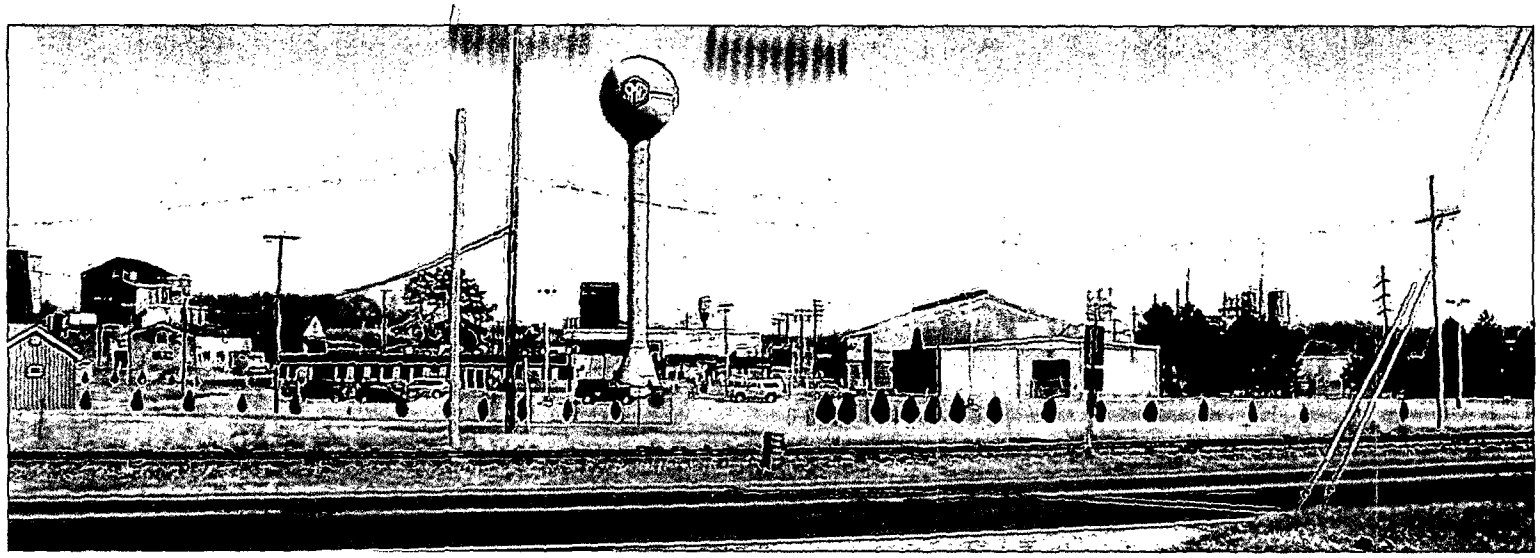


DECOMMISSIONING PLAN

SHIELDALLOY METALLURGICAL CORPORATION

NEWFIELD, NEW JERSEY

REVISION 1b: AUGUST 2009

Appendix 19.7 ENGINEERING EVALUATIONS
Attachments K-S

Appendix 19.8 QA/QC CONSTRUCTION PLAN

Appendix 19.9 OPERATION AND MAINTENANCE PLAN

Appendix 19.10 DCGL DOCUMENT

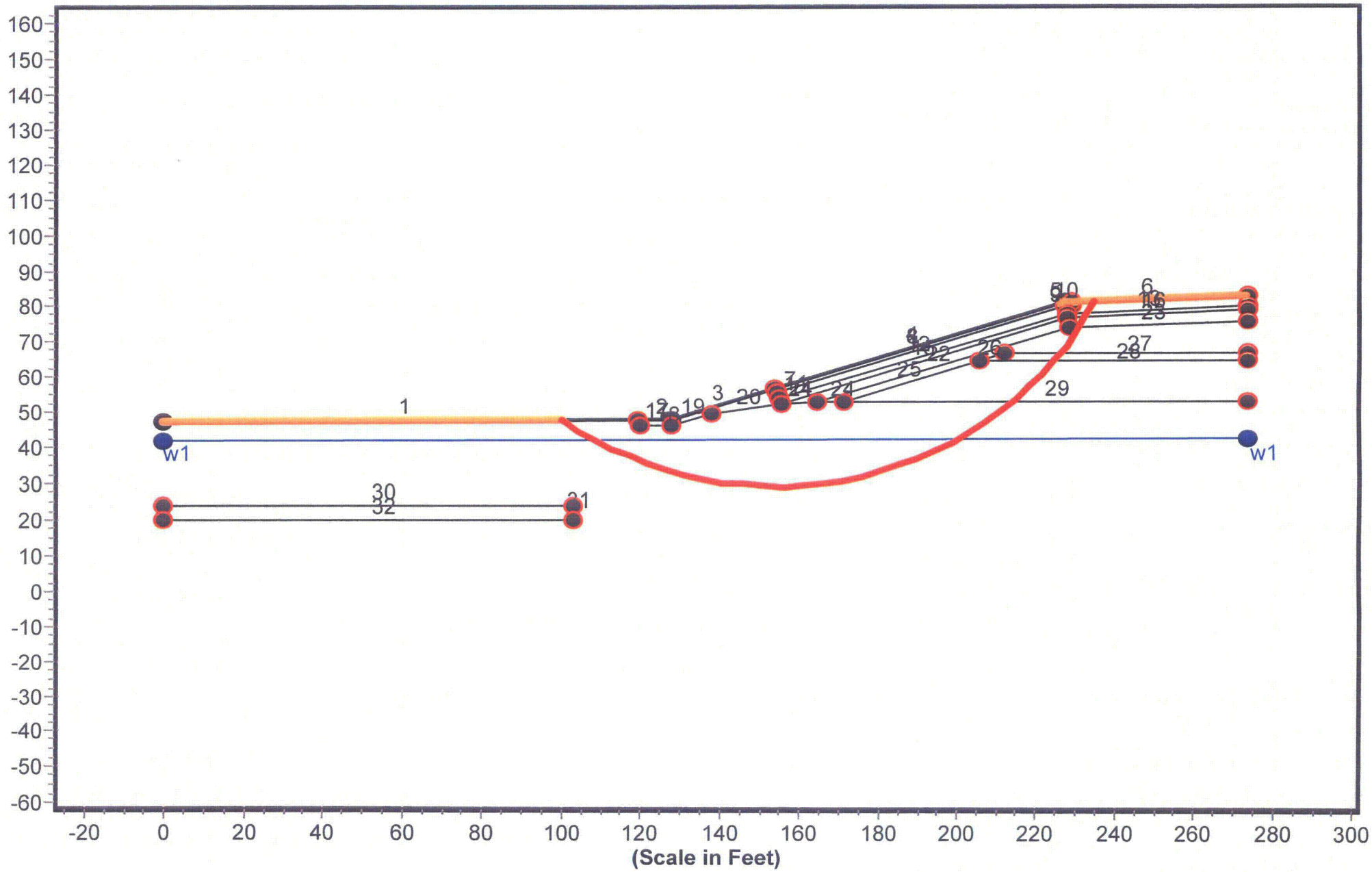
Prepared by

Integrated Environmental Management, Inc. *and* **TRC Environmental Corporation**

