SSCL-SR-1075

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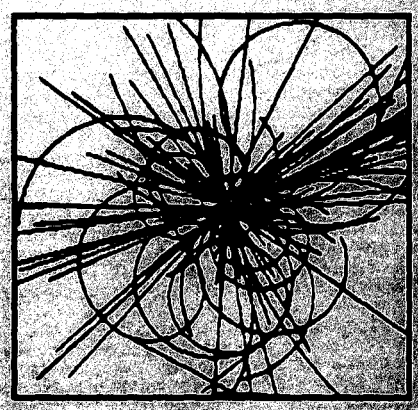
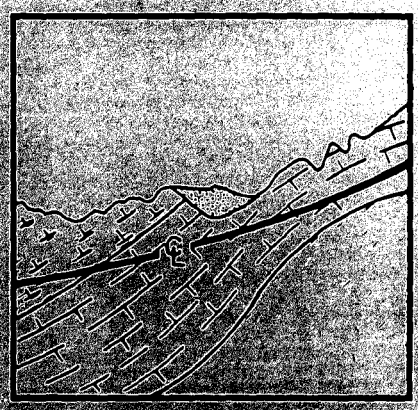
Project No. 87-888-0012

December 1989

GR-16

Data Report for Structure Study Zone SE 1 and Angled Corehole SE 1





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Prepared for: RTK a joint venture
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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: SE1

Objective: Drill a corehole, inclined approximately 50° from horizontal, through a fault at the approximate tunnel depth; obtain samples for geomechanical testing; and conduct packer tests of fault zones.

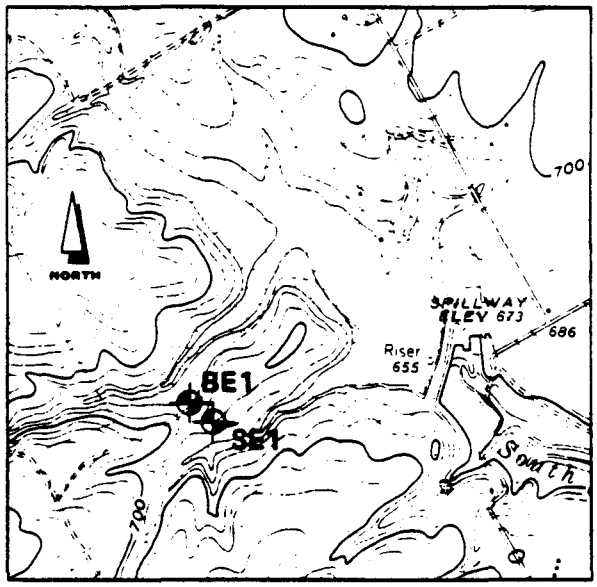
Location: **North** 261,548.2 feet

East 2,172,406.1 feet

Surface Elevation 696.2 feet

SE1 is located on the western side of the ring, about 1.4 miles north of FM 1446.

SE1 is an angled boring with a bearing of S83°W, angled approximately 51° from horizontal.



SCALE 1:24,000

1000 0 1000 2000 3000 FEET

CONTOUR INTERVAL 10 FEET

Scope and Schedule:

Geologic Mapping	May 24 to June 7, 1989
Trenching	May 31, 1989
Coring (full depth)	June 21 to June 26, 1989
Wire-line Logging	June 28, 1989
Down-Hole Photography	June 28, 1989
Hydrologic Testing	June 29, 1989
Laboratory Testing	June 21 to July 7, 1989
Plugging and Abandonment	July 5, 1989

Geologic Mapping: A north 20° east-trending aerial photograph lineament was ground-checked by mapping exposed bedrock over a 2-mile length of the lineament. Adequate outcrops were located to indicate the presence of a fault and partially constrain its location (see Appendix A).

Trenching: Two trenches about 20 feet in length were excavated to further characterize the fault and constrain its location (see Appendix B).

Conditions Encountered: (SE1 is angled approximately 51° from horizontal)

Total Hole Depth 286.0 feet (vertical depth 223.2 feet)*

Soil 0.0 to 0.5 feet (vertical depth 0.0 to 0.4 feet)*

Austin Chalk 0.5 to 166.5 feet (vertical depth 0.4 to 130.9 feet)*

Eagle Ford Shale 166.5 to 286.0 feet (vertical depth 130.9 to 223.2 feet)*
(see lithologic log, Appendix C)

The lower Austin Chalk portion of SE1 is 23 feet shorter (measured vertically) than the lower Austin Chalk portion of nearby vertical Corehole BE1. Hence, 23 feet of fault offset is interpreted; offset appears to have occurred principally on a 3-foot-wide mineralized shear zone encountered at depths of 73 to 77 feet (measured vertically) in boring SE1 (see also Appendix G). Sense of offset (comparing elevations with boring BE1) appears to be down to the south.

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

Spontaneous Potential
Point Resistance
Normal Resistivity (short and long)
Guard Resistivity
Natural Gamma
Compensated Density (caliper)
Sonic Velocity (full wave)
Deviation

Hydrologic Test: (see Table 8)

#1 Double Packer

87.25 to 108.35 feet
(vertical depth 69.6 to 85.9 feet)*

#2 Double Packer

65.25 to 86.35 feet
(vertical depth 52.7 to 68.9 feet)*

Hole Status: Plugged with cement grout and abandoned on July 5, 1989.
(See plugging report, Appendix E)

* Vertical depths interpolated from wire-line deviation logs

TABLE 1. GEOMECHANICAL TEST RESULTS - SE1

Geologic Formation and General Lithology	Boring Depth feet	Vertical Depth* feet	Moisture Content percent	Dry Density pcf	Sample Dimension Ratio L/D	Sample Failure Mode	Unconfined Compressive Strength psi	Triaxial Compression σ_c psi	Triaxial Compression $\sigma_1 - \sigma_3$ psi	Failure Strain percent	Tangent Young's Modulus E_{50} psi x 10^5	Tangent Young's Modulus σ_3 psi	Poisson's Ratio	Direct Shear σ_n psi	Direct Shear τ psi	Brazil Tensile Strength psi	2nd Cycle Slake-Durability Index percent	Modified Tabor Abrasion/ Hardness Index	Swell Pressure Index psi
Austin Chalk Limestone	9.7	9.3	16.7	113.3	1.9		1421												
Austin Chalk Limestone	10.1	9.7														154			
Austin Chalk Limestone	28.0	23.7	11.9	128.8	2.2		1427												
Austin Chalk Limestone	47.4	38.8	13.1	122.3	2.4		1724												
Austin Chalk Limestone	47.9	39.2														277			
Austin Chalk Limestone	96.3	76.6														228			
Austin Chalk Limestone	97.1	77.2												100	56				
Austin Chalk Limestone	97.1	77.2												300	161				
Austin Chalk Limestone	97.1	77.2												900	484				
Austin Chalk Limestone	97.2	77.3	14.0	116.1	2.3		1129				4.1		0.12						
Austin Chalk Limestone	122.6	97.0	13.5	120.4	2.5		1552												
Austin Chalk Limestone	123.1	97.3														214			
Austin Chalk Limestone	154.5	121.7	13.9	121.3															
Austin Chalk Limestone	154.7	121.8	12.0														93.4		
Austin Chalk Limestone	155.0	122.0																0.425	
Austin Chalk Limestone	169.8	133.5	19.6	111.7	2.4			110	137	1.55									
Austin Chalk Limestone	170.2	133.8	21.2	109.2	2.0			20	27	0.38	0.90	20							
Austin Chalk Limestone	170.4	133.9	21.2	112.7	2.0			60	118	1.39	0.17	60							
Austin Chalk Limestone	170.7	134.1	21.2	107.6	1.9			80	82	0.80	0.12	80							
Austin Chalk Limestone	171.3	134.6	21.2	110.5	2.3		114				0.42		0.18						
Austin Chalk Limestone	182.4	143.2	19.0	105.5	2.4		127												
Austin Chalk Limestone	182.8	143.5	19.6	113.8															23
Austin Chalk Limestone	183.0	143.6	19.5	114.2															16
Austin Chalk Limestone	183.4	143.9	19.7	113.5															34
Austin Chalk Limestone	195.8	153.5	18.6	112.7															
Austin Chalk Limestone	196.1	153.7	17.1														29.8		
Austin Chalk Limestone	196.7	154.2																0.375	
Austin Chalk Limestone	215.4	168.5	16.2	115.2	2.0		106												
Eagle Ford Shale	219.6	171.8															9.0		
Eagle Ford Shale	220.2	172.2	18.2	112.9															
Eagle Ford Shale	220.9	172.8																0.678	
Eagle Ford Shale	232.6	181.8	17.1	112.9															
Eagle Ford Shale	232.8	182.0																0.353	
Eagle Ford Shale	233.5	182.5	15.6	114.7	2.2		105				0.60		0.23						
Eagle Ford Shale	234.8	183.5	15.6	112.5	2.3			55	7	1.07									
Eagle Ford Shale	234.8	183.5	15.6	112.5	2.3			110	150	1.96									
Eagle Ford Shale	234.8	183.5			2.3			80	94	1.70									
Eagle Ford Shale	234.8	183.5	15.6	112.5	2.3			110	144	2.87									
Eagle Ford Shale	234.9	183.6	18.8	112.7															34
Eagle Ford Shale	235.1	183.7	18.0	113.1															48
Eagle Ford Shale	235.3	183.9	18.7	111.5															64
Eagle Ford Shale	236.5	184.8															18.4		
Eagle Ford Shale	273.9	213.8	16.7														11.5	0.518	
Procedure			ASTM-D2216				ASTM-D2938	ASTM-D2664			ASTM-D2938		ASTM-D2938	ISRM		ISRM	ISRM	ISRM	

Note: Mineralogical data available in Table 2.
* Vertical depths have been interpolated from wire-line deviation logs.

TABLE 1. GEOMECHANICAL TEST RESULTS - SE1 (cont'd)

Geologic Formation and General Lithology	Boring Depth feet	Vertical Depth* feet	Moisture Content percent	Dry Density pcf	Sample Dimension L/D	Sample Failure Mode	Unconfined Compressive Strength psi	Triaxial Compression σ_c psi	Triaxial Compression σ_1, σ_3 psi	Failure Strain percent	Tangent Young's Modulus E_{50} psi x 10^6	Tangent Young's Modulus σ_3 psi	Poisson's Ratio	Direct Shear σ_n psi	Direct Shear τ psi	Brazil Tensile Strength psi	2nd Cycle Slake-Durability Index percent	Modified Taber Abrasion/ Hardness Index	Swell Pressure Index psi
Eagle Ford Shale	274.5	214.2	16.6	115.5															
Eagle Ford Shale	279.1	217.8			2.1			1350	726										
Eagle Ford Shale	279.5	218.1			2.0			150	446										
Eagle Ford Shale	279.9	218.4			2.0			450	437										
Eagle Ford Shale	280.3	218.8	16.3	115.9	2.2		85				0.70		0.09						
Procedure			ASTM-D2216				ASTM-D2938	ASTM-D2664			ASTM-D2938		ASTM-D2938	ISRM					

* Vertical depths have been interpolated from wire-line deviation logs.

TABLE 2. BULK AND CLAY MINERALOGY TEST RESULTS

Depth* 96.4 feet **Austin Chalk** (vertical depth 76.7 feet)

Whole Rock Composition:

Mineral	Percent
calcite	100
clay minerals	≤1
	100

Relative Clay Abundance:

Mineral	Percent
montmorillonite	100

Depth* 234.8 feet **Eagle Ford Shale** (vertical depth 183.5 feet)

Whole Rock Composition:

Mineral	Percent
clay minerals	100

Relative Clay Abundance:

Mineral	Percent
montmorillonite	80
illite	10
kaolinite	10
	100

Depth* 235.1 feet **Eagle Ford Shale** (vertical depth 183.7 feet)

Whole Rock Composition:

Mineral	Percent
clay minerals	95
quartz	5
	100

Relative Clay Abundance:

Mineral	Percent
montmorillonite	53
illite	26
kaolinite	21
	100

* Vertical depths interpolated from wire-line deviation logs.

TABLE 3. HYDROLOGIC TEST RESULTS

Hole No. SE1

Test Depth	Packer Pressure (psi)	Gauge Pressure (psi)	Formation and Lithology	Hydraulic Conductivity (cm/sec)	Comments
65.25 to 86.35 feet (vertical depth 52.7 to 68.9 feet)*	150	10-15	Austin Chalk ∅ ≅ 1 gpm	3.4×10^{-5} .1 ft/d	upper portion of fracture zone
87.25 to 108.35 feet (vertical depth 69.6 to 85.9 feet)*	150	17-41	Austin Chalk	2.7×10^{-6} .06 ft/d	Lower portion of fracture zone

* Vertical depths interpolated from wire-line deviation logs.

Objective: The objective of these tests is to provide estimates of the hydraulic conductivity at distinct zones within the host bedrock formation (Austin Chalk) characterized by increased frequency of fractures, faults, or bedding plane partings, which may transmit water at increased rates.

Procedure Used: Straddle packer test intervals were selected based on inspection of rock cores and geophysical logs. A straddle packer was lowered to the desired depth and water was pumped through the system. The packers were inflated to a calculated pressure and water was pumped into the test zone at a predetermined pressure. The flow rate and pressure fluctuations were recorded over time. The data were analyzed in accordance with U.S. Bureau of Reclamation procedures (1974, Earth Manual).

Based on inspection of the rock core and a review of boring and wire-line logs, two intervals were selected for hydrogeologic (packer) testing in angle boring SE1. Both intervals selected encompassed zones with multiple small fractures in the Austin Chalk. The first interval (Test 1) was from 87.2 to 108.3 feet (inclined) while the second interval (Test 2) was from 65.2 to 86.2 feet (inclined). Packer and gauge pressures used during testing are listed in Table 3. Flow volumes were derived from flow meter readings. A calibrated container was not used for these tests.

