SSCL-SR-1113

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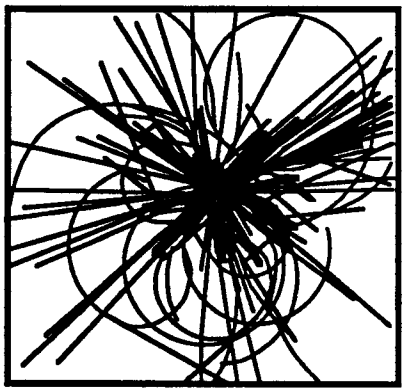
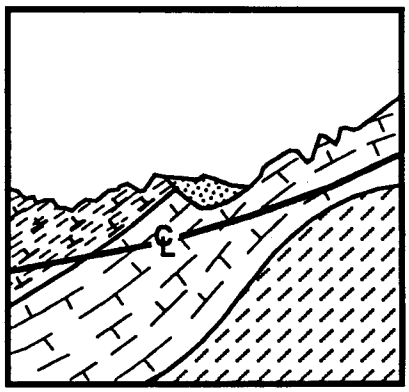
Project No. 87-888-0012
Report No. SSC-GR-54
July 1990

GR-54

Data Report for Structure Study Zone SF 10.1, Air Rotary Boreholes SF 10.1A, SF 10.1B, and Corehole SF 10.9C





Prepared by: The Earth Technology Corporation
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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
- Structure-specific data
- Global data.

This is one in a series of data reports prepared for the global data phase of geotechnical characterization at the SSC site. Data collection for this study phase focused on drillhole-based geological, geohydrological, geophysical, and geotechnical tests in the near vicinity of the E and F access shaft sites. Additionally, several coreholes were drilled where the main tunnel is expected to penetrate geotechnically significant as well as possibly problematic stratigraphic and structural intervals. The global data set has three key attributes: (1) uniform geographic distribution over the site footprint, (2) complete coverage of all of the strata through which the SSC tunnels and shafts will pass, and (3) consistency of the data from sampling site to sampling site throughout the SSC site. In combination with data from the other phases, these data will allow conceptual designs of construction methods. Each data report includes the results of both field and laboratory tests for specific drilling and sampling site(s).

DATA REPORT

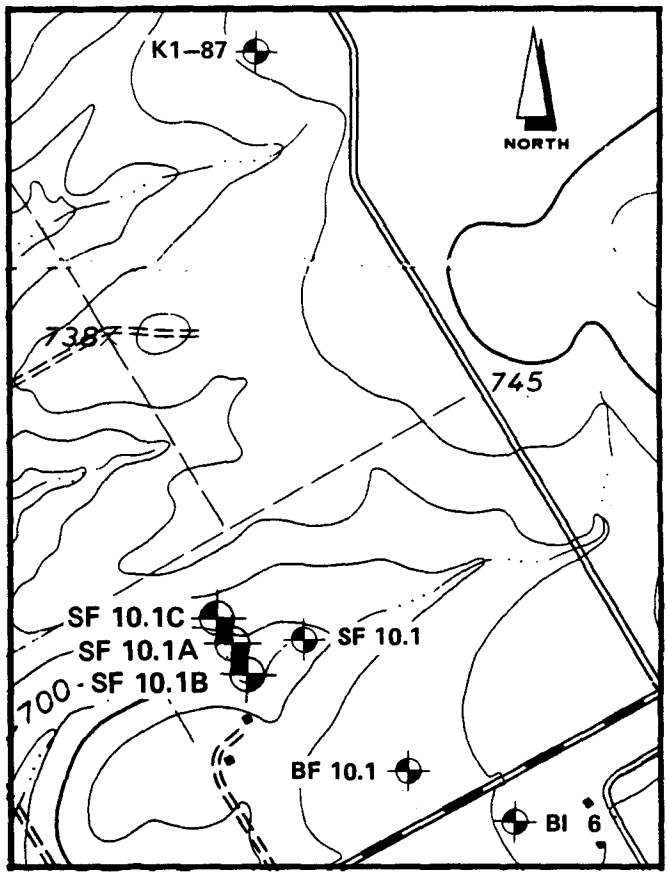
Site Designator: SF 10.1

Objective: The objectives for drilling at this location are to better define the location and nature of the geologic structure identified in surface geologic mapping and from previous borings, and determine geotechnical conditions through in-situ hydrological testing and laboratory geomechanical testing.

Structure Study Zone **SF 10.1** is located on the western side of the proposed tunnel alignment, approximately five miles east northeast of Maypearl, Texas.

SF 10.1A and **SF 10.1B** are vertical air rotary holes.

SF 10.1C is an angled corehole with a bearing of approximately S23°E, angled 50° from horizontal.



SCALE 1:12,000

0 500 1000 1500 2000 Feet

CONTOUR INTERVAL 10 FEET

Boring Locations:

Boring	Northing (feet)	Easting (feet)	Surface Elevation (feet)
SF 10.1A	246,949	2,173,300	715.9
SF 10.1B	246,831	2,173,386	713.1
SF 10.1C	247,047	2,173,209	718.3

Scope and Schedule:

- Borings

Boring	Drilling	Wire-Line Logging	Down-Hole Photography	Hydrologic Testing	Laboratory Testing	Plugging
SF 10.1A	March 14, 1990	March 14, 1990	Not Done	Not Done	Not Done	March 15, 1990
SF 10.1B	March 14, 1990	March 14, 1990	Not Done	Not Done	Not Done	March 14, 1990
SF 10.1C	March 1 to 7, 1990	March 7, 1990	March 15, 1990	March 10, 1990	March 27 to April 13, 1990	March 16, 1990

- Geologic Mapping - February 14 to February 19, 1990 (original mapping was done July 24 to July 27, 1989 for the initial borings at Structure Study Zone SF 10.1).
- Geophysical surveys
  - VLF Survey - February 4 to 6, 1990
  - Seismic Reflection Survey - February 4 to 6, 1990

Conditions Encountered: (see lithologic logs, Appendix A)

Boring	Total Depth (feet)	Soil (feet)	Weathered Chalk (feet)	Austin Chalk (feet)	Eagle Ford Shale (feet)
SF 10.1A	110.0	0.0 to 1.0	1.0-11.0	11.0-110.0	Not encountered
SF 10.1B	110.0	0.0 to 8.5	8.5-19.0	19.0-110.0	Not encountered
SF 10.1C	344.0 (inclined)	Not encountered	0.0-57.7	57.7-269.1	269.1-344.0
	263.5 (vertical)		0.0-44.0	44.0-205.5	205.5-263.5

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

Boring	Spontaneous Potential	Normal Resistivity (Short & Long)	Guard Resistivity	Point Resistance	Natural Gamma	Short & Long Gamma	Compensated Density (caliper)	Sonic Velocity (full wave)	Other
SF 10.1A	X	X	X	Note 1	X	X	X	X	
SF 10.1B	X	X	X	X	X	X	X	X	
SF 10.1C	X	X	X	X	X	X	X	X	Deviation

Note 1: Amplified 16" normal resistivity subtituted for missing point resistance data.

Geologic Mapping Results Summary: (see also Appendix C)

Previous borings and geologic mapping confirmed the presence of a fault. Additional mapping identified two prominent zones of calcite float that trend roughly N65°E through the structure study zone. Very low frequency (VLF) geophysical surveys and seismic reflection data confirm the existence and trend of the faults identified in the field mapping.

Field mapping, boring data, and geophysical studies indicate that the area is bounded by two faults forming a pull-apart graben with about 57 feet of down-drop. The graben appears to be roughly 300 to 550 feet wide. Analysis of boring logs suggests that the rock inside the graben is highly fractured and faulted. Appendix D shows the results of the geophysical studies conducted at the site.

Hydrologic Test Results Summary: (see also Appendix E).

Boring	Vertical Depth (ft)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)
SF 10.1C	198.8-215.5	250	20.0	Austin Chalk/ Eagle Ford Shale, (fracture zone)	8.5×10^{-7}
SF 10.1C	220.3-237.2	200	20.0	Eagle Ford Shale (fractured)	$<4.1 \times 10^{-8}$

Bulk and Clay Mineralogy Test Results:

Boring: SF 10.1C Formation: Eagle Ford Shale Depth: 270.8 feet

Whole Rock Composition:

Mineral	Percent
total clay	100
Total	100

Relative Clay Abundance:

Mineral	Percent
montmorillonite	44
illite	34
kaolinite	22
Total	100

Laboratory Geomechanical Test Results Summary: (see also Appendix F)

Vertical Depth (ft)	Formation/ Lithology	Moisture Content (%)	Dry Density (pcf)	*Compressive Strength (psi)	Tangent Young's Modulus E_{50} (psi x 10^5)	Brazil Tensile Strength (psi)
			SF 10.1C			
191-192	Austin Chalk	13-14	121	1484	4.53	241
198	Austin Chalk	12-14	121-125	793	3.78	
206-207	Eagle Ford Shale	22	105			
214-217	Eagle Ford Shale	15-18	111-118	161-199	0.51-0.88	
221-224	Eagle Ford Shale	15-18	111-114			
234-235	Eagle Ford Shale	15	117-121	153-307 (300)	0.72-1.31 (300)	

* UU Triaxial test indicated by confining pressure in parentheses.

Hole Status: (see also plugging reports, Appendix G). All holes were plugged with cement grout and abandoned.

APPENDIX A

LITHOLOGIC LOGS

LITHOLOGIC LOG

BORING SF 10.1A

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology corporation

TASK NO.: 12

BORING NO: SF 10.1A PG 1 OF 3

LOCATION: N 246,949 ft.
E 2,173,300 ft.

GROUND EL: 715.9 ft.

DATE: 2-14-90 TYPE: Air rotary CASED TO: N/A CONTRACTOR: SwL 89-192

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
									CLAY soft, silty, dark brown to black with roots. 1.0
5									LIMESTONE (Austin Chalk) soft, severely weathered, tan with occasional thin clay layers. 11.0
10									
									LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasoinal soft argillaceous and shaly layers.
15									
20									
25									
30									
35									
40									

SAMPLE LEGEND

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

WATER INFORMATION

Seepage encountered at 10.5'
Boring filled with fresh water upon completion

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1APG 2 OF 3

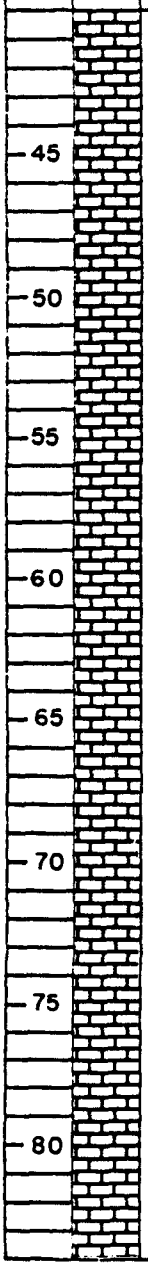
LOCATION: N 246,949 ft.
E 2,173,300 ft.

GROUND EL: 715.9 ft.

DATE: 2-14-90 TYPE: Air Rotary CASED TO: N/A CONTRACTOR: SwL 89-192

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.	SAMPLE LEGEND	WATER INFORMATION
									S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	see p. 1 of 3

DESCRIPTION OF STRATUM



LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasional soft argillaceous and shaly layers

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90)

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 12

BORING NO: SF 10.1A PG 3 OF 3
LOCATION: N 246,949 ft
E 2,173,300 ft.
GROUND EL: 715.9 ft.

DATE: 2-14-90 TYPE: Air Rotary CASED TO: N/A 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 p. 1 of 3

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
										LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasional soft argillaceous and shaly layers.
85										
90										-clay layer, soft, tan and dark gray at 89.0'-90.5'
95										
100										
105										
110										
										Bottom of Exploration at 110.0'
115										
120										

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90)

LITHOLOGIC LOG

BORING SF 10.1B

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1B PG 1 OF 3

LOCATION: N 246,831 ft.
E 2,173,386 ft.

GROUND EL: 713.1 ft.

DATE: 2-14-90 TYPE: Air Rotary CASED TO: 2.0' CONTRACTOR: SwL 89-192

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 soft, silty, dark brown to black, with roots. 3.0
5									CLAY medium, silty, tan and brown with embedded fine limestone fragments. 5.0
10									CLAY medium, silty tan with occasional thin limestone layers. 8.5
15									LIMESTONE (Austin Chalk) soft, severely weathered, tan with occasional thin clay layers. 19.0
20									LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasional soft, argillaceous layers.
25									
30									
35									
40									-shaly limestone, soft, dark gray at 39.0'-39.5'

SAMPLE LEGEND

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

WATER INFORMATION

Seepage encountered at 13.0'
Boring filled with fresh water upon completion

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1B PG 2 OF 3

LOCATION: N 246,831 ft.
E 2,172,386 ft.

GROUND EL: 713.1 ft.

DATE: 2-14-90 TYPE: Air Rotary CASED TO: 2.0' CONTRACTOR: SwL 89-192

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.	SAMPLE LEGEND	WATER INFORMATION
									S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	See p. 1 of 3
									DESCRIPTION OF STRATUM	
45 50 55 60 65 70 75 80									LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasional soft argillaceous and shaly layers.	

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1B PG 3 OF 3

LOCATION: N 246,831 ft.
E 2,173,386 ft.

GROUND EL: 713.1 ft.

DATE: 2-14-90 TYPE: Air Rotary CASED TO: 2.0' CONTRACTOR: SwL 89-192

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
										LIMESTONE (Austin Chalk) medium, fresh, light gray to dark gray with occasional soft argillaceous and shaly layers.
85										
90										
95										
100										-hard calcite layer at 99.5'
105										
110										
										Bottom of Exploration at 110.0'
115										
120										

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 3

DRILLING GEOLOGIST Shawn Wood ASSISTANT _____ CHECKED BY Shawn Wood

(3-7-90)

LITHOLOGIC LOG

BORING SF 10.1C

LOG OF BORING

BORING NO: SF 10.1CPG 1 OF 9

PROJECT: SSC-- Texas Site

CLIENT: The Earth Technology Corporation

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

TASK NO.: 12

DATE: 3/1/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

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.
5									
10		C1	8.7	16.5	62	9			
15									
20		C2	16.5	26.5	95	91			
25									
30		C3	26.5	36.5	60	47			
35									
40		C4	36.5						

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), highly to completely weathered, soft to moderately hard, slightly fossiliferous, tan w/iron-stained fractures

21.2g-21.4s thin, high.wea., mod.argill., soft tan bed

26.5-27.2 fracture, calcite-filled, narrow (~1mm), mod.wea. (N68°E, 50°S)

29.0-29.1 fracture, calcite-filled, narrow (~1mm), mod.wea. (horizontal)

29.85-29.95 fracture, calcite-filled, v.wide (~0.1'), mod.wea- (N60°E, 40°NW)

30.3g-30.7s thin, mod.to high.wea., sli.argill., soft tan bed

30.7s-31.8s thin, mod.wea., sli.fossil., mod.hard tan bed

36.7-37.2 50° fracture, sli.rough, stained, mod.wea.

39.6g-40.0g thin, mod.to high.wea., v.argill./shaly, soft tan bed

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 2 OF 9

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/1/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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.
		C4			49	29			
45				46.5			Stopped Drilling 3-1-90		
		C5	46.5	53.75	60	58	Started Drilling 3-2-90		
50									
55		C6	53.75	56.5	43	43			
		C7	56.5	66.5	97	95			
60									
65									
		C8	66.5	76.5	100	99			
70									
75									
		C9	76.5	83.1	99	74			
80									

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), highly to completely weathered, soft to moderately hard, slightly fossiliferous, tan w/numerous iron-stained fractures

40.6g-41.0g gouge material (clay/limestone), highly to mod. wea., soft, tan
41.0g-41.4g gouge material, sli. to mod. wea., v. argill., soft to mod. hd., med. gray
46.8-47.2 fracture, stained, v. narrow, mod. wea., dk. gray argill. ls. and tan ls. along contact (dip. ~ 50°)
47.2 fracture, slks., med. rough, closed, stained (horizontal)
47.3-47.6 fracture, slks., med. rough, calcite filled, stained (N80°W, 23°SW)
47.6-47.8 fracture, calcite filled, wide, intersects above frac. (E-W, 75° S)
47.7-47.9 fracture (do. above): sep. by 0.1 ft.
50.2-50.4 gouge material, brecciated ls., v. argill., dk. gray.
50.8-50.9 calcite
53.75-54.95 calcite w/brecciated, sli. wea., mod. hd. ls. and v. argill. ls., med. gray to tan
56.0-56.5 void (inferred by driller)
56.5-56.6 fracture, calcite/mod. wea, mod. hd. tan ls., rough, stained, v. wide
56.6g-57.1s thin, mod. wea., med. hd., tan bed
57.1s-57.7s thin, sli. wea., mod. hd., lt. gray bed
57.7s

LIMESTONE (Austin Chalk), fresh, medium to moderately hard, slightly fossiliferous, occasional pyrite, light gray w/ 0.2 to 2.3ft. thick, slightly to very argillaceous/shaly, medium to dark gray, soft to moderately hard interbeds spaced 1.6 to 2.7ft. apart; w/fractures, often w/slickensides, calcite infilling, and occasional brecciated/sheared zones

57.7s-59.0s med. thick, sli. to mod. argill., med. to mod. hd., med. to dk. gray bed w/occ. pyrite
57.8-58.0 fracture, slks., rough, partially clean, v. narrow, fresh w/some pyrite
61.7g-62.8g med. thick, v. argill/shaly, soft to med. hd., dk. gray bed
61.9-62.2 fracture, slks., rough, clean, closed, fresh (N60°E, 20°SE)
62.8g-63.6s thin, sli. argill., mod. hd., med. gray bed
65.7s-66.8s med. thick, v. argill/shaly, soft to med. hd, dk. gray bed
66.6-66.8 fracture, slks., rough, clean, closed, fresh (N30°W, 36°SW)
66.8s-67.2s thin, sli. argill., mod. hd., med. gray bed
67.2s-69.4s med. thick, sli. fossil., lt. gray bed, w/horiz. calcite (~2 to 10mm) @68.3'
69.4s-69.6s thin, v. argill./shaly, soft, dk. gray bed
72.8s-73.3g thin, v. argill./shaly, soft, dk. gray bed
73.3g-74.9g med. thick, sli. to mod. argill., med. hd., med. gray bed
73.6-74.1 fracture, slks., rough, v. narrow, fresh w/pyrite (N30°W, 30°SW)
77.0s-78.2s med. thick, sli. to v. argill./shaly, soft to mod. hd., med. to dk. gray bed (v. argill./shaly, soft, dk. gray 77.6s-79.9s)
79.2-80.3 Shear Zone, brecciated ls., some calcite, soft to mod. hd., black to gray, completely broken w/slks. fractures

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

Rev. 4/19/90

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 3 OF 9

LOCATION: ~N 247,047 Feet
~N 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/2/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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.
		C9		83.1				
		C10	83.1	86.5	94	94		
85		C11	86.5	96.5	100	100		
90								
95								
		C12	96.5	106.5	90	90		
100								
105								
		C13	106.5	116.5	100	100	Stopped Drilling 3-2-90	
110								
115								
		C14	116.5				Started Drilling 3-3-90	
120								

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard sli. fossil., lt. gray, w/ 0.1 to 2.7ft. thick, sli. to v. argill./shaly and occ. bentonitic, med. to dk. gray, soft to mod. hard interbeds spaced 1.0 to 4.0ft. apart; with fractures, often slickensided and occ. calcite-filled

80.3g-81.5g	med. thick, sli. argill. mod. hd., med. gray bed
81.5g-83.0g	med. thick, v. argill./shaly, soft, w/slks. fractures, completely broken
87.1	fracture, closed, clean, fresh (N30°E, 68°NW)
87.2	fracture, slks., sli. rough, clean, closed, fresh (N70°E, 68°NW)
87.2g-87.4g	thin, sli. argill., mod. hd., med. gray bed
87.4g-89.3s	med. thick, v. argill./shaly, soft, dk. gray bed
88.2	fracture, slks., v. rough, clean, fresh (N40°E, 64°NW)
90.8-91.2	fractures, multiple, calcite-filled, wide, fresh (prominent N55°E, 70°SE)
91.2-92.0	fracture, slks., calcite-filled (~0-20mm), wide to v. wide, fresh (N60°E, 70°SE)
92.6	fracture, slks., rough, closed, fresh (horizontal)
93.4	fracture, slks., rough, some calcite filling, fresh (E-W, vertical)
96.5g-96.9s	thin, v. argill./shaly, soft, dk. gray bed
96.8	fracture, slks, rough, clean, closed, fresh (horizontal)
98.4	fracture, rough, calcite-filled, v. wide, fresh (horiz.)
98.4-98.9	fracture, closed, clean, v. narrow, fresh (N80°W, 52°SW)
99.2g-99.5g	thin, v. argill./shaly, soft, dk. gray bed
99.5g-100.4g	thin, mod. argill., soft, med. gray bed
100.4g-100.6s	thin, v. argill./shaly, soft, dk. gray bed
100.5	fracture, slks., rough, closed, clean, fresh (horizontal)
102.5s-103.2g	thin, mod. argill., soft, dk. gray bed
107.0s-108.4s	med. thick, v. argill./shaly, soft, dk. gray bed
109.4s-109.8s	thin, v. argill./shaly, soft, dk. gray bed
110.9s-111.0s	v. thin, mod. argill., med. gray bed
111.0	fracture, slks., rough, clean, closed, fresh (N70°W, 45°NE)
112.8	fracture, slks, clean, closed, fresh (N60°E, vertical)
112.9g-113.5g	thin, v. argill./shaly, soft, dk. gray bed
116.2g-117.0g	thin, sli. argill., med. gray bed
119.1-119.8	fracture, slks., rough, closed, clean, fresh (N80°W, 45-50°SW)
119.8s-120.3s	thin, mod. argill., soft, dk. gray bed w/v. thin (~10mm) bentonite lamination @ 120.0'

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 4 OF 9

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/3/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

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		126.5	99	99			LIMESTONE(Austin Chalk),fresh,med.to mod.hard,sli.fossil.,occ. pyrite nodules,lt.gray w/ 0.2 to 7.5ft.thick sli.to v.argill./ shaly,med.to dk.gray,soft to mod.hard interbeds spaced 0.45 to 4.6ft.apart; with occ.fractures,often w/slickensides 123.1s-123.55g thin,v.argill./shaly,soft,dk.gray bed 123.55g-123.8g thin,sli.argill.,mod.hd.,med.gray bed
125									
		C15	126.5	136.5	100	100			128.4g-128.6s thin,sli.argill.,mod.hd.,med.gray bed 130.0g-135.2g thick,sli.to mod.argill.,mod.hd.,med.gray bed (soft 130.9'-131.6',soft to mod.hd.131.8'to132.2')
130									
135									
		C16	136.5	146.5	97	97			137.4g-139.8g med.thick,sli.to mod.argill.,mod.hd.,med.gray bed(mod.argill.,soft to mod.hd,dk.gray 138.0'-139.1') 140.25g-140.9g thin,sli.argill.,mod.hd.,med.gray bed 143.5g-151.0g thick,sli.to v.argill./shaly,soft to mod.hd.,med. to dk.gray bed(soft 148.4'-150.4',v.argill./ shaly,dk.gray w/pyrite nodules 150.1g -150.4s)
140									
145									
		C17	146.5	156.5	100	100			148.6-149.5 fracture,slks.,sli.rough,clean,closed,fresh (N40°E,55°SE) 148.6 intersecting fractures(2),slks.,sli.rough,clean, closed,fresh(N20°E,63°NW) &(N80°W-50°N) 150.4-150.9 fractures(4),slks.,sli.rough,clean,closed,fresh (4 @ N70°W,55°NW),(1 intersecting @N80°E,43°SE) 152.8s-153.0s thin,v.argill./shaly,soft,dk.gray bed 153.0s-156.6s thick,sli.argill.to v.argill.,soft to mod.hd., med.to dk.gray bed(soft,dk.gray,fractured 153.7'-155.0';soft to mod.hd. 155.0'-156.6') 153.5-153.7 fracture,slks.,sli.rough,clean,closed,fresh (N80°W,75°SW)
150									
155									
		C18	156.5						158.4s-160.0g med.thick,mod.argill.,soft,dk.gray bed 159.8 fracture,slks.,sli.rough,clean,closed,fresh (N50°E,67°NW)
160									

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 5 OF 9

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/3/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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.
		C18			100	100		
165				166.5				
		C19	166.5		100	100		
170								
175				176.5				
		C20	176.5		99	99		
180								
185				186.5			Stopped Drilling 3-3-90	
		C21	186.5		100	100	Started Drilling 3-5-90	
190								
195				196.5				
		C22	196.5					
200								

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossil., lt. gray w/ 0.4 to 3.3ft. thick sli. to v. argill./shaly, and occ. bentonitic, med. to dk. gray, soft to mod. hard interbeds spaced 0.4 to 3.5ft. apart; occ. fractures, often slickensided and occ. calcite-filled

160.1	fracture, slks, rough, clean, closed, fresh (N50°E, 67°NW)
161.3	fracture, rough, partially calcite-filled (~3mm), fresh, (N60°E, 76°NW)
161.3s-162.3g	med. thick, v. argill., soft, dk. gray bed
164.0g-165.5s	med. thick, sli. to mod. argill., soft to mod. hd., med. to dk. gray bed (soft, dk. gray 164.0'-164.8' & 165.1'-165.5')
167.7g-169.1s	med. thick, mod. argill., mod. hd., dk. gray bed
169.8g-172.8g	thick, mod. argill. to v. argill., soft to mod. hd., med. to dk. gray bed (soft, dk. gray 170.6'-171.4')
170.2-171.3	fracture, slks., rough, clean, fresh
172.8g-175.5g	med. thick, mod. hd., lt. gray fractured bed
172.9-173.75	fracture, rough, partially calcite-filled (< 1mm), closed, fresh (N10°W, 60°SW)
173.7-175.0	multiple fractures, rough, calcite-filled (1 to 5mm), fresh (~N30°W, 74°SW)
175.5-176.0	~45° fracture, calcite filled
177.7g-181.0s	thick, sli. argill. to v. argill., soft to mod. hd., med. gray bed (soft 177.7'-178.3')
178.0	fracture, slks., rough, clean, closed, fresh (N50°E, 55°NW)
179.0&179.3	fractures (2), slks., rough, clean, closed, fresh, both @ (N80°W, 72°NE)
179.6	fracture, slks., rough, clean, closed, fresh (N90°W, 77°N)
184.5g-186.4g	med. thick, v. argill./shaly, soft, dk. gray bed
187.9g-189.25s	med. thick, sli. to mod. argill., soft to mod. hd., med. to dk. gray bed w/ lt. gray ls. inclusions (~.05 to 0.1' dia.), trace bentonite
190.6g-194.2g	med. thick, sli. argill. to v. argill., mod. hd., med. gray bed
192.6g-194.2g	med. thick, mod. hd., lt. gray bed, bioturbated @ bottom
194.2g-195.4g	med. thick, v. argill., mod. hd., fossil., med. to dk. gray bed
196.2g-199.1g	med. thick, sli. argill. to v. argill. mod. hd., med. to dk. gray bed (dk. gray 197.1'-197.7')
199.5g-199.9g	thin, sli. argill., mod. hd., med. gray bed

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 6 OF 9

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/5/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

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.
		C22			100	100			
205				206.5					
		C23	206.5		98.5	98.5			
210									
215				216.5					
		C24	216.5		100	100			
220									
225				225.8					
		C25	225.8		100	100			
230									
235				235.8					
		C26	235.8		100	100			
240									

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossil., occ. pyrite nodules, .1t.gray w/ 0.25 to 5.9 ft. thick, sli. to v. argill./shaly and occ. bentonitic, med. to dk.gray, soft to mod. hard interbeds spaced 0.8 to 3.0 ft. apart.

