GEOTECHNICAL CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT

GEOTECHNICAL INVESTIGATION FOR
EBMUD PUMP STATION C STORAGE BASIN
KRUSI PARK, ALAMEDA

FOR

CH2M HILL

FEBRUARY 24, 1994

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INTRODUCTION

This geotechnical data report presents the results of a geotechnical exploration and laboratory testing program performed by Geotechnical Consultants, Inc. (GTC) for CH2M HILL for the proposed East Bay Municipal Utility District (EBMUD) Pump Station C Storage Basin Project. The project site is in Krusi Park, Alameda, California, located as shown in Figure 1 - Location Map.

PROPOSED PROJECT

EBMUD intends to construct an underground reinforced concrete storage basin and new pump station near the existing Pump Station C in Krusi Park. As proposed, the storage basin will be designed as a below-grade tank, approximately 60 feet by 110 feet in plan and embedded about 20 feet to 25 feet deep. The new pump station will be 20 feet by 20 feet in plan and will be 10 feet below the bottom of the storage basin. The top of the basin will be about 1.5 feet below the finish grade. The proposed basin site is within a baseball field in the park. The baseball field will be restored after the project is completed. The project site and location of the basin as presently proposed are shown on Plate 1 - Site Plan.

WORK PERFORMED

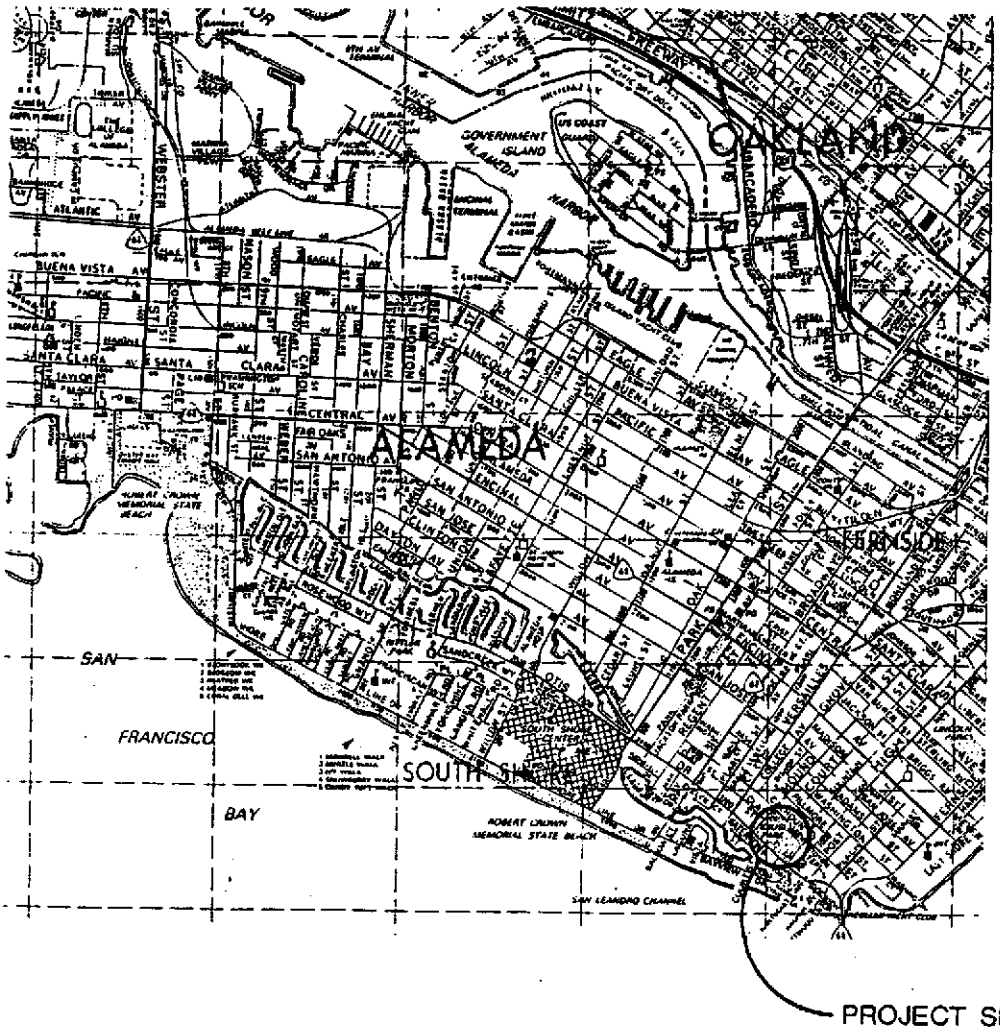
The scope of work for this geotechnical exploration and laboratory testing program was developed through discussions with Dr. John Anderson and Mr. Mike Iverson of CH2M HILL. The work performed included:

1. **Subsurface exploration.** Exploration at the Pump Station C Storage Basin site consisted of drilling four geotechnical drill holes B-1 through B-4, three environmental sampling drill holes E-1 through E-3, and two observation wells, W-1 and W-2. Locations of the drill holes and monitoring wells are shown on Plate 1. Details of the field exploration program as presented in Appendix A - Supporting Geotechnical Data. Drill hole logs for B-1 through B-4 are presented in Plates A1.1 through A1.4 - Log of Drill Hole. Logging of E-1 through E-3 and W-1 and W-2 was not a part of this investigation.

2. **Laboratory Testing.** Soil samples recovered from drill holes B-1 through B-4 during drilling were tested in the laboratory for their index and engineering properties. Tests performed include moisture and density determination, grain size distribution, direct shear, Atterberg limits, and

FIGURE 1

LOCATION MAP



Not to Scale

(Source: The Thomas Guide, 1991)

determination of undrained shear strength using torvane. Brief summaries of the tests and test results are presented in Appendix A.

3. **Sampling for Hazardous Materials Testing.** Samples for environmental testing were taken from drill holes B-1 through B-4, and E-1 through E-3. The samples were then transported to EBMUD's District Laboratory on the same day. Developing a schedule for hazardous materials testing, testing, and interpretation of the test results are not part of this scope of work. A discussion of the sampling procedure and schedule is presented in Appendix A.

4. **Installation of Observation Wells.** Two observation wells, W-1 and W-2, were installed to provide access to measure water levels over a period of time and to obtain water samples. Locations of the observation wells are shown on Plate 1. Water sampling, periodic measurement of water levels, and logging of these holes were not a part of our scope of work. A description of the observation well installation is provided in Appendix A.

5. **Preparation of Geotechnical Data Report and Technical Memorandum.** We have prepared this geotechnical data report summarizing our findings from the field exploration and laboratory testing program. We will also prepare a technical memorandum as a separate submittal. The technical memorandum will contain a generalized subsurface profile at the project site, and recommended geotechnical parameters for lateral earth pressures for cantilever walls, rigid walls, braced flexible walls, additional active earth pressures during seismic loading, and length of cut-off walls to provide excavation bottom stability.

FINDINGS

SITE CONDITIONS

All proposed improvements addressed by this investigation are located within the boundaries of the existing Krusi Park. Krusi Park, which is in a residential area in southwestern Alameda, includes four baseball fields and three floodlit tennis courts. The park is bounded by Mound Street and High Street on the northwest and southeast sides respectively and by Calhoun Street and Otis Drive on the northeast

and southwest sides respectively. The park is essentially level with irrigated and maintained grass lawns. Surface elevation varies between 102 feet and 103 feet. These elevations are with respect to EBMUD datum. (EBMUD datum is NGVD datum plus 100 feet. Unless otherwise specified, all elevations mentioned in this report are with respect to EBMUD datum.) Presently, the project site is about 1,000 feet from the San Francisco bay.

GEOLOGY

The project is located along the eastern margin of San Francisco Bay. The San Francisco Bay Area lies within the Coast Ranges Geomorphic Province of California. In this region, tectonic forces have folded and faulted the underlying bedrock to produce the topography of northwest-trending ridges and valleys characteristic of the Coast Ranges Geomorphic Province.

Faults of the San Andreas fault system have divided the bedrock underlying the San Francisco Bay Area into several major structural blocks. Alameda is underlain by the Bay Block which is bounded on the east by the Hayward fault and on the west by the San Andreas fault. During the Pleistocene (1.6 million years to 11,000 years ago), the Bay Block subsided relative to the adjacent structural blocks and tilted eastward forming the depression now occupied by San Francisco Bay. During the same period, the Santa Cruz Mountains, Diablo Range, and Berkeley Hills were uplifted.

Jurassic to Cretaceous age Franciscan bedrock lies beneath the site at a depth of many hundreds to as much as one thousand feet below the ground surface. Bedrock encountered during drilling along the San Francisco-Oakland Bay Bridge alignment, which is north of the project site, consists of sandstone, graywacke, siltstone, shale, interbedded chert and shale, and various basic and ultra basic igneous rocks altered to greenstone and serpentine (McCrink, 1992).

The bedrock is overlain by a thick sequence of unconsolidated Quaternary sedimentary units: the Alameda Formation, Older Bay Mud, San Antonio Formation, Merritt Sands, and Younger Bay Mud. The Alameda Formation appears to cover the bedrock in Oakland and nearby areas and consists of a lower unit of continental alluvial and fluvial sediments and an upper unit of marine estuarine sediments mixed with continental alluvial sediments. Older Bay Mud (also referred to as "Yerba Buena Mud") is a Pleistocene estuarine marine clay deposited over the Alameda Formation.

The overlying San Antonio Formation is composed of alluvial clays, silts, sands, and gravels deposited over the exposed and eroded Older Bay Mud surface during the late Pleistocene. Merritt Sand is composed of wind and water deposited beach and near-shore deposits (Radbruch, 1957) and is exposed across much of the Alameda and Oakland area. The youngest geologic unit is Holocene age Younger Bay Mud, a soft and compressible marine clay deposited between 11,000 and 6,000 years ago.

