

ORIGINAL

BSU Borehole Engineering Seismology Preliminary Observations

Date: 21 May 96

Type of Phones Geostuff Borehole / OYO Reference

1. Name of well BSU-1 Capital Station

2. Location of well
X= 9754.74 m East

Y= 10174.08 m West

Z= 819.91 m above Casing Elevation, CE.)

3. Depth to top of water table (measured from CE) W. Barash 15.83 ft = 4.825m

4. Height above ground level to CE 0.68m above G

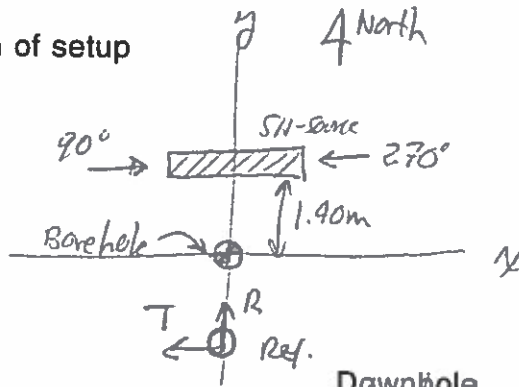
Dummy Tool 3.78m
+ 1.12m
4.90m
(Good agreement)

5. Reference Phone offset from borehole 1.15m South (180° az)

6. Reference Phone depth below ground level 0.15m below G

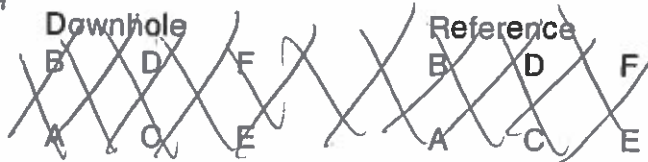
7. Source Offset from borehole 1.40m North (0° az)

8. Sketch of setup



9. Break out box wiring

NOT Used



10. Blue box channel settings

| Channel | Component |
|----------|-----------------------|
| <u>1</u> | Vertical |
| <u>2</u> | Longitudinal (radial) |
| <u>3</u> | Transverse |

Well T/D 18.9m
+ 1.12
20.02m

BSU GEOPHYSICS VSP OBSERVER'S LOG

+1.12
18.9m

Total Depth 3.78m water table

Coordinate System Origin at Borehole
Casing Elevation: 0.68 m above
Azimuth of X-Axis: 90°
Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
Azimuth 180°
Elev. 0.15 m below
X= 0
Y= -1.15

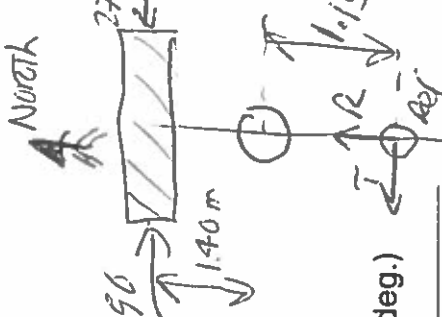
Geostuff Borehole Phone Reference Phone
Channel Configuration: V=Channel 1
R=Channel 2
T=Channel 3

Reference Polarization: V 0
R 0
T 270
Azi. (deg.) 0
Vert. (deg.) 90
90

Date: 21 May 96 Location: Cap. 1st Station BSU-1
High Cut 1000 Low Cut 4 Sample Int. 0.002 seconds
Number of Samples 2500
Location X = 9754.74 m Y = 10174.08 m Z = 819.91 m casing Elev (m.p.) 7.825

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|----------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 1 | BSU00001 | 19.5m | | 1.40m | 0° | | | | 270 | 90 |
| 2 | | 19.5m | | | | | | | 90 | 90 |
| 3 | | 19.25 | | | | | | | 270 | 90 |
| 4 | | 19.25 | | | | | | | 90 | 90 |
| 5 | | 19.00 | | | | | | | 270 | 90 |
| 6 | | 19.00 | | | | | | | 90 | 90 |
| 7 | | 18.75 | | | | | | | 270 | 90 |
| 8 | | 18.75 | | | | | | | 90 | 90 |
| 9 | | 18.50 | | | | | | | 270 | 90 |
| 10 | | 18.50 | | | | | | | 90 | 90 |

