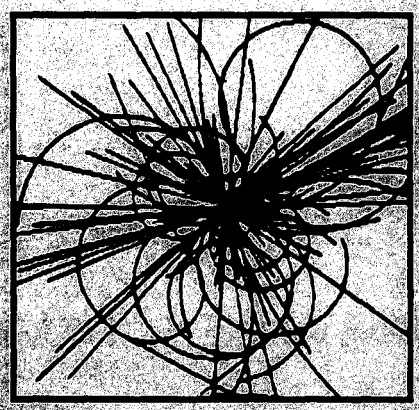
SSCL-SR-1076

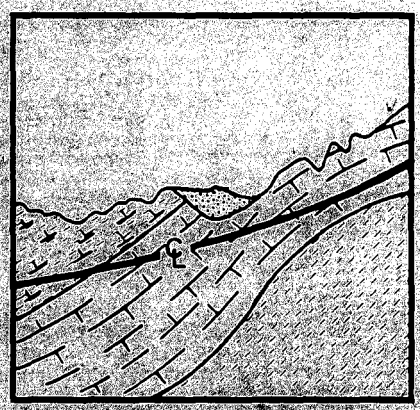
SSCL-SR-1076
Project No. 87-888-0017

December 1989

GR-17

Data Report for Corehole BE 1.7





Prepared by: The Earth Technology Corporation
Long Beach, California

Prepared for: RTK a joint venture
Oakland, California

FOREWORD

The goal of the geotechnical studies at the Texas Superconducting Super Collider (SSC) site is to allow the geologist and engineer to build their level of knowledge and confidence about the geologic structures and geotechnical properties of the site materials to the point at which there remains only a realistically small risk of encountering geotechnical conditions during construction that would significantly increase construction costs or delay construction schedules. To do this, a characterization program has been designed to meet the following objectives:

- To confirm the site's suitability and optimize the ring location (the "footprint") and hall positions on the ring
- To provide data for a preliminary structural design
- To provide a rational framework within which construction contracts and schedules can be formulated
- To maximize the use of the site-specific data already gathered by the proposer.

The geotechnical program to meet these objectives has been divided into the following three phases of study:

- Footprint location data (the present phase)
- Global data (planned)
- Structure-specific data (planned).

The primary purpose of the present footprint location phase is to quickly assess whether individual components of the collider footprint, or the entire footprint, need to be relocated because of geotechnical constraints. Accordingly, the following areas have been assessed:

- Areas on the western side of the footprint where the geologic structure brings the Eagle Ford Shale close to the depth of the tunnel and experimental halls, thus presenting potential constraints due to weak, deformable rock.
- Areas where the tunnel placement is shallow and/or there are nearby sources of vibration such as major highways and railroads that may represent a problem due to unacceptable vibrations at tunnel depth.
- Zones of potentially poor rock quality and high water inflow in the rock that should be avoided for the experimental hall excavations.

This is one in a series of data reports prepared for the footprint phase of geotechnical characterization at the SSC site. Each data report includes the results of both field and laboratory tests for a specific drilling and sampling site. Interpretations of these data will be covered in topical reports, including three planned reports, as follows:

- Train- , traffic-, and quarry-caused vibrations
- Geomechanical properties of the Eagle Ford Shale
- Structure and stratigraphy of the near-cluster.

Future planned program phases--global and structure-specific data collection--will concentrate on (1) evaluating ring areas where few geotechnical data are currently available and (2) conducting more detailed studies at the sites of the injector and experimental halls.

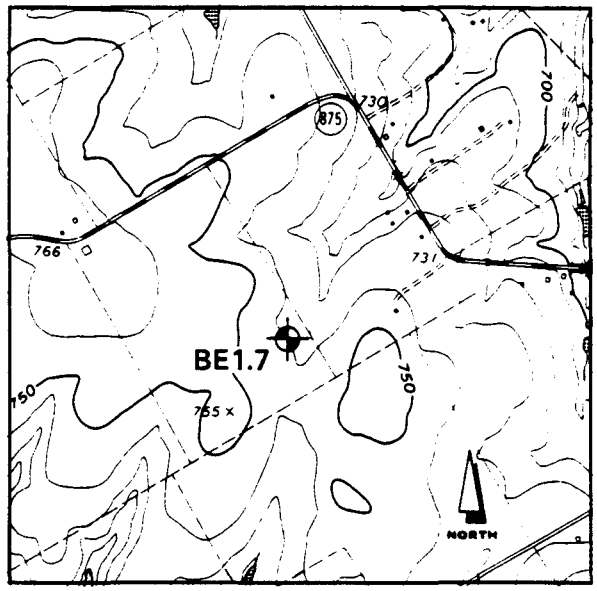
DATA REPORT

Site Designator: BE1.7

Objective: To delimit the top of the Eagle Ford Shale at this location. To obtain core samples of Austin Chalk and Eagle Ford Shale for geomechanical laboratory testing.

Location: North 269,077
East 2,172,642
Surface Elevation 739.9

BE1.7 is located on the western side of the ring, south of State Route 875, about 2 miles west of Lone Elm.



SCALE 1:24,000

1000 0 1000 2000 3000 FEET

CONTOUR INTERVAL 10 FEET

Scope and Schedule:	**Coring**	May 26 to 27, 1989
	Wireline Logging	May 27, 1989
	Laboratory Geomechanical Testing	May 26 to May 30, 1989
	Plugging and Abandonment	May 30, 1989

Conditions Encountered:

Total Hole Depth 225.0 feet
Soil 0.0 to 18.0 feet
Austin Chalk 18.0 to 175.0 feet
Eagle Ford Shale 175.0 to 225.0 feet
(see Lithologic Log, Appendix A)

Geophysical Logging: (See wire-line logs, Appendix B)

Spontaneous Potential
Normal Resistivity (short)
Guarded Resistivity (long)
Natural Gamma
Compensated Density (caliper)
Sonic Velocity (full wave)

Hole Status: Cemented in and abandoned.
(See as-built drawing/cementing report, Appendix C)