APPENDIX A

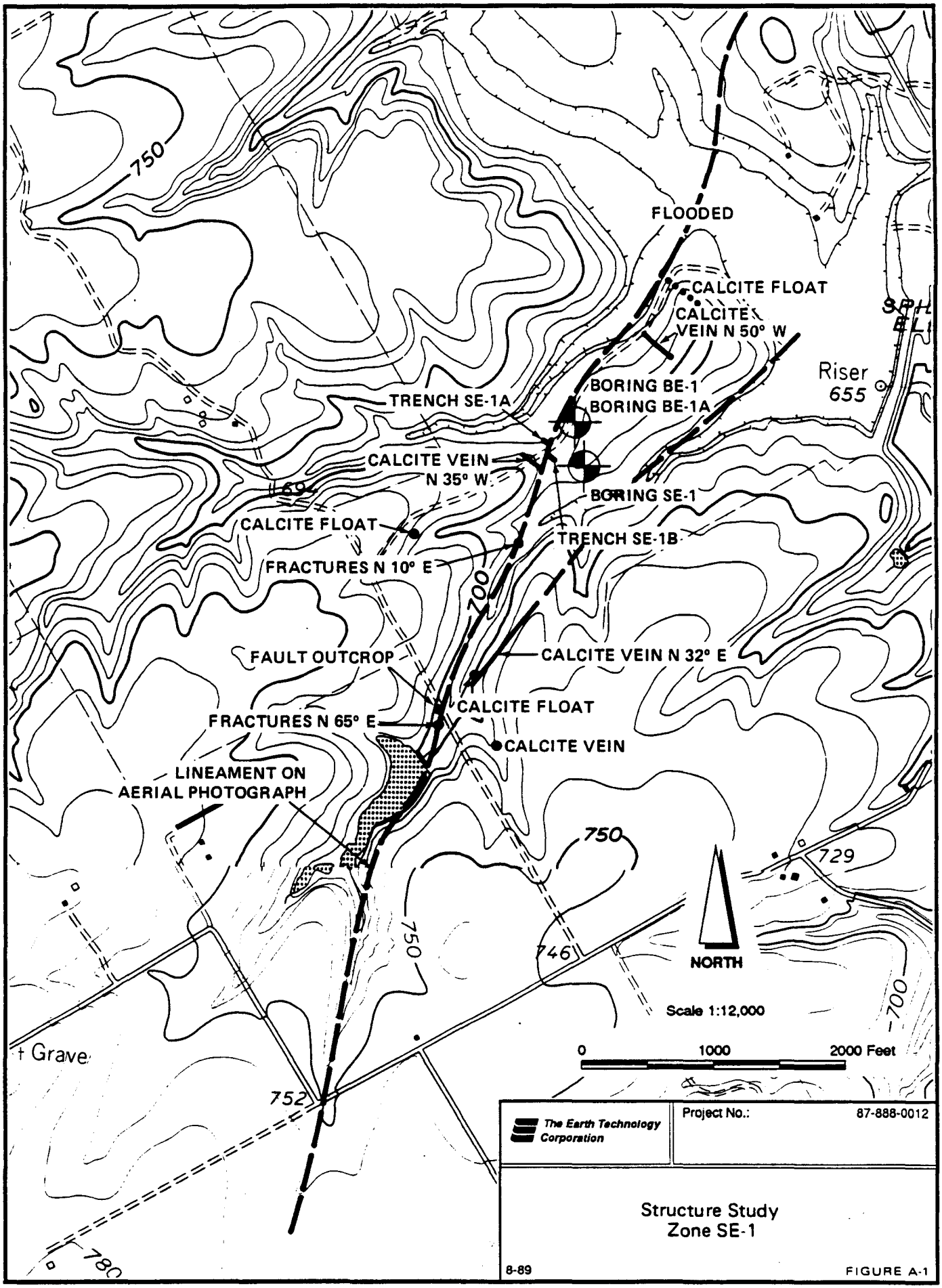
STRUCTURE ZONE MAP

STRUCTURE STUDY ZONE SE1

Field mapping of the structure study zones consisted primarily of locating and measuring the bearing of calcite-filled veins and noting areas of abundant, loose calcite fragments (float). Crystalline and fibrous calcite formed in fractures are primary indicators of faulting in the SSC study area. The bearing of significant bedrock fractures was also mapped.

Field mapping and analysis of boring logs at SE1, BE1, SE1.8, and K2-87 suggest the presence of a graben between SE1 and K2-87. The northern fault trace can be observed in a drainage shown on Figure A-1. The northern fault can be projected past boring BE1 (on the north side) along a prominent linear. The southern fault is interpreted to be coincident with a calcite vein trending N32°E southwest of boring BE1. Two trenches were excavated in an attempt to intersect the northern fault plane. However, soil and alluvium greater than 5 feet in depth prevented the actual observation of the fault in the trenches (see Appendix B).

- **Name of Structure:** Graben SE1.
- **Surface Expression:** Northern fault follows a relatively straight alignment of drainages over much of its length, including a saddle west of boring SE1. Local vein calcite in float is also abundant along its trend. The southern fault is characterized by vein calcite.
- **Trend:** Variable, but generally N10°E in northern fault; N32°E on the southern fault.
- **Width:** Northern fault has approximately 2 feet as encountered in boring SE1 (see Appendix G). Associated zone of closely spaced fractures is 19 feet wide. (Note: the fault was penetrated in chalk – fault width may be greater in the underlying shale). The southern fault has 0-3 inches of calcite. Poor exposures prevented analysis of fracturing.
- **Faults in Outcrop:** The northern fault outcrops along the lineament southwest of BE1 and has closely spaced shears trending N8°E, 44°E. The southern fault is interpreted along a calcite vein trending N32°E.
- **Slickensides and Mineralization:** The northern fault was penetrated by boring SE1; lithologic logs note calcite mineralization and slickensides in the core; vein calcite is present as float along the suspected fault trace. The southern fault has exposed vein calcite 0-4 inches thick along its trace.
- **Offset in Boring:** Comparison of borings BE1, SE1, and K2-87 suggests the presence of a graben structure southeast of boring BE1. The northern fault has 23 feet of down-to-the-south movement on the fault penetrated by boring SE1. Correlation of boring logs and wire-line logs for BE1, SE1, and K2-87 suggest that the southern fault has 25 feet of down-to-the-north movement. The fault is identified by a calcite vein southwest of BE1.


750
FLOODED
CALCITE FLOAT
CALCITE VEIN N 50° W
Riser
655
BORING BE-1
BORING BE-1A
TRENCH SE-1A
CALCITE VEIN N 35° W
BORING SE-1
CALCITE FLOAT
TRENCH SE-1B
FRACTURES N 10° E
700
FAULT OUTCROP
CALCITE VEIN N 32° E
CALCITE FLOAT
FRACTURES N 65° E
CALCITE VEIN
LINEAMENT ON
AERIAL PHOTOGRAPH
750
729
750
746
NORTH
Scale 1:12,000
0
1000
2000 Feet
700
752
780
The Earth Technology Corporation
Project No.:
87-888-0012
Structure Study
Zone SE-1
8-89
FIGURE A-1

APPENDIX B

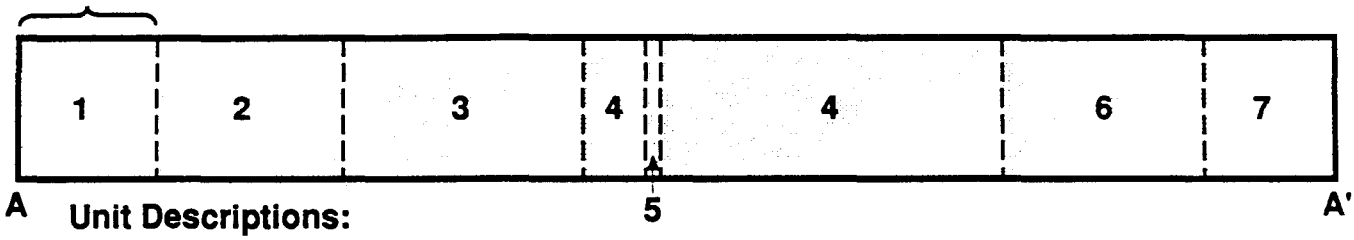
TRENCH LOGS

Trench SE 1A
3.8 Feet Deep

PLAN VIEW

Bedrock floor exposed in wall
Bedrock is thick bedded chalk

S 74° E



Unit Descriptions:

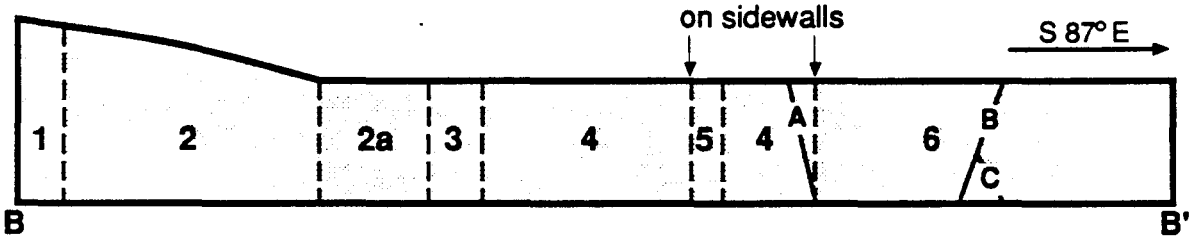
1. Highly plastic silty clay, red
2. Silty clay, reddish brown, clastic, with weathered chalk float and caliche nodules, with angular chalk fragments up to 2 inches
3. Clayey silt, buff brown to orange, <5% chalk pebbles, minor caliche fragments/nodules
4. Clayey silt, buff brown to orange, minor caliche with orange FeO_2 staining
5. Clayey silt, buff brown, scattered 1/2 inch chalk fragments <5%
6. Clayey silt, light tan to orange, with some weathered chalk granules
7. Clayey silt, buff brown, decrease in chalk granules from 6.

Trench SE 1B
4.4 Feet Deep

Note: Thick bedded chalk on sidewalls

PLAN VIEW

S 87° E



Unit Descriptions:

1. Clayey silt, with weathered chalk fragments (1/4"-1/2" dia.), reddish orange to buff brown
2. Clayey silt, buff brown to orange, with chalk clasts <1/4 inch

2a. Clayey silt, chalk fragments (1/2" dia.) 50% of material, subround to round

3. Sandy silt, orange to yellow brown, with well rounded chalk fragments
4. Well-weathered chalk(?), tan with orange iron staining
5. Silty clay highly plastic, reddish brown
6. Chalk bedrock, massive, light gray to white, fine grained, fossiliferous

Fractures:

A. N20° W, 68° SW
B. N50° E, 34° SE
•Fractures A & B in-filled with red, highly plastic silty clay
C. N35° W, 79° SW

Scale (feet)

0 1 2 3 4

Note: Trench locations are shown on Figure A1

The Earth Technology Corporation	Project No.: 87-888-0011
Trenches SE 1A and SE 1B	
8-89	Figure B1

APPENDIX C

LITHOLOGIC LOG

LOG OF BORING

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

BORING NO: SE 1 PG 1 OF 8

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/20/89 TYPE: Nx Core CASED TO: 3.5 CONTRACTOR: MJA

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring
Azimuth ~ S83°W
Inclined ~50° from horizontal

DEPTH IN FEET (INCLINED)	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
									0.0-3.5 Surface Casing Rock @ 0.5
									0.0-0.5 Topsoil CLAY, brown Start coring 3.5
		3.5							LIMESTONE, med. hard, highly to mod. wea., iron staining along fracture surfaces, tan (Austin Chalk)
5		Box 1	3.5	8.5	100	0			3.5-5.1 Highly fractured layer 5.6-6.3 Highly fractured layer 7.5-8.0 fracture, vertical, smooth clean surface 8.3-8.4 fracture, 55°, smooth, clean surface
10		13.4	8.5	16.5	81	45			10.3-10.9 fractures (6), 40°, smooth, clean surfaces 10.6-12.4 shaly zone, area of probable core loss 14.8-15.3 shaly zone, area of probable core loss
15		Box 2	16.5	24.8	100	53			19.1- fracture, 45°, smooth, clean surface
20		23.5							23.1-23.4 fractures, 2 intersecting, 40° and 80° w/smooth, iron stained surfaces
25		Box 3	24.8	26.5	85	85			24.2-25.2 very argillaceous LIMESTONE, fresh, mod. hd., sli. fossiliferous, argillaceous bands, lt. gray (Austin Chalk)
			26.5						LIMESTONE, med. hard, highly wea., tan (Austin Chalk)
30		32.2			100	80			LIMESTONE, fresh, mod. hard, sli. fossiliferous w/argillaceous layers, lt. gray (Austin Chalk) 30.8-31.5 Dark gray very argillaceous zone 32.0-32.1 Dark gray mod. argillaceous zone
35		Box 4		36.5					33.7-35.4 Dark gray mod. argillaceous zone
40		40.8	36.5		96	80			38.0-38.3 Dark gray shaly zone 41.1-41.4 Dark gray shaly zone

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: SE 1 PG 2 OF 8

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/21/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring
Azimuth ~S83W
Inclined ~50° from horizontal

DEPTH IN FEET (INCLINED)	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
		40.8								LIMESTONE, fresh, mod. hard, sli. fossiliferous argillaceous layers, lt. gray (Austin Chalk)
		Box 5			96	80				
45				46.5						
			46.5							48.0-52.0 Dark gray mod.-very argillaceous zone
50		50.9								
					100	80				
										54.5-56.5 Dark gray mod.-very argillaceous zone
55		Box 6		56.5						56.5 fracture, 28°, slickensided, sli.-med. rough (dip: 25°S, strike: E-W)
			56.5							
		59.6								56.5-63.9 Dark gray mod. argillaceous zone
60					100	92				61.0 Trace of slickensides, parallel to core
										63.3-64.4 Dark gray shaly zone
		Box 7								65.1-66.5 Dark gray mod. argillaceous zone
65				66.5						66.5-68.5 Dark gray mod. argillaceous zone
			66.5							67.4-67.5 fracture, 50°, w/sli. to med. rough slickensides (dip: 35°S, strike:E-W)
		68.5								
70					100	72				
										72.2-73.0 Dark gray mod. to very argillaceous zone
		Box 8								72.2-72.3 fracture, 35°, w/sli. rough slickensides (dip: 45°SE, strike: NE-SW)
75										74.7-76.0 Dark gray mod.-very argillaceous zone
		76.5		76.5						74.9-75.1 fracture, 70°, w/med. rough to rough slickensides (dip: 50°N, strike: E-W)
			76.5							77.5-78.8 Dark gray mod. argillaceous zone
80		Box 9			100	92				80.4-84.0 Dark gray mod. argillaceous zone

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC
CLIENT: TETC
TASK NO.: 12

BORING NO: SE 1 PG 3 OF 8
LOCATION: N 261,548.2 feet
E 2,172,406.1 feet
GROUND EL: 696.2

DATE: 6/22/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

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

BOREHOLE INFORMATION
Inclined Boring
Azimuth ~ S83°W
Inclined ~50° from horizontal

DEPTH IN FEET (INCLINED)	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.
		Box 9			100	92		
85		84.9		86.5				
			86.5		99	94		
90		Box 10						
		93.3						
95				96.5				
		Box 11	96.5		95	60		
100								
		103.2						
105				106.5				
			106.5		100	96		
110		Box 12						
		111.4						
		Box 13						
115				116.5				
			116.5		94	84		
120		120.1						

DESCRIPTION OF STRATUM

LIMESTONE, fresh, mod. hard, sli. fossiliferous, argillaceous layers, lt. gray (Austin Chalk)
82.3-82.5 fracture, 70°, w/med. rough slickensides (dip: 80°S, strike: E-W)
82.5 fracture, 35°, w/sli. rough slickensides
82.9-83.1 fracture, 70°, w/med. rough slickensides (dip: 80°S, strike: E-W)

86.5-87.8 Dark gray mod.-very argillaceous zone
89.7-90.7 Dark gray mod.-very argillaceous zone
90.7-90.9 Dark gray shaly zone, area of probable core loss
92.5-92.6 fracture, 45°, slickensided, closed (dip: 65°SE, strike: NE-SW)
92.9-94.0 Dark gray very argillaceous zone
93.1-93.3 fracture, 45°, w/sli. rough slickensides (dip: 65°SE, strike: NE-SW)