202.4s-204.3g med. thick, v.argill. to v.argill./shaly, soft to mod.hd; med. to dk.gray bed (v.argill./shaly, soft dk.gray 203.0g-203.5g; soft to mod.hd. 203.5g-204.3g)

205.8g-208.2s med. thick, sli. to mod.argill., mod.hd., med.gray bed

208.2s-208.35s very thin, v.argill./shaly, bentonitic, soft, dk. gray bed

209.5g-210.8s med. thick, sli.argill., mod.hd, med.gray bed

210.8s-212.1g med. thick, v.argill., soft, dk.gray bed

213.5s-213.75.s thin, v.argill./shaly, bentonitic, soft, dk.gray bed

214.7s-220.6g thick, sli. to v.argill./shaly, soft to mod.hd., med. to dk.gray bed (v.argill./shaly, soft, dk.gray 214.7s-214.9s; v.argill., soft to mod.hd. dk.gray 214.9s-217.0g)

223.6g-224.9g med. thick, mod.argill., mod.hd., med.gray bed w/ pyrite nodule @ 224.75

224.9g-226.3s med. thick, mod.hd., 1t.gray bed w/pyrite nodule

226.3s-228.0g med. thick, mod. to v.argill./shaly, soft to mod. hd., med. to dk.gray bed (v.argill./shaly, soft, dk.gray 226.85g-226.95g)

229.2s-229.5g thin, v.argill./shaly, soft, dk.gray bed

229.5g-230.1g thin, mod.argill., mod.hd., med.gray bed

230.1g-232.2g med. thick, mod.hd., 1t.gray bed, bioturbated @ base

232.2g-233.4g med. thick, sli. to mod.argill., med.gray bed

235.8g-237.4g med. thick, mod.argill., mod.hd., dk.gray bed

238.2g-238.5g thin, sli.argill., mod.hd., med.gray bed

238.5g-239.1g thin, v.argill., mod.hd., fossil., dk.gray, occ. pyrite

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

BORING NO: SF 10.1C PG 7 OF 9

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/5/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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.
		C26		245.8	100	100		
245			245.8					
250		C27	245.8	255.8	95	93	Stopped Drilling 3-5-90	
255								
260		C28	255.8	265.9	100	100	Started Drilling 3-6-90	
265								
270		C29	265.9	274.4	60	60		
275		C30	274.4		100	100		
280								

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE(Austin Chalk),fresh,med.to mod.hd.,sli.fossil.,lt.gray w/ 0.2 to 2.3ft.thick sli.to v.argill./shaly,and occ.bentonitic, med.to dk.gray interbeds spaced 1.0 to 5.0ft.apart;numerous fractures,often slickensided and occ.calcite-filled

241.7g-242.5g	thin,v.argill./shaly,bentonitic,soft,dk.gray bed
244.4s-245.0s	thin,v.argill./shaly,soft,dk.gray bed
245.0s-246.7g	med.thick,mod.argill.,mod.hd.,dk.gray bed
248.65	fracture,clean,closed,fresh,(N40°E,44°NW)
249.5s-249.7s	thin,v.argill./shaly,soft,dk.gray bed
252.6	fracture,slks.,rough,clean,closed(N85°E,32°NW)
252.9	fracture,clean to calcite-filled(~0 to 2mm) (horizontal)
256.4s-256.7s	thin,v.argill./shaly,soft,dk.gray bed
257.7	fracture,slks.,rough,clean to calcite-filled, narrow,fresh(N70°E,30°NW)
258.15	fracture,slks.,rough,clean,closed,fresh(N65°E, 45°NW)
258.4	do.above (N70°W,45°NE)
258.7	do.above (N75°W,42°NE)
258.8	do.above (N60°E,40°NW)
259.3g-260.3g	med.thick,sli.to mod.argill.,mod.hd.,med.gray bed
261.8s-262.6g	thin,mod.to v.argill./shaly,soft,dk.gray bed
261.9	fracture,slks.,rough,clean,closed,fresh(horiz.)
262.4-262.8	do.above (N80°E,45°NW)
263.25	do.above (N80°W,68°NE)
263.3	do.above (N60°E 65°NW)
264.0	do.above (N85°W,75°NE)
265.4-265.5	fractures(3)@50°to horiz.,slks.,rough,clean to calc.-filled(~3mm)
265.9	fracture,slks.,rough,clean,closed,fresh(E-W, 35°N)
265.9g-267.6s	med.thick,mod.hd.fractured bed(265.9'-266.8' comp. brecciated)
265.9-266.8	fractures(numerous),35°-60°,brecciated,slks.,rough
266.8	60°fracture,slks.,rough,clean,fresh
266.9-267.0	65°fracture,slks.,rough,clean,fresh
267.6s	

Transition Zone,med.thick,v.argill./shaly,calc.,soft to mod.hd., 269.1s dk.gray bed

SHALE(Eagle Ford),fresh,soft,v.fine grained,v.thinly bedded,non. calcareous,dk.gray,w/numerous slickensided fractures

274.4-277.8	fractures(multiple)slks.,smooth to rough,sli. undul.,closed,clean,fresh
278.1-280.5	fractures,slks.,smooth to rough,sli.undul.,clean, closed,fresh @ 278.1'-278.5',278.8',278.8-279.2', 279.6'-279.75'

DRILLING GEOLOGIST Boyd Dryer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

BORING NO: SF 10.1C PG 8 OF 9

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/6/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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.
		C30		284.4				
285		C31	284.4	294.4	99	99		
290								
295		C32	294.4	304.4	96	96		
300								
305		C33	304.4	314.4	100	100	Stopped Drilling 3-6-90	
315		C34	314.4		100	100	Started Drilling 3-7-90	
320								

SAMPLE LEGEND

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

WATER INFORMATION

Wet rotary core hole, water level not determinable

DESCRIPTION OF STRATUM

SHALE (Eagle Ford), fresh, soft, v.fine grained, v.thinly bedded, non-calcareous, dk.gray w/occ.septarian concretions, pyrite nodules and numerous slickensided fractures

280.1	fracture slks., smooth to sli.rough, sli.undul., clean, closed, fresh	(N80°E, 75°NW)
284.0	do.above	(N85°W, 72°NE)
284.15	do.above	(E-W, vert.)
285.4	do.above	(E-W, 70°N)
285.5	do.above	(N80°W, vert.)
286.0-288.2	fractures (numerous)-lab sample, no measurements made	
288.2	fracture, slks., smooth to sli.rough, clean, closed fresh	(N80°W, 55°NE)
288.3	do.above	(N10°E, 55°NW)
292.6	do.above	(N35°E, 52°NW)
294.9	pyrite nodule	
295.0-296.8	fractures, multiple	
298.6	fracture, slks., smooth to sli.rough, sli.undul., clean, closed, fresh	(N60°W, 15°SW)
299.6	do.above	(N80°W, 15°SW)
299.6g-300.8g	med.thick, silty, sandy, mod.hd., layers, interbedded w/shale	
299.9	fracture, slks, smooth to sli.rough, sli.undul., clean, closed, fresh	(E-W, 25°SW)
302.0	do.above	(E-W, 10°SW)
302.1	do.above	(E-W, 5°SW)
303.3	do.above	(E-W, 65°N)
303.7	do.above	(horizontal)
305.0-305.2	do.above	(E-W, 10°S)
305.3-305.5	do.above	(E-W, 10°S)
305.6-305.8	do.above w/numerous intersecting fractures	(N80°W, 85°NE)
316.8-316.9	septarian concretion w/pyrite	

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

Rev. 4/19/90

LOG OF BORING

BORING NO: SF 10.1C PG 9 OF 9

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 12

LOCATION: ~N 247,047 Feet
~E 2,173,209 Feet

GROUND EL: ~718.3 Feet

DATE: 3/7/90 TYPE: NX Angle Core (1) CASED TO: 3.0' CONTRACTOR: MJA

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

WATER INFORMATION
Wet rotary core hole, water level not determinable

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
		C34		324.4	100	100				SHALE (Eagle Ford), fresh, soft, very fine grained, very thinly bedded, non-calcareous, dark gray
325		C35	324.4	334.0	100	100				
330										
335		C36	334.0	344.0	100	99				337.5 very thin, fossiliferous, prismatic lamination (~3mm)
340										
345										Total Depth 344.0' 3-7-90
350										(1) Angle Hole Field Azimuth: S22°E Plunge: 50° (2) Wash bored to 8.7' w/o sampling (3) Wireline Logged 3-7-90 (4) Hydrotested 3-10-90 (5) Nx (3/8" dia.) casing was extended from 3.0' to 65.0' and an initial attempt at down-hole photography made on 3-9-90. The borehole was grouted using red dye and reamed full depth on 3-12-90. Successful photography was completed on 3-15-90. (6) Boring Plugged 3-16-90
355										
360										NOTE: ALL FRACTURE ORIENTATIONS (IN PARENTHESES) ARE BASED ON FIELD AZIMUTH AND ASSUME HORIZONTAL BEDDING. ALL OTHERS FEATURES UNABLE TO BE ORIENTED.

DRILLING GEOLOGIST Boyd Dreyer ASSISTANT Gary Kincaid CHECKED BY W.D. Flanigan

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. SF 10.1A **Log Measured From:** Ground Level

Drilling Parameters

Depth 110.0 feet

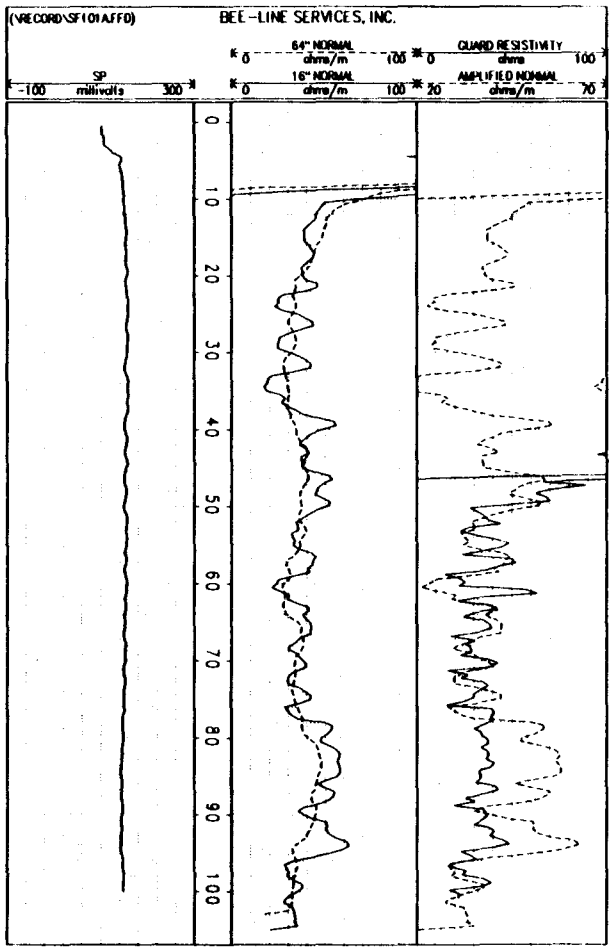
Bit Diameter 4.75 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	February 14, 1990	February 14, 1990	February 14, 1990
Bottom Log Interval	103.0 feet	107.5 feet	103.3 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	none	none	none
Time Since Circulation Stop	3 hours	3 hours	3 hours
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	40 feet/min.	20 feet/min.	20 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot

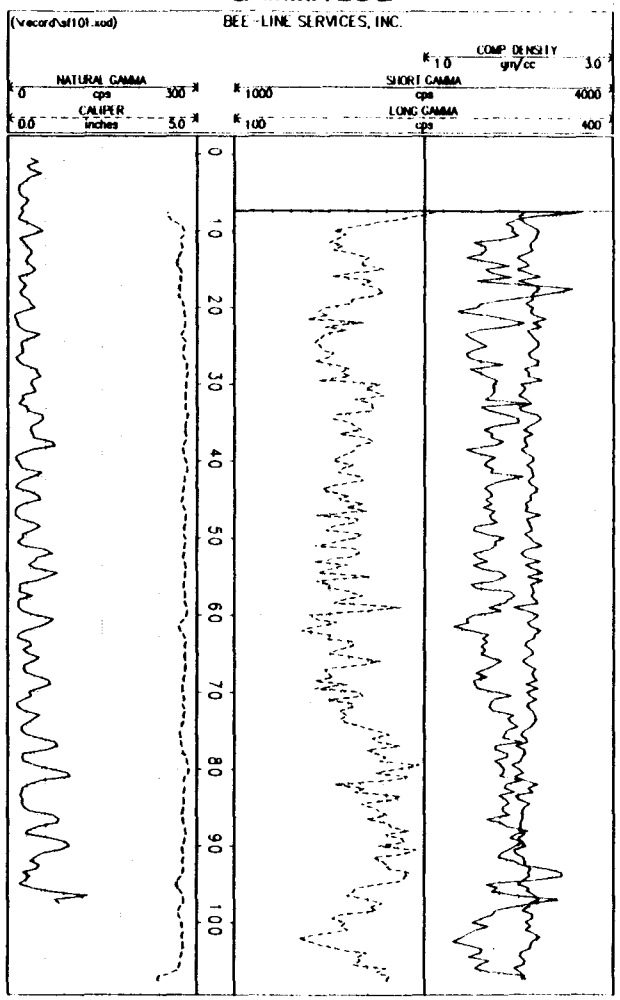
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

SF 10.1A Wire-line logs run February 14, 1990. Surface elevation 715.9 feet.

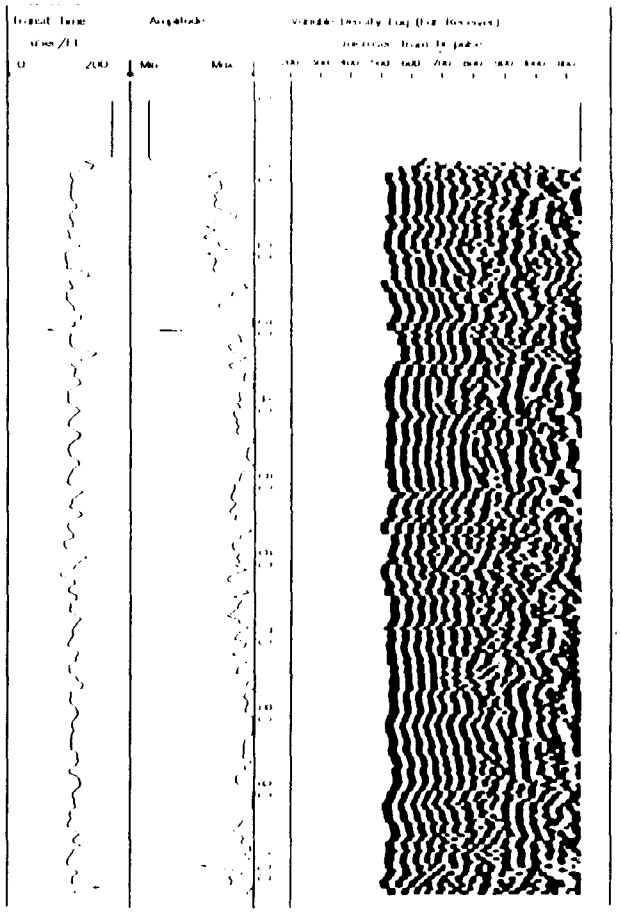
ELECTRICAL LOG



GAMMA LOG



SONIC LOG



WIRE-LINE LOGGING PARAMETERS

Hole No. SF 10.1B **Log Measured From:** Ground Level

Drilling Parameters

Depth 110.0 feet

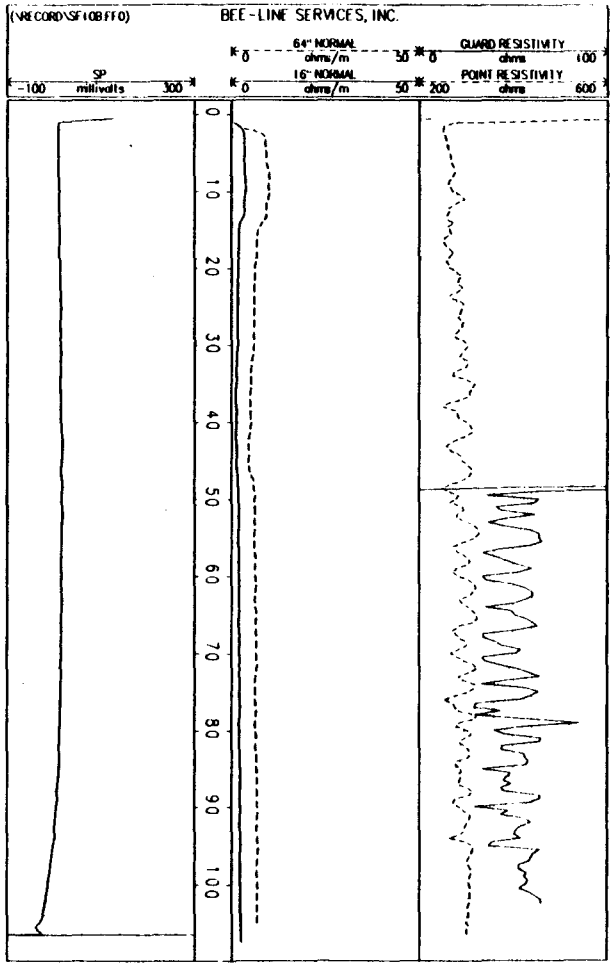
Bit Diameter 4.75 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	February 14, 1990	February 14, 1990	February 14, 1990
Bottom Log Interval	108.0 feet	108.0 feet	102.9 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	none	none	none
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	40 feet/min.	20 feet/min.	20 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot

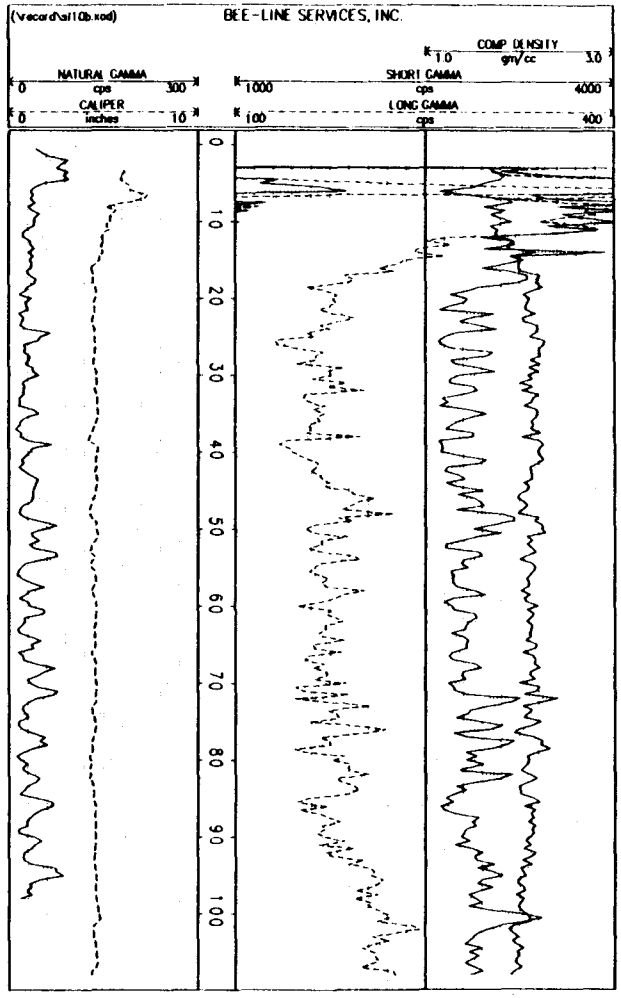
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

SF10.1B Wire-line logs run February 14, 1990. Surface elevation 713.1 feet.

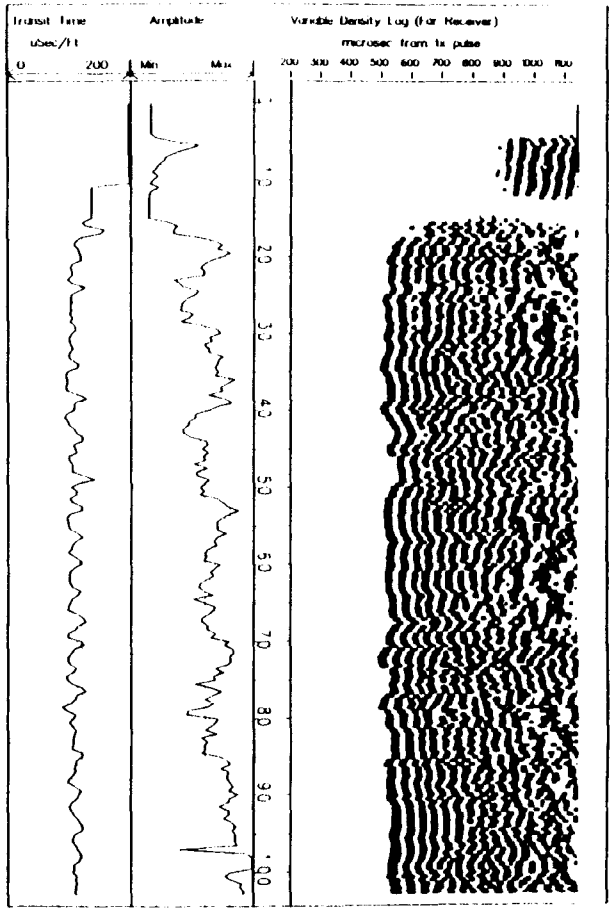
ELECTRICAL LOG



GAMMA LOG



SONIC LOG



WIRE-LINE LOGGING PARAMETERS

Hole No. SF 10.1C **Log Measured From:** Ground Level

Drilling Parameters

Depth 344.0 feet

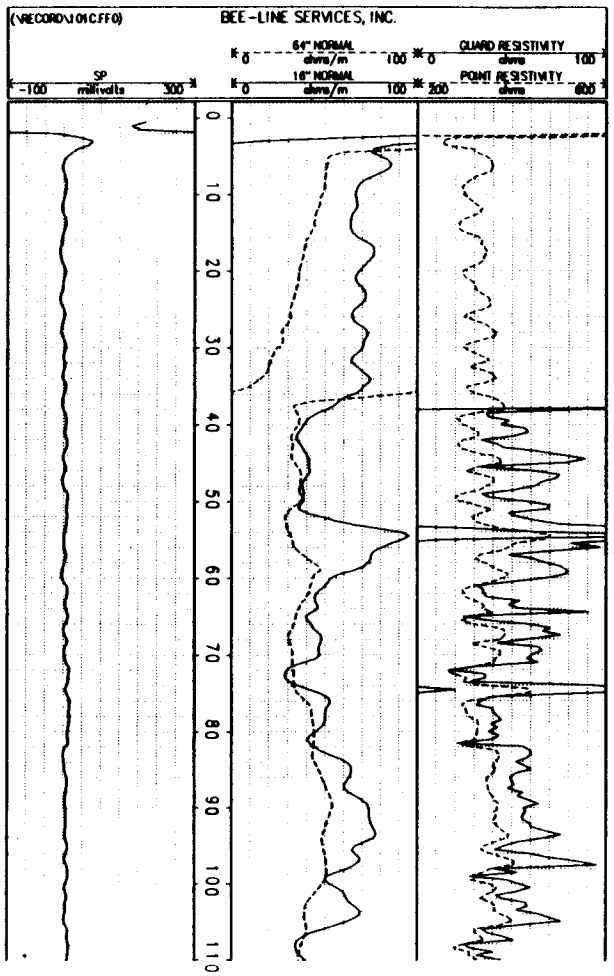
Bit Diameter 3.125 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log	Deviation Log
Date	March 7, 1990	March 7, 1990	March 7, 1990	March 7, 1990
Bottom Log Interval	341 feet	341 feet	337.2 feet	343 feet
Top Log Interval	surface	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	2.5 hours	2.5 hours	2.5 hours	2.5 hours
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A	9055A/135
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A	COMPU-LOG
Logging Speed	40 feet/min.	20 feet/min.	20 feet/min.	60 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot	0.1 foot

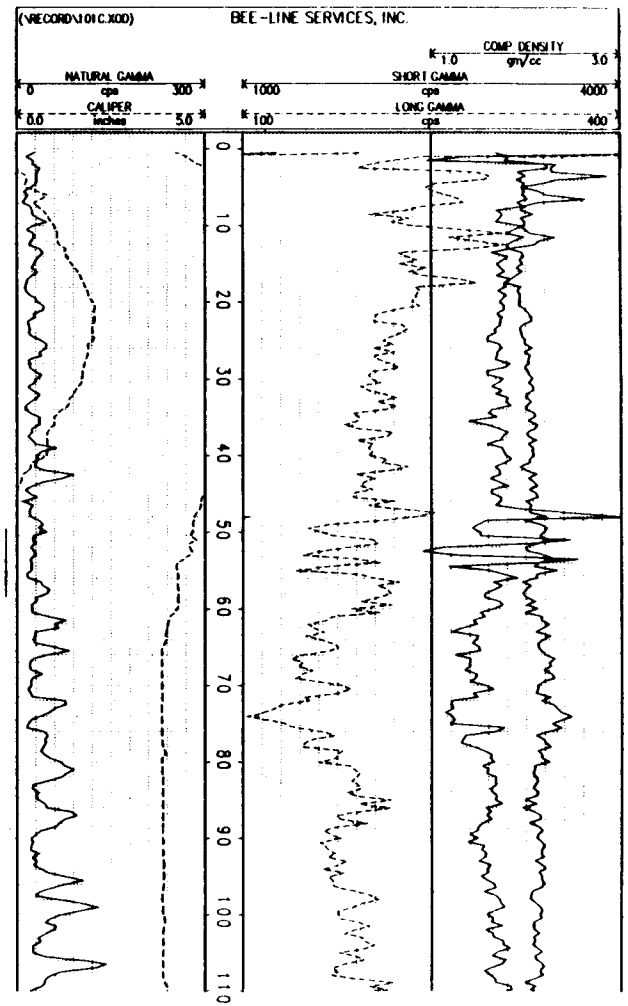
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

SF 10.1C Wire-line logs run March 7, 1990. Surface elevation 718.3 feet.