7.825m
N/C
Table
TOP
(Sub CE)



BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m ABG
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15

Channel Configuration:
 Borehole Phone Geoph
 V=Channel 1
 R=Channel 2
 T=Channel 3
 Reference Phone
 V=Channel 4
 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 11 | | 18.25 | | +1.40m | 0° | | | | 270 | 90 |
| 12 | | 18.25 | | | | | | | 90 | 90 |
| 13 | | 18.60 | | | | | | | 270 | 90 |
| 14 | | 18.00 | | | | | | | 90 | 90 |
| 15 | | 17.75 | | | | | | | 270 | 90 |
| 16 | | 17.75 | | | | | | | 90 | 90 |
| 17 | | 17.50 | | | | | | | 270 | 90 |
| 18 | | 17.50 | | | | | | | 90 | 90 |
| 19 | | 17.25 | | | | | | | 270 | 90 |
| 20 | | 17.25 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 168 Above 0
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15 m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15

Channel Geostuff
 Borehole Phone
 Configuration: V=Channel 1 V=Channel 4
 R=Channel 2 R=Channel 5
 T=Channel 3 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 21 | | 17.00 | | 1.40m | 0° | | | | 270 | 90 |
| 22 | | 17.00 | | | | | | | 90 | 90 |
| 23 | | 16.75 | | | | | | | 270 | 90 |
| 24 | | 16.75 | | | | | | | 90 | 90 |
| 25 | | 16.50 | | | | | | | 270 | 90 |
| 26 | | 16.50 | | | | | | | 90 | 90 |
| 27 | | 16.25 | | | | | | | 270 | 90 |
| 28 | | 16.25 | | | | | | | 90 | 90 |
| 29 | | 16.00 | | | | | | | 270 | 90 |
| 30 | | 16.00 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 0.68m a.b.g
 Azimuth of X-Axis 20'
 Azimuth of Y-Axis 0'

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m below
 X= 0
 Y= -1.15

Channel Configuration: Geophysical
 Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU - 1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 31 | | 15.75 | | 1.40m | 0° | | | | 270 | 90 |
| 32 | | 15.75 | | | | | | | 90 | 90 |
| 33 | | 15.50 | | | | | | | 270 | 90 |
| 34 | | 15.50 | | | | | | | 90 | 90 |
| 35 | | 15.25 | | | | | | | 270 | 90 |
| 36 | | 15.25 | | | | | | | 90 | 90 |
| 37 | | 15.00 | | | | | | | 270 | 90 |
| 38 | | 15.00 | | | | | | | 90 | 90 |
| 39 | | 14.75 | | | | | | | 270 | 90 |
| 40 | | 14.75 | | | | | | | 90 | 90 |

(4)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m above
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15

Channel Configuration:
 Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization:
 V 0
 R 0
 T 270

Azi.(deg.)

Vert.(deg.)
0
90
90

Date: 21 May 96 Location: BSU-1
 High Cut 1600 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 41 | | 14.50 | | | | | | | 270 | 90 |
| 42 | | 14.50 | | | | | | | 90 | 90 |
| 43 | | 14.00 | | | | | | | 270 | 90 |
| 44 | | 14.00 | | | | | | | 90 | 90 |
| 45 | | 13.75 | | | | | | | 280 | 90 |
| 46 | | 13.75 | | | | | | | 90 | 90 |
| 47 | | 13.50 | | | | | | | 270 | 90 |
| 48 | | 13.50 | | | | | | | 90 | 90 |
| 49 | | 13.25 | | | | | | | 270 | 90 |
| 50 | | 13.25 | | | | | | | 90 | 90 |