98.0
CLAY, bentonitic, soft, waxy, non-laminated, bluish-gray zone of probable core loss 98.7

96.4-96.6 fracture, 70°, w/med. rough slickensides, partially filled w/pyrite (dip: near vertical, strike: NE-SW)
96.5-97.2 Dark gray mod.-very argillaceous zone
97.2-97.3 fracture, 45°, w/smooth-sli. rough slickensides (dip:55°SE, strike:NE-SW)
97.7 fractures, 2 intersecting, smooth-sli. rough slickensides, 70° & 30°
98.8-99.0 fracture, 35°, rough, slickensides, w/approx. 3/4" calcite filled
99.0-99.8 Wea. limestone, med. hard, w/multiple (10-20) 65° fractures, most 1/16" - 1/8" calcite filled w/traces of pyrite, and small pyrite nodules throughout
103.5-103.9 Dark gray shaly zone, probable core loss area
108.2-109.3 Dark gray mod.-very argillaceous zone
116.0-116.5 Dark gray shaly zone
116.5-116.9 Dark gray mod. argillaceous zone
117.8-118.4 Dark gray mod. argillaceous zone
120.9-122.2 Dark gray mod. argillaceous zone
121.5- trace of slickensided fracture (parallel to hole)
122.2-122.5 Dark gray very argillaceous zone
123.6-124.0 Dark gray mod. argillaceous zone

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC
CLIENT: TETC
TASK NO.: 12

BORING NO: SE1 PG 4 OF 8
LOCATION: N 261,548.2 feet
E 2,172,406.1 feet
GROUND EL: 696.2

DATE: 6/22/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

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

BOREHOLE INFORMATION
Inclined Boring
Azimuth ~ S83°W
Inclined ~ 50° from horizontal

DEPTH IN FEET (INCLINED)	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
		120.1							LIMESTONE, fresh, mod. hard, sli. fossiliferous, argillaceous layers, lt. gray (Austin Chalk)
					94	84			120.9-122.2 Dark gray mod. argillaceous zone
									121.5- trace of slickensided fracture (parallel to hole)
125									122.2-122.5 Dark gray very argillaceous zone
		Box 14		126.5					123.6-124.0 Dark gray mod. argillaceous zone
			126.5						
		127.65							Recovered .3" from previous core run
									126.8-127.0 Dark gray mod. argillaceous zone
130									129.4-129.85 Dark gray mod. argillaceous zone
		Box 15			103	64			133.1-134.5 Dark gray mod.-very argillaceous zone
135									
		136.1		136.1					
			136.1						138.3-139.85 Dark gray mod.-very argillaceous zone
140		Box 16			100	68			
145		145.5							145.5-146.4 Dark gray mod. argillaceous zone
				146.4					146.4-148.8 Dark gray mod. argillaceous zone
			146.4						
150		Box 17			101	88			
		153.0							
									154.5-156.5 Dark gray mod. argillaceous zone
155									156.5-159.8 Dark gray mod.-very argillaceous zone
				156.5					
			156.5						
160		Box 18							

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

BORING NO: SE1 PG 5 OF 9

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/23/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring

Azimuth ~ S83°W
Inclined ~ 50° from horizontal

DEPTH IN FEET (INCLINED)	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
		162.0							LIMESTONE, fresh, mod. hd., sli. fossiliferous, argillaceous layers, lt.gray (Austin Chalk)
		Box 19			84	84			163.2 Dark gray mod.-very argillaceous
165				166.5					165.0
			166.5						Transition Zone, argill., arenaceous, fossil., mod. hard, med. to dark gray
									166.4
170		170.2			112	112			SHALE, soft to med. hard, very close bedding planes, fresh, mostly non-calcareous, dark gray (Eagle Ford)
				recovered 1.1 from previous run					169.0-169.1 fracture, 55°, smooth clean surface
									170.0-170.1 fracture, 55°, smooth clean surface
175				175.7					
		Box 20	175.7						177.0-177.1 fracture, 70°, sli. rough slickensides, clean (dip: 35°NW, strike: NE-SW)
		178.8							
180					100	100			
185		Box 21		185.8					
		187.5	185.8						187.3-187.5 fracture, 70°, smooth-sli. rough, clean slickensides (dip: 35°W, strike: N-S)
190		Box 22			100	100			191.3 1/2" non-calcareous, lt. brown, mod. hard layer 193.1 1/2" non-calcareous, lt. brown, mod. hard layer
195		195.8		195.8					
			195.8						199.1-199.2 1" layer of bentonitic clay, soft, waxy, non-laminated, bluish-gray
200		Box 23			94	94			

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

BORING NO: SE 1 PG 5 OF 8

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/23/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring
Azimuth ~ S83°W
Inclined ~50° from horizontal

DEPTH IN FEET (INCLINED)	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
		204.5		205.5	94	94				202.4 1/4" mod. hd., non-calcareous, lt. brown band 203.2 1/4" mod. hd., non-calcareous, lt. brown band 205.8-206.0 Concretion
205		Box 24	205.5	214.5	101	101				Picked up 0.3' from previous run 210.0 fracture, 80°, w/smooth-sli. rough slickensides, clean, closed (dip: 60°W, strike: N-S) 211.0 fracture, 45°, w/smooth-sli. rough slickensides, clean, closed (dip: 60°N, strike: E-W)
210		212.5								
215		Box 25	214.5	222.5	96	96				SHALE, soft to med. hard, very close bedding planes, fresh, mostly non-calcareous, dk.gray (Eagle Ford) 218.4-219.5 Arenaceous, fossiliferous (bioclastics), non-calcareous, mod. hard zone (very similiar to transition zone material)
220		220.9								
225		Box 26	222.5	232.0	99	99				225.0 Shale, sli. calcareous from 225.0 227.3-228.0 Mod. hd., marly, calcareous, dark gray layer
230		229.7								
235		Box 27 236.5	232.0		99	99				233.4-233.6 fracture, 70°, w/sli. rough, clean, undulatory slickensides (dip: 45°NW, strike: NE-SW) 236.0-236.2 fracture, 70°, w/sli. rough, clean, undulatory slickensides (dip: 35°NW, strike: NE-SW)
240		Box 28								242.0-242.15 1 1/2" bentonitic clay layer, soft, waxy, bluish-gray

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

BORING NO: SE 1 PG 7 OF 8

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/23/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring

Azimuth ~ S83°W
Inclined ~50° from horizontal

DEPTH IN FEET (INCLINED)	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
		Box 28		242.0					SHALE, soft to med. hard, very close bedding planes, fresh, mostly non-calcareous, dk. gray (Eagle Ford)
			242.0						244.1 1/4" pyrite layer
		244.7							
245					100	100			245.0-247.4 Med.-mod. hard, arenaceous, sli. calcareous layer
250		Box 29		252.0					
		253.0	252.0						252.0-253.0 Mod. hd., very arenaceous, fossiliferous layer
255		Box 30			100	100			
260		262.0		262.0					258.1 fracture, 60°, smooth, clean slickensides (dip: 20°SW, strike: NW-SE)
			262.0						
265		Box 31			47	40			265.9-266.0 fracture, 55°, w/clean, smooth slickensides (dip: 15°W, strike: N-S)
									266.1-266.5 concretion
									267.0-267.3 Bentonitic clay, soft, waxy, bluish-gray
270		271.4		272.0					266.7-272.0 Core loss zone - due to concretion @ 266.1-266.4
			272.0						
275		Box 32		276.5	100	100			
			276.5						
280									

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: SE1 PG 8 OF 8

PROJECT: SSC

CLIENT: TETC

TASK NO.: 12

LOCATION: N 261,548.2 feet
E 2,172,406.1 feet

GROUND EL: 696.2

DATE: 6/26/89 TYPE: Nx Core CASED TO: 26.5 CONTRACTOR: MJA

DEPTH IN FEET (INCLINED)	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
		Box 33								SHALE, soft to med. hard, very close bedding planes, fresh, mostly non-calcareous, dk.gray (Eagle Ford)
285		286.0		286.0						
290										Bottom of Boring 6/26/89 Photographed 6/28/89 Wireline Logged 6/28/89 Hydrotested 6/29/89 Nx Boring Plugged 7/5/89

SAMPLE LEGEND

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

BOREHOLE INFORMATION

Inclined Boring

Azimuth ~ S83°W
Inclined ~50° from horizontal

Note: Fracture angles are recorded with respect to core axis. Strike and dip measurements (in parentheses) are approximations of trends and are based on field observations, assumption of horizontal bedding, and constant 50° inclination of boring.

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Mark Glicer CHECKED BY W. D. Flanigan

APPENDIX D

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. SE1 **Log Measured From:** Ground Level

Drilling Parameters
Depth 286 feet
Bit Diameter 4 inches

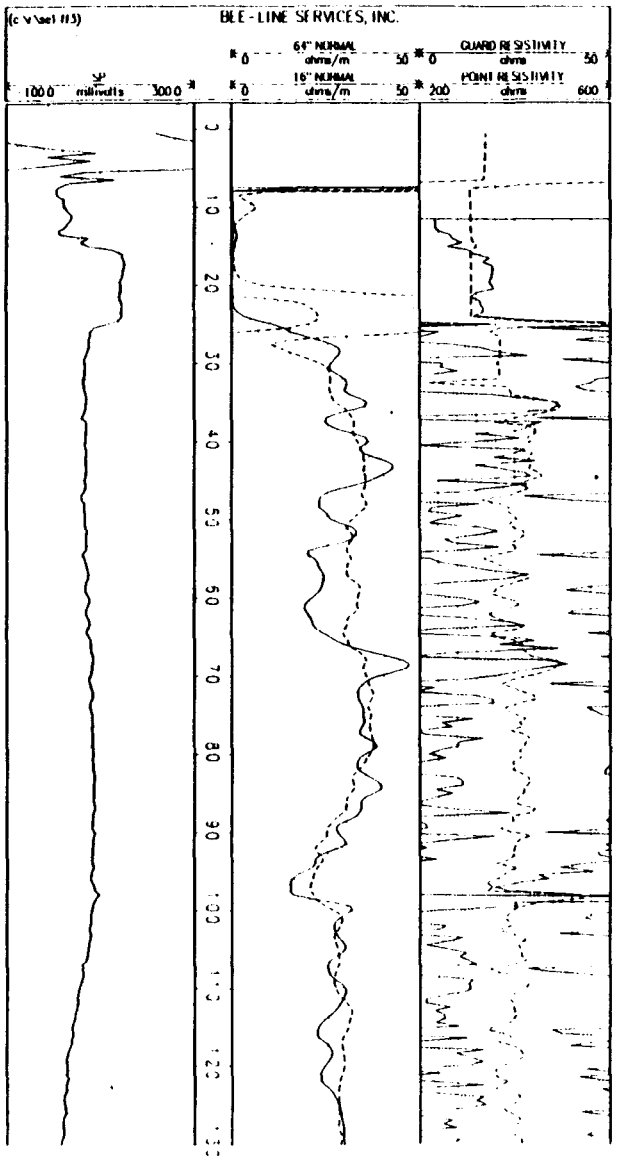
Logging Parameters	Electrical Log	Gamma Log	Sonic Log	Resistivity Log	Deviation Log
Date	June 28, 1989	June 28, 1989	June 28, 1989	June 28, 1989	June 28, 1989
Bottom Log Interval	282 feet	282 feet	273.3 feet	282 feet	273 feet
Top Log Interval	surface	surface	surface	surface	surface
Type of Fluid in Hole	boring fluid	boring fluid	boring fluid	boring fluid	boring fluid
Time Since Circulation Stop	30 minutes	30 minutes	30 minutes	30 minutes	–
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A	9055A	9055A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A	COMPU-LOG	COMPU-LOG
Logging Speed	30 feet/min.	19 feet/min.	10.5 feet/min.	60 feet/min.	–
Sample Interval	0.5 feet	0.5 feet	0.5 feet	0.1 feet	10 feet

Comments: Matrix density: 2.71; matrix delta T: 57; fluid density: 1.1; fluid delta T: 189; neutron matrix: limestone.

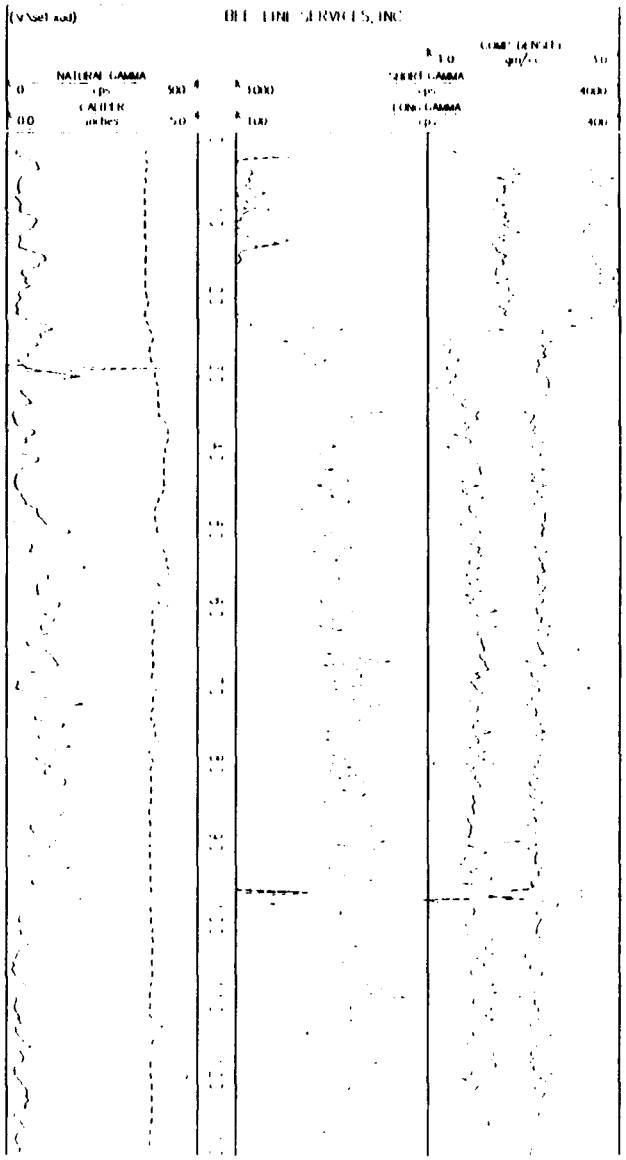
Logged by: BEE-LINE SERVICES, INC.
P.O. Box 2096
Corsicana, TX 75151

SE1 Wire-line logs run June 28,1989. Surface elevation 692.2 feet.