TABLE 1. GEOMECHANICAL TEST RESULTS - COREHOLE BE 1.7

Geologic Formation and General Lithology	Depth	Moisture Content	Dry Density	Sample Dimension Ratio L/D	Unconfined Compressive Strength	Triaxial Compression		Failure Strain	Direct Shear		Brazil Tensile Strength	2nd Cycle Slake-Durability Index	Swell Pressure Index	Comments
						σ_c	σ_1, σ_3		σn	τ				
	feet	percent	pcf		psi	psi	psi	percent	psi	psi	psi	percent	psi	
Austin Chalk/Limestone	30.5	16.9	126.7	2.4	1770			1.2						
Austin Chalk/Limestone	30.9										161			
Austin Chalk/Limestone	90.3								32	287				
Austin Chalk/Limestone	90.6								86	367				
Austin Chalk/Limestone	90.8								259	487				
Austin Chalk/Limestone	169.4	12.7	124.3	2.4	2650			1.5						
Eagle Ford Shale	178.2											2.3		
Eagle Ford Shale	178.8	17.6	113.4										86	
Eagle Ford Shale	179.0	18.1	115.1										80	
Eagle Ford Shale	179.1	18.0	113.9										115	
Eagle Ford Shale	180.8											2.2		
Eagle Ford Shale	181.4	17.9	113.9											
Eagle Ford Shale	193.6											15.6		
Eagle Ford Shale	194.2	15.5	118.4	2.0	260			1.3						
Eagle Ford Shale	194.6	14.9	113.9										50	
Eagle Ford Shale	194.7	16.0	117.5										33	
Eagle Ford Shale	194.8	16.6	117.5										36	
Eagle Ford Shale	200.8											11.6		
Eagle Ford Shale	201.4	15.6	121.2	2.2	380			1.8						
Eagle Ford Shale	203.6	15.1	117.8	2.0	262									
Eagle Ford Shale	204.2			1.9		400	269							
Eagle Ford Shale	204.6			1.9		200	310							
Eagle Ford Shale	209.0											15.7		
Eagle Ford Shale	209.7	16.2	118.4	2.4	310			1.2						
Eagle Ford Shale	210.1	16.7	119.9										29	
Eagle Ford Shale	210.2	16.3	120.4										29	
Eagle Ford Shale	210.3	16.3	116.9										29	
Eagle Ford Shale	212.5											8.5		
Eagle Ford Shale	213.3	17.2	114.5	2.1	350			1.6						
Eagle Ford Shale	213.8	17.3	113.0										36	
Eagle Ford Shale	213.9	17.1	112.4										36	
Eagle Ford Shale	214.0	17.5	114.1										43	
Eagle Ford Shale	219.2	14.4	118.9	2.0	270									
Eagle Ford Shale	219.6			1.9		200	373							
Eagle Ford Shale	220.0			1.9		400	314							
Eagle Ford Shale	222.8											17.3		
Eagle Ford Shale	223.9	17.8	114.8	1.5	170			1.9						Correction applied for L/D < 2.0
Eagle Ford Shale	224.2	17.5	116.0										36	
Eagle Ford Shale	224.3	17.2	114.8										29	
Eagle Ford Shale	224.4	17.1	113.8										22	
Procedure		ASTM-D2216			ASTM-D2938	ASTM-D2664			ISRM		ISRM	ISRM	ISRM	

Note: Mineralogical data available in Table 2.

TABLE 2. BULK AND CLAY MINERALOGY TEST RESULTS

Depth 31.0 feet **Austin Chalk**

Whole Rock Composition:

Mineral	Percent
quartz	1.1
K-feldspar	0.0
plagioclase	0.0
calcite	97.0
dolomite	< 1
pyrite	< 1
clay minerals	0.9
	100

Relative Clay Abundance:

Mineral	Percent
illite	15.6
kaolinite	4.0
Fe-chlorite	0.0
illite/smectite	80.4
	100

Depth 178.9 feet **Eagle Ford Shale**

Whole Rock Composition:

Mineral	Percent
quartz	19.9
K-feldspar	8.8
plagioclase	< 1
calcite	0.0
dolomite	< 1
pyrite	3.8
clay minerals	66.7
	100

Relative Clay Abundance:

Mineral	Percent
illite	28.2
kaolinite	11.8
Fe-chlorite	0.0
illite/smectite	60.0
	100

TABLE 2. BULK AND CLAY MINERALOGY TEST RESULTS

Depth 201.4 feet **Eagle Ford Shale**

Whole Rock Composition:

Mineral	Percent
quartz	28.2
K-feldspar	7.8
plagioclase	<1
calcite	1.1
dolomite	<1
pyrite	3.1
clay minerals	58.9
	100

Relative Clay Abundance:

Mineral	Percent
illite	29.4
kaolinite	11.8
Fe-chlorite	0.0
illite/smectite	58.8
	100

Depth 223.7 feet **Eagle Ford Shale**

Whole Rock Composition:

Mineral	Percent
quartz	28.8
K-feldspar	6.0
plagioclase	3.3
calcite	<1
dolomite	<1
pyrite	4.5
clay minerals	57.1
	100

Relative Clay Abundance:

Mineral	Percent
illite	32.2
kaolinite	27.4
Fe-chlorite	<1
illite/smectite	40.2
	100

APPENDIX A

LITHOLOGIC LOG

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 1 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/26/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND

S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION

Drilled with air rotary to 25', water encountered at 17.0'; cored with air water injection to 165' and water rotary to bottom of exploration

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES		HAND PEN. TSF.	DESCRIPTION OF STRATUM
										CLAY, silty, traces of roots and organic debris, dark brown
										3.0
										3.5 CLAY, silty, jointed, tan and brown
5										CLAY, silty, embedded limestone fragments, tan to light brown
10										
15										
										18.0
20										LIMESTONE (Austin Chalk), severely weathered, extremely fractured into angular fragments, tan
										24.0
25			25.0		100					LIMESTONE (Austin Chalk), severely weathered, moderately fractured, occasional fossils, tan
										27.85
30		C1			100	100				LIMESTONE (Austin Chalk), firm to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, light gray to dark gray -15° angular joint at 33.6', smooth -20° angular joint at 33.7', smooth
35				35.0						-shale, firm dark gray at 34.0-35.5'
			35.0							
40		C2			98	98				-fossil parting at 43.3'

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 2 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/26/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND:
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION: (see page no. 1 of 6)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES		HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C2		45.0						LIMESTONE (Austin Chalk), firm to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, light gray to dark gray
45										-fossil parting at 44.7'
		C3	45.0	55.0	100	100				-shale, firm, dark gray at 44.7-45.9' -fossil parting at 45.3' -fossil parting at 45.5' -fossil parting at 45.7' -fossil parting at 49.1'
50										
55		C4	55.0	65.0	98	98				-shale, firm, dark gray 56.0-56.2'
60										-fossil parting at 59.1' -fossil parting at 59.3'
										-shale, firm, dark gray 63.9-64.1'
65		C5	65.0	75.0	99	99				-extremely fossiliferous at 65.8-66.3' and 68.6-70.1'
70										-fossil parting at 69.0'
75		C6	75.0		99	96				-fossil parting at 76.8' -fossil parting at 77.5'
80										