An 1892 map of Alameda (Moreal, 1892) indicates that most of the existing Krusi Park was part of the old shoreline. This also suggests that the park surface is underlain by recent fill of varying thickness, as is most of Alameda southwest of Otis Drive. The project site was formerly occupied by tidal flats and sloughs flanking the east shoreline of San Francisco Bay (Radbruch, 1969). These tidal flats were covered by artificial fill around the 1920's. As a consequence of the fill placement, the shoreline now lies about 1,000 feet southwest of the site.

FAULTS AND SEISMICITY

The project area is located within the seismically active San Francisco Bay Area. Earthquake activity in the San Francisco Bay region is dominated by the northwest-trending San Andreas fault system. This fault system forms a crustal boundary along which the Pacific and North American tectonic plates move past one another at rates of a few inches per year. Accumulating crustal strain is relieved by right lateral strike slip faulting on the San Andreas and its related faults. In the Bay Area, the fault system is a broad, complex zone across which most of the horizontal slip is distributed over the San Andreas, Hayward, Calaveras, San Gregorio, and Rodgers Creek faults.

A review of historic earthquake records compiled since 1800 indicates that five earthquakes of magnitude 6.0 or greater have occurred within 20 miles of the site during this period (Blake, 1991a). The reported rupture of the northern segment of the Hayward fault in 1836 (estimated Richter Magnitude 6.8), the rupture of the southern segment of the Hayward fault in 1868 (estimated Richter Magnitude 6.8), and the rupture of the northern San Andreas fault during the 1906 San Francisco earthquake (estimated Richter Magnitude 8.2) caused particularly strong groundshaking at the site.

The approximate distance to selected nearby faults and their maximum credible earthquake (MCE) magnitudes are given in Table 1 - Active Faults. No active faults are known to cross the storage basin site.

TABLE 1
ACTIVE FAULTS

Fault	Distance to Site (miles)	MCE[1] Magnitude
Hayward	4	7.00
Calaveras	14	7.00
San Andreas (Northern)	15	8.00
Concord	17	6.75
Palo Colorado-San Gregorio	20	7.75
Greenville	20	7.00
Green Valley	23	7.00

[1]from Blake (1991b) after Anderson (1984) and Wesnousky (1986).

The Working Group on California Earthquake probabilities (1990) have estimated that there is a combined probability of 67 percent that one or more earthquakes of magnitude 7.0 or greater will occur in the San Francisco Bay region during the next 30 years. This conclusion is based on the results of a probabilistic analysis and considers the release of accumulated strain by the 1989 Loma Prieta earthquake. The Working Group study considered potential rupture of segments of the San Andreas, Hayward, and Rodgers Creek faults. Adequate geologic data on the Calaveras fault was unavailable at the time of their study, so this fault's contribution to the regional seismic hazard was not considered by the Working Group.

EARTH MATERIALS

We encountered the following earth materials within the 100-foot maximum depth of our subsurface exploration.

Artificial Fill (af). A 4-foot to 8-foot thick surface layer of artificial fill was present at all our drill hole locations. The fill material encountered during drilling consisted mainly of poorly graded loose sand. The upper 2 feet to 4 feet of sand was

rich in organics, presumably top soil imported for the park lawns. Below this, we encountered assorted debris within the sand matrix. This debris included cobbles, decaying pieces of tree limbs, wood chips, pieces of concrete, asphalt, brick, and glass. **Drill holes B-1 and B-3 at a depth of about 3 feet, encountered an approximately 1-foot layer of sand mixed with a dark, oily substance.** No other oily soils were found in any of the other borings, including the monitoring wells and the environmental borings.

Younger Bay Mud (Qyb). Younger Bay Mud, a soft, moderately to highly plastic, compressible marine clay with abundant shells, is present beneath the artificial fill in all our drill holes. The thickness of the Younger Bay Mud varied from 5 feet to 8 feet. In drill holes B-2, B-3, and B-4, the bottom of the Younger Bay Mud is about 12 feet to 12.5 feet below the ground surface. The Younger Bay Mud extends to a depth of 16 feet in B-1.

Merritt Sand (Qm). An approximately 24-foot to 30-foot layer of Merritt Sand was present below the Younger Bay Mud in all our geotechnical drill holes. This sand, as encountered in our drill holes, is a medium dense to dense, poorly graded silty sand with some shell fragments. Blow counts in this layer ranged from 17 to 47 blows per foot. Grain size tests on selected samples indicate that the sand from this unit contains about 10 to 20 percent fines.

San Antonio Formation (Qs). The San Antonio Formation underlies the Merritt Sand. This formation was 35 feet thick as encountered in B-1 and B-2. This formation consists of layers of stiff to very stiff lean clay, dense poorly graded sand, dense clayey sand, and gravel. Except in B-3, stiff to very stiff lean clay was found immediately beneath the Merritt Sand layer, at a depth of 40 to 45 feet below existing ground. This layer of lean clay was 5 feet thick in B-2 and B-4 and 25 feet thick in B-1. In B-3, the Merritt Sand was underlain by 5-foot layers of dense clayey sand, very dense poorly graded sand, and very dense well graded gravel. Beneath the layer of gravel, at a depth of 50 feet below existing ground, we encountered very stiff to hard lean clay. Blow counts of 79 blows per foot were recorded in the gravel layer in B-3.

Older Bay Mud (Qob). Older Bay Mud, also known as Yerba Buena Mud, was found beneath the San Antonio Formation in B-1 and B-2. The Older Bay Mud encountered consisted of stiff lean clay with fine gravel in B-1 and clayey sand in B-2.

Occasional shell fragments were present in the Older Bay Mud samples from both drill holes.

GROUNDWATER

During our field exploration, groundwater in the geotechnical drill holes varied from 3 feet in B-3 to 7 feet in B-4, corresponding to elevations 99 feet and 96 feet respectively. After installation of the observation wells, groundwater was measured at a depth of 3.7 feet in W-1 and 4.3 feet in W-2, both corresponding to elevation 98.4 feet. Seasonal rainfall and tidal fluctuations of nearby San Francisco Bay influence seasonal and daily groundwater levels at the site.

CLOSURE

Subsurface exploration of any site is confined to selected locations and conditions may, and often do, vary between and around these locations. Should unanticipated subsurface conditions come to light during project development or construction excavations, any geotechnical recommendation based on this report should be reviewed with respect to these conditions.

The findings of this report are presented within the limits prescribed by the client, in accordance with generally accepted professional engineering and geologic practices. There is no other warranty, either express or implied.

Respectfully submitted,
GEOTECHNICAL CONSULTANTS, INC.

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Senior Engineer

M. R. Petersen, C.E.G., G.E.

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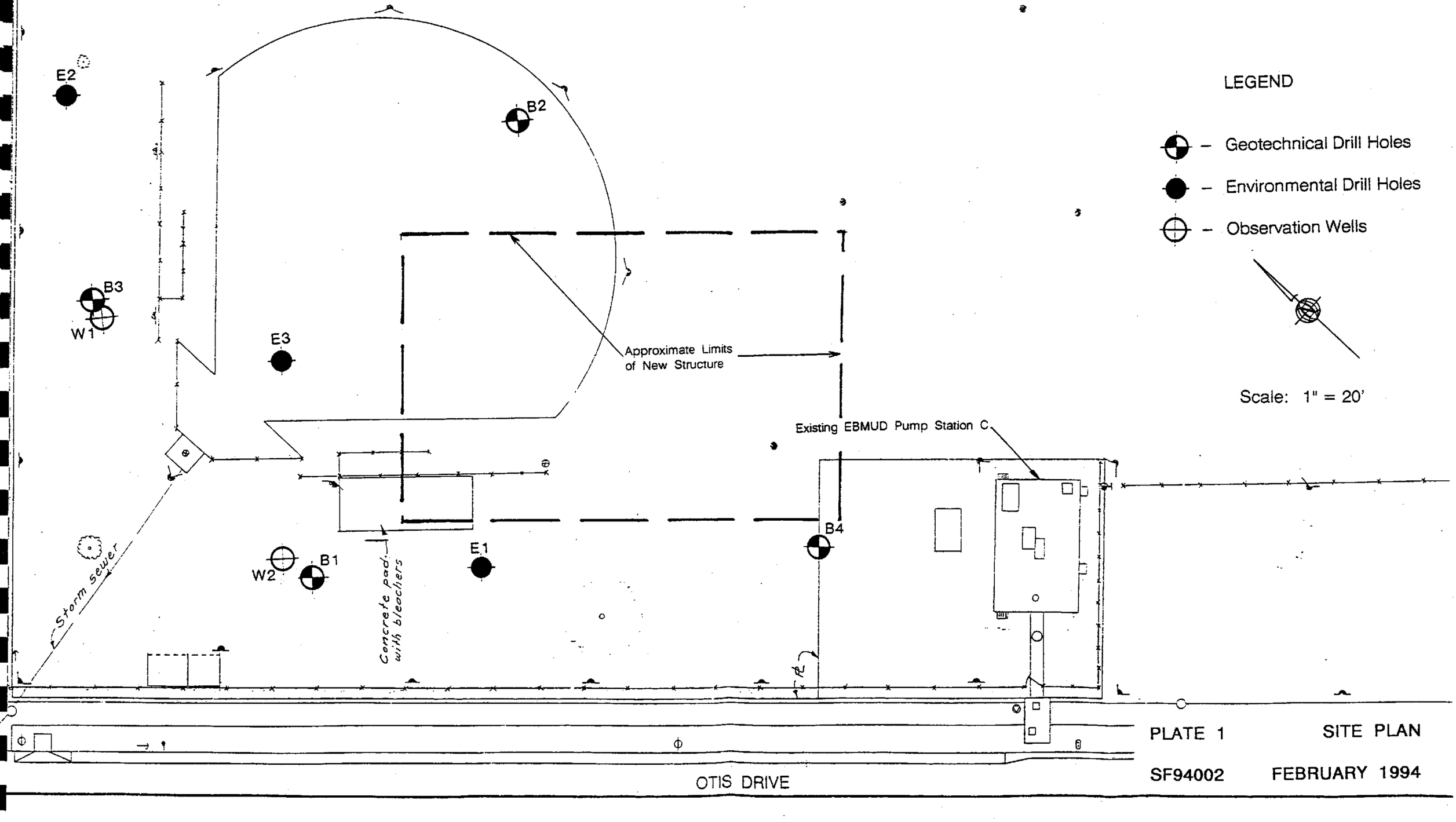


LEGEND

– Geotechnical Drill Holes

– Environmental Drill Holes

– Observation Wells

Scale: 1" = 20'

PLATE 1 SITE PLAN

SF94002 FEBRUARY 1994

APPENDIX A
SUPPORTING GEOTECHNICAL DATA

Exploration at the Pump Station C Storage Basin site consisted of drilling four geotechnical drill holes B-1 through B-4, three environmental drill holes E-1 through E-3, and two observation wells, W-1 and W-2. Drilling was accomplished using a Failing 1500 drill rig and rotary wash drilling method. The exploration was carried out between January 31 and February 3, 1994.