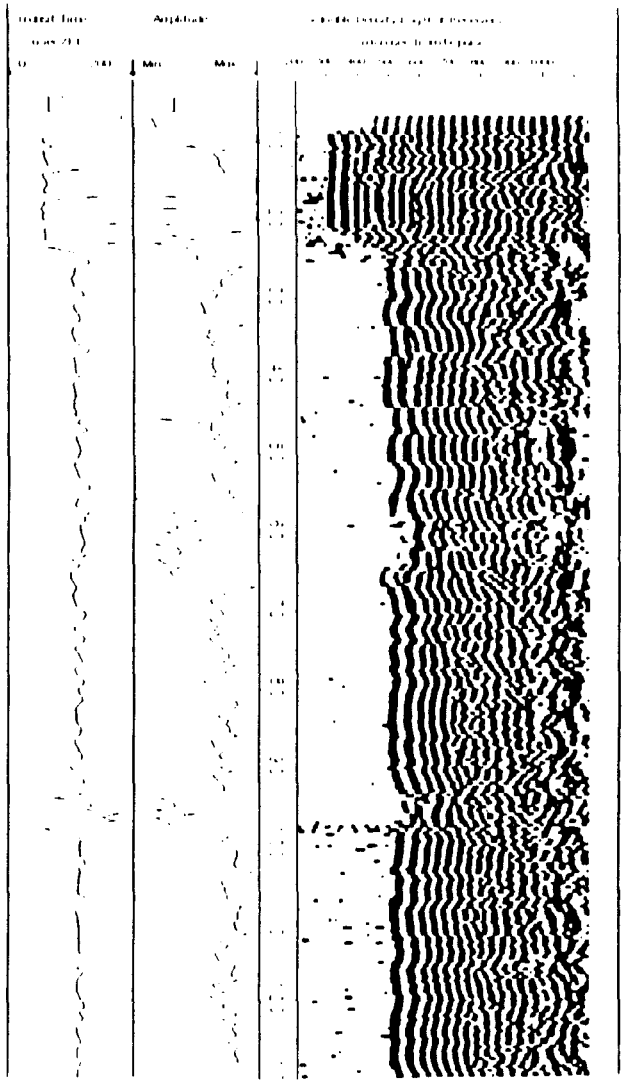
ELECTRICAL LOG



GAMMA LOG

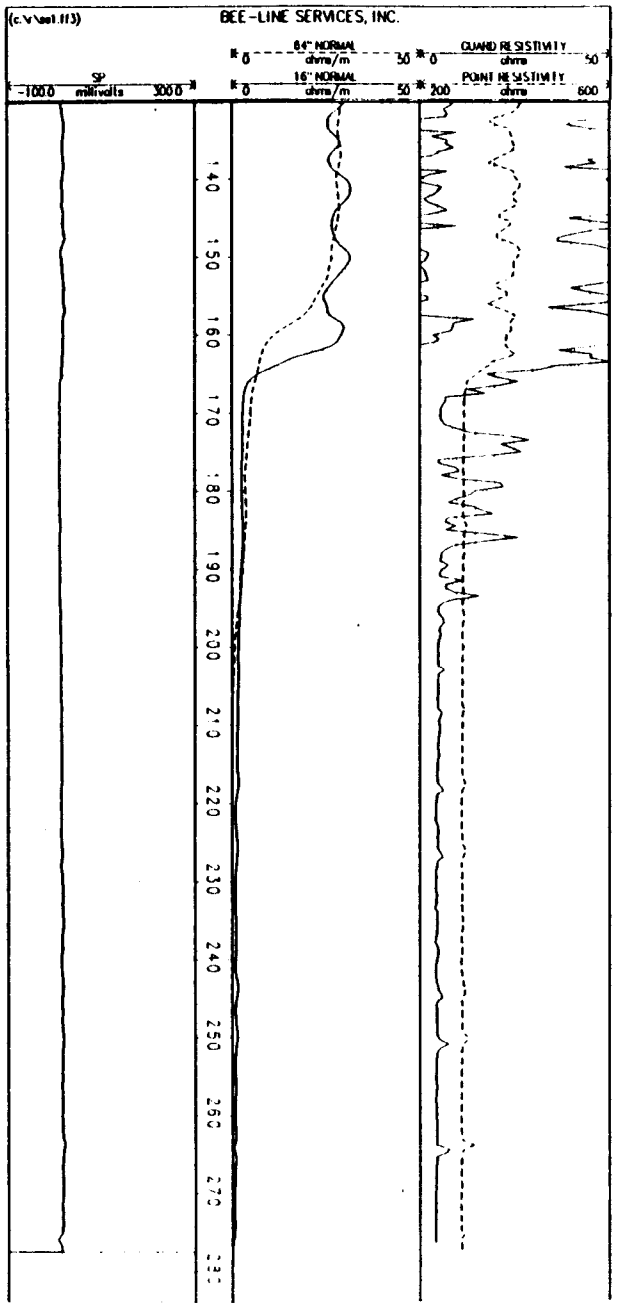


SONIC LOG

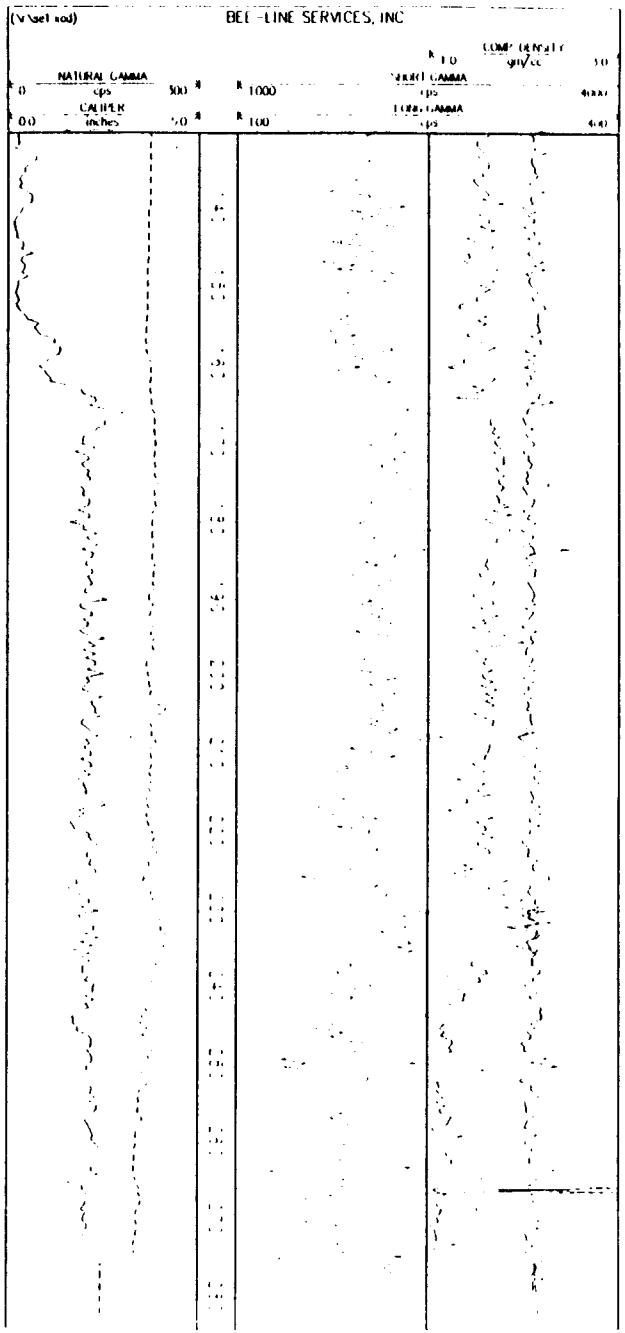


SE1 Wire-line logs run June 28,1989. Surface elevation 692.2 feet.

