

DRAFT

***Subsurface Conditions Data Report
Phase 4 Fill
Third Runway Embankment
Sea-Tac International Airport***



***Prepared for
Port of Seattle
and HNTB***

***November 29, 2000
J-4978-28***

AR 046207

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**SUBSURFACE CONDITIONS DATA REPORT
PHASE 4 FILL
THIRD RUNWAY EMBANKMENT
SEA-TAC INTERNATIONAL AIRPORT**

INTRODUCTION

This data report compiles information on subsurface conditions, based on geotechnical and hydrogeologic field testing and laboratory testing to support the Phase 4 Fill construction for the Third Runway Embankment Project at the Sea-Tac International Airport. A list of documents that include original presentation of the data is provided in the references section. The companion document to this data report is the Phase 4 Engineering Report, which provides discussion of our engineering analyses and geotechnical recommendations for the plans and specifications.

The site is located at the Sea-Tac International Airport, in SeaTac, Washington (refer to Figure 1, Vicinity Map). Figure 1 shows the area where we performed explorations for this study. The shaded area of Figure 1 is presented on Figure 2, Site and Exploration Plan, showing exploration locations.

We have organized this report into several sections. The main text begins with a summary of the geologic units we encountered followed by a more detailed discussion of subsurface conditions. This is followed by a discussion of the hydrogeologic conditions and testing information we have obtained from our explorations to date. Appendices A and B follow the main text and present results of our subsurface explorations and laboratory testing, respectively.

PURPOSE AND SCOPE

This report provides information on subsurface soil and groundwater conditions for the planned Phase 4 Fill for the Third Runway based on explorations within the areas noted. The Phase 4 Fill, as used in this report, includes areas north and south of South 156th Way as well as additional Phase 4 fill (alternate bid item) that might be added to the west of the proposed Phase 4 fill area. The information presented herein provides the basis for geotechnical engineering analyses and recommendations presented elsewhere.

Information presented herein was obtained in general accordance with Tasks 1.03, 1.13, and 1.3.5 presented in our proposal dated April 5, 2000. This report has been prepared for the use of HNTB and the Port of Seattle for the site and

project described herein. We completed the work according to generally accepted geotechnical engineering practices in the same or similar localities, related to the nature of the work accomplished, at the time the services were accomplished. We make no other warranty, express or implied.

GENERALIZED GEOLOGIC DESCRIPTION AND SUBSURFACE SOIL CONDITIONS

This section provides a description of the geologic and subsurface soil conditions within the Phase 4 Fill, shown on Figure 2, based on our recent explorations at the site and explorations by others. The area of the proposed Phase 4 fill is shown by the dashed line on Figure 2.

Generalized Geologic Conditions

Various existing reports (AGI, 1998 and Hart Crowser, 1999a, 2000a, 2000b and 2000c) describe the generalized geologic conditions for areas at the north end of the proposed runway and along part of the west side, including part of the area covered by this report. In summary, the following geologic units have been identified at the Third Runway project site:

- ▶ Fill (loose to medium dense, locally dense, variably graded, silt, sand, and gravel);
- ▶ Alluvium (primarily soft to stiff, peat, clay, and silt; and very loose to medium dense, fine to medium sand);
- ▶ Recessional Outwash (primarily medium dense to dense, silty sand and gravel, and/or medium stiff to hard, sandy silt and/or sandy clay);
- ▶ Glacial Till (dense to very dense, silty sand and gravel);
- ▶ Advance Outwash (dense to very dense, non-silty to silty sand and gravel); and
- ▶ Lawton Clay (very stiff to hard silt and clay).

Subsurface Conditions

Subsurface soil conditions interpreted from materials encountered in explorations at the site and soil properties inferred from laboratory tests formed the basis for the information contained in this report. Variations between explorations occur due to the variability in gradation, moisture content, and

density/consistency of soils at the site. The nature and extent of these variations may not become evident until construction. If variations become evident, it will be necessary to re-evaluate our interpretation of the soil conditions at the site, as well as any recommendations based on those interpretations.

The subsurface conditions beneath the Phase 4 North Fill (north of South 156th Street), the Phase 4 South Fill (south of South 156th Street), and the additional Phase 4 Fill (west of Phase 4 South Fill) were evaluated separately.

Phase 4 North Fill Area

The following soil materials were encountered in the Phase 4 North Fill area:

Loose to Medium Dense, Slightly Gravelly to Gravelly, Slightly Silty to Silty, SAND with some Organic Material. These sands were encountered in most explorations at the ground surface in a loose to medium dense condition. Roots and other organic materials were observed to about 2 feet in depth. This unit extended from the ground surface to depths from 4 to 13 feet. In test pits HC99-TP17 and HC99-TP26, this layer was interbedded with a 2.5-foot-thick layer of stiff sandy silt and a 1-foot-thick layer stiff slightly gravelly, very sandy silt, respectively.

Soft to Hard, Slightly Sandy SILTS and CLAYS. This unit was encountered in all the explorations except AT97-B58 and HC99-TP26. The thickness of this layer varies from 3 to 8 feet.

Medium Dense to Dense, Gravelly SAND and Sandy GRAVEL. Except for HC99-TP16 and HC99-TP17, this unit was encountered in all of our explorations with a thickness ranging from 1 to 10 feet.

Dense to Very Dense, Slightly Gravelly, Silty SAND, or Hard, Slightly Gravelly, Sandy SILT. This material was encountered in most exploration, except in HC99-TP16 and HC99-TP17. The layer was encountered at a depth from 14 to 23 feet below existing ground surface. The coarser materials were encountered in HC99-B61, HC99-B64, HC99-B72, and HC99-TP26, while the finer materials were encountered in HC99-B58 and AT97-B58. It should be noted that for HC99-TP26, this layer was overlain by a 3-foot-thick layer of medium stiff, sandy, silty clay.

Phase 4 South Fill and Additional Phase 4 Fill Area

This area is fairly similar to the Phase 4 North Fill area, with the exception of the deeper layer of very gravelly sand to sandy gravel. In this area, we encountered:

Loose to Medium Dense Sands, with varying amounts of Silts and Gravels, and some Organic Material. This unit was encountered throughout the site from top of existing ground surface to depths ranging from 4 to 12 feet.

Soft to Medium Stiff and Stiff, Sandy Silts. This layer was encountered in most of the explorations, with thickness ranging from 3 to 9 feet.

Medium Dense to Dense and Very Dense Sands, with varying amounts of Silts and Gravels. This layer was encountered in most explorations, and was called out as either Glacial Till or Outwash material.

Hydrogeologic Conditions

Groundwater Occurrence

Groundwater was encountered in most borings during drilling for this phase of work. The water levels observed in the open borings at the time of drilling (ADT) and prior to monitoring well installation and development are shown on the boring logs (Appendix A).

Groundwater Monitoring

Seven monitoring wells were installed within the area of the Phase 4 Fill. At the present time, four wells have been decommissioned or abandoned, while the remaining three wells are still intact. For these three wells, groundwater elevation are being collected monthly to gain a better understanding of seasonal fluctuations in groundwater elevations and flow patterns in the Phase 4 Fill area. The most recent set of depth to water measurements was collected on October 10, 2000. The available data are compiled and presented in Table A-1.

CLOSING

Hart Crowser appreciates the opportunity to provide this information. Please call if you have any questions.

Sincerely,

HART CROWSER, INC.

JUSTEIN AASEN
Staff Geotechnical Engineer

MICHAEL J. BAILEY, P.E.
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AGI Technologies, 1998. Geotechnical Design Recommendations Phase I Embankment Construction, Third Runway Project, Sea-Tac International Airport, Seatac, Washington. January 22, 1998.

Hart Crowser, 1999a. Subsurface Conditions Data Report, 404 Permit Support, Third Runway Embankment, Sea-Tac International Airport, SeaTac, Washington, July 1999 (J-4978-06).

Hart Crowser, 1999b. Subsurface Conditions Data Report, Phase 3 Fill, Third Runway Embankment, Sea-Tac International Airport, SeaTac, Washington, November 12, 1999 (J-4978-16).

Hart Crowser, 2000a. DRAFT Subsurface Conditions Data Report, North Safety Area, Third Runway Embankment, Sea-Tac International Airport, SeaTac, Washington, March 20, 2000 (J-4978-18).

Hart Crowser, 2000b. DRAFT Subsurface Conditions Data Report, West MSE Wall, Third Runway Embankment, Sea-Tac International Airport, SeaTac, Washington, June 2000 (J-4978-21).

Hart Crowser, 2000c. DRAFT Subsurface Conditions Data Report, Additional Field Explorations and Advanced Testing, Third Runway Embankment, Sea-Tac International Airport, Hart Crowser, September 2000 (J-4978-23, -26, -27, and -31).

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APPENDIX A
FIELD EXPLORATIONS METHODS AND ANALYSIS

APPENDIX A FIELD EXPLORATIONS METHODS AND ANALYSIS

This appendix documents the processes Hart Crowser used in determining the nature of the soils underlying the project site addressed by this report. The discussion includes information on the following subjects:

- ▶ Explorations and Their Location;
- ▶ The Use of Auger Borings;
- ▶ Standard Penetration Test (SPT) Procedures;
- ▶ Excavation of Test Pits;
- ▶ The Use of Cone Penetrometer Probes; and
- ▶ Water Level Measurement.

Explorations and Their Location

NOTE: The explorations for this study were compiled from earlier reports. To expedite production of this report, some explorations not located within the Phase 4 Fill area limits had to be included. Figure 2 should be consulted to verify whether an exploration falls within the Phase 4 Fill boundary.

This report includes the following subsurface explorations:

- ▶ **Borings**
HC99-B58, HC99-B61, HC99-B64, HC99-B72, HC99-B75 through HC99-B77, HC99-B79, HC99-B80, HC00-B142, HC00-B300, and HC00-B303 through HC00-B306
- ▶ **Test Pits**
HC98-TP3 through HC98-TP12, HC99-TP3 through HC99-TP6, HC99-TP9, HC99-TP10, HC99-TP13 through HC99-TP18, HC99-TP26 through HC99-TP29, HC99-TP32 through HC99-TP36, HC99-TP36A, HC99-TP36B, HC99-TP36C, HC99-TP36D, HC99-TP37 through HC99-TP40, HC99-TP44, HC00-TP125 through HC00-TP128, and HC00-TP300 through HC00-TP305
- ▶ **CPT Probe**
HC99-P07

The exploration logs within this appendix show our interpretation of the material encountered based on drilling (or excavation), sampling, and testing data. They indicate the depth where the soils change. Note that the change may be gradual. In the field, we classified the samples taken from the explorations according to the methods presented on Figure A-1A - Key to Exploration Logs.

This figure also provides a legend explaining the symbols and abbreviations used in the logs.

Location of Explorations. Figure 2 shows the location of explorations.

In the field, locations for borings and test pits designated J-4978-06 were originally located by hand taping or pacing from existing physical features. The ground surface elevations at these locations were interpreted from the aerial survey topography shown on the figures.

In the field, locations for borings and test pits designated J-4978-16 were located using GPS survey by Hart Crowser on October 1, 1999. Port of Seattle surveyors performed x, y, z survey for all wells on October 13, 1999, which replaced the GPS locations. GPS coordinates were used for the test pits. The ground surface elevations of the test pits can be interpreted from the aerial survey topography shown on Figure 2.

In the field, locations for borings and test pits designated J-4978-18, J-4978-21, and J-4978-23, -26, -27, and -31 were located by using a global positioning system (GPS) survey by Hart Crowser. Port of Seattle surveyors performed an x, y, z survey for the top of the casing elevations of the wells and ground elevations for piezocones, test pits, and some borings completed without wells. Where available, the Port's survey supersedes the GPS locations. Where Port survey data are not available, ground surface elevations were interpreted from aerial survey topography shown on Figure 2.

For all explorations, the method used in the determination of their locations determines the accuracy of the location and elevation of the explorations.

The Use of Auger Borings

With depths ranging from 15.3 to 34.0 feet below the ground surface, five hollow-stem auger borings, designated HC99-B58, HC99-B61, HC99-B64, HC99-B72, HC99-B75 through HC99-B77, HC99-B79, HC99-B80, HC00-B142, HC00-B300 and HC00-B303 through HC00-B306, were drilled from June 4, 1999 to August 10, 2000. The borings used a 3-3/8-inch inside diameter hollow-stem auger and were advanced with a truck-mounted drill rig subcontracted by Hart Crowser. The drilling was continuously observed by an engineering geologist from Hart Crowser. Detailed field logs were prepared of each boring. Using the Standard Penetration Test (SPT), we obtained samples at 2-1/2- to 5-foot-depth intervals.

Groundwater level in the borings were noted at the time of drilling (ATD) and following installation and development of observation wells where noted on the boring logs and shown in Table A-1.

The borings logs are presented on Figures A-2 through A-16 at the end of this appendix.

Standard Penetration Test (SPT) Procedures

This test is an approximate measure of soil density and consistency. To be useful, the results must be used with engineering judgment in conjunction with other tests. The SPT (as described in ASTM D 1587) was used to obtain disturbed samples. This test employs a standard 2-inch outside diameter split-spoon sampler. Using a 140-pound hammer, free falling 30 inches, the sampler is driven into the soil for 18 inches. The number of blows (N value) required to drive the sampler the last 12 inches only is the Standard Penetration Resistance. This resistance, or blow count, measures the relative density of granular soils and the consistency of cohesive soils. The blow counts are plotted on the boring logs at their respective sample depths.

Soil samples are recovered from the split-barrel sampler, field classified, and placed into water tight jars. They are then taken to Hart Crowser's laboratory for further testing.

In the Event of Hard Driving

Occasionally very dense materials or the presence of gravel and/or cobbles prevented driving the total 18-inch sample. When this happens, the penetration resistance is entered on logs as follows:

Penetration less than six inches. The log indicates the total number of blows over the number of inches of penetration.

Penetration greater than six inches. The blow count noted on the log is the sum of the total number of blows completed after the first 6 inches of penetration. This sum is expressed over the number of inches driven that exceed the first 6 inches. The number of blows needed to drive the first 6 inches is not reported. For example, a blow count series of 12 blows for 6 inches, 30 blows for 6 inches, and 50 (the maximum number of blows counted within a 6-inch increment for SPT) for 3 inches would be recorded as 80/9.

Use of Shelby Tubes

To obtain a relatively undisturbed sample for classification and testing in fine-grain soils, a 3-inch-diameter thin-walled steel (Shelby) tube sampler was pushed hydraulically below the auger. The tubes were sealed in the field and taken to our laboratory for extrusion and classification.

Excavation of Test Pits

Fifty test pits, designated HC98-TP3 through HC98-TP12, HC99-TP3 through HC99-TP6, HC99-TP9, HC99-TP10, HC99-TP13 through HC99-TP18, HC99-TP26 through HC99-TP29, HC99-TP32 through HC99-TP36, HC99-TP36A, HC99-TP36B, HC99-TP36C, HC99-TP36D, HC99-TP37 through HC99-TP40, HC99-TP44, HC00-TP125 through HC00-TP128, and HC00-TP300 through HC00-TP305, were excavated across the site with a tractor-mounted backhoe. The test pits were excavated on July 30, 1998 through May 2, 2000. The sides of these excavated pits offer direct observation of the subgrade soils. The test pits were located by and excavated under the direction of an engineering geologist from Hart Crowser. The geologist observed the soil exposed in the test pits and reported the findings on a field log. Our geologist took representative samples of soil types for testing at Hart Crowser's laboratory. He noted groundwater levels or seepage during excavation. The density/consistency of the soils (as presented parenthetically on the test pit logs to indicate their having been estimated) is based on visual observation only, as disturbed soils cannot be measured for in-place density.

The test pit logs are presented on Figures A-17 through A-41.

Piezocone Penetrometer Probes

We used a piezocone penetrometer to probe the subgrade soils for this study. Completed by Northwest Cone Exploration, the probe, designated HC99-PO7, was advanced to a depth of 16 feet below the ground surface. It used a Begemann type cone (See Figure A-1B). The system was mounted on a truck which provided the necessary reaction for the applied loads. The cone probe configuration used in the investigation is similar to that shown on Figure A-1B. This figure also shows the classification method used to develop the soil behavior index represented on the individual logs for classification purposes. The piezocone is arranged to measure the following parameters, which are used for the soil classification:

- ▶ Tip resistance, q_T in tsf (corrected resistance to soil penetration developed at the cone tip);

- ▶ Friction resistance, f_s in tsf (resistance to soil penetration developed along the friction sleeve); and
- ▶ Pore water pressure behind the cone tip, U_{bt} in psi.

The log of the piezocone probes proposed by Northwest Cone Exploration is presented on Figure A-42.

Cone Penetration Test Procedures

The electric piezocone penetrometer test procedure involves hydraulically pushing a series of cylindrical rods into the soil at a constant rate of two centimeters per second and subsequently monitoring soil and pore fluid response near the conical tip. The cylindrical rod at the bottom of the drill string houses the pressure transducer and load cells which, during probing, measure the parameters indicated above. The results are often used with engineering judgment in conjunction with other tests, preferably the SPT procedure, which allows soil sample collection for direct comparison purposes. Tests were performed in general accordance with procedures outlined in ASTM D 3441, Standard Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil.

The cone system is mounted on a truck or bulldozer to provide the necessary reaction for the applied loads. The cone tip has a surface area of about 10 square centimeters (cm^2) and an angle of 30 degrees from the axis. The friction sleeve has a surface area of about 150 cm^2 . Prior to testing, a plastic filter element, which has been saturated under vacuum in glycerin, is placed behind the cone tip. This filter element transmits pore pressures to the transducer. Load cells measure end resistance on the tip and frictional resistance on the friction sleeve. As the cone penetrates the soil, measurements are continuously recorded on a portable computer at depth increments of about 5 centimeters.

The classification method used to develop an interpreted soil profile is based on normalized parameters provided by the piezocone, as there are no soil samples collected with a penetrometer system of this type.

The relationship between the cone tip resistance and friction ratio, which has been normalized for soil overburden stresses, can be established to predict soil behavior (Jeffries and Davies, 1991 and 1993). This relationship has been applied to the soil classification chart developed by Robertson as reported in Lunne et al., 1997 (refer to Figure A-1B) according to the following equation:

$$I_c = \sqrt{\{3 - \log[Q \cdot (1 - B_q)]\}^2 + [1.5 + 1.3 \cdot \log(F)]^2}$$

Where,

I_c = Soil behavior index

Q = Normalized cone tip resistance

$$Q = \frac{q_T - \sigma_{vo}}{\sigma'_{vo}}$$

q_T = Corrected cone tip resistance

σ_{vo} = Total overburden stress

σ'_{vo} = Effective overburden stress

B_q = Normalized pore pressure

$$B_q = \frac{\Delta u}{q_T - \sigma_{vo}}$$

F = Normalized friction ratio

$$R_f = \frac{f_s}{q_T - \sigma_{vo}} \cdot 100\%$$

f_s = Sleeve friction

Using the above equation and the classification chart presented on Figure A-1B, we were able to develop the interpreted soil profile provided on Figure A-42. The classification chart used for this study has been established based on observed soil behavior from numerous studies for various soil types.

Water Level Measurement

Water levels were measured using a Solinst water level probe, graduated in 0.01-foot increments. Depth to water was measured below the top of casing, and recorded to the nearest hundredth of a foot. Depth to water was converted to groundwater elevation using survey information for the top of casing in the wells. Depth to water data and groundwater elevations are summarized in Table A-1.

References for Appendix A

Jeffries, Michael G., and Michael P. Davies, 1991. Soil classification by the cone penetrometer test: Discussion, *Can. Geotech. J.* 28, 173-176.

Jeffries, Michael G., and Michael P. Davies, 1993. Use of CPTu to Estimate Equivalent SPT N_{60} . *Geotechnical Testing Journal*. GTJODJ, Vol. 16, No. 4, 458-468.

Lunne, T. P.K. Robertson, and J.J.M. Powell, 1997. *Cone Penetration Testing in Geotechnical Practice*, Blackie Academic and Professional, London.

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Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:

Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.

Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Density		Consistency		
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling Test Symbols

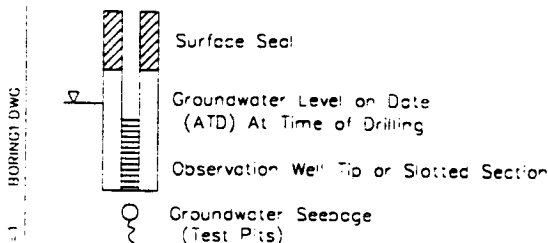
BORING SAMPLES

	Split Spoon
	Shelby Tube
	Cuttings
	Core Run
*	No Sample Recovery
o	Tube Pushed, Not Driven

TEST PIT SAMPLES

	Grab (Jar)
	Bag
	Shelby Tube

Groundwater Observations



Test Symbols

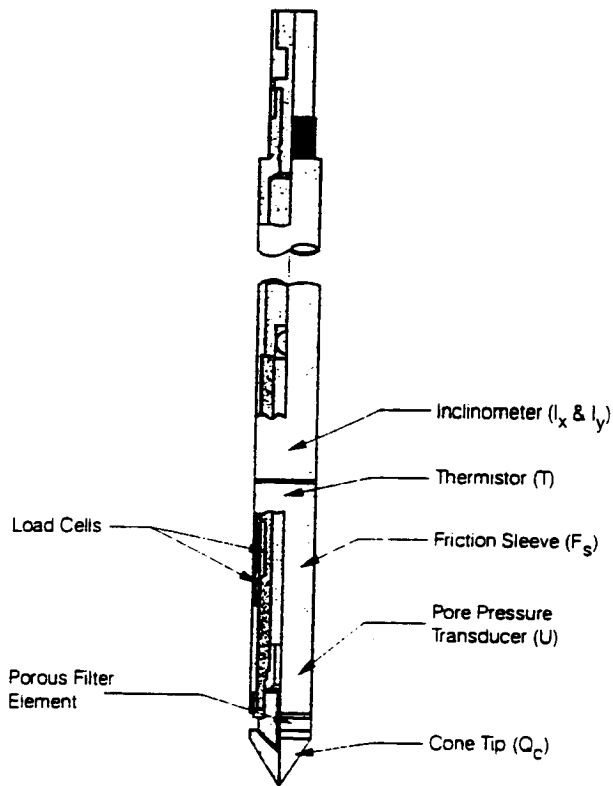
GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
	Water Content in Percent Liquid Limit Natural Plastic Limit Plastic Limit
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	In Situ Density Test

HARTCROWSER
J-4978-28 11/00
Figure A-1A

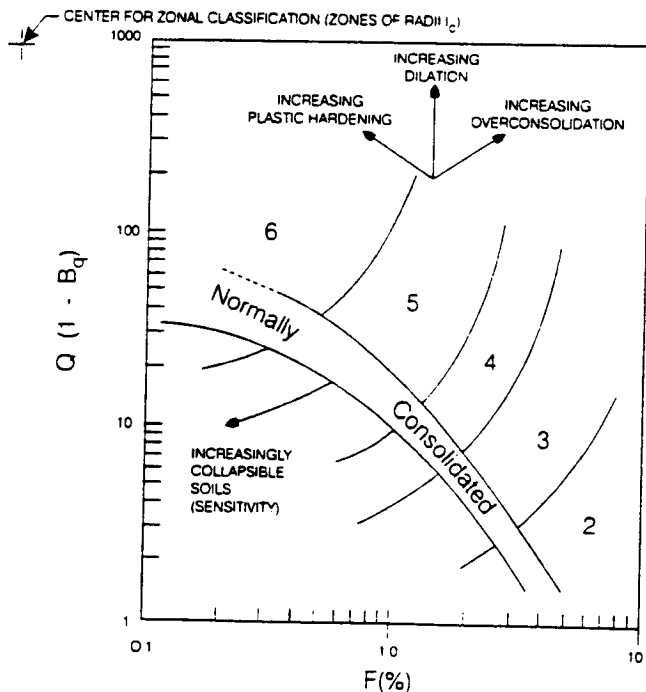
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Electric (Piezocone) Cone Penetrometer

Schematic of Electric Piezocone (Typical)



Simplified Classification Chart (Jefferies and Davies, 1993 after Lunne et al., 1990)



Core#497818/piezocone

Zone	Soil Behavior Type
1	sensitive fine grained
2	organic soils - peats
3	clays - clay to silty clay
4	silt mixtures - clayey silt to silty clay
5	sand mixtures - silty sand to sandy silt
6	sands - clean sand to silty sand

$$Q = \frac{q_T - F_{vo}}{F_{vo}}$$

$$B_q = \frac{u - u_o}{q_T - F_{vo}}$$

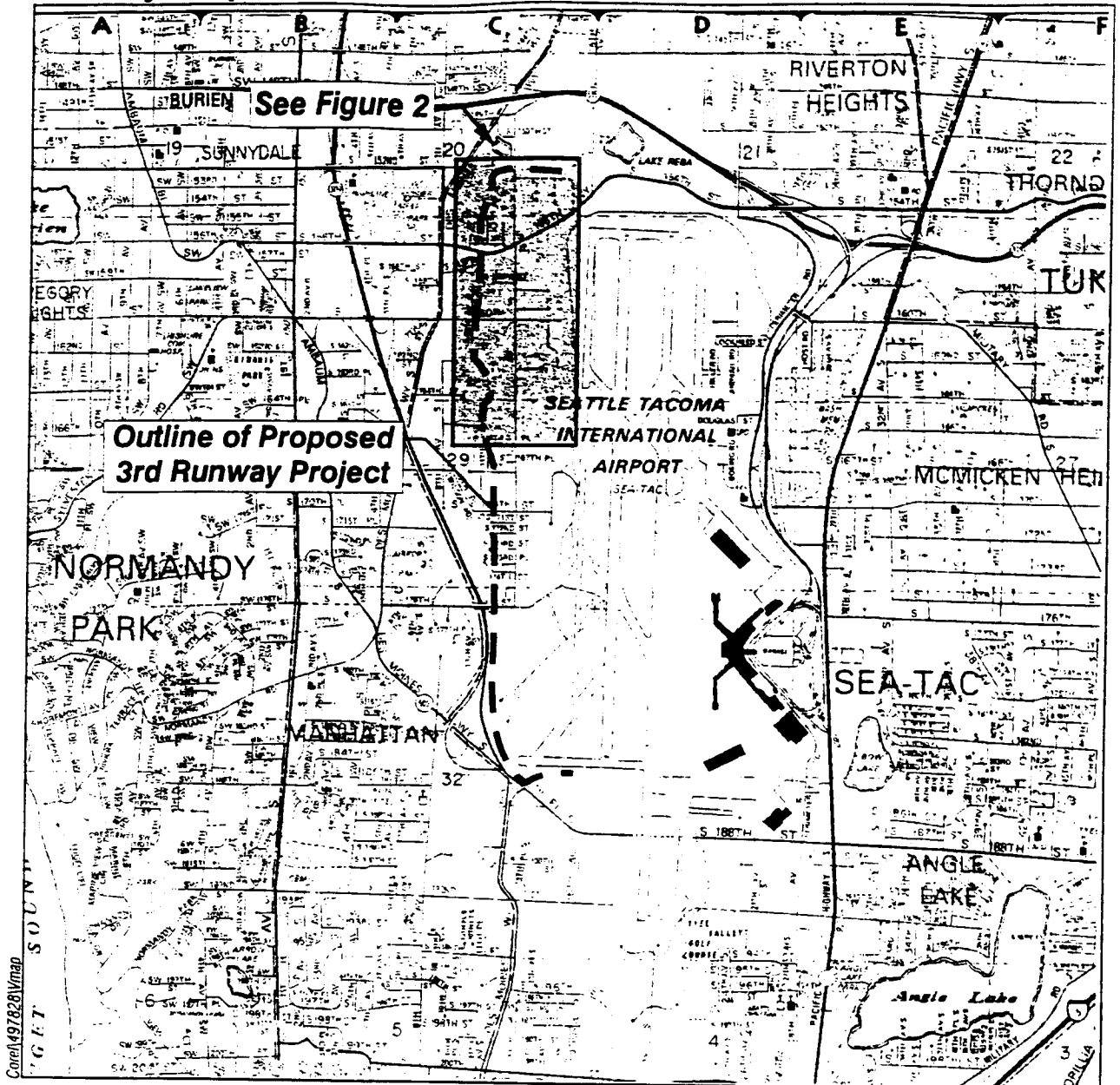
$$F = \frac{f_s}{q_T - F_{vo}} \times 100\%$$



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Figure A-1B

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Vicinity Map



Corel 497828 Vmap



HARTCROWSER

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Figure 1

AR 046227

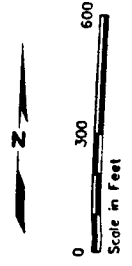
**Site and Exploration Plan
Phase 4 Fill**



Notes:
 1) Base map prepared from drawing provided by HNTB, entitled "Topo_full.dwg", dated October 4, 1999. Wetlands delineations prepared from drawing provided by Parametrix, entitled "w_1106000.dwg", dated November 8, 2000.
 2) Phase 4 FA limits based on drawing provided by HNTB, November 2000.

Exploration Location and Designation

- Existing Log Used in Current Study
- Proposed Log Presented but not used in Current Study
- Other Exploration



AR 046228

Boring Log HC99-B58

N 21254

E 10892

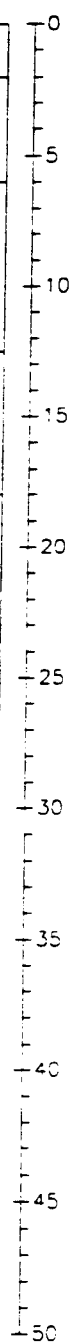
Soil Descriptions

Top of Casing Elevation in Feet: 293.50

Ground Surface Elevation in Feet: 291

0 - 2.5	(Loose), moist, brown, slightly gravelly SAND with trace organics.
2.5 - 5.0	Loose, moist, tan to brown, slightly gravelly SAND.
5.0 - 10.0	Medium stiff, moist, brown and tan mottled, sandy, very silty CLAY.
10.0 - 15.0	Dense, gray, moist to wet, slightly clayey, gravelly SAND.
15.0 - 20.0	Hard, damp, gray, slightly gravelly, sandy SILT.
20.0 - 24.5	Bottom of Boring at 24.5 Feet. Completed 11/9/99.

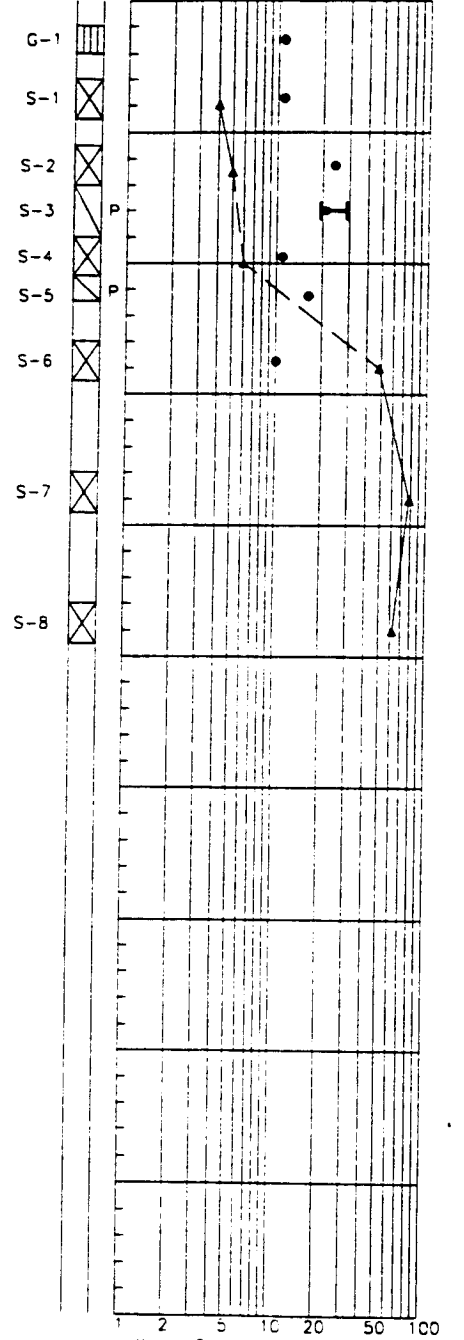
Depth in Feet:



STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

1 2 5 10 20 50 100



LAB TESTS

(S-3)
 PP=2.5,
 2.5, 3.5
 PP=3.25,
 2.25, 3.5
 TV=1.2
 CU, AL

● Water Content in Percent

DIN 11/13/00 1-1
 497818\005
 497818 8.pcz

1. Refer to Figure A-1A for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.



HARTCROWSER

J-4978-18 11/99

Figure A-2

AR 046229

Boring Log HC99-B61

N 20,989

E 10,930

Soil Descriptions

Top of Casing Elevation in Feet: 303.94

Ground Surface Elevation in Feet: 301.8

(Loose), damp, brown, very silty, fine SAND with organic material.

