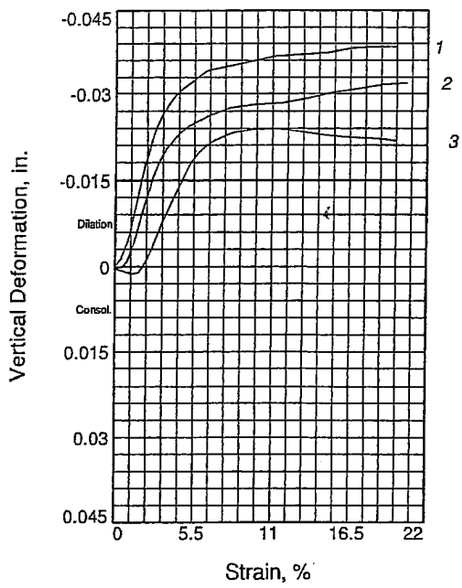
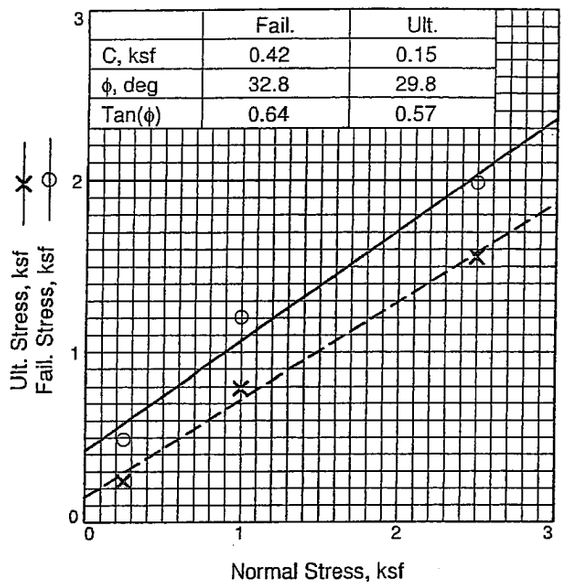
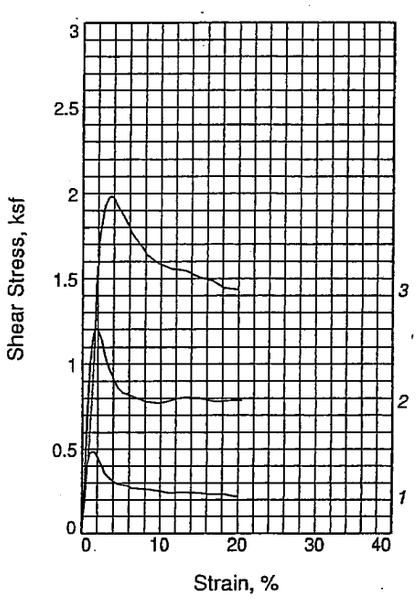
Results of Direct Shear Testing





	Fail.	Ult.
C, ksf	0.42	0.15
ϕ, deg	32.8	29.8
Tan(ϕ)	0.64	0.57



Sample No.		1	2	3
Initial	Water Content, %	10.6	10.2	10.3
	Dry Density, pcf	109.3	109.7	109.6
	Saturation, %	53.0	51.3	51.8
	Void Ratio	0.5425	0.5360	0.5379
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	8.8	8.6	8.8
	Dry Density, pcf	110.2	111.1	111.5
	Saturation, %	45.0	45.2	46.3
	Void Ratio	0.5295	0.5168	0.5119
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.98
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.49	1.21	1.99
Strain, %		1.4	1.9	3.6
Ult. Stress, ksf		0.25	0.79	1.56
Strain, %		13.0	11.6	11.4
Strain rate, %/min.		0.30	0.30	0.30

Sample Type: Remolded, 95% MDD, OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 12% strain. Specimens were unsaturated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-C1
Sample Number: 07-0430E
Proj. No.: 07.1243 **Date Sampled:** 7/18/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date: 7/18/07
Client: J.A. Cesare & Associates, Inc.
Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.: 07.1243
Location: USEN-C1
Sample Number: 07-0430E
Description: sand
Remarks: Failure tangents drawn at peak shear stress and approximately 12% strain. Specimens were unsaturated.
Type of Sample: Remolded, 95% MDD, OMC
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			256.200
Moisture content: Dry soil+tare, gms.			244.590
Moisture content: Tare, gms.			113.090
Moisture, %	10.6	8.8	8.8
Moist specimen weight, gms.	145.5		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	120.9	119.9	
Dry density, pcf	109.3	110.2	
Void ratio	0.5425	0.5295	
Saturation, %	53.0	45.0	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit
Normal stress = 0.25 ksf
Strain rate, %/min. = 0.30
Fail. Stress = 0.49 ksf **at reading no.** 5
Ult. Stress = 0.25 ksf **at reading no.** 23

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0100	0.3311	10.4	0.4	0.33	0.0013
2	0.0150	0.4043	12.7	0.6	0.40	0.0026
3	0.0200	0.4521	14.2	0.8	0.45	0.0041
4	0.0250	0.4839	15.2	1.0	0.48	0.0059
5	0.0350	0.4966	15.6	1.4	0.49	0.0105
6	0.0400	0.4903	15.4	1.7	0.48	0.0130
7	0.0450	0.4775	15.0	1.9	0.47	0.0153
8	0.0500	0.4553	14.3	2.1	0.45	0.0176
9	0.0560	0.4330	13.6	2.3	0.43	0.0196
10	0.0610	0.4139	13.0	2.5	0.41	0.0215
11	0.0650	0.3948	12.4	2.7	0.39	0.0230

Test Readings for Specimen No.

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0700	0.3693	11.6	2.9	0.36	0.0244
13	0.0750	0.3566	11.2	3.1	0.35	0.0256
14	0.0800	0.3438	10.8	3.3	0.34	0.0266
15	0.0900	0.3279	10.3	3.7	0.32	0.0282
16	0.1000	0.3152	9.9	4.1	0.31	0.0297
17	0.1100	0.2993	9.4	4.6	0.30	0.0306
18	0.1450	0.2865	9.0	6.0	0.28	0.0336
19	0.1560	0.2738	8.6	6.5	0.27	0.0342
20	0.2000	0.2674	8.4	8.3	0.26	0.0352
21	0.2450	0.2547	8.0	10.1	0.25	0.0362
22	0.2700	0.2420	7.6	11.2	0.24	0.0368
23	0.3150	0.2483	7.8	13.0	0.25	0.0371
24	0.3610	0.2451	7.7	14.9	0.24	0.0374
25	0.4010	0.2356	7.4	16.6	0.23	0.0382
26	0.4450	0.2356	7.4	18.4	0.23	0.0384
27	0.4800	0.2229	7.0	19.9	0.22	0.0385

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			255.380
Moisture content: Dry soil+tare, gms.			243.960
Moisture content: Tare, gms.			111.900
Moisture, %	10.2	8.6	8.6
Moist specimen weight, gms.	145.5		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	120.9	120.7	
Dry density, pcf	109.7	111.1	
Void ratio	0.5360	0.5168	
Saturation, %	51.3	45.2	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 1.21 ksf at reading no. 9

Ult. Stress = 0.79 ksf at reading no. 25

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0050	0.1210	3.8	0.2	0.12	-0.0001
2	0.0100	0.3820	12.0	0.4	0.38	-0.0001
3	0.0150	0.6686	21.0	0.6	0.66	0.0002
4	0.0200	0.8755	27.5	0.8	0.86	0.0010
5	0.0250	1.0251	32.2	1.0	1.01	0.0022
6	0.0300	1.1270	35.4	1.2	1.11	0.0037
7	0.0350	1.1843	37.2	1.4	1.17	0.0054
8	0.0400	1.2161	38.2	1.7	1.20	0.0072
9	0.0450	1.2225	38.4	1.9	1.21	0.0091
10	0.0500	1.2130	38.1	2.1	1.20	0.0110
11	0.0550	1.1843	37.2	2.3	1.17	0.0127
12	0.0600	1.1588	36.4	2.5	1.14	0.0145
13	0.0650	1.1206	35.2	2.7	1.11	0.0160
14	0.0700	1.0761	33.8	2.9	1.06	0.0173
15	0.0750	1.0379	32.6	3.1	1.02	0.0185
16	0.0800	1.0092	31.7	3.3	1.00	0.0194
17	0.0850	0.9806	30.8	3.5	0.97	0.0203
18	0.0950	0.9424	29.6	3.9	0.93	0.0217
19	0.1000	0.9137	28.7	4.1	0.90	0.0224
20	0.1100	0.8755	27.5	4.6	0.86	0.0234
21	0.1250	0.8468	26.6	5.2	0.84	0.0246
22	0.1600	0.8214	25.8	6.6	0.81	0.0264
23	0.1950	0.7927	24.9	8.1	0.78	0.0277
24	0.2400	0.7832	24.6	9.9	0.77	0.0283
25	0.2800	0.8023	25.2	11.6	0.79	0.0285
26	0.3250	0.8214	25.8	13.5	0.81	0.0293

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3700	0.8118	25.5	15.3	0.80	0.0304
28	0.4150	0.7927	24.9	17.2	0.78	0.0311
29	0.4550	0.7991	25.1	18.8	0.79	0.0318
30	0.4960	0.7991	25.1	20.5	0.79	0.0321

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			256.950
Moisture content: Dry soil+tare, gms.			245.380
Moisture content: Tare, gms.			113.490
Moisture, %	10.3	8.8	8.8
Moist specimen weight, gms.	145.5		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	120.9	121.3	
Dry density, pcf	109.6	111.5	
Void ratio	0.5379	0.5119	
Saturation, %	51.8	46.3	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.30

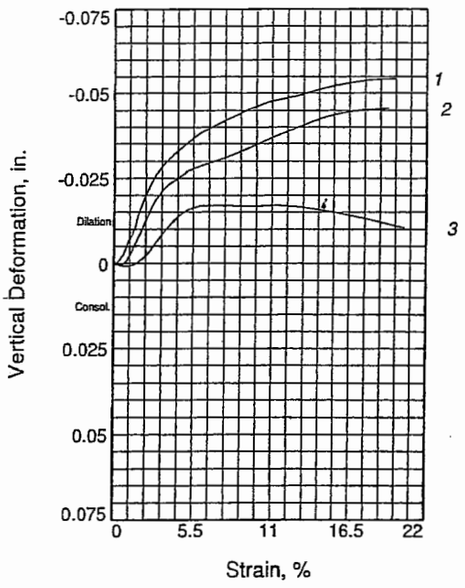
Fail. Stress = 1.99 ksf at reading no. 17

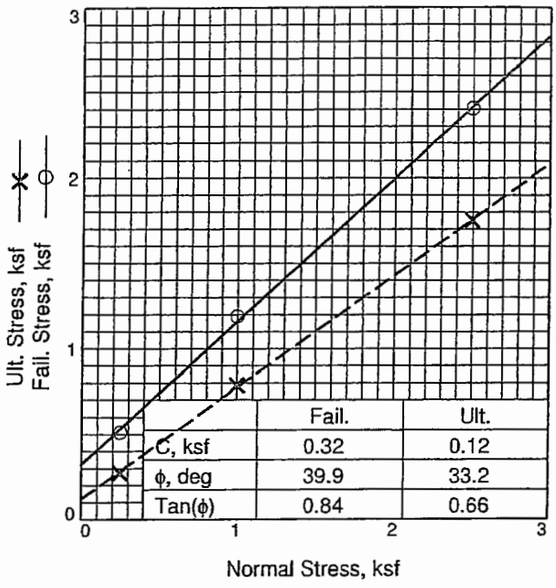
Ult. Stress = 1.56 ksf at reading no. 27

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0010	0.0000	0.0	0.0	0.00	-0.0002
2	0.0010	0.0605	1.9	0.0	0.06	-0.0002
3	0.0100	0.1846	5.8	0.4	0.18	-0.0006
4	0.0150	0.3438	10.8	0.6	0.34	-0.0007
5	0.0200	0.5030	15.8	0.8	0.50	-0.0009
6	0.0250	0.6686	21.0	1.0	0.66	-0.0010
7	0.0310	0.8341	26.2	1.3	0.82	-0.0011
8	0.0350	0.9901	31.1	1.4	0.98	-0.0011
9	0.0400	1.1588	36.4	1.7	1.14	-0.0009
10	0.0450	1.4899	46.8	1.9	1.47	-0.0002
11	0.0500	1.6491	51.8	2.1	1.63	0.0007
12	0.0550	1.7892	56.2	2.3	1.77	0.0017
13	0.0600	1.8465	58.0	2.5	1.82	0.0028
14	0.0650	1.9070	59.9	2.7	1.88	0.0040
15	0.0700	1.9547	61.4	2.9	1.93	0.0054
16	0.0800	1.9993	62.8	3.3	1.97	0.0080
17	0.0860	2.0120	63.2	3.6	1.99	0.0092
18	0.0960	2.0057	63.0	4.0	1.98	0.0116

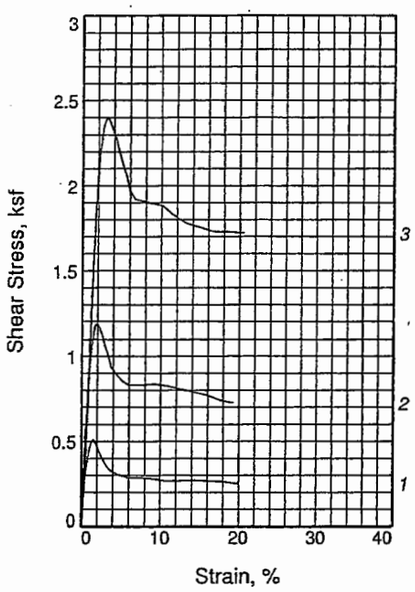
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
19	0.1060	1.9611	61.6	4.4	1.93	0.0139
20	0.1260	1.8974	59.6	5.2	1.87	0.0179
21	0.1400	1.8465	58.0	5.8	1.82	0.0198
22	0.1510	1.7956	56.4	6.3	1.77	0.0208
23	0.1660	1.7510	55.0	6.9	1.73	0.0219
24	0.1850	1.7032	53.5	7.7	1.68	0.0228
25	0.2000	1.6618	52.2	8.3	1.64	0.0234
26	0.2360	1.6109	50.6	9.8	1.59	0.0240
27	0.2760	1.5791	49.6	11.4	1.56	0.0241
28	0.3200	1.5695	49.3	13.2	1.55	0.0235
29	0.3650	1.5281	48.0	15.1	1.51	0.0229
30	0.4050	1.5090	47.4	16.8	1.49	0.0225
31	0.4360	1.4676	46.1	18.0	1.45	0.0224
32	0.4800	1.4549	45.7	19.9	1.44	0.0220





	Fail.	Ult.
C, ksf	0.32	0.12
ϕ, deg	39.9	33.2
Tan(ϕ)	0.84	0.66



Sample No.		1	2	3
Initial	Water Content, %	9.6	9.0	9.6
	Dry Density, pcf	112.2	112.8	112.2
	Saturation, %	51.5	49.0	51.6
	Void Ratio	0.5025	0.4940	0.5029
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	8.1	8.6	8.6
	Dry Density, pcf	113.2	114.3	115.0
	Saturation, %	44.7	48.7	50.1
	Void Ratio	0.4891	0.4744	0.4651
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.97
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.51	1.19	2.41
Strain, %		1.5	1.9	3.1
Ult. Stress, ksf		0.27	0.79	1.75
Strain, %		14.5	14.5	15.1
Strain rate, %/min.		0.30	0.30	0.30

Sample Type: Remolded 95% MDD, OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-C2
Sample Number: 07-0430F
Proj. No.: 07.1243 **Date Sampled:** 7/18/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date: 7/18/07
Client: J.A. Cesare & Associates, Inc.
Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.: 07.1243
Location: USEN-C2
Sample Number: 07-0430F
Description: sand
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.
Type of Sample: Remolded 95% MDD, OMC
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			259.770
Moisture content: Dry soil+tare, gms.			248.830
Moisture content: Tare, gms.			113.830
Moisture, %	9.6	8.1	8.1
Moist specimen weight, gms.	147.9		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	122.9	122.4	
Dry density, pcf	112.2	113.2	
Void ratio	0.5025	0.4891	
Saturation, %	51.5	44.7	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit
Normal stress = 0.25 ksf
Strain rate, %/min. = 0.30
Fail. Stress = 0.51 ksf **at reading no.** 7
Ult. Stress = 0.27 ksf **at reading no.** 25

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0050	0.1751	5.5	0.2	0.17	0.0002
2	0.0100	0.2993	9.4	0.4	0.30	0.0012
3	0.0160	0.3725	11.7	0.7	0.37	0.0027
4	0.0200	0.4298	13.5	0.8	0.42	0.0046
5	0.0250	0.4744	14.9	1.0	0.47	0.0066
6	0.0310	0.5094	16.0	1.3	0.50	0.0085
7	0.0360	0.5189	16.3	1.5	0.51	0.0109
8	0.0400	0.5062	15.9	1.7	0.50	0.0135
9	0.0450	0.4935	15.5	1.9	0.49	0.0161
10	0.0500	0.4680	14.7	2.1	0.46	0.0185
11	0.0550	0.4489	14.1	2.3	0.44	0.0207

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0600	0.4266	13.4	2.5	0.42	0.0227
13	0.0650	0.4043	12.7	2.7	0.40	0.0245
14	0.0700	0.3884	12.2	2.9	0.38	0.0261
15	0.0760	0.3693	11.6	3.1	0.36	0.0274
16	0.0800	0.3534	11.1	3.3	0.35	0.0285
17	0.0900	0.3343	10.5	3.7	0.33	0.0304
18	0.1000	0.3215	10.1	4.1	0.32	0.0322
19	0.1150	0.3088	9.7	4.8	0.30	0.0343
20	0.1450	0.2897	9.1	6.0	0.29	0.0384
21	0.1850	0.2897	9.1	7.7	0.29	0.0419
22	0.2250	0.2833	8.9	9.3	0.28	0.0454
23	0.2600	0.2706	8.5	10.8	0.27	0.0476
24	0.3060	0.2738	8.6	12.7	0.27	0.0492
25	0.3500	0.2770	8.7	14.5	0.27	0.0514
26	0.3900	0.2706	8.5	16.1	0.27	0.0530
27	0.4350	0.2674	8.4	18.0	0.26	0.0542
28	0.4800	0.2547	8.0	19.9	0.25	0.0545