← Repeat
 ←

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m above
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15m

Channel Configuration: Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0
 R 0
 T 270

Date: 21/07/96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 51 | | 13.00 | | 1.40m | 0° | | | | 270 | 90 |
| 52 | | 13.00 | | | | | | | 90 | 90 |
| 53 | | 12.75 | | | | | | | 270 | 90 |
| 54 | | 12.75 | | | | | | | 90 | 90 |
| 55 | | 12.50 | | | | | | | 270 | 90 |
| 56 | | 12.50 | | | | | | | 90 | 90 |
| 57 | | 12.25 | | | | | | | 270 | 90 |
| 58 | | 12.25 | | | | | | | 70 | 90 |
| 59 | | 12.00 | | | | | | | 270 | 90 |
| 60 | | 12.00 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68 m above
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15 m
 Azimuth 180°
 Elev. 15 m below
 X= 0
 Y= -1.15 m

Channel Geoff
 Borehole Phone
 Configuration: V=Channel 1 Reference Phone
 R=Channel 2 V=Channel 4
 T=Channel 3 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: KSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 61 | | 11.75 | | 1.40m | 0° | | | | 270 | 90 |
| 62 | | 11.75 | | | | | | | 90 | 90 |
| 63 | | 11.50 | | | | | | | 270 | 90 |
| 64 | | 11.50 | | | | | | | 90 | 90 |
| 65 | | 11.25 | | | | | | | 270 | 90 |
| 66 | | 11.25 | | | | | | | 90 | 90 |
| 67 | | 11.00 | | | | | | | 270 | 90 |
| 68 | | 11.00 | | | | | | | 90 | 90 |
| 69 | | 10.75 | | | | | | | 270 | 90 |
| 70 | | 10.75 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: .68m above G
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. .15m below G
 X= 0
 Y= -1.15

Channel Geostuff
 Borehole Phone
 Configuration: V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0
 R 0
 T 270

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .00028s Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 71 | | 10.50 | | 1.40m | 0° | | | | 270 | 90 |
| 72 | | 10.50 | | | | | | | 90 | 90 |
| 73 | | 10.25 | | | | | | | 270 | 90 |
| 74 | | 10.25 | | | | | | | 90 | 90 |
| 75 | | 10.00 | | | | | | | 270 | 90 |
| 76 | | 10.00 | | | | | | | 90 | 90 |
| 77 | | 9.75 | | | | | | | 270 | 90 |
| 78 | | 9.75 | | | | | | | 90 | 90 |
| 79 | | 9.50 | | | | | | | 270 | 90 |
| 80 | | 9.50 | | | | | | | 90 | 90 |

(8)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m above
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m below
 X= 0
 Y= -1.15m

Channel Geostuff
 Borehole Phone
 Configuration: V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 Nov 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 81 | | 9.25 | | | | | | | 270 | 90 |
| 82 | | 9.25 | | | | | | | 90 | 90 |
| 83 | | 9.00 | | | | | | | 270 | 90 |
| 84 | | 9.00 | | | | | | | 90 | 90 |
| 85 | | 8.75 | | | | | | | 270 | 90 |
| 86 | | 8.75 | | | | | | | 90 | 90 |
| 87 | | 8.50 | | | | | | | 270 | 90 |
| 88 | | 8.50 | | | | | | | 90 | 90 |
| 89 | | 8.25 | | | | | | | 270 | 90 |
| 90 | | 8.25 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: -68m above G
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 180°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m below G
 X= 0
 Y= -1.15m

Channel Configuration: Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BP4-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 91 | | 8.00 | | 1.40m | 0° | | | | 270 | 90 |
| 92 | | 8.00 | | | | | | | 90 | 90 |
| 93 | | 7.75 | | | | | | | 270 | 90 |
| 94 | | 7.75 | | | | | | | 90 | 90 |
| 95 | | 7.50 | | | | | | | 270 | 90 |
| 96 | | 7.50 | | | | | | | 90 | 90 |
| 97 | | 7.25 | | | | | | | 270 | 90 |
| 98 | | 7.25 | | | | | | | 90 | 90 |
| 99 | | 7.00 | | | | | | | 270 | 90 |
| 100 | | 7.00 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m above
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15