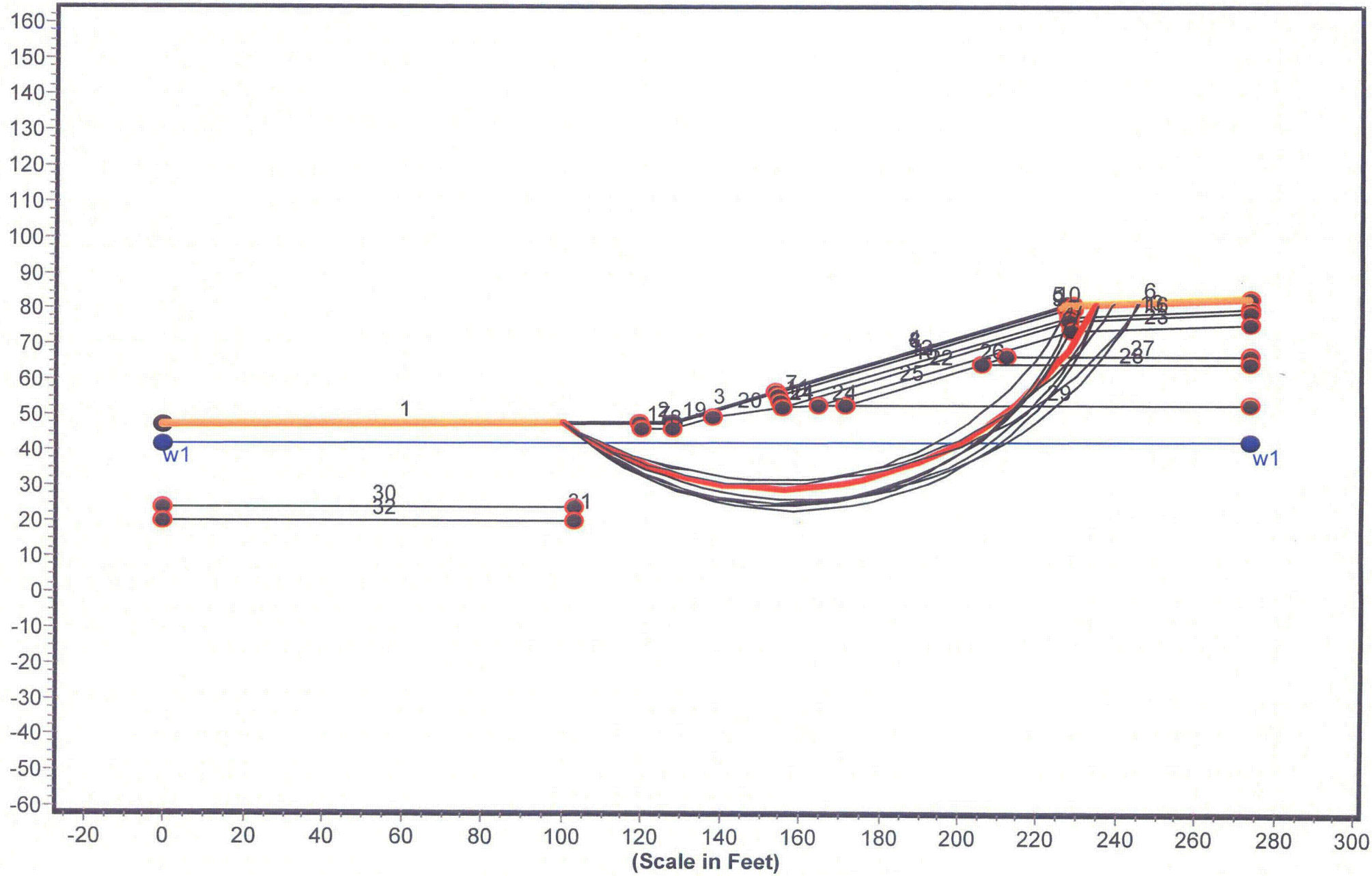
ATTACHMENT K
Seismic Stability Model Analyses