SUBSURFACE EXPLORATION

After obtaining necessary permits and clearances, we drilled four exploratory geotechnical drill holes, B-1 through B-4, using the rotary wash drilling method. Drill holes B-1 and B-2 extended to depths of about 100 feet and 75 feet respectively. The remaining two were drilled to depths of about 50 feet. Locations of the geotechnical drill holes are shown on Plate 1. Drill hole logs are presented in Plates A1.1 through A1.4 - Log of Drill Hole. After drilling and sampling was completed, the soil cuttings and drilling mud were transferred to steel drums and placed within the existing Pump Station C enclosure. The drill holes were grouted with cement slurry.

Along the geotechnical drill holes, relatively undisturbed samples were recovered at selected depths during drilling using a 3-inch O. D., 2.5-inch I. D. split barrel sampler with 6-inch long brass sampling liners. Additionally, a Standard Penetration Test (SPT) sampler (2-inch O. D., 1-3/8-inch I. D.) was also used to retrieve disturbed samples. The sampler was driven into underlying deposits by repeatedly dropping a 140-pound hammer from a 30-inch height onto the drill rod to which the sampler was attached. The blow-count, which is the number of blows required to drive the sampler the last 12 inches of an 18-inch penetration, was recorded as an indication of the density of the subsurface materials. In addition, thin-walled Shelby tubes, measuring 3 inches in diameter and 30 inches long, were used to recover samples of the soft Younger Bay mud.

All samples of the earth materials obtained were sent to the laboratory for examination, testing, and classification using the Unified Classification System and Group Symbol. The engineering descriptions and soil classifications of earth materials encountered are presented on Plates A-1.1 through A-1.4. A legend to logs are presented on Plate A-2 - Legend to Logs.

LABORATORY TESTING

MOISTURE AND DENSITY TEST

The moisture content and densities of undisturbed samples were determined prior to additional testing. The in-place wet densities of the samples were measured and the moisture contents were determined in accordance with Standard Test Method ASTM D2216. The measured moisture contents considered to represent the moisture content of the entire sample in order to determine the samples' dry densities. The test results are presented on the drill hole logs and in Table A1 - Moisture and Density Test Results.

TABLE A1
MOISTURE AND DENSITY TEST RESULTS

Drill Hole	Depth (feet)	Dry Density (pcf)	Moisture Content
B-1	6.0	66	32%
B-1	10.5	50	80%
B-1	15.5	111	19%
B-1	25.5	109	18%
B-2	4.0	111	11%
B-2	15.5	112	18%
B-2	20.5	112	20%
B-3	11.5	110	22%
B-4	5.5	103	2%
B-4	8.0	53	82%
B-4	20.5	108	18%
B-4	40.5	107	21%

DIRECT SHEAR TEST

Direct Shear Tests were conducted on three selected granular samples. The tests were performed in accordance with Standard Test Method ASTM D3080. Test results are presented on Plates A-3.1 through A-3.3 - Direct Shear Test Data.

GRAIN-SIZE DISTRIBUTION

Grain-size distribution tests were conducted on eight samples in accordance with Standard Test Method ASTM D422. Test results are presented on Plates A-4.1 through A-4.4 - Grain-Size Distribution Data.

ATTERBERG LIMIT TEST

The Atterberg Limits, liquid limits and plastic limits, were determined on five samples of fine grained materials. Testing was performed in accordance with Standard Test Method ASTM D4318. The test results are presented on the drill hole logs.

TORVANE TEST

Torvane tests were performed on three soil samples obtained within the layer of Younger Bay Mud. Testing was performed in accordance with Standard Test Method ASTM D4648. The test results are presented on the drill hole logs.

SAMPLING FOR HAZARDOUS MATERIALS TESTING

Two soil samples for hazardous materials testing were taken within the top 30 feet of B-1 through B-4. At the direction of CH2M HILL's environmental engineer, additional samples for hazardous materials testing were recovered from environmental drill holes E-1 through E-3, whose locations are shown on Plate 1. The samples in E-1 through E-3 were recovered within five feet of existing grade. Prior to drilling each drill hole, the drill equipment was decontaminated by steam cleaning. Before recovering samples for hazardous materials testing, the sampler and sampling sleeves were decontaminated using a solution of alconox and water. After recovering the soil samples, the samples were sealed with teflon and stored in a cooler at approximately 4 degrees Celsius.

The samples were then transported to EBMUD's District Laboratory on the same day. Developing a schedule for hazardous materials testing, testing, and interpretation of the test results are not part of this scope of work.

INSTALLATION OF OBSERVATION WELLS

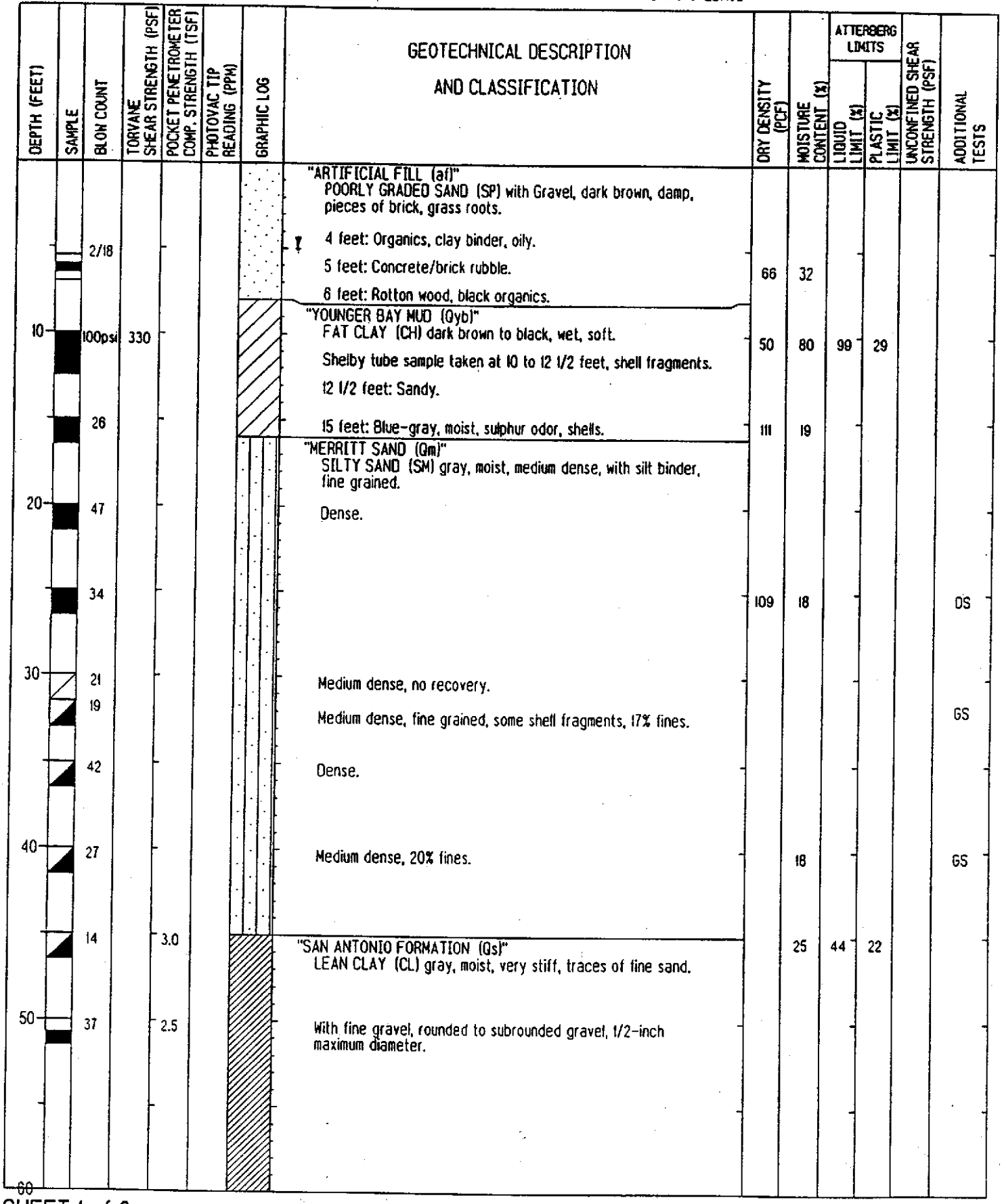
Two observation wells, W-1 and W-2, were installed to provide the opportunity to measure water levels over a period of time and to obtain water samples at: (1) the shallow layer of Younger Bay Mud, a soft and compressible clay, encountered at a depth of about 8 feet, and (2) the poorly graded Merritt sand found beneath the layer of Younger Bay Mud. After obtaining necessary permits from Zone 7 Water Agency of Alameda County, we installed W-1 and W-2 to depths of 30 feet and 13 feet respectively. The locations of the observation wells are shown on Plate 1. The drilling equipment was decontaminated by steam cleaning prior to drilling each well. The wells were constructed using 2-inch diameter flush threaded Schedule 40 PVC pipes. Machine slotted well screens with 0.02 inch slots were used between 20 feet and 30 feet in W-1 and between 9 feet and 13 feet in W-2. Monterey No. 3 sand, a coarse, poorly graded sand, was introduced in the annulus between the drill hole side walls and the slotted sections of the pipes. Above the slotted section, the drill holes were sealed using bentonite and cement slurry.