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 3 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/26/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION
(see page no. 1 of 6)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C6		85.0					LIMESTONE (Austin Chalk), firm to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, light gray to dark gray
85		C7	85.0	95.0	98	98			-shale, 1" layer at 85.9' -fossil parting at 87.8' -fossil parting at 92.8'
90									
95		C8	95.0	105.0	99	96			-shale, firm, dark gray, extremely fossiliferous at 99.0-99.8' -fossil parting at 99.8' -fossil parting at 100.9' -bentonitic shale, soft, dark gray at 102.7-103.1' -bentonite, soft, light gray at 103.1-103.5' -smooth, tight 40° shear at 104.1' -fossil parting at 107.4'
100									
105		C9	105.0	115.0	99	99			
110									
115		C10	115.0		98	86			-healed 70° calcite filled shear at 116.4-117.3' (filling 1.5" thick with transverse shears) -shale, firm, dark gray 117.9-118.4' -30° shear at 118.0' -45° shear at 120.3' -30° shear at 120.4' -30° shear at 120.6' -50° shear at 121.2' (shears at 118.0' to 121.2' all smooth, tight)
120									

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 4 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/26-27/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION
(see page no. 1 of 6)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES		HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C10		125.0						LIMESTONE (Austin Chalk), firm to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, light gray to dark gray
125		C11	125.0	135.0	99	99				-shale, firm, dark gray at 126.9-127.1' -shale, firm, dark gray at 130.9-131.6' -shale, 1" layer at 134.1'
130										
135		C12	135.0	145.0	99	99				-shale, 1" layers at 142.5 and 144.0'
140										
145		C13	145.0	155.0	99	99				-shale, firm, dark gray at 146.2-146.5'
150										
155		C14	155.0		93	93				
160										

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 5 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/27/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SWL (89-192)

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION
(see page no. 1 of 6)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C14		165.0					LIMESTONE (Austin Chalk), firm to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, light gray to dark gray
165		C15	165.0	175.0	100	100			-fossil parting at 165.9' -fossil parting at 170.5' -extremely fossiliferous at 172.4-174.2'
170									
175		C16	175.0	185.0	96	73			174.2 175.0 SHALY LIMESTONE (transition), moderately hard, fresh, sound, extremely argillaceous, abundant fragments of fish bones, teeth and other fossil debris SHALE (Eagle Ford), firm, fresh, moderately fractured, slightly fossiliferous, fissile, occasional pyrite nodules and septarian concretions, dark gray -30° shears at 175.9', 176.2' and 177.8' -horizontal shear at 178.0' -30° shears at 180.2', 180.3' and 180.5' -20° shear at 180.6' -45° shear at 180.8'
180									
185		C17	185.0	195.0	100	97			-25° shears at 181.7 and 182.2' -45° and 60° transverse shears at 182.9' -45° and 20° transverse shears at 183.2' -20° shear at 183.3' -45° shear at 183.7' -35° shear at 185.7' -fossil partings at 189.4' and 190.6' -fossil parting at 196.2' -30° shear at 196.6'
190									
195		C18	195.0		74	71			(shears from 175.9' to 196.6' all smooth, tight)
200									

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 11

BORING NO: BE1.7 PG 6 OF 6

LOCATION: N 269,077 feet
E 2,172,642 feet

GROUND EL: 739.9 feet

DATE: 5/27/89 TYPE: Air/Water Rotary CASED TO: 24' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND:
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION: (see page no. 1 of 6)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES		HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C18		205.0						SHALE (Eagle Ford), firm, fresh, moderately fractured, slightly fossiliferous, fissile, occasional pyrite nodules and septarian concretions, dark gray
205		C19	205.0	212.0	100	97				-tight rough 20° shear at 206.1' -tight rough 30° shear at 206.8' -pyrite seam at 212.8' -carbonate nodule at 217.8-219.0'
210		C20	212.0	215.0	100	100				
215		C21	215.0	225.0	94	94				-fossil parting at 220.5' -tight healed 45° shear at 221.5' -tight healed 40° shear at 221.8'
220										
225										Bottom of Exploration at 225.0'
230										NOTE: Borehole grouted after completion
235										
240										

DRILLING GEOLOGIST S. Wood ASSISTANT D. Thomas

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BE1.7 Log Measured From: Ground Level

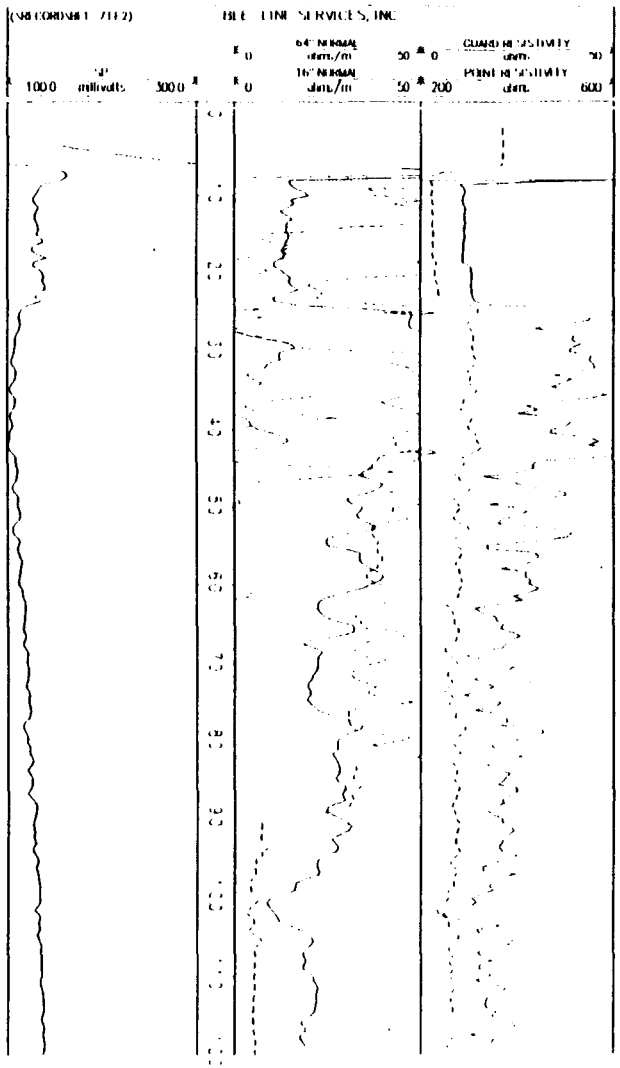
Drilling Parameters
Depth 221 + feet
Bit Diameter 4.5 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	May 27, 1989	May 27, 1989	May 27, 1989
Bottom Log Interval	221.5 feet	221.5 feet	218 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	boring fluid	boring fluid	boring fluid
Time Since Circulation Stop	1 hour	1 hour	1 hour
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	18 feet/min.	18 feet/min.	7 feet/min.
Sample Interval	0.5 feet	0.5 feet	0.1 feet