JANBU #1 SEISMIC CIRCULAR

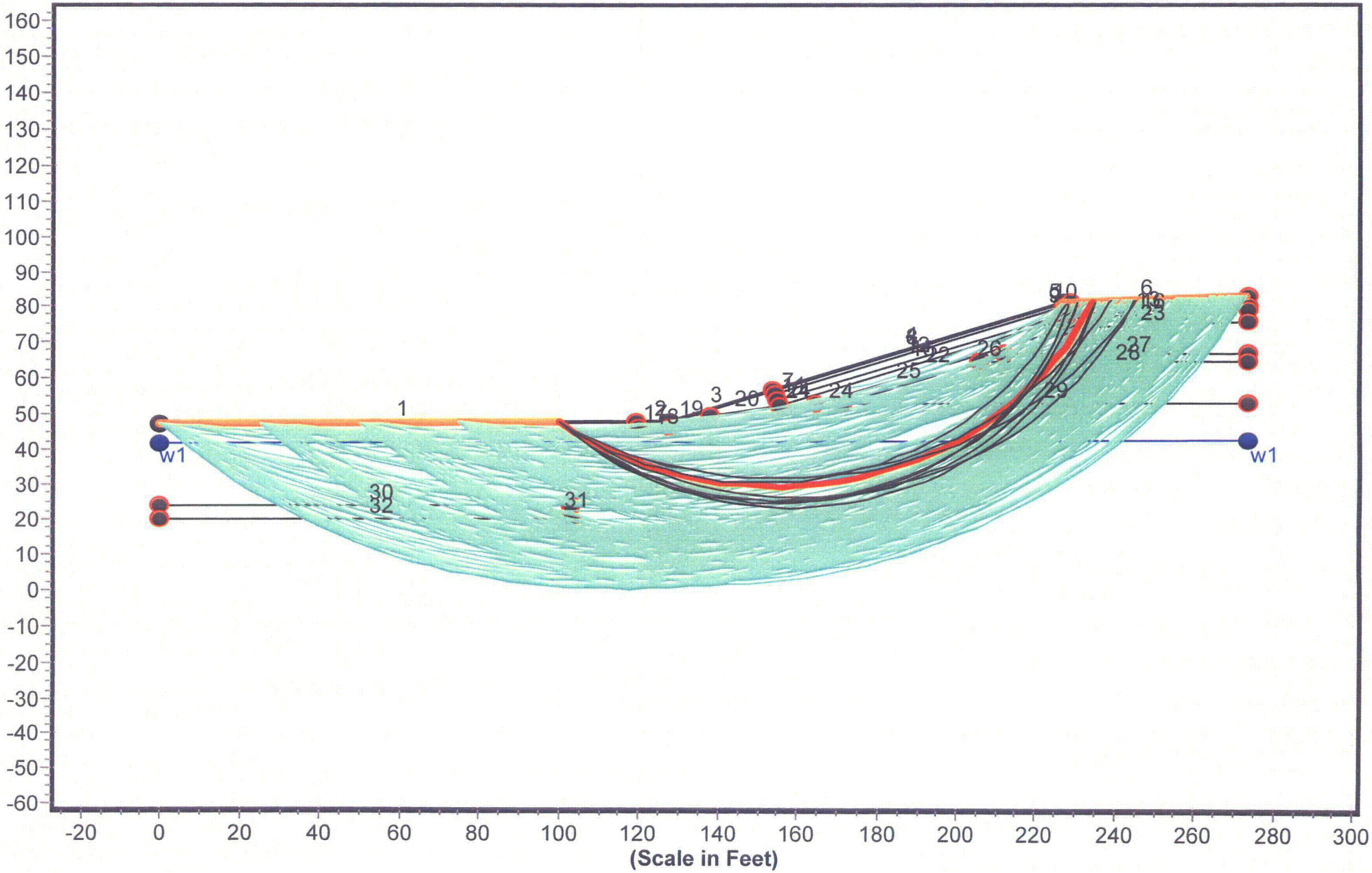
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.66

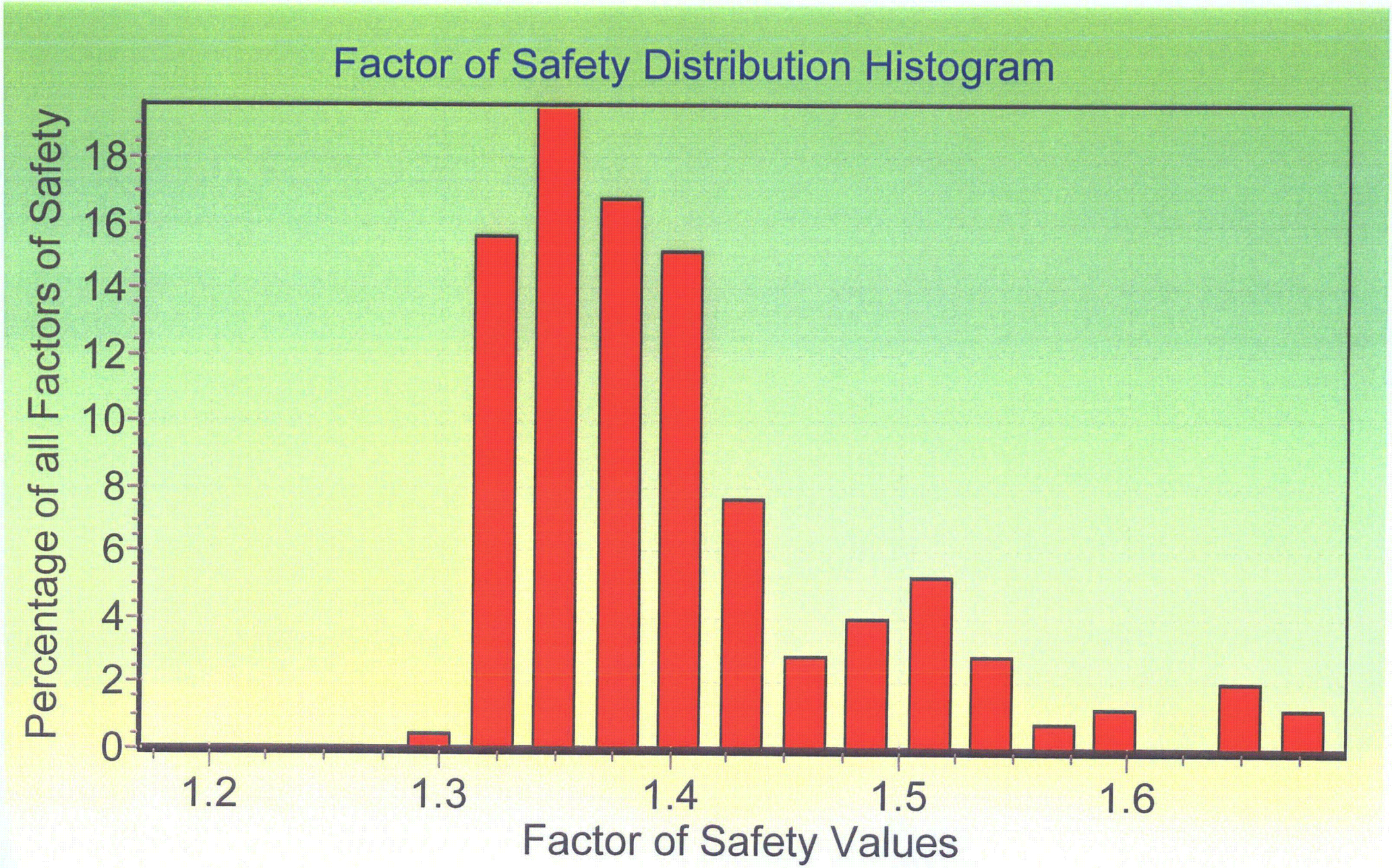


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.66



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.66




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
2
4
6
8
10
12
14
16
18
1.2
1.3
1.4
1.5
1.6
Factor of Safety Values

** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X = 0.00 ft.
and X = 100.00 ft.

Each Surface Terminates Between X = 226.00 ft.
and X = 273.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And -5.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.02	44.93
3	108.20	42.19
4	112.54	39.69
5	117.00	37.45
6	121.59	35.46
7	126.29	33.74
8	131.07	32.29
9	135.93	31.12
10	140.85	30.22
11	145.81	29.61
12	150.80	29.28
13	155.80	29.24
14	160.80	29.48
15	165.77	30.00
16	170.70	30.81
17	175.58	31.90
18	180.39	33.27
19	185.12	34.91
20	189.74	36.81
21	194.25	38.98
22	198.62	41.40
23	202.85	44.06

24	206.92	46.96
25	210.82	50.09
26	214.54	53.44
27	218.06	56.99
28	221.36	60.74
29	224.45	64.67
30	227.31	68.78
31	229.94	73.03
32	232.31	77.43
33	234.17	81.41

*** 1.660 ***

Individual data on the 60 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.0	691.9	0.0	0.0	0.0	0.0	58.6	58.6	0.0
2	4.2	2103.8	0.0	0.0	0.0	0.0	178.1	178.1	0.0
3	0.3	201.5	0.0	0.0	0.0	0.0	17.1	17.1	0.0
4	4.0	3362.9	0.0	339.0	0.0	0.0	284.8	284.8	0.0
5	4.5	5064.1	0.0	1080.6	0.0	0.0	428.8	428.8	0.0
6	2.5	3373.7	0.0	871.6	0.0	0.0	285.7	285.7	0.0
7	0.1	144.1	0.0	38.8	0.0	0.0	12.2	12.2	0.0
8	2.0	3022.0	0.0	834.3	0.0	0.0	255.9	255.9	0.0
9	4.7	7907.8	0.0	2327.1	0.0	0.0	669.6	669.6	0.0
10	1.2	2207.3	0.0	672.9	0.0	0.0	186.9	186.9	0.0
11	0.3	557.1	0.0	171.0	0.0	0.0	47.2	47.2	0.0
12	3.3	6534.3	0.0	1982.1	0.0	0.0	553.3	553.3	0.0
13	4.9	11145.7	0.0	3240.0	0.0	0.0	943.8	943.8	0.0
14	2.0	4965.2	0.0	1392.7	0.0	0.0	420.5	420.5	0.0
15	3.0	7914.7	0.0	2174.7	0.0	0.0	670.2	670.2	0.0
16	5.0	14497.4	0.0	3807.2	0.0	0.0	1227.6	1227.6	0.0
17	5.0	15919.4	0.0	3958.7	0.0	0.0	1348.1	1348.1	0.0
18	3.1	10476.5	0.0	2488.7	0.0	0.0	887.2	887.2	0.0
19	0.3	1036.8	0.0	241.5	0.0	0.0	87.8	87.8	0.0
20	0.6	2085.2	0.0	483.1	0.0	0.0	176.6	176.6	0.0
21	0.4	1398.6	0.0	322.2	0.0	0.0	118.4	118.4	0.0
22	0.6	2121.3	0.0	486.0	0.0	0.0	179.6	179.6	0.0
23	5.0	18068.3	0.0	3995.2	0.0	0.0	1530.0	1530.0	0.0
24	3.8	14287.8	0.0	2981.9	0.0	0.0	1209.9	1209.9	0.0
25	1.2	4473.5	0.0	898.2	0.0	0.0	378.8	378.8	0.0
26	4.9	19202.9	0.0	3676.3	0.0	0.0	1626.1	1626.1	0.0
27	0.3	1169.2	0.0	215.2	0.0	0.0	99.0	99.0	0.0
28	4.6	18251.8	0.0	3169.4	0.0	0.0	1545.6	1545.6	0.0
29	4.8	19421.3	0.0	3006.1	0.0	0.0	1644.6	1644.6	0.0
30	4.7	19164.4	0.0	2541.8	0.0	0.0	1622.8	1622.8	0.0
31	4.6	18660.0	0.0	1993.3	0.0	0.0	1580.1	1580.1	0.0
32	4.5	17922.7	0.0	1362.5	0.0	0.0	1517.7	1517.7	0.0
33	4.4	16971.1	0.0	651.2	0.0	0.0	1437.1	1437.1	0.0
34	1.4	5348.2	0.0	46.0	0.0	0.0	452.9	452.9	0.0
35	2.8	10517.0	0.0	0.0	0.0	0.0	890.6	890.6	0.0
36	2.9	10712.4	0.0	0.0	0.0	0.0	907.1	907.1	0.0
37	1.1	4002.9	0.0	0.0	0.0	0.0	339.0	339.0	0.0
38	3.9	13438.0	0.0	0.0	0.0	0.0	1137.9	1137.9	0.0
39	1.0	3245.8	0.0	0.0	0.0	0.0	274.9	274.9	0.0

40	2.2	7256.7	0.0	0.0	0.0	0.0	614.5	614.5	0.0
41	0.5	1534.9	0.0	0.0	0.0	0.0	130.0	130.0	0.0
42	3.5	10379.2	0.0	0.0	0.0	0.0	878.9	878.9	0.0
43	3.3	8602.2	0.0	0.0	0.0	0.0	728.4	728.4	0.0
44	3.0	6723.3	0.0	0.0	0.0	0.0	569.3	569.3	0.0
45	0.1	117.9	0.0	0.0	0.0	0.0	10.0	10.0	0.0
46	1.3	2566.4	0.0	0.0	0.0	0.0	217.3	217.3	0.0
47	1.1	1912.0	0.0	0.0	0.0	0.0	161.9	161.9	0.0
48	0.2	327.9	0.0	0.0	0.0	0.0	27.8	27.8	0.0
49	0.2	343.1	0.0	0.0	0.0	0.0	29.1	29.1	0.0
50	0.1	135.5	0.0	0.0	0.0	0.0	11.5	11.5	0.0
51	0.2	309.5	0.0	0.0	0.0	0.0	26.2	26.2	0.0
52	0.6	880.9	0.0	0.0	0.0	0.0	74.6	74.6	0.0
53	0.6	810.1	0.0	0.0	0.0	0.0	68.6	68.6	0.0
54	0.1	128.1	0.0	0.0	0.0	0.0	10.8	10.8	0.0
55	1.0	1210.5	0.0	0.0	0.0	0.0	102.5	102.5	0.0
56	0.6	626.0	0.0	0.0	0.0	0.0	53.0	53.0	0.0
57	1.7	1226.1	0.0	0.0	0.0	0.0	103.8	103.8	0.0
58	0.1	41.2	0.0	0.0	0.0	0.0	3.5	3.5	0.0
59	0.4	194.0	0.0	0.0	0.0	0.0	16.4	16.4	0.0
60	1.4	296.6	0.0	0.0	0.0	0.0	25.1	25.1	0.0