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			260.920
Moisture content: Dry soil+tare, gms.			249.300
Moisture content: Tare, gms.			113.530
Moisture, %	9.0	8.6	8.6
Moist specimen weight, gms.	147.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	122.9	124.1	
Dry density, pcf	112.8	114.3	
Void ratio	0.4940	0.4744	
Saturation, %	49.0	48.7	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 1.19 ksf at reading no. 11

Ult. Stress = 0.79 ksf at reading no. 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0010	0.0000	0.0	0.0	0.00	0.0001
2	0.0010	0.0382	1.2	0.0	0.04	0.0001
3	0.0050	0.2324	7.3	0.2	0.23	-0.0003
4	0.0100	0.5253	16.5	0.4	0.52	-0.0003
5	0.0150	0.6272	19.7	0.6	0.62	-0.0002
6	0.0200	0.8405	26.4	0.8	0.83	0.0007
7	0.0250	0.9837	30.9	1.0	0.97	0.0019
8	0.0300	1.0856	34.1	1.2	1.07	0.0035
9	0.0350	1.1493	36.1	1.4	1.13	0.0053
10	0.0400	1.1875	37.3	1.7	1.17	0.0072
11	0.0460	1.2066	37.9	1.9	1.19	0.0093
12	0.0500	1.2002	37.7	2.1	1.18	0.0113
13	0.0600	1.1620	36.5	2.5	1.15	0.0153
14	0.0650	1.1302	35.5	2.7	1.12	0.0172
15	0.0700	1.0920	34.3	2.9	1.08	0.0187
16	0.0750	1.0538	33.1	3.1	1.04	0.0200
17	0.0800	1.0283	32.3	3.3	1.01	0.0212
18	0.0850	0.9901	31.1	3.5	0.98	0.0222
19	0.0900	0.9519	29.9	3.7	0.94	0.0231
20	0.1000	0.9264	29.1	4.1	0.91	0.0244
21	0.1100	0.9010	28.3	4.6	0.89	0.0256
22	0.1250	0.8691	27.3	5.2	0.86	0.0273
23	0.1450	0.8437	26.5	6.0	0.83	0.0287
24	0.1850	0.8437	26.5	7.7	0.83	0.0311
25	0.2250	0.8500	26.7	9.3	0.84	0.0339
26	0.2650	0.8373	26.3	11.0	0.83	0.0369

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3060	0.8182	25.7	12.7	0.81	0.0398
28	0.3500	0.7991	25.1	14.5	0.79	0.0428
29	0.3900	0.7800	24.5	16.1	0.77	0.0445
30	0.4250	0.7545	23.7	17.6	0.74	0.0454
31	0.4650	0.7354	23.1	19.2	0.73	0.0457

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.			264.980
Moisture content: Dry soil+tare, gms.			253.340
Moisture content: Tare, gms.			118.380
Moisture, %	9.6	8.6	8.6
Moist specimen weight, gms.	147.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.97	
Net decrease in height, in.		0.03	
Wet Density, pcf	122.9	125.0	
Dry density, pcf	112.2	115.0	
Void ratio	0.5029	0.4651	
Saturation, %	51.6	50.1	

Test Results for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.30

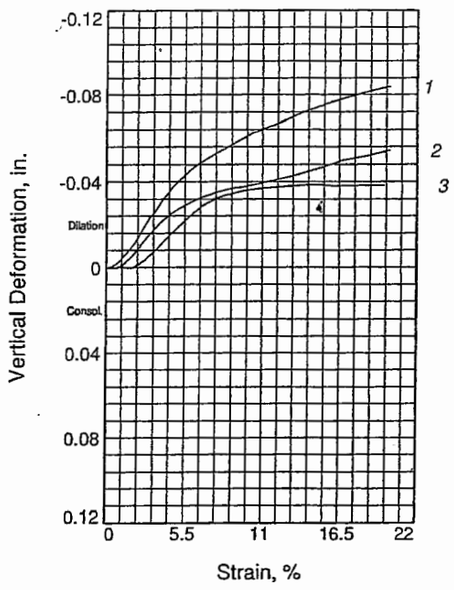
Fail. Stress = 2.41 ksf **at reading no.** 15

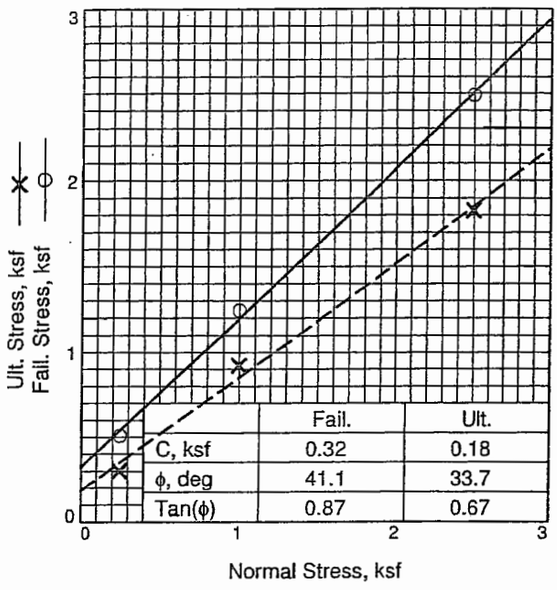
Ult. Stress = 1.75 ksf **at reading no.** 28

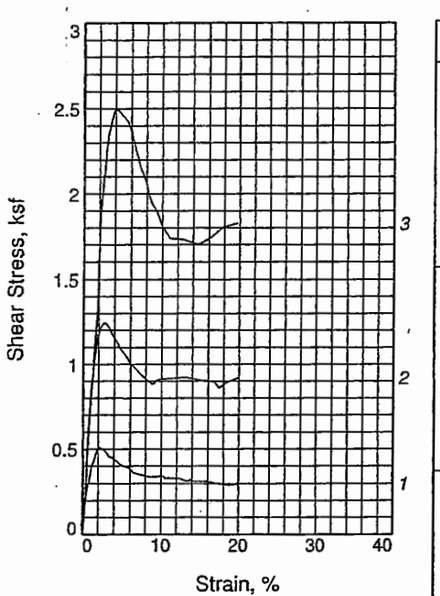
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0010	0.0000	0.0	0.0	0.00	0.0001
2	0.0050	0.1146	3.6	0.2	0.11	-0.0002
3	0.0100	0.2802	8.8	0.4	0.28	-0.0004
4	0.0150	0.5508	17.3	0.6	0.54	-0.0006
5	0.0200	0.8309	26.1	0.8	0.82	-0.0007
6	0.0250	1.1111	34.9	1.0	1.10	-0.0007
7	0.0300	1.3753	43.2	1.2	1.36	-0.0005
8	0.0350	1.6109	50.6	1.4	1.59	-0.0002
9	0.0400	1.8115	56.9	1.7	1.79	0.0003
10	0.0450	1.9929	62.6	1.9	1.97	0.0010
11	0.0500	2.1330	67.0	2.1	2.10	0.0018
12	0.0560	2.2508	70.7	2.3	2.22	0.0028
13	0.0610	2.3240	73.0	2.5	2.29	0.0038
14	0.0650	2.3845	74.9	2.7	2.35	0.0050
15	0.0760	2.4387	76.6	3.1	2.41	0.0074
16	0.0800	2.4259	76.2	3.3	2.39	0.0086
17	0.0960	2.3495	73.8	4.0	2.32	0.0119

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
18	0.1050	2.2827	71.7	4.3	2.25	0.0136
19	0.1150	2.2158	69.6	4.8	2.19	0.0149
20	0.1250	2.1458	67.4	5.2	2.12	0.0159
21	0.1360	2.0757	65.2	5.6	2.05	0.0165
22	0.1450	1.9993	62.8	6.0	1.97	0.0170
23	0.1600	1.9484	61.2	6.6	1.92	0.0171
24	0.2000	1.9293	60.6	8.3	1.90	0.0170
25	0.2460	1.9102	60.0	10.2	1.88	0.0169
26	0.2750	1.8592	58.4	11.4	1.83	0.0172
27	0.3200	1.8019	56.6	13.2	1.78	0.0166
28	0.3650	1.7765	55.8	15.1	1.75	0.0154
29	0.4050	1.7510	55.0	16.8	1.73	0.0141
30	0.4500	1.7510	55.0	18.6	1.73	0.0124
31	0.4950	1.7446	54.8	20.5	1.72	0.0106







Sample No.		1	2	3
Initial	Water Content, %	10.8	10.8	10.8
	Dry Density, pcf	111.1	110.8	111.3
	Saturation, %	56.6	56.0	56.8
	Void Ratio	0.5168	0.5216	0.5148
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	10.6	10.2	10.5
	Dry Density, pcf	112.4	112.5	113.7
	Saturation, %	57.3	55.3	58.9
	Void Ratio	0.4999	0.4985	0.4829
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.98	0.98
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.51	1.24	2.49
Strain, %		2.3	2.9	3.9
Ult. Stress, ksf		0.30	0.92	1.83
Strain, %		20.1	20.1	19.7
Strain rate, %/min.		0.25	0.25	0.25

Sample Type: Remolded, 95% MDD @ OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not saturated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-C1 & C2, 5% Zeolite Clay
Sample Number: 07-0605C
Proj. No.: 07.1243 **Date Sampled:** 8/23/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

8/24/2007

Date: 8/23/07
Client: J.A. Cesare & Associates, Inc.
Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.: 07.1243
Location: USEN-C1 & C2, 5% Zeolite Clay
Sample Number: 07-0605C
Description: sand
Remarks: Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not saturated.
Type of Sample: Remolded, 95% MDD @ OMC
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	528.780		238.950
Moisture content: Dry soil+tare, gms.	489.810		224.760
Moisture content: Tare, gms.	129.880		90.950
Moisture, %	10.8	10.6	10.6
Moist specimen weight, gms.	148.2		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	123.2	124.3	
Dry density, pcf	111.1	112.4	
Void ratio	0.5168	0.4999	
Saturation, %	56.6	57.3	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit
Normal stress = 0.25 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.51 ksf **at reading no.** 11
Ult. Stress = 0.30 ksf **at reading no.** 32

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0001
1	0.0050	0.1464	4.6	0.2	0.14	-0.0002
2	0.0100	0.2260	7.1	0.4	0.22	0.0003
3	0.0150	0.2865	9.0	0.6	0.28	0.0012
4	0.0200	0.3375	10.6	0.8	0.33	0.0023
5	0.0250	0.3757	11.8	1.0	0.37	0.0036
6	0.0300	0.4171	13.1	1.2	0.41	0.0052
7	0.0360	0.4457	14.0	1.5	0.44	0.0069
8	0.0410	0.4775	15.0	1.7	0.47	0.0086
9	0.0460	0.5030	15.8	1.9	0.50	0.0103
10	0.0500	0.5221	16.4	2.1	0.52	0.0121
11	0.0550	0.5157	16.2	2.3	0.51	0.0144

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0650	0.5030	15.8	2.7	0.50	0.0191
13	0.0750	0.4839	15.2	3.1	0.48	0.0238
14	0.0800	0.4648	14.6	3.3	0.46	0.0251
15	0.0950	0.4521	14.2	3.9	0.45	0.0315
16	0.1050	0.4362	13.7	4.3	0.43	0.0349
17	0.1150	0.4202	13.2	4.8	0.41	0.0382
18	0.1250	0.4075	12.8	5.2	0.40	0.0410
19	0.1450	0.3916	12.3	6.0	0.39	0.0459
20	0.1550	0.3725	11.7	6.4	0.37	0.0478
21	0.1750	0.3597	11.3	7.2	0.35	0.0511
22	0.2100	0.3438	10.8	8.7	0.34	0.0564
23	0.2500	0.3502	11.0	10.3	0.35	0.0624
24	0.2550	0.3375	10.6	10.6	0.33	0.0628
25	0.3000	0.3375	10.6	12.4	0.33	0.0675
26	0.3250	0.3184	10.0	13.5	0.31	0.0705
27	0.3350	0.3311	10.4	13.9	0.33	0.0717
28	0.3450	0.3184	10.0	14.3	0.31	0.0726
29	0.3850	0.3184	10.0	15.9	0.31	0.0766
30	0.4160	0.3056	9.6	17.2	0.30	0.0791
31	0.4560	0.2929	9.2	18.9	0.29	0.0819
32	0.4850	0.3056	9.6	20.1	0.30	0.0838

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	528.780		266.510
Moisture content: Dry soil+tare, gms.	489.810		252.920
Moisture content: Tare, gms.	129.880		119.760
Moisture, %	10.8	10.2	10.2
Moist specimen weight, gms.	147.7		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	122.8	124.0	
Dry density, pcf	110.8	112.5	
Void ratio	0.5216	0.4985	
Saturation, %	56.0	55.3	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.24 ksf **at reading no.** 13

Ult. Stress = 0.92 ksf **at reading no.** 32

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.1146	3.6	0.2	0.11	-0.0002
2	0.0100	0.3120	9.8	0.4	0.31	-0.0004
3	0.0150	0.5094	16.0	0.6	0.50	-0.0005
4	0.0200	0.6813	21.4	0.8	0.67	-0.0001
5	0.0250	0.8214	25.8	1.0	0.81	0.0007
6	0.0300	0.9360	29.4	1.2	0.92	0.0016
7	0.0350	1.0315	32.4	1.4	1.02	0.0028
8	0.0400	1.1047	34.7	1.7	1.09	0.0041
9	0.0450	1.1652	36.6	1.9	1.15	0.0056
10	0.0500	1.2034	37.8	2.1	1.19	0.0072
11	0.0550	1.2352	38.8	2.3	1.22	0.0090
12	0.0650	1.2607	39.6	2.7	1.24	0.0126
13	0.0700	1.2607	39.6	2.9	1.24	0.0144
14	0.0810	1.2352	38.8	3.4	1.22	0.0179
15	0.0900	1.1907	37.4	3.7	1.17	0.0206
16	0.1050	1.1461	36.0	4.3	1.13	0.0242
17	0.1150	1.1111	34.9	4.8	1.10	0.0261
18	0.1250	1.0856	34.1	5.2	1.07	0.0278
19	0.1350	1.0570	33.2	5.6	1.04	0.0293
20	0.1450	1.0188	32.0	6.0	1.01	0.0307
21	0.1600	0.9933	31.2	6.6	0.98	0.0326
22	0.1750	0.9583	30.1	7.2	0.95	0.0341
23	0.1900	0.9328	29.3	7.9	0.92	0.0353
24	0.2150	0.8946	28.1	8.9	0.88	0.0372
25	0.2310	0.9232	29.0	9.6	0.91	0.0375
26	0.2750	0.9296	29.2	11.4	0.92	0.0400

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3200	0.9360	29.4	13.2	0.92	0.0429
28	0.3610	0.9201	28.9	14.9	0.91	0.0460
29	0.4050	0.9105	28.6	16.8	0.90	0.0499
30	0.4200	0.8723	27.4	17.4	0.86	0.0506
31	0.4450	0.9041	28.4	18.4	0.89	0.0518
32	0.4850	0.9360	29.4	20.1	0.92	0.0544

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	528.780		267.630
Moisture content: Dry soil+tare, gms.	489.810		253.550
Moisture content: Tare, gms.	129.880		119.840
Moisture, %	10.8	10.5	10.5
Moist specimen weight, gms.	148.4		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	123.3	125.6	
Dry density, pcf	111.3	113.7	
Void ratio	0.5148	0.4829	
Saturation, %	56.8	58.9	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.25

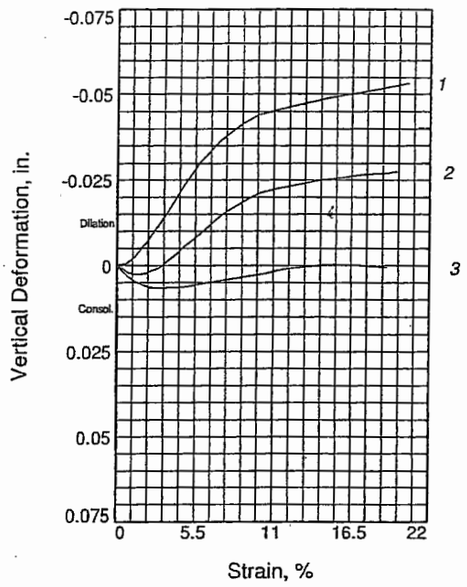
Fail. Stress = 2.49 ksf **at reading no.** 17

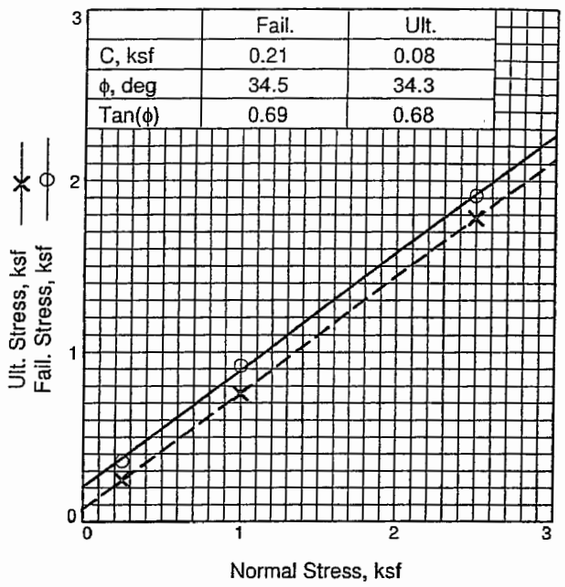
Ult. Stress = 1.83 ksf **at reading no.** 35

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.1643	5.2	0.2	0.16	-0.0001
2	0.0100	0.3168	10.0	0.4	0.31	-0.0002
3	0.0150	0.5481	17.2	0.6	0.54	-0.0003
4	0.0200	0.7235	22.7	0.8	0.71	0.0001
5	0.0260	0.8862	27.8	1.1	0.87	0.0004
6	0.0300	0.9507	29.9	1.2	0.94	0.0003
7	0.0350	1.0697	33.6	1.4	1.06	-0.0002
8	0.0400	1.1875	37.3	1.7	1.17	-0.0002
9	0.0450	1.3308	41.8	1.9	1.31	-0.0002
10	0.0500	1.7892	56.2	2.1	1.77	0.0006
11	0.0550	1.9547	61.4	2.3	1.93	0.0014
12	0.0600	2.0916	65.7	2.5	2.06	0.0024
13	0.0660	2.2031	69.2	2.7	2.17	0.0035
14	0.0700	2.2954	72.1	2.9	2.26	0.0047
15	0.0750	2.3750	74.6	3.1	2.34	0.0061
16	0.0860	2.4705	77.6	3.6	2.44	0.0088