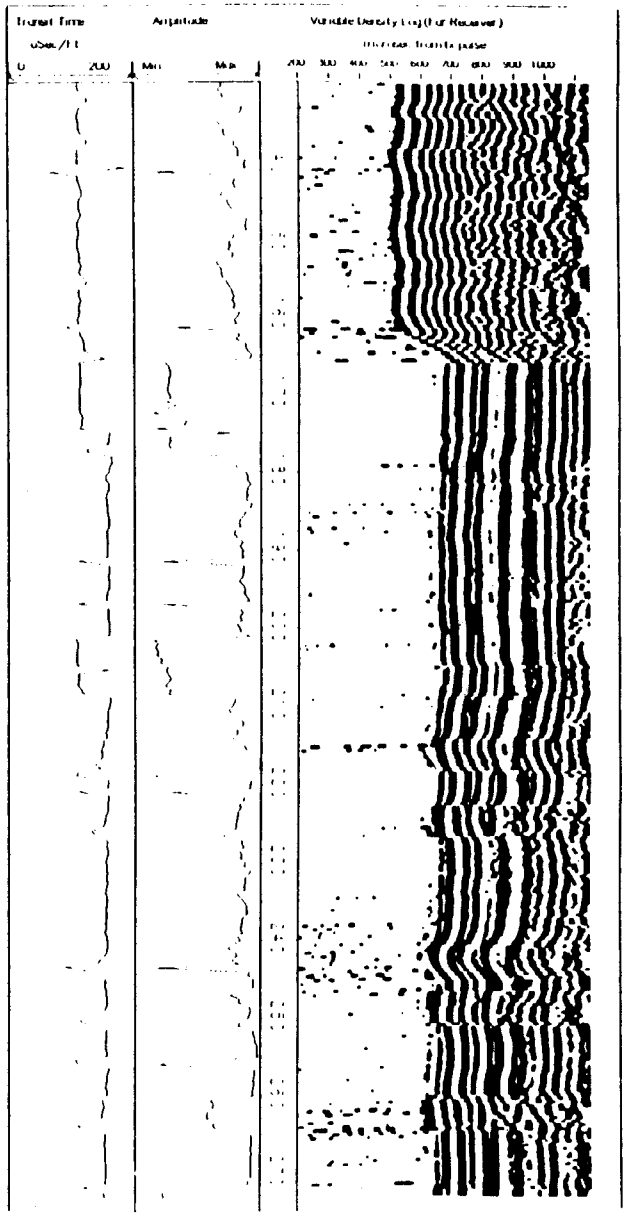
ELECTRICAL LOG CONTINUED

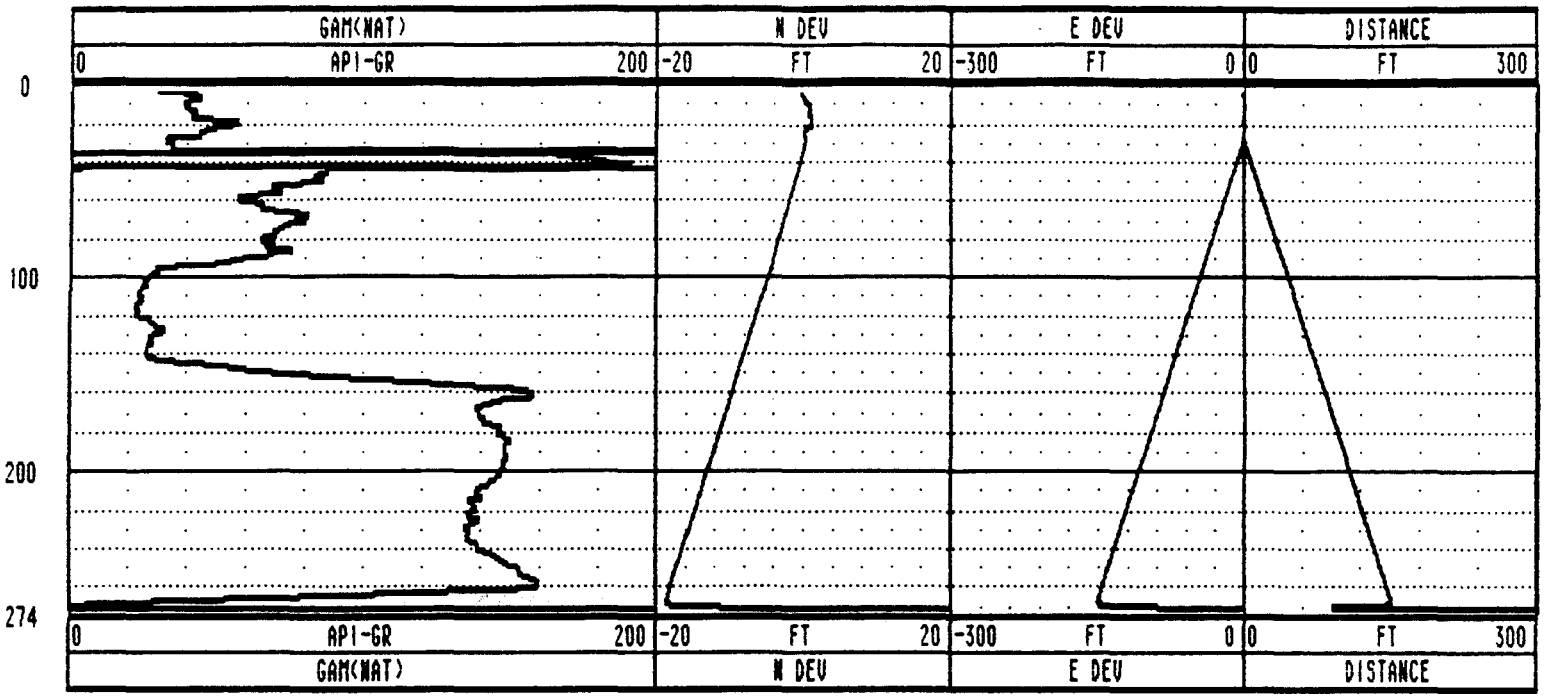


GAMMA LOG CONTINUED



SONIC LOG CONTINUED




GAM(NAT)
0 API-GR 200
N DEV
-20 FT 20
E DEV
-300 FT 0
DISTANCE
0 FT 300
0
100
200
274

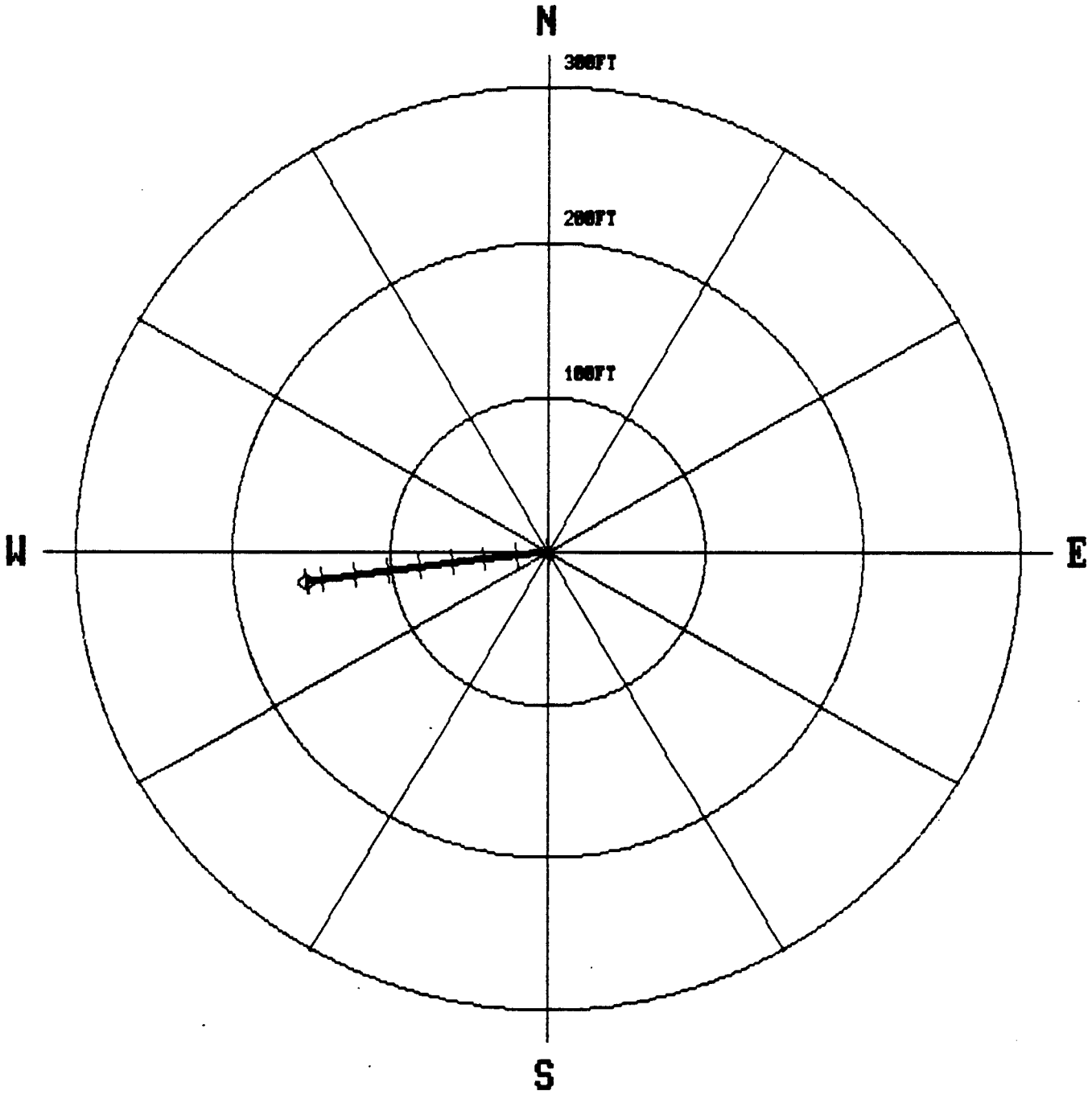
PLAN VIEW

COMPU-LOG DEVIATION

CLIENT: TEXAS SSC SITE
LOCATION: ELLIS COUNTY TEXAS
HOLE ID: SE 1 TASK #12
DATE OF LOG: 06/28/89
PROBE: 9055A 135

MAG DECL: 7.0

SCALE: 100 FT/IN
TRUE DEPTH: 212.51 FT
AZIMUTH: 262.9
DISTANCE: 153.6 FT
+ = 25 FT INCR
○ = BOTTOM OF HOLE



SCHLUMBERGER VERTICAL DEVIATION

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
4.0	4.00	0.00	0.00	0.0	0.0	0.0	0.0
5.0	5.00	0.00	0.00	0.0	0.0	0.0	0.0
6.0	6.00	0.00	0.00	0.0	0.0	0.0	0.0
7.0	7.00	0.00	0.00	0.0	0.0	0.0	0.0
8.0	8.00	0.00	0.00	0.0	0.0	0.0	0.0
9.0	8.83	-0.23	0.03	0.2	172.0	39.1	354.8
10.0	9.61	0.38	0.07	0.4	10.6	38.2	0.3
11.0	10.40	0.15	0.06	0.2	22.2	38.2	344.5
12.0	11.18	0.77	0.06	0.8	4.6	38.7	12.8
13.0	11.96	1.01	0.14	1.0	7.7	38.6	15.0
14.0	12.75	0.78	0.21	0.8	15.3	38.5	141.0
15.0	13.53	1.18	0.22	1.2	10.7	38.5	349.9
16.0	14.31	1.05	-0.10	1.1	354.7	38.6	189.9
17.0	15.09	0.67	0.30	0.7	24.6	38.5	115.3
18.0	15.87	0.77	-0.07	0.8	354.7	38.7	326.6
19.0	16.66	1.19	-0.51	1.3	336.5	38.7	320.7
20.0	17.44	1.17	-0.03	1.2	358.6	38.6	82.3
21.0	18.22	1.18	-0.16	1.2	352.5	38.5	106.9
22.0	19.00	1.36	0.20	1.4	8.4	38.3	355.4
23.0	19.79	1.08	0.43	1.2	21.9	37.7	7.0
24.0	20.57	0.95	0.67	1.2	35.2	37.5	154.0
25.0	21.35	0.48	1.07	1.2	65.7	38.5	145.2
26.0	22.14	0.28	0.85	0.9	71.5	39.1	274.2
27.0	22.92	0.06	1.18	1.2	87.1	38.4	106.7
28.0	23.71	0.23	1.19	1.2	78.9	37.5	298.1
29.0	24.49	0.41	0.61	0.7	56.2	38.2	276.4
30.0	25.28	0.45	-0.01	0.5	358.8	38.4	272.2
31.0	26.06	0.46	-0.63	0.8	305.9	38.7	267.8
32.0	26.84	0.41	-1.25	1.3	288.1	38.3	264.2
33.0	27.62	0.37	-1.88	1.9	281.1	38.5	264.1
34.0	28.41	0.29	-2.49	2.5	276.6	38.0	261.0
35.0	29.20	0.20	-3.10	3.1	273.7	38.2	263.3
36.0	29.99	0.10	-3.70	3.7	271.6	39.0	268.9
37.0	30.77	0.06	-4.32	4.3	270.9	38.7	263.3
38.0	31.55	-0.01	-4.95	4.9	269.9	38.7	262.6
39.0	32.33	-0.08	-5.57	5.6	269.2	39.0	263.6
40.0	33.10	-0.14	-6.20	6.2	268.7	39.4	264.3
41.0	33.88	-0.22	-6.82	6.8	268.2	38.9	262.9
42.0	34.65	-0.28	-7.45	7.5	267.8	39.2	265.0
43.0	35.43	-0.35	-8.08	8.1	267.5	39.2	264.3
44.0	36.20	-0.42	-8.71	8.7	267.2	39.2	263.6
45.0	36.98	-0.50	-9.33	9.3	267.0	39.2	263.4
46.0	37.75	-0.57	-9.96	10.0	266.7	39.3	262.4
47.0	38.53	-0.66	-10.59	10.6	266.4	39.2	262.4
48.0	39.30	-0.71	-11.22	11.2	266.4	39.4	264.3
49.0	40.07	-0.80	-11.85	11.9	266.2	39.3	262.6
50.0	40.85	-0.87	-12.48	12.5	266.0	39.3	263.6
51.0	41.62	-0.94	-13.11	13.1	265.9	39.4	264.4
52.0	42.39	-1.01	-13.74	13.8	265.8	39.3	263.0
53.0	43.17	-1.08	-14.37	14.4	265.7	39.3	263.1
54.0	43.94	-1.16	-15.00	15.0	265.6	39.3	262.6
55.0	44.72	-1.24	-15.62	15.7	265.5	39.2	263.2

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
56.0	45.49	-1.32	-16.25	16.3	265.4	39.2	263.2
57.0	46.27	-1.39	-16.88	16.9	265.3	39.3	263.4
58.0	47.04	-1.46	-17.51	17.6	265.2	39.2	262.8
59.0	47.82	-1.55	-18.14	18.2	265.1	39.2	262.1
60.0	48.59	-1.63	-18.76	18.8	265.0	39.2	263.2
61.0	49.37	-1.70	-19.39	19.5	265.0	39.2	263.4
62.0	50.14	-1.78	-20.02	20.1	264.9	39.2	263.1
63.0	50.91	-1.85	-20.65	20.7	264.9	39.4	263.2
64.0	51.69	-1.93	-21.28	21.4	264.8	39.2	262.5
65.0	52.46	-2.00	-21.90	22.0	264.8	39.3	264.0
66.0	53.24	-2.07	-22.53	22.6	264.7	39.3	263.4
67.0	54.01	-2.15	-23.16	23.3	264.7	39.3	263.7
68.0	54.78	-2.22	-23.79	23.9	264.7	39.5	262.9
69.0	55.55	-2.30	-24.42	24.5	264.6	39.5	263.1
70.0	56.33	-2.38	-25.05	25.2	264.6	39.2	262.2
71.0	57.10	-2.46	-25.68	25.8	264.5	39.4	262.9
72.0	57.87	-2.52	-26.31	26.4	264.5	39.5	263.9
73.0	58.65	-2.61	-26.94	27.1	264.5	39.3	261.5
74.0	59.42	-2.68	-27.57	27.7	264.4	39.4	264.1
75.0	60.19	-2.75	-28.20	28.3	264.4	39.5	263.4
76.0	60.96	-2.83	-28.83	29.0	264.4	39.4	262.5
77.0	61.74	-2.91	-29.46	29.6	264.4	39.2	262.7
78.0	62.51	-2.99	-30.09	30.2	264.3	39.5	263.8
79.0	63.28	-3.04	-30.73	30.9	264.3	39.6	263.5
80.0	64.05	-3.13	-31.36	31.5	264.3	39.5	262.6
81.0	64.82	-3.21	-31.99	32.1	264.3	39.4	262.5
82.0	65.60	-3.29	-32.62	32.8	264.2	39.3	264.0
83.0	66.37	-3.36	-33.25	33.4	264.2	39.0	265.4
84.0	67.14	-3.43	-33.88	34.1	264.2	40.1	264.8
85.0	67.91	-3.49	-34.52	34.7	264.2	38.5	259.5
86.0	68.67	-3.57	-35.15	35.3	264.2	40.0	266.4
87.0	69.44	-3.65	-35.79	36.0	264.2	39.6	263.1
88.0	70.21	-3.71	-36.42	36.6	264.2	39.5	262.6
89.0	70.99	-3.77	-37.05	37.2	264.2	38.8	265.0
90.0	71.76	-3.87	-37.68	37.9	264.1	39.5	265.8
91.0	72.52	-3.93	-38.33	38.5	264.2	42.0	269.0
92.0	73.28	-3.92	-38.97	39.2	264.3	39.4	263.9
93.0	74.05	-3.99	-39.60	39.8	264.2	42.3	270.0
94.0	74.82	-4.06	-40.23	40.4	264.2	39.1	257.9
95.0	75.58	-4.10	-40.88	41.1	264.3	40.2	268.4
96.0	76.35	-4.17	-41.51	41.7	264.3	39.9	264.2
97.0	77.12	-4.24	-42.15	42.4	264.3	39.7	263.9
98.0	77.90	-4.36	-42.76	43.0	264.2	40.3	255.2
99.0	78.66	-4.44	-43.39	43.6	264.2	39.2	261.8
100.0	79.44	-4.51	-44.02	44.2	264.1	39.1	263.2
101.0	80.22	-4.59	-44.64	44.9	264.1	39.0	261.7
102.0	80.99	-4.68	-45.27	45.5	264.1	38.9	262.6
103.0	81.77	-4.77	-45.89	46.1	264.1	38.9	258.1
104.0	82.55	-4.85	-46.51	46.8	264.0	39.0	262.3
105.0	83.33	-4.94	-47.13	47.4	264.0	38.9	261.9
106.0	84.10	-5.02	-47.76	48.0	264.0	39.2	262.9
107.0	84.88	-5.10	-48.39	48.7	264.0	39.2	262.7

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
108.0	85.65	-5.18	-49.01	49.3	264.0	39.2	262.7
109.0	86.43	-5.26	-49.64	49.9	264.0	39.4	264.0
110.0	87.20	-5.32	-50.27	50.6	264.0	38.7	261.3
111.0	87.98	-5.40	-50.90	51.2	263.9	39.3	264.5
112.0	88.75	-5.50	-51.52	51.8	263.9	39.1	267.5
113.0	89.53	-5.60	-52.14	52.4	263.9	38.6	259.8
114.0	90.31	-5.68	-52.76	53.1	263.9	38.9	263.0
115.0	91.09	-5.77	-53.38	53.7	263.8	38.8	261.9
116.0	91.87	-5.86	-54.00	54.3	263.8	38.8	261.4
117.0	92.65	-5.95	-54.62	54.9	263.8	38.9	261.9
118.0	93.43	-6.03	-55.24	55.6	263.8	39.0	264.6
119.0	94.20	-6.11	-55.87	56.2	263.8	39.0	264.5
120.0	94.98	-6.18	-56.49	56.8	263.8	39.1	260.9
121.0	95.75	-6.23	-57.12	57.5	263.8	39.3	263.0
122.0	96.53	-6.32	-57.75	58.1	263.8	39.3	262.1
123.0	97.30	-6.40	-58.38	58.7	263.7	39.3	262.2
124.0	98.07	-6.49	-59.01	59.4	263.7	39.4	262.6
125.0	98.85	-6.57	-59.64	60.0	263.7	39.3	262.3
126.0	99.62	-6.64	-60.27	60.6	263.7	39.3	263.1
127.0	100.39	-6.72	-60.90	61.3	263.7	39.3	263.1
128.0	101.17	-6.80	-61.52	61.9	263.7	39.3	262.7
129.0	101.94	-6.88	-62.15	62.5	263.7	39.6	263.8
130.0	102.71	-6.96	-62.78	63.2	263.7	38.9	258.8
131.0	103.49	-7.06	-63.41	63.8	263.6	39.2	262.9
132.0	104.26	-7.16	-64.03	64.4	263.6	39.0	258.0
133.0	105.04	-7.24	-64.66	65.1	263.6	39.5	263.1
134.0	105.81	-7.32	-65.29	65.7	263.6	39.4	262.5
135.0	106.58	-7.40	-65.92	66.3	263.6	39.3	262.1
136.0	107.36	-7.49	-66.54	67.0	263.6	39.5	261.4
137.0	108.13	-7.59	-67.17	67.6	263.6	39.3	260.7
138.0	108.90	-7.68	-67.80	68.2	263.5	39.1	261.4
139.0	109.68	-7.77	-68.42	68.9	263.5	39.4	264.3
140.0	110.45	-7.84	-69.05	69.5	263.5	39.5	264.1
141.0	111.22	-7.91	-69.68	70.1	263.5	39.6	262.7
142.0	112.00	-8.00	-70.31	70.8	263.5	39.2	262.3
143.0	112.77	-8.07	-70.94	71.4	263.5	39.5	264.2
144.0	113.54	-8.15	-71.57	72.0	263.5	39.5	262.8
145.0	114.32	-8.24	-72.20	72.7	263.5	39.3	262.7
146.0	115.09	-8.31	-72.83	73.3	263.5	39.3	262.7
147.0	115.86	-8.40	-73.46	73.9	263.5	39.4	261.7
148.0	116.64	-8.50	-74.08	74.6	263.5	39.1	259.7
149.0	117.41	-8.59	-74.71	75.2	263.4	39.1	264.1
150.0	118.19	-8.67	-75.34	75.8	263.4	39.6	264.1
151.0	118.96	-8.74	-75.97	76.5	263.4	39.6	262.9
152.0	119.73	-8.83	-76.59	77.1	263.4	39.6	262.2
153.0	120.50	-8.90	-77.23	77.7	263.4	39.4	262.2
154.0	121.28	-8.99	-77.86	78.4	263.4	39.6	260.2
155.0	122.04	-9.08	-78.49	79.0	263.4	39.7	263.1
156.0	122.82	-9.16	-79.12	79.6	263.4	39.3	262.5
157.0	123.58	-9.22	-79.76	80.3	263.4	40.0	265.4
158.0	124.35	-9.29	-80.40	80.9	263.4	39.7	262.8
159.0	125.12	-9.37	-81.03	81.6	263.4	39.3	264.2