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B1
DRILLING DATE: January 31, 1994
ELEVATION: 102.67 feet
DATUM: EBMUD



LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B1
DRILLING DATE: January 31, 1994
ELEVATION: 102.67 feet
DATUM: EBMUD

DEPTH (FEET)	SAMPLE	BLOW COUNT	TORVANE SHEAR STRENGTH (PSF)	POCKET PENETROMETER COMP. STRENGTH (TSF)	PHOTOVAC TIP READING (PPM)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	UNCONFINED SHEAR STRENGTH (PSF)	ADDITIONAL TESTS
		60		3.5			Less gravelly.						
70		54					"SAN ANTONIO FORMATION (Qs)" POORLY GRADED SAND (SP) gray, moist, very dense, medium grained, trace of clay binder.						
80		12		1.5			"OLDER BAY MUD (Qob)" LEAN CLAY (CL) with Gravel, gray, moist, stiff, shell fragments, with fine gravel. 81 feet: Lean Clay (CL) gray, moist, stiff, no gravel.						
90		48		3.0			Some silt and fine sand, very stiff.						
100		55		4.5			Hard.						
110							Bottom of drill hole at 101 1/2 feet. Groundwater encountered at 5 feet. Hole grouted with cement slurry, soil cuttings drummed, sealed and left in Pump Station C enclosure.						
120													

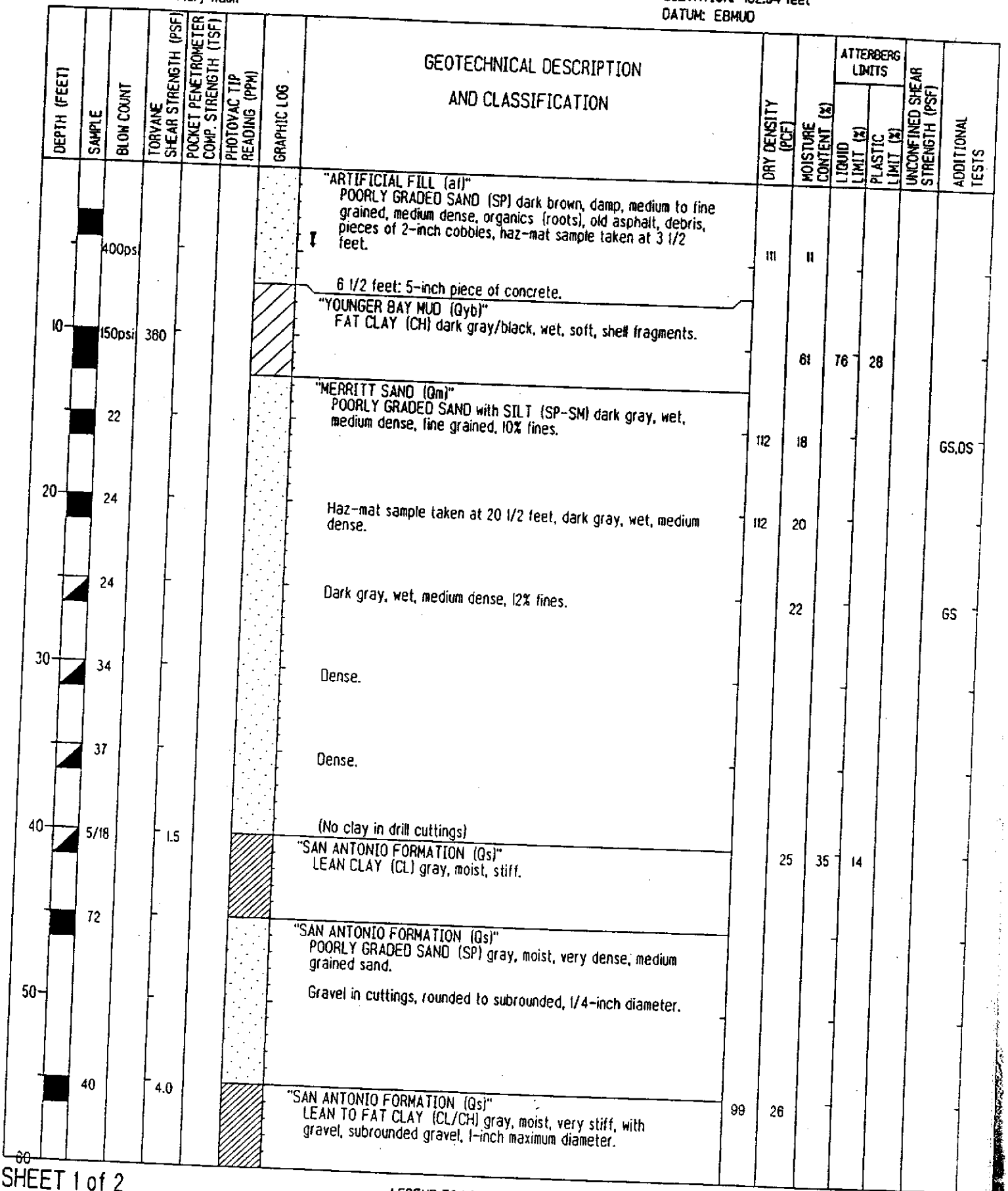
LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B2
DRILLING DATE: February 1, 1994
ELEVATION: 102.94 feet
DATUM: EBMUD



LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B2
DRILLING DATE: February 1, 1994
ELEVATION: 102.94 feet
DATUM: EBMUD

DEPTH (FEET)	SAMPLE	BLOW COUNT	TORVANE SHEAR STRENGTH (PSF)	POCKET PENETROMETER COMP. STRENGTH (TSF)	PHOTOVAC TIP READING (PPM)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	UNCONFINED SHEAR STRENGTH (PSF)	ADDITIONAL TESTS
							No gravel in cuttings.						
		41		2.5			No gravel.						
70													
		29					"OLDER BAY MUD (Qob)" CLAYEY SAND (SC) gray, moist, medium dense, with shells.						
							Bottom of drill hole at 76 1/2 feet. Groundwater encountered at 4 1/2 feet. Hole grouted with cement slurry, soil cuttings drummed, sealed and left in Pump Station C enclosure.						
80													
90													
100													
110													
120													

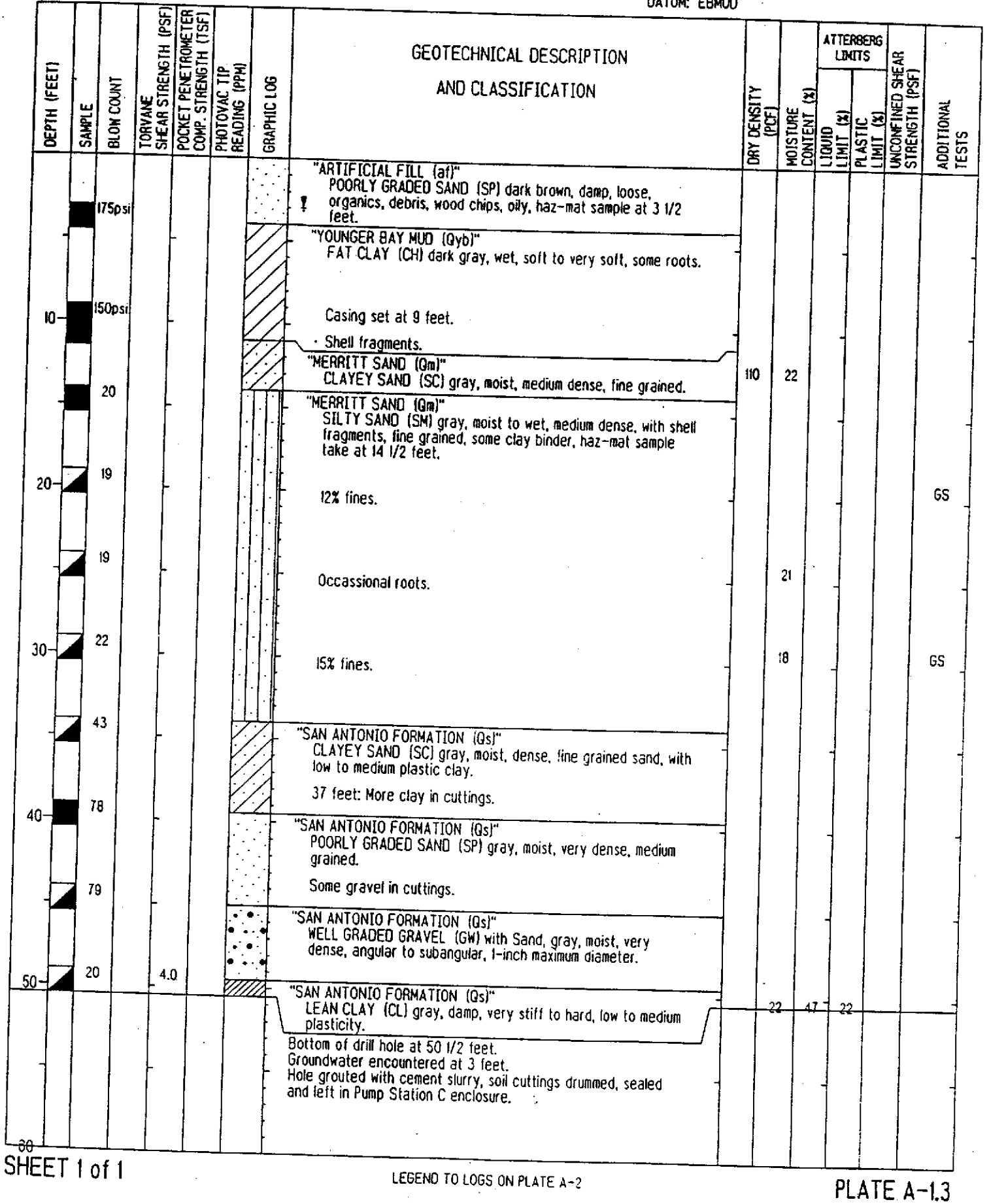
LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B3
DRILLING DATE: February 2, 1994
ELEVATION: 102.12 feet
DATUM: EBMUD