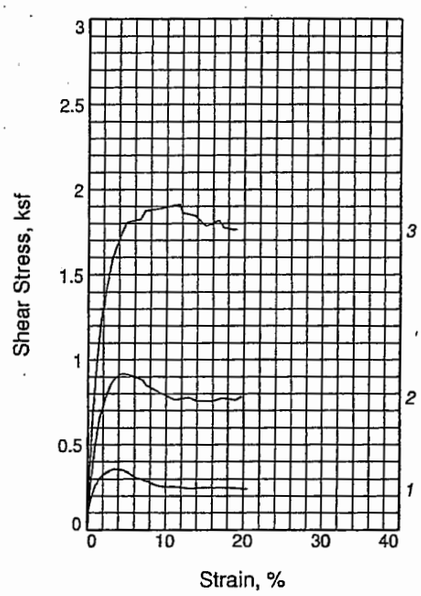
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
17	0.0950	2.5246	79.3	3.9	2.49	0.0116
18	0.1000	2.5278	79.4	4.1	2.49	0.0130
19	0.1050	2.5278	79.4	4.3	2.49	0.0145
20	0.1350	2.4578	77.2	5.6	2.42	0.0223
21	0.1450	2.4004	75.4	6.0	2.37	0.0247
22	0.1550	2.3177	72.8	6.4	2.29	0.0269
23	0.1650	2.2476	70.6	6.8	2.22	0.0290
24	0.1750	2.1744	68.3	7.2	2.15	0.0306
25	0.1910	2.1012	66.0	7.9	2.07	0.0327
26	0.2000	2.0248	63.6	8.3	2.00	0.0337
27	0.2100	1.9738	62.0	8.7	1.95	0.0343
28	0.2250	1.9197	60.3	9.3	1.89	0.0354
29	0.2400	1.8401	57.8	9.9	1.82	0.0362
30	0.2660	1.7637	55.4	11.0	1.74	0.0371
31	0.3100	1.7574	55.2	12.8	1.73	0.0379
32	0.3550	1.7255	54.2	14.7	1.70	0.0388
33	0.3950	1.7701	55.6	16.3	1.75	0.0381
34	0.4300	1.8274	57.4	17.8	1.80	0.0382
35	0.4750	1.8529	58.2	19.7	1.83	0.0383





	Fail.	Ult.
C, ksf	0.21	0.08
ϕ, deg	34.5	34.3
Tan(ϕ)	0.69	0.68



Sample No.		1	2	3
Initial	Water Content, %	15.9	15.9	15.9
	Dry Density, pcf	98.4	98.4	98.4
	Saturation, %	60.2	60.2	60.2
	Void Ratio	0.7134	0.7134	0.7134
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	15.4	15.0	15.0
	Dry Density, pcf	98.9	100.4	103.1
	Saturation, %	58.9	59.7	63.8
	Void Ratio	0.7048	0.6782	0.6356
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.98	0.95
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.36	0.92	1.91
Strain, %		3.7	4.6	11.6
Ult. Stress, ksf		0.25	0.76	1.78
Strain, %		16.8	14.1	15.1
Strain rate, %/min.		0.30	0.30	0.30

Sample Type: Remolded loose, +4% OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D1
Sample Number: 07-0430G
Proj. No.: 07.1243 **Date Sampled:** 7/19/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date: 7/19/07
Client: J.A. Cesare & Associates, Inc.
Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.: 07.1243
Location: USEN-D1
Sample Number: 07-0430G
Description: sand
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.
Type of Sample: Remolded loose, +4% OMC
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		252.960
Moisture content: Dry soil+tare, gms.	294.330		235.150
Moisture content: Tare, gms.	149.820		119.330
Moisture, %	15.9	15.4	15.4
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	114.0	114.1	
Dry density, pcf	98.4	98.9	
Void ratio	0.7134	0.7048	
Saturation, %	60.2	58.9	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit
Normal stress = 0.25 ksf
Strain rate, %/min. = 0.30
Fail. Stress = 0.36 ksf **at reading no.** 15
Ult. Stress = 0.25 ksf **at reading no.** 29

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0002
1	0.0010	0.0000	0.0	0.0	0.00	0.0000
2	0.0050	0.1305	4.1	0.2	0.13	0.0001
3	0.0110	0.1783	5.6	0.5	0.18	0.0001
4	0.0160	0.2133	6.7	0.7	0.21	0.0004
5	0.0200	0.2388	7.5	0.8	0.24	0.0009
6	0.0250	0.2642	8.3	1.0	0.26	0.0015
7	0.0310	0.2802	8.8	1.3	0.28	0.0023
8	0.0350	0.2961	9.3	1.4	0.29	0.0032
9	0.0400	0.3088	9.7	1.7	0.30	0.0042
10	0.0450	0.3215	10.1	1.9	0.32	0.0054
11	0.0500	0.3311	10.4	2.1	0.33	0.0064

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0600	0.3406	10.7	2.5	0.34	0.0089
13	0.0700	0.3502	11.0	2.9	0.35	0.0112
14	0.0800	0.3597	11.3	3.3	0.35	0.0139
15	0.0900	0.3629	11.4	3.7	0.36	0.0165
16	0.1150	0.3534	11.1	4.8	0.35	0.0235
17	0.1300	0.3406	10.7	5.4	0.34	0.0275
18	0.1400	0.3279	10.3	5.8	0.32	0.0299
19	0.1510	0.3152	9.9	6.3	0.31	0.0318
20	0.1660	0.3056	9.6	6.9	0.30	0.0346
21	0.1750	0.2961	9.3	7.2	0.29	0.0362
22	0.1950	0.2865	9.0	8.1	0.28	0.0389
23	0.2050	0.2770	8.7	8.5	0.27	0.0402
24	0.2150	0.2674	8.4	8.9	0.26	0.0413
25	0.2400	0.2579	8.1	9.9	0.25	0.0438
26	0.2800	0.2579	8.1	11.6	0.25	0.0456
27	0.3210	0.2483	7.8	13.3	0.25	0.0472
28	0.3660	0.2547	8.0	15.1	0.25	0.0490
29	0.4060	0.2515	7.9	16.8	0.25	0.0500
30	0.4510	0.2515	7.9	18.7	0.25	0.0515
31	0.4950	0.2451	7.7	20.5	0.24	0.0531

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		252.850
Moisture content: Dry soil+tare, gms.	294.330		235.320
Moisture content: Tare, gms.	149.820		118.420
Moisture, %	15.9	15.0	15.0
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.0	115.5	
Dry density, pcf	98.4	100.4	
Void ratio	0.7134	0.6782	
Saturation, %	60.2	59.7	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 0.92 ksf at reading no. 18

Ult. Stress = 0.76 ksf at reading no. 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0001
1	0.0050	0.1305	4.1	0.2	0.13	-0.0005
2	0.0100	0.2674	8.4	0.4	0.26	-0.0010
3	0.0150	0.3725	11.7	0.6	0.37	-0.0016
4	0.0200	0.4616	14.5	0.8	0.46	-0.0021
5	0.0260	0.5253	16.5	1.1	0.52	-0.0024
6	0.0300	0.5826	18.3	1.2	0.57	-0.0026
7	0.0350	0.6367	20.0	1.4	0.63	-0.0027
8	0.0400	0.6781	21.3	1.7	0.67	-0.0027
9	0.0460	0.7163	22.5	1.9	0.71	-0.0025
10	0.0500	0.7482	23.5	2.1	0.74	-0.0023
11	0.0550	0.7800	24.5	2.3	0.77	-0.0019
12	0.0600	0.8055	25.3	2.5	0.79	-0.0016
13	0.0650	0.8309	26.1	2.7	0.82	-0.0013
14	0.0700	0.8532	26.8	2.9	0.84	-0.0008
15	0.0750	0.8755	27.5	3.1	0.86	-0.0004
16	0.0850	0.9041	28.4	3.5	0.89	0.0010
17	0.1010	0.9264	29.1	4.2	0.91	0.0032
18	0.1100	0.9328	29.3	4.6	0.92	0.0047
19	0.1150	0.9328	29.3	4.8	0.92	0.0055
20	0.1460	0.9137	28.7	6.0	0.90	0.0099
21	0.1700	0.8946	28.1	7.0	0.88	0.0136
22	0.1800	0.8628	27.1	7.5	0.85	0.0150
23	0.2010	0.8437	26.5	8.3	0.83	0.0173
24	0.2250	0.8182	25.7	9.3	0.81	0.0196
25	0.2460	0.7991	25.1	10.2	0.79	0.0213
26	0.2700	0.7768	24.4	11.2	0.77	0.0222

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3150	0.7895	24.8	13.0	0.78	0.0238
28	0.3410	0.7673	24.1	14.1	0.76	0.0248
29	0.3850	0.7673	24.1	15.9	0.76	0.0257
30	0.4200	0.7864	24.7	17.4	0.78	0.0267
31	0.4600	0.7736	24.3	19.0	0.76	0.0270
32	0.4750	0.7927	24.9	19.7	0.78	0.0275

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		246.390
Moisture content: Dry soil+tare, gms.	294.330		229.000
Moisture content: Tare, gms.	149.820		113.120
Moisture, %	15.9	15.0	15.0
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.95	
Net decrease in height, in.		0.05	
Wet Density, pcf	114.0	118.5	
Dry density, pcf	98.4	103.1	
Void ratio	0.7134	0.6356	
Saturation, %	60.2	63.8	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 1.91 ksf **at reading no.** 24

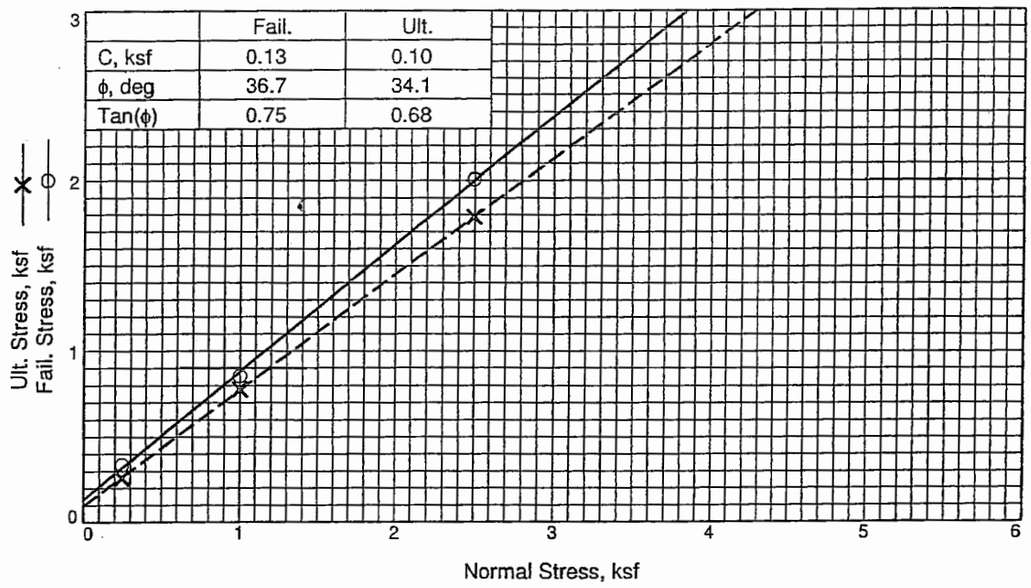
Ult. Stress = 1.78 ksf **at reading no.** 27

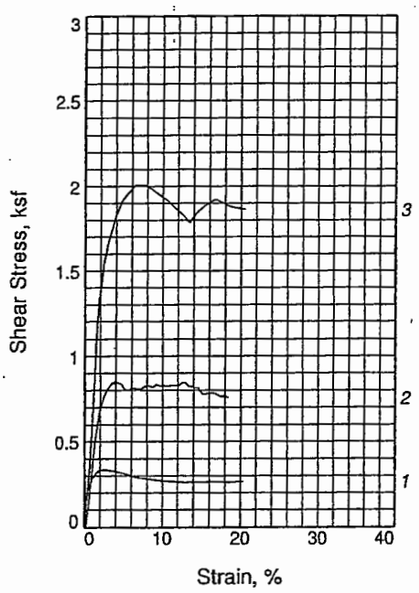
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0002
1	0.0050	0.3024	9.5	0.2	0.30	-0.0012
2	0.0100	0.4998	15.7	0.4	0.49	-0.0019
3	0.0150	0.6781	21.3	0.6	0.67	-0.0027
4	0.0200	0.8182	25.7	0.8	0.81	-0.0035
5	0.0250	0.9328	29.3	1.0	0.92	-0.0041
6	0.0300	1.0347	32.5	1.2	1.02	-0.0047
7	0.0350	1.1302	35.5	1.4	1.12	-0.0051
8	0.0400	1.2130	38.1	1.7	1.20	-0.0055
9	0.0450	1.2925	40.6	1.9	1.28	-0.0059
10	0.0510	1.3467	42.3	2.1	1.33	-0.0062
11	0.0550	1.4103	44.3	2.3	1.39	-0.0065
12	0.0600	1.4613	45.9	2.5	1.44	-0.0066
13	0.0650	1.5059	47.3	2.7	1.49	-0.0068
14	0.0700	1.5568	48.9	2.9	1.54	-0.0068
15	0.0750	1.6077	50.5	3.1	1.59	-0.0068
16	0.0850	1.6714	52.5	3.5	1.65	-0.0067

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
17	0.0950	1.7160	53.9	3.9	1.69	-0.0067
18	0.1050	1.7733	55.7	4.3	1.75	-0.0066
19	0.1200	1.8306	57.5	5.0	1.81	-0.0063
20	0.1600	1.8497	58.1	6.6	1.82	-0.0050
21	0.1750	1.9006	59.7	7.2	1.88	-0.0047
22	0.2150	1.9102	60.0	8.9	1.88	-0.0035
23	0.2500	1.9261	60.5	10.3	1.90	-0.0026
24	0.2810	1.9388	60.9	11.6	1.91	-0.0013
25	0.2900	1.8879	59.3	12.0	1.86	-0.0010
26	0.3300	1.8720	58.8	13.7	1.85	-0.0004
27	0.3650	1.8083	56.8	15.1	1.78	0.0002
28	0.4050	1.8433	57.9	16.8	1.82	0.0000
29	0.4200	1.7987	56.5	17.4	1.77	-0.0002
30	0.4600	1.7860	56.1	19.0	1.76	-0.0007

	Fail.	Ult.
C, ksf	0.13	0.10
ϕ, deg	36.7	34.1
Tan(ϕ)	0.75	0.68





Sample No.		1	2	3
Initial	Water Content, %	14.6	14.6	14.6
	Dry Density, pcf	100.2	100.2	100.2
	Saturation, %	57.9	57.9	57.9
	Void Ratio	0.6817	0.6816	0.6816
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	11.0	12.8	13.8
	Dry Density, pcf	100.6	101.2	102.2
	Saturation, %	44.0	52.0	57.3
	Void Ratio	0.6759	0.6648	0.6488
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.98
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.34	0.85	2.01
Strain, %		2.5	3.9	6.4
Ult. Stress, ksf		0.26	0.78	1.79
Strain, %		15.1	15.1	13.5
Strain rate, %/min.		0.30	0.33	0.33

Sample Type: Remolded loose, +4% OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D2
Sample Number: 07-0430H
Proj. No.: 07.1243 **Date Sampled:** 7/20/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date:	7/20/07
Client:	J.A. Cesare & Associates, Inc.
Project:	U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.:	07.1243
Location:	USEN-D2
Sample Number:	07-0430H
Description:	sand
Remarks:	Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.
Type of Sample:	Remolded loose, +4% OMC

Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		251.180
Moisture content: Dry soil+tare, gms.	259.040		237.710
Moisture content: Tare, gms.	112.680		115.340
Moisture, %	14.6	11.0	11.0
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet Density, pcf	114.9	111.6	
Dry density, pcf	100.2	100.6	
Void ratio	0.6817	0.6759	
Saturation, %	57.9	44.0	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 0.25 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 0.34 ksf **at reading no.** 13

Ult. Stress = 0.26 ksf **at reading no.** 24

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0000	0.0000	0.0	0.0	0.00
1	0.0010	0.0003	0.0	0.0	0.00
2	0.0050	0.1560	4.9	0.2	0.15
3	0.0100	0.2133	6.7	0.4	0.21
4	0.0150	0.2451	7.7	0.6	0.24
5	0.0200	0.2706	8.5	0.8	0.27
6	0.0250	0.2897	9.1	1.0	0.29
7	0.0300	0.3024	9.5	1.2	0.30
8	0.0350	0.3184	10.0	1.4	0.31
9	0.0400	0.3279	10.3	1.7	0.32
10	0.0450	0.3343	10.5	1.9	0.33
11	0.0500	0.3387	10.6	2.1	0.33

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
12	0.0560	0.3396	10.7	2.3	0.34
13	0.0600	0.3412	10.7	2.5	0.34
14	0.0650	0.3406	10.7	2.7	0.34
15	0.0700	0.3406	10.7	2.9	0.34
16	0.1100	0.3279	10.3	4.6	0.32
17	0.1250	0.3184	10.0	5.2	0.31
18	0.1400	0.3088	9.7	5.8	0.30
19	0.1600	0.2961	9.3	6.6	0.29
20	0.2000	0.2865	9.0	8.3	0.28
21	0.2350	0.2770	8.7	9.7	0.27
22	0.2760	0.2706	8.5	11.4	0.27
23	0.3200	0.2642	8.3	13.2	0.26
24	0.3650	0.2642	8.3	15.1	0.26
25	0.4050	0.2706	8.5	16.8	0.27
26	0.4510	0.2642	8.3	18.7	0.26
27	0.4900	0.2738	8.6	20.3	0.27

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		253.590
Moisture content: Dry soil+tare, gms.	259.040		237.960
Moisture content: Tare, gms.	112.680		115.800
Moisture, %	14.6	12.8	12.8
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	114.9	114.2	
Dry density, pcf	100.2	101.2	
Void ratio	0.6816	0.6648	
Saturation, %	57.9	52.0	