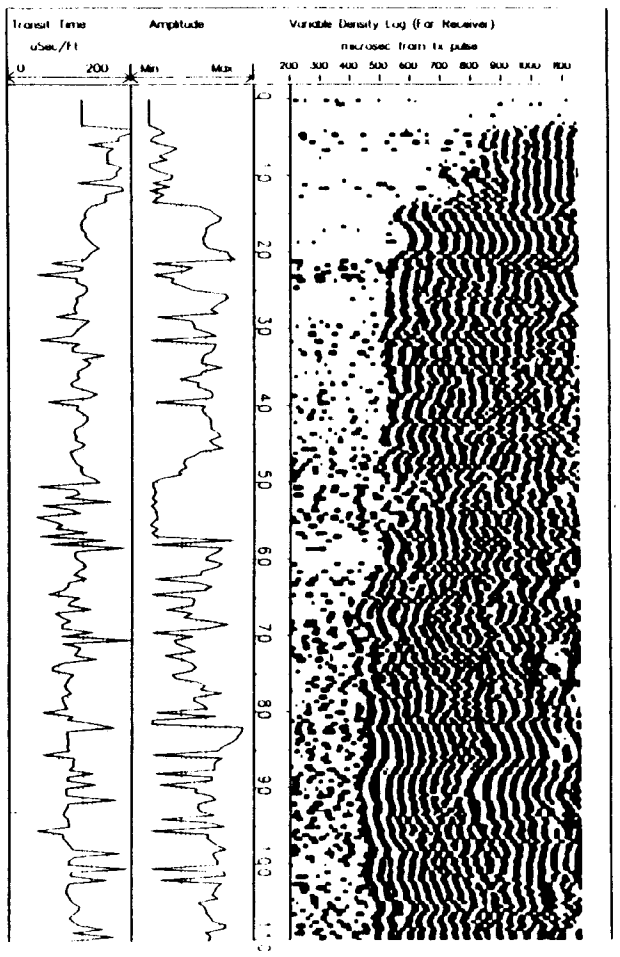
ELECTRICAL LOG



GAMMA LOG

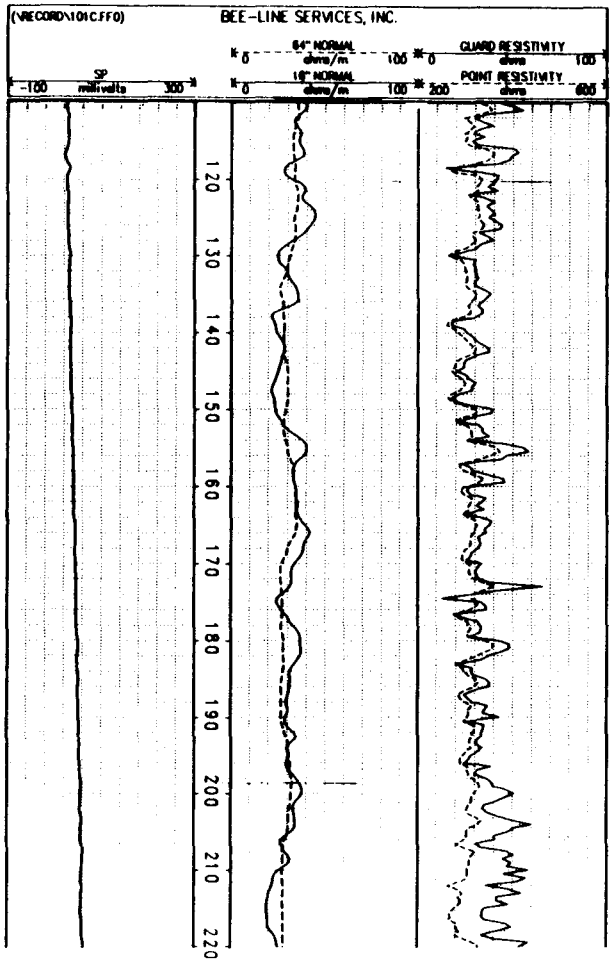


SONIC LOG

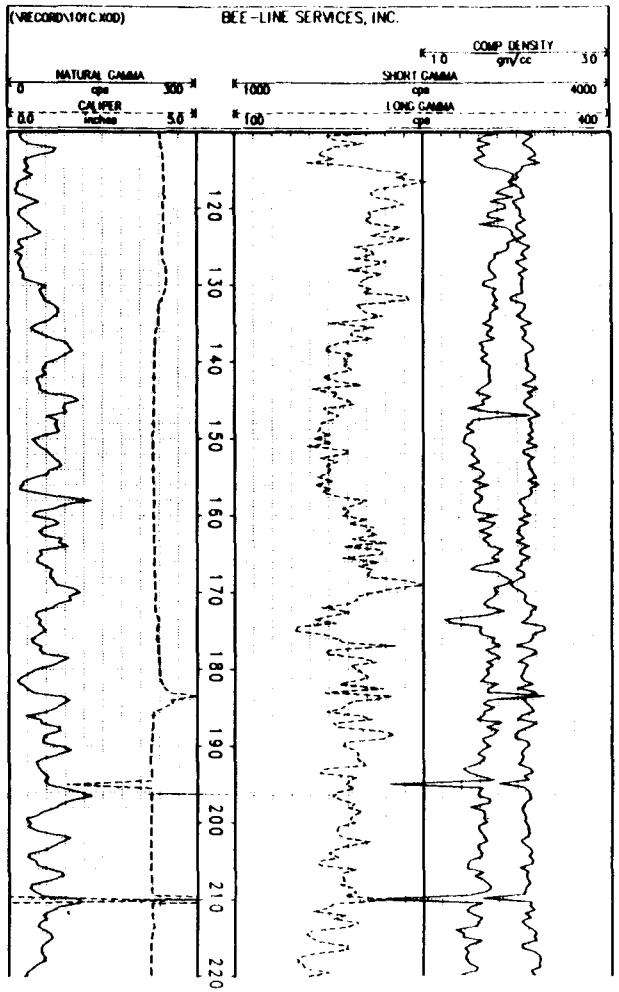


SF 10.1C Wire-line logs run March 7, 1990 (Continued). Surface elevation 718.3 feet.

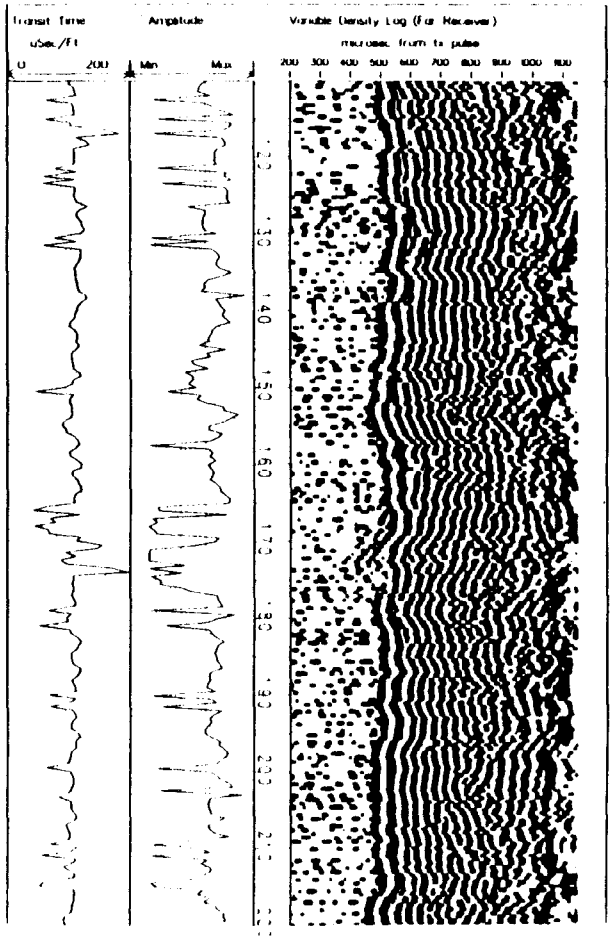
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED

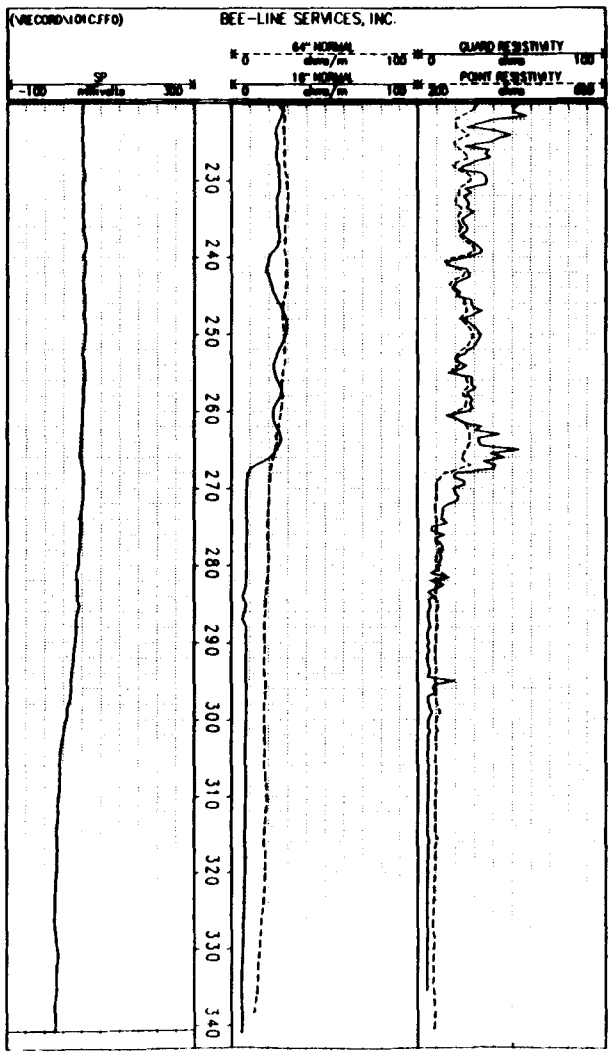


SONIC LOG CONTINUED

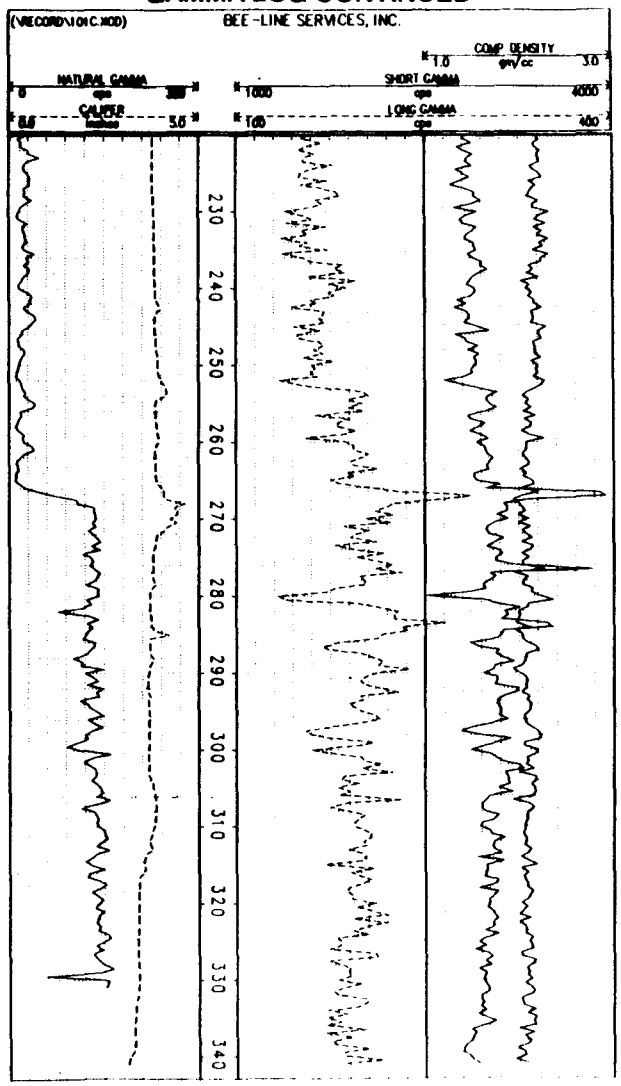


SF 10.1C Wire-line logs run March 7, 1990 (Continued). Surface elevation 718.3 feet.

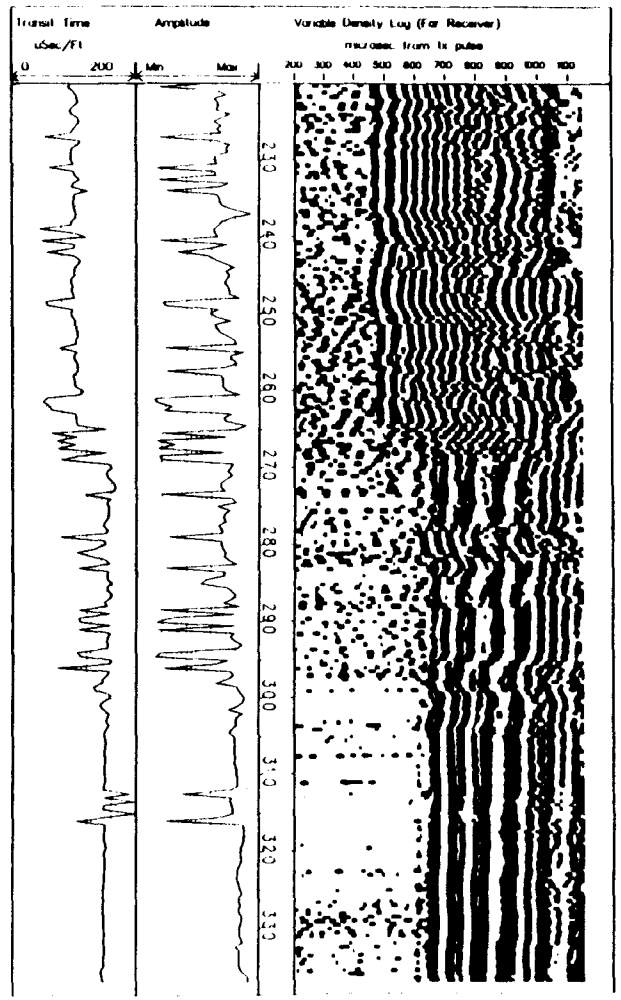
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



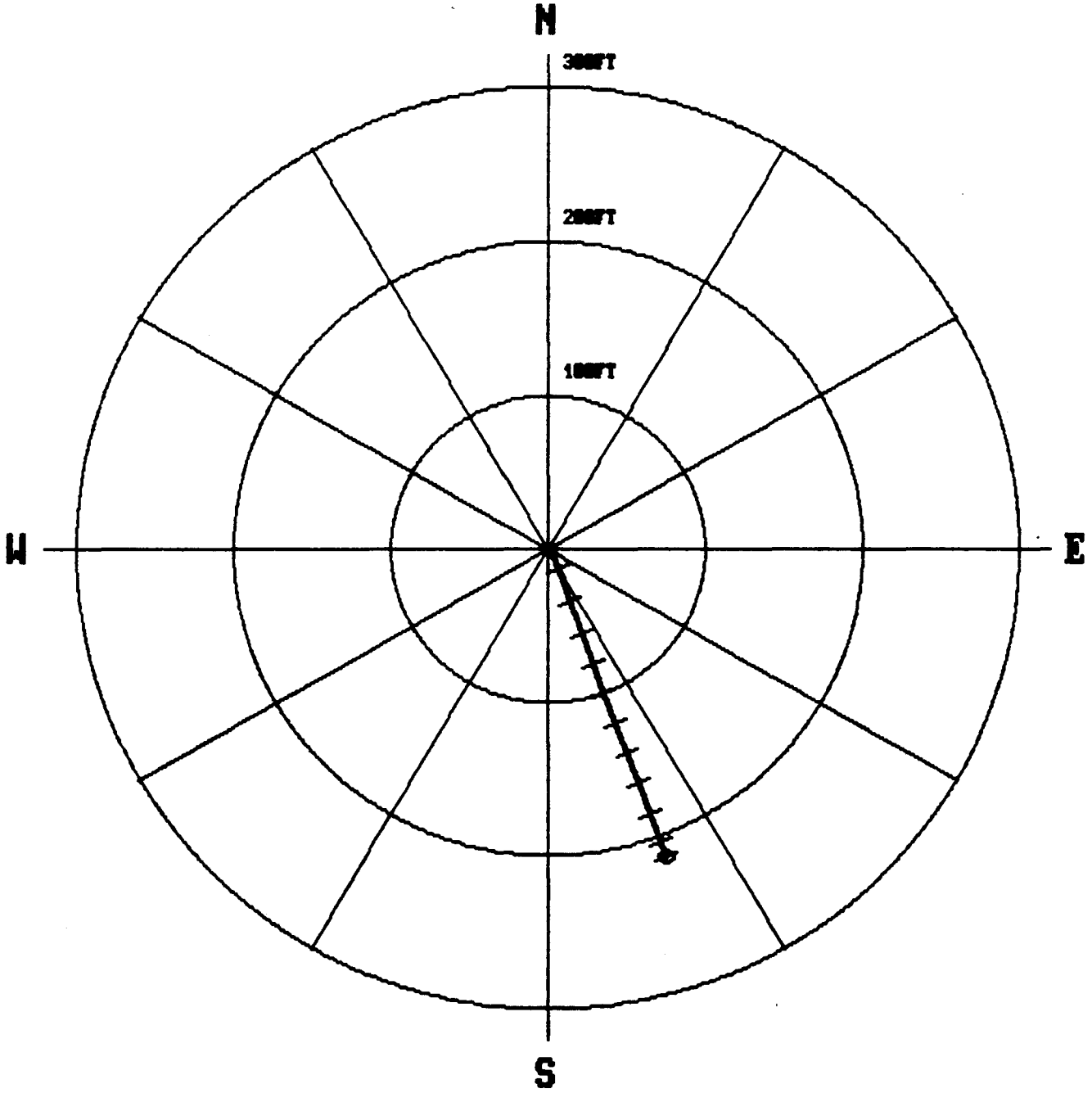
PLAN VIEW

COMPU-LOG DEVIATION

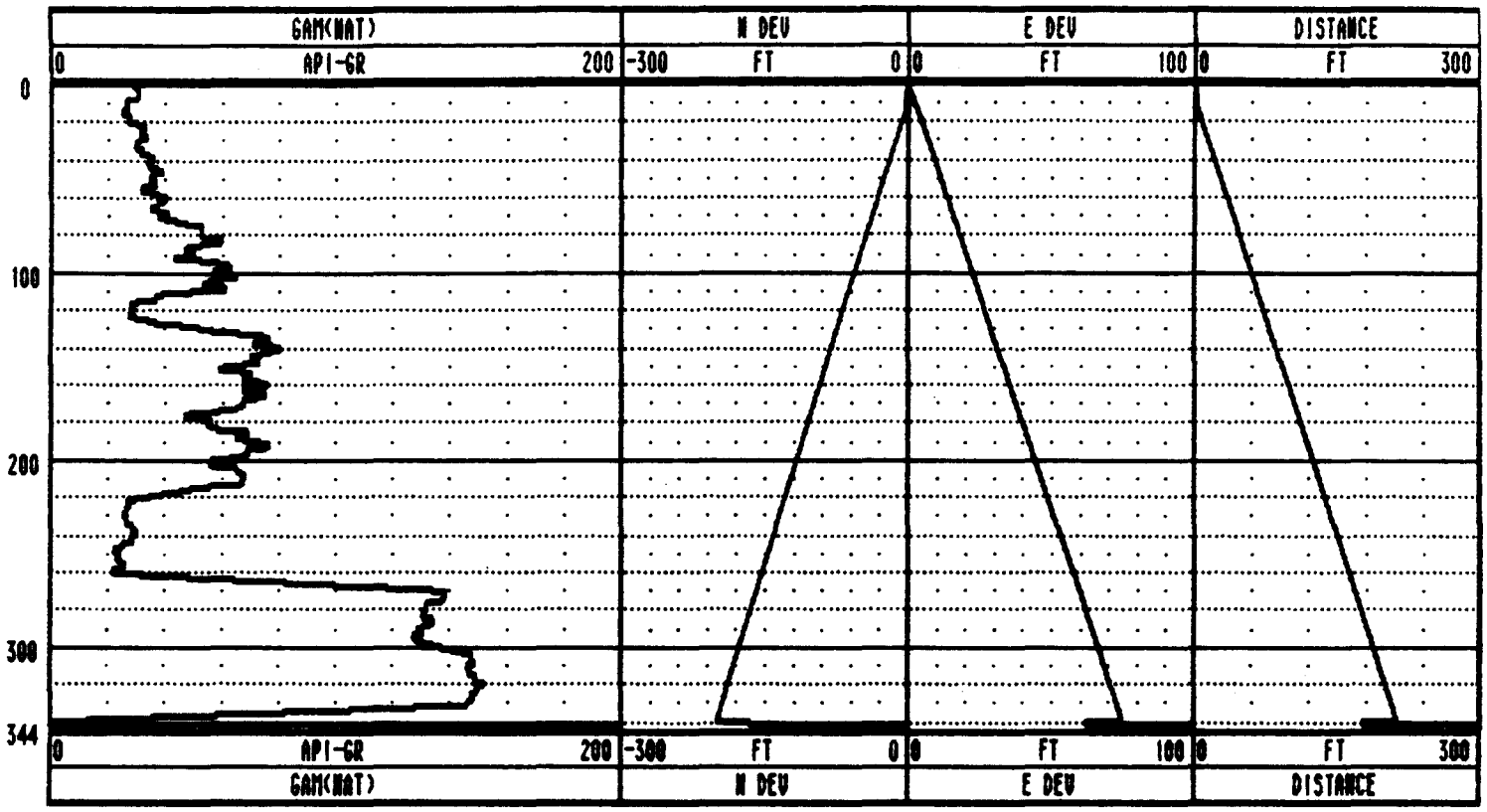
CLIENT: TETC
LOCATION: SSC
HOLE ID: SF10.1C
DATE OF LOG: 03/07/90
PROBE: 9055A 249

MAG DECL: 7.0

SCALE: 100 FT/IN
TRUE DEPTH: 262.71
AZIMUTH: 159.4
DISTANCE: 214.0 FT
+ = 25 FT INCR
O = BOTTOM OF HOLE



Profile View
Compu-log Deviation Survey
SF 10.1C



CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
4.0	3.77	-0.56	-0.03	0.6	183.5	45.1	184.1
5.0	4.48	-1.26	0.01	1.3	179.8	44.1	165.1
6.0	5.22	-1.87	0.27	1.9	171.7	41.9	156.2
7.0	5.96	-2.47	0.58	2.5	166.9	41.3	154.4
8.0	6.72	-2.34	1.14	2.6	154.2	41.1	58.3
9.0	7.47	-2.48	1.30	2.8	152.3	40.5	168.0
10.0	8.23	-2.77	1.41	3.1	153.0	40.8	43.4
11.0	8.99	-2.29	1.85	3.0	141.1	40.8	41.7
12.0	9.75	-1.79	2.27	2.9	128.3	41.0	36.8
13.0	10.50	-1.75	2.17	2.8	129.0	40.9	262.9
14.0	11.26	-1.37	2.46	2.8	119.1	40.5	61.3
15.0	12.02	-1.94	2.77	3.4	125.1	40.6	152.9
16.0	12.78	-2.52	3.08	4.0	129.3	41.0	152.6
17.0	13.53	-3.12	3.33	4.6	133.1	40.7	157.5
18.0	14.29	-3.72	3.59	5.2	136.0	40.9	157.2
19.0	15.05	-4.32	3.84	5.8	138.4	41.0	156.0
20.0	15.80	-4.93	4.10	6.4	140.2	40.6	156.6
21.0	16.56	-5.52	4.36	7.0	141.7	40.9	155.6
22.0	17.32	-6.13	4.61	7.7	143.1	40.9	158.7
23.0	18.08	-6.74	4.85	8.3	144.3	40.8	157.7
24.0	18.83	-7.35	5.08	8.9	145.3	41.1	160.7
25.0	19.59	-7.97	5.30	9.6	146.4	41.1	160.1
26.0	20.34	-8.58	5.53	10.2	147.2	41.0	159.2
27.0	21.09	-9.20	5.77	10.9	147.9	41.3	158.6
28.0	21.84	-9.82	5.99	11.5	148.6	41.7	160.0
29.0	22.59	-10.44	6.22	12.2	149.2	41.3	159.8
30.0	23.34	-11.06	6.45	12.8	149.8	41.2	160.1
31.0	24.09	-11.68	6.68	13.5	150.2	41.5	160.0
32.0	24.84	-12.30	6.91	14.1	150.7	41.5	159.4
33.0	25.59	-12.92	7.14	14.8	151.1	41.5	160.1
34.0	26.34	-13.54	7.38	15.4	151.4	41.3	160.5
35.0	27.09	-14.17	7.60	16.1	151.8	41.7	159.6
36.0	27.83	-14.79	7.83	16.7	152.1	41.8	158.6
37.0	28.58	-15.41	8.06	17.4	152.4	41.7	160.8
38.0	29.33	-16.04	8.27	18.0	152.7	41.2	161.4
39.0	30.08	-16.66	8.50	18.7	153.0	41.8	158.1
40.0	30.82	-17.30	8.71	19.4	153.3	41.9	161.9
41.0	31.57	-17.93	8.93	20.0	153.5	41.9	161.1
42.0	32.31	-18.55	9.16	20.7	153.7	41.8	158.7
43.0	33.06	-19.17	9.40	21.4	153.9	41.7	160.6
44.0	33.81	-19.80	9.63	22.0	154.1	41.8	159.9
45.0	34.55	-20.43	9.85	22.7	154.3	42.2	165.0
46.0	35.29	-21.07	10.05	23.3	154.5	41.8	160.3
47.0	36.04	-21.70	10.27	24.0	154.7	41.8	160.3
48.0	36.78	-22.33	10.50	24.7	154.8	41.9	160.9
49.0	37.53	-22.96	10.71	25.3	155.0	41.3	160.1
50.0	38.28	-23.58	10.94	26.0	155.1	41.7	159.1
51.0	39.02	-24.21	11.16	26.7	155.2	41.9	161.9
52.0	39.77	-24.83	11.40	27.3	155.3	41.6	159.4
53.0	40.51	-25.46	11.60	28.0	155.5	41.7	160.5
54.0	41.26	-26.09	11.83	28.6	155.6	41.7	161.0
55.0	42.01	-26.71	12.05	29.3	155.7	41.6	160.2