SHEET 1 of 1

LEGEND TO LOGS ON PLATE A-2

PLATE A-1.3

LOG OF DRILL HOLE

JOB NO.: SF94002
PROJECT: Pump Station C Storage Basin
LOCATION: Krusi Park, Alameda
DRILLING METHOD: Rotary Wash

LOGGED BY: G. Neelakantan
CHECKED BY: M.R. Petersen

DRILL HOLE NO.: B4
DRILLING DATE: February 2, 1994
ELEVATION: 102.88 feet
DATUM: EBMUD

DEPTH (FEET)	SAMPLE	BLOW COUNT	TORVANE SHEAR STRENGTH (PSF)	POCKET PENETROMETER COMP. STRENGTH (TSF)	PHOTOVAC TIP READING (PPM)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	UNCONFINED SHEAR STRENGTH (PSF)	ADDITIONAL TESTS
							"ARTIFICIAL FILL (af)" POORLY GRADED SAND (SP) dark brown, damp, loose to medium dense, fine grained, with organics, roots, debris, haz-mat sample taken at 3 feet.						
		600psi					Dry, fine grained loose sand (beach sand), no debris.	103	2				
10		175psi	360				"YOUNGER BAY MUD (Qyb)" LEAN CLAY (CL) dark gray, moist to wet, soft, with fine sand intrusions, organic odor.	53	82				
							Shell fragments in cutting.						
		20		1.5			Stiff, with shell fragments.						
20		33					"MERRITT SAND (Qm)" SILTY SAND (SM) gray, moist, medium dense, fine grained.						
							Dense, with less fines, moist to wet.	106	18				OS
		17					Medium dense with shell fragments, 12% fines.		22				GS
30		21					19% fines.						GS
		32					Dense, with clay binder.						
							Clay in cuttings.						
40		16		1.5			"SAN ANTONIO FORMATION (Qs)" LEAN CLAY (CL) gray, moist, stiff, with some fine sand, medium to low plasticity.	107	21	30	13		
		96/10					"SAN ANTONIO FORMATION (Qs)" WELL GRADED SAND (SW) gray, moist, very dense, with subangular to subrounded gravel, 0.5-inch maximum diameter.						
50		63					"SAN ANTONIO FORMATION (Qs)" WELL GRADED GRAVEL (GW) gray-brown, moist, very dense, subangular to subrounded, 0.5-inch maximum diameter, with coarse sand and silt.						
							Bottom of drill hole at 51 1/2 feet. Groundwater encountered at 7 feet. Hole grouted with cement slurry, soil cuttings drummed, sealed and left in Pump Station C enclosure.						
60													

SHEET 1 of 1

LEGEND TO LOGS ON PLATE A-2

PLATE A-1.4

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION			GROUP SYMBOL	DESCRIPTION	GRAPHIC LOG
COARSE GRAINED SOILS Over 50% By Weight Coarser Than No.200 Sieve Size	GRAVELLY SOILS OVER 50% OF COARSE FRACTION LARGER THAN NO.4 SIEVE SIZE	CLEAN GRAVELLY SOILS LITTLE OR NO FINES	GW	WELL GRADED GRAVELS OR GRAVEL - SAND MIXTURES	
			GP	POORLY GRADED GRAVELS OR GRAVEL - SAND MIXTURES	
		GRAVELLY SOILS WITH FINES OVER 12% FINES	GM	SILTY GRAVELS OR GRAVEL - SAND - SILT MIXTURES	
			GC	CLAYEY GRAVELS OR GRAVEL - SAND - CLAY MIXTURES	
	SANDY SOILS OVER 50% OF COARSE FRACTION SMALLER THAN NO.4 SIEVE SIZE	CLEAN SANDY SOILS LITTLE OR NO FINES	SW	WELL GRADED SANDS OR GRAVELLY SANDS	
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS	
		SANDY SOILS WITH FINES OVER 12% FINES	SM	SILTY SANDS OR SAND - SILT MIXTURES	
			SC	CLAYEY SANDS OR SAND - CLAY MIXTURES	
FINE GRAINED SOILS Over 50% By Weight Finer Than No.200 Sieve Size	SILTY AND CLAYEY SOILS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, SILTY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY	
			CL	INORGANIC CLAYS, GRAVELLY, SANDY, SILTY, OR LEAN CLAYS, OF LOW TO MEDIUM PLASTICITY	
			OL	ORGANIC CLAYS OR ORGANIC SILTS OF LOW PLASTICITY	
	SILTY AND CLAYEY SOILS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
			OH	ORGANIC CLAYS OR ORGANIC SILTS OF MEDIUN TO HIGH PLASTICITY	
HIGHLY ORGANIC SOILS			Pt	PEAT OR OTHER HIGHLY ORGANIC SOIL, ORGANIC CONTENT GREATER THAN 80%	
				TRASH FILL - LANDFILL REFUSE (NOT A PART OF UNIFIED SOIL CLASSIFICATION SYSTEM)	

SAMPLE TYPES:

- UNDISTURBED SLEEVE
- DISTURBED
- UNSUCCESSFUL ATTEMPT
- STANDARD PENETRATION

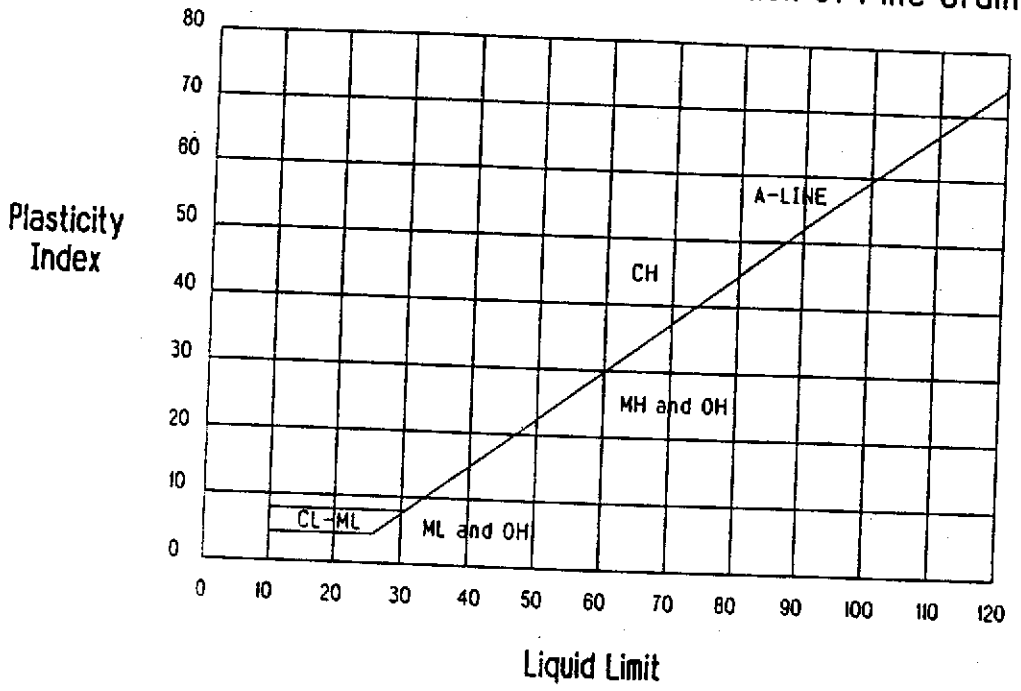
CAVING:

- LIGHT CAVING
- HEAVY CAVING

WATER LEVEL:

LEGEND TO LOGS

PLASTICITY CHART – Used for Classification of Fine Grained Soils



BLOW COUNT – The number of blows required to drive the sampler the last 12 inches of an 18-inch drive. When the sampler is not advanced the last 12 inches, i.e. 100 blows in 9 inches, the notation is 100/9. Symbols designating various hammer weights, drop heights, and sampling methods are shown below. A number not enclosed by one of the following symbols indicates a Standard Penetration Test (SPT) using a 140-pound hammer and 30-inch drop height.