Test Readings for Specimen No. 2

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.33

Fail. Stress = 0.85 ksf **at reading no.** 15

Ult. Stress = 0.78 ksf **at reading no.** 42

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0060	0.000	0.0	0.0	0.00
1	0.0110	0.400	0.4	0.2	0.01
2	0.0160	2.800	2.8	0.4	0.09
3	0.0210	5.700	5.7	0.6	0.18
4	0.0260	8.700	8.7	0.8	0.27
5	0.0310	11.700	11.7	1.0	0.37
6	0.0410	17.100	17.1	1.4	0.54
7	0.0510	20.900	20.9	1.9	0.66
8	0.0610	23.300	23.3	2.3	0.73
9	0.0660	24.200	24.2	2.5	0.76
10	0.0710	24.900	24.9	2.7	0.78
11	0.0760	25.500	25.5	2.9	0.80
12	0.0860	26.500	26.5	3.3	0.83
13	0.0910	26.900	26.9	3.5	0.84
14	0.0960	26.800	26.8	3.7	0.84
15	0.1010	27.200	27.2	3.9	0.85
16	0.1110	26.900	26.9	4.3	0.84
17	0.1210	26.700	26.7	4.8	0.84
18	0.1310	25.700	25.7	5.2	0.81
19	0.1410	25.500	25.5	5.6	0.80
20	0.1510	25.800	25.8	6.0	0.81
21	0.1610	25.900	25.9	6.4	0.81
22	0.1700	25.700	25.7	6.8	0.81
23	0.1800	25.700	25.7	7.2	0.81
24	0.1900	26.100	26.1	7.6	0.82
25	0.2000	26.500	26.5	8.0	0.83
26	0.2100	26.300	26.3	8.4	0.83
27	0.2200	26.100	26.1	8.9	0.82

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
28	0.2300	26.700	26.7	9.3	0.84
29	0.2400	26.300	26.3	9.7	0.83
30	0.2500	26.500	26.5	10.1	0.83
31	0.2600	26.300	26.3	10.5	0.83
32	0.2700	26.300	26.3	10.9	0.83
33	0.2810	26.500	26.5	11.4	0.83
34	0.2900	26.400	26.4	11.8	0.83
35	0.3000	26.500	26.5	12.2	0.83
36	0.3100	26.900	26.9	12.6	0.84
37	0.3210	26.900	26.9	13.0	0.84
38	0.3300	26.300	26.3	13.4	0.83
39	0.3410	26.200	26.2	13.9	0.82
40	0.3500	25.900	25.9	14.2	0.81
41	0.3600	25.900	25.9	14.7	0.81
42	0.3700	24.800	24.8	15.1	0.78
43	0.3810	24.700	24.7	15.5	0.78
44	0.3900	24.900	24.9	15.9	0.78
45	0.4000	24.900	24.9	16.3	0.78
46	0.4100	24.900	24.9	16.7	0.78
47	0.4200	24.600	24.6	17.1	0.77
48	0.4300	24.200	24.2	17.5	0.76
49	0.4400	24.500	24.5	18.0	0.77
50	0.4500	24.100	24.1	18.4	0.76

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		257.980
Moisture content: Dry soil+tare, gms.	259.040		241.440
Moisture content: Tare, gms.	112.680		121.290
Moisture, %	14.6	13.8	13.8
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.9	116.3	
Dry density, pcf	100.2	102.2	
Void ratio	0.6816	0.6488	
Saturation, %	57.9	57.3	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.33

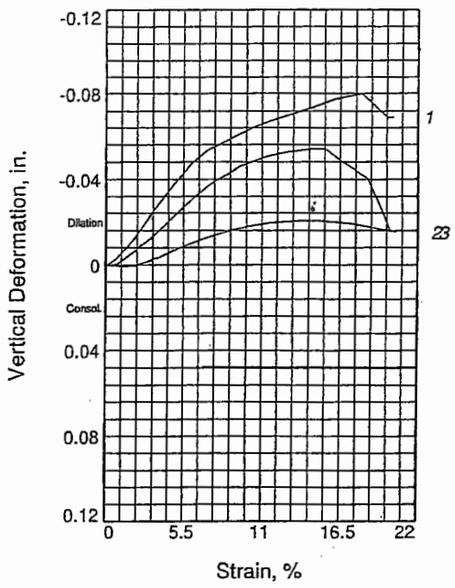
Fail. Stress = 2.01 ksf **at reading no.** 22

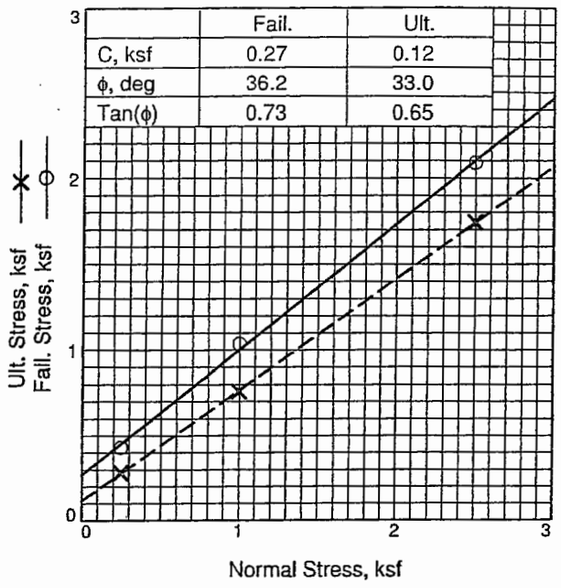
Ult. Stress = 1.79 ksf **at reading no.** 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0000	0.0000	0.0	0.0	0.00
1	0.0050	0.1719	5.4	0.2	0.17
2	0.0100	0.2197	6.9	0.4	0.22
3	0.0160	0.3470	10.9	0.7	0.34
4	0.0200	0.4998	15.7	0.8	0.49
5	0.0250	0.6781	21.3	1.0	0.67
6	0.0300	0.8564	26.9	1.2	0.84
7	0.0350	1.0601	33.3	1.4	1.05
8	0.0400	1.2098	38.0	1.7	1.19
9	0.0450	1.3339	41.9	1.9	1.32
10	0.0500	1.4231	44.7	2.1	1.40
11	0.0550	1.4995	47.1	2.3	1.48
12	0.0600	1.5759	49.5	2.5	1.55
13	0.0650	1.6205	50.9	2.7	1.60
14	0.0700	1.6650	52.3	2.9	1.64
15	0.0750	1.7096	53.7	3.1	1.69
16	0.0850	1.7765	55.8	3.5	1.75
17	0.0950	1.8465	58.0	3.9	1.82
18	0.1050	1.8943	59.5	4.3	1.87
19	0.1150	1.9356	60.8	4.8	1.91
20	0.1300	1.9770	62.1	5.4	1.95
21	0.1510	2.0248	63.6	6.3	2.00
22	0.1550	2.0343	63.9	6.4	2.01
23	0.1900	2.0343	63.9	7.9	2.01
24	0.2250	1.9866	62.4	9.3	1.96
25	0.2560	1.9452	61.1	10.6	1.92
26	0.2810	1.8974	59.6	11.6	1.87

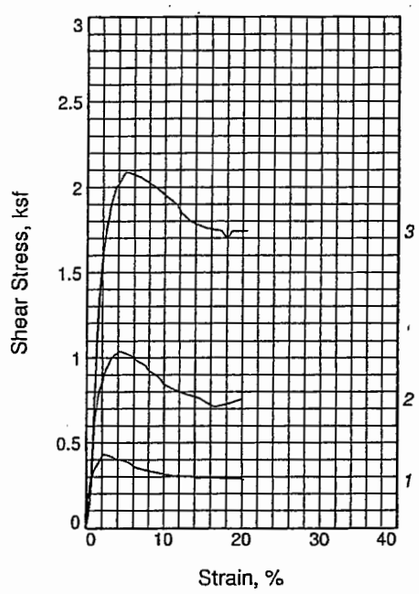
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
27	0.3050	1.8561	58.3	12.6	1.83
28	0.3250	1.8115	56.9	13.5	1.79
29	0.3460	1.8688	58.7	14.3	1.84
30	0.3710	1.9102	60.0	15.4	1.88
31	0.4050	1.9516	61.3	16.8	1.93
32	0.4500	1.9070	59.9	18.6	1.88
33	0.4950	1.8879	59.3	20.5	1.86





	Fail.	Ult.
C, ksf	0.27	0.12
ϕ, deg	36.2	33.0
Tan(ϕ)	0.73	0.65



Sample No.		1	2	3
Initial	Water Content, %	13.4	13.4	13.4
	Dry Density, pcf	101.0	101.0	101.0
	Saturation, %	54.2	54.2	54.2
	Void Ratio	0.6682	0.6682	0.6682
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	12.9	13.2	12.8
	Dry Density, pcf	101.3	103.0	104.9
	Saturation, %	52.5	55.8	56.9
	Void Ratio	0.6632	0.6372	0.6070
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.98	0.96
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.43	1.04	2.09
Strain, %		2.3	4.1	5.0
Ult. Stress, ksf		0.28	0.76	1.74
Strain, %		20.3	20.1	20.5
Strain rate, %/min.		0.25	0.25	0.25

Sample Type: Remolded 83% MDD @ OMC +4%
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D1 & D2, 5% Zeolite Clay
Sample Number: 07-0605D
Proj. No.: 07.1243 **Date Sampled:** 8/20/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

8/24/2007

Date:	8/20/07
Client:	J.A. Cesare & Associates, Inc.
Project:	U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.:	07.1243
Location:	USEN-D1 & D2, 5% Zeolite Clay
Sample Number:	07-0605D
Description:	sand
Remarks:	Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not inundated.
Type of Sample:	Remolded 83% MDD @ OMC +4%

Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		512.660
Moisture content: Dry soil+tare, gms.	442.370		497.050
Moisture content: Tare, gms.	115.320		376.050
Moisture, %	13.4	12.9	12.9
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet Density, pcf	114.6	114.4	
Dry density, pcf	101.0	101.3	
Void ratio	0.6682	0.6632	
Saturation, %	54.2	52.5	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 0.25 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 0.43 ksf **at reading no.** 11

Ult. Stress = 0.28 ksf **at reading no.** 29

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0050	0.1751	5.5	0.2	0.17	0.0004
2	0.0100	0.2388	7.5	0.4	0.24	0.0014
3	0.0160	0.2897	9.1	0.7	0.29	0.0025
4	0.0200	0.3215	10.1	0.8	0.32	0.0038
5	0.0250	0.3470	10.9	1.0	0.34	0.0052
6	0.0300	0.3661	11.5	1.2	0.36	0.0067
7	0.0360	0.3852	12.1	1.5	0.38	0.0083
8	0.0410	0.4011	12.6	1.7	0.40	0.0099
9	0.0460	0.4171	13.1	1.9	0.41	0.0114
10	0.0500	0.4298	13.5	2.1	0.42	0.0130
11	0.0550	0.4362	13.7	2.3	0.43	0.0150

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0610	0.4362	13.7	2.5	0.43	0.0171
13	0.0800	0.4234	13.3	3.5	0.42	0.0249
14	0.0900	0.4107	12.9	3.7	0.41	0.0286
15	0.1150	0.4011	12.6	4.8	0.40	0.0374
16	0.1300	0.3916	12.3	5.4	0.39	0.0422
17	0.1400	0.3789	11.9	5.8	0.37	0.0452
18	0.1450	0.3693	11.6	6.0	0.36	0.0467
19	0.1550	0.3597	11.3	6.4	0.35	0.0491
20	0.1750	0.3470	10.9	7.2	0.34	0.0537
21	0.2150	0.3343	10.5	8.9	0.33	0.0593
22	0.2500	0.3184	10.0	10.3	0.31	0.0641
23	0.2800	0.3088	9.7	11.6	0.30	0.0674
24	0.3250	0.3088	9.7	13.5	0.30	0.0714
25	0.3460	0.2961	9.3	14.3	0.29	0.0733
26	0.3900	0.3024	9.5	16.1	0.30	0.0775
27	0.4350	0.2929	9.2	18.0	0.29	0.0802
28	0.4800	0.2961	9.3	19.9	0.29	0.0691
29	0.4900	0.2865	9.0	20.3	0.28	0.0694

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		533.060
Moisture content: Dry soil+tare, gms.	442.370		517.040
Moisture content: Tare, gms.	115.320		395.480
Moisture, %	13.4	13.2	13.2
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.6	116.5	
Dry density, pcf	101.0	103.0	
Void ratio	0.6682	0.6372	
Saturation, %	54.2	55.8	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.04 ksf **at reading no.** 16

Ult. Stress = 0.76 ksf **at reading no.** 31

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.0541	1.7	0.2	0.05	-0.0001
2	0.0100	0.1337	4.2	0.4	0.13	-0.0002
3	0.0150	0.2770	8.7	0.6	0.27	0.0001
4	0.0200	0.5157	16.2	0.8	0.51	0.0005
5	0.0250	0.6367	20.0	1.0	0.63	0.0014
6	0.0300	0.7163	22.5	1.2	0.71	0.0024
7	0.0350	0.7736	24.3	1.4	0.76	0.0035
8	0.0400	0.8182	25.7	1.7	0.81	0.0046
9	0.0460	0.8500	26.7	1.9	0.84	0.0057
10	0.0510	0.8882	27.9	2.1	0.88	0.0068
11	0.0550	0.9201	28.9	2.3	0.91	0.0079
12	0.0600	0.9455	29.7	2.5	0.93	0.0091
13	0.0660	0.9678	30.4	2.7	0.95	0.0101
14	0.0750	1.0060	31.6	3.1	0.99	0.0122
15	0.0850	1.0283	32.3	3.5	1.01	0.0146
16	0.1000	1.0506	33.0	4.1	1.04	0.0185
17	0.1050	1.0538	33.1	4.3	1.04	0.0199
18	0.1360	1.0283	32.3	5.6	1.01	0.0277
19	0.1550	0.9997	31.4	6.4	0.99	0.0323
20	0.1800	0.9710	30.5	7.5	0.96	0.0379
21	0.1900	0.9424	29.6	7.9	0.93	0.0397
22	0.2150	0.9137	28.7	8.9	0.90	0.0437
23	0.2300	0.8882	27.9	9.5	0.88	0.0461
24	0.2400	0.8596	27.0	9.9	0.85	0.0471
25	0.2750	0.8246	25.9	11.4	0.81	0.0506
26	0.3100	0.7991	25.1	12.8	0.79	0.0526

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3510	0.7736	24.3	14.5	0.76	0.0542
28	0.3750	0.7482	23.5	15.5	0.74	0.0541
29	0.4000	0.7227	22.7	16.6	0.71	0.0486
30	0.4460	0.7418	23.3	18.5	0.73	0.0406
31	0.4860	0.7704	24.2	20.1	0.76	0.0154

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		532.550
Moisture content: Dry soil+tare, gms.	442.370		516.900
Moisture content: Tare, gms.	115.320		394.650
Moisture, %	13.4	12.8	12.8
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.96	
Net decrease in height, in.		0.04	
Wet Density, pcf	114.6	118.3	
Dry density, pcf	101.0	104.9	
Void ratio	0.6682	0.6070	
Saturation, %	54.2	56.9	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 2.09 ksf **at reading no.** 20

Ult. Stress = 1.74 ksf **at reading no.** 32

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0001
1	0.0060	0.0669	2.1	0.2	0.07	-0.0002
2	0.0110	0.1369	4.3	0.5	0.14	-0.0002
3	0.0150	0.2642	8.3	0.6	0.26	-0.0003
4	0.0200	0.4998	15.7	0.8	0.49	-0.0004
5	0.0250	0.7800	24.5	1.0	0.77	-0.0006
6	0.0300	1.0219	32.1	1.2	1.01	-0.0008
7	0.0350	1.2161	38.2	1.4	1.20	-0.0008
8	0.0400	1.3785	43.3	1.7	1.36	-0.0006
9	0.0450	1.5186	47.7	1.9	1.50	-0.0004
10	0.0500	1.6173	50.8	2.1	1.60	-0.0002
11	0.0550	1.7001	53.4	2.3	1.68	0.0002
12	0.0600	1.7733	55.7	2.5	1.75	0.0006
13	0.0660	1.8369	57.7	2.7	1.81	0.0011
14	0.0700	1.8815	59.1	2.9	1.86	0.0015
15	0.0750	1.9293	60.6	3.1	1.90	0.0020
16	0.0850	2.0025	62.9	3.5	1.98	0.0032
17	0.0900	2.0350	63.9	3.7	2.01	0.0033

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
18	0.0950	2.0375	64.0	3.9	2.01	0.0040
19	0.1100	2.0916	65.7	4.6	2.06	0.0059
20	0.1200	2.1171	66.5	5.0	2.09	0.0071
21	0.1250	2.1171	66.5	5.2	2.09	0.0077
22	0.1660	2.0853	65.5	6.9	2.06	0.0118
23	0.2100	2.0343	63.9	8.7	2.01	0.0157
24	0.2450	1.9770	62.1	10.1	1.95	0.0180
25	0.2800	1.9261	60.5	11.6	1.90	0.0195
26	0.2950	1.8752	58.9	12.2	1.85	0.0198
27	0.3250	1.8210	57.2	13.5	1.80	0.0203
28	0.3700	1.7860	56.1	15.3	1.76	0.0203
29	0.4160	1.7701	55.6	17.2	1.75	0.0192
30	0.4350	1.7223	54.1	18.0	1.70	0.0183
31	0.4500	1.7669	55.5	18.6	1.74	0.0176
32	0.4950	1.7669	55.5	20.5	1.74	0.0153

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0650	0.5030	15.8	2.7	0.50	0.0191
13	0.0750	0.4839	15.2	3.1	0.48	0.0238
14	0.0800	0.4648	14.6	3.3	0.46	0.0251
15	0.0950	0.4521	14.2	3.9	0.45	0.0315
16	0.1050	0.4362	13.7	4.3	0.43	0.0349
17	0.1150	0.4202	13.2	4.8	0.41	0.0382
18	0.1250	0.4075	12.8	5.2	0.40	0.0410
19	0.1450	0.3916	12.3	6.0	0.39	0.0459
20	0.1550	0.3725	11.7	6.4	0.37	0.0478
21	0.1750	0.3597	11.3	7.2	0.35	0.0511
22	0.2100	0.3438	10.8	8.7	0.34	0.0564
23	0.2500	0.3502	11.0	10.3	0.35	0.0624
24	0.2550	0.3375	10.6	10.6	0.33	0.0628
25	0.3000	0.3375	10.6	12.4	0.33	0.0675
26	0.3250	0.3184	10.0	13.5	0.31	0.0705
27	0.3350	0.3311	10.4	13.9	0.33	0.0717
28	0.3450	0.3184	10.0	14.3	0.31	0.0726
29	0.3850	0.3184	10.0	15.9	0.31	0.0766
30	0.4160	0.3056	9.6	17.2	0.30	0.0791
31	0.4560	0.2929	9.2	18.9	0.29	0.0819
32	0.4850	0.3056	9.6	20.1	0.30	0.0838