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
56.0	42.76	-27.34	12.28	30.0	155.8	41.7	160.8
57.0	43.50	-27.98	12.47	30.6	156.0	42.0	162.6
58.0	44.25	-28.59	12.72	31.3	156.0	41.4	157.8
59.0	45.00	-29.22	12.95	32.0	156.1	41.6	159.8
60.0	45.75	-29.84	13.16	32.6	156.2	41.4	165.2
61.0	46.49	-30.48	13.34	33.3	156.4	41.5	159.9
62.0	47.24	-31.10	13.58	33.9	156.4	41.4	157.1
63.0	48.00	-31.71	13.81	34.6	156.5	41.1	160.8
64.0	48.75	-32.33	14.04	35.2	156.5	41.5	160.1
65.0	49.49	-32.96	14.26	35.9	156.6	41.3	161.5
66.0	50.25	-33.58	14.48	36.6	156.7	41.4	160.2
67.0	51.00	-34.20	14.70	37.2	156.7	41.2	159.9
68.0	51.75	-34.83	14.92	37.9	156.8	41.3	161.3
69.0	52.50	-35.45	15.14	38.5	156.9	41.4	160.5
70.0	53.25	-36.07	15.37	39.2	156.9	41.5	159.4
71.0	54.00	-36.69	15.60	39.9	157.0	41.4	159.3
72.0	54.75	-37.31	15.83	40.5	157.0	41.4	159.9
73.0	55.50	-37.94	16.04	41.2	157.1	41.4	160.4
74.0	56.25	-38.56	16.26	41.8	157.1	41.4	161.0
75.0	57.00	-39.19	16.48	42.5	157.2	41.4	160.5
76.0	57.75	-39.81	16.70	43.2	157.2	41.3	160.3
77.0	58.50	-40.43	16.92	43.8	157.3	41.4	160.0
78.0	59.25	-41.05	17.15	44.5	157.3	41.9	157.4
79.0	59.99	-41.67	17.39	45.2	157.3	41.1	162.3
80.0	60.75	-42.29	17.61	45.8	157.4	41.1	160.0
81.0	61.50	-42.92	17.82	46.5	157.5	41.1	161.5
82.0	62.25	-43.54	18.03	47.1	157.5	41.1	160.9
83.0	63.01	-44.15	18.27	47.8	157.5	41.1	158.0
84.0	63.76	-44.77	18.49	48.4	157.6	41.1	160.4
85.0	64.52	-45.39	18.72	49.1	157.6	41.2	159.9
86.0	65.27	-46.00	18.96	49.7	157.6	40.9	159.7
87.0	66.03	-46.61	19.19	50.4	157.6	41.0	158.5
88.0	66.78	-47.22	19.43	51.1	157.6	41.0	159.9
89.0	67.54	-47.84	19.65	51.7	157.7	40.9	160.3
90.0	68.29	-48.46	19.86	52.4	157.7	41.0	160.8
91.0	69.05	-49.07	20.09	53.0	157.7	40.9	159.3
92.0	69.80	-49.69	20.30	53.7	157.8	40.9	161.7
93.0	70.56	-50.31	20.52	54.3	157.8	40.8	159.5
94.0	71.32	-50.92	20.75	55.0	157.8	40.8	160.1
95.0	72.07	-51.54	20.97	55.6	157.9	40.9	160.6
96.0	72.82	-52.14	21.22	56.3	157.9	41.2	154.7
97.0	73.58	-52.76	21.45	57.0	157.9	41.0	160.9
98.0	74.33	-53.37	21.68	57.6	157.9	40.9	160.7
99.0	75.09	-53.99	21.90	58.3	157.9	40.6	159.9
100.0	75.85	-54.60	22.12	58.9	157.9	40.8	159.3
101.0	76.61	-55.22	22.33	59.6	158.0	40.7	162.9
102.0	77.37	-55.83	22.56	60.2	158.0	40.7	155.3
103.0	78.13	-56.44	22.78	60.9	158.0	40.3	160.1
104.0	78.89	-57.06	22.97	61.5	158.1	40.7	162.0
105.0	79.65	-57.67	23.19	62.2	158.1	40.4	160.9
106.0	80.41	-58.27	23.42	62.8	158.1	40.5	160.2
107.0	81.17	-58.88	23.64	63.5	158.1	40.5	160.6

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
108.0	81.93	-59.50	23.86	64.1	158.1	40.4	160.2
109.0	82.69	-60.11	24.08	64.7	158.2	40.4	160.2
110.0	83.45	-60.72	24.29	65.4	158.2	40.4	160.9
111.0	84.21	-61.33	24.51	66.0	158.2	40.3	159.7
112.0	84.98	-61.93	24.73	66.7	158.2	40.4	160.3
113.0	85.74	-62.54	24.96	67.3	158.2	40.2	159.0
114.0	86.50	-63.15	25.18	68.0	158.3	40.4	160.8
115.0	87.27	-63.75	25.41	68.6	158.3	40.0	159.6
116.0	88.03	-64.36	25.60	69.3	158.3	40.1	164.0
117.0	88.79	-64.96	25.85	69.9	158.3	40.3	159.5
118.0	89.56	-65.57	26.07	70.6	158.3	40.1	160.9
119.0	90.33	-66.18	26.27	71.2	158.3	40.0	160.6
120.0	91.09	-66.78	26.49	71.8	158.4	39.9	159.6
121.0	91.86	-67.39	26.70	72.5	158.4	40.1	161.1
122.0	92.62	-67.99	26.93	73.1	158.4	39.8	158.1
123.0	93.39	-68.59	27.17	73.8	158.4	40.1	155.2
124.0	94.16	-69.20	27.35	74.4	158.4	39.7	163.1
125.0	94.93	-69.80	27.56	75.0	158.5	40.0	159.9
126.0	95.69	-70.40	27.81	75.7	158.4	39.9	158.4
127.0	96.46	-71.01	28.01	76.3	158.5	39.6	162.7
128.0	97.23	-71.62	28.18	77.0	158.5	40.2	160.8
129.0	97.99	-72.23	28.39	77.6	158.5	39.7	162.0
130.0	98.76	-72.84	28.57	78.2	158.6	39.5	163.6
131.0	99.53	-73.45	28.76	78.9	158.6	39.5	161.0
132.0	100.30	-74.06	28.95	79.5	158.6	39.7	159.3
133.0	101.07	-74.66	29.18	80.2	158.7	39.7	159.2
134.0	101.84	-75.26	29.39	80.8	158.7	39.9	160.5
135.0	102.61	-75.87	29.60	81.4	158.7	39.8	161.3
136.0	103.38	-76.47	29.80	82.1	158.7	39.8	160.8
137.0	104.14	-77.07	30.02	82.7	158.7	39.7	160.2
138.0	104.91	-77.68	30.24	83.4	158.7	39.9	159.8
139.0	105.68	-78.28	30.45	84.0	158.7	40.0	160.5
140.0	106.45	-78.88	30.67	84.6	158.8	39.9	159.2
141.0	107.21	-79.49	30.89	85.3	158.8	40.0	158.9
142.0	107.98	-80.09	31.12	85.9	158.8	39.9	160.0
143.0	108.75	-80.69	31.34	86.6	158.8	39.9	160.0
144.0	109.52	-81.29	31.57	87.2	158.8	39.8	158.9
145.0	110.28	-81.89	31.79	87.8	158.8	39.9	159.3
146.0	111.05	-82.48	32.02	88.5	158.8	39.9	158.3
147.0	111.82	-83.08	32.26	89.1	158.8	39.9	158.7
148.0	112.59	-83.68	32.49	89.8	158.8	39.9	159.3
149.0	113.35	-84.28	32.71	90.4	158.8	39.9	159.7
150.0	114.12	-84.88	32.93	91.0	158.8	39.9	159.4
151.0	114.89	-85.49	33.15	91.7	158.8	39.7	161.3
152.0	115.65	-86.09	33.37	92.3	158.8	40.2	155.8
153.0	116.42	-86.69	33.59	93.0	158.8	39.7	159.4
154.0	117.19	-87.29	33.80	93.6	158.8	39.9	160.8
155.0	117.96	-87.90	34.01	94.2	158.8	39.9	160.2
156.0	118.73	-88.50	34.23	94.9	158.9	39.8	158.0
157.0	119.50	-89.10	34.45	95.5	158.9	39.8	163.2
158.0	120.27	-89.70	34.66	96.2	158.9	39.9	160.8
159.0	121.03	-90.30	34.88	96.8	158.9	39.8	160.5

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
160.0	121.80	-90.91	35.08	97.4	158.9	39.7	162.4
161.0	122.57	-91.51	35.30	98.1	158.9	39.8	157.6
162.0	123.34	-92.12	35.50	98.7	158.9	40.0	162.4
163.0	124.11	-92.72	35.72	99.4	158.9	39.9	158.6
164.0	124.87	-93.32	35.93	100.0	158.9	39.9	160.5
165.0	125.65	-93.93	36.12	100.6	159.0	39.5	165.2
166.0	126.41	-94.54	36.34	101.3	159.0	39.3	163.5
167.0	127.18	-95.14	36.54	101.9	159.0	39.9	159.1
168.0	127.95	-95.74	36.76	102.6	159.0	39.8	160.5
169.0	128.72	-96.35	36.98	103.2	159.0	39.8	158.6
170.0	129.49	-96.95	37.20	103.8	159.0	39.9	160.5
171.0	130.25	-97.55	37.41	104.5	159.0	40.0	161.4
172.0	131.02	-98.16	37.63	105.1	159.0	39.9	162.3
173.0	131.79	-98.76	37.85	105.8	159.0	39.9	157.8
174.0	132.55	-99.35	38.11	106.4	159.0	39.9	159.8
175.0	133.32	-99.95	38.34	107.0	159.0	39.8	163.4
176.0	134.09	-100.55	38.55	107.7	159.0	39.6	161.2
177.0	134.86	-101.14	38.78	108.3	159.0	39.9	155.8
178.0	135.62	-101.74	39.02	109.0	159.0	40.0	158.9
179.0	136.39	-102.34	39.25	109.6	159.0	39.9	159.1
180.0	137.16	-102.94	39.47	110.2	159.0	40.2	160.1
181.0	137.92	-103.54	39.72	110.9	159.0	40.1	156.9
182.0	138.69	-104.13	39.96	111.5	159.0	39.9	157.1
183.0	139.46	-104.72	40.20	112.2	159.0	39.4	157.8
184.0	140.23	-105.33	40.41	112.8	159.0	39.8	157.5
185.0	141.00	-105.93	40.60	113.4	159.0	39.8	159.6
186.0	141.77	-106.53	40.83	114.1	159.0	39.8	159.7
187.0	142.53	-107.13	41.06	114.7	159.0	39.8	158.9
188.0	143.30	-107.73	41.29	115.4	159.0	39.6	160.1
189.0	144.07	-108.33	41.51	116.0	159.0	40.2	158.5
190.0	144.84	-108.93	41.73	116.6	159.0	39.7	161.1
191.0	145.61	-109.53	41.95	117.3	159.0	39.9	159.1
192.0	146.37	-110.13	42.18	117.9	159.0	39.7	159.7
193.0	147.14	-110.73	42.40	118.6	159.0	39.8	159.3
194.0	147.91	-111.33	42.62	119.2	159.1	40.0	158.9
195.0	148.68	-111.92	42.86	119.8	159.0	39.9	158.2
196.0	149.45	-112.52	43.10	120.5	159.0	39.7	160.1
197.0	150.22	-113.11	43.32	121.1	159.0	39.9	160.4
198.0	150.99	-113.72	43.52	121.8	159.1	37.5	171.9
199.0	151.76	-114.33	43.67	122.4	159.1	39.4	159.5
200.0	152.53	-114.94	43.84	123.0	159.1	40.1	164.6
201.0	153.30	-115.54	44.07	123.7	159.1	39.9	157.5
202.0	154.06	-116.13	44.32	124.3	159.1	39.8	159.0
203.0	154.83	-116.73	44.54	124.9	159.1	39.4	159.4
204.0	155.60	-117.33	44.77	125.6	159.1	39.7	158.5
205.0	156.37	-117.92	45.00	126.2	159.1	39.7	158.5
206.0	157.14	-118.52	45.22	126.9	159.1	39.3	163.0
207.0	157.91	-119.12	45.43	127.5	159.1	39.1	155.3
208.0	158.68	-119.73	45.64	128.1	159.1	40.8	160.0
209.0	159.44	-120.33	45.88	128.8	159.1	39.9	161.6
210.0	160.21	-120.92	46.11	129.4	159.1	39.8	158.0
211.0	160.98	-121.52	46.34	130.1	159.1	39.7	160.2

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
212.0	161.75	-122.12	46.56	130.7	159.1	39.7	160.3
213.0	162.52	-122.72	46.77	131.3	159.1	39.8	160.1
214.0	163.29	-123.32	46.99	132.0	159.1	39.8	158.8
215.0	164.06	-123.92	47.21	132.6	159.1	39.6	160.5
216.0	164.82	-124.53	47.42	133.3	159.2	40.0	158.2
217.0	165.59	-125.13	47.64	133.9	159.2	39.8	159.0
218.0	166.36	-125.73	47.87	134.5	159.2	39.6	159.9
219.0	167.13	-126.33	48.08	135.2	159.2	40.2	161.3
220.0	167.90	-126.93	48.30	135.8	159.2	39.3	166.0
221.0	168.67	-127.54	48.49	136.4	159.2	39.7	160.6
222.0	169.44	-128.14	48.71	137.1	159.2	40.0	160.2
223.0	170.20	-128.74	48.93	137.7	159.2	39.7	159.7
224.0	170.97	-129.35	49.14	138.4	159.2	39.9	161.3
225.0	171.74	-129.94	49.38	139.0	159.2	40.1	158.5
226.0	172.50	-130.54	49.62	139.7	159.2	40.0	156.6
227.0	173.27	-131.15	49.82	140.3	159.2	39.8	161.6
228.0	174.04	-131.75	50.03	140.9	159.2	39.9	160.4
229.0	174.81	-132.36	50.25	141.6	159.2	39.9	160.3
230.0	175.57	-132.96	50.47	142.2	159.2	40.0	158.9
231.0	176.34	-133.56	50.69	142.9	159.2	39.8	160.5
232.0	177.11	-134.17	50.90	143.5	159.2	39.9	160.4
233.0	177.88	-134.77	51.11	144.1	159.2	39.7	160.8
234.0	178.64	-135.37	51.35	144.8	159.2	39.9	158.6
235.0	179.41	-135.97	51.56	145.4	159.2	39.2	164.5
236.0	180.17	-136.56	51.81	146.1	159.2	40.8	146.8
237.0	180.93	-137.14	52.11	146.7	159.2	40.6	157.5
238.0	181.70	-137.72	52.39	147.3	159.2	39.4	154.7
239.0	182.47	-138.33	52.58	148.0	159.2	39.8	163.6
240.0	183.23	-138.93	52.81	148.6	159.2	39.9	159.0
241.0	184.00	-139.53	53.04	149.3	159.2	40.2	156.8
242.0	184.77	-140.13	53.23	149.9	159.2	39.9	163.6
243.0	185.54	-140.73	53.46	150.5	159.2	40.0	159.5
244.0	186.30	-141.33	53.68	151.2	159.2	39.9	158.7
245.0	187.07	-141.93	53.92	151.8	159.2	39.9	158.3
246.0	187.84	-142.53	54.15	152.5	159.2	39.8	158.5
247.0	188.61	-143.13	54.36	153.1	159.2	39.8	162.7
248.0	189.37	-143.74	54.58	153.7	159.2	39.7	159.5
249.0	190.14	-144.33	54.80	154.4	159.2	39.6	159.6
250.0	190.91	-144.94	55.00	155.0	159.2	39.8	161.0
251.0	191.68	-145.54	55.23	155.7	159.2	40.0	156.0
252.0	192.45	-146.13	55.49	156.3	159.2	39.9	159.1
253.0	193.21	-146.73	55.71	157.0	159.2	40.2	156.7
254.0	193.98	-147.33	55.94	157.6	159.2	39.7	160.7
255.0	194.75	-147.93	56.15	158.2	159.2	40.3	159.1
256.0	195.52	-148.53	56.38	158.9	159.2	40.0	159.7
257.0	196.28	-149.13	56.61	159.5	159.2	39.8	158.8
258.0	197.05	-149.73	56.84	160.2	159.2	39.9	157.9
259.0	197.82	-150.34	57.04	160.8	159.2	40.0	164.4
260.0	198.59	-150.93	57.28	161.4	159.2	39.9	156.9
261.0	199.35	-151.53	57.53	162.1	159.2	40.2	156.3
262.0	200.11	-152.12	57.77	162.7	159.2	40.2	156.7
263.0	200.88	-152.72	58.02	163.4	159.2	39.8	159.5

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
264.0	201.65	-153.32	58.23	164.0	159.2	40.0	158.9
265.0	202.41	-153.92	58.46	164.6	159.2	40.0	159.8
266.0	203.18	-154.52	58.69	165.3	159.2	40.4	158.8
267.0	203.94	-155.12	58.94	165.9	159.2	40.0	157.1
268.0	204.71	-155.72	59.17	166.6	159.2	39.9	157.8
269.0	205.47	-156.32	59.40	167.2	159.2	40.1	158.8
270.0	206.24	-156.92	59.63	167.9	159.2	39.9	160.8
271.0	207.01	-157.52	59.87	168.5	159.2	40.1	158.9
272.0	207.77	-158.12	60.08	169.2	159.2	40.1	158.1
273.0	208.54	-158.72	60.30	169.8	159.2	39.6	161.6
274.0	209.31	-159.33	60.50	170.4	159.2	39.8	161.3
275.0	210.07	-159.94	60.70	171.1	159.2	39.9	160.9
276.0	210.85	-160.55	60.90	171.7	159.2	39.4	165.4
277.0	211.61	-161.16	61.08	172.3	159.2	40.0	157.9
278.0	212.38	-161.76	61.29	173.0	159.2	39.7	164.1
279.0	213.15	-162.37	61.50	173.6	159.3	39.9	161.8
280.0	213.91	-162.97	61.73	174.3	159.3	40.1	158.0
281.0	214.68	-163.57	61.94	174.9	159.3	39.6	161.4
282.0	215.45	-164.18	62.13	175.5	159.3	39.6	165.2
283.0	216.22	-164.80	62.30	176.2	159.3	39.7	163.3
284.0	216.99	-165.41	62.50	176.8	159.3	39.6	159.8
285.0	217.76	-166.01	62.70	177.5	159.3	39.7	160.9
286.0	218.53	-166.62	62.89	178.1	159.3	39.6	164.0
287.0	219.30	-167.23	63.10	178.7	159.3	40.2	154.1
288.0	220.06	-167.82	63.33	179.4	159.3	39.9	155.5
289.0	220.83	-168.41	63.59	180.0	159.3	40.3	156.8
290.0	221.60	-169.00	63.83	180.7	159.3	41.1	153.6
291.0	222.37	-169.59	64.07	181.3	159.3	39.5	161.3
292.0	223.15	-170.18	64.28	181.9	159.3	39.5	161.3
293.0	223.92	-170.78	64.50	182.6	159.3	39.0	158.1
294.0	224.68	-171.40	64.67	183.2	159.3	40.5	162.3
295.0	225.45	-171.98	64.95	183.8	159.3	39.6	158.4
296.0	226.22	-172.58	65.15	184.5	159.3	39.9	156.2
297.0	226.99	-173.18	65.36	185.1	159.3	39.5	160.5
298.0	227.76	-173.78	65.59	185.7	159.3	39.1	162.6
299.0	228.54	-174.38	65.80	186.4	159.3	39.4	159.3
300.0	229.31	-174.98	65.99	187.0	159.3	38.9	157.9
301.0	230.08	-175.57	66.23	187.6	159.3	39.1	148.5
302.0	230.85	-176.15	66.46	188.3	159.3	39.1	162.8
303.0	231.63	-176.74	66.68	188.9	159.3	39.3	160.8
304.0	232.41	-177.32	66.92	189.5	159.3	38.5	161.8
305.0	233.18	-177.89	67.18	190.2	159.3	38.8	156.0
306.0	233.96	-178.49	67.34	190.8	159.3	39.7	155.8
307.0	234.74	-179.07	67.61	191.4	159.3	37.2	162.2
308.0	235.52	-179.67	67.76	192.0	159.3	38.6	166.4
309.0	236.30	-180.27	67.93	192.6	159.4	38.8	159.5
310.0	237.08	-180.86	68.14	193.3	159.4	38.5	156.0
311.0	237.86	-181.45	68.36	193.9	159.4	38.5	159.7
312.0	238.65	-182.02	68.57	194.5	159.4	37.5	159.1
313.0	239.43	-182.61	68.78	195.1	159.4	38.8	159.6
314.0	240.21	-183.18	69.03	195.8	159.4	38.3	157.3
315.0	240.98	-183.74	69.33	196.4	159.3	39.8	151.8

CLIENT : TETC
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : SF10.1C
DATE OF LOG : 03/07/90
PROBE : 9055A , 249
DEPTH UNITS : FEET LOG 3

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
316.0	241.75	-184.32	69.59	197.0	159.3	39.9	164.1
317.0	242.52	-184.92	69.78	197.7	159.3	37.7	160.3
318.0	243.31	-185.52	69.96	198.3	159.3	39.1	163.7
319.0	244.08	-186.12	70.16	198.9	159.3	39.3	158.3
320.0	244.86	-186.70	70.39	199.5	159.3	39.1	156.7
321.0	245.63	-187.29	70.63	200.2	159.3	39.1	155.6
322.0	246.41	-187.87	70.87	200.8	159.3	39.3	160.6
323.0	247.18	-188.46	71.08	201.4	159.3	39.0	162.0
324.0	247.96	-189.06	71.29	202.1	159.3	38.9	160.9
325.0	248.74	-189.64	71.53	202.7	159.3	39.1	153.0
326.0	249.51	-190.23	71.73	203.3	159.3	39.2	169.7
327.0	250.29	-190.85	71.86	203.9	159.4	39.0	159.0
328.0	251.07	-191.44	72.07	204.6	159.4	38.9	162.5
329.0	251.85	-192.03	72.26	205.2	159.4	38.6	163.8
330.0	252.63	-192.61	72.50	205.8	159.4	38.6	169.5
331.0	253.40	-193.20	72.73	206.4	159.4	40.0	158.0
332.0	254.18	-193.80	72.92	207.1	159.4	39.3	157.6
333.0	254.96	-194.41	73.07	207.7	159.4	38.9	163.6
334.0	255.73	-195.00	73.29	208.3	159.4	39.3	157.8
335.0	256.51	-195.58	73.54	209.0	159.4	39.2	155.9
336.0	257.28	-196.17	73.77	209.6	159.4	39.0	160.4
337.0	258.06	-196.76	73.98	210.2	159.4	39.2	162.9
338.0	258.83	-197.36	74.18	210.8	159.4	39.0	164.8
339.0	259.61	-197.95	74.40	211.5	159.4	39.1	158.3
340.0	260.38	-198.54	74.63	212.1	159.4	39.1	153.7
341.0	261.16	-199.14	74.80	212.7	159.4	39.6	177.5
342.0	261.93	-199.71	75.05	213.3	159.4	35.0	154.6
343.0	262.71	-200.30	75.24	214.0	159.4	38.5	160.1
343.3	262.81	-200.30	75.24	214.0	159.4	0.0	0.0

APPENDIX C

STRUCTURE STUDY ZONE

APPENDIX C
STRUCTURE STUDY ZONE SF 10.1

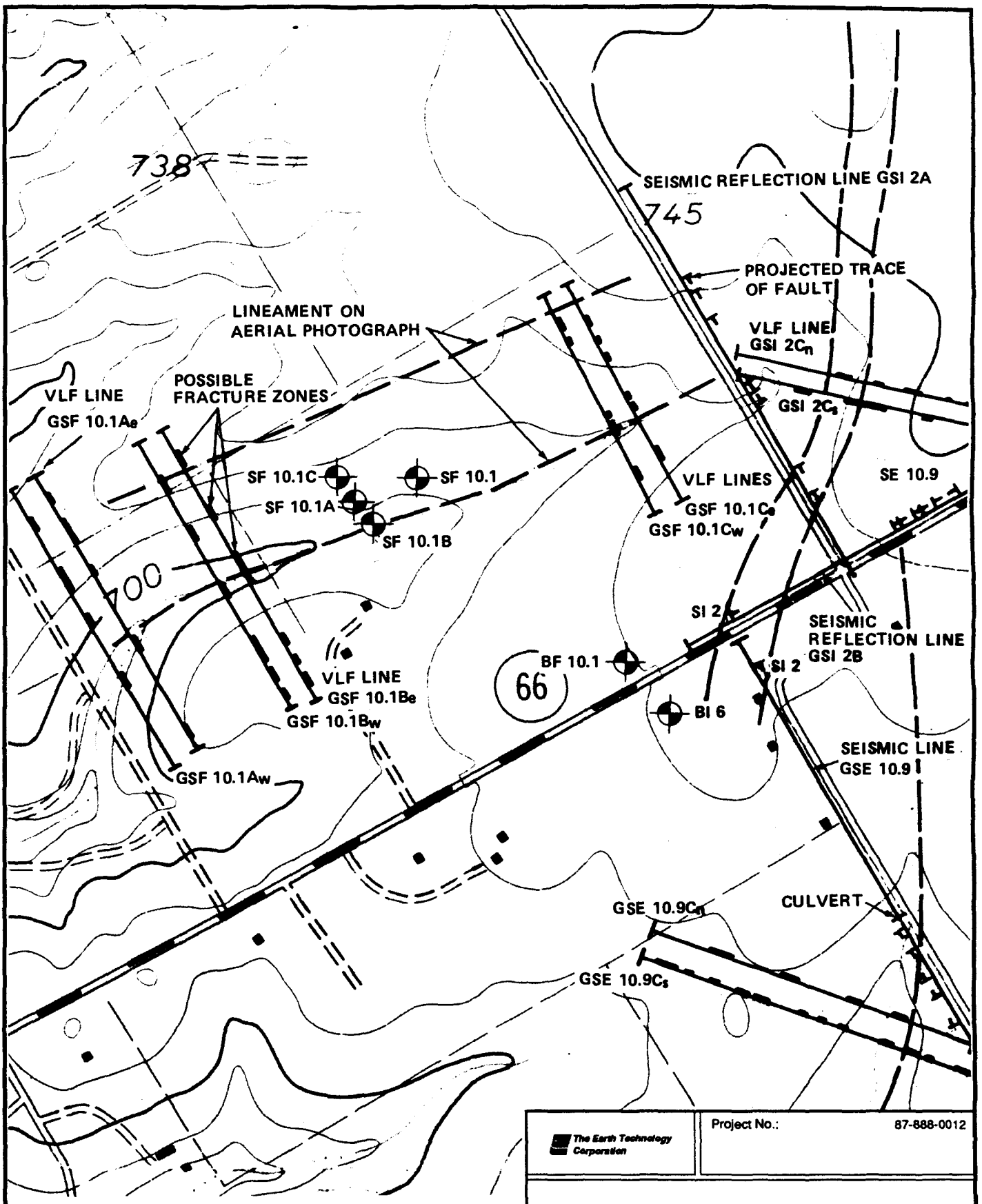
Field mapping of the structure study zone consisted primarily of locating and noting areas of loose calcite fragments (float). Crystalline and fibrous calcite formed in fractures are primary indicators of faulting in the SSC study area. The bearing of significant bedrock fractures was also noted.