Channel Geostuff
 Borehole Phone
 Configuration: V=Channel 4
 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 7 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | Source Polarization | | |
|------|------|-------------------|-------|--------|---------|-------|---|---------------------|---------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 101 | | 6.75 | | 1.40m | 0° | | | | 270 | 90 |
| 102 | | 6.75 | | | | | | | 90 | 90 |
| 103 | | 6.50 | | | | | | | 270 | 90 |
| 104 | | 6.50 | | | | | | | 90 | 90 |
| 105 | | 6.25 | | | | | | | 270 | 90 |
| 106 | | 6.25 | | | | | | | 90 | 90 |
| 107 | | 6.00 | | | | | | | 270 | 90 |
| 108 | | 5.75 | | | | | | | 90 | 90 |
| 109 | | 5.5 | | | | | | | 270 | 90 |
| 110 | | 5.25 | | | | | | | 90 | 90 |

(11)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
Casing Elevation: -68m above G
Azimuth of X-Axis 90°
Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15m
Azimuth 180°
Elev. 15m below G
X= 0
Y= -1.15

Channel Geophys
Borehole Phone
Configuration: V=Channel 4
R=Channel 5
T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
V 0 0
R 0 90
T 270 90

Date: 21 May 96 Location: BSU-1
High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 111 | | 5.50 | | 1.40m | 0° | | | | 270 | 90 |
| 112 | | 5.50 | | | | | | | 90 | 90 |
| 113 | | 5.25 | | | | | | | 270 | 90 |
| 114 | | 5.25 | | | | | | | 90 | 90 |
| 115 | | 5.00 | | | | | | | 270 | 90 |
| 116 | | 5.00 | | | | | | | 90 | 90 |
| 117 | | 4.75 | | | | | | | 270 | 90 |
| 118 | | 4.75 | | | | | | | 90 | 90 |
| 119 | | 4.50 | | | | | | | 270 | 90 |
| 120 | | 4.50 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m AN
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m 61w
 X= 0
 Y= -1.15

Channel Borehole Phone Reference Phone
 Configuration: V=Channel 1 V=Channel 4
 R=Channel 2 R=Channel 5
 T=Channel 3 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1066 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 121 | | 4.25 | | 1.40m | 0° | | | | 270 | 90 |
| 122 | | 4.25 | | | | | | | 90 | 90 |
| 123 | | 4.00 | | | | | | | 270 | 90 |
| 124 | | 4.00 | | | | | | | 90 | 90 |
| 125 | | 3.75 | | | | | | | 270 | 90 |
| 126 | | 3.75 | | | | | | | 90 | 90 |
| 127 | | 3.50 | | | | | | | 270 | 90 |
| 128 | | 3.50 | | | | | | | 270 | 90 |
| 129 | | 3.25 | | | | | | | 270 | 90 |
| 130 | | 3.25 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 168m abv
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. -15m bblw
 X= 0
 Y= -1.15

Channel Geotiff
 Borehole Phone
 Configuration: V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 130 | | 3.00 | | 1.40m | 0° | | | | 270 | 90 |
| 132 | | 3.00 | | | | | | | 90 | 90 |
| 133 | | 2.75 | | | | | | | 270 | 90 |
| 134 | | 2.75 | | | | | | | 90 | 90 |
| 135 | | 2.50 | | | | | | | 270 | 90 |
| 136 | | 2.50 | | | | | | | 90 | 90 |
| 137 | | 2.25 | | | | | | | 270 | 50 |
| 138 | | 2.25 | | | | | | | 90 | 90 |
| 139 | | 2.00 | | | | | | | 270 | 90 |
| 140 | | 2.00 | | | | | | | 90 | 90 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68 m abv
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.5m
 Azimuth 180°
 Elev. 15m blw
 X= 0
 Y= -1.5