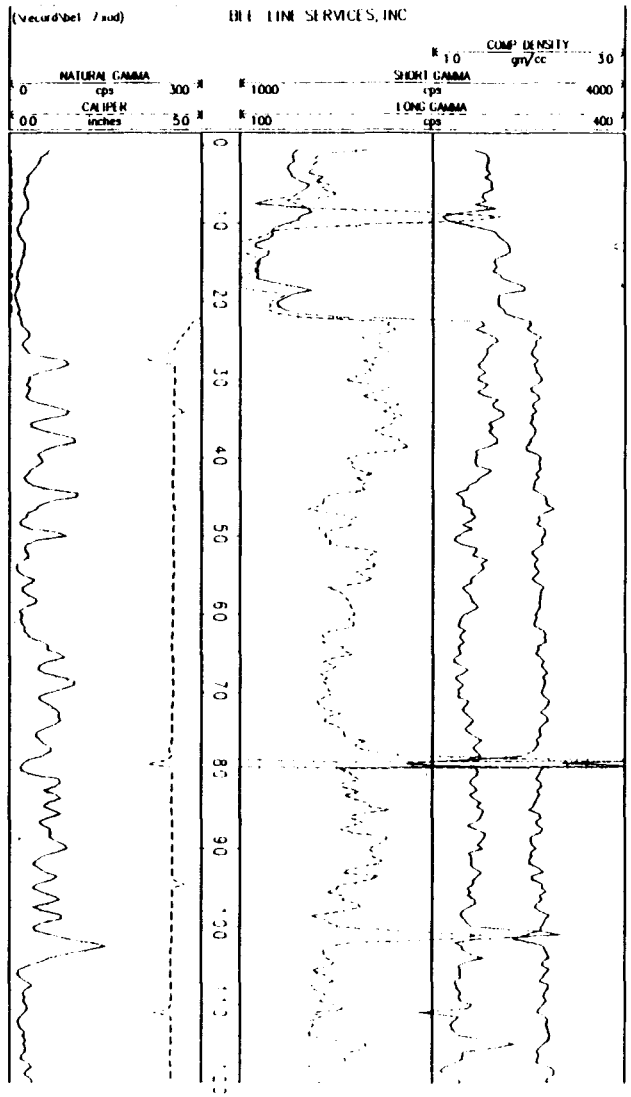
Logged by: BEE-LINE SERVICES, INC.
P.O. Box 2096
Corsicana, TX 75151

BE1.7 Wire-line logs run May 27,1989. Surface elevation 739.9 feet.