Field mapping, very low frequency (VLF) geophysical surveys and seismic reflection surveys, and the analysis of wire-line and lithologic logs from previous borings (SF 10.1 and BF 10.1) identified a graben trending approximately N65° E. Comparison of lithologic logs and wire-line logs from the original borings suggested approximately 50 feet of down-to-the north offset along the southern fault and approximately 25 feet of down-to-the-south offset along the northern fault. Additional borings (this report) have been drilled to better constrain the location of the faults and to provide more specific information regarding engineering and hydrogeological properties of the geologic structure.

- **Name of Structure:** SF 10.1
- **Faults in Outcrop:** No faults were observed in outcrop.
- **Trend:** Two parallel-trending aerial photograph lineaments (see Figure C-1) about 2,000 feet long and 350 feet apart. The lineaments comprise subtle drainage alignments and trend about N65°E. VLF data indicate a fracture trend of N46°E to East-West with a dominant N50°E trend (see Appendix D Geophysical Surveys).
- **Offset in Borings:** Based on previous correlations from borings SF 10.1 and BF 10.1, offset on the northern fault is approximately 25 feet down to the south, and offset on the southern fault is approximately 50 feet down to the north. Correlation of new rotary wash borings (SF 10.1A and SF 10.1B) indicates that these rotary borings are in the down-thrown graben block. Strata in SF 10.1A are about 10 feet higher than comparable strata in SF 10.1. Strata in SF 10.1B are about 8 feet lower than the same strata in SF 10.1. Interpretation of wire-line data from SF 10.1C (angled corehole) indicates that the borehole was located along or very close to a fault. Based on wire-line data, SF 10.1C is assumed to have penetrated this fault in at least two places; the upper portion of the boring repeats a section of the Austin Chalk from 154 to 184 feet (angled depth). In the lower part of the boring, the Austin Chalk is shortened by about 26.0 feet near the Eagle Ford Shale contact. The overall interpretation is a northwest-dipping main fault with approximately 50 to 57 feet of down-to-the- north displacement surmounted by an antithetic fault to the north that is assumed to dip 50° to 65° southeast and has approximately 25 feet of down-to-the north displacement (see Figure C-2, geologic cross-section).
- **Mineralization/Alteration:** Mapping of calcite float identified an east-northeast-trending alignment of calcite float north of the rotary wash borings, and a zone of less pronounced calcite float near the drainage. Analysis of boring logs from SF 10.1 and SF 10.1C suggests that the area between the southern main fault and northern antithetic fault is extremely fractured and faulted. The fractures at depth (greater than 46 vertical feet) are generally unweathered and typically calcite filled where they cut the Austin Chalk. Some fractures in boring SF 10.1C have a fault gouge that consists of highly brecciated limestone and occasional clay. In general, most fractures in the Austin Chalk are rough, slickensided, and where the rock surfaces are separated, calcite filled. Fractures in the Eagle Ford Shale are typically smooth to slightly rough, slickensided, slightly undulating, and closed.
- **Direction of Dip:** Slickensides are present on all fracture planes. In boring SF 10.1C, fracture orientations range from N10° E to S70° E with the majority of the fractures dipping 30° to 90° northwest. The surface trace of the fault as interpreted from calcite in float and VLF anomalies suggests a N50°-60° E trend.
- **Width of the Fault Zone:** Data collected from three vertical coreholes, two rotary borings, one angled corehole, VLF and seismic reflection geophysical surveys, and geologic mapping suggest the graben has a minimum width of about 300 feet. Seismic reflection data 2,000 feet east of boring SF 10.1C suggest a maximum width of about 550 feet (see Appendix D, Geophysical Surveys).

Boring data and VLF surveys indicate that the rocks between the two bounding faults are highly fractured. Assuming a dip of 65° on the fault planes, the antithetic fault penetrated by boring SF 10.1 and SF 10.1 C is between 0.3 and 1.1 feet thick in the Austin Chalk. The main fault is penetrated by boring SF 10.1C in the Eagle Ford Shale at a vertical depth of 220 feet and appears to be about 2.3 feet thick.

- **Fault Characteristics at Depth:** Analysis of boring logs from boring SF 10.1 and SF 10.1C suggests that the fracture spacing along the antithetic fault ranges from less than 0.1 foot to 6.1 feet with the average spacing about 1.8 feet. All fractures appear to be slickensided. Fractures that have been separated (rock walls are separated) are typically completely healed by calcite mineralization. Calcite veins range from less than 0.05 inch up to 1.25 inches thick. Fracture spacing near the main fault in the Eagle Ford Shale averages about 0.6 feet (± 0.6 feet).



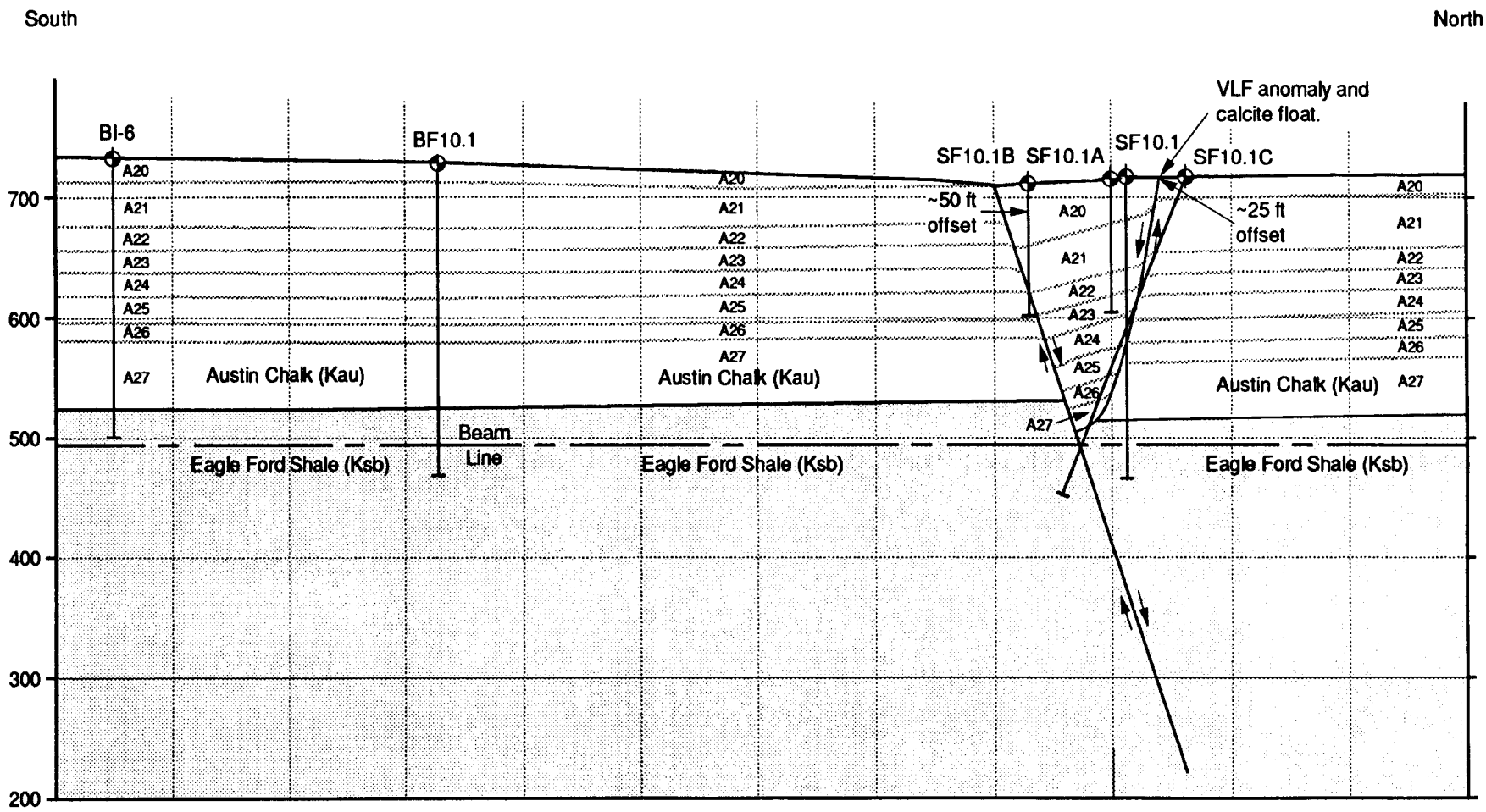
The Earth Technology Corporation

Project No.: 87-888-0012

Structural Study Zone
SF 10.1

7/90

Figure C-1



0 200 400 600 Feet
Horizontal Scale

0 100 200 300 Feet
Vertical Scale

The Earth Technology Corporation

Project No.: 87-888-0012

SF10.1 Geologic Cross-Section

7-90

Figure C-2

APPENDIX D

GEOPHYSICAL STUDIES

APPENDIX D
GEOPHYSICAL STUDIES

The objective of geophysical surveys was to locate faults identified by geologic mapping. Very Low Frequency (VLF) technique was used to map electrically conductive subsurface zone; water- and/or saturated clay-filling, normal faults within the Austin Chalk could produce a VLF anomaly. High-resolution, shallow-penetration seismic reflection surveys were done across traces of suspected faults.

VLF Geophysical Survey:

The ABEM Company "WADI" system was used to collect the VLF data. This system can measure and store the horizontal component of the primary VLF signal and both the in-phase and quadrature-phase of the vertical component of the induced secondary signal. The system also stores profile geometry. The instruments and capabilities are described by ABEM (1987a). Detailed VLF measuring procedures are described by ABEM (1987a). Data were continuously monitored during acquisition to ensure good data quality.

At each site, the probable fault location was determined by interpreting aerial photographs and by geologic field mapping. A VLF profile was constructed perpendicular to the suspected fault trace to fine tune the fault's location. Another profile was then constructed parallel with the first and offset 100 to 130 feet. Profiles usually terminated at buried utilities, metal fences, or other cultural features that would have negatively effected data quality. Stations along the profiles were established at 16.4-foot intervals using a measuring tape.

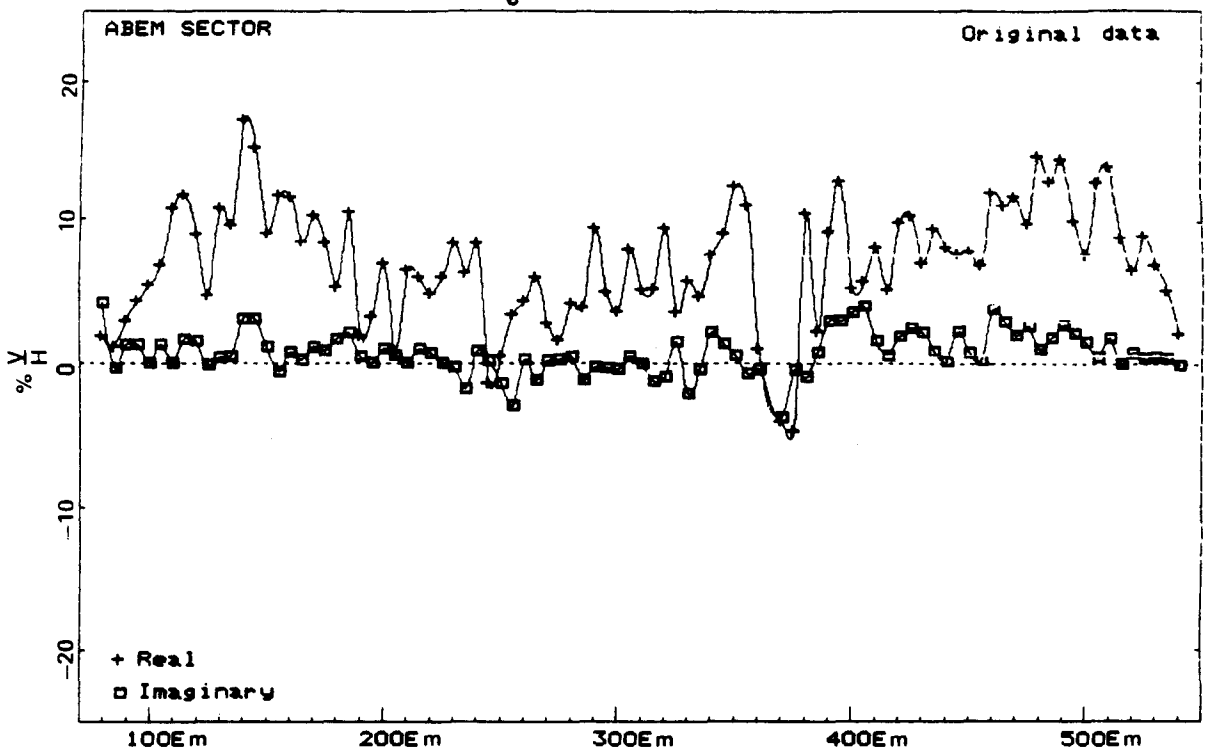
Data were electronically transferred from the instrument to a personal computer for analysis. Data were convolved with an Hjelt filter (Wright, 1988) and the resulting cross-sections plotted. Raw data files and graphs, pseudo-sections, and individual cross sections were plotted. All data and results were stored on diskette. Qualitative interpretation of the data followed the procedures described by ABEM (1987b) and Wright (1988).

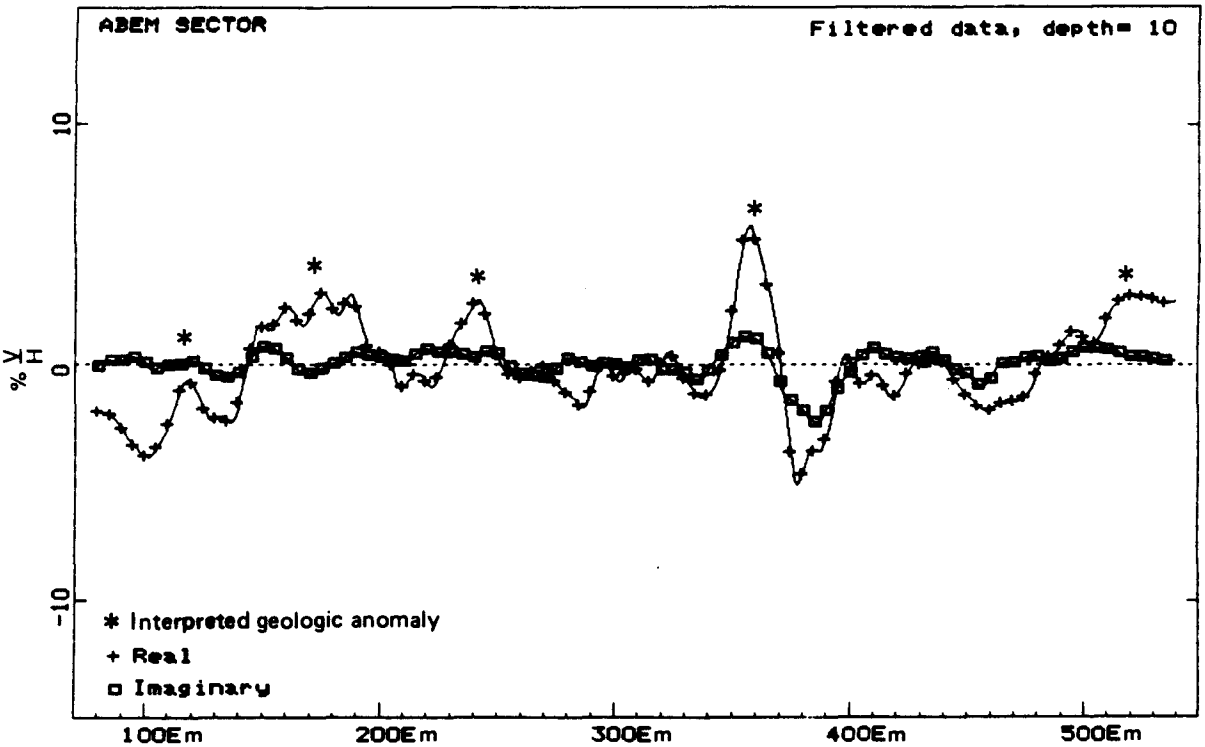
VLF anomalies thought to represent faults in the Austin Chalk were highlighted on the cross sections and transferred to the base maps. Similar shaped anomalies on the pair of lines at a site were connected and the general anomaly direction measured. The anomalies' locations and orientations were compared to the expected fault characteristics. Profile and anomaly locations were marked on air photographs and USGS quad maps (scale 1:24,000). See Figure C-1, structure study map, for the location of the VLF lines and the identified anomalies. Figures D-1 through D-6 are profiles of the actual data. VLF anomalies are interpreted as high-value peaks on the filtered data graphs (indicated by asterisks).

REFERENCES:

ABEM, 1987a. WADI INSTRUCTION MANUAL, Bromma, Sweden.
ABEM, 1987b. WADI INTERPRETATION GUIDE, Bromma, Sweden.
Wright, J.L., 1988. VLF INTERPRETATION MANUAL, Ontario, Canada.

Profile: 0200S (24 kHz) **GSF 10.1A$_e$** → S28°E





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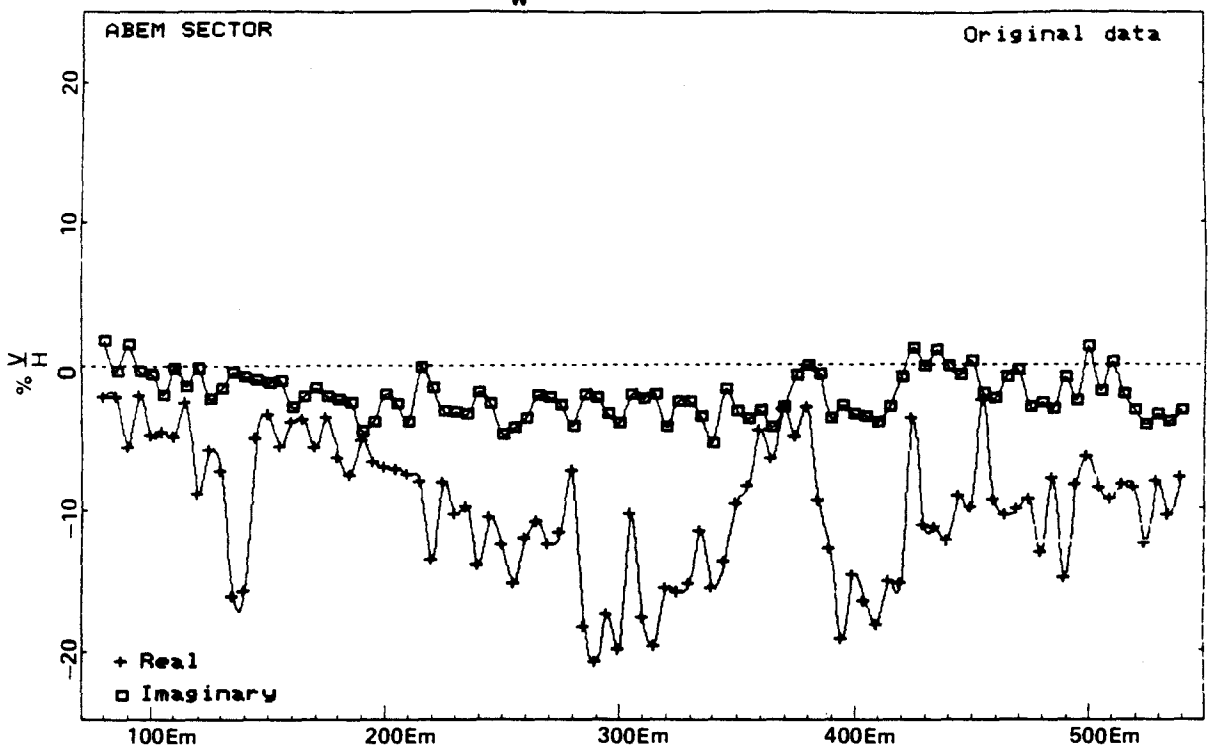
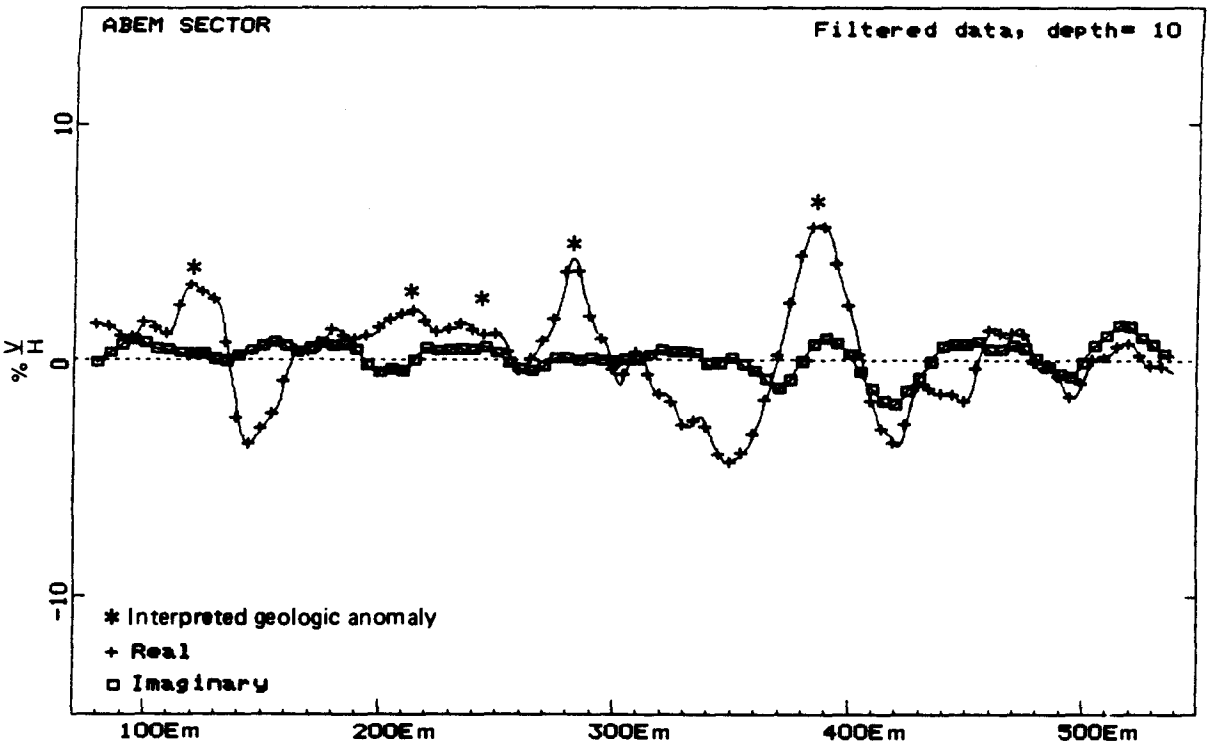
VLF Profile
GSF 10.1A$_e$