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	528.780		266.510
Moisture content: Dry soil+tare, gms.	489.810		252.920
Moisture content: Tare, gms.	129.880		119.760
Moisture, %	10.8	10.2	10.2
Moist specimen weight, gms.	147.7		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	122.8	124.0	
Dry density, pcf	110.8	112.5	
Void ratio	0.5216	0.4985	
Saturation, %	56.0	55.3	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.24 ksf **at reading no.** 13

Ult. Stress = 0.92 ksf **at reading no.** 32

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.1146	3.6	0.2	0.11	-0.0002
2	0.0100	0.3120	9.8	0.4	0.31	-0.0004
3	0.0150	0.5094	16.0	0.6	0.50	-0.0005
4	0.0200	0.6813	21.4	0.8	0.67	-0.0001
5	0.0250	0.8214	25.8	1.0	0.81	0.0007
6	0.0300	0.9360	29.4	1.2	0.92	0.0016
7	0.0350	1.0315	32.4	1.4	1.02	0.0028
8	0.0400	1.1047	34.7	1.7	1.09	0.0041
9	0.0450	1.1652	36.6	1.9	1.15	0.0056
10	0.0500	1.2034	37.8	2.1	1.19	0.0072
11	0.0550	1.2352	38.8	2.3	1.22	0.0090
12	0.0650	1.2607	39.6	2.7	1.24	0.0126
13	0.0700	1.2607	39.6	2.9	1.24	0.0144
14	0.0810	1.2352	38.8	3.4	1.22	0.0179
15	0.0900	1.1907	37.4	3.7	1.17	0.0206
16	0.1050	1.1461	36.0	4.3	1.13	0.0242
17	0.1150	1.1111	34.9	4.8	1.10	0.0261
18	0.1250	1.0856	34.1	5.2	1.07	0.0278
19	0.1350	1.0570	33.2	5.6	1.04	0.0293
20	0.1450	1.0188	32.0	6.0	1.01	0.0307
21	0.1600	0.9933	31.2	6.6	0.98	0.0326
22	0.1750	0.9583	30.1	7.2	0.95	0.0341
23	0.1900	0.9328	29.3	7.9	0.92	0.0353
24	0.2150	0.8946	28.1	8.9	0.88	0.0372
25	0.2310	0.9232	29.0	9.6	0.91	0.0375
26	0.2750	0.9296	29.2	11.4	0.92	0.0400

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3200	0.9360	29.4	13.2	0.92	0.0429
28	0.3610	0.9201	28.9	14.9	0.91	0.0460
29	0.4050	0.9105	28.6	16.8	0.90	0.0499
30	0.4200	0.8723	27.4	17.4	0.86	0.0506
31	0.4450	0.9041	28.4	18.4	0.89	0.0518
32	0.4850	0.9360	29.4	20.1	0.92	0.0544

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	528.780		267.630
Moisture content: Dry soil+tare, gms.	489.810		253.550
Moisture content: Tare, gms.	129.880		119.840
Moisture, %	10.8	10.5	10.5
Moist specimen weight, gms.	148.4		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	123.3	125.6	
Dry density, pcf	111.3	113.7	
Void ratio	0.5148	0.4829	
Saturation, %	56.8	58.9	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.25

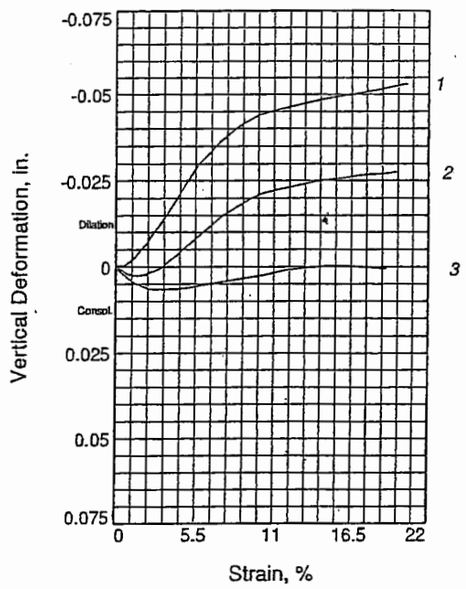
Fail. Stress = 2.49 ksf **at reading no.** 17

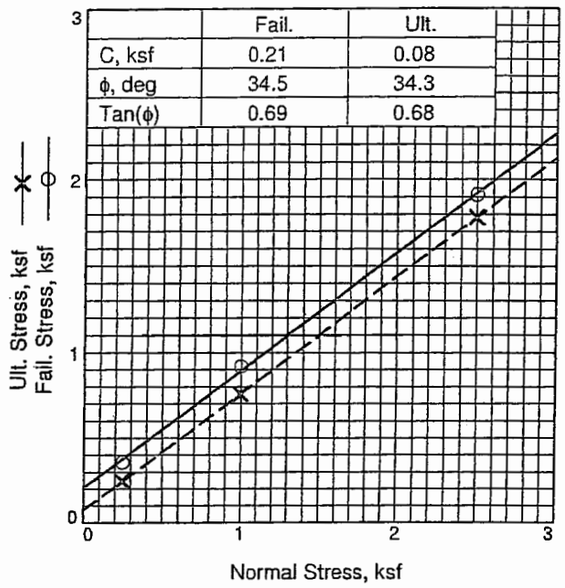
Ult. Stress = 1.83 ksf **at reading no.** 35

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.1643	5.2	0.2	0.16	-0.0001
2	0.0100	0.3168	10.0	0.4	0.31	-0.0002
3	0.0150	0.5481	17.2	0.6	0.54	-0.0003
4	0.0200	0.7235	22.7	0.8	0.71	0.0001
5	0.0260	0.8862	27.8	1.1	0.87	0.0004
6	0.0300	0.9507	29.9	1.2	0.94	0.0003
7	0.0350	1.0697	33.6	1.4	1.06	-0.0002
8	0.0400	1.1875	37.3	1.7	1.17	-0.0002
9	0.0450	1.3308	41.8	1.9	1.31	-0.0002
10	0.0500	1.7892	56.2	2.1	1.77	0.0006
11	0.0550	1.9547	61.4	2.3	1.93	0.0014
12	0.0600	2.0916	65.7	2.5	2.06	0.0024
13	0.0660	2.2031	69.2	2.7	2.17	0.0035
14	0.0700	2.2954	72.1	2.9	2.26	0.0047
15	0.0750	2.3750	74.6	3.1	2.34	0.0061
16	0.0860	2.4705	77.6	3.6	2.44	0.0088

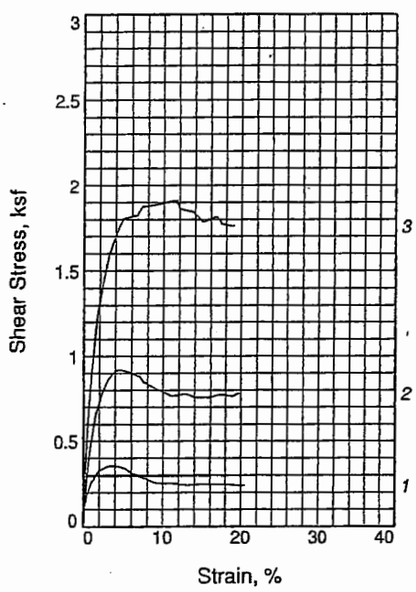
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
17	0.0950	2.5246	79.3	3.9	2.49	0.0116
18	0.1000	2.5278	79.4	4.1	2.49	0.0130
19	0.1050	2.5278	79.4	4.3	2.49	0.0145
20	0.1350	2.4578	77.2	5.6	2.42	0.0223
21	0.1450	2.4004	75.4	6.0	2.37	0.0247
22	0.1550	2.3177	72.8	6.4	2.29	0.0269
23	0.1650	2.2476	70.6	6.8	2.22	0.0290
24	0.1750	2.1744	68.3	7.2	2.15	0.0306
25	0.1910	2.1012	66.0	7.9	2.07	0.0327
26	0.2000	2.0248	63.6	8.3	2.00	0.0337
27	0.2100	1.9738	62.0	8.7	1.95	0.0343
28	0.2250	1.9197	60.3	9.3	1.89	0.0354
29	0.2400	1.8401	57.8	9.9	1.82	0.0362
30	0.2660	1.7637	55.4	11.0	1.74	0.0371
31	0.3100	1.7574	55.2	12.8	1.73	0.0379
32	0.3550	1.7255	54.2	14.7	1.70	0.0388
33	0.3950	1.7701	55.6	16.3	1.75	0.0381
34	0.4300	1.8274	57.4	17.8	1.80	0.0382
35	0.4750	1.8529	58.2	19.7	1.83	0.0383





	Fail.	Ult.
C, ksf	0.21	0.08
ϕ, deg	34.5	34.3
Tan(ϕ)	0.69	0.68



Sample No.		1	2	3
Initial	Water Content, %	15.9	15.9	15.9
	Dry Density, pcf	98.4	98.4	98.4
	Saturation, %	60.2	60.2	60.2
	Void Ratio	0.7134	0.7134	0.7134
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	15.4	15.0	15.0
	Dry Density, pcf	98.9	100.4	103.1
	Saturation, %	58.9	59.7	63.8
	Void Ratio	0.7048	0.6782	0.6356
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.98	0.95
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.36	0.92	1.91
Strain, %		3.7	4.6	11.6
Ult. Stress, ksf		0.25	0.76	1.78
Strain, %		16.8	14.1	15.1
Strain rate, %/min.		0.30	0.30	0.30

Sample Type: Remolded loose, +4% OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D1
Sample Number: 07-0430G
Proj. No.: 07.1243 **Date Sampled:** 7/19/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date: 7/19/07
Client: J.A. Cesare & Associates, Inc.
Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.: 07.1243
Location: USEN-D1
Sample Number: 07-0430G
Description: sand
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.
Type of Sample: Remolded loose, +4% OMC
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		252.960
Moisture content: Dry soil+tare, gms.	294.330		235.150
Moisture content: Tare, gms.	149.820		119.330
Moisture, %	15.9	15.4	15.4
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	114.0	114.1	
Dry density, pcf	98.4	98.9	
Void ratio	0.7134	0.7048	
Saturation, %	60.2	58.9	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit
Normal stress = 0.25 ksf
Strain rate, %/min. = 0.30
Fail. Stress = 0.36 ksf **at reading no.** 15
Ult. Stress = 0.25 ksf **at reading no.** 29

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0002
1	0.0010	0.0000	0.0	0.0	0.00	0.0000
2	0.0050	0.1305	4.1	0.2	0.13	0.0001
3	0.0110	0.1783	5.6	0.5	0.18	0.0001
4	0.0160	0.2133	6.7	0.7	0.21	0.0004
5	0.0200	0.2388	7.5	0.8	0.24	0.0009
6	0.0250	0.2642	8.3	1.0	0.26	0.0015
7	0.0310	0.2802	8.8	1.3	0.28	0.0023
8	0.0350	0.2961	9.3	1.4	0.29	0.0032
9	0.0400	0.3088	9.7	1.7	0.30	0.0042
10	0.0450	0.3215	10.1	1.9	0.32	0.0054
11	0.0500	0.3311	10.4	2.1	0.33	0.0064

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0600	0.3406	10.7	2.5	0.34	0.0089
13	0.0700	0.3502	11.0	2.9	0.35	0.0112
14	0.0800	0.3597	11.3	3.3	0.35	0.0139
15	0.0900	0.3629	11.4	3.7	0.36	0.0165
16	0.1150	0.3534	11.1	4.8	0.35	0.0235
17	0.1300	0.3406	10.7	5.4	0.34	0.0275
18	0.1400	0.3279	10.3	5.8	0.32	0.0299
19	0.1510	0.3152	9.9	6.3	0.31	0.0318
20	0.1660	0.3056	9.6	6.9	0.30	0.0346
21	0.1750	0.2961	9.3	7.2	0.29	0.0362
22	0.1950	0.2865	9.0	8.1	0.28	0.0389
23	0.2050	0.2770	8.7	8.5	0.27	0.0402
24	0.2150	0.2674	8.4	8.9	0.26	0.0413
25	0.2400	0.2579	8.1	9.9	0.25	0.0438
26	0.2800	0.2579	8.1	11.6	0.25	0.0456
27	0.3210	0.2483	7.8	13.3	0.25	0.0472
28	0.3660	0.2547	8.0	15.1	0.25	0.0490
29	0.4060	0.2515	7.9	16.8	0.25	0.0500
30	0.4510	0.2515	7.9	18.7	0.25	0.0515
31	0.4950	0.2451	7.7	20.5	0.24	0.0531

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		252.850
Moisture content: Dry soil+tare, gms.	294.330		235.320
Moisture content: Tare, gms.	149.820		118.420
Moisture, %	15.9	15.0	15.0
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.0	115.5	
Dry density, pcf	98.4	100.4	
Void ratio	0.7134	0.6782	
Saturation, %	60.2	59.7	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 0.92 ksf at reading no. 18

Ult. Stress = 0.76 ksf at reading no. 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0001
1	0.0050	0.1305	4.1	0.2	0.13	-0.0005
2	0.0100	0.2674	8.4	0.4	0.26	-0.0010
3	0.0150	0.3725	11.7	0.6	0.37	-0.0016
4	0.0200	0.4616	14.5	0.8	0.46	-0.0021
5	0.0260	0.5253	16.5	1.1	0.52	-0.0024
6	0.0300	0.5826	18.3	1.2	0.57	-0.0026
7	0.0350	0.6367	20.0	1.4	0.63	-0.0027
8	0.0400	0.6781	21.3	1.7	0.67	-0.0027
9	0.0460	0.7163	22.5	1.9	0.71	-0.0025
10	0.0500	0.7482	23.5	2.1	0.74	-0.0023
11	0.0550	0.7800	24.5	2.3	0.77	-0.0019
12	0.0600	0.8055	25.3	2.5	0.79	-0.0016
13	0.0650	0.8309	26.1	2.7	0.82	-0.0013
14	0.0700	0.8532	26.8	2.9	0.84	-0.0008
15	0.0750	0.8755	27.5	3.1	0.86	-0.0004
16	0.0850	0.9041	28.4	3.5	0.89	0.0010
17	0.1010	0.9264	29.1	4.2	0.91	0.0032
18	0.1100	0.9328	29.3	4.6	0.92	0.0047
19	0.1150	0.9328	29.3	4.8	0.92	0.0055
20	0.1460	0.9137	28.7	6.0	0.90	0.0099
21	0.1700	0.8946	28.1	7.0	0.88	0.0136
22	0.1800	0.8628	27.1	7.5	0.85	0.0150
23	0.2010	0.8437	26.5	8.3	0.83	0.0173
24	0.2250	0.8182	25.7	9.3	0.81	0.0196
25	0.2460	0.7991	25.1	10.2	0.79	0.0213
26	0.2700	0.7768	24.4	11.2	0.77	0.0222

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3150	0.7895	24.8	13.0	0.78	0.0238
28	0.3410	0.7673	24.1	14.1	0.76	0.0248
29	0.3850	0.7673	24.1	15.9	0.76	0.0257
30	0.4200	0.7864	24.7	17.4	0.78	0.0267
31	0.4600	0.7736	24.3	19.0	0.76	0.0270
32	0.4750	0.7927	24.9	19.7	0.78	0.0275

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	317.320		246.390
Moisture content: Dry soil+tare, gms.	294.330		229.000
Moisture content: Tare, gms.	149.820		113.120
Moisture, %	15.9	15.0	15.0
Moist specimen weight, gms.	137.2		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.95	
Net decrease in height, in.		0.05	
Wet Density, pcf	114.0	118.5	
Dry density, pcf	98.4	103.1	
Void ratio	0.7134	0.6356	
Saturation, %	60.2	63.8	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 1.91 ksf **at reading no.** 24

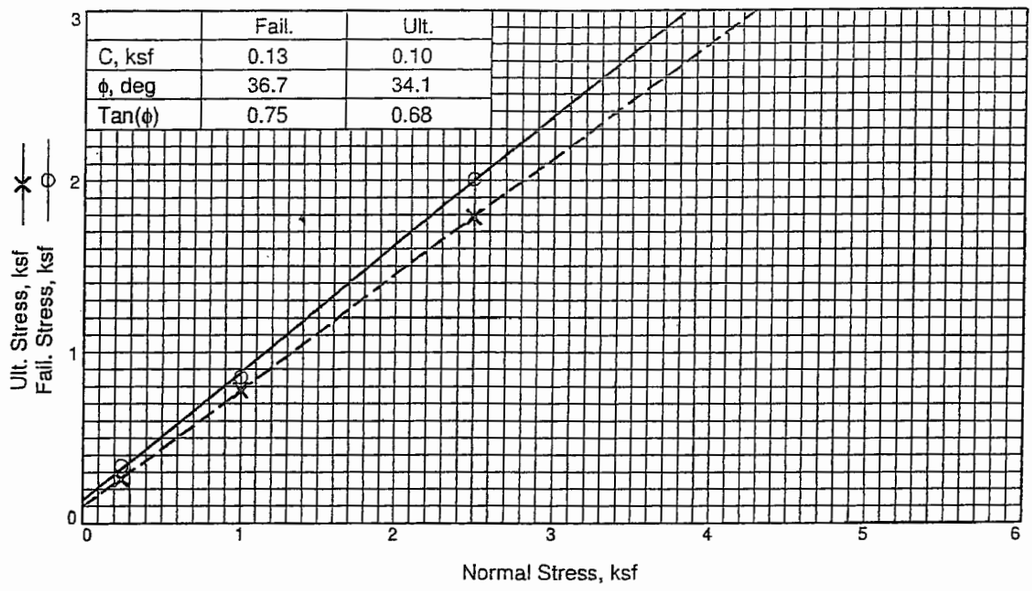
Ult. Stress = 1.78 ksf **at reading no.** 27