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
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HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
160.0	125.89	-9.45	-81.66	82.2	263.4	39.8	262.6
161.0	126.66	-9.53	-82.29	82.8	263.4	39.7	262.2
162.0	127.43	-9.60	-82.93	83.5	263.4	38.9	261.2
163.0	128.19	-9.67	-83.57	84.1	263.4	40.0	266.9
164.0	128.96	-9.77	-84.20	84.8	263.4	39.7	267.6
165.0	129.74	-9.89	-84.82	85.4	263.4	39.2	260.9
166.0	130.52	-9.96	-85.44	86.0	263.3	38.9	262.3
167.0	131.29	-10.03	-86.07	86.7	263.4	39.4	264.5
168.0	132.07	-10.11	-86.70	87.3	263.3	39.3	263.8
169.0	132.83	-10.17	-87.34	87.9	263.4	39.7	267.0
170.0	133.61	-10.25	-87.97	88.6	263.4	39.5	260.4
171.0	134.38	-10.36	-88.59	89.2	263.3	39.8	260.0
172.0	135.15	-10.45	-89.22	89.8	263.3	39.5	262.0
173.0	135.92	-10.53	-89.85	90.5	263.3	39.7	263.7
174.0	136.69	-10.62	-90.49	91.1	263.3	40.0	263.5
175.0	137.46	-10.69	-91.12	91.7	263.3	39.6	263.7
176.0	138.23	-10.76	-91.75	92.4	263.3	39.8	263.4
177.0	139.00	-10.86	-92.38	93.0	263.3	39.6	261.4
178.0	139.77	-10.94	-93.01	93.7	263.3	39.5	262.3
179.0	140.54	-11.01	-93.65	94.3	263.3	39.5	265.1
180.0	141.31	-11.11	-94.28	94.9	263.3	39.5	260.4
181.0	142.08	-11.20	-94.91	95.6	263.3	39.8	263.2
182.0	142.85	-11.27	-95.55	96.2	263.3	39.8	264.1
183.0	143.62	-11.35	-96.18	96.8	263.3	39.8	261.9
184.0	144.39	-11.44	-96.81	97.5	263.3	39.7	260.3
185.0	145.16	-11.53	-97.44	98.1	263.3	39.5	263.1
186.0	145.93	-11.61	-98.08	98.8	263.2	39.9	262.6
187.0	146.70	-11.73	-98.70	99.4	263.2	39.3	253.4
188.0	147.47	-11.77	-99.34	100.0	263.2	39.2	261.1
189.0	148.24	-11.88	-99.96	100.7	263.2	39.7	261.3
190.0	149.00	-11.98	-100.60	101.3	263.2	40.6	265.3
191.0	149.77	-12.04	-101.24	102.0	263.2	39.9	264.1
192.0	150.54	-12.10	-101.88	102.6	263.2	39.7	263.7
193.0	151.30	-12.19	-102.51	103.2	263.2	40.3	262.4
194.0	152.07	-12.25	-103.15	103.9	263.2	39.4	260.8
195.0	152.85	-12.33	-103.78	104.5	263.2	39.3	264.5
196.0	153.62	-12.41	-104.41	105.1	263.2	39.6	266.2
197.0	154.38	-12.47	-105.05	105.8	263.2	40.3	264.8
198.0	155.15	-12.54	-105.68	106.4	263.2	39.8	263.6
199.0	155.92	-12.63	-106.31	107.1	263.2	39.7	260.0
200.0	156.70	-12.80	-106.92	107.7	263.2	39.5	256.5
201.0	157.46	-12.86	-107.57	108.3	263.2	40.3	267.4
202.0	158.23	-12.94	-108.20	109.0	263.2	39.9	263.7
203.0	159.00	-13.03	-108.83	109.6	263.2	39.6	262.3
204.0	159.77	-13.11	-109.46	110.2	263.2	39.6	263.3
205.0	160.54	-13.17	-110.10	110.9	263.2	39.8	264.5
206.0	161.31	-13.30	-110.72	111.5	263.1	39.9	255.5
207.0	162.08	-13.39	-111.35	112.2	263.1	39.1	261.5
208.0	162.85	-13.47	-111.98	112.8	263.1	39.4	265.2
209.0	163.62	-13.54	-112.61	113.4	263.1	39.9	266.0
210.0	164.39	-13.61	-113.25	114.1	263.1	39.8	263.0
211.0	165.16	-13.69	-113.88	114.7	263.1	40.3	265.8

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
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HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
212.0	165.92	-13.73	-114.53	115.3	263.2	39.5	264.6
213.0	166.69	-13.82	-115.16	116.0	263.2	39.5	260.9
214.0	167.46	-13.91	-115.79	116.6	263.2	39.8	262.9
215.0	168.23	-13.98	-116.42	117.3	263.2	39.8	263.5
216.0	169.00	-14.07	-117.06	117.9	263.1	39.8	262.8
217.0	169.77	-14.14	-117.69	118.5	263.1	39.5	262.6
218.0	170.54	-14.22	-118.32	119.2	263.1	39.7	263.5
219.0	171.31	-14.30	-118.96	119.8	263.1	39.6	261.9
220.0	172.08	-14.39	-119.59	120.4	263.1	39.5	263.1
221.0	172.85	-14.47	-120.22	121.1	263.1	39.7	262.5
222.0	173.62	-14.55	-120.85	121.7	263.1	39.5	261.7
223.0	174.40	-14.64	-121.48	122.4	263.1	39.5	262.7
224.0	175.17	-14.73	-122.11	123.0	263.1	39.6	259.7
225.0	175.94	-14.82	-122.74	123.6	263.1	39.2	260.9
226.0	176.71	-14.90	-123.38	124.3	263.1	39.9	264.0
227.0	177.48	-14.98	-124.01	124.9	263.1	39.5	261.1
228.0	178.25	-15.08	-124.63	125.5	263.1	39.1	263.5
229.0	179.03	-15.13	-125.26	126.2	263.1	39.2	252.2
230.0	179.79	-15.21	-125.89	126.8	263.1	40.0	265.4
231.0	180.57	-15.34	-126.51	127.4	263.1	39.5	261.8
232.0	181.34	-15.40	-127.14	128.1	263.1	39.1	261.9
233.0	182.12	-15.49	-127.77	128.7	263.1	39.4	262.0
234.0	182.89	-15.60	-128.39	129.3	263.1	39.0	260.2
235.0	183.67	-15.74	-129.00	130.0	263.0	38.7	256.5
236.0	184.45	-15.81	-129.63	130.6	263.0	39.6	264.2
237.0	185.22	-15.93	-130.24	131.2	263.0	38.9	246.1
238.0	185.98	-16.05	-130.88	131.9	263.0	40.2	265.2
239.0	186.75	-16.13	-131.52	132.5	263.0	40.3	265.5
240.0	187.51	-16.21	-132.15	133.1	263.0	39.9	262.0
241.0	188.28	-16.30	-132.79	133.8	263.0	40.3	264.3
242.0	189.05	-16.38	-133.42	134.4	263.0	39.6	260.3
243.0	189.81	-16.46	-134.06	135.1	263.0	39.7	264.0
244.0	190.58	-16.52	-134.70	135.7	263.0	39.6	266.3
245.0	191.35	-16.60	-135.34	136.4	263.0	39.8	264.2
246.0	192.11	-16.69	-135.98	137.0	263.0	41.2	262.5
247.0	192.87	-16.75	-136.62	137.6	263.0	40.0	262.4
248.0	193.64	-16.83	-137.25	138.3	263.0	40.4	262.9
249.0	194.41	-16.92	-137.89	138.9	263.0	39.8	262.9
250.0	195.18	-17.00	-138.52	139.6	263.0	39.7	262.5
251.0	195.94	-17.08	-139.16	140.2	263.0	40.7	275.0
252.0	196.72	-17.20	-139.78	140.8	263.0	38.6	256.1
253.0	197.49	-17.30	-140.40	141.5	263.0	39.2	258.8
254.0	198.27	-17.40	-141.03	142.1	263.0	39.2	260.9
255.0	199.04	-17.48	-141.66	142.7	263.0	39.7	262.3
256.0	199.81	-17.56	-142.29	143.4	263.0	39.7	260.0
257.0	200.58	-17.63	-142.93	144.0	263.0	39.8	262.8
258.0	201.35	-17.73	-143.56	144.6	263.0	39.1	260.2
259.0	202.12	-17.79	-144.19	145.3	263.0	37.8	268.2
260.0	202.89	-17.89	-144.81	145.9	263.0	40.8	267.5
261.0	203.65	-17.92	-145.45	146.5	263.0	39.1	257.5
262.0	204.42	-18.00	-146.08	147.2	263.0	39.9	264.0
263.0	205.19	-18.05	-146.72	147.8	263.0	40.1	266.9

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FIELD OFFICE : CORSICANA
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HOLE ID. : SE 1 TASK #12
DATE OF LOG : 06/28/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 9

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
264.0	205.96	-18.13	-147.35	148.5	263.0	39.3	261.3
265.0	206.78	-18.10	-147.81	148.9	263.0	38.8	304.5
266.0	207.55	-18.17	-148.41	149.5	263.0	37.6	243.2
267.0	208.32	-18.28	-149.04	150.2	263.0	40.4	260.5
268.0	209.10	-18.36	-149.66	150.8	263.0	38.8	262.0
269.0	209.87	-18.49	-150.28	151.4	263.0	42.0	261.2
270.0	210.64	-18.61	-150.90	152.0	263.0	39.1	265.1
271.0	211.42	-18.70	-151.53	152.7	263.0	38.9	262.6
272.0	212.20	-18.82	-152.15	153.3	262.9	39.2	258.9
272.7	212.61	-18.87	-152.39	153.6	262.9	0.0	0.0

APPENDIX E

PLUGGING REPORT

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0012

Task No. 12

Boring No. SE-1

Texas Coordinate Location:

N 261,548.2 feet

E 2,172,406.1 feet

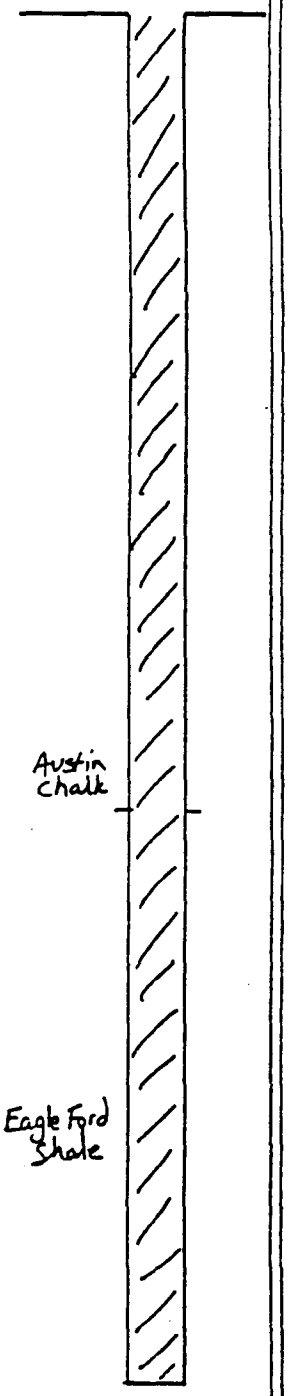
Surface Elevation: 696.2 feet

Total Boring Depth: 286.0 (Inclined)

Plugging Remarks: Boring grouted with cement/bentonite upon completion of drilling, photography, wireline, and hydrotesting. 15 sacks of cement and 3 sacks of bentonite were used utilizing approximately 7 gallons of water per sack of mixture. Grout was placed using pvc tremie pipe in open hole to full depth. (No casing was left in hole.

