeoTracker and the USGS Water Data Library (WDL) websites (Appendix C) suggests that some conditions similar to the Brentwood area exist in the southwestern quadrant of the study area, but, in general, do not exist elsewhere in the study area. Generally, detectable nitrate levels trend lower across the study area from the southwest to the northwest. In the northeastern and eastern portions of the study area, closer to Emerson, Little Dutch, Dutch and Rock Sloughs, nitrate is generally not detectable in groundwater. This pattern of lower nitrate levels in the northeast may be attributable to the local groundwater recharge conditions that are comprised of significant amounts of irrigation with higher quality river water and without much use of agrichemicals (fertilizers and pesticides). The river water is expected to have non-detectable nitrate levels. Nitrate was not detected in groundwater that services the communities located on Sandmound Road, Bethel Island, and Holland Tract.

An example of the localized and sporadic occurrence of elevated nitrate levels occurs in the vicinity of Delta Road and State Highway 4. A groundwater well at the Bethel Mission Baptist Church located just west of Highway 4 had a nitrate as NO_3 level of 46 mg/l while the groundwater well at Delta Kids Center located less than a 1,000 feet to the east of the church on Delta Road does not have detectable levels of nitrate. One well, located at the intersection of Sellers Avenue and Cypress Road is only 90 feet deep and had a nitrate as NO_3 level of 93 mg/l. A large area of orchards is shown on aerial photographs of the study area (USGS, 1998) in the immediate vicinity and upgradient of this well that may have a localized affect on the groundwater quality less than 100 feet deep.

In contrast, in the vicinity of the City of Oakley where less farming occurs, nitrate as NO_3 levels are low, ranging from less than 4 mg/l at Diablo Water District's Contra Costa Canal Pumping Station (well likely greater than 100 feet deep) to 12 mg/l at State Well Number 002N002E036M001M (a well that is 130 feet deep) located approximately ½ mile further west of the Bethel Mission Baptist Church.

In July 2003, ENGEO conducted a focused investigation on shallow groundwater in the immediate vicinity of the Emerson Dairy north of the site that indicated nitrate as NO_3 levels were below analytical detection levels in six of the seven samples collected. One sample had a nitrate as NO_3 concentration of 320 mg/l that was in close proximity to the wash water disposal pond for the dairy operation and was considered a localized affect since nitrate levels were below detection levels at locations less than 500 feet away.

5.1.2 Total Dissolved Solids

Review of the available data regarding total dissolved solids (TDS) concentrations in groundwater presented in the LSCE report and online at Geotracker and the USGS WDL sites indicate a slightly different trend in the distribution of concentrations in the study area with respect to surrounding areas like Brentwood and Discovery Bay. Higher concentrations (generally above 1,000 mg/l) are evident in the Brentwood compared to the study area and Discovery Bay (generally between 500 and 1,000 mg/l). It can not be concluded that TDS concentrations show the same trend with depth as nitrate concentrations. It appears that the groundwater beneath Brentwood has a higher component of groundwater recharge from the Coast Ranges geomorphic providence (notorious for having high TDS concentrations) than the Great Valley or Sierra Nevada providences to the east that may have a stronger influence on groundwater beneath the study area than in Brentwood. Another plausible explanation for the lower TDS concentrations beneath the study area and the Discovery Bay area is their closer proximity to the San Joaquin River and Delta resulting in a greater component of stream bed recharge of higher quality surface water, generally having low TDS concentrations, to their underlying aquifers than recharge from the Coast Ranges. The lithologic profile in the study area indicates generally thicker and shallower sequences of sand that would increase the chances for surface water infiltration to reach the underlying aquifer.

5.1.3 Chloride

Review of the available data regarding chloride concentrations in groundwater presented in the LSCE report and online at Geotracker and the USGS WDL sites again indicate lower chloride concentrations in the study area compared to the areas to the south and west (e.g., the Brentwood and central Oakley areas). However, in general, chloride concentrations are below 200 mg/l, well below concentrations considered brackish (e.g., 500 mg/l).

The data collected in and surrounding the study area suggest that, in general, groundwater in the study area is less impacted with nitrates than in the Brentwood area where farming of row crops that use agrichemicals more heavily appears to have contributed significantly to nitrate in groundwater. The study area has primarily been used to raise cattle feed and, in general, application of fertilizers, pesticides and herbicides is not done, and therefore, irrigation infiltration in the study area has a lower propensity to cause nitrate contamination in the groundwater.

Finally, water quality in the sloughs appears to be of higher quality (i.e. lower TDS and no nitrates) than agricultural runoff water that also infiltrates to the groundwater table (high TDS and nitrates). Figure 9 provides graphs of river stage and electrical conductivity (EC) for a monitoring station on Rock Slough (available from the California Data Exchange Center [CDEC]) located upstream of the intake for the Contra Costa Canal. The EC values essentially represent water quality at the mixing point between: (1) agricultural runoff and groundwater base flow into the slough from the heavily farmed upland areas to the south and west with (2) the San Joaquin River water that flows to the slough from the southern Central Valley of California. A key observation of the charts is that EC drops as the river stage rises during higher flows of the San Joaquin River, which represents an improvement in water quality. Parallels in water quality can be drawn between the surface water at this location and groundwater under a future urbanized scenario. With the onset of urbanization and a reversal of the groundwater flow direction, water quality is expected to improve as a result of slough water recharge, much like the water quality improves at the Rock Slough CDEC monitoring station when the river stage is high and there is an influx of river water to the area.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General Conclusions

Based on information gathered for this study, the following conclusions regarding current groundwater conditions can be made:

- The study area groundwater conditions are static with a current excess flux of 1,455 ac-ft per year through the area exiting to the north and east due to recharge amounts exceeding pumpage amounts.
- Groundwater quality in the area is generally suitable for domestic water supplies but has been marginally impacted with nitrates to depths of up to 100 feet bgs in the southwest portions due to agricultural practices in that area.
- Significant differences in groundwater quantity and quality exist between the study area and the Brentwood area to the south.

The planned development on the site is part of an overall urbanization in the entire study area. The combined affects of this urbanization will result in a change in the sources of recharge and pumpage within the overall groundwater budget. While these changes are appreciable in quantity, they have a tendency to counteract each other and will not result in a significant overall loss of groundwater supply or a significant drop in the groundwater table elevation. In addition, the changes in sources of recharge and pumpage in the groundwater beneath the study area has the potential to improve the general quality of the groundwater by changing the groundwater flow direction. The following points support these conclusions:

- Urbanization can cause significant loss of available recharge, in some cases up to 90 percent, but this affect is not expected to reach that rate in the study area due to the nature of the planned development (e.g. extensive green spaces will continue to be irrigated and large parcels [25 percent of the overall land developed] will remain as agricultural land use). However, for the purpose of this study and to be conservative, a 90 percent recharge loss rate was used.

- It is estimated that urbanization will have an overall affect of removing 1,455 ac-ft per year of current excess inflow to groundwater in the area (i.e. current recharge minus current pumpage in the area) and creating a groundwater deficit of 1,440 ac-ft per year (i.e. future recharge minus future pumpage). However, at the same time, up to 7,240 less ac-ft per year of irrigation water will be diverted from the sloughs adjacent to the study area while the deficit of 1,440 ac-ft per year may be replaced by recharge from the base of the sloughs as a result of lower groundwater table conditions.

- With the onset of a potential change in the groundwater flow direction due to urbanization in the study area (from northeastward to southwestward in the area adjacent to the sloughs), a potential beneficial effect of improving groundwater quality in the region may be realized. This is because future slough water that is capable of recharging the groundwater is of higher quality than a substantial portion of the irrigation water currently recharging groundwater. The poorer quality irrigation water that appears to currently affect groundwater is limited to a four-square-mile region around the communities of Knightsen and Sand Hill in the southwest portion of the study area.

6.2 Recommendations

As stated in Section 1 of this report, a specific need exists to perform one or more pumping tests to determine the aquifer characteristics for the site for the purpose of designing water supply wells. Based on pervious ENGEO studies and site reconnaissance observations, a high-production well exists at the Emerson Dairy (Well I-1 on Figure 6) that would be suitable for conducting a long-term pump test. WWDRs exist for other nearby wells and well lithology and geophysical logs are available for the DWD wells to the east (LSCE, 2005) (DWD-North and DWD-South on Figure 6) that adequately characterize the lithologic conditions at the proposed pump test well site. Construction characteristics of the proposed pump test well can be investigated prior to the pump test to determine the well's water bearing depth for correlation to the available logs. Therefore, it is recommended that a one- to two-week pump test be conducted on the well. The actual duration of the pump test is dependent on the changes in the rate of drawdown and should be determined during the pump test. Prior to conducting the pump test, short-duration, step-drawdown tests need to be conducted to determine a suitable pumping rate for the well that will provide for adequate stress to the aquifer while not exceeding the sustainable well yield during the test. In addition, four observation monitoring wells, two at approximately 100 and 250 feet downgradient of the pumping well and two at approximately 50 and 100 feet in a cross gradient direction, should be installed in the same production zone of the pumping well (150 to 180 feet bgs). These observation wells, as well as the pumping well, should be outfitted with automated water level data recorders to measure the changes in water levels during the pump test and recovery period. An accurate flow meter and flow control valve also may need to be installed on the discharge line to the pumping well and monitored to maintain a constant flow rate during the pump test. A water level transducer should also be installed at the end of Little Dutch Slough lateral to determine if the slough is hydraulically connected with the groundwater table and affected by the pumping well.

Alternatively, a new well could be constructed with a design based on existing well designs in the area that would be sited adjacent to infrastructure planned to have future groundwater demands (i.e., adjacent to surface water lakes and street landscaping) with the intention of serving the future groundwater demands for the site. Once installed, a long-duration pump test, similar to the one described above could be conducted to determine this well's safe yield. In any event, a pump test must be performed on the actual wells to be used to establish their sustainable aquifer yield.

Multiple groundwater quality samples should also be collected at set intervals during the test to determine if changes in water quality are experienced as a result of changes in the flow field during the test. The samples should be analyzed for general minerals and nitrates. It does not appear to be necessary at this time to assess surface water quality from adjacent sloughs during the test.

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

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

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

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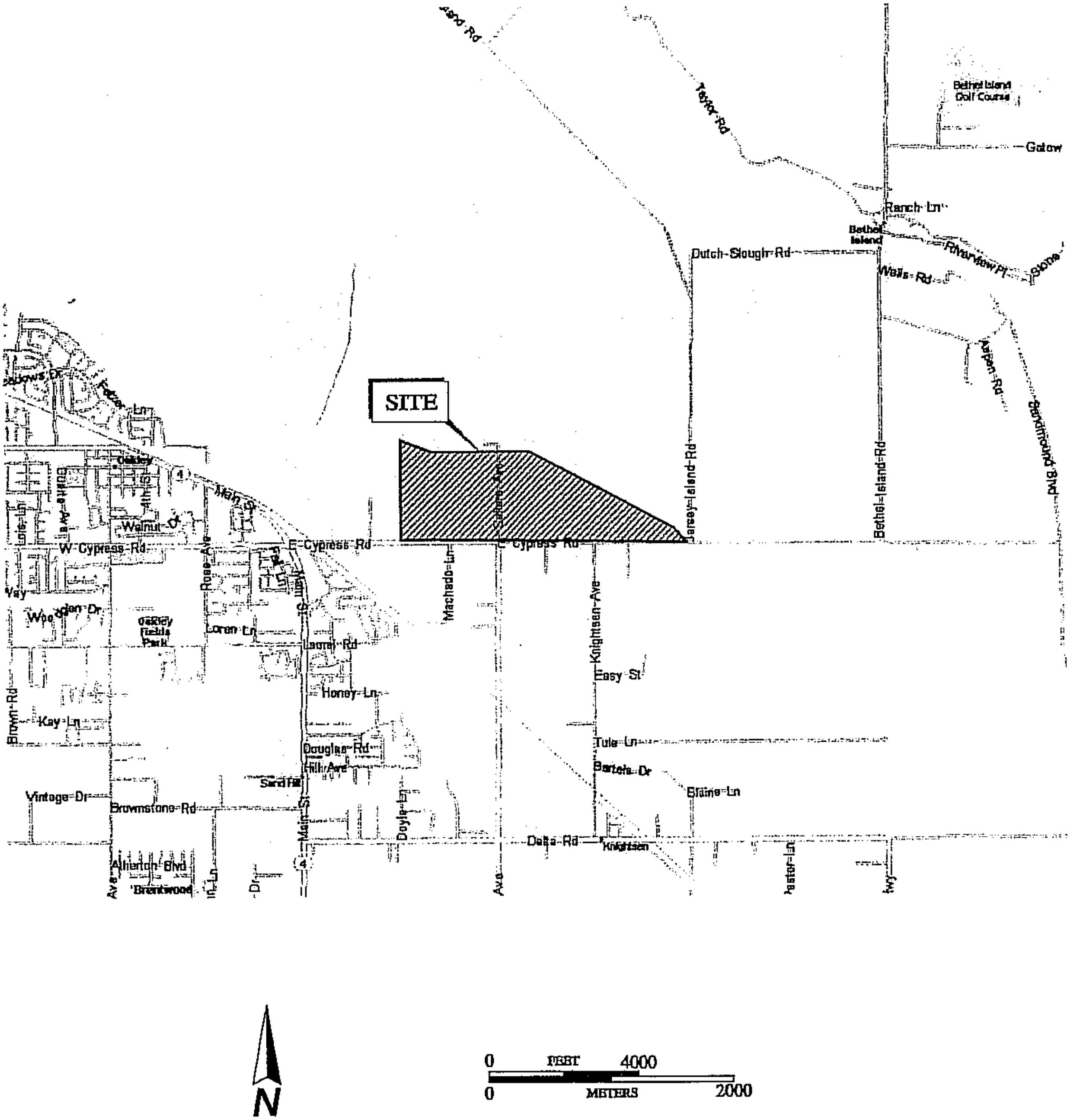
LIST OF FIGURES AND TABLE



BASE MAP SOURCE: MS STREETS AND TRIPS

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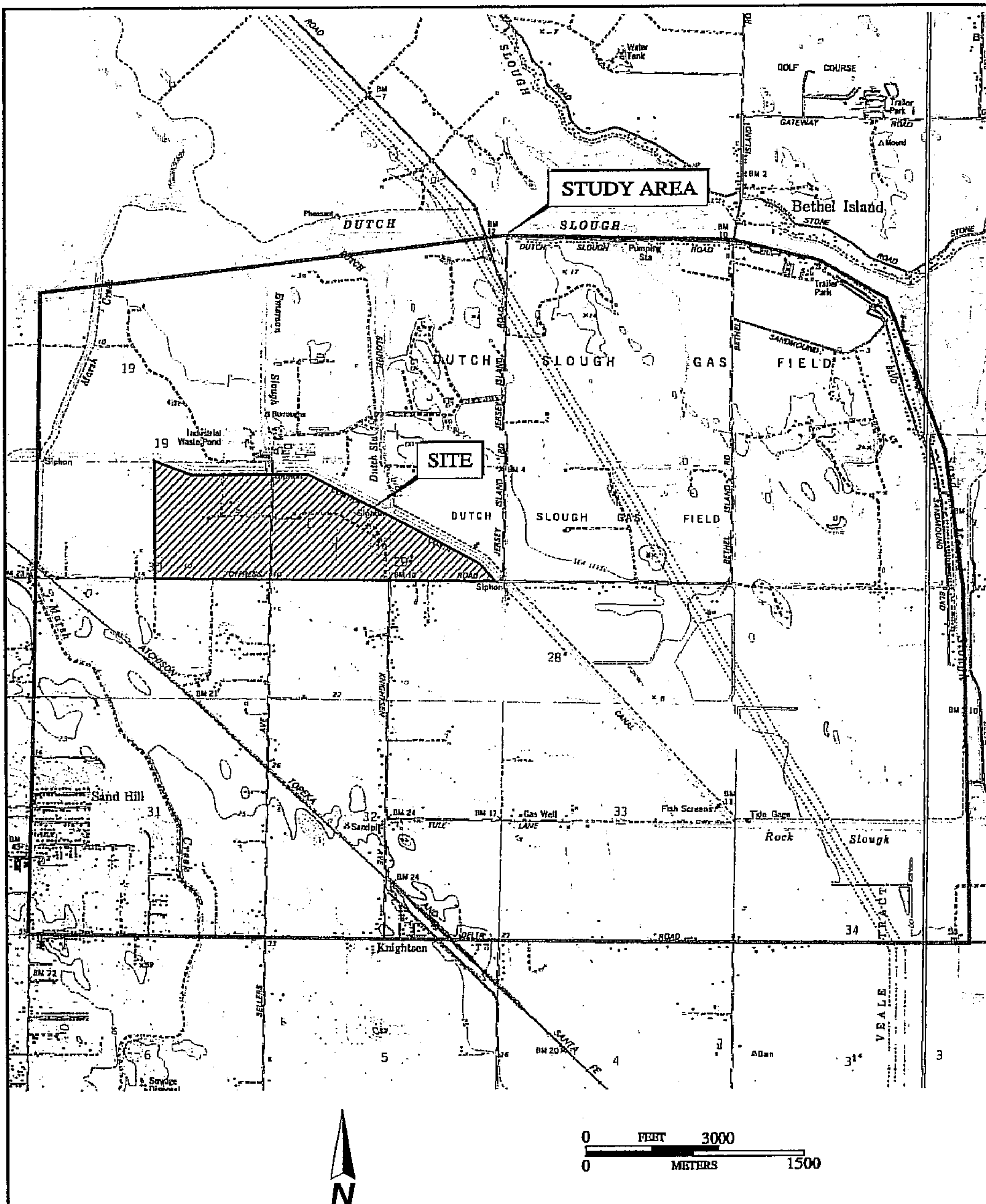

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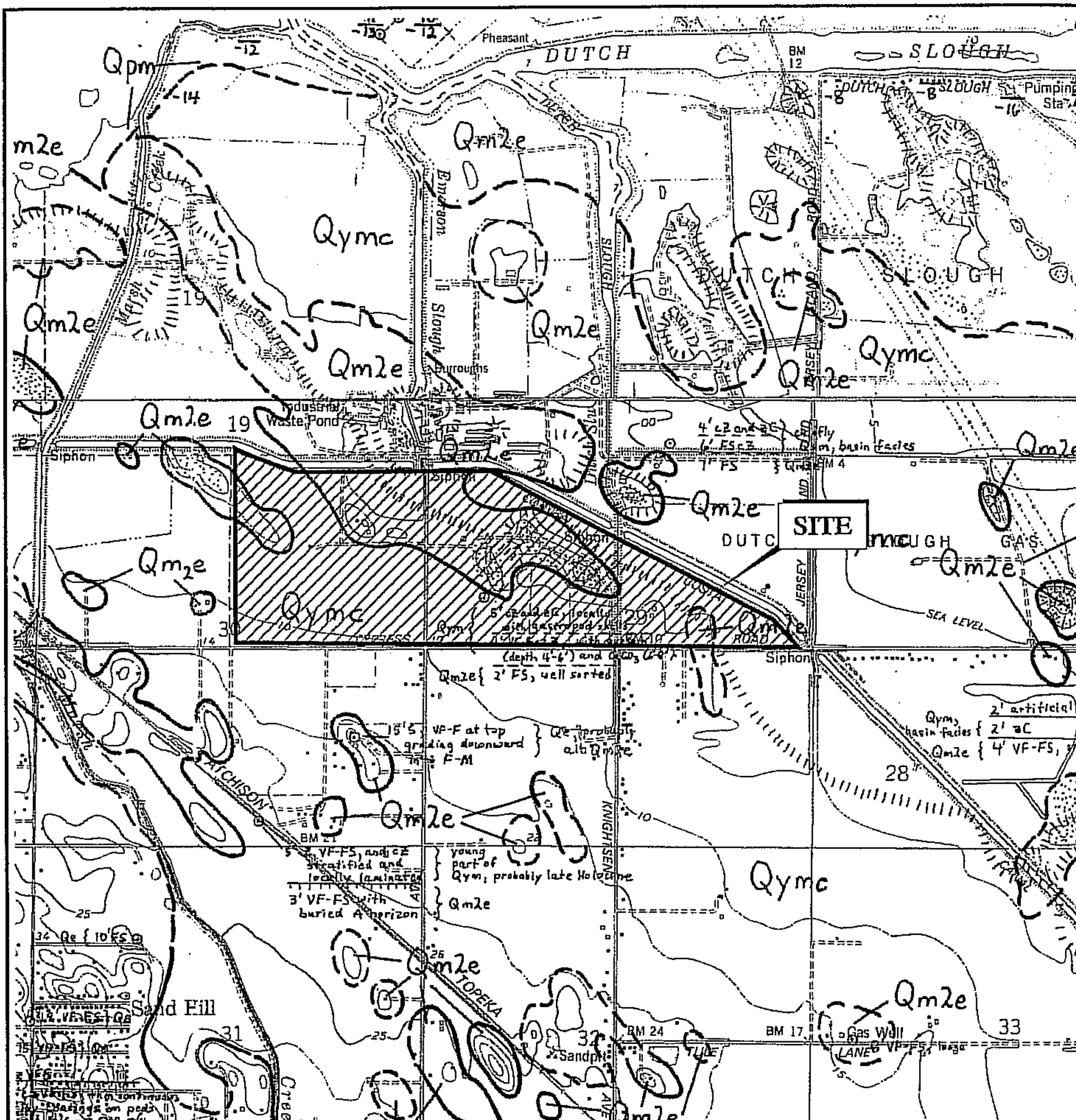

EXPLANATION

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Qm2e EOLIAN DEPOSITS OF UPPER MEMBER OF THE MODESTO FORMATION (UPPER PLEISTOCENE)

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BASE MAP SOURCE: ATWATER, 1982

ENGEO INCORPORATED — EXCELLENT SERVICE SINCE 1971	GEOLOGIC MAP EMERSON AND BURROUGHS PROPERTIES CONTRA COSTA COUNTY, CALIFORNIA	PROJECT NO.: 4603.4.101.02 DATE: OCTOBER 2005 DRAWN BY: JEP CHECKED BY: SM	FIGURE NO. 3

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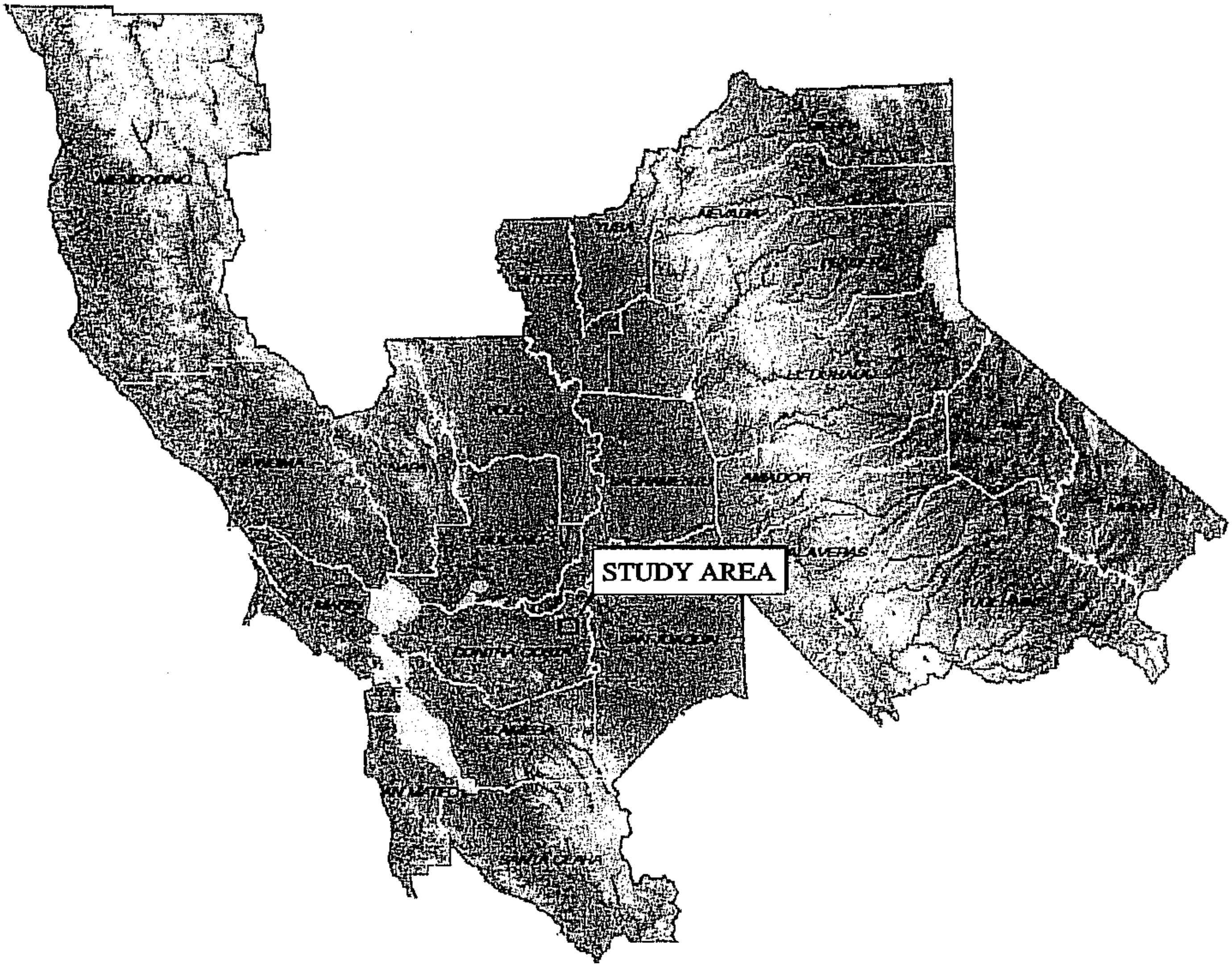

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BASE MAP SOURCE: STATE OF CALIFORNIA

ENGEO INCORPORATED
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DWR CENTRAL DISTRICT BOUNDARY
EMERSON AND BURROUGHS PROPERTIES
CONTRA COSTA COUNTY, CALIFORNIA

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FIGURE NO. 4

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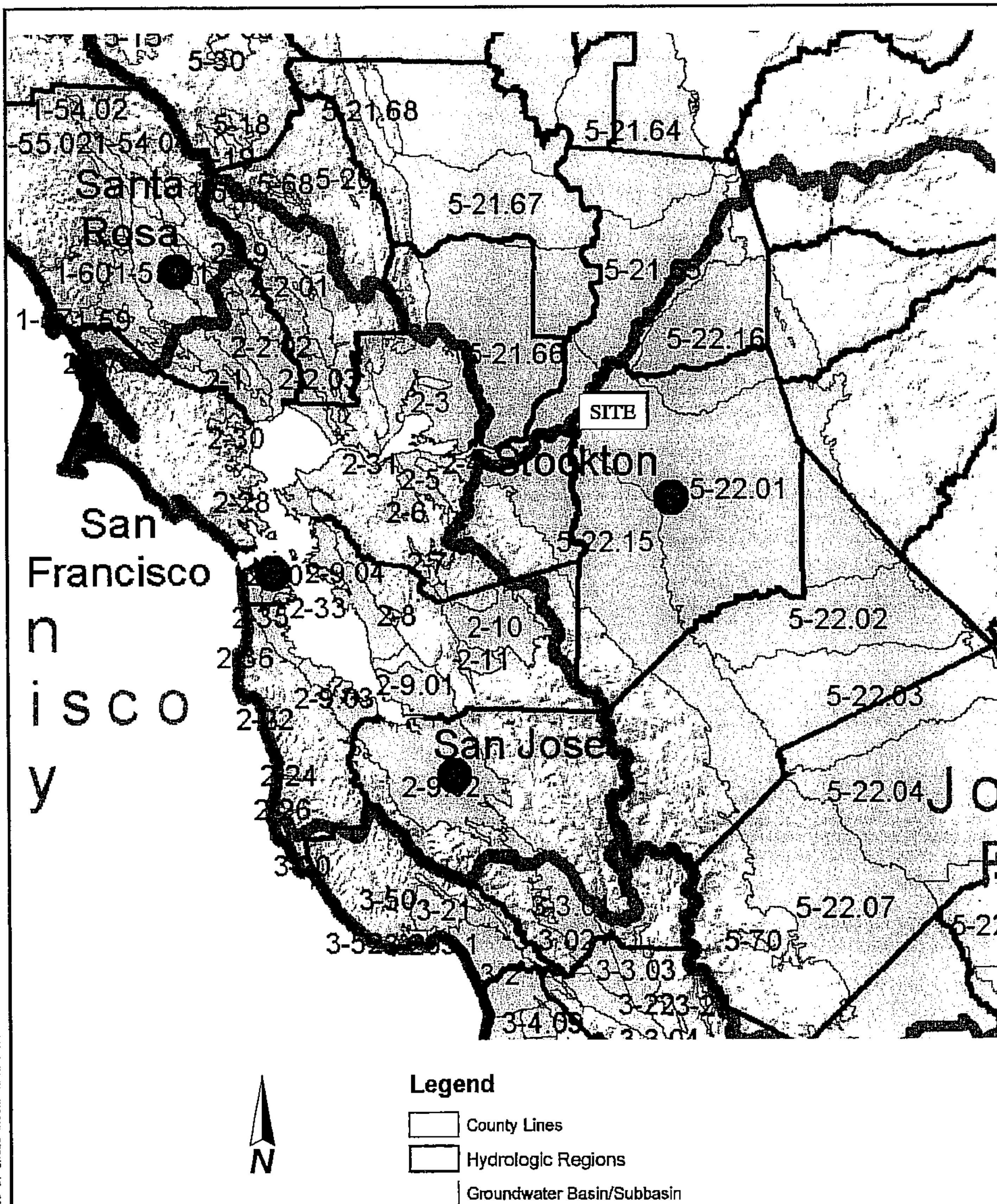

BASE MAP SOURCE: STATE OF CALIFORNIA

NO SCALE

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	GROUNDWATER BASIN BOUNDARIES EMERSON AND BURROUGHS PROPERTIES CONTRA COSTA COUNTY, CALIFORNIA	PROJECT NO.: 4603.4.101.02 DATE: OCTOBER 2005 DRAWN BY: JEP CHECKED BY: SM	FIGURE NO. 5

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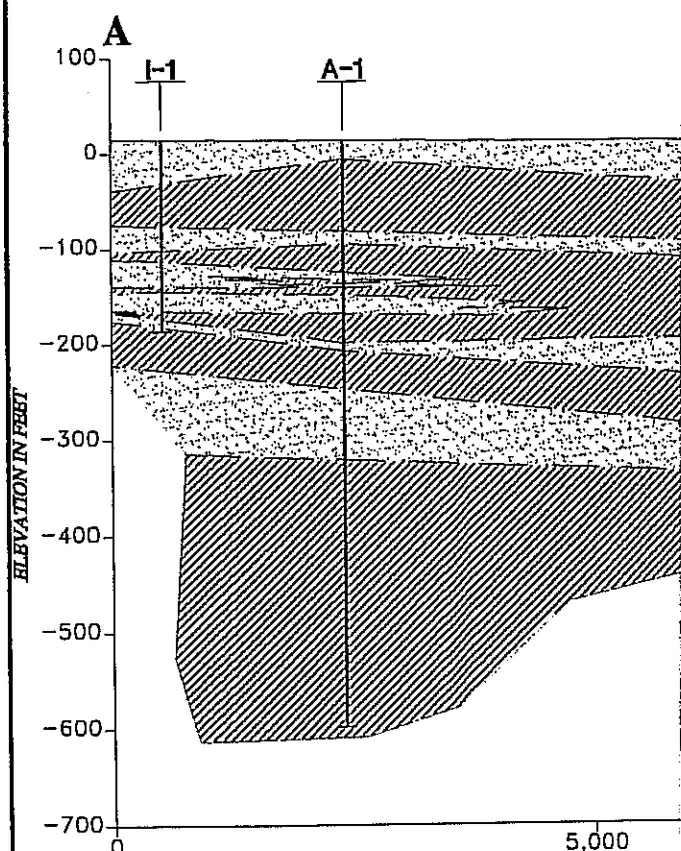

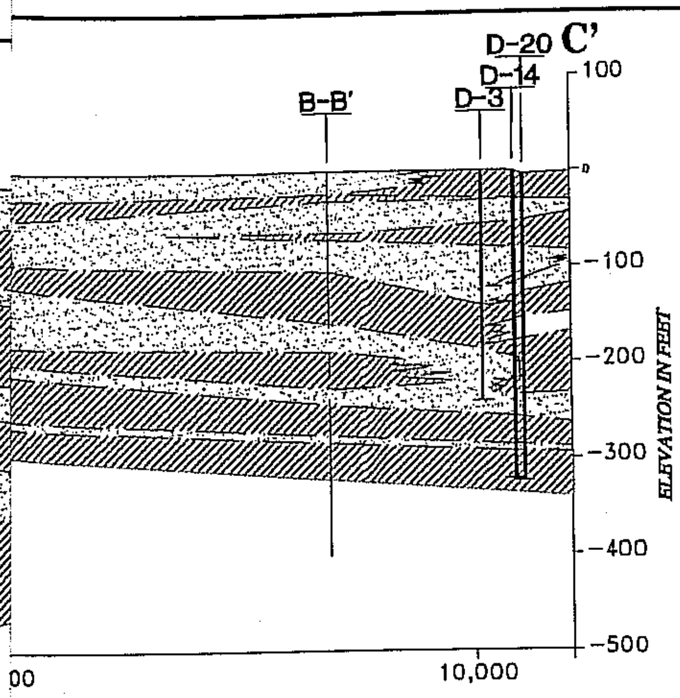

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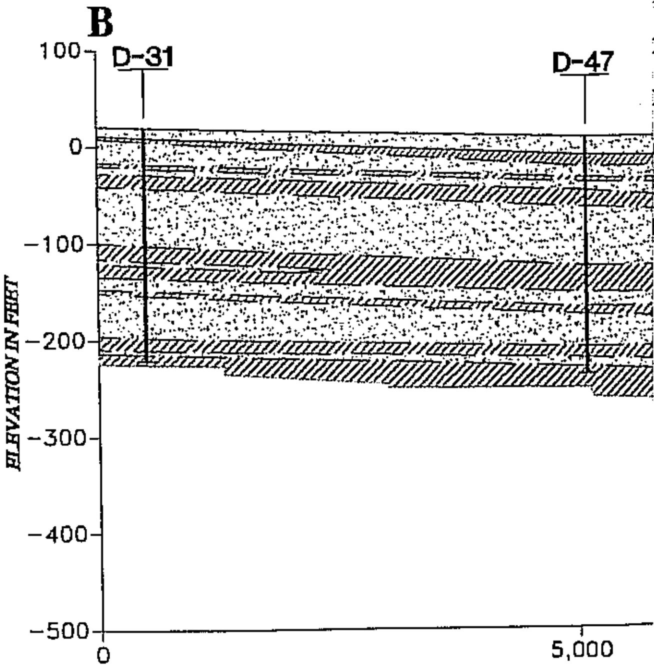

LANATION

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PROJECT NO.: 4603.4.101.02		FIGURE NO. 7
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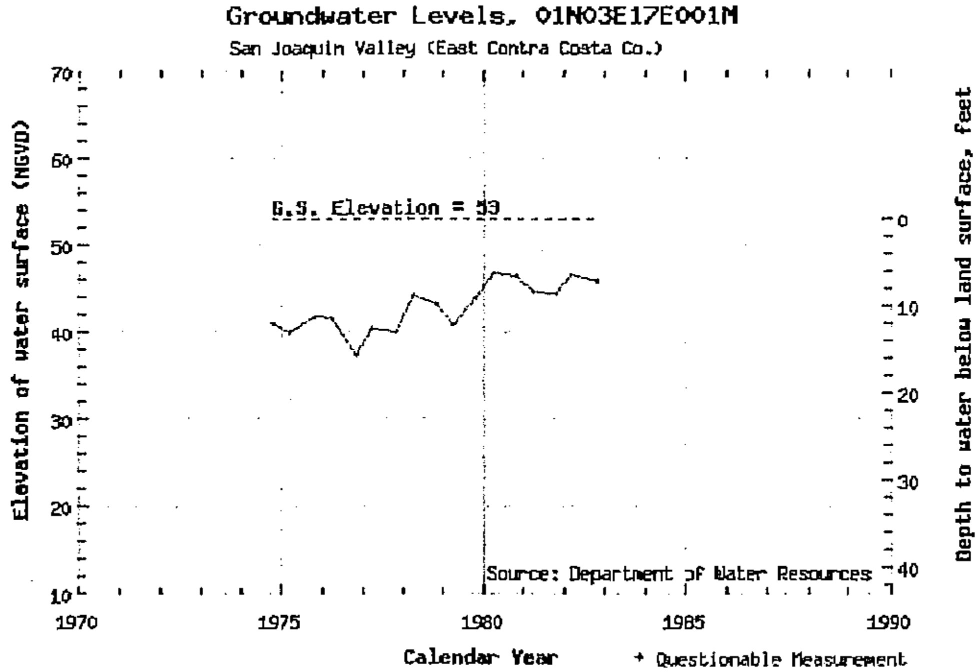

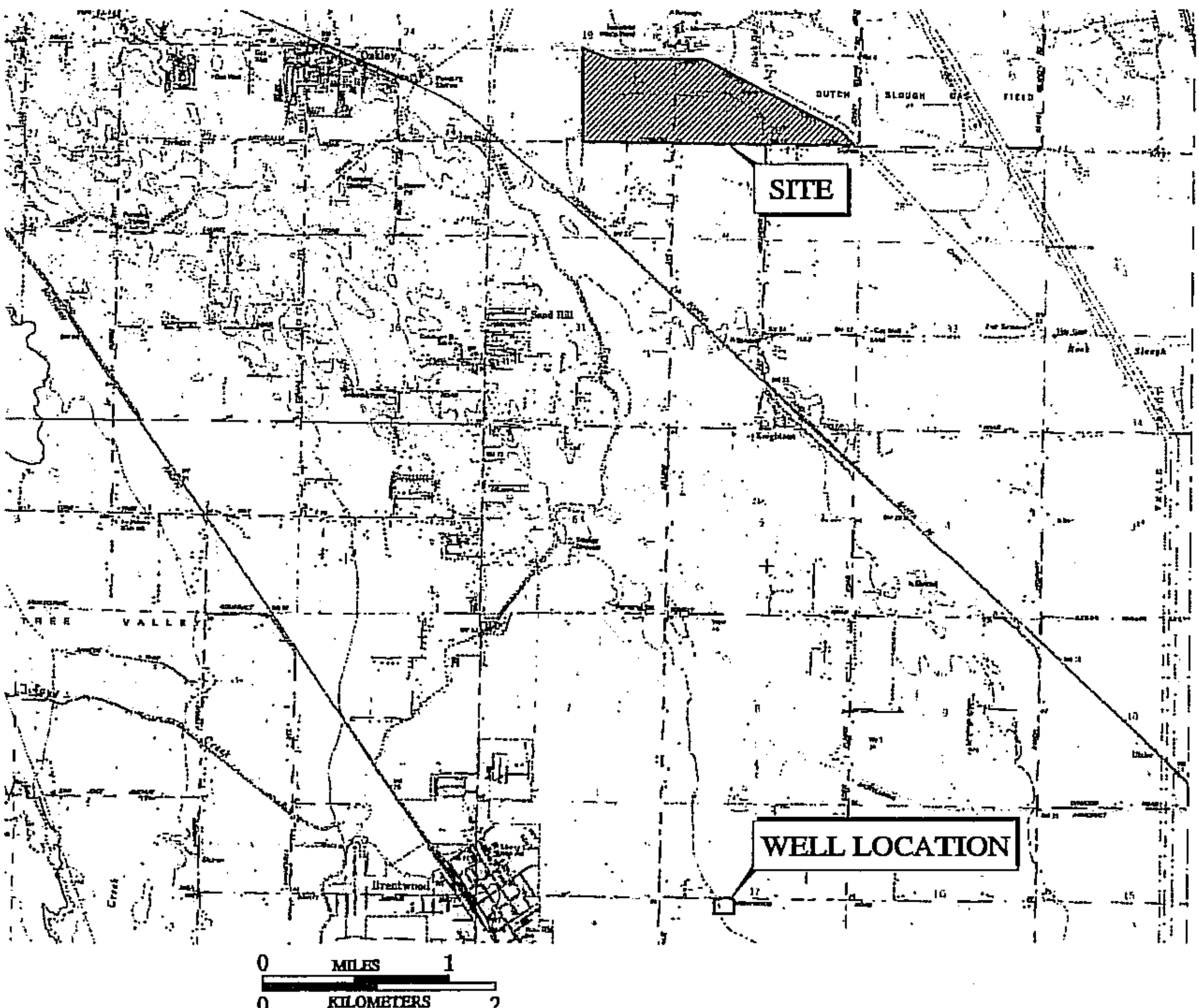

BASE MAP SOURCE: USGS

ENGEO INCORPORATED
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HISTORIC GROUNDWATER LEVELS
EMERSON AND BURROUGHS PROPERTIES
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.: 4603.4.101.02		FIGURE NO. 8
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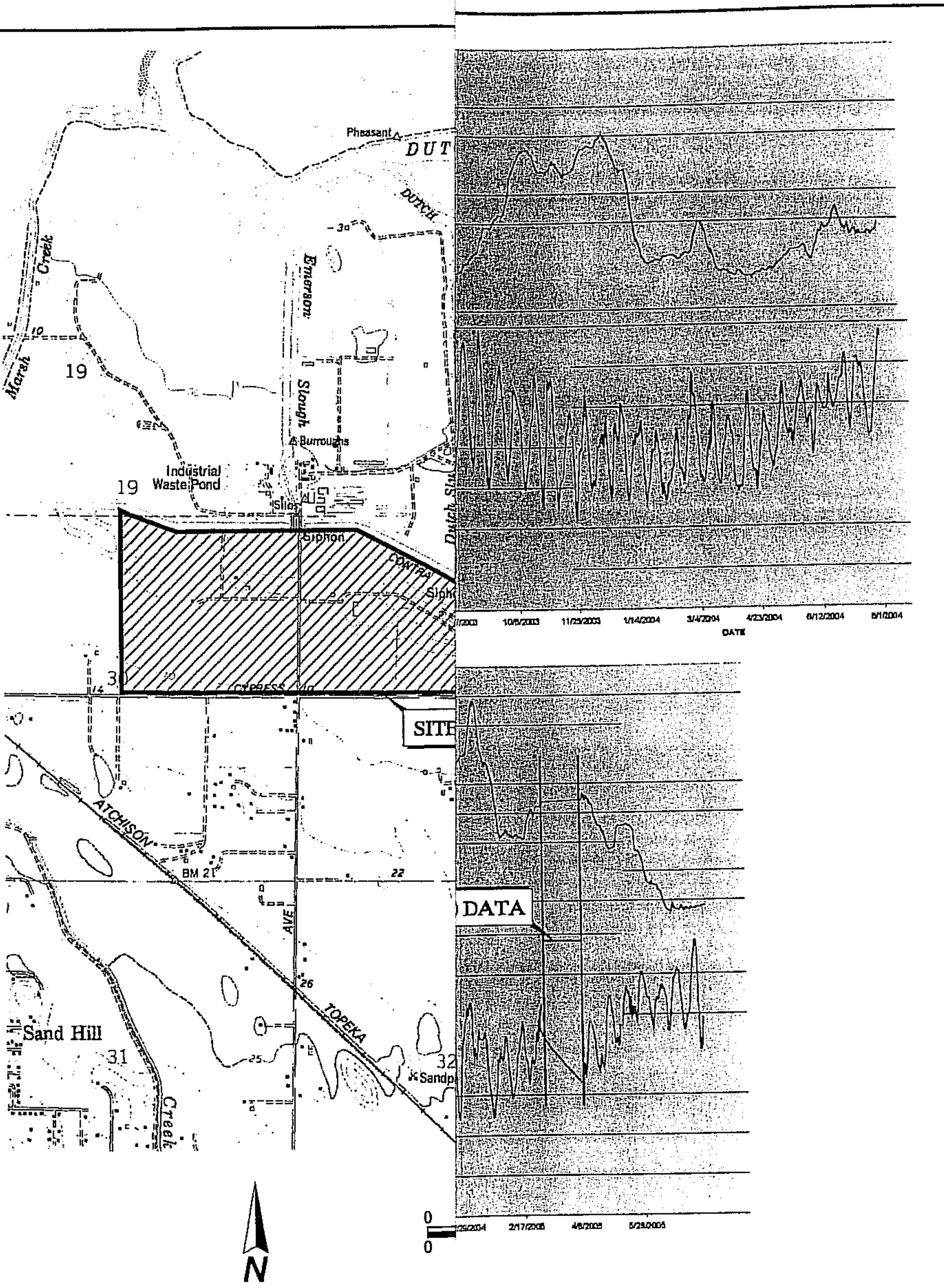

ROCK SLOUGH	PROJECT NO.: 4603.4.101.02	FIGURE NO.
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GROUNDWATER STUDY

EMERSON PROPERTY

Table I - Existing and Historical Well Details Based on Water Well Drillers Reports

Well Identifier	Date Drilled	Location	Owner Name	Total Depth	Log Available	Casing Depth	Casing Diameter	Seal Depth	Screen Type	Screen Interval	Formation Stabilizer	Depth to Groundwater	Date Measured	Well Yield	Average Pump Rate	Existing /Idle/ Destroyed?
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
I-1	9/5/1980	South side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	200	Y	180	10	153	Slot (0.45")	155 - 180	#3-16	20	9/5/1980		80-160	E
I-2D	1/11/1982	North side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	198	Y	190	10	153	Slot (1/32")	160 - 190	#3-16	22	1/12/1982			D; 6/21/1993
I-3	6/23/1993	North side of Emerson second milk barn at end of Sellers Avenue	Emerson Dairy	191	Y	190	10	153	Slot (1/32")	160 - 190	1/4" Gravel	30	6/24/1993		20	E
I-4D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	85	N	85	8									D; 3/6/1998
I-5D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	170	N	170	3									D; 3/6/1998
I-6D	1/1/1965	Northeast side of Emerson first milk barn at end of Sellers Avenue	Emerson Dairy	160	N	160	3									D; 3/6/1998
D-1	1/1/1905	Emerson Residence west of Sellers Ave	Stan Emerson		N											E
D-2	4/15/1984	West of Jersey Island Road north of Cypress Rd	Vaughn Hummel	240	Y	235	6	210	Slot (0.45")	215 - 235	#3-16	11	4/15/1984			E?
A-1	8/10/1959 to 12/19/1959	5/8 mi N and 100 ft E of Cypress and Sellers Ave	Burroughs Brothers	610	Y	333	18	31	Torch (1/4")	161 - 185; 209 - 233; 257-333	3/4" gravel					
A-2	10/13/1961 to 11/16/1961	1 mi N and 1/4 mi W from Cypress and Jersey Island Roads	Burroughs Brothers	428	Y	350	22	200	Torch (1/4")	206 - 254; 302 - 305	3/4" gravel					
M-1	7/6/1985	On Dutch Slough Road (south side) 3/4 mi E of Jersey Island	Dutch Slough Water Works	300	Y	245	6	215	Slot (0.45")	225 - 245	#3-16	22	7/6/1985			
D-3	10/4/1979	4220 Sand Mound Road	Morgan Fong	240	Y	240	2	50	Slot (1/16")	180 - 220	1/8"	11	10/4/1979			
D-4	2/13/1981	5372 Tule Tree Lane	B. Adams	200	Y	200	2.5	40	Saw (1/8")	160 - 180	1/8"	12	2/13/1981			
D-5	7/7/1985	Sand Mound Road (southwest side)	Ellis Sidney	220	Y	210	6	175	Slot (0.45")	190 - 210	#3-16	18	7/7/1985			

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				(feet bgs)	(Y/N)	(feet bgs)	(Inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-61	1/10/1977	3600 Stone Road	Sand Mound Mutual Water Co.	201	Y	155	8	50	Screen	145 - 155	pea gravel	2	1/10/1977			
D-62	8/1/1983	2566 Taylor Road	Farrar Park Water Co.	520	Y	265	6	230	Slot (0.45")	245 - 265	#3-16	5	8/1/1983			
M-4	9/1/1983	3600 Stone Road	Sand Mound Mutual Water Co.	240	Y	152	6	120	Slot (0.45")	220 - 240	3/8" gravel	10	9/1/1983			
D-6	9/26/1983	Sandmound Road 1/2 mi east of Bethel Island Road	John Dunn	300	Y	300	6	240	Slot (0.45")	280 - 300	3/8" gravel	10	9/26/1983			
D-7	6/23/1986	3460 Sandmound Road	Monroe Long	252	Y	252	2.5	60	Saw (1/8")	232 - 252	1/8"	3	6/23/1986			
D-8D		5332 Tule Tree Lane	Diane Maybee	80	N		6									D; 1/31/1990
D-9	3/9/1989	West side of Aspen Road	Betty Bunting	270	Y	220	6	190	Slot (1/16")	200 - 220	1/4"	5	3/9/1989			
D-10	7/3/1989	3500 Sandmound Road (south side)	Greg Nordine	320	Y	300	4.5	260	Slot (1/16")	280 - 300	1/4"	4	7/3/1989			
D-11D		Wells Road at Mariner	Willow Park Marina H.O.A.	167	N		3									D; 12/1/89
D-12D		Wells Road at Mariner	Willow Park Marina H.O.A.	190	N		3									D; 12/1/89
M-5	9/24/1996	5998 Bethel Island Road (200 yds in to east)	Mark Gilbert	320	Y	300	6	240	Screen (0.40")	240 - 300	1/4" gravel	10	9/26/1997			
M-6	2/3/1972	3600 Stone Road (1/2 mi SW of Betheyl Island Road)	Sand Mound Mutual Water Co.	197	Y	161	8 5/8	50	Slot (3"x1/8")	140 - 161	pea gravel	5	2/3/1972			
D-13	6/11/1973	Tule Tree Lane	Carl Jackson	180	Y	170	6.5	0	Slot (3"x1/8")	156 - 170	pea gravel	10	6/11/1973			
D-14	5/7/1986	End of Sandmound Road	Darrell Edwards	320	Y	312	6	230	Slot (1/16")	282 - 312	#3-16	8	5/7/1986			
D-61	7/18/1984	Cypress Road 1 mi East of Kightson Road	Pacific Water Systems	260	Y	260	6	70	Screen	240 - 260	Sand & Gravel	8	7/18/1984			
D-62	7/23/1984	Cypress Road 1 mi East of Kightson Road	Pacific Water Systems	187	Y	187	4	40	Screen	169 - 187	Sand & Gravel	8	7/23/1984			
D-15	6/17/1986	Bethel Island Road	Manuel Bonilla	113	Y	113	5	50	Slot (0.05")	93 - 113	1/8"	8	6/19/1986			
D-16	7/3/1989	3761 Cypress Rd.	Charles Pringle	260	Y	250	6	195	Slot (1/16")	230-250	1/4" gravel	8				
D-17	3/30/1981	Bethel Island Road	E&C Gorgas/Bruce Their	215	Y	215	8	175	Slot (1/8x6")	175-215	3/8" pea gravel	8	4/15/1981		30 after 4 hours	
D-18	10/9/1989	1751 Tule Lane	Robert Lloyd	160	Y	140	6	55		120-160	Sand		10/9/1989			

GROUNDWATER STUDY

EMERSON PROPERTY

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				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-19	12/12/1989	Sellars Ave	Fred & Jan Grexton	180	Y	120	6	80	Slot (1/16")	100-120	1/4" Gravel	20	12/13/1989			
D-20	11/30/1989	End of Sandmound Road	James Aberer Jr.	320	Y	255	4.5"	200	Slot (1/16")	235-255	1/4" Gravel	5	12/2/1989			
A-3	10/19/1984	Delta Road in Contra Costa County	Rich Fuller	260	Y	245	8	70	45th	225-245	#3-16	11	10/19/1984			
D-21	4/11/1978	Third Lot on east side of Crismore Rd., Parcel C	Travis Crismore	139	Y	135	6	20	Slot (1/16")	115-135	#3-16	15	4/17/1978		250	
D-22	1/27/1978	5 miles south of Bethel Island on Sandmound Rd.	EJ Brown	160	Y	180	3	20	Slot (1/16")	162-182		5	1/27/1978			
D-23	8/11/1981	Delta Road in Contra Costa County	Al Fuller	240	Y	240	6	70	45th	220-240	#3-16	10	8/11/1981			
D-24	8/12/1981	Delta Road in Contra Costa County	Rich Fuller	260	Y	245	6	70	45th	225-245	#3-16	12	8/12/1981			
D-25	2/21/1973	Delta and Eden Plains Rd., past school	Carl Jackson	110	Y	75	6.5		Slot (1/8x3")	65-75	pea gravel	17	2/21/1973			
D-26	12/12/1997	2800 Delta Rd.	Zenalda Ramirez	160	Y	140	6	115	slot (40/1000")	115-140	1/4" Gravel	7	12/12/1997			
A-4	4/16/1987	Tule Lane	Dante Massoni	180	Y	141	6	80	Slot (1/16")	121-141	1/4" Gravel	18	4/16/1987			
D-27	7/19/1989	4019 Meadows Lane Oakley	Mr. Showaker	160	Y	155	6	125	Slot (1/16")	135-155	1/4" Gravel	30	7/20/1989			
A-5	11/24/1987	North end of sellers Ave on West side down road	Emerson Dairy	180	Y	180	10	155	Slot (1/16")	155-185	1/4" Gravel	20	11/28/1987			
D-28	11/6/1985	Machado Ln., Oakley	L.H. Bennet	113	Y	113	5	30	0.04	103-113	1/8" Gravel	19	11/6/1985			
D-29	Jun-83	Machado Ln., Oakley	Paulino Hajas	100	Y	90	6	46	45th	70-90	#3-16	27	Jun-83			
D-30	Aug-82	Sellars Ave., 1/2 mi. south of Cypress, west side	D.C. Ellison	180	Y	165	6	60	45th	145-165	#3-16	15	Aug-82			
D-31	9/28/1984	Sellars Ave.	Gary Frost	240	Y	235	6	175	45th	195-235	#3-16	17	9/28/1984			
D-32	5/1/1987	300 Yards South of Cypress Rd. on West side of Sellars Ave.	Juan Nodal	122	Y	122	4.5	50	0.02	102-122	pea gravel	18	5/1/1987			
D-33	7/25/1985	North Sellars Ave	Manuel Gansalves	175	Y	163	6	130	0.045	143-163	#3-16	18	7/25/1985			
D-34	6/26/1985	Laurel Rd.	Jim Nabas	140	Y	134	6	112	0.045	114-134	#3-16	26	6/27/1985			
D-35	1/24/1978	Cypress Road 2 mi south of bethel island	Floyd Duegon	230	Y		6	20	Slot (1/16")	212-232	pea gravel	10	2/9/1978			
D-36	12/26/1984	Rt 2 Box 210-a Oakley CA	Donald Durst	230	Y	210	6	150	0.045	190-210	#3-16	5	12/26/1985			
D-37	12/23/1996	2901 E Cypress Road	Milan Petrovich	240	Y	200	5	165	Slot (1/32")	180-200	1/4" Gravel	8	12/23/1996			

GROUNDWATER STUDY

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				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-38	12/1/1997	2521 E Cypress Road	Pam Boyce	240	Y	217	6	195	0.04	197-217	1/4" Gravel	4	12/28/1997			
D-39	9/28/1980	South side of cypress, between sellers & knightsen	George Ferreira	140	Y	120	6	45	45th	100-120	#3-16	8	9/28/1980			
D-40	11/2/1981	Knightsen Ave 1/2 mile south of cypress rd.	James Baca	140	Y	135	6	50	45th	115-135	#3-16	13	11/2/1981			
D-41	7/12/1978	Sellars Rd 1000' south of cypress rd, east side	John Moore	100	Y	100	6	20	"screen"	80-100	Birdseye	11	7/12/1978			
D-42	3/14/1979	Knightsen Ave one mile south of Cypress on West side of road	Don Kirkpatrick	138	Y		6	37	45th	118-138	1/4" Gravel	20	3/14/1979			
D-43	4/18/1979	East side of Knightsen Ave 0.3 miles south of Cypress Ave	Bill Parkhurst	146	Y	125	6	38	45th	105-125	#3-16	6	4/18/1979			
D-44	7/10/1979	1/4 mile south of Cypress Ave on E side of Broadway st.	Louis Hernandez	240	Y	215	6	155	45th	195-215	#3-16	12	7/11/1979			
D-45	8/3/1979	100 Yds W of Jersey Island Rd. on N side of Cypress Rd	Arley Reeves	240	Y	210	6	140	45th	190-210	#3-16	10	8/3/1979			
D-46	5/26/1976	Sellars Ave, 1/4 mile S of Cypress Ave, E side	Charles Marin	100	Y	88	6	20		78-88	pea gravel	12	5/26/1976			
D-47	6/22/1976	Cypress Rd between Jersey Island & Knightsen Rd.	Ernest Burroughs	245	Y	237	6-5/8"	20	Slot (3"x1/8")	205-215, 222-237	Birdseye	15	6/22/1976			
D-48	4/25/1986	Cypress Rd. Oakley	Russel Hooper	260	Y	245	6	216	Slot (1/16")	225-245	#3-16	5	4/26/1986			
D-49	Sep-84	South of Cypress Rd.	Jim Owens	140	Y	118	6	50	45th	118-198	#3-16	10	Sep-84			
A-6	12/29/1982	1/4 mile S of Cypress Rd on Knightsen Ave	Wayne West	139	Y	138	8	70	45th	119-139	#3-16	15	12/29/1982			
D-50	10/3/1989	Cypress Rd/Broadway	Bill Koenig	220	Y	200	6-3/4"	50	0.02	200-220	1/8" pea		10/9/1989			
D-51	10/6/1973	Broadway St. off Cypress Ave, Oakley	Gelasia Velez	212	Y	212	6.5		Slot (3"x1/8")	202-212	pea gravel	10	10/6/1973			
D-52	5/8/1979	4002 Creekside Dr., Oakley	Bob Buchanan	100	Y		6	30	Slot (2x1/16")	50-100	1/4" Gravel	15	5/9/1979	150+		
D-53	9/13/1978	Oakley	Ken Grunstad	152	Y	152	6-5/8"	40	Slot (3"x1/8")	122-142	1/4" Gravel	25	9/15/1978			
D-54	7/25/1980	North of Meadow Ln.	Edward Rogers	160	Y	154	6	50	45th	134-154	#3-16	25	7/25/1980			
D-55	7/25/1981	North of Creekside Way	Wm Bankson	160	Y	154	6	50	45th	134-154	#3-16	25	7/25/1981			

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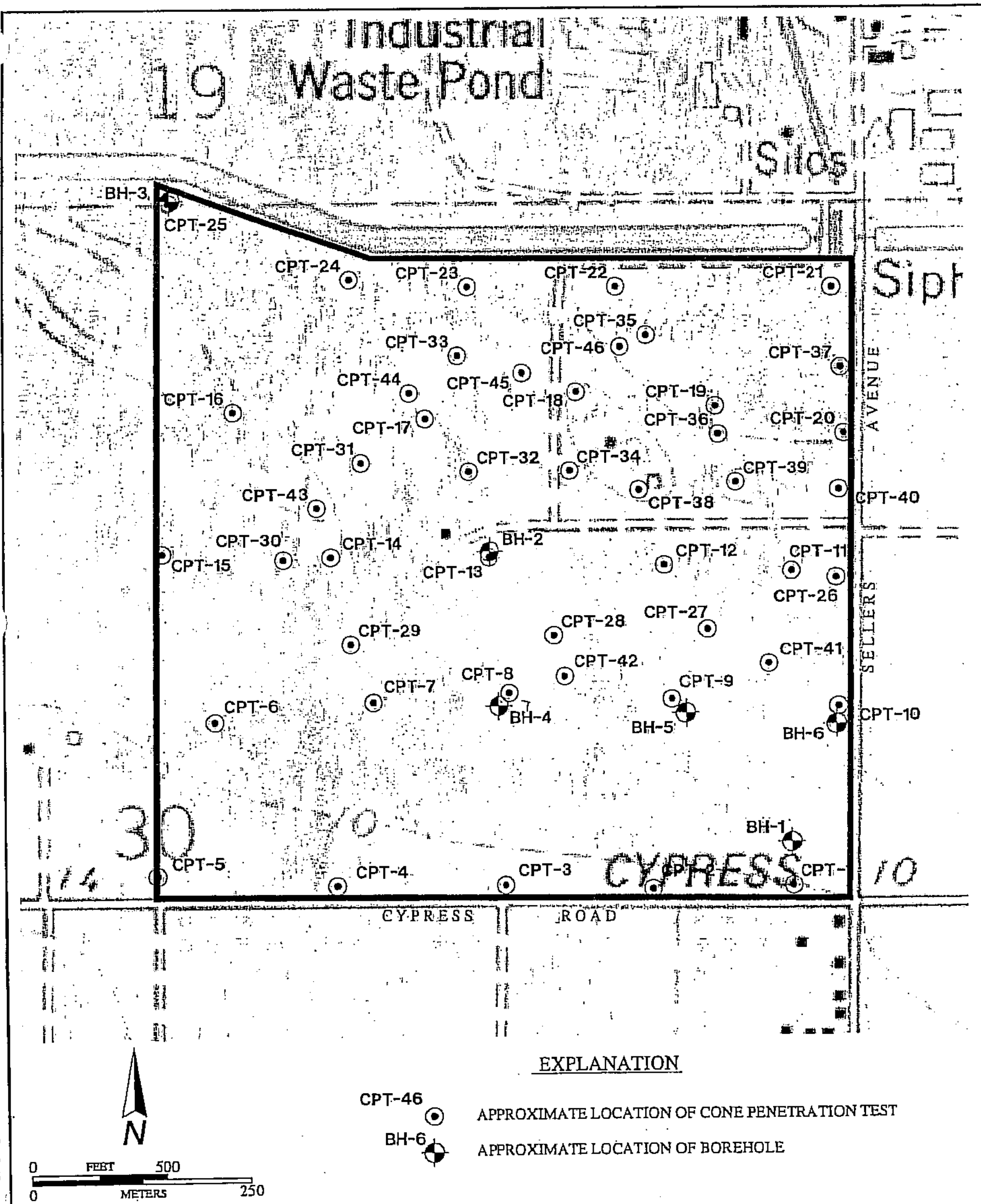
				(feet bgs)	(Y/N)	(feet bgs)	(inches)	(feet bgs)		(feet bgs)		(feet bgs)		(gpm)	(gpm)	(E/I/D)
D-56	4/25/1979	End of Laurel Rd., 1/2 mile east of Hwy 4	Steve Watty	145	Y	145	6	20	Slot (2x1/16")	115-145	3/8" gravel	19	4/27/1979	60+		
A-7	6/21/1978	Cypress Rd South 100 ft from W Machado Ln.	Frank Stonebarger	68	Y	65	3		Slot (3/16")			15	6/21/1978	100		
D-57	7/23/1979	S side of Cypress Rd 200 yards west of Sellars Ave	Steve Hinman	180	Y	159	6	50	45th	139-159	#3-16	13	7/23/1979			
D-58	3/27/1980	100ft E of Meadows Ln	Edward Rogers	155	Y	155	6	60	45th	135-155	#3-16	18	3/27/1980			
D-59	4/10/1980	NW corner of Creekside Ct	Ruben Quesada	152	Y	152	6	45	45th	132-152	#3-16	17	4/10/1980			
D-60	11/24/1986	Off Cypress Rd	Hogas Paulino	155	Y	120	8	50	45th	100-120	Sand & Gravel	15	11/24/1986			

APPENDIX A

ENGEO INCORPORATED

[illegible]



BASE MAP SOURCE: U.S.G.S.

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE PLAN
EMERSON PROPERTY
OAKLEY, CALIFORNIA

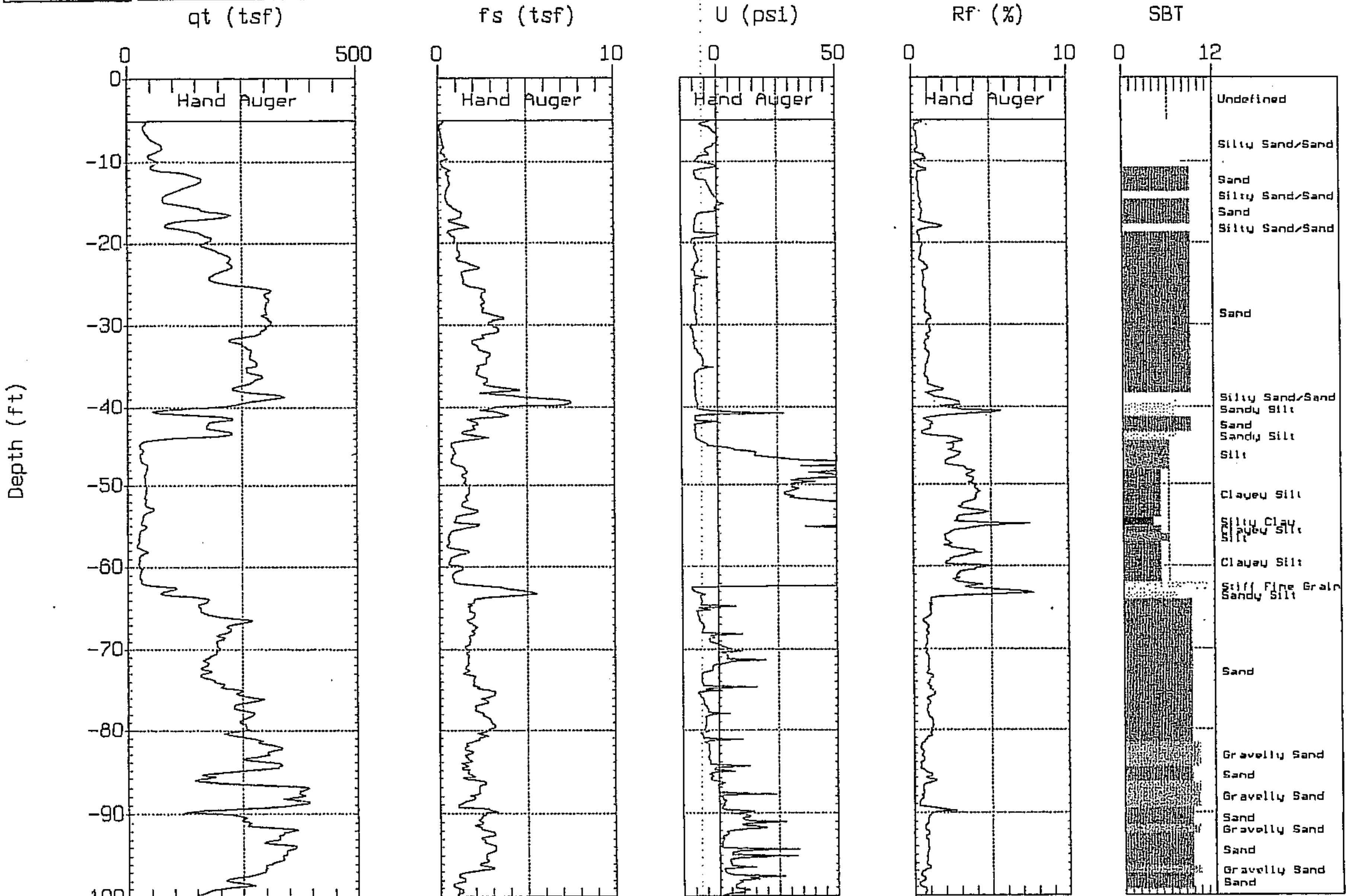
PROJECT NO.: 4603.4.100.01	
DATE: MARCH 2005	
DRAWN BY: PC	CHECKED BY: JT

FIGURE NO. 2

C:\Drafting\DRAFTING2_Dwg\4603\100\460341000l-2-SITE-0305.dwg 3-08-05 07:46:42 AM

ORIGINAL FIGURE PRINTED IN COLOR

GREGG ENGEO	Site: KB HOMES Location: SCPT-51	Engineer: S.HARRIS Date: 08:05:05 08:09



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

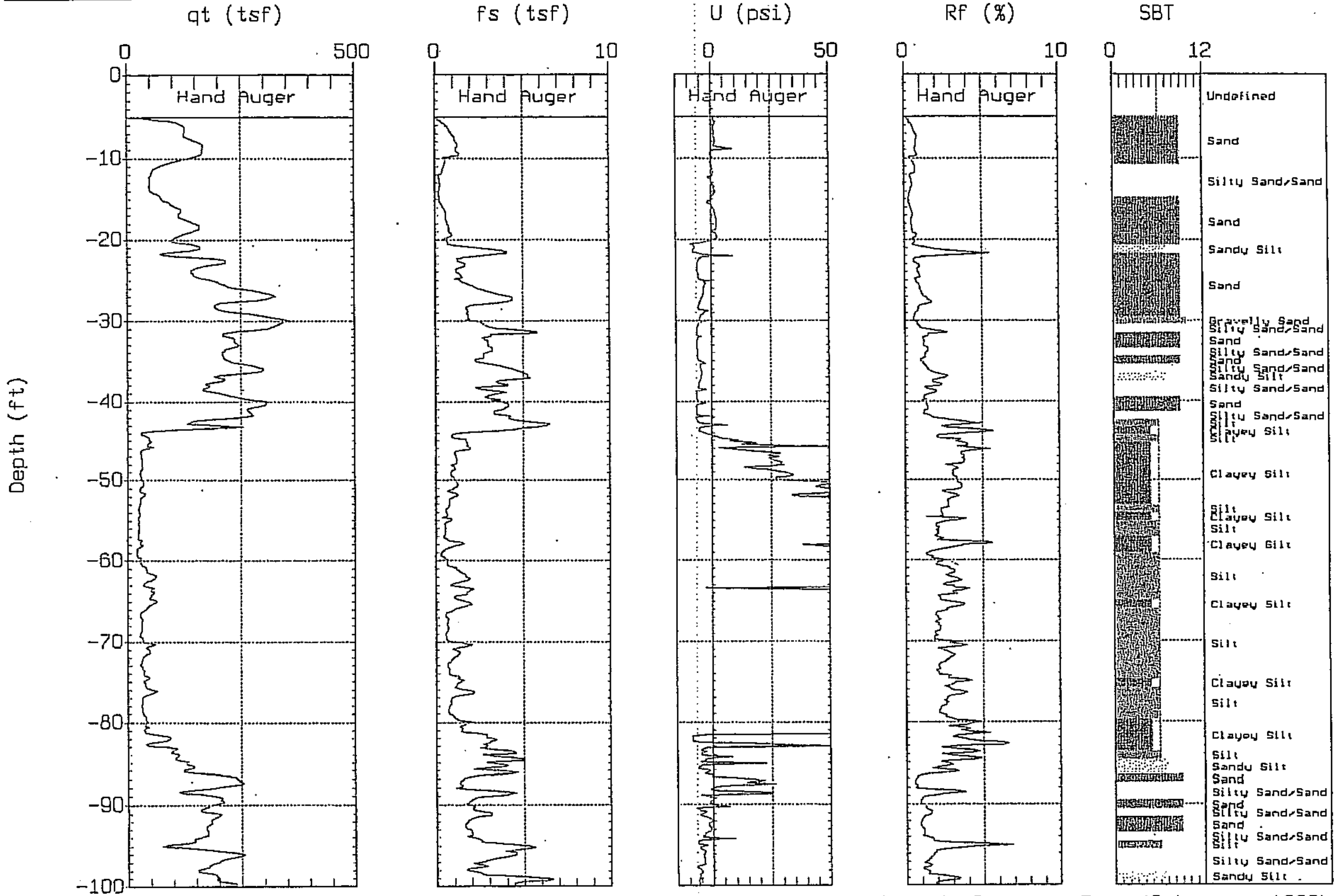
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: SCPT-52

Engineer: S.HARRIS
Date: 08:05:05 11:36



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

KEY TO BORING LOGS

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

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE — CLEAR SQUARE SIEVE OPENINGS

	200	40	10	4	3/4 "	3"	12"
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

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

CONSISTENCY

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

MOISTURE CONDITION

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

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

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

SAMPLER SYMBOLS

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

LINE TYPES

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

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

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

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

DATE OF BORING: June 14, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			Disced field / loose soil.				
	1	1-1	SILTY CLAY (CL), very dark greyish brown, very stiff, moist, with sand.	22			11.1
5	2	1-2	SILTY CLAY (CL), olive brown, medium stiff, wet. ∇	7	*0.75	85	35.7
10	3	1-3	SILTY CLAY (CL), mottled, brown, grey and olive, medium stiff, saturated, trace sand.	6	*1.0	95	29.3
15	4, 5		No sample recovered.	15			
20	6	1-4	SILTY SAND (SM), light olive brown, medium dense, saturated, trace clay, fine-grained sand.	19		103	22.1
25	7, 8	1-5	SILTY CLAY (CL) with sand, mottled olive grey and reddish brown, oxidation, stiff, saturated, with sand.	11			37.2
30	9		SILTY SAND (SM), light olive brown, very dense, saturated, medium- to fine-grained sand, some silt.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES
OAKLEY, CALIFORNIA

BORING NO.: B-1
LOGGED BY: Z. Crawford
CHECKED BY
PROJ. NO.: 4603.4.100.01
FIGURE NO. A-1

ENGEO BOREL... 60341000I EMERSON PROPERTY.GPJ 3/10/05

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: June 14, 2004 SURFACE ELEVATION: Approx. 12 feet (4 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		1-6			79		113	17.7
	10							
35	11	1-7		SAND (SP), greyish brown, very dense, saturated, medium- to fine-grained sand, some silt.	54		115	17.1
40	12	1-8			40			21.0
	13							
45	14	1-9		CLAYEY SILT(ML) with sand, olive greyish brown, very stiff, saturated, fine-grained sand.	19			26.7
50	15	1-10		CLAYEY SILT (ML), olive grey, hard, saturated, some oxidation.	31	*3.0	102	24.4
	16			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				
55	17							
60	18							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-1

ENGEO BOREL .60341000I EMERSON PROPERTY.GPJ 3/10/05

DATE OF BORING: June 15, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil.				
				SAND with silt (SM), olive brown, medium dense, moist to wet, fine-grained sand.				
	1	2-1			15			7.3
5				No sample recovered.	12			
				▽				
	2			SILTY SAND (SM), light olive brown, loose, saturated, some silt, fine-grained sand.				
		2-2			7			17.2
10	3							
		2-3			6			22.0
	4							
15				SILTY SAND (SM), light olive brown, medium dense, saturated, fine-grained sand, trace clay.				
	5	2-4			15			31.4
20	6			SAND (SP) with silt, light olive brown, medium dense, saturated, fine-grained sand.				
		2-5			20			24.6
	7							
25				SILTY SAND (SM), olive brown, dense, saturated, fine-grained sand.				
	8	2-6			34		112	19.0
30	9			SILTY SAND (SM), olive brown, very dense, fine-grained sand.				

DATE OF BORING: June 15, 2004

SURFACE ELEVATION: Approx. 12 feet (4 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
		2-7			92		112	19.1
	10							
35	11	2-8		SILTY CLAY (CL) with sand, olive brown, very stiff, saturated, fine-grained sand.	27			24.7
40	12, 13	2-9		SILTY SAND (SM), olive brown, very dense, saturated, fine-grained sand.	74		112	18.6
45	14	2-10		SILTY CLAY, olive, hard, saturated.	32	*4.0	98	27.1
50	15	2-11		CLAYEY SILT (ML), olive brown, hard, saturated.	49	*4.5	105	22.6
	16			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 6 feet during drilling.				
55	17							
60	18							

46034100001 EMERSON PROPERTY.GPJ 3/10/05

ENGEO_BOREL

ENGEO INCORPORATED

EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-2

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION (DATE OF BORING: June 15, 2004; SURFACE ELEVATION: Approx. 10 feet (3 meters))	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				Loose soil, dry grass. SAND with some silt (SP), light brown, loose to very loose, dry.				
	1	3-1		CLAY (CH), dark grayish brown, oxidation, stiff, wet, some silt. ▽	10	*3.0	90	30.2
5	2							
10	3	3-2		SILTY SAND (SM), brown, loose, saturated, loose medium- to fine-grained sand.			95	17.7
		3-3		CLAY with some silt (CL), olive brown, medium stiff to stiff, saturated, trace sand.	9	*1.5	107	21.4
15	4, 5	3-4		CLAY (CL), mottled brown and gray, stiff, saturated, trace silt.	12	*2.0	85	36.3
20	6	3-5		SAND with silt (SM), yelloish brown, medium dense, saturated, fine-grained sand.	24		111	18.9
25	7, 8	3-6		SAND with silt (SP), olive gray to olive brown, very dense, saturated, fine-grained sand.	66			17.0
30	9							

EMERSON PROPERTY - SOUTHERN 140 ACRES
OAKLEY, CALIFORNIA

BORING NO.: B-3
LOGGED BY: Z. Crawford
PROJ. NO.: 4603.4.100.01
CHECKED BY
FIGURE NO. A-3

DATE OF BORING: June 15, 2004

SURFACE ELEVATION: Approx. 10 feet (3 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
	10	3-7			50			23.2
35	11	3-8		SAND with silt (SM), olive brown, medium dense, saturated, fine-grained sand.	26			22.0
40	12, 13	3-9		SILT (ML) with sand, olive brown, medium dense, saturated, fine-grained sand, trace clay.	14			31.4
45	14	3-10		SILTY CLAY (CL), light olive brown, very stiff, saturated, trace sand.	23			23.9
50	15	3-11		SILTY CLAY (CL), olive brown, hard, saturated.	52		110	20.7
55, 60	16, 17, 18			Bottom of boring at approximately 51.5 feet. Groundwater encountered at 4 feet during drilling.				

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY - SOUTHERN 140 ACRES

OAKLEY, CALIFORNIA

BORING NO.: B-3

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-3

DATE OF BORING: July 2, 2004

SURFACE ELEVATION: Approx. feet (meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated.				
5				∇				
		4-1				*1.0		
	2	4-2		CLAY with some sand (CL), olive brown, medium stiff, saturated.	7	*0.75		
		4-3				*1.0		
10	3	4-4		SANDY CLAY (CL), olive brown, stiff, saturated, fine-grained sand.	9	*1.5		
				Bottom of boring at approximately 10 feet. Groundwater encountered at 5.5 feet during drilling.				
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-4

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-4

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, stiff, moist.				
	1			CLAY with some silt (CL), olive brown, stiff, wet to saturated. ∇				
5		5-1				*1.0		
		5-2			7	*1.0		
	2			Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-5

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-5

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: July 2, 2004 SURFACE ELEVATION: Approx. feet (meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY CLAY (CL), olive brown, very stiff, moist, trace sand.				
	1	6-1			7	*3.5		
5				▽CLAY with some silt (CL), dark olive brown, medium stiff, wet to saturated.				
		6-2				*0.75		
	2	6-3			5	*0.75		
				Bottom of boring at approximately 6.5 feet. Groundwater encountered at 5 feet during drilling.				
10	3							
	4							
15	5							
20	6							
	7							
25	8							
30	9							

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

EMERSON PROPERTY

OAKLEY, CALIFORNIA

BORING NO.: BH-6

LOGGED BY: Z. Crawford

PROJ. NO.: 4603.4.100.01

CHECKED BY

FIGURE NO. A-6

LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
1	0	0.00	0	50	0	pass
2	3.5	14-17.5	0.84	14	3.5	pass
3	5	7-12	1.2	7	7	borderline
	1	13 – 14	0.24			
	1	19 – 20	0.24			
4	1	15 – 16.5	0.24	15	3	pass
	2	22 – 23.5	0.48			
5	3.5	23 – 27.5	0.84	23	3.5	pass
6	3.5	17 – 20.5	0.84	17	3.5	pass
7	3	12.5 -15.5	0.72	12.5	3	pass
8	1.5	16 – 17.5	0.36	16	1.5	pass
9	2.5	19.5 – 22	0.6	19.5	2.5	pass
10	3	15.5 -18.5	0.72	15.5	3	pass
11	9.5	6 – 15.5	2.28	6	9.5	fail
12	8	6.5 – 14.5	1.92	6.5	10.5	fail
	2.5	21 – 23.5	0.6			
13	5	6.5 – 11.5	1.2	6.5	6	fail
	1	22 – 23	0.24			
14	9	6 – 15	2.16	6	9	fail
15	2	18 – 20	0.48	18	2	pass
16	5	7 – 12	1.2	7	5	pass
17	6	6.5 – 12.5	1.44	6.5	6	fail
18		0			0	
19	5.5	5 – 10.5	1.32	5	6.5	fail
	1	11.5 -12.5	0.24			
20	0.7	5.2 – 5.9	0.17	5.2	9.5	fail
	5	6.7 – 11.7	1.2			
	0.7	12.6 – 11.3	0.17			
	3	14 – 17	0.72			
21	1.5	14.2 -15.7	0.36	14.2	1.5	pass

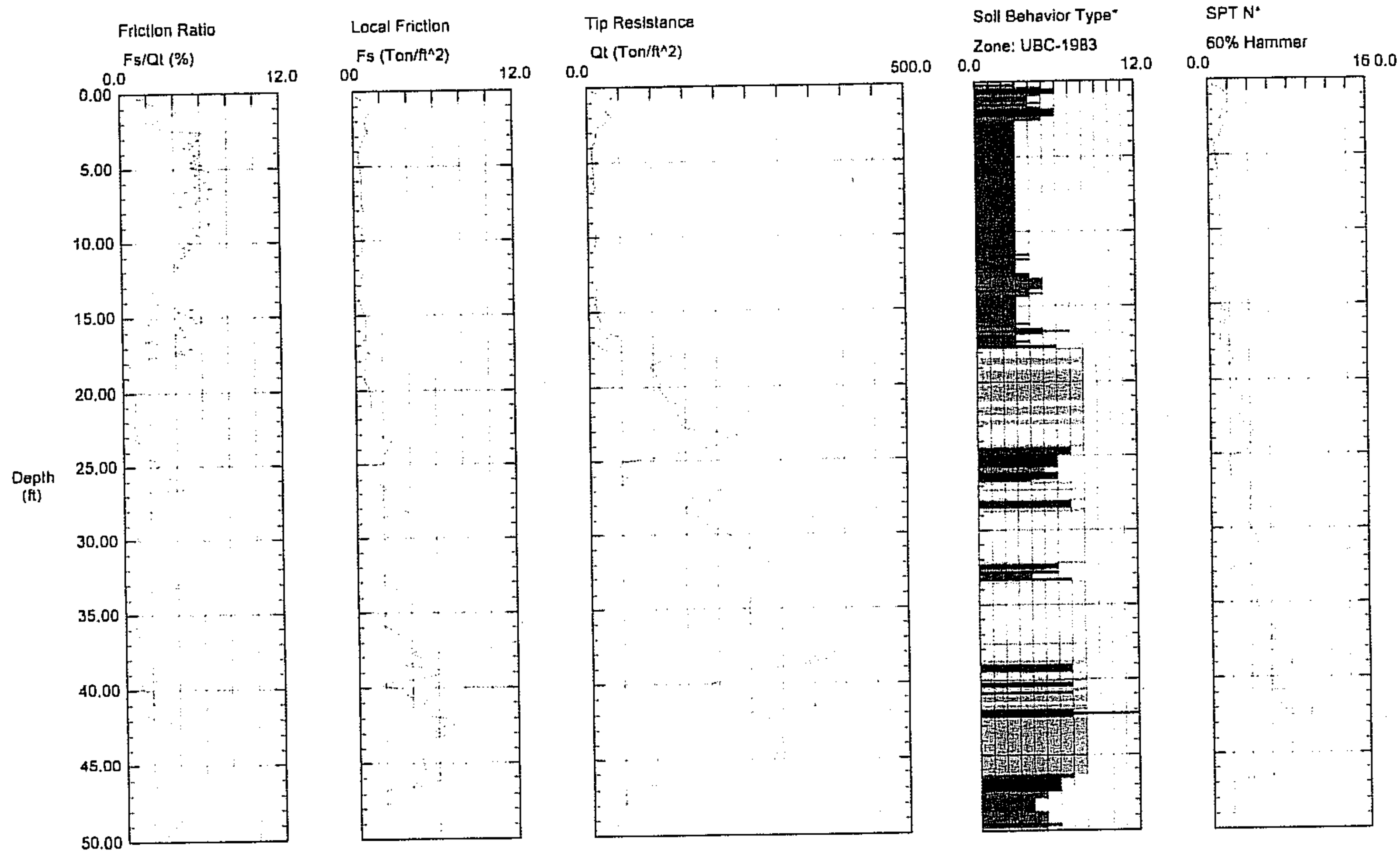
LIQUEFACTION ZONES WITHIN CPTS						
CPT #	Thickness of Layer (feet)	Depth of Layer (feet)	Settlement (inch)	Cap Thickness (feet)	Total Liquifiable Thickness (feet)	Ishihara (Pass/Fail)
22	1	6 - 7	0.24	6	2.5	pass
	1.5	9.5 - 11	0.36			
23	4	11 - 15	0.96	11	4	pass
24	3.2	5.3 - 8.5	0.77	5.3	3.2	pass
25	4	7.5 - 11.5	0.96	7.5	4	pass
26	13	6.5 - 19.5	3.12	6.5	13	fail
27	1	15-16	0.24	15	1	pass
28						
29	1	14 - 15	0.24	14	1	pass
30	0	-	0	-	0	pass
31	8	5 - 13	1.92	5	13	fail
32						
33	5	6.5 - 11.5	1.2	6.5	5	borderline
34	7.4	6.2 - 13.6	1.78	6.2	7.4	fail
35	1	5 - 6	0.24	5	3.5	pass
	1.5	10.5 - 12	0.36			
	1	13 - 14	0.24			
36	6	5.3 - 11.3	1.44	5.3	6.3	fail
37						
38	10	9 - 19	2.4	8.2	11	fail
39	3	11-14	0.72	11	6	pass
	3	15 - 18	0.72			
40	5	9 - 14	1.2	9	5	pass
41	4.5	14.5 - 19	1.08	14.5	4.5	pass
42	1.5	18 - 19.5	0.36	18	1.5	pass
43	4	9.5 - 13.5	0.96	9.5	6	pass
	2	15 - 17	0.48			
44	8.5	5.5 - 14	2.04	5.5	8.5	fail
45	2	11 - 13	0.48	11	2	pass
46	9	6.5 - 15.5	2.16	6.5	9	fail

*Soil behavior type and ..ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W052
Cone Used: HO738TC

CPT Date/Time: 06-14-04 09:19
Location: CPT-1
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

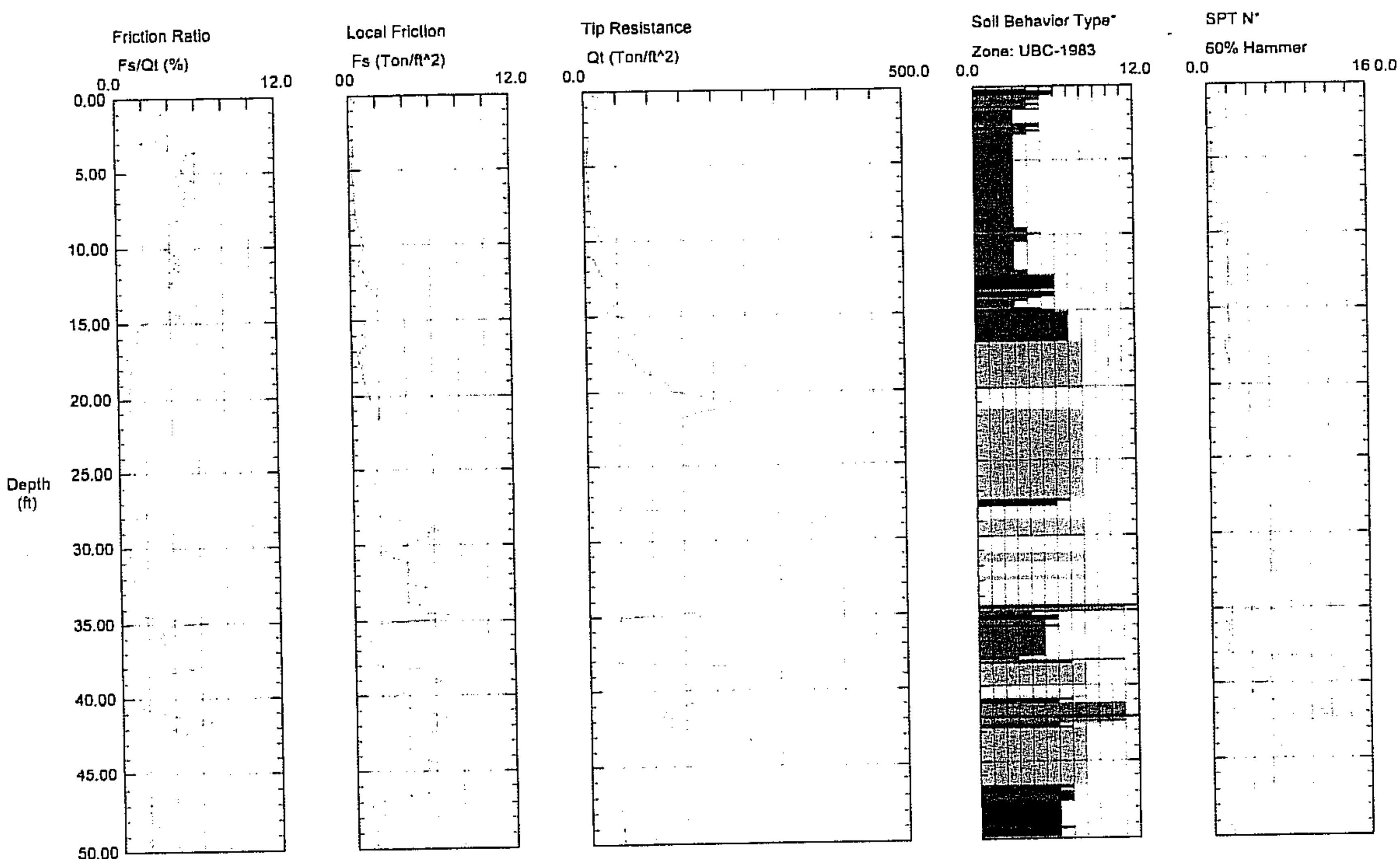
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and ... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W053
Cone Used: HO738TC

CPT Date/Time: 06-14-04 11:03
Location: CPT-2
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

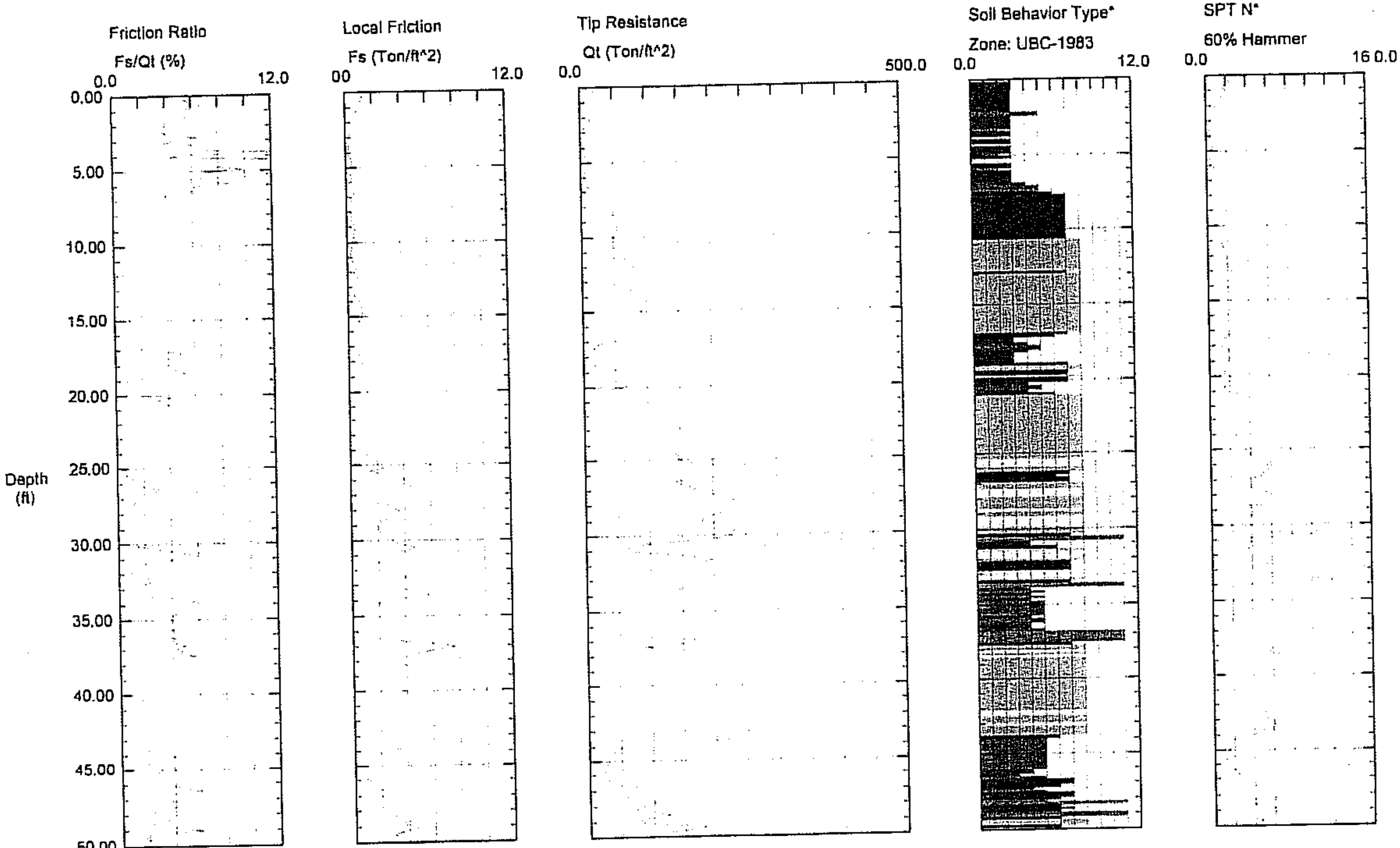
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ,ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W054
Cone Used: HO738TC

CPT Date/Time: 06-14-04 13:40
Location: CPT-3
Job Number: 4603.4100.01



Maximum Depth = 50.03 feet

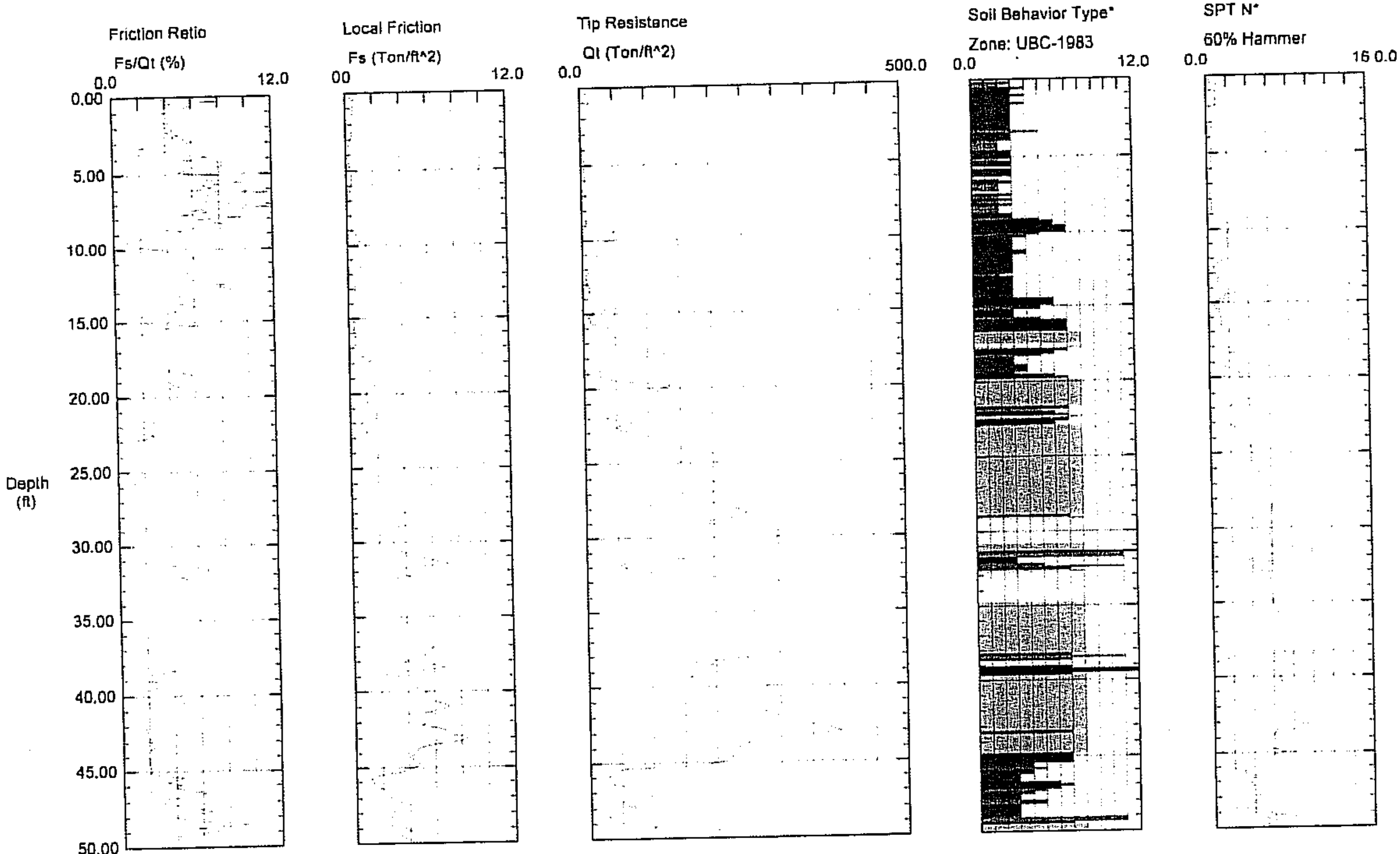
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W055
Cone Used: HO738TC

CPT Date/Time: 06-14-04 15:15
Location: CPT-4
Job Number: 4603.4100.01



Maximum Depth = 51.67 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

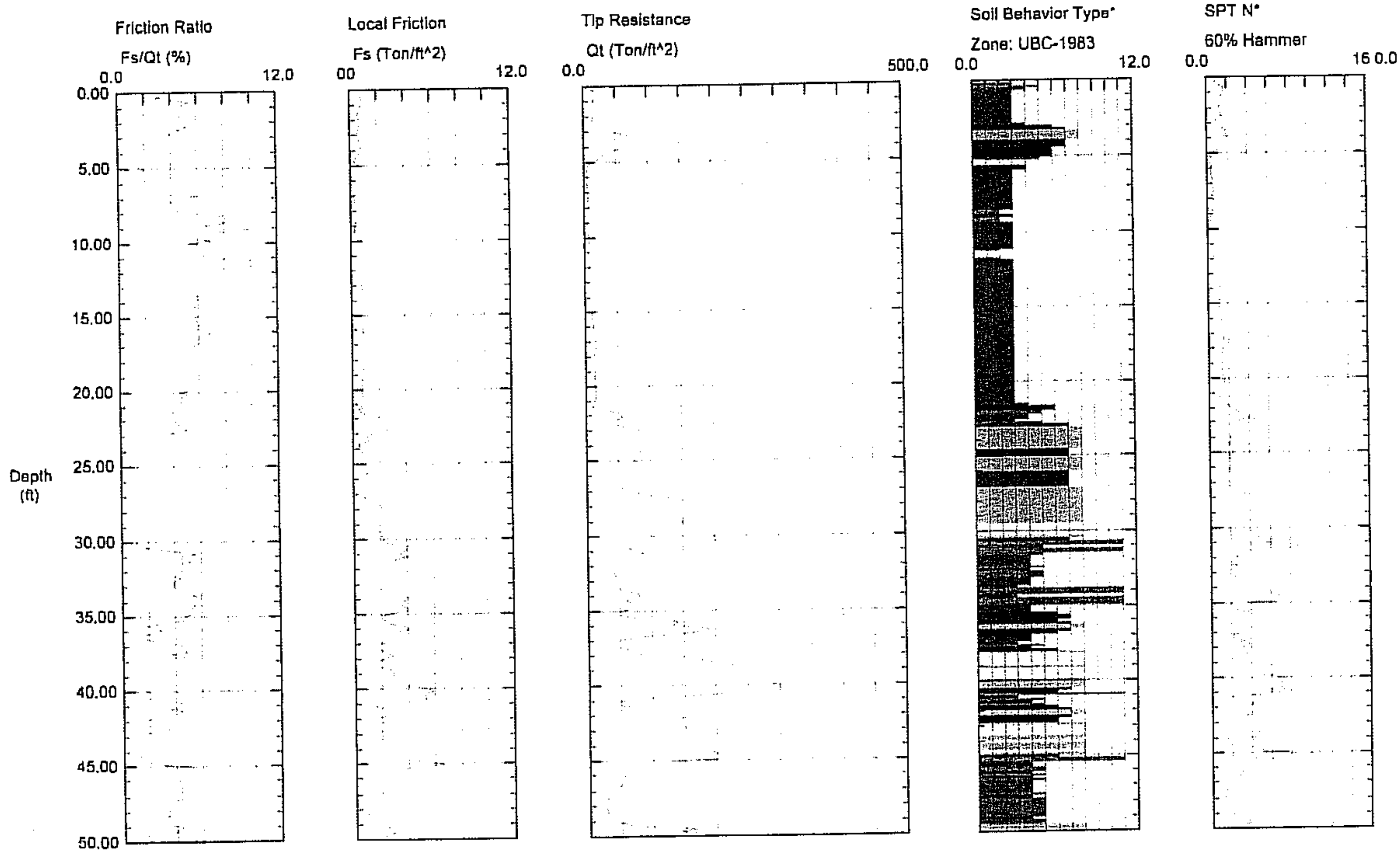
oil behavior type and *sed on data from UBC-1 983

Soil behavior type anc   used on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W056
Cone Used: HO738TC

CPT Date/Time: 06-15-04 07:26
Location: CPT-5
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

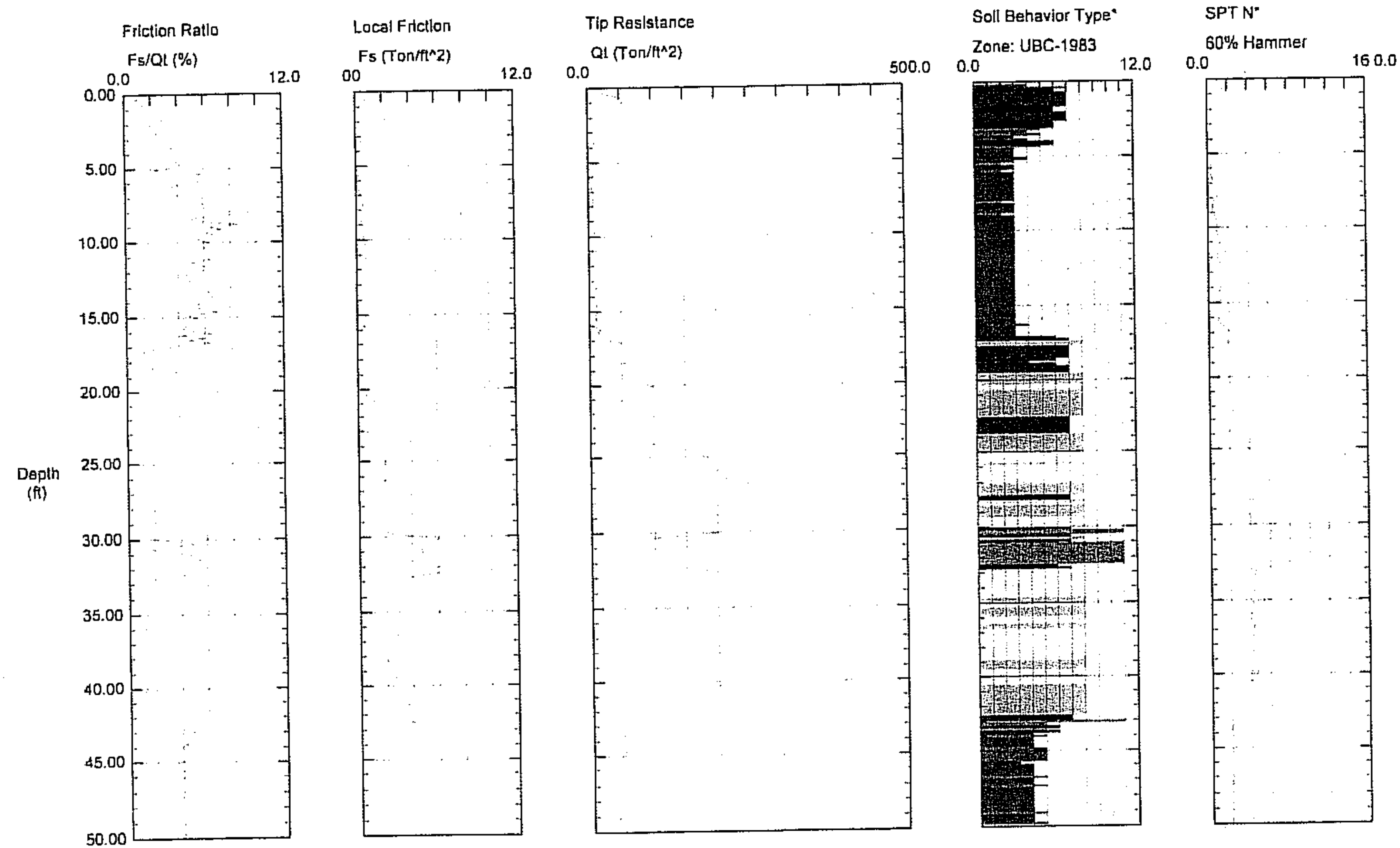
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W057
Cone Used: HO738TC