Loose to medium dense, damp, brown to gray, medium to fine SAND.
Trace organic material.

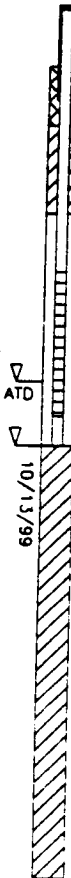
Soft, moist, green-gray, slightly sandy, silty CLAY.

Medium dense, moist to wet, gray, slightly gravelly, silty SAND.

Very dense, moist, gray, slightly gravelly, very silty SAND.

Bottom of Boring at 27.8 Feet.
Completed 9/27/99.

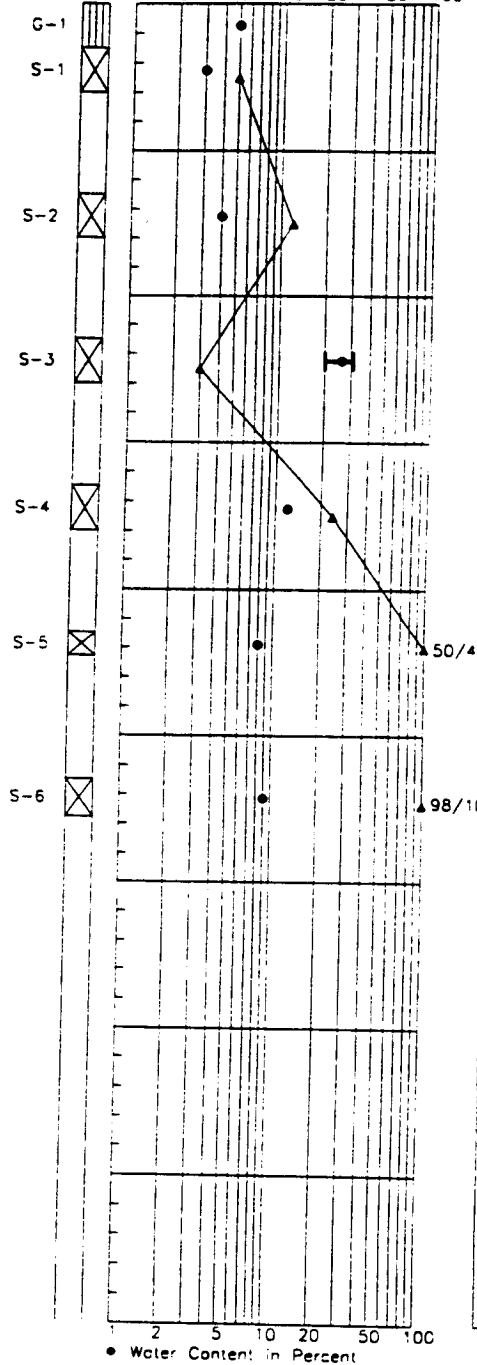
Depth in Feet



STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

1 2 5 10 20 50 100



LAB TESTS



● Water Content in Percent

WOODS LOCK 8 INC

DIN 11/13/00 1-1
497816 BORING

1. Refer to Figure A-1 for explanation of descriptions and symbols
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-16 9/99
Figure A-3

AR 046230

Boring Log HC99-B64

N 20681

E 10761

Soil Descriptions

Top of Casing Elevation in Feet: 294.20

Ground Surface Elevation in Feet: 292

	Depth in Feet
Loose, wet, dark brown, silty, medium to fine SAND with some organic material.	0
Loose to medium dense, moist to wet, brown, gravelly SAND.	5
Medium stiff, wet, gray, silty CLAY.	10
Medium dense, wet, slightly gravelly, silty, fine SAND.	15
Very dense, moist to wet, gray, silty, fine SAND with gravelly inclusions.	20
	25
	30
	35
	40
	45
	50

Bottom of Boring at 34.0 Feet.
Completed 11/8/99.

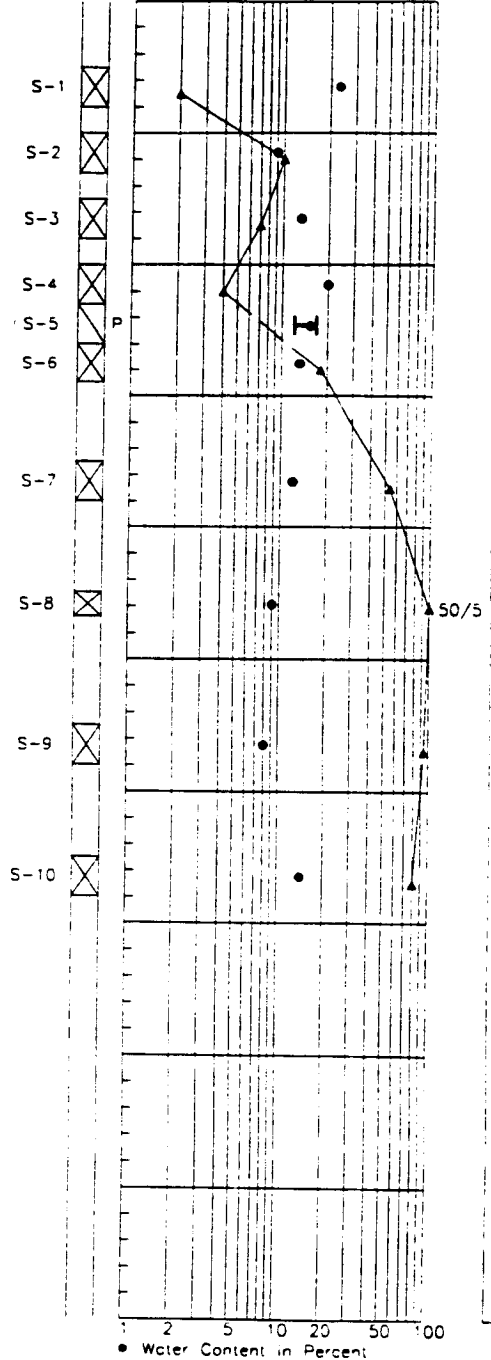
Depth
in Feet



STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

Sample 1 2 5 10 20 50 100



LAB
TESTS

OS. A:

01N 11/13/00 1-1
 497818\005

1. Refer to Figure A-1A for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.



HARTCROWSER

J-4978-18 11/99

Figure A-4

AR 046231

Boring Log HC99-B72

N 21023

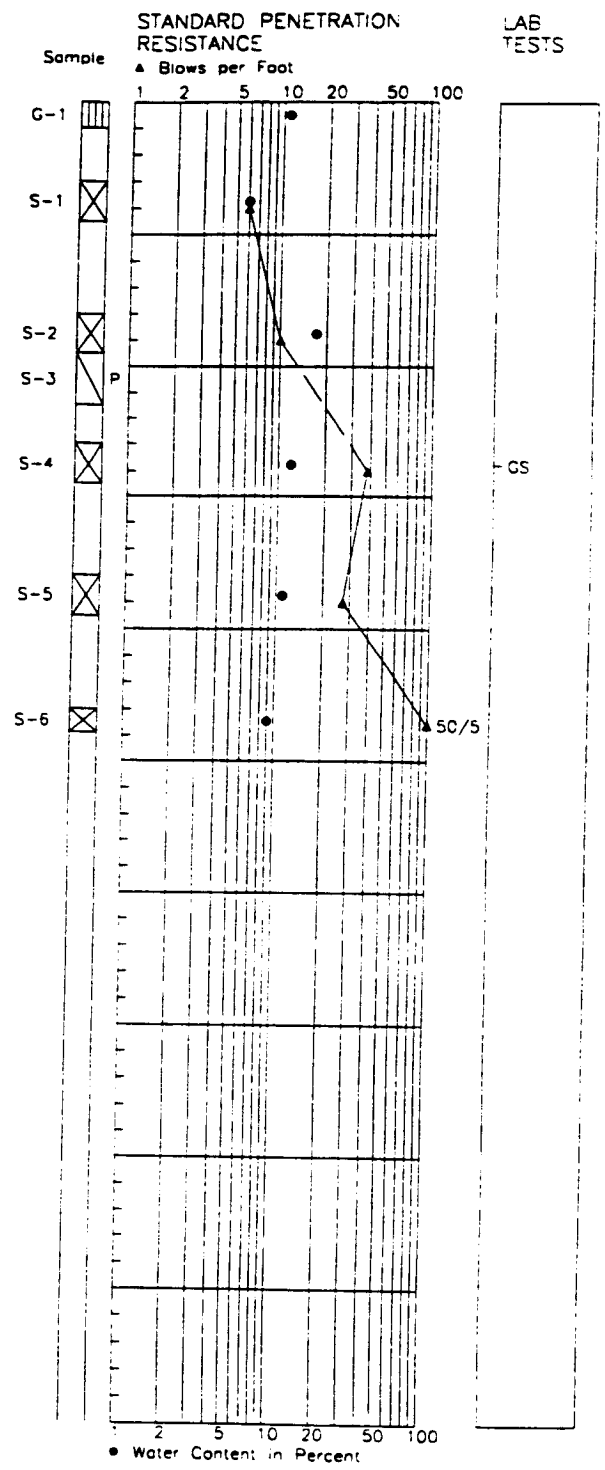
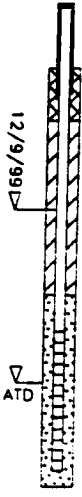
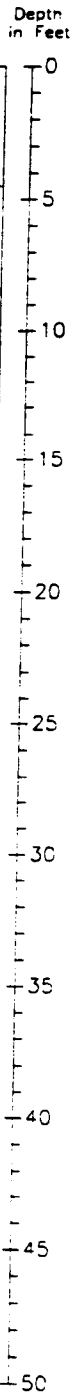
E 10730

Soil Descriptions

Top of Casing Elevation in Feet: 283.81
 Ground Surface Elevation in Feet: 282


	0 Loose, damp, brown, slightly gravelly SAND with some organics.
	5 Stiff, wet, gray, slightly sandy, clayey SILT.
	15 Medium dense to very dense, wet, gray, slightly gravelly, very silty, SAND with increasing gravel content with depth.

Bottom of Boring at 23.9 Feet.
 Completed 11/8/99.



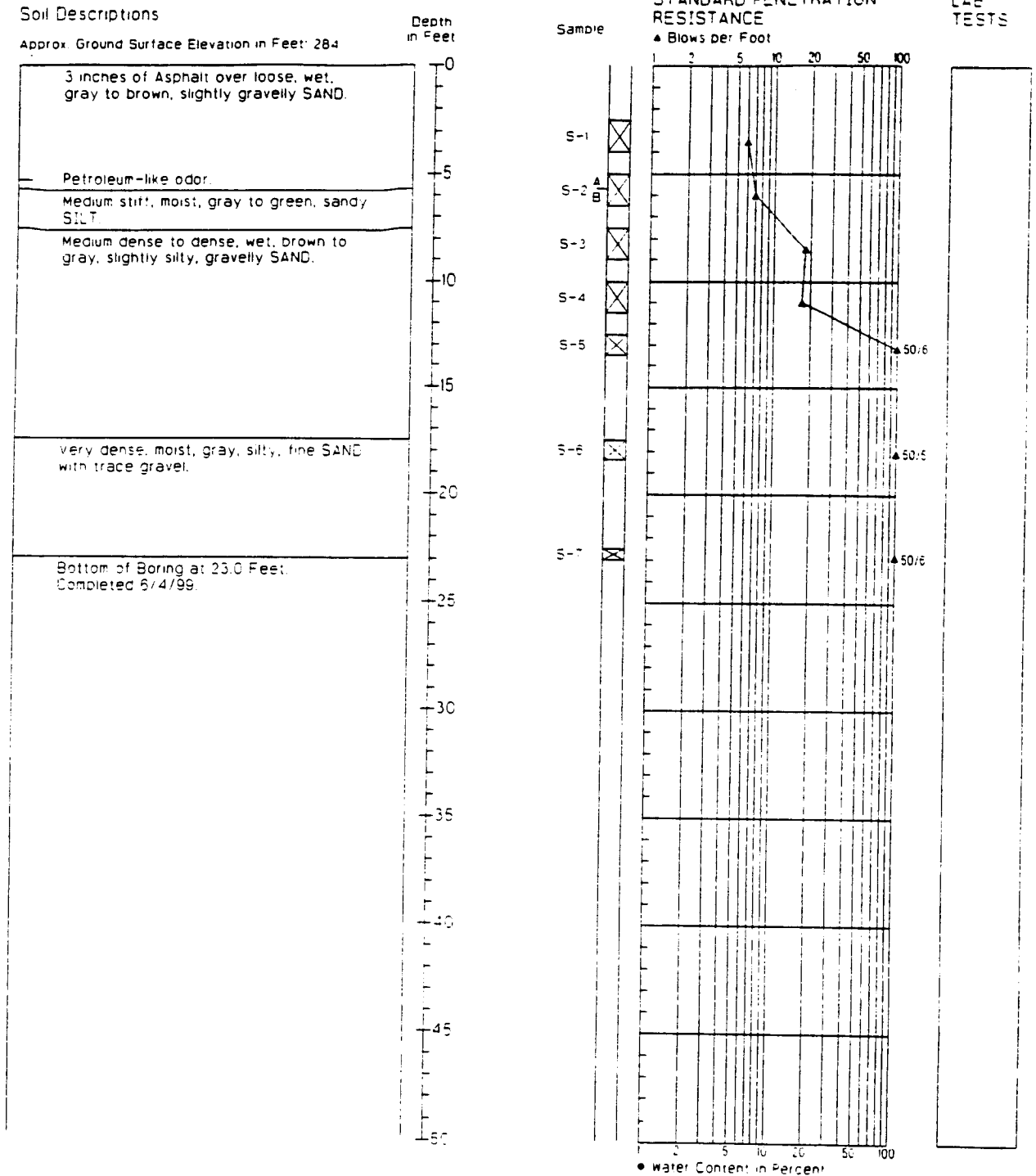
Date: 11/13/00 1:1
 497818\005

1. Refer to Figure A-1A for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.


HARTCROWSER
 J-4978-18 11/99
 Figure A-5

AR 046232

Boring Log HC99-B75

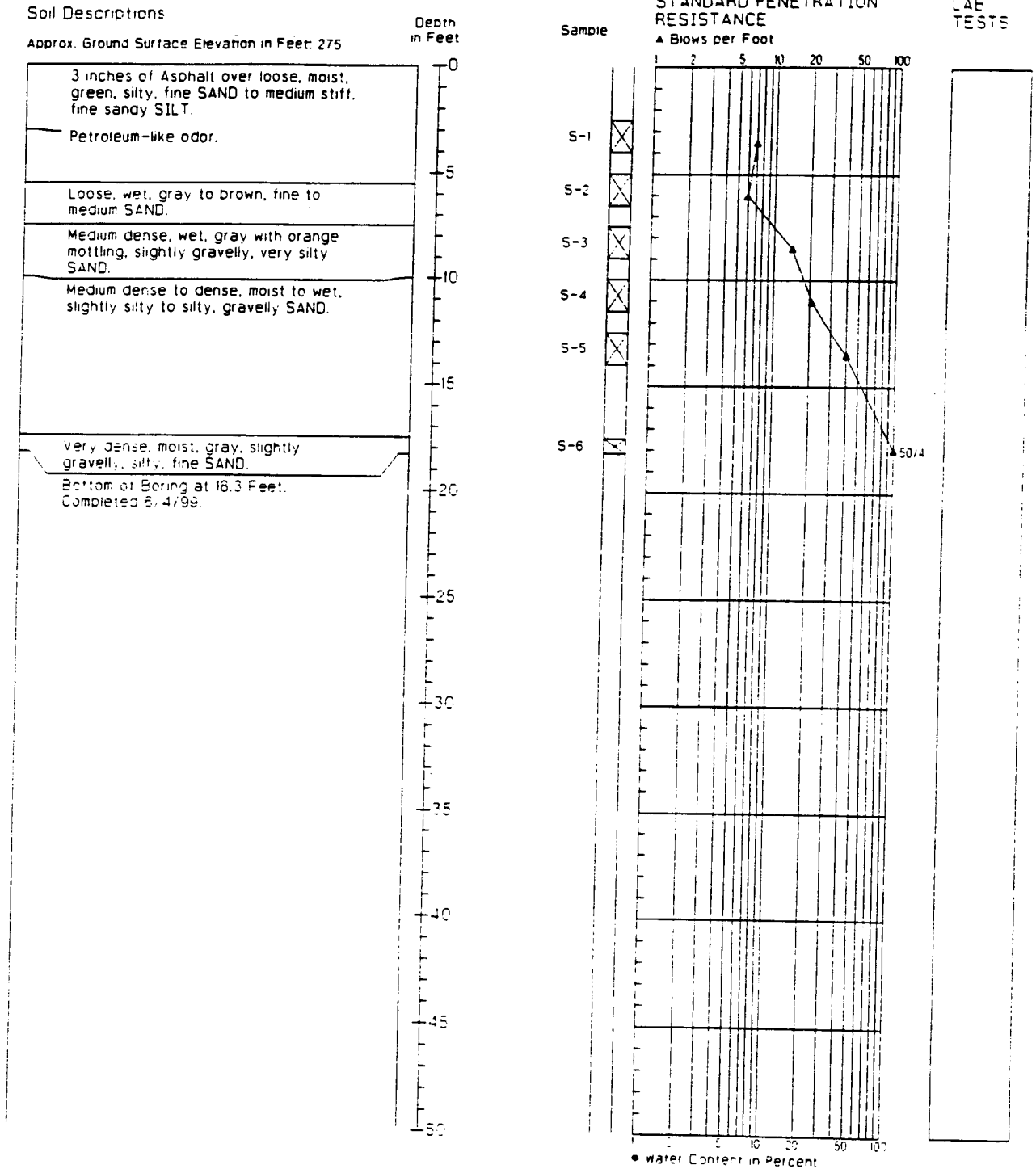


1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATC) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-07 8/99
Figure A-8

AR 046233

Boring Log HC99-B76



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil description and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (A.M.) or for date specified. Level may vary with time.

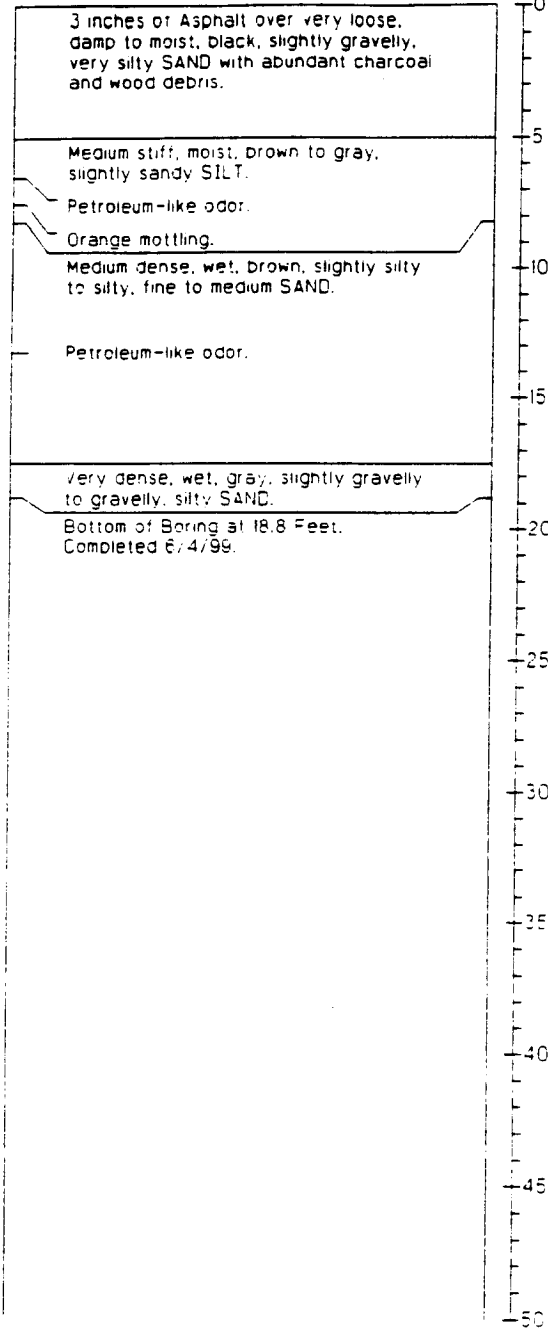
HARTCROWSER
J-4978-07 8/99
Figure A-7

AR 046234

Boring Log HC99-B77

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 266



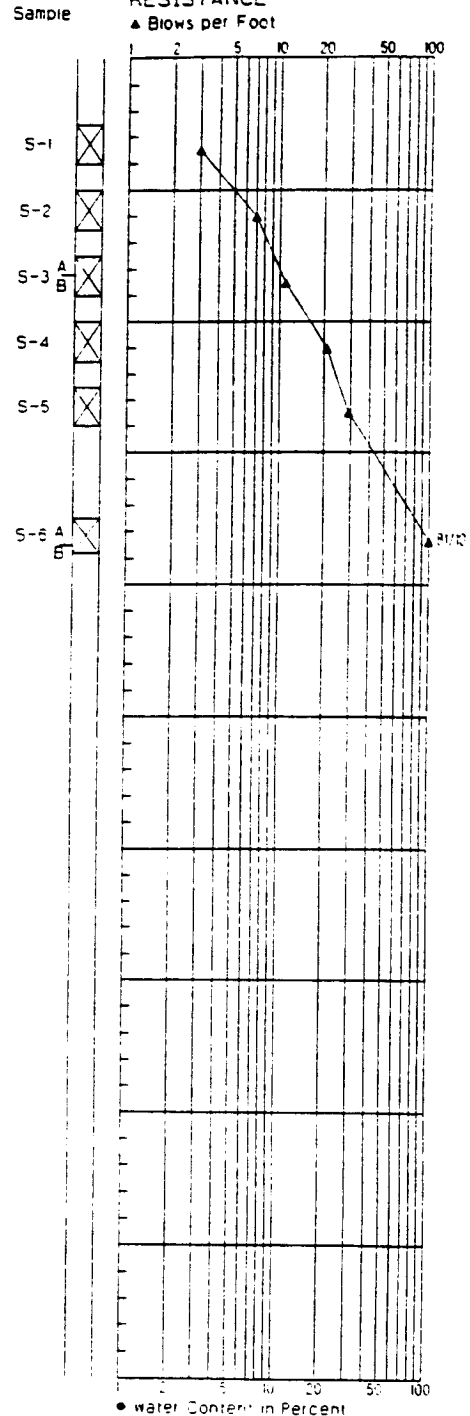
Depth in Feet

ATD

STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

LAB TESTS



• water Content in Percent

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

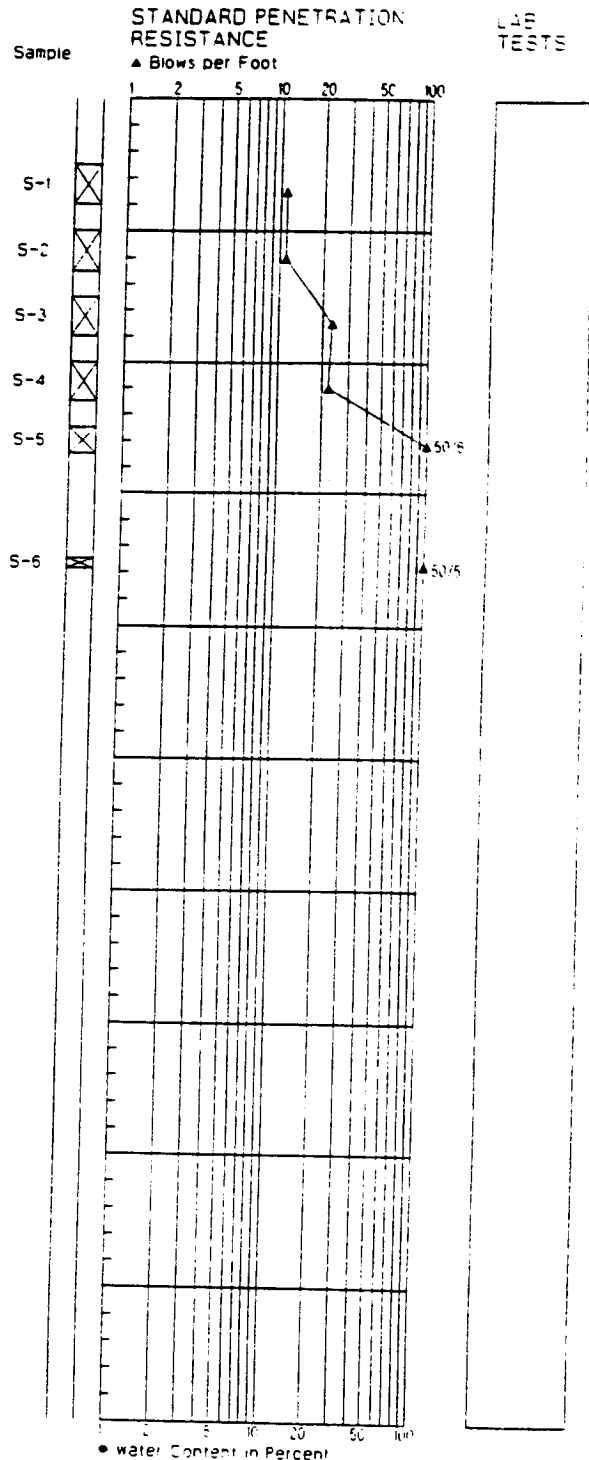
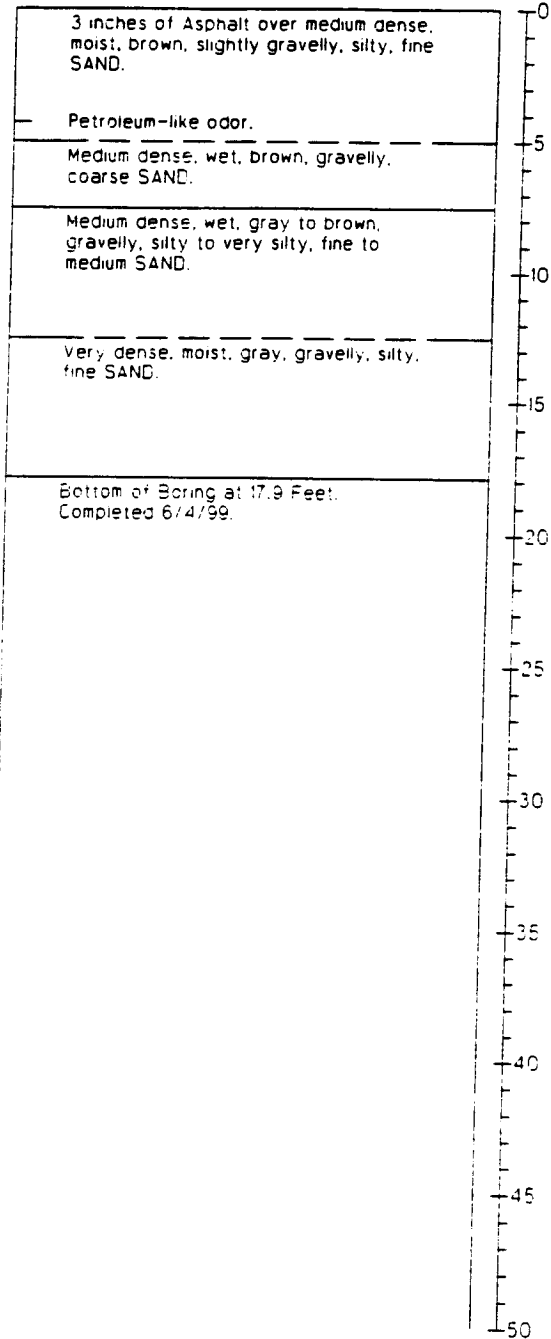
HARTCROWSER
J-4978-07 8/99
Figure A-8

AR 046235

Boring Log HC99-B79

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 279



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

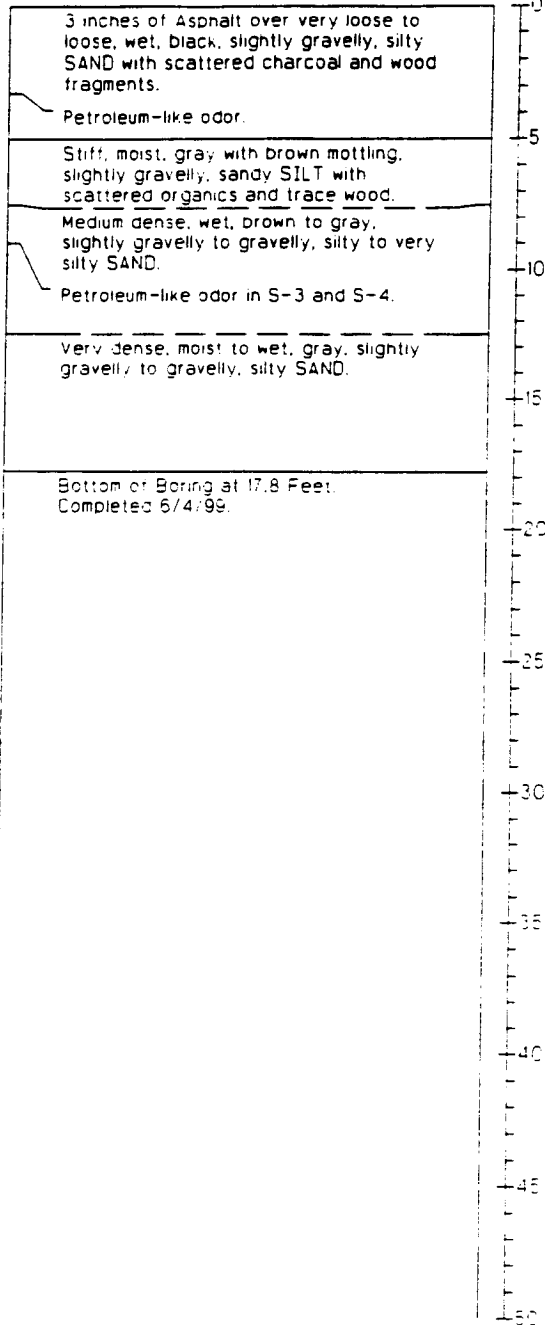
HARTCROWSER
J-4978-07 6/99
Figure A-9

AR 046236

Boring Log HC99-B80

Soil Descriptions

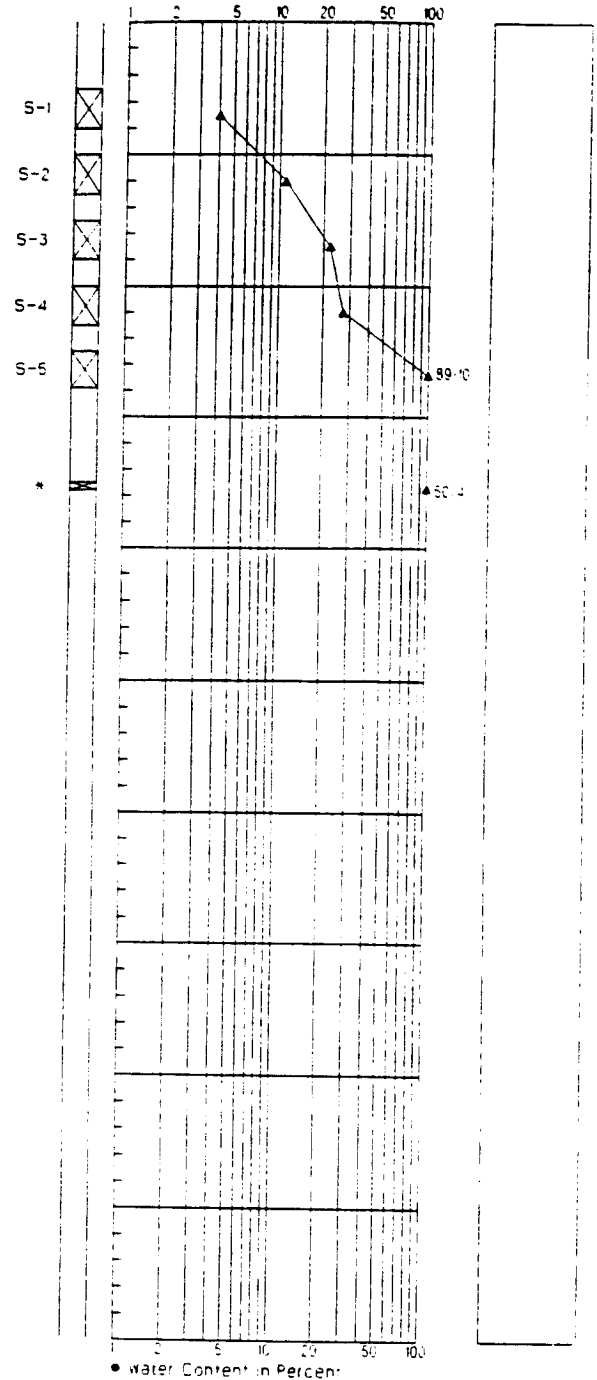
Approx. Ground Surface Elevation in Feet: 282



STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

LSE TESTS



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.