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.03	44.94
3	108.23	42.23
4	112.59	39.77
5	117.08	37.59
6	121.70	35.68
7	126.43	34.05
8	131.25	32.71
9	136.14	31.67
10	141.08	30.92
11	146.06	30.47
12	151.06	30.32
13	156.06	30.48
14	161.04	30.93
15	165.98	31.69
16	170.87	32.75
17	175.68	34.09
18	180.41	35.73
19	185.02	37.65
20	189.52	39.84
21	193.87	42.30
22	198.06	45.02
23	202.09	47.99
24	205.93	51.19
25	209.56	54.63
26	212.98	58.27
27	216.18	62.12
28	219.14	66.15
29	221.85	70.35
30	224.30	74.71
31	226.48	79.21
32	227.27	81.12

*** 1.665 ***

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.22	45.23
3	108.58	42.77
4	113.06	40.55
5	117.65	38.56
6	122.33	36.81
7	127.10	35.30
8	131.94	34.04
9	136.83	33.04
10	141.78	32.29
11	146.75	31.79
12	151.75	31.55
13	156.75	31.57
14	161.74	31.85
15	166.71	32.39
16	171.65	33.18
17	176.54	34.23
18	181.36	35.53
19	186.12	37.08
20	190.79	38.87
21	195.36	40.89
22	199.82	43.16
23	204.15	45.65
24	208.36	48.36
25	212.41	51.28
26	216.31	54.41
27	220.04	57.74
28	223.60	61.25
29	226.97	64.94
30	230.14	68.81
31	233.11	72.83
32	235.87	77.00
33	238.41	81.31
34	238.56	81.59

*** 1.669 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	103.70	44.53
3	107.59	41.40
4	111.67	38.51
5	115.92	35.87

6	120.32	33.49
7	124.85	31.39
8	129.51	29.57
9	134.27	28.04
10	139.11	26.80
11	144.02	25.86
12	148.98	25.22
13	153.97	24.88
14	158.97	24.85
15	163.96	25.12
16	168.93	25.70
17	173.85	26.57
18	178.71	27.75
19	183.49	29.22
20	188.17	30.98
21	192.73	33.03
22	197.16	35.34
23	201.45	37.93
24	205.56	40.77
25	209.50	43.85
26	213.23	47.17
27	216.76	50.71
28	220.07	54.46
29	223.14	58.41
30	225.97	62.54
31	228.54	66.83
32	230.84	71.26
33	232.86	75.83
34	234.61	80.52
35	234.89	81.44

*** 1.678 ***

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	103.65	44.49
3	107.51	41.31
4	111.57	38.39
5	115.80	35.73
6	120.20	33.35
7	124.74	31.25
8	129.40	29.45
9	134.17	27.95
10	139.03	26.76
11	143.95	25.88
12	148.92	25.32
13	153.92	25.08
14	158.91	25.15
15	163.90	25.55
16	168.85	26.26
17	173.74	27.29
18	178.56	28.63
19	183.28	30.28

20	187.89	32.22
21	192.36	34.46
22	196.68	36.97
23	200.83	39.76
24	204.80	42.80
25	208.56	46.10
26	212.10	49.63
27	215.41	53.37
28	218.48	57.32
29	221.28	61.46
30	223.82	65.77
31	226.07	70.23
32	228.04	74.83
33	229.70	79.55
34	230.19	81.25

*** 1.681 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	103.64	44.47
3	107.49	41.29
4	111.54	38.35
5	115.77	35.68
6	120.16	33.29
7	124.69	31.18
8	129.35	29.36
9	134.12	27.85
10	138.97	26.65
11	143.89	25.76
12	148.86	25.19
13	153.85	24.93
14	158.85	25.00
15	163.83	25.39
16	168.78	26.09
17	173.68	27.11
18	178.50	28.44
19	183.22	30.08
20	187.83	32.02
21	192.31	34.24
22	196.63	36.75
23	200.79	39.54
24	204.76	42.58
25	208.52	45.87
26	212.07	49.39
27	215.38	53.13
28	218.45	57.08
29	221.26	61.22
30	223.80	65.53
31	226.06	69.99
32	228.02	74.59
33	229.69	79.30
34	230.24	81.25

*** 1.681 ***

1

Failure Surface Specified By 36 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	103.92	44.80
3	108.00	41.91
4	112.23	39.25
5	116.60	36.81
6	121.09	34.62
7	125.70	32.67
8	130.40	30.97
9	135.19	29.53
10	140.05	28.34
11	144.96	27.42
12	149.92	26.77
13	154.90	26.38
14	159.90	26.27
15	164.90	26.42
16	169.88	26.84
17	174.83	27.53
18	179.74	28.48
19	184.59	29.70
20	189.37	31.17
21	194.06	32.90
22	198.65	34.89
23	203.13	37.11
24	207.48	39.57
25	211.69	42.27
26	215.75	45.18
27	219.65	48.31
28	223.38	51.65
29	226.92	55.18
30	230.26	58.90
31	233.40	62.79
32	236.32	66.85
33	239.03	71.05
34	241.50	75.40
35	243.73	79.87
36	244.59	81.83

*** 1.687 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90

2	103.56	44.39
3	107.33	41.10
4	111.30	38.06
5	115.45	35.27
6	119.76	32.75
7	124.23	30.50
8	128.82	28.53
9	133.54	26.86
10	138.34	25.48
11	143.23	24.40
12	148.17	23.64
13	153.14	23.18
14	158.14	23.03
15	163.14	23.20
16	168.12	23.67
17	173.05	24.46
18	177.93	25.56
19	182.73	26.95
20	187.44	28.65
21	192.03	30.63
22	196.48	32.90
23	200.79	35.44
24	204.93	38.24
25	208.89	41.30
26	212.64	44.60
27	216.19	48.13
28	219.51	51.87
29	222.58	55.81
30	225.41	59.93
31	227.97	64.23
32	230.26	68.67
33	232.26	73.25
34	233.98	77.95
35	235.02	81.45