CPT Date/Time: 06-15-04 09:10
Location: CPT-6
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

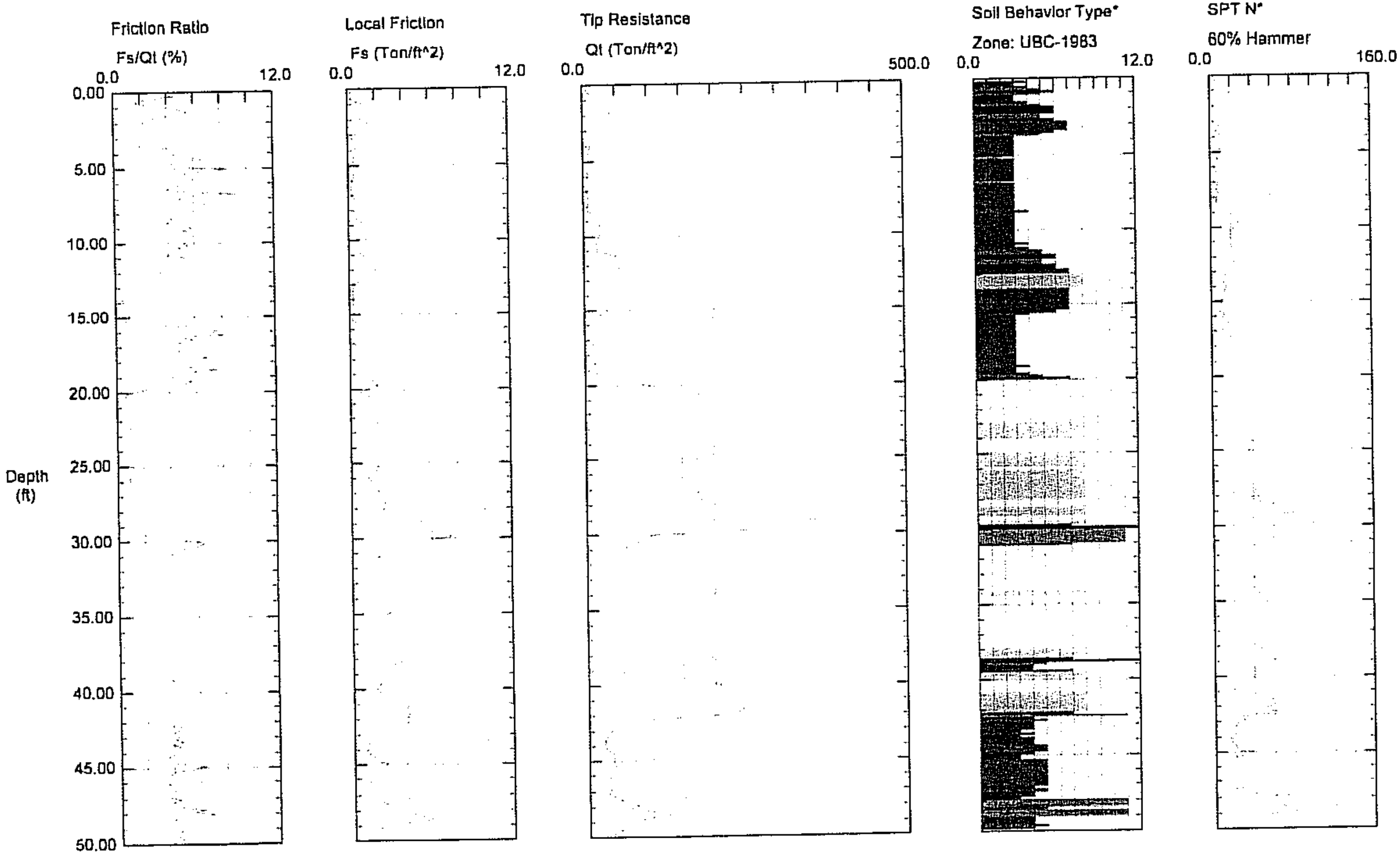
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ 'esting

Operator: Mike Robertson
Sounding: 04W058
Cone Used: HO738TC

CPT Date/Time: 06-15-04 10:26
Location: CPT-7
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

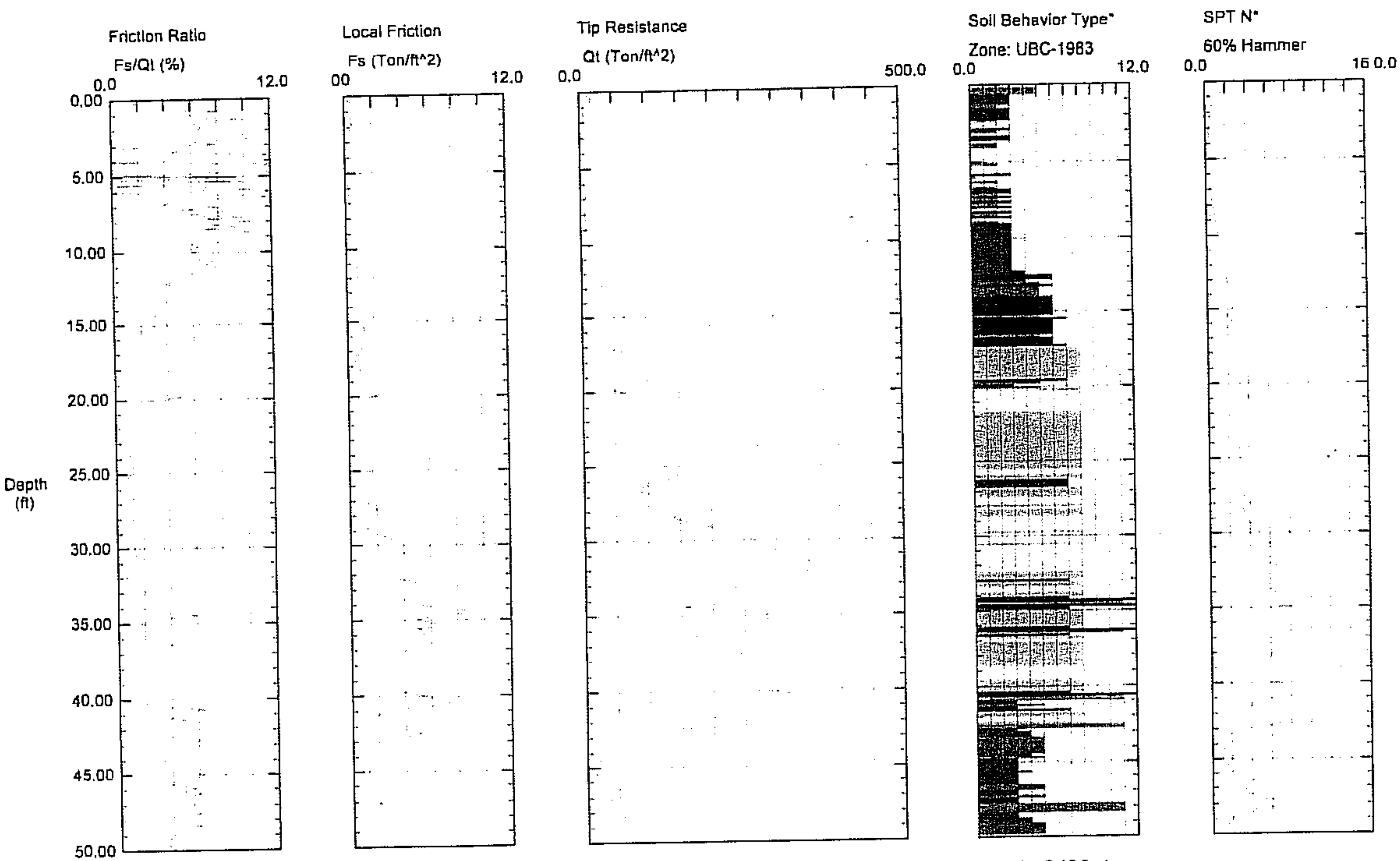
*oil behavior type and ased on data from UBC-1983

Soil behavior type an.   based on data from UBC-1 983

VBI In-Situ ,esting

Operator: Mike Robertson
Sounding: 04W059
Cone Used: HO738TC

CPT Date/Time: 06-15-04 12:04
Location: CPT-8
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

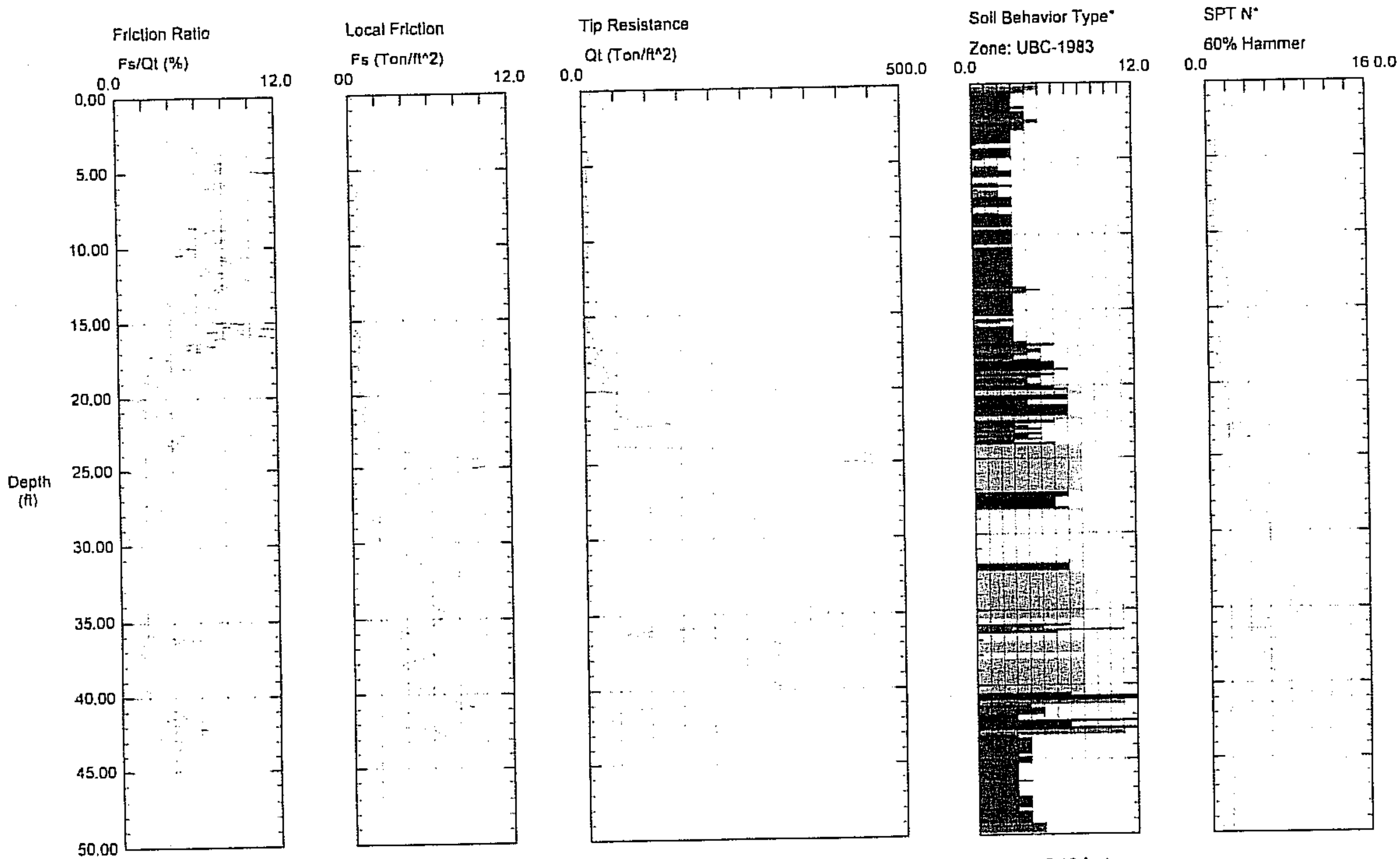
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   ɔased on data from UBC-1 983

VBI In-Situ ┌esting

Operator: Mike Robertson
Sounding: 04W060
Cone Used: HO738TC

CPT Date/Time: 06-15-04 13:46
Location: CPT-9
Job Number: 4603.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

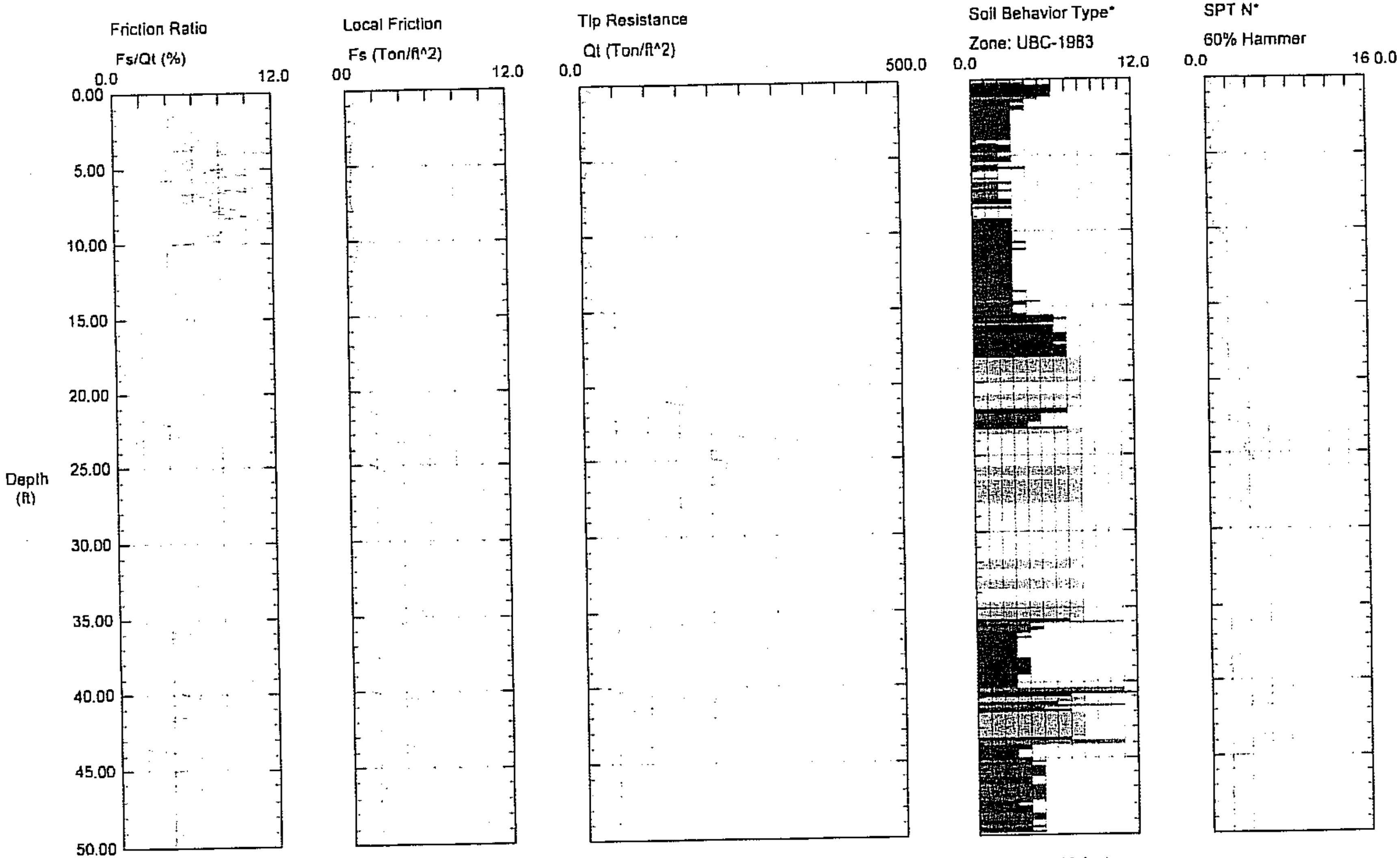
1 sensitive fine grained
2 organic material
3 - clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ 'esting

Operator: Mike Robertson
Sounding: 04W061
Cone Used: HO738TC

CPT Date/Time: 06-15-04 15:22
Location: CPT-10
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

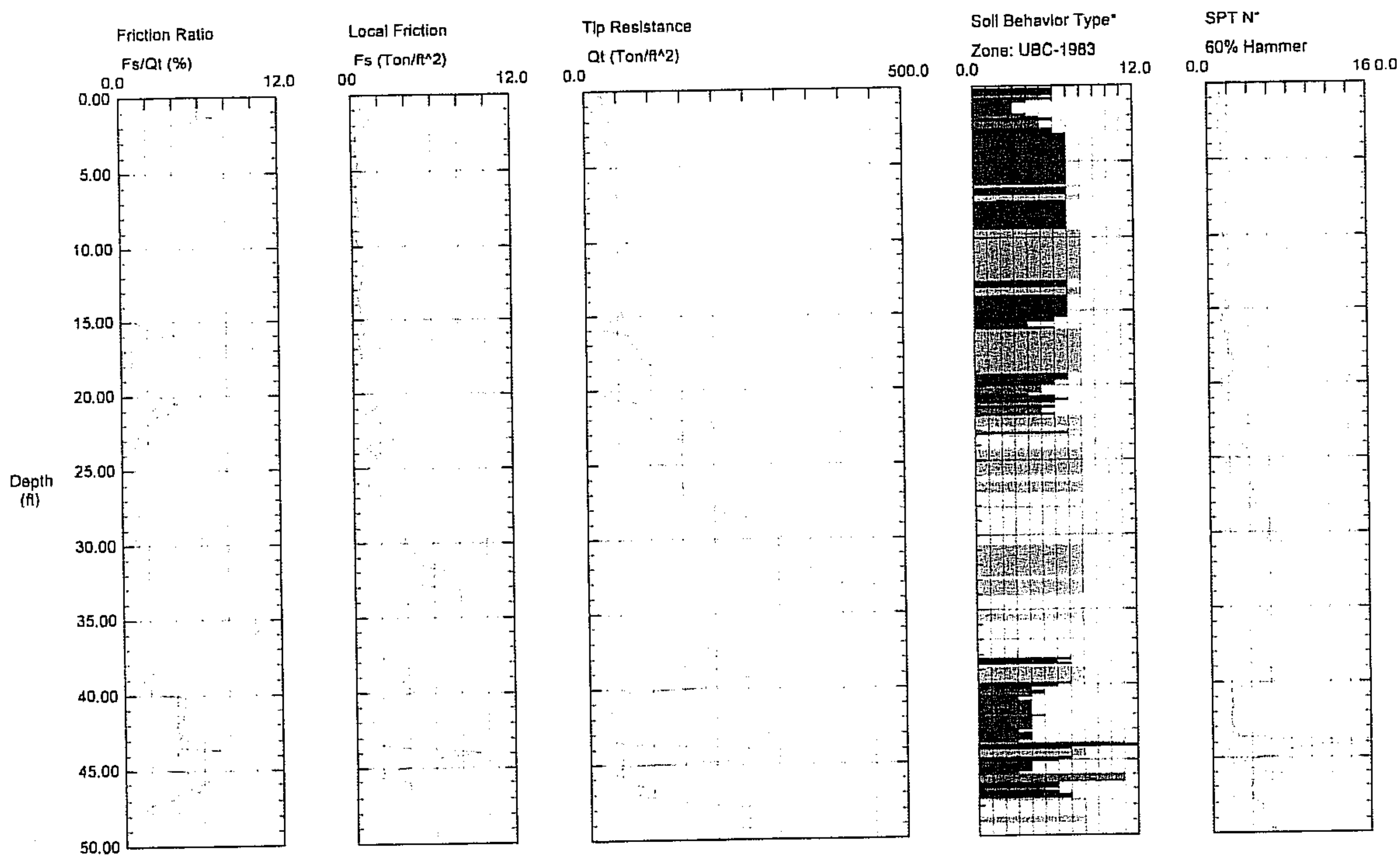
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W062
Cone Used: HO738TC

CPT Date/Time: 06-15-04 16:34
Location: CPT-11
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

Depth Increment = 0.16 feet

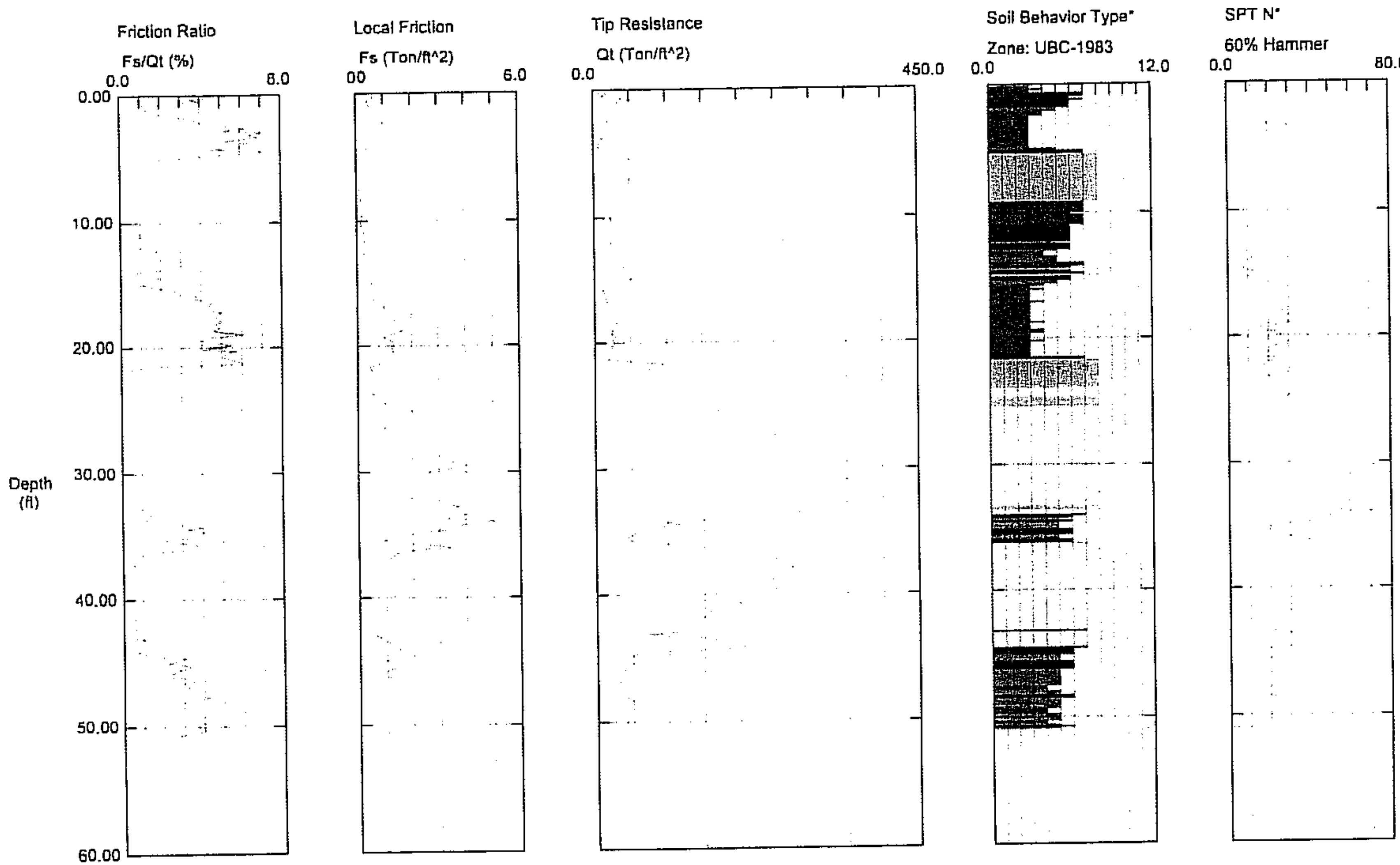
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc   ɹased on data from UBC-1 983

VBI In-Situ ˈesting

Operator: Mike Robertson
Sounding: 04W063
Cone Usad: HO839TC

CPT Date/Time: 06-16-04 07:27
Location: CPT-12
Job Number: 4603.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

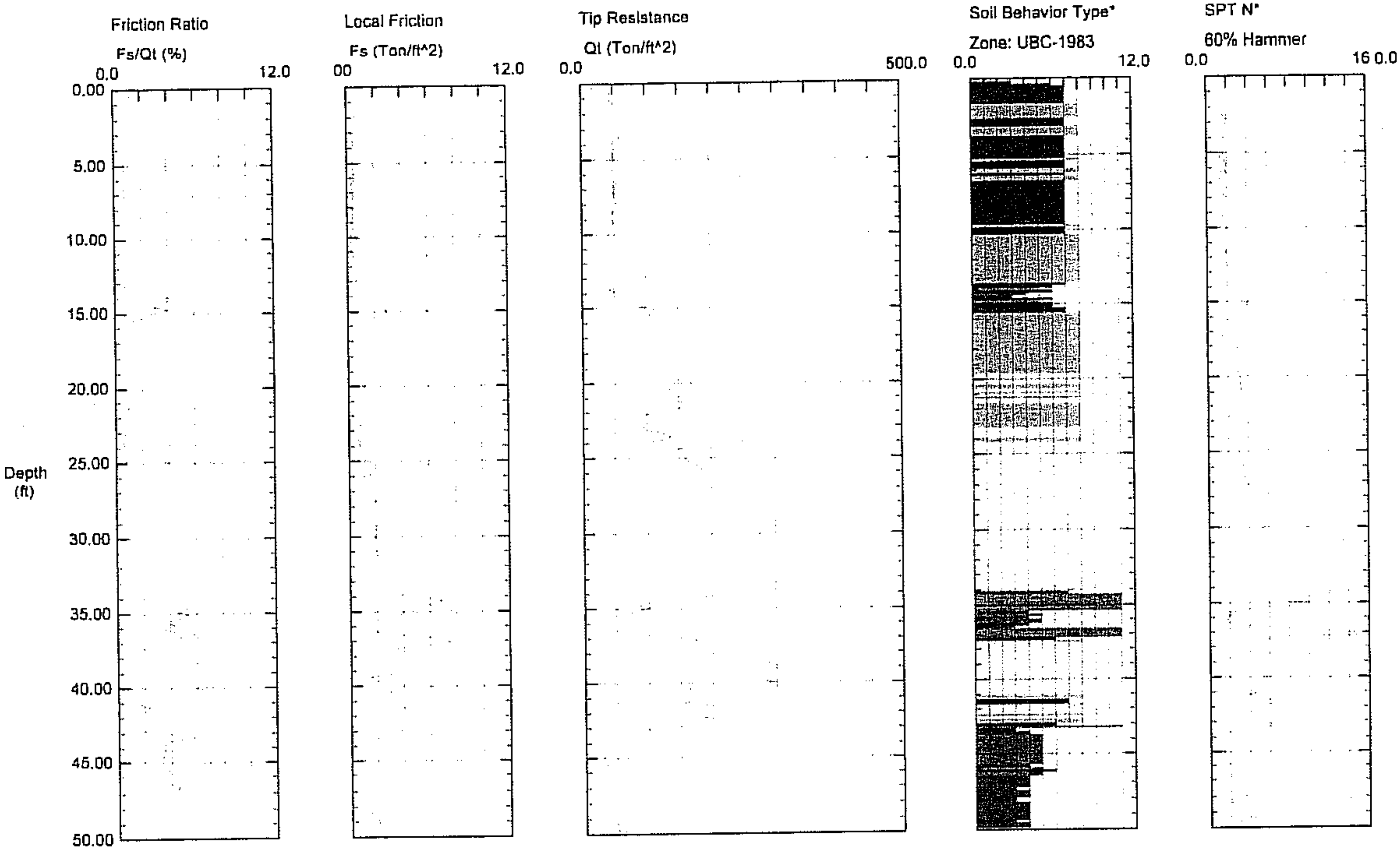
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type an.   based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W064
Cone Used: HO839TC

CPT Date/Time: 06-16-04 08:45
Location: CPT-13
Job Number: 4603.4100.01



Maximum Depth = 52.49 feet

Depth Increment = 0.16 feet

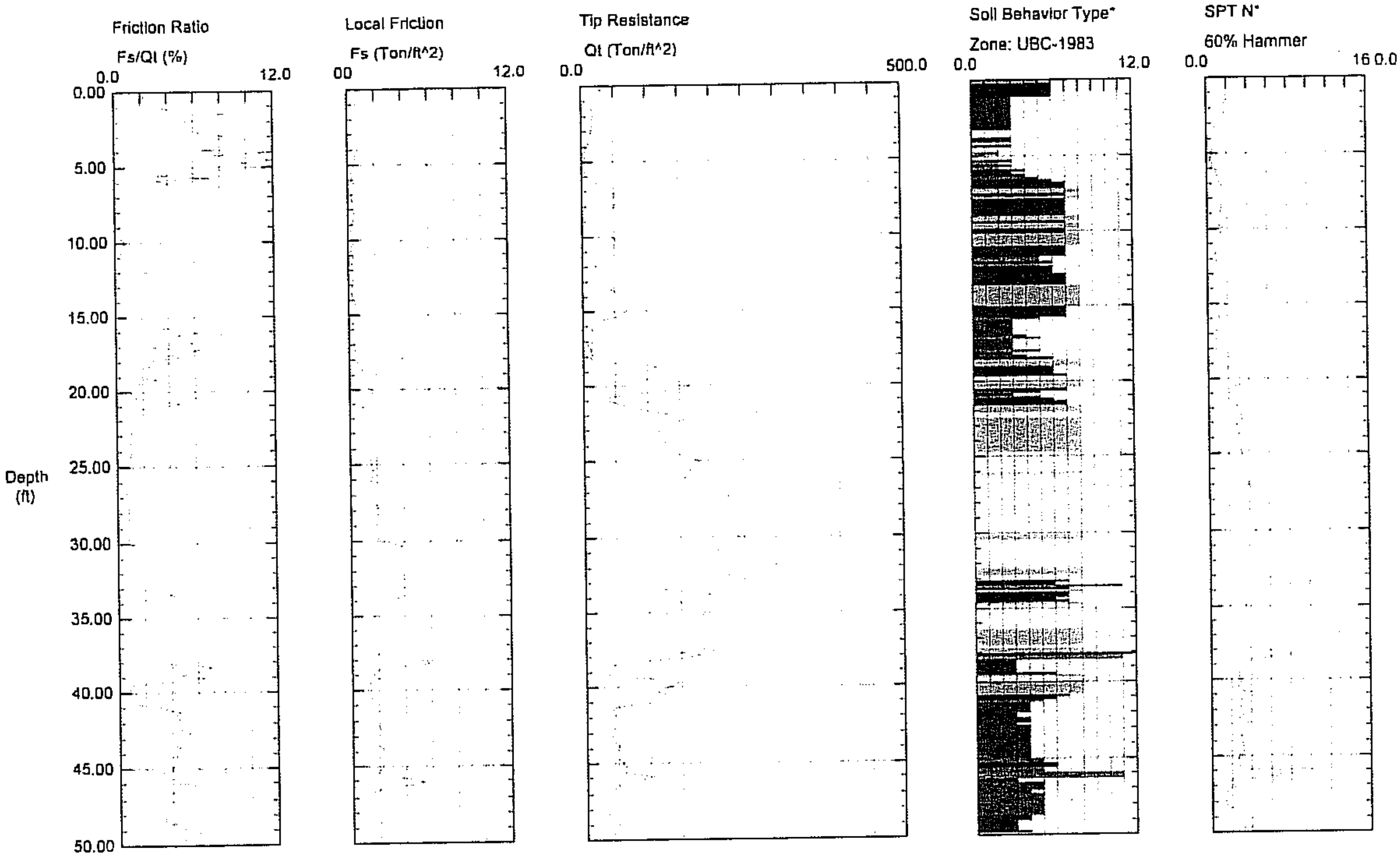
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type a[illegible] based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W065
Cone Used: HO839TC

CPT Date/Time: 06-16-04 11:12
Location: CPT-14
Job Number: 4603.4100.01



Maximum Depth = 50.20 feet

Depth Increment = 0.16 feet

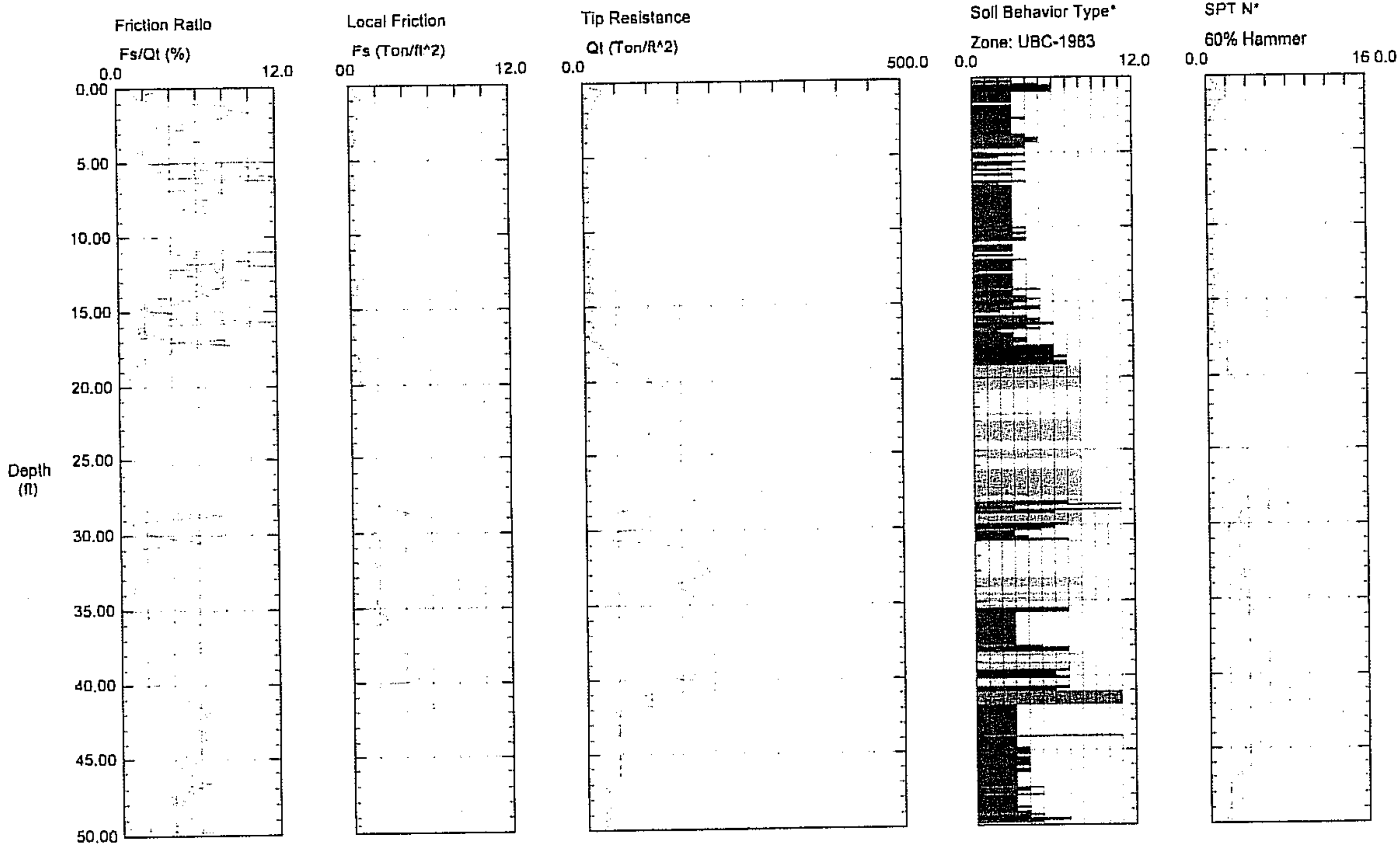
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*Soil behavior type an based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W066
Cone Used: HO839TC

CPT Date/Time: 06-16-04 13:05
Location: CPT-15
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

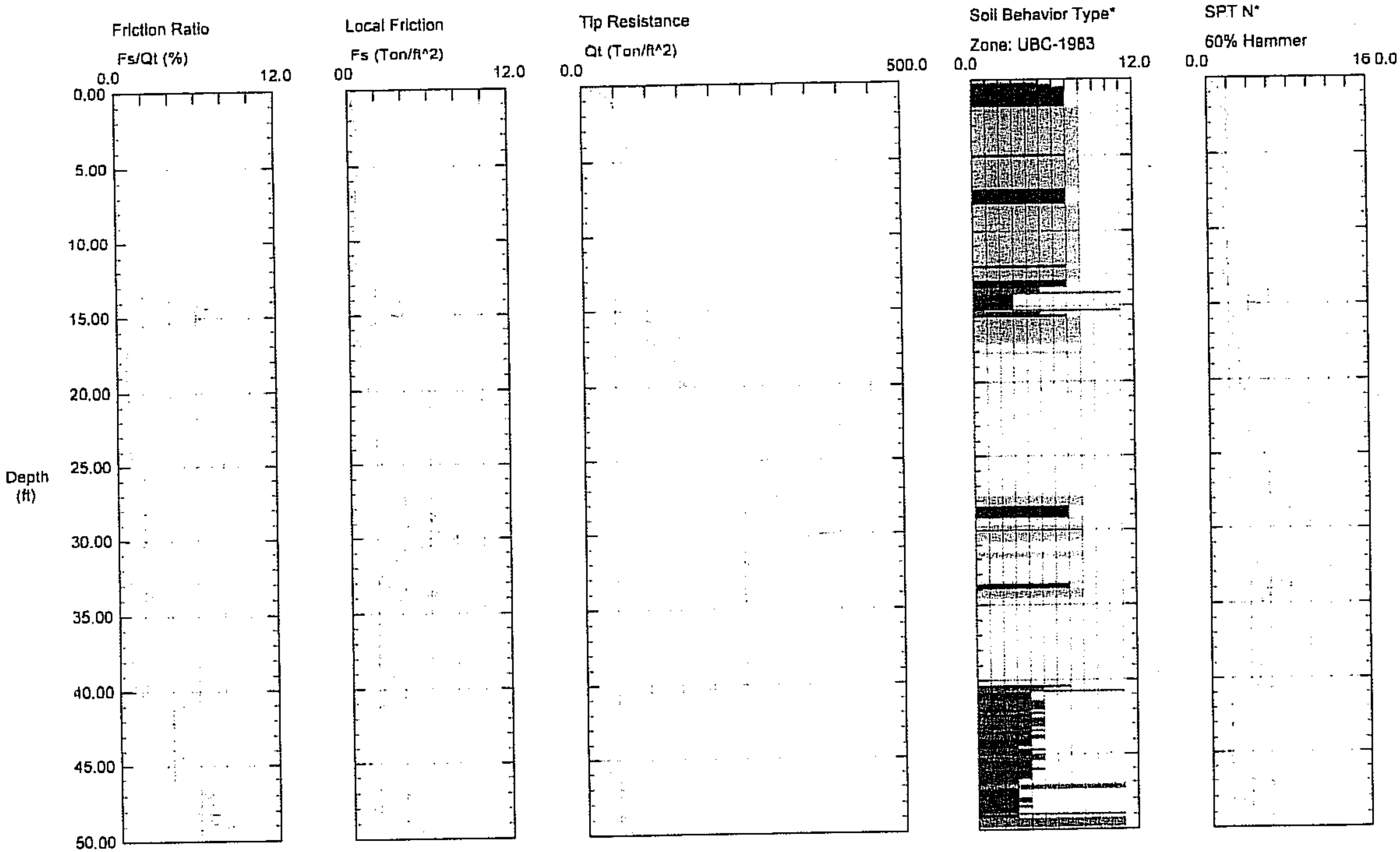
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ esting

Operator: Mike Robertson
Sounding: 04W067
Cone Used: HO839TC

CPT Date/Time: 06-16-04 14:57
Location: CPT-16
Job Number: 4603.4100.01



Maximum Depth = 51.51 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

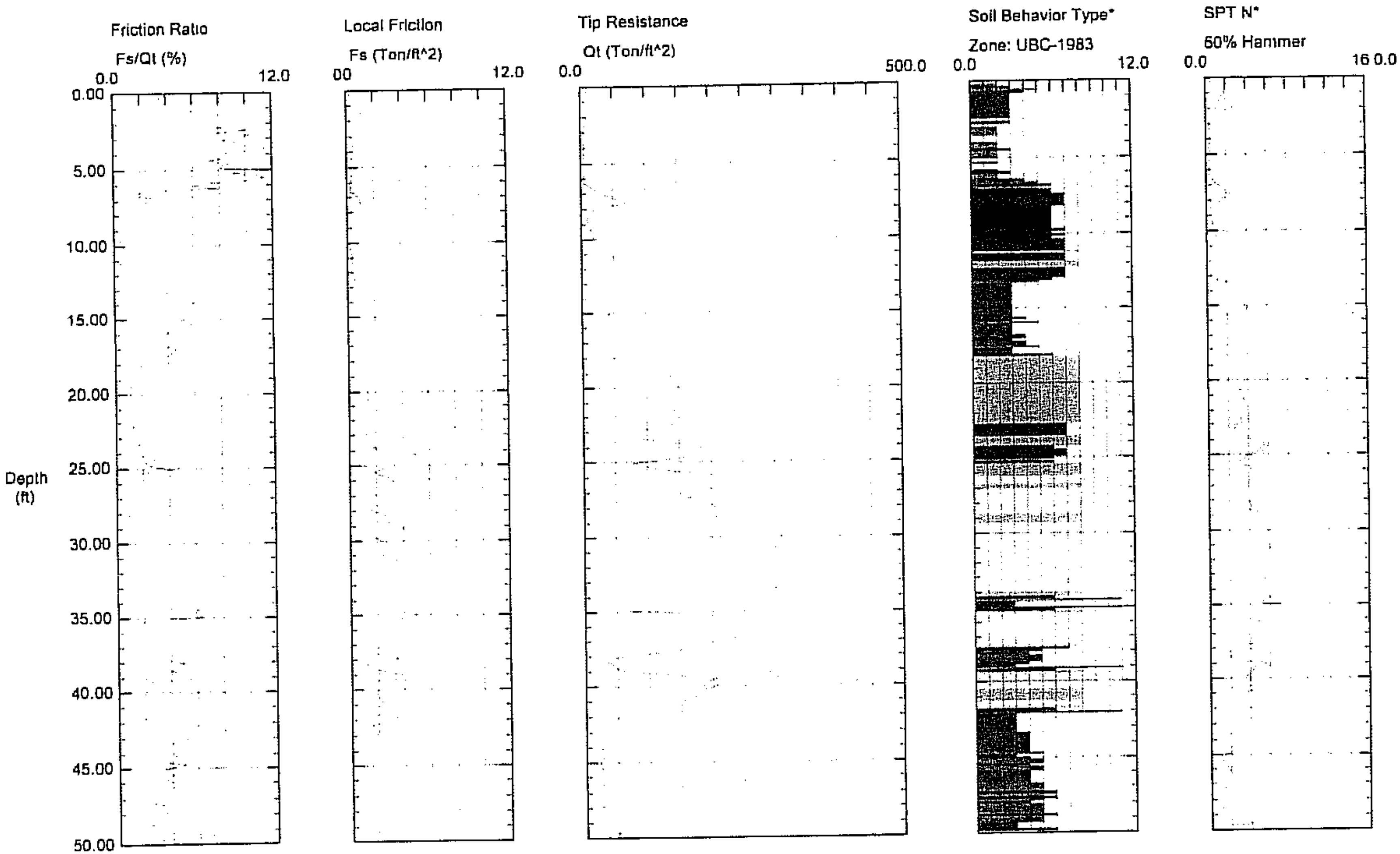
*Soil behavior type ar based on data from UBC-1 983

Soil behavior type anc   ɔased on data from UBC-1 983

VBI In-Situ ˈesting

Operator: Mike Robertson
Sounding: 04W068
Cone Used: HO839TC

CPT Date/Time: 06-17-04 07:25
Location: CPT-17
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

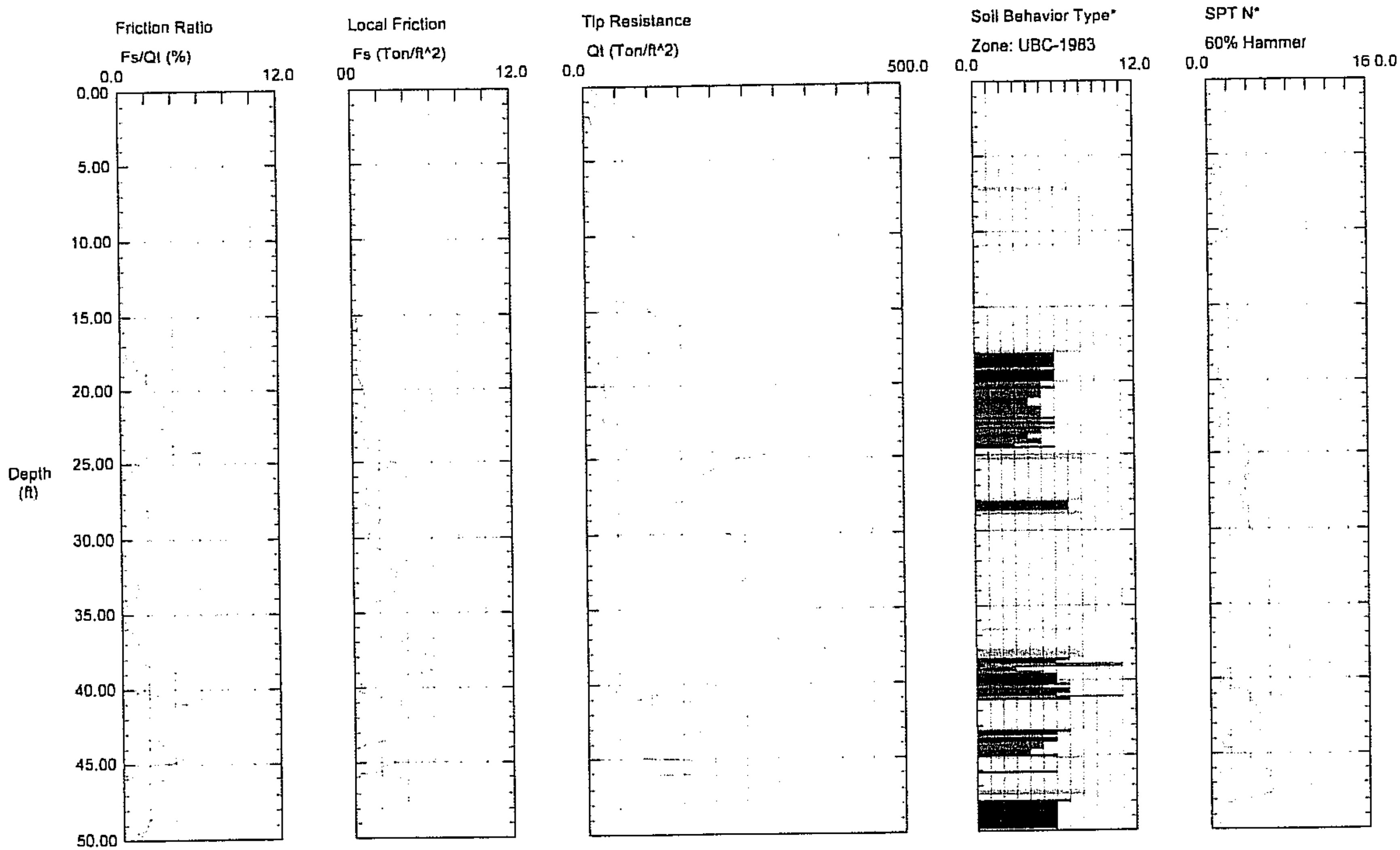
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type an based on data from UBC-1 983

VBI In-Situ ı esting

Operator: Mike Robertson
Sounding: 04W069
Cone Used: HO839TC

CPT Date/Time: 06-17-04 08:42
Location: CPT-18
Job Number: 4603.4100.01



Maximum Depth = 51.02 feet

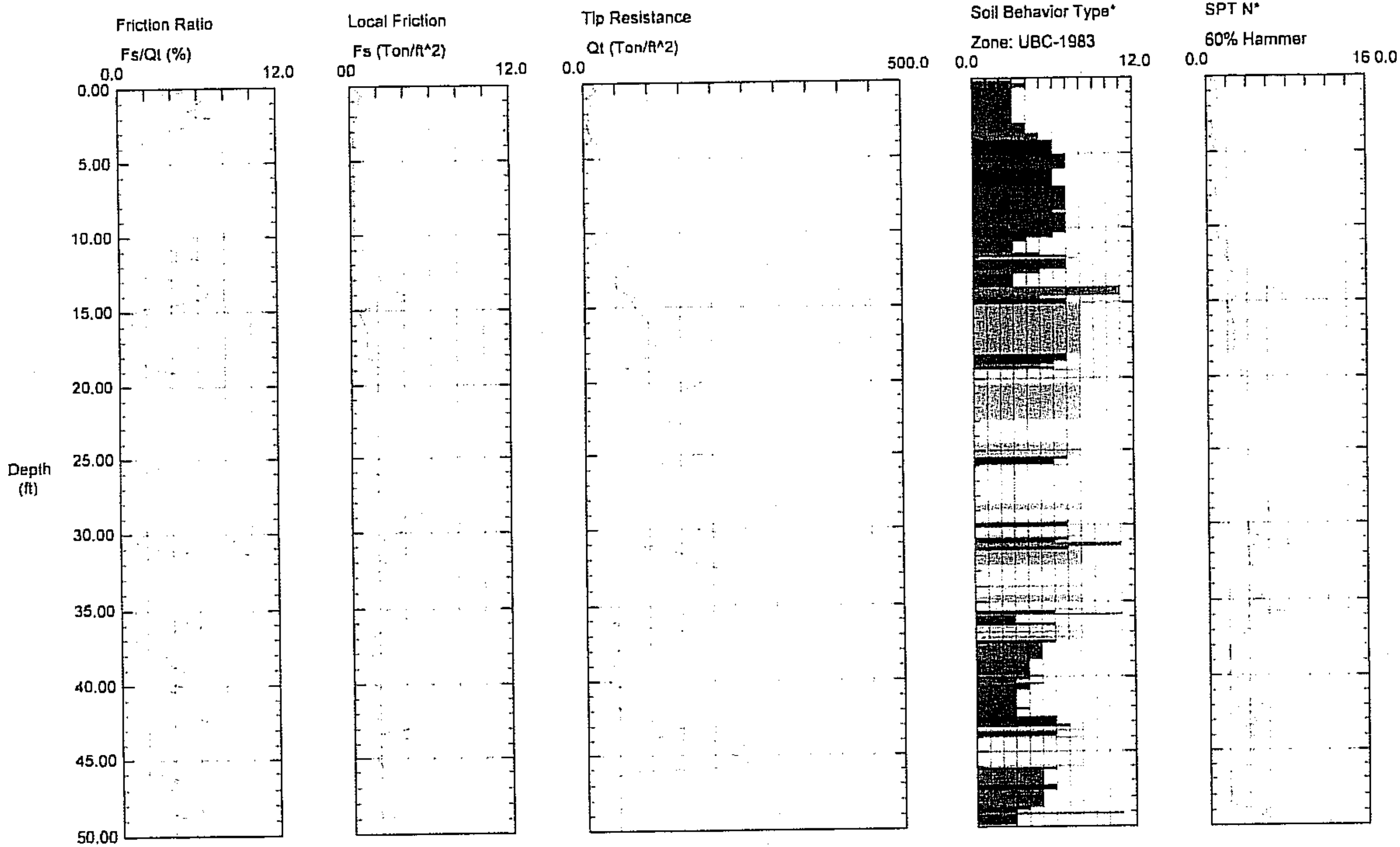
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W070
Cone Used: HO839TC

CPT Date/Time: 06-17-04 10:37
Location: CPT-19
Job Number: 4603.4100.01



Maximum Depth = 50.69 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

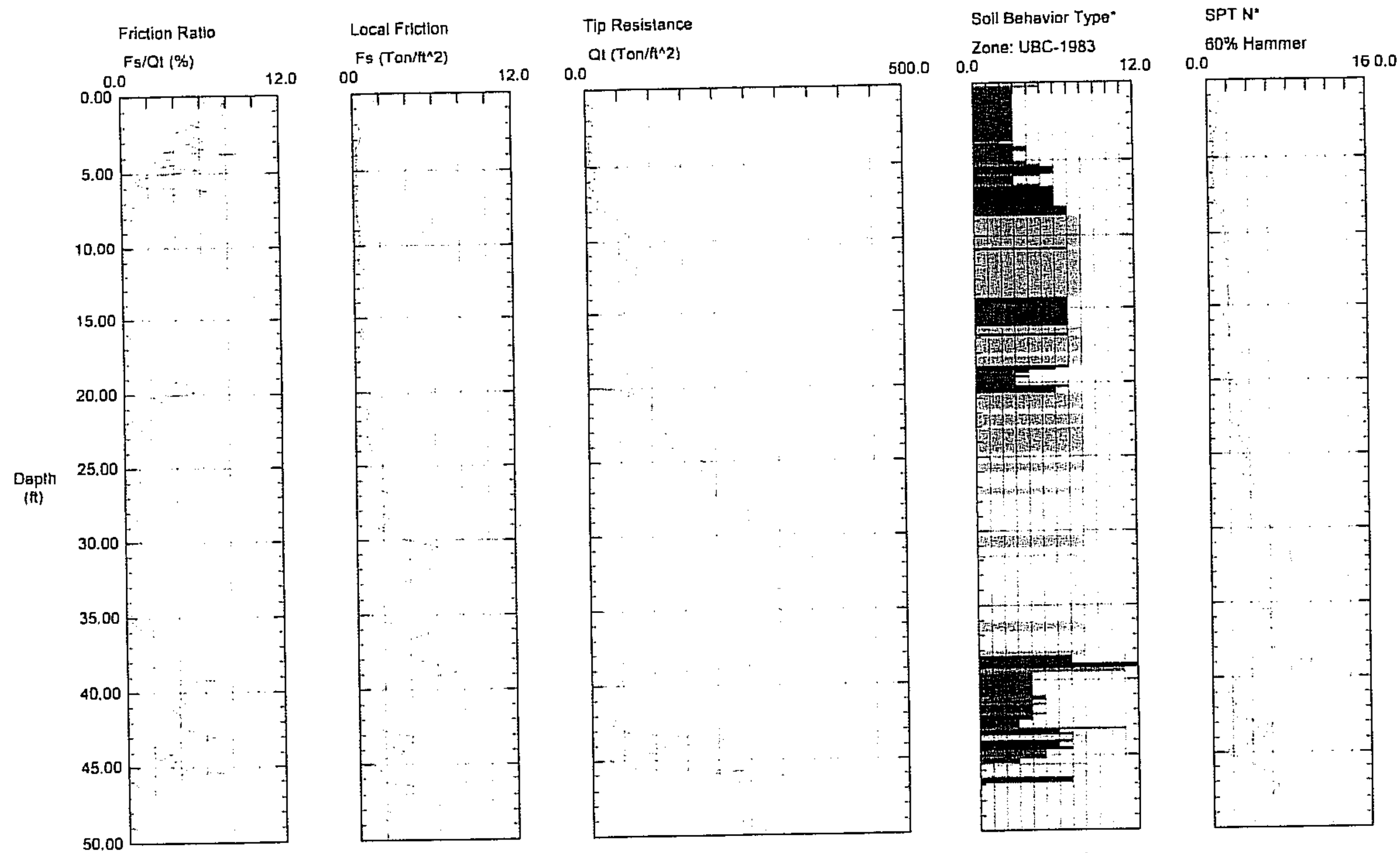
Soil behavior type an[illegible] based on data from UBC-1 983

Soil behavior type and ... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W071
Cone Used: HO839TC

CPT Date/Time: 06-17-04 11:40
Location: CPT-20
Job Number: 4603.4100.01



Maximum Depth = 50.52 feet

Depth Increment = 0.16 feet

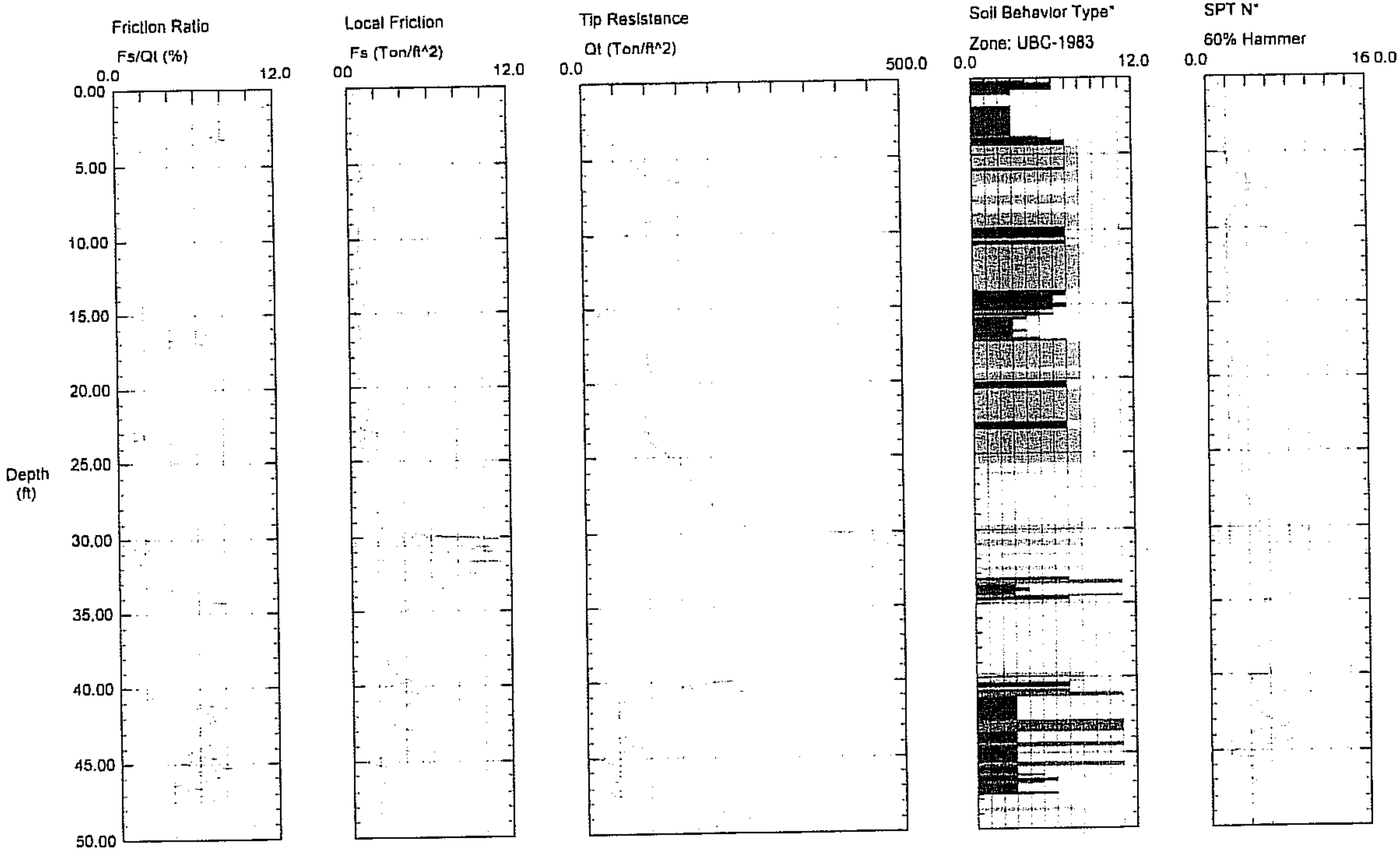
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Soil behavior type and ased on data from UBC-1 983

Operator: Mike Robertson
Sounding: 04W072
Cone Used: HO839TC

CPT Date/Time: 06-17-04 12:40
Location: CPT-21
Job Number: 4603,4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

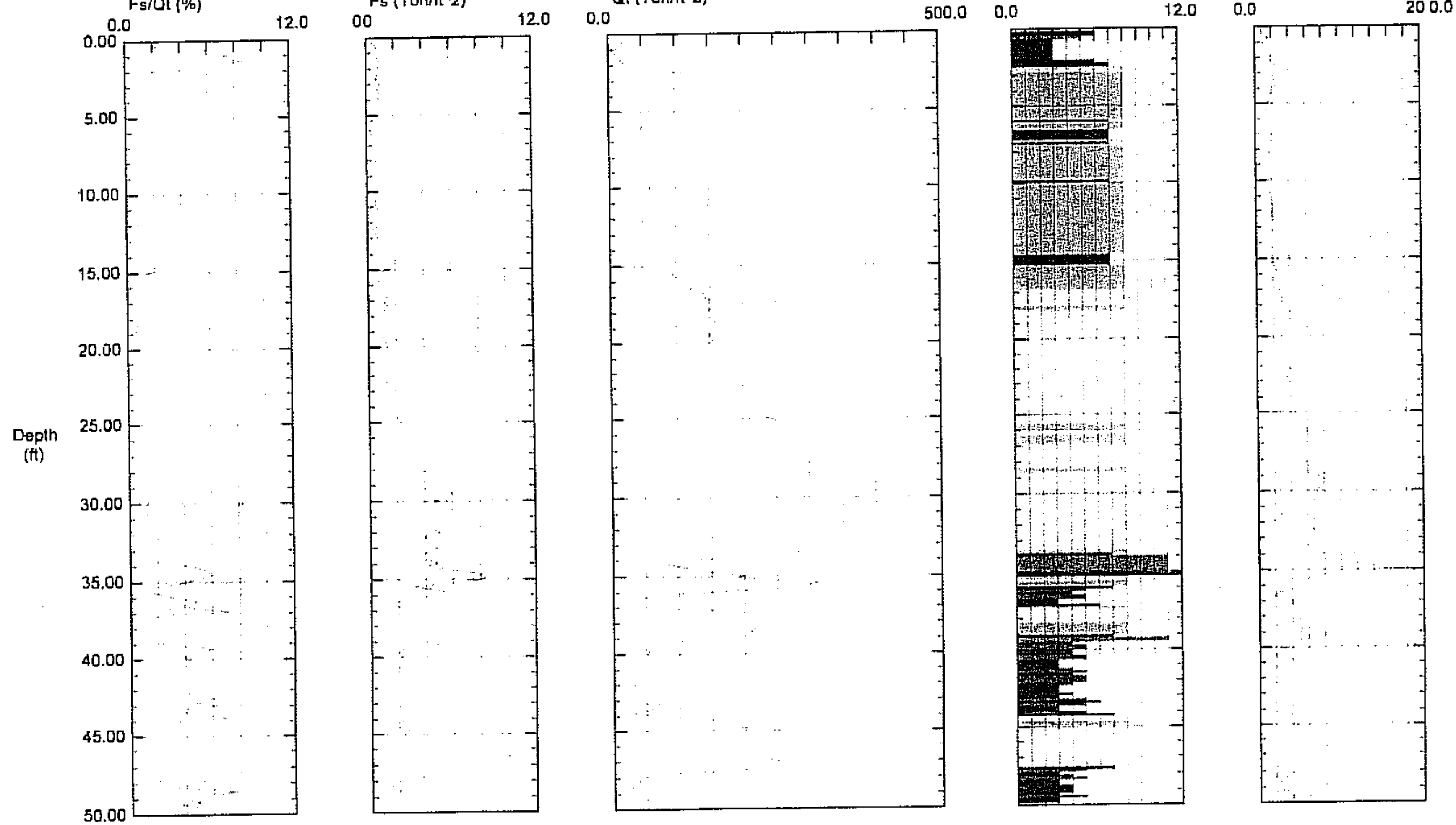
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W073
Cone Used: HO839TC

CPT Date/Time: 06-17-04 14:33
Location: CPT-22
Job Number: 4603.4100.01



Maximum Depth = 50.85 feet

Depth Increment = 0.16 feet

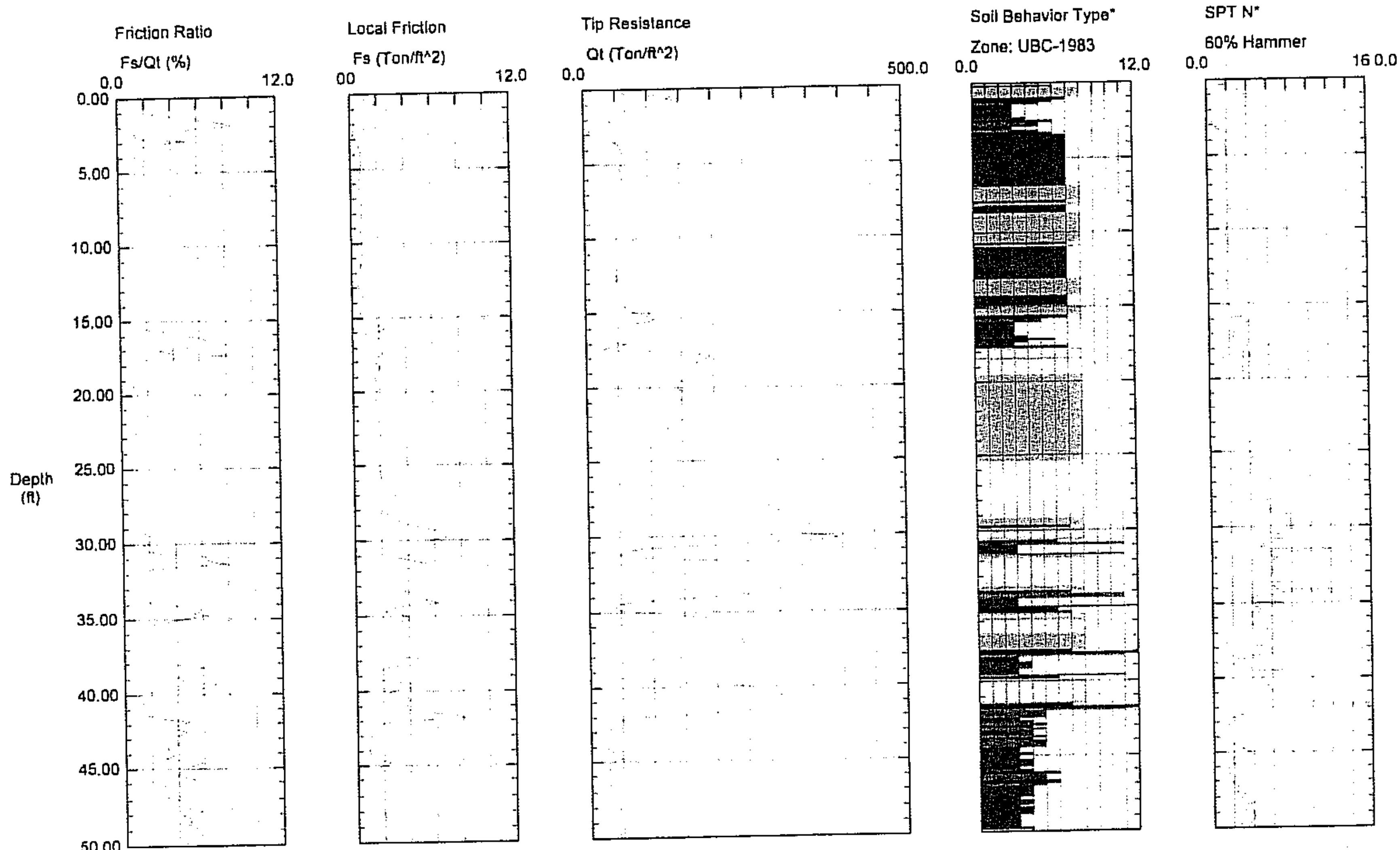
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an... based on data from UBC-1 983

VBI In-Situ ·esting

Operator: Mike Robertson
Sounding: 04W074
Cone Used: HO839TC

CPT Date/Time: 06-17-04 15:42
Location: CPT-23
Job Number: 4803.4100.01



Maximum Depth = 51.18 feet

Depth Increment = 0.16 feet

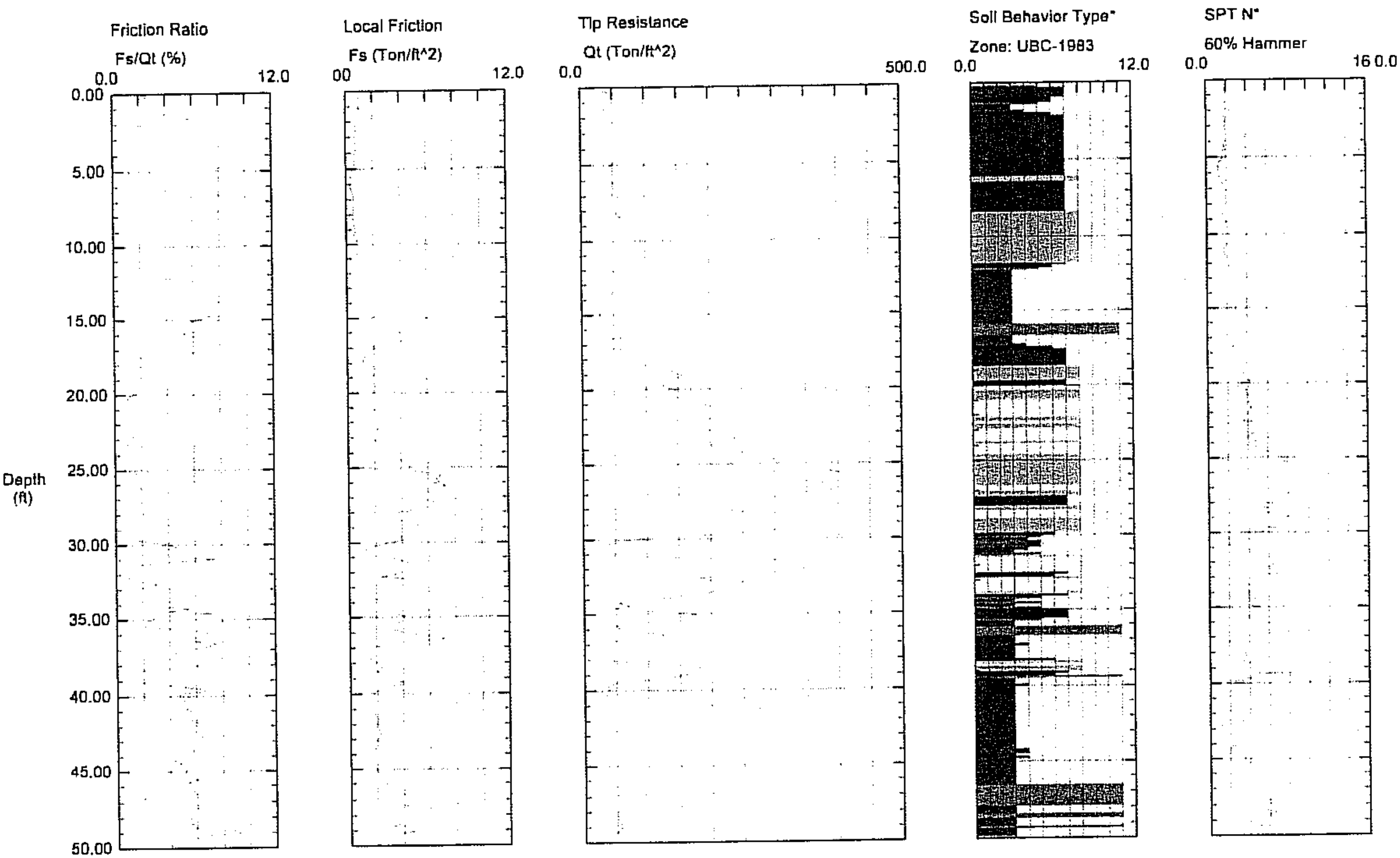
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and ... based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04W075
Cone Used: HO839TC

CPT Date/Time: 06-17-04 16:56
Location: CPT-24
Job Number: 4603.4100.01



Maximum Depth = 51.35 feet

Depth Increment = 0.16 feet

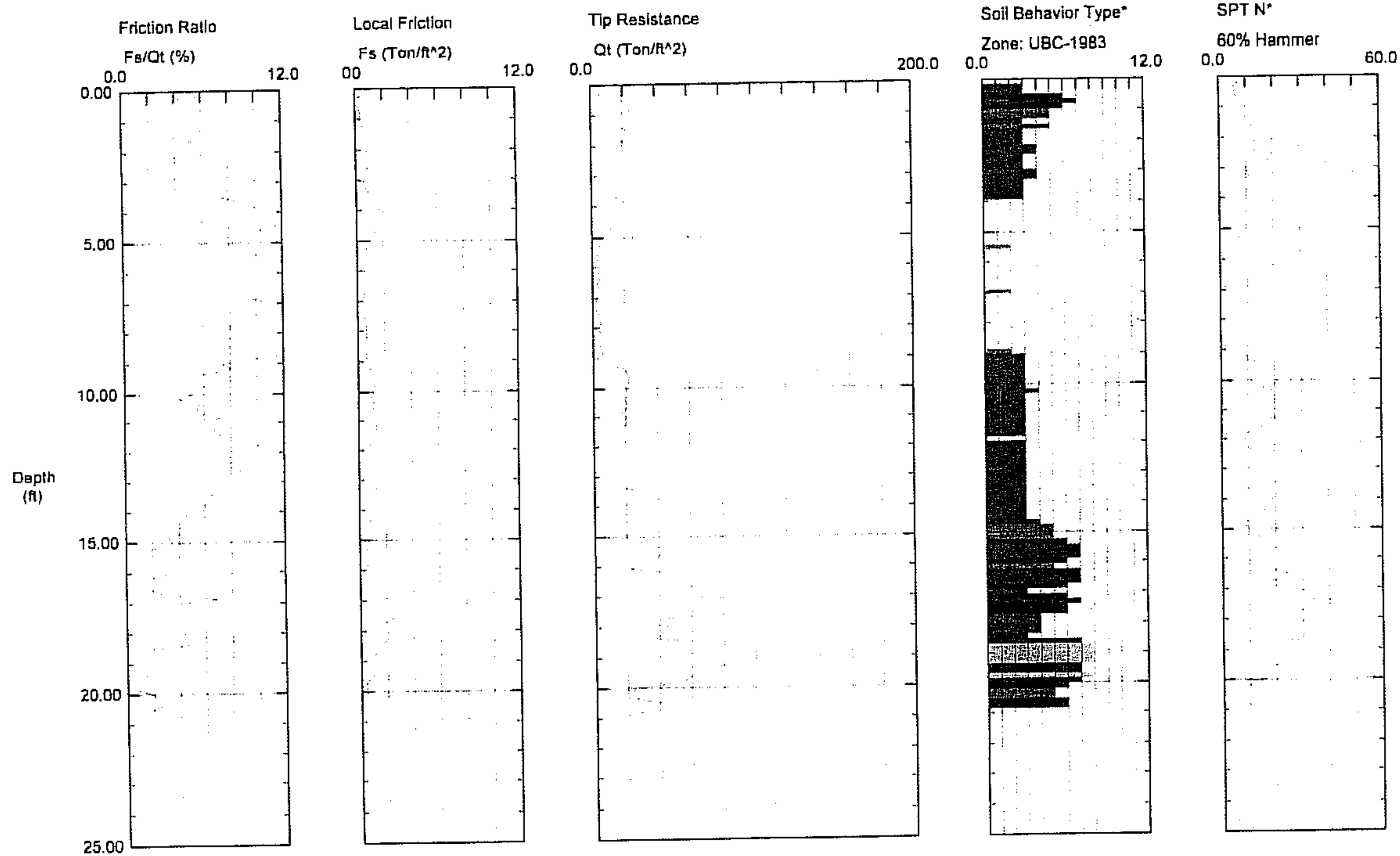
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Soil behavior type anc ɔased on data from UBC-1 983

VBI In-Situ ɾesting

Operator: Mike Robertson
Sounding: 04W088
Cone Used: HO856TC

CPT Date/Time: 07-14-04 11:04
Location: CPT-27
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

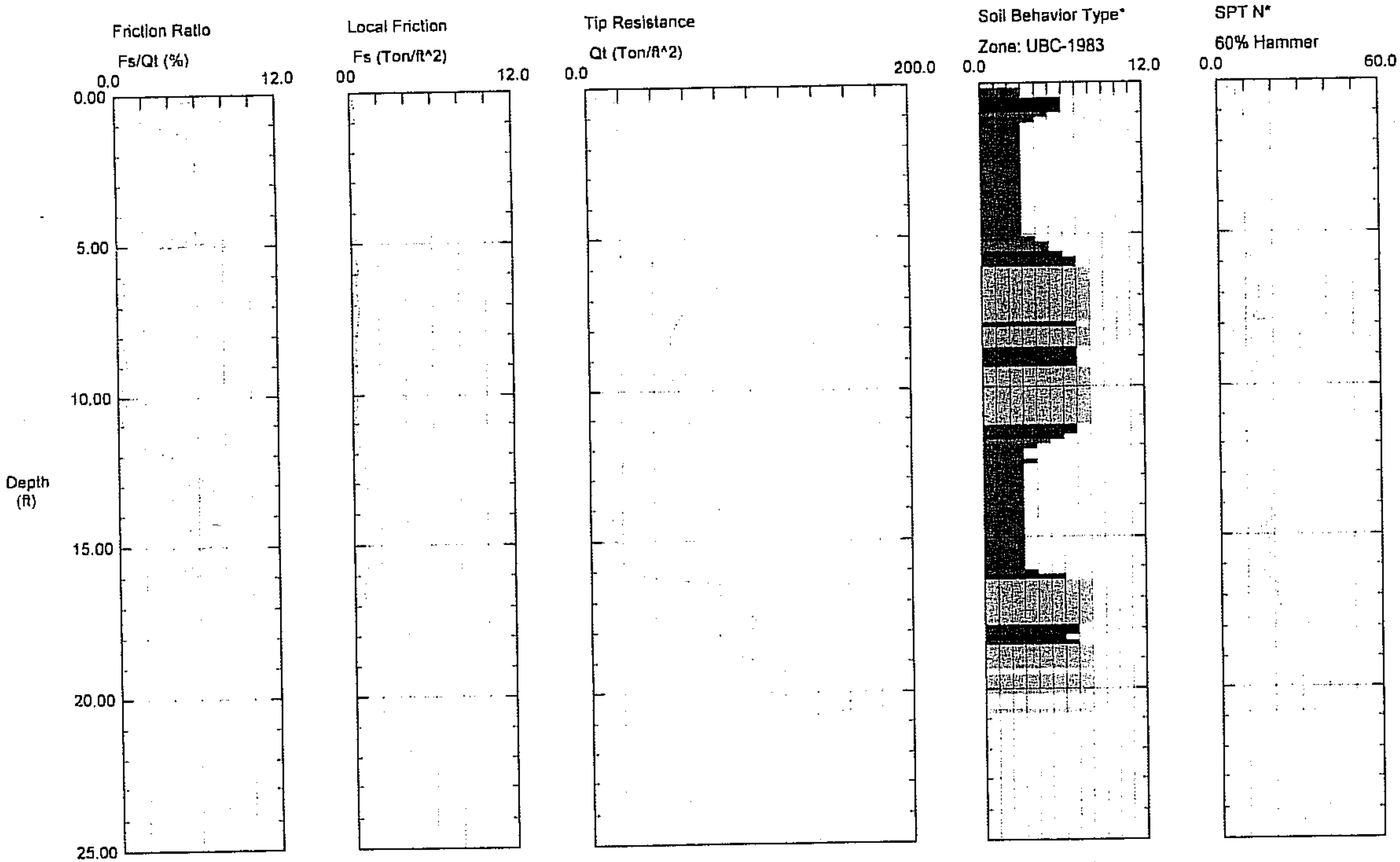
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type ar.   based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w089
Cone Used: HO856TC

CPT Date/Time: 07-14-04 13:14
Location: CPT-28
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet   Depth Increment = 0.16 feet

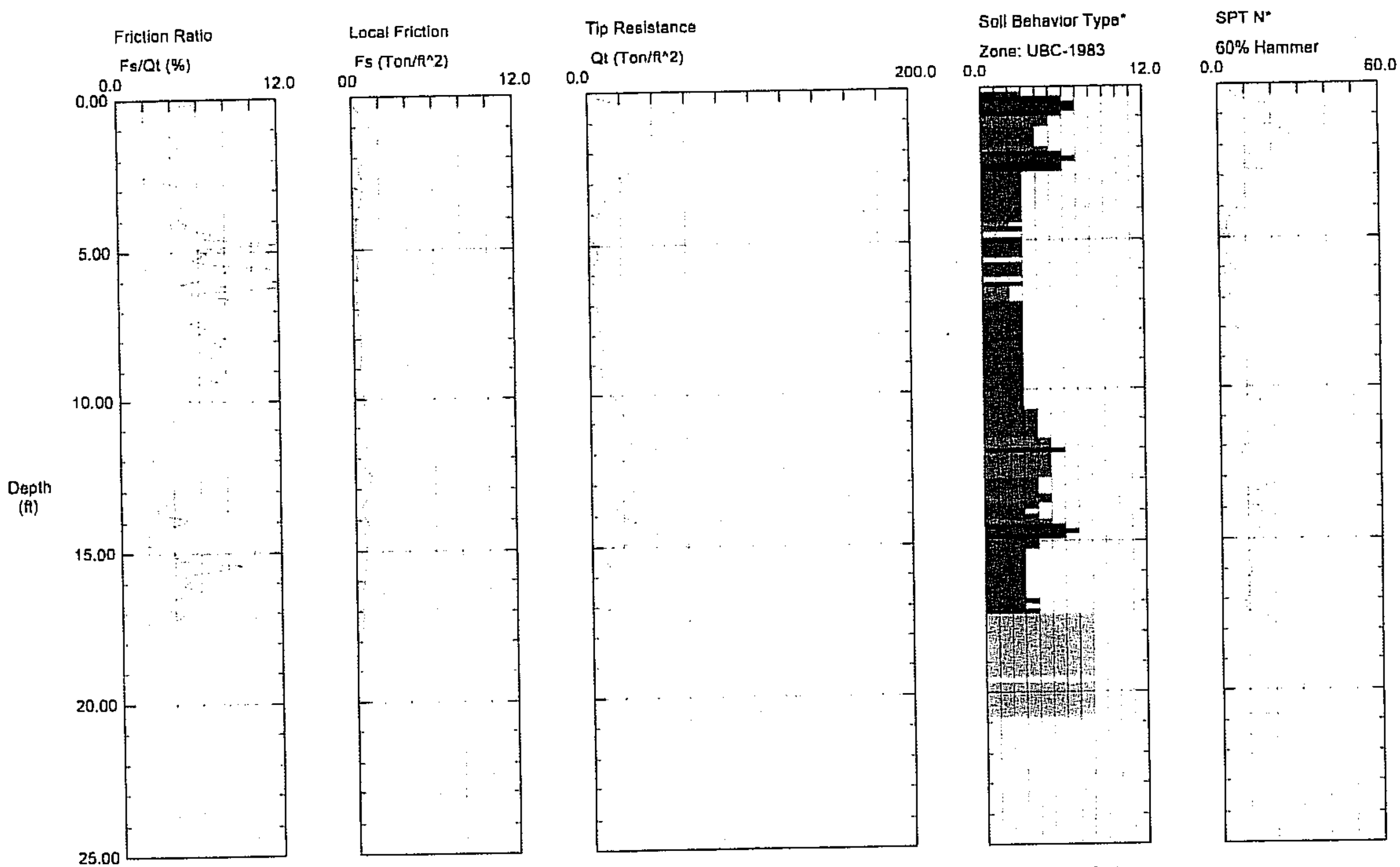
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type an… based on data from UBC-1 983

VBI In-Situ resting

Operator: Mike Robertson
Sounding: 04w090
Cone Used: HO856TC

CPT Date/Time: 07-14-04 14:17
Location: CPT-29
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

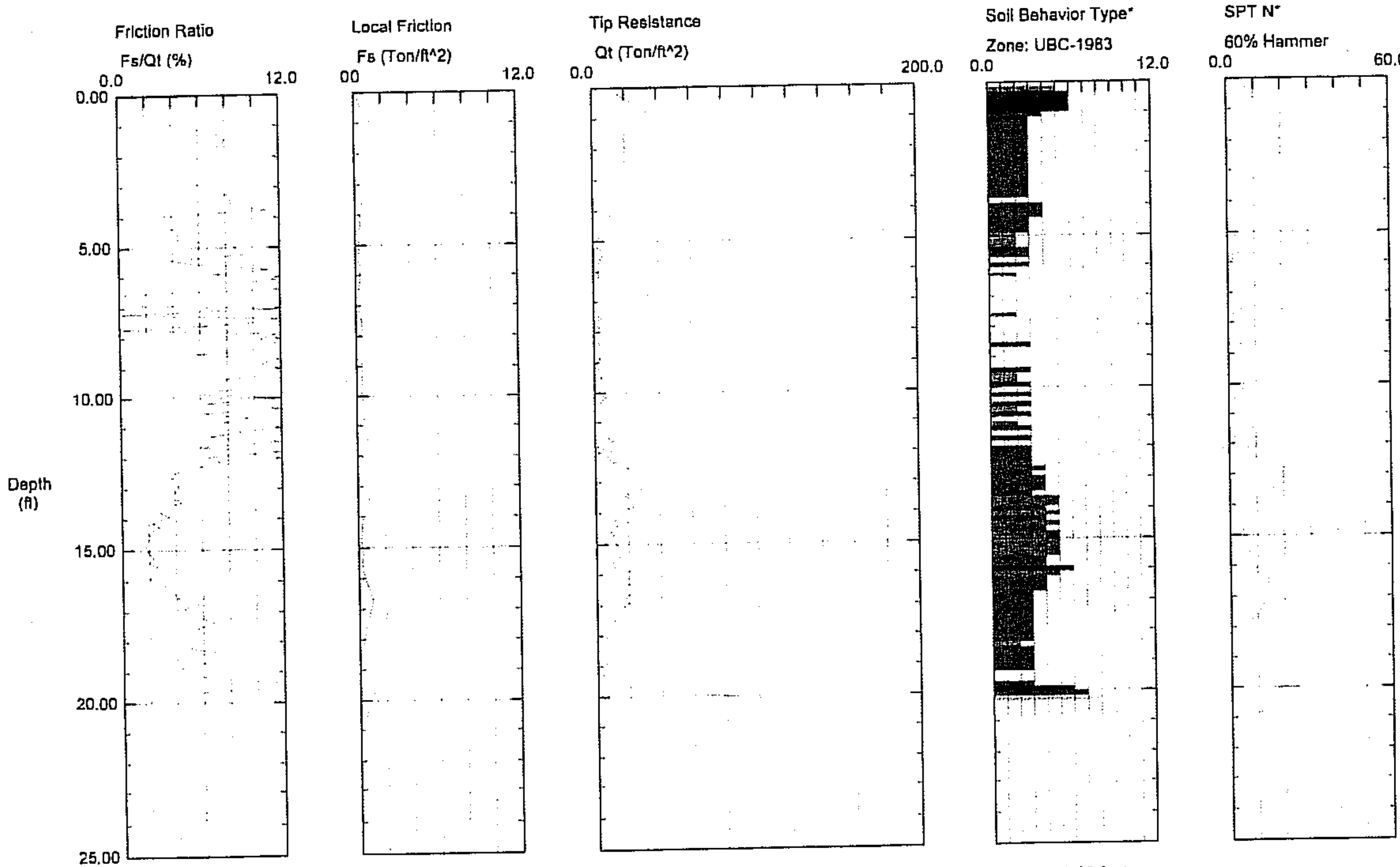
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anu   based on data from UBC-1 983

VBI In-Situ resting

Operator: Mike Robertson
Sounding: 04w091
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:10
Location: CPT-30
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

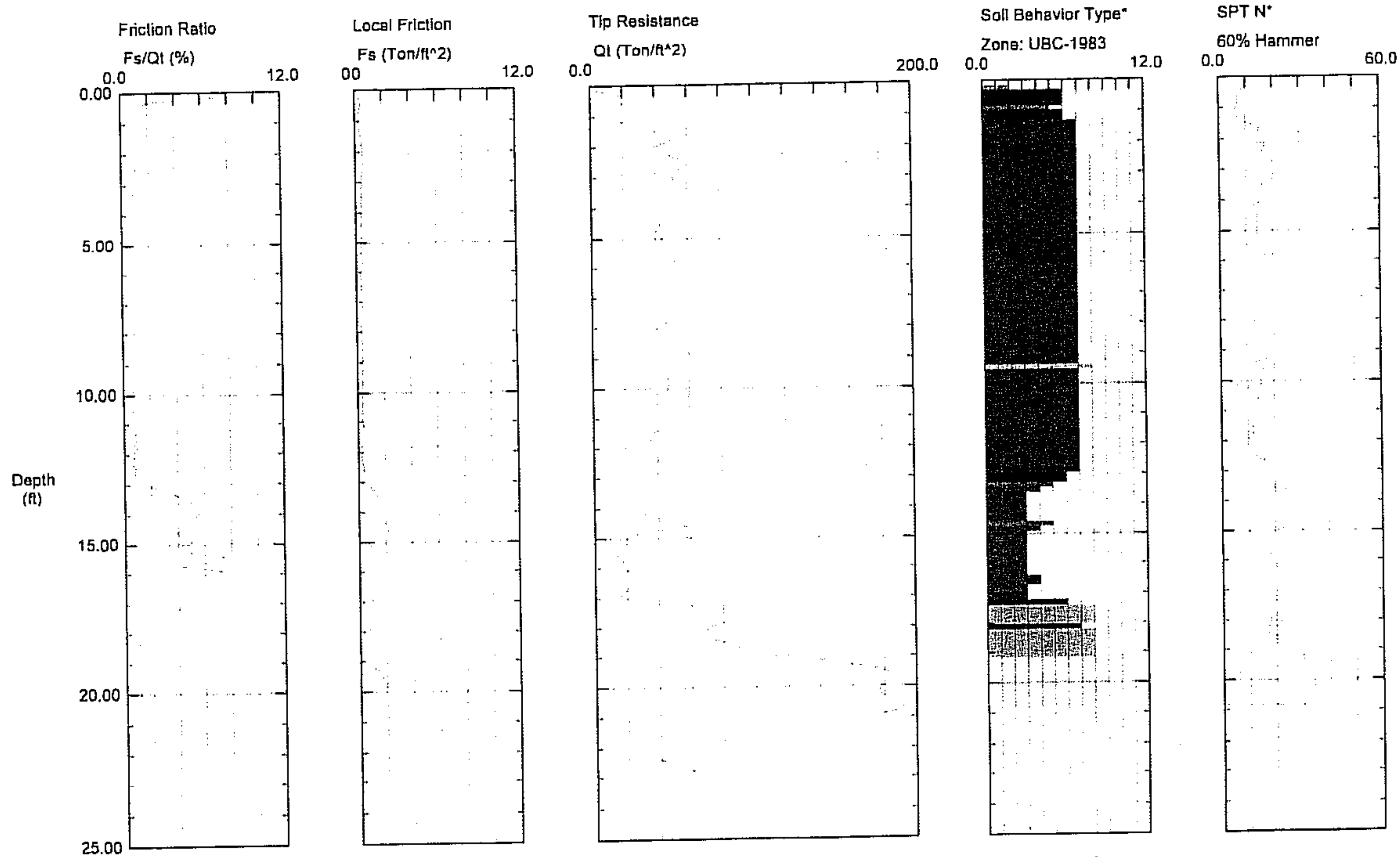
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anc based on data from UBC-1 983

VBI In-Situ resting

Operator: Mike Robertson
Sounding: 04w092
Cone Used: HO856TC

CPT Date/Time: 07-14-04 15:59
Location: CPT-31
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

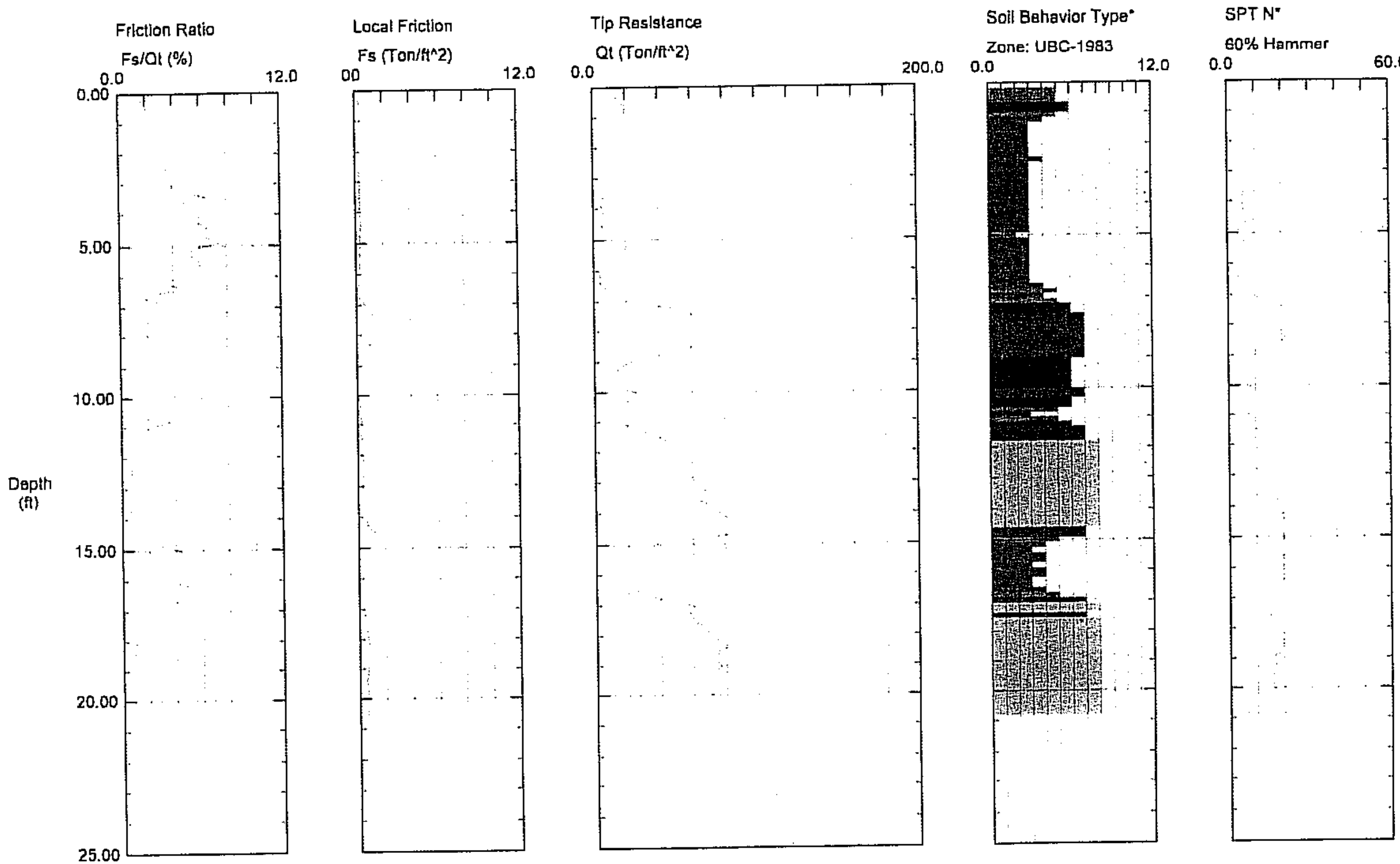
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type al. ' based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w093
Cone Used: HO856TC

CPT Date/Time: 07-15-04 07:32
Location: CPT-32
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

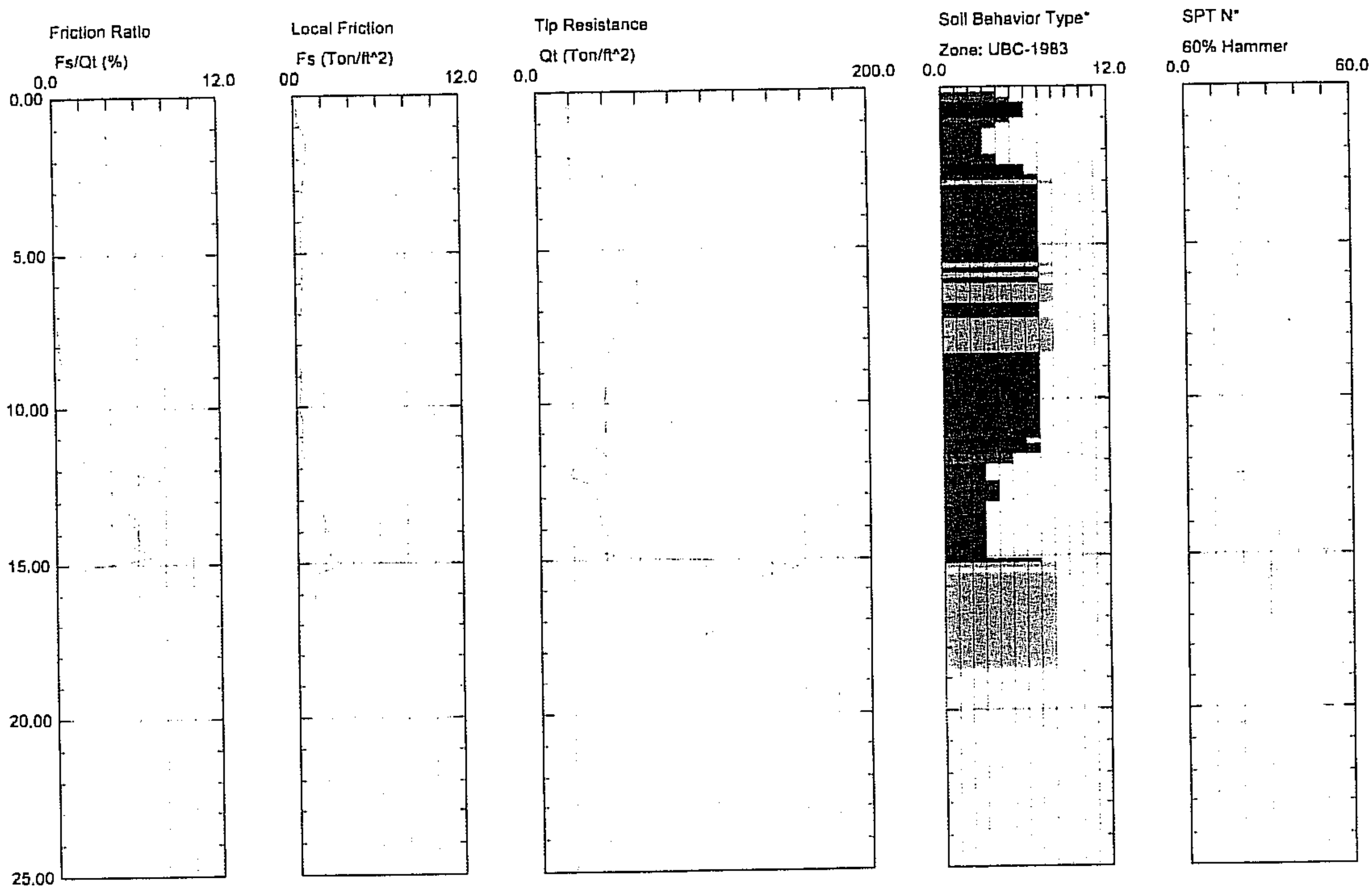
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w094
Cone Used: HO856TC

CPT Date/Time: 07-15-04 08:22
Location: CPT-33
Job Number: 4603.4100.01



Maximum Depth = 20.83 feet

Depth Increment = 0.16 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

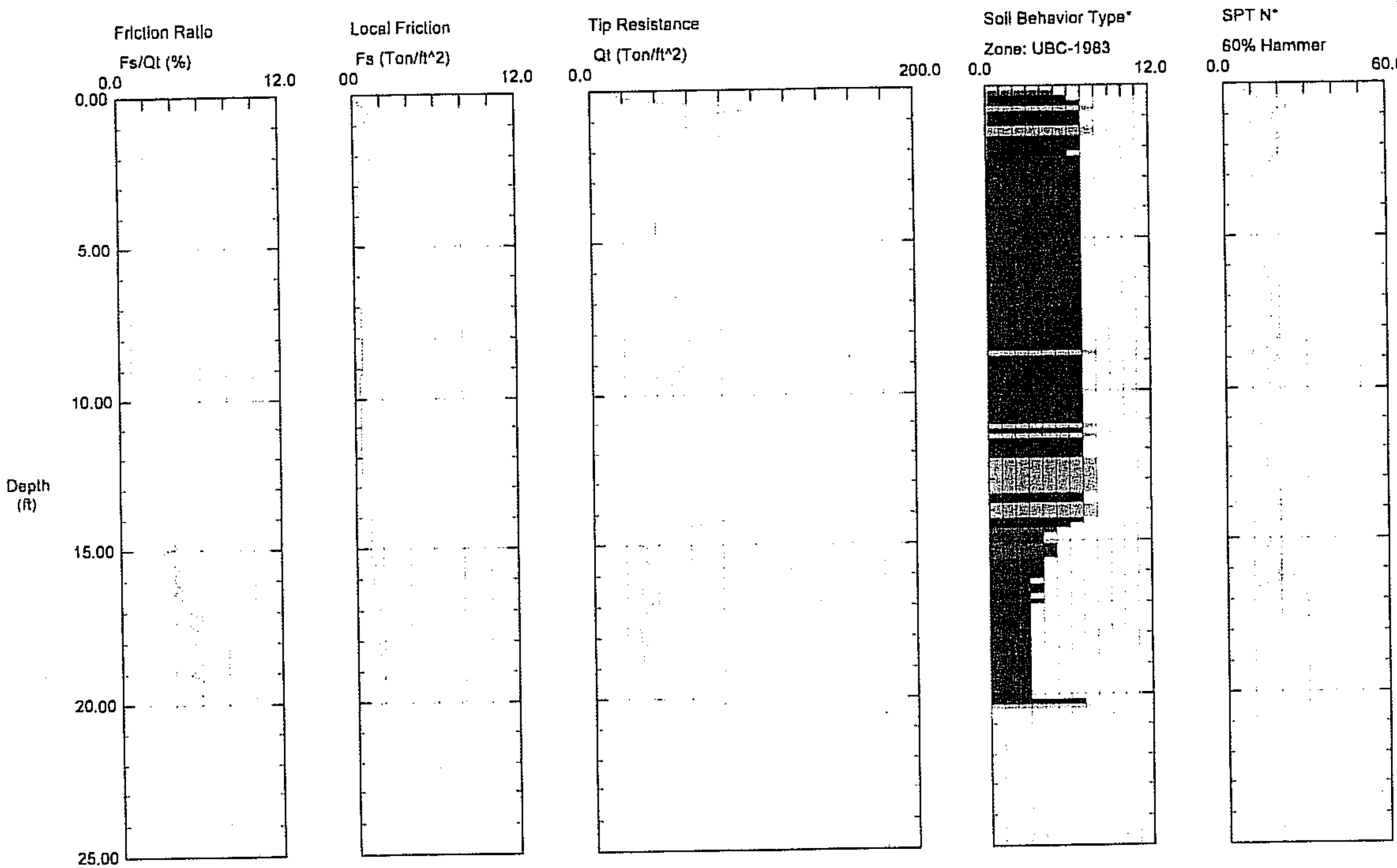
*Soil behavior type and ... ased on data from UBC-1 983

Soil behavior type and S. ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w095
Cone Used: HO856TC

CPT Date/Time: 07-15-04 09:22
Location: CPT-34
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