Channel Geophys Reference Phone 0x0
 Configuration: V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1020 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Vertical |
| 141 | | 1.75 | | 1.40m | 0° | | | | 90 |
| 142 | | 1.75 | | | | | | | 90 |
| 143 | | 1.50 | | | | | | | 90 |
| 144 | | 1.50 | | | | | | | 90 |
| 145 | | 1.25 | | | | | | | 90 |
| 146 | | 1.25 | | | | | | | 90 |
| 147 | | 1.00 | | | | | | | 90 |
| 148 | | 1.00 | | | | | | | 90 |
| 149 | | 0.75 | | | | | | | 90 |
| 150 | | 0.75 | | | | | | | 90 |

20°
 N
 W

13.40

(15)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m abv
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m b/w
 X= 0
 Y= -1.5

Channel Configuration:
 Borehole Phone
 V=Channel 4
 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 0002 Number of Samples 2500

P-wave
 S-wave

| Shot | | Borehole Geophone | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Vertical |
| 151 | | 19.5m | | 4.40m | 0° | | | | 180 |
| 152 | | 19.25 | | | | | | | 180 |
| 153 | | 19.00 | | | | | | | 180 |
| 154 | | 18.75 | | | | | | | 180 |
| 155 | | 18.50 | | | | | | | 180 |
| 156 | | 18.25 | | | | | | | 180 |
| 157 | | 18.00 | | | | | | | 180 |
| 158 | | 17.75 | | | | | | | 180 |
| 159 | | 17.50 | | | | | | | 180 |
| 160 | | 17.25 | | | | | | | 180 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 168m above 0
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m above 0
 X= 0
 Y= -1.15

Channel Configuration:
 Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization:
 V 0 Vert.(deg.) 0
 R 0 90
 T 270 90

Date: 21 May 98 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 161 | | 17.0 | | 1.40m | 0° | | | | 0 | 180 |
| 162 | | 16.75 | | 1 | 1 | | | | 0 | 180 |
| 163 | | 16.50 | | 1 | 1 | | | | 0 | 180 |
| 164 | | 16.25 | | 1 | 1 | | | | 0 | 180 |
| 165 | | 16.00 | | 1 | 1 | | | | 0 | 180 |
| 166 | | 15.75 | | 1 | 1 | | | | 0 | 180 |
| 167 | | 15.50 | | 1 | 1 | | | | 0 | 180 |
| 168 | | 15.25 | | 1 | 1 | | | | 0 | 180 |
| 169 | | 15.00 | | 1 | 1 | | | | 0 | 180 |
| 170 | | 14.75 | | 1 | 1 | | | | 0 | 180 |

(17)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 168m 0.6V
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m 51m
 X= 0
 Y= -1.15

Channel Geostuff
 Borehole Phone 070
 Configuration: V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 Nov 96 Location: BP4-1
 High Cut low Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 171 | | 14.50 | | 1.40m | 0° | | | | 0 | 180 |
| 172 | | 14.25 | | | | | | | 0 | 180 |
| 173 | | 14.00 | | | | | | | 0 | 180 |
| 174 | | 13.75 | | | | | | | 0 | 180 |
| 175 | | 13.50 | | | | | | | 0 | 180 |
| 176 | | 13.25 | | | | | | | 0 | 180 |
| 177 | | 13.00 | | | | | | | 0 | 180 |
| 178 | | 12.75 | | | | | | | 0 | 180 |
| 179 | | 12.50 | | | | | | | 0 | 180 |
| 180 | | 12.25 | | | | | | | 0 | 180 |

(18)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: -68m asv
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. -15m slw
 X= 0
 Y= -1.15