*** 1.691 ***

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	103.57	44.40
3	107.36	41.14
4	111.36	38.14
5	115.55	35.41
6	119.91	32.96
7	124.42	30.80
8	129.06	28.94
9	133.81	27.39
10	138.66	26.16
11	143.58	25.25
12	148.54	24.67
13	153.54	24.41
14	158.53	24.49
15	163.52	24.89

16	168.46	25.62
17	173.35	26.67
18	178.16	28.04
19	182.87	29.73
20	187.45	31.72
21	191.90	34.01
22	196.18	36.59
23	200.29	39.44
24	204.20	42.56
25	207.89	45.93
26	211.36	49.53
27	214.58	53.36
28	217.54	57.39
29	220.23	61.60
30	222.64	65.98
31	224.75	70.51
32	226.56	75.17
33	228.06	79.94
34	228.36	81.17

*** 1.691 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.28	45.31
3	108.67	42.92
4	113.17	40.75
5	117.78	38.80
6	122.47	37.07
7	127.24	35.57
8	132.07	34.29
9	136.96	33.26
10	141.90	32.46
11	146.87	31.89
12	151.86	31.57
13	156.86	31.48
14	161.85	31.64
15	166.84	32.04
16	171.80	32.67
17	176.72	33.54
18	181.60	34.65
19	186.41	35.99
20	191.16	37.56
21	195.83	39.36
22	200.40	41.38
23	204.87	43.61
24	209.23	46.06
25	213.47	48.72
26	217.57	51.57
27	221.54	54.62
28	225.35	57.86
29	229.00	61.27
30	232.48	64.86
31	235.79	68.61

32	238.91	72.51
33	241.85	76.56
34	244.58	80.75
35	245.23	81.86

*** 1.692 ***

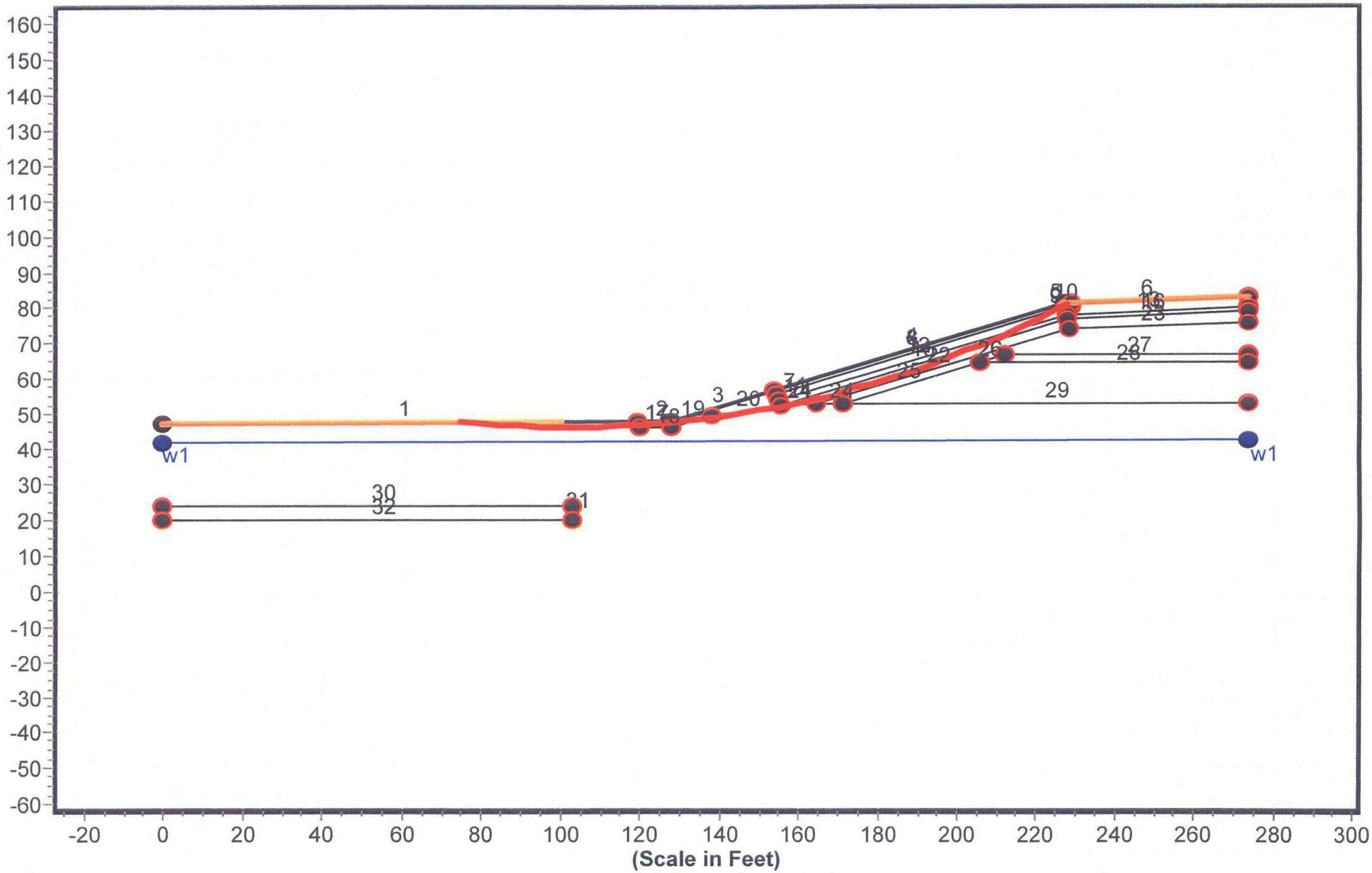
1

```
            Y           A     X     I     S           F     T

            0.00     34.20     68.40    102.60    136.80    171.00

X      0.00 +-----**--+-W-*-----+---------+---------+---------+
            -           ...
            -          ....
            -        .....
            -       .......
            -      ........
      34.20 +     .........
            -    .........
            -    .........
            -  ............
            -  ............
            - ............
A     68.40 + ............
            - ............
            -.............
            -.............
            ..............
            ..............
X    102.60 ......**.....11
            ............13.
            ..........441..
            ..........11..*
            .........41...*
            ........812....
I    136.80 .......8413....*
            .......841......
            .......471......
            -......471.....***
            -......471......
            -......471.....*.
S    171.00 + .....8412....*.
            - .....8412.......
            - ......7412.......
            -  .....84.12......
            -  ......8412.......
            -   ......44122......
     205.20 +    ......74112...*.
            -     ......743122.*..
            -      ......7841122...
            -      .......774311.22.
            -        .......774311***
            -         ........7073411
F    239.40 +          ..........77.3
            -            ..........77
            -             ...........
            -               .........
```