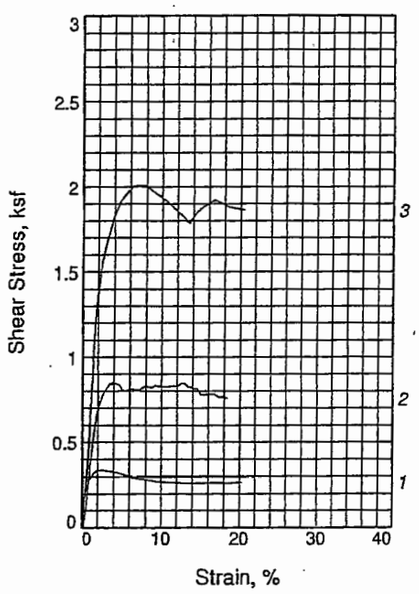
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0002
1	0.0050	0.3024	9.5	0.2	0.30	-0.0012
2	0.0100	0.4998	15.7	0.4	0.49	-0.0019
3	0.0150	0.6781	21.3	0.6	0.67	-0.0027
4	0.0200	0.8182	25.7	0.8	0.81	-0.0035
5	0.0250	0.9328	29.3	1.0	0.92	-0.0041
6	0.0300	1.0347	32.5	1.2	1.02	-0.0047
7	0.0350	1.1302	35.5	1.4	1.12	-0.0051
8	0.0400	1.2130	38.1	1.7	1.20	-0.0055
9	0.0450	1.2925	40.6	1.9	1.28	-0.0059
10	0.0510	1.3467	42.3	2.1	1.33	-0.0062
11	0.0550	1.4103	44.3	2.3	1.39	-0.0065
12	0.0600	1.4613	45.9	2.5	1.44	-0.0066
13	0.0650	1.5059	47.3	2.7	1.49	-0.0068
14	0.0700	1.5568	48.9	2.9	1.54	-0.0068
15	0.0750	1.6077	50.5	3.1	1.59	-0.0068
16	0.0850	1.6714	52.5	3.5	1.65	-0.0067

Test Readings for Specimen No. 5

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
17	0.0950	1.7160	53.9	3.9	1.69	-0.0067
18	0.1050	1.7733	55.7	4.3	1.75	-0.0066
19	0.1200	1.8306	57.5	5.0	1.81	-0.0063
20	0.1600	1.8497	58.1	6.6	1.82	-0.0050
21	0.1750	1.9006	59.7	7.2	1.88	-0.0047
22	0.2150	1.9102	60.0	8.9	1.88	-0.0035
23	0.2500	1.9261	60.5	10.3	1.90	-0.0026
24	0.2810	1.9388	60.9	11.6	1.91	-0.0013
25	0.2900	1.8879	59.3	12.0	1.86	-0.0010
26	0.3300	1.8720	58.8	13.7	1.85	-0.0004
27	0.3650	1.8083	56.8	15.1	1.78	0.0002
28	0.4050	1.8433	57.9	16.8	1.82	0.0000
29	0.4200	1.7987	56.5	17.4	1.77	-0.0002
30	0.4600	1.7860	56.1	19.0	1.76	-0.0007

	Fail.	Ult.
C, ksf	0.13	0.10
ϕ, deg	36.7	34.1
Tan(ϕ)	0.75	0.68





Sample No.		1	2	3
Initial	Water Content, %	14.6	14.6	14.6
	Dry Density, pcf	100.2	100.2	100.2
	Saturation, %	57.9	57.9	57.9
	Void Ratio	0.6817	0.6816	0.6816
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	11.0	12.8	13.8
	Dry Density, pcf	100.6	101.2	102.2
	Saturation, %	44.0	52.0	57.3
	Void Ratio	0.6759	0.6648	0.6488
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.98
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.34	0.85	2.01
Strain, %		2.5	3.9	6.4
Ult. Stress, ksf		0.26	0.78	1.79
Strain, %		15.1	15.1	13.5
Strain rate, %/min.		0.30	0.33	0.33

Sample Type: Remolded loose, +4% OMC
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D2
Sample Number: 07-0430H
Proj. No.: 07.1243 **Date Sampled:** 7/20/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

7/24/2007

Date:	7/20/07
Client:	J.A. Cesare & Associates, Inc.
Project:	U.S. Ecology-NY Miscellaneous Testing Proj.#07-3113
Project No.:	07.1243
Location:	USEN-D2
Sample Number:	07-0430H
Description:	sand
Remarks:	Failure tangents drawn at peak shear stress and approximately 15% strain. Specimens were not inundated.
Type of Sample:	Remolded loose, +4% OMC

Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		251.180
Moisture content: Dry soil+tare, gms.	259.040		237.710
Moisture content: Tare, gms.	112.680		115.340
Moisture, %	14.6	11.0	11.0
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet Density, pcf	114.9	111.6	
Dry density, pcf	100.2	100.6	
Void ratio	0.6817	0.6759	
Saturation, %	57.9	44.0	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 0.25 ksf

Strain rate, %/min. = 0.30

Fail. Stress = 0.34 ksf **at reading no.** 13

Ult. Stress = 0.26 ksf **at reading no.** 24

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0000	0.0000	0.0	0.0	0.00
1	0.0010	0.0003	0.0	0.0	0.00
2	0.0050	0.1560	4.9	0.2	0.15
3	0.0100	0.2133	6.7	0.4	0.21
4	0.0150	0.2451	7.7	0.6	0.24
5	0.0200	0.2706	8.5	0.8	0.27
6	0.0250	0.2897	9.1	1.0	0.29
7	0.0300	0.3024	9.5	1.2	0.30
8	0.0350	0.3184	10.0	1.4	0.31
9	0.0400	0.3279	10.3	1.7	0.32
10	0.0450	0.3343	10.5	1.9	0.33
11	0.0500	0.3387	10.6	2.1	0.33

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
12	0.0560	0.3396	10.7	2.3	0.34
13	0.0600	0.3412	10.7	2.5	0.34
14	0.0650	0.3406	10.7	2.7	0.34
15	0.0700	0.3406	10.7	2.9	0.34
16	0.1100	0.3279	10.3	4.6	0.32
17	0.1250	0.3184	10.0	5.2	0.31
18	0.1400	0.3088	9.7	5.8	0.30
19	0.1600	0.2961	9.3	6.6	0.29
20	0.2000	0.2865	9.0	8.3	0.28
21	0.2350	0.2770	8.7	9.7	0.27
22	0.2760	0.2706	8.5	11.4	0.27
23	0.3200	0.2642	8.3	13.2	0.26
24	0.3650	0.2642	8.3	15.1	0.26
25	0.4050	0.2706	8.5	16.8	0.27
26	0.4510	0.2642	8.3	18.7	0.26
27	0.4900	0.2738	8.6	20.3	0.27

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		253.590
Moisture content: Dry soil+tare, gms.	259.040		237.960
Moisture content: Tare, gms.	112.680		115.800
Moisture, %	14.6	12.8	12.8
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet Density, pcf	114.9	114.2	
Dry density, pcf	100.2	101.2	
Void ratio	0.6816	0.6648	
Saturation, %	57.9	52.0	

Test Readings for Specimen No. 2

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.33

Fail. Stress = 0.85 ksf at reading no. 15

Ult. Stress = 0.78 ksf at reading no. 42

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0060	0.000	0.0	0.0	0.00
1	0.0110	0.400	0.4	0.2	0.01
2	0.0160	2.800	2.8	0.4	0.09
3	0.0210	5.700	5.7	0.6	0.18
4	0.0260	8.700	8.7	0.8	0.27
5	0.0310	11.700	11.7	1.0	0.37
6	0.0410	17.100	17.1	1.4	0.54
7	0.0510	20.900	20.9	1.9	0.66
8	0.0610	23.300	23.3	2.3	0.73
9	0.0660	24.200	24.2	2.5	0.76
10	0.0710	24.900	24.9	2.7	0.78
11	0.0760	25.500	25.5	2.9	0.80
12	0.0860	26.500	26.5	3.3	0.83
13	0.0910	26.900	26.9	3.5	0.84
14	0.0960	26.800	26.8	3.7	0.84
15	0.1010	27.200	27.2	3.9	0.85
16	0.1110	26.900	26.9	4.3	0.84
17	0.1210	26.700	26.7	4.8	0.84
18	0.1310	25.700	25.7	5.2	0.81
19	0.1410	25.500	25.5	5.6	0.80
20	0.1510	25.800	25.8	6.0	0.81
21	0.1610	25.900	25.9	6.4	0.81
22	0.1700	25.700	25.7	6.8	0.81
23	0.1800	25.700	25.7	7.2	0.81
24	0.1900	26.100	26.1	7.6	0.82
25	0.2000	26.500	26.5	8.0	0.83
26	0.2100	26.300	26.3	8.4	0.83
27	0.2200	26.100	26.1	8.9	0.82

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
28	0.2300	26.700	26.7	9.3	0.84
29	0.2400	26.300	26.3	9.7	0.83
30	0.2500	26.500	26.5	10.1	0.83
31	0.2600	26.300	26.3	10.5	0.83
32	0.2700	26.300	26.3	10.9	0.83
33	0.2810	26.500	26.5	11.4	0.83
34	0.2900	26.400	26.4	11.8	0.83
35	0.3000	26.500	26.5	12.2	0.83
36	0.3100	26.900	26.9	12.6	0.84
37	0.3210	26.900	26.9	13.0	0.84
38	0.3300	26.300	26.3	13.4	0.83
39	0.3410	26.200	26.2	13.9	0.82
40	0.3500	25.900	25.9	14.2	0.81
41	0.3600	25.900	25.9	14.7	0.81
42	0.3700	24.800	24.8	15.1	0.78
43	0.3810	24.700	24.7	15.5	0.78
44	0.3900	24.900	24.9	15.9	0.78
45	0.4000	24.900	24.9	16.3	0.78
46	0.4100	24.900	24.9	16.7	0.78
47	0.4200	24.600	24.6	17.1	0.77
48	0.4300	24.200	24.2	17.5	0.76
49	0.4400	24.500	24.5	18.0	0.77
50	0.4500	24.100	24.1	18.4	0.76

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	280.420		257.980
Moisture content: Dry soil+tare, gms.	259.040		241.440
Moisture content: Tare, gms.	112.680		121.290
Moisture, %	14.6	13.8	13.8
Moist specimen weight, gms.	138.2		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.9	116.3	
Dry density, pcf	100.2	102.2	
Void ratio	0.6816	0.6488	
Saturation, %	57.9	57.3	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.33

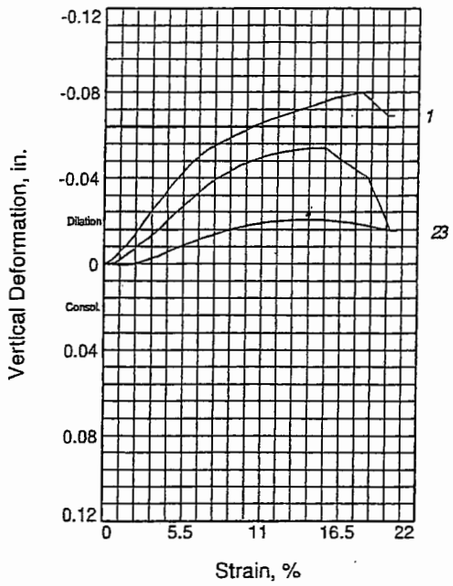
Fail. Stress = 2.01 ksf **at reading no.** 22

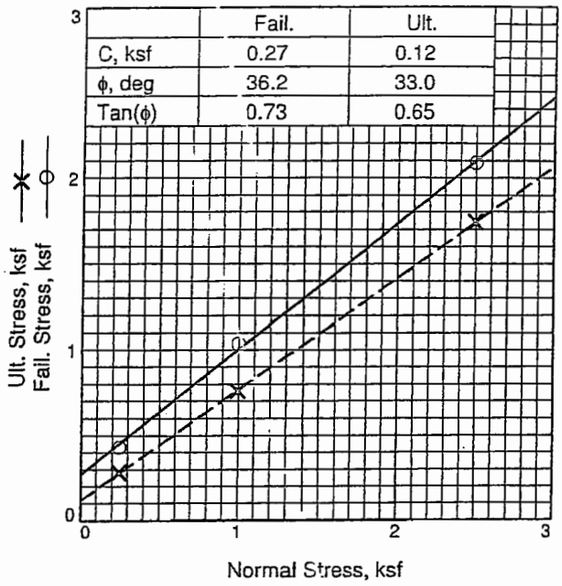
Ult. Stress = 1.79 ksf **at reading no.** 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
0	0.0000	0.0000	0.0	0.0	0.00
1	0.0050	0.1719	5.4	0.2	0.17
2	0.0100	0.2197	6.9	0.4	0.22
3	0.0160	0.3470	10.9	0.7	0.34
4	0.0200	0.4998	15.7	0.8	0.49
5	0.0250	0.6781	21.3	1.0	0.67
6	0.0300	0.8564	26.9	1.2	0.84
7	0.0350	1.0601	33.3	1.4	1.05
8	0.0400	1.2098	38.0	1.7	1.19
9	0.0450	1.3339	41.9	1.9	1.32
10	0.0500	1.4231	44.7	2.1	1.40
11	0.0550	1.4995	47.1	2.3	1.48
12	0.0600	1.5759	49.5	2.5	1.55
13	0.0650	1.6205	50.9	2.7	1.60
14	0.0700	1.6650	52.3	2.9	1.64
15	0.0750	1.7096	53.7	3.1	1.69
16	0.0850	1.7765	55.8	3.5	1.75
17	0.0950	1.8465	58.0	3.9	1.82
18	0.1050	1.8943	59.5	4.3	1.87
19	0.1150	1.9356	60.8	4.8	1.91
20	0.1300	1.9770	62.1	5.4	1.95
21	0.1510	2.0248	63.6	6.3	2.00
22	0.1550	2.0343	63.9	6.4	2.01
23	0.1900	2.0343	63.9	7.9	2.01
24	0.2250	1.9866	62.4	9.3	1.96
25	0.2560	1.9452	61.1	10.6	1.92
26	0.2810	1.8974	59.6	11.6	1.87

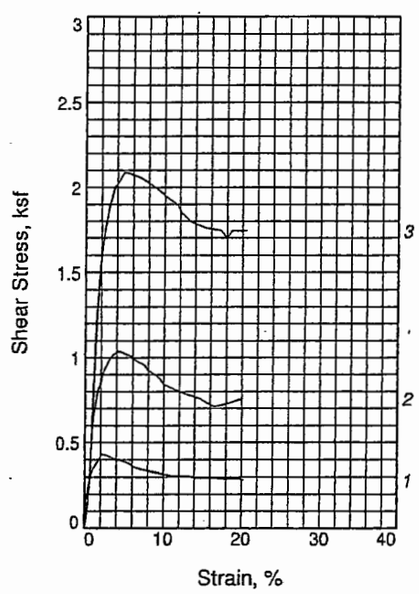
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf
27	0.3050	1.8561	58.3	12.6	1.83
28	0.3250	1.8115	56.9	13.5	1.79
29	0.3460	1.8688	58.7	14.3	1.84
30	0.3710	1.9102	60.0	15.4	1.88
31	0.4050	1.9516	61.3	16.8	1.93
32	0.4500	1.9070	59.9	18.6	1.88
33	0.4950	1.8879	59.3	20.5	1.86





	Fail.	Ult.
C, ksf	0.27	0.12
ϕ, deg	36.2	33.0
Tan(ϕ)	0.73	0.65



Sample No.		1	2	3
Initial	Water Content, %	13.4	13.4	13.4
	Dry Density, pcf	101.0	101.0	101.0
	Saturation, %	54.2	54.2	54.2
	Void Ratio	0.6682	0.6682	0.6682
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	12.9	13.2	12.8
	Dry Density, pcf	101.3	103.0	104.9
	Saturation, %	52.5	55.8	56.9
	Void Ratio	0.6632	0.6372	0.6070
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.98	0.96
Normal Stress, ksf		0.25	1.00	2.50
Fail. Stress, ksf		0.43	1.04	2.09
Strain, %		2.3	4.1	5.0
Ult. Stress, ksf		0.28	0.76	1.74
Strain, %		20.3	20.1	20.5
Strain rate, %/min.		0.25	0.25	0.25

Sample Type: Remolded 83% MDD @ OMC +4%
Description: sand

Assumed Specific Gravity= 2.7
Remarks: Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not inundated.

Fig. _____

Client: J.A. Cesare & Associates, Inc.