No. of Blows	Driving Weight (pounds)	Drop Height (inches)	Sampling Method
( )			
[ ]			
{ }			
< >			

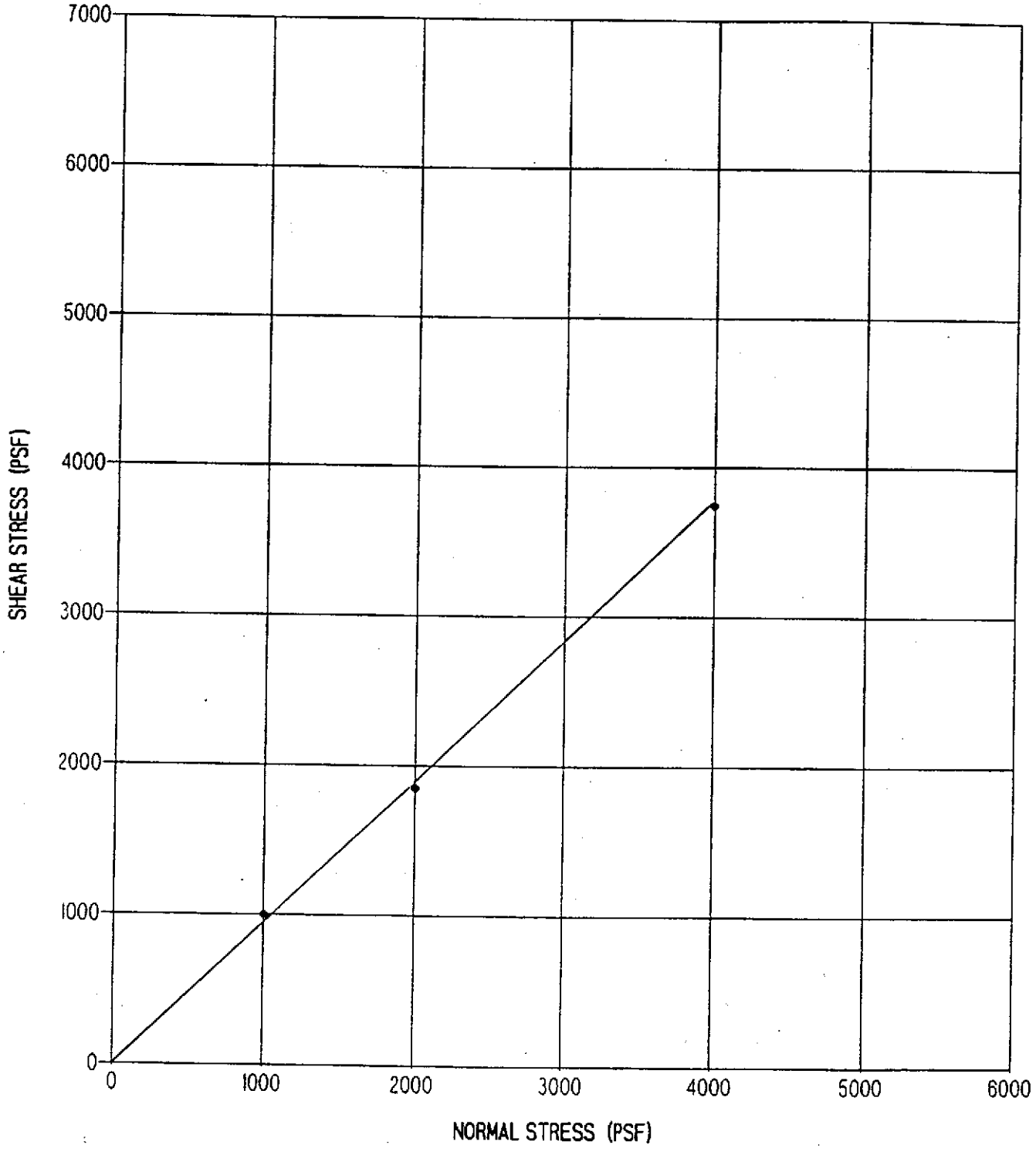
ADDITIONAL TESTS –

C : Consolidation
CL : Chloride
CP : Compaction
DS : Direct Shear
EX : Expansion
GS : Grain Size Distribution
pH : Hydrogen Ion Concentration
PM : Permeability
RS : Resistivity
RV : R-Value
S : Swell
SE : Sand Equivalent
SP : Specific Gravity
SU : Sulphate
TD : Triaxial Compression, Drained
TDy: Triaxial Compression, Dynamic
TU : Triaxial Compression, Undrained
Corr: Corrosion

LEGEND TO LOGS

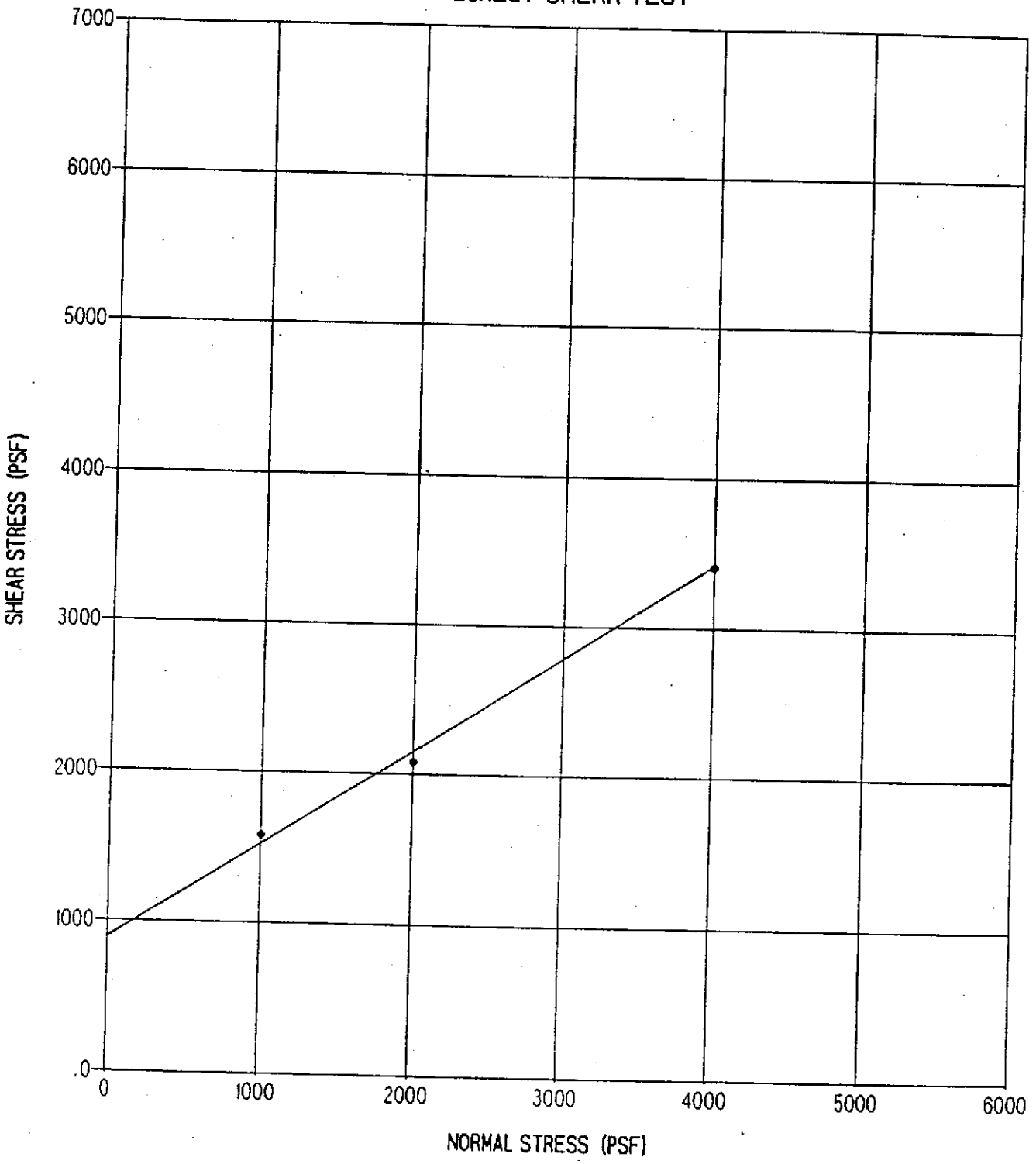
PLATE A-2

DIRECT SHEAR TEST



DRILL HOLE NO.: B1	DEPTH (FEET): 26	MOISTURE CONTENT (%): 18
DRY UNIT WEIGHT (PCF): 109	FRICTION ANGLE (DEGREES): 42	COHESION (PSF): 0
DESCRIPTION: SAND (SM) bluish gray, dense, fine grained.		

DIRECT SHEAR TEST



DRILL HOLE NO.: B2	DEPTH (FEET): 15.5	MOISTURE CONTENT (%): 20
DRY UNIT WEIGHT (PCF): 112	FRICTION ANGLE (DEGREES): 32	COHESION (PSF): 900
DESCRIPTION: SAND (SP-SM) gray, dense.		