7/90

Figure D-1

Profile: 0199S (24 kHz) **GSF 10.1A$_W$** S28°E





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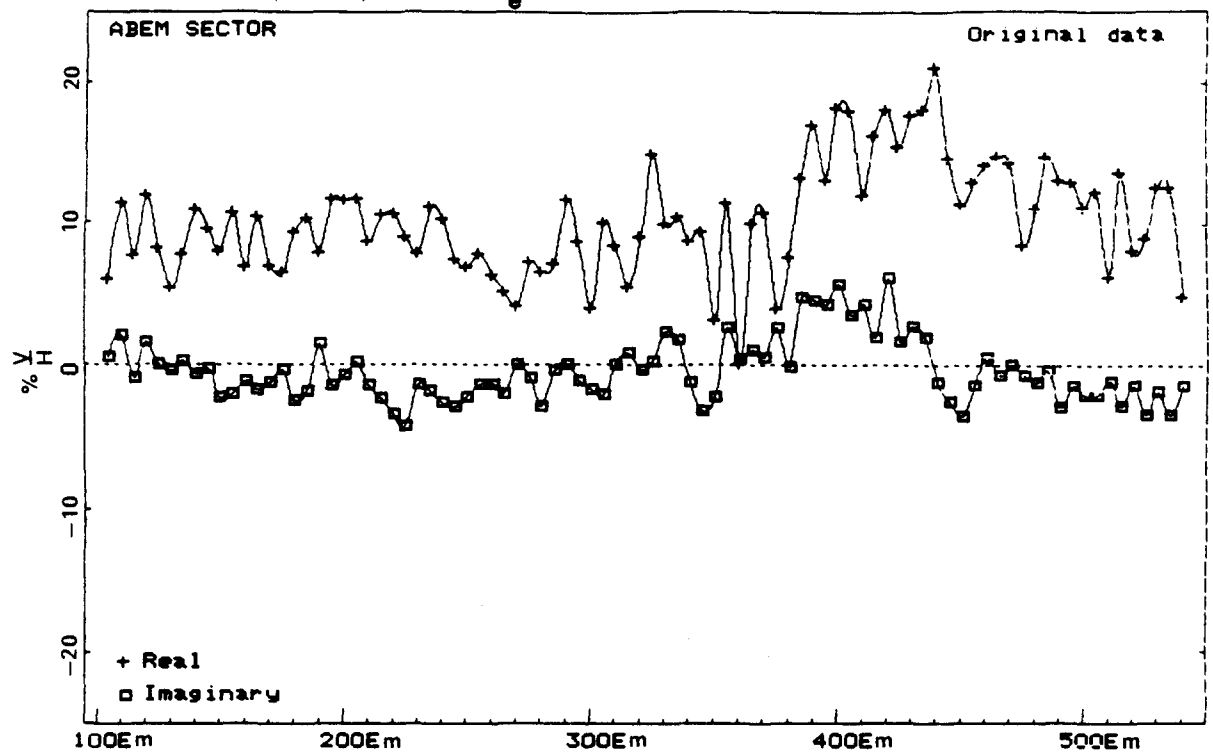
Project No.: 87-888-0012

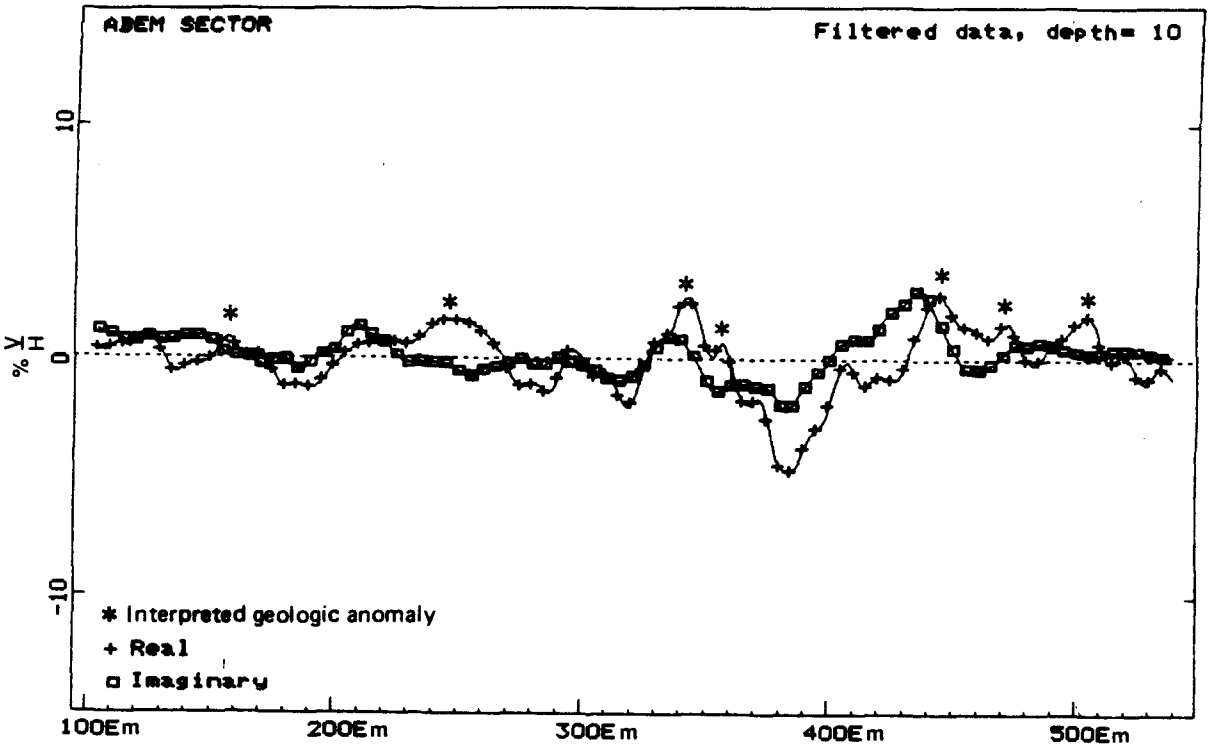
VLF Profile
GSF 10.1A$_W$

7/90

Figure D-2

Profile: 0220S (24 kHz) GSF 10.1B$_e$ S28°E





The Earth Technology Corporation

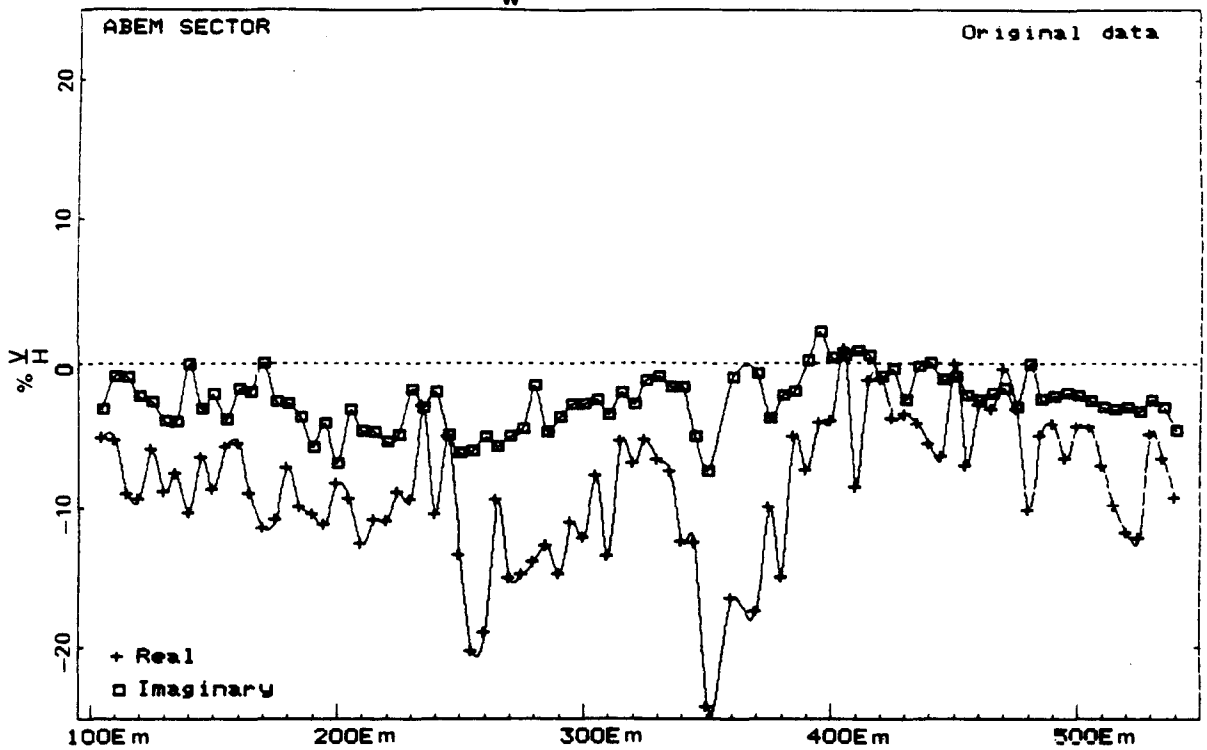
Project No.: 87-888-0012

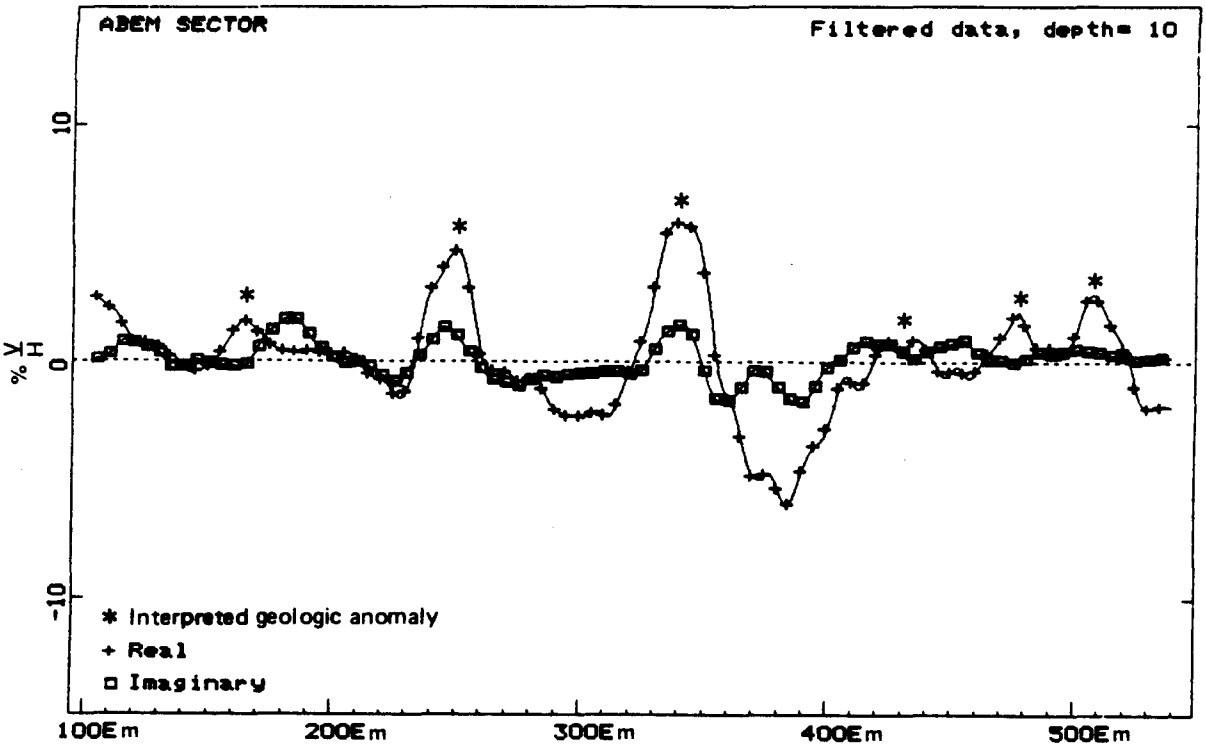
VLF Profile
GSF 10.1B$_e$

7/90

Figure D-3

Profile: 0219S (24 kHz) GSF 10.1B_W S28°E





The Earth Technology Corporation

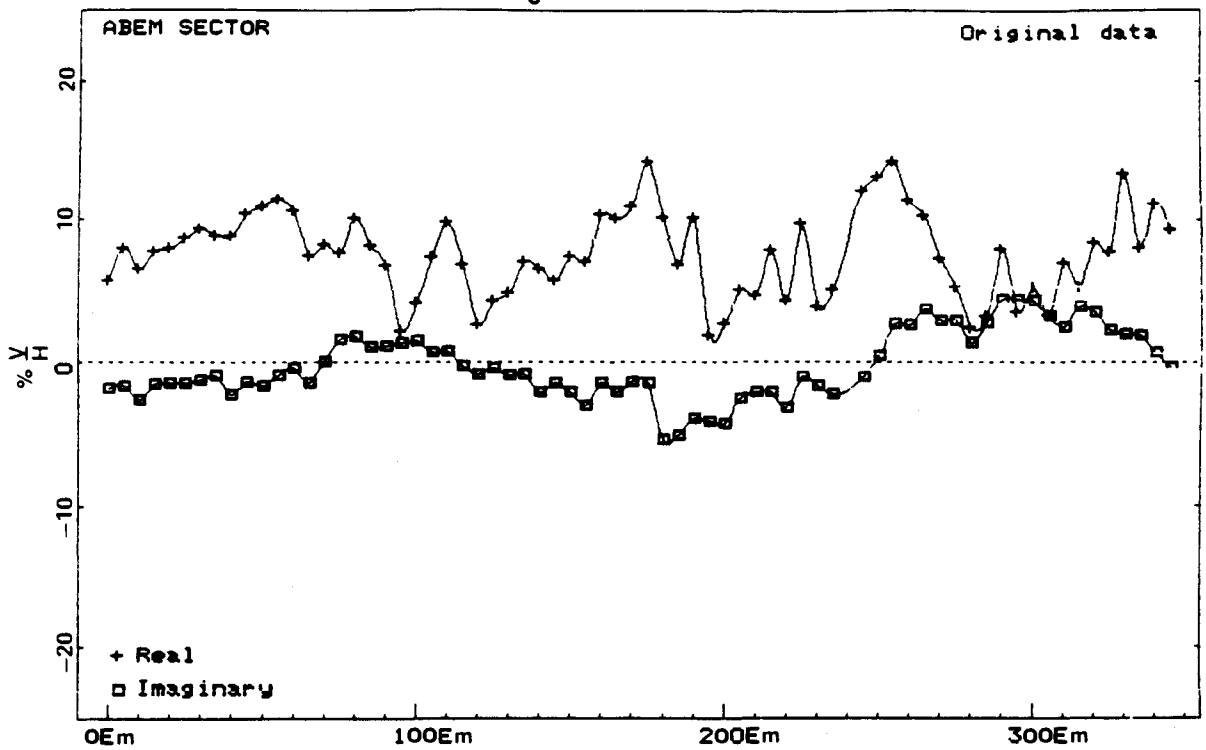
Project No.: 87-888-0012

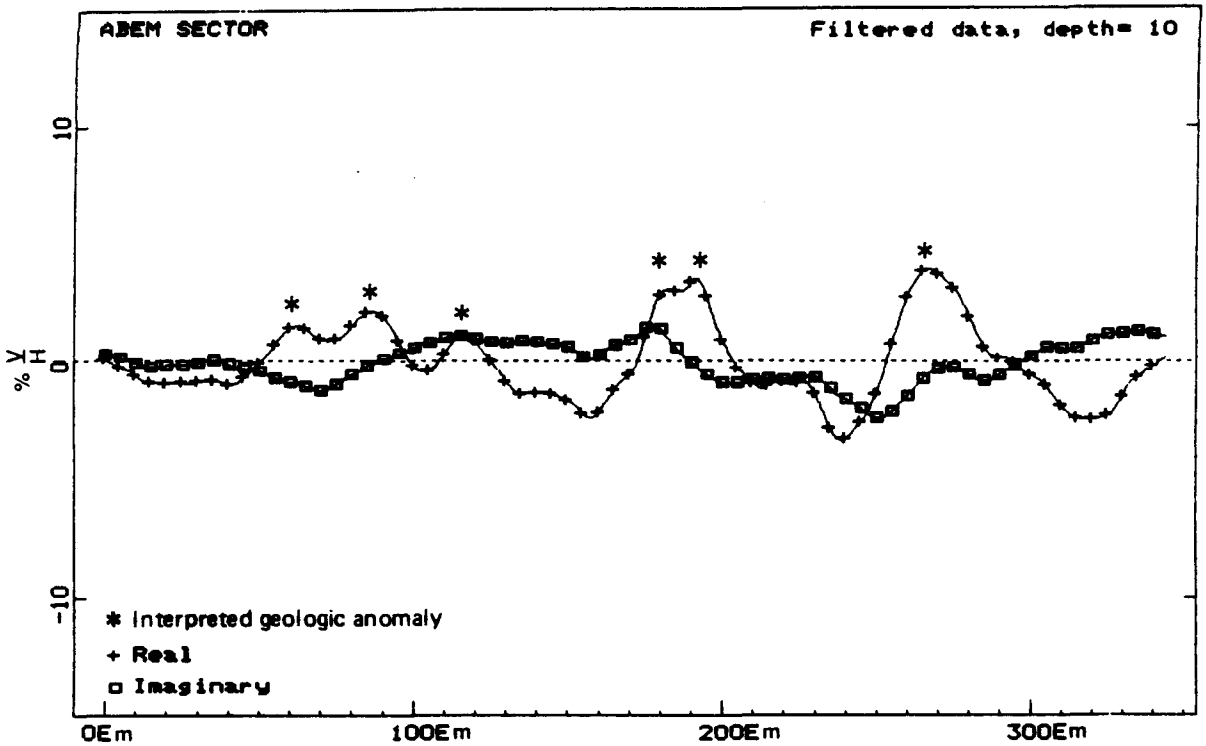
VLF Profile
GSF 10.1B_W

7/90

Figure D-4

Profile: 0241S (21.4 kHz) GSF 10.1C_e S24°E





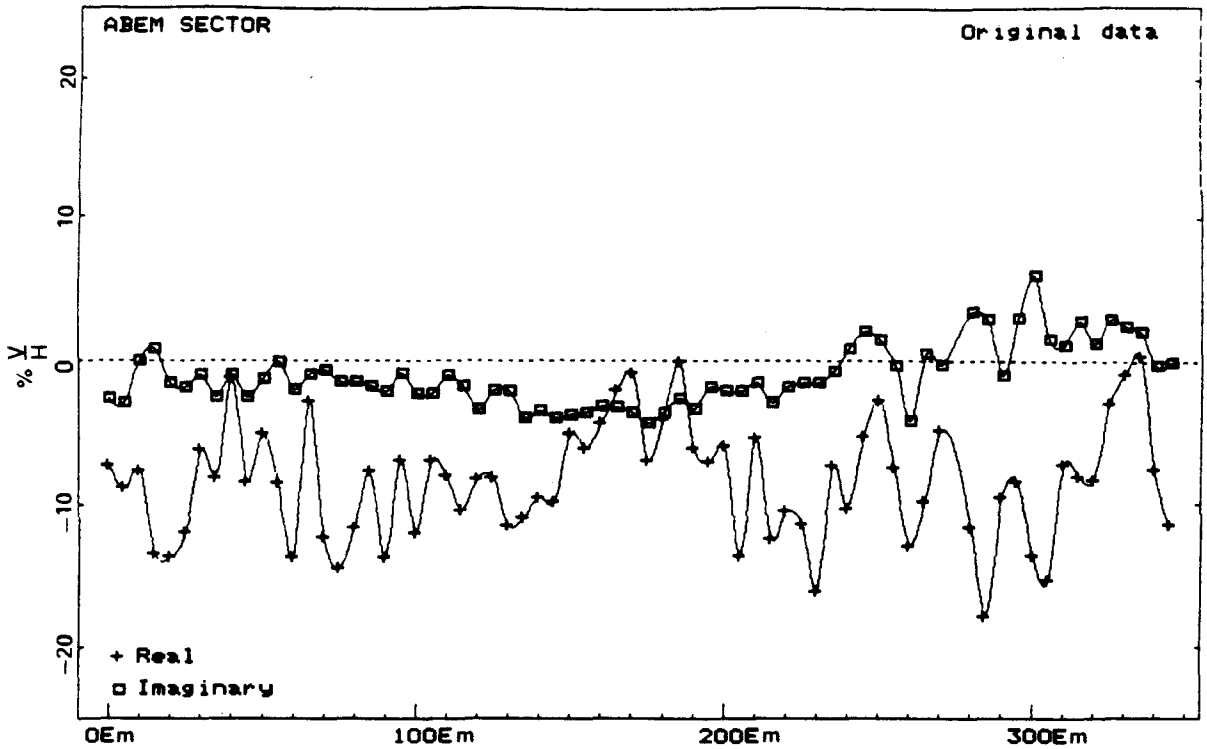
The Earth Technology Corporation	Project No.: 87-888-0012

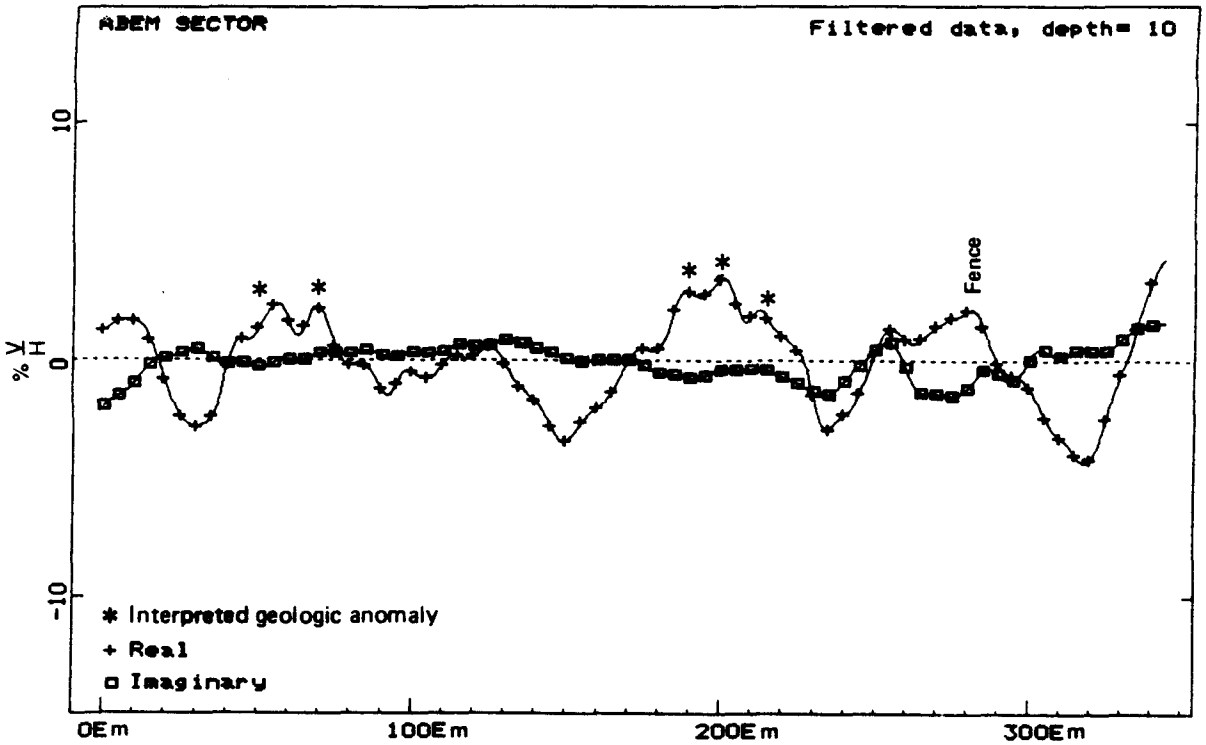
VLF Profile
GSF 10.1C_e

7/90

Figure D-5

Profile: 0240S (21.4 kHz) GSF 10.1C$_W$ S24°E





The Earth Technology Corporation

Project No.: 87-888-0012

VLF Profile
GSF 10.1C$_W$

7/90

Figure D-6

Seismic Reflection Profiles:

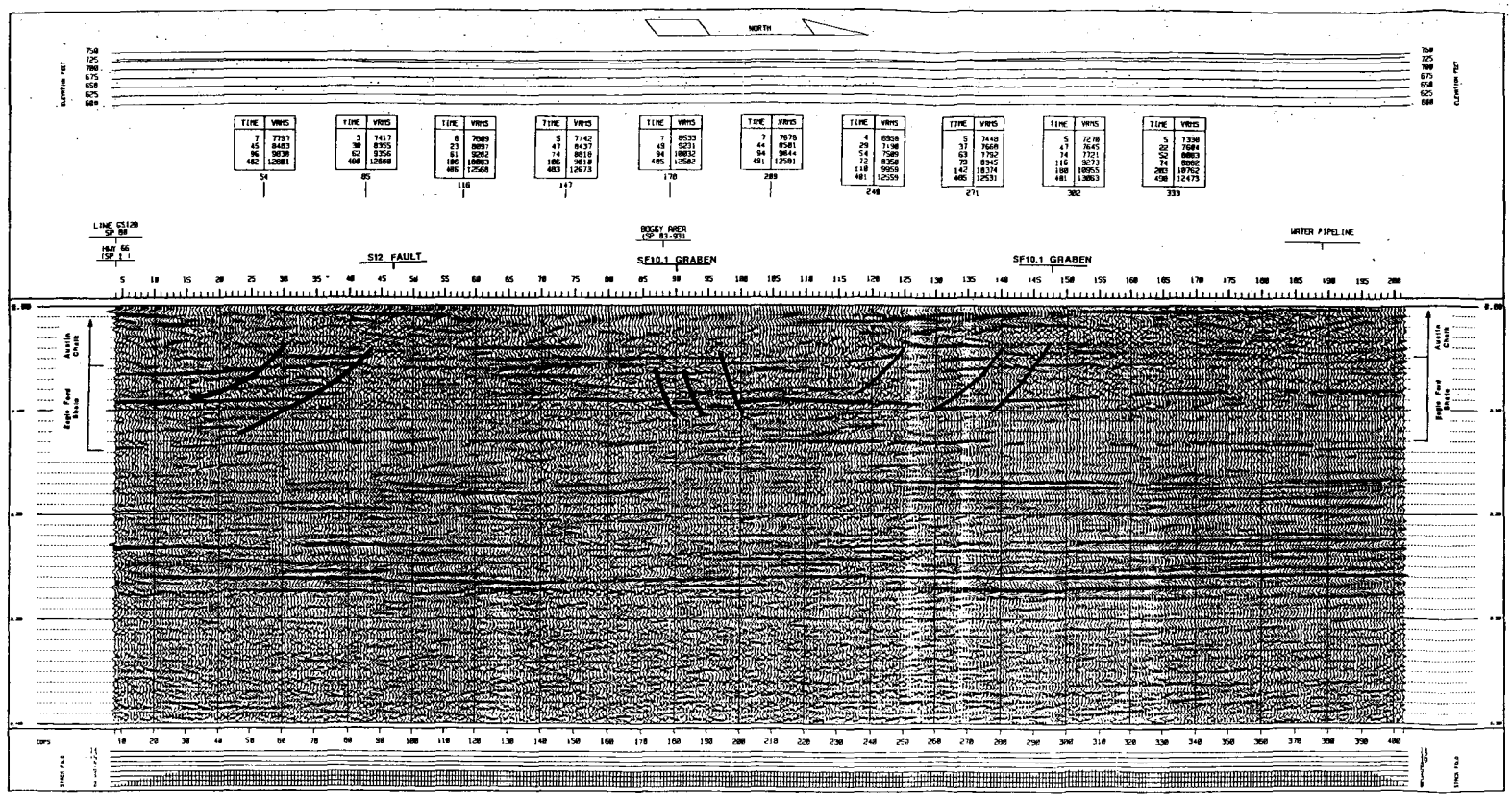
Figure D-7 is a seismic reflection line across the eastern end of Structure Study Zone SF 10.1. This seismic line was acquired to help define the geologic structure in the area.