Channel Configuration: Borehole Phone
 V=Channel 1
 R=Channel 3
 T=Channel 3

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0
 R 0
 T 270

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 180 | | 12.60 | | 1.40m | 0° | | | | 0 | 180 |
| 181 | | 11.75 | | | | | | | 0 | 180 |
| 183 | | 11.50 | | | | | | | 0 | 180 |
| 184 | | 11.25 | | | | | | | 0 | 180 |
| 185 | | 11.00 | | | | | | | 0 | 180 |
| 186 | | 10.75 | | | | | | | 0 | 180 |
| 187 | | 10.50 | | | | | | | 0 | 180 |
| 188 | | 10.25 | | | | | | | 0 | 180 |
| 189 | | 10.00 | | | | | | | 0 | 180 |
| 190 | | 9.75 | | | | | | | 0 | 180 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 168m abv
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m b/w
 X= 0
 Y= -1.15

Channel Configuration:
 Borehole Phone
 V=Channel 1
 R=Channel 2
 T=Channel 3

Reference Polarization:
 V 0
 R 0
 T 270
 Vert.(deg.)
0
90
90

Date: 21 May 91 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. .0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 191 | | 9.50 | | 1.40 | 0° | | | | 0 | 180 |
| 192 | | 9.25 | | | | | | | 0 | 180 |
| 193 | | 9.00 | | | | | | | 0 | 180 |
| 194 | | 8.75 | | | | | | | 0 | 180 |
| 195 | | 8.50 | | | | | | | 0 | 180 |
| 196 | | 8.25 | | | | | | | 0 | 180 |
| 197 | | 8.00 | | | | | | | 0 | 180 |
| 198 | | 7.75 | | | | | | | 0 | 180 |
| 199 | | 7.50 | | | | | | | 0 | 180 |
| 200 | | 7.25 | | | | | | | 0 | 180 |

(20)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m base
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 1.15m blue
 X= 0
 Y= -1.15

Channel 6 base
 Borehole Phone
 Configuration: V=Channel 1 Reference Phone
 R=Channel 2 V=Channel 4
 T=Channel 3 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 1.0002 Number of Samples 2500

| Shot | | Borehole Geophone | | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Azimuth | Vertical |
| 201 | | 7.00 | | 1.40m | 0° | | | | 0 | 180 |
| 202 | | 6.75 | | | | | | | 0 | 180 |
| 203 | | 6.50 | | | | | | | 0 | 180 |
| 204 | | 6.25 | | | | | | | 0 | 180 |
| 205 | | 6.00 | | | | | | | 0 | 180 |
| 206 | | 5.75 | | | | | | | 0 | 180 |
| 207 | | 5.50 | | | | | | | 0 | 180 |
| 208 | | 5.25 | | | | | | | 0 | 180 |
| 209 | | 5.00 | | | | | | | 0 | 180 |
| 210 | | 4.75 | | | | | | | 0 | 180 |

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: -68m above
 Azimuth of X-Axis 90°
 Azimuth of Y-Axis 0°

Reference Phone: Offset 1.15
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.5

Channel Geophy
 Borehole Phone
 Configuration: V=Channel 4
 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | Source | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---------------------|---|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y |
| 211 | | 4.50 | | 1.40m | 0° | | | |
| 212 | | 4.25 | | | | | | |
| 213 | | 4.00 | | | | | | |
| 214 | | 3.75 | | | | | | |
| 215 | | 3.50 | | | | | | |
| 216 | | 3.25 | | | | | | |
| 217 | | 3.00 | | | | | | |
| 218 | | 2.75 | | | | | | |
| 219 | | 2.50 | | | | | | |
| 220 | | 2.25 | | | | | | |

(22)

BSU GEOPHYSICS VSP OBSERVER'S LOG

Coordinate System Origin at Borehole
 Casing Elevation: 68m above
 Azimuth of X-Axis: 90°
 Azimuth of Y-Axis: 0°

Reference Phone: Offset 1.15m
 Azimuth 180°
 Elev. 15m below
 X= 0
 Y= -1.15

Channel Geophys Borehole Phone 070
 Configuration: V=Channel 4
 R=Channel 5
 T=Channel 6