Project: U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113

Location: USEN-D1 & D2, 5% Zeolite Clay

Sample Number: 07-0605D

Proj. No.: 07.1243 **Date Sampled:** 8/20/07

Knight Piésold CONSULTING

Tested By: jdb **Checked By:** spb

DIRECT SHEAR TEST

8/24/2007

Date:	8/20/07
Client:	J.A. Cesare & Associates, Inc.
Project:	U.S. Ecology-NV Miscellaneous Testing Proj.#07-3113
Project No.:	07.1243
Location:	USEN-D1 & D2, 5% Zeolite Clay
Sample Number:	07-0605D
Description:	sand
Remarks:	Failure tangents drawn at peak shear stress and approximately 20% strain. Specimens were not inundated.
Type of Sample:	Remolded 83% MDD @ OMC +4%

Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		512.660
Moisture content: Dry soil+tare, gms.	442.370		497.050
Moisture content: Tare, gms.	115.320		376.050
Moisture, %	13.4	12.9	12.9
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet Density, pcf	114.6	114.4	
Dry density, pcf	101.0	101.3	
Void ratio	0.6682	0.6632	
Saturation, %	54.2	52.5	

Test Readings for Specimen No. 1

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 0.25 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 0.43 ksf **at reading no.** 11

Ult. Stress = 0.28 ksf **at reading no.** 29

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0001
1	0.0050	0.1751	5.5	0.2	0.17	0.0004
2	0.0100	0.2388	7.5	0.4	0.24	0.0014
3	0.0160	0.2897	9.1	0.7	0.29	0.0025
4	0.0200	0.3215	10.1	0.8	0.32	0.0038
5	0.0250	0.3470	10.9	1.0	0.34	0.0052
6	0.0300	0.3661	11.5	1.2	0.36	0.0067
7	0.0360	0.3852	12.1	1.5	0.38	0.0083
8	0.0410	0.4011	12.6	1.7	0.40	0.0099
9	0.0460	0.4171	13.1	1.9	0.41	0.0114
10	0.0500	0.4298	13.5	2.1	0.42	0.0130
11	0.0550	0.4362	13.7	2.3	0.43	0.0150

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
12	0.0610	0.4362	13.7	2.5	0.43	0.0171
13	0.0800	0.4234	13.3	3.3	0.42	0.0249
14	0.0900	0.4107	12.9	3.7	0.41	0.0286
15	0.1150	0.4011	12.6	4.8	0.40	0.0374
16	0.1300	0.3916	12.3	5.4	0.39	0.0422
17	0.1400	0.3789	11.9	5.8	0.37	0.0452
18	0.1450	0.3693	11.6	6.0	0.36	0.0467
19	0.1550	0.3597	11.3	6.4	0.35	0.0491
20	0.1750	0.3470	10.9	7.2	0.34	0.0537
21	0.2150	0.3343	10.5	8.9	0.33	0.0593
22	0.2500	0.3184	10.0	10.3	0.31	0.0641
23	0.2800	0.3088	9.7	11.6	0.30	0.0674
24	0.3250	0.3088	9.7	13.5	0.30	0.0714
25	0.3460	0.2961	9.3	14.3	0.29	0.0733
26	0.3900	0.3024	9.5	16.1	0.30	0.0775
27	0.4350	0.2929	9.2	18.0	0.29	0.0802
28	0.4800	0.2961	9.3	19.9	0.29	0.0691
29	0.4900	0.2865	9.0	20.3	0.28	0.0694

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		533.060
Moisture content: Dry soil+tare, gms.	442.370		517.040
Moisture content: Tare, gms.	115.320		395.480
Moisture, %	13.4	13.2	13.2
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet Density, pcf	114.6	116.5	
Dry density, pcf	101.0	103.0	
Void ratio	0.6682	0.6372	
Saturation, %	54.2	55.8	

Test Readings for Specimen No. 2

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 1.0 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.04 ksf **at reading no.** 16

Ult. Stress = 0.76 ksf **at reading no.** 31

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	0.0000
1	0.0050	0.0541	1.7	0.2	0.05	-0.0001
2	0.0100	0.1337	4.2	0.4	0.13	-0.0002
3	0.0150	0.2770	8.7	0.6	0.27	0.0001
4	0.0200	0.5157	16.2	0.8	0.51	0.0005
5	0.0250	0.6367	20.0	1.0	0.63	0.0014
6	0.0300	0.7163	22.5	1.2	0.71	0.0024
7	0.0350	0.7736	24.3	1.4	0.76	0.0035
8	0.0400	0.8182	25.7	1.7	0.81	0.0046
9	0.0460	0.8500	26.7	1.9	0.84	0.0057
10	0.0510	0.8882	27.9	2.1	0.88	0.0068
11	0.0550	0.9201	28.9	2.3	0.91	0.0079
12	0.0600	0.9455	29.7	2.5	0.93	0.0091
13	0.0660	0.9678	30.4	2.7	0.95	0.0101
14	0.0750	1.0060	31.6	3.1	0.99	0.0122
15	0.0850	1.0283	32.3	3.5	1.01	0.0146
16	0.1000	1.0506	33.0	4.1	1.04	0.0185
17	0.1050	1.0538	33.1	4.3	1.04	0.0199
18	0.1360	1.0283	32.3	5.6	1.01	0.0277
19	0.1550	0.9997	31.4	6.4	0.99	0.0323
20	0.1800	0.9710	30.5	7.5	0.96	0.0379
21	0.1900	0.9424	29.6	7.9	0.93	0.0397
22	0.2150	0.9137	28.7	8.9	0.90	0.0437
23	0.2300	0.8882	27.9	9.5	0.88	0.0461
24	0.2400	0.8596	27.0	9.9	0.85	0.0471
25	0.2750	0.8246	25.9	11.4	0.81	0.0506
26	0.3100	0.7991	25.1	12.8	0.79	0.0526

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
27	0.3510	0.7736	24.3	14.5	0.76	0.0542
28	0.3750	0.7482	23.5	15.5	0.74	0.0541
29	0.4000	0.7227	22.7	16.6	0.71	0.0486
30	0.4460	0.7418	23.3	18.5	0.73	0.0406
31	0.4860	0.7704	24.2	20.1	0.76	0.0154

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	486.240		532.550
Moisture content: Dry soil+tare, gms.	442.370		516.900
Moisture content: Tare, gms.	115.320		394.650
Moisture, %	13.4	12.8	12.8
Moist specimen weight, gms.	137.9		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.96	
Net decrease in height, in.		0.04	
Wet Density, pcf	114.6	118.3	
Dry density, pcf	101.0	104.9	
Void ratio	0.6682	0.6070	
Saturation, %	54.2	56.9	

Test Readings for Specimen No. 3

Load ring constant = 31.4108 lbs. per input unit

Normal stress = 2.5 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 2.09 ksf **at reading no.** 20

Ult. Stress = 1.74 ksf **at reading no.** 32

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0.00	-0.0001
1	0.0060	0.0669	2.1	0.2	0.07	-0.0002
2	0.0110	0.1369	4.3	0.5	0.14	-0.0002
3	0.0150	0.2642	8.3	0.6	0.26	-0.0003
4	0.0200	0.4998	15.7	0.8	0.49	-0.0004
5	0.0250	0.7800	24.5	1.0	0.77	-0.0006
6	0.0300	1.0219	32.1	1.2	1.01	-0.0008
7	0.0350	1.2161	38.2	1.4	1.20	-0.0008
8	0.0400	1.3785	43.3	1.7	1.36	-0.0006
9	0.0450	1.5186	47.7	1.9	1.50	-0.0004
10	0.0500	1.6173	50.8	2.1	1.60	-0.0002
11	0.0550	1.7001	53.4	2.3	1.68	0.0002
12	0.0600	1.7733	55.7	2.5	1.75	0.0006
13	0.0660	1.8369	57.7	2.7	1.81	0.0011
14	0.0700	1.8815	59.1	2.9	1.86	0.0015
15	0.0750	1.9293	60.6	3.1	1.90	0.0020
16	0.0850	2.0025	62.9	3.5	1.98	0.0032
17	0.0900	2.0350	63.9	3.7	2.01	0.0033

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
18	0.0950	2.0375	64.0	3.9	2.01	0.0040
19	0.1100	2.0916	65.7	4.6	2.06	0.0059
20	0.1200	2.1171	66.5	5.0	2.09	0.0071
21	0.1250	2.1171	66.5	5.2	2.09	0.0077
22	0.1660	2.0853	65.5	6.9	2.06	0.0118
23	0.2100	2.0343	63.9	8.7	2.01	0.0157
24	0.2450	1.9770	62.1	10.1	1.95	0.0180
25	0.2800	1.9261	60.5	11.6	1.90	0.0195
26	0.2950	1.8752	58.9	12.2	1.85	0.0198
27	0.3250	1.8210	57.2	13.5	1.80	0.0203
28	0.3700	1.7860	56.1	15.3	1.76	0.0203
29	0.4160	1.7701	55.6	17.2	1.75	0.0192
30	0.4350	1.7223	54.1	18.0	1.70	0.0183
31	0.4500	1.7669	55.5	18.6	1.74	0.0176
32	0.4950	1.7669	55.5	20.5	1.74	0.0153

ATTACHMENT 2

RESULTS OF GEOPHYSICAL SURVEY OF TRENCH 12 AREA

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July 23, 2007

Chris Bolin
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303-771-9150

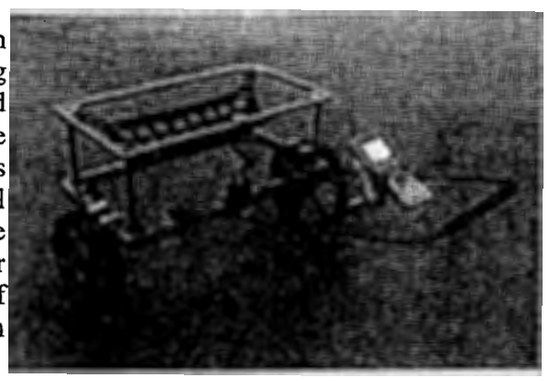
Subject: ***Geophysical Investigation at the US Ecology Nevada facility, Beatty, NV***

This letter represents the final report for the geophysical investigation conducted at the US Ecology Nevada facility near Beatty, NV (see Figure 1). The work was performed under a contract agreement between AquAeTer, Inc. and Zonge Geosciences, Inc. (Zonge). Geophysical data were collected from July 9th to July 11th, 2007. The report is composed of two sections, an Objective/Scope of Work section and Results section. Figures are presented at the end of the report.

Objective/Scope of Work

The objective of the geophysical investigation was to detect any buried metallic objects that may be related to burial pits, trenches or 55-gallon drums. To meet the project objective two geophysical methods were employed: time-domain electromagnetics (TDEM) and magnetics. Zonge utilized the Geonics EM61-MK2 high-sensitivity metal detector for the TDEM field surveys and the Geometrics G858 total-field magnetometer.

The EM61-MK2 (pictured at right) is a high resolution metal detector, capable of detecting buried ferrous and non-ferrous (e.g., iron and aluminum, respectively) metallic objects. The system is comprised of two 1 by ½ meter coils mounted one over the other. The lower coil contains a transmitter and a receiver, and the upper coil is strictly a receiver coil. The lower coil is positioned approximately 16 inches off the ground while the top coil is placed an additional 12 inches above the lower coil.



The EM61-MK2 can detect very small metallic objects (e.g., cans, small rebar, etc.), and the occurrence of a large amount of surface metal debris will likely screen the response from a deeper metal object or target. Depth of investigation is target and soil dependent. Larger items may be detected at greater depths (i.e., 55 gallon drums may be detected to depths up to 10 feet below the surface per the manufacturers specifications) while smaller items (pliers, hammer, etc.) may not be detected beyond 12 inches beneath the surface.

The G858 (pictured at left) measures the earth's total magnetic field and the superposition of the magnetic field associated with ferrous objects. The detection capability depends on the size and ferrous content of the causative body but a 55-gallon drum may easily be detected at a depth of 15 feet if interference due to other bodies or buildings is minimal. Barrows and Rocchio (1980) indicate that a 55-gallon drum in a horizontal position and located 11 feet away from the sensor will have a total response of 80nT and an areal extent of more than 25 feet. This article was obtained from the Geometrics website (www.geomterics.com) on August 2, 2007 and has been included in the appendices. Although the authors report that a 55-gallon drum would be easily detectable at 11 feet from the sensor, actual detection capabilities will vary depending on local site conditions. The magnetic sensor was placed approximately 2-3 feet off the ground for this survey. A magnetic base station was not used for this survey.

Both geophysical instruments were coupled with a Real Time Kinematic (RTK) Global Positioning System (GPS) for data positioning. With proper satellite coverage and data acquisition, data may be positioned to within ±15cm of their true location.

Data were collected with the G858 and the EM61-MK2 at 10 readings per second. At a walking speed of 2-3 miles per hour this results in a recorded data value every 0.3 to 0.4 feet. A 5-6 foot line spacing was used for both systems.

For more information regarding the methodology and operation of these instruments please refer to the attached appendices.

Results

The G858 magnetometer was the primary geophysical tool used for the survey because of its ability to detect metallic debris to greater depths than the EM61-MK2. The EM61-MK2 was used in areas where above ground metallic cultural features negatively impacted the magnetic data. These areas included along the chain link fence and office buildings. Figure 2 shows a plan view of the facility. Areas surveyed with each instrument have been identified and plotted on Figure 2. Approximately 8.5 acres of geophysical data were collected.

Figure 3 shows the resulting magnetic data collected at the facility while the EM61-MK2 data are shown in Figure 4. Data are displayed using local coordinate system supplied by AquAeTer. Items to note regarding both the magnetic and EM61-MK2 data collection include:

1. The metal fence located along the northern, western, and southern border is visible in both the magnetic and EM data and may conceal anomalies of interest in close proximity to the fence (< 5feet);
2. EM61-MK2 data were only collected in areas where cultural features influenced the magnetic data;
3. Magnetic data were not collected in the building area due to the large number of cultural features present;
4. Areas selected for investigation have been outlined with solid lines and are listed in Table 2 for reference;
5. Anomalous areas were identified as those that had the highest chance of containing 55-gallon drums or similar objects;
6. An additional column in Table 2 identifies the probability that selected anomalies are the result of 55 gallon drums or burial trenches.
7. Anomalous areas with an areal extent with a diameter greater than 15 feet are identified with a 2, those that are smaller are identified with a 1. Anomalous areas that are interpreted to be trenches are identified with a 3.
8. There is no indication of buried trenches containing metallic debris in the geophysical data.
9. Depth estimates for detected anomalies were not made.

Table 1 lists the coordinates used to reference the anomalous zones to a local coordinate system. The point used for the GPS base station is also listed.

Table 1 – Coordinates of fence posts and GPS base station

ID	State Plane Coordinate (Nevada Central)(feet)		Local (feet)	
	X	Y	X	Y
NW Fence Corner	1631907.6	20420109.1	10003.7	9997.5
SW Fence Corner	1631904.7	20419629.6	10002.4	9519.0
GPS Base	1633094.3	20420107.6	11187.9	10000.1

Twenty-eight (28) areas were marked out in the field and are shown on Figures 2 and 3 with a solid line. The coordinates of the polygons drawn around each area are presented in Table 2 in both a local coordinate system using the northwest corner fencepost as the origin and also in WGS84/State Plane Nevada Central Zone coordinates in feet. As listed in Table 2 nine (9) anomalies have the areal extent that may be expected for a 55-gallon drum.

All but one of the anomalies (#10) are more than likely the result of single metallic objects. This interpretation is based on the areal extent, magnitude, and shape of the anomaly. Anomaly #10 appears to be the result of multiple metallic objects based on the multiple dipolar features in this

area. As discussed with Bob Marchand of US Ecology Nevada, anomaly #1 is likely the result of a caisson buried by the United States Geological Survey (USGS).

It is Zonge's recommendation that a hand held metal detector (i.e. Schonstedt or similar instrument) be used to aid the anomaly excavation. The hand held instrument will allow the excavation team to determine if the metallic object is still buried deeper or has been removed during the digging.

As stated previously depth estimates were not made from the geophysical data. Anomaly signatures will vary depending upon local site conditions. A local test plot that contained multiple 55-gallon drums at varying depths may have provided enough information to make estimates of anomaly depths. Although helpful it would not have constrained the depth estimates to any value closer than ±50% of the estimated depth.

Conclusions

Data were collected using both the EM61-MK2 and G858 magnetometer. The geophysical data were successful at identifying subsurface metallic debris at 28 locations. These anomalous zones have been labeled 1 through 28 and marked on Figures 3 and 4.

If you have any questions regarding the objective, field methods including acquisition and processing, please do not hesitate to contact me. We appreciate the opportunity to work with you and hope the geophysical investigation will aid in your assessment of the site.

Respectfully,

Todd Meglich
Senior Geophysicist
Zonge Geosciences, Inc.

Figure 1 - Survey area (marked with yellow X) located along Highway 95, southeast of Beatty, NV
(maps.google.com, retrieved July 19, 2007)

Table 2 - Coordinates of anomalous areas

Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
1	1632643	20419737	10739	9629	2
	1632636	20419734	10732	9625	
	1632634	20419731	10730	9622	
	1632635	20419727	10730	9618	
	1632638	20419723	10734	9615	
	1632645	20419719	10741	9611	
	1632652	20419719	10748	9610	
	1632657	20419721	10752	9612	
	1632658	20419724	10754	9616	
	1632658	20419728	10754	9620	
	1632657	20419733	10752	9624	
	1632651	20419737	10747	9628	
	1632645	20419737	10741	9629	
2	1632510	20419704	10606	9596	2
	1632507	20419704	10603	9596	
	1632504	20419701	10600	9593	
	1632503	20419697	10599	9588	
	1632506	20419695	10602	9587	
	1632509	20419697	10605	9588	
	1632511	20419701	10607	9592	
	1632510	20419703	10607	9594	
3	1632696	20419773	10791	9665	2
	1632694	20419767	10789	9658	
	1632696	20419763	10792	9655	
	1632701	20419763	10796	9655	
	1632703	20419769	10798	9661	
	1632702	20419774	10798	9666	
	1632698	20419774	10793	9666	
4	1632702	20419840	10797	9731	1
	1632700	20419837	10795	9729	
	1632701	20419834	10796	9726	
	1632704	20419833	10799	9725	
	1632705	20419836	10800	9728	
	1632705	20419839	10800	9731	

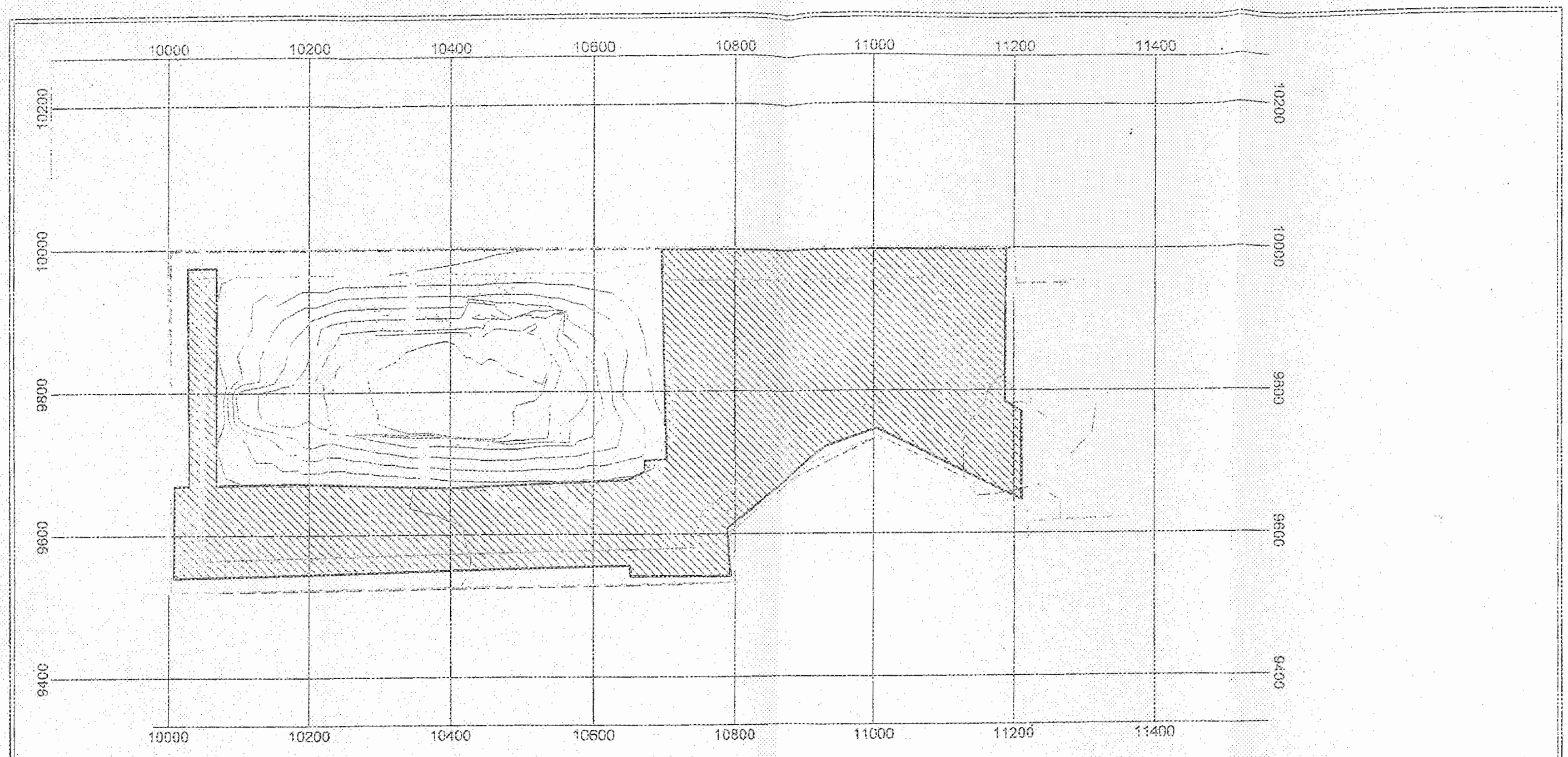
Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
5	1632800	20419892	10895	9784	2
	1632795	20419889	10890	9781	
	1632794	20419884	10889	9776	
	1632797	20419882	10892	9774	
	1632801	20419882	10896	9774	
	1632804	20419884	10899	9776	
	1632805	20419889	10900	9781	
	1632803	20419892	10898	9784	
6	1632822	20419845	10917	9737	1
	1632820	20419845	10915	9737	
	1632818	20419842	10913	9734	
	1632820	20419841	10915	9733	
	1632822	20419842	10917	9734	
	1632823	20419845	10918	9737	
7	1632869	20419890	10964	9782	2
	1632864	20419898	10958	9790	
	1632854	20419894	10949	9787	
	1632853	20419883	10948	9775	
	1632859	20419880	10954	9772	
	1632870	20419882	10965	9774	
8	1632790	20420004	10885	9895	2
	1632786	20420001	10881	9893	
	1632784	20419996	10878	9887	
	1632786	20419994	10881	9886	
	1632790	20419994	10885	9886	
	1632792	20419998	10887	9890	
	1632792	20420001	10887	9893	
9	1632793	20420045	10887	9937	1
	1632791	20420047	10886	9939	
	1632788	20420046	10882	9938	
	1632788	20420042	10882	9933	
	1632791	20420040	10886	9932	
	1632793	20420042	10887	9933	