Line GSI-2A, Figure D-7 runs along a dirt road (Arrowhead Road) from Route 66 north for just over 2,000 feet. The line crosses a boggy creek area from approximately shot points 83-93. Heavy vegetation cover in this area made for poorer source and geophone ground coupling and increased wind noise.

The SF 10.1 graben feature is quite obvious on the seismic reflection profile from stations 90 to 145. This overall apparent width (550 feet) is greater than that noted in Appendix C, which cites an approximate width of 350 feet. The interpreted throws on the faults are about 40 feet on the southern (left on figure) fault and about 30 feet on the northern fault. Drilling results indicate throws of 57 feet and 25 feet, respectively.

Reference:

LCT Geophysical Services' Technical Memorandum - Seismic Reflection Investigation Superconducting Supercollider Ring near Waxahachie, Texas, dated March 1990.



RTK

PROSPECT : SUPERCOLLIDER TEST

WAXAHACHIE, TX

LINE GS12A

SPS. 1 - 193

MIGRATION

RECORDING PARAMETERS

DATE	2-2-90
RECORDED BY	LET HOUSTON, INC.
PARTY NO	1
ENERGY SOURCE	BUFFALO GUN
CHARGE SIZE	12 GAUGE
SHOT INTERVAL	20 FT
CABLE	24 DATA TRACES
GEOPHONE PATTERN	SINGLE
GROUP INTERVAL	10 FT
RECORDING INSTRUMENTS	DS-2401
FORMAT	SEGD (FLOPPY DISK)
SAMPLE RATE	1 MSEC
FILTER	LOF : 30 HZ HF : 300 HZ

PROCESSING PARAMETERS

1 REFORMAT
2 TRACE EDIT
3 SPHERICAL DIVERGENCE CORRECTION
4 REFRACTION STATICS ANALYSIS
5 DECONVOLUTION: BURG TECHNIQUE ON SHOT ENSEMBLE 21 FT OPERATOR
6 CDP SORT
7 SPECTRAL WHITENING 70 - 300 HZ
8 VELOCITY ANALYSIS
9 TWO STATICS
10 VELOCITY ANALYSIS
11 NMO APPLICATION
12 NMO STRETCH MUTE
13 STACK 600%
14 SURFACE TO FIXED DATUM. DATUM = 700 FT.
15 ENHANCE / TAU-P NOISE REDUCTION
16 MIGRATION
17 FILTER 70 - 250 HZ
18 200 MSEC SLIDING GATE BALANCE
19 DISPLAY

PRESENTATION

VERTICAL SCALE	20 & 1MS/CM
HORIZONTAL SCALE	12 TR/IN
BRIGHT	7.0
GAIN	6
POLARITY	SEG POSITIVE
PROCESSING DATE	FEBRUARY, 1990

ENTROPIC GEOPHYSICAL
1155 DAIRY ASHFORD #105
HOUSTON, TX 77079

Figure D-7
Seismic Reflection Profile
Structure Study Zone SF 10.1

APPENDIX E

HYDROLOGIC TEST RESULTS

APPENDIX E

The objectives of the hydrologic (packer) tests were to provide estimates of the hydraulic conductivity within the Taylor Marl, Austin Chalk, and Eagle Ford Shale formations in unfractured zones, fractured or other suspected water-bearing zones, at the formation contacts, and at the tunnel elevation. Intervals within boreholes were selected for packer testing based on visual inspections of rock cores and the results of borehole geophysical testing. Sections of a borehole that exhibited increased frequency of fractures orbedding plane parting were commonly packer tested.

Standard procedures used to conduct these tests included lowering a pair of pneumatically operated rubber packers (in straddle-packer configuration) separated by a known legnth of performed pipe into the drill hole to a predetermined depth. The packer interval was approximately 20 feet. The packers were then inflated to a precalculated pressure to seal against the rock side walls and water was pumped into the test interval at a selected pressure while the flow rate was measured with a cumulative flow meter. To improve the accuracy of measurements at low flow rates, water was pumped from a large container (e.g., a drum or section of casing) and the volume removed was recorded. In addition to monitoring the water pressure and flow rate at appropriate intervals, the height of the water pressure gauge above ground surface, as well as the diameter and length of water pipe used, were recorded. The tests were continued until five consecutive readings indicated a stabilization of the flow rate but for a minimum of at least 10 minutes. Standard forms were used for data records and the hydraulic conductivity was calculated using standard Bureau of Reclamation procedures.

STRADDLE PACKER TEST RESULTS

Boring	Test Depth (feet)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)	Estimated Static Water Level* (feet)
SF 10.1C	260.3-282.1 (198.9-215.5 vertical depth)	250	20	Austin Chalk/ Eagle Ford Shale, fracture zone	8.5×10^{-7}	10
SF 10.1C	288.3-310.1 (220.3-237.2 vertical depth)	200	20	Eagle Ford Shale (fractured)	$< 4.1 \times 10^{-8}$	10

*Based on measured water level in boring BI 6 (< 0.4 mile away to the southeast).

At boring SF 10.1C, two test intervals were selected based on a review of the lithologic and wire-line logs. The upper test interval encompassed fracture zones on either side of the Austin Chalk/Eagle Ford Shale contact. The lower interval straddled an area of fractured Eagle Ford Shale at the potential tunnel elevation. Hydrologic (packer) testing followed the general procedures outlined above. Packer and gauge pressures used during the testing along with the calculated hydraulic conductivities are listed in the table above. Flow volumes were measured using a flow meter; no calibrated container was used for the tests.

APPENDIX F

LABORATORY RESULTS

GEOMECHANICAL TEST RESULTS–BORING SF 10.1C

GENERAL LITHOLOGY	VERTICAL DEPTH	BORING DEPTH	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	ATTERBERG LIMITS		FRACTION FINER THAN # 200 SIEVE	CARBONATE CONTENT	SAMPLE DIMENSION RATIO L/D	SAMPLE FAILURE MODE/ DEGREES *	UNCONFINED COMPRESSIVE STRENGTH	TRIAXIAL COMPRESSION		FAILURE STRAIN	TANGENT YOUNG'S MODULUS			POISSON'S RATIO	BRAZIL TENSILE STRENGTH	2ND CYCLE SLAKE DURABILITY INDEX	MODIFIED TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX	COMMENTS
						LL	PI						CONFINING PRESSURE σ_3 psi	DEVIATOR STRESS $\sigma_1-\sigma_3$ psi		E50 (psi)x10E5	UNLOAD/ RELOAD (psi)x10E5	σ_3 psi					
	feet	feet	percent	pcf				percent	percent			psi			percent					psi	percent		percent	
AUSTIN CHALK	190.9	250.0	13.7	121.1																				
AUSTIN CHALK	191.4	250.6	13.9	120.9						2.5	E	1484			0.40	4.53		0						
AUSTIN CHALK	191.7	251.0	13.4																	241				
AUSTIN CHALK	198.2	259.5	12.4	124.9						2.4	D	793			0.36	3.78		0						
AUSTIN CHALK	198.5	259.9	13.8	120.7																				
EAGLE FORD SHALE	206.2	269.9			2.69	89	65	99.1	4.8															
EAGLE FORD SHALE	206.6	270.5	21.8	104.7																				
EAGLE FORD SHALE	213.8	279.8	15.3	118.1																				
EAGLE FORD SHALE	214.9	281.3	15.4	117.9		67	42	97.8	7.8	2.2	D	199			0.42	0.88		0						
EAGLE FORD SHALE	216.3	283.1	17.0	114.2		75	47	98.3	6.1	2.2	B-1/30	161			0.52	0.51		0						
EAGLE FORD SHALE	216.6	283.5	17.9	111.3																				
EAGLE FORD SHALE	221.5	289.2	15.5																					
EAGLE FORD SHALE	221.7	289.4																			7.2			
EAGLE FORD SHALE	223.9	293.0	17.7	113.5																				
EAGLE FORD SHALE	224.2	293.4	17.6	114.0		86	58	98.6	5.3														27.0	
EAGLE FORD SHALE	224.5	293.7	18.0	110.9																			19.0	
EAGLE FORD SHALE	234.2	306.3	14.7	121.0	2.72	64	38	99.1	4.0	2.1	B-2/40		200	228	0.28	1.05		200						
EAGLE FORD SHALE	234.5	306.7	15.1	120.6						2.1	B-2/40		300	307	0.45	1.00		300						NOTE 1
EAGLE FORD SHALE	234.5	306.7														1.31			0.01					NOTE 2
EAGLE FORD SHALE	235.0	307.3	15.0	117.1						2.3	B-1/50	153			0.31	0.72		0						
EAGLE FORD SHALE	235.3	307.7	15.5	121.5																				
PROCEDURE			ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

SF101CPR.WK1
REVISION: 1.0
DATE: 4/24/90

PRELIMINARY
(Subject to Revision)

* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

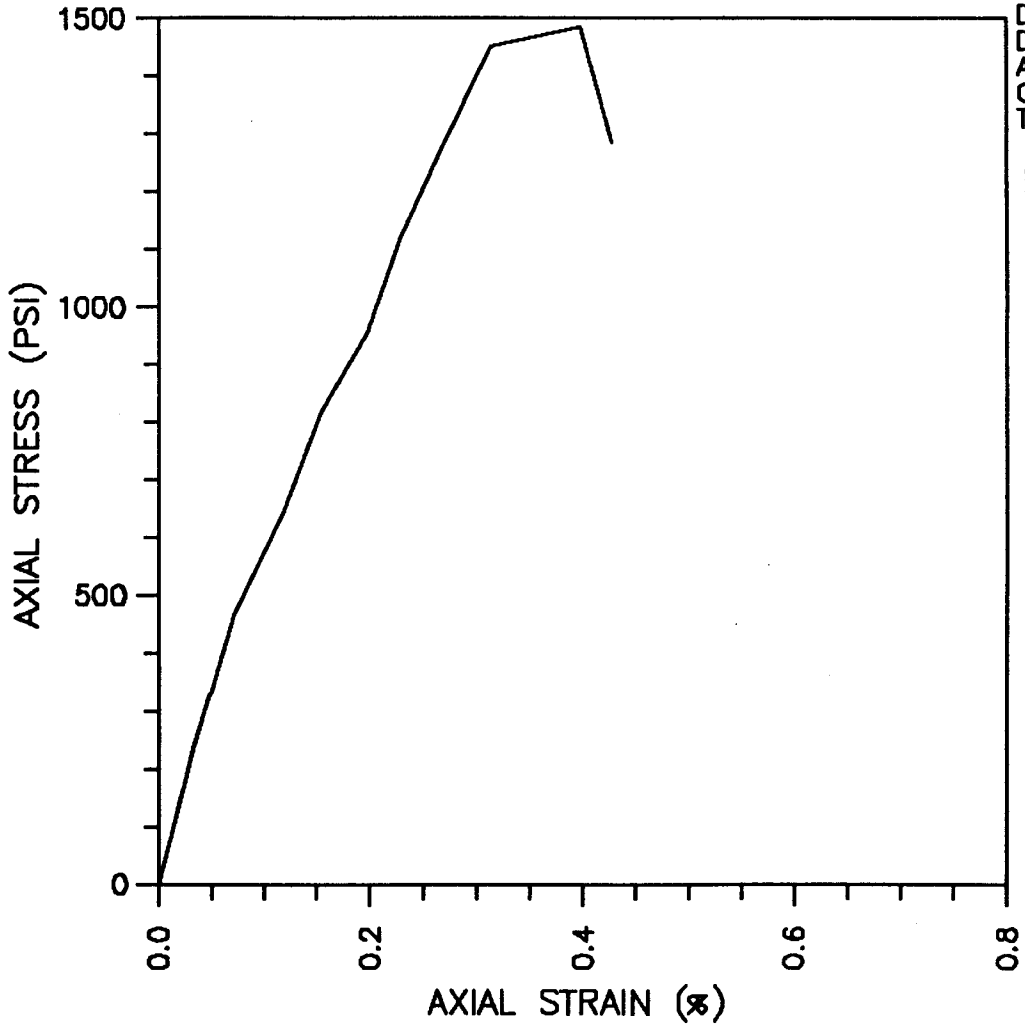
Symbol	Failure Type	Symbol	Failure Type
A	No discernible failure plane	B-4	Combination
(B)	Well defined shear plane @ "X" angle (deg) to vertical or to long axis of core	C	Barreling/Bulging
B-1	Shear plane	D	Longitudinal (axial) splitting
B-2	Bedding plane shear	E	Conical
B-3	Shear plane along pre-existing fracture, shear zone, etc.	F	No information

Note: Some values in this table may be revised based on reviews of test procedures and individual test results. The reader should refer to the latest revision of the gINT geotechnical data base (geotechnical report GR-70).

NOTES: 1) MODULUS WAS CALCULATED FROM AXIAL STRAINS MEASURED USING DIAL MICROMETER. AXIAL LENGTH IS THE SAMPLE LENGTH.

2) MODULII AND POISSON'S RATIO WERE CALCULATED FROM AXIAL AND LATERAL STRAINS MEASURED USING 3 AXIAL AND 3 LATERAL LVDTS OFFSET @ 120 DEGREES APART. AXIAL LENGTH IS 2.8 INCHES.

BORING NO.: SF10.1C
BORING DEPTH: 250.6 FEET
AUSTIN CHALK LIMESTONE
VERTICAL DEPTH: 191.4 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 13.9
DRY UNIT WEIGHT (PCF): 120.9
DEG. OF SATURATION (%): 95.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

STILE: F10C2508 DATE: 08-14-90 CAL: MCLJ

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.528 x10E5 PSI

FAILURE MODE:
CONICAL FAILURE

TEXAS SSC SITE

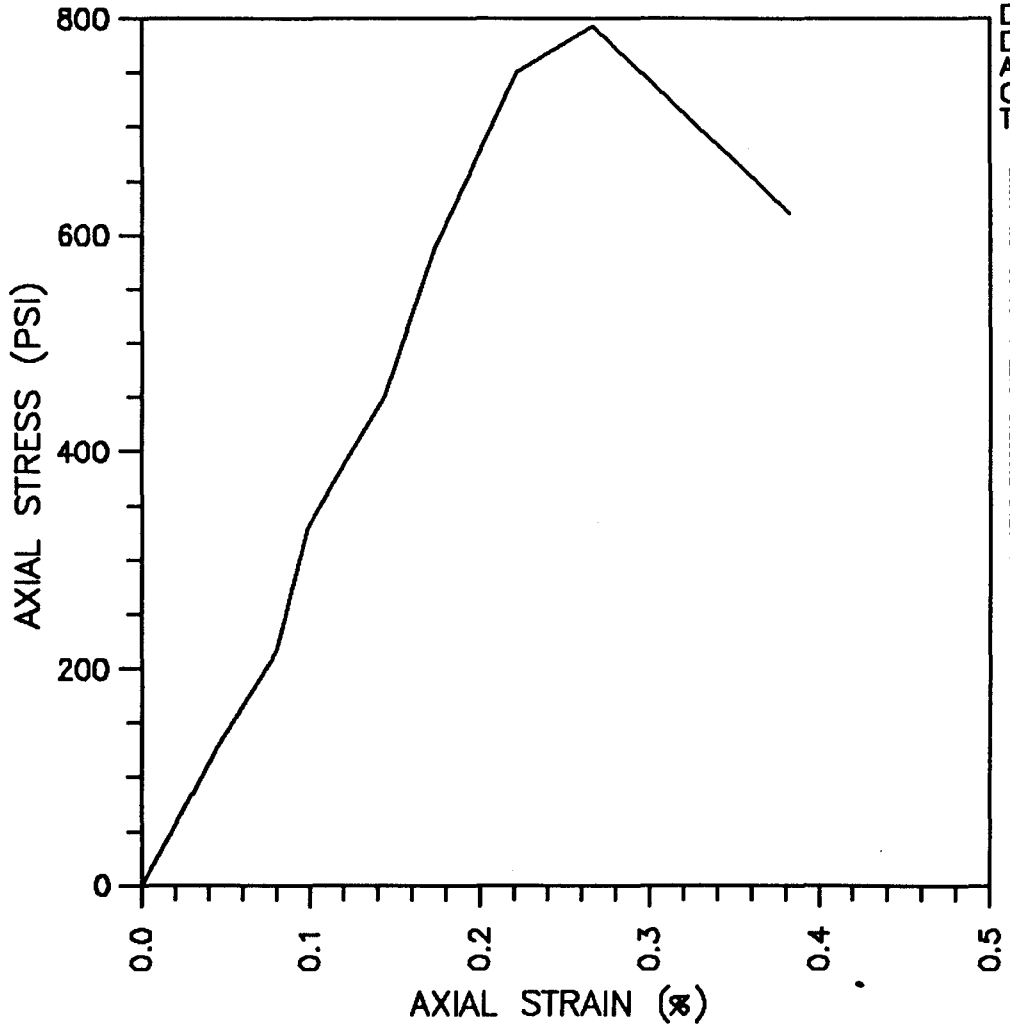
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 259.5 FEET
AUSTIN CHALK LIMESTONE
VERTICAL DEPTH: 198.2 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 12.4
DRY UNIT WEIGHT (PCF): 124.9
DEG. OF SATURATION (%): 95.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: F10C2586 DATE: 08-14-90 CAL: MCLS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.784 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

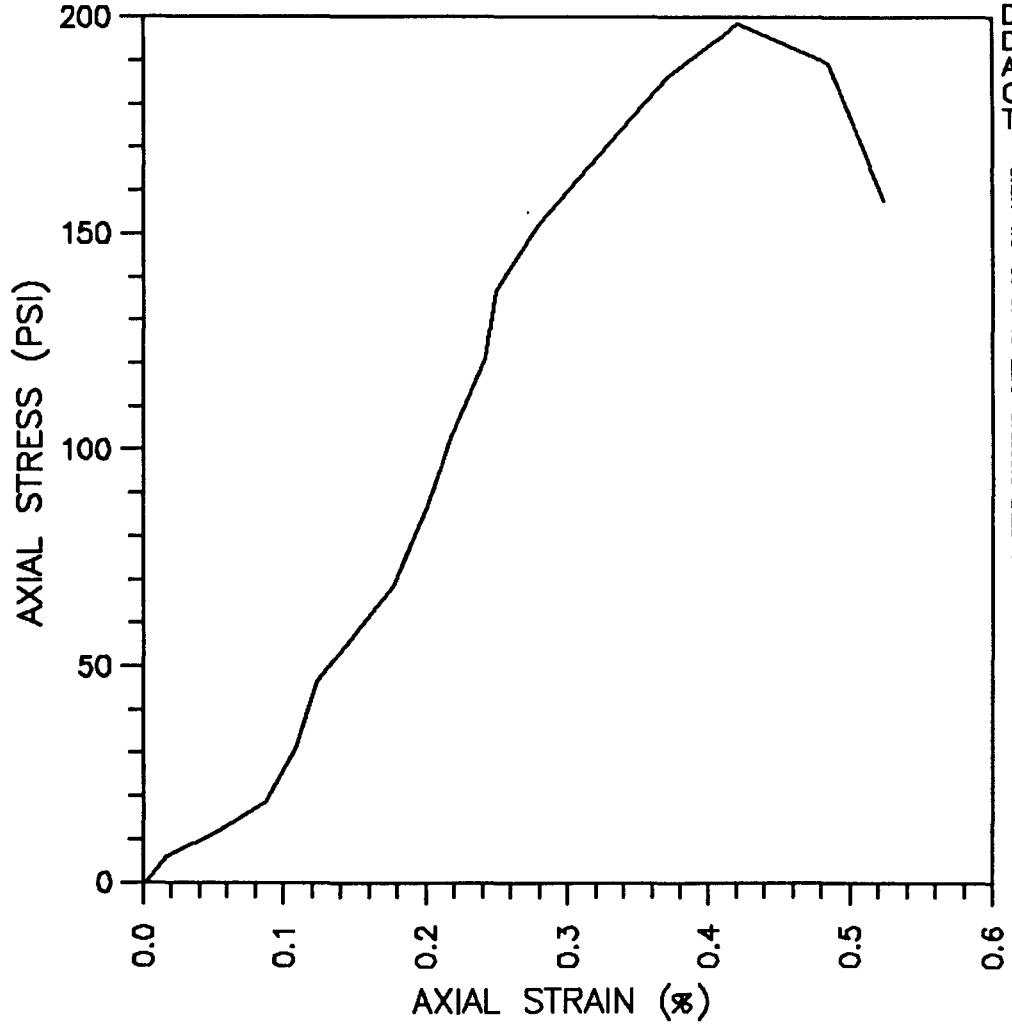
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 281.3 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 214.9 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 15.4
DRY UNIT WEIGHT (PCF): 117.9
DEG. OF SATURATION (%): 96.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: F10C2813 DATE: 04-19-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.878 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

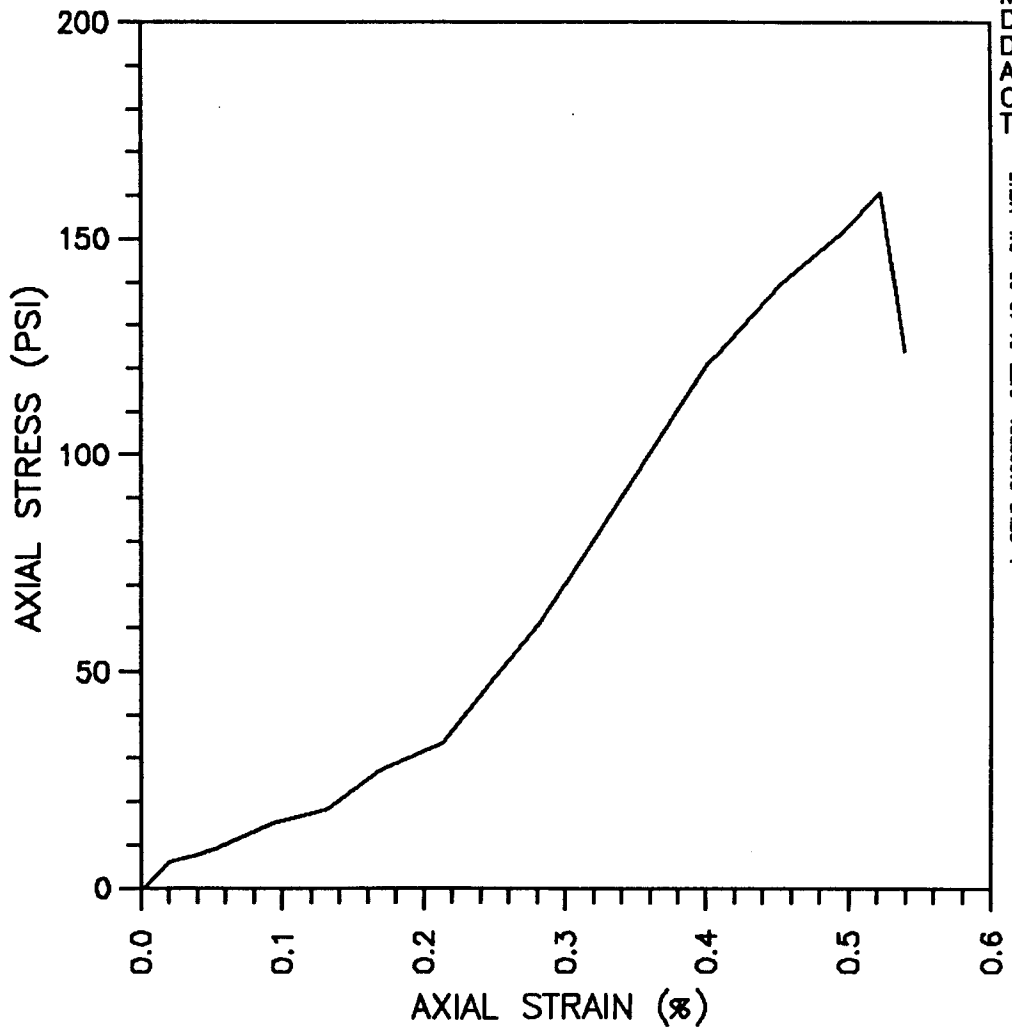
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 283.1 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 216.3 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 17.0
DRY UNIT WEIGHT (PCF): 114.2
DEG. OF SATURATION (%): 96.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: F10C2B31 DATE: 04-19-90 CAL: MCLS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.509 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG.