Reference Polarization: Azi.(deg.) Vert.(deg.)
 V 0 0
 R 0 90
 T 270 90

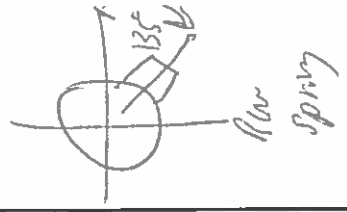
Date: 21 May 96 Location: BSU-1
 High Cut 1000 Low Cut 4 Sample Int. 0.002 Number of Samples 2500

| Shot | | Borehole Geophone | | Source | | | | Source Polarization | |
|------|------|-------------------|-------|--------|---------|-------|---|---------------------|----------|
| Rec | File | Depth | Elev. | Offset | Azimuth | Elev. | X | Y | Vertical |
| 221 | | 2.00 | | 1.40 | 0° | | | | 180 |
| 222 | | 1.75 | | | | | | | 180 |
| 223 | | 1.50 | | | | | | | 180 |
| 224 | | 1.25 | | | | | | | 180 |
| 225 | | 1.00 | | | | | | | 180 |
| 226 | | 0.75 | | | | | | | 180 |
| | | | | | | | | | |
| | | 15.00 | | | | | | | 180 |
| | | 14.50 | | | | | | | 180 |
| | | 14.00 | | | | | | | 180 |

BSU
INST

AST
INST

(23)



Down Hole Geophone Field Check List

Project: Capital Station

Date: 21 May 96 Odometer Start: _____ Finish: _____

OFFICE

| Item | Out | In | Comment |
|------------------------------------|-----|----|---------------------|
| BHG-2 Borehole Geophone | ✓ | ✓ | |
| BHGC-1 Geophone Controller (Blue) | ✓ | | |
| Cable: Spool to BHGC-1 | ✓ | | |
| Cable: BHGC-1 to Bison | ✓ | | |
| Ban./Alligator Power Cables BHGC-1 | ✓ | | |
| Break out Box | ✓ | | Not used |
| Oyo 3-C Reference Phone (Blue) | ✓ | | |
| Dummy tool | ✓ | | |
| Pulley/Winch Assem. | ✓ | | |
| Bison Seismograph | | | Jack - 5/25 |
| Vertical Hammer Source | ✓ | | |
| Black Tape | ✓ | | |
| WD-40 | ✓ | | |
| Observer's Sheets/Note Book | ✓ | | |
| Rope | ✓ | | |
| Rock Hammer | ✓ | | |
| Tape measure (50 m) | ✓ | | |
| Gloves | | | |
| Compass and Maps | ✓ | | |
| Trigger Switch Toggle Box | | | Don't need |
| Gas Card & Keys | ✓ | | |
| Water Table Logging Probe | | | NOT AVAILABLE |

Lincoln Street and Garage

| Item | Out | In | Comment |
|---|-----|----|--|
| Bison Cable Box (yellow) Power Cable ✓ Trigger Cables ✓ Black Tape | ✓ | | |
| Bison Tool Box (grey) Paper for bison Miscl. Electronics/Safety | ✓ | | needs more paper + rolls only one ↓ |
| Tool Box | | | |
| Trigger Extension Cord | ✓ | | from office |
| Tripod Head | ✓ | | |
| Tripod Legs (3) | ✓ | | |
| Batteries (12V car) Need 2 | ✓ | | |
| Jumper Cable for 24V operation | | | |
| Railroad Tie Horizontal Hammers | ✓ | | |
| Sand Bags (2) | ✓ | | |
| Shovel | ✓ | | |
| Pick | ✓ | | |
| Nails to hold off hammer heads | ✓ | | |
| Post Hole Digger | ✓ | | |
| need Jumper Cable for pickup truck — | | | |
| | | | |
| | | | |
| | | | |
| | | | |