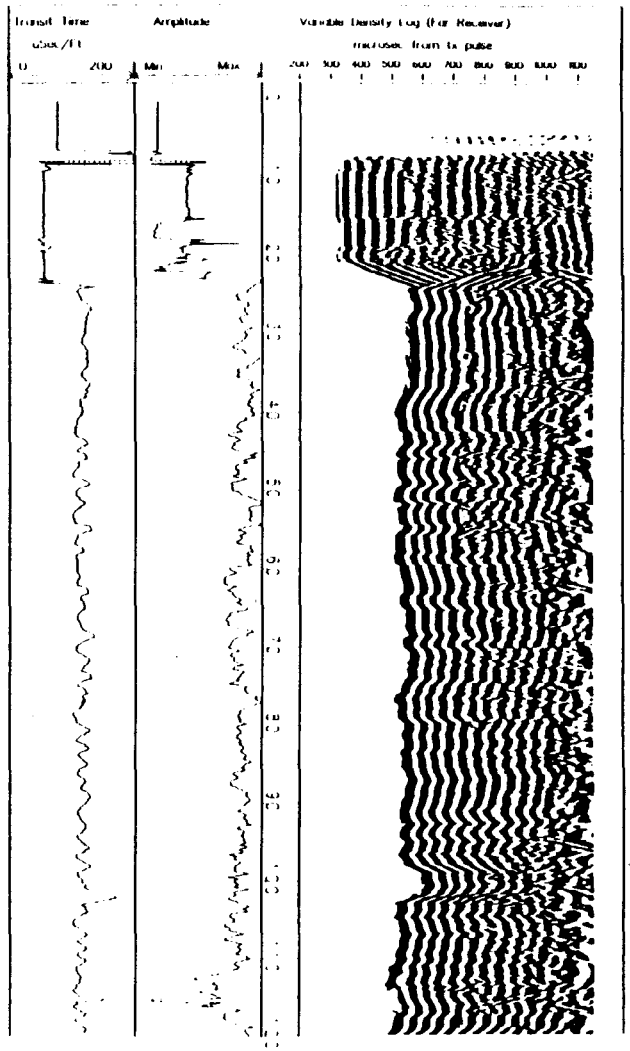
ELECTRICAL LOG



GAMMA LOG

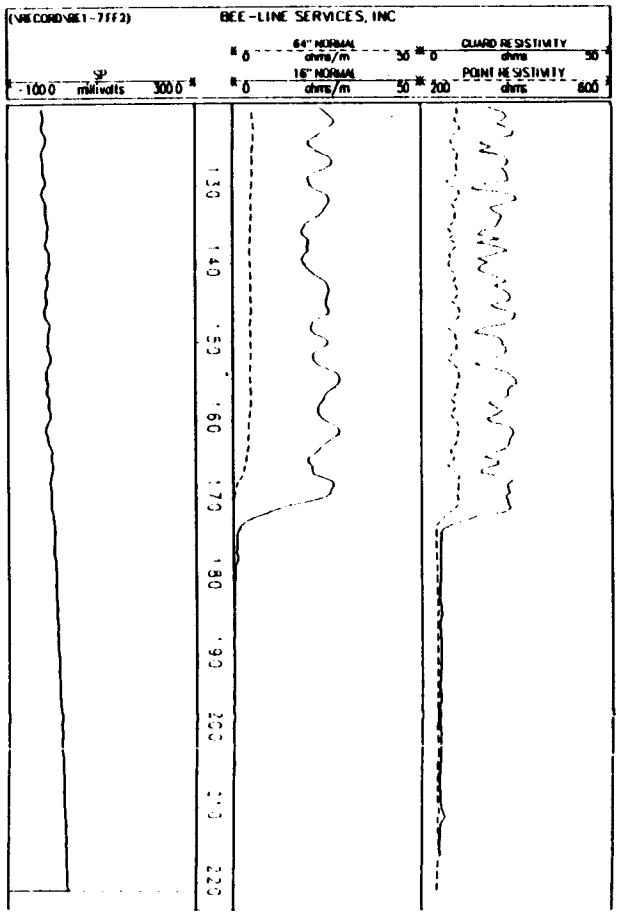


SONIC LOG

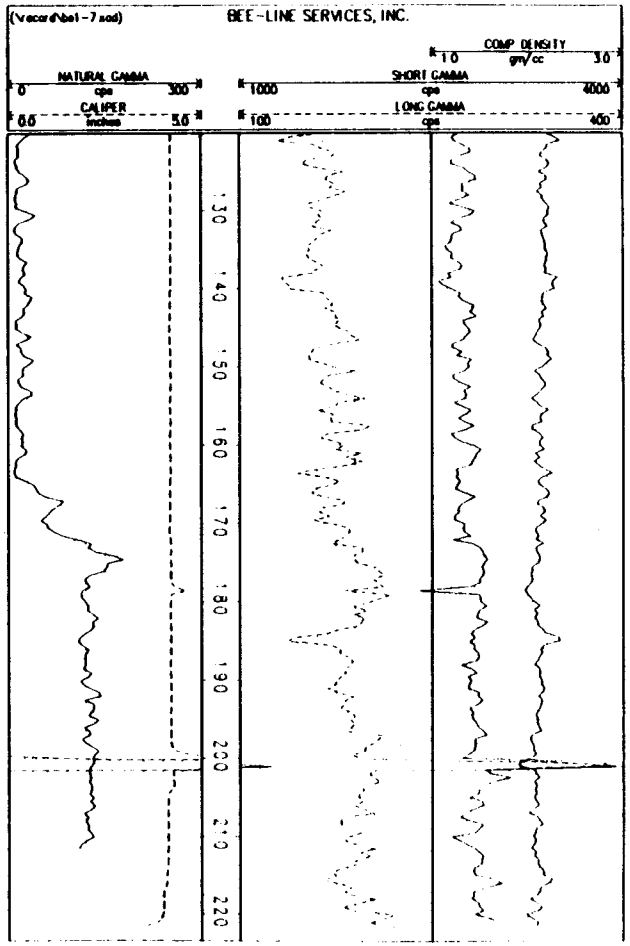


BE1.7 Wire-line logs run May 27, 1989. Surface elevation 739.9 feet.

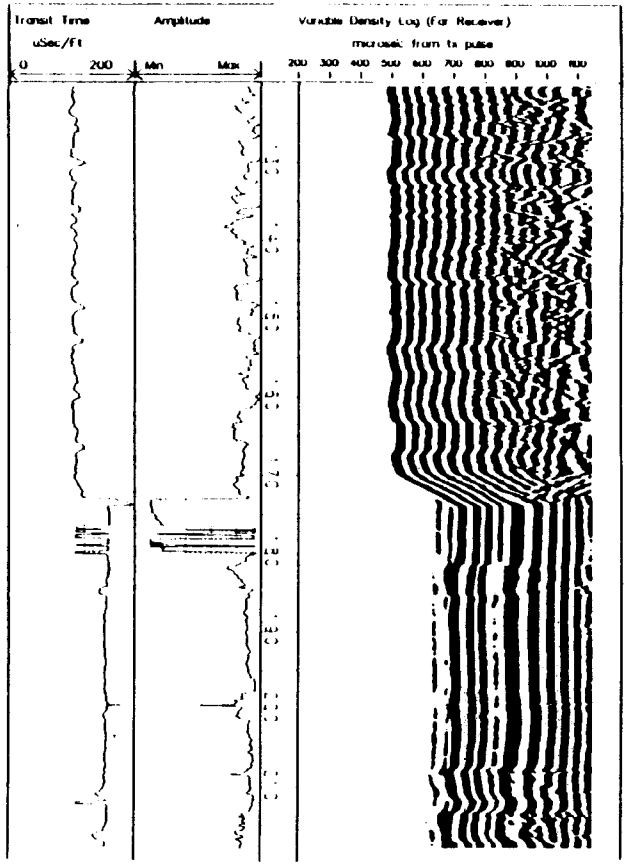
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX C

PLUGGING REPORT

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-88-0017

Task No. 17

Boring No. BE 1.7

Texas Coordinate Location: N 269,077 feet
E 2,172,642 feet

Surface Elevation: 739.9 feet

Total Boring Depth: ~ 225.0'

Date Drilled: 5/26/89 - 5/27/89

Date Plugged: 5/30/89

Time Completed: 12:30 p.m.

Remarks:

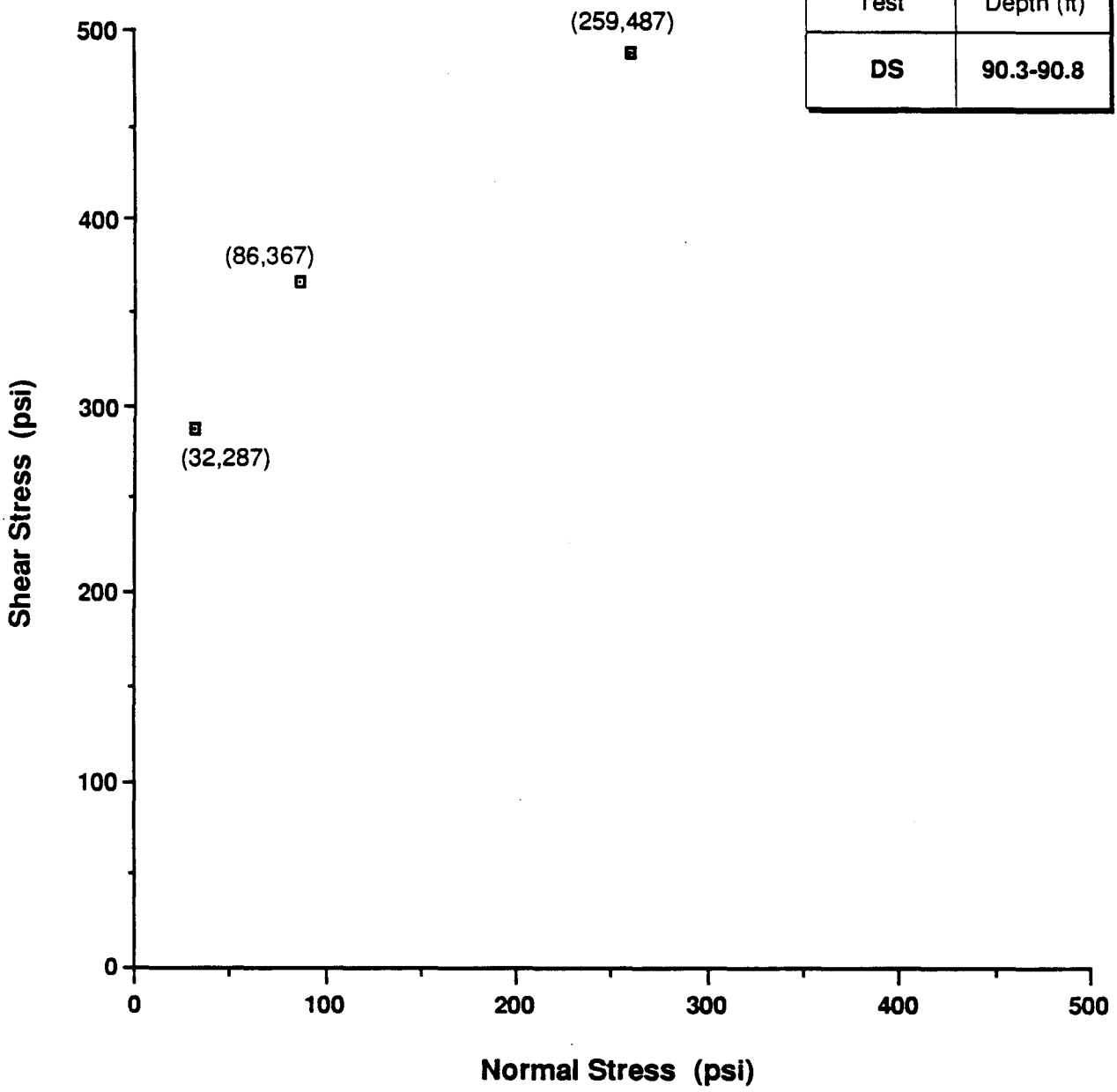
264 gallons of grout was used to completely cement boring from bottom to top. 25 sacks of Portland Cement and 1½ sacks of Polygel Bentonite combined with water comprised the total grout mixture. Water/cement ratio was approximately 7.5 gallons per sack.

Drilling Geologist: Shawn D. Wood
SwL Coordinator: Bruce Bailey
SwL Report No. 89-192