HARTCROWSER

J-4978-07

6/99

Figure A-10

AR 046237

Boring Log HC00-B142

N 19263

E 10890

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 270
Top of Casing Elevation in Feet: 272.72

	0	
(Loose) to medium dense, wet, brown to dark brown, silty, gravelly fine to medium SAND.		
Peat noted.	5	
Stiff, wet, gray, gravelly, sandy SILT.		
	10	
Medium dense, wet, gray, silty, gravelly SAND.		
	15	
Very dense, wet, gray, slightly gravelly, very silty SAND.		
	20	
Bottom of Boring at 24.8 Feet. Completed 2/15/00.	25	
	30	
	35	
	40	
	45	
	50	
	55	
	60	

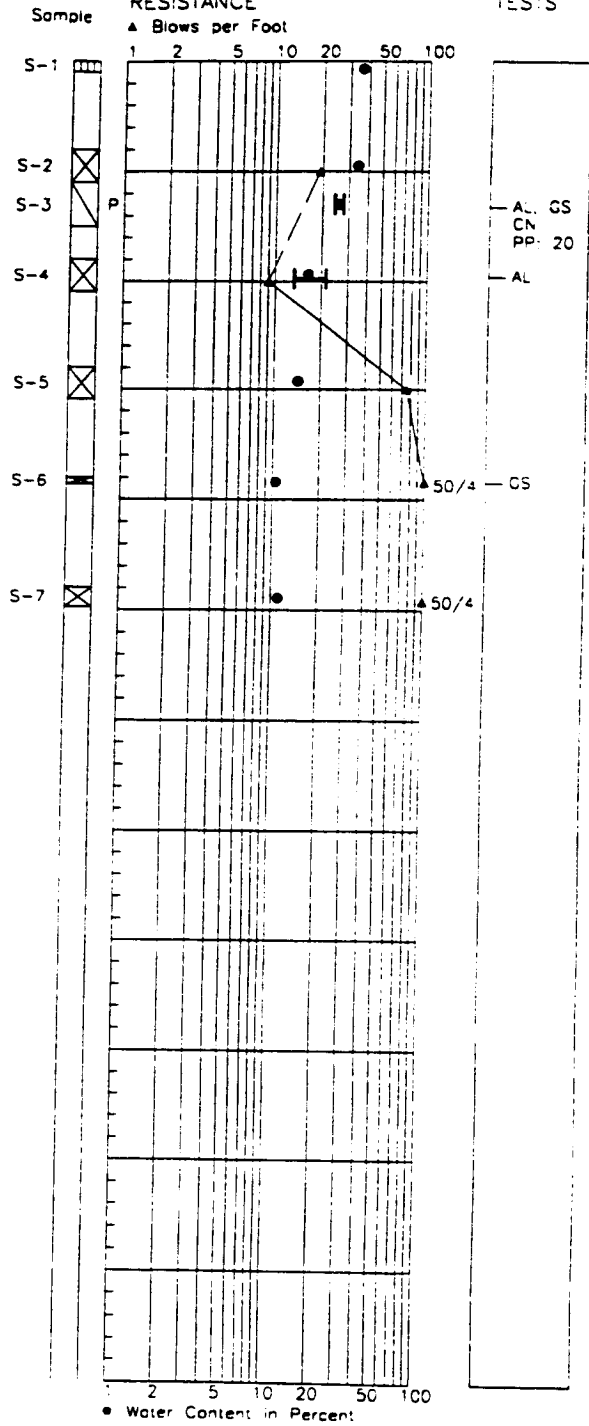
Depth in Feet



STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

1 2 5 10 20 50 100



LAB TESTS

AL GS
CN
PP- 20
AL

• Water Content in Percent

DIN 11/13/00 1-1
woodstock pg2
497821 1065

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-11

AR 046238

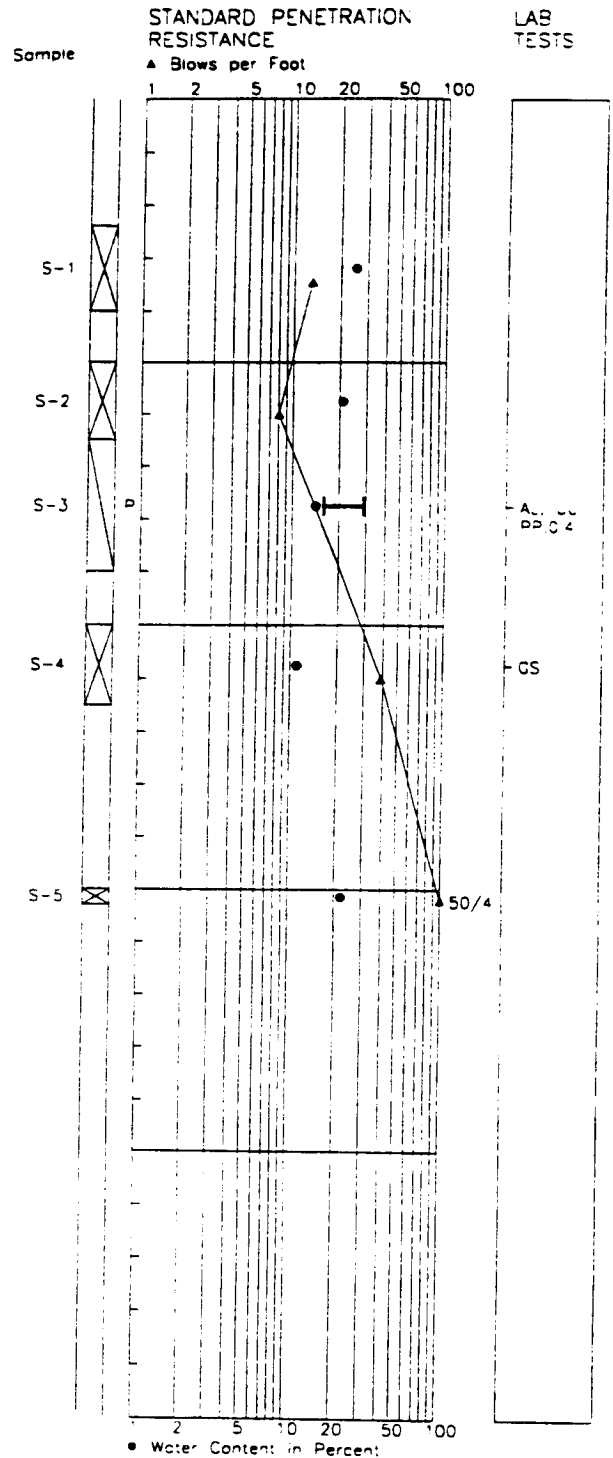
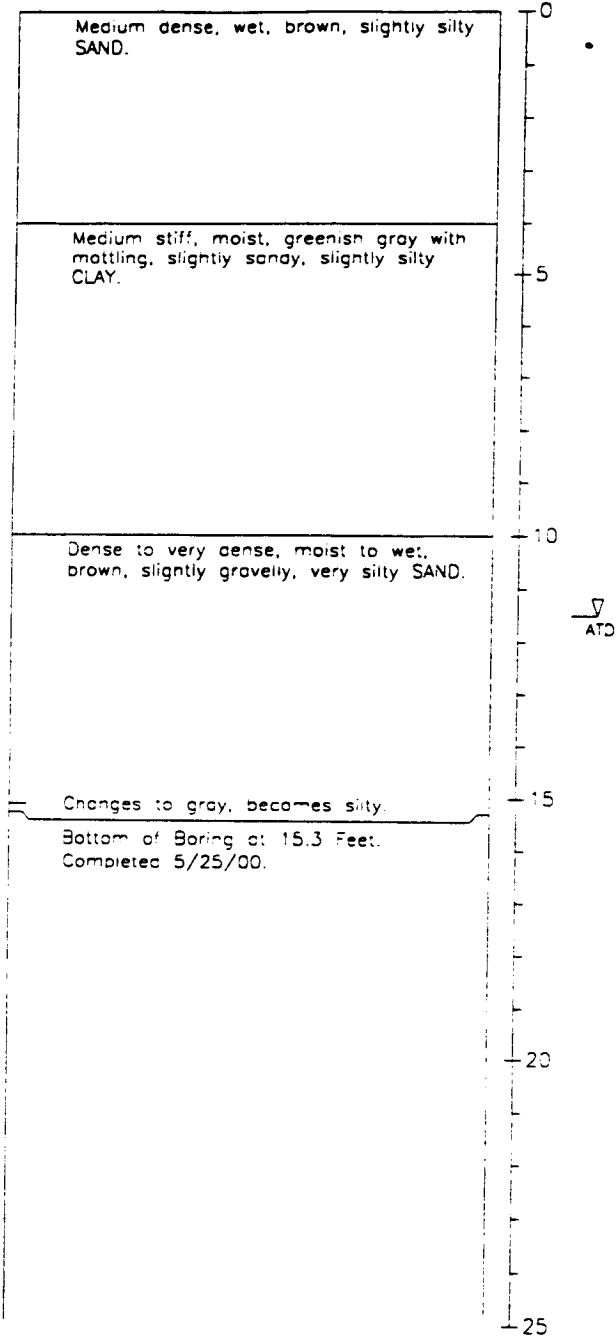
Boring Log HC00-B300

N 19818

E 10889

Soil Descriptions

Ground Surface Elevation in Feet: 291



DIM 11/13/00 1-1
 CHARLIE BPCZ
 BORINGS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

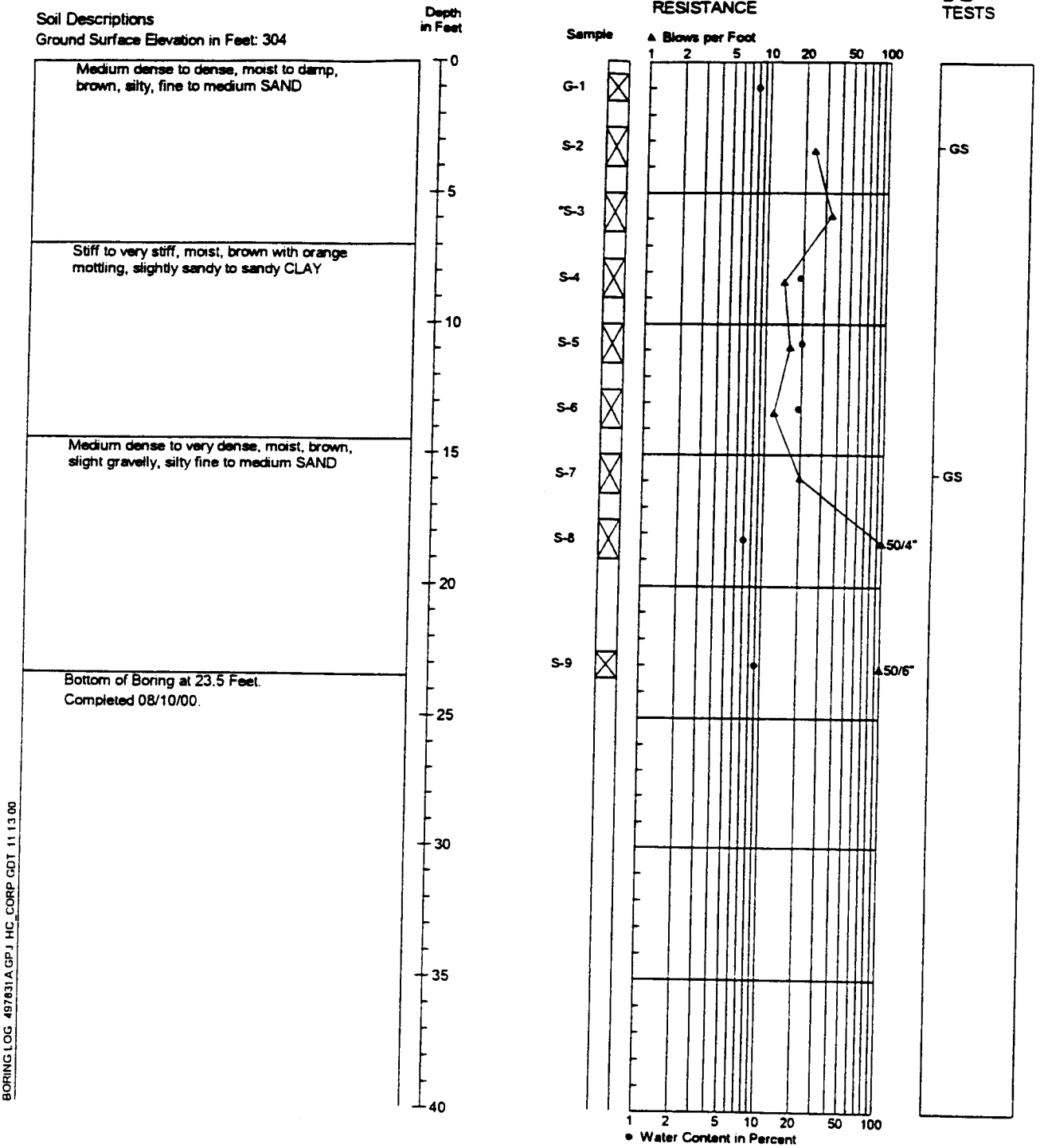
HARTCROWSER
 J-4978-26 5/00
 Figure A-12

AR 046239

Monitoring Well Log HC00-B303

Northing (ft): 20224
 Easting (ft): 10971

Soil Descriptions
 Ground Surface Elevation in Feet: 304



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

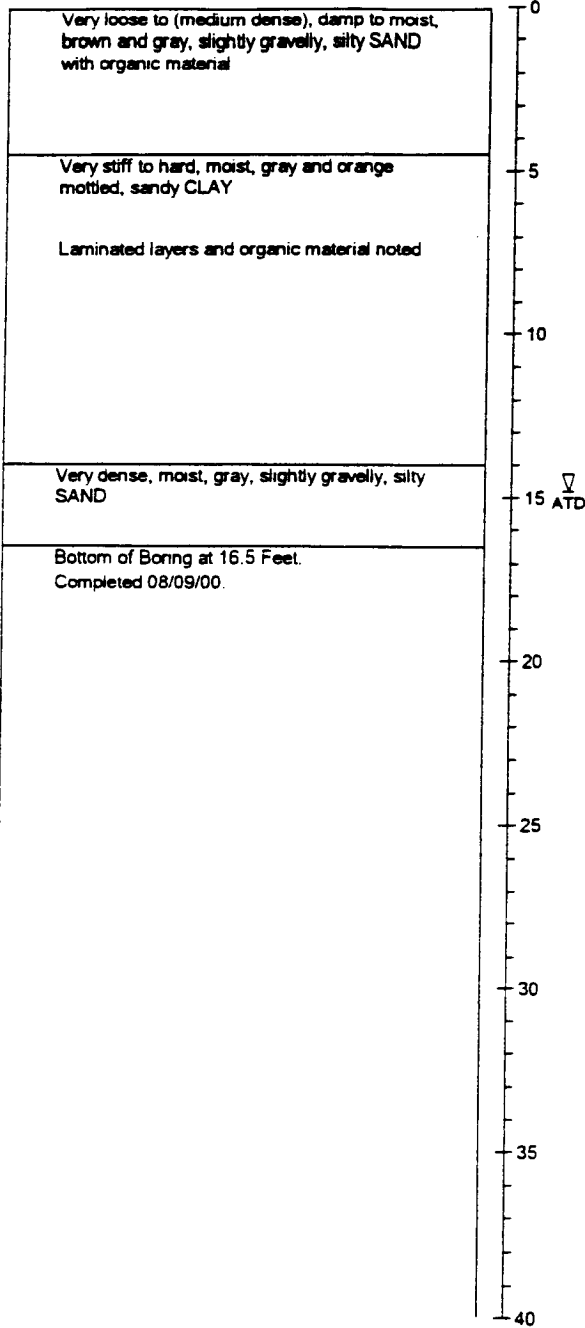
HARTCROWSER
 4978-31 08/00
 Figure A-13

AR 046240

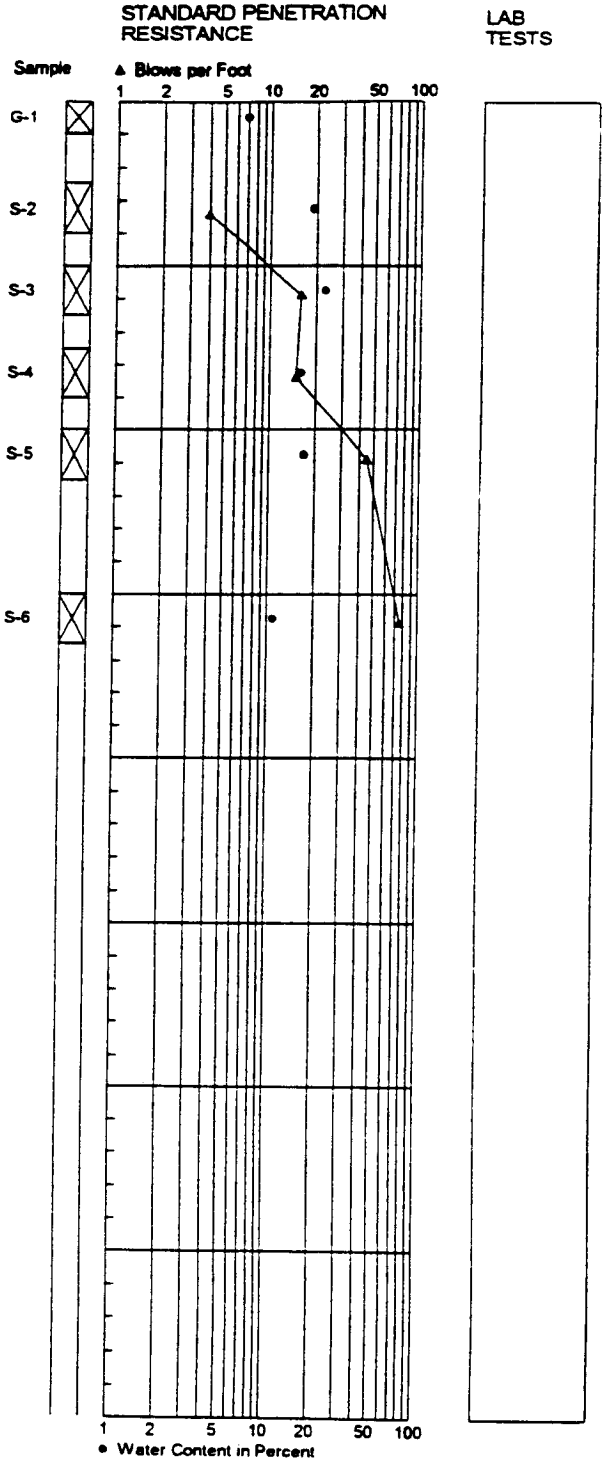
Monitoring Well Log HC00-B304

Northing (ft): 20009
 Easting (ft): 10758

Soil Descriptions
 Ground Surface Elevation in Feet: 286



BORING LOG 497831A.GPJ HC_CORP.GDT 11:13:00



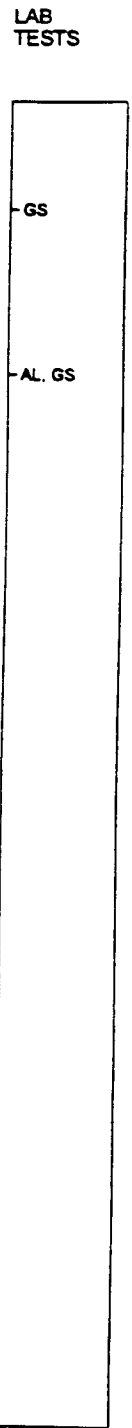
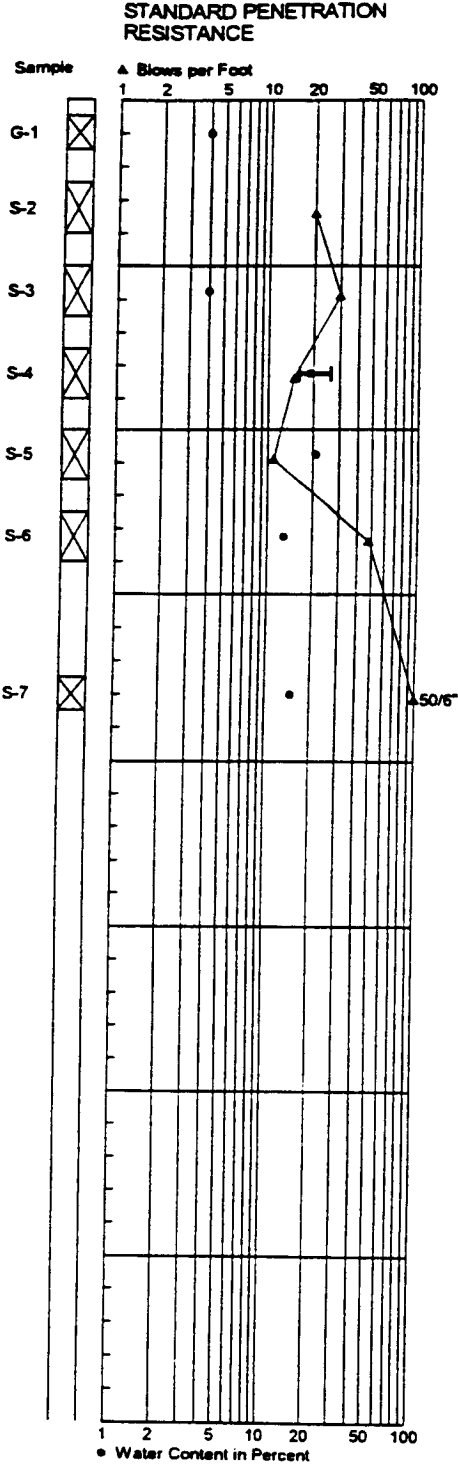
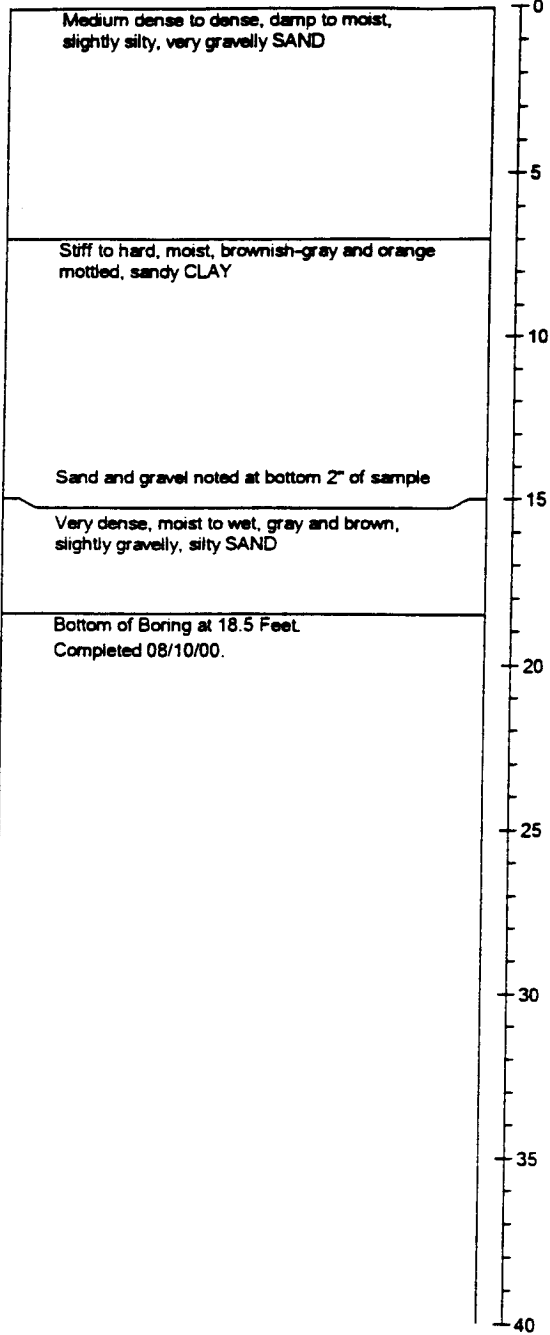
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
 4978-31 08/00
 Figure A-14

Monitoring Well Log HC00-B305

Northing (ft): 19808
 Easting (ft): 10808

Soil Descriptions
 Ground Surface Elevation in Feet: 284



BORING LOG 497831 A.G.P.J. HC-CORP GDT 11 13 00

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.



4978-31 08/00
 Figure A-15

AR 046242

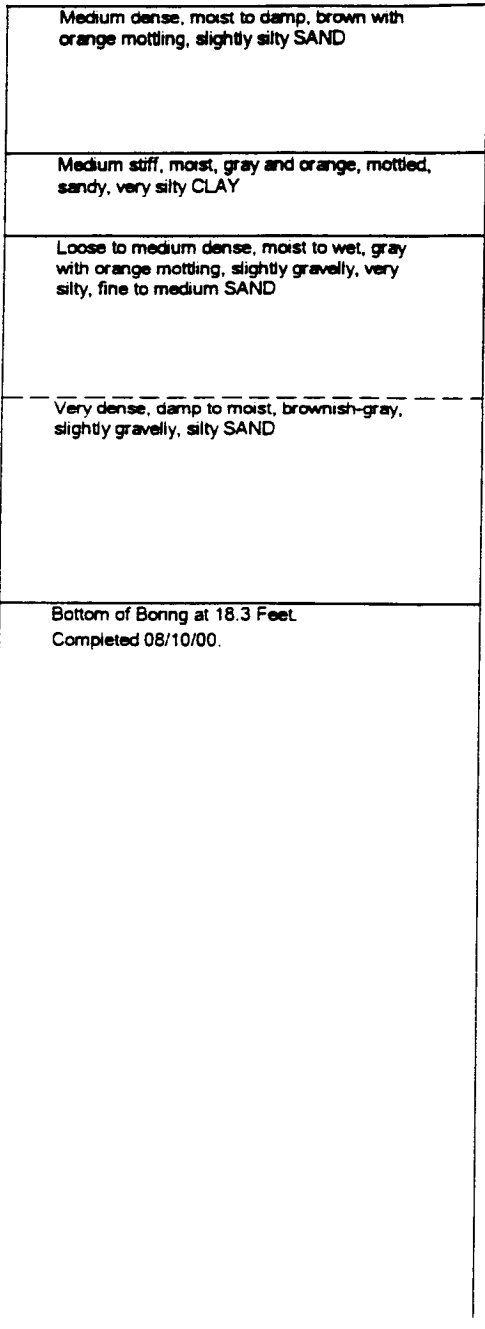
Monitoring Well Log HC00-B306

Northing (ft): 19434

Easting (ft): 10866

Soil Descriptions

Ground Surface Elevation in Feet: 278.65



Depth in Feet

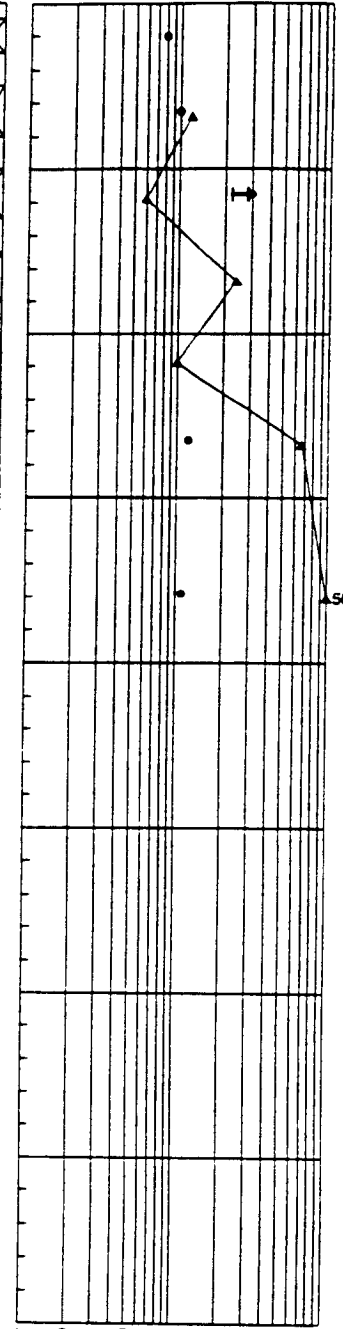
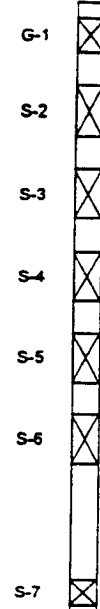
Sample

STANDARD PENETRATION RESISTANCE

▲ Blows per Foot

1 2 5 10 20 50 100

LAB TESTS



BORING LOG 497831A.GPJ HC_CORP.GDT 11 13 00

● Water Content in Percent

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.