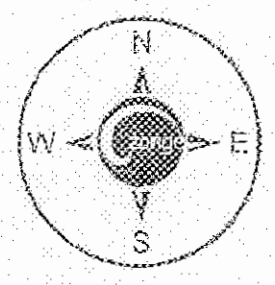
Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
10	1632711	20419944	10806	9836	2
	1632715	20419941	10810	9833	
	1632724	20419944	10819	9836	
	1632730	20419948	10825	9840	
	1632729	20419951	10824	9843	
	1632729	20419955	10823	9846	
	1632725	20419958	10820	9850	
	1632719	20419962	10814	9853	
	1632715	20419962	10810	9853	
	1632712	20419959	10807	9851	
	1632708	20419954	10803	9845	
	1632708	20419950	10803	9842	
	1632708	20419947	10803	9839	
11	1632713	20419981	10808	9872	1
	1632706	20419979	10801	9870	
	1632706	20419975	10801	9867	
	1632710	20419972	10804	9864	
	1632714	20419974	10809	9865	
	1632716	20419976	10811	9868	
	1632714	20419980	10809	9872	
12	1632690	20419966	10785	9858	1
	1632690	20419969	10784	9860	
	1632688	20419968	10783	9860	
	1632687	20419967	10782	9858	
	1632687	20419965	10782	9856	
	1632690	20419965	10785	9856	
	1632691	20419966	10786	9857	
13	1632703	20419901	10798	9793	1
	1632697	20419905	10792	9797	
	1632691	20419905	10787	9796	
	1632689	20419897	10784	9789	
	1632691	20419895	10786	9786	
	1632696	20419892	10791	9784	
	1632701	20419897	10797	9788	
	1632702	20419899	10797	9790	

Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
14	1632669	20419937	10764	9829	1
	1632665	20419937	10760	9828	
	1632664	20419935	10759	9827	
	1632664	20419932	10760	9824	
	1632668	20419932	10763	9824	
	1632670	20419934	10765	9826	
15	1632657	20419955	10752	9846	1
	1632656	20419952	10751	9843	
	1632659	20419951	10754	9842	
	1632665	20419951	10760	9843	
	1632664	20419954	10759	9846	
	1632660	20419957	10755	9848	
16	1632707	20419936	10802	9828	1
	1632704	20419937	10799	9829	
	1632703	20419934	10798	9826	
	1632706	20419935	10801	9826	
17	1632686	20419931	10781	9822	1
	1632685	20419932	10780	9824	
	1632682	20419932	10777	9824	
	1632682	20419929	10777	9821	
	1632682	20419929	10778	9820	
	1632685	20419929	10780	9820	
18	1632636	20420004	10731	9895	1
	1632638	20420006	10732	9897	
	1632636	20420008	10730	9899	
	1632633	20420007	10728	9898	
	1632633	20420004	10728	9896	
	1632635	20420004	10730	9895	
19	1632615	20419979	10710	9870	1
	1632618	20419983	10713	9874	
	1632616	20419985	10711	9876	
	1632614	20419986	10709	9877	
	1632612	20419985	10707	9876	
	1632610	20419983	10705	9874	
	1632610	20419981	10705	9872	
	1632614	20419979	10709	9870	

Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
20	1632672	20419988	10766	9880	1
	1632668	20419990	10763	9881	
	1632664	20419989	10758	9881	
	1632663	20419987	10758	9879	
	1632662	20419985	10757	9876	
	1632664	20419984	10759	9875	
	1632669	20419984	10764	9875	
	1632671	20419985	10766	9876	
	1632671	20419987	10766	9878	
21	1632699	20420012	10793	9904	1
	1632695	20420013	10790	9905	
	1632692	20420013	10786	9904	
	1632691	20420011	10785	9902	
	1632692	20420009	10787	9901	
	1632697	20420010	10791	9901	
	1632699	20420010	10793	9902	
22	1633078	20419891	11173	9784	1
	1633077	20419889	11171	9782	
	1633077	20419887	11171	9780	
	1633080	20419885	11175	9778	
	1633082	20419885	11177	9778	
	1633083	20419888	11178	9781	
	1633083	20419889	11177	9782	
	1633080	20419891	11175	9784	
	1633079	20419891	11174	9784	
23	1633010	20419834	11105	9727	2
	1633010	20419836	11104	9729	
	1633007	20419837	11102	9730	
	1633005	20419837	11100	9730	
	1633003	20419836	11097	9729	
	1633000	20419833	11095	9726	
	1633002	20419830	11097	9723	
	1633006	20419830	11101	9723	
	1633010	20419833	11104	9726	

Anomaly	State Plane Coordinate (Nevada Central)(feet)		Local Coordinate (feet)		Identifier
	X (East)	Y (North)	X (East)	Y (North)	1 = diameter < drum 2 = diameter => drum 3 = trench
24	1632998	20419949	11092	9842	1
	1632994	20419952	11088	9845	
	1632992	20419951	11086	9844	
	1632991	20419948	11086	9841	
	1632993	20419945	11087	9838	
	1632998	20419945	11093	9837	
	1632999	20419947	11093	9839	
25	1632941	20419892	11035	9784	1
	1632938	20419894	11033	9787	
	1632935	20419894	11030	9786	
	1632933	20419892	11028	9785	
	1632935	20419890	11029	9782	
	1632937	20419889	11032	9781	
	1632940	20419889	11034	9781	
	1632941	20419890	11035	9783	
26	1632901	20419902	10995	9795	2
	1632899	20419905	10994	9797	
	1632896	20419905	10991	9797	
	1632895	20419902	10990	9795	
	1632897	20419901	10992	9793	
	1632900	20419900	10995	9793	
27	1632321	20419676	10417	9567	1
	1632318	20419677	10415	9568	
	1632317	20419676	10413	9567	
	1632317	20419675	10414	9565	
	1632319	20419674	10416	9565	
	1632320	20419675	10417	9566	
28	1632861	20419851	10956	9741	1
	1632858	20419849	10953	9740	
	1632858	20419846	10953	9737	
	1632860	20419845	10955	9735	
	1632864	20419846	10959	9737	
	1632864	20419849	10959	9740	





Scale 1:1800

100 0 100 200 300

(feet)

Plant Coordinates

Notes

This map shows coverage from both the magnetic and EM geophysical surveys.

Legend

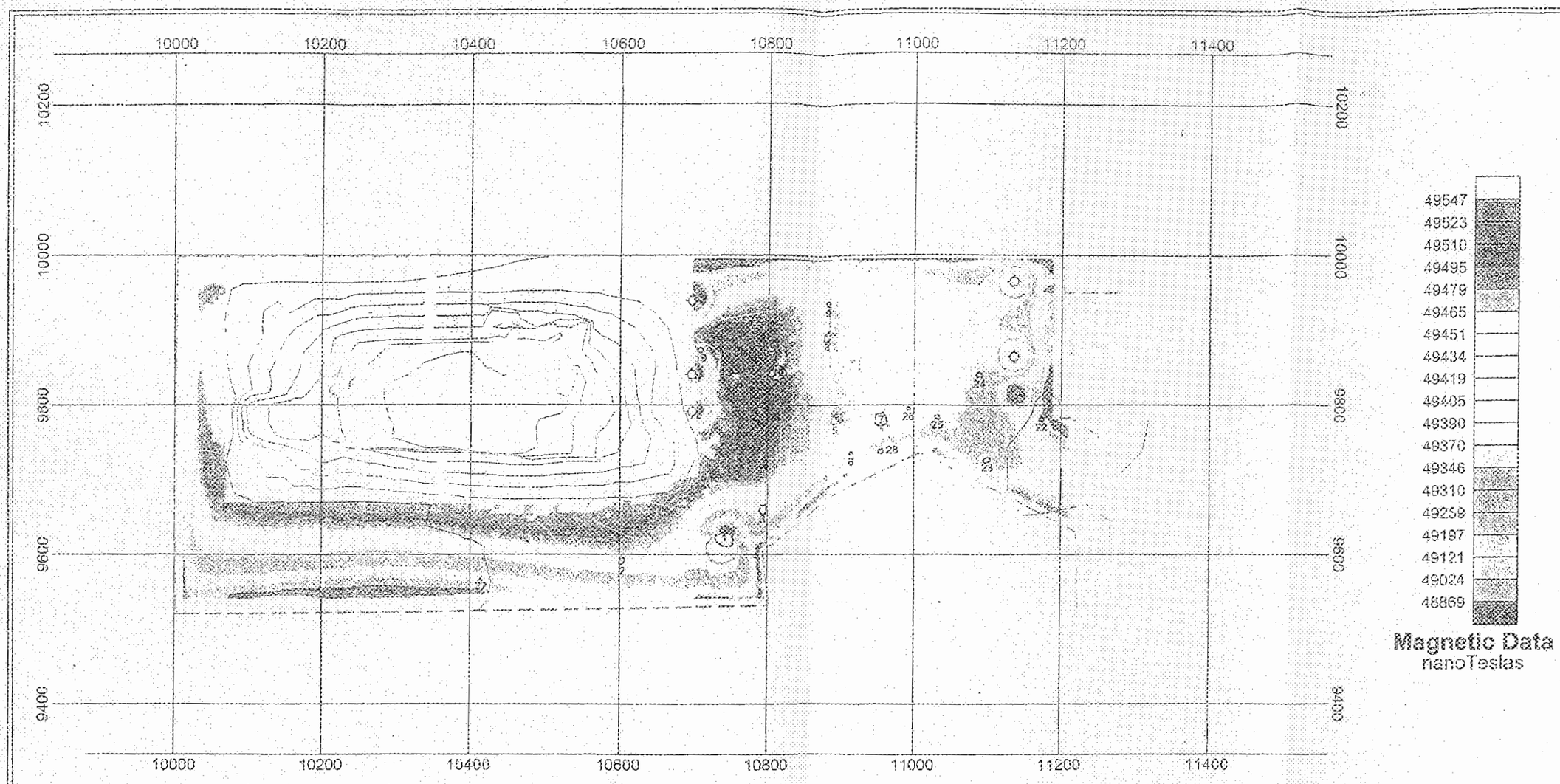
- Steel Posts
- Chain Link Fence
- Major Contour Lines
- Minor Contour Lines
- Magnetic data coverage
- EM61 data coverage
- Building

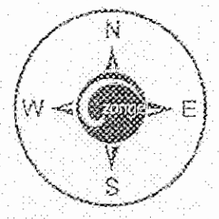
AquAeTer, Inc.

Geophysical Survey
US Ecology Nevada
Beatty, NV

Figure 2
Coverage Map
Magnetic and EM Data
July 9th-11th, 2007

Zonge Geosciences, Denver, CO





Scale 1:1800

100 0 100 200 300

(feet)

Plant Coordinates

Notes

This map shows the magnetic data collected at the site. Anomalies have been labeled and marked on the map along with known cultural features.

Legend

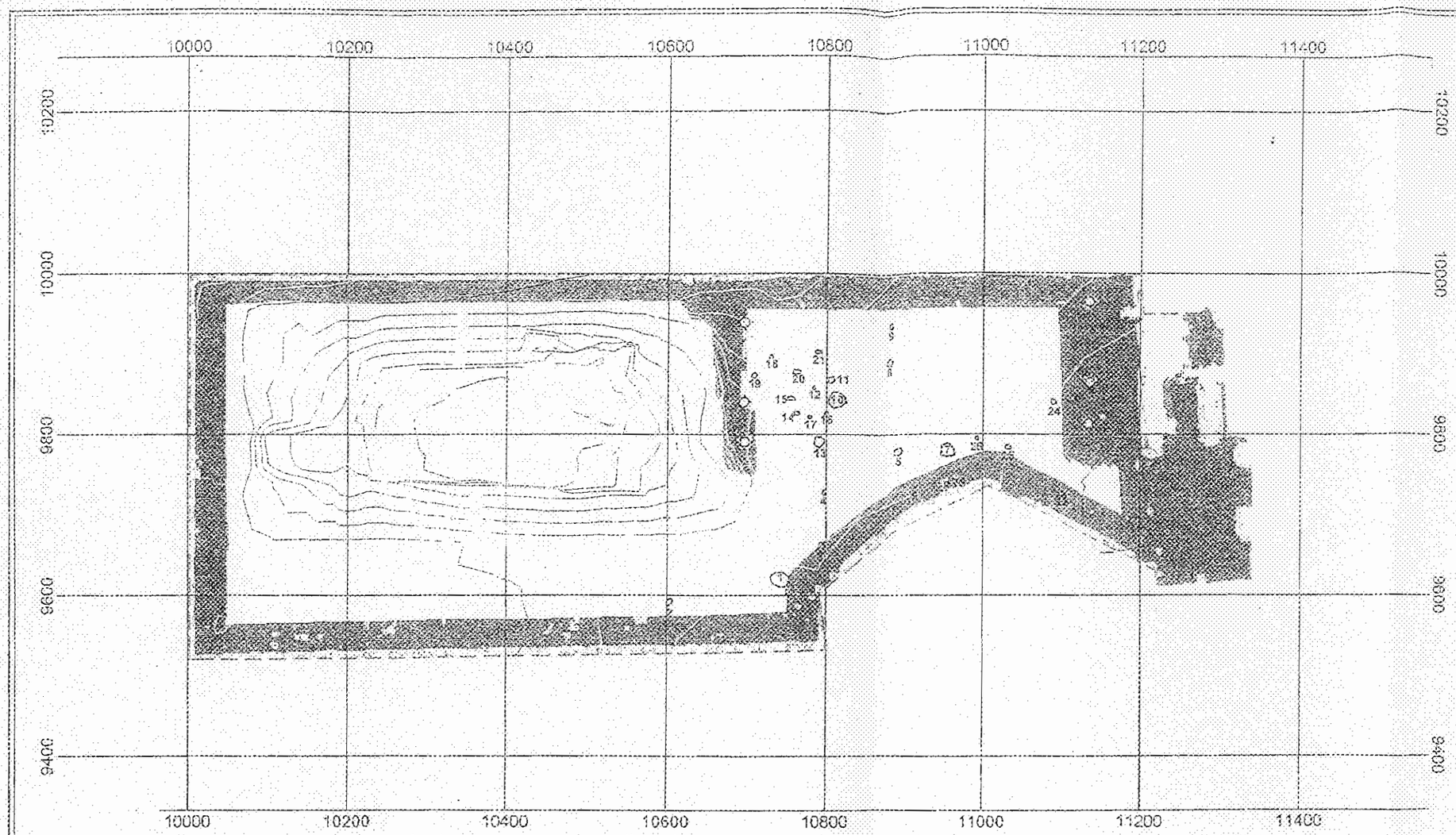
- Steel Posts
- Chain Link Fence
- Major Contour Lines
- Minor Contour Lines
- Anomaly
- Building

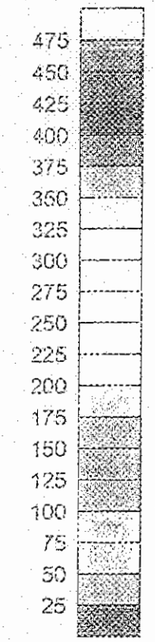
AquAeTer, Inc.

Geophysical Survey
US Ecology Nevada
Beatty, NV

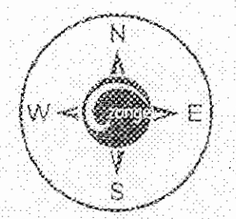
Figure 3
Magnetic Data
July 9th-11th, 2007

Zonge Geosciences, Denver, CO





EM61 Data
Channel 2 (milliVolts)



Scale 1:1800

100 0 100 200 300
(feet)

Plant Coordinates

Notes

This map shows the EM data collected at the site. EM data were collected to fill coverage gaps in the magnetic data. Coverage gaps were areas where the magnetic data were negatively impacted by cultural features. Anomalies have been labeled and marked on the map along with known cultural features.

Legend

- Steel Posts
- Chain Link Fence
- Major Contour Lines
- Minor Contour Lines
- Anomaly
- Building

AquAeTer, Inc.

Geophysical Survey
US Ecology Nevada
Beatty, NV

Figure 4
EM Data
July 9th-11th, 2007

Zonge Geosciences, Denver, CO