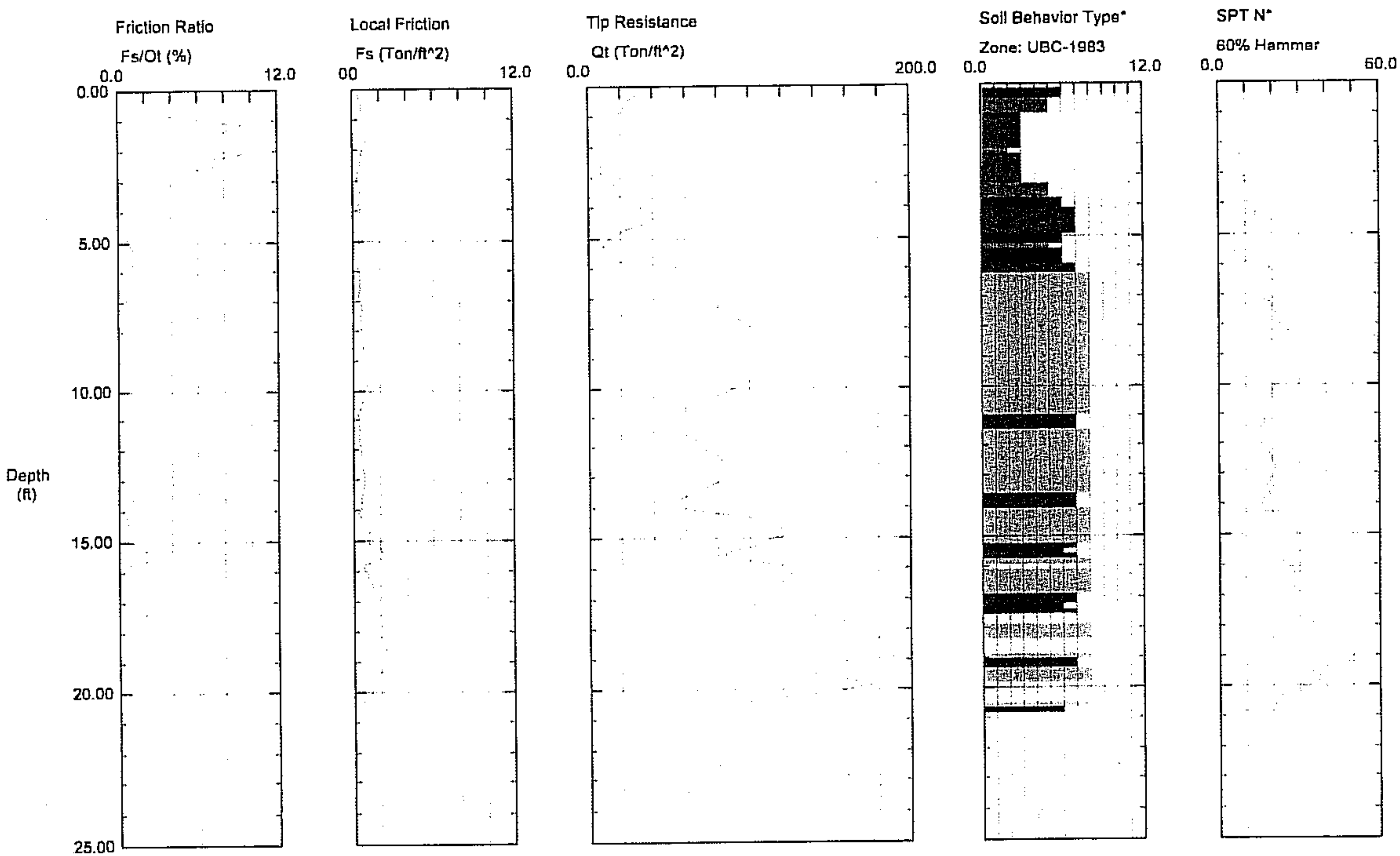
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and ... based on data from UBC-1983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w096
Cone Used: HO856TC

CPT Date/Time: 07-15-04 10:24
Location: CPT-35
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

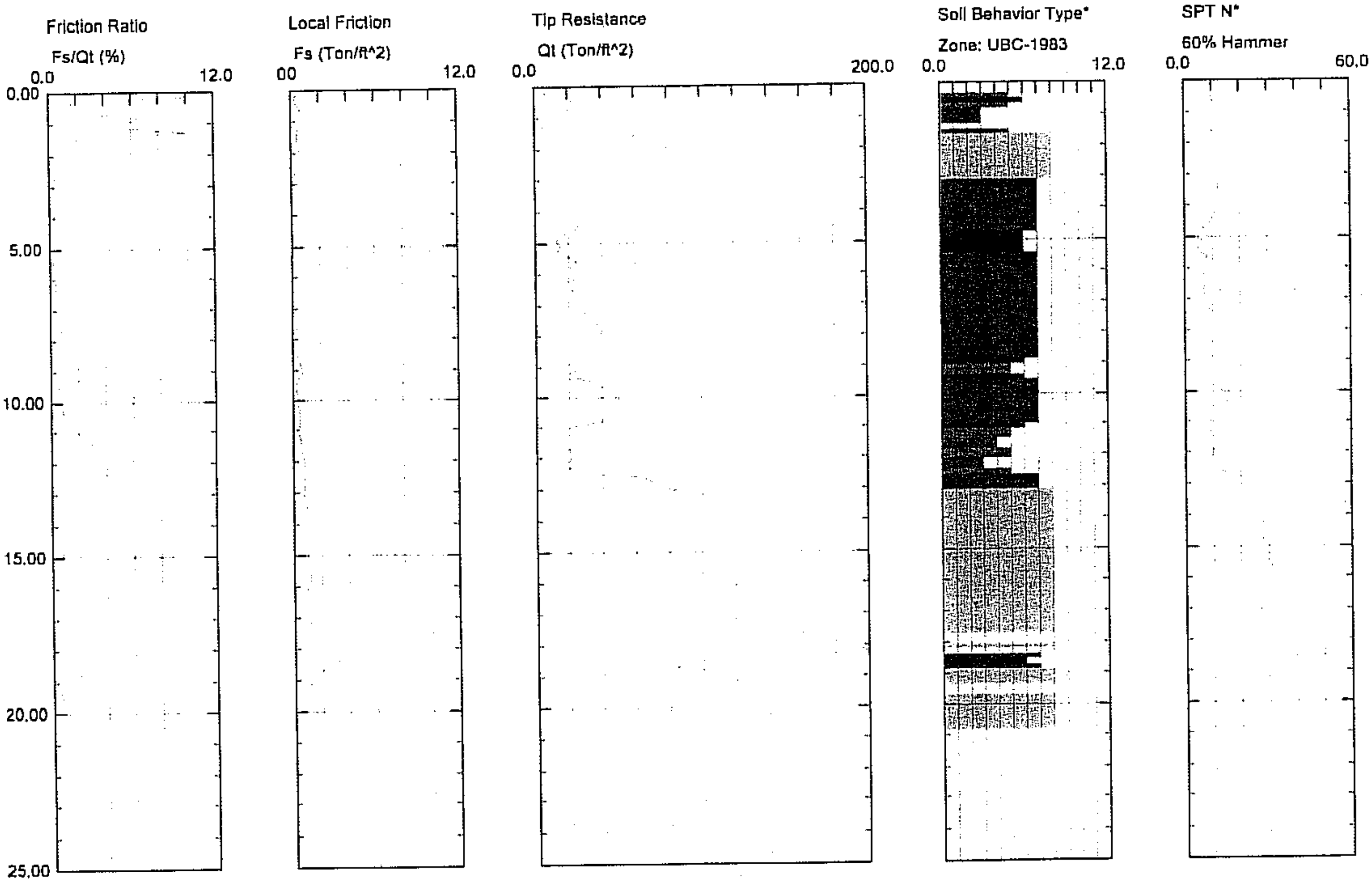
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w097
Cone Used: HO856TC

CPT Date/Time: 07-15-04 12:34
Location: CPT-36
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

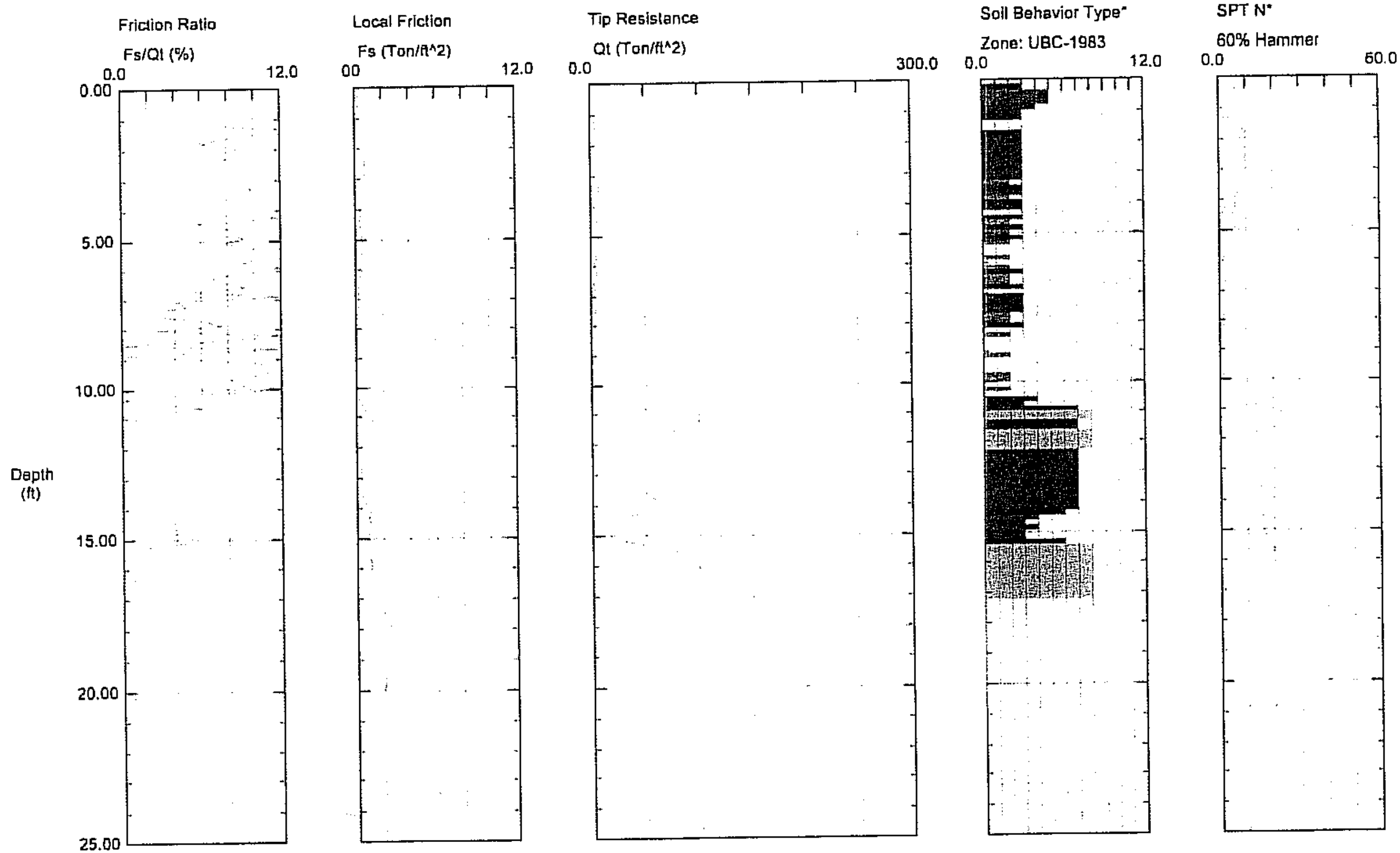
Soil behavior type and ›ased on data from UBC-1 983

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w098
Cone Used: HO856TC

CPT Date/Time: 07-15-04 13:27
Location: CPT-37
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

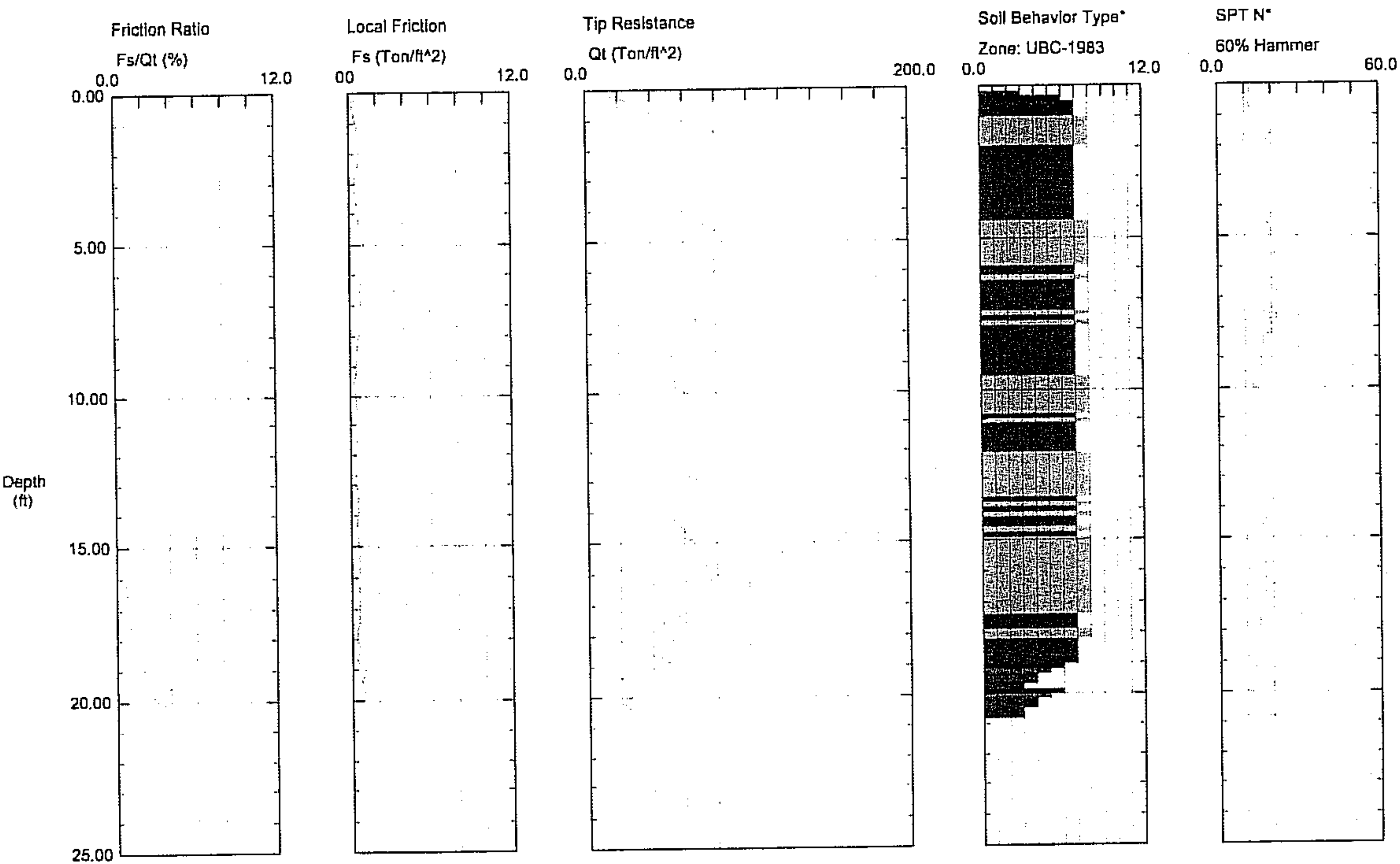
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w099
Cone Used: HO856TC

CPT Date/Time: 07-15-04 14:24
Location: CPT-38
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

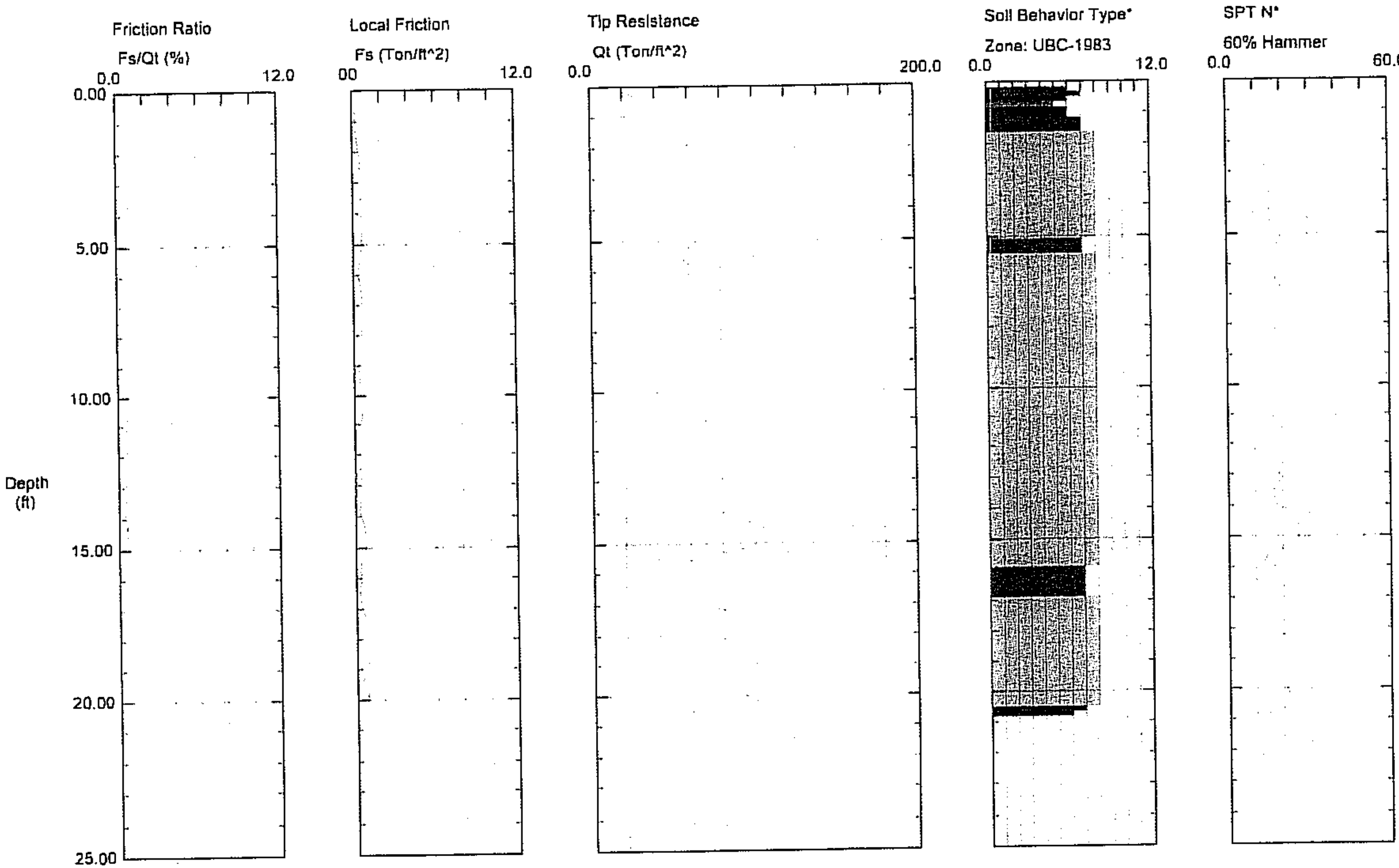
*Soil behavior type anc oased on data from UBC-1 983

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w100
Cone Used: HO856TC

CPT Date/Time: 07-15-04 15:24
Location: CPT-39
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

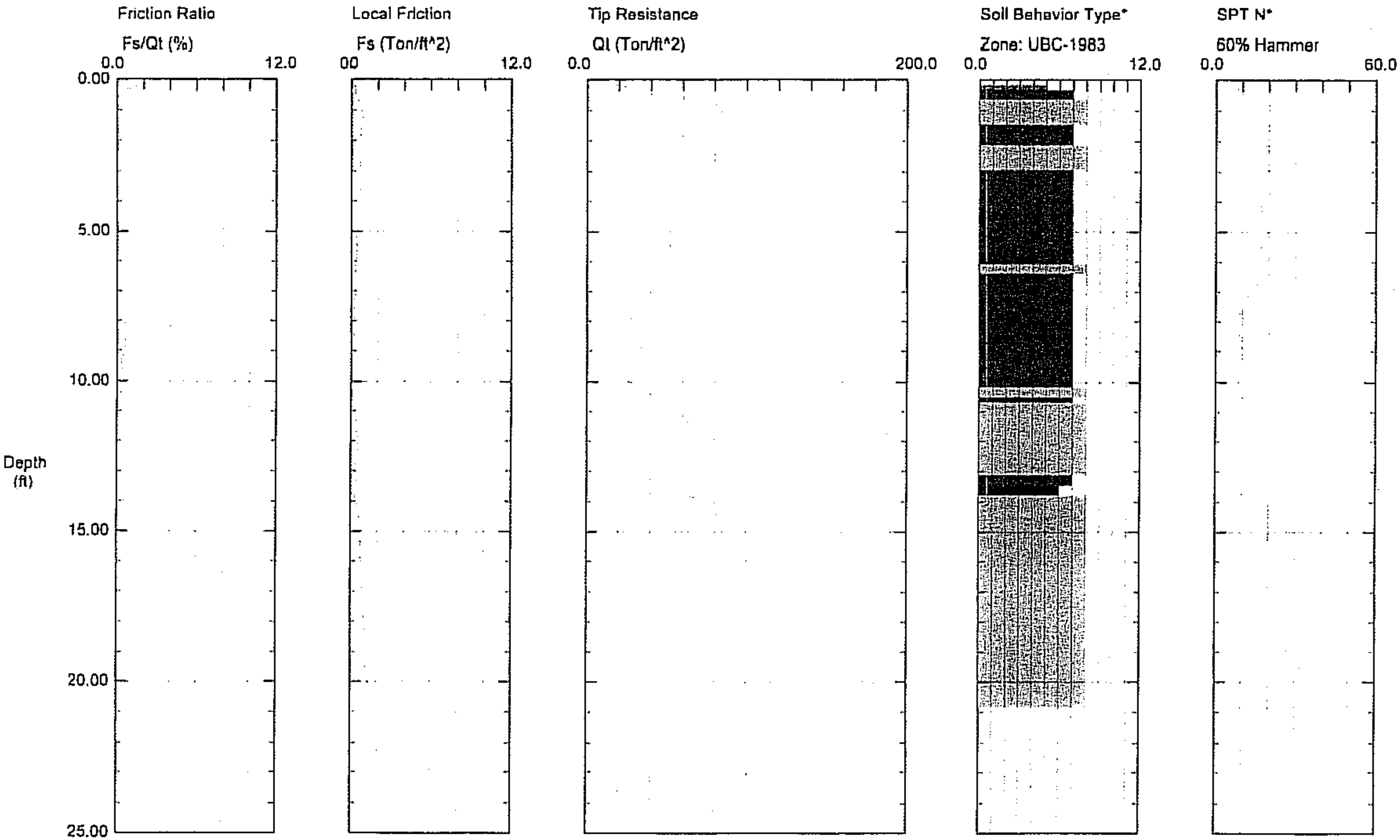
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and based on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w101
Cone Used: HO856TC

CPT Date/Time: 07-15-04 16:20
Location: CPT-40
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

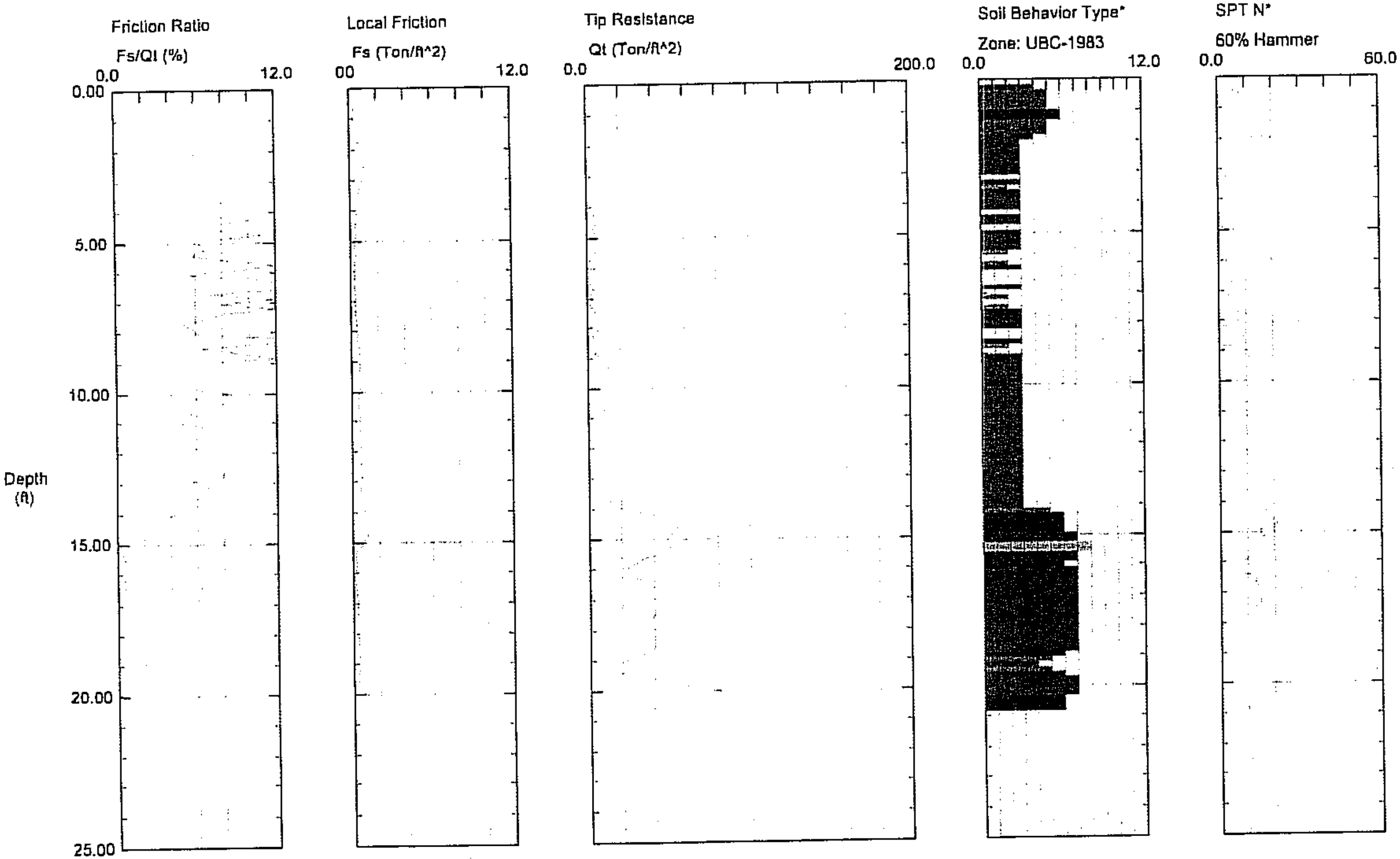
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ 'resting

Operator: Mike Robertson
Sounding: 04w102
Cone Used: HO856TC

CPT Date/Time: 07-16-04 08:26
Location: CPT-41
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

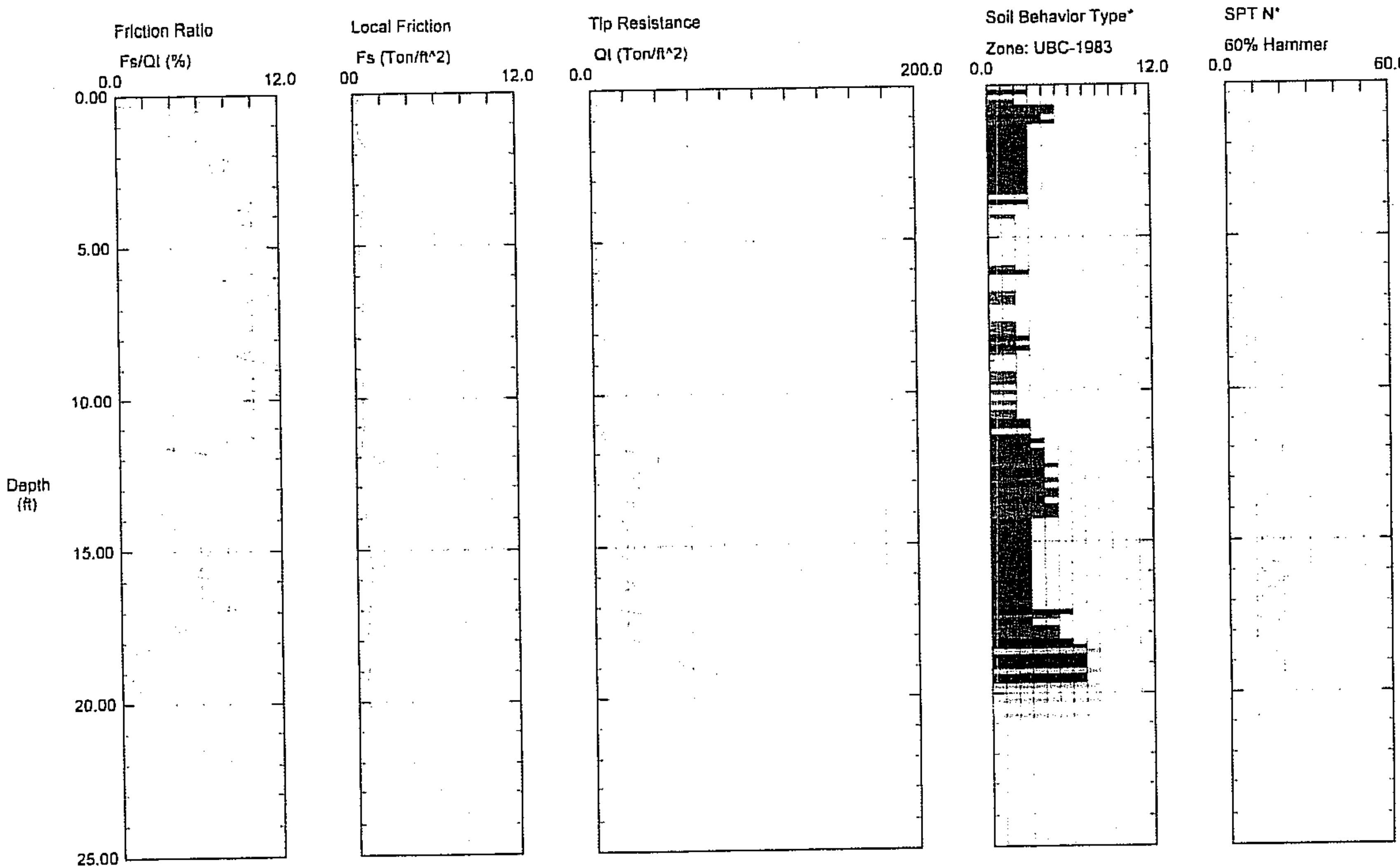
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type and ... ased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w103
Cone Used: HO856TC

CPT Date/Time: 07-16-04 09:18
Location: CPT-42
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

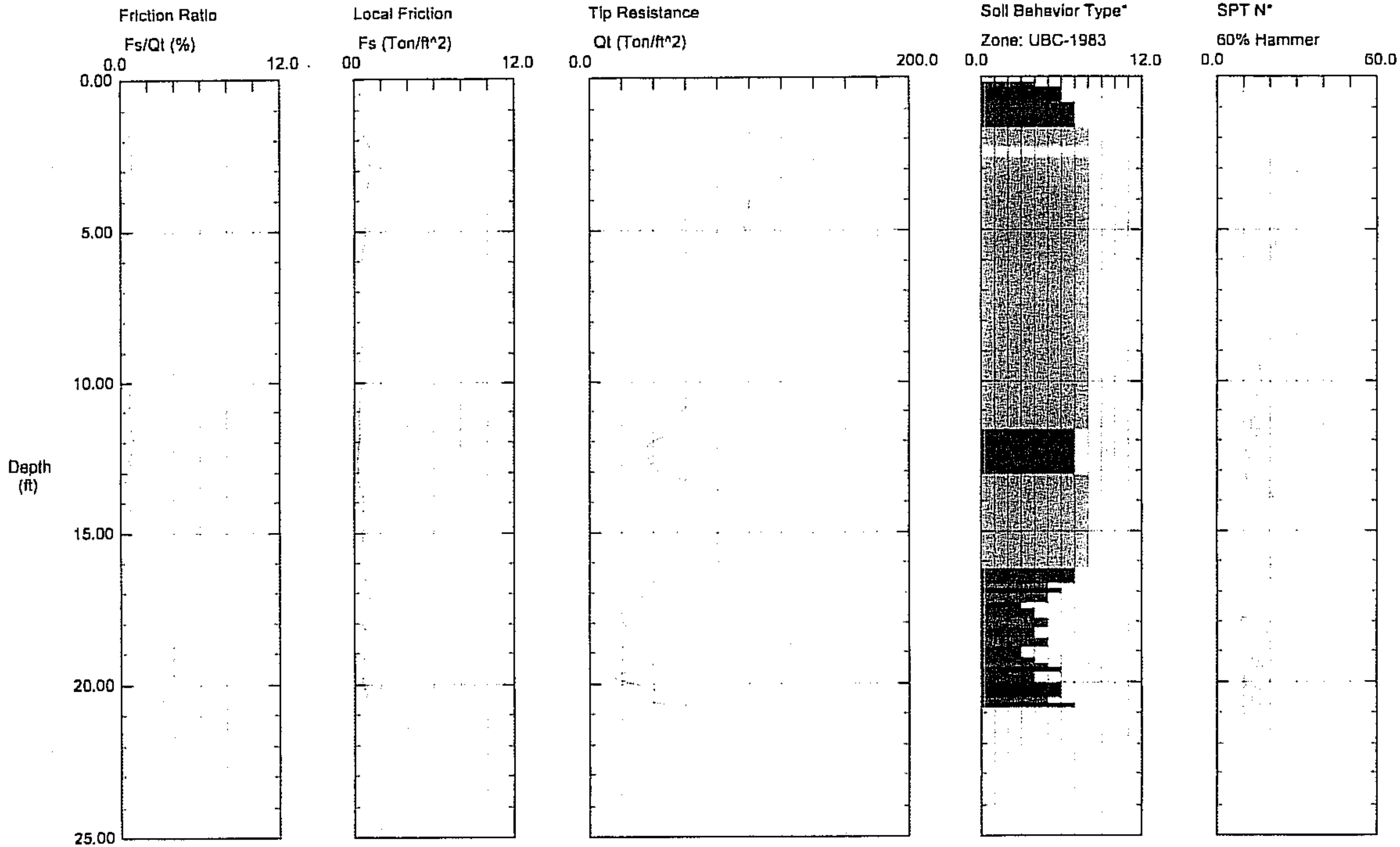
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Soil behavior type anL   ɔased on data from UBC-1 983

VBI In-Situ Testing

Operator: Mike Robertson
Sounding: 04w104
Cone Used: HO856TC

CPT Date/Time: 07-16-04 10:24
Location: CPT-43
Job Number: 4603.4100.01



Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

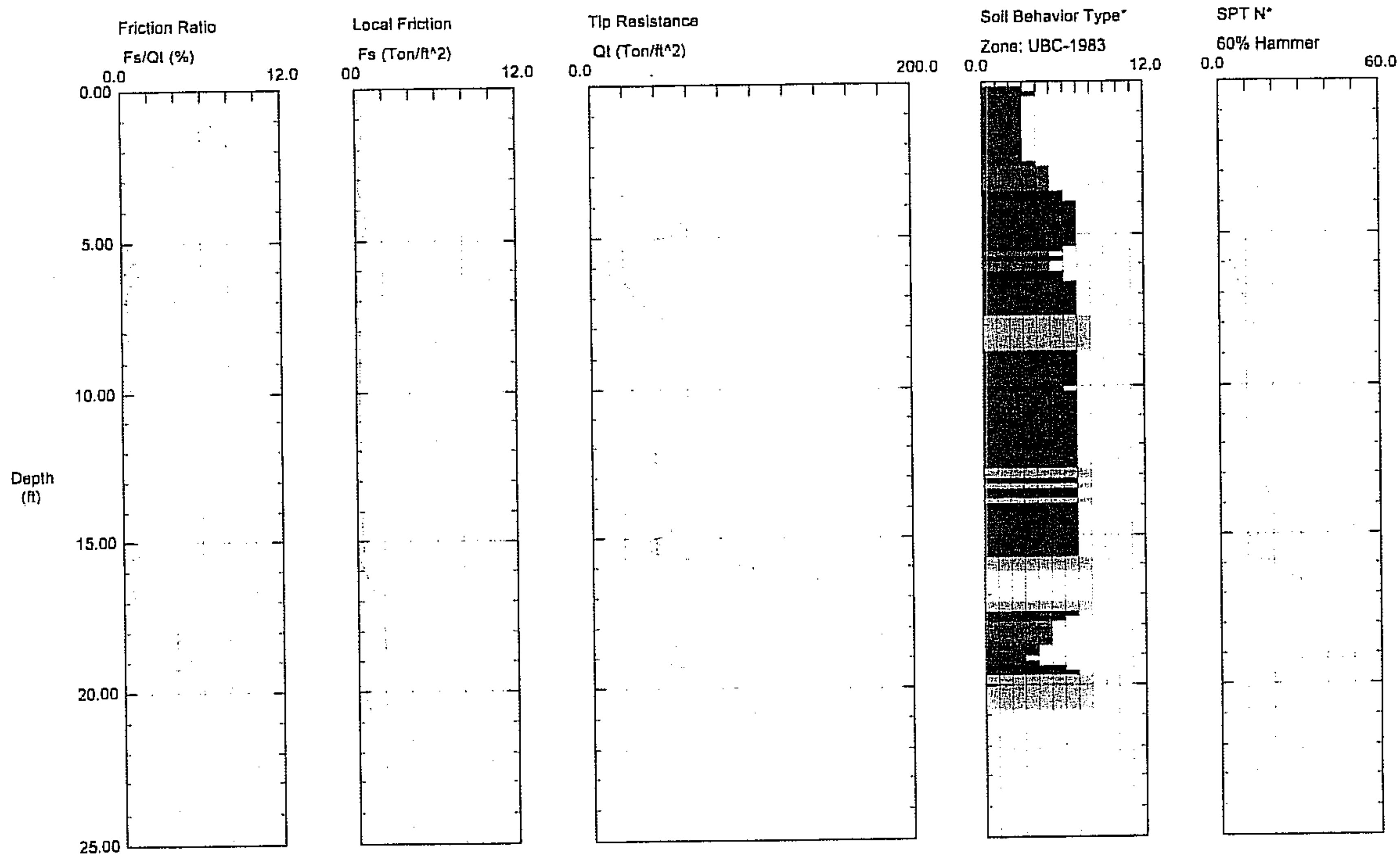
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Soil behavior type and ased on data from UBC-1 983

VBI In-Situ ' esting

Operator: Mike Robertson
Sounding: 04w107
Cone Used: HO856TC

CPT Date/Time: 07-16-04 12:09
Location: CPT-46
Job Number: 4603.4100.01

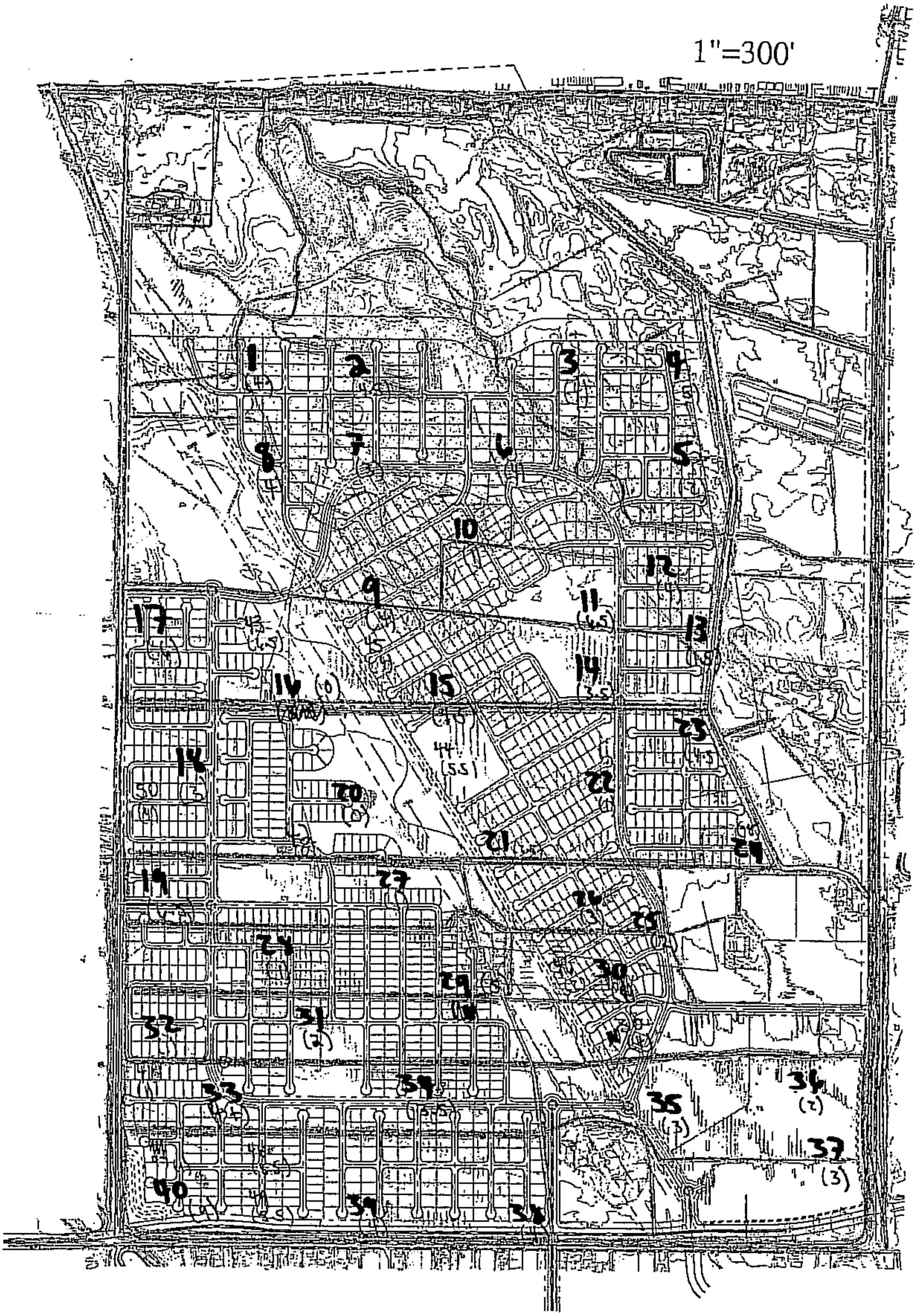


Maximum Depth = 21.00 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

1"=300'


1
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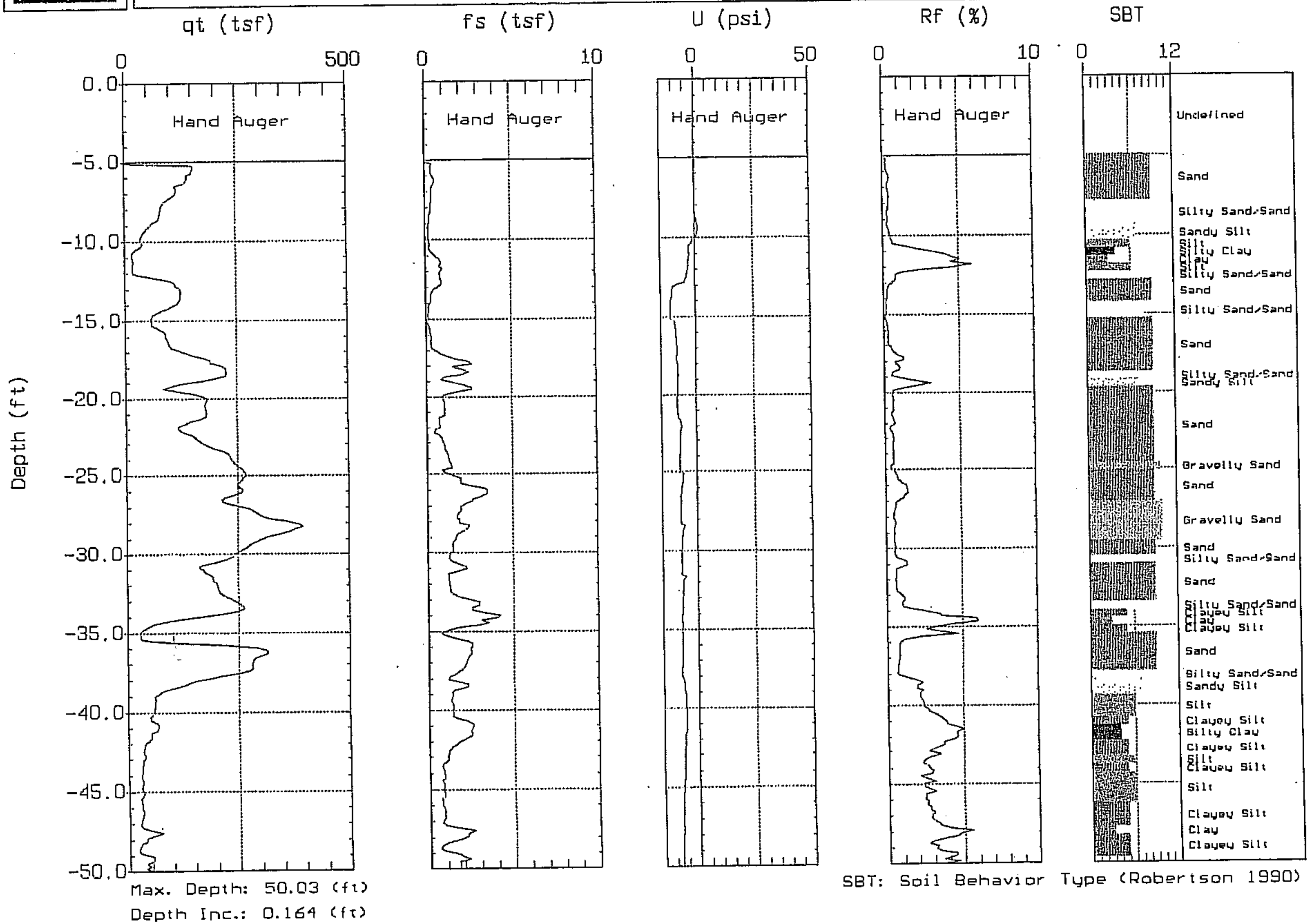
GREGG ENGEO

Site: KB HOMES
Location: CPT-1

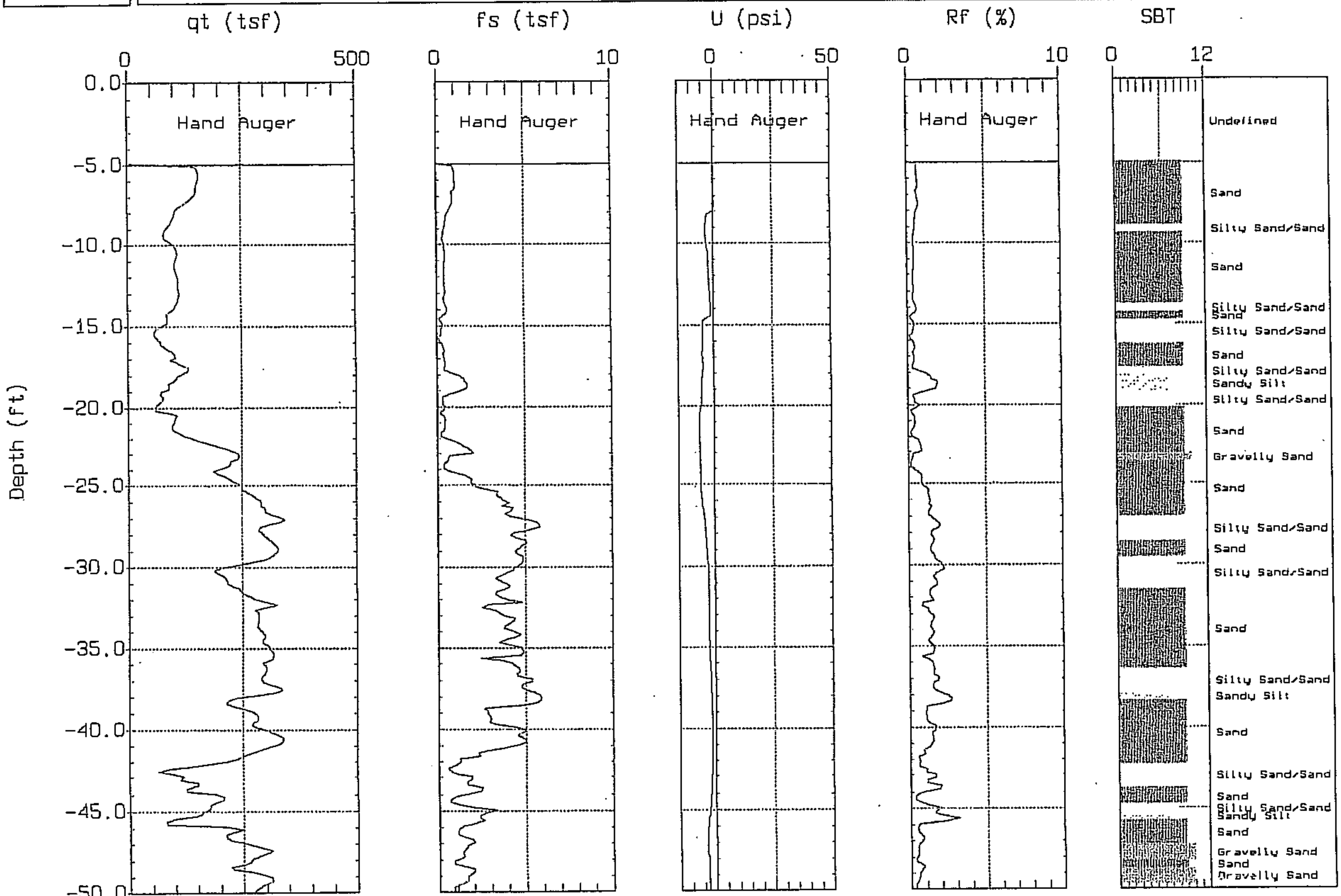
Engineer: S.HARRIS
Date: 07:15:05 10:24



ENGEO

Site: KB HOMES
Location: CPT-2

Engineer: S.HARRIS
Date: 07:15:05 11:06



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

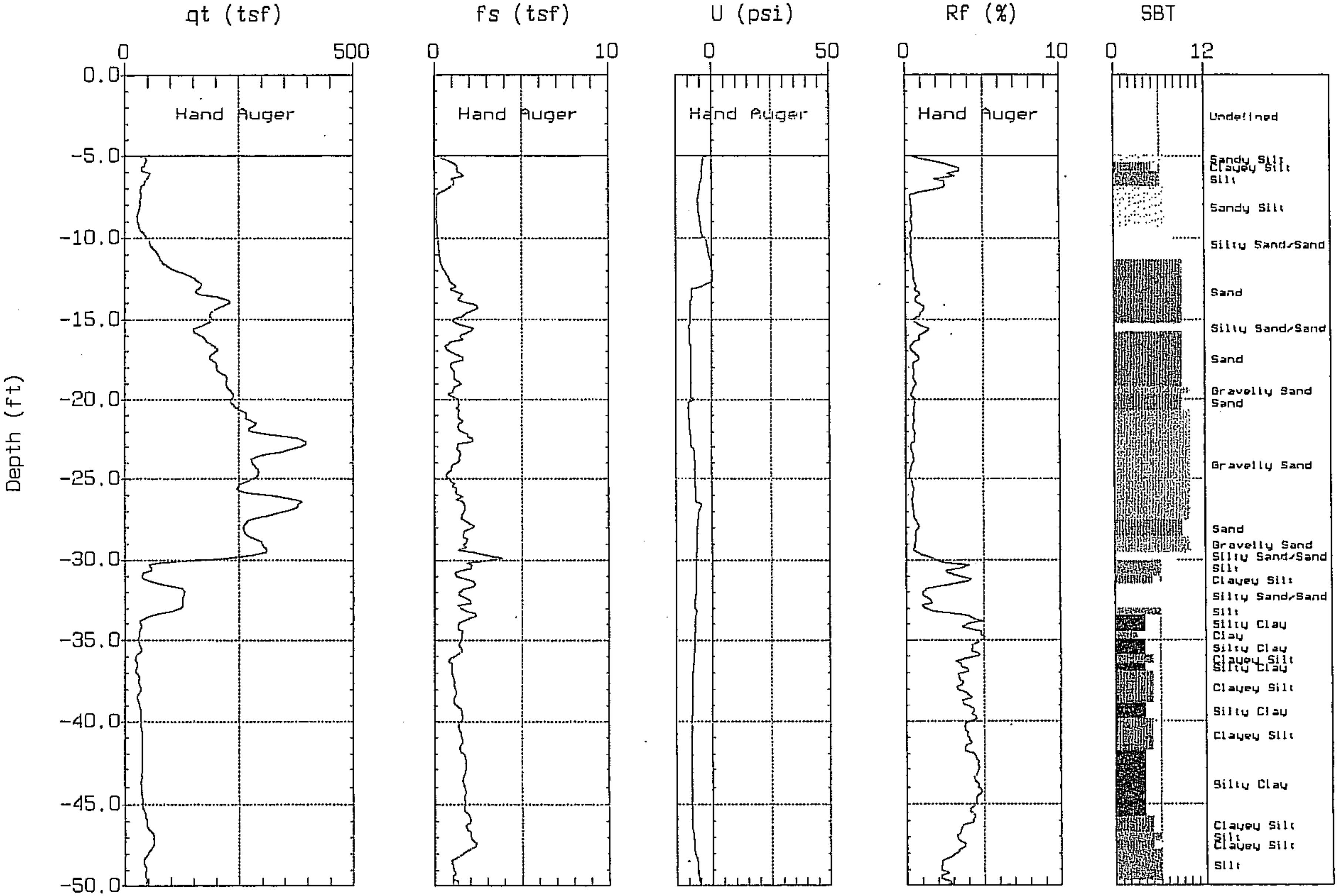
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-3

Engineer: S.HARRIS
Date: 07:18:05 15:25



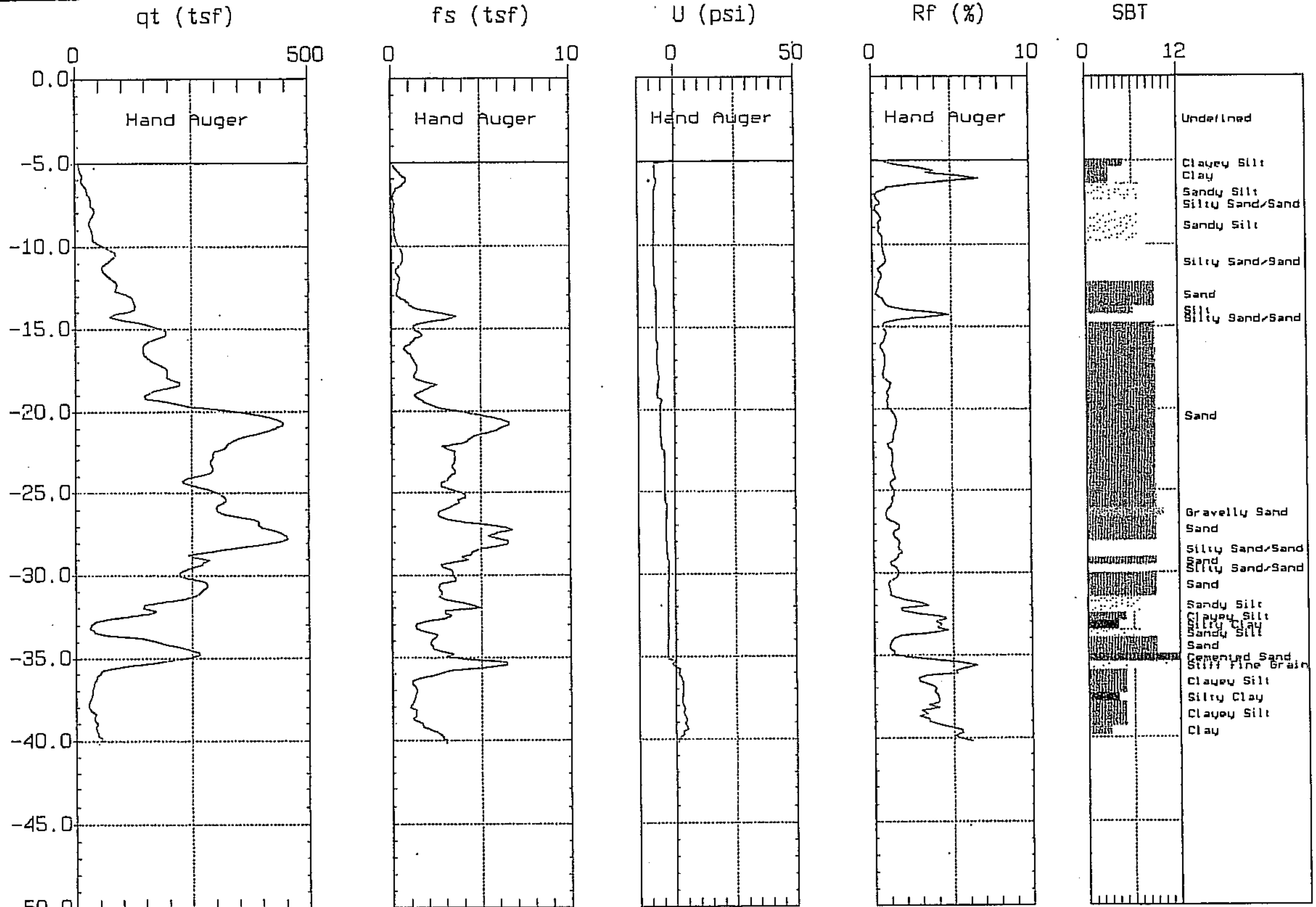
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-4

Engineer: S.HARRIS
Date: 07:18:05 14:41



Max. Depth: 40.19 (ft)
Depth Inc.: 0.164 (ft)

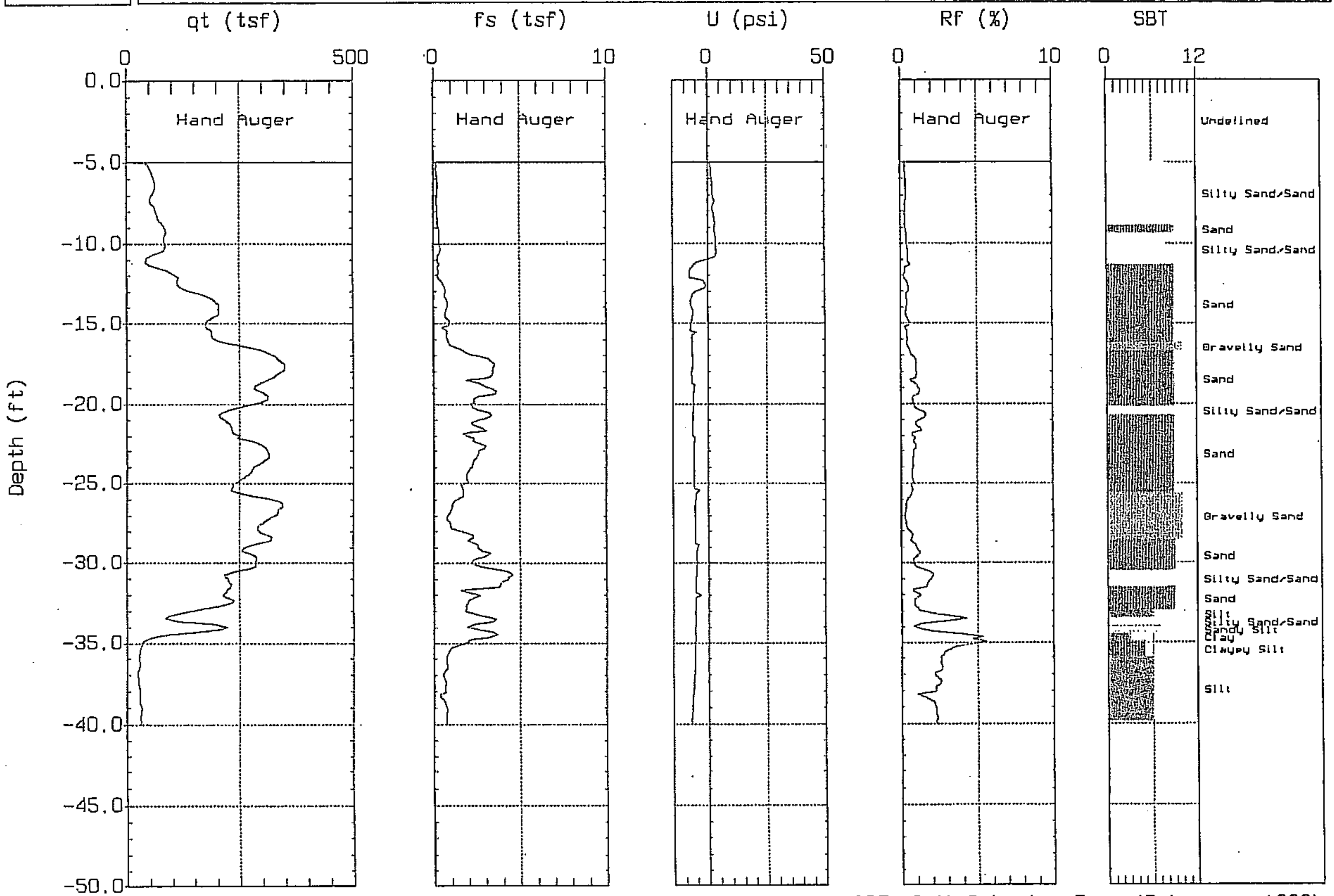
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-5

Engineer: S.HARRIS
Date: 07:19:05 07:46



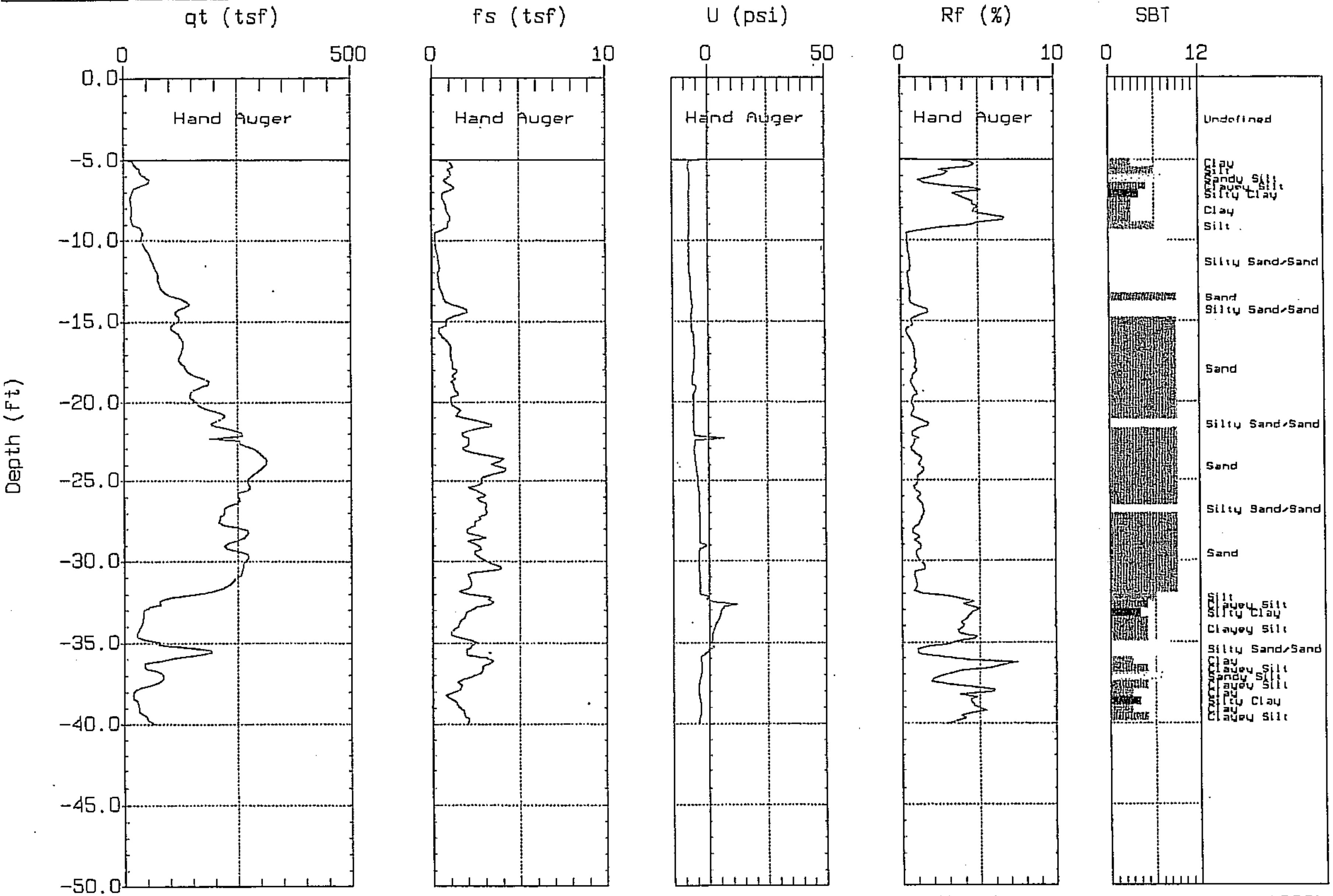
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-6

Engineer: S.HARRIS
Date: 07:18:05 11:49



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

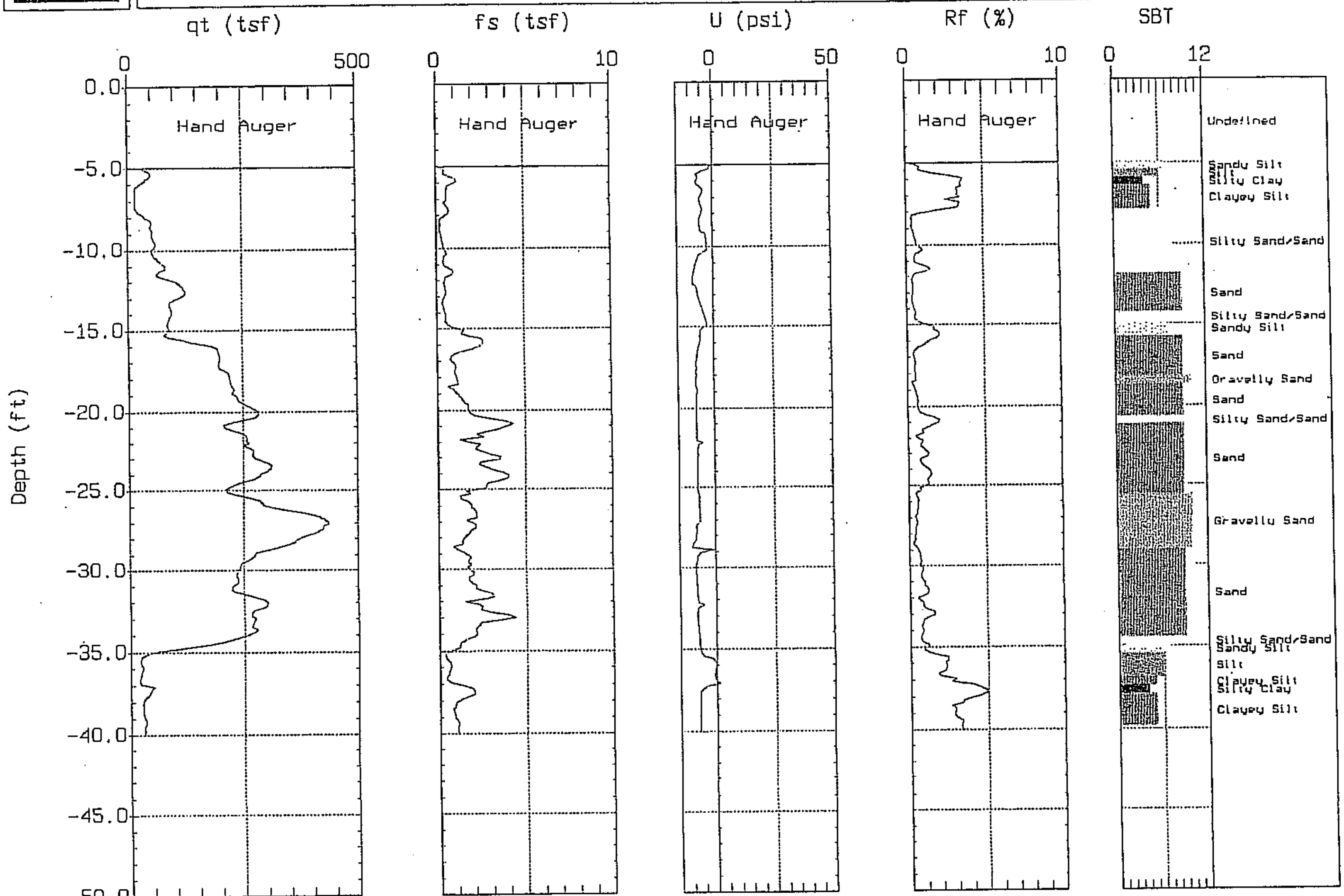
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-7

Engineer: S.HARRIS
Date: 07:18:05 10:47



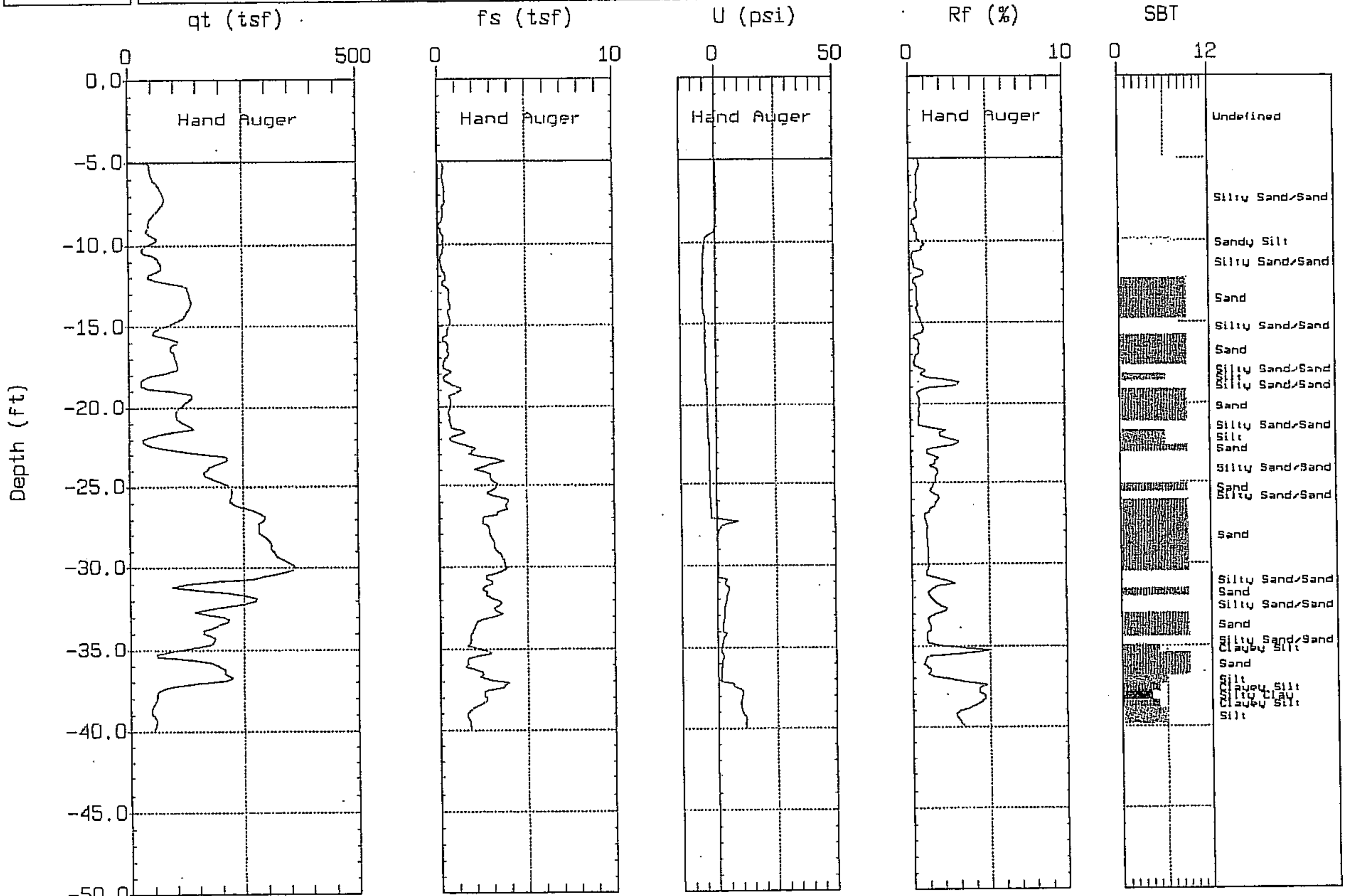
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO

Site: KB HOMES
Location: CPT-8

Engineer: S.HARRIS
Date: 07:15:05 09:53



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

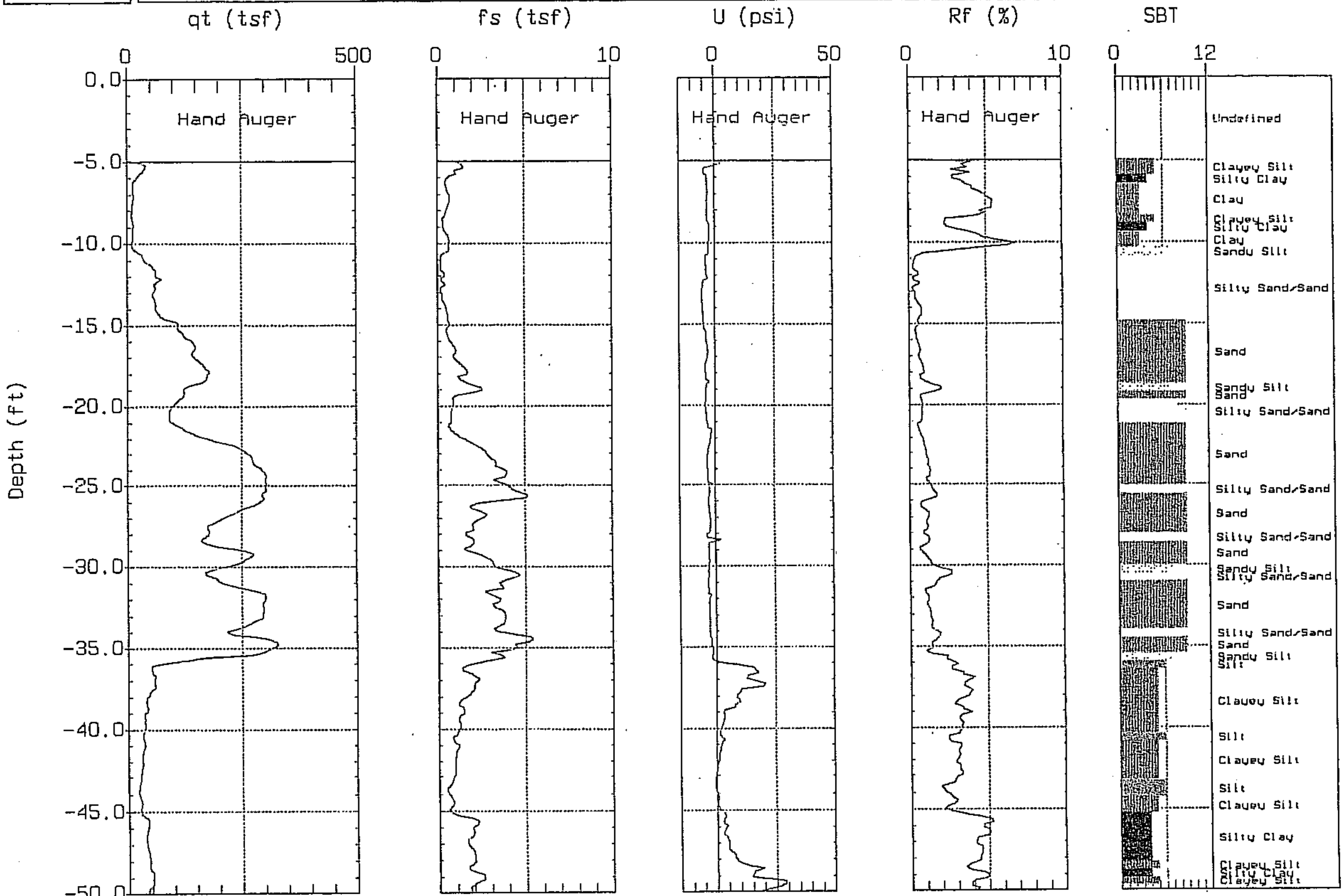
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-9

Engineer: S.HARRIS
Date: 07:15:05 08:34



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

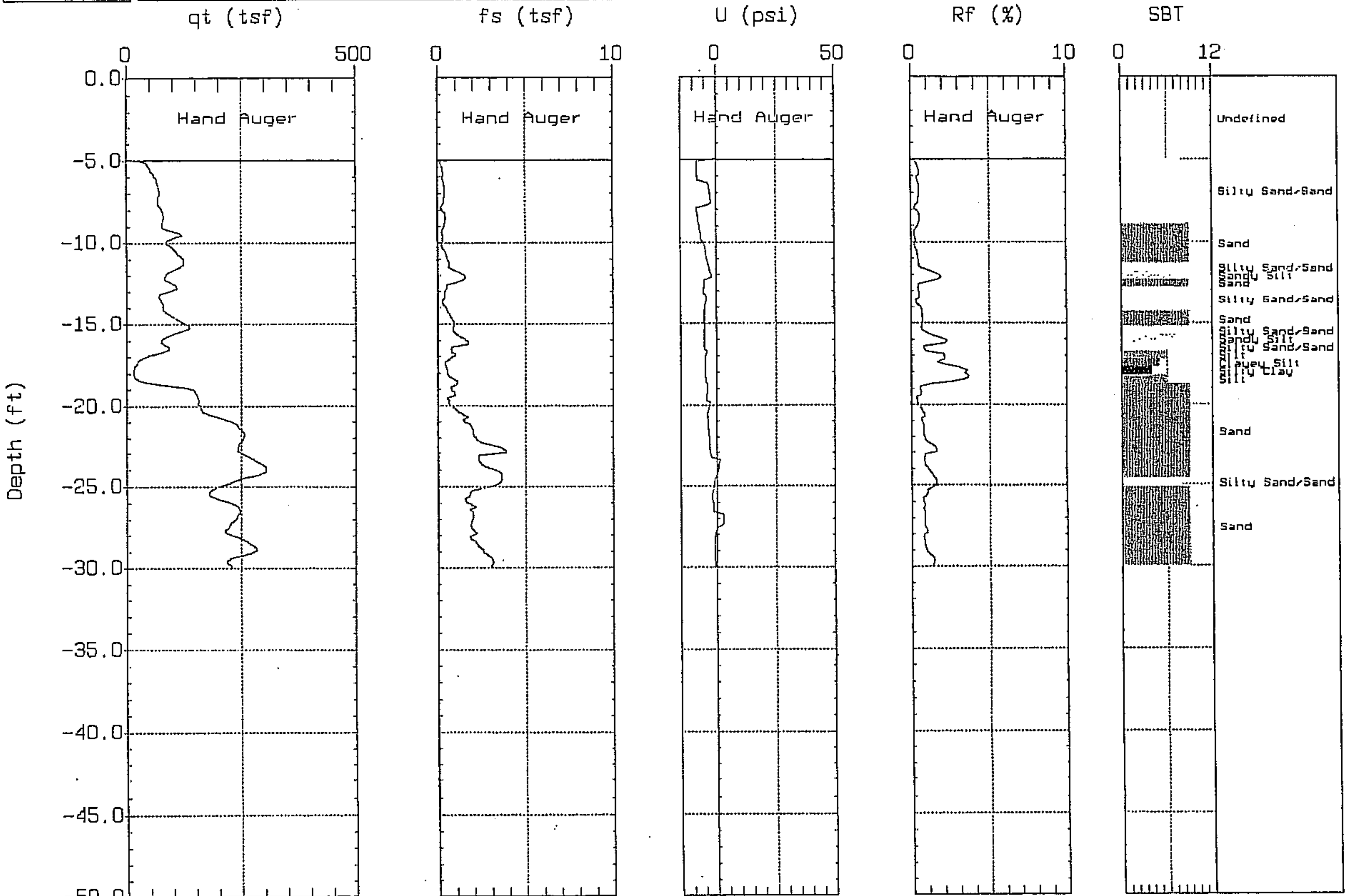
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-10

Engineer: S.HARRIS
Date: 07:18:05 11:27



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

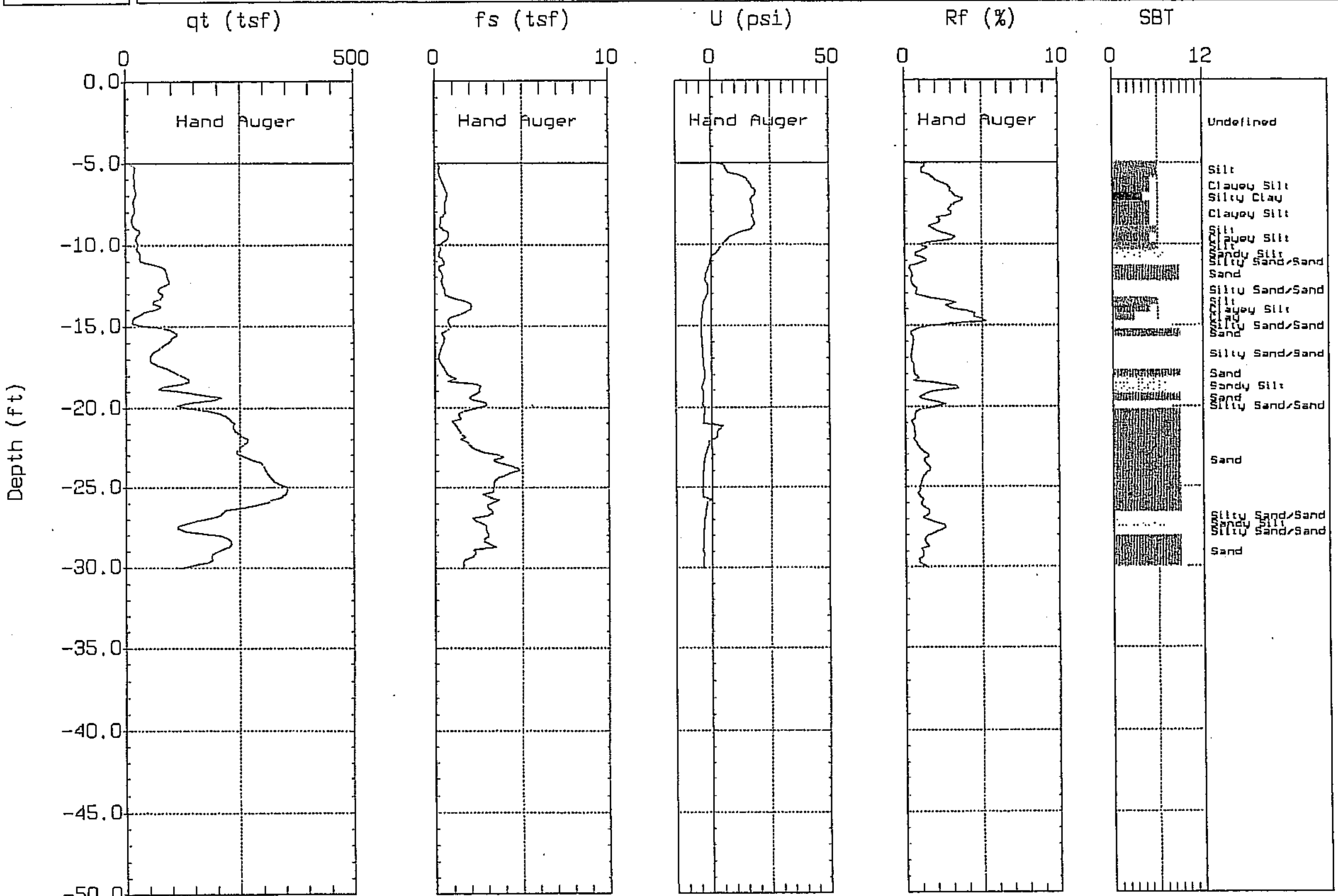
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-11

Engineer: S.HARRIS
Date: 07:15:05 09:07



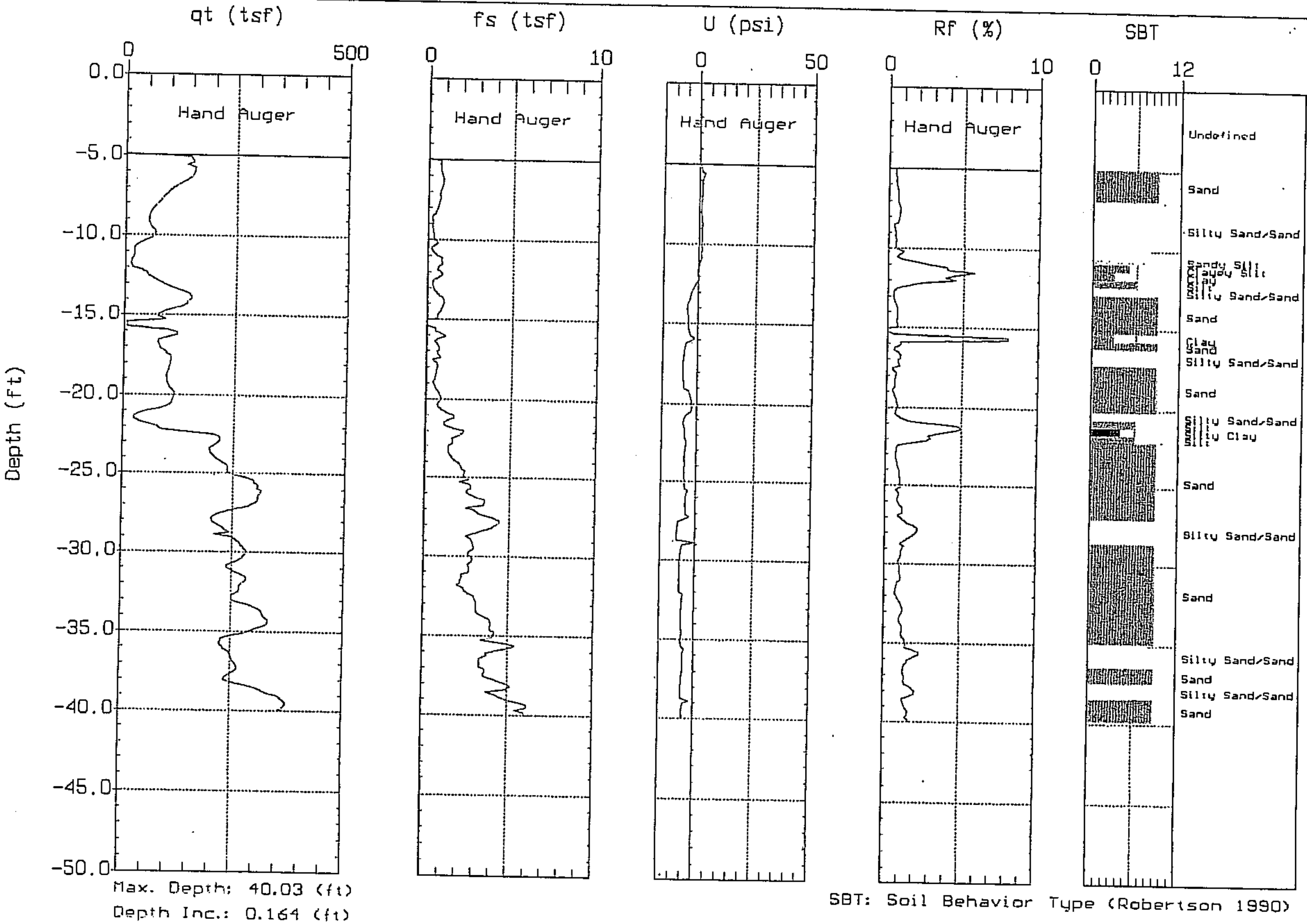
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-12

Engineer: S.HARRIS
Date: 07:18:05 12:29



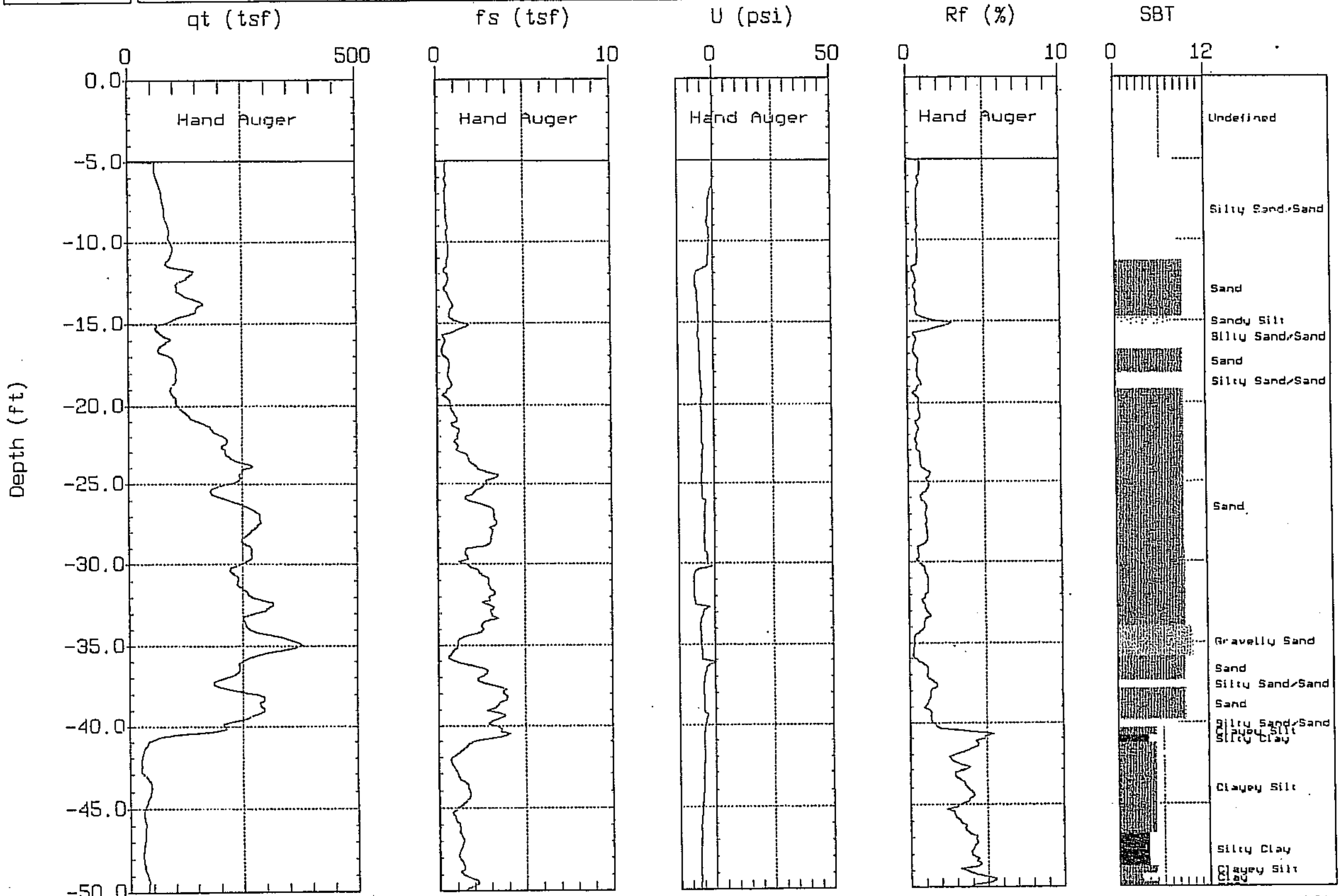
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KG HOMES
Location: CPT-13

Engineer: S.HARRIS
Date: 07:18:05 13:04



Max. Depth: 50.36 (ft)
Depth Inc.: 0.164 (ft)

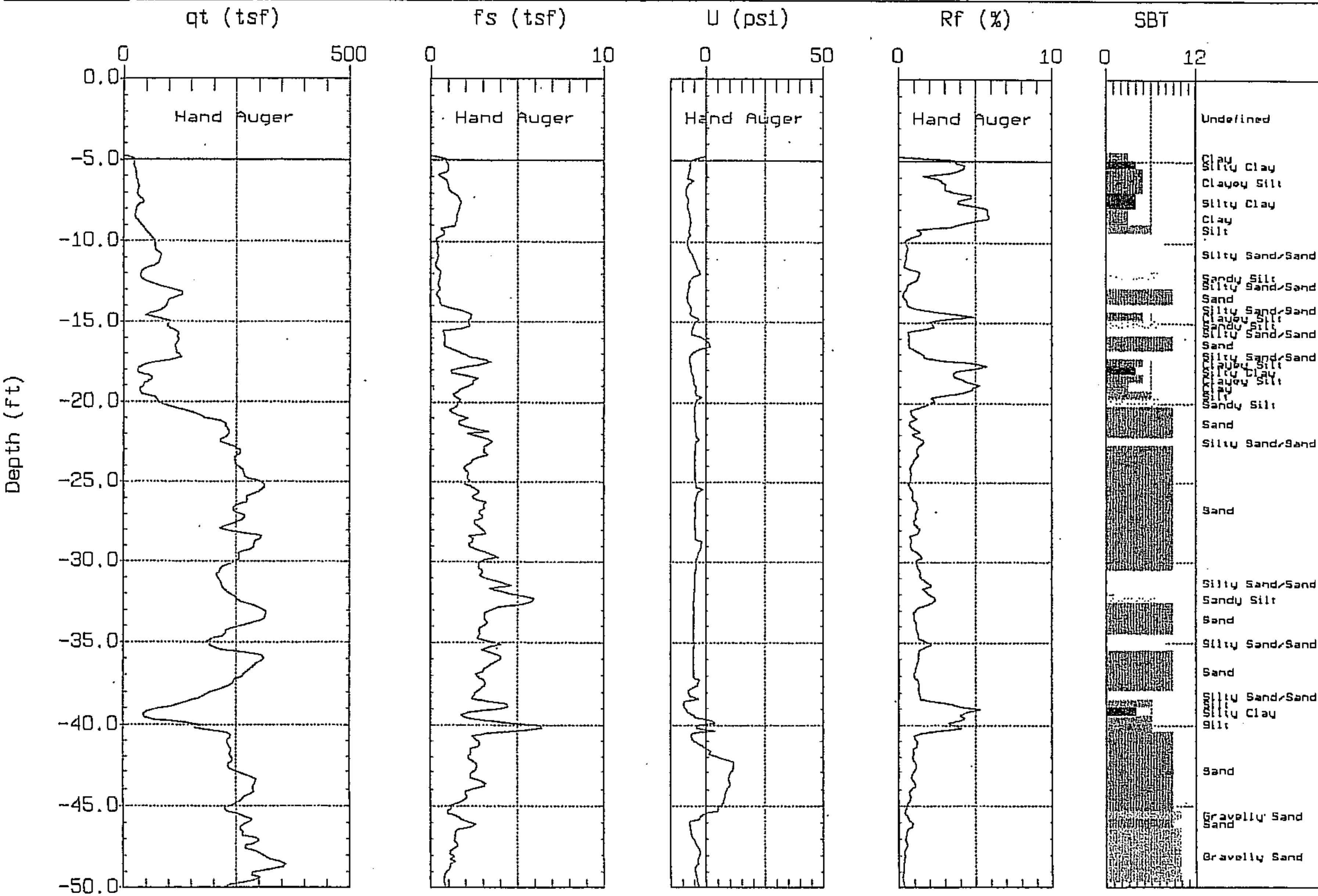
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-14

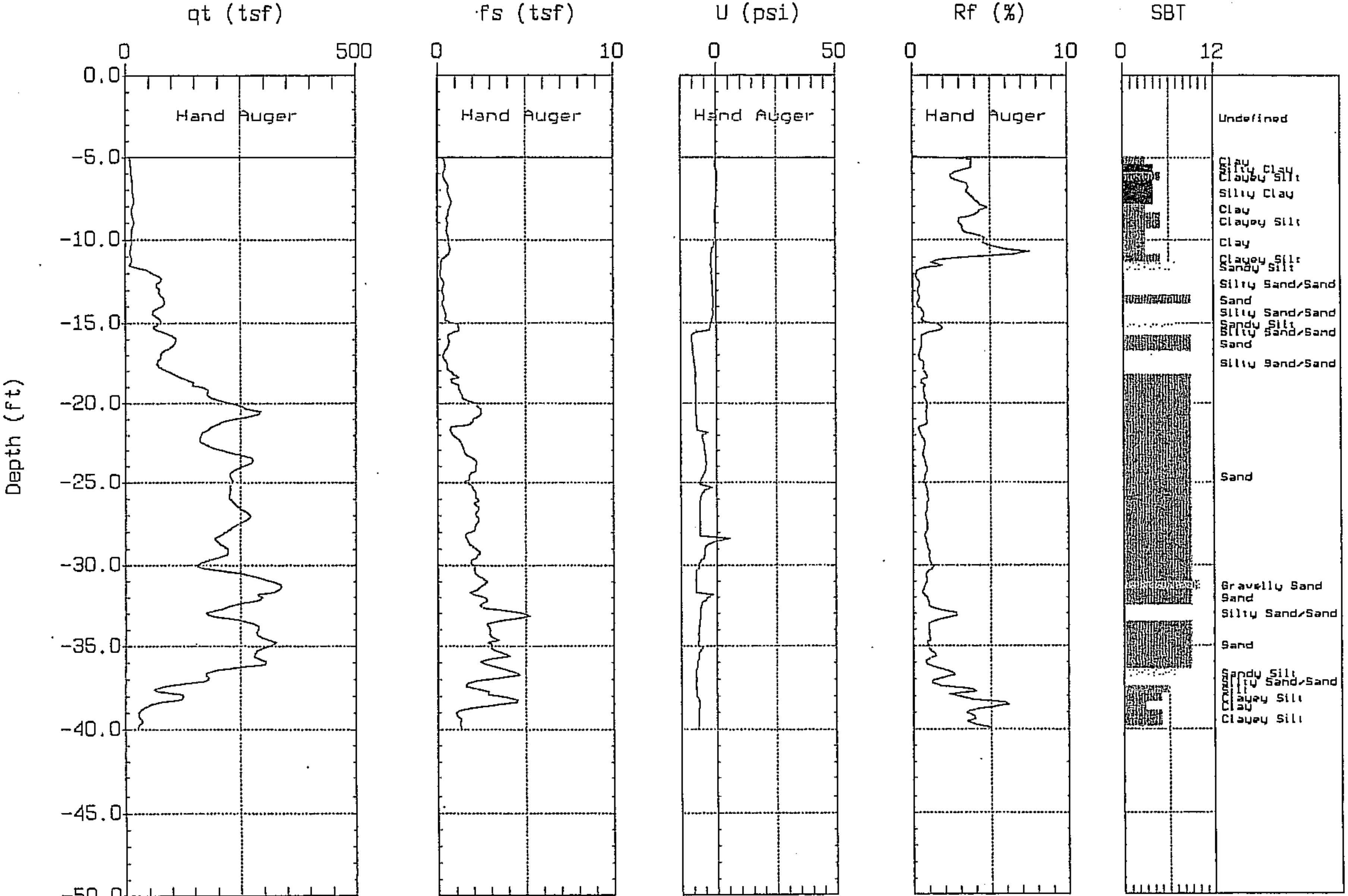
Engineer: S.HARRIS
Date: 07:15:05 07:39



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES
Location: CPT-15 | Engineer: S.HARRIS
Date: 07:14:05 15:31



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

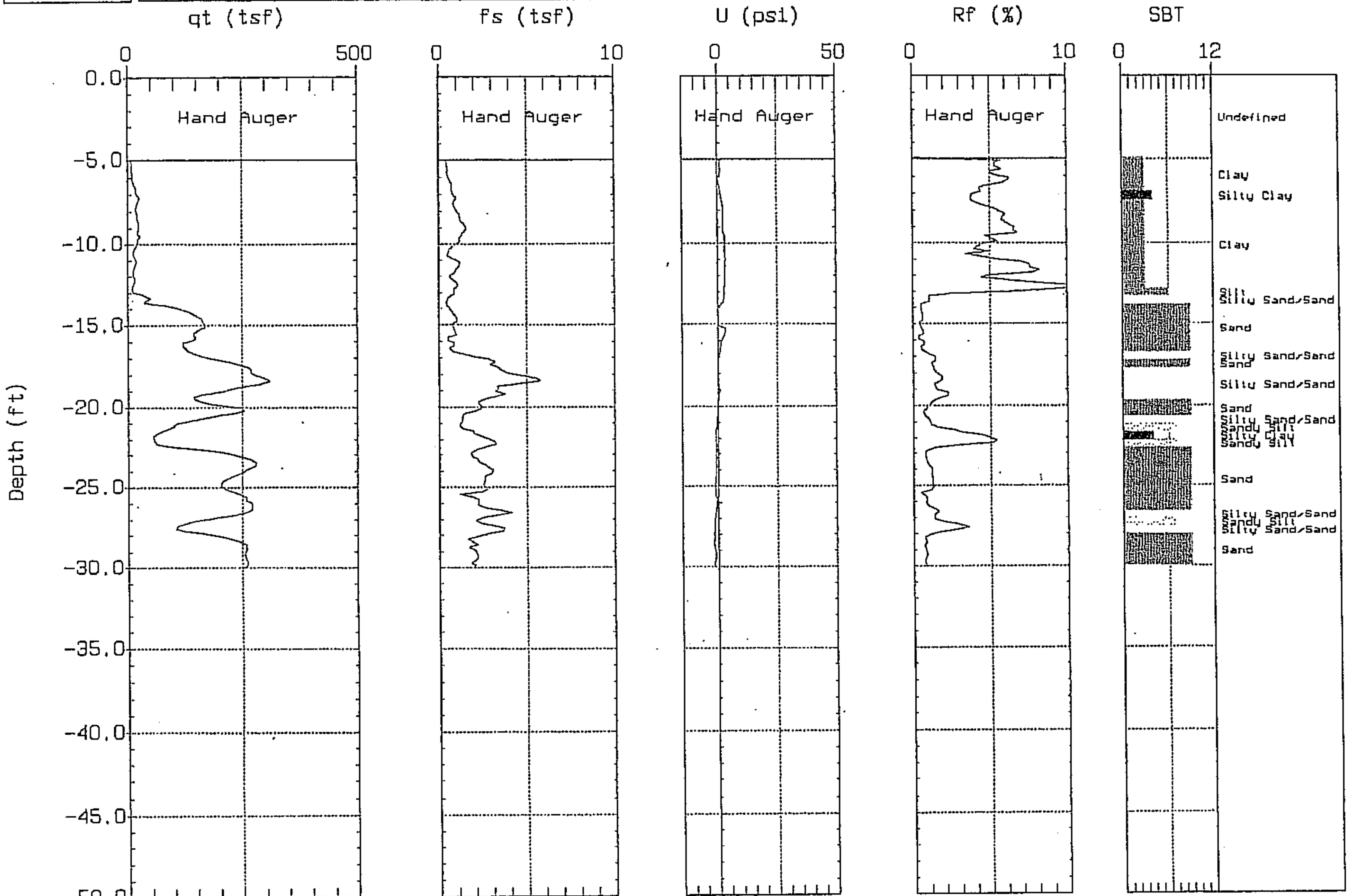
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-16

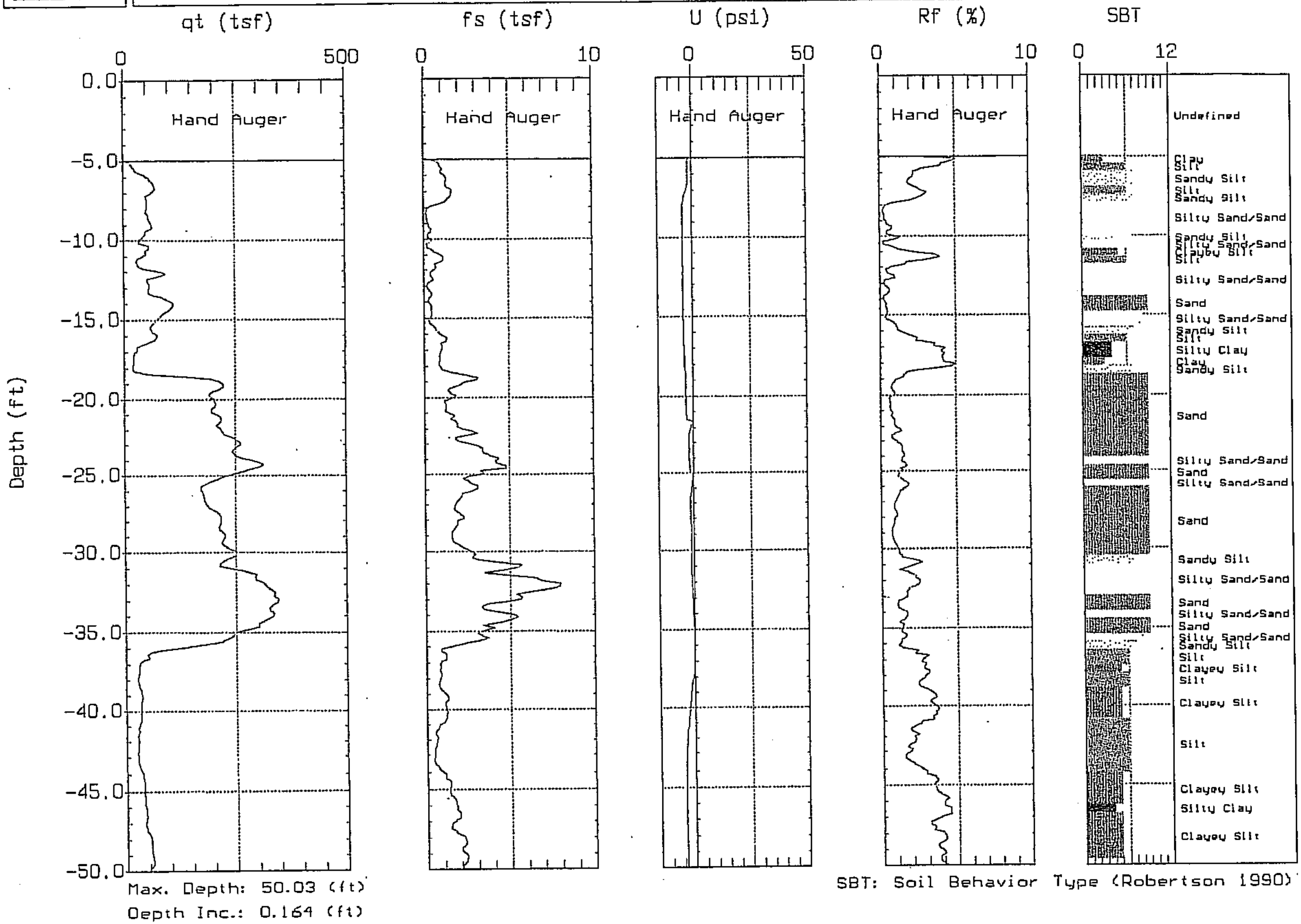
Engineer: S.HARRIS
Date: 07:14:05 14:18



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES
Location: CPT-17 | Engineer: S.HARRIS
Date: 07:14:05 14:57