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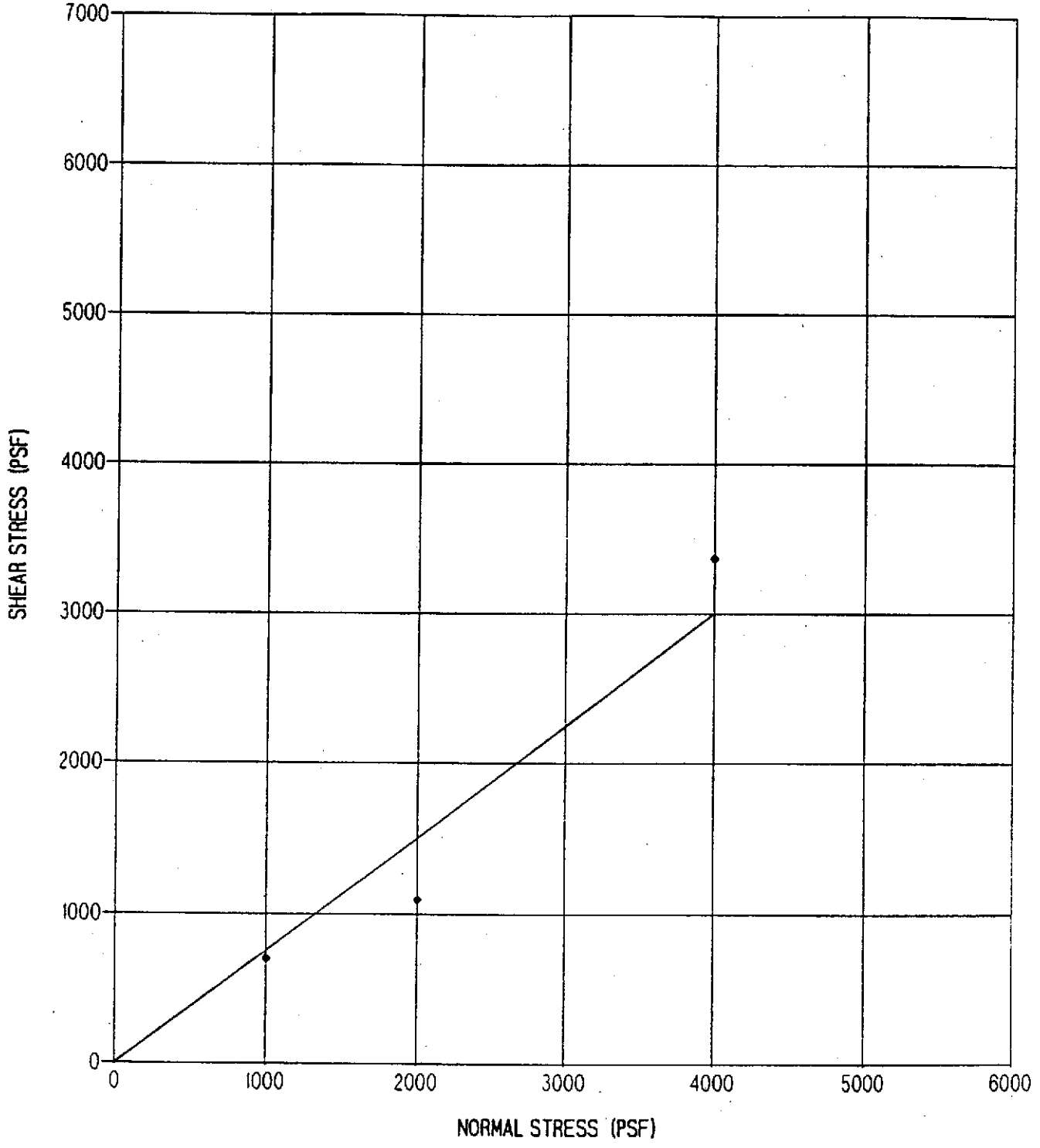
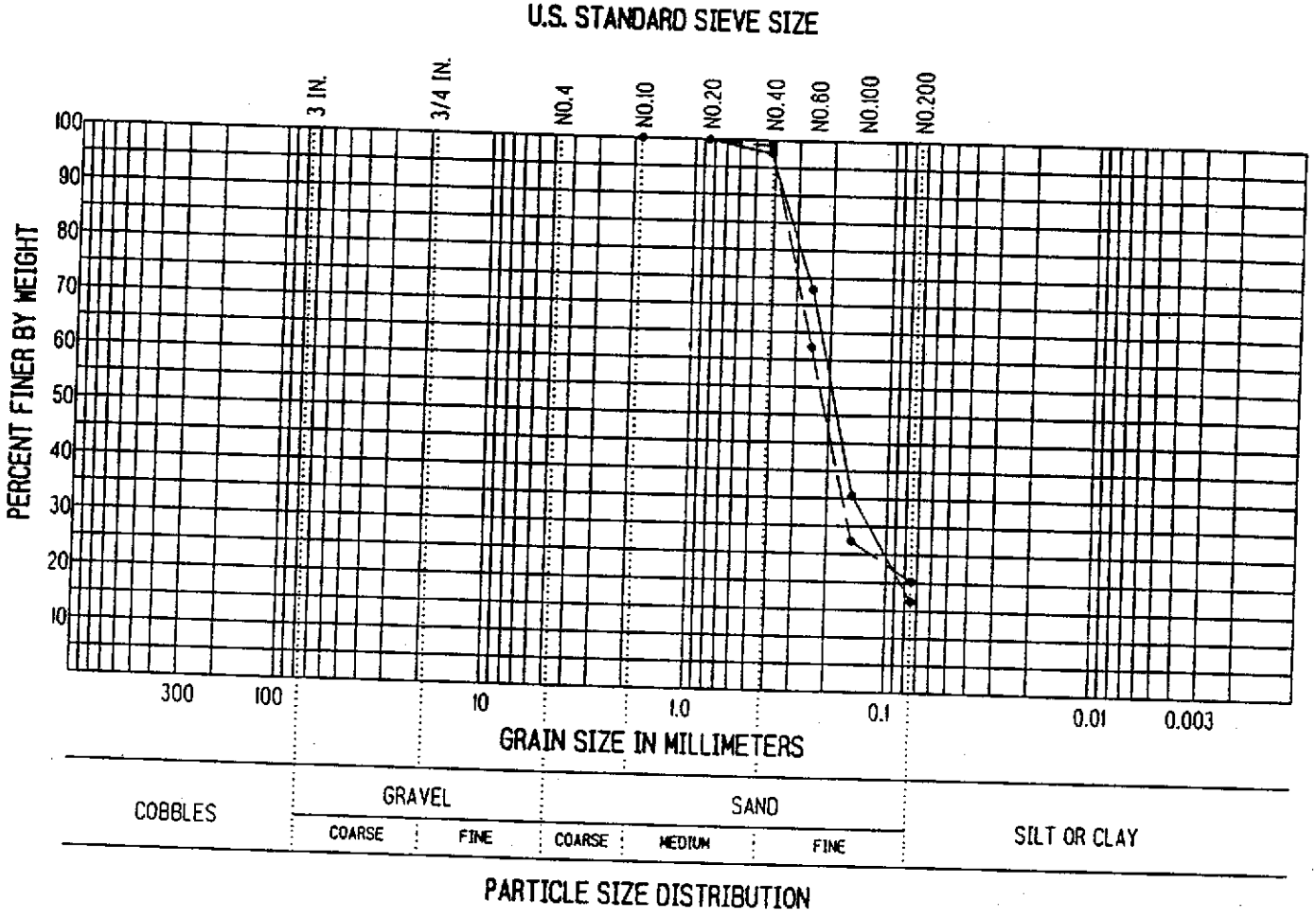
PLATE A-3.2

DIRECT SHEAR TEST



DRILL HOLE NO.: B4	DEPTH (FEET): 21	MOISTURE CONTENT (%): 18
DRY UNIT WEIGHT (PCF): 108	FRICTION ANGLE (DEGREES): 37	COHESION (PSF): 0
DESCRIPTION: SAND (SM) gray, dense, fine.		

GRAIN-SIZE DISTRIBUTION



PARTICLE SIZE DISTRIBUTION

LINE SYMBOL	DRILL HOLE NO.	DEPTH (FEET)	CLASSIFICATION
———	B1	31.5	SM
— — —	B1	40	SM
- - - - - -			
.....			

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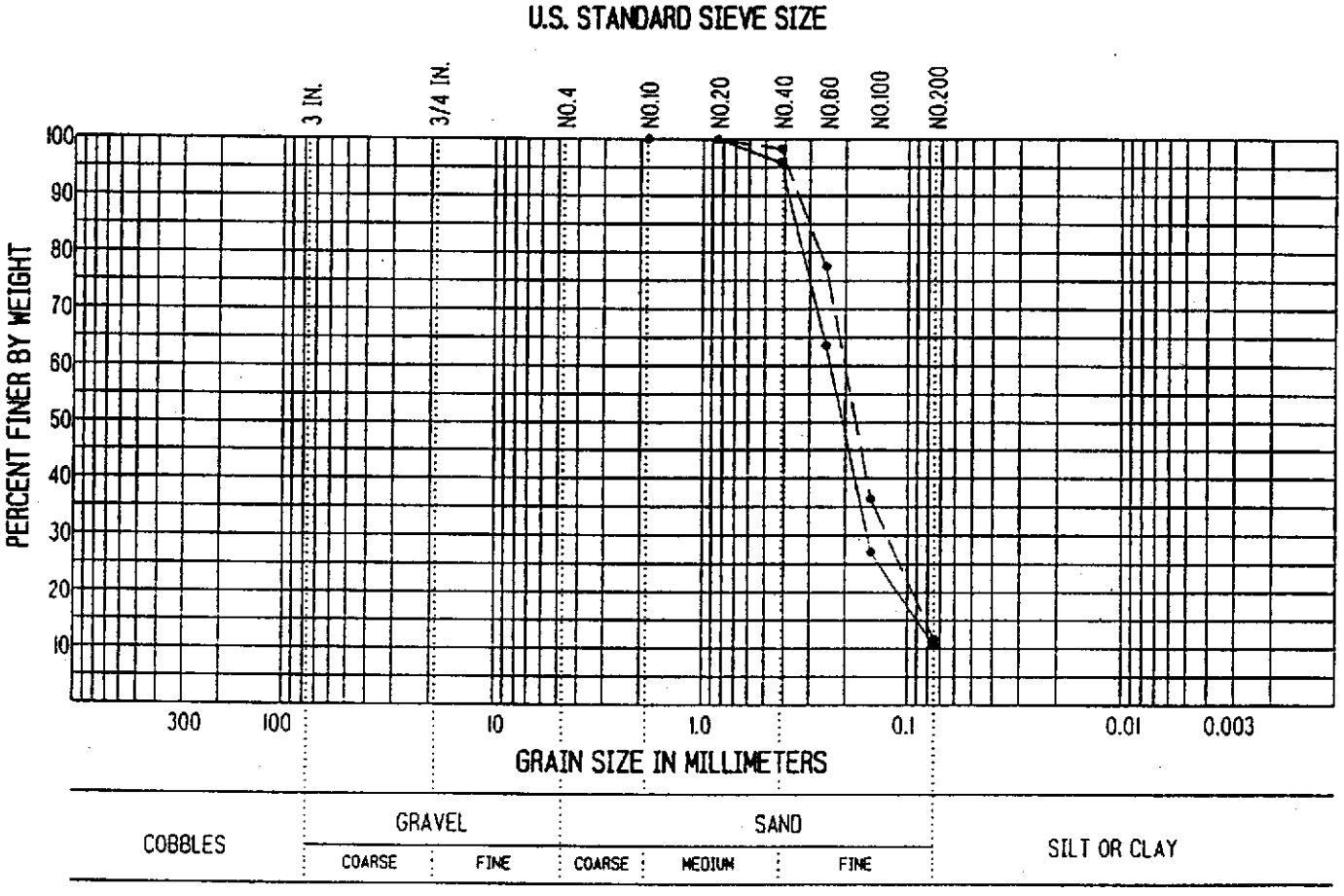
PLATE A-4.1