4978-31

08/00

Figure A-16

AR 046243

Test Pit Log HC98-TP3

N 17,560, E 11,410

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
			Ground Surface Elevation in Feet: 299
S-1	8	0	(Loose to medium dense), moist, gray, slightly gravelly, silty, fine to medium SAND. (FILL)
S-2	10	1	
S-3	21	2	
S-4	16	3	
		4	(Very stiff), moist, gray-brown mottled, fine sandy SILT.
		5	(Dense), moist, gray, silty, fine SAND.
		6	
S-5	14	7	(Very dense), moist, gray, silty, gravelly, fine SAND to gravelly SAND.
S-6	3	8	
S-7	27	9	(Stiff), moist, gray, clayey SILT with slickensides and fractures.
		10	
		11	
		12	
		13	
		14	
		15	Bottom of Test Pit at 15 Feet. Completed 7/30/98.
		16	
		17	
		18	
		19	
		20	

Test Pit Log HC98-TP4

N 17,780, E 11,380

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet: 274
S-1	9		0	(Medium dense), moist, brown-gray, silty, gravelly SAND. (FILL)
			1	
			2	
S-2	10		3	(Dense), moist, gray-brown mottled, slightly gravelly, silty, fine to medium SAND to gravelly, fine to medium SAND.
			4	
			5	
			6	
S-3	9		7	(Dense), wet, gray, silty, fine to medium SAND
			8	
			9	
			10	
			11	
S-4	16	GS	12	(Dense), wet, mottled gray and red-brown, slightly silty, gravelly SAND.
			13	
			14	
			15	
S-5	17		16	Bottom of Test Pit at 15 Feet. Completed 7/30/98.
			17	
			18	Groundwater seepage observed at a depth of 12 and 14 1/2 feet. Slight caving observed from depth of 14 to 15 feet.
			19	
			20	

DIN 11/13/00 1-1 WOSIK BPC2
4978V005\98 1151 PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

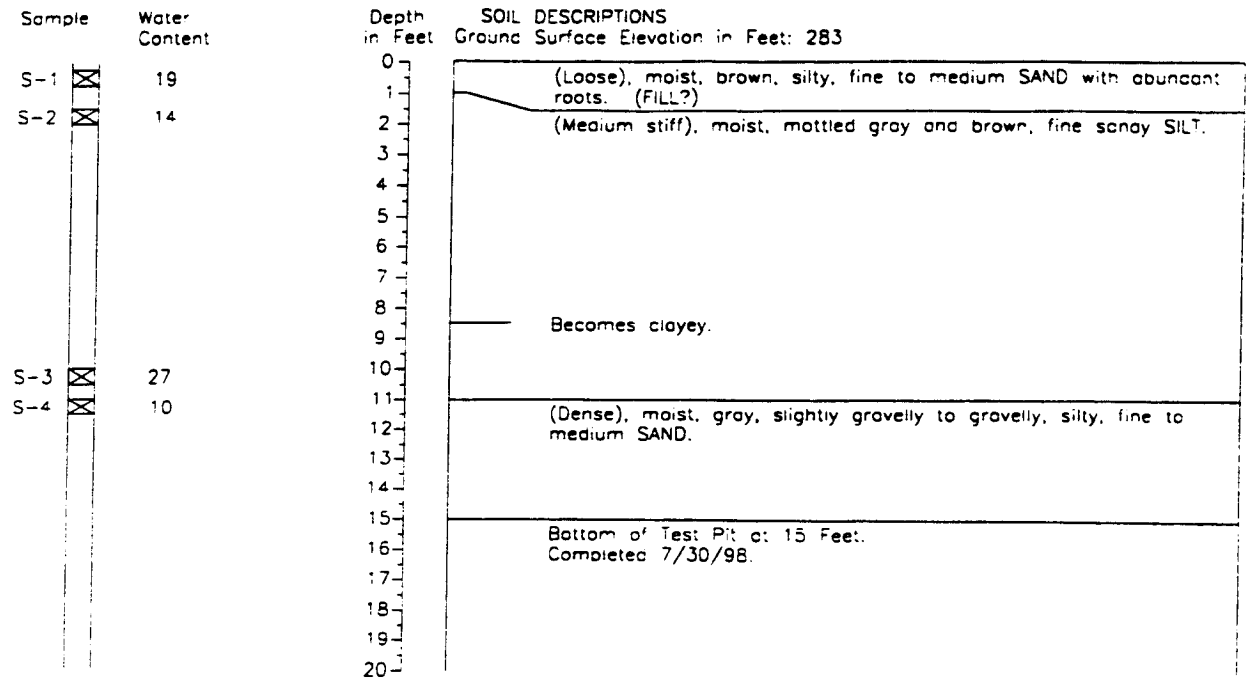
J-4978-06 7/98

Figure A-17

AR 046244

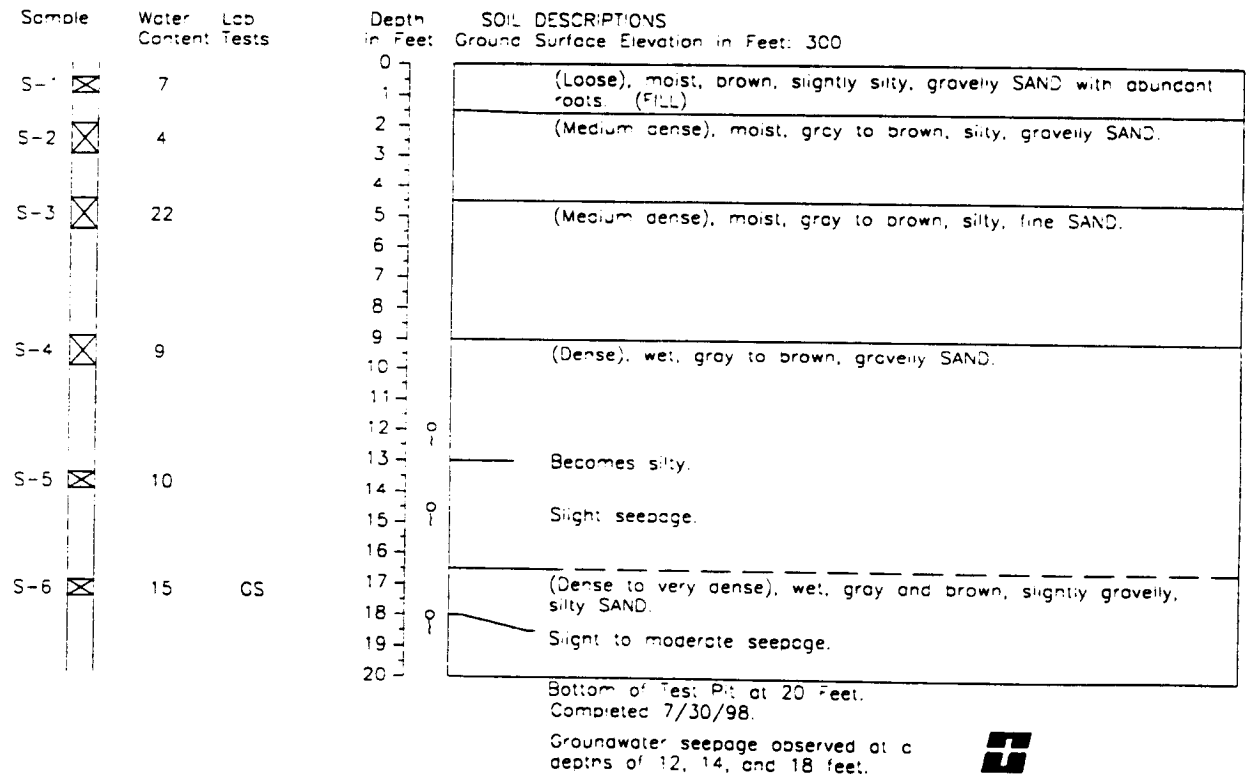
Test Pit Log HC98-TP5

N 17,930, E 11,430



Test Pit Log HC98-TP6

N 18,330, E 11,500



CVO 5/1/99 1-1 WOSIK BPCZ 4978V-005\98 HST P115

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



J-4978-06 7/98

Figure A-18

AR 046245

Test Pit Log HC98-TP7

N 18,550, E 11,520

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 308
S-1	6		0	(Loose), moist, brown, silty, gravelly SAND with occasional roots. (FILL)
S-2	4		1	
S-3	3		2	
S-4	14		3	
			4	(Stiff), moist, gray with brown, fine sandy SILT.
			5	
			6	
			7	
			8	
			9	
S-5	11		10	(Dense), moist, mottled gray and brown, silty, gravelly SAND.
S-6	9		11	
			12	(Dense), wet, gray, slightly silty, medium SAND.
			13	
			14	(Dense), wet, gray, gravelly SAND with occasional silty zones
S-7	14		15	
S-8	25	GS	16	(Dense), wet, gray-brown, fine to medium SAND.
			17	Substantial seepage.
			18	Bottom of Test Pit at 18 Feet. Completed 7/30/98.
			19	
			20	

Groundwater seepage observed at depths of 14 and 16 feet.
Moderate caving below 10 feet.

Test Pit Log HC98-TP8

N 18,305.82, E 11,339.54

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 278
S-1	3		0	(Loose), moist, gray and brown, slightly silty, slightly gravelly, fine to medium SAND with scattered roots. (FILL)
S-2	4		1	
			2	(Dense), moist, gray and brown, gravelly, fine to medium SAND.
S-3	19		3	
			4	(Stiff), moist, gray and brown, slightly gravelly, sandy SILT.
			5	
			6	
			7	
S-4	10		8	(Dense), moist, red-brown to gray-brown, silty, gravelly SAND.
			9	
			10	(Dense), wet, gray, slightly gravelly, silty SAND.
S-5	15	GS	11	
			12	Bottom of Test Pit at 14 Feet. Completed 7/30/98.
			13	
			14	Groundwater seepage observed at a depth of 13 feet.
			15	
			16	
			17	
			18	
			19	
			20	

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-06 7/98

Figure A-19

CVD 5/13/99 1:1 WBSIK 8PCZ
 4978/1005/98 1151 P15

AR 046246

Test Pit Log HC98-TP9

N 18,450, E 11,320

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 286
S-1	8		0	(Loose to medium dense), moist to dry, light brown, gravelly, silty, fine SAND with scattered roots. (FILL)
S-2	7		1	
S-3	8		2	
			3	(Medium dense), moist, light gray-brown, fine SAND.
			4	
S-4	27		5	(Stiff), moist, light gray, slightly sandy SILT. Iron staining.
			6	
			7	
S-5	34		8	(Stiff), moist, mottled light gray, slightly sandy SILT with fractures.
			9	
S-6	15		10	(Medium dense), wet, gray-brown, slightly silty, gravelly, fine to medium SAND.
			11	
S-7	36	AL	12	(Stiff), moist to wet, gray, silty CLAY.
			13	
S-8	15		14	(Very dense), wet, gray, slightly silty, gravelly, fine to medium SAND. Bottom of Test Pit at 18 Feet. Completed 7/30/98. Groundwater seepage observed at a depth of 16 feet. Moderate caving from depth of 10 to 14 feet.
			15	
			16	
			17	
			18	
			19	
			20	

Test Pit Log HC98-TP10

N 18,950, E 11,390

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 306
S-1	19		0	(Stiff), moist, mottled gray and red-brown, fine sandy SILT.
S-2	8		1	
			2	(Loose), moist, brown, silty, gravelly SAND.
			3	
S-3	30		4	(Dense), moist, mottled gray and red-brown, fine to medium SAND. Pipe encountered.
S-4	11	GS	5	
			6	6-inch layer of sandy SILT.
			7	
S-5	16		8	(Dense), wet, gray, slightly gravelly to gravelly, silty to very silty, fine to medium SAND. Bottom of Test Pit at 14 Feet. Completed 7/30/98. Groundwater seepage observed at a depth of 7 feet. Severe caving below 5 feet.
			9	
			10	
			11	
S-6	11		12	(Dense), wet, gray, slightly silty, gravelly, fine to medium SAND.
			13	
			14	
			15	
			16	
			17	
			18	
			19	
			20	

CWD 5/1/99 1-1 MUSIK BPC2
 4978\005\88 TEST PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



J-4978-06 7/98

Figure A-20

AR 046247

Test Pit Log HC98-TP11

N 18,130, E 11,390

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
Ground Surface Elevation in Feet: 287			
S-1	14	0	(Soft), moist, light brown, sandy SILT with scattered roots.
S-2	15	1	(Medium stiff), moist, light brown, slightly sandy SILT with scattered organic material.
S-3	17	2	(Medium dense), moist, gray-brown, silty SAND.
		3	scattered organic material.
S-4	8	4	(Dense), moist, gray, slightly silty, gravelly, fine to medium SAND.
		5	
S-5	11	6	(Very dense), wet, gray-brown, silty, gravelly, fine to medium SAND.
		7	
S-6	13	8	
S-7	13	9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	Bottom of Test Pit at 15-1/2 feet.
		17	Completed 7/30/98.
		18	Groundwater seepage observed at a depth of 15 feet.
		19	Moderate caving below 10 feet.
		20	


Test Pit Log HC98-TP12

N 11,330, E 17,930

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
Ground Surface Elevation in Feet: 260				
S-1	17		0	(Loose), moist, brown, silty, fine to medium SAND (FILL)
S-2	7		1	(Dense), moist, gray, slightly silty, gravelly, fine to medium SAND (FILL)
S-3	18		2	Pipe encountered Flow approximately 2 gpm.
S-4	35	AL	3	(Hard), moist, gray, sandy, gravelly SILT.
			4	(Stiff), wet, gray and brown, clayey SILT.
			5	
			6	
S-5	18		7	(Dense), wet, gray, slightly silty, gravelly, fine to medium SAND.
			8	
			9	
			10	
			11	
			12	
			13	
			14	
			15	
			16	Bottom of Test Pit at 15 Feet.
			17	Completed 7/30/98.
			18	Groundwater seepage observed at a depth of 7-1/2 feet.
			19	Severe caving at 7-1/2 feet.
			20	

CVD 5/3/99 1-1 MODIK-B PC2
4978\005\98 TEST PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER
J-4978-06 7/98
Figure A-21

AR 046248

Test Pit Log HC99-TP3

N 48,819.88, E 11,698.04

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 33'
S-1	22		0	(Loose to dense), moist, brown, silty, gravelly SAND to sandy SILT. (FILL)
S-2	13		2	
S-3	28		4	
			5	(Soft), moist, brown, slightly sandy SILT.
			6	
			7	
			8	
			9	(Stiff to hard), moist, gray mottled with brown, slightly sandy, silty CLAY.
S-4	32	AL	10	
			11	
S-5	19		12	(Dense to very dense), moist to wet, gray, silty, fine SAND.
			13	
			14	
			15	
			16	
S-7	28		17	Grades to fine to medium SAND.
			18	Bottom of Test Pit at 17½ Feet. Completed 2/16/99.
			19	
			20	Groundwater seepage at 15 feet; groundwater table encountered at a depth of 17½ feet.


Test Pit Log HC99-TP4

N 19,100.40, E 11,642.99

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 339
S-1	19	0	(Soft), moist, brown, sandy SILT.
S-2	7	2	
		3	(Loose to medium dense), moist, brown, silty, very gravelly SAND with scattered concrete and asphalt blocks. (FILL)
		4	2-foot-diameter concrete pipe.
S-3	14	5	(Medium dense), moist, gray, slightly gravelly, silty SAND to sandy SILT.
		6	
S-4	15	7	Grades to (medium dense), gravelly, very silty SAND to very sandy SILT.
		8	
		9	Becomes saturated.
		10	Bottom of Test Pit at 9 Feet. Completed 2/16/99.
		11	Groundwater seepage encountered at a depth of 7½ Feet.
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	

D:\N 11/13/00 1-1 W051K-B PC2
 4978\005\99 11\SIP1\1P03_04

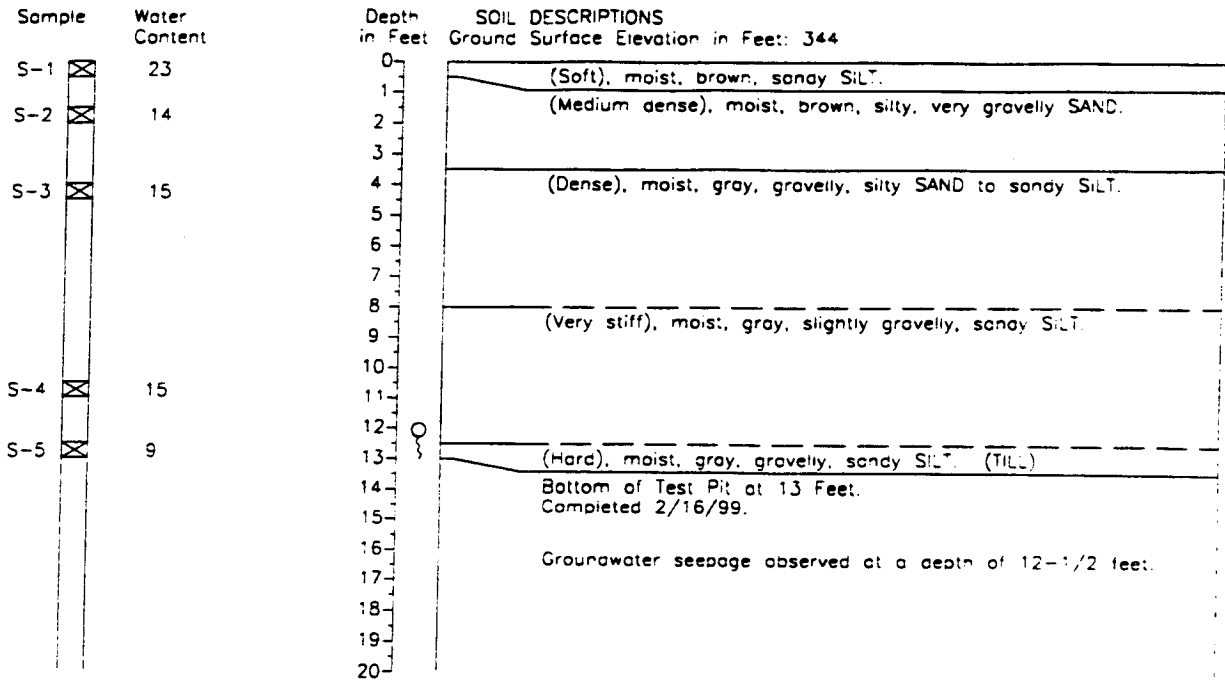
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-06 2/99
 Figure A-22

AR 046249

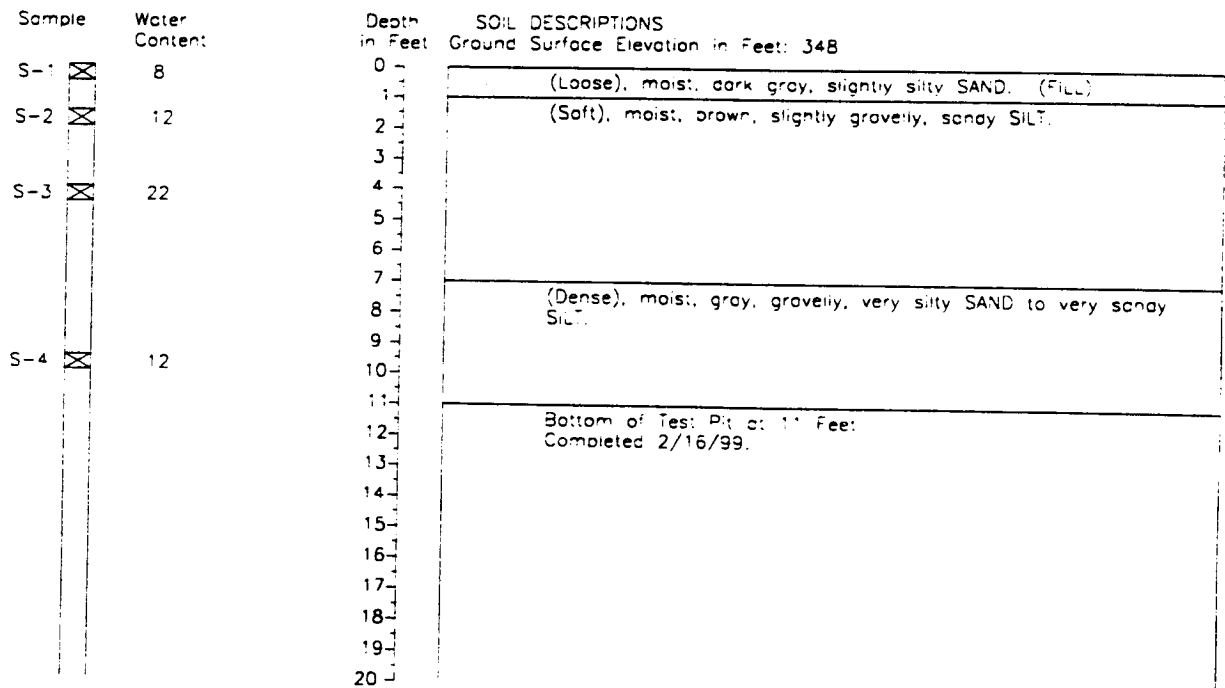
Test Pit Log HC99-TP5

N 19,178.74, E 11,663.86



Test Pit Log HC99-TP6

N 19,284.06, E 11,656.03



D:\IN\11\13\00 1-1 WDSIK - B PC2
 4978\005\99 TEST PITS\TP05-06

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

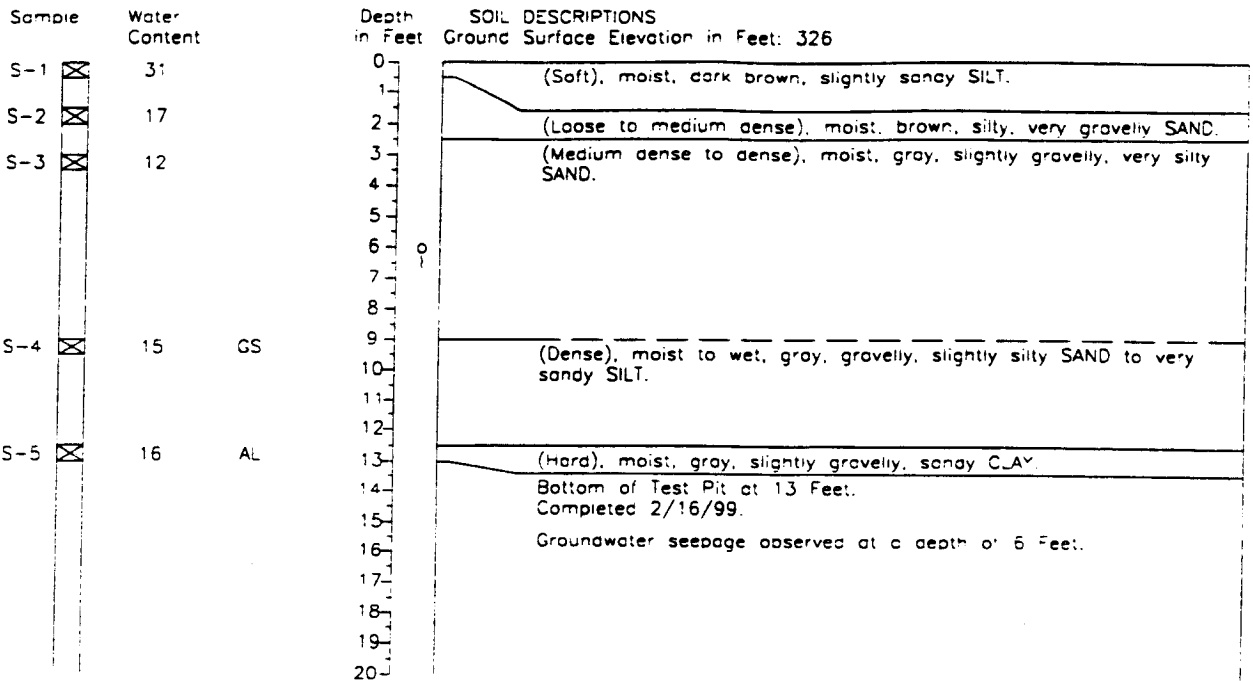
J-4978-06 2/99

Figure A-23

AR 046250

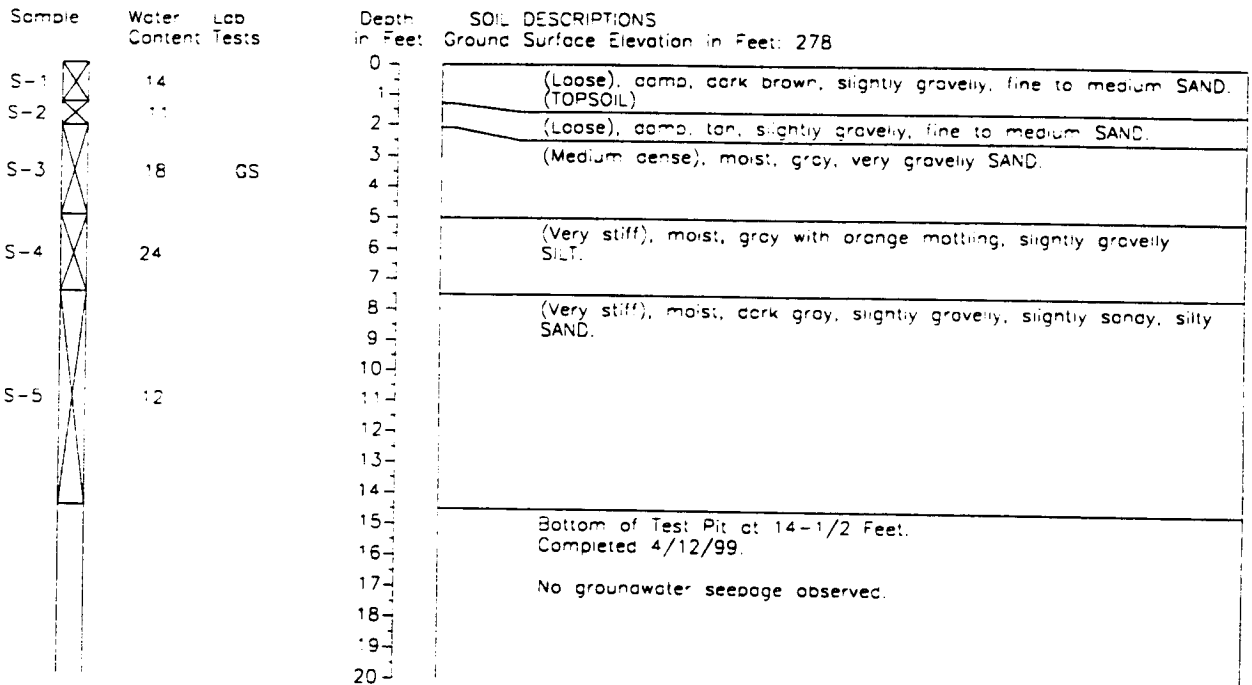
Test Pit Log HC99-TP9

N 19,190.28, E 11,517.076



Test Pit Log HC99-TP10

N 21,671.89, E 11,058.59



DN 11/13/00 1 of 1 WDSIK-B PCZ
49/8\OGS\99 TEST PITS\TP09-10

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HARTCROWSER
J-4978-06 2/99
Figure A-24

AR 046251

Test Pit Log HC99-TP13

N 21,287.50, E 11,064.60

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 290
S-1	13	0	(Loose), damp to moist, dark brown, silty SAND with occasional debris (brick fragments and plastic). (FILL)
		1	(Loose), moist to wet, brown, silty, medium SAND.
		2	
		3	
		4	
		5	Seepage approximately 1 gpm.
S-2	22	6	(Loose to medium dense), wet, gray, slightly silty, very gravelly, medium to coarse SAND.
		7	
		8	(Stiff to hard), wet, blue-gray, slightly sandy, slightly gravelly SILT.
		9	
S-3	23	10	
		11	
		12	
		13	
		14	
		15	Bottom of Test Pit at 15 Feet. Completed 4/12/99.
		16	
		17	Groundwater seepage observed at a depth of 4 1/2 feet.
		18	
		19	
		20	

Test Pit Log HC99-TP14

N 20,847.31, E 11,018.33

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 308
S-1	24	0	(Loose), damp, dark brown, slightly gravelly, silty SAND.
		1	(Loose to medium dense), moist, brown, silty fine SAND.
S-2	19	2	
		3	
		4	6-inch layer of (stiff), damp, tan with orange mottling, slightly gravelly SILT.
		5	
S-3	10	6	(Medium dense), moist to wet, gray, very sandy GRAVEL.
		7	
		8	Very slight seepage.
S-4	20	9	(Stiff to hard), moist, tan with orange mottling, slightly sandy, gravelly, clayey SILT.
		10	
		11	
		12	(Dense), moist to wet, slightly silty, gravelly SAND.
		13	
S-5	12	14	
		15	
		16	
		17	Bottom of Test Pit at 17 Feet. Completed 4/12/99.
		18	
		19	Groundwater seepage observed at a depth of 7 1/2 feet.
		20	

0:\IN\11\13\00 1-1 WBS\K 8-PC2
 4978\005\99 TEST PITS\TP13 14

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-06 4/99

Figure A-25

AR 046252

Test Pit Log HC99-TP15

N 21,200.49, E 10,705.64

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 276
S-1	12	0 - 3	(Medium dense), damp to moist, brown, gravelly, silty SAND with organic material and debris (brick fragments and concrete pieces). (FILL)
S-2	7	4 - 8	(Dense), moist, tan, slightly gravelly, medium SAND.
S-3	22	9 - 16	6-inch layer of (hard), damp, tan and gray, gravelly SILT. (Stiff), moist to wet, gray, slightly sandy SILT.
		16	Bottom of Test Pit at 16 Feet. Completed 4/8/99.
		8 - 9	Groundwater seepage observed at depths of 8 and 9 feet. Slight petroleum-like odor noted at a depth of 8 feet.

Test Pit Log HC99-TP16

N 20,889.3, E 10,778.91

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 290
S-1	19	0 - 3	(Medium dense), damp to moist, brown, gravelly, silty SAND with abundant debris (brick fragments and concrete pieces). (FILL)
S-2	23	4 - 6	(Loose), moist to wet, brown and orange, slightly gravelly, slightly silty, coarse SAND. Large 3-foot-diameter boulder encountered.
S-3	15	7 - 16	(Stiff to hard), moist to wet, gray, sandy, gravelly SILT. Increasing silt content.
		16-1/2	Bottom of Test Pit at 16-1/2 feet. Completed 4/12/99.
		8-1/2 - 9	Groundwater seepage observed at depths of 8-1/2 and 9 feet.

D:\N\113\00 1-1 WISIK-BPCZ
4978\06S\99 IT ST PH15\TP15-16

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-06 4/99

Figure A-26

AR 046253

Test Pit Log HC99-TP17

N 20,624.32, E 10,818.27

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 296
S-1	15	0 - 1	(Medium dense), damp, dark brown, slightly gravelly, silty SAND with debris (brick fragments, concrete pieces, and wood). (FILL)
S-2	17	1 - 4	(Medium dense), moist, brown SAND.
S-3	28	4 - 7	(Stiff), moist to wet, brown with orange mottling, sandy SILT.
S-4	23	7 - 11	(Loose), moist, gray SAND.
S-5	19	11 - 12	8 inches of (Loose), wet, brown, very sandy GRAVEL.
		12 - 13	(Stiff to hard), wet, gray, sandy SILT.
		13 - 15	Bottom of Test Pit at 15 Feet. Completed 4/12/99.
		15 - 20	Groundwater seepage observed at a depth of 11-3/4 feet.

Test Pit Log HC99-TP18

N 10,628.87, E 20,757.75

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 284
S-1	8		0 - 1	(Loose), damp, gray and brown, slightly silty, very gravelly SAND with debris (brick fragments and charcoal). (FILL)
S-2	22		1 - 2	(Medium dense), damp, orange to brown, slightly gravelly, silty SAND with organic material.
S-3	25		2 - 4	(Loose), wet, gray, slightly silty, very gravelly, medium to coarse SAND.
S-4	15	GS	4 - 7	(Stiff), moist to wet, gray with orange mottling, slightly sandy, clayey SILT.
S-5	24	AL	7 - 9	(Medium stiff to hard), wet, gray, slightly sandy, clayey SILT.
S-6	22		9 - 16	Bottom of Test Pit at 16-1/2 Feet. Completed 4/12/99.
			16 - 20	Groundwater seepage observed at depths of 4 and 7 feet.

D:\IN 11/13/00 1-1 WOSIK 8.PC2
 49/9/0005/99 TEST PITS\TP17-18

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-06 4/99

Figure A-27

AR 046254

Test Pit Log HC99-TP26

N 21,054

E 11,018

Sample	Water Content	Lab Tests	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	7			0-1	3 inches of Sod over (loose), damp, brown, slightly gravelly, silty SAND with occasional roots and trace brick fragments.
S-2	7			1-4	(Medium dense), moist, brown, slightly gravelly SAND with trace roots to 4-foot depth.
S-2.5	20			4-6	(Stiff), moist, brown with orange mottling, slightly gravelly, very sandy SILT.
				6-7	(Loose to medium dense), moist, gray with orange mottling, very silty SAND.
S-3	23	AL	PP=1.2	7-11	(Medium dense), wet, brown to gray, sandy GRAVEL. (Medium stiff), moist to wet, gray, slightly sandy, silty CLAY.
S-4	16			11-15	(Very dense), moist to wet, gray, gravelly, silty to clayey SAND.
				15-17 1/2	Bottom of Test Pit at 17 1/2 Feet. Completed 9/29/99. Slight groundwater seepage at a depth of 11 feet. Significant side wall sloughing from 7 to 11 feet.

Test Pit Log HC99-TP27

N 21,036

E 11,700

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	8	0-2	(Very dense), moist, slightly silty, gravelly SAND with roots and wood debris.
S-2	6	2-4	(Dense), moist, brown SAND.
S-3	11	4-7	(Very dense), moist, grayish brown, gravelly, very silty SAND.
S-4	12	7-12	(Dense), moist, brown, slightly gravelly SAND.
		12-15	Grades to (dense), moist, brown SAND.
		15-15	Bottom of Test Pit at 15 Feet. Completed 10/1/99.