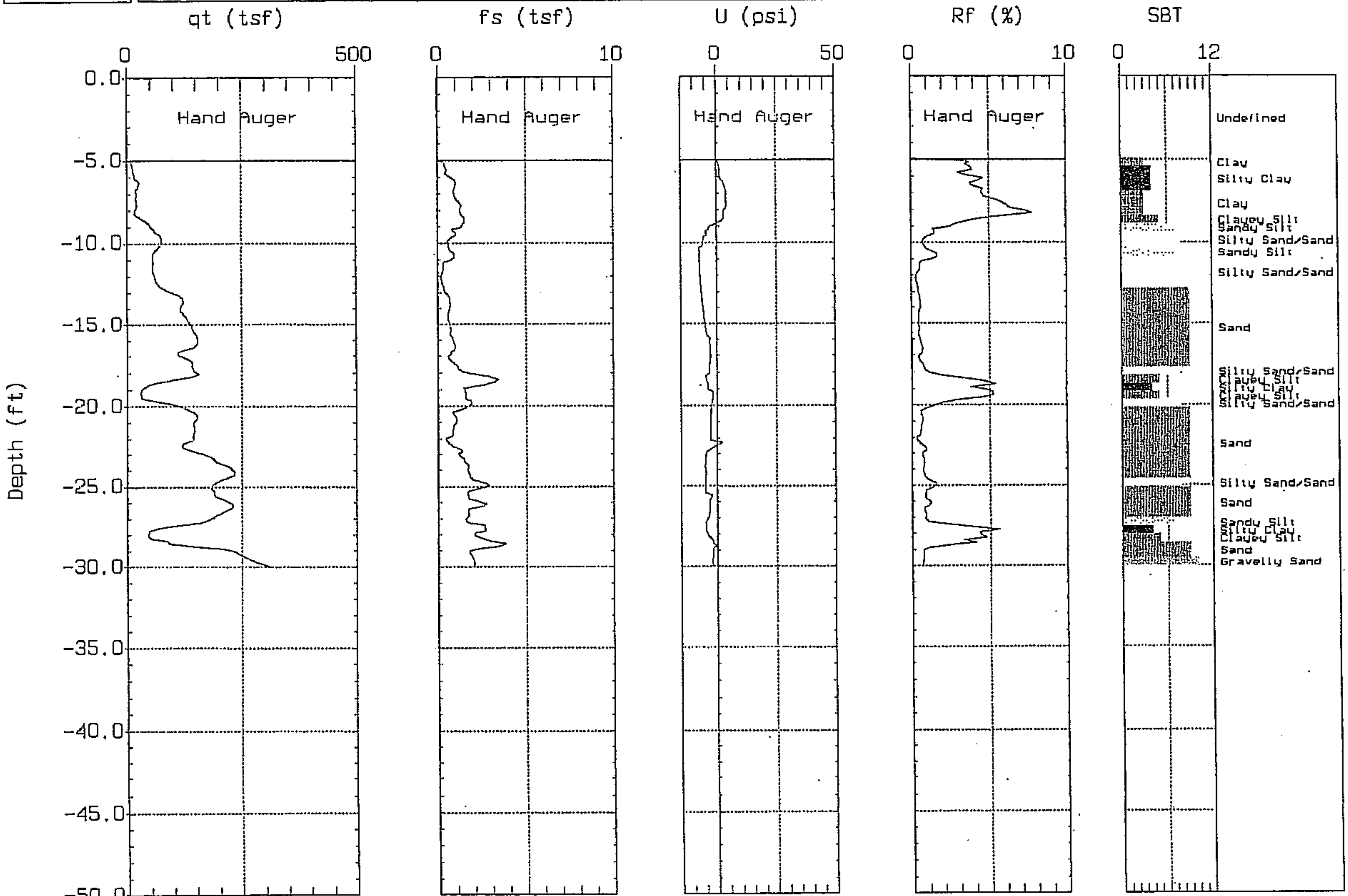
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-18

Engineer: S.HARRIS
Date: 07:19:05 08:41



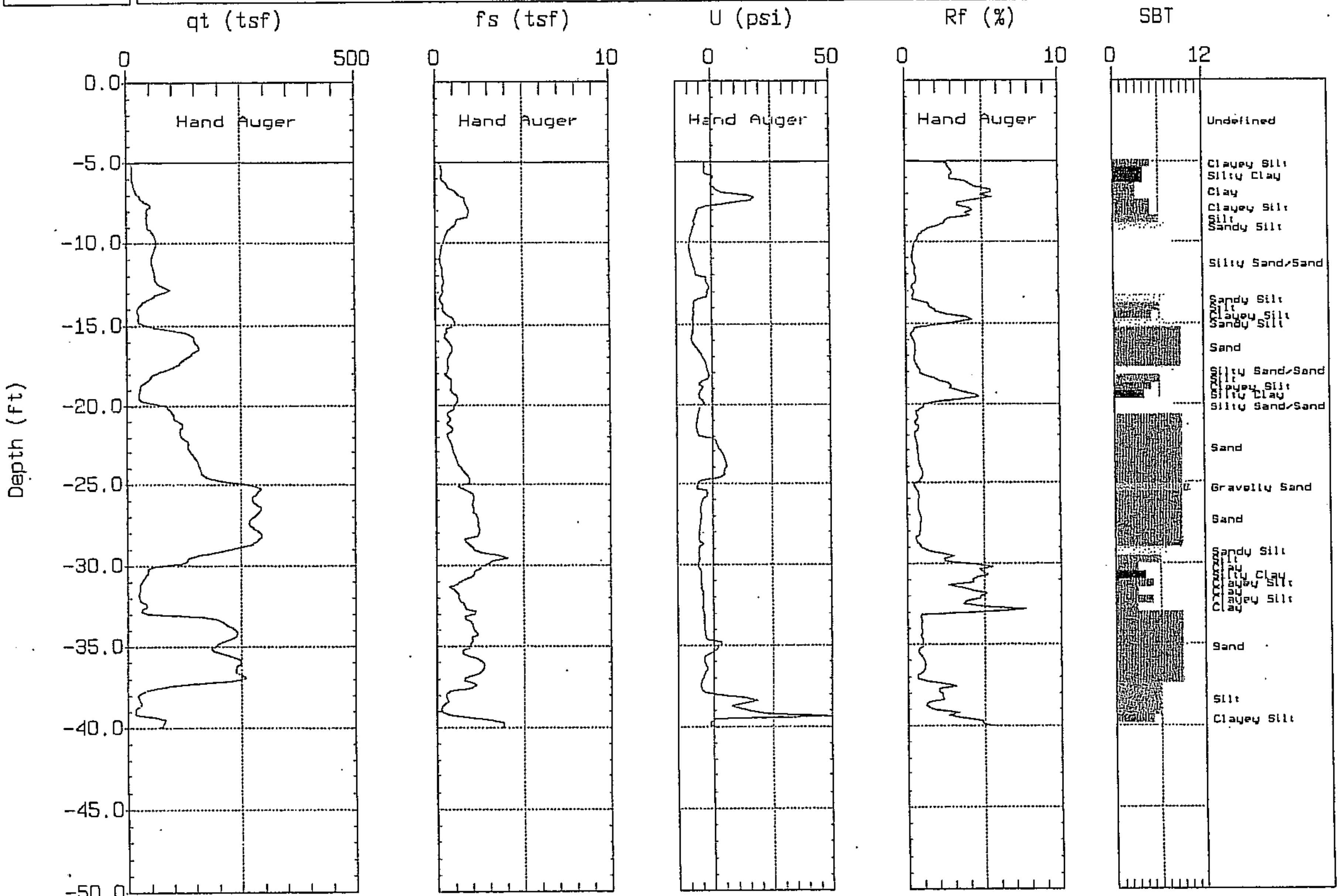
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-19

Engineer: S.HARRIS
Date: 07:14:05 07:52



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

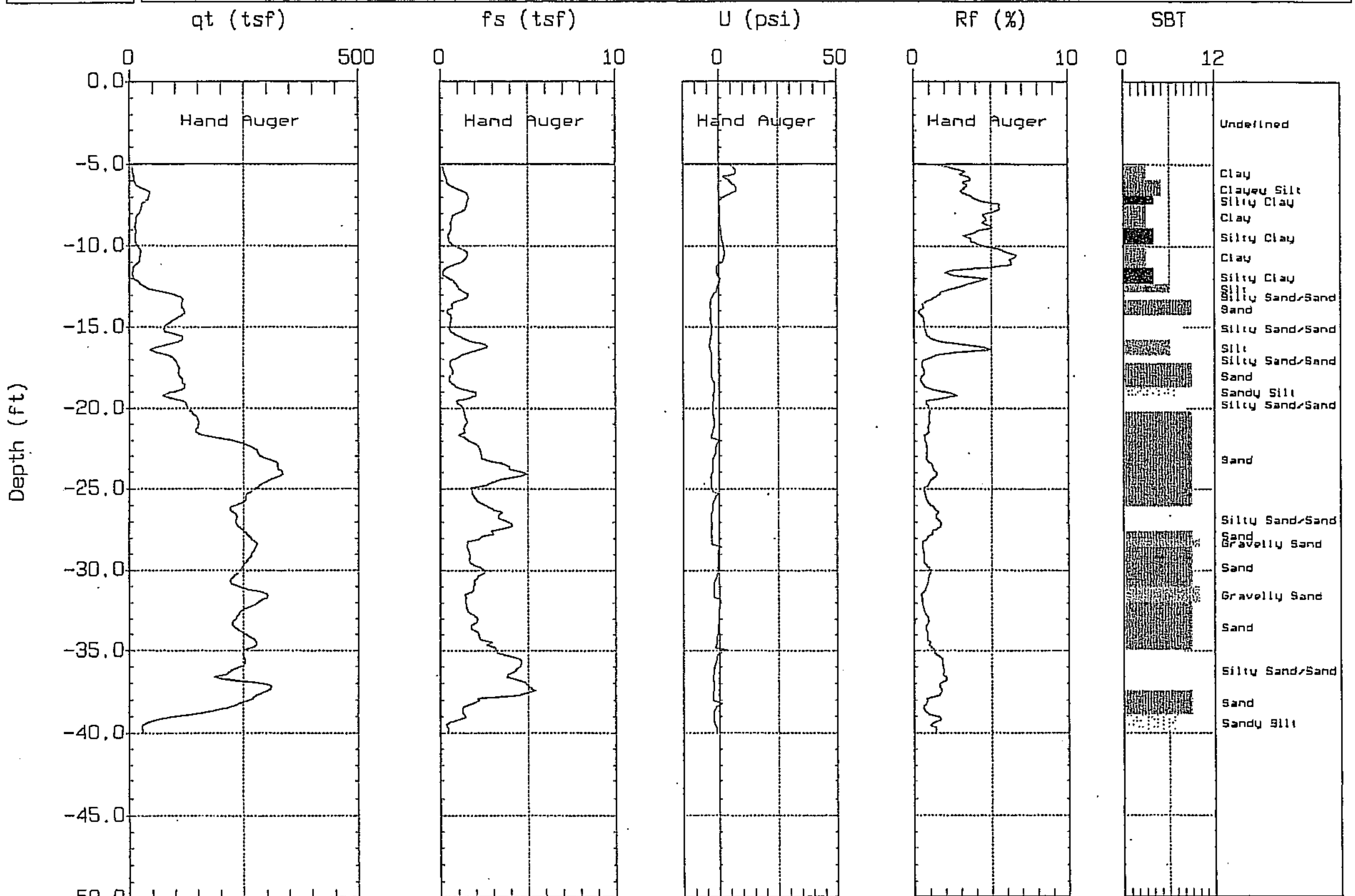
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-20

Engineer: S.HARRIS
Date: 07:19:05 09:36



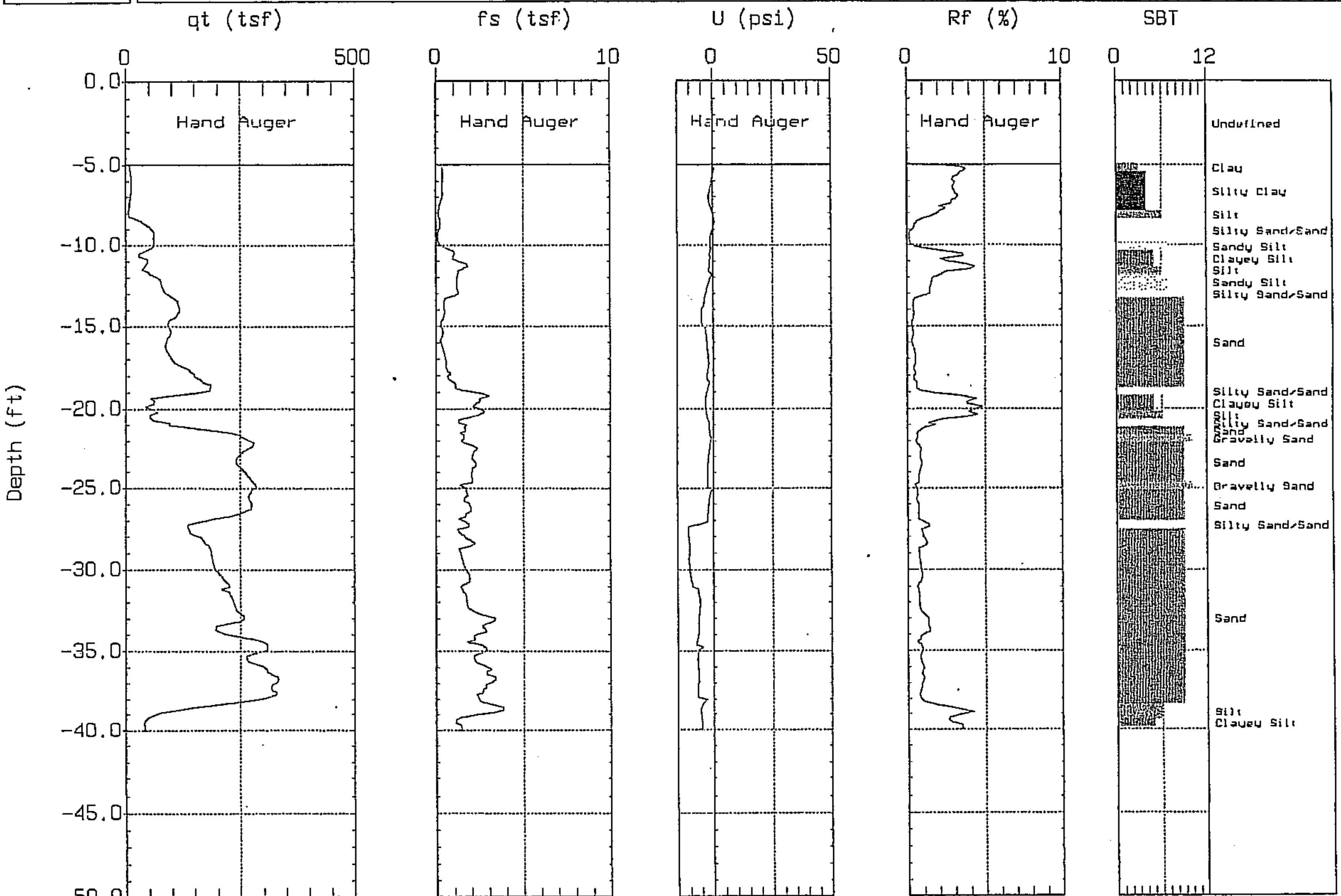
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-21

Engineer: S.HARRIS
Date: 07:19:05 10:35



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

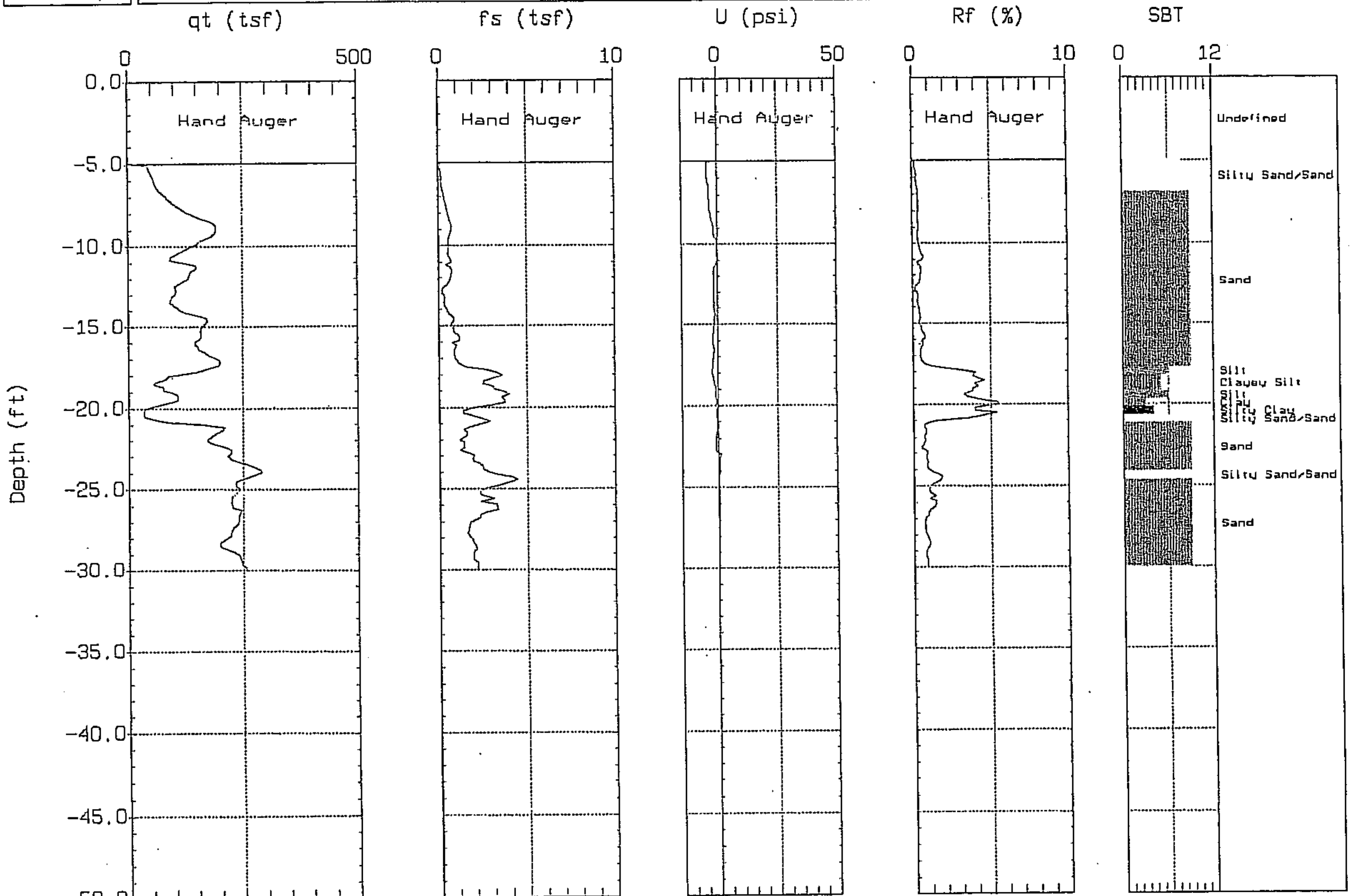
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-22

Engineer: S.HARRIS
Date: 07:19:05 11:14



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

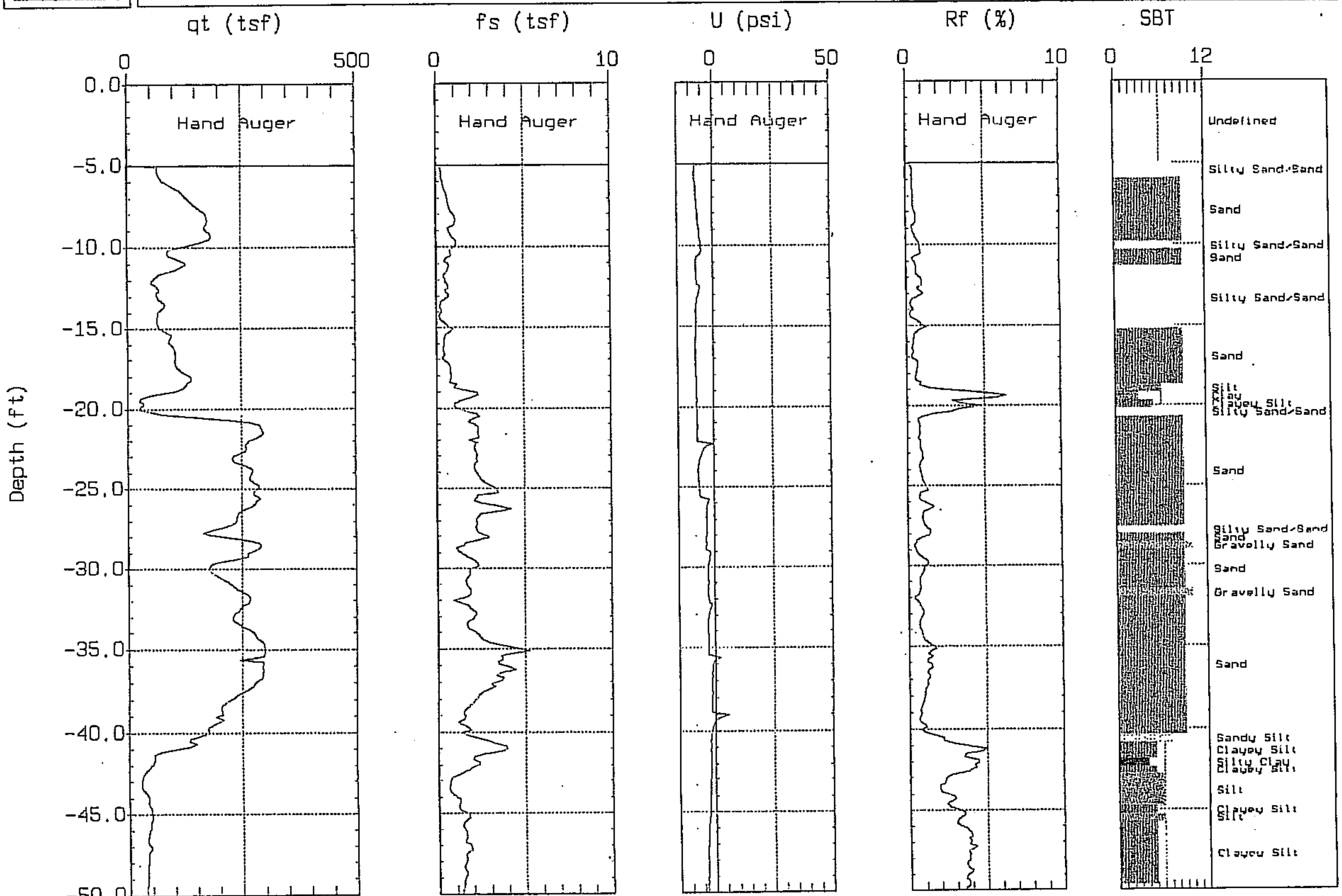
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-23

Engineer: S.HARRIS
Date: 07:19:05 12:56



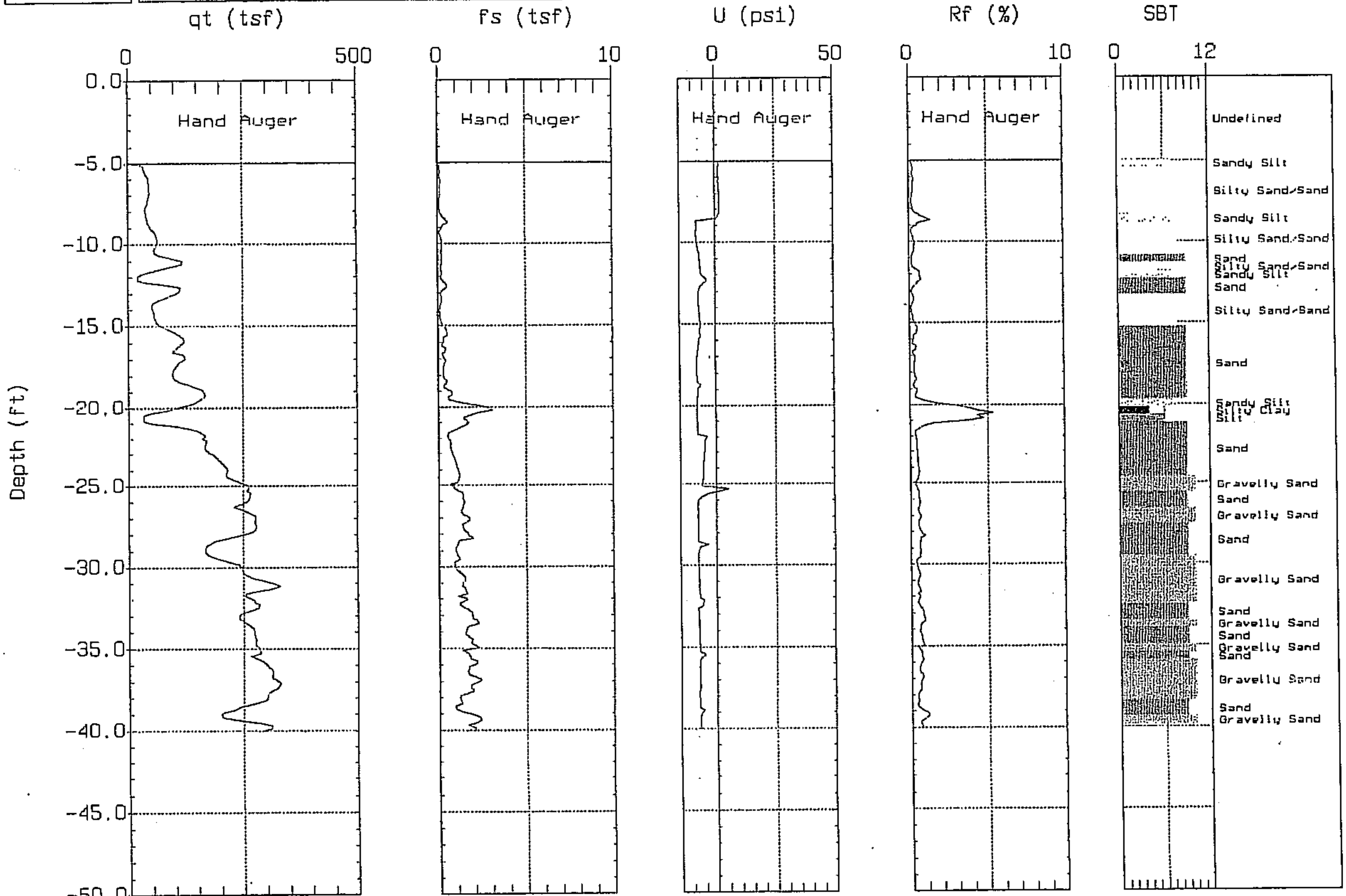
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: KB HOMES
Location: CPT-24

Engineer: S.HARRIS
Date: 07:19:05 13:35



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

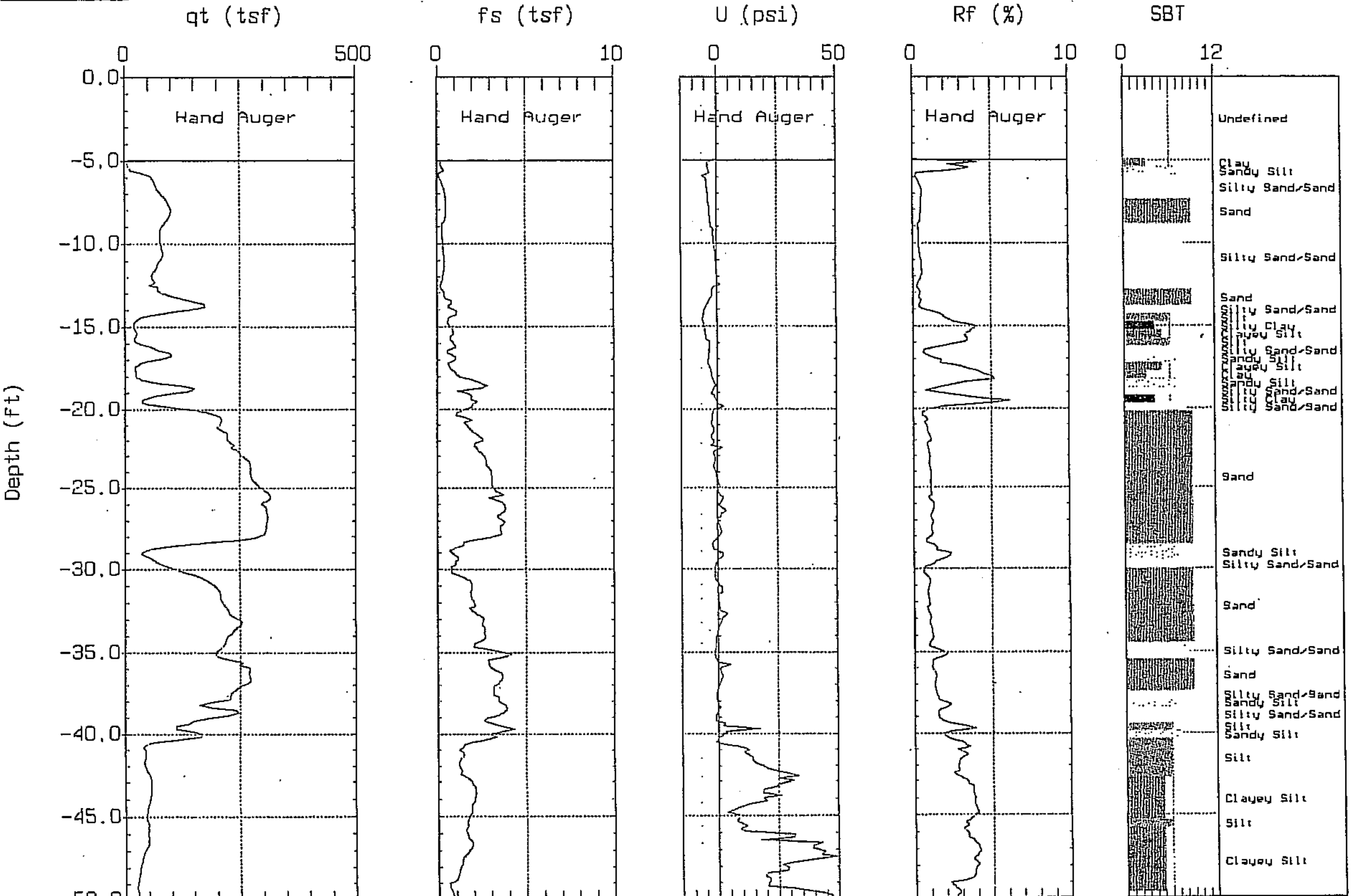
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-25

Engineer: S.HARRIS
Date: 07:14:05 08:34



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

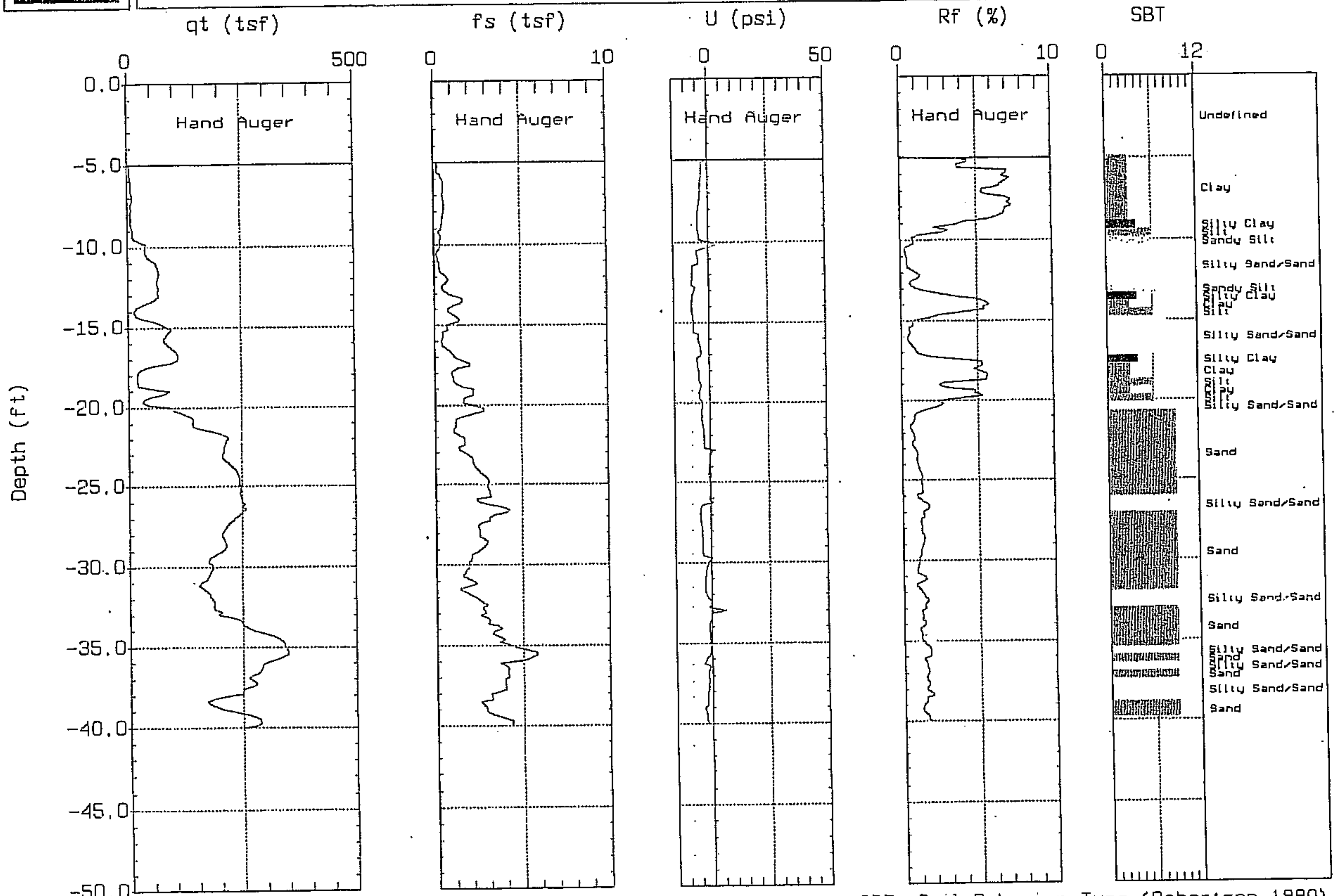
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-26

Engineer: S.HARRIS
Date: 07:14:05 09:13



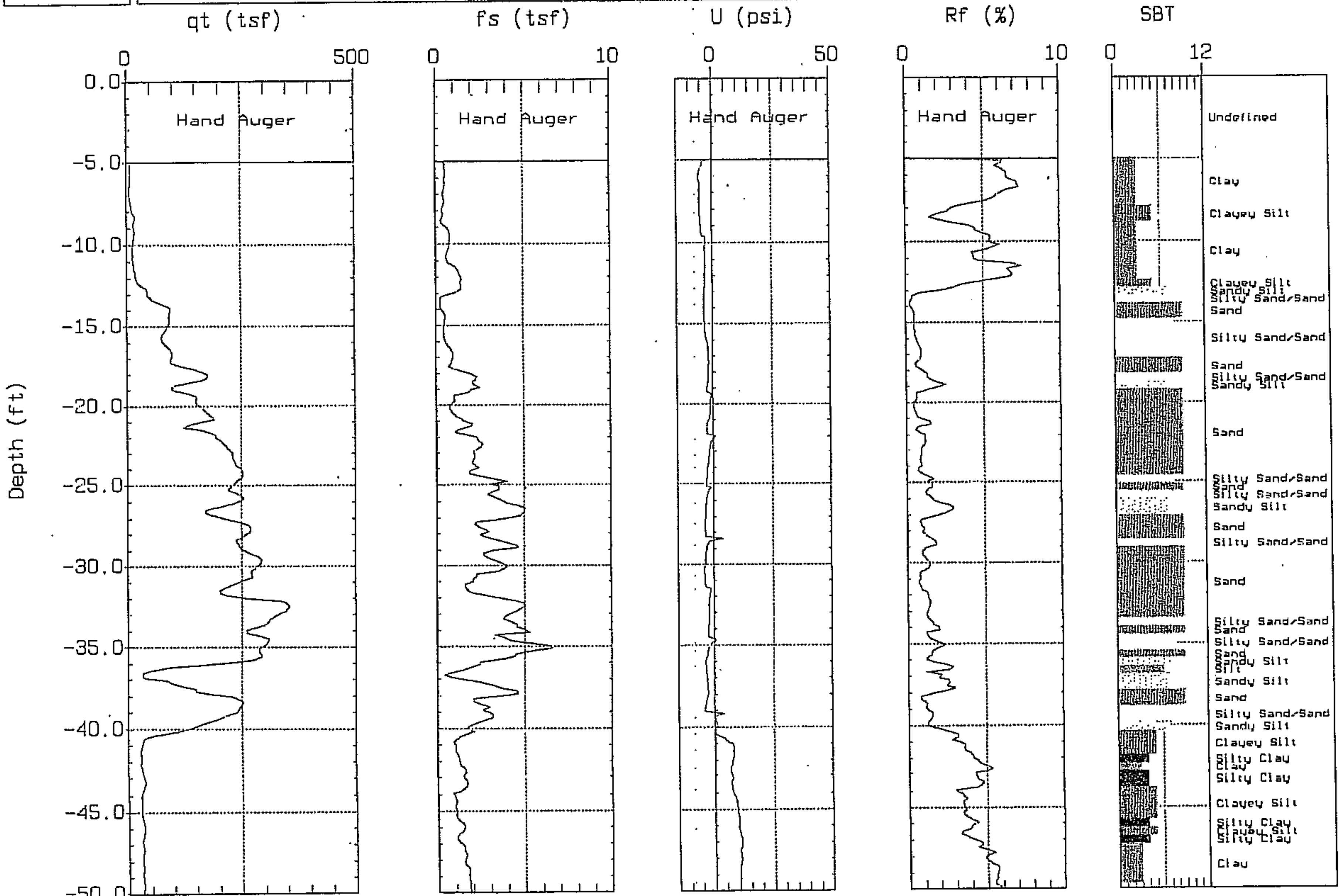
Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-27

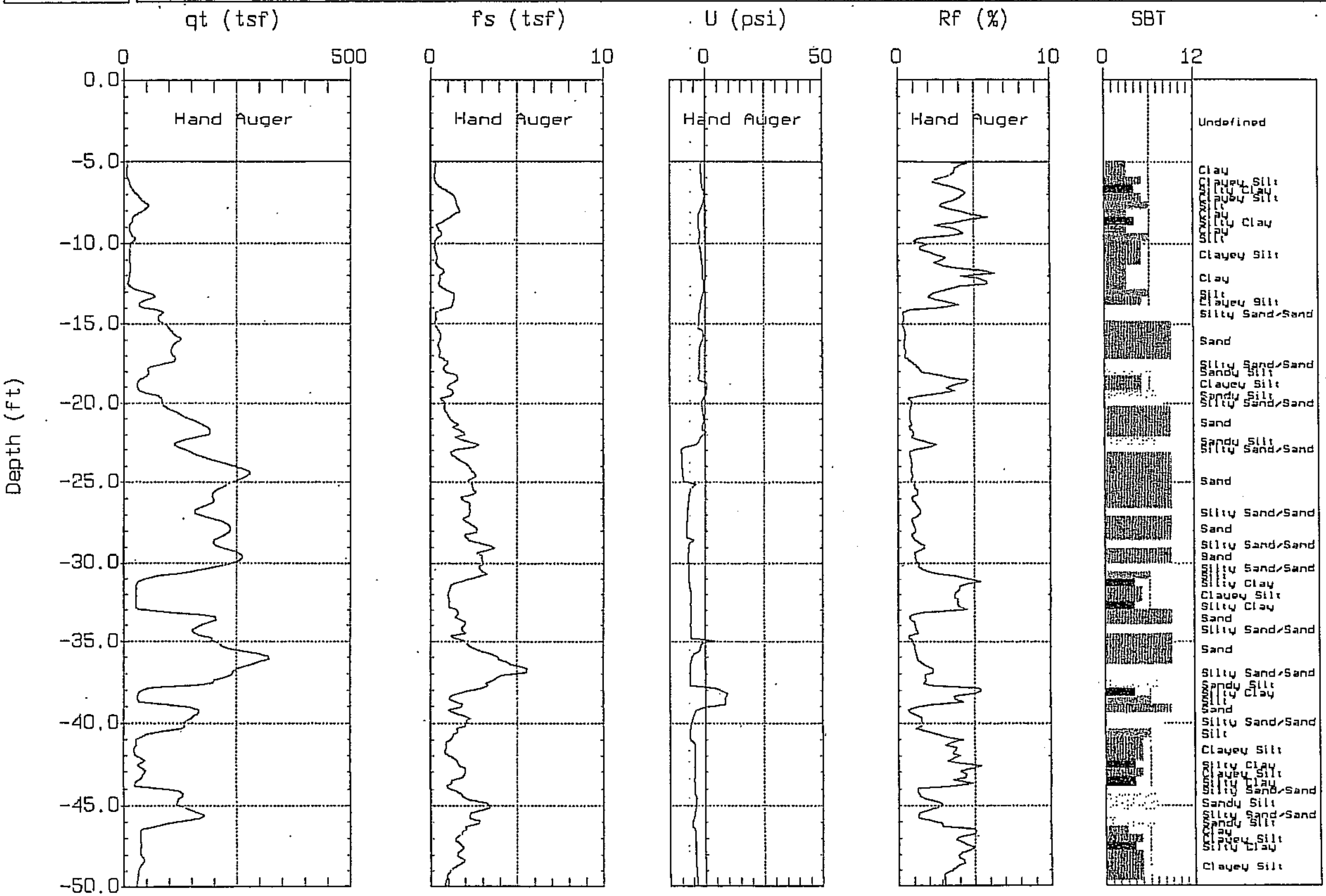
Engineer: S.HARRIS
Date: 07:13:05 16:01



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES | Engineer: S.HARRIS
Location: CPT-28 | Date: 07:13:05 15:28



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

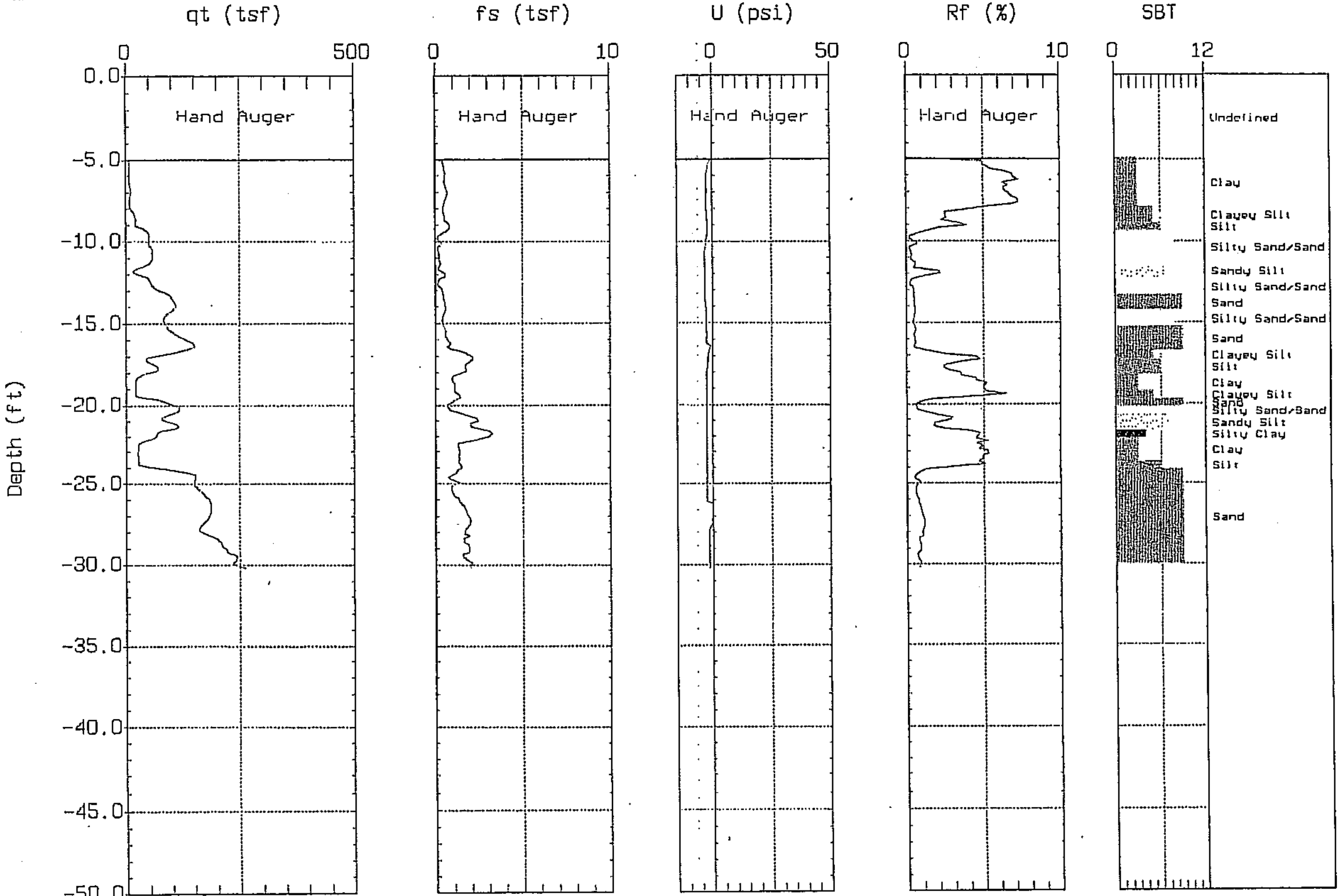
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-29

Engineer: S.HARRIS
Date: 07:13:05 15:06



Max. Depth: 30.19 (ft)
Depth Inc.: 0.164 (ft)

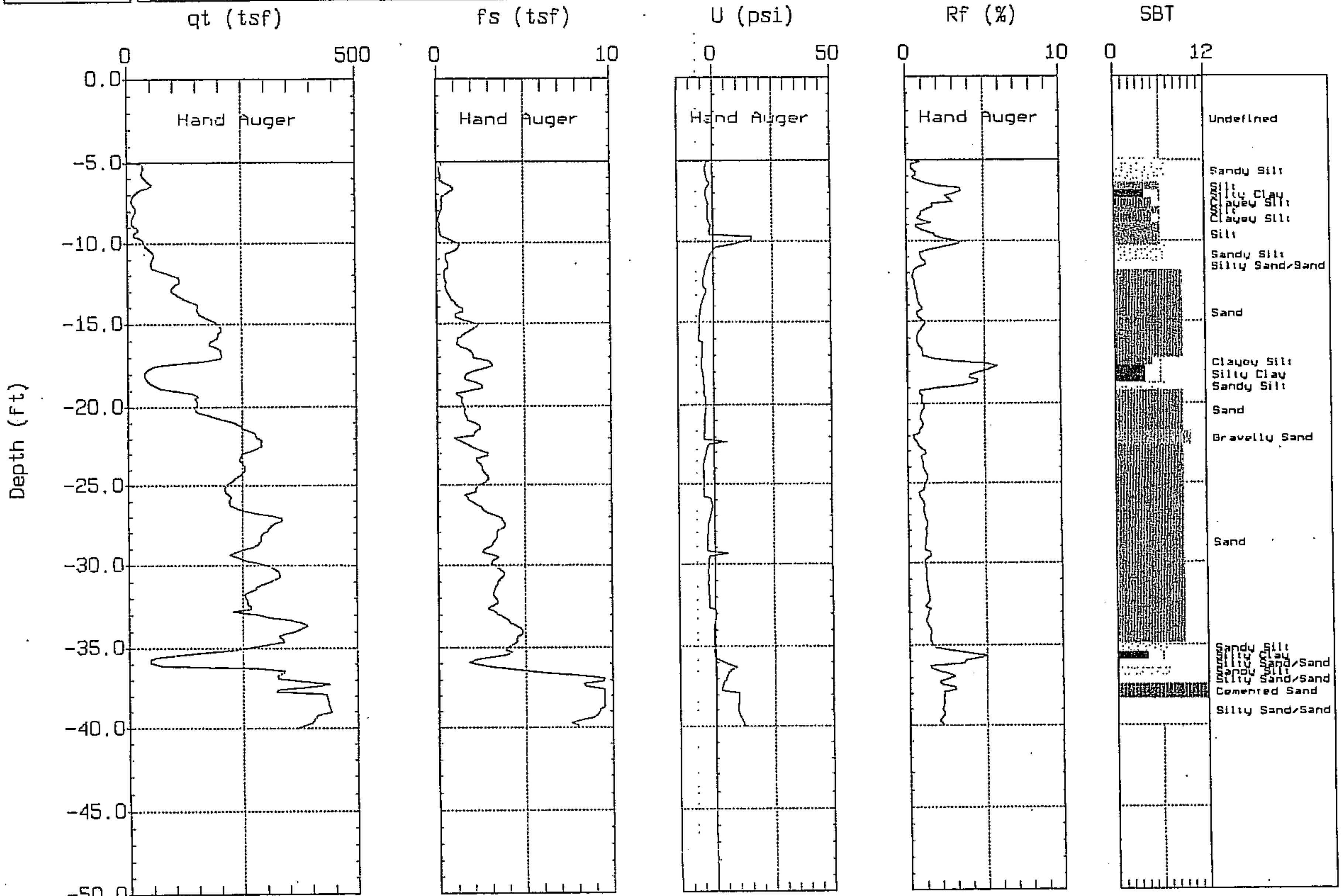
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-30

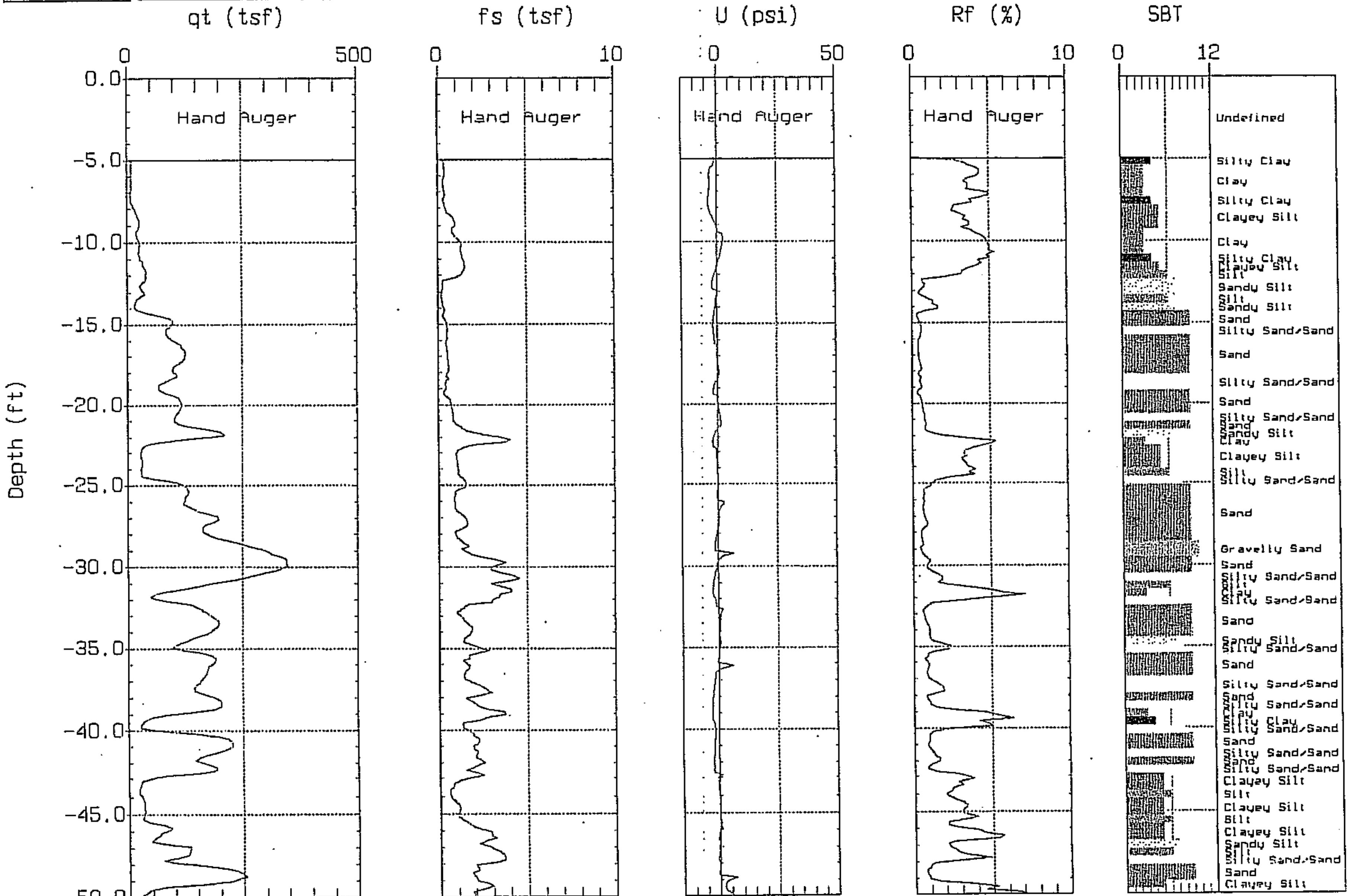
Engineer: S.HARRIS
Date: 07:14:05 09:53



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES | Engineer: S.HARRIS
Location: CPT-31 | Date: 07:13:05 14:22



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

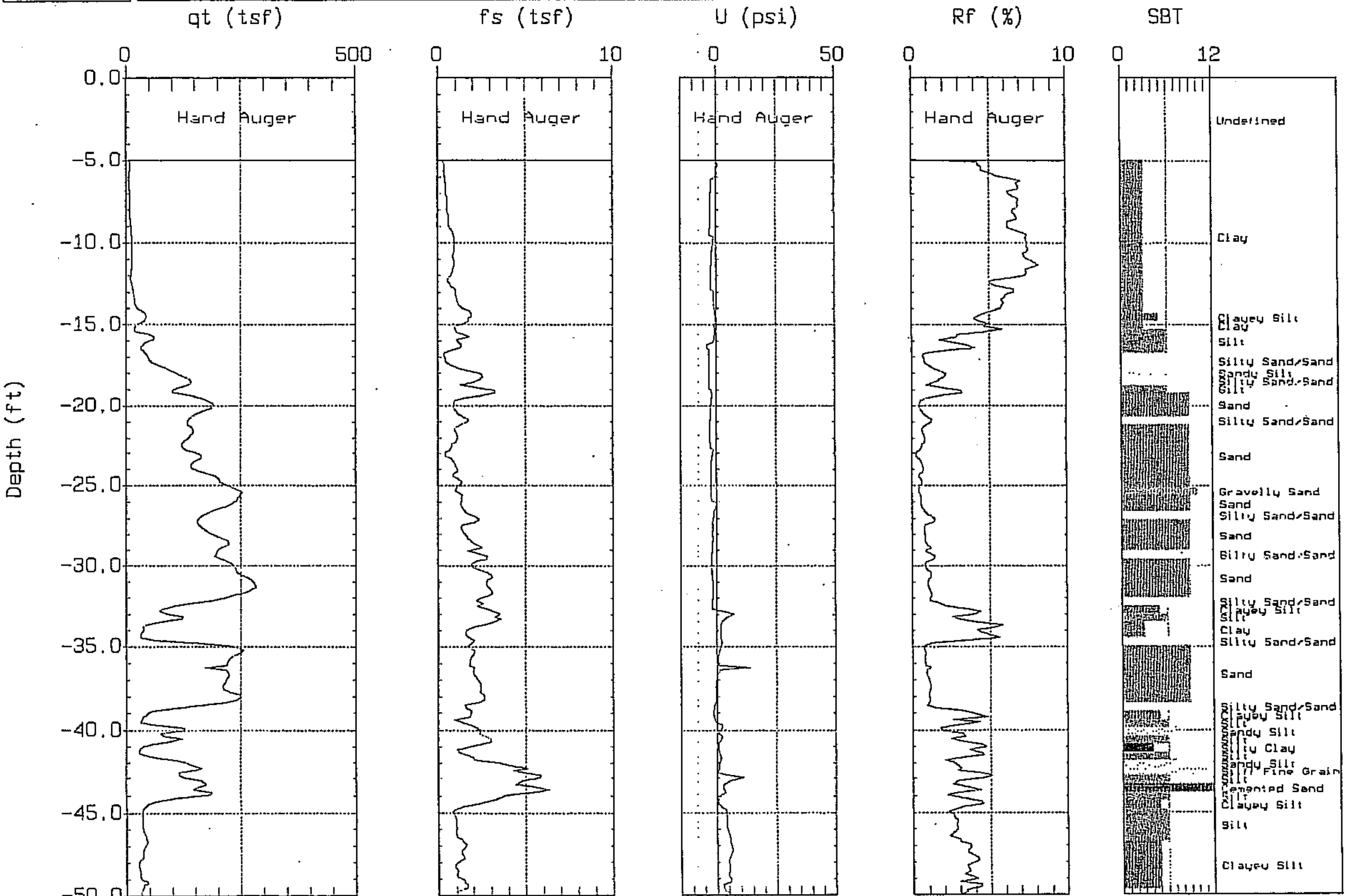
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-32

Engineer: S.HARRIS
Date: 07:20:05 09:19



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

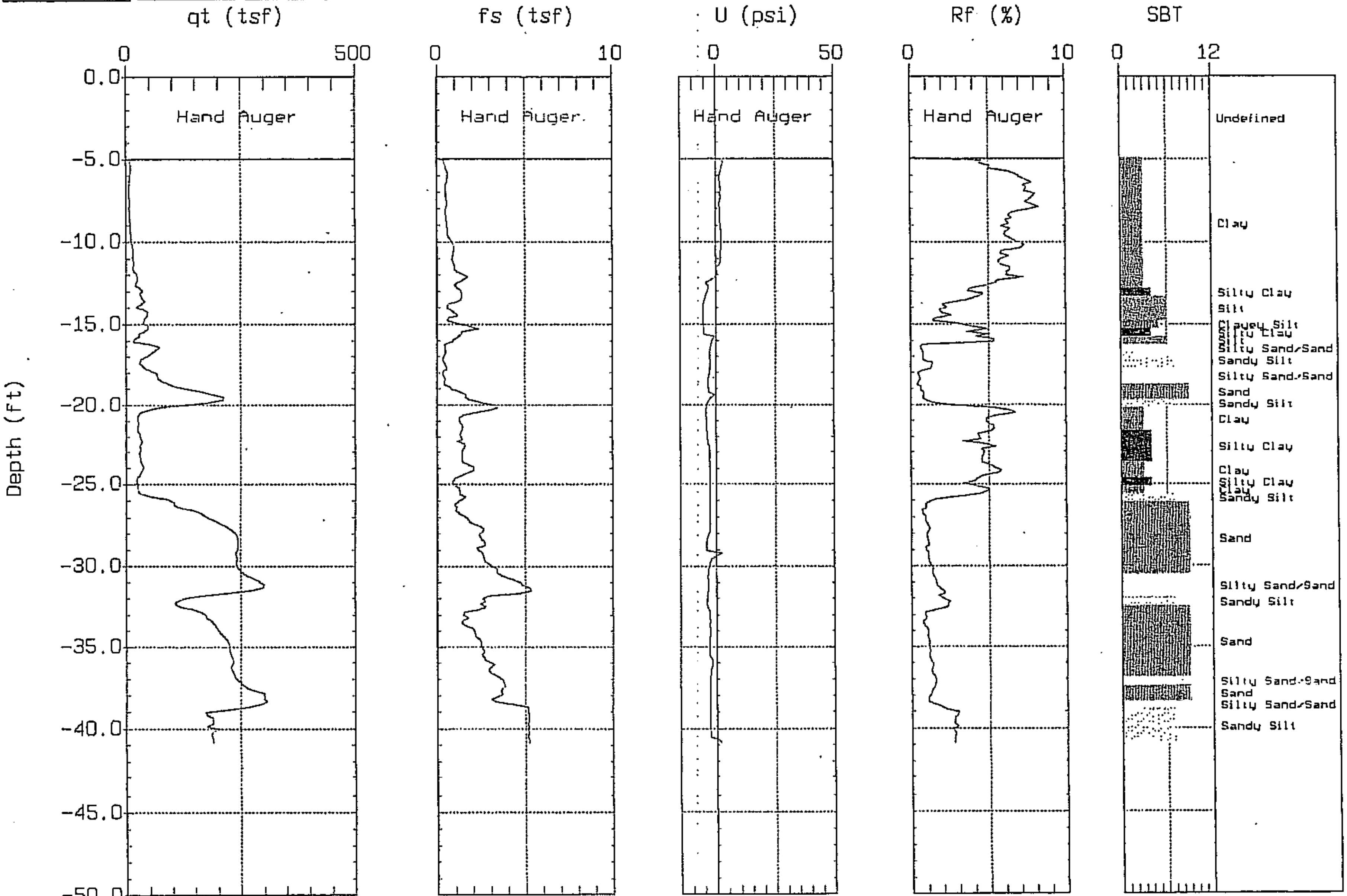
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-33

Engineer: S.HARRIS
Date: 07:13:105 13:26



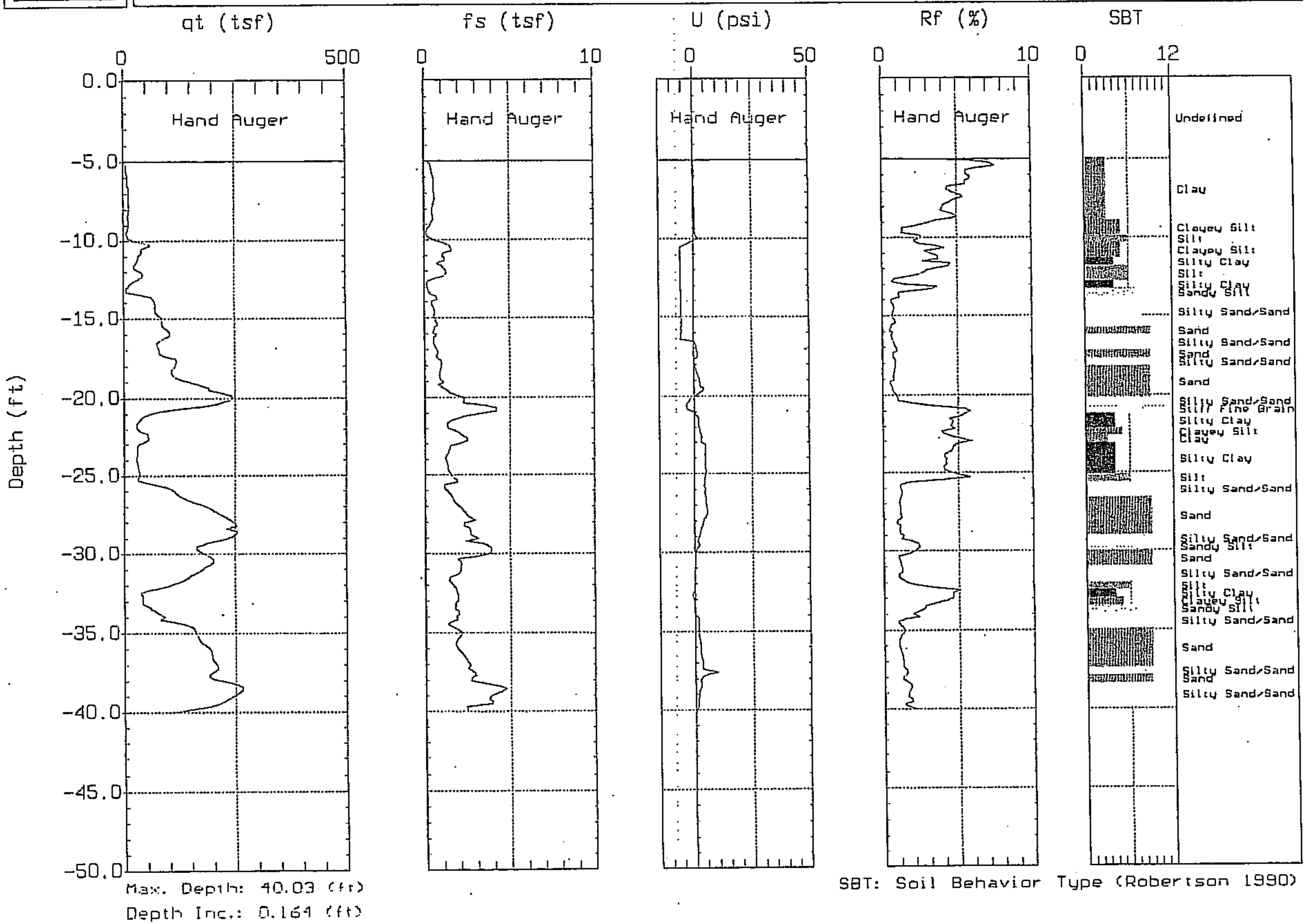
Max. Depth: 40.85 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-34

Engineer: S.HARRIS
Date: 07:13:05 11:13



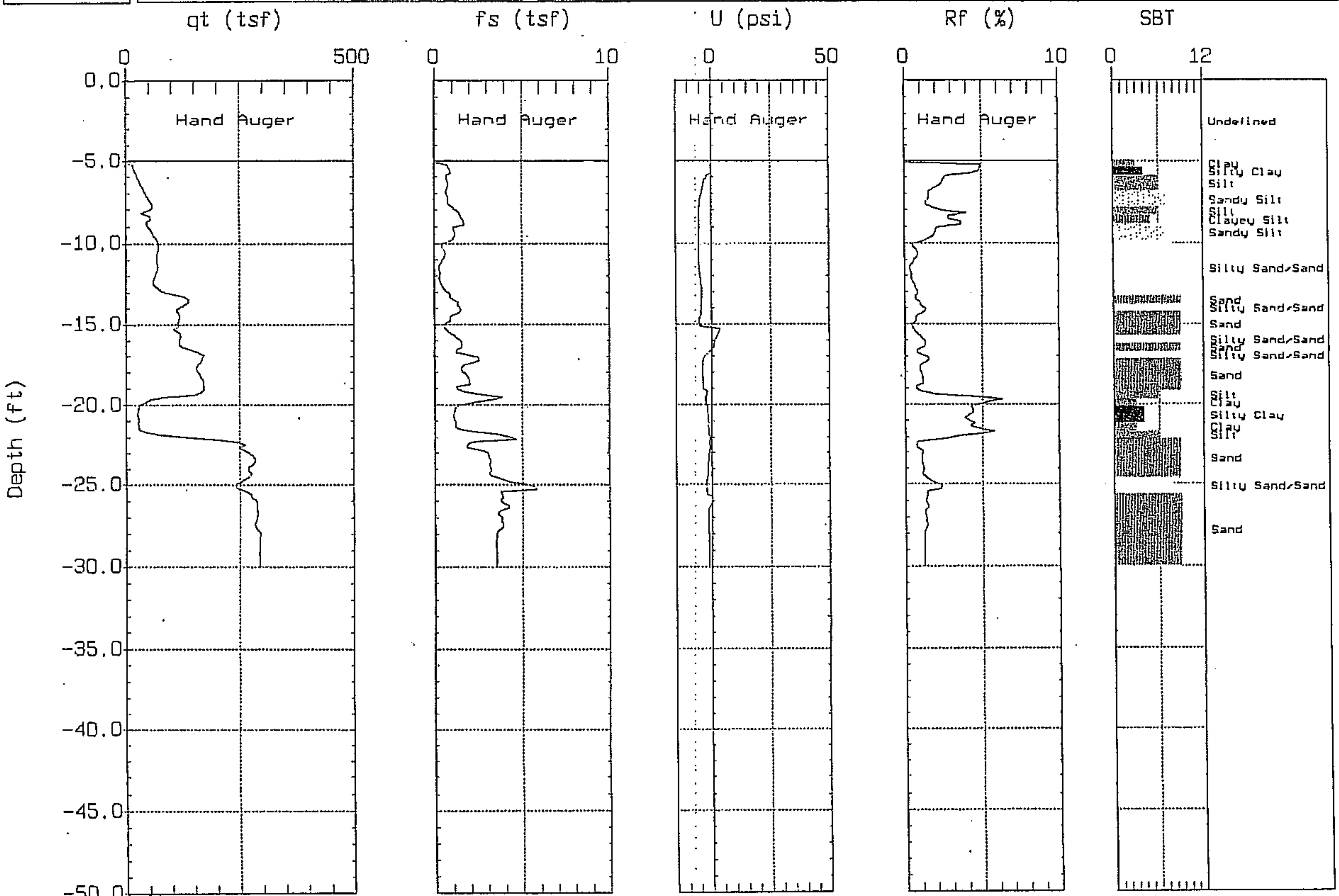
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-35

Engineer: S.HARRIS
Date: 07:14:05 10:32



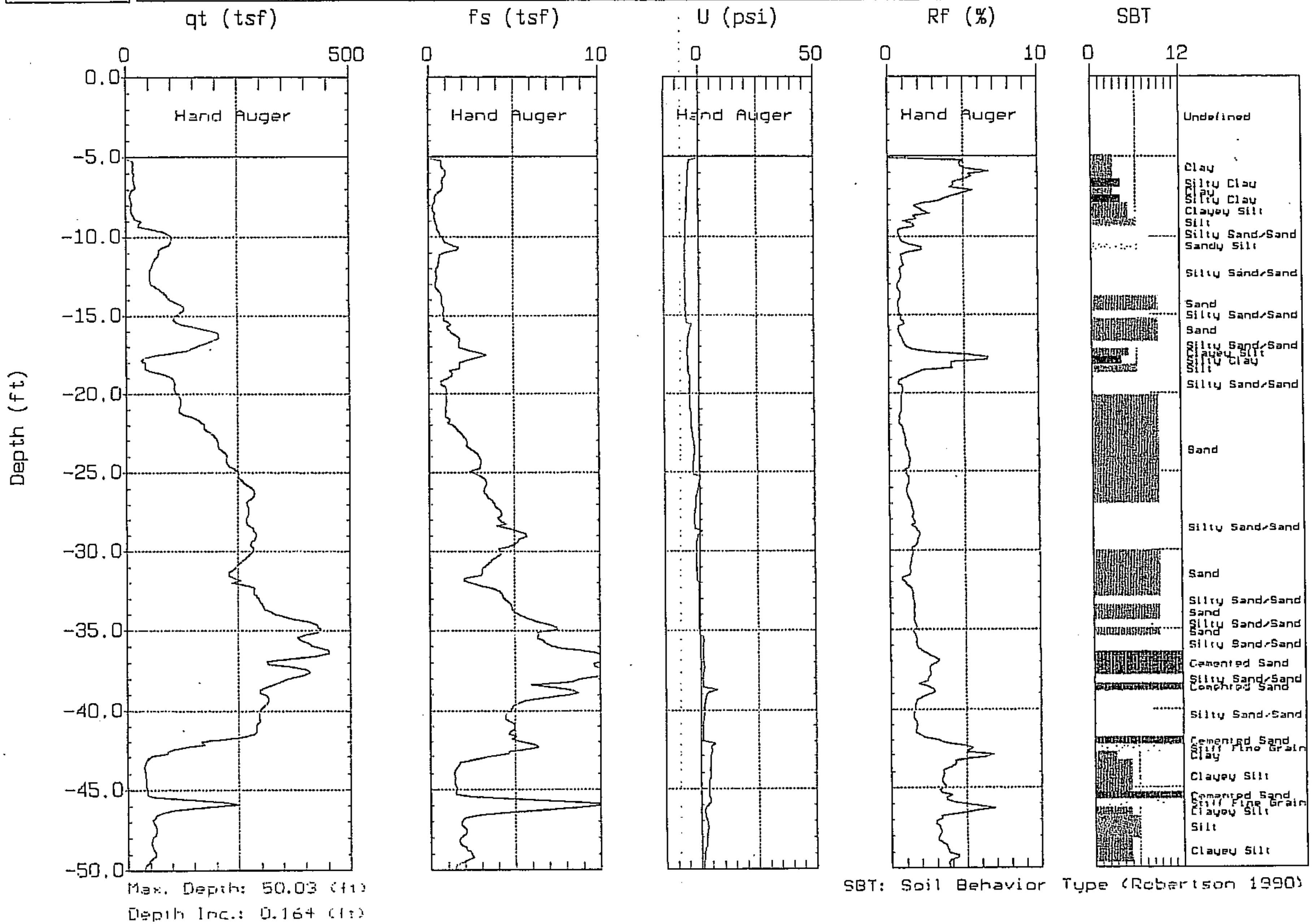
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-36

Engineer: S.HARRIS
Date: 07:14:05 12:41



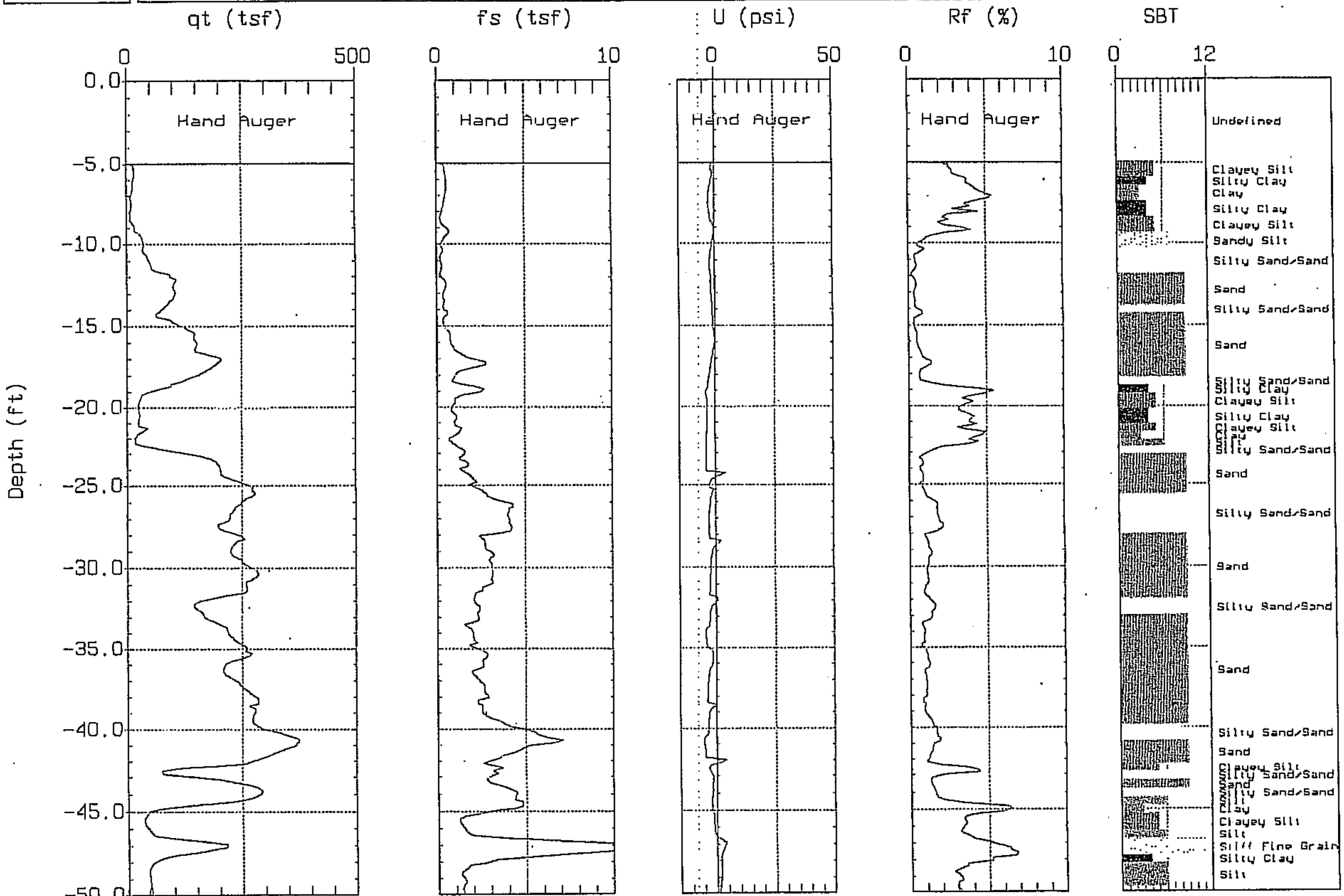
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-37

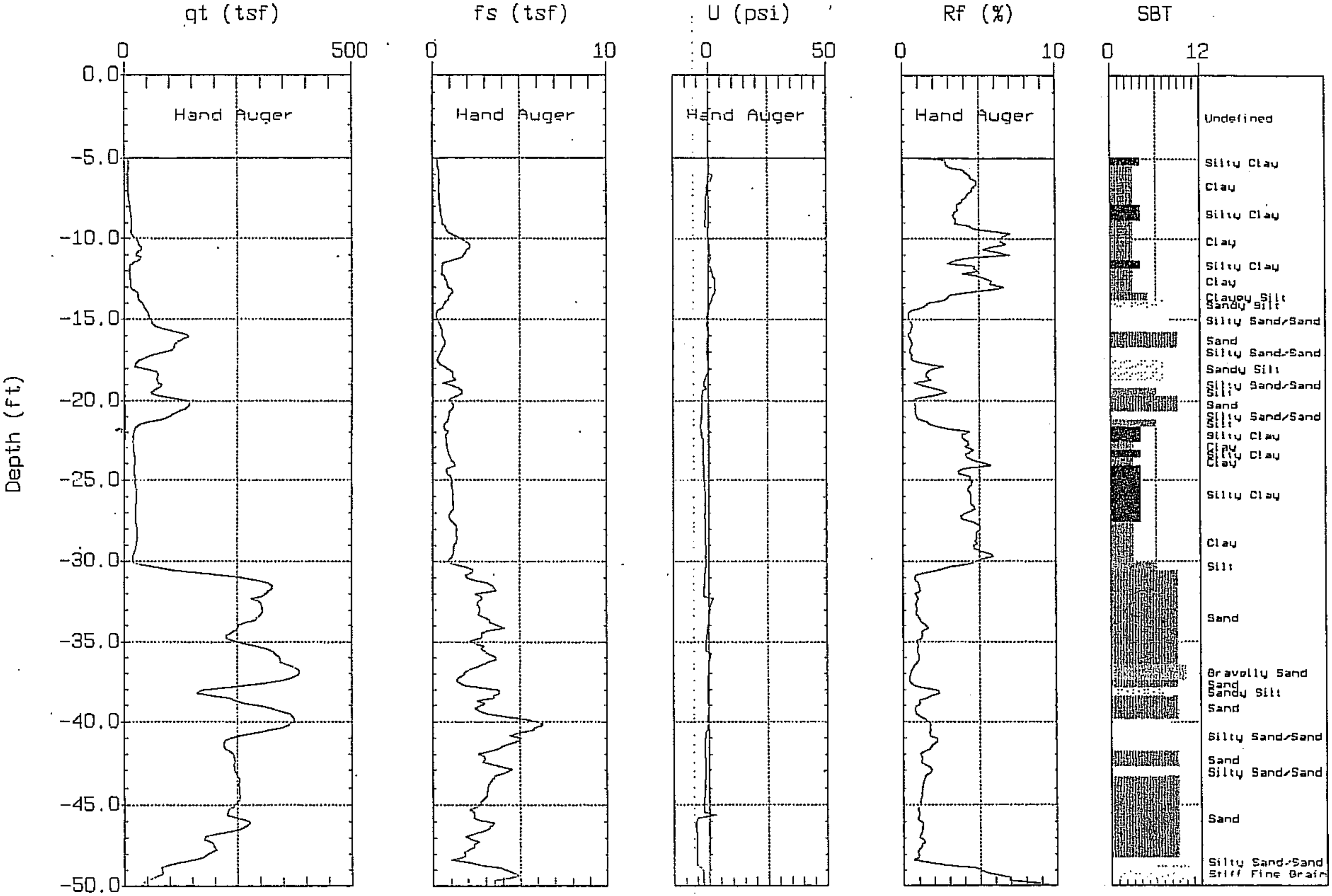
Engineer: S.HARRIS
Date: 07:14:05 13:10



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG	ENGEO	Site: KB HOMES Location: CPT-38	Engineer: S.HARRIS Date: 07:13:05 10:19



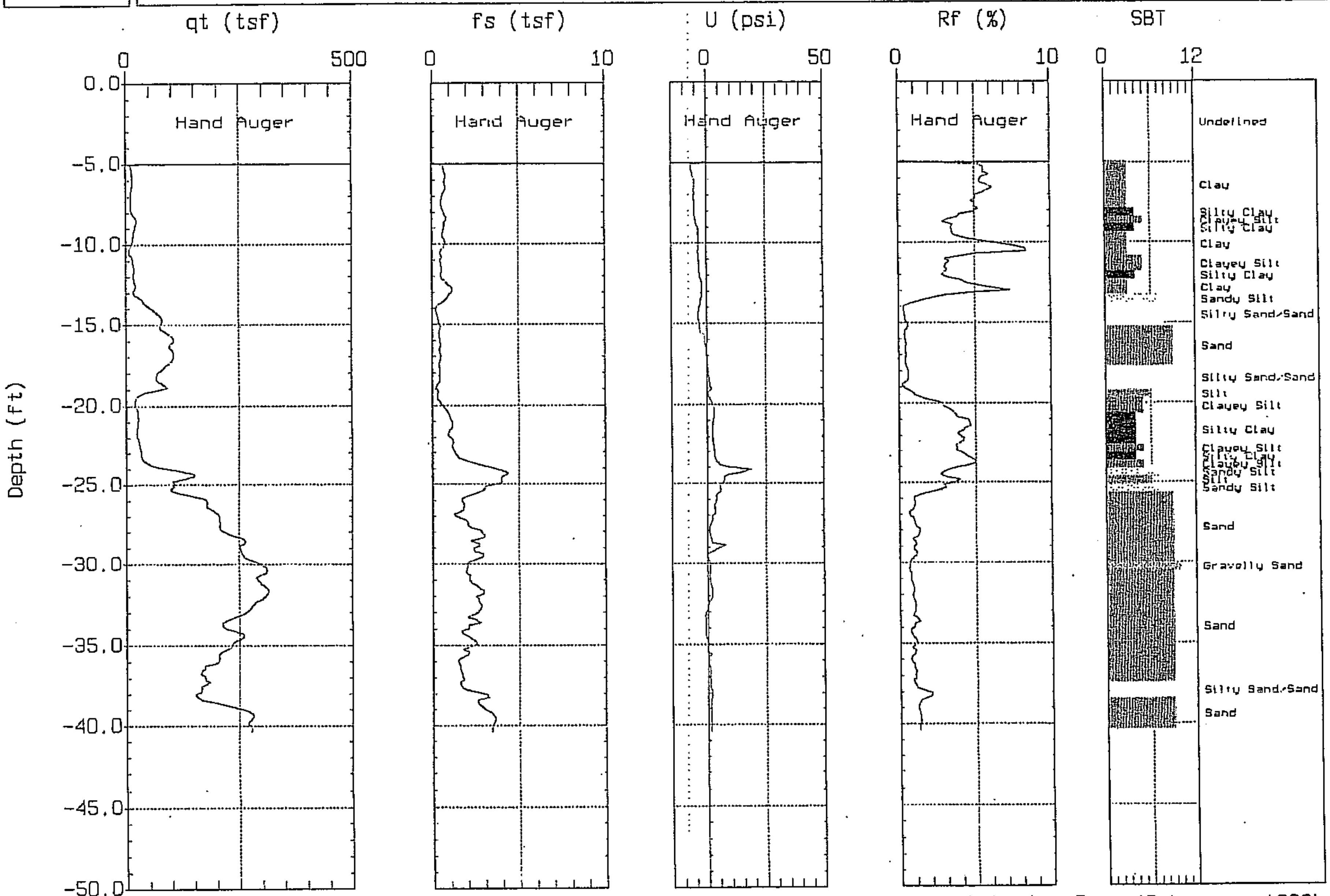
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-39

Engineer: S.HARRIS
Date: 07:13:05 09:34



Max. Depth: 40.35 (ft)
Depth Inc.: 0.164 (ft)

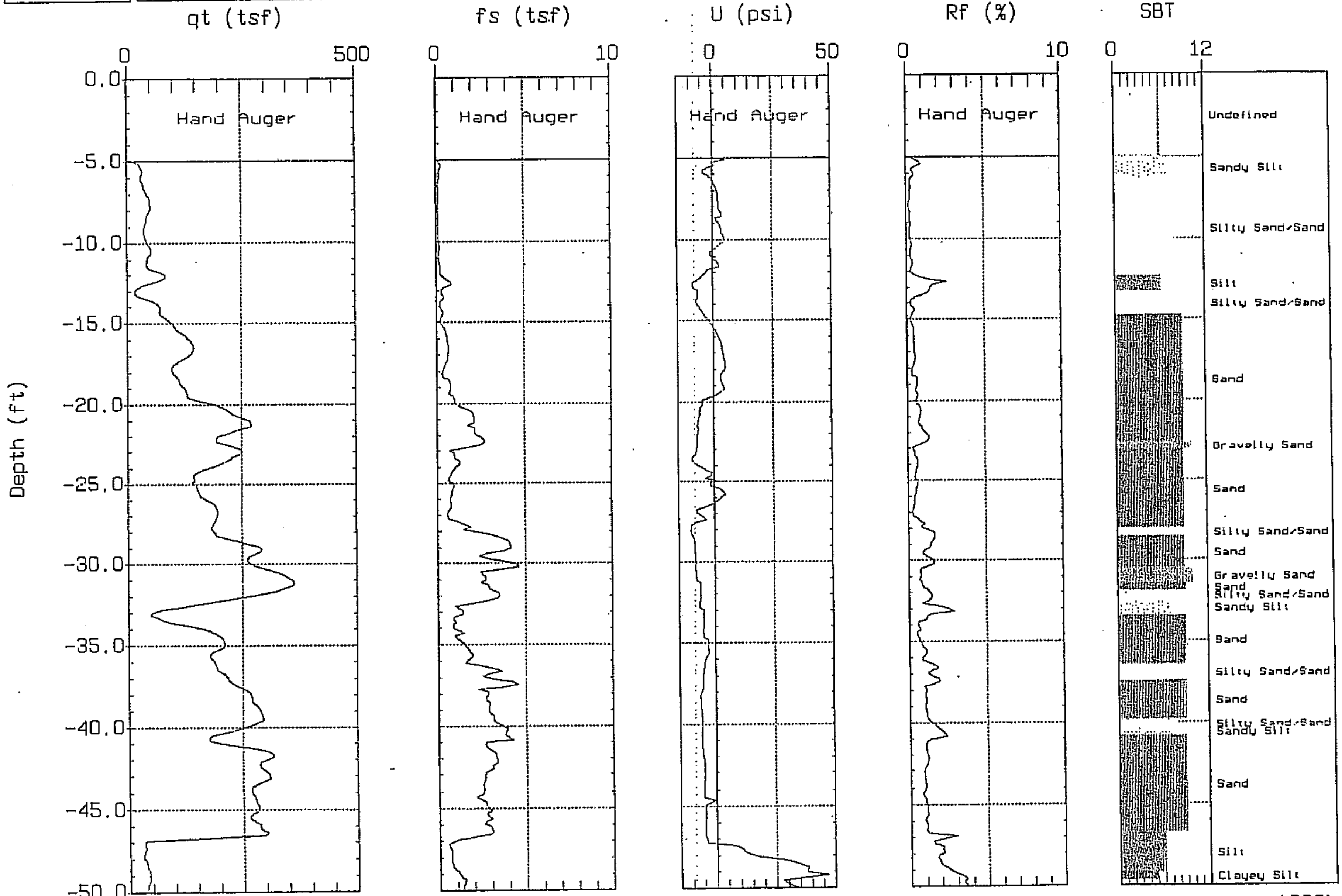
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-40

Engineer: S.HARRIS
Date: 07:13:05 08:42



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

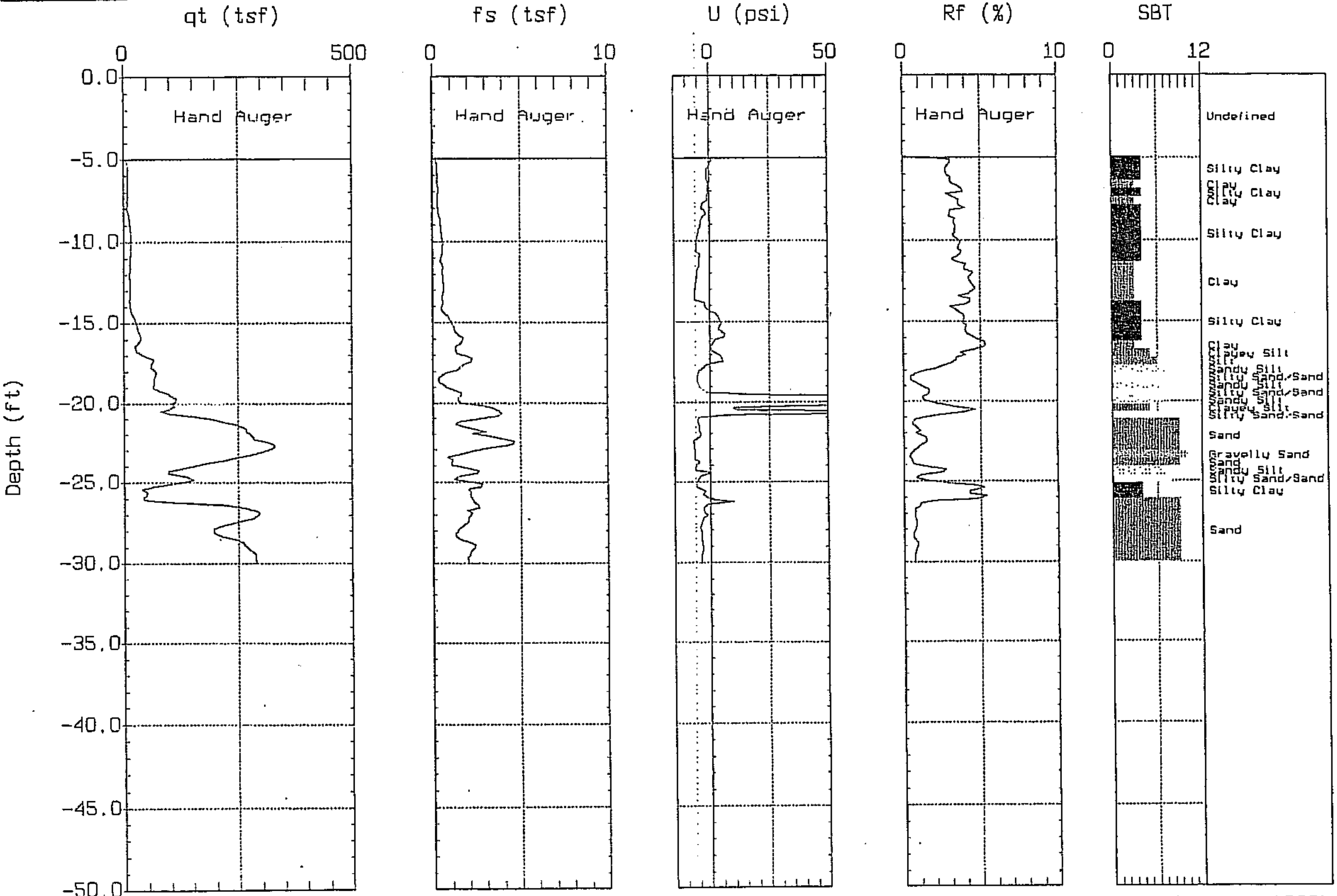
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-41

Engineer: S.HARRIS
Date: 07:20:05 07:46



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

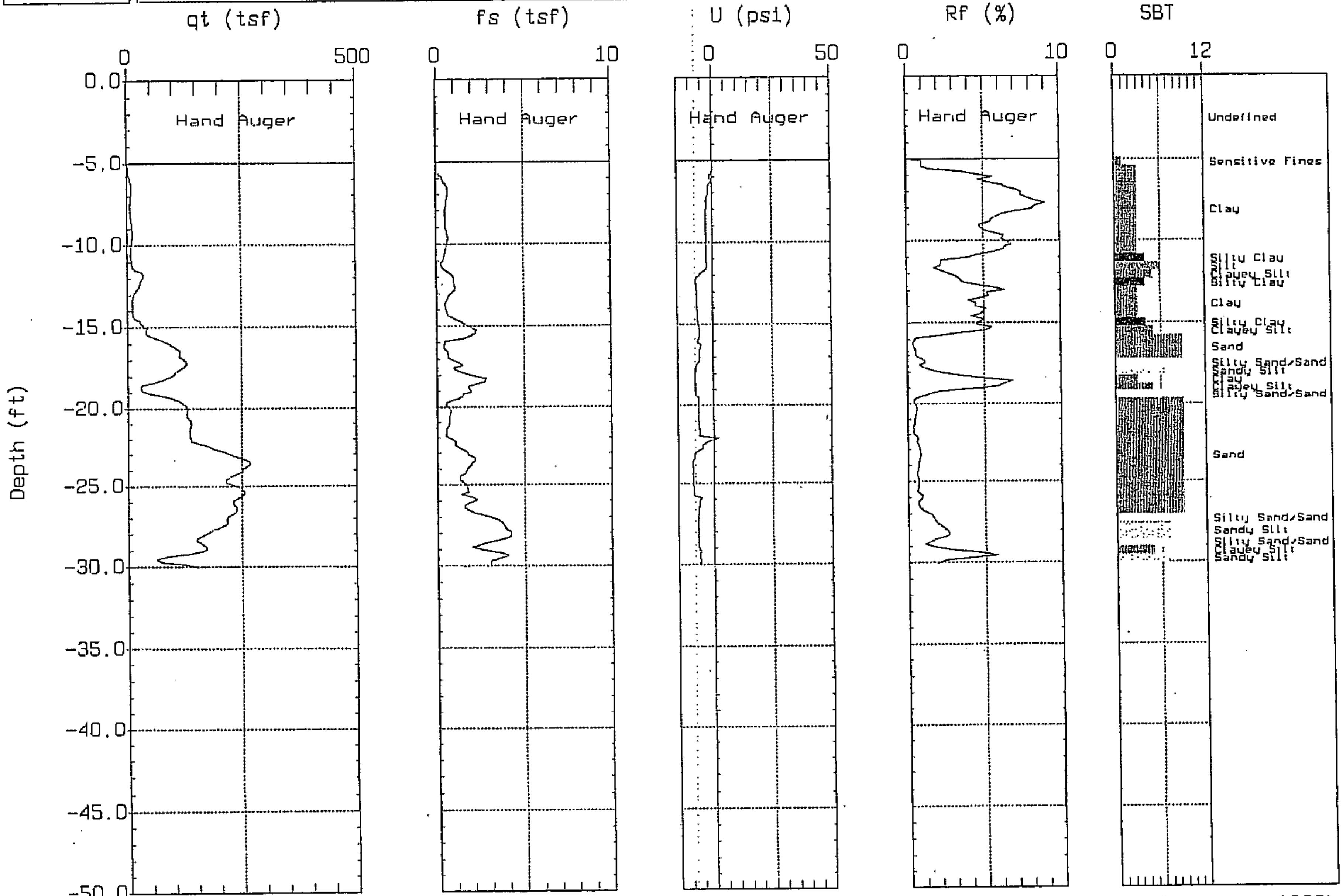
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-42

Engineer: S.HARRIS
Date: 07:20:05 12:33



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

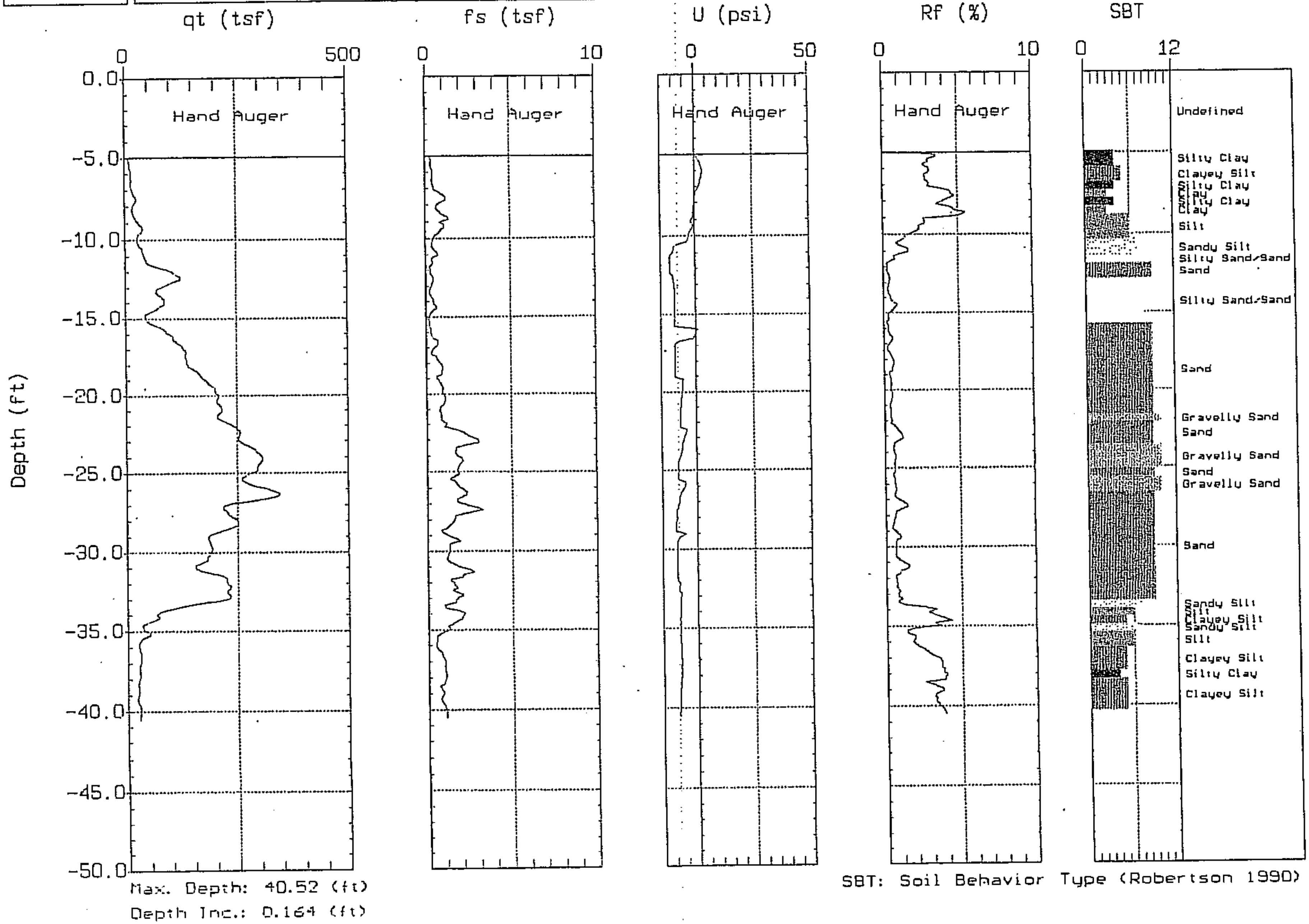
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

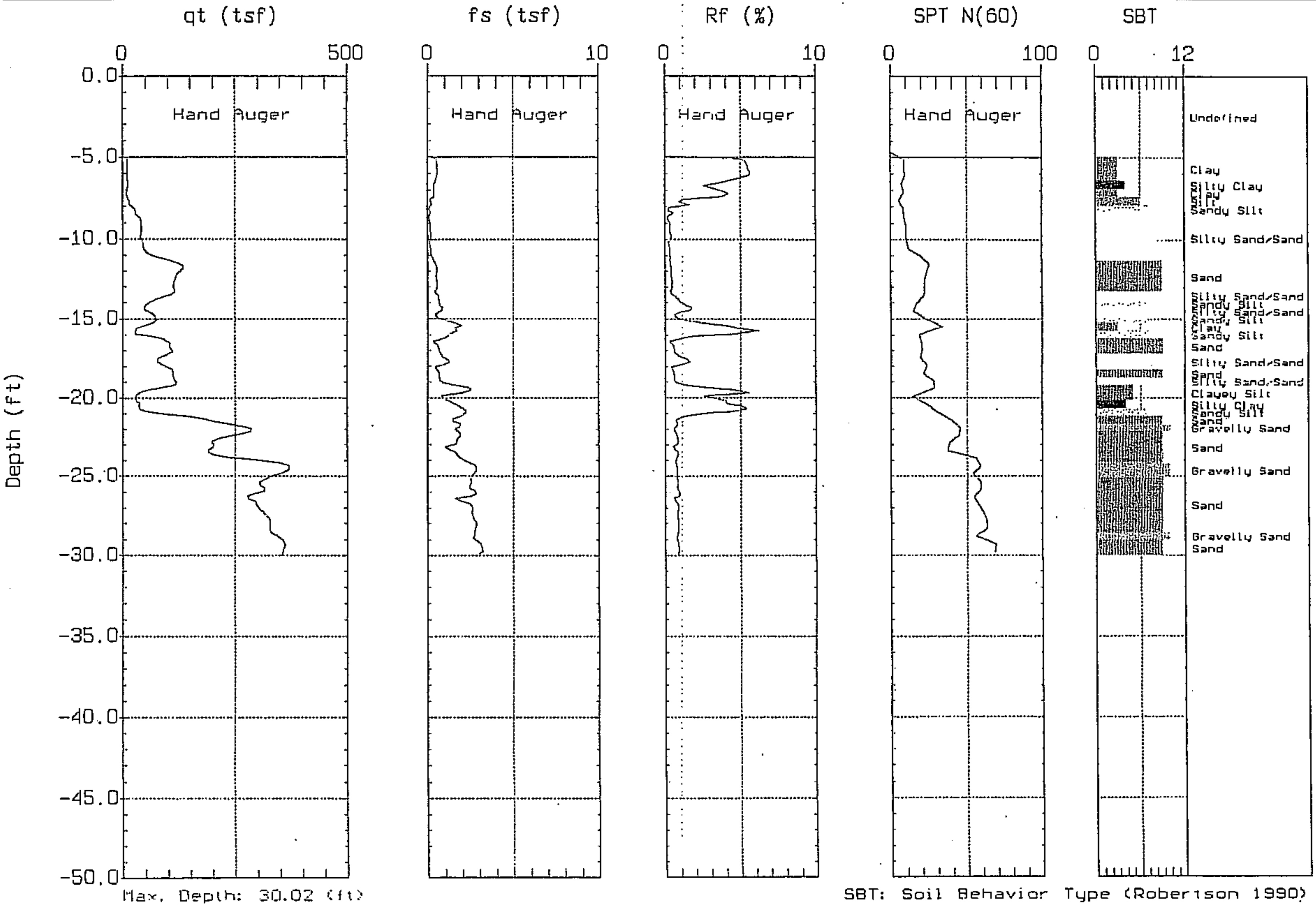
Site: KB HOMES
Location: CPT-43

Engineer: S.HARRIS
Date: 07:20:05 14:06



SBT: Soil Behavior Type (Robertson 1990)

GREGG | ENGEO | Site: KB HOMES | Engineer: S.HARRIS
Location: CPT-44 | Date: 07:20:05 13:24