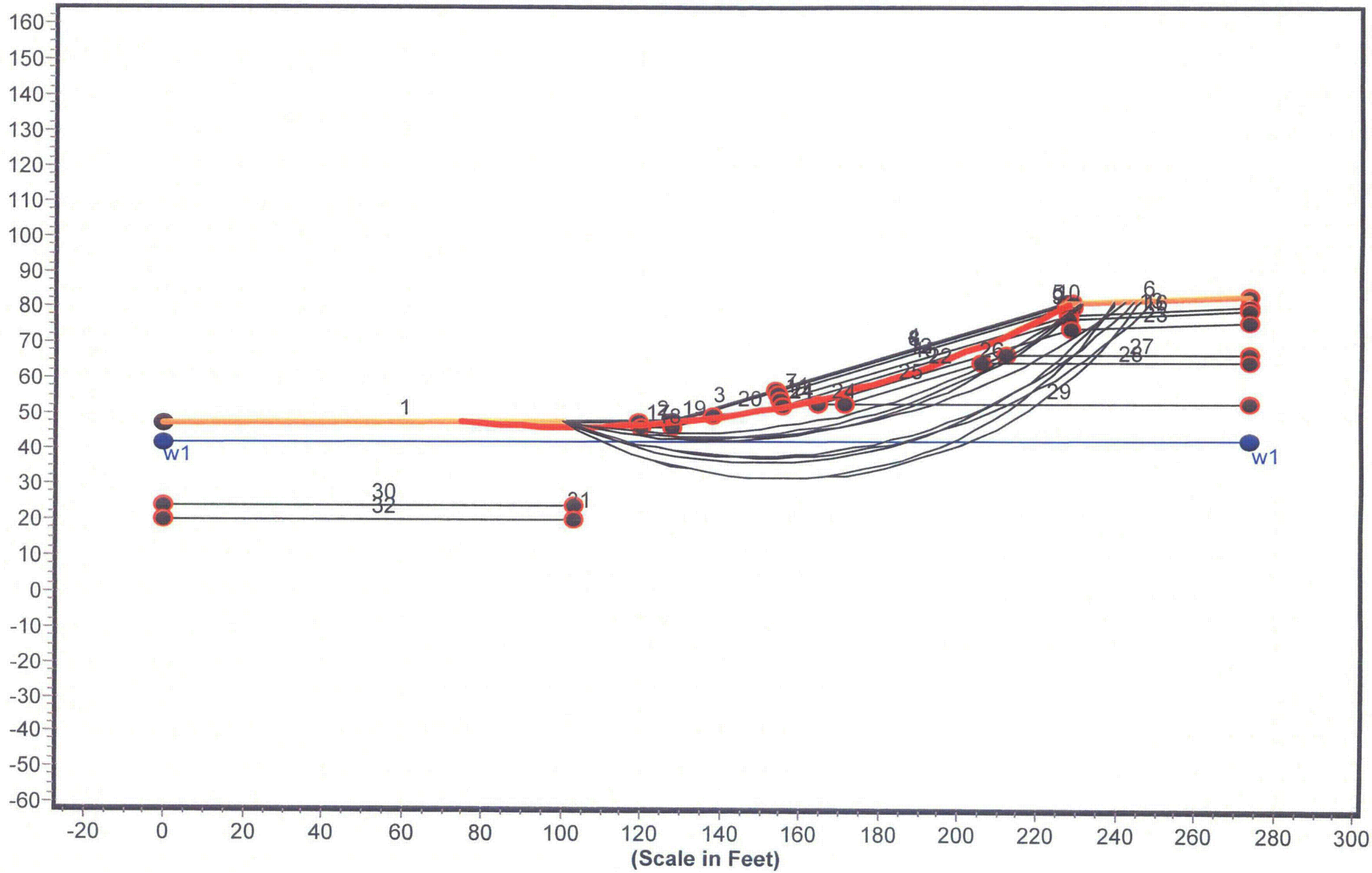
```
                 -                    .......
                 -                       ....
T     273.60 +           W  *   *  ***
```

BISHOP #1 SEISMIC CIRCULAR

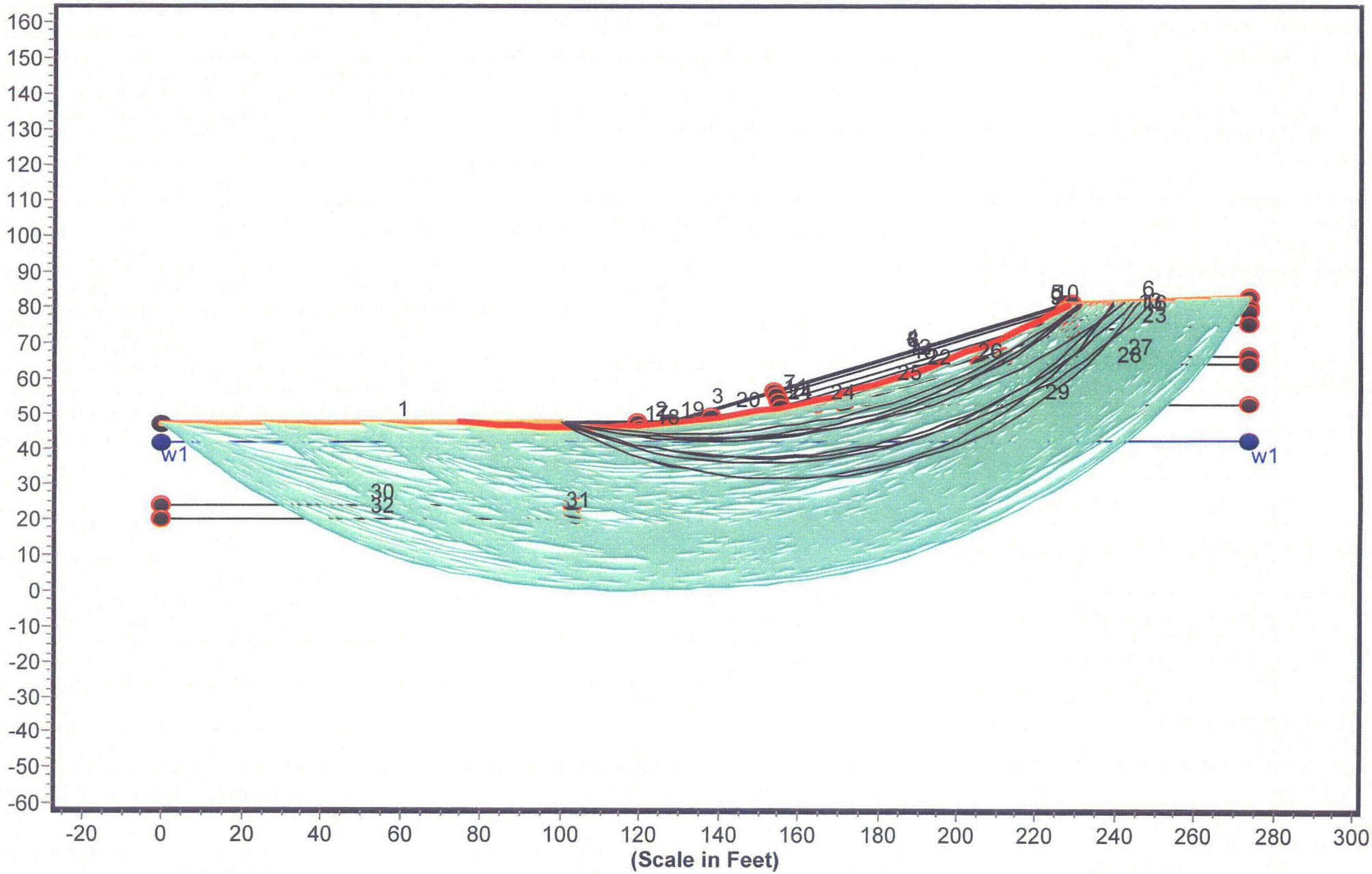
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.743