D:\N 11/13/00 1-1 woodstock 8 pc2 49/816 TEST PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-16 9/99

Figure A-28

AR 046255

Test Pit Log HC99-TP28

N 20,830

E 10,867

Sample	Water Content	Lab Test	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	4			0	(Loose), damp, dark brown to reddish brown, silty SAND with abundant roots grading to no roots at approximately 3-foot depth.
S-2	3			1	
S-3	26			2	
S-4	10			3	
				4	(Loose to medium dense), moist, gray with orange and brown mottling, very silty SAND to sandy SILT.
				5	(Loose to medium dense), moist to wet, brown to gray SAND.
				6	
				7	
S-5	9			8	(Medium dense), wet, brown, sandy GRAVEL.
				9	
S-6	20	AL	PP=1.2	10	(Very soft to soft), moist to wet, gray, slightly sandy, very silty CLAY with occasional GRAVEL.
				11	
S-7	11			12	(Very dense), moist to wet, gray, gravelly, silty to very silty SAND.
				13	
				14	Bottom of Test Pit at 17½ Feet. Completed 9/29/99. Groundwater seepage at a depth of 10½ feet.
				15	
				16	
				17	
				18	
				19	
				20	

Test Pit Log HC99-TP29


N 20,962

E 11,959

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	15	0	(Very dense), moist, brown, slightly silty, gravelly SAND.
		1	
		2	
		3	
S-2	10	4	(Very dense), moist, gray, slightly gravelly, very silty SAND.
		5	
S-3	7	6	Cobbles encountered.
		7	
		8	(Very dense), moist, grayish brown, slightly silty, gravelly SAND.
		9	
		10	Bottom of Test Pit at 14½ Feet. Completed 10/1/99.
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	

0 IN 11/13/00 1-1 woodstock 8 pc2
 49/816 1151 PHS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-16 9/99
 Figure A-29

AR 046256

Test Pit Log HC99-TP32

N 20,220

E 11,136

Sample	Water Content	Lab Tests	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	7			0-1	(Medium dense), damp to moist, reddish brown, slightly gravelly SAND with occasional cobbles.
S-2	6			1-3	
S-3	10			4-5	(Medium dense to dense), moist, brown to gray SAND.
S-4	23	AL	PP=1.7	6-7	(Very stiff), moist, gray with orange mottling, sandy, clayey SILT.
S-5	11			8-12	(Very dense), moist to wet, gray, silty, gravelly to very gravelly SAND.
				12-20	Bottom of Test Pit at 12½ Feet. Completed 10/1/99. Slight groundwater seepage at a depth of 12 feet.

Test Pit Log HC99-TP33

N 19,908

E 11,009

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	6	0-1	(Medium dense), damp, light brown, slightly silty, slightly gravelly, fine SAND.
S-2	10	1-3	
S-3	5	4-5	(Stiff), damp, light brown, slightly gravelly, sandy SILT.
S-4	4	6-7	(Dense), moist, brown, slightly gravelly SAND.
S-5	17	8-9	(Medium dense), moist, gray, slightly silty SAND.
S-6	13	10-11	(Very stiff), moist, gray with orange mottling, slightly gravelly, sandy SILT.
		12-15	(Dense), moist, gray, slightly silty, gravelly SAND with occasional cobbles.
		16-20	Bottom of Test Pit at 15 Feet. Completed 10/1/99.

DIN 11/13/00 1-1 woodstock - B pc2 497816 TEST PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-16 9/99

Figure A-30

AR 046257

Test Pit Log HC99-TP34

N 20,164

E 10,952

Sample	Water Content	Lab Tests	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	13			0	3 inches of Sod over (medium dense), damp, reddish-brown, slightly gravelly, silty, fine SAND with occasional organic material.
S-2	6			1	
S-3	16			2	
				3	(Medium dense to dense), damp, gray-brown, silty to very silty, fine SAND.
				4	(Dense), damp, gray, fine to medium SAND with occasional gravel lenses.
				5	
				6	
				7	Grades to sandy GRAVEL.
				8	(Very stiff to hard), moist, gray with orange mottling, sandy, silty CLAY with occasional gravel.
			PP=4.2	9	
			PP=2.0	10	
			PP=3.0	11	
S-4	24	AL		12	(Dense), wet, gray, slightly silty to silty SAND with occasional gravel.
S-5	14			13	
				14	Bottom of Test Pit at 15½ Feet. Completed 9/28/99.
				15	
				16	
				17	
				18	
				19	
				20	

Test Pit Log HC99-TP35

N 20,374

E 10,976

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
S-1	8		0	2 inches of Sod over (medium dense to dense), dry to damp, brown, silty, very gravelly SAND. (FILL)
S-2	6		1	
			2	(Dense), damp, reddish-brown, slightly gravelly, silty SAND with concrete debris in upper 3 feet. (FILL)
			3	(Medium stiff to stiff), moist, gray with orange mottling, slightly sandy, silty CLAY with trace gravel.
			4	
			5	
S-3	24	AL	6	(Medium dense to dense), moist to wet, brown, slightly gravelly, silty SAND.
			7	
			8	
			9	
S-4A	15		10	Becomes wet.
S-4B	14		11	
			12	Bottom of Test Pit at 15½ Feet. Completed 9/28/99.
			13	
			14	
			15	
			16	
			17	
			18	
			19	
			20	

DIN 11/13/00 1-1
497616 TEST M15
woodstock-B pc7

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-16 9/99
 Figure A-31

AR 046258

Test Pit Log HC99-TP36

N 20,287

E 10,730

Sample	Water Content	Lab Tests	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	15			0-2	(Medium dense), moist, brown, slightly gravelly, slightly silty to silty, fine to medium SAND with burnt debris. (FILL)
S-2	8			2-3	(Medium dense), moist, brown and gray, gravelly, fine to medium SAND.
S-3	20		PP=3.0	3-5	(Hard), moist, gray with orange mottling, slightly gravelly, slightly sandy, silty CLAY.
S-4	30	AL	PP=1.0	5-10	(Very stiff), moist, gray, silty CLAY.
S-5	14			10-12	(Dense), moist, gray, slightly gravelly, very silty SAND.
				12-15	
				15-20	Bottom of Test Pit at 15 Feet. Completed 9/28/99.

Test Pit Log HC99-TP36A

N 20,102

E 10,759

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	12	0-3	(Dense), moist, brown, silty SAND with decreasing organic material down to approximately 3 feet.
S-2	21	3-5	(Stiff), moist to damp, gray with orange-brown mottling, slightly gravelly SILT.
S-3	17	5-7	(Medium dense), moist to damp, brown, slightly gravelly SAND.
S-4	20	7-10	(Hard), moist, gray, slightly gravelly, slightly sandy, silty CLAY.
		10-15	
		15-20	Bottom of Test Pit at 15 Feet. Completed 9/29/99.

DIN 11/13/00 1=1
49/816 TEST PITS
woodstock 8 pc2

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-16 9/99

Figure A-32

AR 046259

Test Pit Log HC99-TP36B

N 20,215
E 10,744

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	7	0 - 1	(Dense), moist, brown, slightly gravelly, silty SAND.
S-2	27	1 - 3	(Stiff), moist, gray with orange mottling, slightly sandy, slightly clayey SILT.
S-3	10	3 - 4	Interbedded (stiff), moist, gray with orange mottling, slightly sandy, slightly clayey SILT and (dense), moist, brown, slightly gravelly, silty SAND.
S-4	20	4 - 7	(Hard), moist, gray with orange mottling, slightly gravelly, slightly sandy SILT.
S-5	16	7 - 12	(Medium dense to dense), wet, gray, slightly silty, slightly gravelly SAND.
		13	Bottom of Test Pit at 15 Feet. Completed 9/29/99. Slight groundwater seepage at a depth of 13 feet.

Test Pit Log HC99-TP36C

N 20,030
E 10,956

Sample	Depth in Feet	SOIL DESCRIPTIONS
	0	Ground Surface Elevation in Feet: 302
	0 - 1	(Medium dense), damp, brown, slightly silty, slightly gravelly SAND with organic material.
	1 - 2	(Dense), moist, brown, slightly silty, gravelly SAND
	2 - 3	(Hard), moist, gray with orange mottling, sandy SILT.
	3 - 8	(Very dense), moist, grayish brown, slightly silty, gravelly SAND with cobbles to 2 inches.
	15	Bottom of Test Pit at 15 Feet. Completed 9/29/99.

1. Refer to Figure A-1 for expansion of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

J-4978-16 9/99

Figure A-33

AR 046260

Test Pit Log HC99-TP36D

N 20,051

E 10,781

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
S-1	8		0-1	3 inches of Sod over brown, silty SAND with abundant sma roots
S-2	16		1-2	(Loose to medium dense), damp, orange-brown, slightly gravelly, fine SAND with trace small roots.
S-3	19	AL	2-3	(Dense), moist, gray with orange motting, silty to very silty SAND.
			3-4	(Stiff to very stiff), moist, gray with orange motting, slightly sandy, silty CLAY with occasional gravel.
			4-9	(Very dense), moist, gray and brown with orange motting, gravelly, silty SAND with occasional cobbles.
			9-10	Bottom of Test Pit at 9½ Feet. Completed 9/30/99.

Test Pit Log HC99-TP37

N 19,575

E 10,328

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
			Ground Surface Elevation in Feet: 260
S-1	9	0-1	4 inches of Sod over (medium dense), moist, dark brown, very silty SAND with scattered roots.
S-2A	9	1-2	
S-2B	12	2-3	(Medium dense), moist, gray and red-brown, very silty SAND
S-3	24	3-4	(Medium dense), moist, reddish brown, slightly silty SAND with occasional gravel.
S-4A	12	4-5	(Dense), moist, gray with orange motting, slightly gravelly, very silty SAND.
		5-14	(Very dense), moist to wet, gray, slightly gravelly, silty SAND.
S-4B	9	14-15	Bottom of Test Pit at 14½ Feet. Completed 9/29/99. Slight groundwater seepage at a depth of 13½ feet.

DIN 11/13/00 1x1
43/816 TEST PITS
WOODSTOCK, B 027

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

H
HARTCROWSER
J-4978-18 9/99
Figure A-34

AR 046261

Test Pit Log HC99-TP38

N 20,450
E 11,172

Sample	Water Content	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	4		0	3 inches of Sod over (loose), damp, brown, silty, gravelly SAND.
S-2	5		1	(Medium dense), damp, brown, slightly silty to silty, gravelly, fine to medium SAND with roots.
S-3	3		2	(Medium dense to dense), moist, brown SAND.
			3	Grades to very gravelly.
S-4	21	PP=2.7	4	
			5	
			6	(Very stiff to hard), moist, gray with orange mottling, slightly gravelly, sandy SILT.
S-5	18		7	
			8	
			9	
S-6	11		10	(Medium dense to dense), wet, grayish brown, slightly silty, slightly gravelly SAND.
			11	
			12	
			13	(Very dense), moist, gray, gravelly, silty to very silty SAND.
			14	Bottom of Test Pit at 12½ Feet. Completed 9/28/99.
			15	Note: Minor sloughing between 2- and 4-foot depths. Slight groundwater seepage at a depth of 10 feet.
			16	
			17	
			18	
			19	
			20	


Test Pit Log HC99-TP39

N 20,700
E 10,518

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	6	0	2 inches of Sod over (loose), damp, dark brown, gravelly, silty SAND with occasional brick and concrete debris.
S-2	4	1	(Medium dense), damp, brown, slightly gravelly SAND.
S-3	20	2	
		3	
		4	(Medium stiff to stiff), damp, gray with orange-brown mottling, slightly gravelly, sandy SILT.
		5	
		6	
		7	
		8	
S-4	13	9	(Dense to very dense), moist to wet, gray, gravelly, silty to very silty SAND with occasional cobbles.
		10	
		11	
		12	
S-5	7	13	
		14	Bottom of Test Pit at 13½ Feet. Completed 9/28/99.
		15	Slight groundwater seepage at a depth of 12½ feet.
		16	
		17	
		18	
		19	
		20	

DIN 11/13/00 1-1
49/816 TEST PITS
woodslock - 8 pc2

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER
J-4978-16 9/99
Figure A-35

AR 046262

Test Pit Log HC99-TP40

N 21,533

E 12,134

Sample	Water Content	Lab Tests	Field Test	Depth in Feet	SOIL DESCRIPTIONS
S-1	12			0-5	(Dense), brown, silty, gravelly SAND.
S-2	21	P ₂₀₀ =78%		5-6	(Stiff), moist, gray with orange mottling, sandy SILT.
				6-10	(Medium dense to dense), moist, brown, slightly silty, slightly gravelly SAND.
S-3	11			10-14	Cobbles and boulders encountered.
				14-14.5	Bottom of Test Pit at 14½ Feet. Completed 10/1/99.

Test Pit Log HC99-TP44

N 19,768

E 11,173

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
S-1	6	0-2	(Medium dense), damp, light to dark brown, slightly silty, gravelly SAND with roots.
S-2	4	2-5	(Medium dense), damp to moist, light brown, fine SAND.
S-3	20	5-8	(Stiff), moist, gray with orange mottling, slightly sandy, slightly gravelly SILT.
S-4	12	8-14	(Dense), moist to wet, gray, slightly silty to silty, gravelly SAND.
		14-14.5	Bottom of Test Pit at 14½ Feet. Completed 9/30/99. Heavy groundwater seepage at a depth of 13½ feet.

Ground Surface Elevation in Feet: 308

DIN 11/13/00 1-1 woodstock-8 pc2 492816 TEST PITS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.



HARTCROWSER

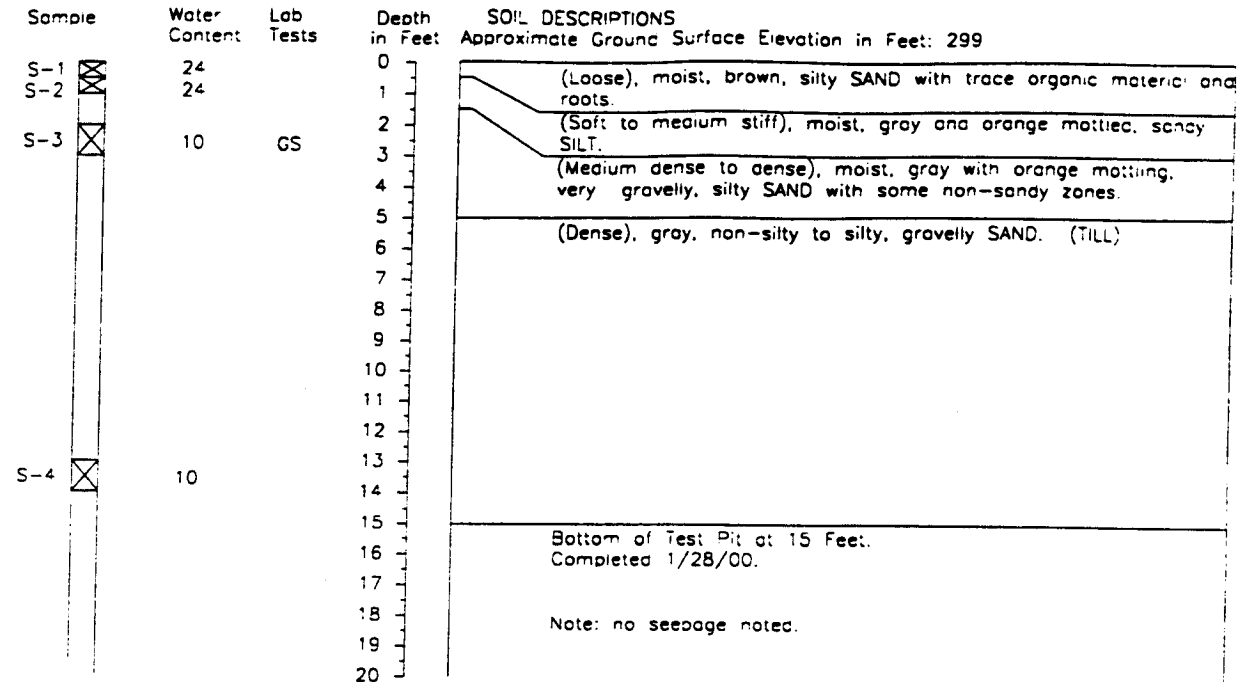
J-4978-16 9/99

Figure A-36

AR 046263

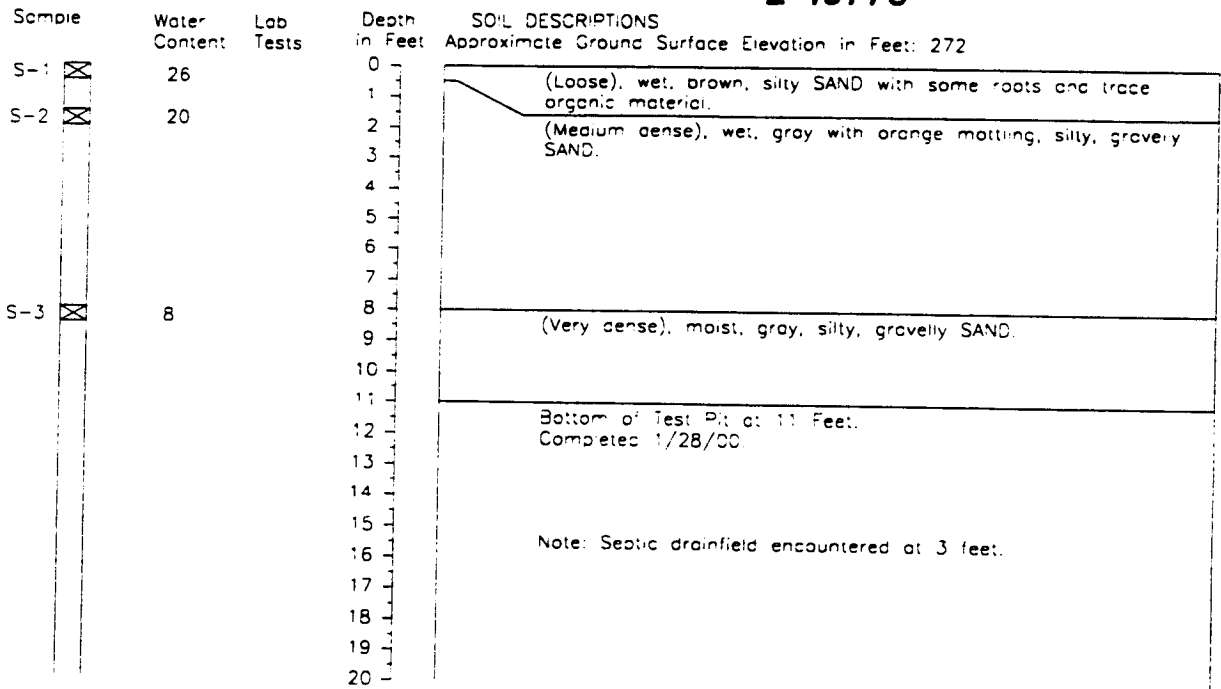
Test Pit Log HC00-TP125

N 19168
E 11187



Test Pit Log HC00-TP126

N 19443
E 10773



497821 testlogs woodstock pc7

D:\N 11/13/00 1-1

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-37

AR 046264

Test Pit Log HC00-TP127

N 19166
E 11086

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
Approximate Ground Surface Elevation in Feet: 292				
S-1	11	.	0	(Loose), moist, gray, silty, gravelly SAND. (Fill)
			1	(Loose), moist, brown, slightly silty SAND.
S-2	6	.	2	(Loose to medium dense), moist, gray, slightly gravelly SAND.
			3	
			4	
			5	
S-3	13	GS	6	(Dense), moist, gray with orange mottling, gravelly, very silty SAND.
			7	
			8	
			9	
			10	
			11	
			12	
			13	
			14	
			15	Bottom of Test Pit at 15 Feet.
			16	Completed 1/28/00.
			17	
			18	
			19	
			20	Note: no seepage noted.

Test Pit Log HC00-TP128

N 18732
E 11003

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
Approximate Ground Surface Elevation in Feet: 273				
S-1	18		0	(Loose), moist, brown, silty SAND with some roots
			1	(Medium dense), moist, gray-brown SAND.
S-2	8		2	
S-3	11		3	(Medium dense), wet, gray with orange mottling, silty, gravelly SAND with some non-silty zones.
			4	
			5	
			6	
			7	
			8	
			9	
			10	
			11	
			12	
			13	
			14	
S-4	11		15	Bottom of Test Pit at 15 Feet.
			16	Completed 1/28/00.
			17	
			18	
			19	
			20	Note: no seepage noted.

497821 testpits woodcock bc7

DIN 11/13/00 1-1

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-38

AR 046265

Test Pit Log HC00-TP300

**N 20404
E 10845**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 299
S-1	14	0-1	(Medium dense), moist, dark brown, slightly silty SAND with organic material. (TOPSOIL)
S-2	10	1-3	(Medium dense), moist, brown, slightly silty, fine SAND with trace organic material.
S-3	20	3-5	(Stiff), moist, orange to gray, very sandy, very clayey SILT.
S-4	20	5-7	(Stiff), moist, gray to orange, slightly gravelly, sandy SILT. (Weathered)
S-5	18	7-10	(Stiff), moist, gray, sandy SILT.
		15-16	Bottom of Test Pit at 15 Feet. Completed 5/2/00.
		16-20	No groundwater seepage observed.


Test Pit Log HC00-TP301

**N 20247
E 10838**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 295
S-1	23	0-1	(Medium dense), moist, brown, silty SAND with organic material. (TOPSOIL)
S-2	20	1-3	(Medium dense), moist, brown SAND with trace roots.
S-3	22	3-5	(Stiff), moist, gray and orange CLAY.
S-4	21	5-7	(Stiff), moist, gray and orange, slightly gravelly, sandy SILT. (Weathered)
S-5	9	12-14	(Very dense), moist, gray, gravelly, silty SAND.
		15-16	Bottom of Test Pit at 15 Feet. Completed 5/2/00.
		16-20	Groundwater seepage observed at a depth of 12 1/2 feet.

DIM 11/13/00 1-1
 CHARLIE B PCZ
 RESPIRUS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-26 5/00
 Figure A-39

AR 046266

Test Pit Log HC00-TP302

**N 20083
E 10860**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 295
S-1	7	0 - 1	(Medium dense), moist, dark brown, slightly silty SAND with organic material.
S-2	13	2 - 3	(Medium dense), moist to wet, brown SAND with silt and gravel lenses.
S-3	23	4 - 11	(Stiff to hard), moist, gray and orange, slightly gravelly, sandy SILT. (Weathered)
S-4	24	12 - 13	(Very stiff), moist, gray, slightly sandy to sandy SILT.
		15	Bottom of Test Pit at 15 Feet. Completed 5/2/00.
		17	Groundwater seepage observed at a depth of 4 feet.


Test Pit Log HC00-TP303

**N 19940
E 10887**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 297
S-1	16	0 - 1	(Medium dense), moist, brown, gravelly, silty SAND with roots.
S-2	18	2 - 3	(Stiff), moist, orange, gray and tan, sandy SILT with trace roots in top.
S-3	19	4 - 11	(Hard), moist, brownish gray, slightly gravelly, sandy SILT.
		12 - 14	Increasing density with depth.
		15	Bottom of Test Pit at 15 Feet. Completed 5/2/00.
		17	No groundwater seepage observed.

CHART: BWC
 01N 11/15/00 1 1
 1LS1P15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-26 5/00
 Figure A-40

AR 046267

Test Pit Log HC00-TP304

**N 19855
E 10748**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
			Ground Surface Elevation in Feet: 284
S-1	10	0 - 1	(Medium dense), moist, brown, slightly gravelly SAND with roots
S-2	17	1 - 4	(Stiff to hard), moist, gray, tan, and orange, slightly gravelly, sandy SILT.
		4 - 10	increasing sand and decreasing silt, gravel sizes up to 6 inches.
S-3	13	10 - 11	Wet, gray, slightly silty, gravelly SAND.
S-4	13	11 - 15	(Very dense), moist, gray, slightly gravelly, silty SAND.
		15 - 20	Bottom of Test Pit at 15 Feet. Completed 5/2/00. Groundwater seepage observed at a depth of 10 1/2 feet.


Test Pit Log HC00-TP305

**N 19427
E 10922**

Sample	Water Content	Depth in Feet	SOIL DESCRIPTIONS
			Ground Surface Elevation in Feet: 279
S-1	7	0 - 1	3 inches of roots over (medium dense), moist, brown, fine to medium SAND.
S-2	13	1 - 4	(Dense), moist, gray and orange, gravelly, silty SAND.
		4 - 11	Grading to very dense, gray-brown.
		11 - 20	Bottom of Test Pit at 11 Feet. Completed 5/2/00. Refusal at 11 feet. No groundwater seepage observed.

DIM 11/13/00 1s=1
 HES/PLS
 CHARL BPCZ

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.


HARTCROWSER
 J-4978-26 5/00
 Figure A-41

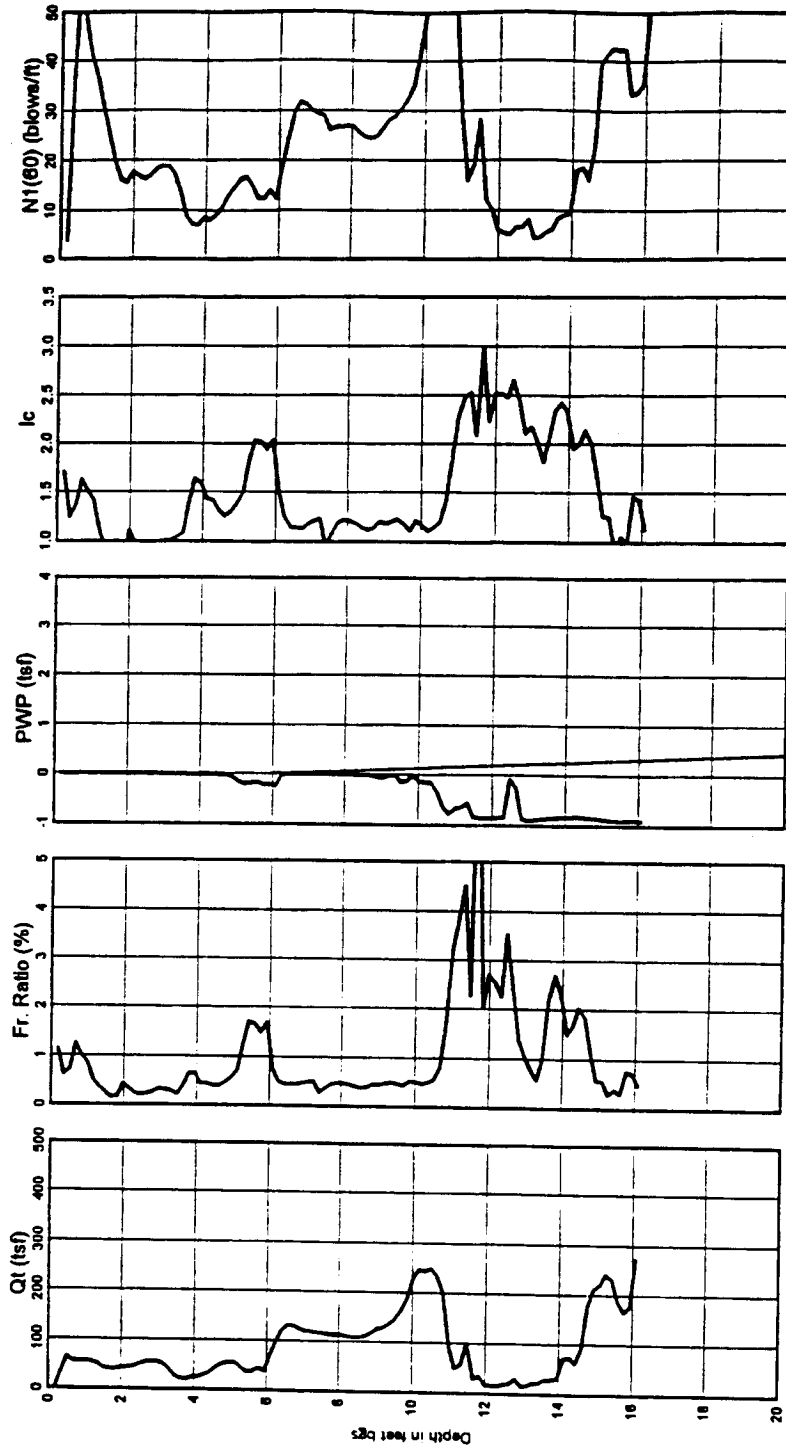
AR 046268

Cone Penetration Probe Log HC99-P07 N 20879 E 10960

Test Date : Dec 01, 1999
 Location : Third Runway North Safety Area

Operator : Northwest Cone Exploration

Ground Surf Elev. : 303
 Water Table Depth : 6.00



After Jiffster and Davies (1993)

After Jiffster and Davies (1991)
 $I_c < 1.35$ Overallly sand
 $1.35 < I_c < 1.90$ Clean to silty sand
 $1.90 < I_c < 2.35$ Silty sand to sandy silt
 $2.35 < I_c < 2.70$ Clayey silt to silty clay
 $2.70 < I_c < 3.25$ Clay

Fr. Ratio = $100 \cdot f / (Q - U_{tip})$
 Chart = 120.3 per f

Qt normalized for
 unequal end area effects

PROJECT NO 4978-18 DATE December 7, 1999 DRAWN BY Keith Brown Hart Crowser

H
HARTCROWSER
 J-4978-18 12/99
 Figure A-42

AR 046269

APPENDIX B
LABORATORY TESTING PROGRAM

APPENDIX B LABORATORY TESTING PROGRAM

A laboratory testing program was performed for this study to evaluate the basic index and geotechnical engineering properties of the site soils. Both disturbed and relatively undisturbed samples were tested. The tests performed and the procedures followed are outlined below.

NOTE: Laboratory test results for this study were compiled from earlier reports. These reports should be consulted in the interpretation of the laboratory test data.

Soil Classification

Field Observation and Laboratory Analysis. Soil samples from the explorations were visually classified in the field and then taken to our laboratory where the classifications were verified in a relatively controlled laboratory environment. Field and laboratory observations include density/consistency, moisture condition, and grain size and plasticity estimates.

The classifications of selected samples were checked by laboratory tests such as Atterberg limits determinations and grain size analyses. Classifications were made in general accordance with the Unified Soil Classification (USC) System, ASTM D 2487, as presented on Figure B-1.

Water Content Determinations

Water contents were determined for most samples recovered in the explorations in general accordance with ASTM D 2216, as soon as possible following their arrival in our laboratory. Water contents were not determined for very small samples nor samples where large gravel contents would result in values considered unrepresentative. The results of these tests are plotted at the respective sample depth on the exploration logs. In addition, water contents are routinely determined for samples subjected to other testing. These are also presented on the exploration logs.

Grain Size Analysis (GS)

Grain size distribution was analyzed on representative samples in general accordance with ASTM D 422. Wet sieve analysis was used to determine the size distribution greater than the U.S. No. 200 mesh sieve. The size distribution for particles smaller than the No. 200 mesh sieve was determined by the hydrometer method for a selected number of samples. The results of the tests

are presented as curves on Figures B-2 through B-13 plotting percent finer by weight versus grain size.

Atterberg Limits (AL)

We determined Atterberg limits for selected fine-grained soil samples. The liquid limit and plastic limit were determined in general accordance with ASTM D 4318-84. The results of the Atterberg limits analyses and the plasticity characteristics are summarized in the Liquid and Plastic Limits Test Report, Figures B-14 through B-24. This relates the plasticity index (liquid limit minus the plastic limit) to the liquid limit. The results of the Atterberg limits tests are shown graphically on the boring logs as well as where applicable on figures presenting various other test results.

Pocket Penetrometer (PP) and Torvane (TV)

The pocket penetrometer and torvane procedures provide quick approximate tests of the consistency (undrained shear strength) of a cohesive soil sample. The pocket penetrometer device consists of a calibrated spring mechanism which measures penetration resistance of a 1/4-inch-diameter steel tip over a given distance. The penetration resistance is correlated to the unconfined compressive strength of the soil, which is typically twice the undrained shear strength of a saturated, cohesive soil.

The torvane device consists of a 1-inch-diameter plate with eight equally spaced and radially arranged 1/4-inch vanes. The vanes are pressed into the soil and the device is rotated. The vanes force a shear failure to take place over the area of plate face. The resistance at failure, as measured by a calibrated spring, correlates to the undrained shear strength of the sample tested. The exploration logs show the results of the pocket penetrometer and torvane tests.

Triaxial Unconsolidated Undrained Compression Test (TUU)

The triaxial unconsolidated undrained compression test estimates the undrained shear strength of the soil. This test was performed in general accordance with ASTM D 2850. A relatively undisturbed fine-grained sample was trimmed to a length of about 6 inches, encased in a rubber membrane, and placed in the triaxial cell. An all-around confining pressure was applied hydraulically, but the sample was not allowed to consolidate, and no back pressure was applied. An axial load was then applied at a constant strain rate to the sample without allowing drainage from the specimen. The stress-strain behavior was recorded until failure occurred.

The failure stress was generally taken as the maximum load on the sample or the load recorded at 20 percent strain, whichever was greater. The test results plotted in terms of axial strain versus deviator stress are presented on Figure B-25. The shear strength is considered to be one-half the maximum stress difference based on the $\theta = 0$ concept and a total stress analysis.