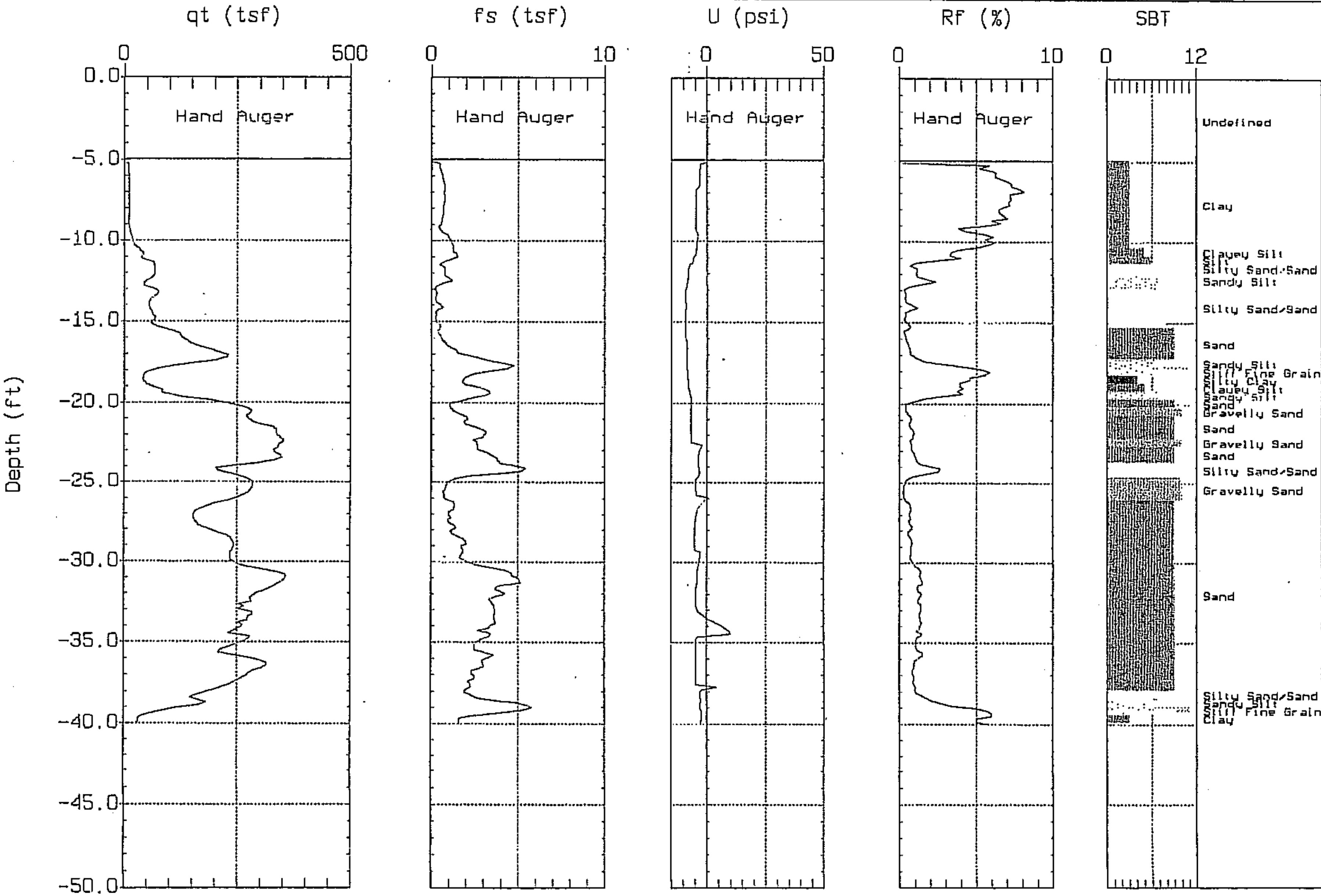
Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: KB HOMES
Location: CPT-45

Engineer: S.HARRIS
Date: 07:20:05 14:32



Max. Depth: 40.03 (ft)
Depth Inc.: 0.164 (ft)

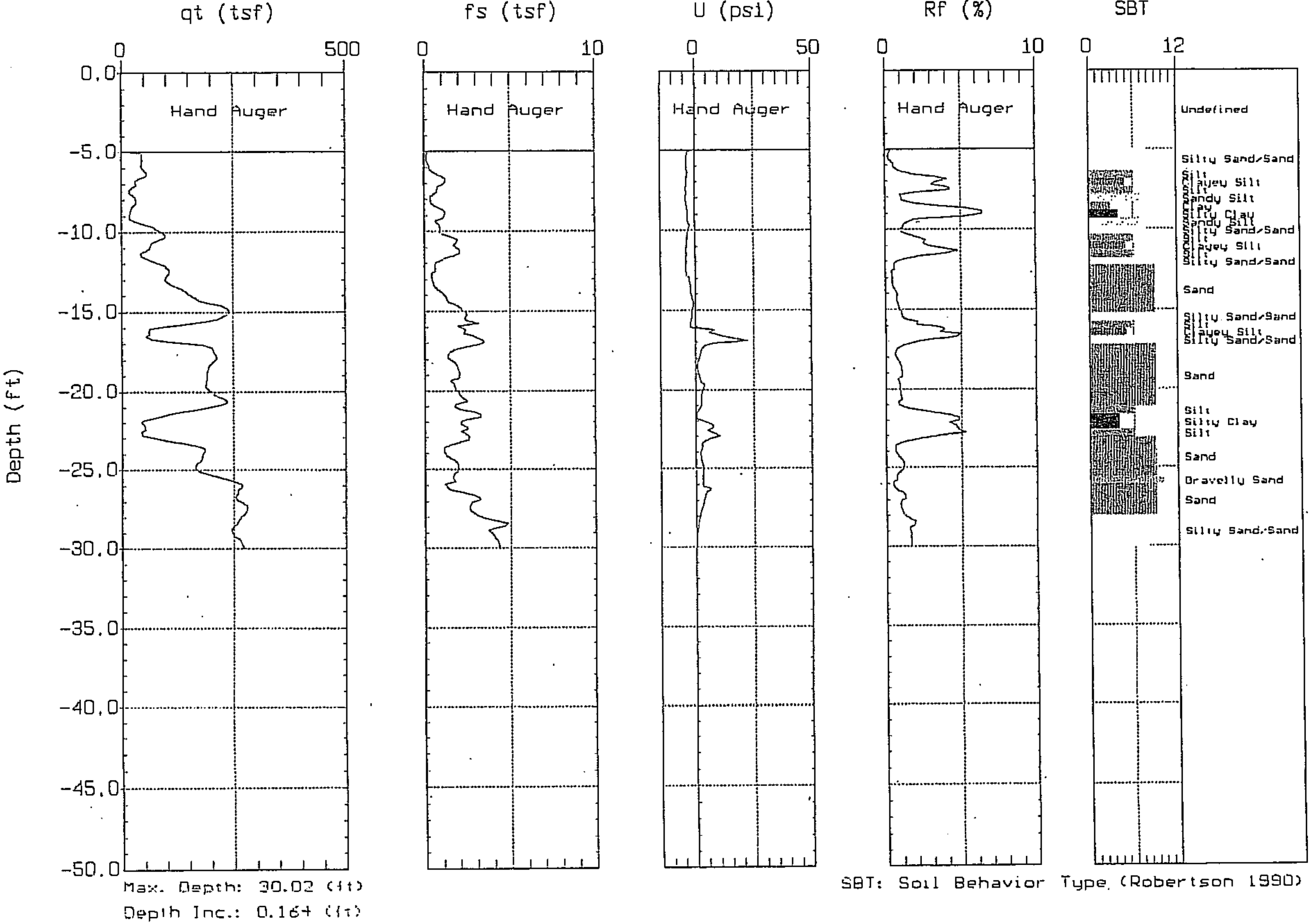
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-46

Engineer: S.HARRIS
Date: 07:20:05 08:29



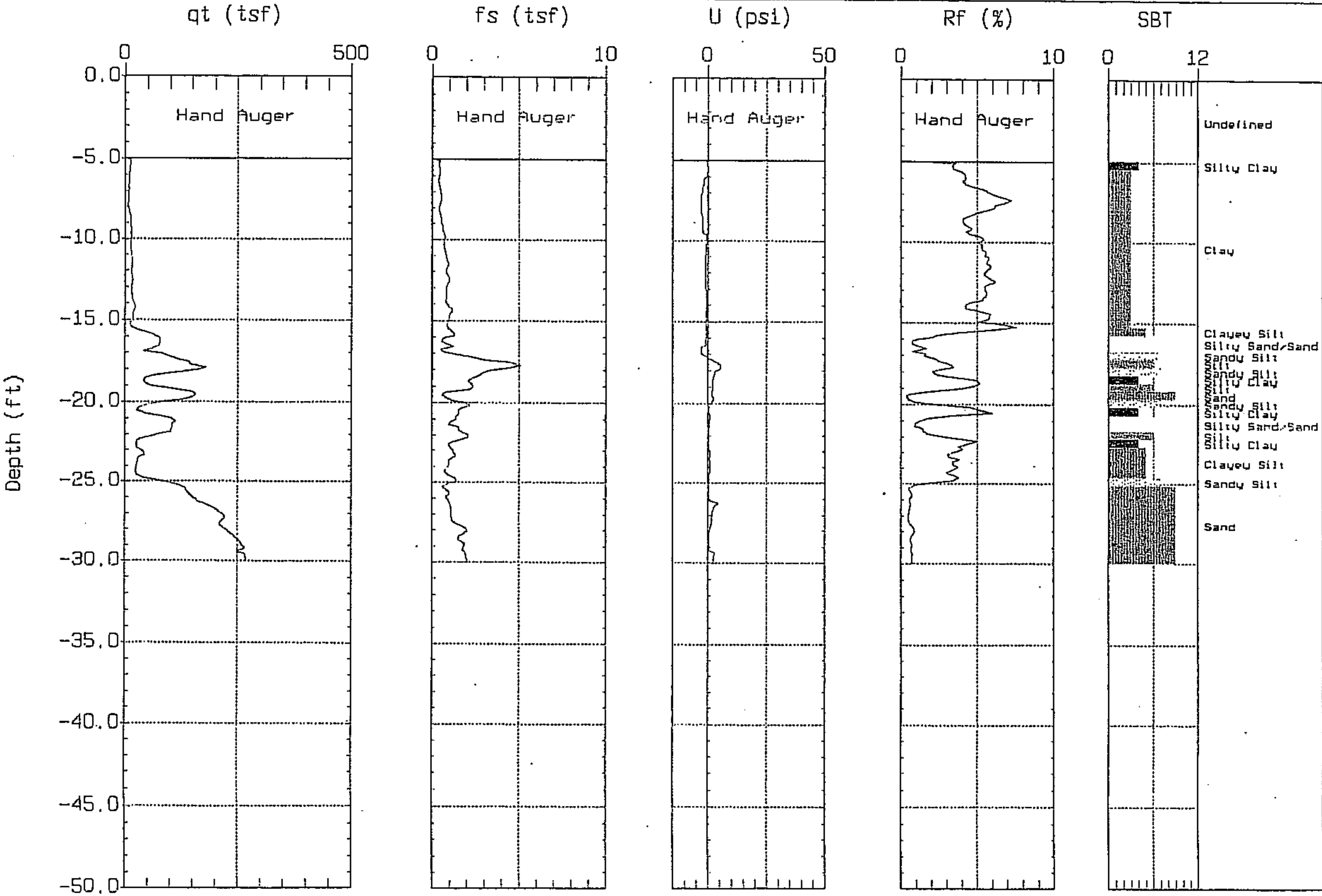
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-47

Engineer: S.HARRIS
Date: 07:19:05 15:55



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

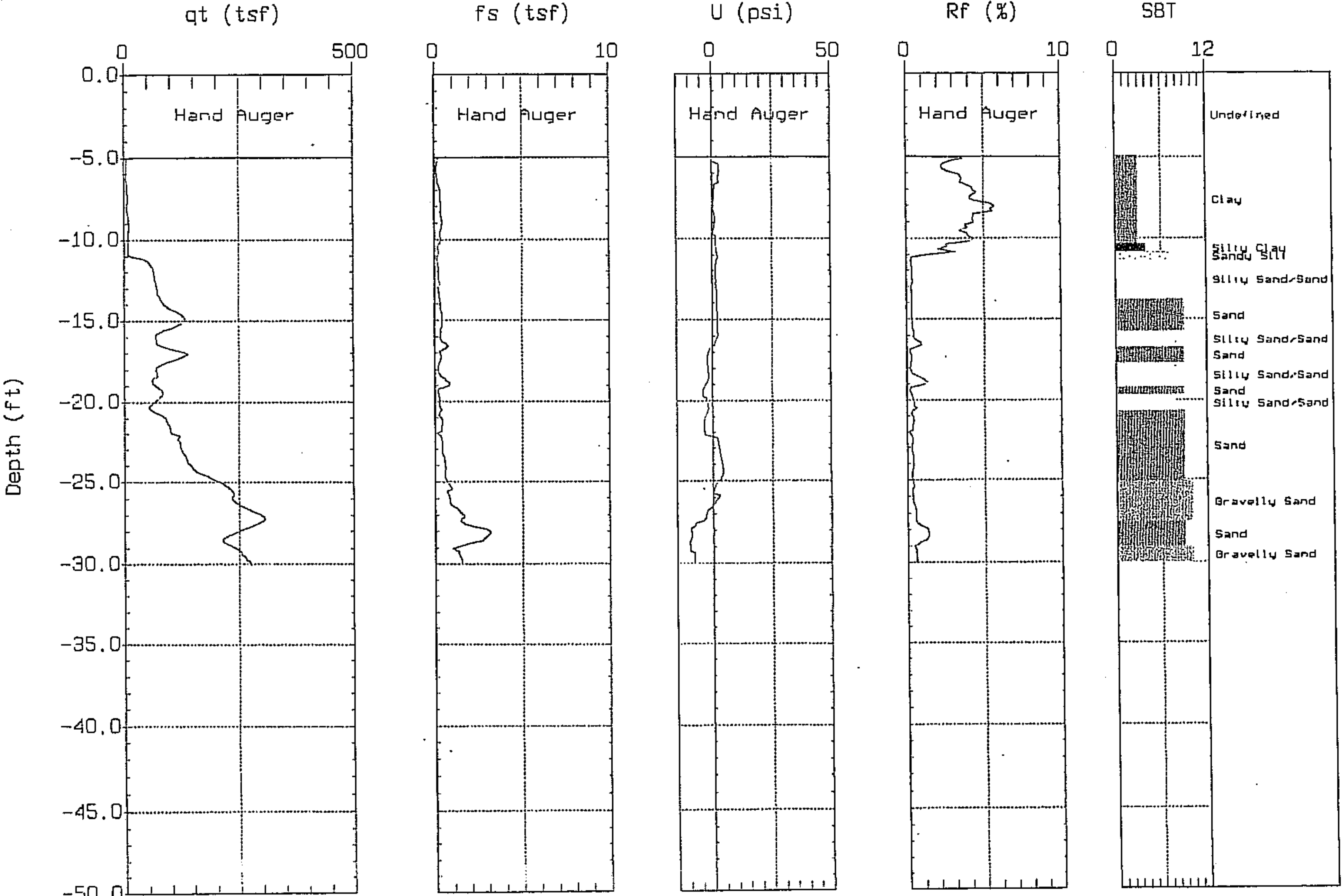
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-48

Engineer: S.HARRIS
Date: 07:19:05 15:24



Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

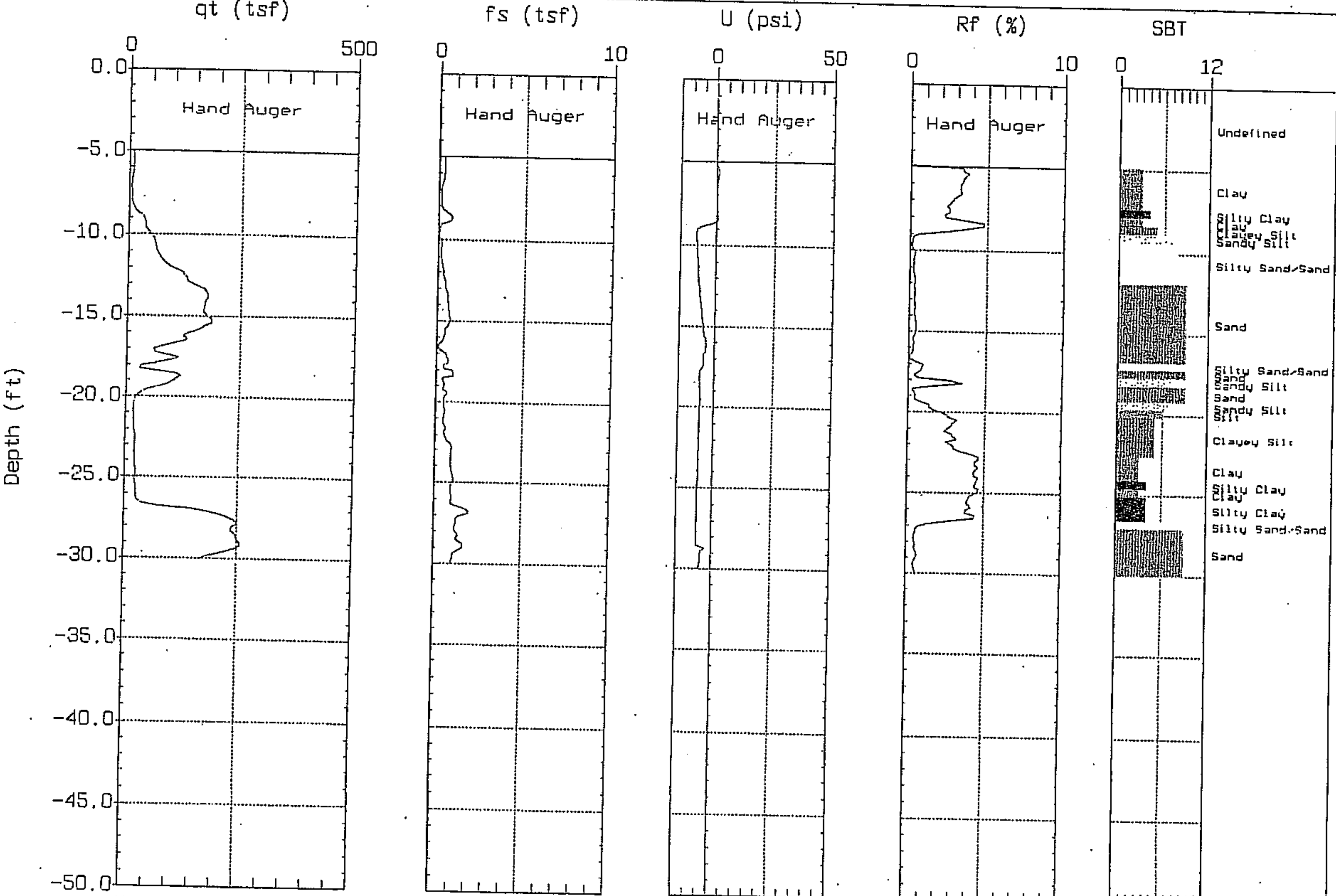
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: KB HOMES
Location: CPT-49

Engineer: S.HARRIS
Date: 07:19:05 15:04

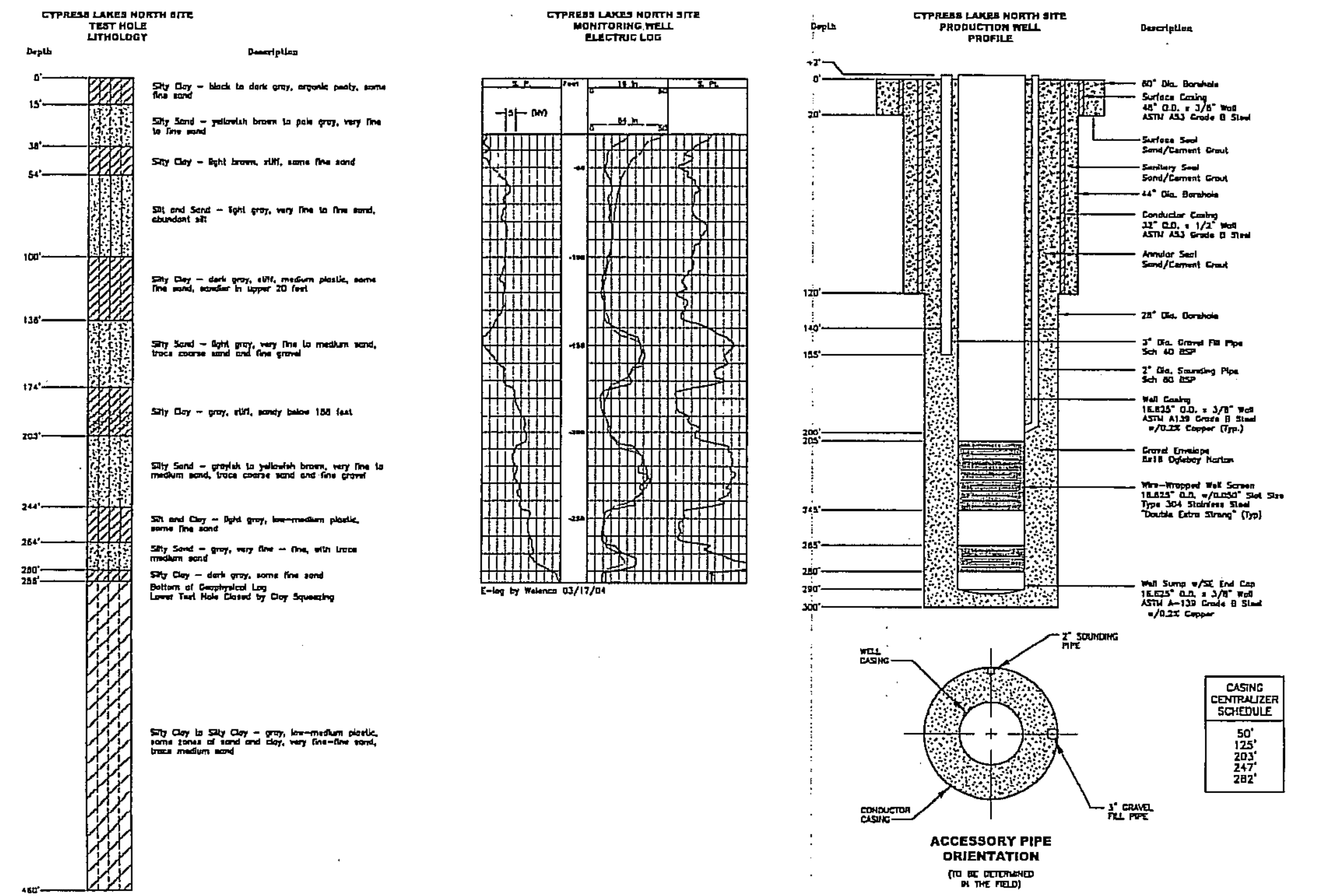


Max. Depth: 30.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX B

LUHDORFF AND SCALMANINI CONSULTING ENGINEERS



PRODUCTION WELL PROFILE–NORTH
North & South Water Supply Wells
Cypress Lakes Development
Contra Costa County, California

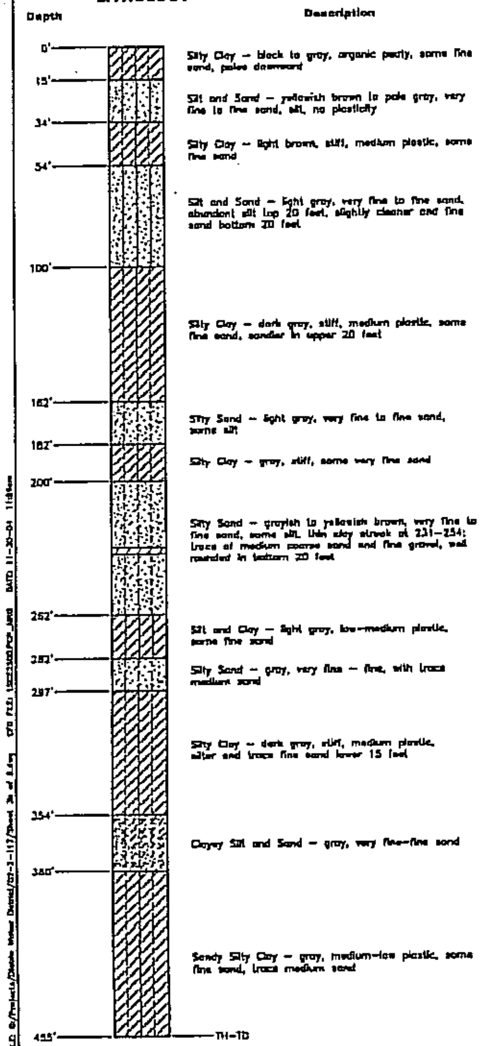
LUHDORFF & SCALMANINI CONSULTING ENGINEERS

NO.	DATE	REVISION

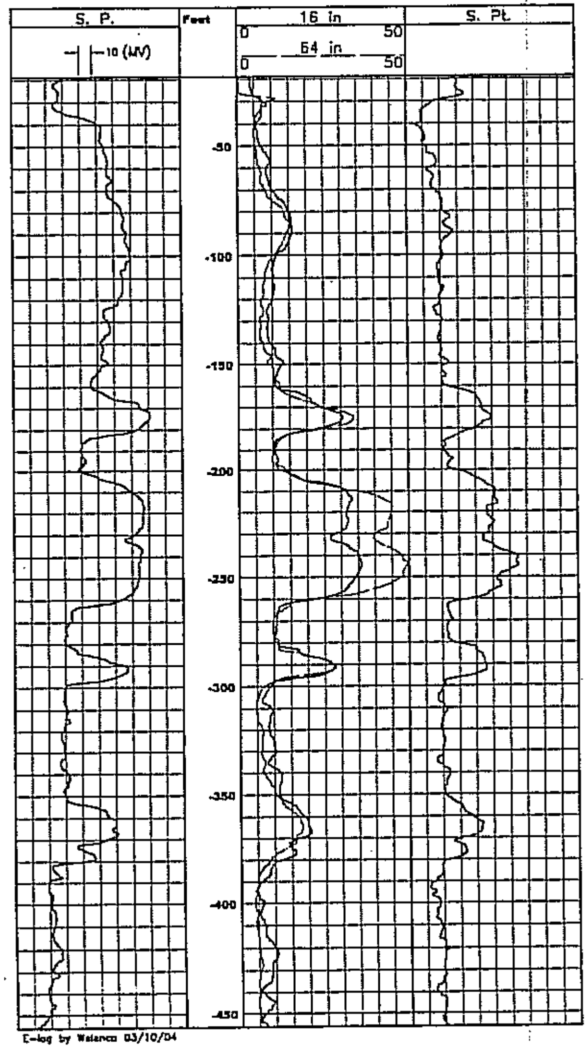
DATE: SEPTEMBER 2004
JOB NO. 102-2-117
DESIGN BY: TDE
DRAWN BY: DWT
CHECKED BY: LHE
FILE: Sheet 3a of 5.dwg

SHEET: 3a
OF: 5

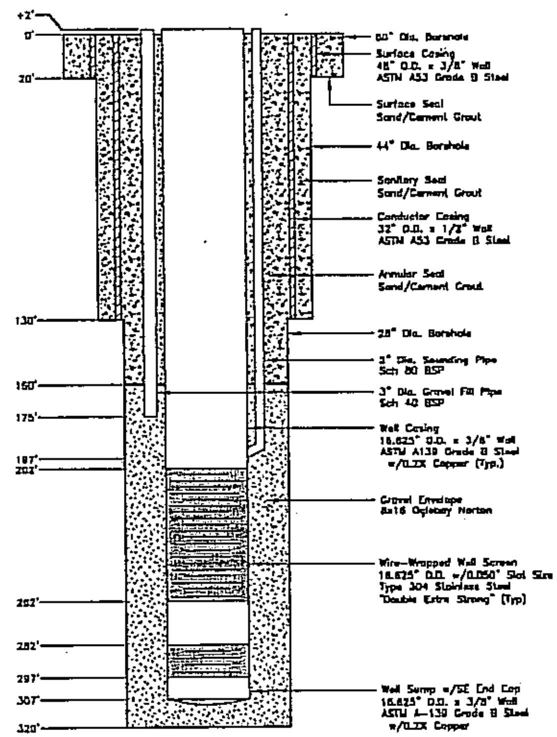
CYPRESS LAKES SOUTH SITE TEST HOLE LITHOLOGY

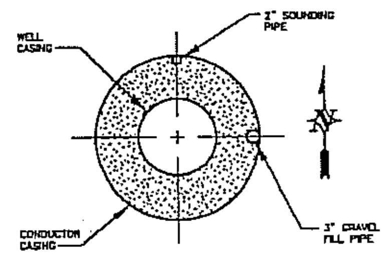


CYPRESS LAKES SOUTH SITE TEST HOLE ELECTRIC LOG



CYPRESS LAKES SOUTH SITE PRODUCTION WELL PROFILE





ACCESSORY PIPE ORIENTATION

CASING CENTRALIZER SCHEDULE
50'
125'
200'
264'
299'

PRODUCTION WELL PROFILE–SOUTH
North & South Water Supply Wells
Cypress Lakes Development
Contra Costa County, California

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

REVISIONS

NO.	DATE	REVISION

DATE: SEPTEMBER 2004
JOB NO.: 02-2-117
DESIGN BY: TDE
DRAWN BY: DWT
CHECKED BY: LUK
FILE: Sheet 3b of 5.dwg

SHEET: 3b OF: 5

CAD FILE: G:/Projects/Discovery Bay/02-2-117/Sheet 3b of 5.dwg CTB FILE: LSCE2000.PCP_ARB DATE: 11-30-04 11:06am

ENGEO INCORPORATED

APPENDIX C

Groundwater Quality and Quantity Data
from Federal, State and Local Sources

[illegible]
October [illegible]

Water Resources

Data Category: Ground Water
Geographic Area: California
go

Ground-water Site Inventory for California

Site Selection Results -- 282 sites found

Site type = Spring, Ground Water
County = Contra Costa

Save file of selected sites to local disk for future upload

Data for individual sites can be obtained by selecting the site number below

Agency	Site Number	Site Name
USGS	363659119221801	015S024E20A001M
USGS	374242121533101	002S001E32N001M
USGS	374304121505801	001S001E34K002M
USGS	374357121543701	002S001E30E001M
USGS	374357121543702	002S001E30E002M
USGS	374418121563201	002S001W26C002M
USGS	374422121545001	002S001W24R001M
USGS	374430121521201	002S001E21P001M
USGS	374436121561401	002S001W23K001M
USGS	374453121522701	002S001E21E001M
USGS	374457121522501	002S001E21D002M
USGS	374500121522301	002S001E21D001M
USGS	374544121572501	002S001W15F001M
USGS	374545121515801	002S001E16G002M
USGS	374546121520101	002S001E16G001M
Agency	Site Number	Site Name
USGS	374551121562701	002S001W15B003M
USGS	374558121483501	002S001E13B001M
USGS	374600121493101	002S001E11R001M
USGS	374614121473701	002S002E18B001M
USGS	374616121552601	002S001W12L001M
USGS	374617121483201	002S001E12K001M
USGS	374627121505801	002S001E10L001M
USGS	374631121480101	002S001E12G001M

USGS	374632121482801	002S002E12H001M
USGS	374635121492401	002S001E11H001M
USGS	374635121494501	002S001E11G001M
USGS	374638121513801	002S001E09H001M
USGS	374649121514501	002S001E09A001M
USGS	374655121534201	002S001E06R002M
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USGS	374712121514001	002S001E04J006M
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USGS	374713121513501	002S001E04J005M
USGS	374713121533601	002S001E05M001M
USGS	374719121510301	002S001E03F004M
USGS	374722121510001	002S001E03L001M
USGS	374726121535001	002S001E06H008M
USGS	374727121513001	002S001E03E001M
USGS	374727121513401	002S001E04H002M
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USGS	374727121535001	002S001E06H006M
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USGS	374732121513701	002S001E04A006M
USGS	374735121532401	002S001E05F001M
USGS	374735121534801	002S001E06A001M
USGS	374735121535301	002S001E06A002M
USGS	374736121535301	002S001E06A011M
USGS	374737121533801	002S001E05D002M
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USGS	374738121534801	002S001E06A008M
USGS	374742121535001	002S001E06A009M
USGS	374743121512501	002S002E03D001M
USGS	374743121513201	002S001E04A001M

USGS	374746121513501	001S001E33R002M
USGS	374746121545001	002S001W13R002M
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USGS	374753121525501	001S001E32Q001M
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Agency	Site Number	Site Name
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USGS	374812121513101	001S001E33H001M
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Agency	Site Number	Site Name
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USGS	375337121372001	001N003E34A001M
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USGS	375753121422801	001N002E01F001M
USGS	375800121360001	002N003E35G001M
USGS	375806121393001	001N003E04D001M
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USGS	375809121383401	001N003E04A001M
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USGS	375810121414001	002N003E31N001M
USGS	375817121410201	002N003E31Q001M No data
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USGS	380017121443201	002N002E22L001M
USGS	380017121455901	002N002E21K001M
USGS	380019121464601	002N002E20F001M
USGS	380019121473401	002N002E19F001M
USGS	380020121443901	002N002E22F001M
USGS	380024121471501	002N002E19G002M

Agency	Site Number	Site Name
USGS	380024121490801	002S001E24E001M
USGS	380024121490802	002N001E24E002M
USGS	380024121490803	002N001E24E003M
USGS	380025121471101	002N002E19G001M
USGS	380043121461201	002N002E20A001M
USGS	380044121510301	002N001E22C001M
USGS	380045122031701	002N002W14P002M
USGS	380048121460901	002N002E17R002M
USGS	380048121460902	002N002E17R003M
USGS	380048121470701	002N002E17N001M
USGS	380049122015301	002N002W13P001M
Agency	Site Number	Site Name
USGS	380055121374001	002N003E15Q001M
USGS	380102121480801	002N002E18M001M
USGS	380104121530001	002N001E17K002M
USGS	380107121530201	002N001E17K001M
USGS	380108121391001	002N003E16L001M
USGS	380122121390101	002N003E16F002M
USGS	380123122015401	002N002W13B005M
USGS	380124122014201	002N002W13B003M
USGS	380124122014701	002N002W13B004M
USGS	380129121543901	002N001E18D001M
USGS	380131121543101	002N001E18C001M
USGS	380137121535701	002N001E07R001M
USGS	380138121552501	002N001W12P003M
USGS	380138121552601	002N001W12P001M
USGS	380140121535501	002N001E07R002M
Agency	Site Number	Site Name
USGS	380140121552501	002N001W12P002M
USGS	380141121540001	002N001E07R004M
USGS	380141121540601	002N001E07R003M
USGS	380141121552501	002N001W12P004M
USGS	380207121372901	002N003E10H004M
USGS	380207121372902	002N003E10H005M
USGS	380207121372903	002N003E10H006M
USGS	380208121372901	002N003E10H001M
USGS	380208121372902	002N003E10H002M

USGS	380208121372903	002N003E10H003M
USGS	380216121573801	002N001W10C001M
USGS	380218121380901	002N003E10D001M
USGS	380221121590801	002N001W09D002M
USGS	380226121591201	002N001W09D001M
USGS	380226121591202	002N001W09D003M
Agency	**Site Number**	**Site Name**
USGS	380231121403201	002N003E05N001M
USGS	380239121583801	002N001W04Q001M
USGS	380817121520101	003N001E14B002M
USGS	380917121582601	004N001W33A001M
USGS	381129122075001	004N002W18M001M
USGS	381230122045601	004N002W09H001M
USGS	381235121531701	004N001E08F001M
USGS	381302122062501	004N002W05Q002M
USGS	381342122055701	004N002W04D001M
USGS	381348122041402	005N002W34P004M
USGS	381438121585501	005N001W28P001M
USGS	381443121550301	005N001W25R001M

Questions about data California NWISWeb Data Inquiries
Feedback on this website California NWISWeb Maintainer

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Explanation of terms

Ground-water Site Inventory -- 282 sites found
http://waterdata.usgs.gov/ca/nwis/gwsi?

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

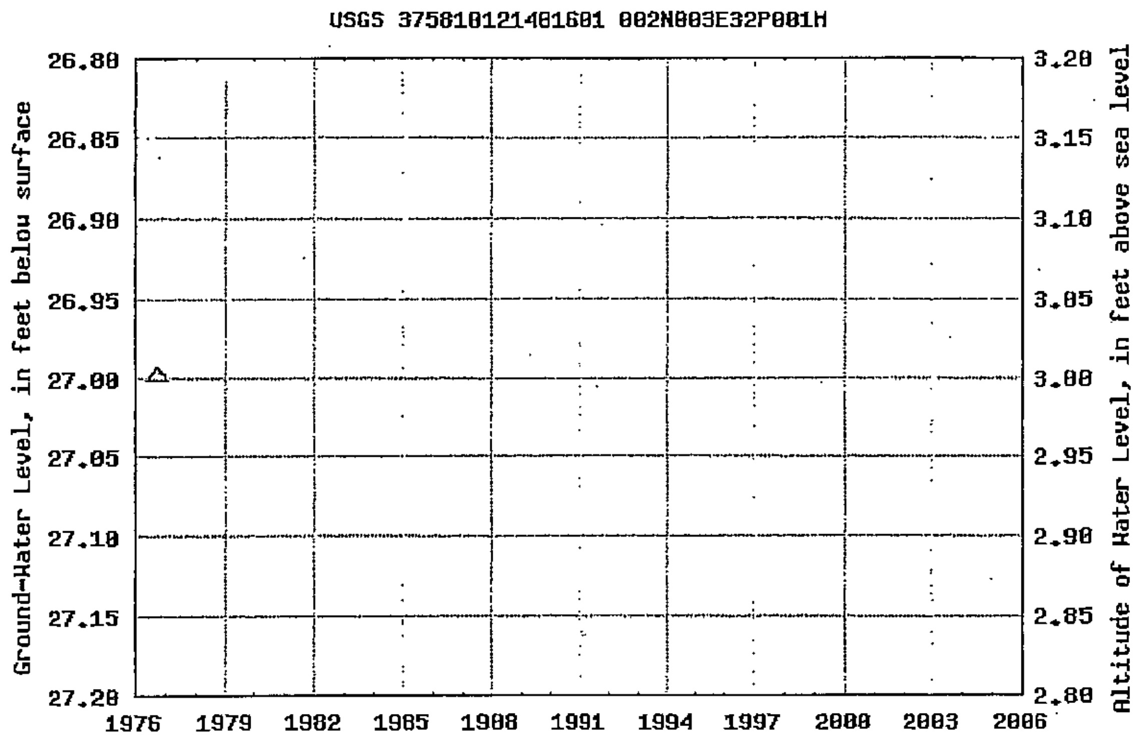
site_no list =	• 375810121401601

Save file of selected sites to local disk for future upload

USGS 375810121401601 002N003E32P001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°58'10", Longitude 121°40'16" NAD27 Gage datum 30.00 feet above sea level NGVD29 The depth of the well is 113 feet below land surface. The depth of the hole is 126 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375810121414001

Save file of selected sites to local disk for future upload

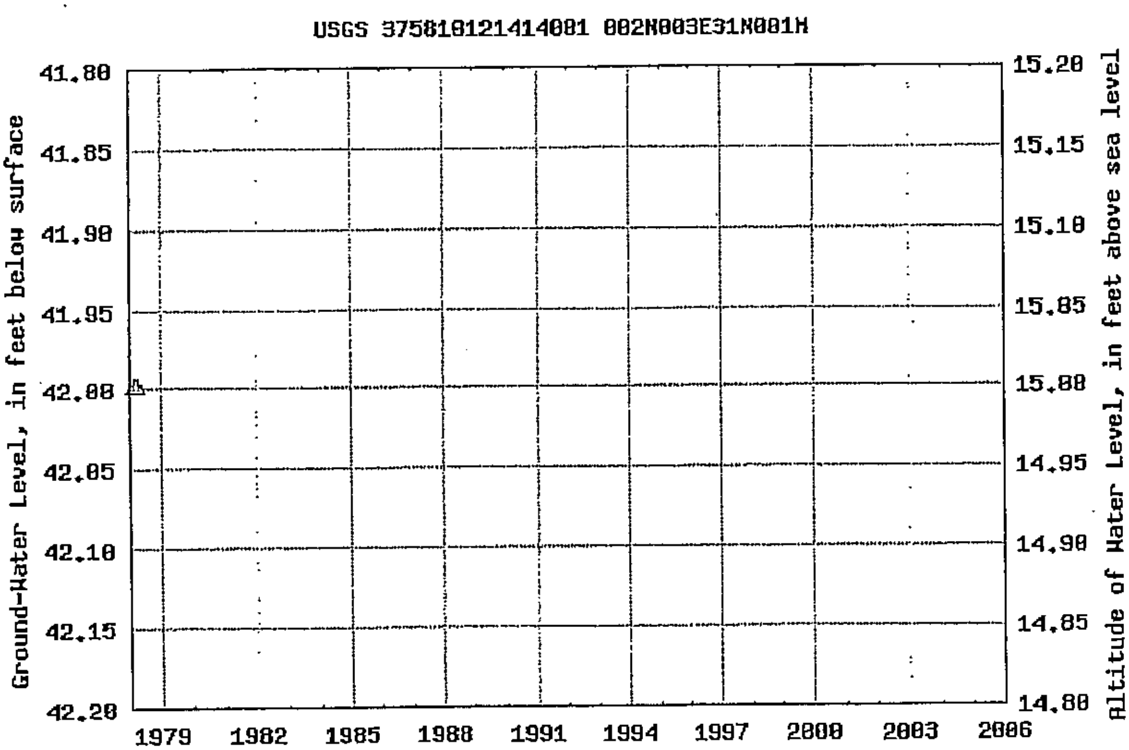
USGS 375810121414001 002N003E31N001M

Available data for this site Ground-water: Levels GO

~~Contra Costa County, California~~
Hydrologic Unit Code 18040003
Latitude 37°58'10", Longitude 121°41'40" NAD27
Gage datum 57.00 feet above sea level NGVD29
The depth of the well is 93.0 feet below land surface.
The depth of the hole is 132 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375825121405301

Save file of selected sites to local disk for future upload

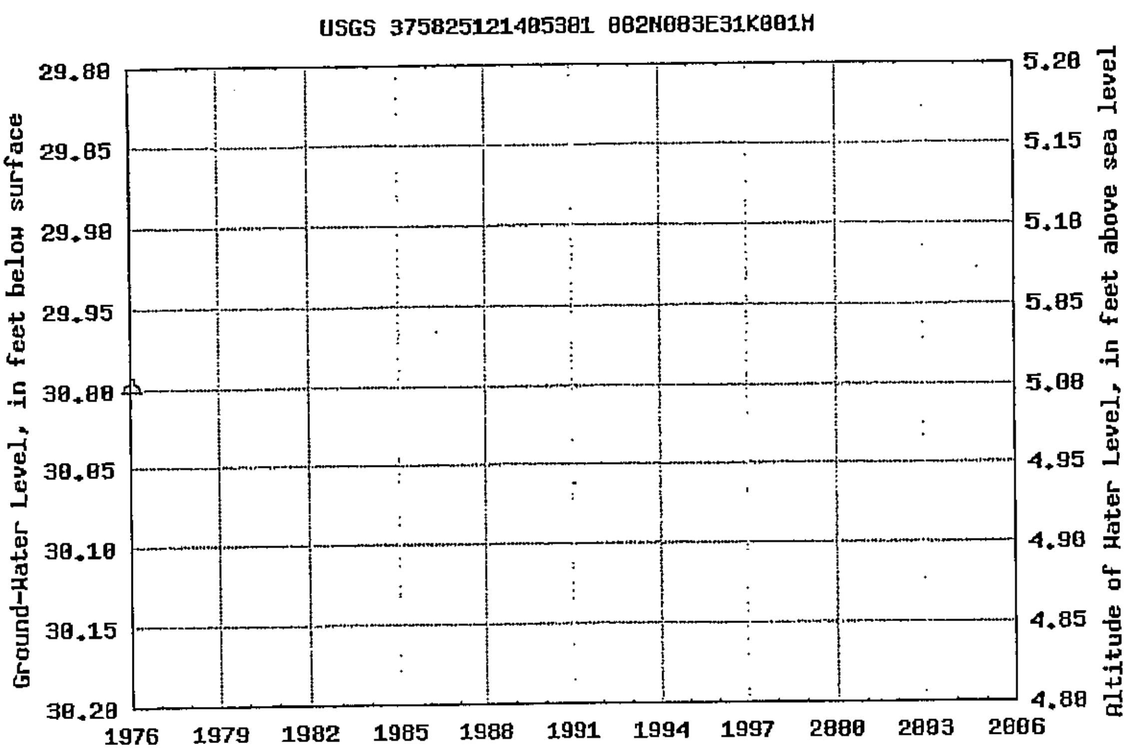
USGS 375825121405301 002N003E31K001M

Available data for this site Ground-water: Levels GO

~~Contra Costa County, California~~
Hydrologic Unit Code 18040003
Latitude 37°58'25", Longitude 121°40'53" NAD27
Gage datum 35.00 feet above sea level NGVD29
The depth of the well is 150 feet below land surface.
The depth of the hole is 155 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

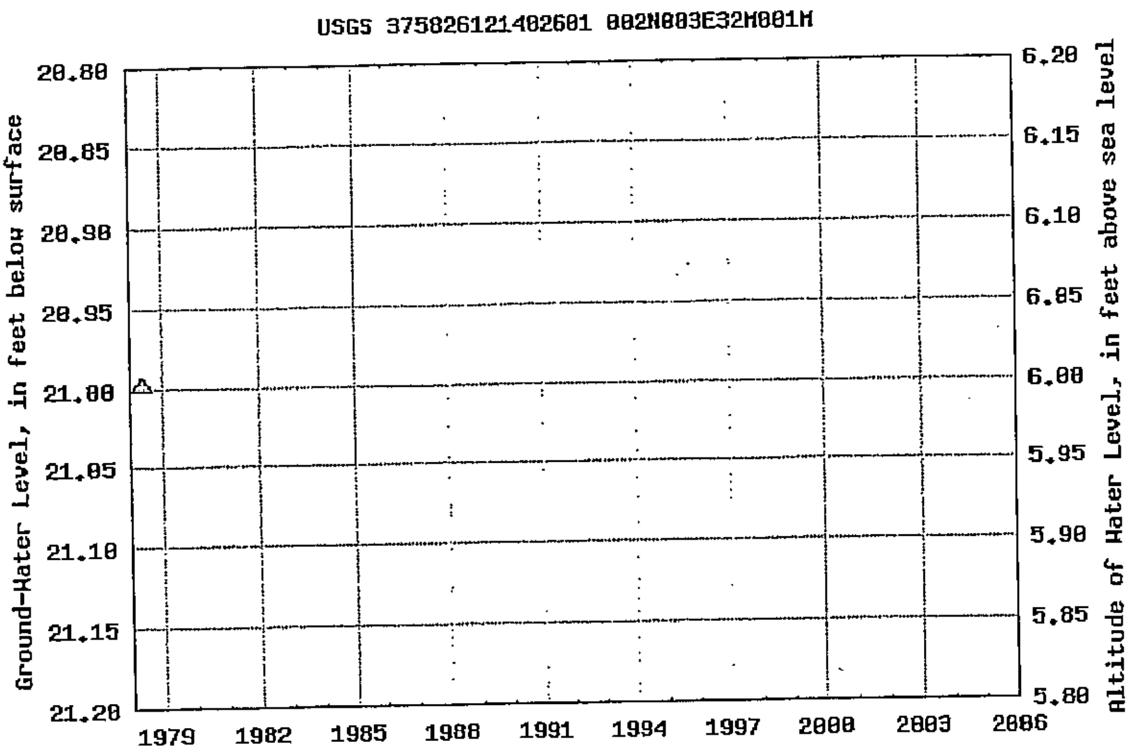
site_no list =	• 375826121402601

Save file of selected sites to local disk for future upload

USGS 375826121402601 002N003E32M001M

Available data for this site Ground-water: Levels GO

	Output formats
~~Contra Costa County, California~~ Hydrologic Unit Code 18040003 Latitude 37°58'26", Longitude 121°40'26" NAD27 Gage datum 27.00 feet above sea level NGVD29 The depth of the well is 105 feet below land surface. The depth of the hole is 125 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375858121394601

Save file of selected sites to local disk for future upload

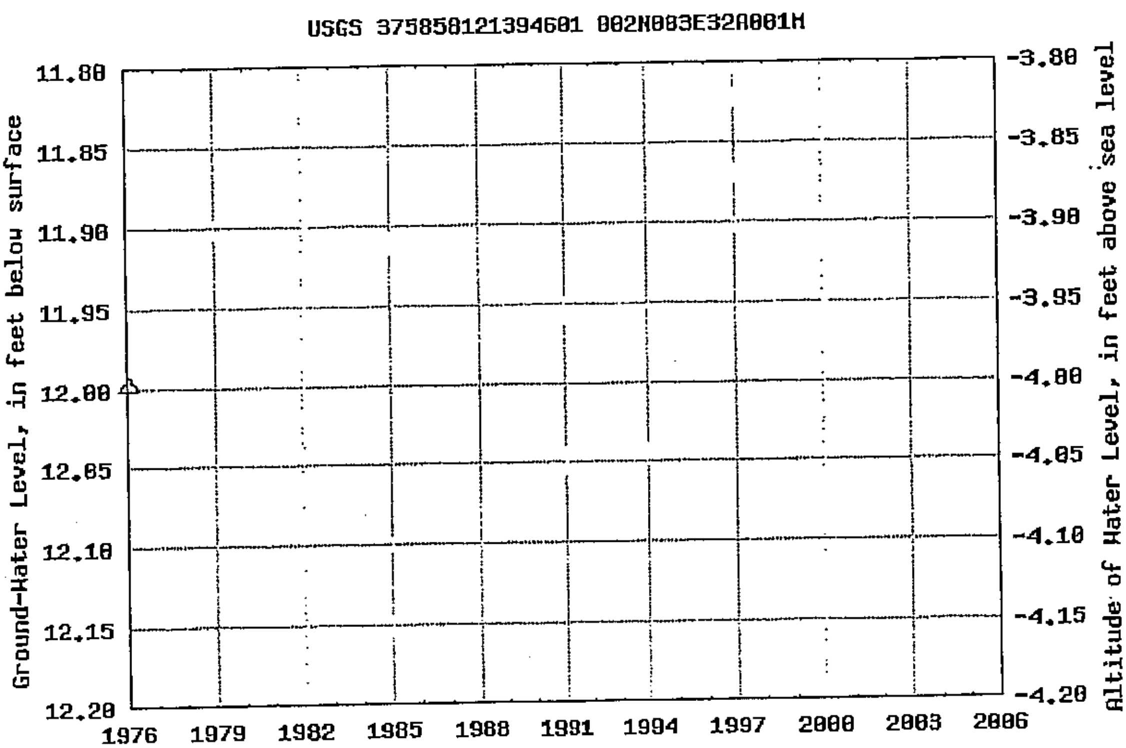
USGS 375858121394601 002N003E32A001M

Available data for this site Ground-water: Levels GO

~~Contra Costa County, California~~
Hydrologic Unit Code 18040003
Latitude 37°58'58", Longitude 121°39'46" NAD27
Gage datum 8.00 feet above sea level NGVD29
The depth of the well is 105 feet below land surface.
The depth of the hole is 110 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375916121382301

Save file of selected sites to local disk for future upload

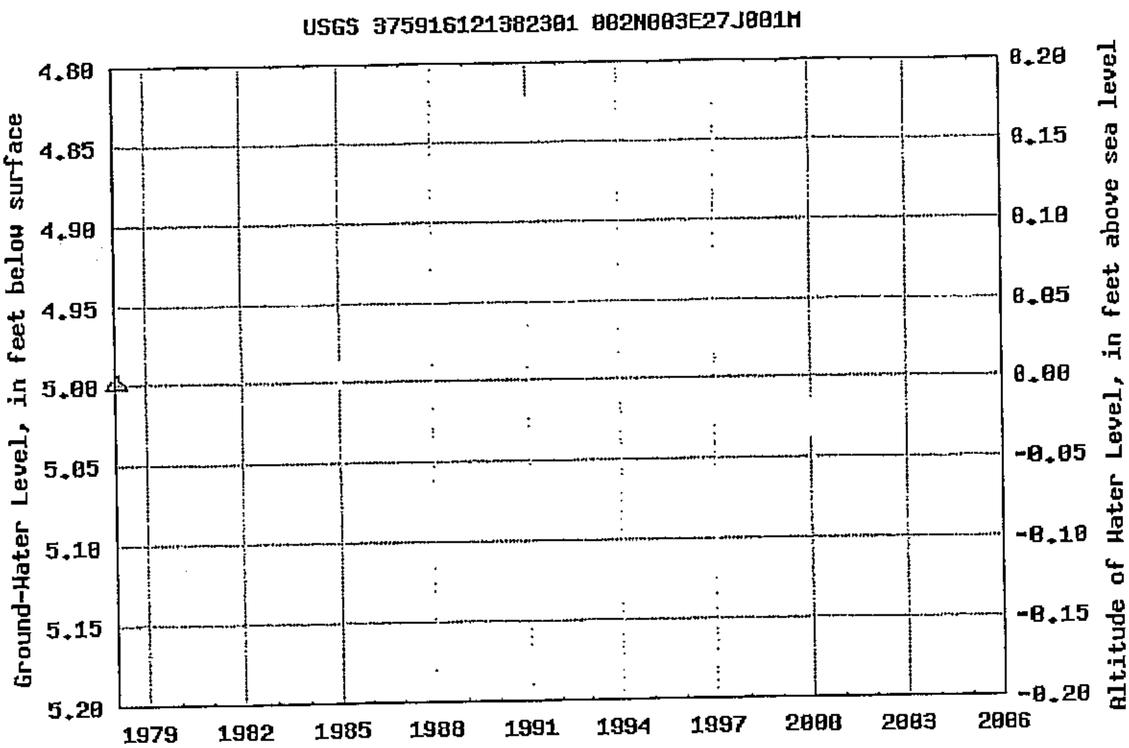
USGS 375916121382301 002N003E27J001M

Available data for this site: Ground-water: Levels GO

~~Contra Costa County, California~~
Hydrologic Unit Code 18040003
Latitude 37°59'16", Longitude 121°38'23" NAD27
Gage datum 5.00 feet above sea level NGVD29
The depth of the well is 162 feet below land surface.
The depth of the hole is 182 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

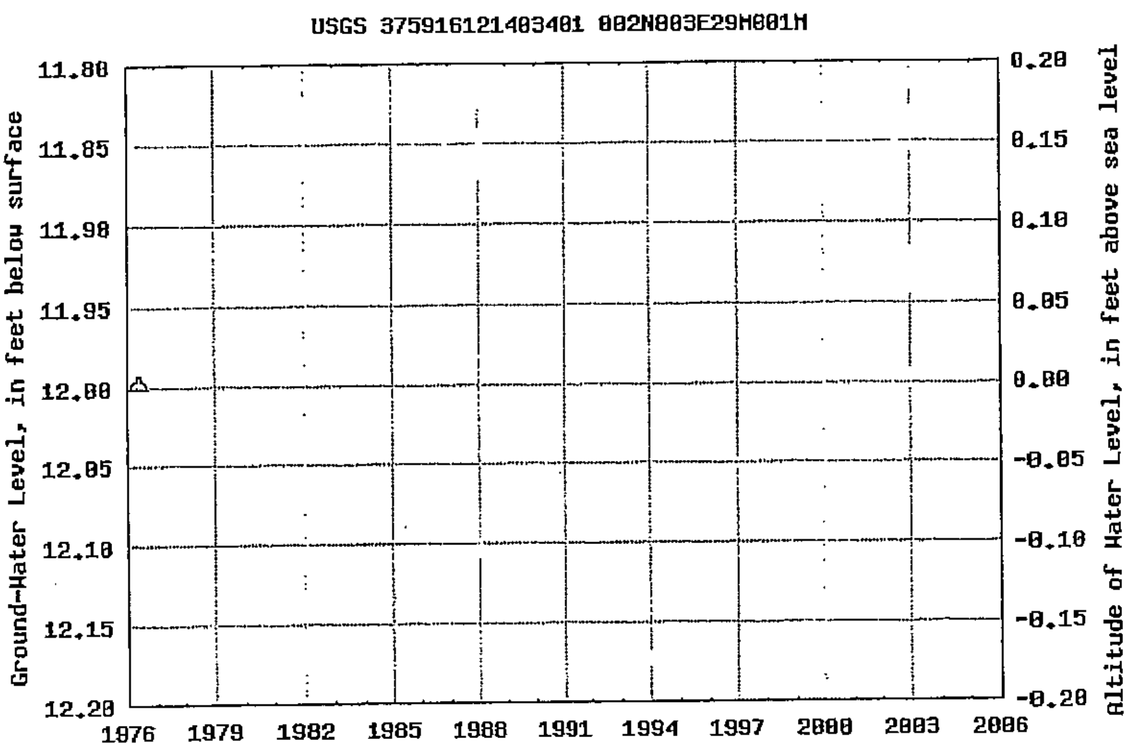
site_no list =	• 375916121403401

Save file of selected sites to local disk for future upload

USGS 375916121403401 002N003E29M001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California	Table of data
Hydrologic Unit Code 18040003	Tab-separated data
Latitude 37°59'16", Longitude 121°40'34" NAD27	Graph of data
Gage datum 12.00 feet above sea level NGVD29	Reselect period
The depth of the well is 88.0 feet below land surface.	
The depth of the hole is 100 feet below land surface.	
This well is completed in ALLUVIAL-FAN DEPOSITS (111ALVF)	



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd      - Agency Code
#  site_no        - USGS site number
#  sample_dt      - Date of sample
#  sample_tm      - Time of sample
#  parameter_cd   - Parameter Code
#  result_va      - Value
#  remark_cd      - Remark Code
#  qw_method_cd   - Quality Assurance Method Code
#  anl_stat_cd    - Analysis Stat Code
#  anl_src_cd     - Analysis Source Code
#  hyd_cond_cd    - Hydrologic Cond Code
#  samp_type_cd   - Sample Type Code
#  hyd_event_cd   - Hydrologic Event Code
#  medium_cd      - Sample medium code
#
# Data for the following sites are included:
#  USGS 375916121403401 002N003E29M001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00028  - Agency analyzing sample, code
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00660  - Orthophosphate, water, filtered, milligrams per liter
#  00671  - Orthophosphate, water, filtered, milligrams per liter as phosphorus
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01000  - Arsenic, water, filtered, micrograms per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  01046  - Iron, water, filtered, micrograms per liter
#  01056  - Manganese, water, filtered, micrograms per liter
#  01106  - Aluminum, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
```

```
# N  - Presumptive evidence of presence of material
# S  - Most probable value
# U  - Material specifically analyzed for but not detected
# V  - Value affected by contamination
#
#
agency_cd       site_no sample_dt          sample_tm       parameter_cd      result_va
5s       15s      10d     4d        5s     12n      1s      1s       1s       1s       1s
USGS     375916121403401 1979-06-05                 00010   22.0                       7
USGS     375916121403401 1979-06-05                 00028   80020                      7
USGS     375916121403401 1979-06-05                 00095   1860                       7
USGS     375916121403401 1979-06-05                 00400   7.4                        7
USGS     375916121403401 1979-06-05                 00410   360                        7
USGS     375916121403401 1979-06-05                 00618   21.0                       7
USGS     375916121403401 1979-06-05                 00660   .250                       7
USGS     375916121403401 1979-06-05                 00671   .080                       7
USGS     375916121403401 1979-06-05                 00900   690                        7
USGS     375916121403401 1979-06-05                 00915   140                        7
USGS     375916121403401 1979-06-05                 00925   82.0                       7
USGS     375916121403401 1979-06-05                 00930   150                        7
USGS     375916121403401 1979-06-05                 00931   2                          7
USGS     375916121403401 1979-06-05                 00932   32                         7
USGS     375916121403401 1979-06-05                 00935   3.20                       7
USGS     375916121403401 1979-06-05                 00940   170                        7
USGS     375916121403401 1979-06-05                 00945   310                        7
USGS     375916121403401 1979-06-05                 00950   .10                        7
USGS     375916121403401 1979-06-05                 00955   35.0                       7
USGS     375916121403401 1979-06-05                 01000   3.0                        7
USGS     375916121403401 1979-06-05                 01020   1700                       7
USGS     375916121403401 1979-06-05                 01046   10       <                 7
USGS     375916121403401 1979-06-05                 01056   300                        7
USGS     375916121403401 1979-06-05                 01106   100      <                 7
USGS     375916121403401 1979-06-05                 70300   1260                       7
USGS     375916121403401 1979-06-05                 71851   93.0                       7
```

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

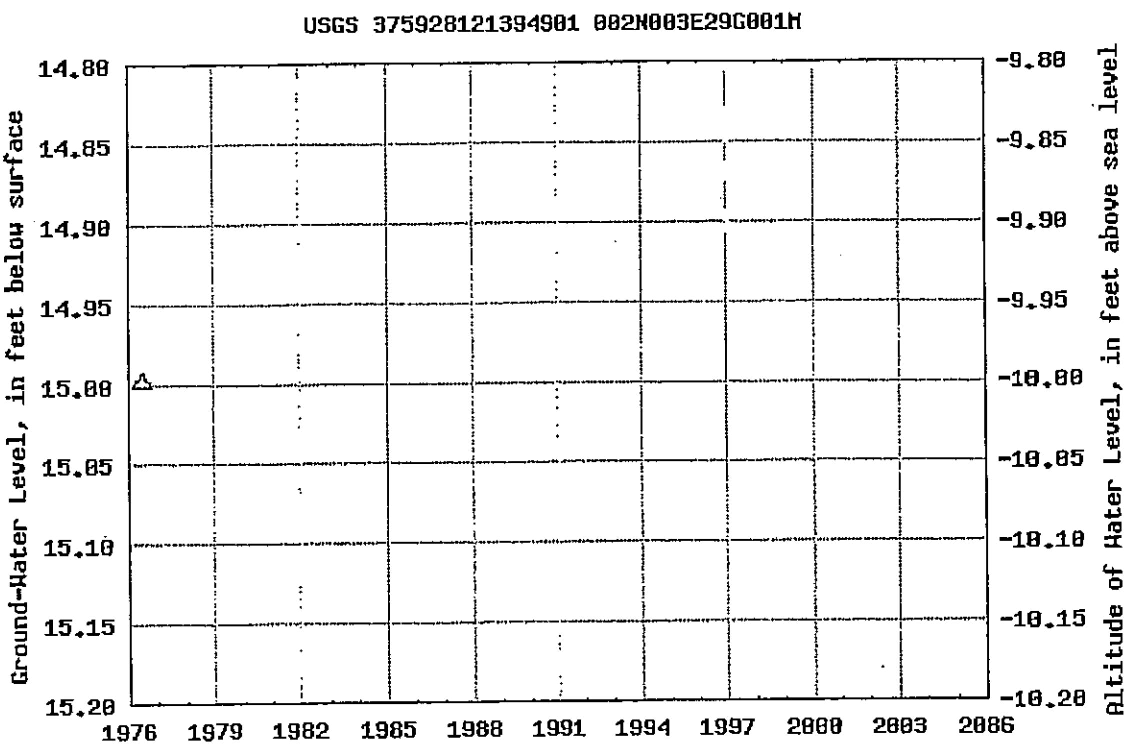
site_no list =	• 375928121394901

Save file of selected sites to local disk for future upload

USGS 375928121394901 002N003E29G001M

Available data for this site Ground-water: Levels GO

	Output formats
~~Contra Costa County, California~~ Hydrologic Unit Code 18040003 Latitude 37°59'28", Longitude 121°39'49" NAD27 Gage datum 5.00 feet above sea level NGVD29 The depth of the well is 237 feet below land surface. The depth of the hole is 245 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

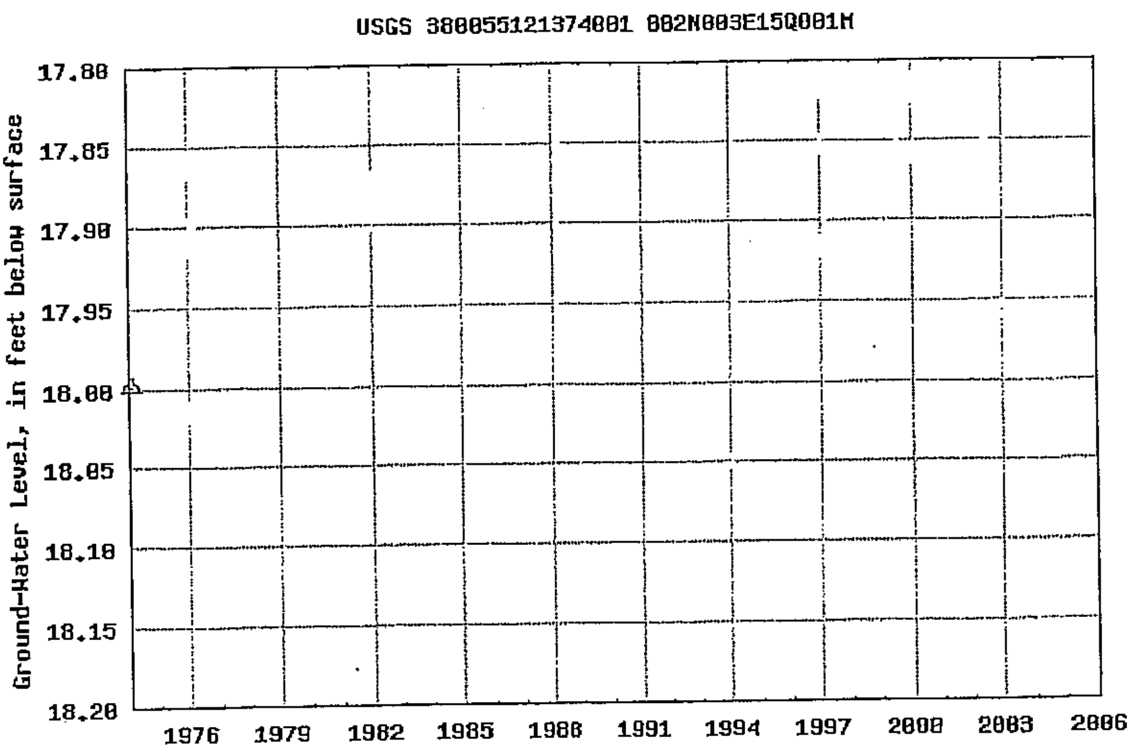
site_no list =	• 380055121374001

Save file of selected sites to local disk for future upload

USGS 380055121374001 002N003E15Q001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°00'55", Longitude 121°37'40" NAD27 The depth of the well is 165 feet below land surface. The depth of the hole is 236 feet below land surface. This well is completed in FLOOD-BASIN DEPOSITS (111FLDB)	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

5s	15s	10d	4d	5s	12n	1s	1s	1s	1s	1s
USGS	380055121374001	1979-06-05				00010	25.0			7
USGS	380055121374001	1979-06-05				00095	1330			7
USGS	380055121374001	1979-06-05				00400	8.1			7
USGS	380055121374001	1979-06-05				00410	270			7
USGS	380055121374001	1979-06-05				00618	.02			7
USGS	380055121374001	1979-06-05				00900	300			7
USGS	380055121374001	1979-06-05				00915	63.0			7
USGS	380055121374001	1979-06-05				00925	35.0			7
USGS	380055121374001	1979-06-05				00930	140			7
USGS	380055121374001	1979-06-05				00931	4			7
USGS	380055121374001	1979-06-05				00932	50			7
USGS	380055121374001	1979-06-05				00935	3.80			7
USGS	380055121374001	1979-06-05				00940	200			7
USGS	380055121374001	1979-06-05				00945	73.0			7
USGS	380055121374001	1979-06-05				00950	.10	<		7
USGS	380055121374001	1979-06-05				00955	34.0			7
USGS	380055121374001	1979-06-05				01020	500			7
USGS	380055121374001	1979-06-05				70300	768			7
USGS	380055121374001	1979-06-05				71851	.100			7

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd      - Agency Code
#  site_no        - USGS site number
#  sample_dt      - Date of sample
#  sample_tm      - Time of sample
#  parameter_cd   - Parameter Code
#  result_va      - Value
#  remark_cd      - Remark Code
#  qw_method_cd   - Quality Assurance Method Code
#  anl_stat_cd    - Analysis Stat Code
#  anl_src_cd     - Analysis Source Code
#  hyd_cond_cd    - Hydrologic Cond Code
#  samp_type_cd   - Sample Type Code
#  hyd_event_cd   - Hydrologic Event Code
#  medium_cd      - Sample medium code
#
# Data for the following sites are included:
#  USGS 380055121374001 002N003E15Q001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
# N  - Presumptive evidence of presence of material
# S  - Most probable value
# U  - Material specifically analyzed for but not detected
# V  - Value affected by contamination
#
#
agency_cd      site_no sample_dt      sample_tm      parameter_cd     result_va
```

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

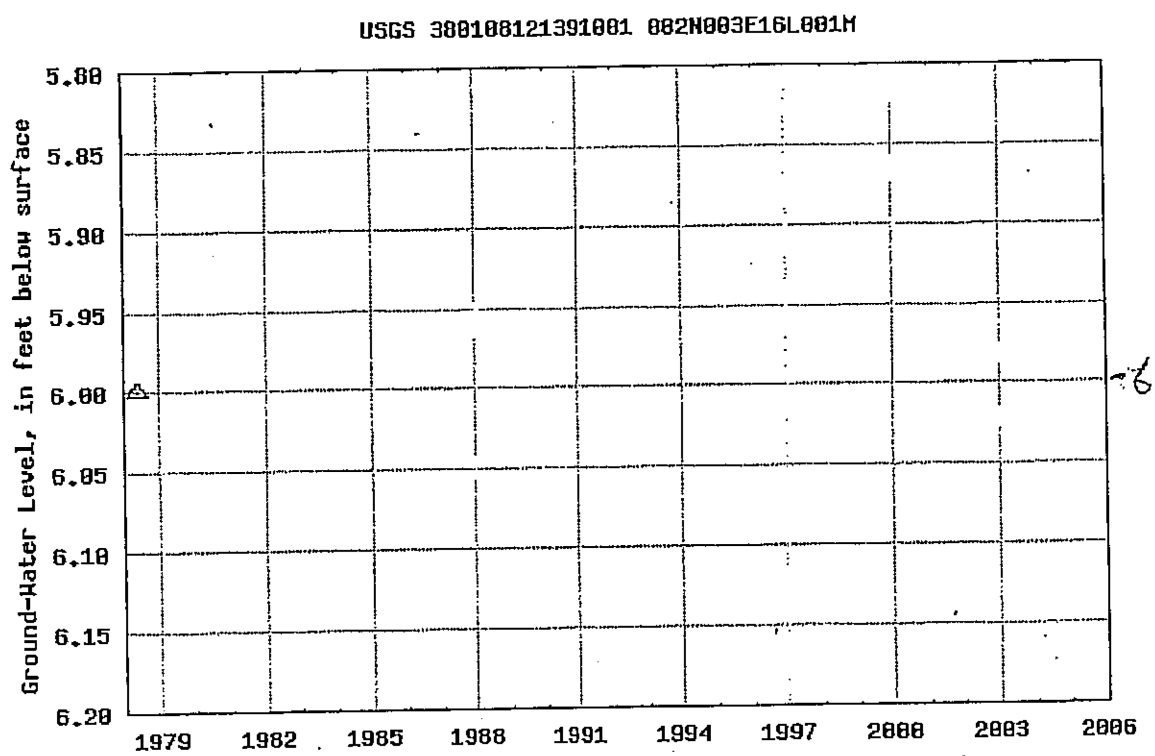
site_no list =	• 380108121391001

Save file of selected sites to local disk for future upload

USGS 380108121391001 002N003E16L001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°01'08", Longitude 121°39'10" NAD27 The depth of the well is 255 feet below land surface. The depth of the hole is 270 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

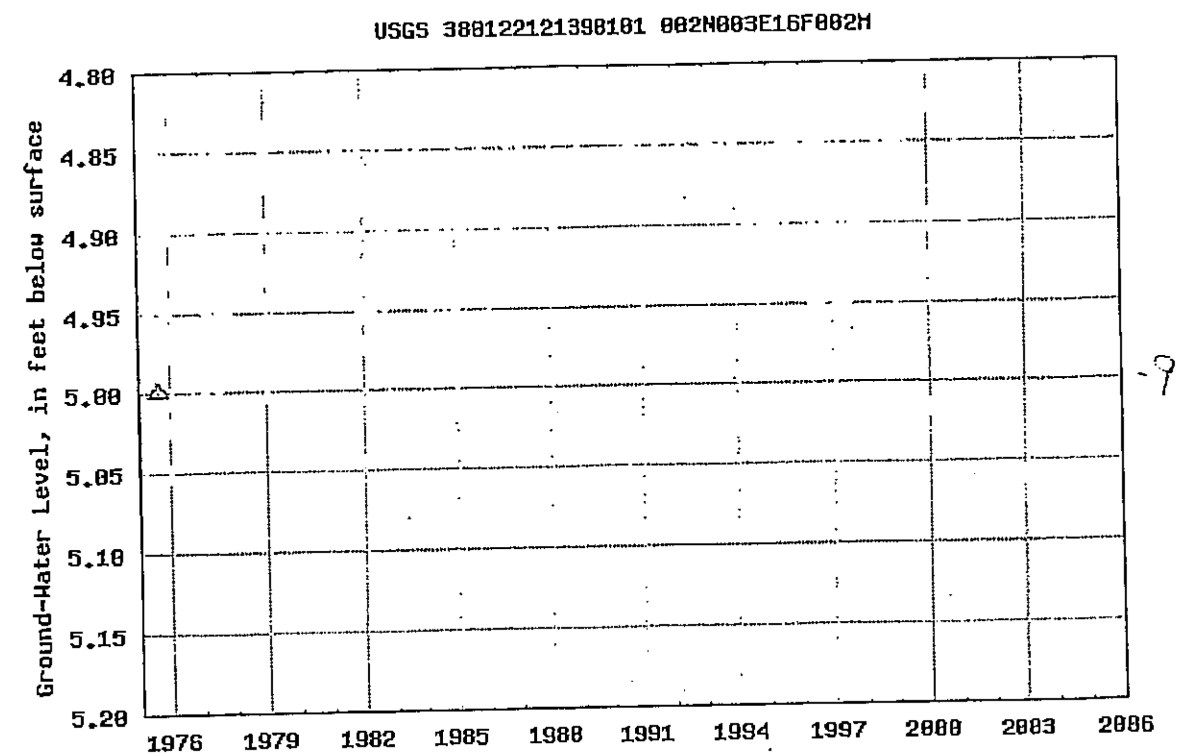
Agency code = usgs	
site_no list =	• 380122121390101

Save file of selected sites to local disk for future upload

USGS 380122121390101 002N003E16F002M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°01'22", Longitude 121°39'01" NAD27 The depth of the well is 50.0 feet below land surface. The depth of the hole is 61.0 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period



-9

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

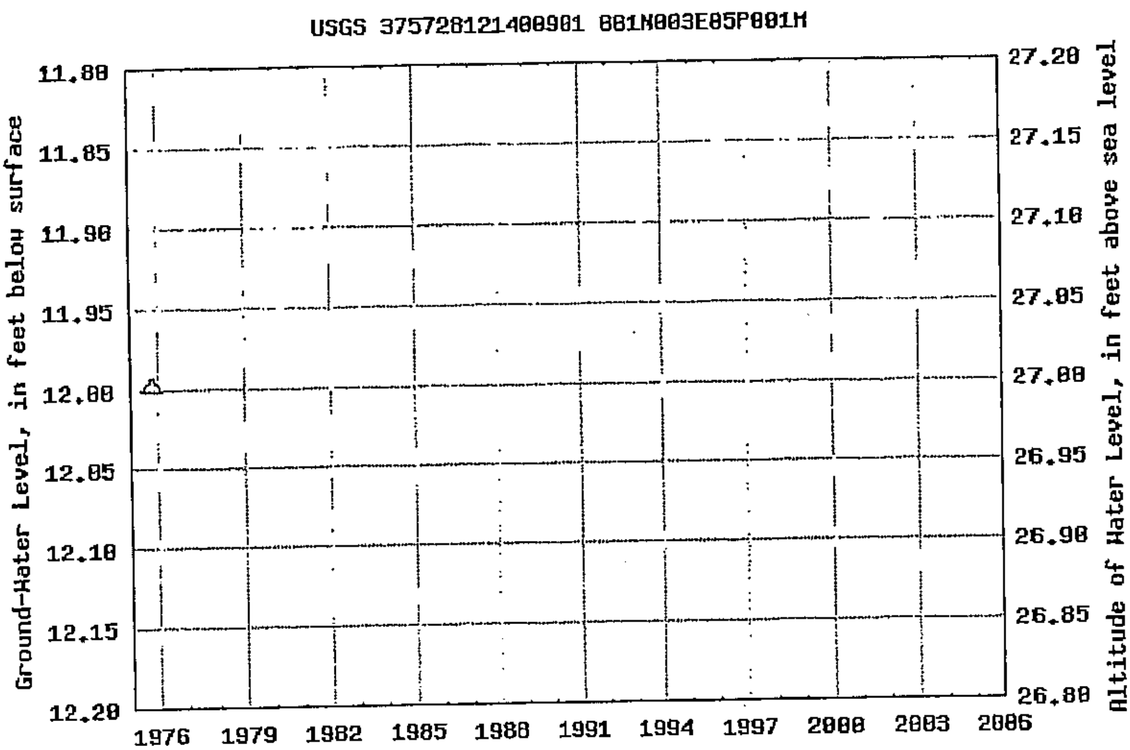
site_no list =	• 375728121400901

Save file of selected sites to local disk for future upload

USGS 375728121400901 001N003E05P001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 37°57'28", Longitude 121°40'09" NAD27 Gage datum 39.00 feet above sea level NGVD29 The depth of the well is 65.0 feet below land surface. The depth of the hole is 95.0 feet below land surface.	**Output formats** Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water | Geographic Area: United States | go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375807121381201

Save file of selected sites to local disk for future upload

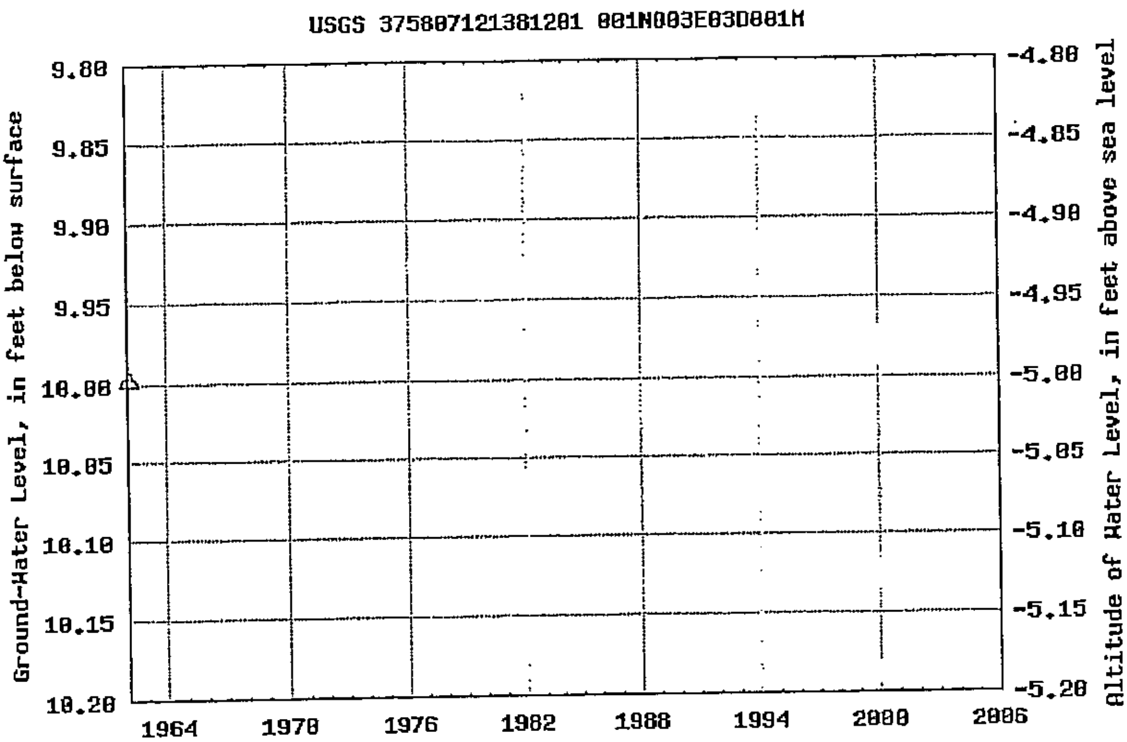
USGS 375807121381201 001N003E03D001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°58'07", Longitude 121°38'12" NAD27
Gage datum 5.00 feet above sea level NGVD29
The depth of the well is 147 feet below land surface.
The depth of the hole is 255 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375806121393001

Save file of selected sites to local disk for future upload

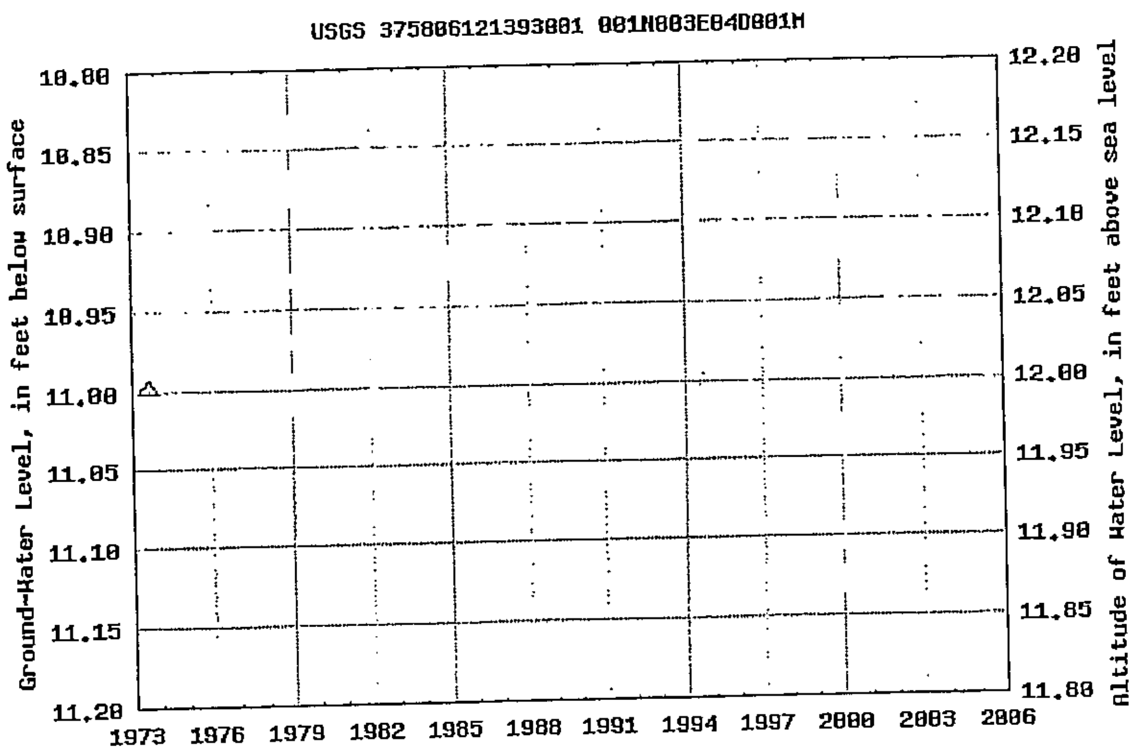
USGS 375806121393001 001N003E04D001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°58'06", Longitude 121°39'30" NAD27
Gage datum 23.00 feet above sea level NGVD29
The depth of the well is 75.0 feet below land surface.
The depth of the hole is 90.0 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

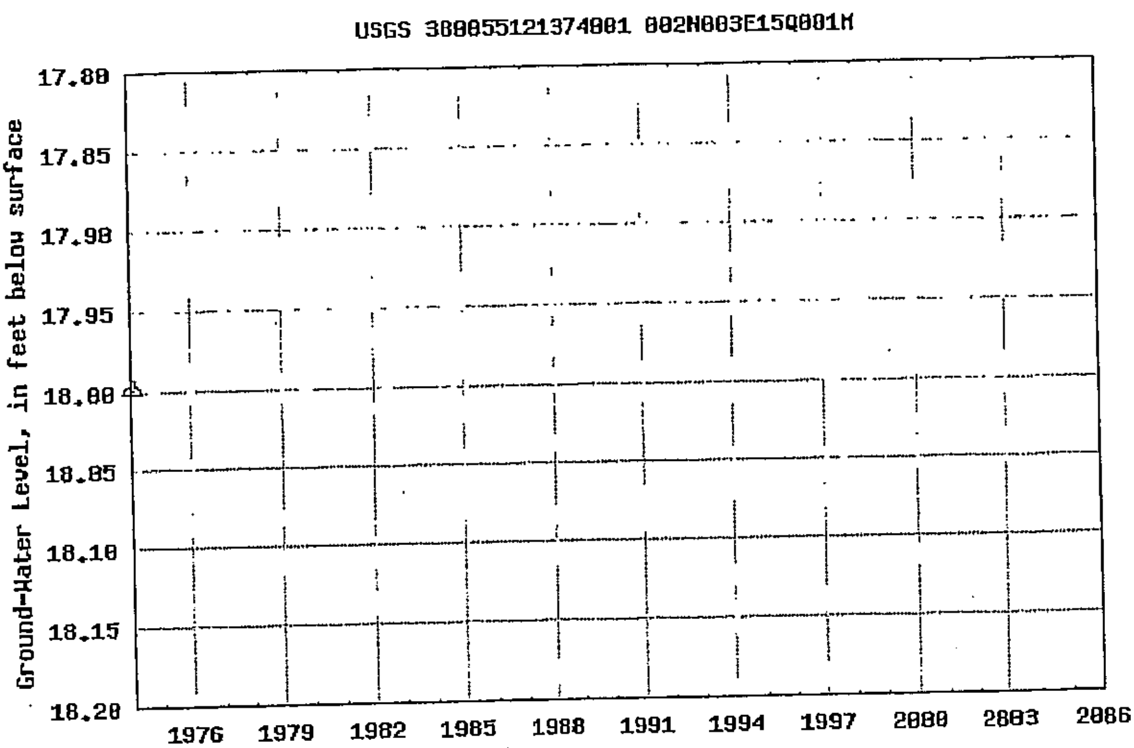
site_no list =	• 380055121374001

Save file of selected sites to local disk for future upload

USGS 380055121374001 002N003E15Q001M

Available data for this site Ground-water: Levels GO

	Output formats
Contra Costa County, California Hydrologic Unit Code 18040003 Latitude 38°00'55", Longitude 121°37'40" NAD27 The depth of the well is 165 feet below land surface. The depth of the hole is 236 feet below land surface. This well is completed in FLOOD-BASIN DEPOSITS (111FLDB)	Table of data Tab-separated data Graph of data Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Water Resources

Data Category: Ground Water
Geographic Area: United States
go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

site_no list =	• 375809121383401

Save file of selected sites to local disk for future upload

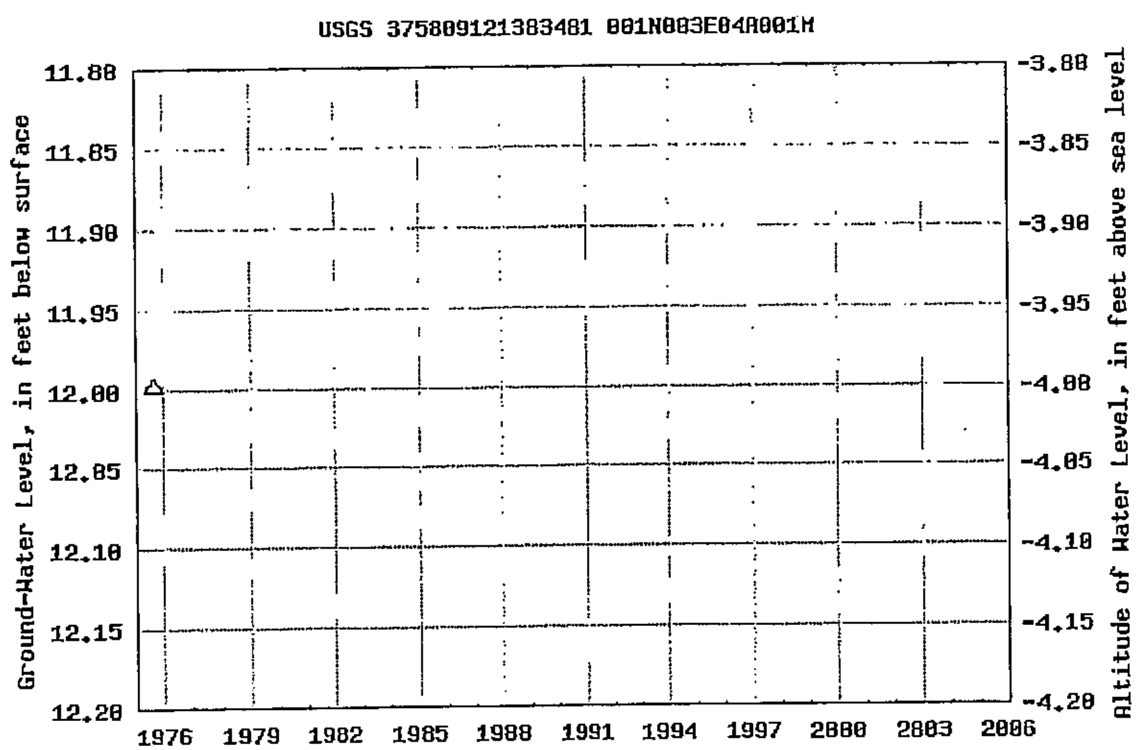
USGS 375809121383401 001N003E04A001M

Available data for this site Ground-water: Levels GO

Contra Costa County, California
Hydrologic Unit Code 18040003
Latitude 37°58'09", Longitude 121°38'34" NAD27
Gage datum 8.00 feet above sea level NGVD29
The depth of the well is 65.0 feet below land surface.
The depth of the hole is 80.0 feet below land surface.

Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period



Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd      - Agency Code
#  site_no        - USGS site number
#  sample_dt      - Date of sample
#  sample_tm      - Time of sample
#  parameter_cd   - Parameter Code
#  result_va      - Value
#  remark_cd      - Remark Code
#  qw_method_cd   - Quality Assurance Method Code
#  anl_stat_cd    - Analysis Stat Code
#  anl_src_cd     - Analysis Source Code
#  hyd_cond_cd    - Hydrologic Cond Code
#  samp_type_cd   - Sample Type Code
#  hyd_event_cd   - Hydrologic Event Code
#  medium_cd      - Sample medium code
#
# Data for the following sites are included:
#  USGS 380055121374001 002N003E15Q001M
#
# The following parameters are included:
#  00010  - Temperature, water, degrees Celsius
#  00095  - Specific conductance, water, unfiltered, microsiemens per centimeter at
#  00400  - pH, water, unfiltered, field, standard units
#  00410  - Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) t
#  00618  - Nitrate, water, filtered, milligrams per liter as nitrogen
#  00900  - Hardness, water, milligrams per liter as calcium carbonate
#  00915  - Calcium, water, filtered, milligrams per liter
#  00925  - Magnesium, water, filtered, milligrams per liter
#  00930  - Sodium, water, filtered, milligrams per liter
#  00931  - Sodium adsorption ratio, water, number
#  00932  - Sodium, water, percent in equivalents of major cations
#  00935  - Potassium, water, filtered, milligrams per liter
#  00940  - Chloride, water, filtered, milligrams per liter
#  00945  - Sulfate, water, filtered, milligrams per liter
#  00950  - Fluoride, water, filtered, milligrams per liter
#  00955  - Silica, water, filtered, milligrams per liter
#  01020  - Boron, water, filtered, micrograms per liter
#  70300  - Residue on evaporation, dried at 180 degrees Celsius, water, filtered, m
#  71851  - Nitrate, water, filtered, milligrams per liter
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
# N  - Presumptive evidence of presence of material
# S  - Most probable value
# U  - Material specifically analyzed for but not detected
# V  - Value affected by contamination
#
#
agency_cd      site_no sample_dt      sample_tm      parameter_cd    result_va
```

5s	15s	10d	4d	5s	12n	1s	1s	1s	1s	1s
USGS	380055121374001	1979-06-05				00010	25.0			7
USGS	380055121374001	1979-06-05				00095	1330			7
USGS	380055121374001	1979-06-05				00400	8.1			7
USGS	380055121374001	1979-06-05				00410	270			7
USGS	380055121374001	1979-06-05				00618	.02			7
USGS	380055121374001	1979-06-05				00900	300			7
USGS	380055121374001	1979-06-05				00915	63.0			7
USGS	380055121374001	1979-06-05				00925	35.0			7
USGS	380055121374001	1979-06-05				00930	140			7
USGS	380055121374001	1979-06-05				00931	4			7
USGS	380055121374001	1979-06-05				00932	50			7
USGS	380055121374001	1979-06-05				00935	3.80			7
USGS	380055121374001	1979-06-05				00940	200			7
USGS	380055121374001	1979-06-05				00945	73.0			7
USGS	380055121374001	1979-06-05				00950	.10	<		7
USGS	380055121374001	1979-06-05				00955	34.0			7
USGS	380055121374001	1979-06-05				01020	500			7
USGS	380055121374001	1979-06-05				70300	768			7
USGS	380055121374001	1979-06-05				71851	.100			7

Water Resources

Data Category: Ground Water

Geographic Area: United States

go

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

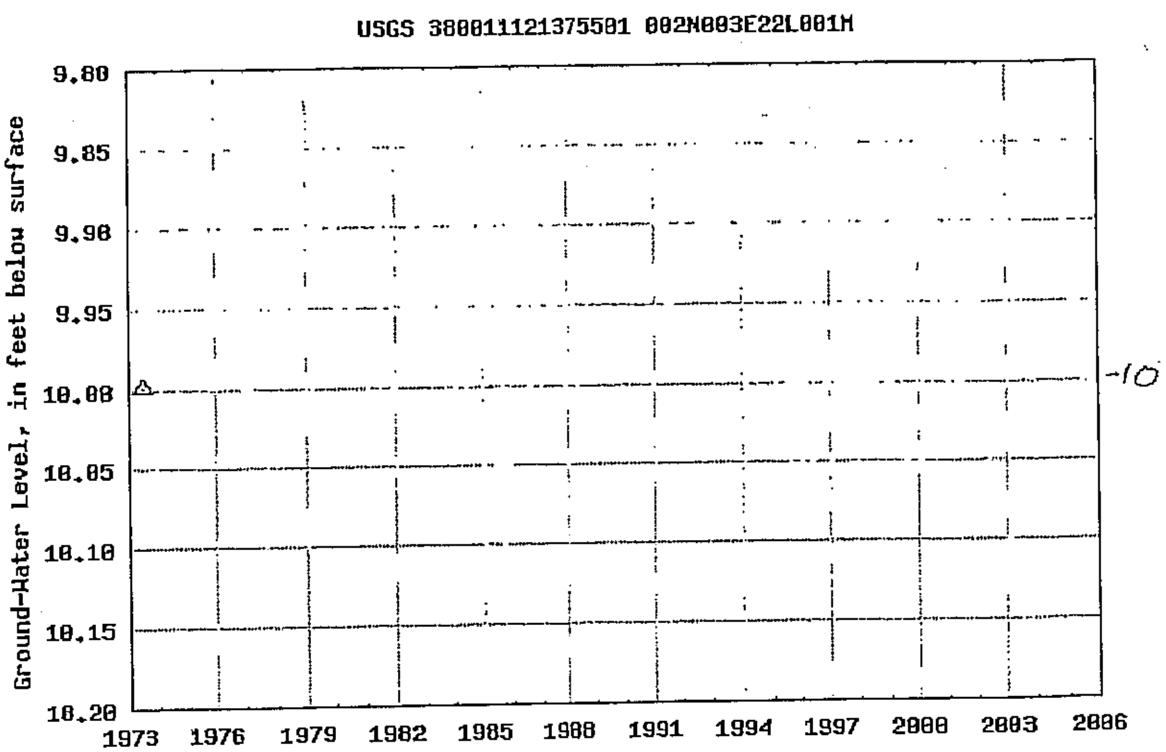
site_no list =	• 380011121375501

Save file of selected sites to local disk for future upload

USGS 380011121375501 002N003E22L001M D-13

Available data for this site: Ground-water: Levels GO

	Output formats
San Joaquin County, California Hydrologic Unit Code 18040003 Latitude 38°00'11", Longitude 121°37'55" NAD27 The depth of the well is 170 feet below land surface. The depth of the hole is 180 feet below land surface.	Table of data Tab-separated data Graph of data Reselect period

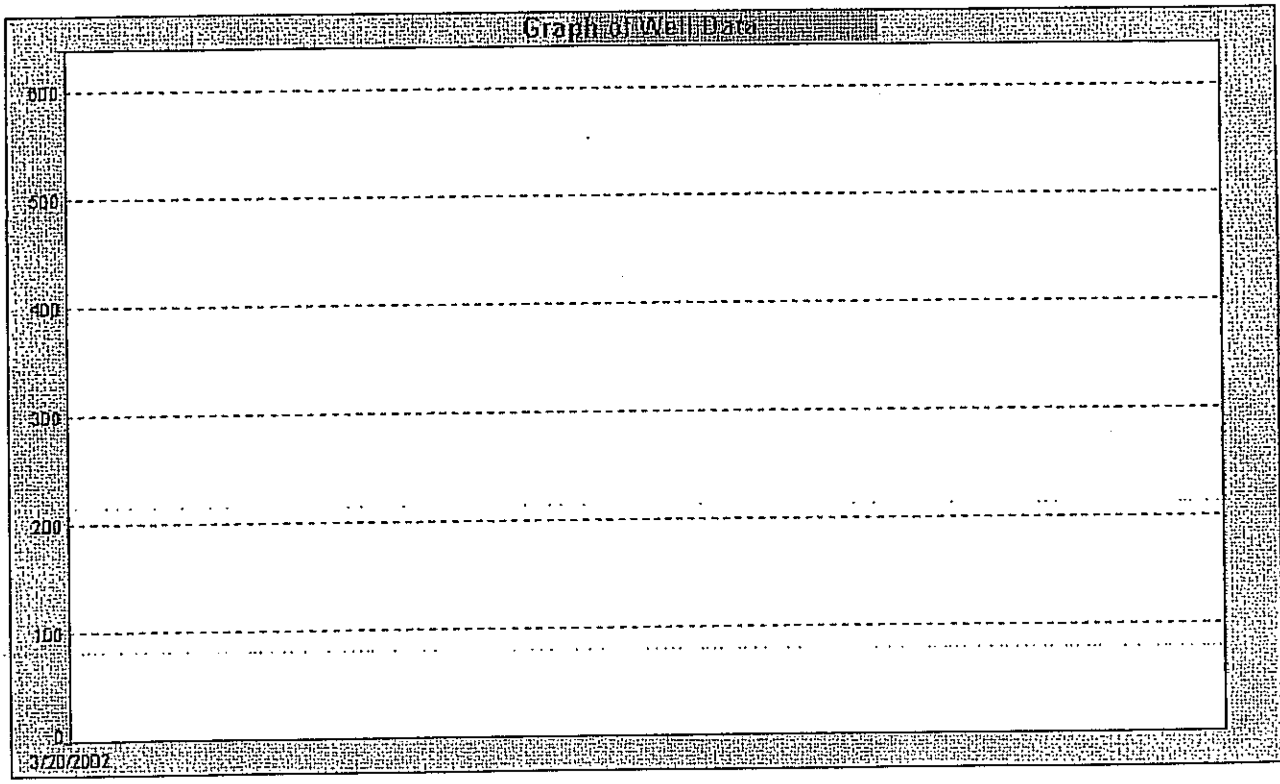


Breaks in the plot represent a gap of at least one calendar year between two consecutive points.

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500

From Date:	To Date:	Graph Size	Normalized	
		Small		Redraw

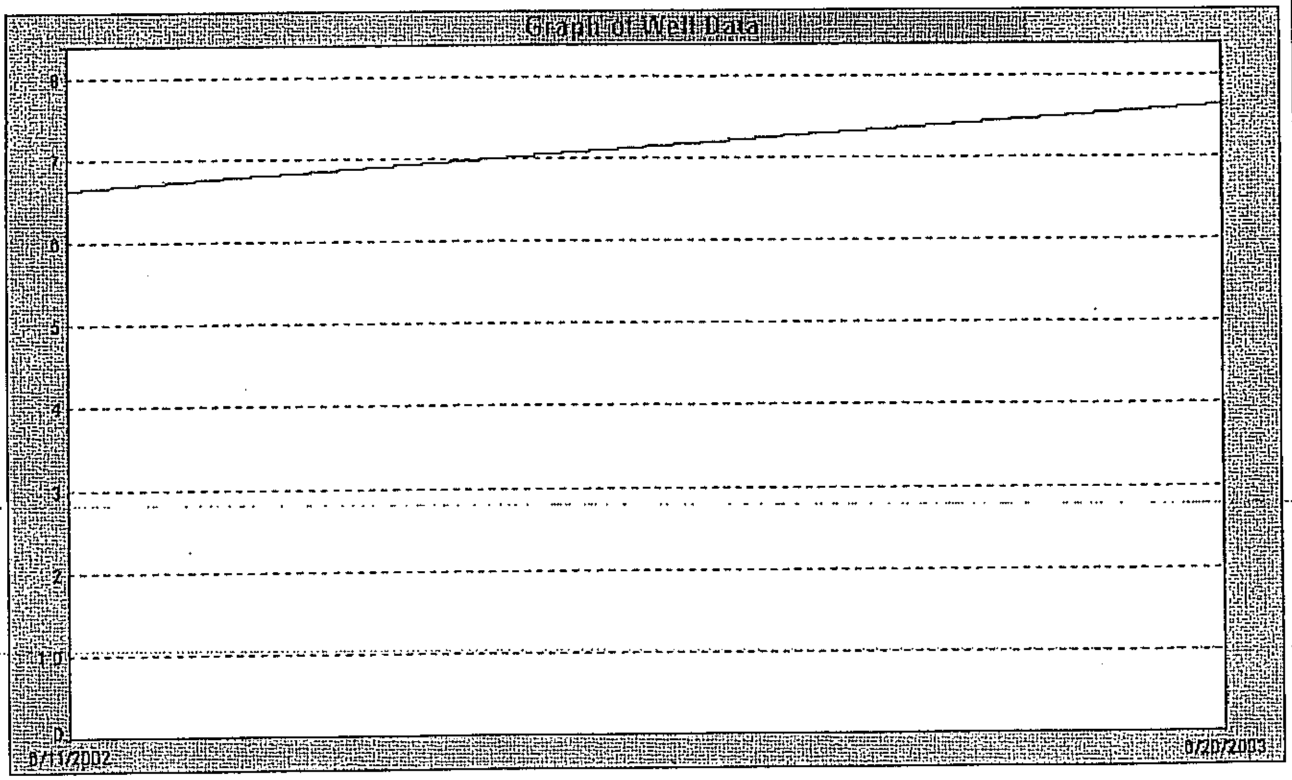
Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

4-24

DELTA KIDS CENTER (OAKLEY)
WELL HEAD
State Well Number: 0706048-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



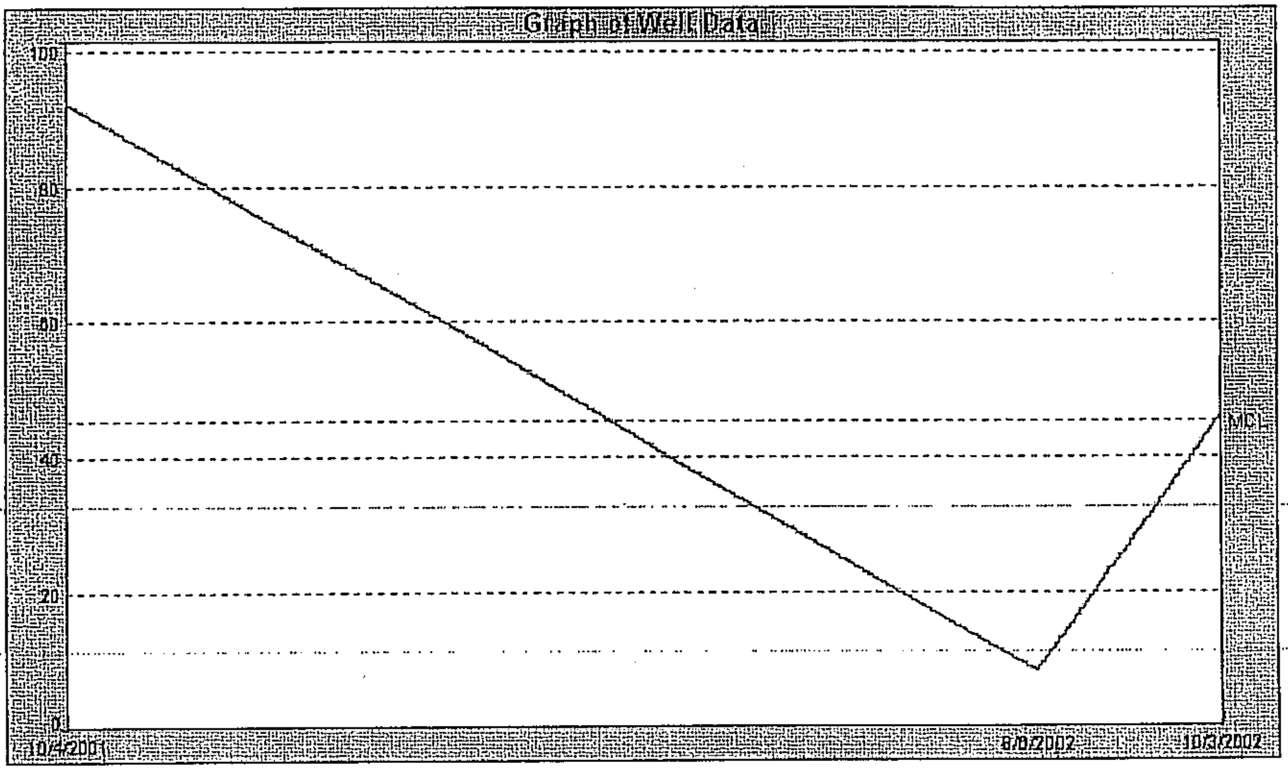
Date	Parameter	Qualifier	Result	Units	MCL
6/20/2003	NITRATE (AS NO3)		7.6	mg/L	45
6/11/2002	NITRATE (AS NO3)		6.6	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

Well Data Graph

BETHEL MISSIONARY BAPTIST (OAKLEY)
WELL HEAD
State Well Number: 0706032-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
10/3/2002	NITRATE (AS NO3)		46	mg/L	45
8/6/2002	NITRATE (AS NO3)		8	mg/L	45
10/4/2001	NITRATE (AS NO3)		92	mg/L	45

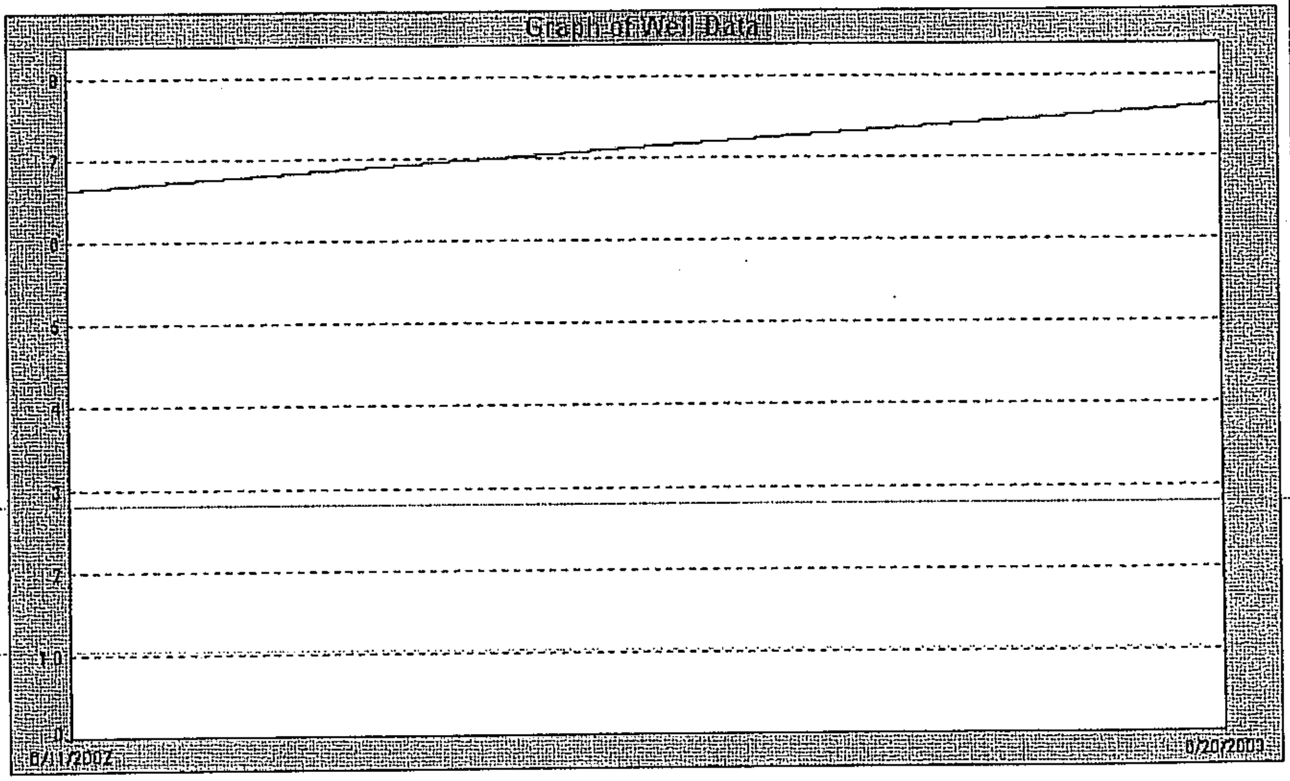
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DELTA KIDS CENTER (OAKLEY)
WELL HEAD
State Well Number: 0706048-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/20/2003	NITRATE (AS NO3)		7.6	mg/L	45
6/11/2002	NITRATE (AS NO3)		6.6	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

BETHEL MISSIONARY BAPTIST (OAKLEY)
WELL HEAD
State Well Number: 0706032-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

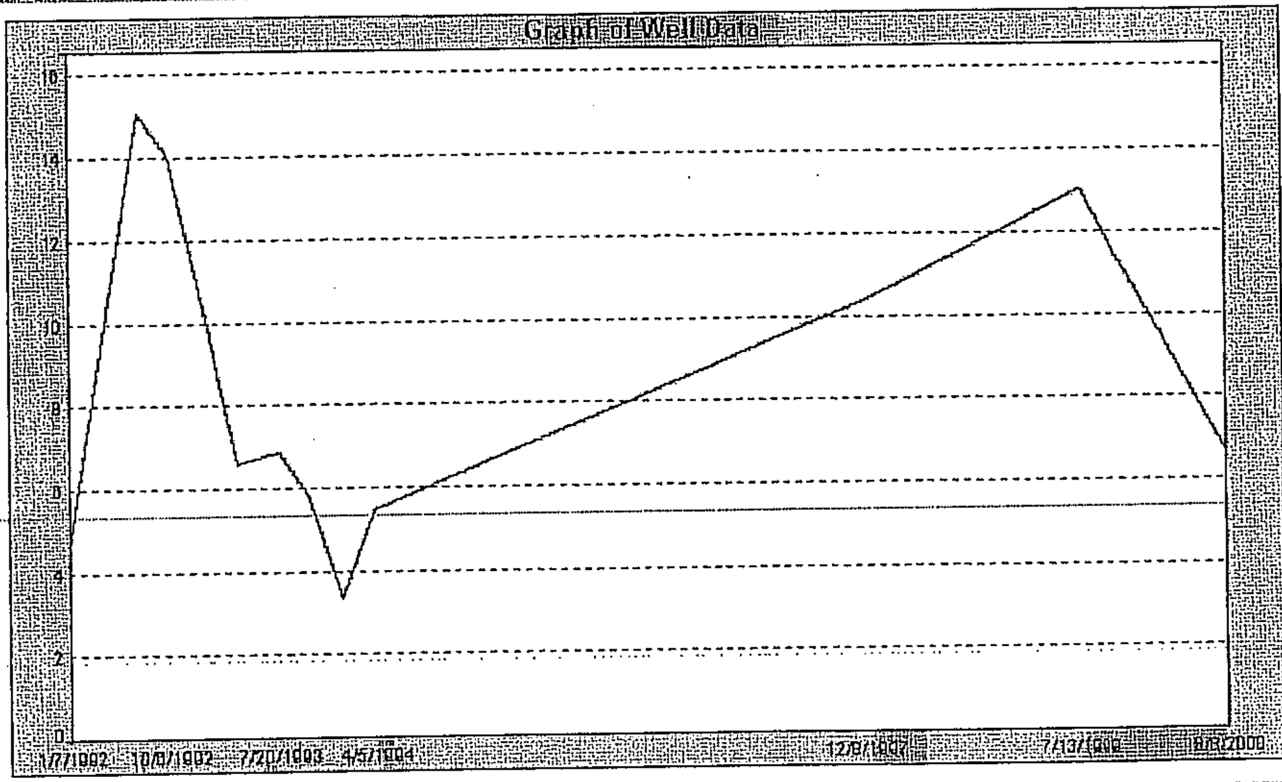
Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/3/2002	NITRATE (AS NO3)		46	mg/L	45	

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY) Near Oakley Builder's Supply
WELL 01 - STANDBY
State Well Number: 0710007-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	NITRATE (AS NO3)		6.6	mg/L	45
7/13/1999	NITRATE (AS NO3)		13	mg/L	45
12/8/1997	NITRATE (AS NO3)		10.3	mg/L	45
4/5/1994	NITRATE (AS NO3)		5.4	mg/L	45
1/4/1994	NITRATE (AS NO3)		3.3	mg/L	45
10/5/1993	NITRATE (AS NO3)		5.8	mg/L	45
7/20/1993	NITRATE (AS NO3)		6.8	mg/L	45
4/5/1993	NITRATE (AS NO3)		6.5	mg/L	45
10/6/1992	NITRATE (AS NO3)		14	mg/L	45
7/13/1992	NITRATE (AS NO3)		15	mg/L	45
1/7/1992	NITRATE (AS NO3)		4.5	mg/L	45

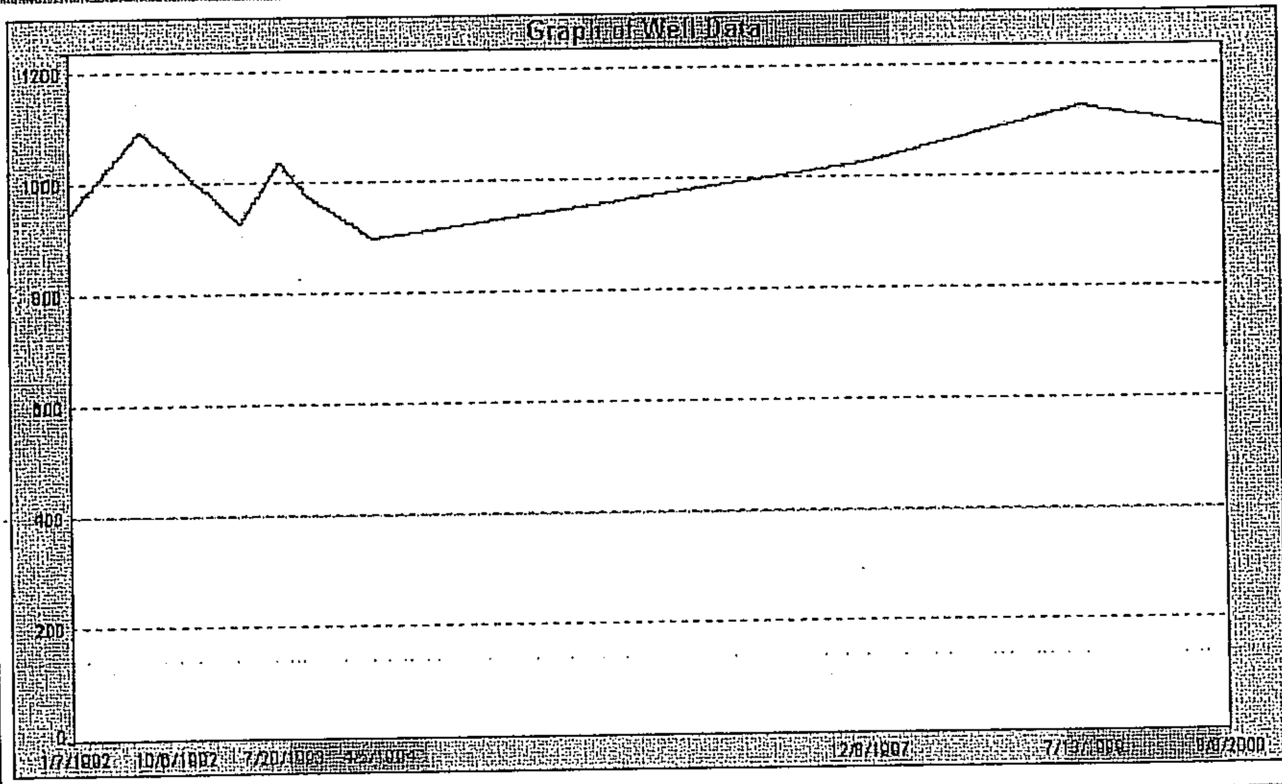
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
WELL 01 - STANDBY
State Well Number: 0710007-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	TOTAL DISSOLVED SOLIDS		1080	mg/L	1500
7/13/1999	TOTAL DISSOLVED SOLIDS		1120	mg/L	1500
12/8/1997	TOTAL DISSOLVED SOLIDS		1020	mg/L	1500
4/5/1994	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
1/4/1994	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
10/5/1993	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
7/20/1993	TOTAL DISSOLVED SOLIDS		1030	mg/L	1500
4/5/1993	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
10/6/1992	TOTAL DISSOLVED SOLIDS		1040	mg/L	1500
7/13/1992	TOTAL DISSOLVED SOLIDS		1090	mg/L	1500
1/7/1992	TOTAL DISSOLVED SOLIDS		940	mg/L	1500

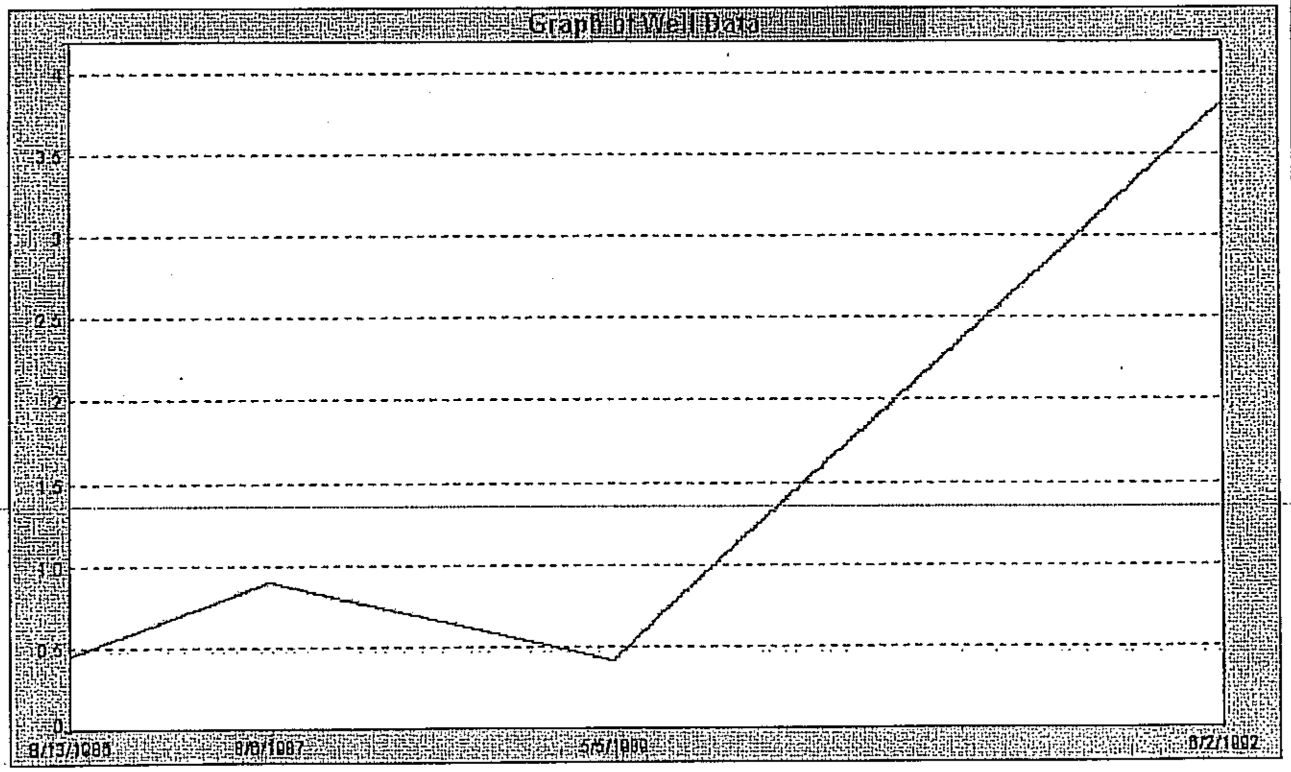
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	NITRATE (AS NO3)		3.8	mg/L	45
5/5/1989	NITRATE (AS NO3)	<	0.4	mg/L	45
8/6/1987	NITRATE (AS NO3)		0.89	mg/L	45
8/13/1986	NITRATE (AS NO3)	<	0.44	mg/L	45

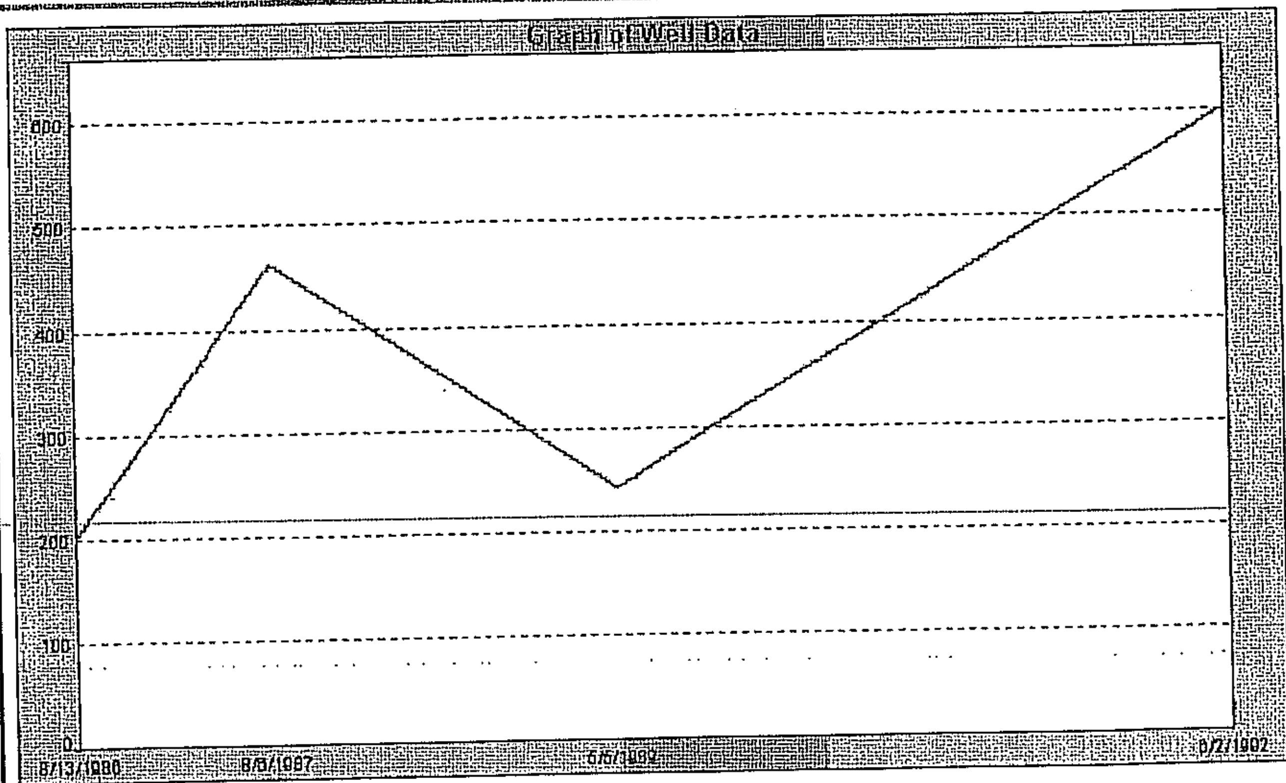
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	TOTAL DISSOLVED SOLIDS		600	mg/L	1500
5/5/1989	TOTAL DISSOLVED SOLIDS		240	mg/L	1500
8/6/1987	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
8/13/1986	TOTAL DISSOLVED SOLIDS		199	mg/L	1500

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

GREG'S MOTEL & HARBOR (OAKLEY)
WELL HEAD
State Well Number: 0707526-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals   Reset Boxes   **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

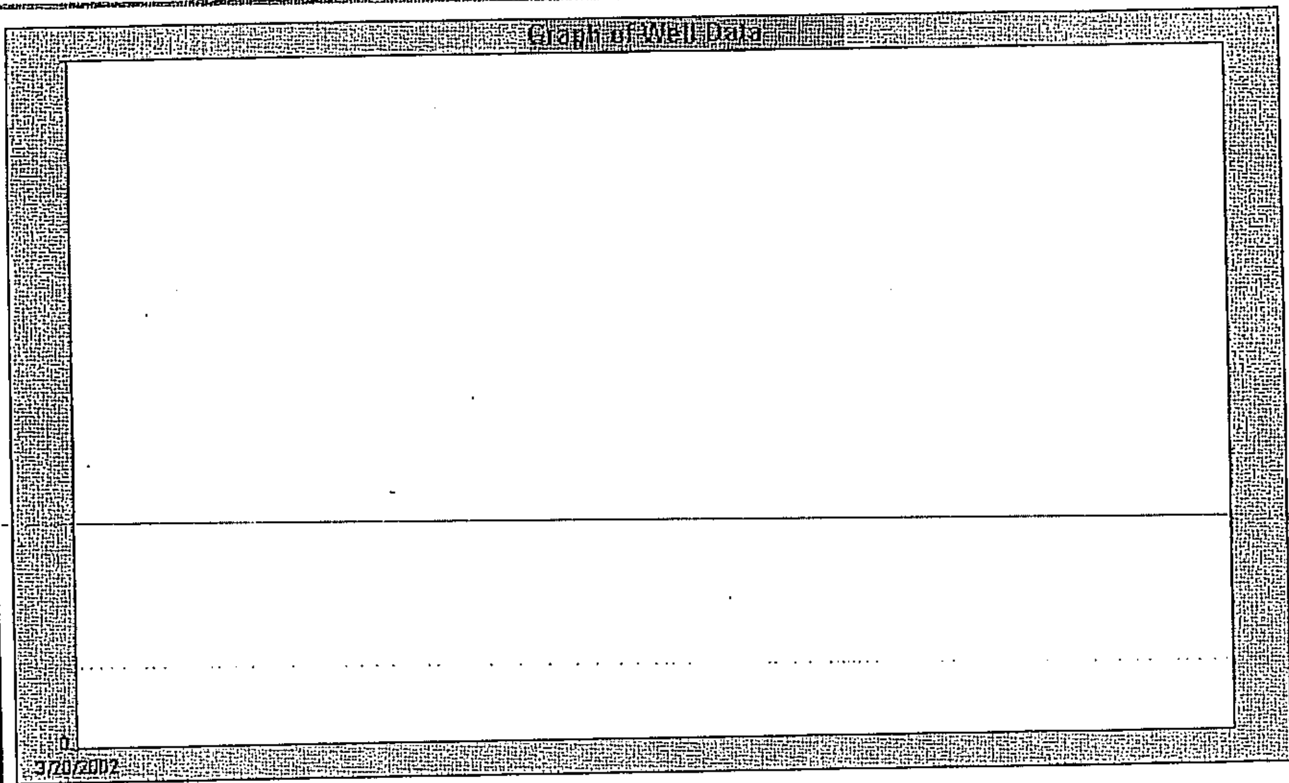
Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/15/2002	NITRATE (AS NO3)		0	mg/L	45	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
EAST WELL
State Well Number: 0706004-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	NITRITE (AS N)		0	ug/L	1000

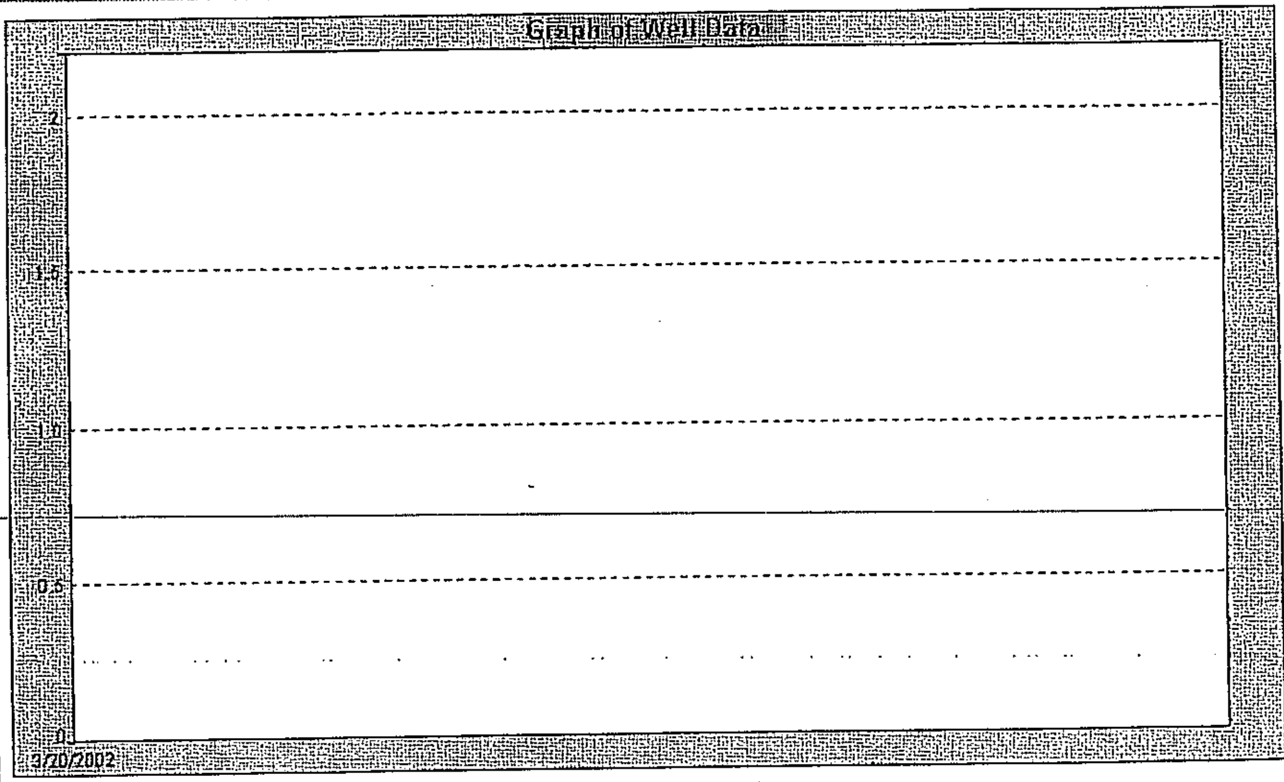
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
3/20/2002	ALKALINITY (TOTAL) AS CACO3		290	mg/L	NA	
3/20/2002	ALUMINUM		0	ug/L	1000	
3/20/2002	ARSENIC		0	ug/L	50	
3/20/2002	BARIUM		0	ug/L	1000	
3/20/2002	CADMIUM		0	ug/L	5	
3/20/2002	CALCIUM		60	mg/L	NA	
3/20/2002	CHLORIDE		85	mg/L	600	
3/20/2002	CHROMIUM (TOTAL)		0	ug/L	50	
3/20/2002	COLOR		7	UNITS	15	
3/20/2002	COPPER		0	ug/L	1000	
3/20/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	
3/20/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	
3/20/2002	HARDNESS (TOTAL) AS CACO3		260	mg/L	NA	
3/20/2002	IRON		140	ug/L	300	
3/20/2002	LEAD		0	ug/L	NA	
3/20/2002	MAGNESIUM		28	mg/L	NA	
3/20/2002	MANGANESE		170	ug/L	50	
3/20/2002	MERCURY		0	ug/L	2	
6/19/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45	
3/20/2002	NITRITE (AS N)		0	ug/L	1000	
3/20/2002	ODOR THRESHOLD @ 60 C		2	TON	3	
3/20/2002	PH, LABORATORY		7.9		NA	
3/20/2002	POTASSIUM		2	mg/L	NA	
3/20/2002	SELENIUM		0	ug/L	50	
3/20/2002	SILVER		0	ug/L	100	
3/20/2002	SODIUM		110	mg/L	NA	
3/20/2002	SOURCE TEMPERATURE C		19.5	C	NA	

3/20/2002	SPECIFIC CONDUCTANCE		960	US	2200	☐
3/20/2002	SULFATE		100	mg/L	600	☐
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500	☑
3/20/2002	TURBIDITY, LABORATORY		0.46	NTU	5	☐
3/20/2002	ZINC	<	50	ug/L	5000	☐

Public Water System Information

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
LINDQUIST LANDING MARINA SWS

Water System Address:
LINDQUIST LANDING MARINA SWS
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
23

Population Served:
20

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
4/29/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	
4/29/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	
4/29/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	
4/29/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	
4/29/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	
4/29/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	
~~4/29/1986~~	~~1,2-DICHLOROETHANE~~	~~<~~	~~0.5~~	~~ug/L~~	~~0.5~~	
4/29/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	
4/29/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	
4/29/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	
4/29/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	
5/7/1986	BENOMYL	<	100	ug/L	NA	
4/29/1986	BENZENE	<	0.5	ug/L	1	
4/29/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	
4/29/1986	BROMOFORM (THM)	<	0.5	ug/L	100	
4/29/1986	BROMOMETHANE	<	0.5	ug/L	NA	
4/29/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	
4/29/1986	CHLOROETHANE	<	0.5	ug/L	NA	
4/29/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	
4/29/1986	CHLOROMETHANE	<	0.5	ug/L	NA	
4/29/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	
4/29/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	
4/29/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	
4/29/1986	DICHLOROMETHANE	<	0.5	ug/L	5	
4/29/1986	ETHYLBENZENE	<	0.5	ug/L	700	
4/29/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	
4/29/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	
4/29/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	

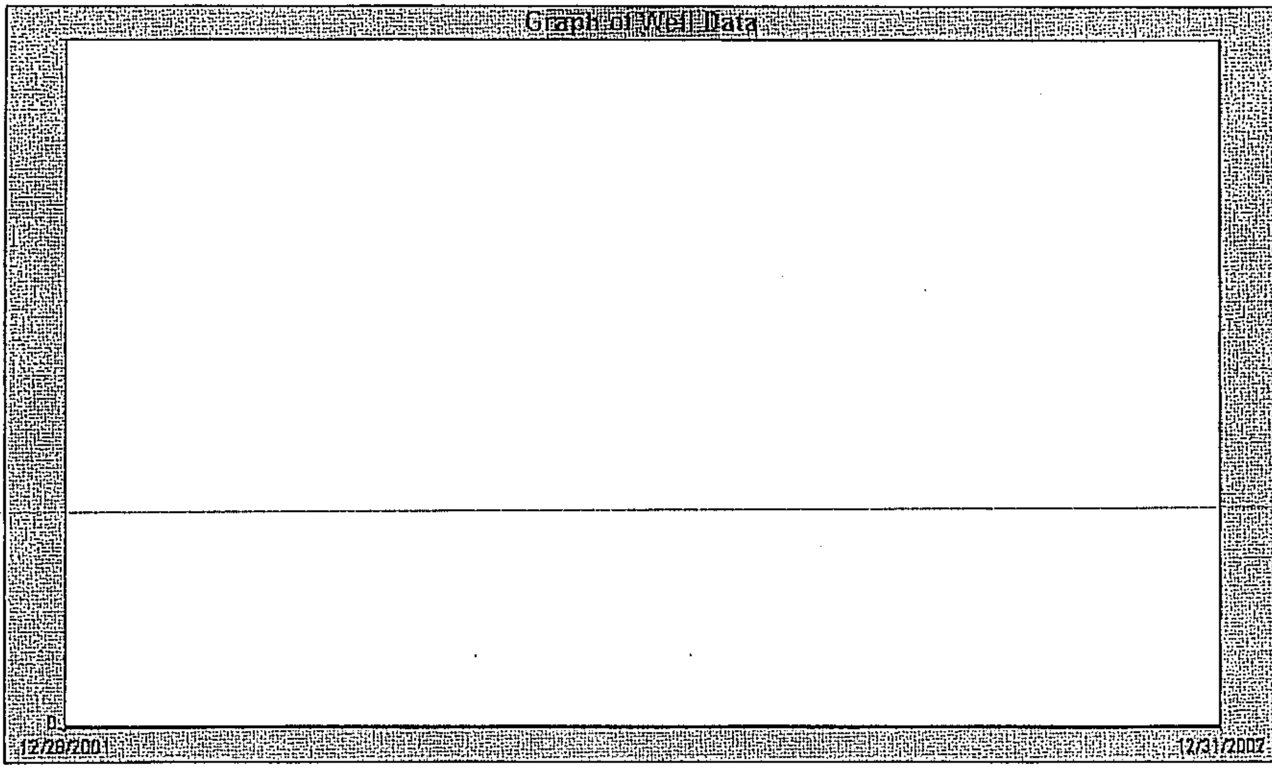
12/31/2002	NITRATE (AS NO3)		0	mg/L	45	
4/29/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	5	
4/29/1986	TOLUENE	<	0.5	ug/L	150	
4/29/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	10	
4/29/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	
4/29/1986	TRICHLOROETHYLENE	<	0.5	ug/L	5	
4/29/1986	TRICHLOROFLUOROMETHANE	<	0.5	ug/L	150	
4/29/1986	VINYL CHLORIDE	<	1	ug/L	0.5	
4/29/1986	XYLENES (TOTAL)	<	0.5	ug/L	1750	

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

LINDQUIST LANDING MARINA SWS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707534-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

RED COACH DELI (KNIGHTSEN)
LPA REPORTED PRIMARY SOURCE
State Well Number: 0706043-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
RED COACH DELI

Water System Address:
PO BOX 2
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections: 1

Population Served: 25

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

RED COACH DELI (KNIGHTSEN)
LPA REPORTED PRIMARY SOURCE
State Well Number: 0706043-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot

No water quality data for this well has been reported to Department of Health Services.

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Wells Owned By W0600707556

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND MUTUAL
BETHEL ISLAND , CA 94511

State Well No.	Well Common Name		
0707556-001	SANDMOUND RD WELL	Show on Map	Report
0707556-002	STONE ROAD WELL	Show on Map	Report
PWS MAIN FAC	0707556	Show on Map	Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND RD WELL
State Well Number: 0707556-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
SANDMOUND MUTUAL

Water System Address:
SANDMOUND MUTUAL
BETHEL ISLAND, CA 94511

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections: ~~30~~

Population Served: ~~175~~

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

SANDMOUND MUTUAL (BETHEL ISLAND)
SANDMOUND RD WELL
State Well Number: 0707556-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
2/26/2003	ALUMINUM		0	ug/L	1000	☐
2/26/2003	ANTIMONY		0	ug/L	6	☐
2/26/2003	ARSENIC		0	ug/L	50	☐
2/26/2003	ASBESTOS		0	MFL	7	☐
2/26/2003	BARIUM		172	ug/L	1000	☐
2/26/2003	BERYLLIUM		0	ug/L	4	☐
2/26/2003	CADMIUM		0	ug/L	5	☐
2/26/2003	CHROMIUM (TOTAL)		0	ug/L	50	☐
2/26/2003	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	☐
2/26/2003	GROSS ALPHA		2.79	PCI/L	15	☐
2/26/2003	GROSS ALPHA COUNTING ERROR		1.54	PCI/L	NA	☐
11/4/1997	GROSS BETA		2.55	PCI/L	50	☐
11/4/1997	GROSS BETA COUNTING ERROR		0.56	PCI/L	NA	☐
2/26/2003	LEAD		0	ug/L	NA	☐
2/26/2003	MERCURY		0	ug/L	2	☐
2/26/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
2/26/2003	NICKEL		0	ug/L	100	☐
2/26/2003	NITRATE (AS NO3)		0	mg/L	45	☐
2/26/2003	NITRITE (AS N)		0	ug/L	1000	☐
2/26/2003	SELENIUM		0	ug/L	50	☐
2/26/2003	THALLIUM		0	ug/L	2	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

SANDMOUND MUTUAL (BETHEL ISLAND)
STONE ROAD WELL
State Well Number: 0707556-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
SANDMOUND MUTUAL

Water System Address:
SANDMOUND MUTUAL
BETHEL ISLAND, CA 94511

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
30

Population Served:
175

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

SANDMOUND MUTUAL (BETHEL ISLAND)
STONE ROAD WELL
State Well Number: 0707556-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

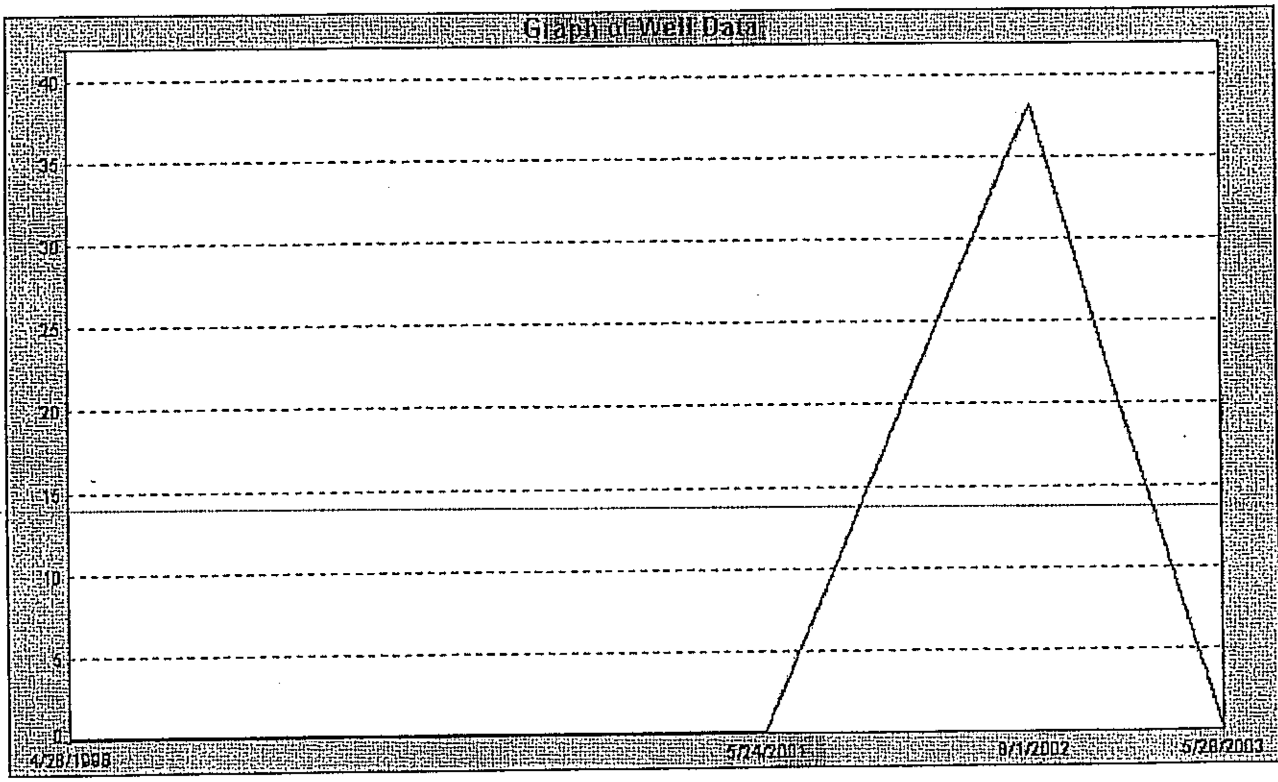
Date	Parameter	Qualifier	Result	Units	MCL	Plot
2/26/2003	ALUMINUM		0	ug/L	1000	☐
2/26/2003	ANTIMONY		0	ug/L	6	☐
2/26/2003	ARSENIC		15	ug/L	50	☐
2/26/2003	ASBESTOS		0	MFL	7	☐
2/26/2003	BARIUM	<	160	ug/L	1000	☐
2/26/2003	BERYLLIUM		0	ug/L	4	☐
2/26/2003	CADMIUM		0	ug/L	5	☐
2/26/2003	CHROMIUM (TOTAL)		0	ug/L	50	☐
2/26/2003	FLUORIDE (TEMPERATURE DEPENDENT)		0	mg/L	1.7	☐
2/26/2003	GROSS ALPHA		1.04	PCI/L	15	☐
2/26/2003	GROSS ALPHA COUNTING ERROR		2.05	PCI/L	NA	☐
2/26/2003	LEAD		0	ug/L	NA	☐
2/26/2003	MERCURY		0	ug/L	2	☐
2/26/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
2/26/2003	NICKEL		0	ug/L	100	☐
2/26/2003	NITRATE (AS NO3)		0	mg/L	45	☐
2/26/2003	NITRITE (AS N)		0	ug/L	1000	☐
2/26/2003	SELENIUM		0	ug/L	50	☐
2/26/2003	THALLIUM		0	ug/L	2	☐

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

ISLAND PARK TRAILER COURT (BETHEL ISLAND)
WELL 01
State Well Number: 0707574-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
5/28/2003	NITRATE (AS NO3)		0	mg/L	45
8/1/2002	NITRATE (AS NO3)		38	mg/L	45
5/24/2001	NITRATE (AS NO3)		0	mg/L	45
4/28/1998	NITRATE (AS NO3)		0	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Wells Owned By W0600710004

CITY OF BRENTWOOD (BRENTWOOD)
161 Sycamore Avenue
BRENTWOOD , CA 94516

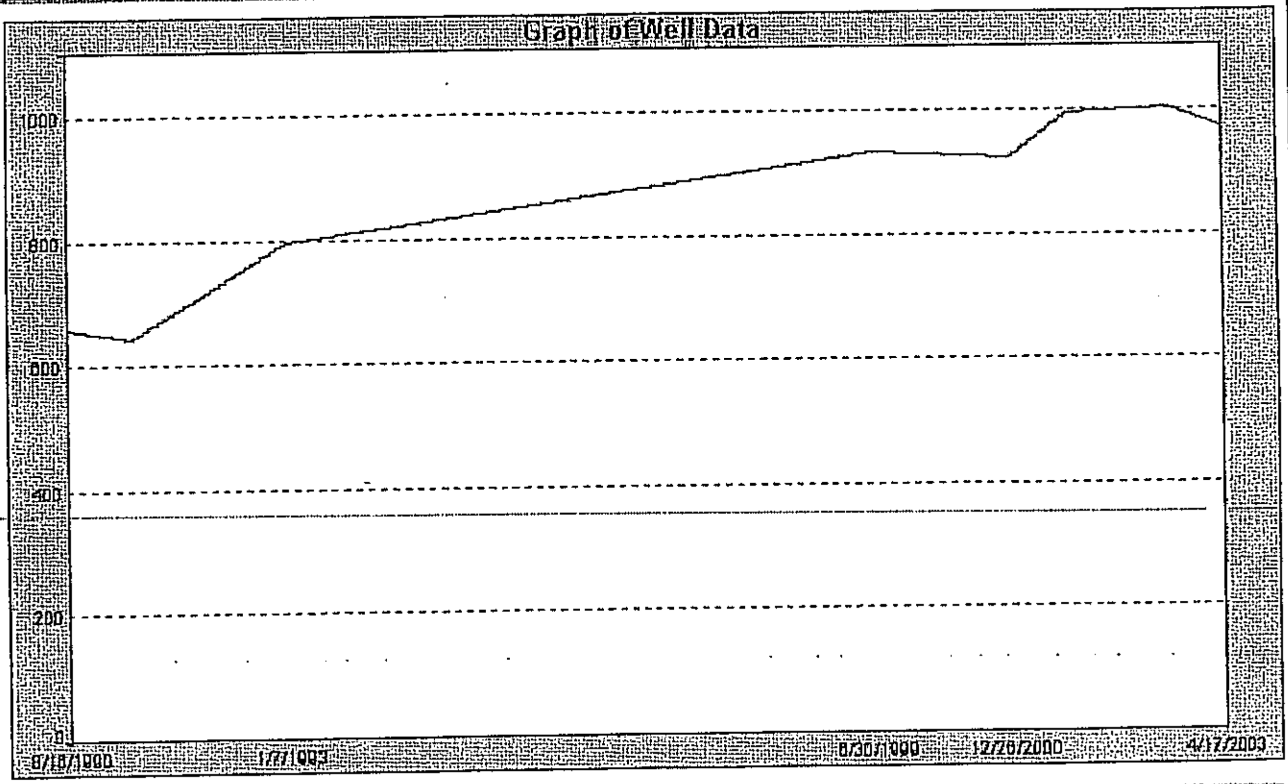
3	TDS	State Well No.	Well Common Name	
7.5	1166	0710004-001	WELL 01 - ABANDONED	Show on Map Report
2.2	934	0710004-002	WELL 02 - ABANDONED	Show on Map Report
NA	NA	0710004-003	WELL 03 - ABANDONED	Show on Map Report
10.5	939	0710004-004	WELL 04 - ABANDONED	Show on Map Report
NA	NA	0710004-005	WELL 05 - ABANDONED	Show on Map Report
17.8	970	0710004-006	WELL 06 8.9-17.8	Show on Map Report
8.2	760	0710004-007	WELL 07	Show on Map Report
4.5	890	0710004-008	WELL 08	Show on Map Report
25.	1230	0710004-009	WELL 10A - IRRIGATION - AGRICULTURAL	Show on Map Report
41.	960	0710004-010	WELL 11	Show on Map Report
7.5	530	0710004-011	WELL 12	Show on Map Report
6.4	490	0710004-012	WELL 13	Show on Map Report
NA	NA	0710004-013	DIABLO WD PS/RANDALL BOLD WTP	Show on Map Report
11.1	930	0710004-014	WELL 14	Show on Map Report
		0710004-015	WELL 10A - IRRIGATION - TREATED-INACTIVE	Show on Map Report
		0710004-016	WELL 11 - TREATED	Show on Map Report
		0710004-017	WELL 12 - TREATED	Show on Map Report
		0710004-018	WELL 14 - TREATED	Show on Map Report
		0710004-019	WELL 06 - TREATED	Show on Map Report
		0710004-020	WELL 07 - TREATED	Show on Map Report
		0710004-021	WELL 08 - TREATED	Show on Map Report
		0710004-022	WELL 13 - TREATED	Show on Map Report
		0710004-023	DIABLO WD/RANDALL-BOLD - TREATED	Show on Map Report
		0710004-024		Show on Map Report
		0710004-025		Show on Map Report
		PWS MAIN FAC 0710004		Show on Map Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 06
State Well Number: 0710004-006

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		1000	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		990	mg/L	1500
12/26/2000	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
1/7/1993	TOTAL DISSOLVED SOLIDS		793	mg/L	1500
4/30/1991	TOTAL DISSOLVED SOLIDS		640	mg/L	1500
8/16/1990	TOTAL DISSOLVED SOLIDS		657	mg/L	1500

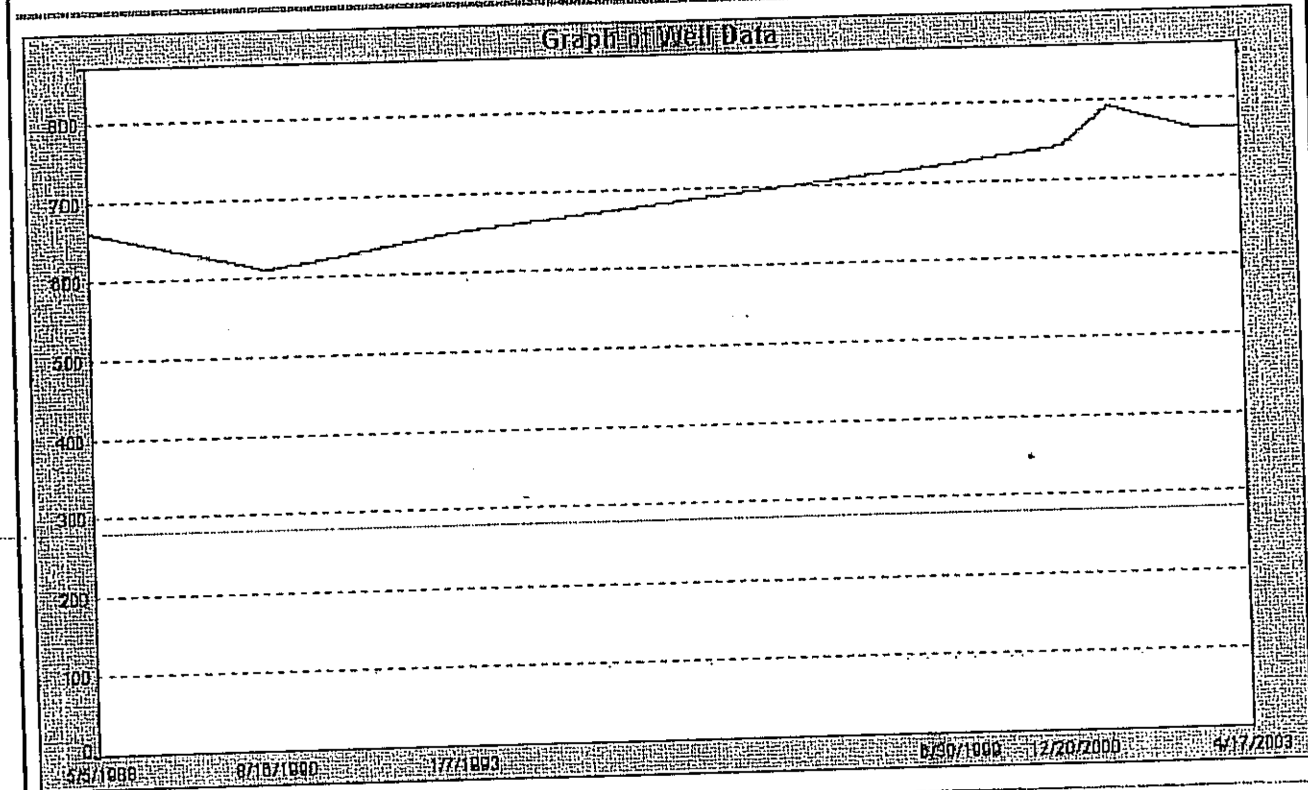
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 07
State Well Number: 0710004-007

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		760	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		760	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		790	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		740	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		720	mg/L	1500
1/7/1993	TOTAL DISSOLVED SOLIDS		650	mg/L	1500
4/30/1991	TOTAL DISSOLVED SOLIDS		620	mg/L	1500
8/16/1990	TOTAL DISSOLVED SOLIDS		608	mg/L	1500
5/5/1988	TOTAL DISSOLVED SOLIDS		660	mg/L	1500

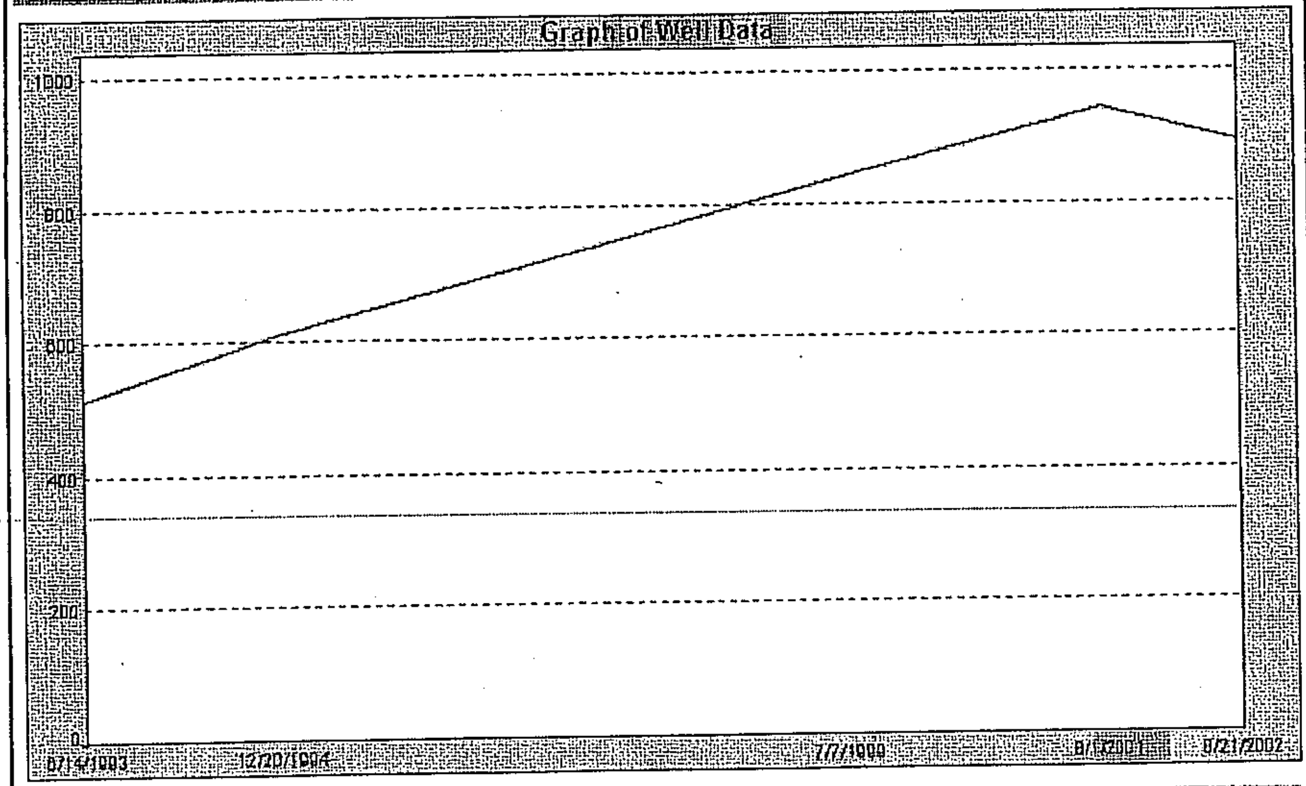
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 08
State Well Number: 0710004-008

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/21/2002	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		940	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		840	mg/L	1500
12/20/1994	TOTAL DISSOLVED SOLIDS	<	606	mg/L	1500
6/14/1993	TOTAL DISSOLVED SOLIDS		510	mg/L	1500

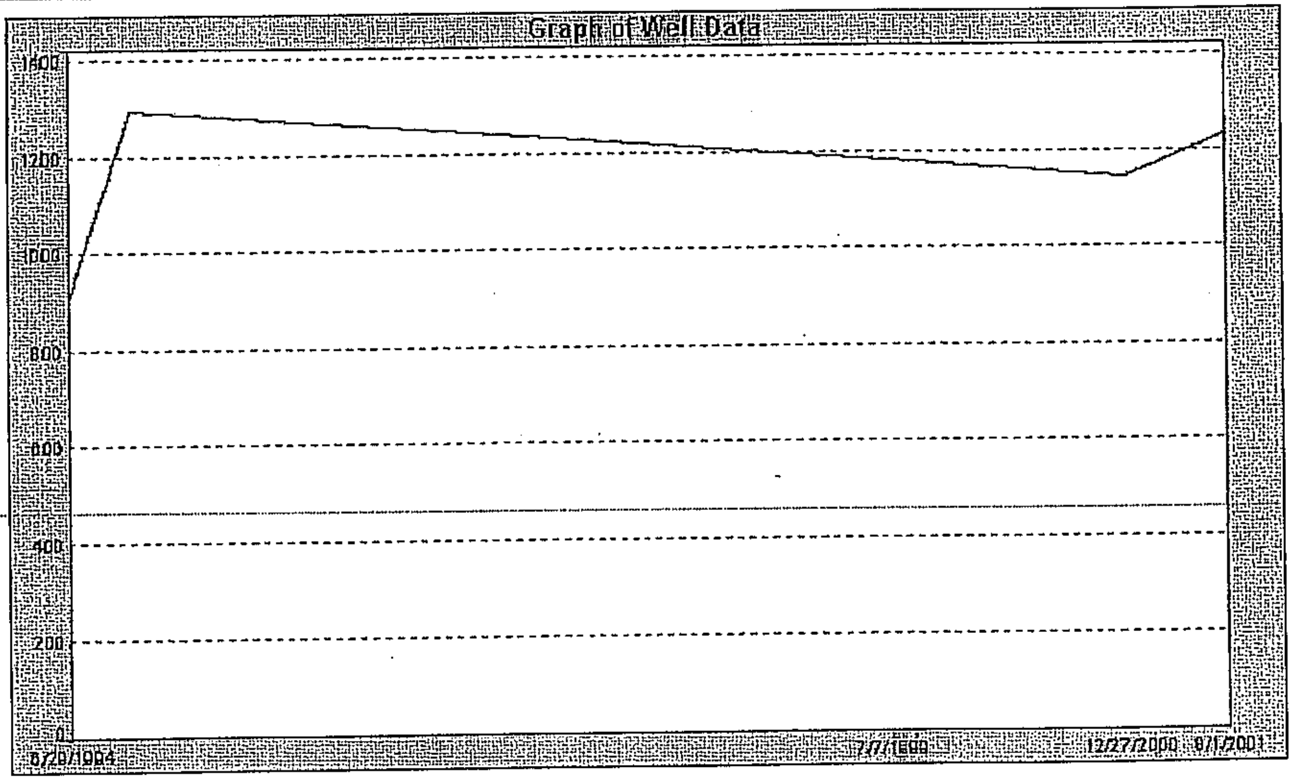
From Date: **To Date:** **Graph Size** Small **Normalized** ☐ Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 10A - IRRIGATION - AGRICULTURAL
State Well Number: 0710004-009

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/1/2001	TOTAL DISSOLVED SOLIDS		1230	mg/L	1500
12/27/2000	TOTAL DISSOLVED SOLIDS		1140	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		1180	mg/L	1500
11/10/1994	TOTAL DISSOLVED SOLIDS		1289	mg/L	1500
6/29/1994	TOTAL DISSOLVED SOLIDS		900	mg/L	1500

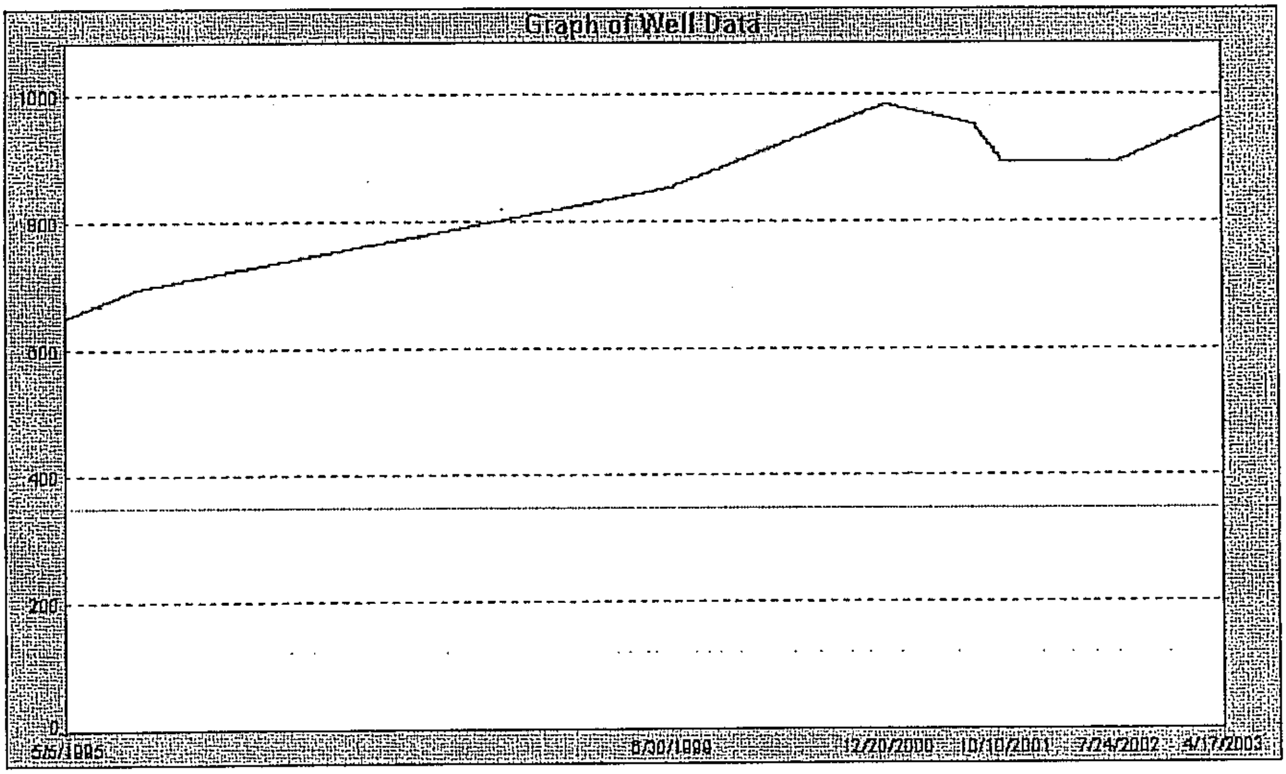
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 11
State Well Number: 0710004-010

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		960	mg/L	1500
7/24/2002	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
10/10/2001	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
8/1/2001	TOTAL DISSOLVED SOLIDS		950	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		980	mg/L	1500
6/30/1999	TOTAL DISSOLVED SOLIDS		850	mg/L	1500
10/26/1995	TOTAL DISSOLVED SOLIDS		688	mg/L	1500
5/5/1995	TOTAL DISSOLVED SOLIDS		645	mg/L	1500

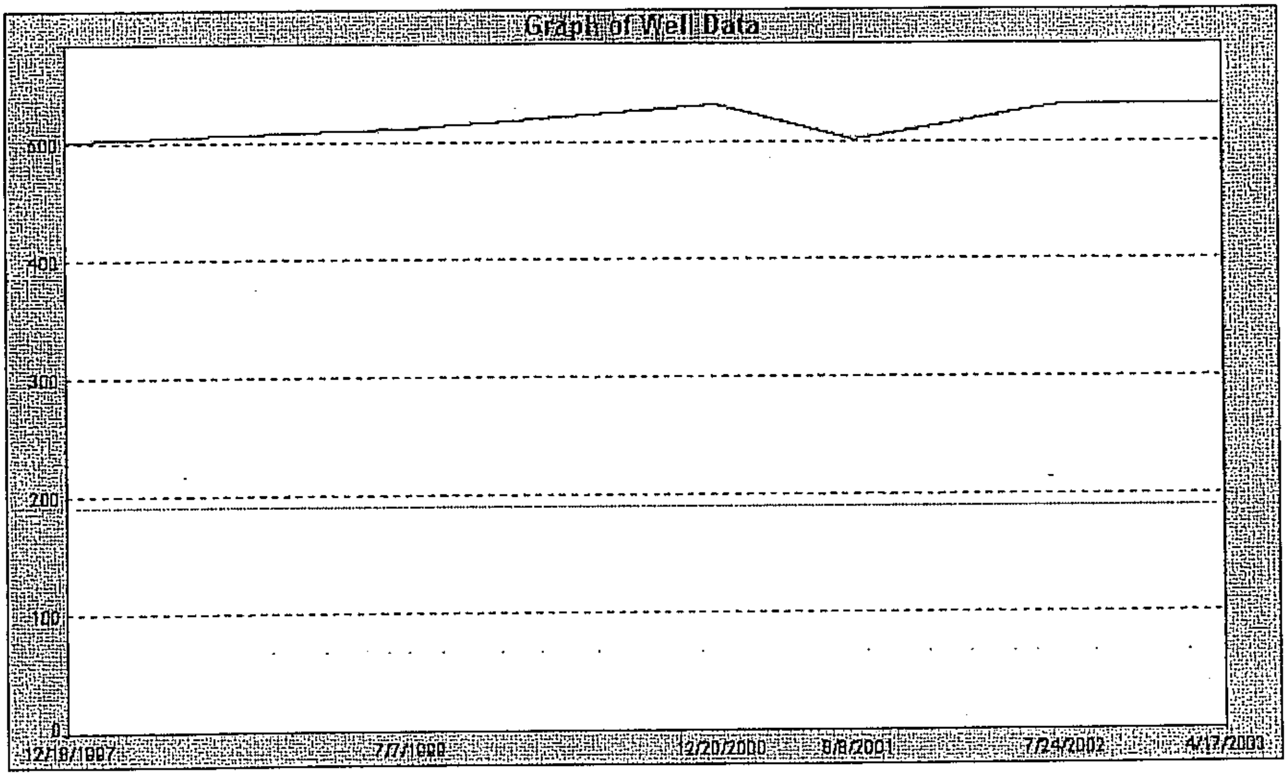
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 12
State Well Number: 0710004-011

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
7/24/2002	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
8/8/2001	TOTAL DISSOLVED SOLIDS		500	mg/L	1500
12/20/2000	TOTAL DISSOLVED SOLIDS		530	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		510	mg/L	1500
12/18/1997	TOTAL DISSOLVED SOLIDS		500	mg/L	1500

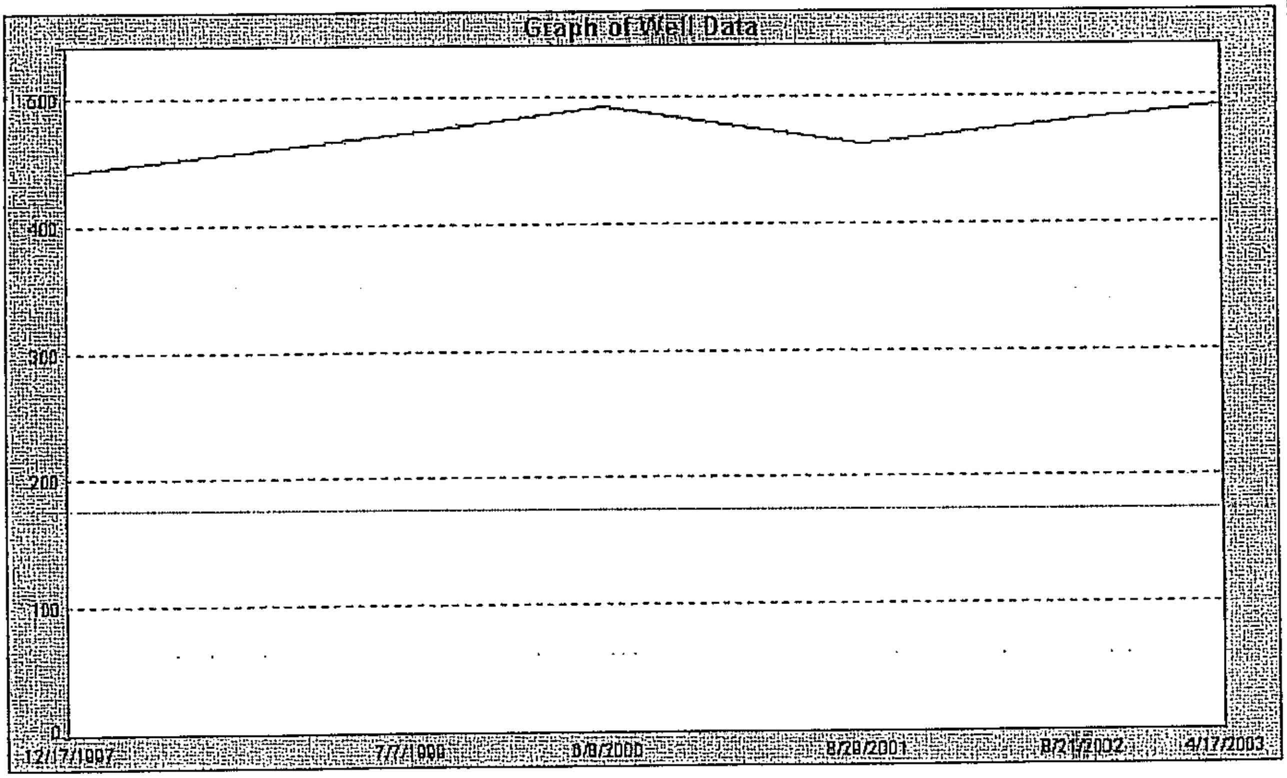
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 13
State Well Number: 0710004-012

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	TOTAL DISSOLVED SOLIDS		490	mg/L	1500
8/21/2002	TOTAL DISSOLVED SOLIDS		480	mg/L	1500
8/29/2001	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
6/8/2000	TOTAL DISSOLVED SOLIDS		490	mg/L	1500
7/7/1999	TOTAL DISSOLVED SOLIDS		470	mg/L	1500
12/17/1997	TOTAL DISSOLVED SOLIDS		440	mg/L	1500

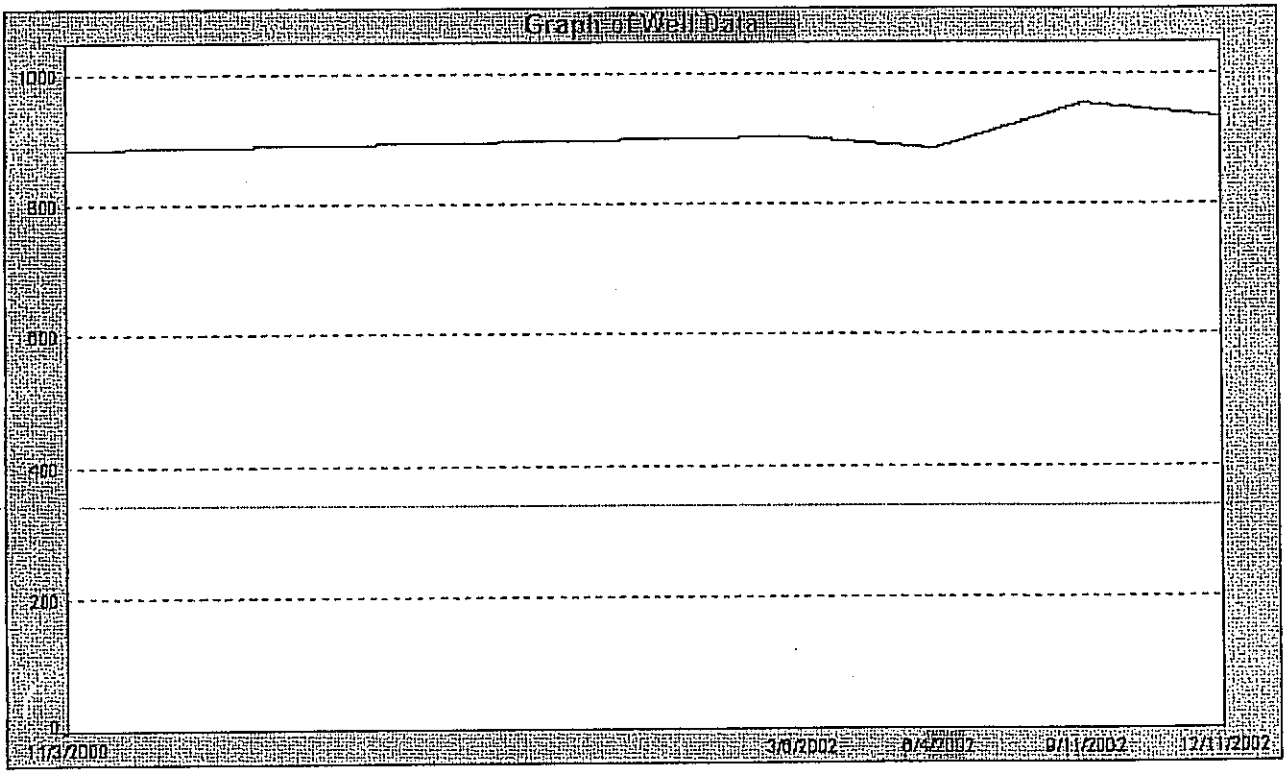
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 14
State Well Number: 0710004-014

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/11/2002	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
9/11/2002	TOTAL DISSOLVED SOLIDS		950	mg/L	1500
6/4/2002	TOTAL DISSOLVED SOLIDS		880	mg/L	1500
3/6/2002	TOTAL DISSOLVED SOLIDS		900	mg/L	1500
11/3/2000	TOTAL DISSOLVED SOLIDS		880	mg/L	1500

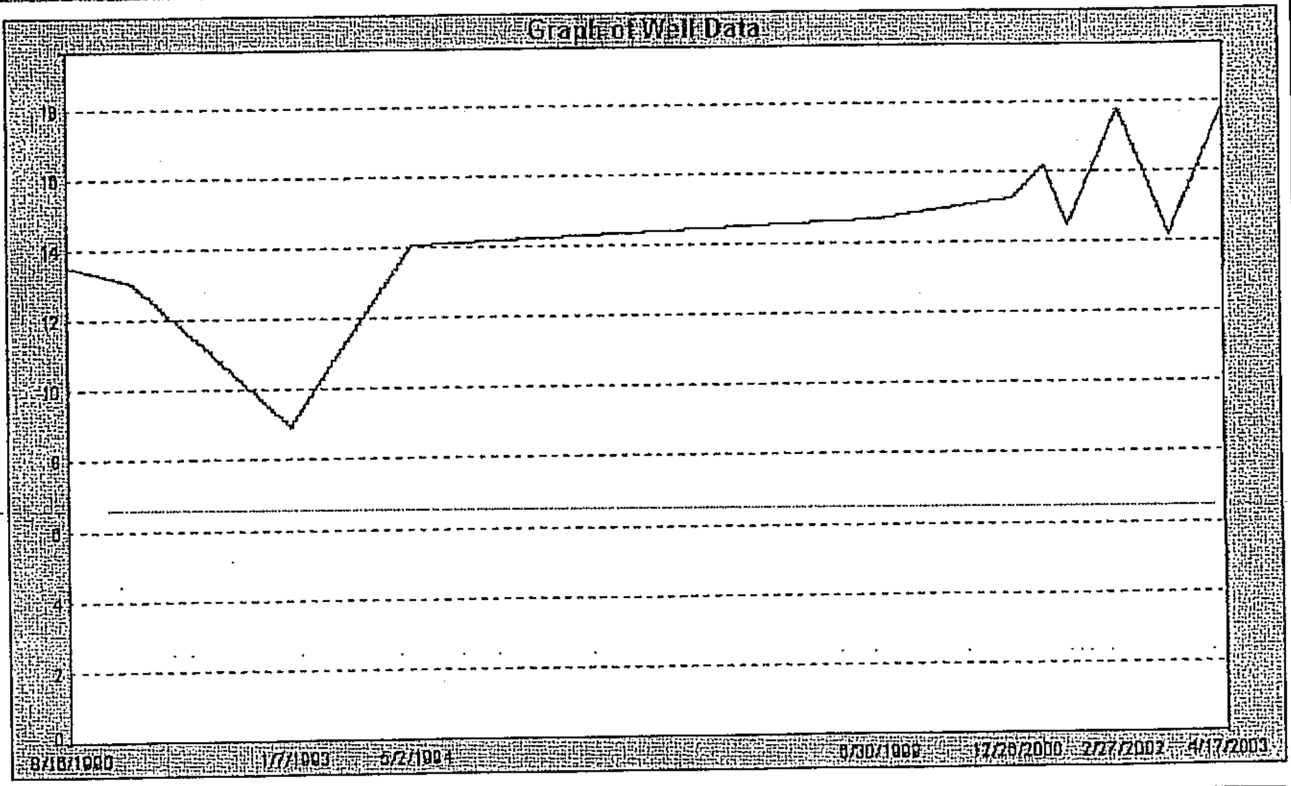
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 06
State Well Number: 0710004-006

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		17.8	mg/L	45
9/11/2002	NITRATE (AS NO3)		14.1	mg/L	45
2/27/2002	NITRATE (AS NO3)		17.7	mg/L	45
8/1/2001	NITRATE (AS NO3)		14.4	mg/L	45
5/2/2001	NITRATE (AS NO3)		16.1	mg/L	45
12/26/2000	NITRATE (AS NO3)		15.2	mg/L	45
6/30/1999	NITRATE (AS NO3)		14.6	mg/L	45
5/2/1994	NITRATE (AS NO3)		14	mg/L	45
1/7/1993	NITRATE (AS NO3)		8.9	mg/L	45
4/30/1991	NITRATE (AS NO3)		13	mg/L	45
8/16/1990	NITRATE (AS NO3)		13.5	mg/L	45

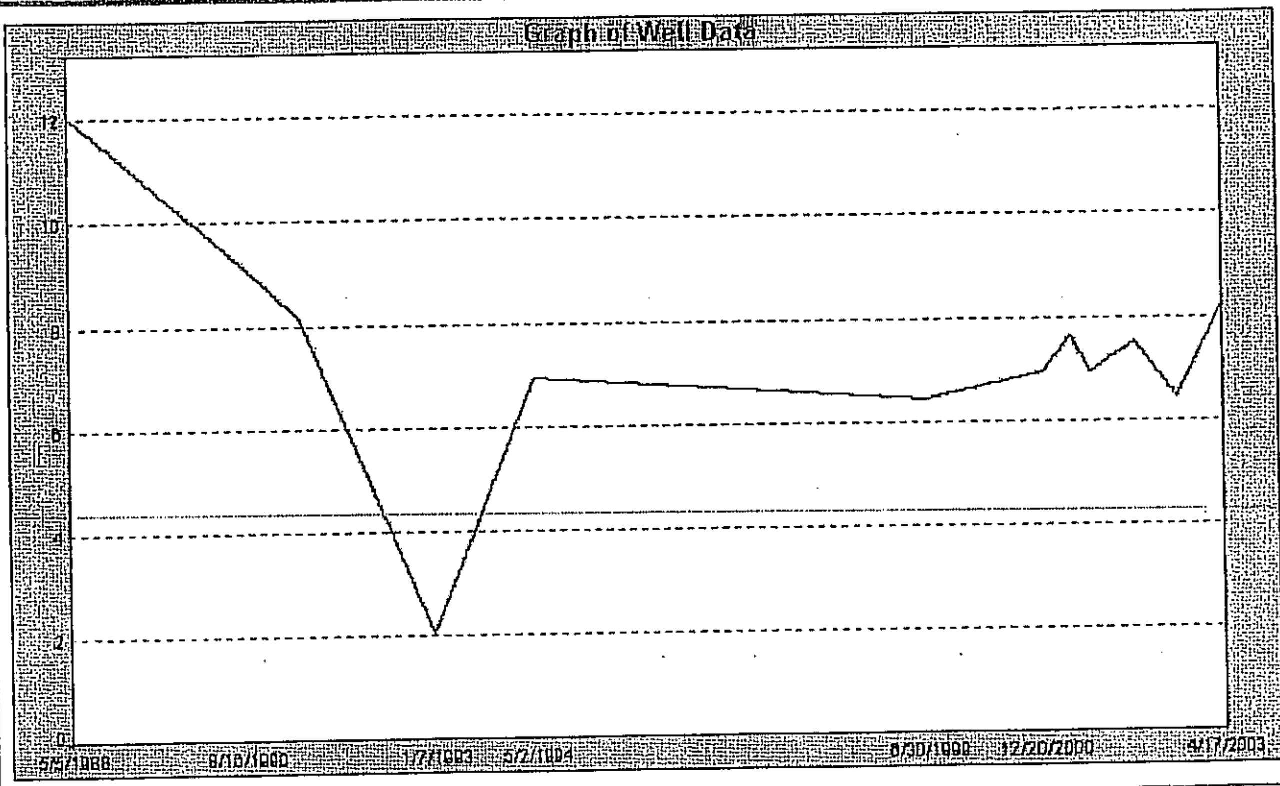
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 07
State Well Number: 0710004-007

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		8.2	mg/L	45
9/11/2002	NITRATE (AS NO3)		6.4	mg/L	45
2/27/2002	NITRATE (AS NO3)		7.5	mg/L	45
8/1/2001	NITRATE (AS NO3)		6.9	mg/L	45
5/2/2001	NITRATE (AS NO3)		7.6	mg/L	45
12/20/2000	NITRATE (AS NO3)		6.9	mg/L	45
6/30/1999	NITRATE (AS NO3)		6.4	mg/L	45
5/2/1994	NITRATE (AS NO3)		6.9	mg/L	45
1/7/1993	NITRATE (AS NO3)		2	mg/L	45
4/30/1991	NITRATE (AS NO3)		8.1	mg/L	45
8/16/1990	NITRATE (AS NO3)		9.1	mg/L	45
5/5/1988	NITRATE (AS NO3)		12	mg/L	45

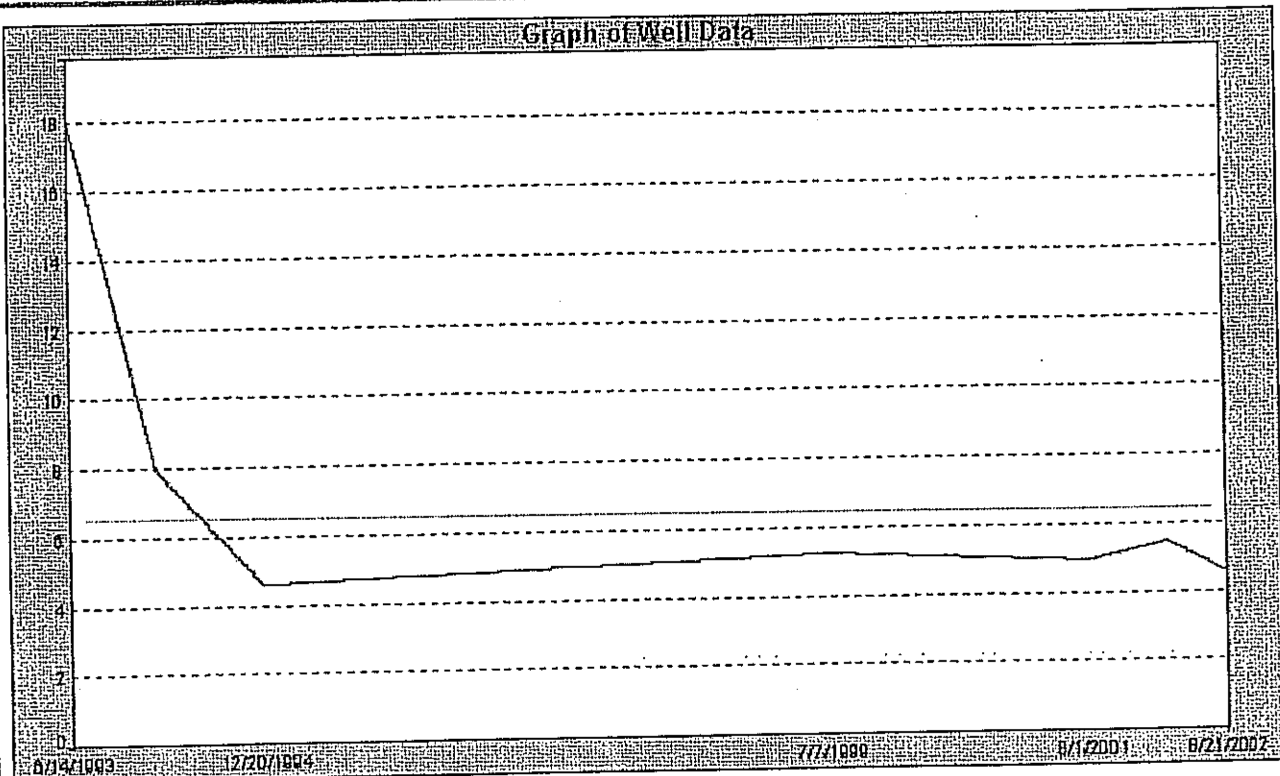
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 08
State Well Number: 0710004-008

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/21/2002	NITRATE (AS NO3)		4.5	mg/L	45
3/6/2002	NITRATE (AS NO3)		5.4	mg/L	45
8/1/2001	NITRATE (AS NO3)		4.9	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.2	mg/L	45
12/20/1994	NITRATE (AS NO3)	<	4.52	mg/L	45
2/15/1994	NITRATE (AS NO3)		7.9	mg/L	45
6/14/1993	NITRATE (AS NO3)		18	mg/L	45

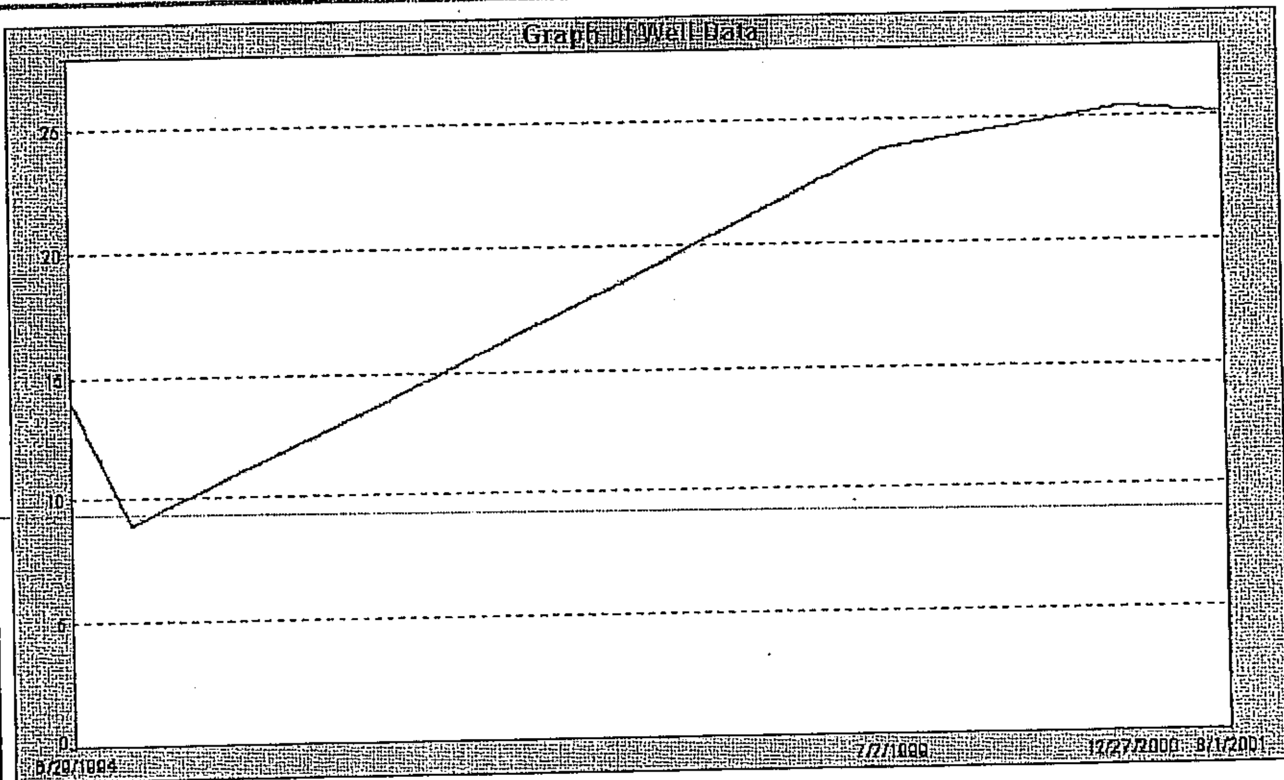
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 10A - IRRIGATION - AGRICULTURAL
State Well Number: 0710004-009

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/1/2001	NITRATE (AS NO3)		25.1	mg/L	45
12/27/2000	NITRATE (AS NO3)		25.3	mg/L	45
7/7/1999	NITRATE (AS NO3)		23.7	mg/L	45
11/10/1994	NITRATE (AS NO3)		8.82	mg/L	45
6/29/1994	NITRATE (AS NO3)		14	mg/L	45

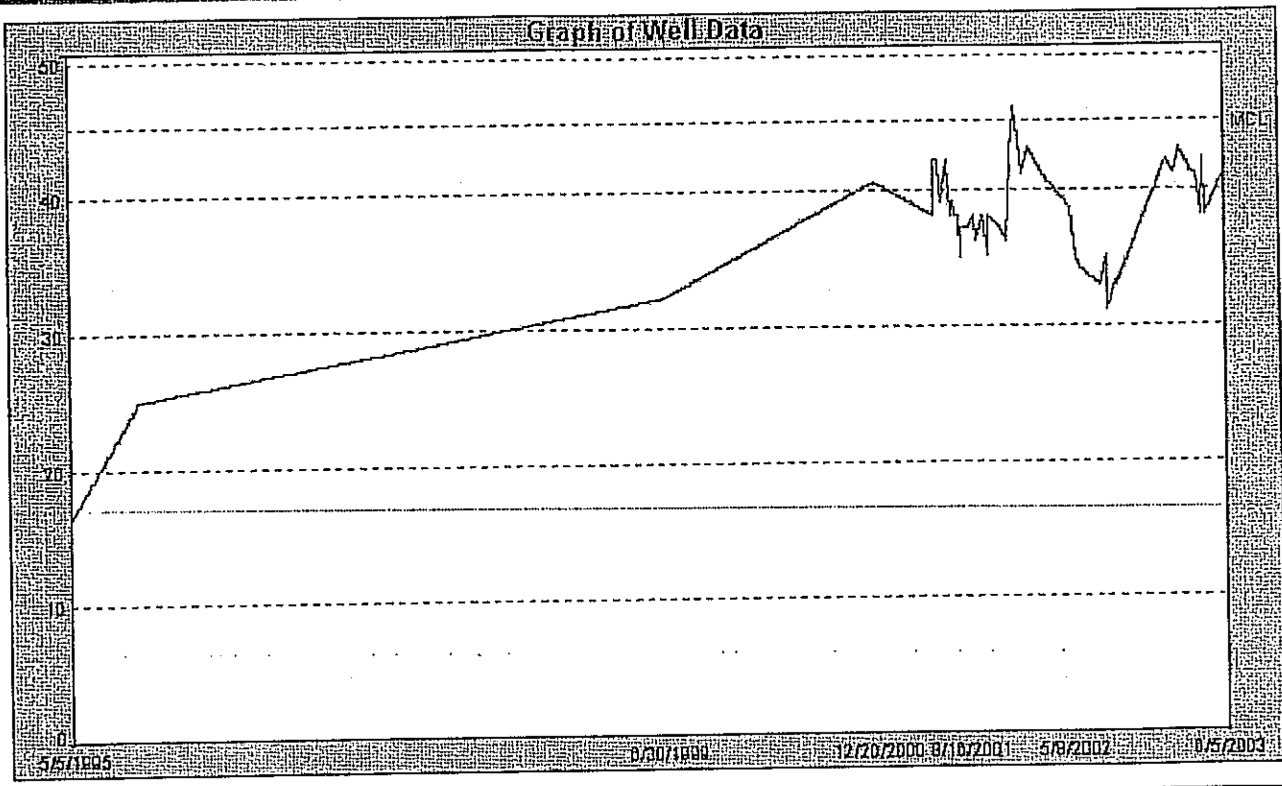
From Date: | To Date: | Graph Size: Small | Normalized | Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 11
State Well Number: 0710004-010

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/5/2003	NITRATE (AS NO3)		41	mg/L	45
4/22/2003	NITRATE (AS NO3)		38	mg/L	45
4/17/2003	NITRATE (AS NO3)		42.2	mg/L	45
4/8/2003	NITRATE (AS NO3)		38	mg/L	45
3/27/2003	NITRATE (AS NO3)		41	mg/L	45
3/13/2003	NITRATE (AS NO3)		41	mg/L	45
2/27/2003	NITRATE (AS NO3)		42	mg/L	45
2/11/2003	NITRATE (AS NO3)		43	mg/L	45
1/28/2003	NITRATE (AS NO3)		41	mg/L	45
1/9/2003	NITRATE (AS NO3)		42	mg/L	45
8/14/2002	NITRATE (AS NO3)		31	mg/L	45
8/13/2002	NITRATE (AS NO3)		35	mg/L	45
7/24/2002	NITRATE (AS NO3)		32.8	mg/L	45
6/11/2002	NITRATE (AS NO3)		34	mg/L	45
5/22/2002	NITRATE (AS NO3)		34.7	mg/L	45
5/8/2002	NITRATE (AS NO3)		38.6	mg/L	45
2/26/2002	NITRATE (AS NO3)		41	mg/L	45
2/12/2002	NITRATE (AS NO3)		42	mg/L	45
1/22/2002	NITRATE (AS NO3)		43	mg/L	45
1/8/2002	NITRATE (AS NO3)		41	mg/L	45
12/18/2001	NITRATE (AS NO3)		46	mg/L	45

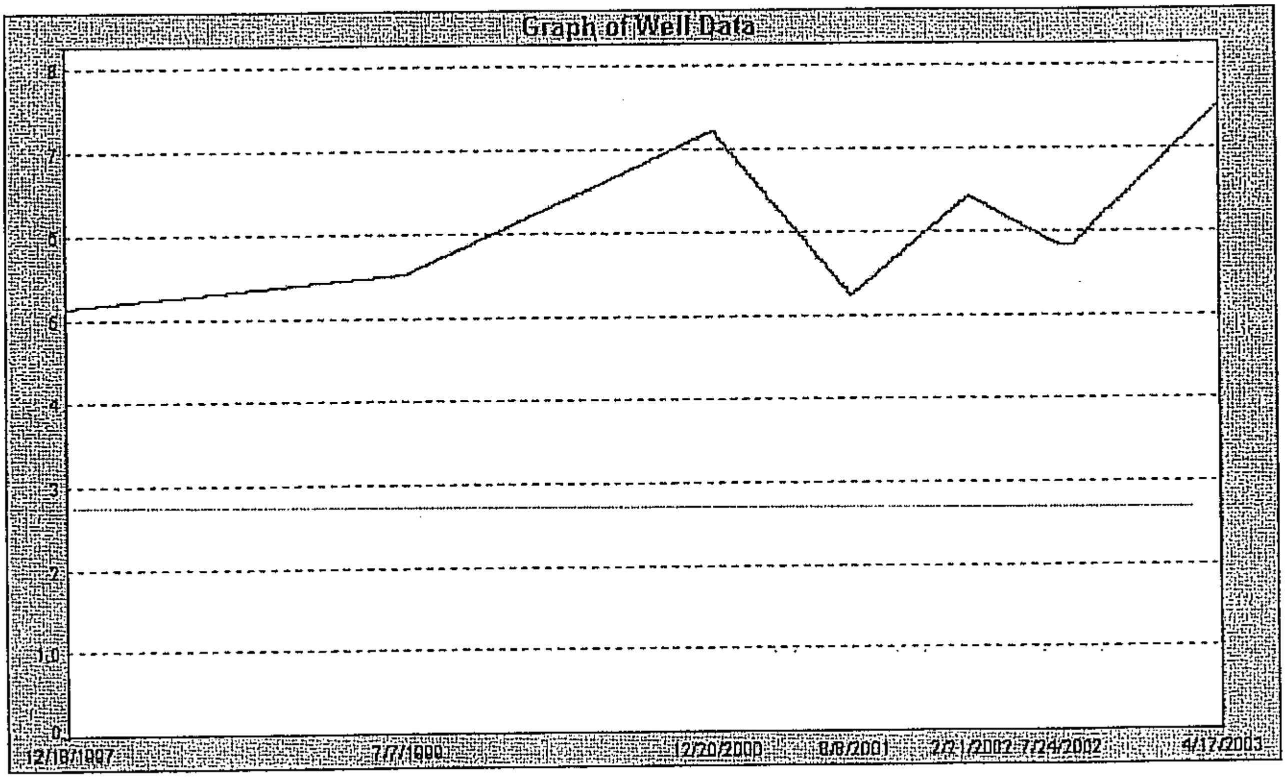
		44	mg/L	45
12/13/2001	NITRATE (AS NO3)	45	mg/L	45
12/11/2001	NITRATE (AS NO3)	36	mg/L	45
11/27/2001	NITRATE (AS NO3)	37	mg/L	45
11/13/2001	NITRATE (AS NO3)	38	mg/L	45
10/12/2001	NITRATE (AS NO3)	35	mg/L	45
10/10/2001	NITRATE (AS NO3)	38	mg/L	45
9/28/2001	NITRATE (AS NO3)	36	mg/L	45
9/13/2001	NITRATE (AS NO3)	38	mg/L	45
9/5/2001	NITRATE (AS NO3)	37	mg/L	45
8/24/2001	NITRATE (AS NO3)	37	mg/L	45
8/16/2001	NITRATE (AS NO3)	37	mg/L	45
8/2/2001	NITRATE (AS NO3)	34.8	mg/L	45
8/1/2001	NITRATE (AS NO3)	38	mg/L	45
7/26/2001	NITRATE (AS NO3)	38	mg/L	45
7/19/2001	NITRATE (AS NO3)	39	mg/L	45
7/12/2001	NITRATE (AS NO3)	38	mg/L	45
7/6/2001	NITRATE (AS NO3)	42	mg/L	45
6/28/2001	NITRATE (AS NO3)	39	mg/L	45
6/13/2001	NITRATE (AS NO3)	40	mg/L	45
6/6/2001	NITRATE (AS NO3)	42	mg/L	45
6/1/2001	NITRATE (AS NO3)	42	mg/L	45
5/25/2001	NITRATE (AS NO3)	38	mg/L	45
5/21/2001	NITRATE (AS NO3)	40.4	mg/L	45
12/20/2000	NITRATE (AS NO3)	32.1	mg/L	45
6/30/1999	NITRATE (AS NO3)	24.8	mg/L	45
10/26/1995	NITRATE (AS NO3)	16.2	mg/L	45
5/5/1995	NITRATE (AS NO3)			

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 12
State Well Number: 0710004-011

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		7.5	mg/L	45
8/14/2002	NITRATE (AS NO3)		5.8	mg/L	45
7/24/2002	NITRATE (AS NO3)		5.8	mg/L	45
2/21/2002	NITRATE (AS NO3)		6.4	mg/L	45
8/8/2001	NITRATE (AS NO3)		5.2	mg/L	45
12/20/2000	NITRATE (AS NO3)		7.2	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.5	mg/L	45
12/18/1997	NITRATE (AS NO3)		5.1	mg/L	45

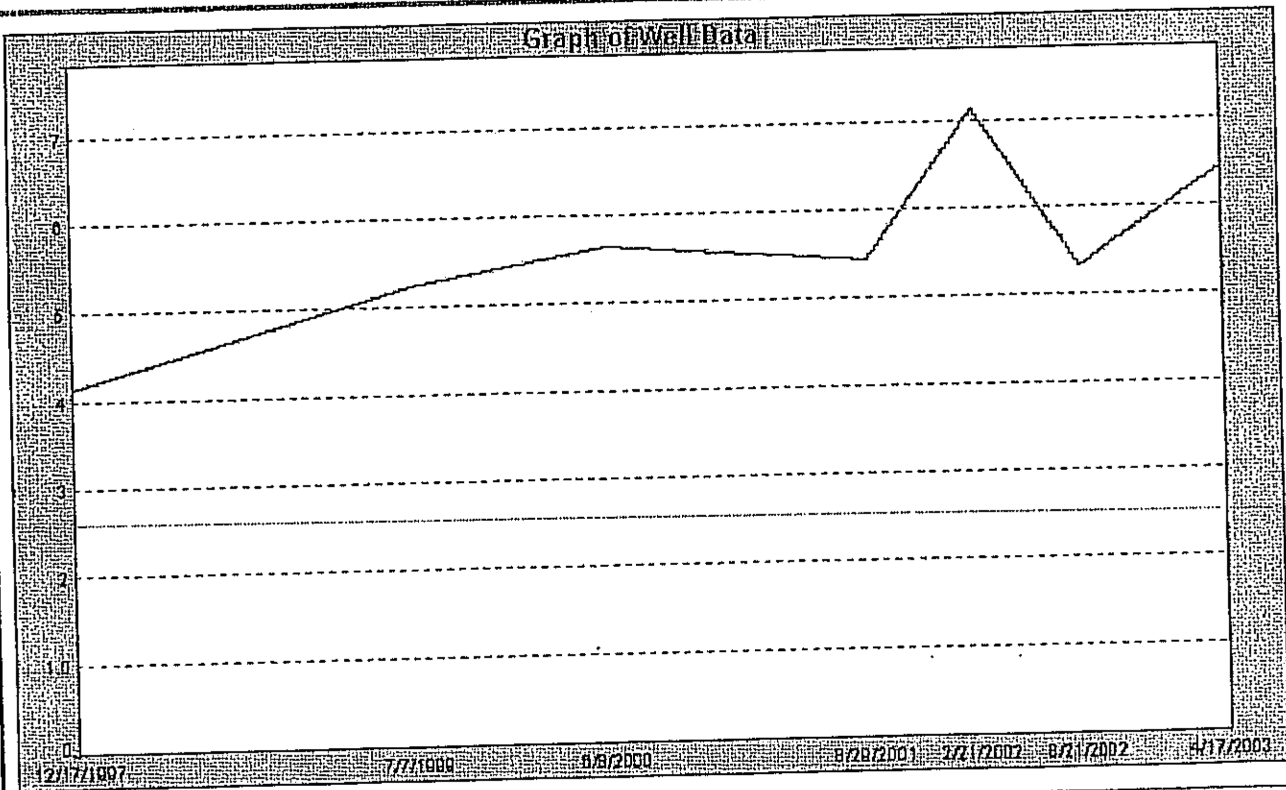
From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 13
State Well Number: 0710004-012

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/17/2003	NITRATE (AS NO3)		6.4	mg/L	45
8/21/2002	NITRATE (AS NO3)		5.3	mg/L	45
2/21/2002	NITRATE (AS NO3)		7.1	mg/L	45
8/29/2001	NITRATE (AS NO3)		5.4	mg/L	45
6/8/2000	NITRATE (AS NO3)		5.6	mg/L	45
7/7/1999	NITRATE (AS NO3)		5.2	mg/L	45
12/17/1997	NITRATE (AS NO3)		4.1	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

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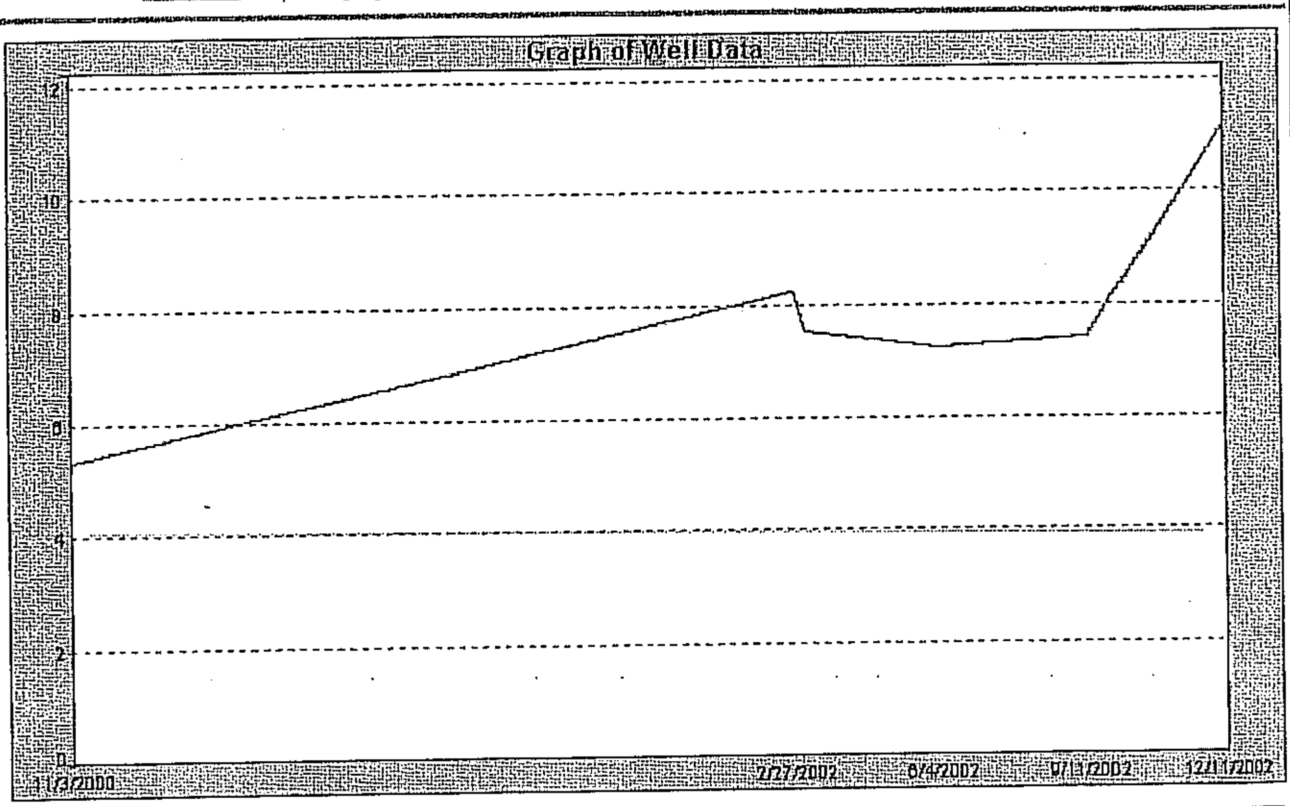
Well Data Graph

CITY OF BRENTWOOD (BRENTWOOD)
WELL 14
State Well Number: 0710004-014

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/11/2002	NITRATE (AS NO3)		11.1	mg/L	45
9/11/2002	NITRATE (AS NO3)		7.4	mg/L	45
6/4/2002	NITRATE (AS NO3)		7.2	mg/L	45
3/6/2002	NITRATE (AS NO3)		7.5	mg/L	45
2/27/2002	NITRATE (AS NO3)		8.2	mg/L	45
11/3/2000	NITRATE (AS NO3)		5.3	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

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DHS Water Quality

GREG'S MOTEL & HARBOR (OAKLEY)
WELL HEAD
State Well Number: 0707526-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
10/15/2002	NITRATE (AS NO3)		0	mg/L	45	☐

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Yahoo! Maps - Oakley, CA 94561-5085

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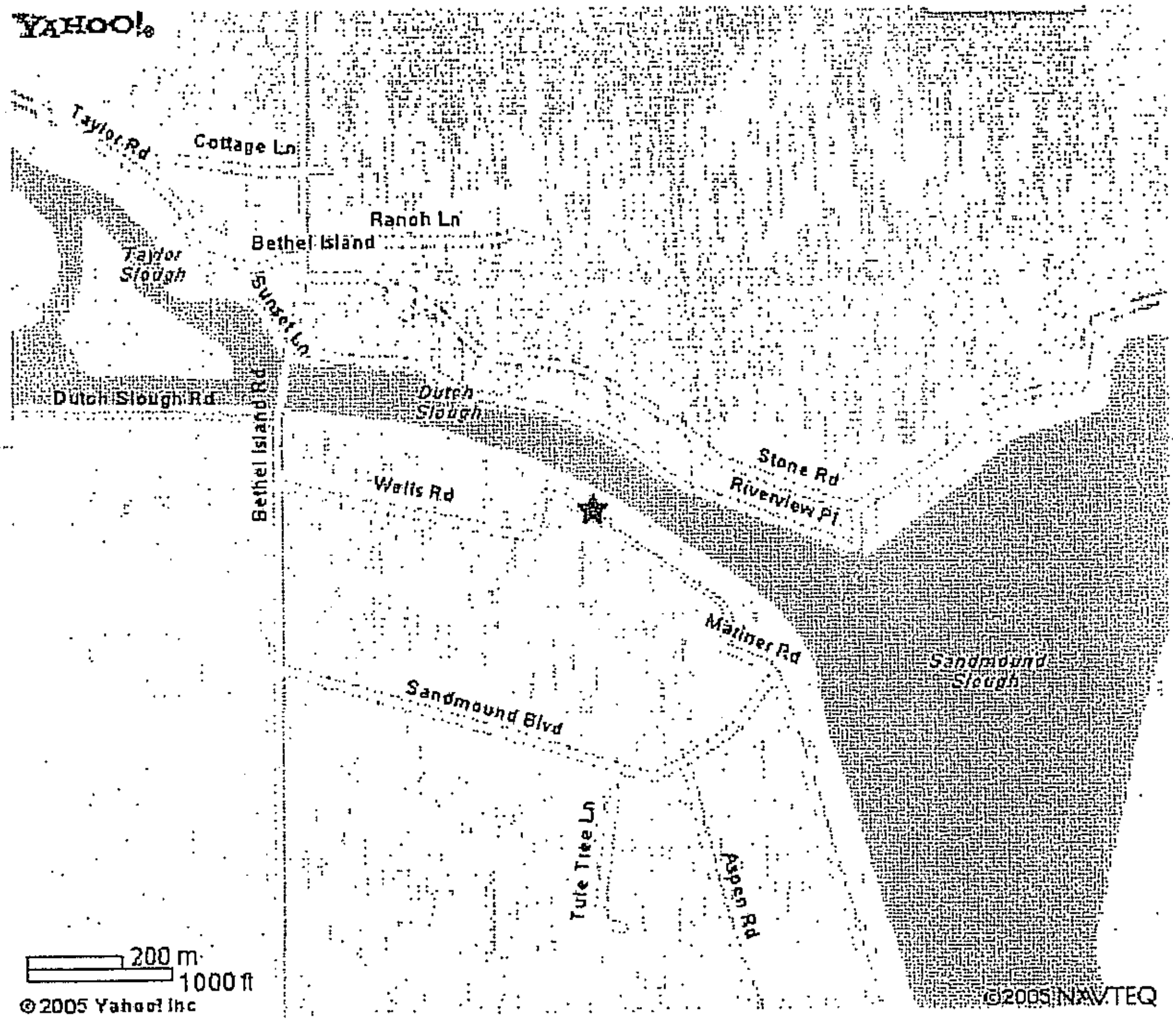
★ Casa del Rio Motel & Marina, 3295 Wells Rd Oakley, CA 94561-5085 (925) 684-2242



When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

DHS Water Quality

OAKLEY MUTUAL WATER CO. (OAKLEY)
WEST WELL
State Well Number: 0706004-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
3/20/2002	ALKALINITY (TOTAL) AS CACO3		290	mg/L	NA	☐
3/20/2002	ALUMINUM		0	ug/L	1000	☐
3/20/2002	ARSENIC		0	ug/L	50	☐
3/20/2002	BARIUM		0	ug/L	1000	☐
3/20/2002	CADMIUM		0	ug/L	5	☐
3/20/2002	CALCIUM		60	mg/L	NA	☐
3/20/2002	CHLORIDE		85	mg/L	600	☐
3/20/2002	CHROMIUM (TOTAL)		0	ug/L	50	☐
3/20/2002	COLOR		7	UNITS	15	☐
3/20/2002	COPPER		0	ug/L	1000	☐
3/20/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0.2	mg/L	1.7	☐
3/20/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	☐
3/20/2002	HARDNESS (TOTAL) AS CACO3		260	mg/L	NA	☐
3/20/2002	IRON		140	ug/L	300	☐
3/20/2002	LEAD		0	ug/L	NA	☐
3/20/2002	MAGNESIUM		28	mg/L	NA	☐
3/20/2002	MANGANESE		170	ug/L	50	☐
3/20/2002	MERCURY		0	ug/L	2	☐
6/19/2003	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
3/20/2002	NITRATE (AS NO3)	<	2	mg/L	45	☐
3/20/2002	NITRITE (AS N)		0	ug/L	1000	☐
3/20/2002	ODOR THRESHOLD @ 60 C		2	TON	3	☐
3/20/2002	PH, LABORATORY		7.9		NA	☐
3/20/2002	POTASSIUM		2	mg/L	NA	☐
3/20/2002	SELENIUM		0	ug/L	50	☐
3/20/2002	SILVER		0	ug/L	100	☐
3/20/2002	SODIUM		110	mg/L	NA	☐
3/20/2002	SOURCE TEMPERATURE C		19.5	C	NA	☐

3/20/2002	SPECIFIC CONDUCTANCE		960	US	2200	☐
3/20/2002	SULFATE		100	mg/L	600	☐
3/20/2002	TOTAL DISSOLVED SOLIDS		580	mg/L	1500	☑
3/20/2002	TURBIDITY, LABORATORY		0.46	NTU	5	☐
3/20/2002	ZINC	<	50	ug/L	5000	☐

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Well Search Results

42 records found

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SITE NAME	ADDRESS	CITY	COUNTY	
ANGEL MARINE CENTER	P.O. BOX 1870	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ANGLER'S RANCH #3	ANGLER'S RANCH #3	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ANGLER'S SUBDIVISION #4	ANGLER'S SUBDIVISION 4	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL BAPTIST CHURCH	BETHEL BAPTIST CHURCH	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL HARBOR	BETHEL HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND GOLF & RESORT	BETHEL ISLAND GOLF & RESORT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND LODGE	BETHEL ISLAND LODGE **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL ISLAND MUTUAL WATER CO.	BETHEL ISLAND MUTUAL WATER CO	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BETHEL MARKET **	BETHEL MARKET **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BILLECI'S	_ PO BOX	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BOAT HOUSE LOUNGE	BOAT HOUSE LOUNGE **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
BONNIE & CLYDE SALOON	BONNIE & CLYDE SALOON	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
CALIENTE ISLE	CALIENTE ISLE	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DELTA MUTUAL WATER COMPANY	DELTA MUTUAL WATER COMPANY	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DELTA SPORTSMAN	DELTA SPORTSMAN	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DOC'S MARINA	DOC'S MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
DUTCH SLOUGH WATER WORKS	DUTCH SLOUGH WATER WORKS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FARRAR PARK PROPERTY OWNERS	FARRAR PARK PROPERTY OWNERS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FLAMINGO MOBILE MANOR	FLAMINGO MOBILE MANOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
FRANK'S MARINA INC	FRANK'S MARINA INC	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
HARRIS MARINA	HARRIS MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
HENNIS MARINA - INACTIVE	_ P O BOX	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
ISLAND PARK TRAILER COURT 3505 Gateway Rd	ISLAND PARK TRAILER COURT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
KELLER LIQUORS	_ P O BOX 5	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
LEISURE LANDING MARINA	LEISURE LANDING MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
LUNDBORG LANDING	LUNDBORG LANDING	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
MARINA MOBILE MANOR	MARINA MOBILE MANOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
MARINE EMPORIUM RICHARDS YACHT	MARINE EMPORIUM RICHARDS YACHT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

MARS HARBOR	MARS HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
NEW ANCHOR MARINA	NEW ANCHOR MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

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Well Search Results

42 records found Page 2 of 2

SITE NAME	ADDRESS	CITY	COUNTY	
PARK MARINA	PARK MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
PLEASANTIMES MUTUAL WATER CO.	PLEASANTIMES MUTUAL WATER CO	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RIVERVIEW MARINA SWS	RIVERVIEW MARINA SWS	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RIVERVIEW WATER ASSN	RIVERVIEW WATER ASSN	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
RUSSO'S MOBILE PARK	_ P O BOX 4	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
-16 SANDMOUND MUTUAL	SANDMOUND MUTUAL	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SANDY POINT MOBILE HOME PARK	SANDY POINT MOBILE HOME PARK 5625 Sandmound	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SUGAR BARGE RV PARK & MARINA	SUGAR BARGE RV PARK & MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
SUNSET HARBOR	SUNSET HARBOR	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
TONY'S FAMILY RESTAURANT	TONY'S FAMILY RESTAURANT	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
WALLY'S RESTAURANT & DELI **	WALLY'S RESTAURANT & DELI **	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS
WILLOW PARK MARINA	WILLOW PARK MARINA	BETHEL ISLAND	CONTRA COSTA	VIEW PWS WELLS

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DHS Water Quality

ISLAND PARK TRAILER COURT (BETHEL ISLAND)
WELL 01
State Well Number: 0707574-001

3505 Gateway Rd
Bethel Island, CA
(925) 684-2144

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
8/1/2002	1,1,1,2-TETRACHLORETHANE		0	ug/L	NA	☐
8/1/2002	1,1,1-TRICHLOROETHANE		0	ug/L	200	☐
8/1/2002	1,1,2,2-TETRACHLOROETHANE		0	ug/L	1	☐
8/1/2002	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE		0	ug/L	1200	☐
8/1/2002	1,1,2-TRICHLOROETHANE		0	ug/L	5	☐
8/1/2002	1,1-DICHLOROETHANE		0	ug/L	5	☐
8/1/2002	1,1-DICHLOROETHYLENE		0	ug/L	6	☐
8/1/2002	1,1-DICHLOROPROPENE		0	ug/L	NA	☐
8/1/2002	1,2,3-TRICHLOROBENZENE		0	ug/L	NA	☐
8/1/2002	1,2,3-TRICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	1,2,4-TRICHLOROBENZENE		0	ug/L	70	☐
8/1/2002	1,2,4-TRIMETHYLBENZENE		0	ug/L	NA	☐
8/1/2002	1,2-DICHLOROBENZENE		0	ug/L	600	☐
8/1/2002	1,2-DICHLOROETHANE		0	ug/L	0.5	☐
8/1/2002	1,2-DICHLOROPROPANE		0	ug/L	5	☐
8/1/2002	1,3,5-TRIMETHYLBENZENE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROBENZENE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	1,3-DICHLOROPROPENE (TOTAL)		0	ug/L	0.5	☐
8/1/2002	1,4-DICHLOROBENZENE		0	ug/L	5	☐
8/1/2002	1-PHENYLPROPANE (N-PROPYLBENZENE)		0	ug/L	NA	☐
8/1/2002	2,2-DICHLOROPROPANE		0	ug/L	NA	☐
8/1/2002	2-CHLOROTOLUENE		0	ug/L	NA	☐
8/1/2002	4-CHLOROTOLUENE		0	ug/L	NA	☐
8/1/2002	ALKALINITY (TOTAL) AS CACO3		620	mg/L	NA	☐
8/1/2002	ALUMINUM		0	ug/L	1000	☐
10/21/2002	ANTIMONY		0	ug/L	6	☐
8/1/2002	ARSENIC		7	ug/L	50	☐

4/28/1998	ATRAZINE	0	ug/L	3	☐
8/1/2002	BARIUM	0	ug/L	1000	☐
8/1/2002	BENZENE	0	ug/L	1	☐
8/1/2002	BERYLLIUM	0	ug/L	4	☐
8/1/2002	BICARBONATE ALKALINITY	760	mg/L	NA	☐
4/28/1998	BROMACIL	0	ug/L	NA	☐
8/1/2002	BROMOBENZENE	0	ug/L	NA	☐
8/1/2002	BROMOCHLOROMETHANE	0	ug/L	NA	☐
8/1/2002	BROMODICHLORMETHANE (THM)	0	ug/L	100	☐
8/1/2002	BROMOFORM (THM)	0	ug/L	100	☐
8/1/2002	BROMOMETHANE	0	ug/L	NA	☐
4/28/1998	BUTACHLOR	0	ug/L	NA	☐
8/1/2002	CADMIUM	0	ug/L	5	☐
8/1/2002	CALCIUM	24	mg/L	NA	☐
8/1/2002	CARBON TETRACHLORIDE	0	ug/L	0.5	☐
8/1/2002	CARBONATE ALKALINITY	0	mg/L	NA	☐
8/1/2002	CHLORIDE	220	mg/L	600	☐
8/1/2002	CHLOROETHANE	0	ug/L	NA	☐
8/1/2002	CHLOROFORM (THM)	0.72	ug/L	100	☐
8/1/2002	CHLOROMETHANE	0	ug/L	NA	☐
8/1/2002	CHROMIUM (TOTAL)	0	ug/L	50	☐
8/1/2002	CIS-1,2-DICHLOROETHYLENE	0	ug/L	6	☐
8/1/2002	COLOR	1	UNITS	15	☐
8/1/2002	COPPER	0	ug/L	1000	☐
4/28/1998	DIAZINON	0	ug/L	NA	☐
8/1/2002	DIBROMOCHLOROMETHANE (THM)	0	ug/L	100	☐
8/1/2002	DIBROMOMETHANE	0	ug/L	NA	☐
8/1/2002	DICHLORODIFLUOROMETHANE	0	ug/L	NA	☐
8/1/2002	DICHLOROMETHANE	0	ug/L	5	☐
8/1/2002	DIISOPROPYL ETHER	0	ug/L	NA	☐
4/28/1998	DIMETHOATE	0	ug/L	NA	☐
8/1/2002	ETHYL-TERT-BUTYL ETHER	0	ug/L	NA	☐
8/1/2002	ETHYLBENZENE	0	ug/L	700	☐
8/1/2002	FLUORIDE (TEMPERATURE DEPENDENT)	2.4	mg/L	1.7	☐
8/1/2002	FOAMING AGENTS (MBAS)	0	ug/L	500	☐
8/1/2002	HARDNESS (TOTAL) AS CACO3	180	mg/L	NA	☐
8/1/2002	HEXACHLOROBUTADIENE	0	ug/L	NA	☐

8/1/2002	HYDROXIDE ALKALINITY		0	mg/L	NA	☐
8/1/2002	IRON	<	100	ug/L	300	☐
8/1/2002	ISOPROPYLBENZENE		0	ug/L	NA	☐
8/1/2002	LEAD		0	ug/L	NA	☐
8/1/2002	M,P-XYLENE		0	ug/L	1750	☐
8/1/2002	MAGNESIUM		28	mg/L	NA	☐
8/1/2002	MANGANESE		0	ug/L	50	☐
8/1/2002	MERCURY		0	ug/L	2	☐
8/1/2002	METHYL ISOBUTYL KETONE		0	ug/L	NA	☐
8/1/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
4/28/1998	METOLACHLOR	<	0.5	ug/L	NA	☐
4/28/1998	METRIBUZIN	<	0.25	ug/L	NA	☐
4/28/1998	MOLINATE		0	ug/L	20	☐
8/1/2002	MONOCHLOROBENZENE		0	ug/L	70	☐
8/1/2002	N-BUTYLBENZENE		0	ug/L	NA	☐
8/1/2002	NAPHTHALENE		0	ug/L	NA	☐
8/1/2002	NICKEL		20	ug/L	100	☐
5/28/2003	NITRATE (AS NO3)		0	mg/L	45	☐
8/1/2002	NITRITE (AS N)		0	ug/L	1000	☐
8/1/2002	O-XYLENE		0	ug/L	1750	☐
8/1/2002	ODOR THRESHOLD @ 60 C		1	TON	3	☐
8/1/2002	P-ISOPROPYLTOLUENE		0	ug/L	NA	☐
8/1/2002	PH, LABORATORY		7.8		NA	☐
8/1/2002	POTASSIUM		1.9	mg/L	NA	☐
4/28/1998	PROMETRYN		0	ug/L	NA	☐
4/28/1998	PROPACHLOR		0	ug/L	NA	☐
8/1/2002	SEC-BUTYLBENZENE		0	ug/L	NA	☐
8/1/2002	SELENIUM		0	ug/L	50	☐
8/1/2002	SILVER		0	ug/L	100	☐
4/28/1998	SIMAZINE		0	ug/L	4	☐
8/1/2002	SODIUM		430	mg/L	NA	☑
8/1/2002	SPECIFIC CONDUCTANCE		2000	US	2200	☐
8/1/2002	STYRENE		0	ug/L	100	☐
8/1/2002	SULFATE		160	mg/L	600	☐
8/1/2002	TERT-AMYL-METHYL ETHER		0	ug/L	NA	☐
8/1/2002	TERT-BUTYL ALCOHOL		0	ug/L	NA	☐
8/1/2002	TERT-BUTYLBENZENE		0	ug/L	NA	☐

8/1/2002	TETRACHLOROETHYLENE		0	ug/L	5	☐
8/1/2002	THALLIUM		0	ug/L	2	☐
4/28/1998	THIOBENCARB		0	ug/L	70	☐
8/1/2002	TOLUENE		0	ug/L	150	☐
8/1/2002	TOTAL DISSOLVED SOLIDS		1300	mg/L	1500	☑
8/1/2002	TOTAL TRIHALOMETHANES		0.72	ug/L	100	☐
8/1/2002	TRANS-1,2-DICHLOROETHYLENE		0	ug/L	10	☐
8/1/2002	TRICHLOROETHYLENE		0	ug/L	5	☐
8/1/2002	TRICHLOROFLUOROMETHANE		0	ug/L	150	☐
8/1/2002	TURBIDITY, LABORATORY		0	NTU	5	☐
8/1/2002	VINYL CHLORIDE		0	ug/L	0.5	☐
8/1/2002	XYLENES (TOTAL)		0	ug/L	1750	☐
8/1/2002	ZINC	<	50	ug/L	5000	☐

Wells Owned By W0600707569

ANGLER'S SUBDIVISION #4 (BETHEL ISLAND)
ANGLER'S SUBDIVISION 4
BETHEL ISLAND , CA 94511

State Well No.	Well Common Name		
0707569-001	WELL 1 - 1696 TAYLOR	Show on Map	Report
0707569-002	WELL 2 - 1398 TAYLOR	Show on Map	Report
0707569-003	WELL 3 - 1698 TAYLOR	Show on Map	Report
PWS MAIN FAC	0707569	Show on Map	Report

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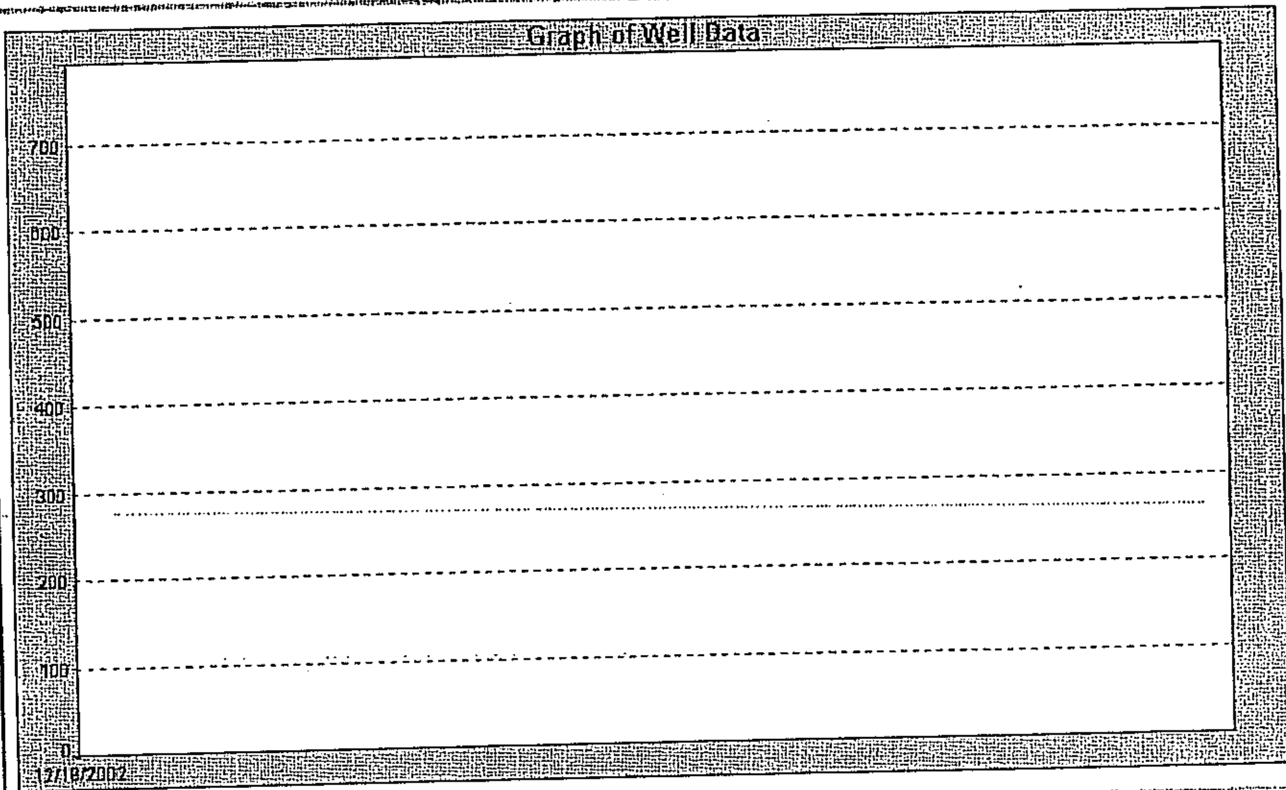
Well Data Graph

FRANK'S MARINA INC (BETHEL ISLAND) on Piper Slough
WELL HEAD
State Well Number: 0707575-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/18/2002	TOTAL DISSOLVED SOLIDS		720	mg/L	1500

From Date: To Date: Graph Size Small Normalized Redraw

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DHS Water Quality

FRANK'S MARINA INC (BETHEL ISLAND)
WELL HEAD
State Well Number: 0707575-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
12/18/2002	1,1,1,2-TETRACHLORETHANE		0	ug/L	NA	☐
12/18/2002	1,1,1-TRICHLOROETHANE		0	ug/L	200	☐
12/18/2002	1,1,2,2-TETRACHLOROETHANE		0	ug/L	1	☐
12/18/2002	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE		0	ug/L	1200	☐
12/18/2002	1,1,2-TRICHLOROETHANE		0	ug/L	5	☐
12/18/2002	1,1-DICHLOROETHANE		0	ug/L	5	☐
12/18/2002	1,1-DICHLOROETHYLENE		0	ug/L	6	☐
12/18/2002	1,1-DICHLOROPROPENE		0	ug/L	NA	☐
12/18/2002	1,2,3-TRICHLOROBENZENE		0	ug/L	NA	☐
12/18/2002	1,2,3-TRICHLOROPROPANE		0	ug/L	NA	☐
12/18/2002	1,2,4-TRICHLOROBENZENE		0	ug/L	70	☐
12/18/2002	1,2,4-TRIMETHYLBENZENE		0	ug/L	NA	☐
12/18/2002	1,2-DICHLOROBENZENE		0	ug/L	600	☐
12/18/2002	1,2-DICHLOROETHANE		0	ug/L	0.5	☐
12/18/2002	1,2-DICHLOROPROPANE		0	ug/L	5	☐
12/18/2002	1,3,5-TRIMETHYLBENZENE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROBENZENE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROPROPANE		0	ug/L	NA	☐
12/18/2002	1,3-DICHLOROPROPENE (TOTAL)		0	ug/L	0.5	☐
12/18/2002	1,4-DICHLOROBENZENE		0	ug/L	5	☐
12/18/2002	1-PHENYLPROPANE (N-PROPYLBENZENE)		0	ug/L	NA	☐
12/18/2002	2,2-DICHLOROPROPANE		0	ug/L	NA	☐
2/27/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
12/18/2002	2-CHLOROTOLUENE		0	ug/L	NA	☐
12/18/2002	4-CHLOROTOLUENE		0	ug/L	NA	☐
12/18/2002	ALKALINITY (TOTAL) AS CACO3		200	mg/L	NA	☐
12/18/2002	ALUMINUM		0	ug/L	1000	☐
12/18/2002	ANTIMONY		0	ug/L	6	☐

12/18/2002	ARSENIC		0	ug/L	50	☐
12/18/2002	ASBESTOS		0	MFL	7	☐
12/18/2002	BARIUM		130	ug/L	1000	☐
12/18/2002	BENZENE		0	ug/L	1	☐
12/18/2002	BERYLLIUM		0	ug/L	4	☐
12/18/2002	BICARBONATE ALKALINITY		250	mg/L	NA	☐
12/18/2002	BROMOBENZENE		0	ug/L	NA	☐
12/18/2002	BROMOCHLOROMETHANE		0	ug/L	NA	☐
12/18/2002	BROMODICHLORMETHANE (THM)		0	ug/L	100	☐
12/18/2002	BROMOFORM (THM)		0	ug/L	100	☐
12/18/2002	BROMOMETHANE		0	ug/L	NA	☐
12/18/2002	CADMIUM		0	ug/L	5	☐
12/18/2002	CALCIUM		28	mg/L	NA	☐
12/18/2002	CARBON TETRACHLORIDE		0	ug/L	0.5	☐
12/18/2002	CARBONATE ALKALINITY		0	mg/L	NA	☐
12/18/2002	CHLORIDE		180	mg/L	600	☐
12/18/2002	CHLOROETHANE		0	ug/L	NA	☐
12/18/2002	CHLOROFORM (THM)		0	ug/L	100	☐
12/18/2002	CHLOROMETHANE		0	ug/L	NA	☐
12/18/2002	CHROMIUM (TOTAL CR-CRVI SCREEN)		1.3	UG/L	NA	☐
12/18/2002	CHROMIUM (TOTAL)		0	ug/L	50	☐
12/18/2002	CIS-1,2-DICHLOROETHYLENE		0	ug/L	6	☐
2/27/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
12/18/2002	COLOR		1	UNITS	15	☐
12/18/2002	COPPER		0	ug/L	1000	☐
12/18/2002	DIBROMOCHLOROMETHANE (THM)		0	ug/L	100	☐
12/18/2002	DIBROMOMETHANE		0	ug/L	NA	☐
12/18/2002	DICHLORODIFLUOROMETHANE		0	ug/L	NA	☐
12/18/2002	DICHLOROMETHANE		0	ug/L	5	☐
12/18/2002	DIISOPROPYL ETHER		0	ug/L	NA	☐
12/18/2002	ETHYL-TERT-BUTYL ETHER		0	ug/L	NA	☐
12/18/2002	ETHYLBENZENE		0	ug/L	700	☐
12/18/2002	FLUORIDE (TEMPERATURE DEPENDENT)		0	mg/L	1.7	☐
12/18/2002	FOAMING AGENTS (MBAS)		0	ug/L	500	☐
12/18/2002	HARDNESS (TOTAL) AS CACO3		130	mg/L	NA	☐
12/18/2002	HEXACHLOROBUTADIENE		0	ug/L	NA	☐
12/18/2002	HYDROXIDE ALKALINITY		0	mg/L	NA	☐

12/18/2002	IRON		0	ug/L	300	☐
12/18/2002	ISOPROPYLBENZENE		0	ug/L	NA	☐
12/18/2002	LEAD		0	ug/L	NA	☐
12/18/2002	M,P-XYLENE		0	ug/L	1750	☐
12/18/2002	MAGNESIUM		15	mg/L	NA	☐
12/18/2002	MANGANESE		140	ug/L	50	☐
12/18/2002	MERCURY		0	ug/L	2	☐
2/27/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
12/18/2002	METHYL ISOBUTYL KETONE		0	ug/L	NA	☐
12/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
12/18/2002	MONOCHLOROBENZENE		0	ug/L	70	☐
12/18/2002	N-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	NAPHTHALENE		0	ug/L	NA	☐
12/18/2002	NICKEL		20	ug/L	100	☐
12/18/2002	NITRATE (AS NO3)		0	mg/L	45	☐
12/18/2002	NITRITE (AS N)		0	ug/L	1000	☐
12/18/2002	O-XYLENE		0	ug/L	1750	☐
12/18/2002	ODOR THRESHOLD @ 60 C		1	TON	3	☐
12/18/2002	P-ISOPROPYLTOLUENE		0	ug/L	NA	☐
12/18/2002	PH, LABORATORY		8.1		NA	☐
12/18/2002	POTASSIUM		2.3	mg/L	NA	☐
12/18/2002	SEC-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	SELENIUM		0	ug/L	50	☐
12/18/2002	SILVER		0	ug/L	100	☐
12/18/2002	SODIUM		230	mg/L	NA	☐
12/18/2002	SPECIFIC CONDUCTANCE		1200	US	2200	☐
12/18/2002	STYRENE		0	ug/L	100	☐
12/18/2002	SULFATE		130	mg/L	600	☐
12/18/2002	TERT-AMYL-METHYL ETHER		0	ug/L	NA	☐
12/18/2002	TERT-BUTYL ALCOHOL		0	ug/L	NA	☐
12/18/2002	TERT-BUTYLBENZENE		0	ug/L	NA	☐
12/18/2002	TETRACHLOROETHYLENE		0	ug/L	5	☐
12/18/2002	THALLIUM		0	ug/L	2	☐
12/18/2002	TOLUENE		0	ug/L	150	☐
12/18/2002	TOTAL DISSOLVED SOLIDS		720	mg/L	1500	☑
12/18/2002	TOTAL TRIHALOMETHANES		0	ug/L	100	☐
12/18/2002	TRANS-1,2-DICHLOROETHYLENE		0	ug/L	10	☐

2/27/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
12/18/2002	TRICHLOROETHYLENE		0	ug/L	5	☐
12/18/2002	TRICHLOROFLUOROMETHANE		0	ug/L	150	☐
12/18/2002	TURBIDITY, LABORATORY		0.12	NTU	5	☐
12/18/2002	VINYL CHLORIDE		0	ug/L	0.5	☐
12/18/2002	XYLENES (TOTAL)		0	ug/L	1750	☐
12/18/2002	ZINC	<	50	ug/L	5000	☐

Public Water System Information

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Way east on Middle River

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
HOLLAND RIVERSIDE MARINA

Water System Address:
HOLLAND RIVERSIDE MARINA
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Date Entered System:

Deactivation Date:

Service Area:

System Status:

Last Revised:

Connection Information

Number of Service Connections:
255

Population Served:
25

- List all wells for this Public Water System

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DHS Water Quality

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

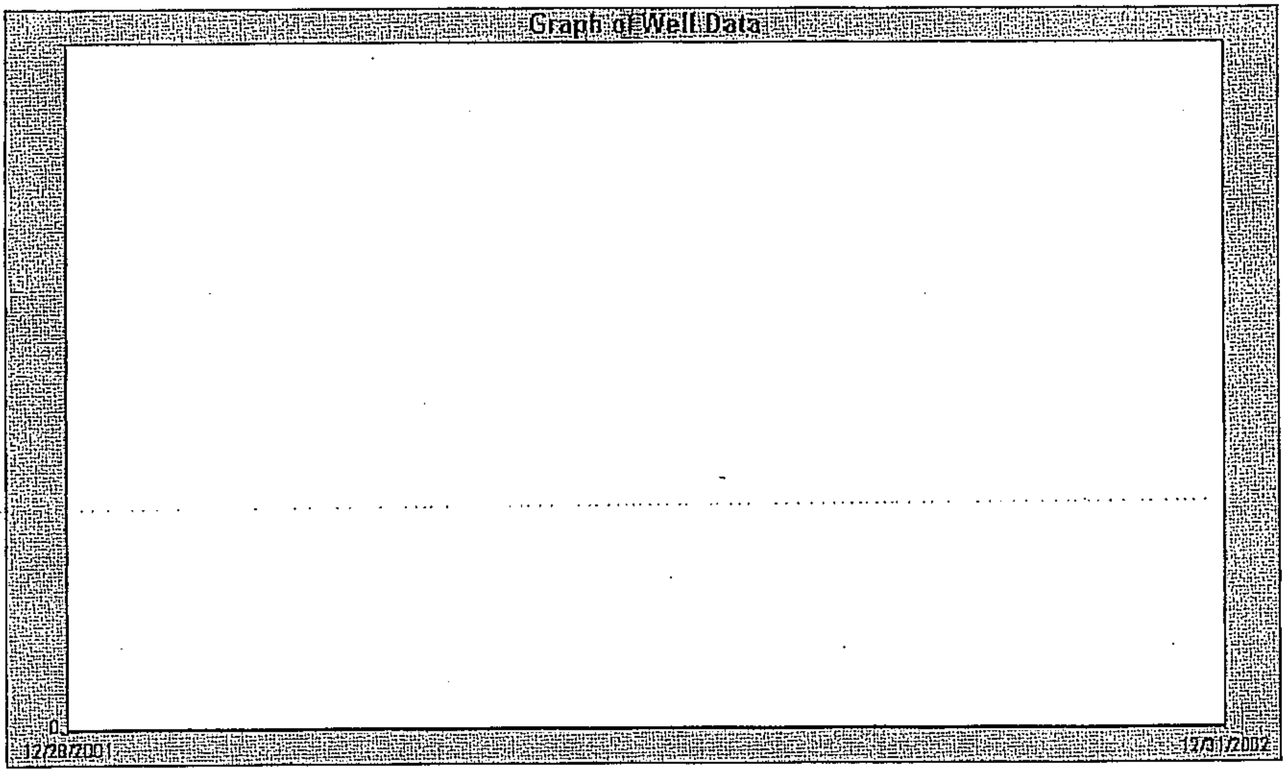
Date	Parameter	Qualifier	Result	Units	MCL	Plot
5/7/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	☐
5/7/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	☐
5/7/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	☐
5/7/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	☐
5/7/1986	1,2-DICHLOROETHANE	<	0.5	ug/L	0.5	☐
5/7/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	☐
5/7/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	☐
5/7/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	☐
5/7/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
5/7/1986	BENZENE	<	0.5	ug/L	1	☐
5/7/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	☐
5/7/1986	CHLOROETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	CHLOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	DICHLOROMETHANE	<	0.5	ug/L	5	☐
5/7/1986	ETHYLBENZENE	<	0.5	ug/L	700	☐
5/7/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
5/7/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	☐
5/7/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	☐
12/31/2002	NITRATE (AS NO3)		0	mg/L	45	☑

5/7/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	5	☐
5/7/1986	TOLUENE	<	0.5	ug/L	150	☐
5/7/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	10	☐
5/7/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	TRICHLOROETHYLENE	<	0.5	ug/L	5	☐
5/7/1986	TRICHLOROFLUOROMETHANE	<	0.5	ug/L	150	☐
5/7/1986	VINYL CHLORIDE	<	1	ug/L	0.5	☐
5/7/1986	XYLENES (TOTAL)	<	0.5	ug/L	1750	☐

Well Data Graph

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL HEAD
State Well Number: 0706034-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** ☐ Redraw

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Public Water System Information

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL 2
State Well Number: 0706034-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
HOLLAND RIVERSIDE MARINA

Water System Address:
HOLLAND RIVERSIDE MARINA
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:
255

Population Served:
25

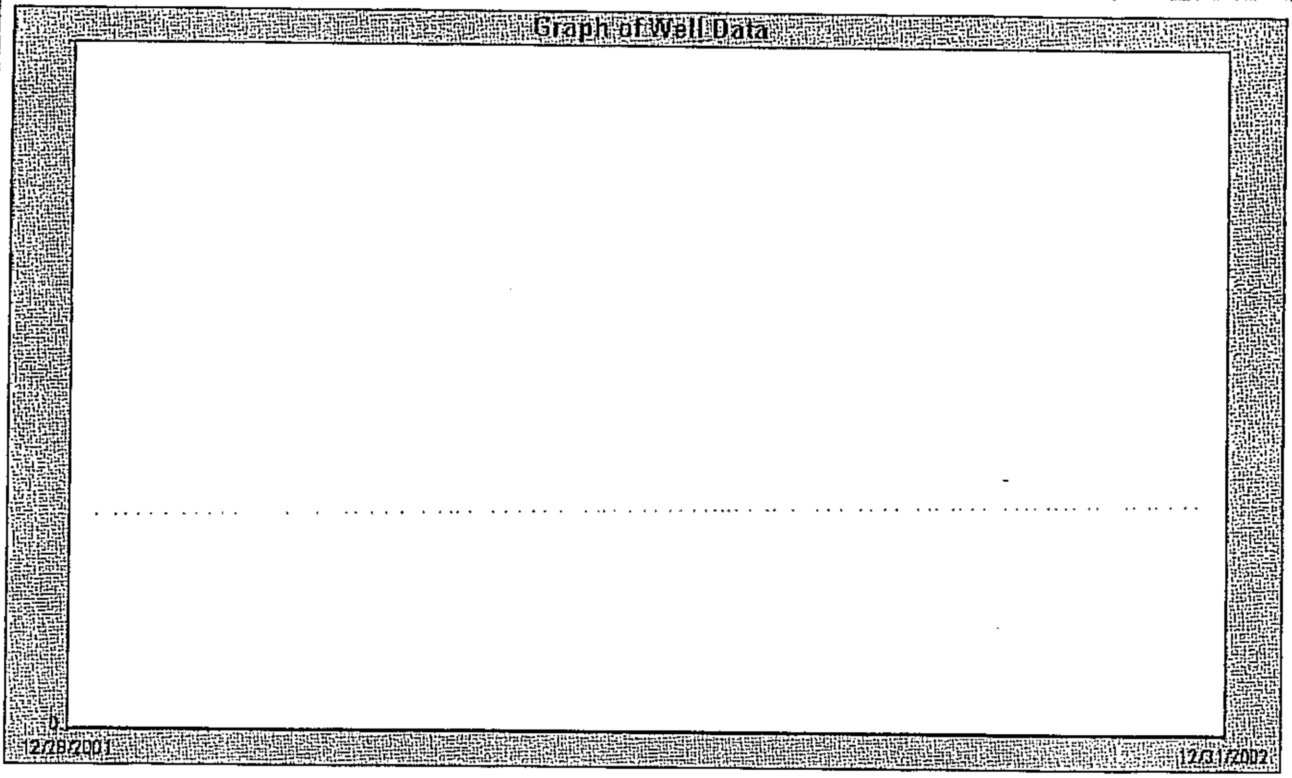
- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

HOLLAND RIVERSIDE MARINA (KNIGHTSEN)
WELL 2
State Well Number: 0706034-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
12/31/2002	NITRATE (AS NO3)		0	mg/L	45
12/28/2001	NITRATE (AS NO3)		0	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** ☐ Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Public Water System Information

-U-69
77
-K-68

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Public Water System
KNIGHTSEN ELEMENTARY SCHOOL

Water System Address:
KNIGHTSEN ELEMENTARY SCHOOL
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Service Area:

Date Entered System:

System Status:

Deactivation Date:

Last Revised:

Connection Information

Number of Service Connections:	Population Served:
5	324

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

DHS Water Quality

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
5/7/1986	1,1,1-TRICHLOROETHANE	<	0.5	ug/L	200	☐
5/7/1986	1,1,2,2-TETRACHLOROETHANE	<	0.5	ug/L	1	☐
5/7/1986	1,1,2-TRICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHANE	<	0.5	ug/L	5	☐
5/7/1986	1,1-DICHLOROETHYLENE	<	0.5	ug/L	6	☐
5/7/1986	1,2-DICHLOROBENZENE	<	0.5	ug/L	600	☐
5/7/1986	1,2-DICHLOROETHANE	<	0.5	ug/L	0.5	☐
5/7/1986	1,2-DICHLOROPROPANE	<	0.5	ug/L	5	☐
5/7/1986	1,3-DICHLOROBENZENE	<	0.5	ug/L	NA	☐
5/7/1986	1,4-DICHLOROBENZENE	<	0.5	ug/L	5	☐
5/7/1986	2-CHLOROETHYLVINYL ETHER	<	1	ug/L	NA	☐
5/7/1986	BENZENE	<	0.5	ug/L	1	☐
5/7/1986	BROMODICHLORMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	BROMOMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CARBON TETRACHLORIDE	<	0.5	ug/L	0.5	☐
5/7/1986	CHLOROETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CHLOROFORM (THM)	<	0.5	ug/L	100	☐
5/7/1986	CHLOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	CIS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
5/7/1986	DIBROMOCHLOROMETHANE (THM)	<	0.5	ug/L	100	☐
5/7/1986	DICHLORODIFLUOROMETHANE	<	0.5	ug/L	NA	☐
5/7/1986	DICHLOROMETHANE	<	0.5	ug/L	5	☐
5/7/1986	ETHYLBENZENE	<	0.5	ug/L	700	☐
5/7/1986	METHYL ETHYL KETONE	<	1	ug/L	NA	☐
5/7/1986	METHYL ISOBUTYL KETONE	<	1	ug/L	NA	☐
1/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
5/7/1986	MONOCHLOROBENZENE	<	0.5	ug/L	70	☐

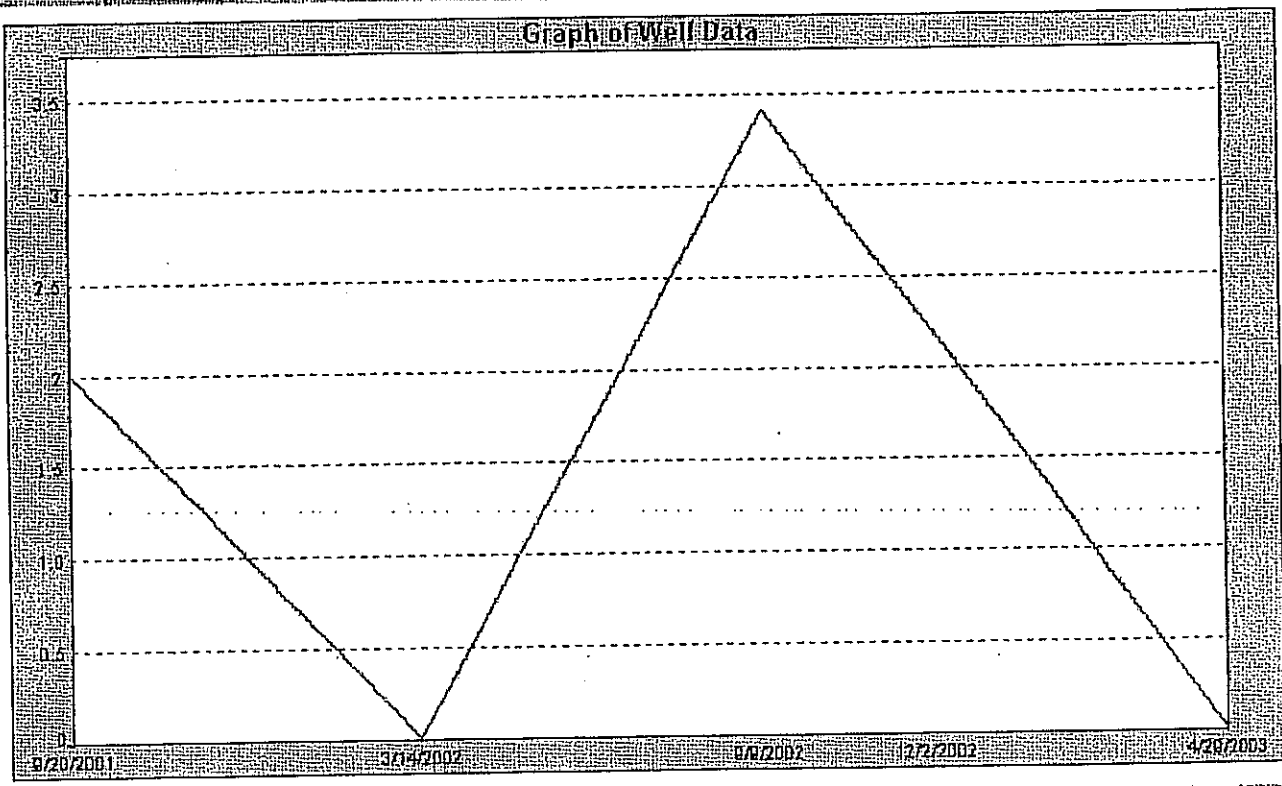
29' 3	NITRATE (AS NO3)		0	mg/L	45	☑
7/1986	TETRACHLOROETHYLENE	<	0.5	ug/L	5	☐
7/1986	TOLUENE	<	0.5	ug/L	150	☐
/7/1986	TRANS-1,2-DICHLOROETHYLENE	<	0.5	ug/L	10	☐
/7/1986	TRANS-1,3-DICHLOROPROPENE	<	0.5	ug/L	0.5	☐
/7/1986	TRICHLOROETHYLENE	<	0.5	ug/L	5	☐
5/7/1986	TRICHLOROFLUOROMETHANE	<	0.5	ug/L	150	☐
5/7/1986	VINYL CHLORIDE	<	1	ug/L	0.5	☐
5/7/1986	XYLENES (TOTAL)	<	0.5	ug/L	1750	☐

Well Data Graph

1:74
68

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
NORTH WELL
State Well Number: 0706028-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/29/2003	NITRATE (AS NO3)		0	mg/L	45
12/2/2002	NITRATE (AS NO3)		2.2	mg/L	45
9/9/2002	NITRATE (AS NO3)		3.4	mg/L	45
3/14/2002	NITRATE (AS NO3)		0	mg/L	45
9/20/2001	NITRATE (AS NO3)		2	mg/L	45

From Date: To Date: Graph Size Small Normalized Redraw

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DHS Water Quality

2-69

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
SOUTH WELL
State Well Number: 0706028-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

Plot Selected Chemicals | Reset Boxes | **Note: You may select up to 6 chemicals.**

(All Data) | (Most Recent) | (Maximum Concentrations)

Date	Parameter	Qualifier	Result	Units	MCL	Plot
1/18/2002	METHYL-TERT-BUTYL-ETHER (MTBE)		0	ug/L	5	☐
4/29/2003	NITRATE (AS NO3)		25	mg/L	45	☐

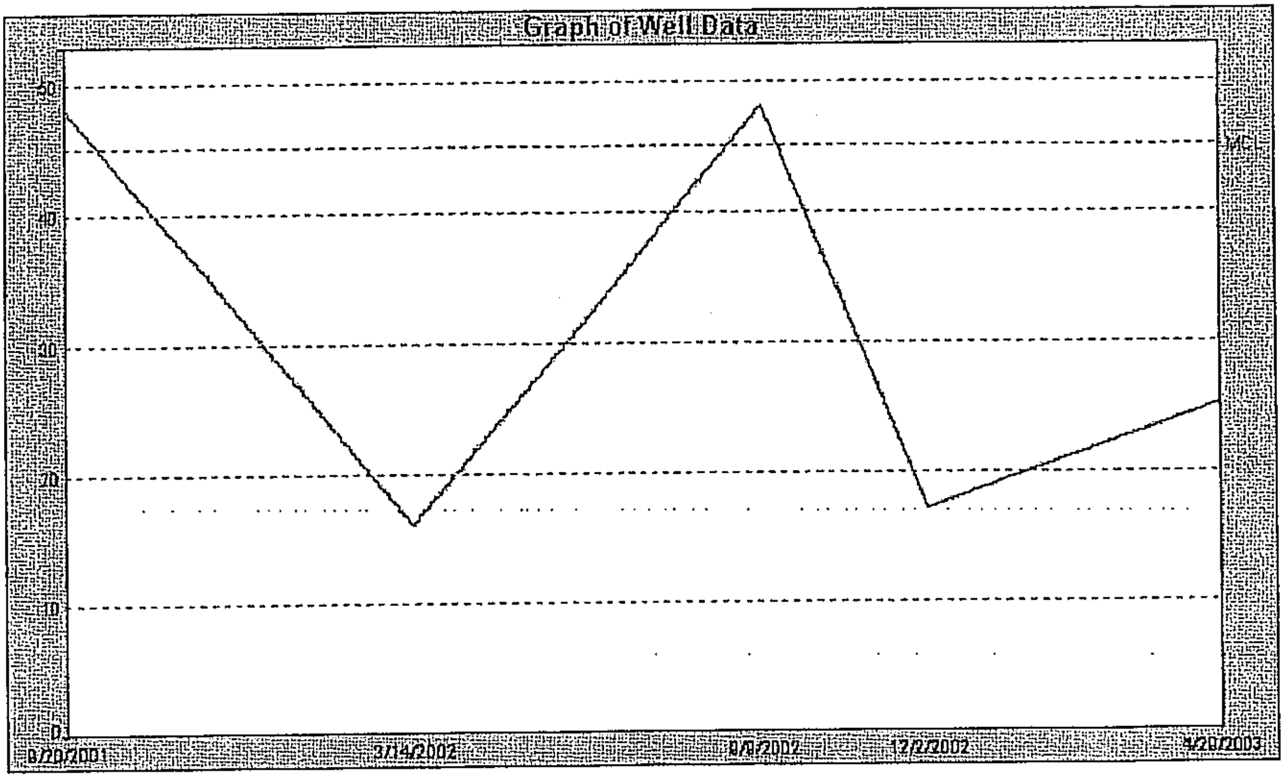
Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

1-69

KNIGHTSEN ELEMENTARY SCHOOL (KNIGHTSEN)
SOUTH WELL
State Well Number: 0706028-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
4/29/2003	NITRATE (AS NO3)		25	mg/L	45
12/2/2002	NITRATE (AS NO3)		17	mg/L	45
9/9/2002	NITRATE (AS NO3)		48	mg/L	45
3/14/2002	NITRATE (AS NO3)		16	mg/L	45
9/20/2001	NITRATE (AS NO3)		48	mg/L	45

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Public Water System Information

u-70

KNIGHTSEN COMMUNITY WATER SYS (KNIGHTSEN)
WELL HEAD
State Well Number: 0707547-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information

MTBE only

Public Water System
KNIGHTSEN COMMUNITY WATER SYS

Water System Address:
KNIGHTSEN COMMUNITY WATER SYS
KNIGHTSEN, CA 94548

PWS Class:

Ownership/Regulation

Ownership:

Regulating Entity:

Date Entered System:

Deactivation Date:

Service Area:

System Status:

Last Revised:

Connection Information

Number of Service Connections:
21

Population Served:
150

- List all wells for this Public Water System

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

No data

Nitrate only

BACK TO SEARCH | GEOTRACKER HOME

Well Search Results

8 records found Page 1 of 1

SITE NAME	ADDRESS	CITY	COUNTY	
BELLA VISTA TRAILER COURT	4253_MACHADO LN	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BETHEL MISSIONARY BAPTIST	BETHEL MISSIONARY BAPTIST	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BIG OAK MOBILE PARK	BIG OAK MOBILE PARK	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
BLUE STAR GAS MART	BLUE STAR GAS MART	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
DELTA KIDS CENTER	DELTA KIDS CENTER	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
DIABLO WATER DISTRICT	5325 P.O. BOX 127	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
GREG'S MOTEL & HARBOR	GREG'S MOTEL & HARBOR	OAKLEY	CONTRA COSTA	VIEW PWS WELLS
OAKLEY MUTUAL WATER CO.	OAKLEY MUTUAL WATER CO	OAKLEY	CONTRA COSTA	VIEW PWS WELLS

Nitrate only

No data

Nitrate only

925-754-2242

Wood's Marina

M

3215 Wells Rd

NWIS

Wells Owned By W0600710007

DIABLO WATER DISTRICT (OAKLEY)
5325 P.O. Box 127
OAKLEY , CA 94513

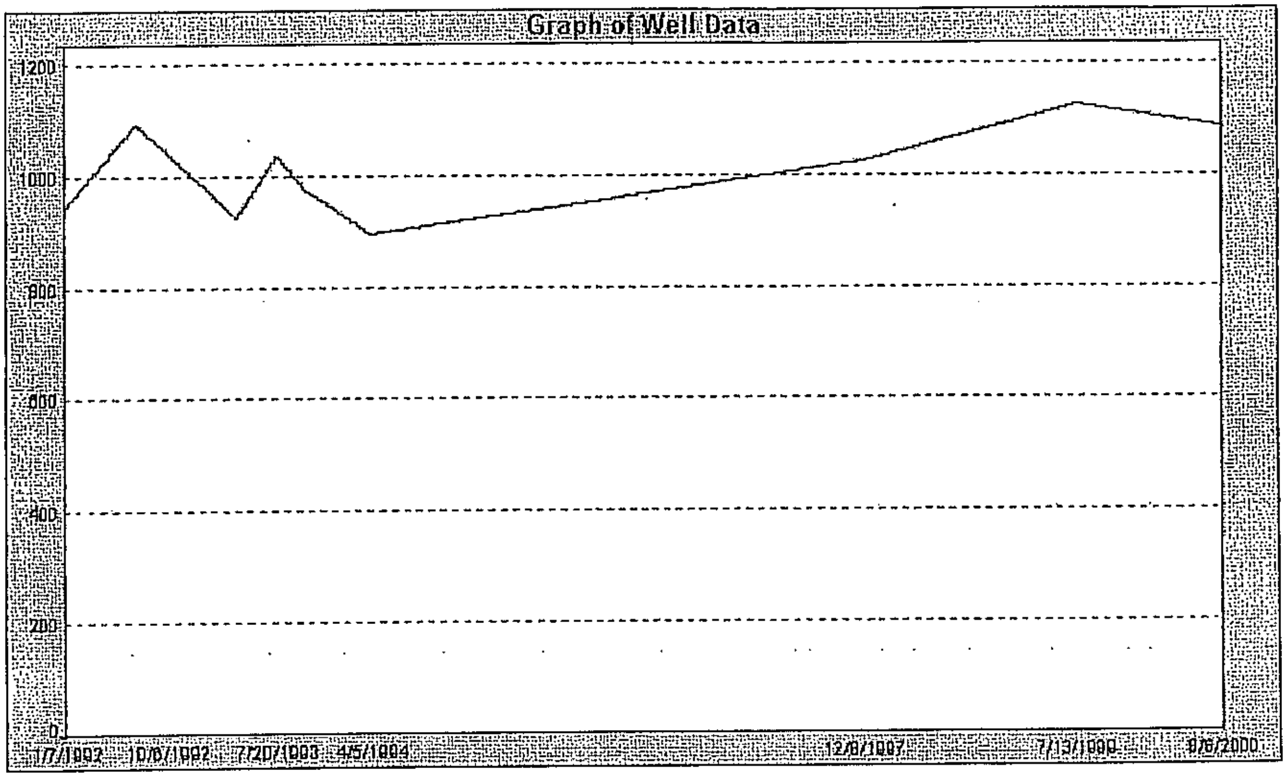
State Well No.	Well Common Name		
0710007-001	CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND	Show on Map	Report
0710007-002	WELL 01 - STANDBY	Show on Map	Report
0710007-003	RANDALL-BOLD WTP - TREATED	Show on Map	Report
0710007-004	WELL 01 - TREATED - STANDBY	Show on Map	Report
PWS MAIN FAC	0710007	Show on Map	Report

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
WELL 01 - STANDBY
State Well Number: 0710007-002

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
8/8/2000	TOTAL DISSOLVED SOLIDS		1080	mg/L	1500
7/13/1999	TOTAL DISSOLVED SOLIDS		1120	mg/L	1500
12/8/1997	TOTAL DISSOLVED SOLIDS		1020	mg/L	1500
4/5/1994	TOTAL DISSOLVED SOLIDS		890	mg/L	1500
1/4/1994	TOTAL DISSOLVED SOLIDS		930	mg/L	1500
10/5/1993	TOTAL DISSOLVED SOLIDS		970	mg/L	1500
7/20/1993	TOTAL DISSOLVED SOLIDS		1030	mg/L	1500
4/5/1993	TOTAL DISSOLVED SOLIDS		920	mg/L	1500
10/6/1992	TOTAL DISSOLVED SOLIDS		1040	mg/L	1500
7/13/1992	TOTAL DISSOLVED SOLIDS		1090	mg/L	1500
1/7/1992	TOTAL DISSOLVED SOLIDS		940	mg/L	1500

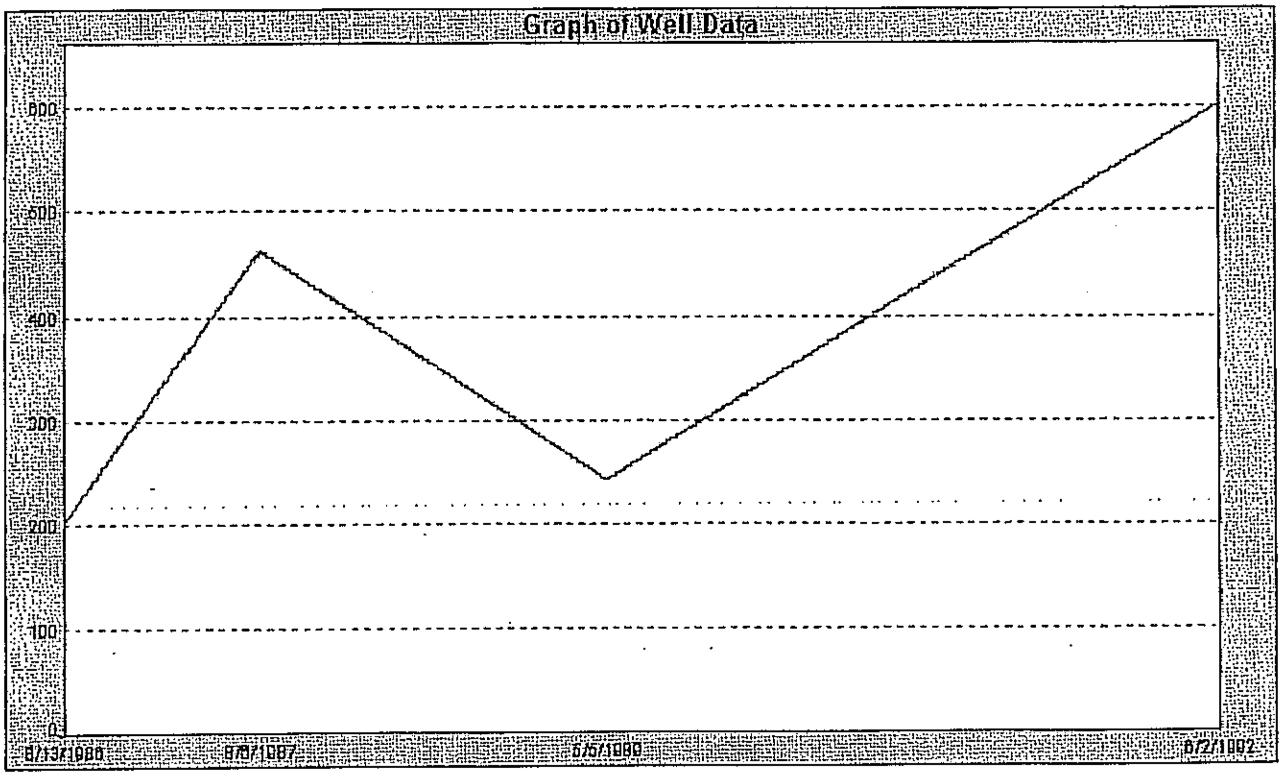
From Date: To Date: Graph Size Small Normalized Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Well Data Graph

DIABLO WATER DISTRICT (OAKLEY)
CONTRA COSTA CANAL-OAKLEY WTP-TRTD, ABND
State Well Number: 0710007-001

Well Details | Geographic Information | DHS Water Quality Data | PWS Detailed Information



Date	Parameter	Qualifier	Result	Units	MCL
6/2/1992	TOTAL DISSOLVED SOLIDS		600	mg/L	1500
5/5/1989	TOTAL DISSOLVED SOLIDS		240	mg/L	1500
8/6/1987	TOTAL DISSOLVED SOLIDS		460	mg/L	1500
8/13/1986	TOTAL DISSOLVED SOLIDS		199	mg/L	1500

From Date: **To Date:** **Graph Size** Small **Normalized** Redraw

Geotracker Home | Site/Facility Finder | Case Finder | MTBE/Case Reports

Preliminary Stormwater Management Plan for the Emerson Property, City of Oakley, California

Report prepared for:

Ponderosa Homes

Prepared by:

Hilary Ewing

Eric Riedner

Edward D. Ballman, P.E.

Balance Hydrologics, Inc.

October 2005

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1. INTRODUCTION

1.1 Purpose

This report presents the Preliminary Stormwater Management Plan (SWMP) for the proposed Emerson project in the City of Oakley, Contra Costa County, California.

Ponderosa Homes requested that Balance Hydrologics, Inc. prepare a preliminary SWMP at an early stage of the project planning process to help guide the design in a manner that directly addresses potential impacts related to hydrology and water quality. This plan will be refined during subsequent design stages to provide a high level of protection to the significant beneficial uses of the local Delta waters.

This SWMP is based on a review of specific conditions both on-site and downstream. The associated opportunities and constraints for stormwater management have been evaluated and combined with newly-revised regional water quality recommendations to guide the selection, design, construction and maintenance of stormwater infrastructure and Best Management Practices (BMPs) at the site.

1.2 Objectives of the Preliminary Stormwater Management Plan

Management strategies that are being pursued by a number of agencies, including the City of Oakley, the Contra Costa Clean Water Program (CCCWP) and the Central Valley Regional Water Quality Control Board (RWQCB) have recognized the importance of a watershed-based perspective in assessing and addressing potential impacts related to stormwater runoff. This implies that both the local and regional hydrologic context of each site will have a direct bearing on specific plans for development as well as the type and location of BMPs to be employed. The respective BMPs need to address issues related to stormwater quantity (for example peak flow rates and the potential for on- and off-site flooding), as well as the water quality of runoff discharged into the municipal storm drain system and, ultimately in this case, into the Sacramento/San Joaquin Delta.

These considerations framed the selection of specific objectives for the Preliminary SWMP, which include:

- assembling reference meteorological, geological and soils information needed to describe hydrologic conditions of the site, as well as previous studies related to the project;
- utilizing this information to identify opportunities and constraints for dealing with stormwater quantity and quality on the site;
- identifying and modeling stormwater management infrastructure to be included in the project design that mitigates for potential increases in peak discharge and safely discharges the runoff from all storms to the Delta over the surrounding levee system;
- developing a hierarchy of BMPs that reflect the standards and goals of the City of Oakley, the Contra Costa Clean Water Program, and the Central Valley Regional Water Quality Control Board with a special emphasis on providing a plan that is consistent with the recent requirements promulgated by the CCCWP and RWQCB regarding treatment requirements and avoiding impacts due to hydromodification;
- providing all pertinent regulatory agencies with reasonable certainty that appropriate measures adequate to address urban runoff impacts and to comply with regulatory requirements will be implemented;
- establishing systems that are self-maintaining and self-perpetuating to the greatest extent possible.

2. HYDROLOGIC SETTING

2.1 Geographic Description of the Emerson Property Site

The Emerson project site is located immediately to the north of Cypress Road and west of Sellers Avenue in the northeast of the City of Oakley, approximately 0.8 miles east of State Route 4 (Figure 1). The Contra Costa Canal, a major water supply canal for the Contra Costa Water District (CCWD) and Diablo Water District (DWD) borders the project to the north. The site comprises a portion of the Cypress Corridor planning area as identified in the Oakley 2020 General Plan (City of Oakley, 2002) and covers an area of approximately 142 acres, essentially all of which would be impacted by grading to construct the proposed project.

Currently the site consists of former agricultural lands that have been used for both dry-land and irrigated crop production. As such, the predominant land cover is fallow crop lands. The preliminary project plan would construct approximately 624 medium density residential units, a small 9.4 acre commercial area, and an associated neighborhood park space along with a central lake feature that plays an integral role in the stormwater management strategy.