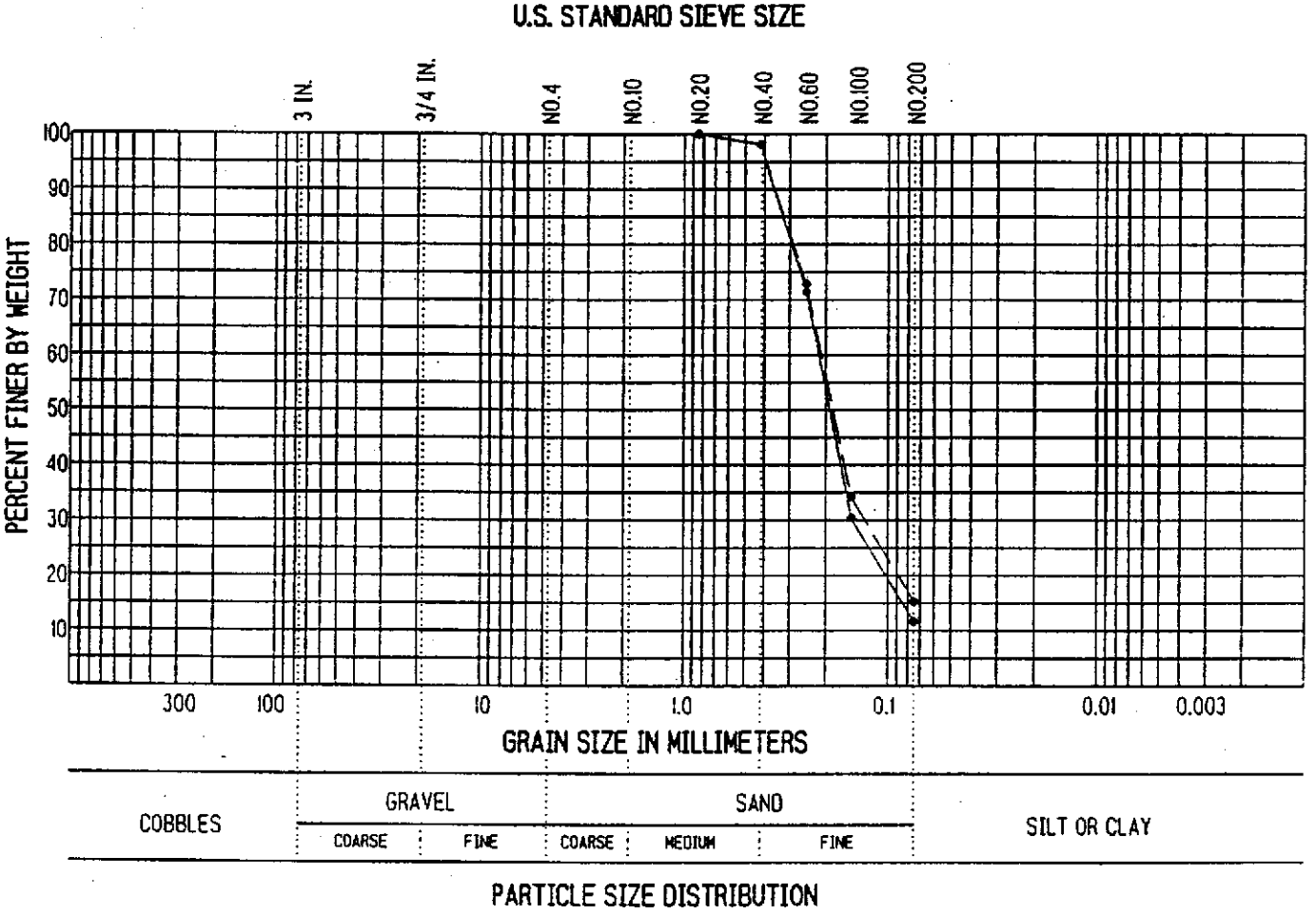
GRAIN-SIZE DISTRIBUTION



PARTICLE SIZE DISTRIBUTION

LINE SYMBOL	DRILL HOLE NO.	DEPTH (FEET)	CLASSIFICATION
———	B2	16	SP-SM
— — —	B2	25	SP-SM
- - - - - -			
.....			

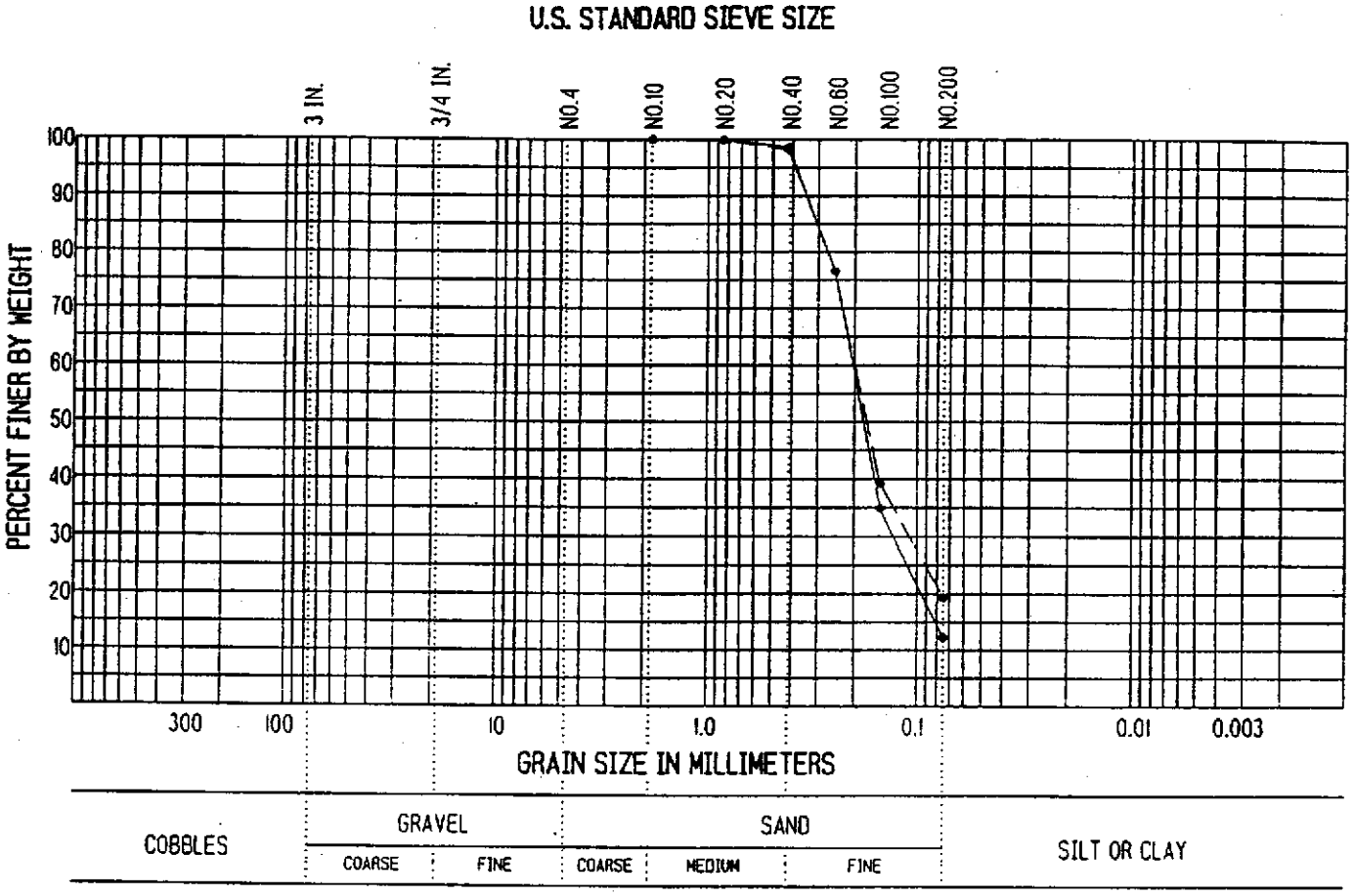
GRAIN-SIZE DISTRIBUTION



PARTICLE SIZE DISTRIBUTION

LINE SYMBOL	DRILL HOLE NO.	DEPTH (FEET)	CLASSIFICATION
———	B3	19	SM
— — —	B3	29	SM
- - - - - - -			
.....			

GRAIN-SIZE DISTRIBUTION



PARTICLE SIZE DISTRIBUTION

LINE SYMBOL	DRILL HOLE NO.	DEPTH (FEET)	CLASSIFICATION
———	B4	25	SM
— — —	B4	30	SM
- - - - - -			
.....			

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PLATE A-4.4