Triaxial Consolidated Undrained Compression Test (TCU)

The triaxial consolidated undrained compression test with pore pressure measured estimates the effective strength of the soil at various stress levels. A relatively undisturbed fine-grained sample was trimmed to a length of about 6 inches, encased in a rubber membrane, and placed in the triaxial cell. With the sample in the triaxial test cell, an all-around pressure was applied hydraulically. The sample was allowed to consolidate under the applied pressure with drainage occurring through porous stones through slotted filter paper placed around the sample. When consolidation was completed, drainage lines from the sample were closed, a back pressure was applied to saturate the sample, and the sample was loaded to failure under undrained conditions by application of increasing axial load at a constant strain rate.

During loading, we recorded the magnitude of excess pore water pressure developed. From the data, an effective stress plot was developed to illustrate the variation in effective shear strength with varying consolidation (or overburden) pressures. The data are plotted using shear stress versus principal stress as Mohr's circles. The tangent to the Mohr's circles for a test series represents the effective angle of internal friction (ϕ'). The intercept along the vertical axis is the apparent cohesion (c'). The test results are shown on Figures B-26 and B-27.

Direct Shear Test (DS)

The drained direct shear test estimates the effective stress parameters of the soil. The test was performed in general accordance with ASTM D 3080. The test sample was trimmed from a relatively undisturbed soil sample and placed in the direct shear box, (or: The test sample was formed by placing disturbed soil in the direct shear box and hand compacting to achieve the desired density). The sample was allowed to consolidate under an applied vertical load prior to shearing. Following consolidation, a horizontal force was applied to the shear box containing the sample. In this way, the sample fails along a predetermined failure plane. The shearing took place at a constant strain rate which was slow enough to allow complete drainage to occur.

The data are presented on a Mohr-Coulomb diagram plotting shear stress versus normal stress. The line through the points of failure represents the effective angle of internal friction (ϕ') and the intercept along the vertical axis the apparent cohesion (c'). The test results are shown on Figure B-28.

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Unified Soil Classification (USC) System

Soil Grain Size

Size of Opening in Inches										Number of Mesh per Inch (US Standard)					Grain Size in Millimetres													
12	6	4	2	1 1/2	1	3/4	5/8	1/2	1/4	3/8	4	10	20	40	60	100	200	06	04	03	02	01	008	006	004	003	002	001
300	200	100	80	60	40	30	20	10	8	6	4	3	2	1	06	06	04	03	02	01	008	006	004	003	002	001	001	
COBBLES													GRAVEL					SAND					SILT and CLAY					
Coarse-Grained Soils													Fine-Grained Soils															

Coarse-Grained Soils

G W	G P	G M	G C	S W	S P	S M	S C
Clean GRAVEL <5% fines	GRAVEL with >12% fines	Clean SAND <5% fines	SAND with >12% fines				
GRAVEL >50% coarse fraction larger than No. 4				SAND >50% coarse fraction smaller than No. 4			
Coarse-Grained Soils >50% larger than No. 200 sieve							

G W and S W $\frac{D_{60}}{D_{10}} > 4$ for G W & $1 \leq \frac{(D_{30})^2}{D_{10} \times D_{60}} \leq 3$
 $\frac{D_{60}}{D_{10}} > 6$ for S W

G P and S P Clean GRAVEL or SAND not meeting requirements for G W and S W

G M and S M Atterberg limits below A line with PI < 4

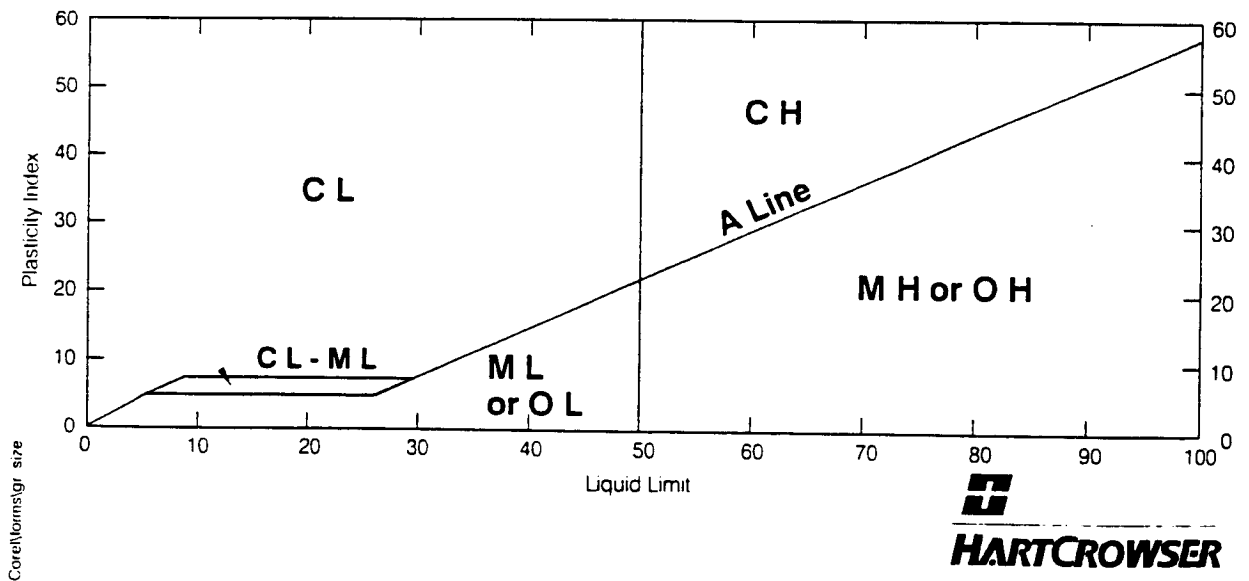
G C and S C Atterberg limits above A Line with PI > 7

* Coarse-grained soils with percentage of fines between 5 and 12 are considered borderline cases required use of dual symbols.

D_{10} , D_{30} , and D_{60} are the particles diameter of which 10, 30, and 60 percent, respectively, of the soil weight are finer.

Fine-Grained Soils

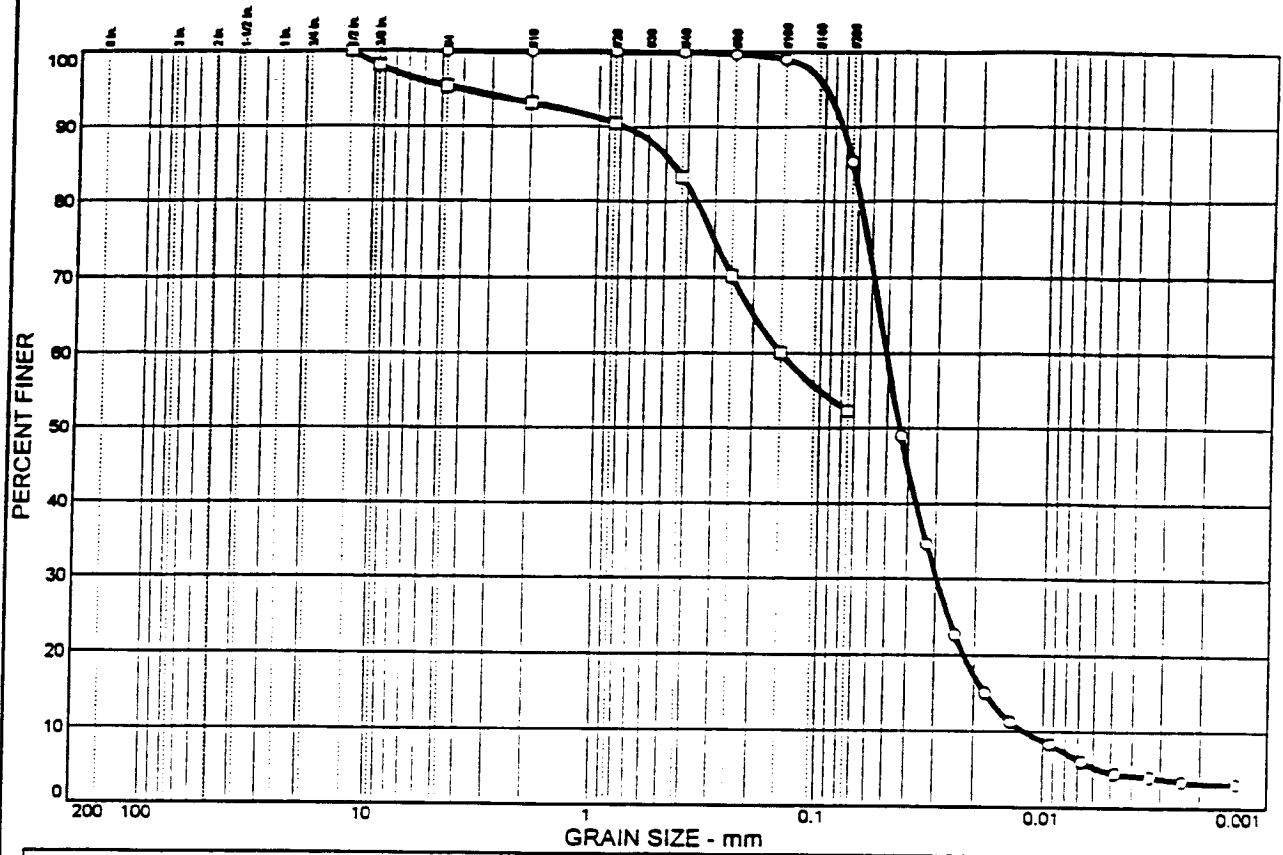
M L	C L	O L	M H	C H	O H	Pt
SILT	CLAY	Organic	SILT	CLAY	Organic	Highly Organic Soils
Soils with Liquid Limit <50%			Soils with Liquid Limit >50%			
Fine-Grained Soils >50% smaller than No. 200 sieve						



HARTCROWSER
 J-4978-28 10/00
 Figure B-1

AR 046275

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
<input type="checkbox"/>	0.0	0.0	0.0	0.2	14.5	80.7	4.6
<input type="checkbox"/>	0.0	4.7	2.1	9.8	30.9	52.5	

<input checked="" type="checkbox"/>	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
<input type="checkbox"/>	25	NP	0.0746	0.0509	0.0439	0.0296	0.0178	0.0121	1.42	4.19
<input type="checkbox"/>			0.464	0.149						

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
<input type="checkbox"/> Sandy SILT	ML	26%
<input type="checkbox"/> Very sandy SILT-CLAY	ML	14%

Remarks:

Project: Third Runway Westside

Client: HNTB

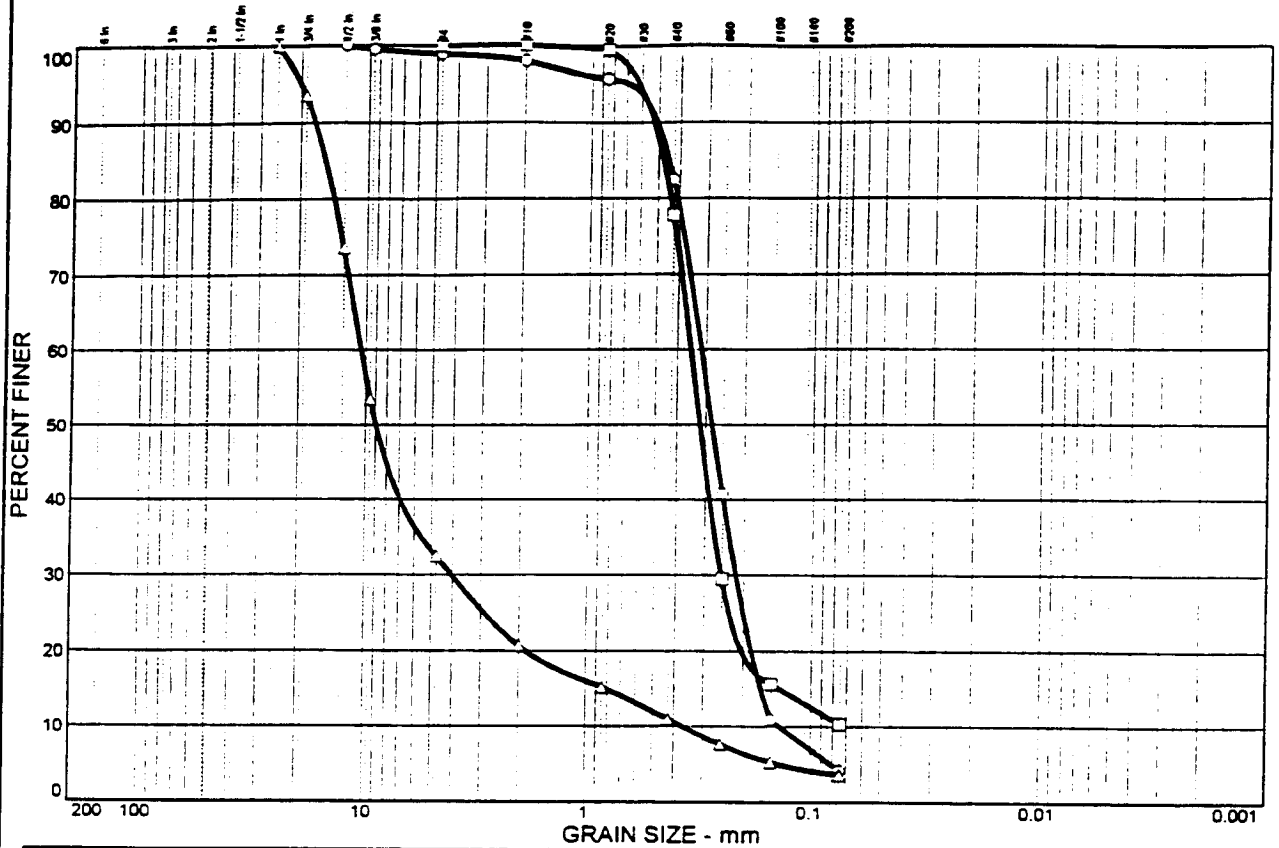
Source: HC00-B142 **Sample No.:** S-3

Source: HC00-B146 **Sample No.:** S-3



J4978-21 3/10/2000
Figure No. **B-3A**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	1.1	1.0	15.4	78.4	4.1	
□	0.0	0.0	0.0	22.1	67.5	10.4	
△	0.0	61.2	11.8	9.7	7.4	3.6	

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○		0.446	0.314	0.280	0.217	0.166	0.137	1.09	2.29
□		0.472	0.349	0.316	0.252	0.138			
△		15.4	10.5	8.92	4.04	0.819	0.365	4.26	28.68

MATERIAL DESCRIPTION		USCS	NAT. MOIST.
○	Medium to fine SAND	SP	4%
□	Slightly silty, medium to fine SAND	SP-SM	20%
△	Very sandy GRAVEL	GP	6%

Remarks:

○

□

△

Project: Third Runway Embankment

Client: The Port of Seattle

○ **Source:** HC99-B61 **Sample No.:** S-2

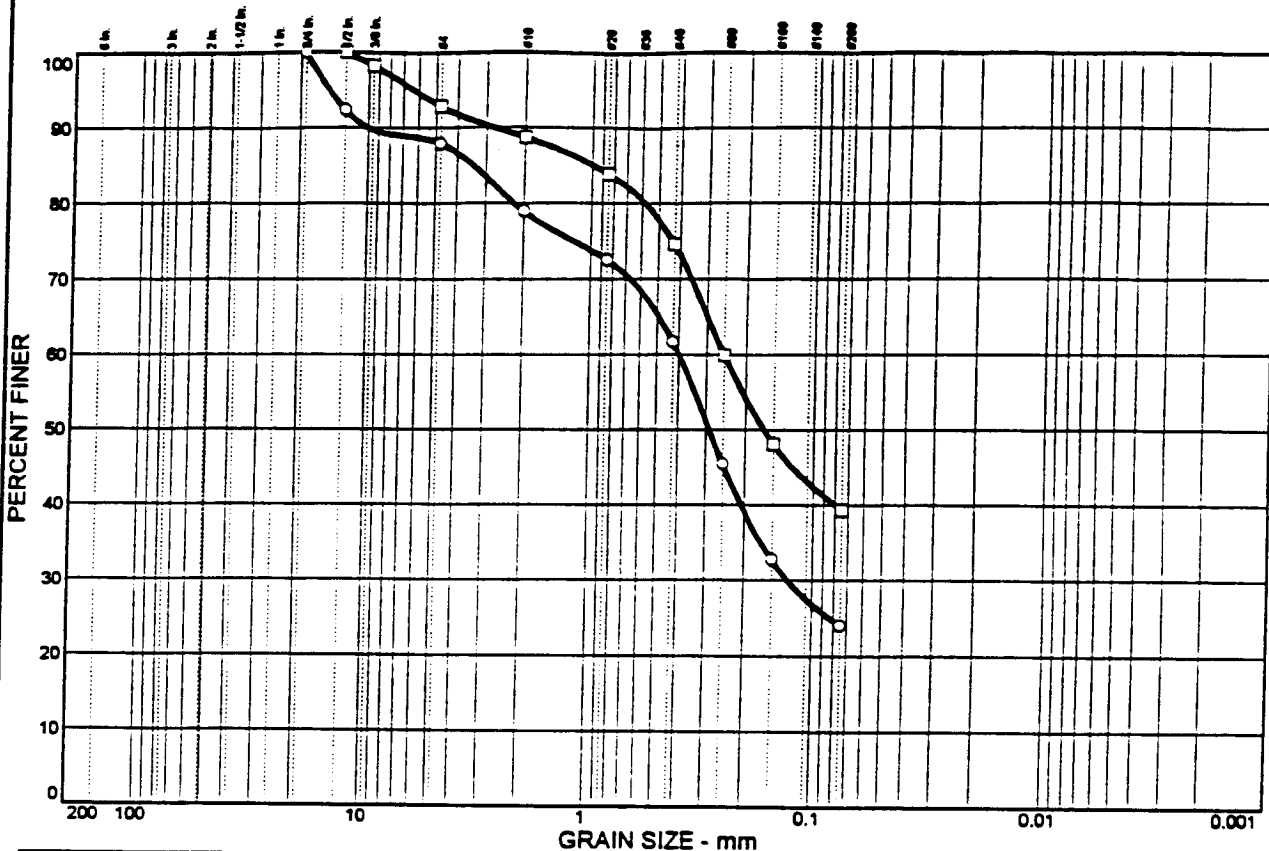
□ **Source:** HC99-B65 **Sample No.:** S-8

△ **Source:** HC99-B73 **Sample No.:** G-1

HARTCROWSER

J-4978-16 11/3/99
Figure No **B-4**

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	12.1	8.9	17.2	37.7	24.1	
□	0.0	0.0	7.2	4.1	14.1	35.3	39.3	

×	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			3.39	0.397	0.288	0.128				
□			0.989	0.250	0.165					

MATERIAL DESCRIPTION		USCS	NAT. MOIST.
○ Gravelly, silty SAND		SM	9%
□ Slightly gravelly, very silty, medium to coarse SAND		SM	14%

Remarks:

○

□

Project: Third Runway

Client: HNTB

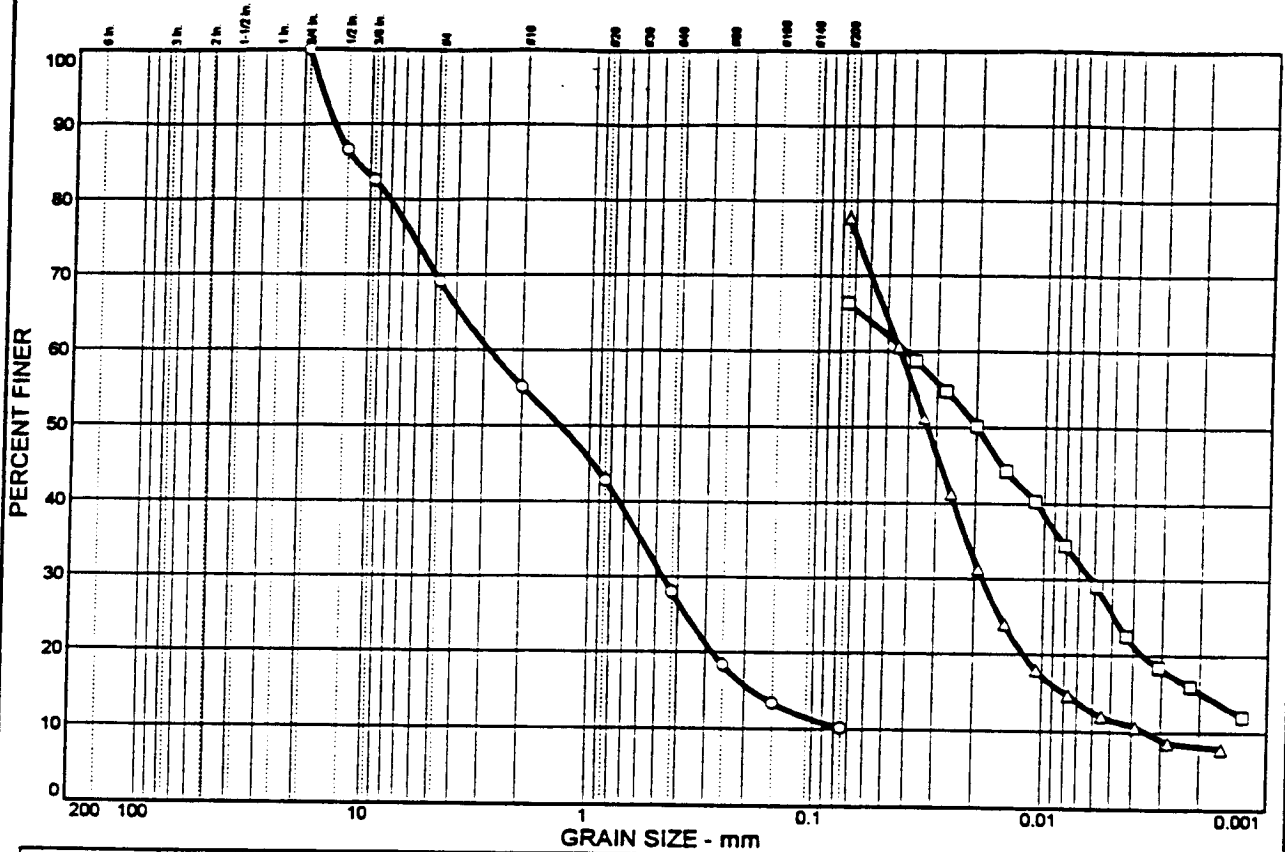
○ **Source:** HC00-B138 **Sample No.:** S-5

□ **Source:** HC00-B300 **Sample No.:** S-4

HARTCROWSER

J-4978-26 6/14/2000
Figure No. B-5

PARTICLE SIZE DISTRIBUTION TEST REPORT



Symbol	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	30.9	13.9	27.2	17.8	10.2	
□							40.8	25.6
△							66.2	11.6

Symbol	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			11.6	2.82	1.34	0.466	0.185			
□	26	10		0.0415	0.0198	0.0062	0.0019			
△	28	6		0.0441	0.0328	0.0185	0.0079	0.0034	2.26	12.84

MATERIAL DESCRIPTION		USCS	NAT. MOIST.
○	Slightly silty, very gravelly SAND	SP-SM	3%
□		CL	19%
△		CL-ML	30%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-B305 **Sample No.:** S-2

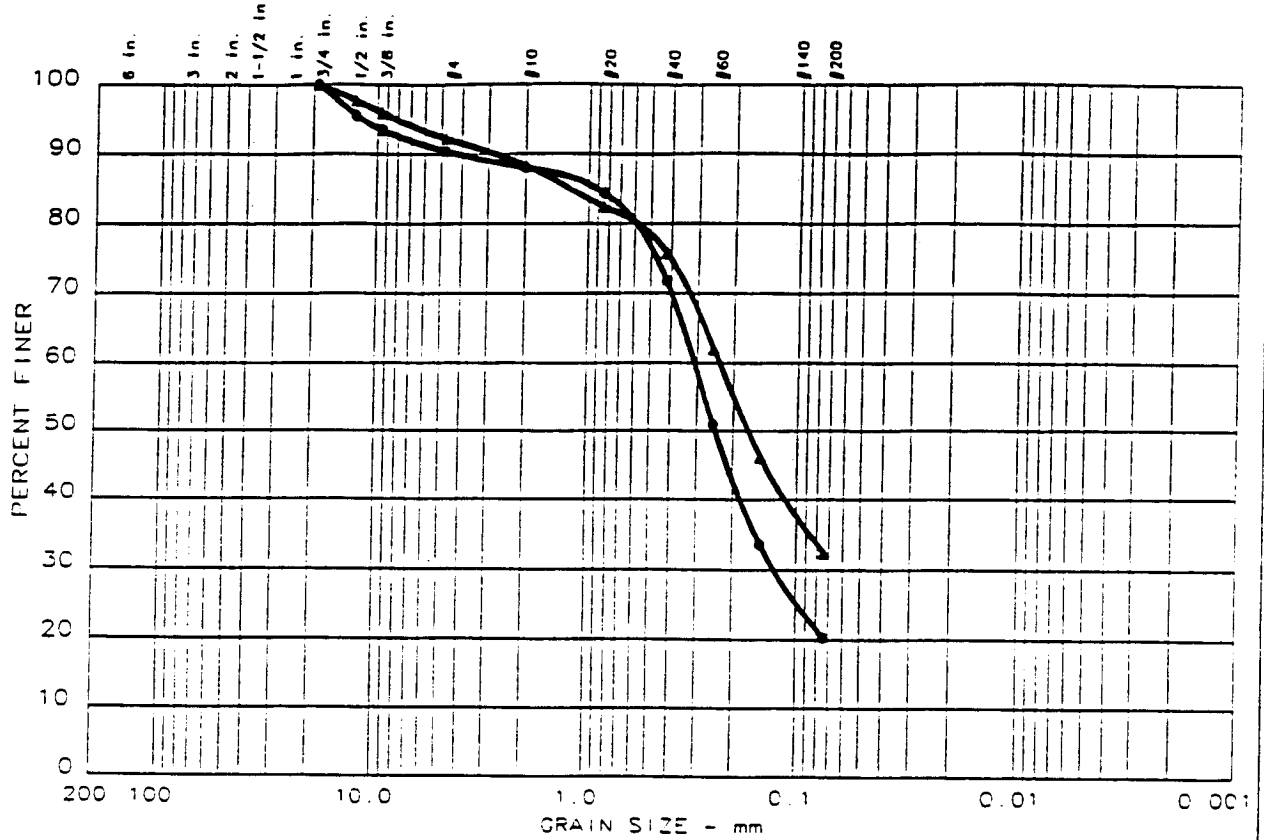
□ **Source:** HC00-B305 **Sample No.:** S-4

△ **Source:** HC00-B306 **Sample No.:** S-3

HARTCROWSER

J-4978-31 8/18/2000
Figure No. B-7

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	9.5	70.2	20.3	
▲	0.0	7.7	59.8	32.5	

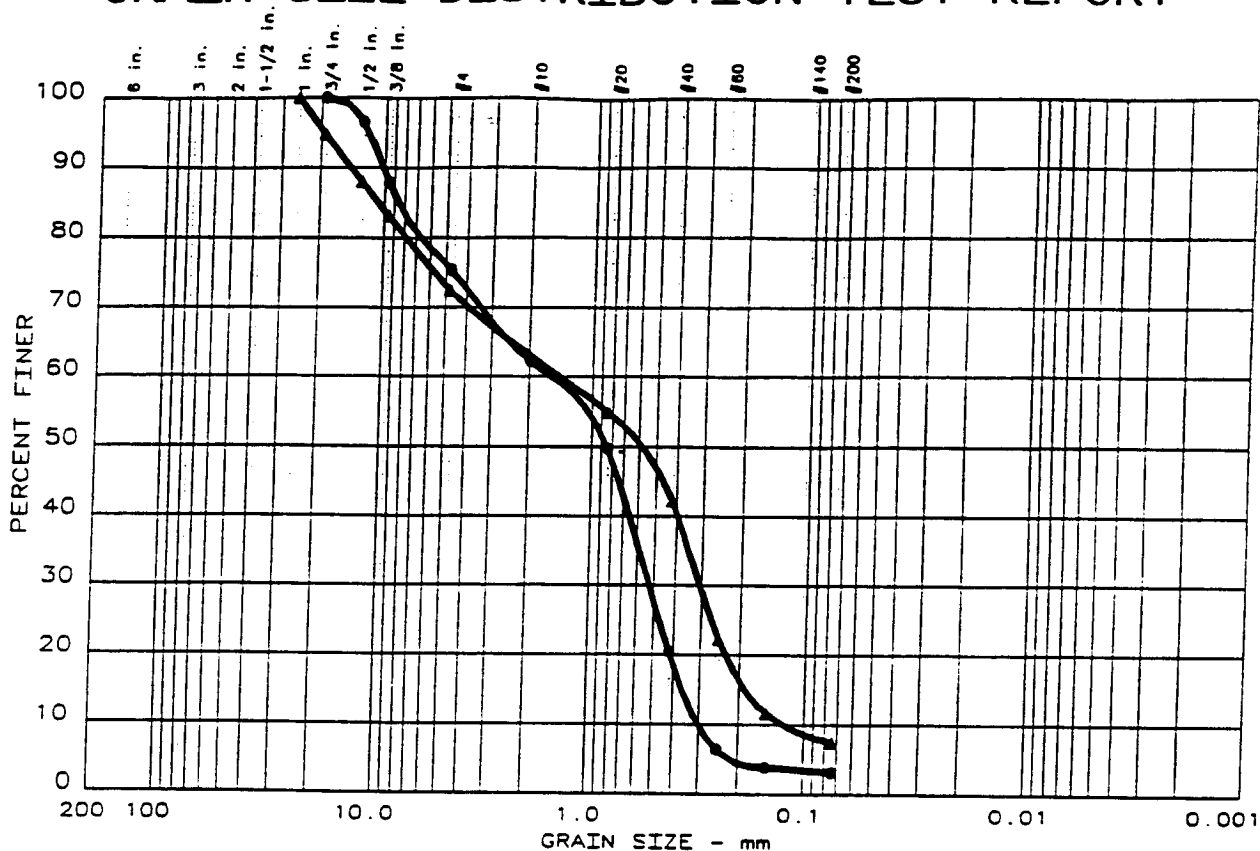
	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
●			0.89	0.31	0.24	0.126				
▲			1.22	0.23	0.17					

	MATERIAL DESCRIPTION	USCS	NAT. MOIST.
●	Slightly gravelly, silty SAND	SM	15%
▲	Slightly gravelly, very silty SAND	SM	11%

Remarks:

Project: 3rd Runway Phase II
 ● Location: HC98-TP8, S-5
 ▲ Location: HC98-TP10, S-4

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	24.7	72.3	3.0	
▲	0.0	27.5	65.1	7.4	

	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
●			8.51	1.55	0.85	0.523	0.3610	0.3027	0.58	5.1
▲			10.47	1.41	0.58	0.305	0.1862	0.1245	0.53	11.4

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● Gravelly SAND	SP	18%
▲ Slightly silty, gravelly SAND	SP-SM	15%