The site is located near the Delta fringe just east of the mouth of Marsh Creek at Big Break and lies atop the distal portions of the large alluvial fan built up by the creek in eastern Contra Costa County. Therefore, the terrain is generally low-lying with a gentle slope to the northeast. The minimum elevation is approximately 3.2 feet (NGVD) along the northern edge of the property.

2.2 Climate Characteristics of the Site

The area encompassing Emerson Property is located in the Mediterranean climate zone typical of transitional areas between the coastal and interior climates of central California. This local climate is characterized by cool, relatively dry winters and hot, dry summers.

The lower elevation areas in eastern Contra Costa County lie within the rain shadow of the coastal mountain ranges that remove much of the moisture from incoming storm systems. In fact, the City of Oakley is located in one of the driest regions in the county and one of the driest regions in the State of California outside of the deserts. Mean seasonal rainfall maps prepared by Contra Costa County indicate that the mean seasonal rainfall at the site is on the order of

11.5 inches per year. This is markedly lower than areas in the western portion of the county that receive more than twice this annual average. Although the average rainfall is quite low, the site does experience the wide range in annual precipitation that accompany drought years and wet years such as those related to the El Niño Southern Oscillation (ENSO). Excellent long-term precipitation records are available for the Antioch Pumping Plant, located roughly 3.1 miles west of Emerson Property. The minimum annual precipitation recorded at the Antioch Pumping Plant was 5.6 inches (in Water Year 1976) and the maximum was 27.1 inches (in Water Year 1983).[1] Table 1 illustrates the monthly rainfall distribution based on the data from the Antioch Pumping Plant.

Annual temperature patterns are typical of interior areas of the state, although somewhat tempered by cooling breezes originating at sea and in the San Francisco Bay system. Evaporation rates are quite high in summer. In fact, evaporation rates exceed rainfall in all but the wettest winter months. Table 1 includes data that show mean annual pan evaporation is on the order of 71 inches, or over five times mean annual precipitation, based on the record from the Antioch Pumping Plant for the period from 1955 to 1978.

2.3 Soil Characteristics

The soil survey for Contra Costa County (Welch, 1977) identifies a total of four different soil types at the project site as shown in Figure 2. The hydrologic properties of these soils are summarized in Table 2.

The most widespread is the Sycamore silty clay loam (So), which underlies approximately 50 percent of the site. This soil is placed in hydrologic soil group C and is described as poorly drained, formed in alluvium from sedimentary rock on floodplains. The hydrologic soil groups range from A to D, with D having the highest runoff potential.

Approximately 20 percent of the site is underlain by Marcuse clay (Mb) which extends in a single plume from the south eastern edge of the site. This soil is described as consisting of very poorly drained soils that formed an alluvium from sedimentary rock. This soil type is categorized in hydrologic soil group D.

1 The water year runs from October to September and is a common reporting basis for rainfall in California. For example, water year 1976 ran from October 1975 through September 1976.

Delhi sand (DaC) covers approximately 19% of the project site and is described as somewhat excessively drained soils that formed in wind-modified stream deposit. The Delhi sands are the only hydrologic soil group A soils found at the project.

A small portion of the site, roughly 11 percent, is underlain by Piper loamy sand (Pe) soil type, described as consisting of poorly drained soils formed on low aeolian mounds and ridges that have become more prominent as the surrounding organic soils subsided. This soil is categorized in hydrologic soil group C.

2.4 Surface Water Drainage

2.4.1 Existing drainage patterns

The Emerson project site has historically been served by a conventional agricultural drainage system (see Figure 3). Storm water and irrigation return flows for the site are directed via a series of shallow ditches. The site is split into two main drainage areas – 52.9 acres flows into a ditch running from west to east on the northern perimeter and 88.6 acres flows into a separate ditch running from west to east through the middle of the property. Both of these main drainage ditches divert flow towards the north eastern corner of the site, with the point of discharge being via culverts to Emerson Slough.

The only other drainage area that needs to be considered in the description of existing conditions is the southern parcel of land across Cypress Road from the project site. This land is bordered by Cypress Road to the north, Sellers Avenue to the east, the Burlington Northern Santa Fe Railroad to the south, and the Cypress Grove project to the west. Runoff on this site drains towards its northeast corner, where it can collect during large storms in the broad shallow depression found there. Presently, the runoff from the southern area drains from this northeast depression, under Cypress Road, through an 18-inch storm drain, and is carried to Emerson Slough in a largely unmaintained open ditch, which runs along Sellers Avenue. It is important to note that no runoff from the south side area actually enters the proposed project site, but this extra drainage does depend on the roadside ditch along Seller's Avenue to reach Emerson Slough. In addition, the limited capacity of the 18-inch pipeline to drain the entire 184 acres of the south side area to the other side of Cypress Road can cause flooding in the northeast section. The depression located at this corner can pool during large storms until the water surface reaches the crown of Cypress Road to the north, where it can then spill over the road and flow into the drainage ditch leading to Emerson Slough. Therefore, large flood events

2.5 Floodplain Mapping and Levees

As shown in Figure 5, the site is not in a designated floodplain as mapped by the Federal Emergency Management Agency (FEMA, 2002). It is important to note that, with the exception of the dune areas, the entire site is currently protected from flooding by the levees that run along the Contra Costa Canal. The properties to the north of the Canal are presently mapped in Special Flood Hazard Area Zone A, indicating that they are subject to flooding during a 100-year event in the Delta. The base flood elevation from Delta flooding is shown as 7.0 feet.

Per FEMA and CCFCD regulations, areas lower than this elevation must be protected by levees with a minimum of 3.0 feet of freeboard above the base flood elevation, a level of protection that FEMA recognizes as presently provided by the Contra Costa Canal levees. However, CCWD is pursuing plans to underground all or part of the canal in the vicinity of the project and the District has indicated that the material in the levee may be needed as part of that project. In any case, the Emerson project site will be provided further protection by a new levee system that will be built along the east, west, north and south perimeters of the project to FEMA urban standard levee specifications. This new levee will tie into the higher grades of Cypress Road to the south.

2.6 Ground Water

A detailed description of the ground-water hydrology at the Emerson site is beyond the scope of this report. For a comprehensive analysis, see the report prepared by ENGEO, Inc.

However, a number of characteristics of the overall ground-water system underlying the area are important to bear in mind. Data prepared by CCWD shows that the project site overlies a regional aquifer that is characterized by flow to the north and east. Recharge of this aquifer from rainfall at the site is likely to be minimal given the very low mean annual precipitation at Emerson Property. Infiltration of irrigation water applied during the summer months represents a more important potential recharge source, but is expected to be relatively small compared to other recharge sources such as that from higher elevation areas on the Marsh Creek and Kellogg Creek alluvial fans. This, coupled with the overall low elevations within the area, explains, in large part, the presence of seasonally high ground-water levels at various locations within the site as observed by Balance staff during field visits and routinely documented by others. The maximum upper limit of the shallow ground-water table during wet periods is likely defined by the release point elevations of the system of drainage ditches that drain the site.

The majority of the wells used to supply groundwater for domestic uses in the Cypress Corridor area draw from relatively deep water-bearing layers. These wells are generally from 150 to 350 feet deep, although some shallower wells exist (County of Contra Costa, 1992).

Studies are being conducted by the Contra Costa Water District (CCWD) to investigate the potential impacts to shallow groundwater from development along the Contra Costa Canal. These studies are intended to identify and quantify the degree of connection between the unlined canal and the surrounding shallow ground-water system. Mean tide levels in the Canal (see Section 2.4.1) are such that water may seep into or out of the Canal, depending on the season and annual rainfall characteristics. This reflects the fact that the Canal is not lined and is directly connected to Rock Slough at its entrance further to the east. During the summer months, average water levels in the Canal are higher than the typical water table at Emerson Property. However, in mid to late winter, shallow ground-water elevations come nearly to the surface, at which point some seepage into the Canal is theoretically possible. Considerations related to potential impacts to the shallow ground-water system are an integral part of the stormwater management strategy at the site as described in Sections 4 and 5.

2.7 Regional Water-quality Context

The receiving waters for runoff from Emerson Property are located far enough upstream in the Delta that the surrounding channels are typically freshwater environments. Higher salinity water generally moves toward the Delta from San Francisco Bay once the higher runoff associated with the spring and early summer snowmelt has diminished. Incursions of high salinity water have occurred during prolonged dry periods, such as the severe drought of water years 1976 and 1977.

Detailed long-term water-quality monitoring data for the slough channels immediately adjacent to Emerson Property is limited in the range of constituents analyzed and time period covered, with the notable exception of Rock Slough where Contra Costa Water District regularly tests the raw water inflow to the Contra Costa Canal. However, no runoff will be discharged to Rock Slough from the project. One set of representative data for evaluating potential impacts to the local sloughs is that from the Regional Monitoring Program (RMP) carried out by the San Francisco Estuary Institute. The RMP has monitored a wide range of constituents throughout the estuary since its inception in 1993 and includes a monitoring station on the San Joaquin River just east of Antioch. Table 5 summarizes the long-term data from this site, which will be generally representative of expected conditions at the points where runoff from Emerson Property discharge to the sloughs. The data has been selected to include those monitoring events that occurred during the wet season, in this case November through April, as this is the period when stormwater runoff will occur.

The Central Valley Regional Water Quality Control Board (RWQCB) has established water-quality objectives for a number of trace elements and other constituents (RWQCB, 1998). Where applicable, these objectives have been included in Table 5. The RMP data show that the numerical objectives were met. Additional objectives exist in the western Delta for electrical conductivity, a measure of salinity, which influences fish and wildlife. However, the objectives vary with the amount of unregulated flow that would occur in the system (a measure of drought conditions).

3. REGULATORY SETTING

The California State Water Resources Control Board (SWRCB or State Board) and the nine Regional Water Quality Control Boards (RWQCB or Regional Board) have the authority in California to protect and enhance water quality, both through their designation as the lead agencies in implementing the Section 319 nonpoint source program of the federal Clean Water Act, and from the state's primary water-pollution control legislation, the Porter-Cologne Act. The RWQCB Region 5 office guides and regulates water quality in streams and aquifers of the Central Valley, Sacramento River and San Joaquin River Basins, through designation of beneficial uses, establishment of water-quality objectives, administration of the National Pollution Discharge Elimination System (NPDES) permit program for stormwater and construction site runoff, and 401 water-quality certification where development results in fill of jurisdictional wetlands or waters of the United States, under Section 404 of the Clean Water Act.

3.1 Central Valley Water Quality Control Plan

In addition to the NPDES permitting program, the RWQCB regulates water quality for the region in accordance with the Water Quality Control Plan or 'Basin Plan' (RWQCB, 1998). The Basin Plan presents the beneficial uses that the Regional Board has designated for local aquifers, streams, marshes, rivers and the Delta as well as the water-quality objectives and criteria that must be met to protect these uses. Multiple beneficial uses have been designated for the Sacramento-San Joaquin Delta, the receiving waters for runoff from Emerson Property. These are summarized in Table 4 and include municipal, domestic and agricultural supply, industrial process and service supply, contact and non-contact water recreation, warm and cold freshwater habitat and fish migration, warm water fish spawning, wildlife habitat, and navigation.

3.2 NPDES Municipal Stormwater Permit

The 1987 amendments to the Clean Water Act [Section 402(p)] provided for U.S. EPA regulation of several new categories of nonpoint pollution sources within the existing National Pollutant Discharge Elimination Program (NPDES). In Phase 1, NPDES permits were issued for urban runoff discharges from municipalities of over 100,000 people, from plants in industries recognized by the EPA as being likely sources of stormwater pollutants, and from construction activities that disturb more than 5 acres. Phase 2 implementation, effective March 10, 2003, extended NPDES urban runoff discharge permitting to cities of 50,000 to 100,000 people, and to construction sites that disturb between 1 and 5 acres. The EPA has delegated management of California's NPDES Municipal Separate Storm Sewer System (MS4) permit program to the State and Regional Boards.

Control of stormwater runoff is a major current focus of the Central Valley RWQCB. Urbanized counties and cities that implement a comprehensive control program for urban runoff management, meeting Regional Board standards, can apply to the RWQCB for a joint city-county NPDES permit. Upon acceptance, the authority to regulate storm runoff discharges from municipal storm drain systems is transferred to the permit holders, allowing them to more effectively integrate the storm-water control program with other nonpoint source control programs. The City of Oakley is covered under the Region 5 city-county MS4 permit issued June 16, 2000 to Contra Costa County (Christine Palisoc, RWQCB, personal communication).

The NPDES permit program for Contra Costa County is implemented by the Contra Costa Clean Water Program, an agency representing the County, its incorporated cities and the CCCFCD. Important new initiatives to meet the conditions of the NPDES permits have recently been summarized in the Stormwater C.3 Guidebook (CCCWP, 2005). This guidebook identifies appropriate BMPs and sets forth sizing criteria to be used for BMP implementation in the County.

3.3 NPDES General Permit for Construction Activities

Construction of the Emerson project will disturb more than one acre of land and will be required to submit a Notice of Intent (NOI) to the State Board and apply for coverage under the NPDES Construction General Permit. Administration of these permits has not been delegated to cities, counties, or Regional Boards but remains with the State Board. Enforcement of permit conditions, however, is the responsibility of Regional Board staff, assisted by local municipal or county staff. Once grading begins, the Stormwater Pollution Prevention Plan (SWPPP) must be kept on-site and updated as needed while construction progresses. The SWPPP details the site-specific BMPs to control erosion and sedimentation and maintain water quality during the construction phase. The SWPPP also contains a summary of the structural and non-structural BMPs to be implemented during the post-construction period, pursuant to the nonpoint source practices and procedures encouraged by the Contra Costa Clean Water Program and the Public

Works and Engineering Division of the Community Development Department of the City of Oakley.

3.4 General Plan Elements Related to Hydrology and Water Quality

A number of policies relating to hydrology and water quality have been included in the recently completed Oakley 2020 General Plan. It is important that the project comply with these elements for consistency with other areas of the City and to assure that the General Plan goals are achieved. The most important elements of the General Plan relating to drainage are identified in Appendix A.

4. STORMWATER MANAGEMENT OPPORTUNITIES AND CONSTRAINTS

4.1 Stormwater Management Constraints

The background information presented in Section 2 alluded to several of the most significant constraints with regard to stormwater management at the site. These include several important considerations, including:

- *Need to collect and pump stormwater runoff.* As described in Section 2.5, the entire project site is surrounded by levees that protect against flooding associated with large storms in the Central Valley and Sierra Nevada Mountains that occasionally result in high flood elevations in the Delta. The Flood Insurance Study for the City of Oakley (FEMA, 2002) identifies the base flood elevation as 7.0 feet in the adjacent Delta waters. The base flood elevation is such that local drainage systems will not be able to drain by gravity to the sloughs unless the surrounding ground elevations are well above 7.0 feet. This elevation is markedly higher than the existing ground elevations on roughly 100 acres of the site. Therefore, a gravity storm drain system cannot reliably convey stormwater to the Delta in all circumstances, and it will be necessary to pump stormwater runoff from the site over the levee system to Emerson Slough.

- *Seasonally high ground water levels and potential seepage to or away from the Contra Costa Canal.* The issue of seasonal ground-water levels was discussed briefly in Section 2.6. The potential for flow to or away from the Contra Costa Canal will need to be explicitly addressed in all site planning, and especially with respect to ground-water management. The seasonally high ground-water table will limit the use of infiltration-based BMPs unless they are underdrained, with a positive release to the storm drain system. Equally important, any stormwater storage (such as the proposed lake) will need to be physically separated from local shallow groundwater by liners or other appropriate means.

- *Need to capture south side drainage.* As mentioned in Section 2.4, the area immediately to the south of the Emerson Project has historically drained towards the shallow depression in its northeast corner. From there it has drained under Cypress Road and along Sellers Avenue to discharge finally into Emerson Slough. Because the Emerson Project will include regrading parts of both Cypress Road and Sellers Avenue, the south side drainage will need to be captured at its northeast corner in a new set of storm drain lines. Due to the low grade along Sellers Avenue, it is preferable to not install gravity drains the entire distance to Emerson Slough, but instead to take this drainage first to the Emerson lake where it will be pumped to Emerson Slough along with all of the project site runoff.

4.2 Stormwater Management Opportunities

The significant constraints outlined above are compensated by a number of distinct opportunities presented by the physical characteristics of the site. These opportunities should be exploited to the greatest extent possible in the selection and design of BMPs and include the following:

- *Relatively low rainfall totals and intensities.* The mean annual precipitation (MAP) at the site is roughly 11.5 inches as discussed previously. This is among the lowest MAP values found in Contra Costa County. This reflects the project's location at low elevations inland from ranges to the west. The volume of rainfall in individual storm events, as well as the peak rainfall intensities, will be substantially lower than other locations in the County. The net result is that less volume and lower flow rates will need to be accommodated to meet annual runoff treatment goals.
- *Gentle topography.* The gentle topography that characterizes the site is conducive to the use a number of BMPs. This is particularly true of micro-ponding/bioretention type structural BMPs that are discussed in detail in the Stormwater C.3. Guidebook

4.3 Preliminary Project Storm Drainage Plan

4.3.1 Drainage plan watershed boundaries

The hydrologic parameters associated with each sub-watershed for both pre-project and post-project conditions are summarized in Table 6. It is important to note that the project is part of a larger drainage area that is part of the City of Oakley's master drainage planning efforts. This larger area includes the approximately 184 acre watershed adjacent to Emerson Property, which extends out to the Burlington Northern Santa Fe Railroad tracks approximately one mile south of Cypress Road. While this drainage is included in the storm water plans for the Emerson site, it is assumed that when new development occurs at this large adjacent watershed the future landowners and developers will include a detention basin or its equivalent, so as not to overwhelm the Emerson system with new runoff.

4.3.2 Gravity-flow storm drain

The primary conveyance component of the system will consist of a conventional gravity-flow storm drain network that will collect stormwater runoff and convey it in underground pipes to the lake. Storm drain trunk lines will ultimately be connected to the northeast corner of the adjacent south of Cypress Road drainage via a new 48 inch storm drain.

4.3.3 Multi-purpose lake

The focal point of the stormwater management strategy is the central lake feature on the Emerson property. The physical characteristics of the proposed lake are summarized in Table 7 and a typical lake cross-section is illustrated in Figure 6. The lake is a multi-purpose feature that will provide water-quality and peak runoff control benefits, serve as an integral part of the commons-area irrigation system and provide aesthetic benefits to the project.

Several of the most important aspects of the pond design include the following:

1. Normal water surface elevation. The normal water surface elevation in the pond will be set at least 5.0 feet below the elevation of adjacent streets. For the purposes of the analyses in this report, the normal water surface was taken to be 2.0 feet NGVD, although other elevations would work equally well as long as there is at least 5.0 feet of separation to the lowest adjacent street level.[2]

2. Lake lining. The lake bottom will be lined to separate the stored water from the adjacent and/or underlying water table. This is a common practice in constructed lakes throughout California where separation from the water table is desired.

3. Grading considerations. The lake depth will be a minimum of 10.0 feet below the normal water surface elevation to enhance water quality and discourage the growth of emergent aquatic plants. The interior slopes will feature a safety bench at the lake edge just below the normal water surface. Exterior slopes adjacent to the lake will generally be graded at slopes no greater than 4:1.

4. Storage volume. The lake will be able to temporarily store water above its normal water surface. In fact, assuming a maximum allowable water surface elevation of 6.0 feet, the lake can provide up to 19.7 acre-feet of active storage volume. The lowermost part of this volume would be used to store and slowly release the runoff from the small to moderate storm events that generate 80 percent of the mean annual rainfall. The volume above this water-quality elevation is reserved to accommodate the runoff from large events up to and including the CCCFCD 100-year design storms.

5. Recovery of storage volume. Per Contra Costa County guidelines, the storage volume in the pond must be recovered (in this case by pumping) in a timely manner to provide storage for subsequent storms. The guidelines stipulate that the entire volume should be recovered within 48 hours of the peak storm runoff and 70 percent of that in the first 24 hours.

[2] NGVD refers to the National Geodetic Vertical Datum of 1929. All elevations refer to this datum unless otherwise noted.

6. Irrigation water storage. The lake will also serve as part of the irrigation system for commons areas in the project. This irrigation system will pump from the lake, thereby markedly improving turnover rates with associated benefits to maintaining a high level of water quality in the lake itself. This also makes it possible to use runoff water that is stored in the lake as additional irrigation supply under appropriate conditions.

4.3.4 Stormwater pump system and force main

The lake will be drained by a stormwater pump station equipped with reserve pumps and emergency power generation equipment, such that the pumps can operate through extreme events. The pumps will send the outflow from the lake to the ultimate outfall at the end of Emerson Slough through a storm drain force main. Important aspects of the pump system include:

1. Water-quality pump operation. The pump or pumps used to drain the water-quality volume will initially be programmed to discharge the treatment volume over a period of 48 hours. A preliminary estimate is that the required pumping rate will be roughly 1.4 cfs (540 gpm), commencing when the water level rises above the normal pond surface elevation of 2.0 feet and continuing until the normal pond water surface elevation is restored.

2. Stormwater pump operation. The pump system will feature much larger stormwater pumps to handle runoff from storms that push the water surface elevation above the normal water surface elevation. The total capacity of this pump (or pumps) will be 34 cfs (15,300 gpm), such that the combined discharge from the water-quality and stormwater pumps does not exceed 35 cfs (15,700 gpm) at the outfall. The stormwater pumps will be programmed to start at the water-quality elevation of 2.9 feet and will operate until that elevation is restored.

4.3.5 Storm drain outfall at Emerson Slough

The outfall location for the water pumped from the Emerson Property lake is located at the south end of Emerson Slough, just north of the Contra Costa Canal at the end of Sellers Avenue. The proposed outfall structure was discussed in detail in the Stormwater Management Plan for the Cypress Grove Project (Brulotte and others, 2004) and in the report, Anticipated Water Quality and Hydrologic Impacts of the Cypress Grove Project (Mallory and Ballman, 2003) that formed part of the essential fish habitat assessment work that was completed as part of the outfall permitting process.

The outfall structure was designed, analyzed for impacts and permitted as part of the previous Cypress Grove project. To minimize impacts over time, the outfall was designed with four pipe outlets: one for Cypress Grove, one for the Emerson project, one for drainage from areas south of Cypress Road, and one for the Emerson project. Therefore, there will be no new permitting required for the ultimate outfall from Emerson Property.

5. BEST MANAGEMENT PRACTICES AT THE EMERSON PROPERTY SITE

In light of the opportunities and constraints that exist at the project site, developing an effective BMP framework will require implementing a number of practices specific to the site conditions. The BMP framework will be based on a hierarchical approach advocated by stormwater quality regulators (e.g. see BASMAA, 1999 and CCCWP, 2005). The hierarchical approach has the following levels:

- Level I – Site Design. One of the key elements of the SWMP for the project will be incorporating appropriate site design elements that enhance efforts to limit water quality impacts. Properly implemented features in essence "set the stage" for an effective plan by establishing a land use pattern that limits the amount of directly connected impervious areas (DCIAs) to the greatest extent practicable.

- Level II – Source Control. Another of the primary focuses of this plan is a strong and broad-based source control program. This approach capitalizes on the fact that it is generally more effective, both in impact and cost, to prevent or limit constituents of concern from being released than it is to remove them from the environment once they have been mobilized (BASMAA, 1999).

- Level III – Treatment Controls. The term "treatment controls" refers to those BMPs that are designed to reduce constituents of concern once they have been mobilized in stormwater runoff. They are generally seen as a "last line of defense" in the overall suite of BMPs that are employed. Treatment controls are generally considered necessary BMPs since even the most aggressive site design and source control programs cannot guarantee that constituents of concern will not be mobilized from the site. In sites with low infiltration soils, such as at the Emerson site, treatment controls will be practically essential to mitigate for potential water-quality and peak flow impacts from development.

5.1 Site Design Elements

An often-cited goal of water-quality sensitive site design is to limit the amount of directly connected impervious area (DCIA), and this is particularly challenging in higher density project sites. In concept, limiting DCIA promotes infiltration (though modestly in areas with low permeability and potentially high ground-water elevations), increases times of concentration within sub-basins and reduces runoff volumes. Additionally, lower impervious area generally leads to increased amounts of space that can be dedicated to landscaping and open space uses that limit the introduction of pollutants to the environment and can filter out pollutants that already have been mobilized.

Specific site design features that will be included to the maximum extent practicable include the following:

- *Reduced street widths.* The project proposes to make use of private alleyways as an entrance point for some of the residences. These roads will average 20 feet in width and are much narrower than typical residential roads.

- *Designated open-space.* The proposed project includes several park areas that will reduce overall impervious area.

5.2 Source Control Elements

The source control program will incorporate a number of strategies:

- *Education and outreach.* The City of Oakley has several outreach strategies designed to engage residents in the need to control nonpoint source pollution. One proven tactic in this regard is the marking of storm drain inlets and collection points to indicate that runoff can directly impact receiving waters. At this site, such markings may be along the lines of "Drains to the Delta" or "Drains to Emerson Slough".

- *Regular street sweeping.* Regular street sweeping can have a significant impact on the control of such constituents of concern as trash and debris, particulates, and heavy metals. The City of Oakley coordinates a regular street sweeping program that will include the project area.

5.3 Guidelines for Treatment Control Elements

Treatment control is generally considered necessary as a final element in water-quality protection even when the use of approved site planning and source control BMPs is maximized. Pollutants typically found in urban runoff include household and lawn-care chemicals (insecticides, herbicides, fungicides and rodenticides), heavy metals (i.e., copper, lead, zinc, cadmium, mercury), oils and greases, nutrients (nitrogen and phosphorus), and coliform bacteria.

5.3.1 Basis of design for flow-based treatment controls

The CCCWP and RWQCB generally require that BMPs be implemented so as to reduce stormwater pollution to the maximum extent practical. In order to meet this goal, minimum hydraulic sizing design criteria are specified in the Stormwater C.3 Guidebook and these criteria represent the basis of design for the on-site treatment controls.

Flow-based treatment controls include bioretention areas, bioswales, and similar BMPs where the rate of runoff is the primary design criterion and not the total runoff volume (as would be the case with extended detention basins or wet ponds). The sizing criteria establishing design values for flow-based controls as set forth in the Stormwater C.3 Guidebook and as also included in the new NPDES permits are for:

1. 10% of the 50-year peak flow rate; or
2. the flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths; or
3. the flow of runoff resulting from a rain event equal to at least 0.2 inches per hour intensity.

The third standard is the one that will be applied to the sizing of the treatment control BMPs at the Emerson site.

5.3.2 Basis of design for volume-based treatment controls

The multi-purpose lake at the Emerson project will function as a volume-based treatment control providing additional treatment for runoff prior to leaving the site. Volume-based controls are those wherein the treatment volume is the primary design criterion. The lake will be sized to serve as an extended detention BMP for the entire contributing watershed (including the current watershed south of Cypress Road) and could therefore meet the C.3 criteria as a stand-alone treatment control.

The sizing calculations for deriving the appropriate water-quality treatment volume were taken directly from the Stormwater C.3 Guidebook and are summarized in Figure 7 based on a conservative estimate of the directly-connected impervious area in the contributing watershed. The required treatment volume is 4.7 acre-feet, corresponding to the lake filled to an elevation of 2.9 feet (0.9 feet above the assumed normal water surface of 2.0 feet). The lake would only fill to this elevation during moderately large storms or when a sustained series of storms resulted in more than 4.7 acre-feet of runoff in 48 hours.

5.4 Lake Management Considerations

In addition to its critical role in the stormwater management system, the proposed lake will be an important aesthetic element in the project. Regular care and maintenance will be essential to ensure that the lake will meet all of the design objectives and function as intended. The details of the required care and maintenance will be summarized in a separate Operations and Maintenance Manual (OMM) that will be compiled when the final lake design is developed. Several aspects related to lake management can be identified at a preliminary design stage and are discussed below.

5.4.1 Make-up water requirements

Although the lake will be lined, it will still lose volume during dry periods, primarily through evaporation during the hot summer months. During these periods, the lake will need make-up water to maintain its normal water surface elevation. Calculations of the required make-up volume on a monthly basis are included in Table 8. These calculations show that the lake will likely need make-up water from May into October during average years, with the most significant demand in the June and July, a period when the required make-up water will average approximately 3 acre-feet/month.

The most likely source of this make-up water will be ground water pumped by a well or wells located near the lake itself. This is consistent with the lake as a central element in the commons area irrigation system, which would also use the same ground-water source. However, it is important to note that the property has traditionally used surface water from the local sloughs as an irrigation source. Therefore, selective withdrawals of slough water could be used as make-up water as long as the quality of the water is consistent with overall lake maintenance goals as described below. If the surface water were withdrawn from the traditional location, there would not be any adverse impacts to the sloughs, since the peak need for make-up water would coincide with the traditional peak months of agricultural irrigation in the recent past.

As mentioned previously, using the lake as storage for the irrigation system can have a number of benefits. These include enhanced turnover rates for the lake water, which will reduce filtration and nutrient control needs. In fact, this system would take advantage of nutrients in the lake water that would act as low-level fertilizers when applied to landscape areas. Additionally, Table 8 shows that the lake will receive more water from runoff and direct rainfall in seven of twelve months than it loses in evaporation. During these months, the

6. STORMWATER MANAGEMENT AND HYDROMODIFICATION IMPACTS

An important aspect of the Emerson Property SWMP is the consideration of potential hydromodification impacts in framing the stormwater management strategy. Hydromodification is the term used to describe the suite of changes (with respect to pre-project conditions) in key hydrologic parameters that can result from all types of development. Examples include increases in peak storm discharges; shifts in the magnitude, duration and frequency of channel forming flows; increases or decreases in annual ground water recharge; and increases in annual runoff volume. The project has been designed to minimize and avoid potential off-site impacts from hydromodification, primarily by using the large volume of the lake to reduce peak discharge rates to Emerson Slough.

Urban development can alter the hydrology of watersheds in a number of significant ways depending on both the nature of the watershed and the development. Perhaps the most significant of these impacts results from increasing the area of low or zero infiltration capacity in the watershed, and by increasing the speed with which runoff is delivered to channels. Such land surface changes typically result in increased storm runoff volumes and peak flows (Rantz 1971). Urbanization can also cause temporary increases in sediment yields to channels (Wolman 1967), and, in some instances, a reduction in the length of stream channels available to convey the increased runoff and sediment loads (Dunne and Leopold 1978).

The changes associated with development within a watershed are particularly noticeable in less urbanized upper watershed areas where stormwater runoff is conveyed through natural channel systems. However, the situation at the Emerson Property is markedly different since the primary point of discharge for runoff from the site is the Emerson Slough channel. As mentioned previously, the design and permitting of the outfall at that location has already explicitly considered potential changes in velocity and duration of flow. Overall susceptibility to hydromodification impacts at the outfall were found to be low given the wide channel, low slough channel gradients, and the existing vegetative cover.

7. CONTROL OF PEAK STORMWATER DISCHARGE RATES

7.1 Hydrologic and Hydraulic Modeling

The modeling work focused on predicting the operation of the multi-purpose lake when subjected to Contra Costa County Flood Control District (CCCFCD) 100-year and 10-year design storms of various durations. Per standard practice in the County, the preliminary lake and pump station designs are based on the runoff hydrographs for the proposed project conditions using CCCFCD's Hydro-6 software. A full range of storm durations was modeled, since it was not clear which would be the most conservative with regard to sizing the infrastructure needed to regulate water surface elevations in the lake. Storm events with durations of 6-, 12-, 24- and 96-hours were evaluated. The depth-storage relationship for the pond was assumed from the lake surface area and surrounding side slopes of 4:1. The depth-storage relation for the pond is important since it sets how much runoff can be stored within the given water surface elevation targets. The depth-storage relationship for the preliminary lake configuration is shown in Figure 8.

The input data were used to construct a hydrologic model of the pond using the U.S. Army Corps of Engineers' HEC-HMS software platform. This is a standard hydrologic routing program that includes the hydrographs produced by CCCFCD and allows for various pump station configurations to be tested.

7.2 Modeling Assumptions

As with all hydrologic modeling, a number of assumptions were needed to approximate the actual physical conditions that would prevail at the site. These include the following:

1. <u>Beginning water surface elevation</u>. It was assumed that the beginning water surface elevation in the lake will be 2.0 feet NGVD.

2. <u>Water-quality volume and corresponding elevation</u>. The required water-quality treatment volume was assumed to be 4.7 acre-feet per the calculations presented in Section 5.2. If the normal water surface elevation is set at 2.0 feet NGVD, the water-quality volume is achieved when the pond level rises to 2.9 feet NGVD.

3. Water-quality pump operation. As discussed previously, the water-quality volume will need to be drawn down over 48 hours using an auxiliary pump or a variable speed drive on the large stormwater pump system. The routing calculations include pumping of the water-quality volume during the design storm at the rate of 1.2 cfs (540 gpm), commencing when the pond rises above the normal lake water surface elevation of 2.0 feet and continuing until the normal water surface elevation is achieved again.

4. Stormwater pump operation. It was assumed that stormwater will be removed from the lake with a pump station that ultimately discharges to Emerson Slough outfall. The pump system to control the lake water level during storm events was assumed to activate just above the water-quality elevation of 2.9 feet NGVD.

5. Maximum water surface elevation. The maximum allowable water surface was assumed to be 5.9 feet NGVD for the 100-year storms and 3.7 feet for the 10-year storms.

6. Output hydrograph. Unlike stormwater detention features that are designed to attenuate flow peaks and most often have some type of gravity outfall (e.g. weir, orifice, etc.); the outflow from the pond will be entirely controlled by the stormwater pump system. It was assumed that the pump system would discharge at a constant rate once it activates. Therefore, the output hydrograph will be a constant line at the pump capacity. This assumption will be conservative as long as the pump system is sized to provide the design discharge subject to the maximum lift (e.g. the maximum differential between pond level and the water surface in Emerson Slough).

7.3 Results of the Hydrologic and Hydraulic Modeling

The modeling for the 100-year storms is presented in Appendix B, while that for the 10-year storms is included as Appendix C. Table 9 summarizes the predicted discharge values at selected points of concentration, both for pre-project and for post-project conditions. Table 10 presents the maximum predicted lake water surface elevations for the various design storms given the recommended pumping capacity of 35 cfs.

Other important observations from the modeling include:

1. Controlling criterion. The design criterion that is ultimately the most restrictive is the need to hold the maximum pumping rate to 35 cfs or less. In all cases, the lake drawdown criteria will be met if the pump is sized at this capacity.

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TABLES

Table 1. Mean monthly rainfall and evaporation (1956 - 2003) at the Antioch Pumping Plant, Contra Costa County

Month	Precipitation *(inches)*	Pan Evaporation *(inches)*
October	0.67	4.91
November	1.68	2.07
December	1.93	1.21
January	2.76	1.17
February	2.37	1.99
March	1.94	4.25
April	0.87	6.27
May	0.38	8.96
June	0.10	10.84
July	0.02	11.60
August	0.05	10.06
September	0.22	7.77
Mean	**12.91** Water Year Basis	**70.99**

Notes:

This gage is located at latitude N37°59' and longitude W121°44', approximatley 3.1 miles west of Emerson Property. These values are presented to illustrate the relative monthly distribution of total rainfall and evaporation. Rainfall at Emerson Property is expected to be somewhat less, averaging approximately 11.5 inches on an annual basis.

Values for precipitation are from the record for the period from March 1955 to December 2003 with several months missing data.

Values for pan evaporation are for the period from March 1955 to July 1978 with several months missing data.

Table 2. Recharge and water-holding properties of surficial soils, the Emerson Property, City of Oakley, California

Map Symbol	Soil Series[2]	Hydrologic Soil Group[3]	Erodibility	Depth Zone	USCS[4]	Atterberg Limits		Permeability	Available Water Capacity[5]		Reaction	Parent Materials
						Liquid	Plastic		Per Inch	Profile		
				(in)				(in/hr)	(in./in. of soil)	(total, in)	(pH)	
DaC	Delhi Sand 2 to 9 percent slopes	A	slight	0-60	SP or SM	NP	NP	6.0-20	0.05-0.06	3.3	6.1-7.8	Wind-modified stream deposits of mixed origin
Mb	Marcuse Clay < 2 percent slopes	D	none	0-60	CL	40-50	25-35	0.06-0.2	0.08-0.12	6.0	7.9-9.0	Alluvium from sedimentary sources.
Pe	Piper Loamy Sand 0 to 2 percent slopes	C	slight	0-60	SM	NP	NP	6.0-20	0.05-0.07	3.6	6.1-8.4	Low eolian mounds and ridges
So	Sycamore Silty Clay Loam 0 to 2 percent slopes	C	slight	0-66	ML or CL	30-40	5-15	0.2-0.6	0.15-0.18	10.9	6.6-8.4	Alluvium from sedimentary sources.

Notes:
1. Information taken from the most-recent USDA soil survey for the area
2. This soil survey generally does not distinguish areas smaller than about 20 to 40 acres, so that wetlands, alluvium, or swale fills smaller than 10 to 20 acres are not mapped.
3. A measure of runoff rates during major storms and full saturation. Group D has the most rapid runoff, with least infiltration.
4. USCS = Unified Soils Classification System, commonly used in geotechnical or soil-foundation investigations, and in routine engineering geologic logging
5. Available water capacity is the held water available for use by most plants, usually defined as the difference between the amount of soil water at field capacity (inch/inch) (one day of drainage after a rain or recharge event) and the amount at the wilting point.

Table 3. Tidal datum information for NOAA gages in the vicinity of Emerson Property, City of Oakley

all values in feet, NGVD

Tidal Datum	Dutch Slough at Jersey Island	San Joaquin River at Antioch
Mean higher high water (MHHW)	3.22	3.52
Mean high water (MHW)	2.77	3.06
Mean tide level (MTL)	1.54	1.64
Mean low water (MLW)	0.30	0.23
Mean lower low water (MLLW)	-0.22	-0.35

Notes:

Data from NOAA PORTS tide information web page tidal benchmark sheets, updated for the most recent tidal epoch (1983-2001). Dutch Slough at Jersey Island station id 9415053, San Joaquin River at Antioch station id 9415064.

Table 4. Beneficial uses of receiving waters in the vicinity of the Emerson Property, City of Oakley, California

	Sacramento San Joaquin Delta
Municipal and Domestic Supply (MUN)	E
Agricultural Supply (AGR)	E
Industrial Process Supply (PROC)	E
Industrial Service Supply (IND)	E
Hydropower Generation (POW)	
Water Contact Recreation (REC-1)	E
Non-contact Water Recreation (REC-2)	E
Warm Freshwater Habitat (WARM)	E
Cold Freshwater Habitat (COLD)	E
Fish Migration (MIGR)	E
Fish Spawning - warm (SPWN)	E
Fish Spawning - cold (SPWN)	
Wildlife Habitat (WILD)	E
Navigation (NAV)	E

Notes:

E indicates an identified existing beneficial use and P indicates an identified potential beneficial use.
Information taken from the Central Valley Region, Sacramento River and San Joaquin River Basins (Region 5) Water Quality Control Plan (RWQCB, 1998).

Table 5. Existing water quality during the wet season in the San Joaquin River at Antioch, basin objectives and typical urban runoff

		Regional Monitoring Program[1]			Basin Plan WQ Objective[2]	Typical Urban Runoff[3]
Constituent	Units	Mean	Maximum	Minimum	(Minimum concentration)	(Median Urban Site)
Nitrate	(mg/L)	0.43	0.70	0.22	—	0.68 (NO_{2+3} - N)
Nitrite	(mg/L)	0.02	0.19	0.01	—	—
Phosphate	(mg/L)	0.08	0.17	0.04	—	—
TSS	(mg/L)	29.14	70.00	11.10	—	100
Total Cd	(μg/L)	0.02	0.03	0.01	—	—
Dissolved Cd	(μg/L)	0.01	0.02	0.01	—	—
Total Cr	(μg/L)	8.20	51.15	1.50	—	—
Dissolved Cr	(μg/L)	0.65	2.22	0.14	—	—
Total Cu	(μg/L)	3.44	5.31	2.10	—	34
Dissolved Cu	(μg/L)	1.95	2.94	1.20	10	—
Total Ni	(μg/L)	3.82	6.52	1.80	—	—
Dissolved Ni	(μg/L)	1.54	2.76	0.90	—	—
Total Zn	(μg/L)	4.49	7.60	2.00	—	160
Dissolved Zn	(μg/L)	1.14	3.40	0.36	100	—
Dissolved Oxygen	(mg/L)	9.4	11.2	8.4	5.0	—
Hardness	(mg/L)	95.2	170.0	43.0	—	—
Conductivity	(μmho)	368	1290	110	—	—

Notes:
[1] Regional Monitoring Program (RMP) data from San Francisco Estuary Institute website, www.sfei.org/rmp.
[2] Water Quality Control Plan, Central Valley Region, Sacramento River and San Joaquin Basins, 1998.
[3] Urban Runoff Quality Management, Water Environment Federation, ASCE, 1998.

Table 6. Existing and post-project hydrologic properites of sub-watersheds at Emerson Property, City of Oakley, California

	Mean seasonal rainfall (in) (in)	Lag-time (hr)	Infiltration rate (in/hr)	Hydro N· value	Area (ac)	Channel length (mi)	Channel length from centroid (mi)	Change in elevation (ft)
Existing Conditions								
Emerson Ranch project site	11.5	0.78	0.18	0.070	142	0.76	0.51	7
Drainage South of Cypress Road	11.5	0.74	0.18	0.072	184	0.85	0.48	12
Post-project Conditions								
Emerson Ranch project site	11.5	0.21	0.069	0.050	142	0.4	0.13	11
Drainage South of Cypress Road				No Change				

Table 7. Preliminary hydrologic properties of proposed lake at the Emerson Property, City of Oakley, California

Water Surface Elevation (feet)	Surface Area (ft^2)	Surface Area (acre)	Storage Volume (ft^3)	Storage Volume (ac-ft)
-8	129717	3.0	0	0.0
-7	136792	3.1	133255	3.1
-6	143867	3.3	273584	6.3
-5	150942	3.5	420988	9.7
-4	158016	3.6	575467	13.2
-3	165091	3.8	737021	16.9
-2	172166	4.0	905649	20.8
-1	179240	4.1	1081352	24.8
0	186315	4.3	1264130	29.0
1	193390	4.4	1453982	33.4
2	200515	4.6	1650934	37.9
3	207489	4.8	1854936	42.6
4	214564	4.9	2065963	47.4
5	221739	5.1	2284114	52.4

Table 8. Predicted make-up water requirements for the proposed lake at the Emerson Property

Month	Pan Evaporation (inches)	Lake Evaporation (inches)	Precipitation (inches)	Estimated Runoff (inches)	Runoff to Lake (inches)	Make-up Requirement (inches)	Make-up Requirement (acre-feet)
October	4.9	3.4	0.6	0.1	5.1	-1.7	-0.65
November	2.1	1.4	1.5	0.5	18.3	-16.8	-6.46
December	1.2	0.8	1.6	0.6	26.0	-25.2	-9.65
January	1.2	0.8	2.5	1.0	39.8	-39.0	-14.96
February	2.0	1.4	2.2	0.9	35.1	-33.7	-12.93
March	4.3	3.0	1.7	0.7	28.3	-25.3	-9.71
April	6.3	4.4	0.8	0.2	9.5	-5.1	-1.96
May	9.0	6.3	0.3	0.1	2.8	3.5	1.34
June	10.8	7.6	0.1	0.0	0.0	7.6	2.91
July	11.6	8.1	0.0	0.0	0.0	$\boxed{8.1}$	3.11
August	10.1	7.0	0.0	0.0	0.0	7.0	2.70
September	7.8	5.4	0.2	0.0	0.8	4.6	1.77
Total	**71.0**	**49.8**	**11.5**	**4.1**	**165.8**		

Notes:

Pan evaporation and precipitation data per Table 1, with rainfall adjusted to the expected mean value at the site and lake evaporation taken as 70 percent of pan evaporation. The overall runoff volume coefficient varies by month from a low of 0.0 to a high of 0.4 in mid-winter. The assumed watershed to lake surface area ratio = 187 / 4.6 = 40.7. Negative values for the make-up requirement represent net discharge from the lake.

The maximum predicted make-up water demand is 8.1 inches in the month of July and make-up water will likely be needed from May into October in an average year.

Table 9. **Summary of predicted peak discharge values at selected points of concentration, Emerson Property, City of Oakley, California**

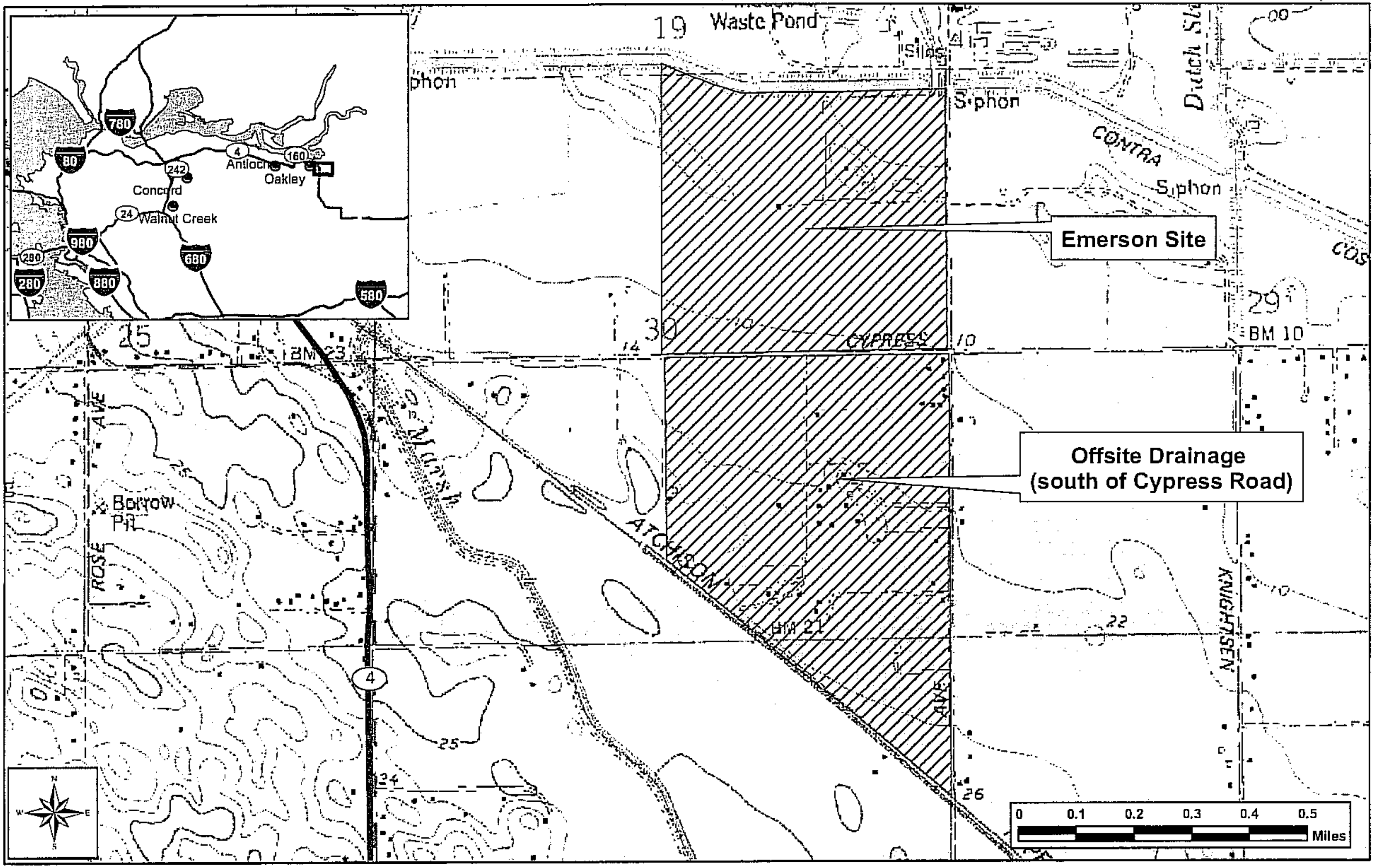
Design Storm	Existing Conditions Flow *(cfs)*			Post-development Conditions Flow *(cfs)*		
	Emerson Project site	South side of Cypress Road	Flow to Dutch Slough	Emerson Project site	South side of Cypress Road	Flow to Dutch Slough
10-year Storms						
10-year, 3-hour	38	54	**92**	110	54	**35**
10-year, 6-hour	18	31	49	97	31	**35**
10-year, 12-hour	20	29	**49**	96	29	**35**
10-year, 24-hour	15	22	**37**	78	22	**35**
10-year, 96-hour	1	1	**2**	31	1	**32**
100-year Storms						
100-year, 3-hour	77	105	**182**	165	105	**35**
100-year, 6-hour	69	95	**164**	150	95	**35**
100-year, 12-hour	65	86	**151**	155	86	**35**
100-year, 24-hour	51	70	**121**	130	70	**35**
100-year, 96-hour	22	31	**53**	52	31	**35**

Table 10. Maximum predicted lake water surface elevations for various design storms, Emerson Property, City of Oakley

	Design Storm	**Maximum Water Surface** *(feet)*
10-year Storms		
	3-hour	3.58
	6-hour	3.67
	12-hour	**3.69**
	24-hour	3.50
	96-hour	2.92
100-year Storms		
	3-hour	5.45
	6-hour	5.55
	12-hour	**5.89**
	24-hour	5.53
	96-hour	3.67

Notes:
All values based on the respective Contra Costa County Flood Control design storms. The maximum 10-year water surface elevation is associated with the 12-hour storm, while the maximum predicted 100-year level is found for the 12-hour storm.

FIGURES

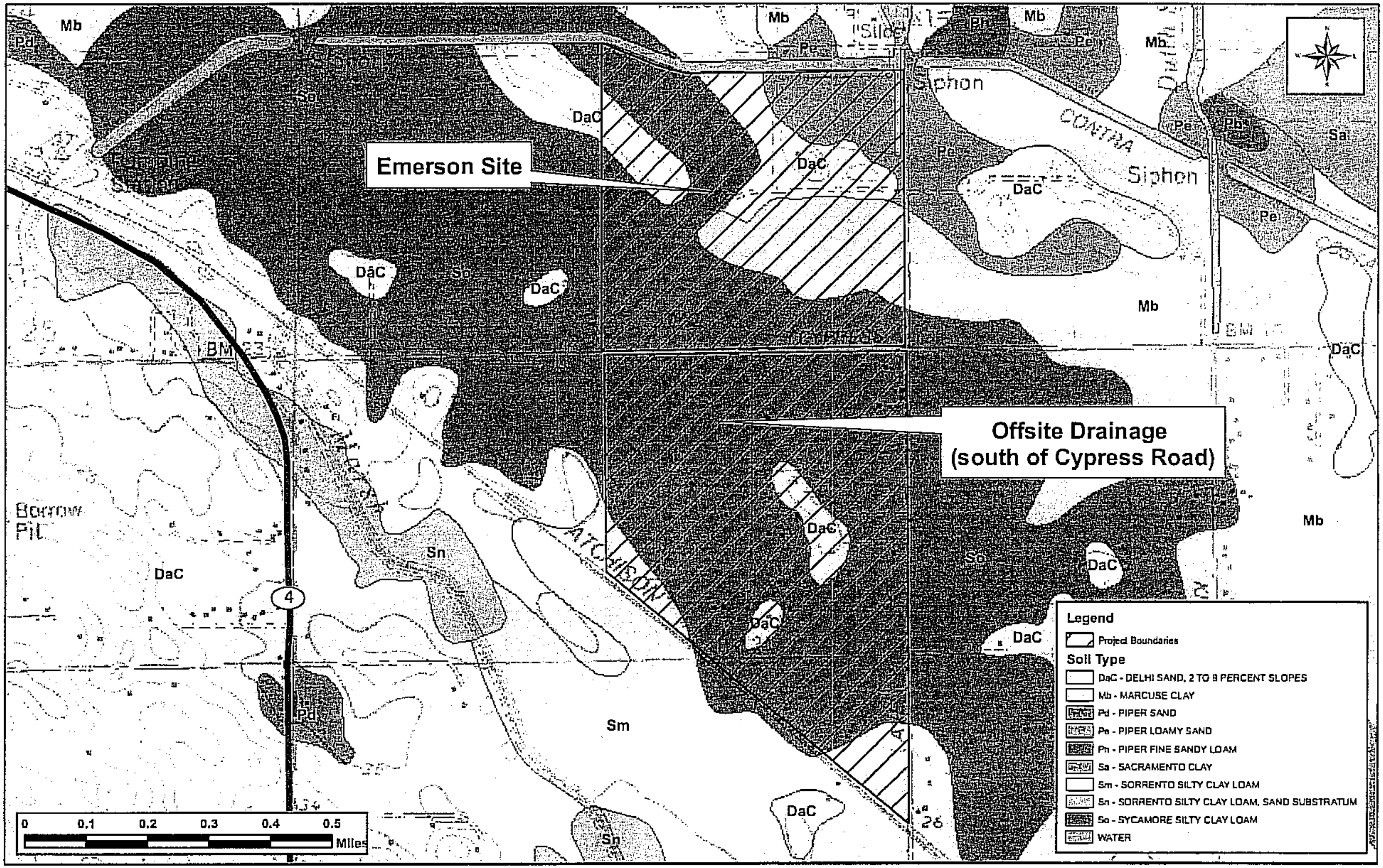


Source: USGS TerraServer DRG, 1989

Balance Hydrologics, Inc.

Figure 1. Location map, Emerson Property
City of Oakley, Contra Costa County, California

W:\Projects\204126 Emerson Property SWMP\Emerson Location Map.mxd

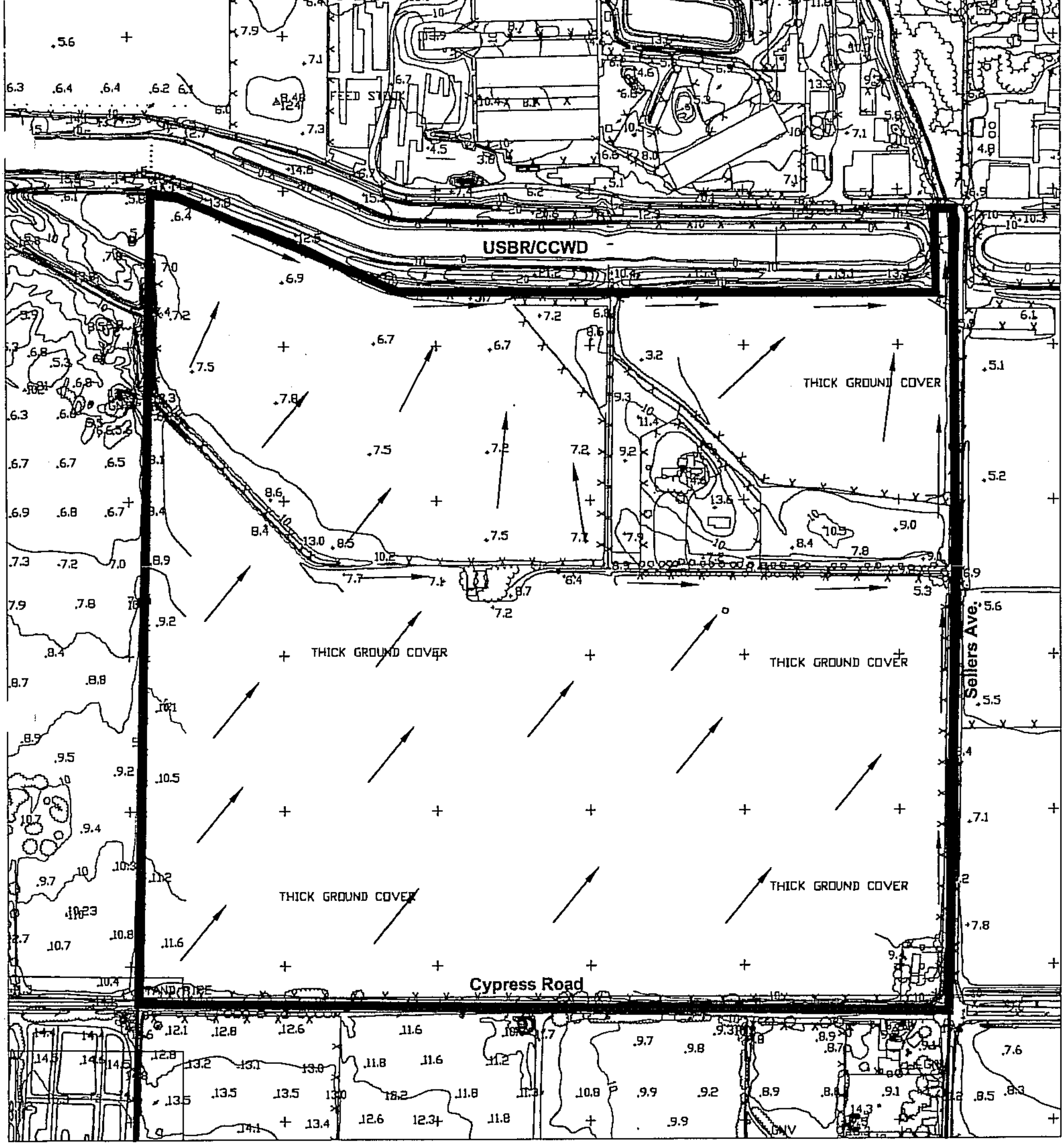


Source data: U.S.Department of Agriculture, Natural Resources Conservation Service, 2004, Soil Survey Geographic database for Contra Costa County, California.

Balance Hydrologics, Inc.

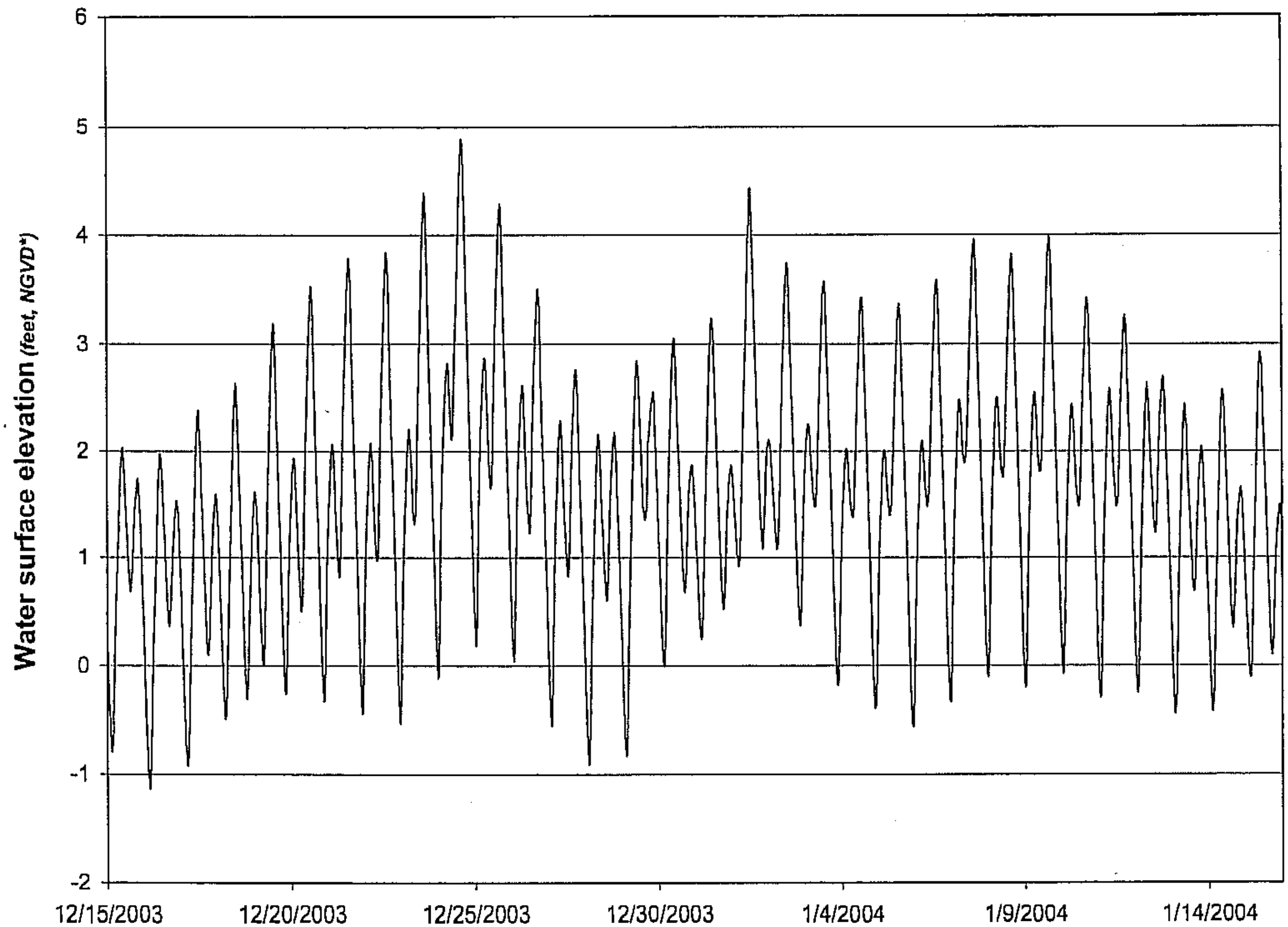
Figure 2. Soils map, Emerson Property
City of Oakley, Contra Costa County, California

W:\Projects\204128 Emerson Property SWMP\Emerson Soil Map_May20.mxd



Balance Hydrologics, Inc.

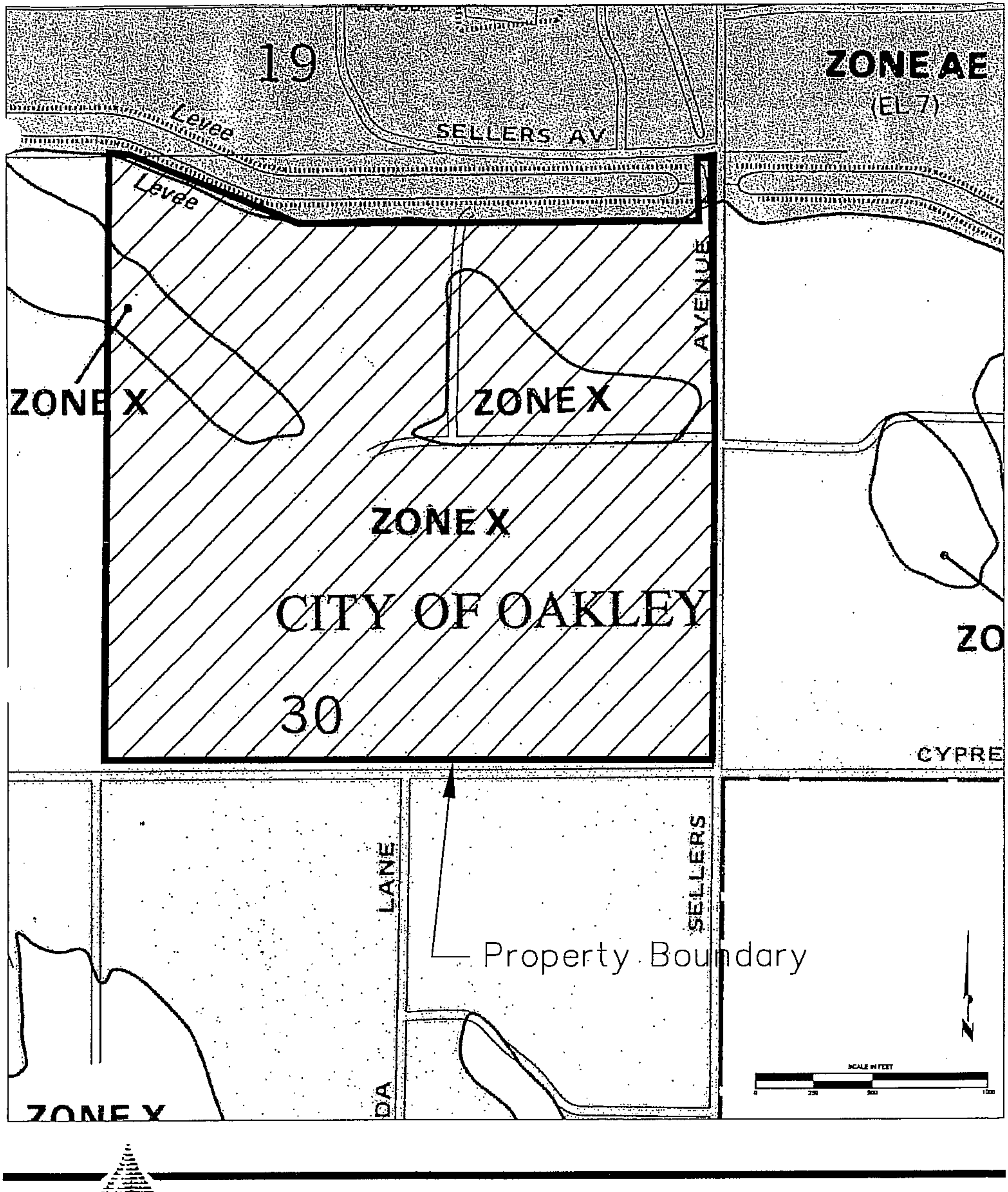
Figure 3. Existing drainage pathways at Emerson Property, City of Oakley, California



Balance Hydrologics, Inc.

Figure 4. **Water surface elevation on Dutch Slough at Jersey Island Bridge December 15, 2003 through January 15, 2004**

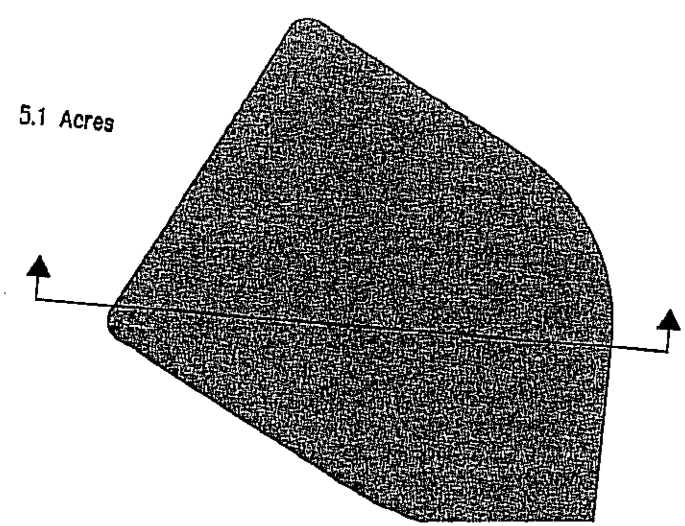
Note: California Data Exchange Computer System (CDEC) - gage DSJ, USGS gage 11313433
*Published stage adjusted by -10.2 feet



Balance Hydrologics, Inc.

Figure 5. FEMA floodplain mapping in the vicinity of Emerson Property, City of Oakley, California

PLAN VIEW OF POND



APPENDIX A
City of Oakley General Plan Elements Related to Hydrology and Water Quality

The following elements that pertain to hydrology and water quality issues in the Specific Plan area are taken from the Oakley 2002 General Plan.

There are a number of items in the Growth Management Element that apply. Selected portions of the Water Services section are pertinent, as follows:

Goal 4.8 Assure the provision of potable water availability in quantities sufficient to serve existing and future residents.

Policies

4.8.14 All proposals for development, including requests for building permits, within 1,000feet of the Contra Costa Canal property line shall be referred to Contra Costa Water District for comment to ascertain the District's standards for the proposed development project.

Programs

4.8.C Cooperate with other regulatory agencies to control point and non-point water pollution sources to protect adopted beneficial uses of water.

The entire Drainage section potentially applies, with the items highlighted below having particular relevance to the East Cypress area.

Goal 4.10 Protect persons and property from the damaging impacts of flooding.

Policies

4.10.1 Work cooperatively with Contra Costa County Flood Control and Water Conservation District (CFCWCD) to ensure and enhance flood protection in the City of Oakley.

4.10.2 Pursue and achieve compliance with all regional, State, and Federal regulations related to flood control, drainage, and water quality.

4.10.3 Recognize the unique flooding constraints of the areas north and east of the Contra Costa Canal.

4.10.4 Pursue responsible and adequate financing for implementation of the Drainage Plan.

4.10.5 Improve and expand the functionality of Marsh Creek as a major drainage corridor.

4.10.6 Develop new drainage facilities and/or improvements to existing facilities to provide additional recreational or environmental benefit, where possible.

4.10.7 Land use planning and zoning should be the primary means for flood management in preference to structural improvements, where possible.

4.10.8 Detention basins should be designed for multiple uses such as parks and playing fields when not used for holding water, where possible.

4.10.9 Detention basin design shall ensure that water entering the basin outflows completely within a specified time, thus minimizing standing water or long-term saturation within the basin.

4.10.10 In conjunction with Contra Costa County Flood Control and Water Conservation District (CFCWCD), develop and approve a Drainage Master Plan in the Cypress Corridor Area and the Cypress Corridor Expansion Area.

4.10.11 Develop open bypass channels, detention basins, and all drainage facility rights of way as an asset to the development of adjacent neighborhoods, e.g. as a secondary recreation use.