APPENDIX D

DIAGRAMS OF LABORATORY RESULTS

BORING BE1.7 Austin Chalk	
Test	Depth (ft)
DS	90.3-90.8

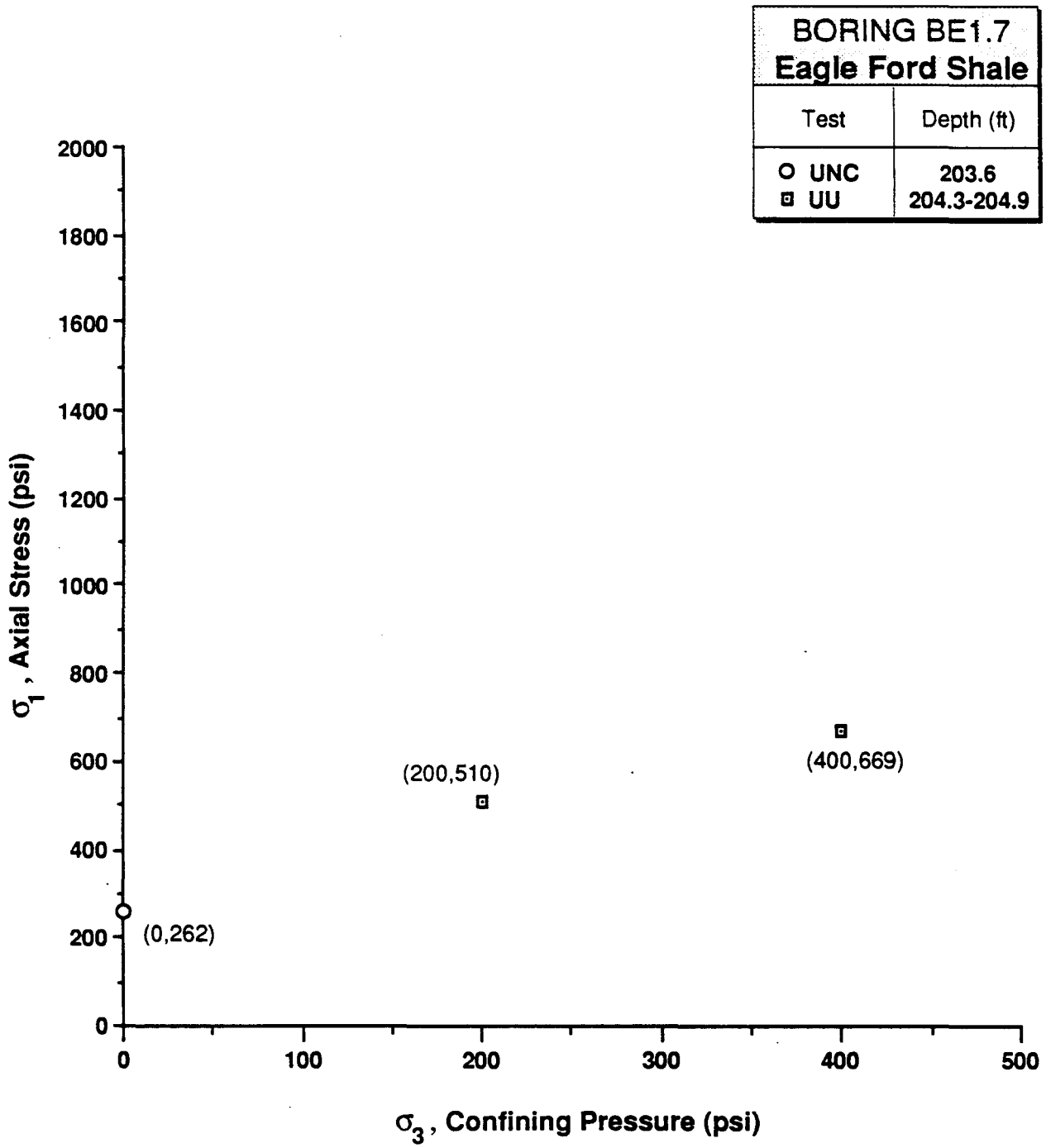


DS-ISRM

The Earth Technology Corporation

Direct Shear Test
Texas SSC Site

FIGURE
D-1



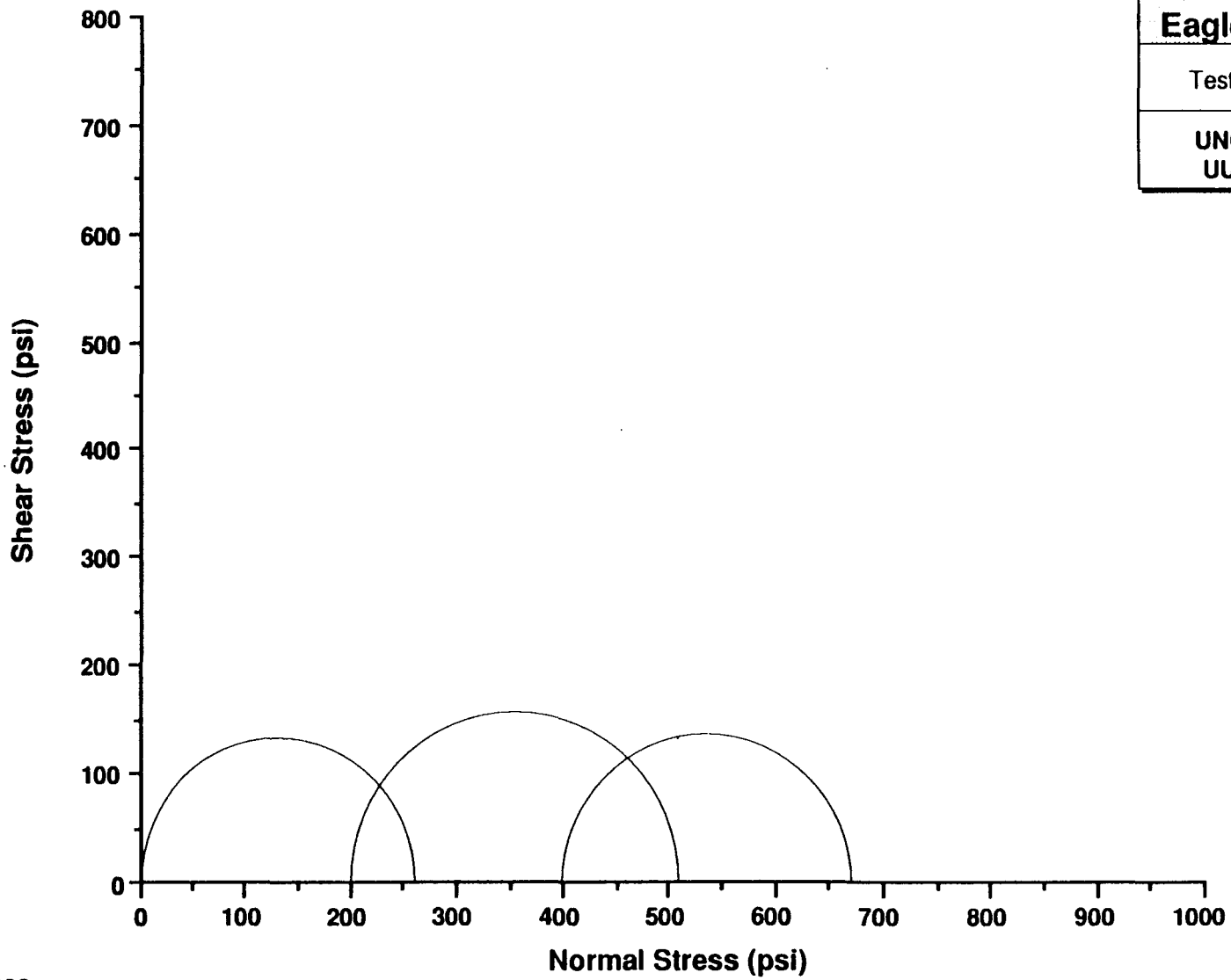
UNC-ASTM D2938
UU- ASTM D2664

The Earth Technology Corporation

Compression Test
Texas SSC Site

FIGURE
D-2

BORING BE1.7 Eagle Ford Shale	
Test	Depth (ft)
UNC UU	203.6 204.3-204.9