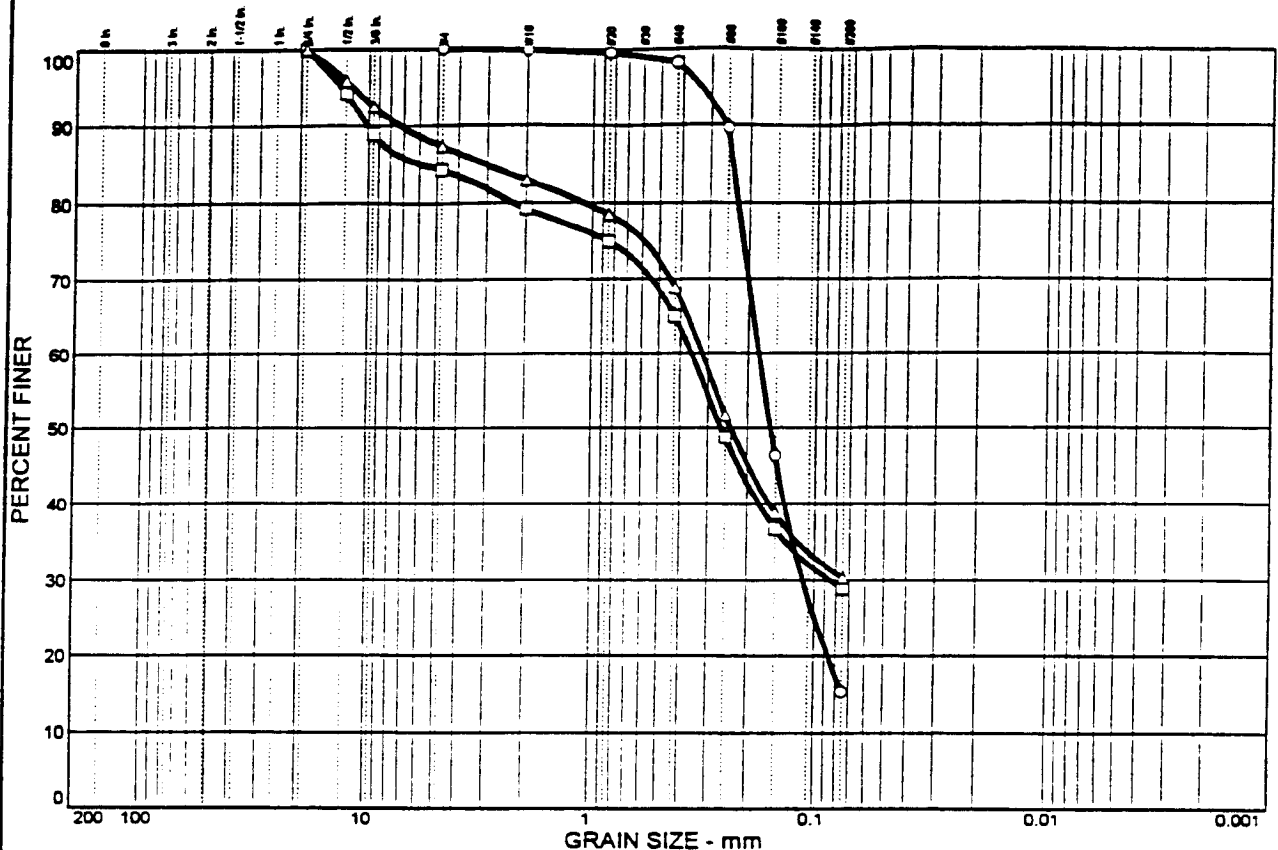
Remarks:

Project: 3R 99 Fill
 ● Location: HC99 -TP10 S-3
 ▲ Location: HC99 -TP9, S-4



J-4978-05 4/24/99
 Figure B-11

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.2	1.6	82.8	15.4	
□	0.0	0.0	15.7	5.0	14.3	36.1	28.9	
△	0.0	0.0	12.6	4.5	14.1	38.5	30.3	

	LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			0.238	0.179	0.158	0.112				
□			5.80	0.357	0.261	0.0851				
△			3.04	0.319	0.236					

	MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○	Silty, fine SAND	SM	13%
□	Gravelly, silty SAND	SM	14%
△	Gravelly, very silty, medium to fine SAND	SM	10%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP120 **Sample No.:** S-1

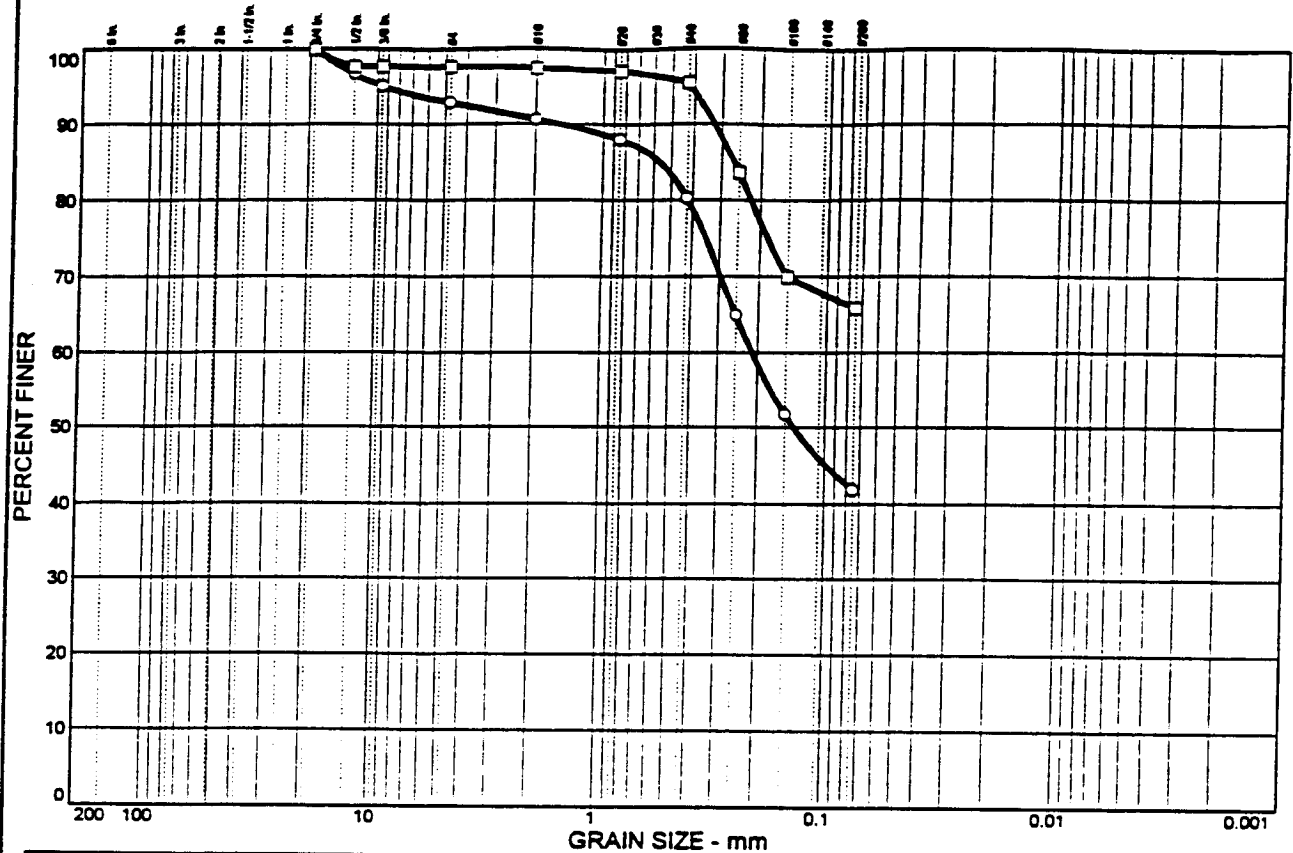
□ **Source:** HC00-TP123 **Sample No.:** S-3

△ **Source:** HC00-TP125 **Sample No.:** S-3



J4978-21 3/10/2000
Figure No. B-12

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	7.1	2.3	10.3	38.6	41.7	
□	0.0	2.3	0.3	1.9	29.7	65.8	

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○		0.564	0.211	0.137					
□		0.263							

MATERIAL DESCRIPTION		USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND		SM	13%
□ Very sandy SILT		ML	22%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

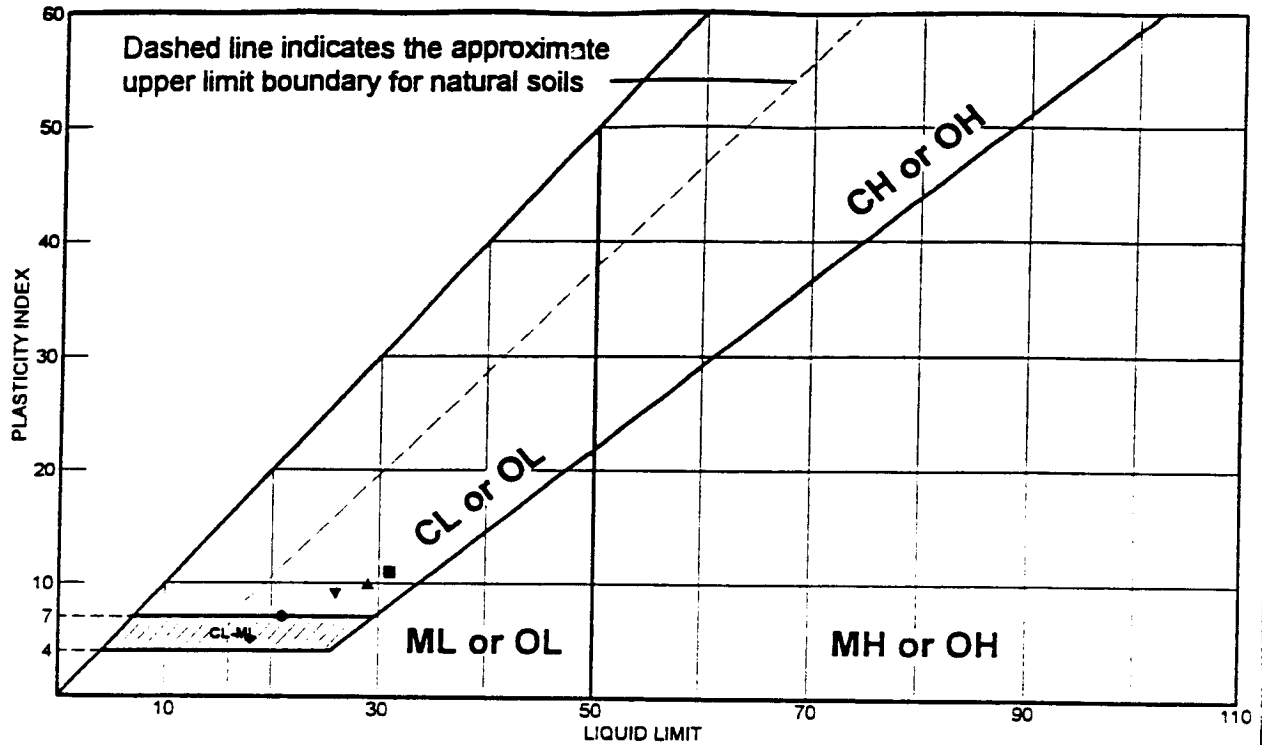
○ **Source:** HC00-TP127 **Sample No.:** S-3

□ **Source:** HC00-TP129 **Sample No.:** S-2



J4978-21 3/10/2000
Figure No. B-13

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC99-B54b Lean CLAY	Sample No.: S-1B	21	14	7		CL
■ Source: HC99-B54c Lean CLAY	Sample No.: S-1C	31	20	11		CL
▲ Source: HC99-B58 Sandy, very silty, lean CLAY	Sample No.: S-3	29	19	10	70.1	CL
◆ Source: HC99-B64 Silty CLAY	Sample No.: S-5	18	13	5		CL-ML
▼ Source: HC00-B160 Lean CLAY	Sample No.: S-4	26	17	9		CL

Remarks:

-
-
- ▲
- ◆
- ▼

Project: Thrd Runway North Safety Area

Client: Port of Seattle

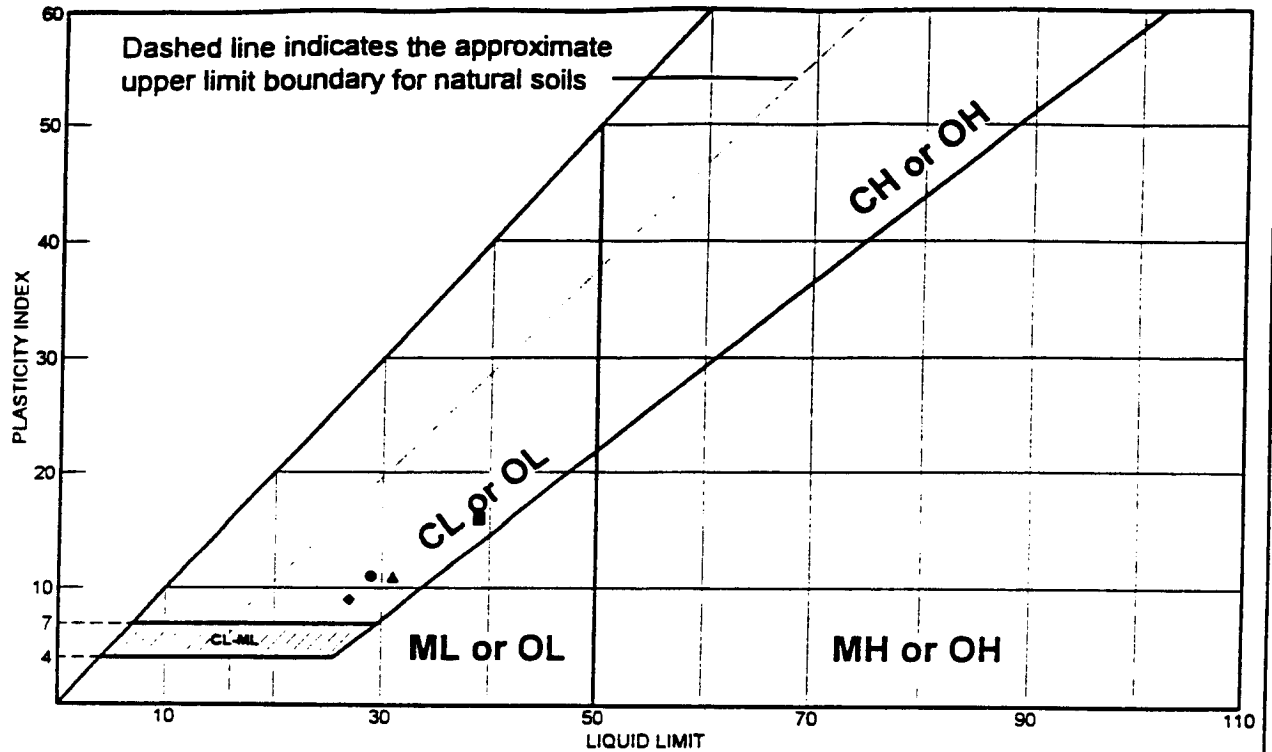
Location:



J-4978-18 3/1/2000
Figure No. B-14

AR 046289

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USC
● Source: HC99-TP36 Silty CLAY Sample No.: S-4	29	18	11		CL
■ Source: HC99-TP36D Slightly sandy, silty CLAY Sample No.: S-3	39	23	16		CL
▲ Source: HC99-B61 Slightly sandy, silty CLAY Sample No.: S-3	31	20	11		CL
◆ Source: HC99-B73 Slightly sandy, silty CLAY Sample No.: S-2	27	18	9		CL

Remarks:

-
-
- ▲
- ◆

Project: Third Runway Embankment

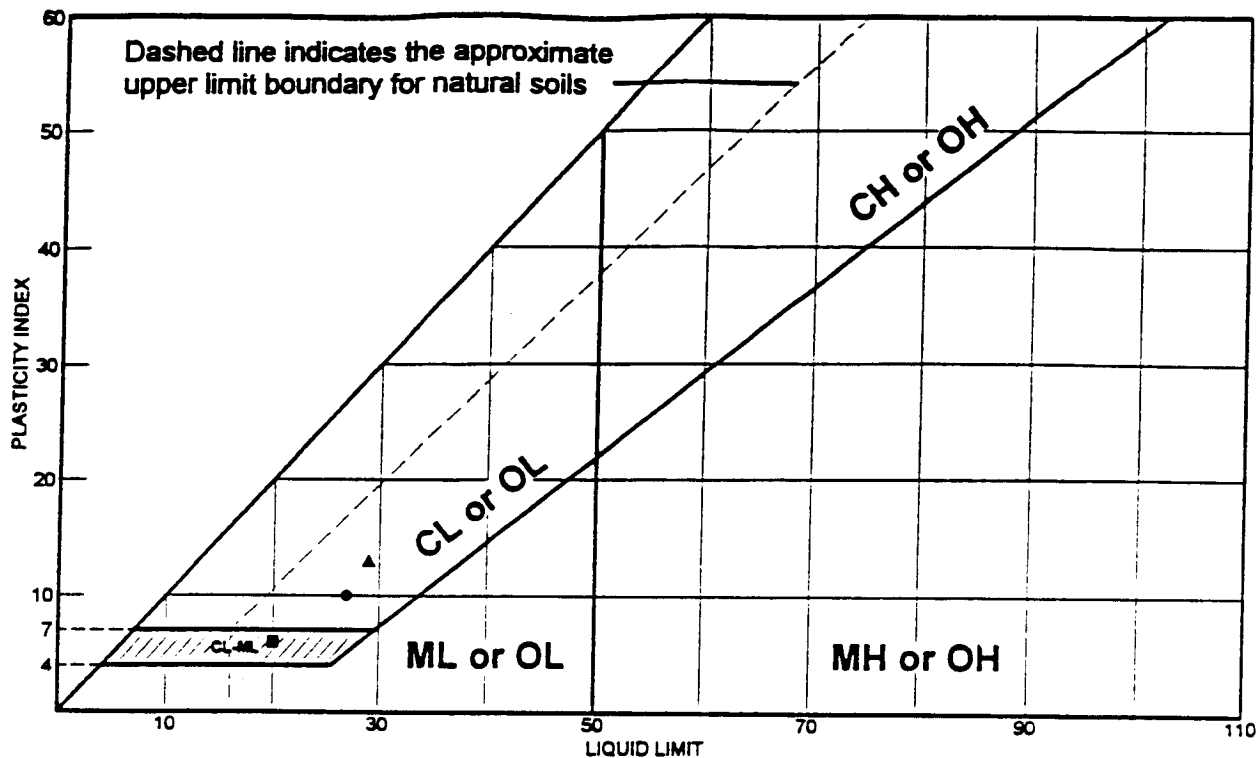
Client: The Port of Seattle

Location: Sea-Tac International Airport



J-4978-16 11/12/99
Figure No. B-15

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC00-B137	Sample No.: S-2					
Lean CLAY		27	17	10		CL
■ Source: HC00-B138	Sample No.: S-3					
CLAY-SILT		20	14	6		CL-ML
▲ Source: HC00-B300	Sample No.: S-3					
Lean CLAY		29	16	13		CL

Remarks:
 ●
 ■
 ▲

Project: Third Runway

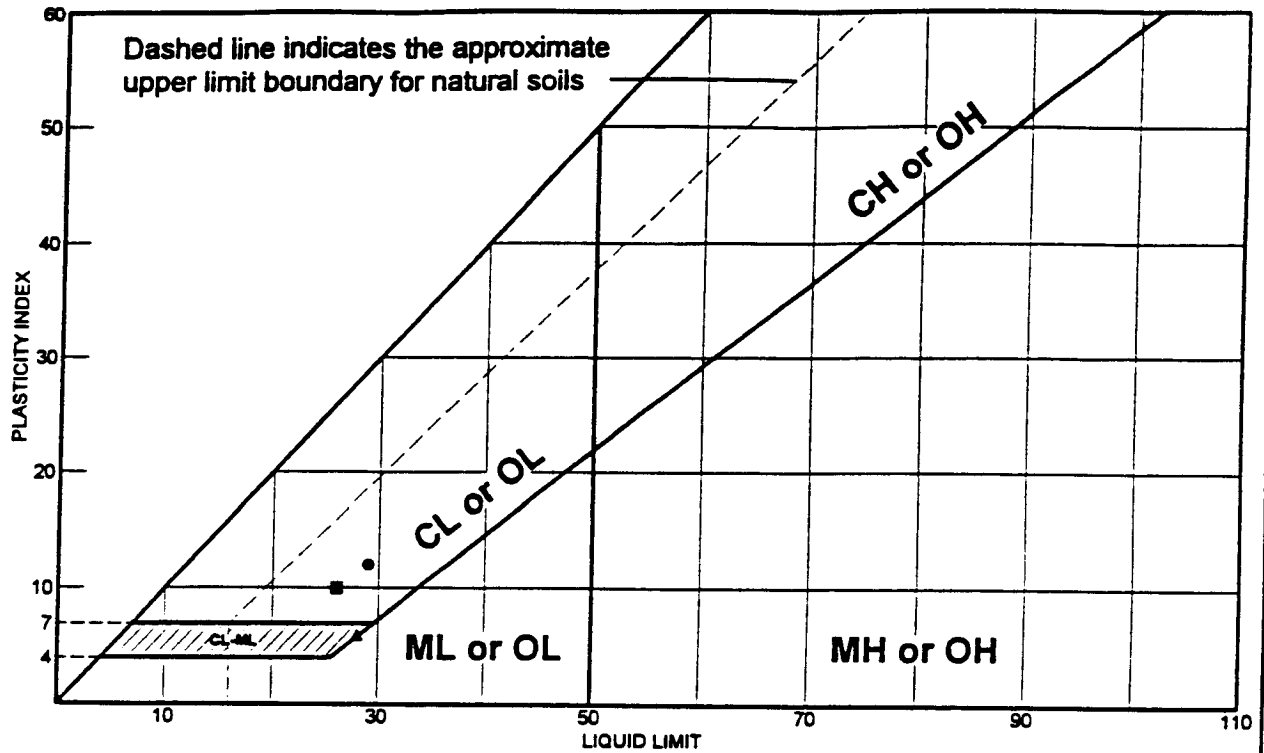
Client: HNTB

Location:



J-4978-26 6/14/2000
 Figure No. B-16

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC00-B302	Sample No.: S-4	29	17	12		
■ Source: HC00-B305	Sample No.: S-4	26	16	10	66.4	CL
▲ Source: HC00-B306	Sample No.: S-3	28	22	6	77.7	CL-ML

Remarks:

-
-
- ▲

Project: Third Runway

Client: HNTB

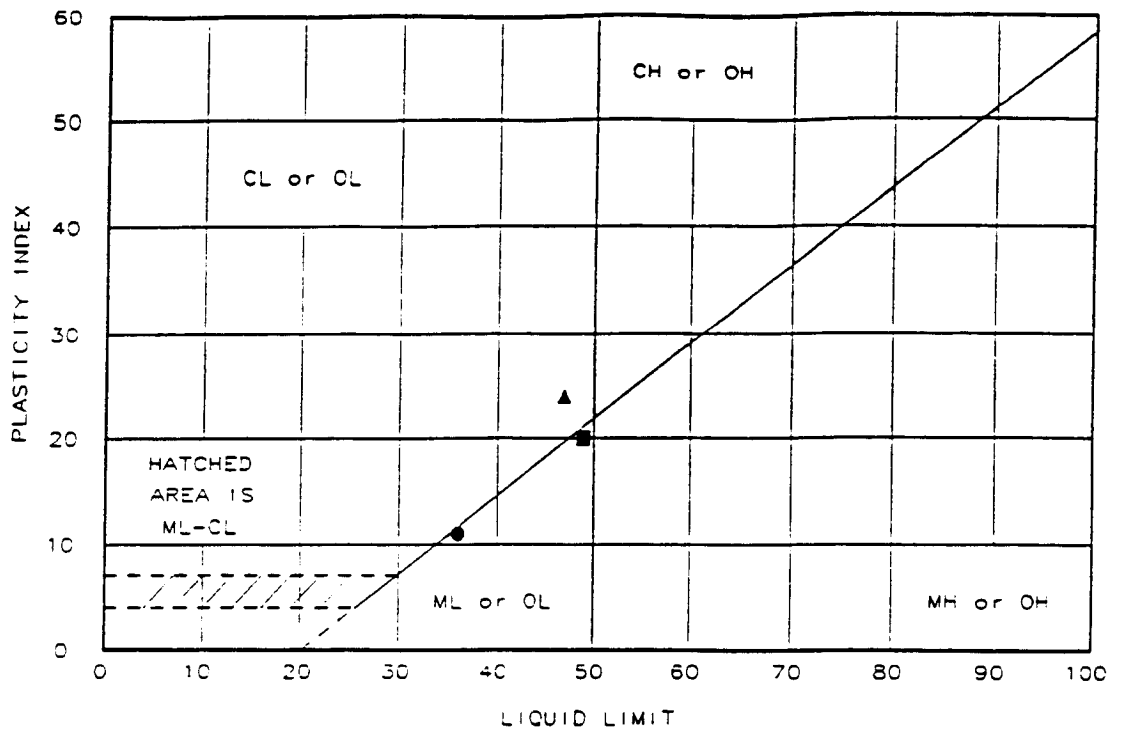
Location:



J-4978-31 8/18/2000
Figure No. B-17

AR 046292

LIQUID AND PLASTIC LIMITS TEST REPORT

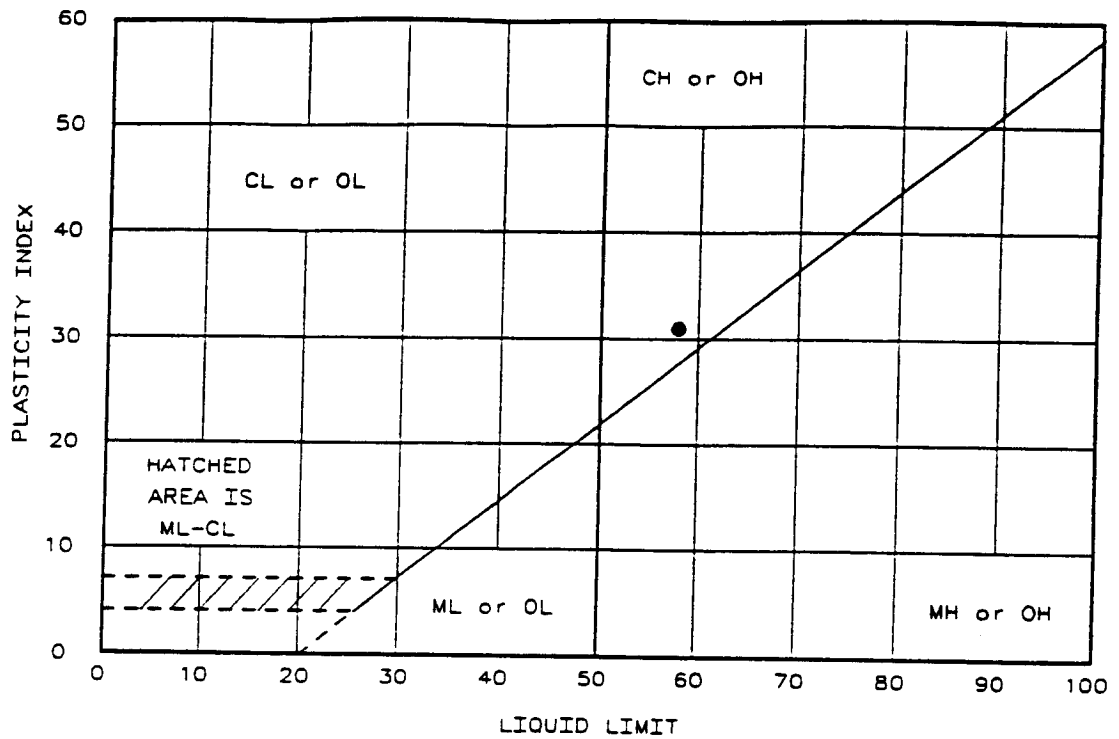


Location + Description	LL	PL	PI	-200	ASTM D 2487-90
● HC98-TP2, S-3, Depth 3.5 to 4.5 feet	36	25	11		SILT
▲ HC98-TP9, S-7, Depth 15 to 16 feet	47	23	24		Silty CLAY
■ HC98-TP12, S-4, Depth 4 to 4.5 feet	49	29	20		Clayey SILT

Remarks:	Project: 3rd Runway
	Client:
Location: Seattle, Washington	J-4978-06 8/3/98 Figure B-18



LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	ASTM D 2487-90
● HC-99/TP-3, S-4 Depth 10.5 to 11 feet	58	27	31		Slightly sandy, silty CLAY

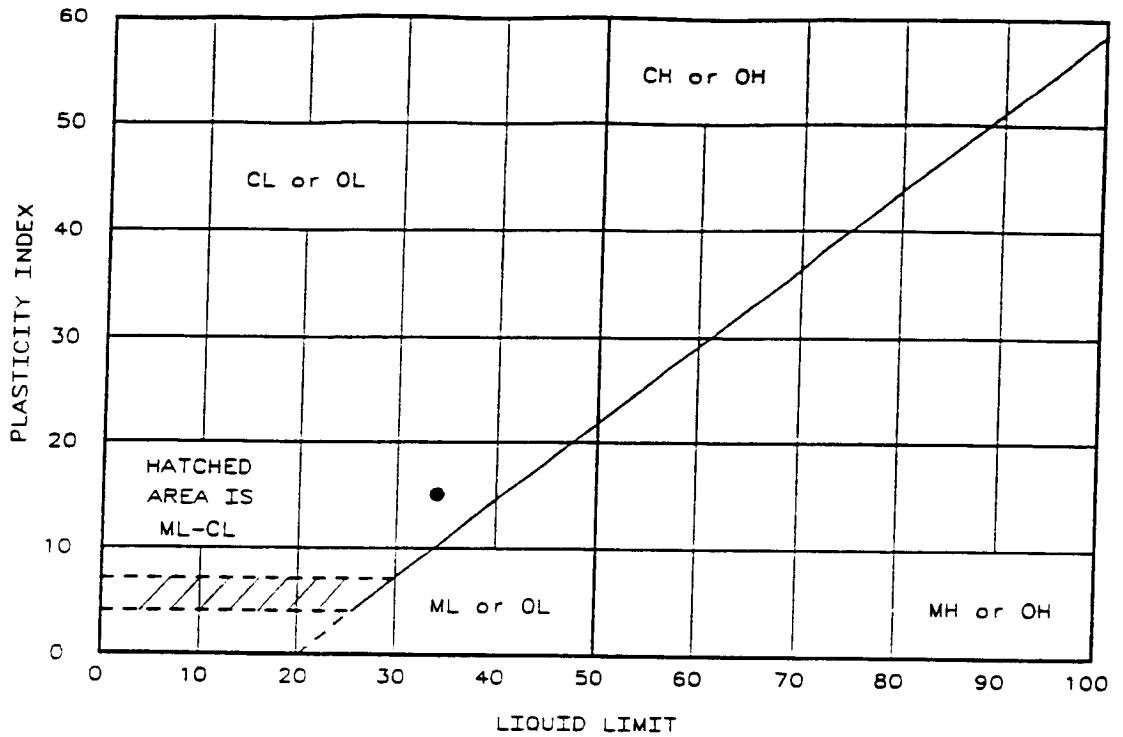
Remarks:

Project: 3rd Runway
 Client:
 Location: SeaTac, Airport, Washington



J-4978-06 3/9/99
 Figure B-19

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	ASTM D 2487-90
● HC99 -TP9, S-5	34	19	15		CLAY

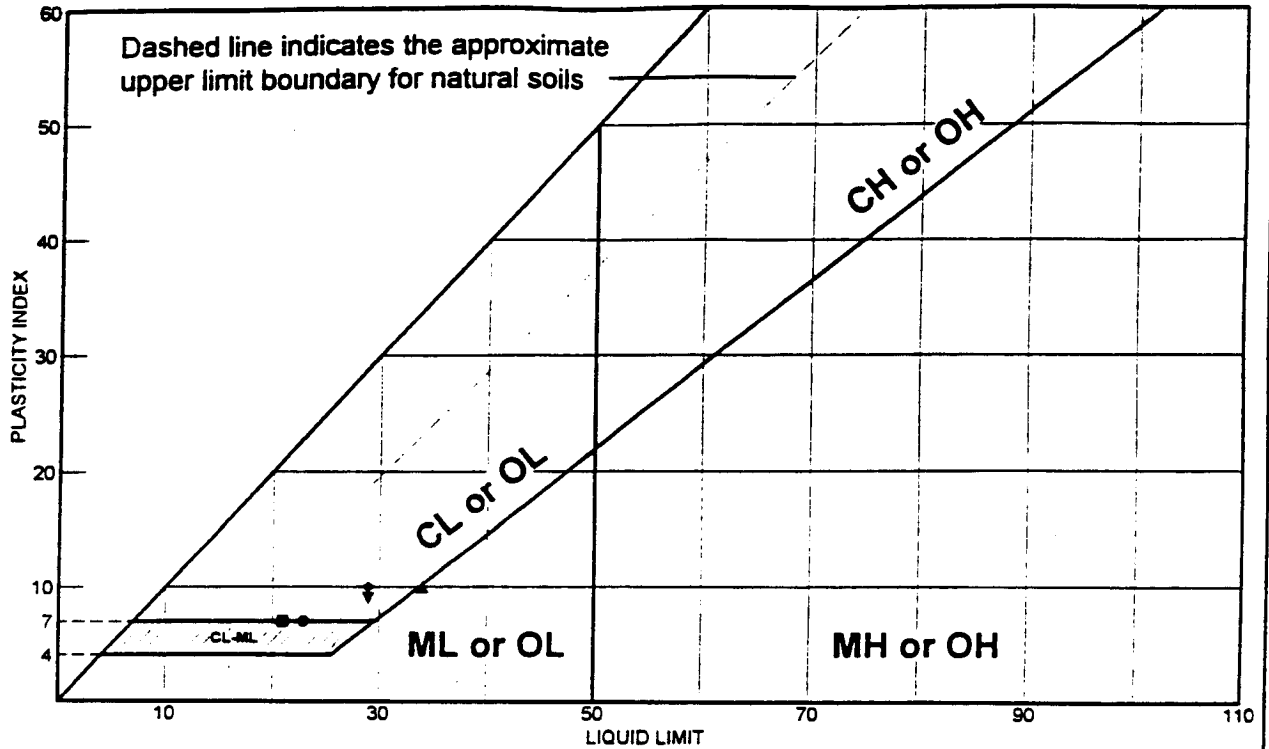
Remarks:

Project: 3R 99 Fill
 Client:
 Location: SeaTac Airport, Washington



J-4978-05 4/24/99
 Figure B-20

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USC
●	Source: HC99-TP26 Slightly sandy, silty CLAY	23	16	7		CL-ML
■	Source: HC99-TP28 Slightly sandy, very silty CLAY	21	14	7		CL-ML
▲	Source: HC99-TP32 Sandy, clayey SILT	34	24	10		ML
◆	Source: HC99-TP34 Sandy, silty CLAY	29	19	10		CL
▼	Source: HC99-TP35 Slightly sandy, silty CLAY	29	20	9		CL

Remarks:

-
-
- ▲
- ◆
- ▼

Project: Third Runway Embankment

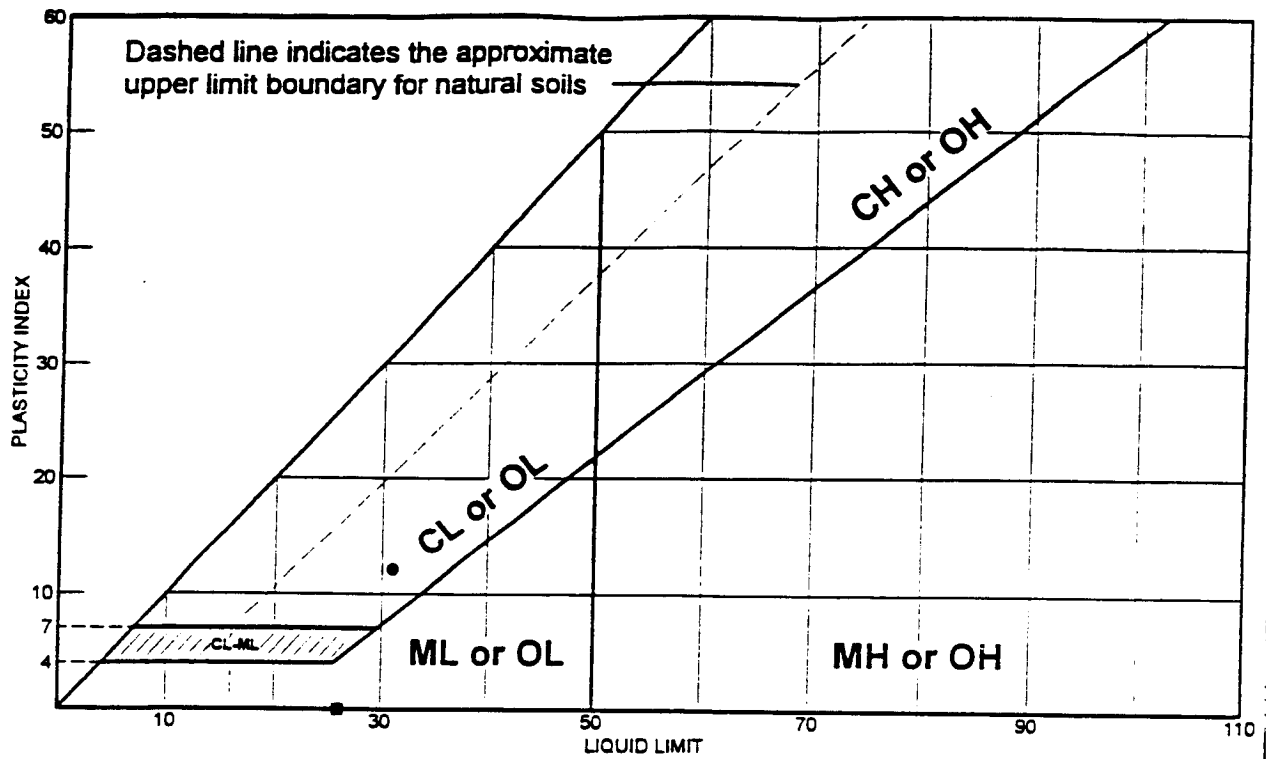
Client: The Port of Seattle

Location: Sea-Tac International Airport



J-4978-16 11/3/99
Figure No. B-21

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: TP-301 Lean CLAY	Sample No.: S-3 31	19	12		CL
■ Source: TP-307 SILT	Sample No.: S-6 26	26	0		ML

Remarks:

-
-

Project: Third Runway

Client: HNTB

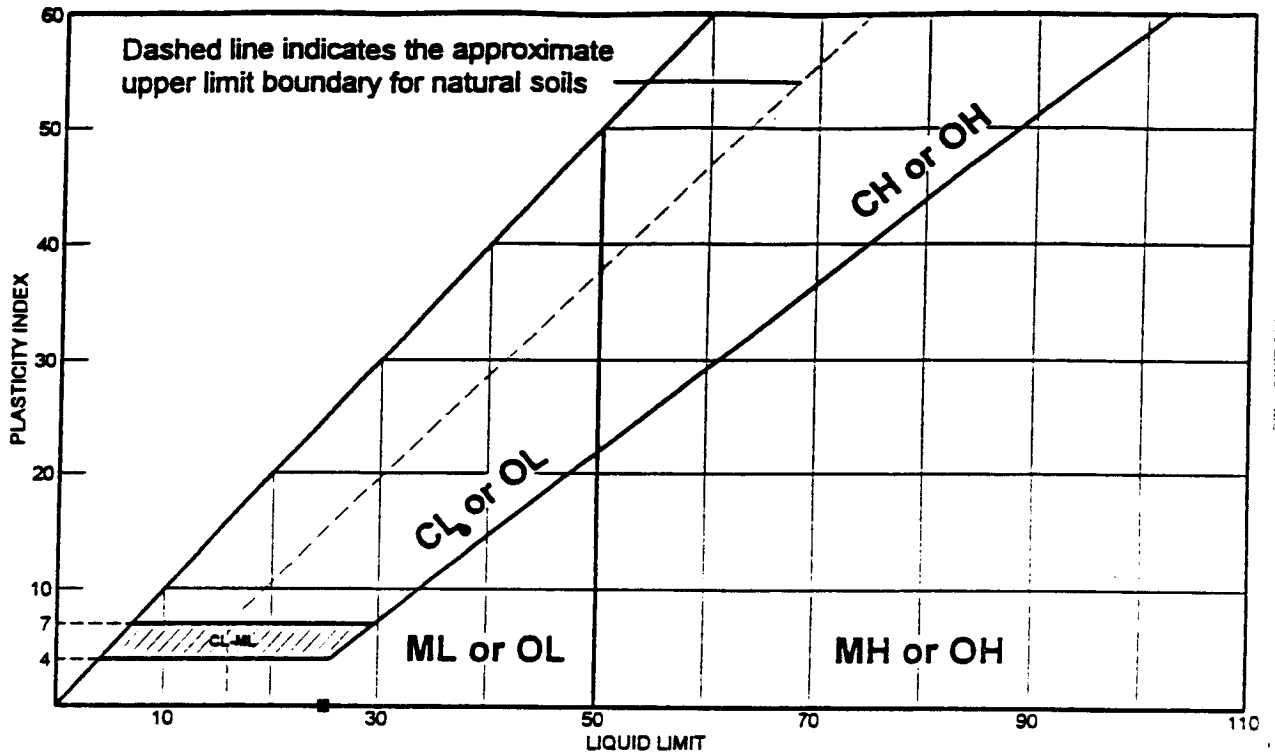
Location:



J-4978-26 5/11/2000
Figure No. B-22

AR 046297

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC00-B129	Sample No.: S-3					
Slightly sandy, lean CLAY		38	23	15	88.4	CL
■ Source: HC00-B142	Sample No.: S-3					
Sandy SILT		25	27	NP	85.3	ML

Remarks:

-
-

Project: Third Runway Westside

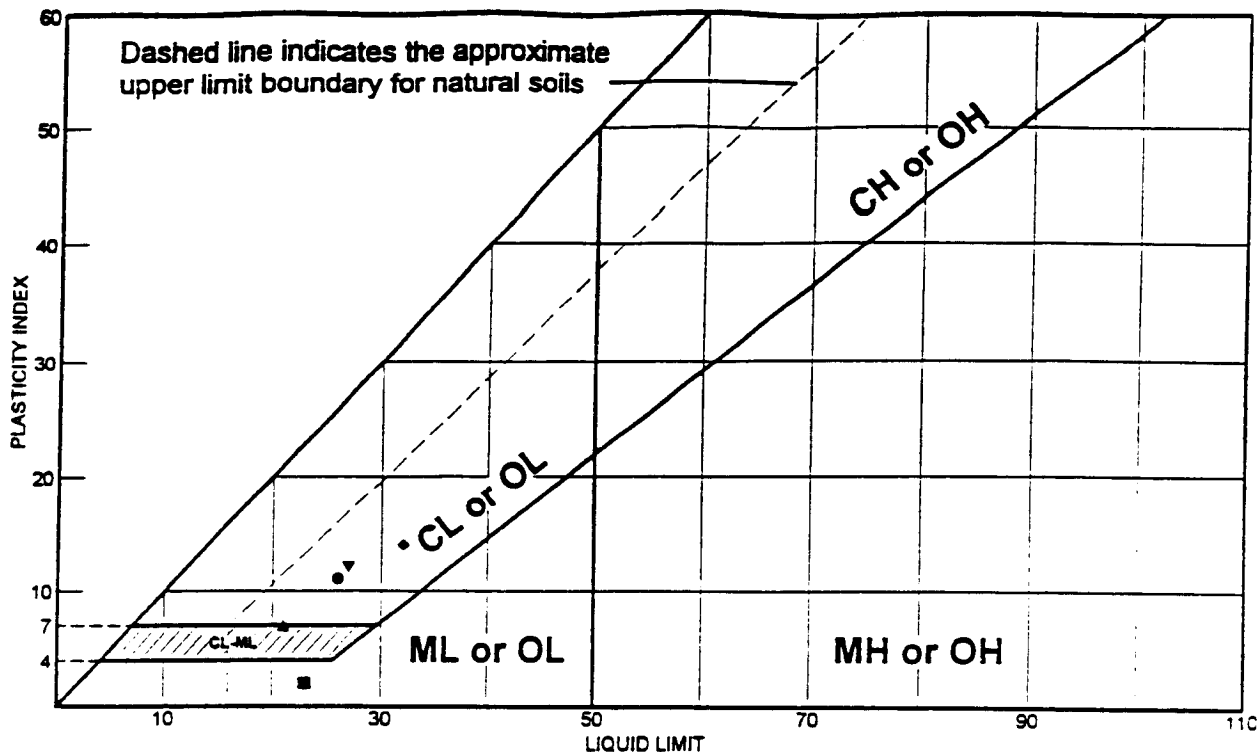
Client: HNTB

Location:



J4978-21 3/10/2000
 Figure No. B-23

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC00-B107	Sample No.: S-2					
Lean CLAY		26	15	11		CL
■ Source: HC00-B140	Sample No.: S-4					
SILT		23	21	2		ML
▲ Source: HC00-B142	Sample No.: S-4					
CLAY-SILT		21	14	7		CL-ML
◆ Source: HC00-B146	Sample No.: S-2					
Lean CLAY		32	18	14		CL
▼ Source: HC00-A137	Sample No.: S-5					
Lean CLAY		27	15	12		CL

Remarks:

-
-
- ▲
- ◆
- ▼

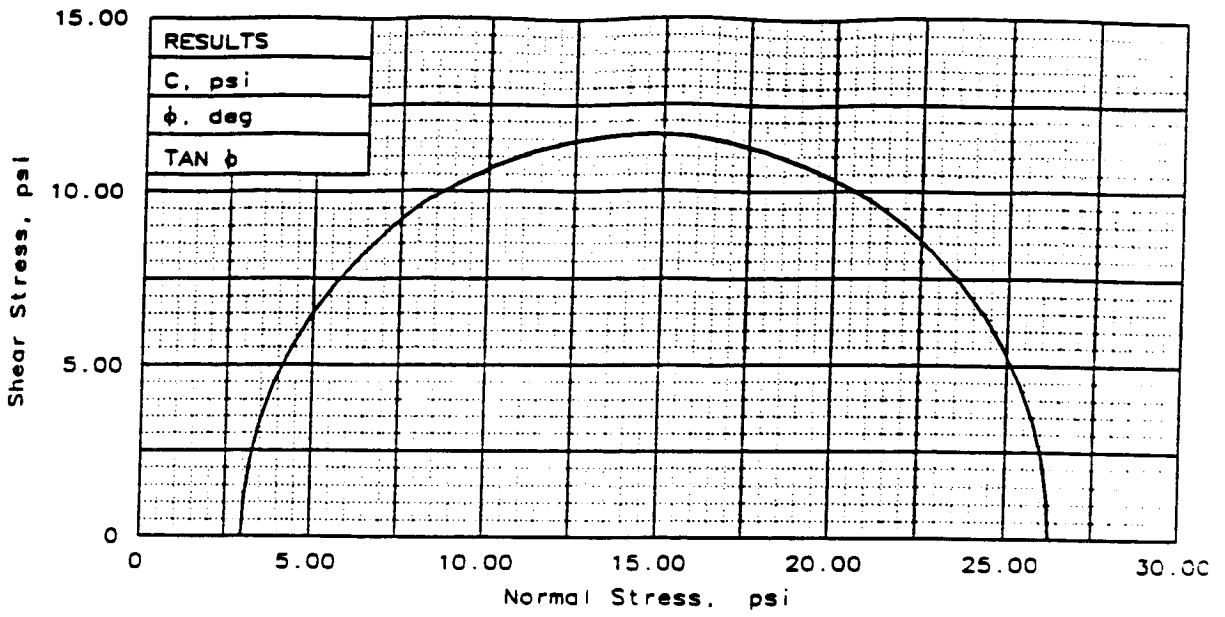
Project: Third Runway Westside

Client: HNTB

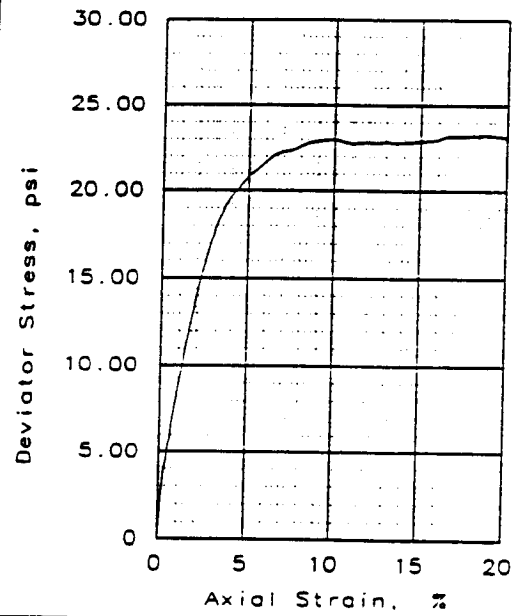
Location:



J4978-21 3/10/2000
Figure No. B-24



RESULTS
C, psi
ϕ , deg
TAN ϕ

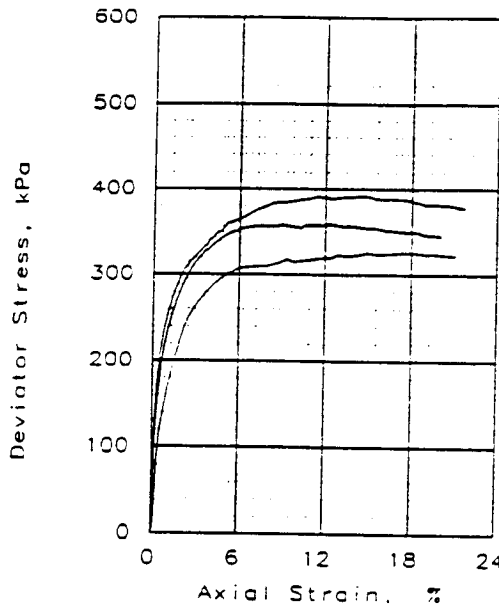
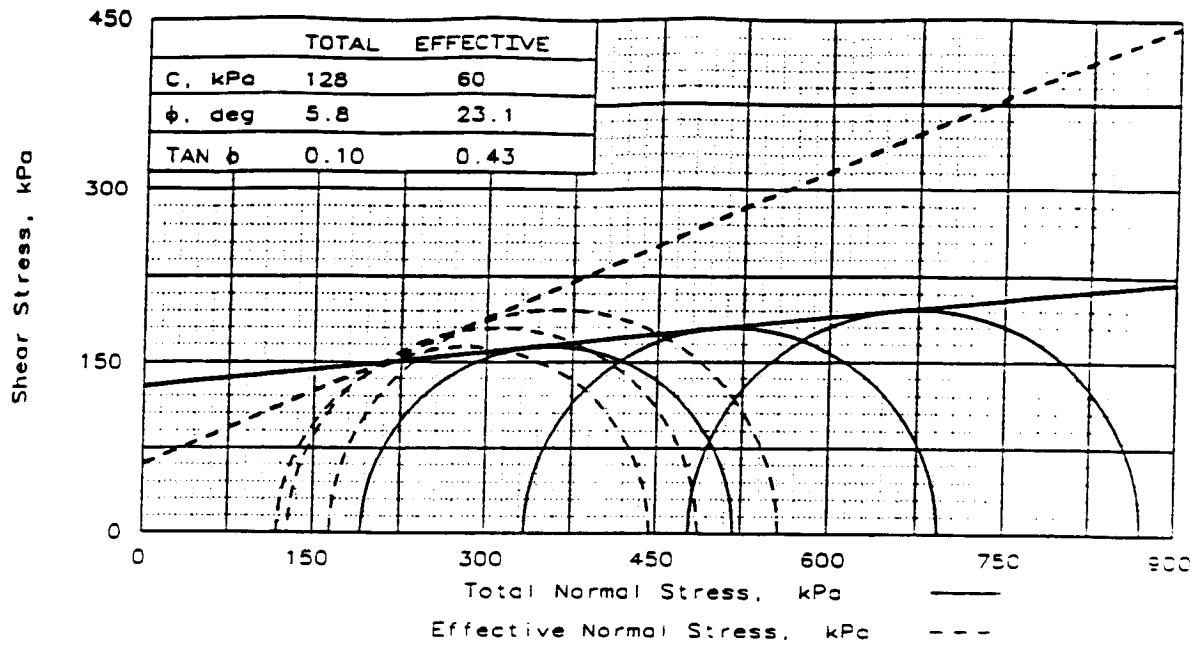


SAMPLE NO. 1		
INITIAL	WATER CONTENT, %	22.4
	DRY DENSITY, pcf	106.9
	SATURATION, %	108.5
	VOID RATIO	0.547
	DIAMETER, cm	7.20
	HEIGHT, cm	15.59
AT TEST	WATER CONTENT, %	22.3
	DRY DENSITY, pcf	106.9
	SATURATION, %	108.1
	VOID RATIO	0.547
	DIAMETER, cm	7.20
	HEIGHT, cm	15.59
BACK PRESSURE, psi	0.00	
CELL PRESSURE, psi	3.00	
FAILURE STRESS, psi	23.27	
PORE PRESSURE, psi		
STRAIN RATE, %/min.	0.300	
ULTIMATE STRESS, psi		
PORE PRESSURE, psi		
σ_1 FAILURE, psi	26.27	
σ_3 FAILURE, psi	3	

TYPE OF TEST:
 Unconsolidated undrained
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Lean CLAY
 LL= 29 PL= 16 PI= 13.0
 SPECIFIC GRAVITY= 2.65
 REMARKS:

CLIENT: HNTB
 PROJECT: Third Runway Wetlands
 SAMPLE LOCATION: HC00-B300/S-3

HART CROWSER J4978-26 6/12/00
 Figure B-25



	1	2	3
INITIAL			
WATER CONTENT, %	23.7	23.1	23.1
DRY DENSITY, g/cc	1.7	1.7	1.7
SATURATION, %	119.2	108.3	108.0
VOID RATIO	0.527	0.565	0.579
DIAMETER, cm	7.11	7.20	7.21
HEIGHT, cm	16.27	16.36	15.61
AT TEST			
WATER CONTENT, %	22.6	19.0	21.5
DRY DENSITY, g/cc	1.8	1.8	1.8
SATURATION, %	133.2	107.3	122.2
VOID RATIO	0.450	0.470	0.467
DIAMETER, cm	6.99	7.05	7.23
HEIGHT, cm	15.99	16.03	15.24
BACK PRESSURE, kPa	207	138	207
CELL PRESSURE, kPa	399	616	542
FAILURE STRESS, kPa	326	392	359
PORE PRESSURE, kPa	281	452	414
STRAIN RATE, %/min.	0.040	0.040	0.040
ULTIMATE STRESS, kPa			
PORE PRESSURE, kPa			
$\bar{\sigma}_1$ FAILURE, kPa	444	557	488
$\bar{\sigma}_3$ FAILURE, kPa	118	165	129

TYPE OF TEST:
 CU with pore pressures
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Sandy, very silty,
 lean CLAY
 LL= 29 PL= 19 PI= 10.0
 SPECIFIC GRAVITY= 2.65
 REMARKS:

CLIENT: HNTB

PROJECT: 3rd Runway North Safety Area

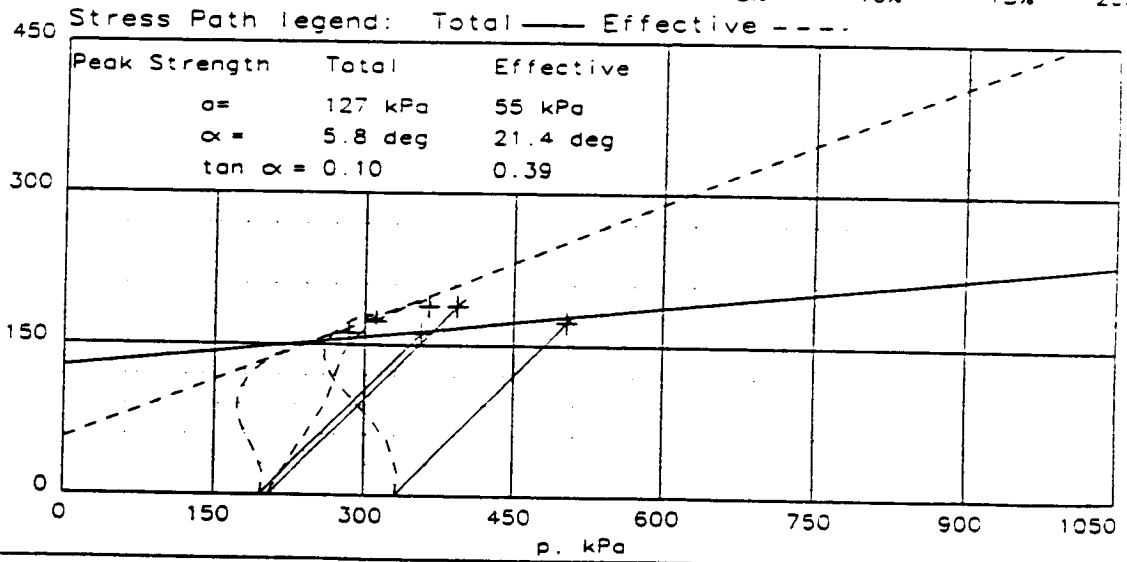
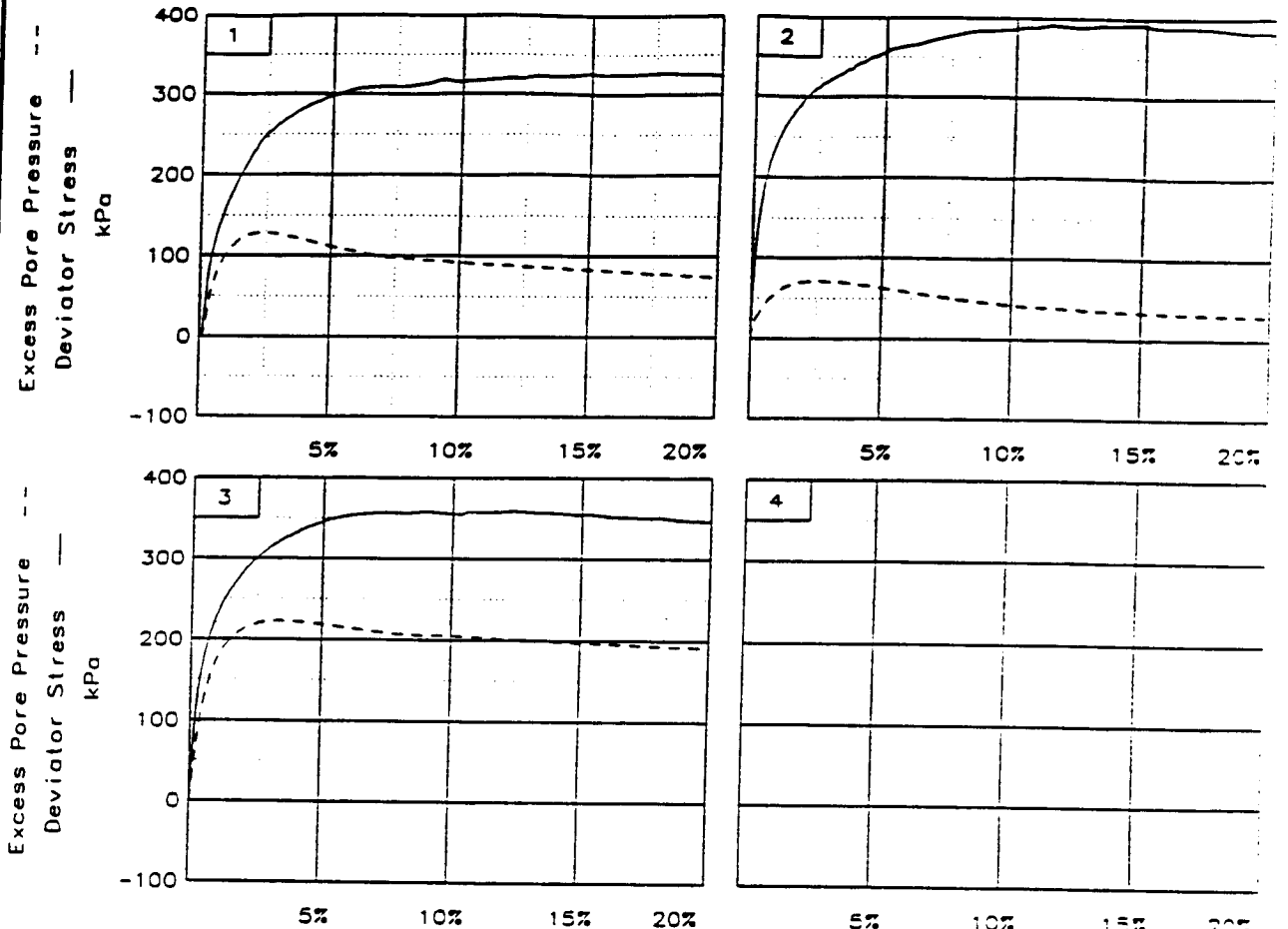
SAMPLE LOCATION: HC99-B58/S-3



J4978-18 1/30/00

Figure B-26

STRESS-STRAIN AND STRESS PATHS REPORT



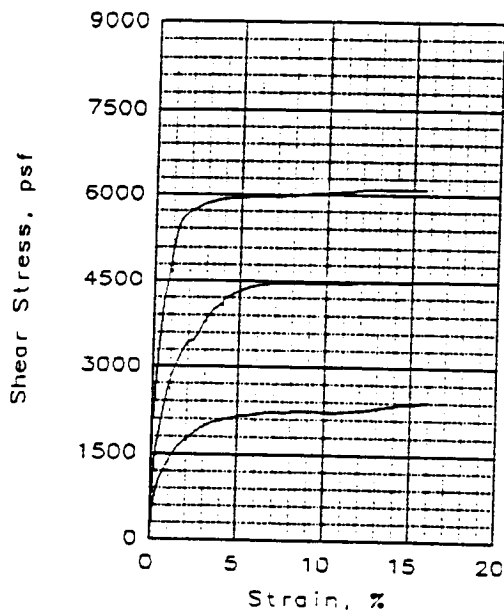
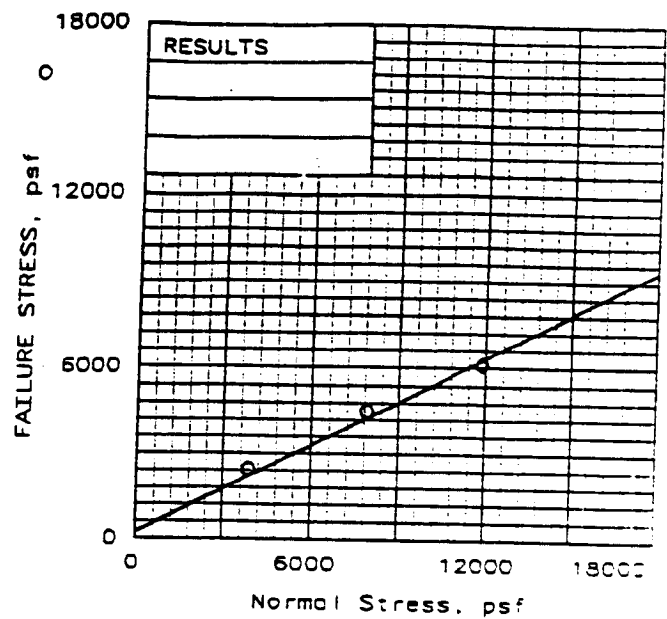
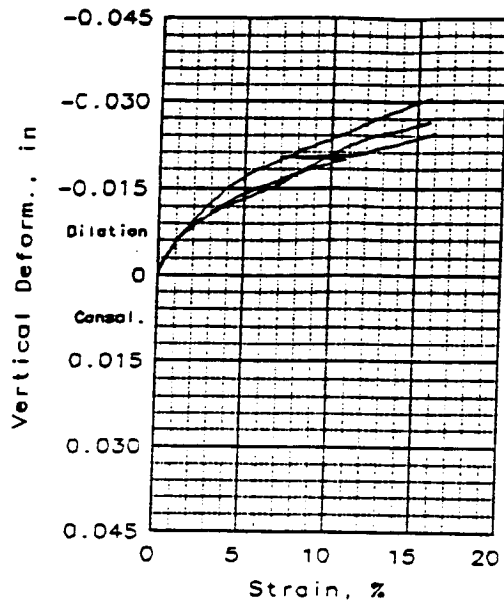
Client: HNTB
 Project: 3rd Runway North Safety
 Location: HC99-B58/S-3
 File: 3RWB



J4978-18 1/30/00

Figure B-27

AR 046302



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	15.3	13.9	14.4
	DRY DENSITY, pcf	116.6	120.8	118.9
	SATURATION, %	86.5	91.0	88.9
	VOID RATIO	0.473	0.421	0.444
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	14.7	11.8	12.7
	DRY DENSITY, pcf	122.6	130.0	127.5
	SATURATION, %	100.8	100.9	100.5
	VOID RATIO	0.400	0.321	0.347
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.95	0.93	0.93
NORMAL STRESS, psf		4000	8000	12000
FAILURE STRESS, psf		2415	4488	6095
STRAIN, %		15.8	15.2	12.2
ULTIMATE STRESS, psf				
STRAIN, %				
Strain rate, in/min		0.1311	0.1311	0.1311

SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Gray silty CLAY
 SPECIFIC GRAVITY= 2.75
 REMARKS: In-situ, some coarse sand

CLIENT: Hart Crowser
 PROJECT: Third Runway - 4978-18
 SAMPLE LOCATION: B-64, S-5
 PROJ. NO.: 745-95082 DATE: 12/10/99

DIRECT SHEAR TEST REPORT
 PROFESSIONAL SERVICE INDUSTRIES

Figure B-28