4.10.12 In conjunction with CFCWCD, develop flood control plans and identify discharge points for unincorporated areas annexed by the City of Oakley. Ensure that flood control implementation and maintenance are performed.

Programs

4.10.A Implement and update, as necessary, the Contra Costa County Drainage Plan for formed drainage areas within the City of Oakley.

4.10.B Actively participate in the Joint Municipal National Pollutant Discharge Elimination System (NPDES) program with the City of Antioch, City of Brentwood and East Contra Costa County.

4.10.C Pursue improvement of existing levees within the City and, as appropriate, compliance and certification from the United States Army Corps of Engineers.

4.10.D Develop and adopt a Specific Drainage Plan for areas north and east of the BNSF Railroad, which includes the Cypress Corridor Area and the Cypress Corridor Expansion Area.

4.10.E Adopt and update, as necessary, development fees for drainage improvements for all new development in the City.

4.10.F Pursue funding from public agencies and other grant sources to plan, design, and implement flood control improvements.

4.10.G Require, upon development, the dedication of property or drainage easement adjacent to Marsh Creek to be used to increase width and capacity of the stream corridor.

4.10.H Coordinate a study of Marsh Creek to determine appropriate strategies for improving, expanding and managing the stream corridor to enhance aesthetic, biological and recreational qualities, as well as providing drainage and flood control.

4.10.I For areas of proposed development that are not within an existing formed drainage area, require that Drainage Master Plans be prepared that include: detailed hydrologic modeling that considers land use, existing facilities, soil, and topographic data; descriptions of proposed flood control facilities; compliance with waste discharge requirements; cost estimates and construction schedule; and identification of which agency is responsible for facility design and construction, Clean Water Program compliance, and facility maintenance.

Several of the items in the Health and Safety Element are directly applicable, with the Flood Hazard section being most pertinent.

Goal 8.2 Protect public safety and minimize the risk of life and property from flooding.

Policies

8.2.1 Applications or development at urban or suburban densities in 100-year floodplain areas where there is a serious risk to life and property shall demonstrate appropriate solutions or be denied.

8.2.2 In mainland areas along the creeks and bays affected by water backing up into the watercourse, it shall be demonstrated prior to development that adequate protection exists through levee protection or change of elevation.

Flooding

8.2.3 Buildings in urban development near the shoreline of the Delta and in flood-prone areas shall be protected from flood dangers, including consideration of rising sea levels.

8.2.4 Habitable areas of structures near the shoreline of the Delta and in flood-prone areas shall be sited above the highest water level expected during the life of the project, or shall be protected for the expected life of the project by levees of an adequate design.

8.2.5 Rights-of-way for levees protecting inland areas from tidal flooding shall be sufficiently wide on the upland side to allow for future levee widening to support additional levee height.

8.2.6 Review flooding policies in the General Plan every five years in order to incorporate any new scientific findings regarding the potential for flooding and projected increases in sea levels.

8.2.7 Review flooding policies as they relate to properties designated by FEMA as within the 100-year floodplains.

8.2.8 Development proposals near the shoreline of the Delta and within flood-prone areas shall be reviewed by the Flood Control District, as an advisory agency, prior to approval by the City.

Subsidence

8.2.9 Development of lands subject to subsidence shall take into account and fully mitigate the potential impacts of flooding based on the best currently available techniques.

8.2.10 Any development approvals for areas subject to subsidence shall include conditions that account for the need to support Delta reclamation and irrigation districts, and to strengthen weak and low levees prior to development.

8.2.11 The pumping of substantial quantities of water, oil, and gas in an area protected by levees is inconsistent with new major development approvals.

Levee, Dam Failure, or Tsunami

8.2.12 In order to protect lives and property, intensive urban and suburban development shall not be permitted in reclaimed areas subject to 100-year flooding, unless flood protection in such areas is constructed. Typically, levees shall meet the standards of the U.S. Army Corps of Engineers, although 'Dry levees' that supplement existing levees may be allowed at the discretion of the City.

Programs

8.2.A Encourage the County Flood Control District to proceed with drainage improvements in areas subject to flooding from inadequate County flood control facilities.

8.2.B Draft and adopt a city drainage master plan to address localized areas affected by creeks, in accordance with the guidelines contained in the Health and Safety Element and the Open Space and Conservation Element of this General Plan.

8.2.C Establish a uniform set of flood damage prevention standards in cooperation with appropriate County, State, and federal agencies.

8.2.D Through the environmental review process, ensure that potential flooding impacts, due to new development, including on-site and downstream flood damage, subsidence, dam or levee failure, and potential inundation from tsunamis and seiches, are adequately addressed. Impose appropriate mitigation measures (e.g. flood proofing, levee protection, Delta reclamations, etc.).

8.2.E Participate in Delta levee rehabilitation plans in cooperation with County, State, federal agencies, and the private sector.

8.2.F Prohibit new structures that would restrict maintenance or future efforts to increase the height of the levees from being constructed on top of or immediately adjacent to the levees.

8.2.G All analysis of levee safety shall include consideration of the worse case situations of high tides coupled with storm-driven waves.

APPENDIX B

100-year Hydrologic/hydraulic model output for post-project conditions, Emerson Property, City of Oakley, California

Table B1. Summary of results for the 100-year, 3-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 13

Start of Run	: 01Jan05 0000	Basin Model	: Post Emerson
End of Run	: 01Jan05 0900	Met. Model	: Met 1
Execution Time	: 03Jun05 1305	Control Specs	: Emerson 3

Computed Results

Peak Inflow	: 225.00 (cfs)	Date/Time of Peak Inflow	: 01 Jan 05 0230
Peak Outflow	: 35.000 (cfs)	Date/Time of Peak Outflow	: 01 Jan 05 0200
Total Inflow	: (in)	Peak Storage	: 45.111(ac-ft)
Total Outflow	: (in)	Peak Elevation	: 10.453(ft)

Table B2. Table of results for the 100-year, 3-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 13

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 01Jan05 0900 Met. Model : Met 1

Execution Time : 03Jun05 1305 Control Specs : Emerson 3

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.460	2.550	1.180
01 Jan 05	0015	30.424	7.465	2.550	1.571
01 Jan 05	0030	30.442	7.469	2.550	1.850
01 Jan 05	0045	30.454	7.472	2.550	2.050
01 Jan 05	0100	30.463	7.474	2.550	2.193
01 Jan 05	0115	30.823	7.553	42.440	7.984
01 Jan 05	0130	31.402	7.680	39.000	17.323
01 Jan 05	0145	31.902	7.789	52.000	25.362
01 Jan 05	0200	32.704	7.961	86.000	35.000
01 Jan 05	0215	34.057	8.236	115.000	35.000
01 Jan 05	0230	36.846	8.805	225.000	35.000
1 Jan 05	0245	40.472	9.534	196.000	35.000
01 Jan 05	0300	43.044	10.048	123.000	35.000
01 Jan 05	0315	44.367	10.307	75.000	35.000
01 Jan 05	0330	44.945	10.421	51.000	35.000
01 Jan 05	0345	45.111	10.453	35.000	35.000
01 Jan 05	0400	44.997	10.431	24.000	35.000
01 Jan 05	0415	44.719	10.376	19.110	35.000
01 Jan 05	0430	44.348	10.304	15.000	35.000
01 Jan 05	0445	43.915	10.219	13.000	35.000
01 Jan 05	0500	43.439	10.125	11.000	35.000
01 Jan 05	0515	42.933	10.026	10.000	35.000
01 Jan 05	0530	42.406	9.921	9.000	35.000
01 Jan 05	0545	41.869	9.814	9.000	35.000
01 Jan 05	0600	41.322	9.704	8.000	35.000
01 Jan 05	0615	40.764	9.593	8.000	35.000
01 Jan 05	0630	40.196	9.479	7.000	35.000
01 Jan 05	0645	39.607	9.361	6.000	35.000
01 Jan 05	0700	38.997	9.239	5.000	35.000
01 Jan 05	0715	38.367	9.113	4.000	35.000
01 Jan 05	0730	37.716	8.983	3.000	35.000
01 Jan 05	0745	37.055	8.848	3.000	35.000
01 Jan 05	0800	36.384	8.711	2.000	35.000
01 Jan 05	0815	35.702	8.572	2.000	35.000
1 Jan 05	0830	35.020	8.433	2.000	35.000
01 Jan 05	0845	34.332	8.292	1.440	35.000
01 Jan 05	0900	33.639	8.151	1.440	35.000

Table B3. Summary of results for the 100-year, 6-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 15

Start of Run	: 01Jan05 0000	Basin Model	: Post Emerson
End of Run	: 01Jan05 1200	Met. Model	: Met 1
Execution Time	: 03Jun05 1309	Control Specs	: Emerson 6

Computed Results

Peak Inflow	: 198.00 (cfs)	Date/Time of Peak Inflow	: 01 Jan 05 0400
Peak Outflow	: 35.000 (cfs)	Date/Time of Peak Outflow	: 01 Jan 05 0345
Total Inflow	: (in)	Peak Storage	: 45.617 (ac-ft)
Total Outflow	: (in)	Peak Elevation	: 10.552 (ft)

Table B4. Table of results for the 100-year, 6-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 15

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 01Jan05 1200 Met. Model : Met 1

Execution Time : 03Jun05 1309 Control Specs : Emerson 6

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.460	2.550	1.180
01 Jan 05	0015	30.424	7.465	2.550	1.571
01 Jan 05	0030	30.442	7.469	2.550	1.850
01 Jan 05	0045	30.454	7.472	2.550	2.050
01 Jan 05	0100	30.612	7.507	19.440	4.602
01 Jan 05	0115	30.911	7.572	23.440	9.405
01 Jan 05	0130	31.133	7.621	20.440	12.981
01 Jan 05	0145	31.274	7.651	21.440	15.252
01 Jan 05	0200	31.530	7.708	38.000	19.379
01 Jan 05	0215	31.913	7.791	44.000	25.547
01 Jan 05	0230	32.204	7.855	40.000	30.241
01 Jan 05	0245	32.333	7.883	35.000	32.312
01 Jan 05	0300	32.336	7.884	30.000	32.365
01 Jan 05	0315	32.277	7.871	28.000	31.405
01 Jan 05	0330	32.385	7.895	47.000	33.144
01 Jan 05	0345	33.044	8.029	85.000	35.000
01 Jan 05	0400	35.245	8.479	198.000	35.000
01 Jan 05	0415	38.520	9.144	189.000	35.000
01 Jan 05	0430	41.247	9.689	145.000	35.000
01 Jan 05	0445	43.106	10.060	105.000	35.000
01 Jan 05	0500	44.294	10.293	80.000	35.000
01 Jan 05	0515	45.028	10.437	61.000	35.000
01 Jan 05	0530	45.431	10.516	48.000	35.000
01 Jan 05	0545	45.617	10.552	40.000	35.000
01 Jan 05	0600	45.575	10.544	26.000	35.000
01 Jan 05	0615	45.327	10.496	20.000	35.000
01 Jan 05	0630	44.976	10.427	16.000	35.000
01 Jan 05	0645	44.553	10.344	13.000	35.000
01 Jan 05	0700	44.079	10.251	11.110	35.000
01 Jan 05	0715	43.575	10.152	10.110	35.000
01 Jan 05	0730	43.049	10.049	9.000	35.000
01 Jan 05	0745	42.501	9.940	8.000	35.000
01 Jan 05	0800	41.933	9.827	7.000	35.000
01 Jan 05	0815	41.355	9.711	7.000	35.000
01 Jan 05	0830	40.766	9.593	6.000	35.000
01 Jan 05	0845	40.156	9.471	5.000	35.000
01 Jan 05	0900	39.526	9.345	4.000	35.000
01 Jan 05	0915	38.875	9.215	3.000	35.000
01 Jan 05	0930	38.214	9.083	3.000	35.000
01 Jan 05	0945	37.543	8.948	2.000	35.000
01 Jan 05	1000	36.861	8.808	2.000	35.000

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
01 Jan 05	1015	36.179	8.669	2.000	35.000
01 Jan 05	1030	35.497	8.530	2.000	35.000
01 Jan 05	1045	34.810	8.390	1.440	35.000
01 Jan 05	1100	34.116	8.248	1.440	35.000
01 Jan 05	1115	33.423	8.107	1.440	35.000
01 Jan 05	1130	32.730	7.966	1.440	35.000
01 Jan 05	1145	32.102	7.833	1.440	28.596
01 Jan 05	1200	31.621	7.728	1.440	20.849

APPENDIX C
10-year Hydrologic/hydraulic model output for post-project conditions, Emerson Property, City of Oakley, California

Table C1. Summary of results for the 10-year, 3-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 38

Start of Run : 01Jan05 0000	Basin Model : Post Emerson
End of Run : 01Jan05 0900	Met. Model : Met 1
Execution Time : 16Jun05 1727	Control Specs : Emerson 3

Computed Results

Peak Inflow : 110.00 (cfs)	Date/Time of Peak Inflow : 01 Jan 05 0215
Peak Outflow : 35.000 (cfs)	Date/Time of Peak Outflow : 01 Jan 05 0215
Total Inflow : (in)	Peak Storage : 35.747(ac-ft)
Total Outflow : (in)	Peak Elevation : 8.5811(ft)

Table C2. Table of results for the 10-year, 3-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 38

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 01Jan05 0900 Met. Model : Met 1

Execution Time : 16Jun05 1727 Control Specs : Emerson 3

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.4600	2.550	1.180
01 Jan 05	0015	30.428	7.4664	2.550	1.180
01 Jan 05	0030	30.457	7.4727	2.550	1.180
01 Jan 05	0045	30.485	7.4791	2.550	1.180
01 Jan 05	0100	30.513	7.4855	2.550	1.180
01 Jan 05	0115	30.542	7.4918	2.550	1.180
01 Jan 05	0130	30.610	7.5073	6.440	1.180
01 Jan 05	0145	30.874	7.5666	21.440	1.180
01 Jan 05	0200	31.478	7.7026	39.440	1.180
01 Jan 05	0215	32.648	7.9496	110.000	35.000
01 Jan 05	0230	33.878	8.1995	79.000	35.000
01 Jan 05	0245	34.807	8.3893	81.000	35.000
01 Jan 05	0300	35.510	8.5326	57.000	35.000
01 Jan 05	0315	35.747	8.5811	36.000	35.000
01 Jan 05	0330	35.644	8.5600	24.000	35.000
01 Jan 05	0345	35.324	8.4947	15.000	35.000
01 Jan 05	0400	34.881	8.4042	12.110	35.000
01 Jan 05	0415	34.376	8.3012	9.000	35.000
01 Jan 05	0430	33.828	8.1894	8.000	35.000
01 Jan 05	0445	33.260	8.0735	7.000	35.000
01 Jan 05	0500	32.671	7.9542	6.000	35.000
01 Jan 05	0515	32.402	7.9102	5.000	2.012
01 Jan 05	0530	32.416	7.9116	5.000	6.658
01 Jan 05	0545	32.409	7.9109	5.000	4.080
01 Jan 05	0600	32.411	7.9111	4.000	4.733
01 Jan 05	0615	32.407	7.9107	4.000	3.593
01 Jan 05	0630	32.409	7.9109	4.000	4.226
01 Jan 05	0645	32.408	7.9108	4.000	3.875
01 Jan 05	0700	32.406	7.9106	3.000	3.292
01 Jan 05	0715	32.405	7.9105	3.000	2.838
01 Jan 05	0730	32.403	7.9103	2.000	2.312
01 Jan 05	0745	32.402	7.9102	2.000	1.827
01 Jan 05	0800	32.403	7.9103	2.000	2.096
01 Jan 05	0815	32.402	7.9102	2.000	1.947
01 Jan 05	0830	32.403	7.9103	2.000	2.030
01 Jan 05	0845	32.401	7.9101	1.440	1.548
01 Jan 05	0900	32.401	7.9101	1.440	1.380

Table C3. Summary of results for the 10-year, 6-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 39

Start of Run	: 01Jan05 0000	Basin Model	: Post Emerson
End of Run	: 01Jan05 1200	Met. Model	: Met 1
Execution Time	: 16Jun05 1732	Control Specs	: Emerson 6

Computed Results

Peak Inflow	: 104.00 (cfs)	Date/Time of Peak Inflow	: 01 Jan 05 0400
Peak Outflow	: 35.000 (cfs)	Date/Time of Peak Outflow	: 01 Jan 05 0345
Total Inflow	: (in)	Peak Storage	: 36.200(ac-ft)
Total Outflow	: (in)	Peak Elevation	: 8.6735(ft)

Table C4. Table of results for the 10-year, 6-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 39

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 01Jan05 1200 Met. Model : Met 1

Execution Time : 16Jun05 1732 Control Specs : Emerson 6

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.4600	2.550	1.180
01 Jan 05	0015	30.428	7.4664	2.550	1.180
01 Jan 05	0030	30.457	7.4727	2.550	1.180
01 Jan 05	0045	30.485	7.4791	2.550	1.180
01 Jan 05	0100	30.513	7.4855	2.550	1.180
01 Jan 05	0115	30.542	7.4918	2.550	1.180
01 Jan 05	0130	30.570	7.4982	2.550	1.180
01 Jan 05	0145	30.598	7.5046	2.550	1.180
01 Jan 05	0200	30.739	7.5363	13.440	1.180
01 Jan 05	0215	31.065	7.6095	20.440	1.180
01 Jan 05	0230	31.411	7.6874	15.440	1.180
01 Jan 05	0245	31.685	7.7491	13.440	1.180
01 Jan 05	0300	31.928	7.8038	12.440	1.180
01 Jan 05	0315	32.160	7.8561	12.440	1.180
01 Jan 05	0330	32.426	7.9126	24.440	9.989
01 Jan 05	0345	32.642	7.9484	41.440	35.000
01 Jan 05	0400	33.421	8.1064	104.000	35.000
01 Jan 05	0415	34.692	8.3657	89.000	35.000
01 Jan 05	0430	35.591	8.5491	68.000	35.000
01 Jan 05	0445	36.066	8.6461	48.000	35.000
01 Jan 05	0500	36.200	8.6735	35.000	35.000
01 Jan 05	0515	36.107	8.6545	26.000	35.000
01 Jan 05	0530	35.859	8.6039	20.000	35.000
01 Jan 05	0545	35.508	8.5322	16.000	35.000
01 Jan 05	0600	35.064	8.4416	11.000	35.000
01 Jan 05	0615	34.537	8.3341	8.000	35.000
01 Jan 05	0630	33.958	8.2160	6.000	35.000
01 Jan 05	0645	33.359	8.0937	6.000	35.000
01 Jan 05	0700	32.751	7.9702	5.110	35.000
01 Jan 05	0715	32.416	7.9116	4.110	6.624
01 Jan 05	0730	32.402	7.9102	3.000	1.852
01 Jan 05	0745	32.407	7.9107	3.000	3.637
01 Jan 05	0800	32.404	7.9104	3.000	2.646
01 Jan 05	0815	32.406	7.9106	3.000	3.196
01 Jan 05	0830	32.405	7.9105	3.000	2.891
01 Jan 05	0845	32.403	7.9103	2.000	2.283
01 Jan 05	0900	32.402	7.9102	2.000	1.843
01 Jan 05	0915	32.403	7.9103	2.000	2.087
01 Jan 05	0930	32.402	7.9102	2.000	1.952
01 Jan 05	0945	32.403	7.9103	2.000	2.027

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
1 Jan 05	1015	32.401	7.9101	1.440	1.573
01 Jan 05	1030	32.401	7.9101	1.440	1.366
01 Jan 05	1045	32.401	7.9101	1.440	1.481
01 Jan 05	1100	32.401	7.9101	1.440	1.417
01 Jan 05	1115	32.401	7.9101	1.440	1.453
01 Jan 05	1130	32.401	7.9101	1.440	1.433
01 Jan 05	1145	32.401	7.9101	1.440	1.444
01 Jan 05	1200	32.401	7.9101	1.440	1.438

Table C5. Summary of results for the 10-year, 12-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 40

Start of Run	: 01Jan05 0000	Basin Model	: Post Emerson
End of Run	: 01Jan05 1800	Met. Model	: Met 1
Execution Time	: 16Jun05 1734	Control Specs	: Emerson 12

Computed Results

Peak Inflow	: 102.00 (cfs)	Date/Time of Peak Inflow	: 01 Jan 05 0545
Peak Outflow	: 35.000 (cfs)	Date/Time of Peak Outflow	: 01 Jan 05 0545
Total Inflow	: (in)	Peak Storage	: 36.291(ac-ft)
Total Outflow	: (in)	Peak Elevation	: 8.6920(ft)

Table C6. Table of results for the 10-year, 12-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 40

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 01Jan05 1800 Met. Model : Met 1

Execution Time : 16Jun05 1734 Control Specs : Emerson 12

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.4600	2.550	1.180
01 Jan 05	0015	30.428	7.4664	2.550	1.180
01 Jan 05	0030	30.457	7.4727	2.550	1.180
01 Jan 05	0045	30.485	7.4791	2.550	1.180
01 Jan 05	0100	30.513	7.4855	2.550	1.180
01 Jan 05	0115	30.542	7.4918	2.550	1.180
01 Jan 05	0130	30.570	7.4982	2.550	1.180
01 Jan 05	0145	30.598	7.5046	2.550	1.180
01 Jan 05	0200	30.626	7.5110	2.550	1.180
01 Jan 05	0215	30.655	7.5173	2.550	1.180
01 Jan 05	0230	30.683	7.5237	2.550	1.180
01 Jan 05	0245	30.711	7.5301	2.550	1.180
01 Jan 05	0300	30.740	7.5364	2.550	1.180
01 Jan 05	0315	30.768	7.5428	2.550	1.180
01 Jan 05	0330	30.796	7.5492	2.550	1.180
01 Jan 05	0345	30.825	7.5555	2.550	1.180
01 Jan 05	0400	30.853	7.5619	2.550	1.180
01 Jan 05	0415	30.881	7.5683	2.550	1.180
01 Jan 05	0430	30.910	7.5746	2.550	1.180
01 Jan 05	0445	30.938	7.5810	2.550	1.180
01 Jan 05	0500	30.966	7.5874	2.550	1.180
01 Jan 05	0515	31.179	7.6353	20.440	1.180
01 Jan 05	0530	31.711	7.7551	33.440	1.180
01 Jan 05	0545	32.737	7.9674	102.000	35.000
01 Jan 05	0600	34.018	8.2281	92.000	35.000
01 Jan 05	0615	35.020	8.4326	75.000	35.000
01 Jan 05	0630	35.691	8.5697	60.000	35.000
01 Jan 05	0645	36.094	8.6519	49.000	35.000
01 Jan 05	0700	36.291	8.6920	40.000	35.000
01 Jan 05	0715	36.291	8.6920	30.000	35.000
01 Jan 05	0730	36.125	8.6582	24.000	35.000
01 Jan 05	0745	35.857	8.6034	20.000	35.000
01 Jan 05	0800	35.516	8.5338	17.000	35.000
01 Jan 05	0815	35.123	8.4537	15.000	35.000
01 Jan 05	0830	34.700	8.3673	14.000	35.000
01 Jan 05	0845	34.255	8.2766	13.000	35.000
01 Jan 05	0900	33.780	8.1796	11.000	35.000
01 Jan 05	0915	33.264	8.0742	9.000	35.000
01 Jan 05	0930	32.727	7.9653	9.000	35.000
01 Jan 05	0945	32.426	7.9126	7.000	10.066

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
. Jan 05	1015	32.418	7.9118	6.000	7.167
01 Jan 05	1030	32.412	7.9112	6.000	5.352
01 Jan 05	1045	32.413	7.9113	5.000	5.582
01 Jan 05	1100	32.408	7.9108	4.000	3.900
01 Jan 05	1115	32.409	7.9109	4.000	4.056
01 Jan 05	1130	32.408	7.9108	4.000	3.969
01 Jan 05	1145	32.406	7.9106	3.110	3.325
01 Jan 05	1200	32.405	7.9105	3.110	2.991
01 Jan 05	1215	32.405	7.9105	2.550	2.741
01 Jan 05	1230	32.404	7.9104	2.550	2.444
01 Jan 05	1245	32.404	7.9104	2.550	2.609
01 Jan 05	1300	32.404	7.9104	2.550	2.517
01 Jan 05	1315	32.404	7.9104	2.550	2.568
01 Jan 05	1330	32.401	7.9101	1.440	1.677
01 Jan 05	1345	32.400	7.9100	1.440	1.309
01 Jan 05	1400	32.401	7.9101	1.440	1.513
01 Jan 05	1415	32.401	7.9101	1.440	1.400
01 Jan 05	1430	32.401	7.9101	1.440	1.462
01 Jan 05	1445	32.401	7.9101	1.440	1.428
01 Jan 05	1500	32.401	7.9101	1.440	1.447
01 Jan 05	1515	32.401	7.9101	1.440	1.436
01 Jan 05	1530	32.401	7.9101	1.440	1.442
01 Jan 05	1545	32.401	7.9101	1.440	1.439
1 Jan 05	1600	32.401	7.9101	1.440	1.441
01 Jan 05	1615	32.401	7.9101	1.440	1.440
01 Jan 05	1630	32.401	7.9101	1.440	1.440
01 Jan 05	1645	32.401	7.9101	1.440	1.440
01 Jan 05	1700	32.401	7.9101	1.440	1.440
01 Jan 05	1715	32.401	7.9101	1.440	1.440
01 Jan 05	1730	32.401	7.9101	1.440	1.440
01 Jan 05	1745	32.401	7.9101	1.440	1.440
01 Jan 05	1800	32.401	7.9101	1.440	1.440

Table C7. Summary of results for the 10-year, 24-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 41

Start of Run	: 01Jan05 0000	Basin Model	: Post Emerson
End of Run	: 02Jan05 0545	Met. Model	: Met 1
Execution Time	: 16Jun05 1735	Control Specs	: Emerson 24

Computed Results

Peak Inflow	: 81.000 (cfs)	Date/Time of Peak Inflow	: 01 Jan 05 0945
Peak Outflow	: 35.000 (cfs)	Date/Time of Peak Outflow	: 01 Jan 05 0945
Total Inflow	: (in)	Peak Storage	: 35.361(ac-ft)
Total Outflow	: (in)	Peak Elevation	: 8.5023(ft)

Table C8. Table of results for the 10-year, 24-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 41

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 02Jan05 0545 Met. Model : Met 1

Execution Time : 16Jun05 1735 Control Specs : Emerson 24

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.4600	2.550	1.180
01 Jan 05	0015	30.428	7.4664	2.550	1.180
01 Jan 05	0030	30.457	7.4727	2.550	1.180
01 Jan 05	0045	30.485	7.4791	2.550	1.180
01 Jan 05	0100	30.513	7.4855	2.550	1.180
01 Jan 05	0115	30.542	7.4918	2.550	1.180
01 Jan 05	0130	30.570	7.4982	2.550	1.180
01 Jan 05	0145	30.598	7.5046	2.550	1.180
01 Jan 05	0200	30.626	7.5110	2.550	1.180
01 Jan 05	0215	30.655	7.5173	2.550	1.180
01 Jan 05	0230	30.683	7.5237	2.550	1.180
01 Jan 05	0245	30.711	7.5301	2.550	1.180
01 Jan 05	0300	30.740	7.5364	2.550	1.180
01 Jan 05	0315	30.768	7.5428	2.550	1.180
01 Jan 05	0330	30.796	7.5492	2.550	1.180
01 Jan 05	0345	30.825	7.5555	2.550	1.180
01 Jan 05	0400	30.853	7.5619	2.550	1.180
01 Jan 05	0415	30.881	7.5683	2.550	1.180
01 Jan 05	0430	30.910	7.5746	2.550	1.180
01 Jan 05	0445	30.938	7.5810	2.550	1.180
01 Jan 05	0500	30.966	7.5874	2.550	1.180
01 Jan 05	0515	30.994	7.5937	2.550	1.180
01 Jan 05	0530	31.023	7.6001	2.550	1.180
01 Jan 05	0545	31.051	7.6065	2.550	1.180
01 Jan 05	0600	31.079	7.6129	2.550	1.180
01 Jan 05	0615	31.108	7.6192	2.550	1.180
01 Jan 05	0630	31.136	7.6256	2.550	1.180
01 Jan 05	0645	31.164	7.6320	2.550	1.180
01 Jan 05	0700	31.193	7.6383	2.550	1.180
01 Jan 05	0715	31.221	7.6447	2.550	1.180
01 Jan 05	0730	31.249	7.6511	2.550	1.180
01 Jan 05	0745	31.277	7.6574	2.550	1.180
01 Jan 05	0800	31.306	7.6638	2.550	1.180
01 Jan 05	0815	31.334	7.6702	2.550	1.180
01 Jan 05	0830	31.362	7.6765	2.550	1.180
01 Jan 05	0845	31.391	7.6829	2.550	1.180
01 Jan 05	0900	31.419	7.6893	2.550	1.180
01 Jan 05	0915	31.447	7.6956	2.550	1.180
01 Jan 05	0930	32.032	7.8273	56.440	1.180
01 Jan 05	0945	33.078	8.0364	81.000	35.000
01 Jan 05	1000	33.905	8.2051	69.000	35.000

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
Jan 05	1015	34.566	8.3400	65.000	35.000
01 Jan 05	1030	35.052	8.4391	52.000	35.000
01 Jan 05	1045	35.310	8.4918	43.000	35.000
01 Jan 05	1100	35.361	8.5023	32.000	35.000
01 Jan 05	1115	35.227	8.4749	25.000	35.000
01 Jan 05	1130	34.979	8.4243	21.000	35.000
01 Jan 05	1145	34.669	8.3611	19.000	35.000
01 Jan 05	1200	34.308	8.2873	16.000	35.000
01 Jan 05	1215	33.895	8.2030	14.000	35.000
01 Jan 05	1230	33.450	8.1123	13.000	35.000
01 Jan 05	1245	32.996	8.0195	13.000	35.000
01 Jan 05	1300	32.510	7.9220	10.000	35.000
01 Jan 05	1315	32.343	7.8972	10.000	1.180
01 Jan 05	1330	32.423	7.9123	8.000	9.056
01 Jan 05	1345	32.418	7.9118	8.000	7.414
01 Jan 05	1400	32.419	7.9119	7.000	7.548
01 Jan 05	1415	32.416	7.9116	7.000	6.696
01 Jan 05	1430	32.415	7.9115	6.000	6.391
01 Jan 05	1445	32.411	7.9111	5.000	5.005
01 Jan 05	1500	32.411	7.9111	5.000	4.997
01 Jan 05	1515	32.411	7.9111	5.000	5.002
01 Jan 05	1530	32.411	7.9111	5.000	4.999
01 Jan 05	1545	32.411	7.9111	5.000	5.001
Jan 05	1600	32.409	7.9109	4.000	4.222
01 Jan 05	1615	32.407	7.9107	3.440	3.441
01 Jan 05	1630	32.405	7.9105	2.550	2.747
01 Jan 05	1645	32.404	7.9104	2.550	2.440
01 Jan 05	1700	32.404	7.9104	2.550	2.611
01 Jan 05	1715	32.404	7.9104	2.550	2.516
01 Jan 05	1730	32.404	7.9104	2.550	2.569
01 Jan 05	1745	32.404	7.9104	2.550	2.540
01 Jan 05	1800	32.404	7.9104	2.550	2.556
01 Jan 05	1815	32.404	7.9104	2.550	2.547
01 Jan 05	1830	32.404	7.9104	2.550	2.552
01 Jan 05	1845	32.404	7.9104	2.550	2.549
01 Jan 05	1900	32.404	7.9104	2.550	2.551
01 Jan 05	1915	32.404	7.9104	2.550	2.550
01 Jan 05	1930	32.404	7.9104	2.550	2.550
01 Jan 05	1945	32.404	7.9104	2.550	2.550
01 Jan 05	2000	32.404	7.9104	2.550	2.550
01 Jan 05	2015	32.404	7.9104	2.550	2.550
01 Jan 05	2030	32.404	7.9104	2.550	2.550
01 Jan 05	2045	32.404	7.9104	2.550	2.550
01 Jan 05	2100	32.404	7.9104	2.550	2.550
01 Jan 05	2115	32.404	7.9104	2.550	2.550
01 Jan 05	2130	32.404	7.9104	2.550	2.550
01 Jan 05	2145	32.404	7.9104	2.550	2.550
Jan 05	2200	32.404	7.9104	2.550	2.550
01 Jan 05	2215	32.404	7.9104	2.550	2.550
01 Jan 05	2230	32.404	7.9104	2.550	2.550
01 Jan 05	2245	32.404	7.9104	2.550	2.550

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
Jan 05	2300	32.404	7.9104	2.550	2.550
01 Jan 05	2315	32.404	7.9104	2.550	2.550
01 Jan 05	2330	32.404	7.9104	2.550	2.550
01 Jan 05	2345	32.404	7.9104	2.550	2.550
01 Jan 05	2400	32.404	7.9104	2.550	2.550
02 Jan 05	0015	32.404	7.9104	2.550	2.550
02 Jan 05	0030	32.404	7.9104	2.550	2.550
02 Jan 05	0045	32.404	7.9104	2.550	2.550
02 Jan 05	0100	32.404	7.9104	2.550	2.550
02 Jan 05	0115	32.404	7.9104	2.550	2.550
02 Jan 05	0130	32.402	7.9101	1.440	1.687
02 Jan 05	0145	32.400	7.9100	1.440	1.303
02 Jan 05	0200	32.401	7.9101	1.440	1.516
02 Jan 05	0215	32.401	7.9101	1.440	1.398
02 Jan 05	0230	32.401	7.9101	1.440	1.463
02 Jan 05	0245	32.401	7.9101	1.440	1.427
02 Jan 05	0300	32.401	7.9101	1.440	1.447
02 Jan 05	0315	32.401	7.9101	1.440	1.436
02 Jan 05	0330	32.401	7.9101	1.440	1.442
02 Jan 05	0345	32.401	7.9101	1.440	1.439
02 Jan 05	0400	32.401	7.9101	1.440	1.441
02 Jan 05	0415	32.401	7.9101	1.440	1.440
02 Jan 05	0430	32.401	7.9101	1.440	1.440
2 Jan 05	0445	32.401	7.9101	1.440	1.440
02 Jan 05	0500	32.401	7.9101	1.440	1.440
02 Jan 05	0515	32.401	7.9101	1.440	1.440
02 Jan 05	0530	32.401	7.9101	1.440	1.440
02 Jan 05	0545	32.401	7.9101	1.440	1.440

Table C10. Table of results for the 10-year, 96-hour storm

HMS * Summary of Results for Reservoir-1

Project : 204128 Run Name : Run 45

Start of Run : 01Jan05 0000 Basin Model : Post Emerson

End of Run : 05Jan05 0600 Met. Model : Met 1

Execution Time : 27Jun05 1800 Control Specs : Emerson 96

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
31 Dec 04	2400	30.400	7.4600	2.550	1.180
01 Jan 05	0015	30.428	7.4664	2.550	1.180
01 Jan 05	0030	30.457	7.4727	2.550	1.180
01 Jan 05	0045	30.485	7.4791	2.550	1.180
01 Jan 05	0100	30.513	7.4855	2.550	1.180
01 Jan 05	0115	30.542	7.4918	2.550	1.180
01 Jan 05	0130	30.570	7.4982	2.550	1.180
01 Jan 05	0145	30.598	7.5046	2.550	1.180
01 Jan 05	0200	30.626	7.5110	2.550	1.180
01 Jan 05	0215	30.655	7.5173	2.550	1.180
01 Jan 05	0230	30.683	7.5237	2.550	1.180
01 Jan 05	0245	30.711	7.5301	2.550	1.180
01 Jan 05	0300	30.740	7.5364	2.550	1.180
01 Jan 05	0315	30.768	7.5428	2.550	1.180
01 Jan 05	0330	30.796	7.5492	2.550	1.180
01 Jan 05	0345	30.825	7.5555	2.550	1.180
01 Jan 05	0400	30.853	7.5619	2.550	1.180
01 Jan 05	0415	30.881	7.5683	2.550	1.180
01 Jan 05	0430	30.910	7.5746	2.550	1.180
01 Jan 05	0445	30.938	7.5810	2.550	1.180
01 Jan 05	0500	30.966	7.5874	2.550	1.180
01 Jan 05	0515	30.994	7.5937	2.550	1.180
01 Jan 05	0530	31.023	7.6001	2.550	1.180
01 Jan 05	0545	31.051	7.6065	2.550	1.180
01 Jan 05	0600	31.079	7.6129	2.550	1.180
01 Jan 05	0615	31.108	7.6192	2.550	1.180
01 Jan 05	0630	31.136	7.6256	2.550	1.180
01 Jan 05	0645	31.164	7.6320	2.550	1.180
01 Jan 05	0700	31.193	7.6383	2.550	1.180
01 Jan 05	0715	31.221	7.6447	2.550	1.180
01 Jan 05	0730	31.249	7.6511	2.550	1.180
01 Jan 05	0745	31.277	7.6574	2.550	1.180
01 Jan 05	0800	31.306	7.6638	2.550	1.180
01 Jan 05	0815	31.334	7.6702	2.550	1.180
01 Jan 05	0830	31.362	7.6765	2.550	1.180
01 Jan 05	0845	31.391	7.6829	2.550	1.180
01 Jan 05	0900	31.419	7.6893	2.550	1.180
01 Jan 05	0915	31.447	7.6956	2.550	1.180
01 Jan 05	0930	31.476	7.7020	2.550	1.180
01 Jan 05	0945	31.504	7.7084	2.550	1.180

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
Jan 05	1015	31.561	7.7211	2.550	1.180
01 Jan 05	1030	31.589	7.7275	2.550	1.180
01 Jan 05	1045	31.617	7.7339	2.550	1.180
01 Jan 05	1100	31.645	7.7402	2.550	1.180
01 Jan 05	1115	31.674	7.7466	2.550	1.180
01 Jan 05	1130	31.702	7.7530	2.550	1.180
01 Jan 05	1145	31.730	7.7593	2.550	1.180
01 Jan 05	1200	31.759	7.7657	2.550	1.180
01 Jan 05	1215	31.787	7.7721	2.550	1.180
01 Jan 05	1230	31.815	7.7784	2.550	1.180
01 Jan 05	1245	31.844	7.7848	2.550	1.180
01 Jan 05	1300	31.872	7.7912	2.550	1.180
01 Jan 05	1315	31.900	7.7975	2.550	1.180
01 Jan 05	1330	31.929	7.8039	2.550	1.180
01 Jan 05	1345	31.957	7.8103	2.550	1.180
01 Jan 05	1400	31.985	7.8167	2.550	1.180
01 Jan 05	1415	32.013	7.8230	2.550	1.180
01 Jan 05	1430	32.042	7.8294	2.550	1.180
01 Jan 05	1445	32.070	7.8358	2.550	1.180
01 Jan 05	1500	32.098	7.8421	2.550	1.180
01 Jan 05	1515	32.127	7.8485	2.550	1.180
01 Jan 05	1530	32.155	7.8549	2.550	1.180
01 Jan 05	1545	32.183	7.8612	2.550	1.180
Jan 05	1600	32.212	7.8676	2.550	1.180
01 Jan 05	1615	32.240	7.8740	2.550	1.180
01 Jan 05	1630	32.268	7.8803	2.550	1.180
01 Jan 05	1645	32.296	7.8867	2.550	1.180
01 Jan 05	1700	32.325	7.8931	2.550	1.180
01 Jan 05	1715	32.353	7.8994	2.550	1.180
01 Jan 05	1730	32.381	7.9058	2.550	1.180
01 Jan 05	1745	32.402	7.9102	2.550	1.911
01 Jan 05	1800	32.405	7.9105	2.550	2.905
01 Jan 05	1815	32.403	7.9103	2.550	2.353
01 Jan 05	1830	32.404	7.9104	2.550	2.659
01 Jan 05	1845	32.404	7.9104	2.550	2.489
01 Jan 05	1900	32.404	7.9104	2.550	2.584
01 Jan 05	1915	32.404	7.9104	2.550	2.531
01 Jan 05	1930	32.404	7.9104	2.550	2.560
01 Jan 05	1945	32.404	7.9104	2.550	2.544
01 Jan 05	2000	32.404	7.9104	2.550	2.553
01 Jan 05	2015	32.404	7.9104	2.550	2.548
01 Jan 05	2030	32.404	7.9104	2.550	2.551
01 Jan 05	2045	32.404	7.9104	2.550	2.549
01 Jan 05	2100	32.404	7.9104	2.550	2.550
01 Jan 05	2115	32.404	7.9104	2.550	2.550
01 Jan 05	2130	32.404	7.9104	2.550	2.550
01 Jan 05	2145	32.404	7.9104	2.550	2.550
1 Jan 05	2200	32.404	7.9104	2.550	2.550
01 Jan 05	2215	32.404	7.9104	2.550	2.550
01 Jan 05	2230	32.404	7.9104	2.550	2.550
01 Jan 05	2245	32.404	7.9104	2.550	2.550

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
Jan 05	2300	32.404	7.9104	2.550	2.550
01 Jan 05	2315	32.404	7.9104	2.550	2.550
01 Jan 05	2330	32.404	7.9104	2.550	2.550
01 Jan 05	2345	32.404	7.9104	2.550	2.550
01 Jan 05	2400	32.404	7.9104	2.550	2.550
02 Jan 05	0015	32.404	7.9104	2.550	2.550
02 Jan 05	0030	32.404	7.9104	2.550	2.550
02 Jan 05	0045	32.404	7.9104	2.550	2.550
02 Jan 05	0100	32.404	7.9104	2.550	2.550
02 Jan 05	0115	32.404	7.9104	2.550	2.550
02 Jan 05	0130	32.404	7.9104	2.550	2.550
02 Jan 05	0145	32.404	7.9104	2.550	2.550
02 Jan 05	0200	32.404	7.9104	2.550	2.550
02 Jan 05	0215	32.404	7.9104	2.550	2.550
02 Jan 05	0230	32.404	7.9104	2.550	2.550
02 Jan 05	0245	32.404	7.9104	2.550	2.550
02 Jan 05	0300	32.404	7.9104	2.550	2.550
02 Jan 05	0315	32.404	7.9104	2.550	2.550
02 Jan 05	0330	32.404	7.9104	2.550	2.550
02 Jan 05	0345	32.404	7.9104	2.550	2.550
02 Jan 05	0400	32.404	7.9104	2.550	2.550
02 Jan 05	0415	32.404	7.9104	2.550	2.550
02 Jan 05	0430	32.404	7.9104	2.550	2.550
Jan 05	0445	32.404	7.9104	2.550	2.550
02 Jan 05	0500	32.404	7.9104	2.550	2.550
02 Jan 05	0515	32.404	7.9104	2.550	2.550
02 Jan 05	0530	32.404	7.9104	2.550	2.550
02 Jan 05	0545	32.404	7.9104	2.550	2.550
02 Jan 05	0600	32.404	7.9104	2.550	2.550
02 Jan 05	0615	32.404	7.9104	2.550	2.550
02 Jan 05	0630	32.404	7.9104	2.550	2.550
02 Jan 05	0645	32.404	7.9104	2.550	2.550
02 Jan 05	0700	32.404	7.9104	2.550	2.550
02 Jan 05	0715	32.404	7.9104	2.550	2.550
02 Jan 05	0730	32.404	7.9104	2.550	2.550
02 Jan 05	0745	32.404	7.9104	2.550	2.550
02 Jan 05	0800	32.404	7.9104	2.550	2.550
02 Jan 05	0815	32.404	7.9104	2.550	2.550
02 Jan 05	0830	32.404	7.9104	2.550	2.550
02 Jan 05	0845	32.404	7.9104	2.550	2.550
02 Jan 05	0900	32.404	7.9104	2.550	2.550
02 Jan 05	0915	32.404	7.9104	2.550	2.550
02 Jan 05	0930	32.404	7.9104	2.550	2.550
02 Jan 05	0945	32.404	7.9104	2.550	2.550
02 Jan 05	1000	32.404	7.9104	2.550	2.550
02 Jan 05	1015	32.404	7.9104	2.550	2.550
2 Jan 05	1030	32.404	7.9104	2.550	2.550
2 Jan 05	1045	32.404	7.9104	2.550	2.550
02 Jan 05	1100	32.404	7.9104	2.550	2.550
02 Jan 05	1115	32.404	7.9104	2.550	2.550
02 Jan 05	1130	32.404	7.9104	2.550	2.550

Date	Time	Reservoir Storage (ac-ft)	Reservoir Elevation (ft)	Inflow (cfs)	Outflow (cfs)
02 Jan 05	1145	32.404	7.9104	2.550	2.550
02 Jan 05	1200	32.404	7.9104	2.550	2.550
02 Jan 05	1215	32.404	7.9104	2.550	2.550
02 Jan 05	1230	32.404	7.9104	2.550	2.550
02 Jan 05	1245	32.404	7.9104	2.550	2.550
02 Jan 05	1300	32.404	7.9104	2.550	2.550
02 Jan 05	1315	32.404	7.9104	2.550	2.550
02 Jan 05	1330	32.404	7.9104	2.550	2.550
02 Jan 05	1345	32.404	7.9104	2.550	2.550
02 Jan 05	1400	32.404	7.9104	2.550	2.550
02 Jan 05	1415	32.404	7.9104	2.550	2.550
02 Jan 05	1430	32.404	7.9104	2.550	2.550
02 Jan 05	1445	32.404	7.9104	2.550	2.550
02 Jan 05	1500	32.404	7.9104	2.550	2.550
02 Jan 05	1515	32.404	7.9104	2.550	2.550
02 Jan 05	1530	32.404	7.9104	2.550	2.550
02 Jan 05	1545	32.404	7.9104	2.550	2.550
02 Jan 05	1600	32.404	7.9104	2.550	2.550
02 Jan 05	1615	32.404	7.9104	2.550	2.550
02 Jan 05	1630	32.404	7.9104	2.550	2.550
02 Jan 05	1645	32.404	7.9104	2.550	2.550
02 Jan 05	1700	32.404	7.9104	2.550	2.550
02 Jan 05	1715	32.404	7.9104	2.550	2.550
02 Jan 05	1730	32.404	7.9104	2.550	2.550
02 Jan 05	1745	32.404	7.9104	2.550	2.550
02 Jan 05	1800	32.404	7.9104	2.550	2.550
02 Jan 05	1815	32.404	7.9104	2.550	2.550
02 Jan 05	1830	32.404	7.9104	2.550	2.550
02 Jan 05	1845	32.404	7.9104	2.550	2.550
02 Jan 05	1900	32.404	7.9104	2.550	2.550
02 Jan 05	1915	32.404	7.9104	2.550	2.550
02 Jan 05	1930	32.404	7.9104	2.550	2.550
02 Jan 05	1945	32.404	7.9104	2.550	2.550
02 Jan 05	2000	32.404	7.9104	2.550	2.550
02 Jan 05	2015	32.404	7.9104	2.550	2.550
02 Jan 05	2030	32.404	7.9104	2.550	2.550
02 Jan 05	2045	32.404	7.9104	2.550	2.550
02 Jan 05	2100	32.404	7.9104	2.550	2.550
02 Jan 05	2115	32.404	7.9104	2.550	2.550
02 Jan 05	2130	32.404	7.9104	2.550	2.550
02 Jan 05	2145	32.404	7.9104	2.550	2.550
02 Jan 05	2200	32.404	7.9104	2.550	2.550
02 Jan 05	2215	32.404	7.9104	2.550	2.550
02 Jan 05	2230	32.404	7.9104	2.550	2.550
02 Jan 05	2245	32.404	7.9104	2.550	2.550
02 Jan 05	2300	32.404	7.9104	2.550	2.550
02 Jan 05	2315	32.404	7.9104	2.550	2.550
02 Jan 05	2330	32.404	7.9104	2.550	2.550
02 Jan 05	2345	32.404	7.9104	2.550	2.550
02 Jan 05	2400	32.404	7.9104	2.550	2.550
03 Jan 05	0015	32.404	7.9104	2.550	2.550

Senate Bill 610 WATER SUPPLY ASSESSMENT
for the
EMERSON PROPERTY PROJECT

by the
DIABLO WATER DISTRICT

Purpose of Report

The Diablo Water District (District) pursuant to the requirements of California Water Code §§ 10910 – 10915 prepared this Water Supply Assessment (WSA) Report for the Emerson Property Project (Project).

As set forth in Senate Bill 610 (SB610), this WSA examines existing water supply entitlements, water rights, and water service contracts relevant to the water supply for the proposed Project and water received in prior years pursuant to those entitlements.

The proposed Project has been identified by the limits set forth in Sections 10910 and 10912 of the California Water Code and is subject to the California Environmental Quality Act (CEQA) (Division 13 of the Public Resources Code) under Section 21080 of the Public Resources Code establishing the need for this Water Supply Assessment.

Project Description

The proposed Emerson Property Project is located in Oakley, California in Contra Costa County. The Project site is located in the eastern portion of the City of Oakley (City). The regional location of the Project is presented in Figure 1. The Project site is bounded on the north by the Contra Costa Water District (CCWD) / United States Bureau of Reclamation (USBR) Canal, on the east by Sellers Avenue, on the south by Cypress Road, and on the west by the partially developed Cypress Grove Project.

The proposed Project development totals 140 acres. The Project development consists of approximately 662 residential units, a 10.5-acre commercial area, a 5-acre stormwater pond, an approximately 3-acre park and an assortment of small trails and roads. The proposed land use plan for the Project is presented in Figure 2.

The existing Project site is generally flat with vegetated grasslands and a limited number of mostly non-native trees.

Figure 1: Emerson Property Regional Location Map
Source: Notice of Preparation of an Environmental Impact Report (NOP), May 23, 2007

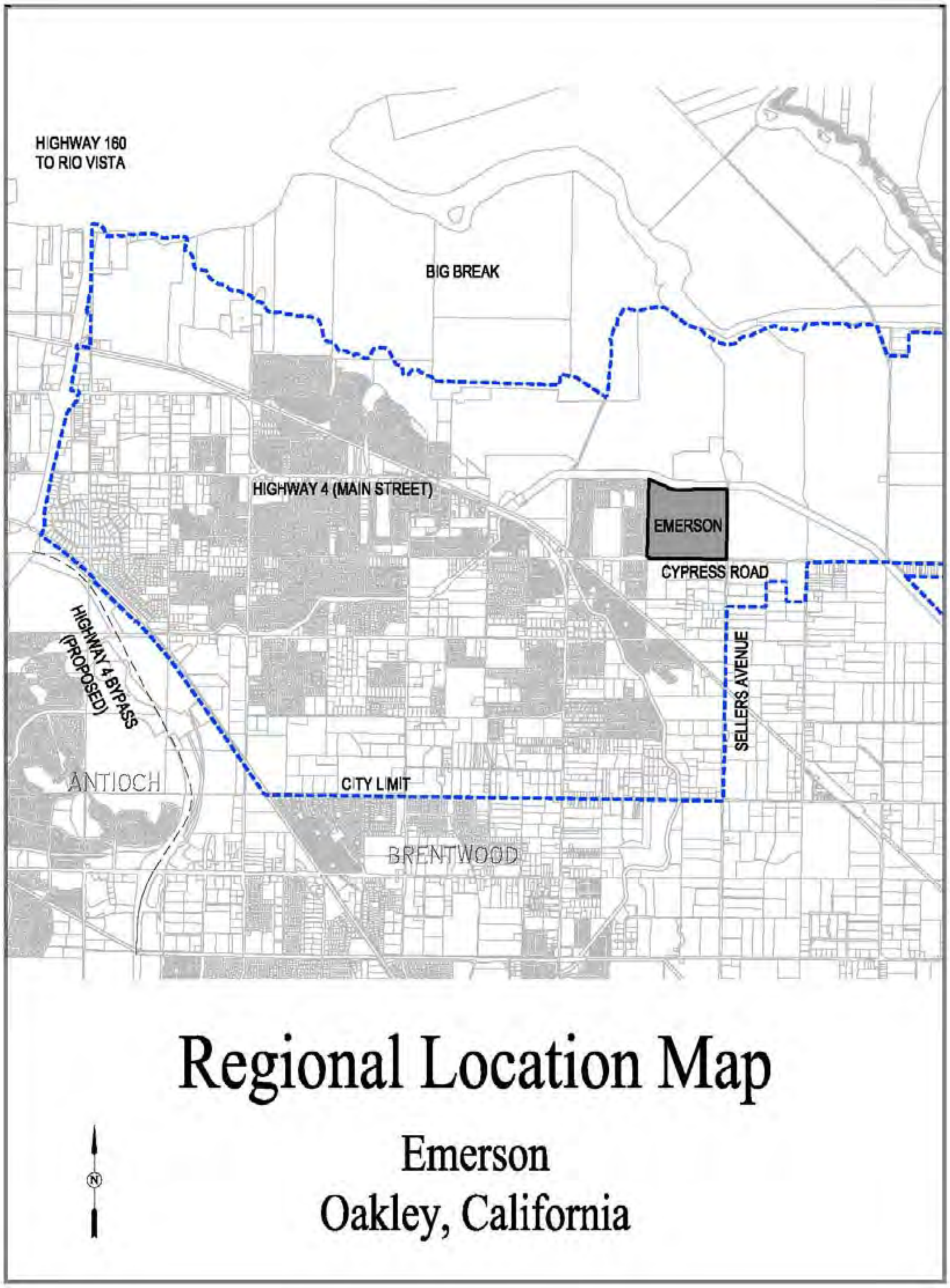
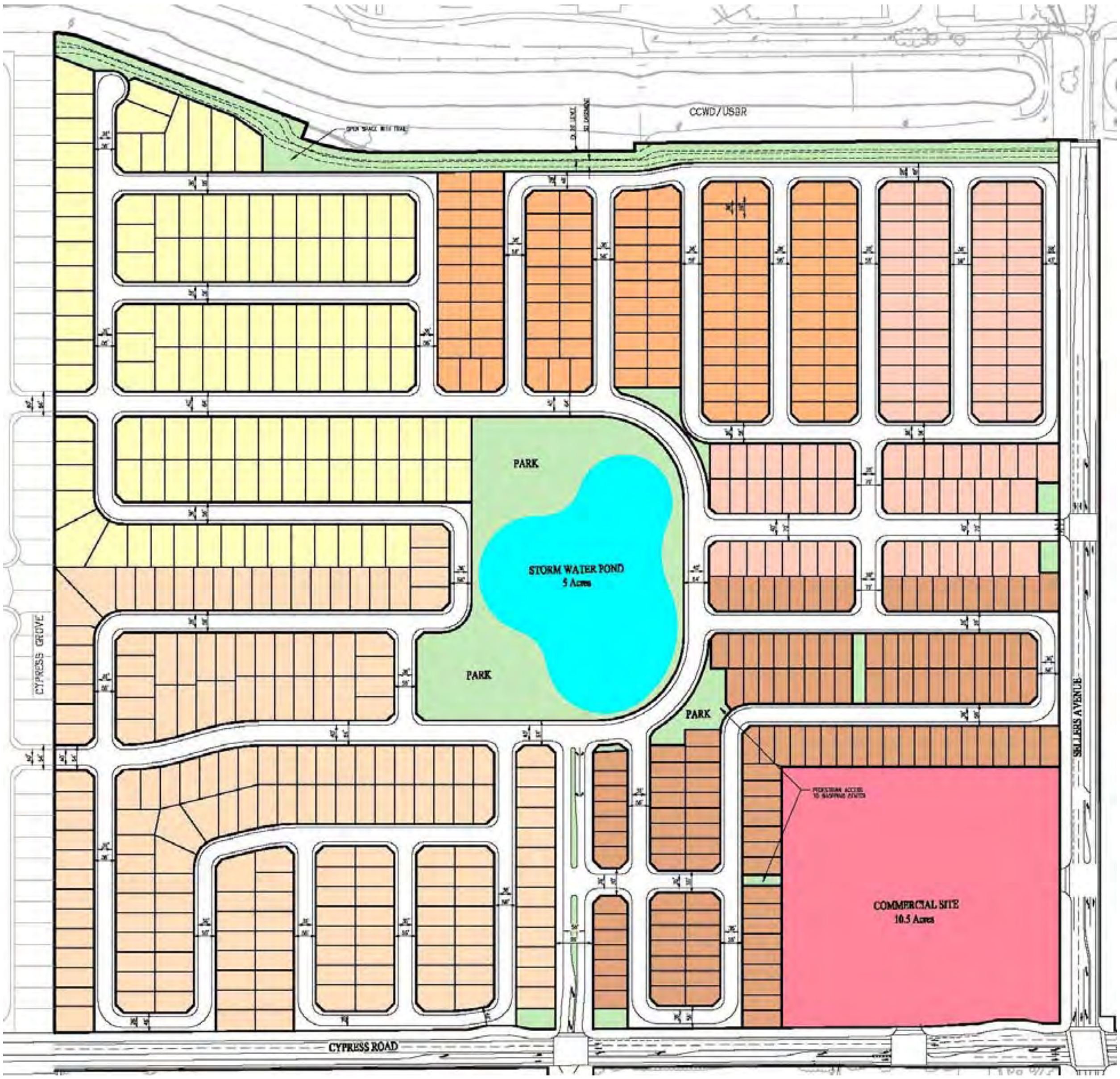


Figure 2: Conceptual Land Use Plan
Source: Notice of Preparation of an Environmental Impact Report (NOP), May 23, 2007



Project Water Demand

Water demand factors for the land use types are from the Urban Water Management Plan (UWMP), (DWD, 2005), that provides water service to Oakley, California. These factors were applied to the individual uses of the proposed Project. The water demands for the proposed Project are presented in Table 1. The total estimated project water demand is 420.7 acre-feet per year (AFY).

Table 1: Emerson Property Project - Proposed Project Water Demand

Land Use Type	Units	Water Demand Rate	Estimated Water Demand	
Single Family Home	662 D.U.	525 gpd / D.U.	347,550 gpd	389.3 AFY
Commercial	10.5 acre	2,250 gpd / acre	23,625 gpd	26.5 AFY
Parks	3.0 acre	1,450 gpd / acre	4,350 gpd	4.9 AFY
			Total Estimated Project Water Demand =	**420.7 AFY**

D.U. = Dwelling Units
gpd = gallons per day
AFY = acre-feet per year

The stormwater pond is anticipated to serve as both a stormwater detention facility and an aesthetic feature of the development. The stormwater pond is anticipated to be partially filled throughout the year. To recharge the pond during the dry season, the Project proposes to obtain water from either the Emerson Slough or through the construction of a new groundwater well located onsite. The project owner - Emerson Homebuilders - currently has water entitlements to surface water supply from Emerson Slough. It is assumed as part of this WSA that the water supplied for the stormwater pond would be from the Emerson Slough and not a new groundwater well.

Identification of Public Water System

The proposed Emerson Property Project is located entirely within the existing incorporated area of the City. The District is the water purveyor, owner, and operator of the water system within the City of Oakley. The District will therefore be the water purveyor to the proposed Project. The District obtains the majority of its water from the CCWD, which in turn obtains its water from the Central Valley Project (CVP). The District obtains a small amount of water supply from local groundwater.

The District has determined that the proposed Project is subject to CEQA. As the water purveyor, the District has prepared this WSA according to the 90-day schedule in Section § 10910 of the California Water Code.

Urban Water Management Plan Review

The District adopted its UWMP, (DWD, 2005) in 2005. The entire Project area and its build-out land uses are included in the UWMP water demands. This WSA is based on the information in the adopted UWMP. The UWMP should be consulted as a reference for detailed information.

Relevant information in the UWMP includes the following:

- Build-out water usage was calculated using build-out land uses from the City General Plan, which includes the water demands for the proposed Project area.
- The District's primary water supply is raw water from CCWD, which in turn gets its water from the CVP managed by the USBR.
- The District has developed a groundwater supply system to provide additional supply reliability during dry years and emergencies. The District is currently using the Glen Park Well at approximately 0.55 million gallons per day (mgd). The maximum pumping capacity is estimated at approximately 2.0 mgd.
- Within the District service area, all wastewater treatment occurs at Ironhouse Sanitary District. Ironhouse Sanitary District produces recycled water that is currently used for irrigation of agricultural lands and is not planned for urban use in conjunction with potable water in the District's service area.
- The District has comprehensive water conservation plans in place to abate water shortages, if needed, in times of decreased supply.
- The UWMP demand projections assume full demands during single and multiple-dry years (3 consecutive dry years), i.e., that customers are not required to ration water use during these dry periods. This assumption provides a conservative comparison of supply versus demand.

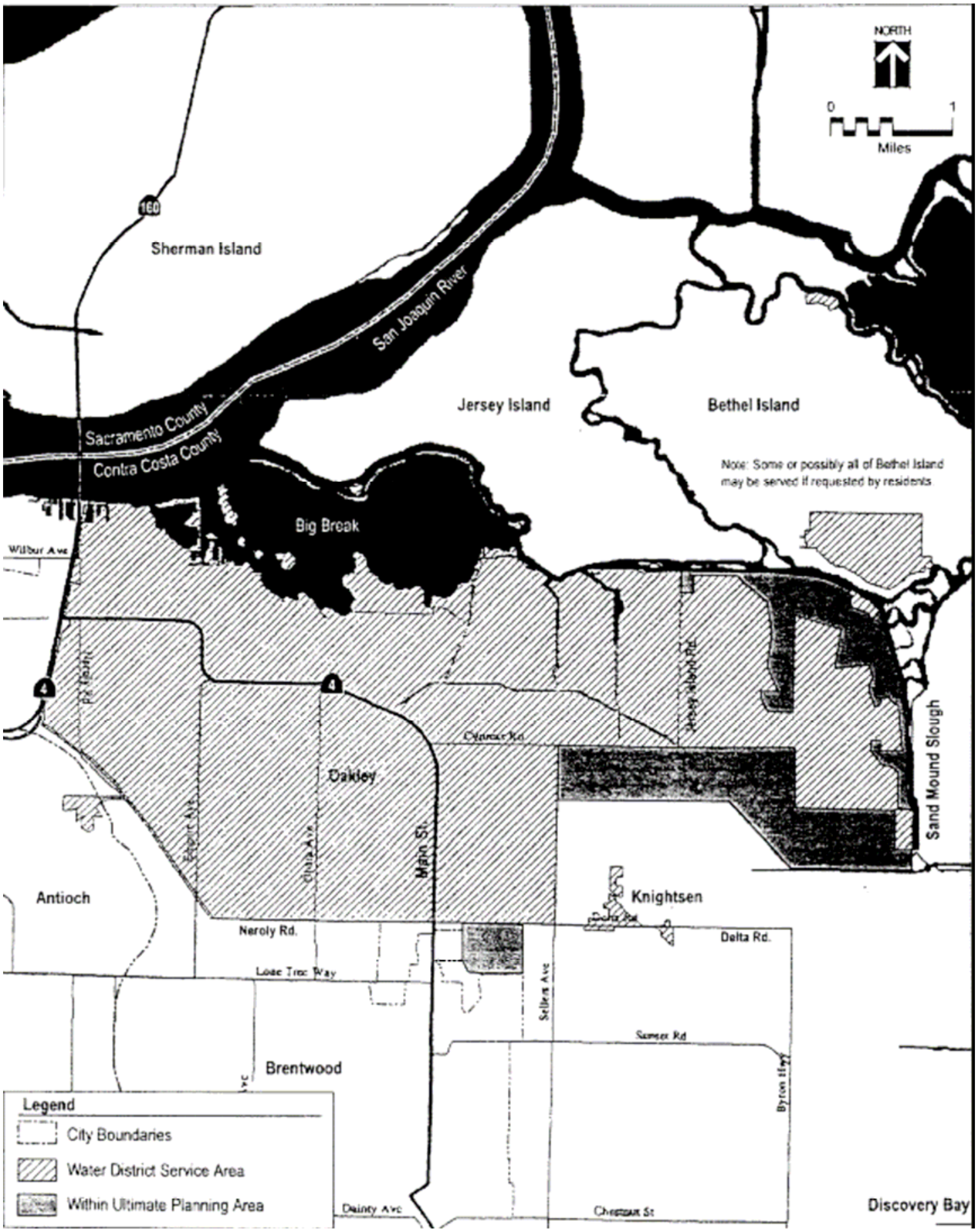
Pursuant the UWMP, the District has adequate supply sources to meet future needs under all conditions for its entire future planning area, including the Project area. The future planning area consists of the Districts service area. The District's service area is presented as Figure 4. The District is entitled to and intends to purchase additional surface water treatment capacity from CCWD, when needed to meet future demands. Ultimately, the District expects to have treatment capacity of 15 mgd on an average annual basis; which will ultimately require treatment capacity of 30 mgd for maximum day demand conditions.

The District's groundwater supply is primarily an alternate to surface water supplies for increased reliability, to help provide peaking capacity in the summer during very hot (maximum demand) days, and to enhance flexibility for cost-effectively operating its system. Groundwater will also provide some of the total required annual supply to meet future demands after 2020. It should be noted that the Project would not rely on groundwater as a source of water supply because the District has sufficient surface supplies to serve build-out of the Project, which is expected to occur in 2012.

According to the City's General Plan, City build-out is expected to occur in 2040. The amount of groundwater supply capacity needed to meet average annual demands at build-out under normal and single dry year conditions is about 2.5 mgd; and under multiple-dry year conditions is about 4.5 mgd to supplement reduced surface water supply. It is anticipated that this 4.5 mgd capacity would be provided by the existing Glen Park Well and 2 planned future wells. Ultimately the District may construct additional wells to have up to 6 to 7 mgd of available groundwater supply to provide additional flexibility for cost-effective system operations and additional reliability during short-term emergencies, such as temporary outages of the surface water treatment plant.

The District may procure additional surface water supply from CCWD sooner than was estimated in the UWMP or may investigate other local supply sources, if future groundwater investigation and monitoring indicates that it will not be possible to provide the anticipated amount of groundwater supply in the anticipated timeframes. The timing for future purchases of additional surface water can be adjusted as needed to meet future conditions. With the UWMP estimated timing for future additional surface water supply, groundwater supply is not required to meet annual demands until 2020 even under multiple-dry year conditions. If the ultimate treatment capacity of surface water supply were purchased sooner than estimated in the UWMP, then groundwater would not be required to meet annual demands until 2035 even under multiple-dry year conditions. Thus, the further development of groundwater can be delayed through the purchasing of CCWD and CVP water.

Figure 4: Map of District Service Area
Source: 2005 District UWMP



Urban Water Management Plan Supply and Demand Projections

The UWMP estimates the water supply and water demand during normal dry and multiple-dry years. A comparison of the normal year water supply and demand for the District is presented in Table 2.1, projected to 2040. Also in the tables is the groundwater needed to meet demands with the existing purchase schedule and an accelerated water purchase schedule from CCWD. Additional groundwater is needed to meet anticipated demands in a normal year starting in 2030 assuming the anticipated schedule in the UWMP for purchases of additional amounts of treatment capacity from CCWD, or by 2035 with an accelerated purchase schedule.

Table 2.1: Projected Supply and Demand Comparison for Normal Year (MG)

Year	2010	2015	2020	2025	2030	2035	2040
Surface Water from CCWD	2,738	3,650	3,650	4,562	4,562	5,457	5,457
DWD groundwater	547	547	1,095	1,095	1,642	1,642	2,189
Supply Total	3,285	4,197	4,745	5,657	6,204	7,099	7,646
Demand	2,324	2,964	3,603	4,242	4,881	5,521	6,350
Difference (Surplus of Supply)	961	1,233	1,142	1,415	1,323	1,578	1,296
Groundwater Needed to Meet Demand in Normal Year assuming anticipated schedule in UWMP for purchase of additional increments of surface water capacity (MG).	0	0	0	0	319	64	893
(MGD)	0.0	0.0	0.0	0.0	0.9	0.2	2.4
Groundwater Needed if DWD purchases their full surface water capacity of 5457 MG by 2030.	0	0	0	0	0	64	893
(MGD)	0	0	0	0	0	0.2	2.4

*MG=Million Gallons

A comparison of the single dry year water supply and demand for the District is presented in Table 2.2 projected to 2040. Groundwater is needed to meet the demands in a single dry year starting in year 2030 assuming anticipated schedule in UWMP for purchase of additional amounts of treatment capacity from CCWD, or by 2035 with an accelerated program.

Table 2.2: Projected Supply and Demand Comparison for a Single Dry Year (MG)							
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Surface Water from CCWD	2,738	3,650	3,650	4,562	4,562	5,457	5,457
DWD groundwater	547	547	1,095	1,095	1,642	1,642	2,189
Supply Total	3,285	4,197	4,745	5,657	6,204	7,099	7,646
Demand	2,324	2,964	3,603	4,242	4,881	5,521	6,350
Difference (Surplus of Supply)	961	1,233	1,142	1,415	1,323	1,578	1,296
Groundwater Needed to Meet Demand in Single Dry Year assuming anticipated schedule in UWMP for purchase of additional increments of surface water capacity (MG).	0	0	0	0	319	64	893
(MGD)	0.0	0.0	0.0	0.0	0.9	0.2	2.4
Groundwater Needed if DWD purchases their full surface water capacity of 5457 MG by 2030.	0	0	0	0	0	64	893
(MGD)	0	0	0	0	0	0.2	2.4

A comparison of the multiple-dry year water supply and demand for the District is presented in Table 2.3 projected to 2040. Groundwater is needed to meet the demand in a multiple-dry year event sometime between 2015 and 2020 with the anticipated schedule in the UWMP for purchase of additional amounts of treatment capacity from CCWD, or between 2025 and 2030 with an accelerated purchase schedule.

Table 2.3: Projected Supply and Demand Comparison for a Multiple-Dry Year Event (MG)								
	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Surface Water from CCWD	2,738	2,738	3,103	3,103	3,878	3,878	4,638	4,638
DWD groundwater	0	547	547	1,095	1,095	1,642	1,642	2,189
Supply Total	2,738	3,285	3,650	4,198	4,973	5,520	6,280	6,827
Demand	1,685	2,324	2,964	3,603	4,242	4,881	5,521	6,350
Difference (Surplus of Supply)	1,053	961	686	595	731	639	759	477
Groundwater Needed to Meet Demand in Multiple-Dry Years assuming anticipated schedule in UWMP for purchase of additional increments of surface water capacity (MG).	0	0	0	500	364	1,003	883	1,712
(MGD)	0.0	0.0	0.0	1.4	1.0	2.7	2.4	4.7
Groundwater Needed if DWD purchases their full surface water capacity of 5457 MG by 2030. (The multiple-dry year supply is 4,638 MG)	0	0	0	0	0	243	883	1,712
(MGD)	0	0	0	0	0	1	2.4	4.7

Pursuant to the UWMP, the District water supply reliability is as presented in Table 2.4. The UWMP estimates an increase in the amount of groundwater pumped to meet reasonably anticipated deficiencies from its surface supply. The total supply is projected to meet the total demand through the year 2040 under drought conditions including single dry and multiple-dry years (3 consecutive dry years).

Table 2.4 Water Supply Source Reliability

Supply Source	Average/Normal Water Year	Single Dry Water Year	Multiple Dry Water Years		
			Year 1	Year 2	Year 3
CCWD Surface Supply (1)	100%	100%	100%	100% to 2010 85% after	100% to 2010 85% after
DWD Groundwater	100%	100%	100%	100%	100%

Source: Table 6-1 Diablo Water District UWMP

(1) CCWD surface supply reliability estimate provided by CCWD to District.

Pursuant to the UWMP, CCWD will supply the District with 100% of its surface water supply during normal and single dry years. However, during multiple-dry years, surface water supplies from CCWD will be reduced to 85% of the normal supply.

Water Supply Entitlements, Water Rights, or Service Contracts

The District's primary water supply for its service area is treated surface water from the CVP purchased from its wholesale provider, the CCWD. CCWD contracts with the USBR for water from the CVP. The CVP water is conveyed through the Contra Costa Canal, and treated at the Randall-Bold Water Treatment Plant (RBWTP) in Oakley, which is jointly owned by the District and CCWD. CCWD has a contract with the USBR for 195,000 AFY of water from the CVP.

The raw surface water is supplied via the Contra Costa Canal (at approximately mile post 7.1) that conveys water from Rock Slough in the Sacramento-San Joaquin Delta. The canal is owned by the USBR and operated by CCWD. The canal water can also be supplemented by surface water stored at CCWD's Los Vaqueros Reservoir. The Los Vaqueros Reservoir is a 100,000 acre-foot storage facility located 8 miles south of the City of Brentwood.

The District currently has a joint powers agreement with CCWD for 15 mgd of treated water from the RBWTP, with the right to purchase additional capacity up to a total of 30 mgd. Accommodating build-out of the District's ultimate service area will require expansion of the existing RBWTP, which has a capacity of 40 mgd and is expandable to 80 mgd.

The District must purchase additional treatment capacity in 5 mgd increments. The District anticipates purchasing this additional capacity in years 2015, 2025, and 2035. However, this schedule can be adjusted to purchase additional capacity sooner, if needed (DWD, 2005).

The District also maintains emergency service ties to the neighboring City of Antioch. The City of Antioch currently obtains its water through CCWD. This connection, however, cannot be used as a water supply source.

Groundwater Supply and Basin Description

The District's groundwater provides additional supplies to supplement surface water and to meet the projected demands of the service area. Groundwater from Glen Park wells is conveyed in a dedicated well supply pipeline to a blending facility located near the RBWTP. At the blending facility, the groundwater is treated and blended with treated surface water within the District's distribution system, prior to distribution; there are negligible impacts on water quality.

The first well, the Glen Park Well was put into service in August of 2006. The Glen Park Well has an estimated maximum pumping capacity of approximately 1,500 gallons per minute (gpm), approximately 2.0 mgd; and is currently operating at an average annual rate of approximately 0.55 mgd. There are no signs of drawdown at the Glen Park well. The District intends to construct additional wells in the future to provide more groundwater capacity. Expansion of the groundwater supply system will be based upon the performance of the Glen Park Well. The District will conduct ongoing data collection and monitoring of groundwater levels and groundwater quality, as well as consult with other well operators to monitor effects on other wells in the region.

The UWMP contains a description of the groundwater supply system and groundwater basin. The wells will be in a groundwater basin that has been studied since the late 1990's by Luhdorff & Scalmanini Consulting Engineers (LSCE). A description of the groundwater basin is in the "Investigation of Groundwater Resources in East Contra Costa County" (LSCE, 1999). This investigation was supplemented by additional studies conducted by LSCE when the Glen Park Well was designed and constructed during 2003-2005.

The groundwater basin is not adjudicated (pumping rights have not been set by a court or Board decision) and has not been studied by the California Department of Water Resources. The groundwater basin is not in overdraft. The District is currently preparing a groundwater management plan, on a voluntary basis, according to the procedures outlined in the Groundwater Management Planning Act (Sections 10546-10750 of the California Water Code AB 3030).

The District wells will be located within the region identified as the Marginal Delta Dunes region (LSCE, 1999). Historical conditions suggest that for much of this region, extraction activities have not exceeded the sustainable yield of the groundwater system. Sustainable yield is unlikely to be exceeded because of the general lack of groundwater development throughout much of these areas. In addition, areas in the vicinity of the river and Delta systems, such as the Marginal Delta Dunes region, have a large source of potential recharge, which could offset potential adverse impacts due to increased extraction.

Based on the groundwater investigations conducted to date, the potential appears low for adverse impacts on existing wells in the area. The Glen Park Well site was chosen to minimize impacts based on a regional groundwater investigation. The design of the Glen Park Well and future District wells is based on wide spacing of the wells from each other to minimize interference and localized impacts, and constructing deep wells with deep annular seals to both avoid impacts to shallow wells in the area and to isolate the District's wells from impacts that may be caused by those wells. Testing during seven days of continuous pumping at the Glen Park Well in April 2004 had no measurable or discernable impact on water levels in nearby shallow wells (DWD, 2005).

The closest municipal well to the Glen Park site is the City of Brentwood Well 14. The April 2004 testing indicated that there would be approximately ten feet of drawdown at the Brentwood Well when pumping at 3 mgd for 30 days. At the Glen Park Well, the test pumping rate is greater than the anticipated 1.5 mgd average and greater than the anticipated 2 mgd maximum well pumping capacity. It was concluded that even pumping at 3 mgd would not be expected to adversely affect the operation of the Brentwood Well, i.e., the amount of the additional drawdown due to Glen Park pumping would not significantly affect the Brentwood pumping operations (DWD, 2005).

The ongoing monitoring will also consider potential water quality impacts. Well pumping could potentially cause water quality degradation if pumping were to induce vertical movement of groundwater from one aquifer to another, i.e., from shallow groundwater to deep groundwater. However, based on several groundwater investigations conducted from 1999 through 2004, the anticipated pumping rates of about 1 to 2 mgd at each well (1.5 mgd on average) are not expected to induce local groundwater quality degradation locally or regionally. Groundwater quality impacts are unlikely to occur due to the multiple clay layers between the aquifers, and the deep annular seals on the District wells (DWD, 2005).

In the event that local wells were to be adversely affected (i.e., lowering of groundwater below existing pumps or degradation of water quality), mitigating actions would be taken by the District on a case-by-case basis and could include supplying the project with a different source of water, lowering or replacing pumps, or installing new wells at alternate locations.

If the District determines that additional groundwater wells would adversely affect other wells in the local area, the District could accelerate the purchase of its next entitled installment of water supply from the CCWD's CVP water. The District currently purchases 15 mgd of treated water from CCWD. The District has the right to purchase additional capacity up a total of 30 mgd, to be purchased in 5 mgd increments (DWD, 2005). Although it is currently anticipated that the District will purchase the 5 mgd increments of additional capacity in 2015, 2025, and 2030, the District may exercise its rights to each 5 mgd increment at any time, provided that CCWD is notified at least three years prior. Thus, if the District purchases its full capacity of 30 mgd earlier than anticipated, it would not need to rely on additional groundwater supply in order to meet all projected demands for the next 20 years. The District may also seek out other alternative sources of water that could be available at a future date.

Conclusion

The proposed Emerson Property Project (Project) would create a maximum estimated water demand of 420.7 acre-feet per year (AFY). The Diablo Water District (District) has included the development area and its build-out demands in its Urban Water Management Plan (UWMP). The UWMP identifies the availability of sufficient water supply to meet future needs projected to build out at year 2040 under all conditions including normal, single dry year, and multiple-dry years.

The District concludes that sufficient water supply exists to support the proposed Project as described above. The District's 2006 Facilities Plan contains a detailed plan for major water system improvements that will be implemented to serve new development, including the Project area, and is based on the same demand projections of the UWMP. Existing potable water pipelines will be extended to the Project area for delivery of water; and the Project will participate in funding its share of storage, transmission and supply improvements. The specific facility requirements for the development will be determined when the specific development plans are prepared. All facility costs required to serve the development will be borne by the developers.

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