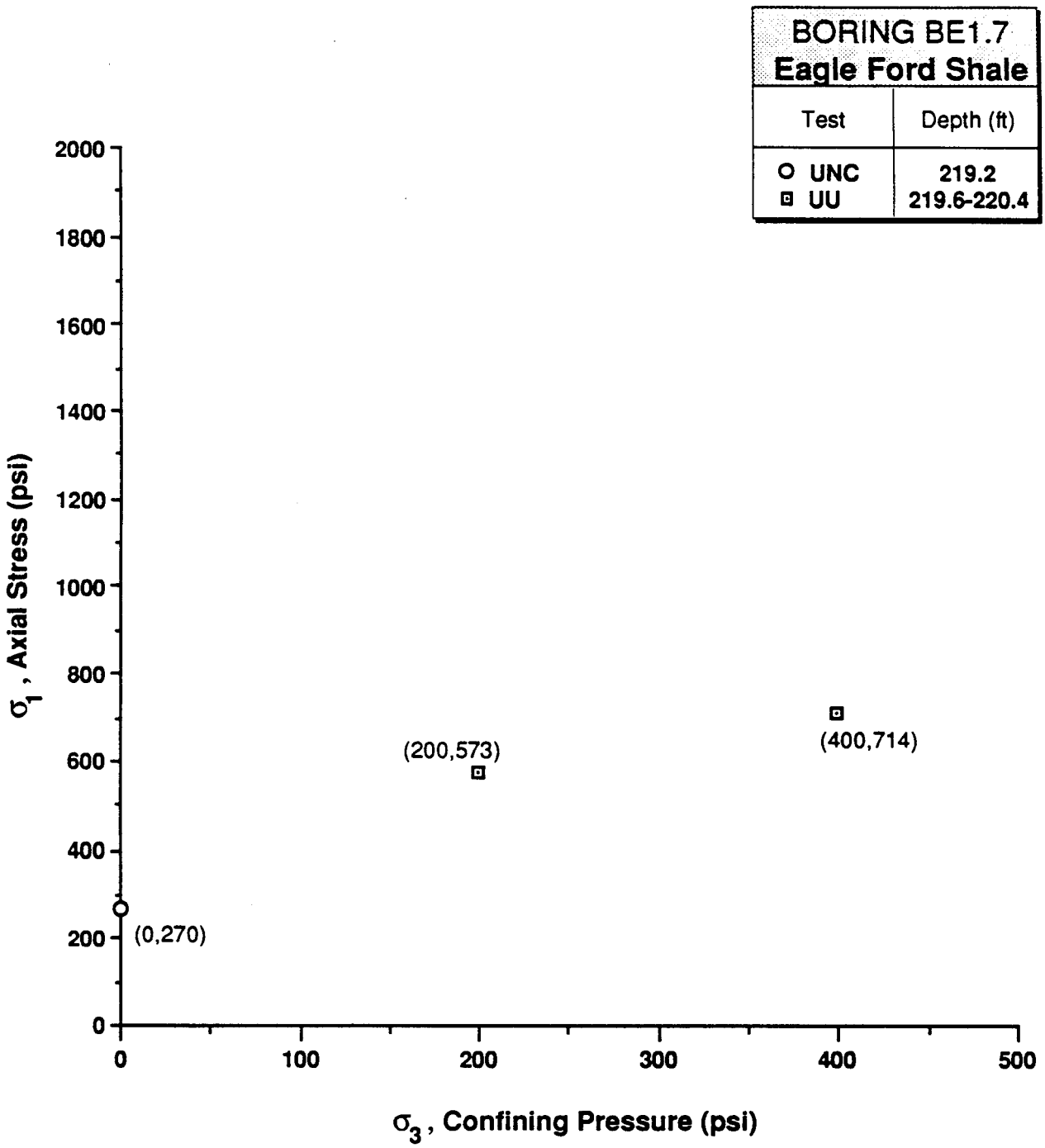


UNC-ASTM D2938
UU-ASTM D2664

The Earth Technology Corporation

Mohr Circle Plot
Texas SSC Site

FIGURE
D-3



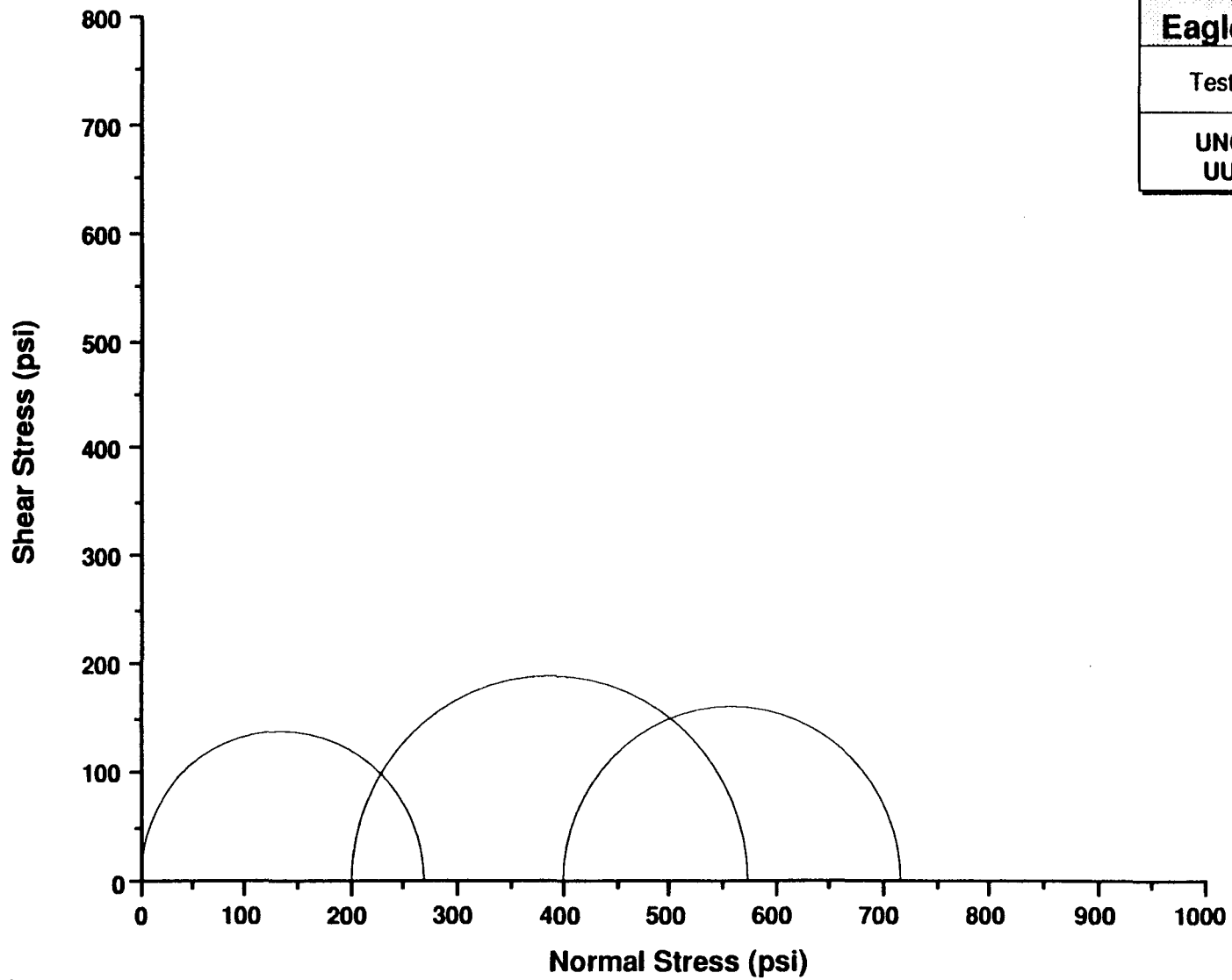
UNC-ASTM D2938
UU- ASTM D2664

The Earth Technology Corporation

Compression Test
Texas SSC Site

FIGURE
D-4

BORING BE1.7 Eagle Ford Shale	
Test	Depth (ft)
UNC	219.2
UU	219.6-220.4



UNC-ASTM D2938
UU-ASTM D2664

The Earth Technology Corporation

Mohr Circle Plot
Texas SSC Site

FIGURE
D-5