TEXAS SSC SITE

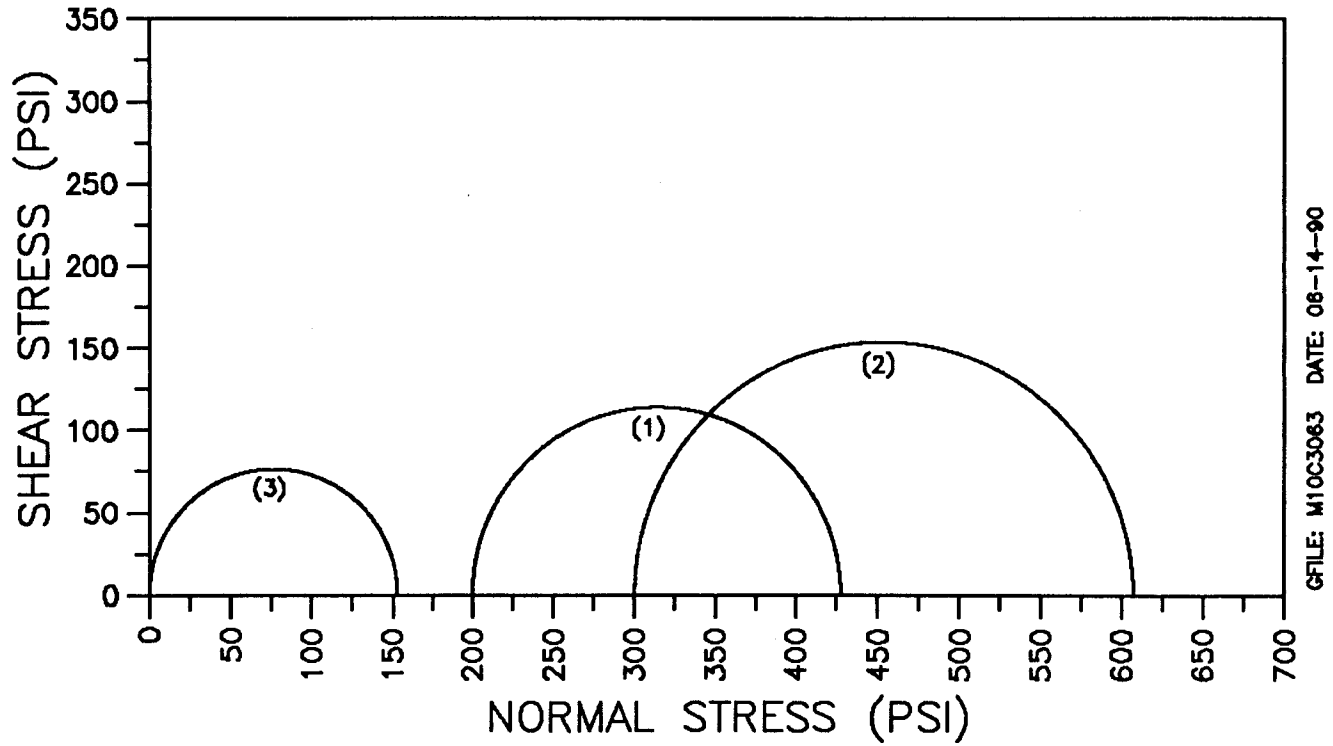
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH RANGE: 306.3-307.7 FEET
EAGLE FORD SHALE
VERTICAL DEPTH RANGE: 234.2-235.3 FEET



GFILE: M10C3063 DATE: 08-14-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

INCL. (DEG. FROM VERT.): APPROX. 40
TEST TYPE: UNCONFINED COMPRESSION (ASTM D2938)
TRIAXIAL COMPRESSION (ASTM D2664)

(1) BORING DEPTH: 306.3 FEET; VERTICAL DEPTH: 234.2 FEET
(2) BORING DEPTH: 306.7 FEET; VERTICAL DEPTH: 234.5 FEET
(3) BORING DEPTH: 307.3 FEET; VERTICAL DEPTH: 235.0 FEET

TEXAS SSC SITE

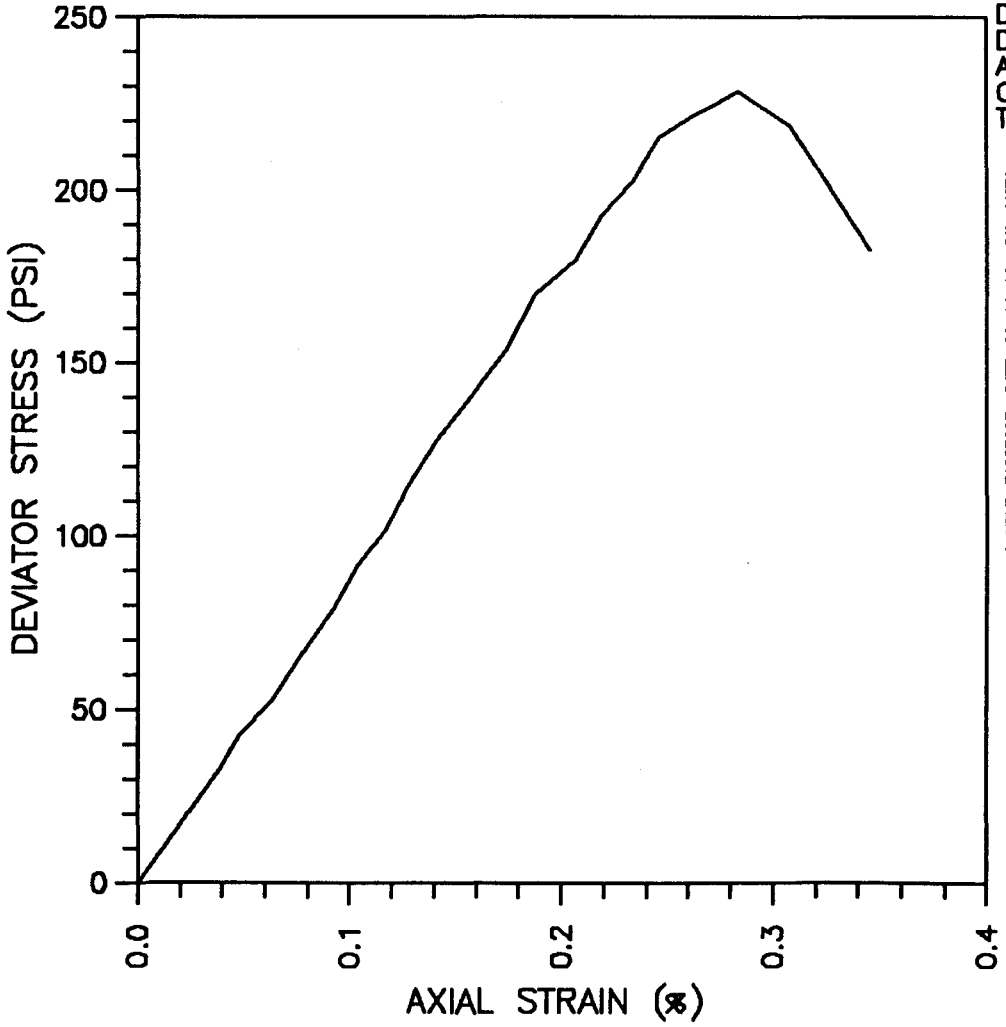
MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 306.3 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 234.2 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 14.7
DRY UNIT WEIGHT (PCF): 121.0
DEG. OF SATURATION (%): 101.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

STILE: F10C3083 DATE: 08-14-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.053 x10E5 PSI

FAILURE MODE:
BEDDING PLANE SHEAR
AT 40 DEG.

TEXAS SSC SITE

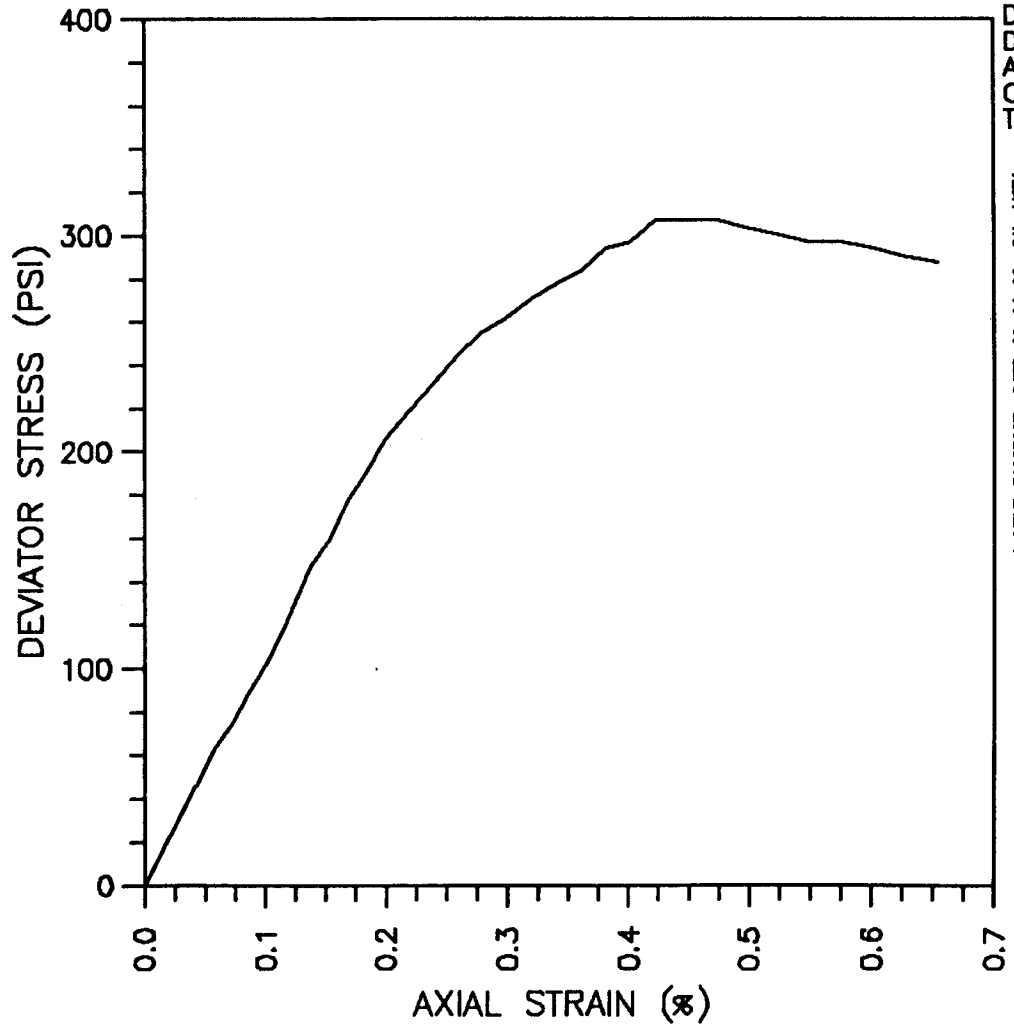
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 306.7 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 234.5 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 15.1
DRY UNIT WEIGHT (PCF): 120.6
DEG. OF SATURATION (%): 102.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 300
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

STILE: F10C3067 DATE: 06-14-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.000 x10E5 PSI

FAILURE MODE:
BEDDING PLANE SHEAR
AT 40 DEG.

TEXAS SSC SITE

STRESS-STRAIN PLOT

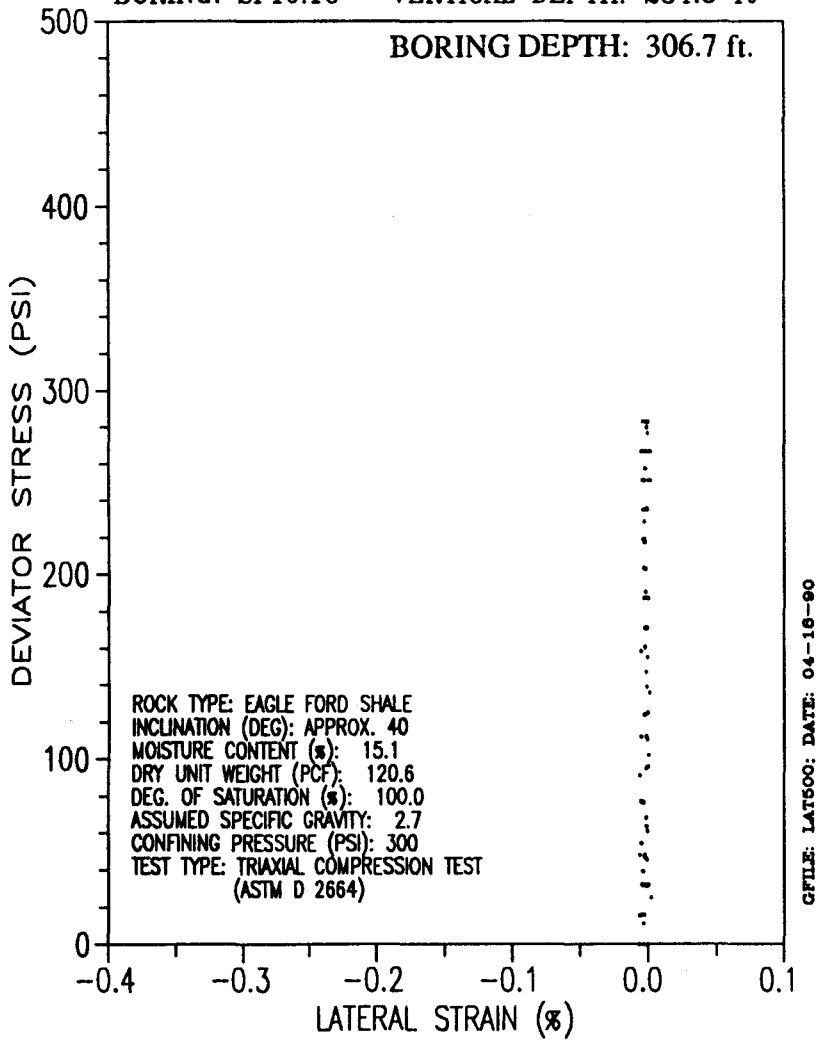
MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

DEVIATOR STRESS vs LATERAL STRAIN

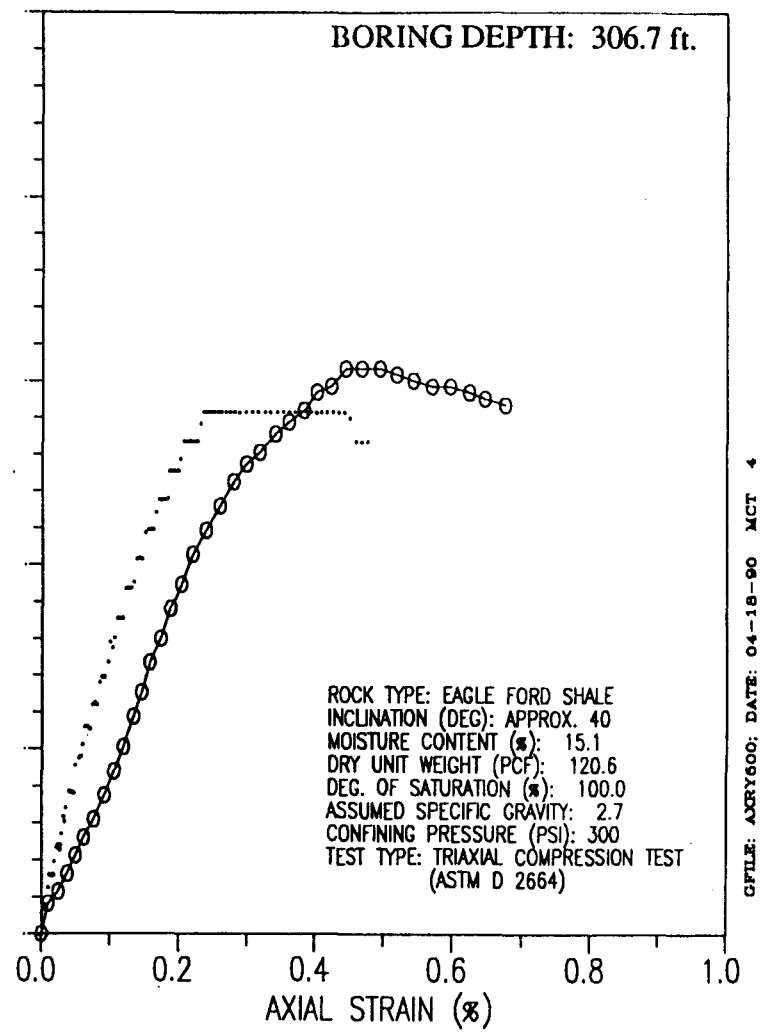
BORING: SF10.1C VERTICAL DEPTH: 234.5 ft



····· JACKET-LVDT (3)

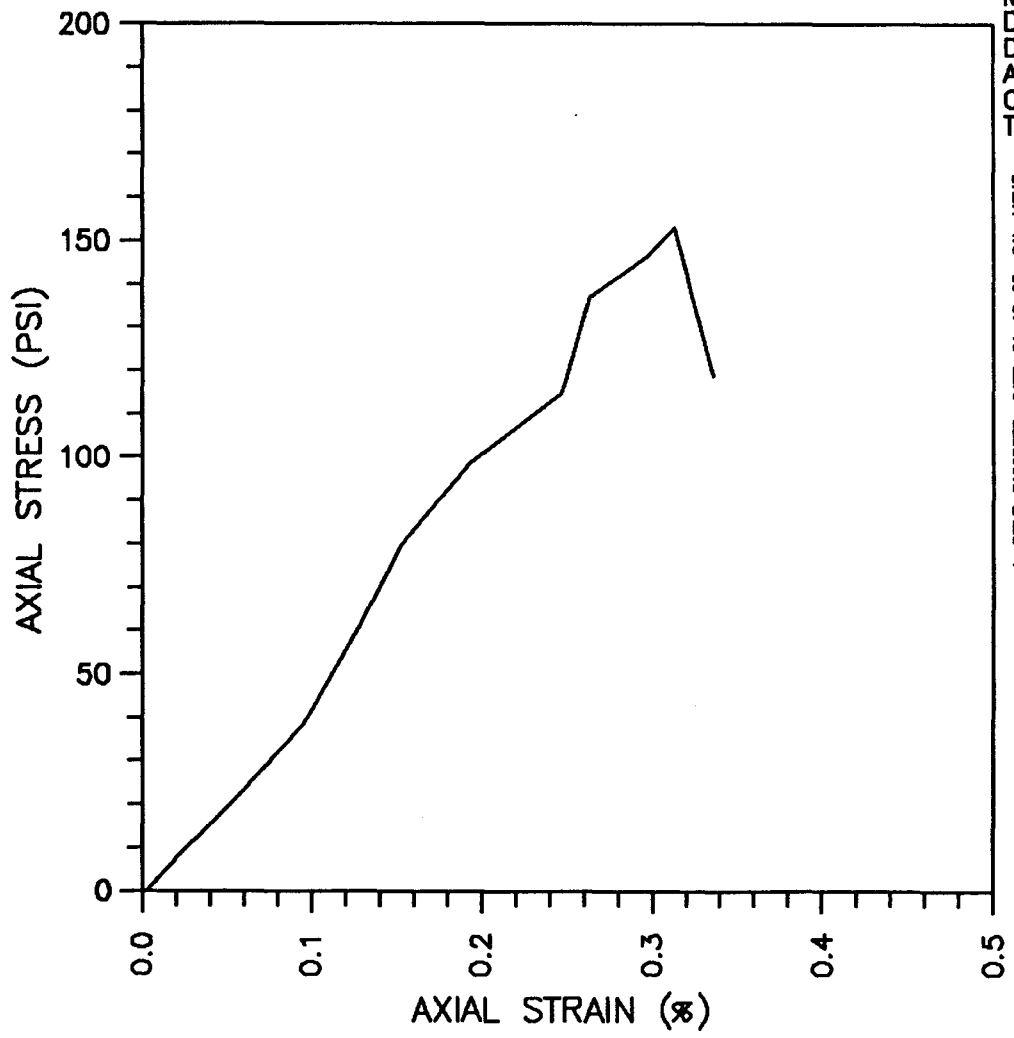
DEVIATOR STRESS vs AXIAL STRAIN

BORING: SF10.1C VERTICAL DEPTH: 234.5 ft



····· JACKET-LVDT (3) ⊖⊖⊖⊖ PLATEN-DIAL GAUGE

BORING NO.: SF10.1C
BORING DEPTH: 307.3 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 235.0 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
MOISTURE CONTENT (%): 15.0
DRY UNIT WEIGHT (PCF): 117.1
DEG. OF SATURATION (%): 92.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: F10C3073 DATE: 04-19-90 CAL: MCUJ

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.723 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 50 DEG.

TEXAS SSC SITE

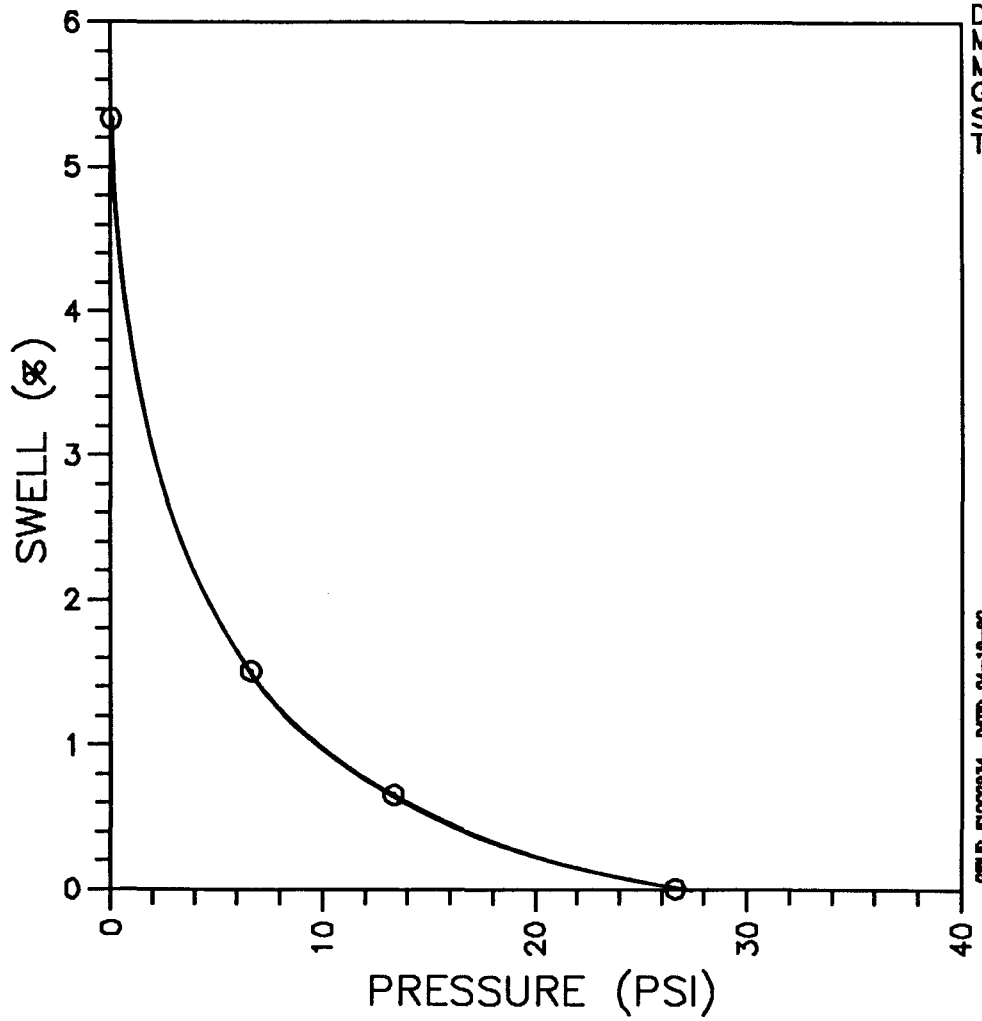
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

BORING NO.: SF10.1C
BORING DEPTH: 293.4 FEET
EAGLE FORD SHALE
VERTICAL DEPTH: 224.2 FEET



INCL. (DEG. FROM VERT.): APPROX. 40
DRY UNIT WEIGHT (PCF): 114.0
M.C. BEFORE TEST (%): 17.6
M.C.AFTER TEST (%): 26.2
GAIN IN MOISTURE (%): 8.6
SWELLING PRESSURE INDEX (PSI): 27
TEST TYPE: SWELLING PRESSURE INDEX (ISRM)

CFILE: F1022834 DATE: 04-19-90

TEXAS SSC SITE

SWELLING PRESSURE INDEX

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.12

FIGURE

APPENDIX G

PLUGGING REPORTS

SSC BOREHOLE PLUGGING REPORT

Project No. 87-888

Task No. 12

Boring No. SF 10.1A

Texas Coordination Location: N 246,949
E 2,173,300

Surface Elevation: 715.9 feet

Total Boring Depth: 110.0 feet

Date Drilled: 2/14/90

Date Plugged: 2/15/90

Time Completed: 5:35 p.m.

Remarks:

112 gallons of grout (tremie placed) was used to completely cement boring from bottom to top. Water/cement ratio was approximately 7 gallons per sack.

Drilling geologist: Shawn Wood
Coordinator: Shawn Wood
SwL Report No. 89-192

SSC BOREHOLE PLUGGING REPORT

Project No. 87-888

Task No. 12

Boring No. SF 10.1B

Texas Coordination Location: N 246,831
E 2,173,386

Surface Elevation: 713.1 feet

Total Boring Depth: 110.0 feet

Date Drilled: 2/14/90

Date Plugged: 2/14/90

Time Completed: 5:10 p.m.

Remarks:

112 gallons of grout (tremie placed) was used to completely cement boring from bottom to top. Water/cement ratio was approximately 7 gallons per sack.

Drilling geologist: Shawn Wood
Coordinator: Shawn Wood
SwL Report No. 89-192

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0012

Task No. 12

Boring No. SF 10.1C

Texas Coordinate Location:

~N247,047;~E2,173,209

Surface Elevation: ~ 718.3

Total Boring Depth: 344.0

Plugging Remarks:

Grouted through 300 feet of 1" diameter tremie pipe. Tremie was pulled and grout was placed. All casing was pulled from the hole and hole was grouted to ground surface. Grout mix used was 5 sacks of Type I cement: 30 gallons of water: and 2 shovels of bentonite.

Date Plugged: 3/16/90

Time Completed: 10:30 am

Drilling Geologist: Jim Sansom
MJA Coordinator: W.D. Flanigan
MJA No.: 5530.12