Azimuth = N 80° W

Vertical Angle = 40°



Date Plugged: 7-5-89

Time Completed: 2:00

Drilling Geologist: Scott Lesikar

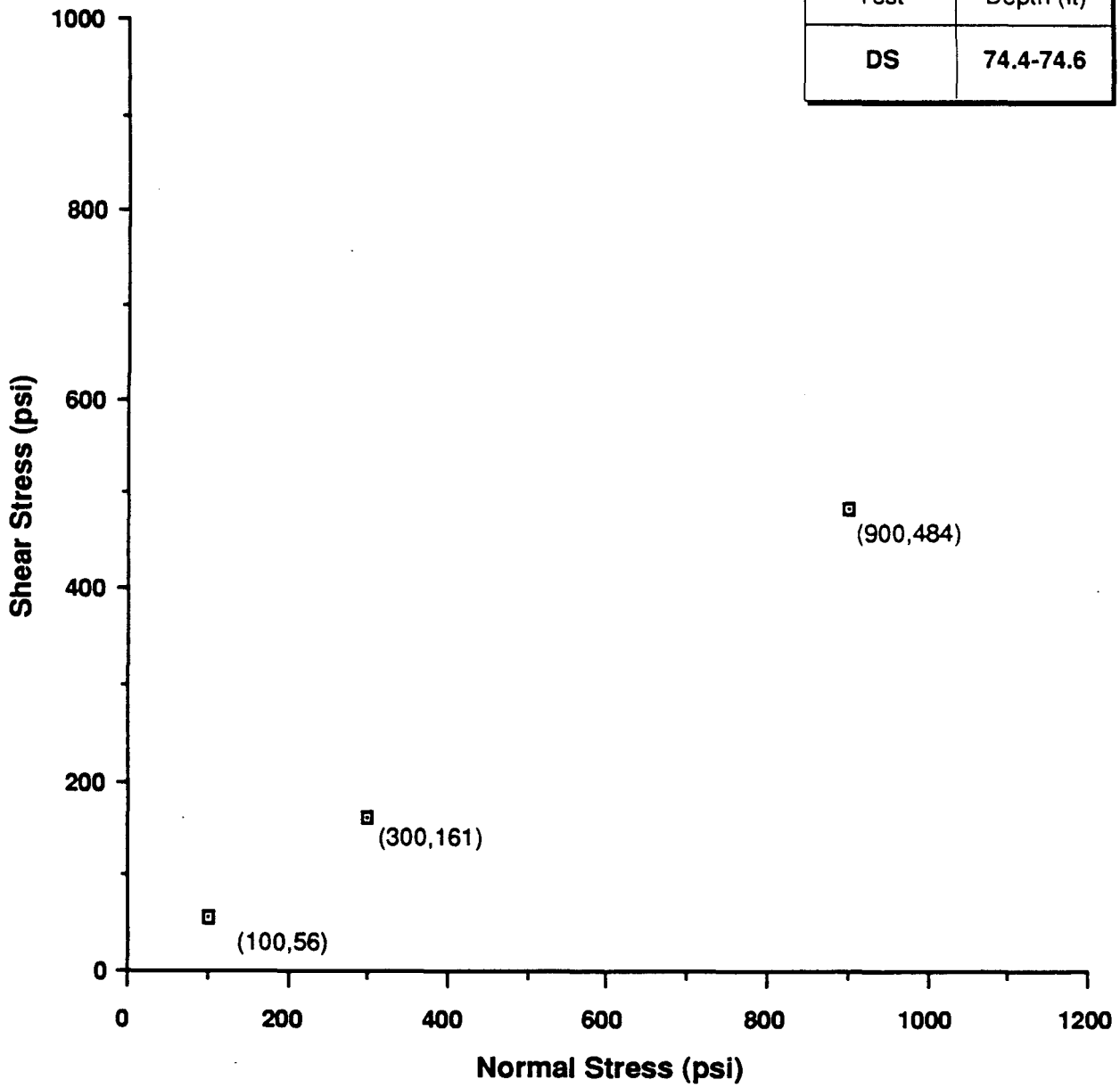
MJA Coordinator: Bill Flanigan

MJA No.: 5530.12

APPENDIX F

DIAGRAMS OF LABORATORY RESULTS

BORING SE1 Austin Chalk	
Test	Depth (ft)
DS	74.4-74.6



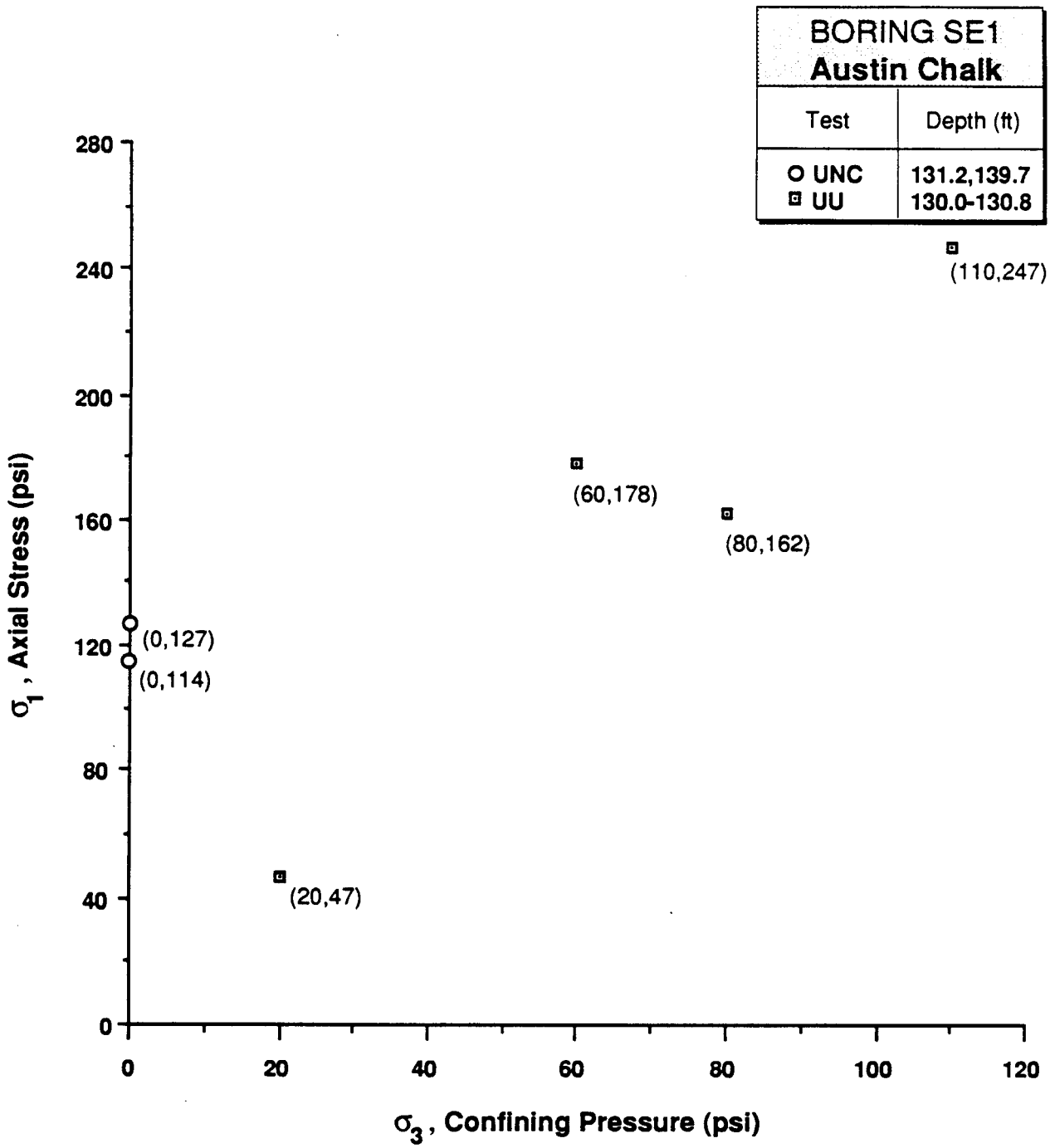
Vertical Depth 59.7-59.9 feet

DS-ISRM

The Earth Technology Corporation

Direct Shear Test
Texas SSC Site

FIGURE
F-1



Vertical Depths UNC 103.6, 110.2 feet
UU 102.7-103.3 feet

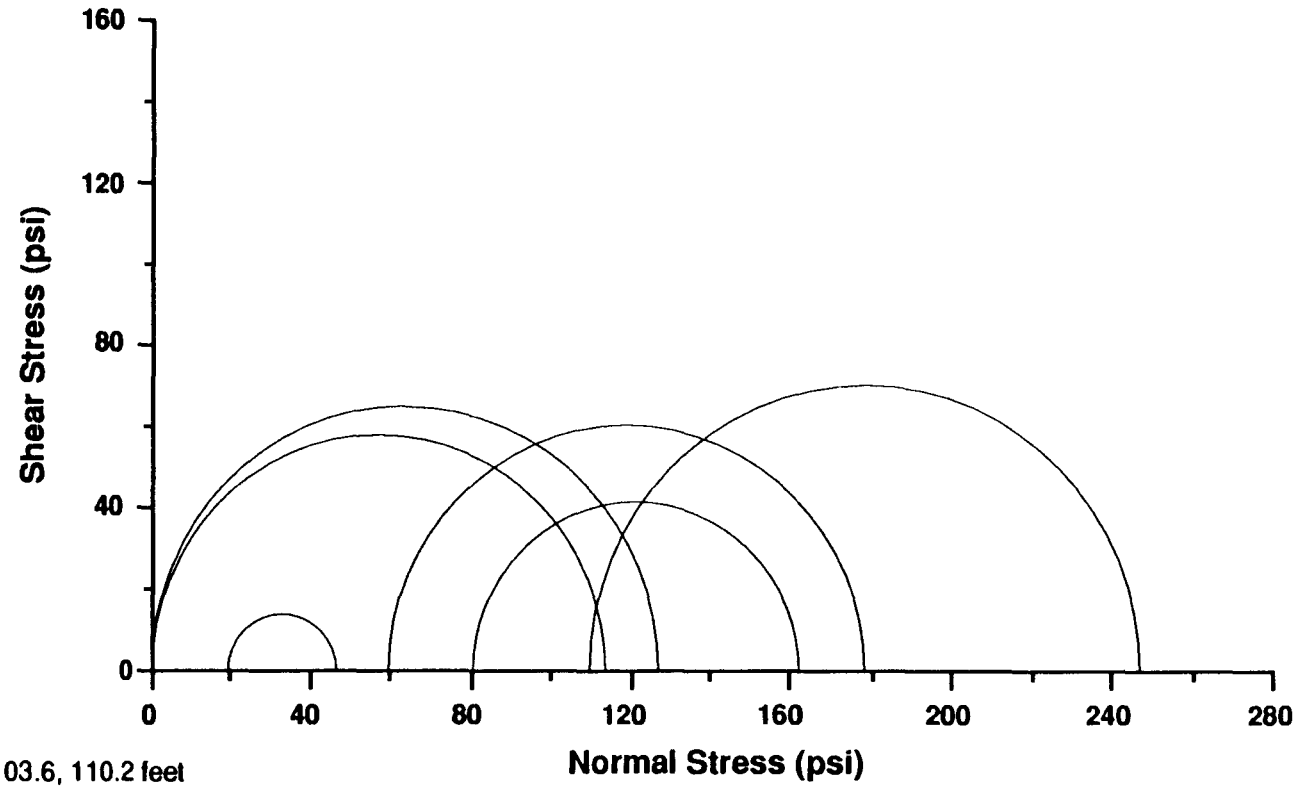
UNC-ASTM D2938
UU -ASTM D2664

The Earth Technology Corporation

Compression Test
Texas SSC Site

FIGURE
F-2

BORING SE1 Austin Chalk	
Test	Depth (ft)
UNC UU	131.2,139.7 130.0-130.8



Vertical Depths UNC 103.6, 110.2 feet
UU 102.7-103.3 feet

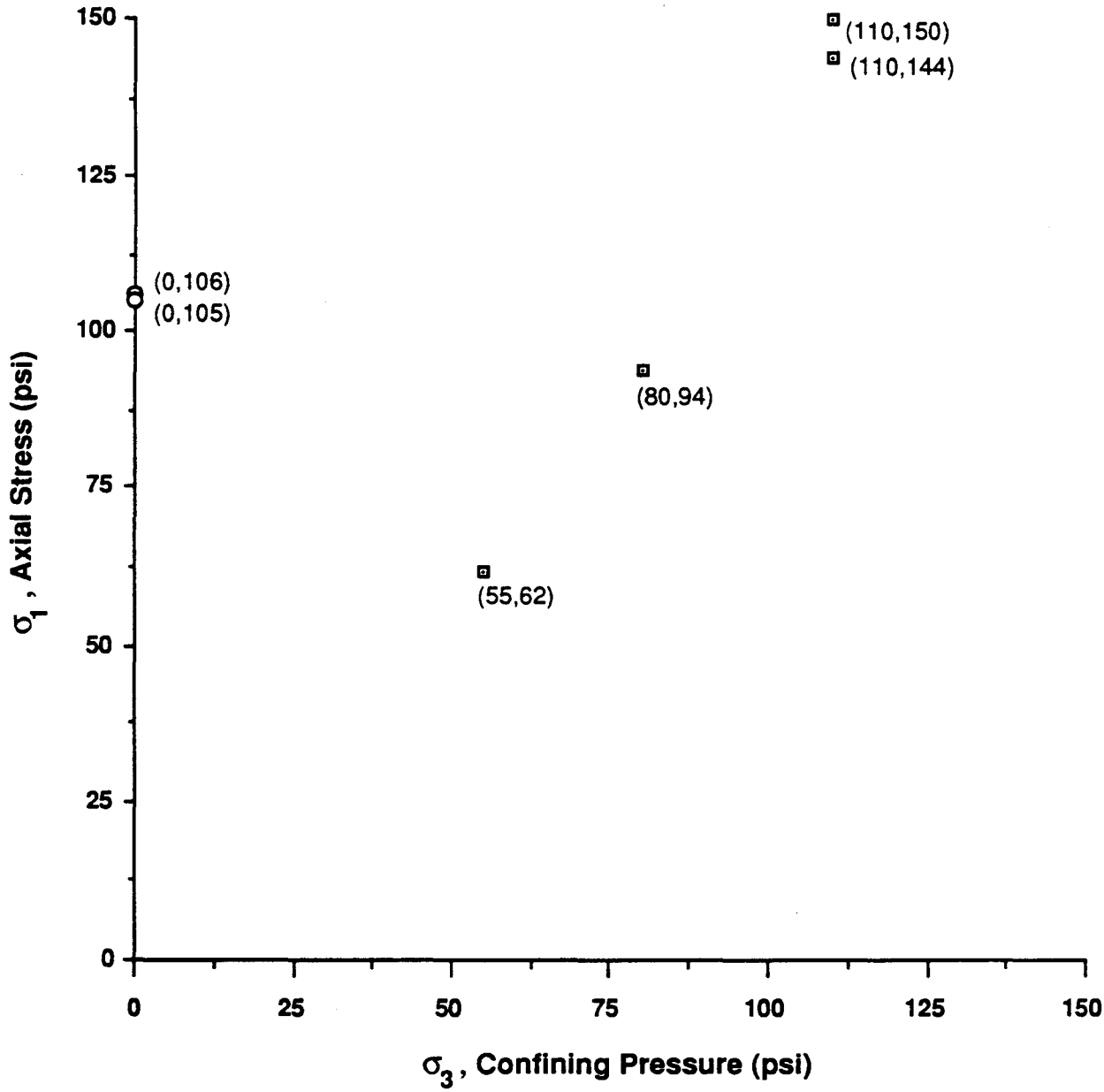
UNC-ASTM D2938
UU-ASTM D2664

The Earth Technology Corporation

Mohr Circle Plot
Texas SSC Site

FIGURE
F-3

BORING SE1 Eagle Ford Shale	
Test	Depth (ft)
O UNC ⊡ UU	165.0,178.9 179.9

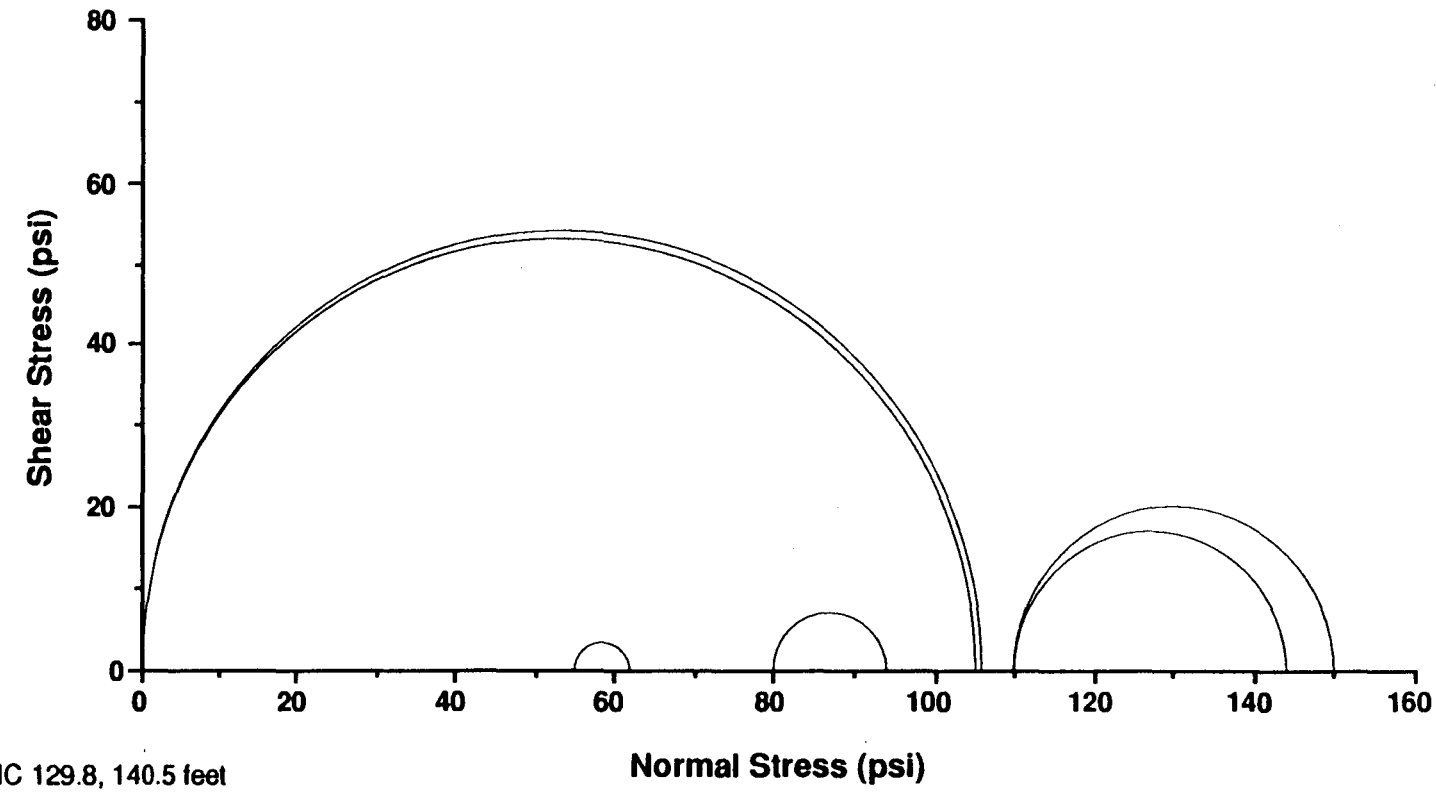


Vertical Depths UNC 129.8, 140.5 feet
UU 141.2 feet

UNC-ASTM D2938
UU -ASTM D2664

The Earth Technology Corporation	Compression Test Texas SSC Site	FIGURE F-4

BORING SE1 Eagle Ford Shale	
Test	Depth (ft)
UNC UU	165.0,178.9 179.9



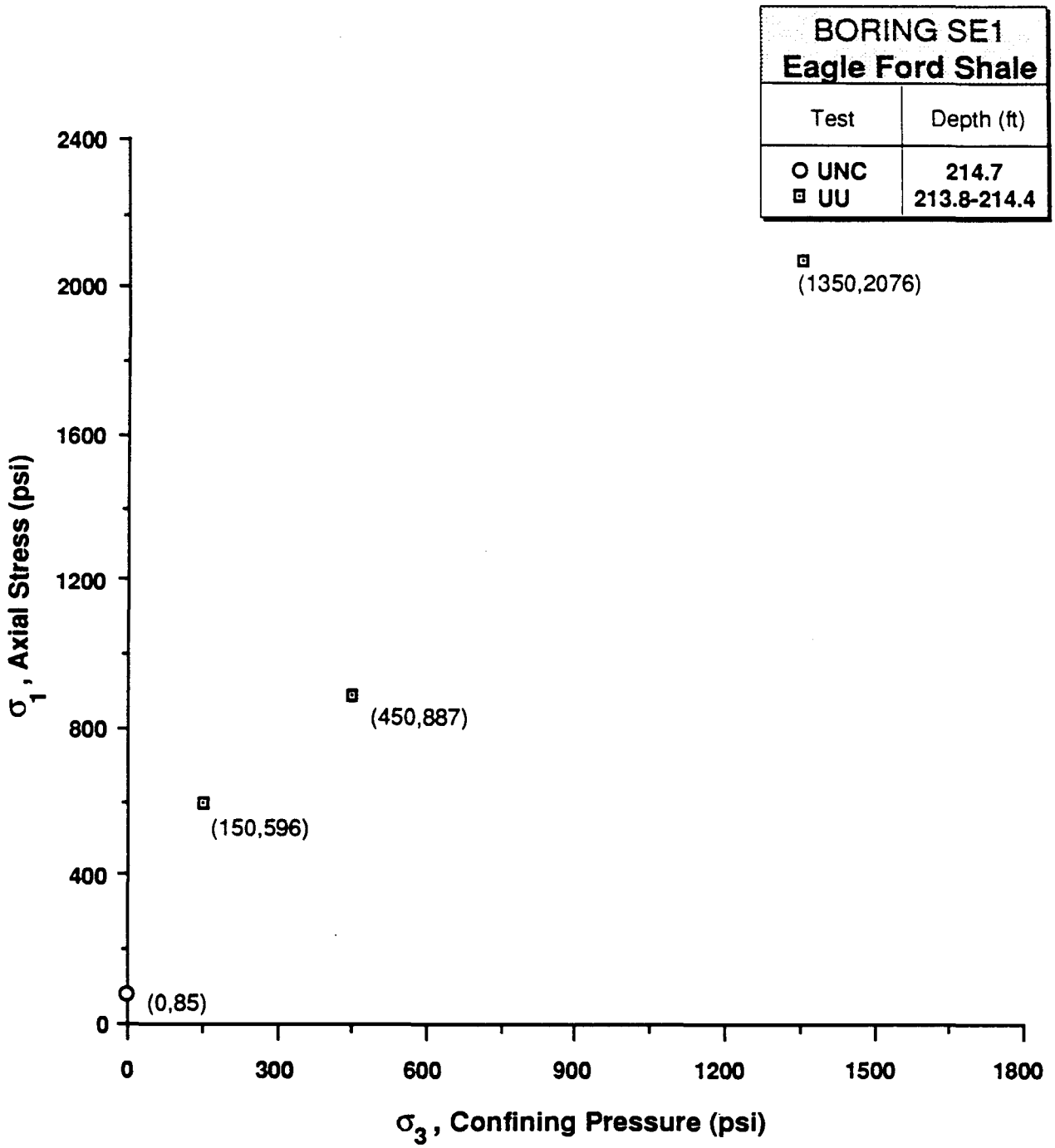
Vertical Depths UNC 129.8, 140.5 feet
UU 141.2 feet

UNC-ASTM D2938
UU-ASTM D2664

The Earth Technology Corporation

Mohr Circle Plot
Texas SSC Site

FIGURE
F-5



Vertical Depth UNC 167.6 feet
UU 166.9-167.3 feet

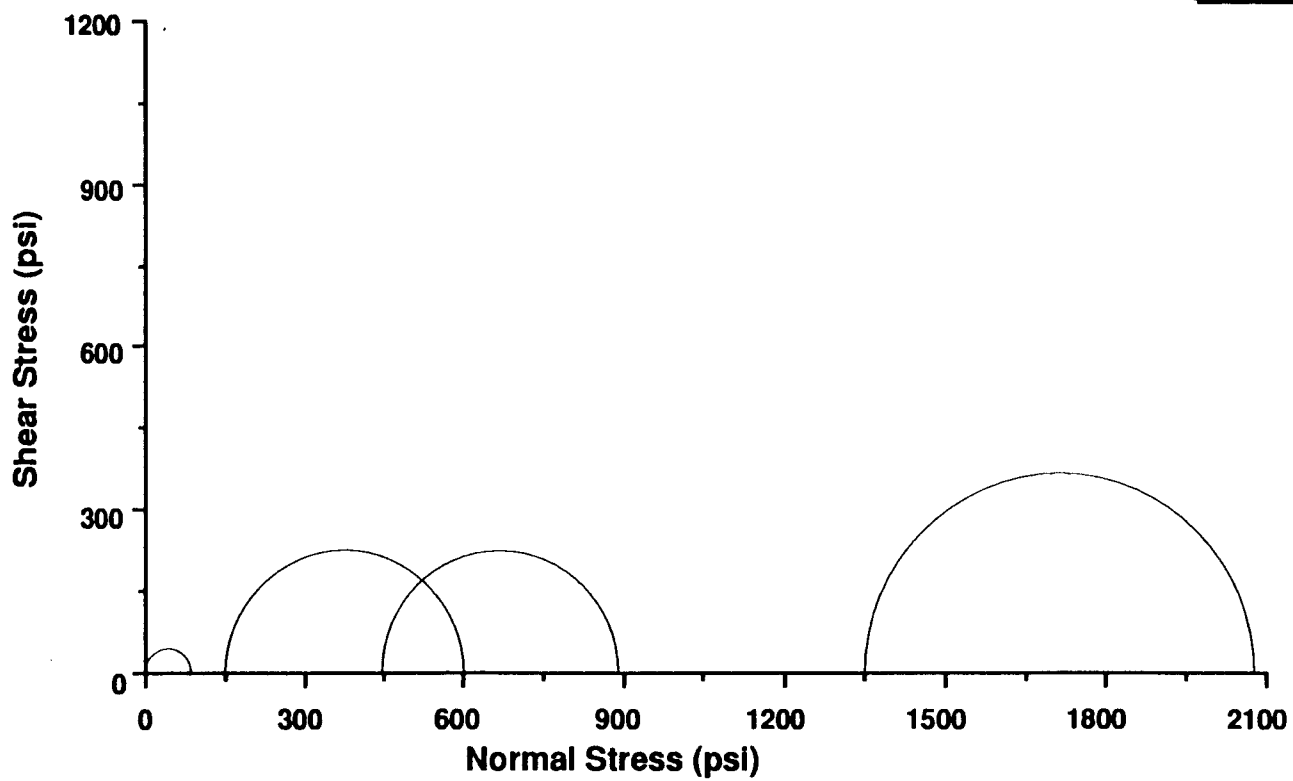
UU -ASTM D2664

The Earth Technology Corporation

Compression Test
Texas SSC Site

FIGURE
F-6

BORING SE1 Eagle Ford Shale	
Test	Depth (ft)
UNC	214.7
UU	213.8-214.4



Vertical Depth UNC 167.6 feet
UU 166.9-167.3 feet

UNC-ASTM D2938
UU-ASTM D2664

The Earth Technology Corporation

Mohr Circle Plot
Texas SSC Site

FIGURE
F-7

APPENDIX G

PHOTOGRAPHIC LOG

SSC Geotechnical Characterization
Client Project No. 87-888-0012
Boring No. SE-1

PHOTOGRAPHIC LOG

Date Photographed: 6/28/89
Bearing: ~S69° W-~S72° W
Vertical Angle: ~39-40°

Iris Setting: 10.5
Boring Condition: Good, Sli. cloudy
Water Condition: Clear

Surface Elevation:

Rock Section Photo: 65.8-105.1
(Vertical depth 53.1 to 83.4 feet)

Depth (ft.)	Feature and Trend	Notes
65.8 (53.1)*		Start Photography
67.2-67.7 (54.2-54.5)*	Fracture, hairline, appears tight Strike & Dip Trend: N40° E/40° SE	
68.1-68.3 (54.9-55.0)*	Fracture, hairline, irregularly curved, appears tight Strike & Dip Trend: N27° E/42° SE	
71.9-72.0 (57.8-57.9)*	Fracture, hairline to 1/16", appears tight Strike and Dip Trend: N43° E/29° SE	
72.6-73.4 (58.3-59.0)*	Fracture, hairline, unable to determine trend accurately due to feature leaving screen in same quadrant as entering Strike and Dip Trend: N25° E/38° NW to N52° E/60° NW	
74.4-75.0 (59.7-60.2)*	Fracture, hairline, w/apparent discontinuous fractures at 74.4, minor calcite mineralization (< 1/8") at 74.4 Strike & Dip Trend: N48° E/48° NW	
81.5-82.3 (65.2-65.8)*	Fracture, multiple (2), hairline to 1/8", appears tight Strike and Dip Trends: N73° E/73° NNW N68° E/51° NNE	
88.3-88.5 (70.4-70.6)*	Fracture, hairline, appears tight Strike & Dip Trend: N59° W/63° NE	

(Note: Vertical depths indicated in parenthesis)
Vertical depths interpolated from wire-line deviation logs

SSC Geotechnical Characterization
Client Project No. 87-888-0012
Boring No. SE-1

PHOTOGRAPHIC LOG

Date Photographed: 6/28/89
Bearing: ~S69° W-~S72° W
Vertical Angle: ~39-40°

Iris Setting: 10.5
Boring Condition: Good, Sli. cloudy
Water Condition: Clear

Surface Elevation:

Rock Section Photo: 65.8-105.1
(Vertical depth 53.1-83.4 feet)

Depth (ft.)	Feature and Trend	Notes
91.2-91.4 (72.7-72.8)*	Fracture, hairline, appears tight Strike & Dip Trend: N14° E/49° ESE	
92.1 (73.4)*	Fracture, hairline, appears tight Strike & Dip Trend: N35° E/65° SE	
94.1-94.2 (74.9-75.0)*	Fracture, hairline, appears tight Strike & Dip Trend: N31° E/48° SE	
94.7-95.3 (75.4-75.8)*	Fracture, hairline to 1/16", appears tight Strike & Dip Trend: N57° E/81° SE to N45° E/89° SE	
96.1-96.3 (76.4-76.6)*	Fracture, hairline, appears tight Strike & Dip Trend: N89° W/60° N	
96.3-97.0 (76.6-77.1)*	Fracture zone, complex, multiple, bentonite present, fractures truncating into additional fractures, hairline to 1/4", appears open Strike & Dip Trend: N64° E/30° SE	
96.8-98.1 (77.0-78.0)*	Complex and multiple fracture zone, seven or more sets of fractures truncating into each other, some wall rock missing due to drilling and washing of borehole, calcite mineralization and bentonite present, weathering noted 97.5-98.4, open intervals to 1/4" Major Trend: N58° W/78° SW Minor Trend: N23° W/81° ENE Minor Trend: N23° E/48° SE	

(Note: Vertical depths indicated in parenthesis)
Vertical depths interpolated from wire-line deviation logs

SSC Geotechnical Characterization
Client Project No. 87-888-0012
Boring No. SE-1

PHOTOGRAPHIC LOG

Date Photographed: 6/28/89
Bearing: ~S69° W-~S72° W
Vertical Angle: ~39-40°

Iris Setting: 10.5
Boring Condition: Good, Sli. cloudy
Water Condition: Clear

Surface Elevation:

Rock Section Photo: 65.8-105.1
(Vertical depth 53.1 to 83.4 feet)

Depth (ft.)	Feature and Trend	Notes
98.1-98.4 (78.0-78.2)*	Fracture, hairline to 1/8", multiple, with some calcite present, appears tight Strike & Dip Trend: N54° E/82° SE	
98.9-99.2 (78.6-78.8)*	Fracture, hairline, appears tight Strike & Dip Trend: N56° E/35° SE	

Note: Strike and dip trends are based upon trends determined in the photographs and upon wireline deviation tool survey. Resolution techniques were accomplished by stereographic methods utilizing a Schmidt Net.

Revised 10/11/89
WDJ.

(Note: Vertical depths indicated in parenthesis)
Vertical depths interpolated from wire-line deviation logs