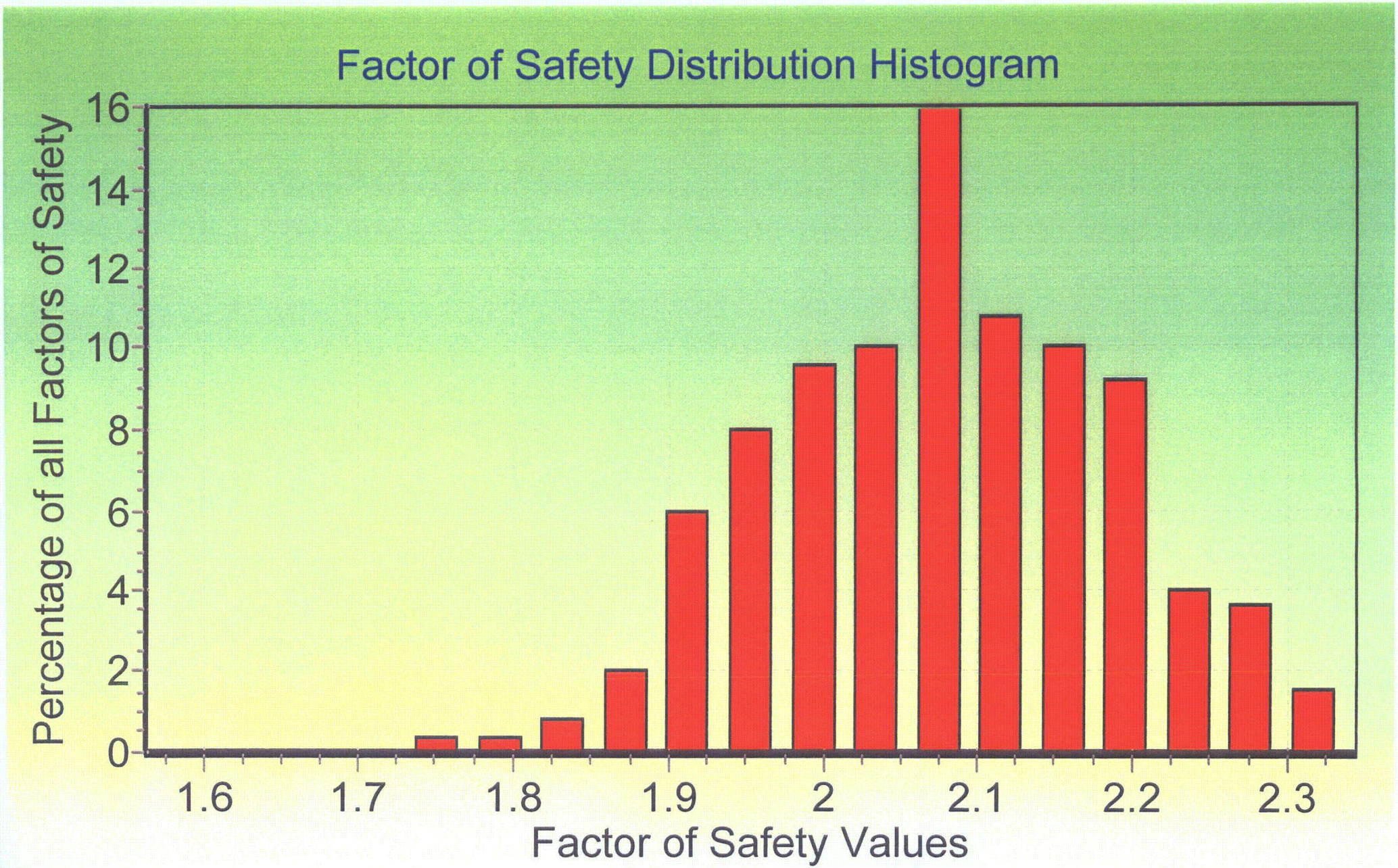


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.743



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.743




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
2
4
6
8
10
12
14
16
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
Factor of Safety Values

SMC Bishop Circular #1 Seismic Results.txt
** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X = 0.00 ft.
and X = 100.00 ft.

Each Surface Terminates Between X = 226.00 ft.
and X = 273.60 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And -5.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	75.00	47.78
2	79.97	47.25
3	84.96	46.84
4	89.95	46.52
5	94.94	46.31
6	99.94	46.20
7	104.94	46.20
8	109.94	46.30
9	114.93	46.50
10	119.93	46.81
11	124.91	47.22
12	129.88	47.73
13	134.84	48.35
14	139.79	49.07
15	144.72	49.89
16	149.64	50.81
17	154.53	51.84
18	159.40	52.96
19	164.25	54.19
20	169.07	55.52
21	173.86	56.95
22	178.62	58.48
23	183.35	60.10

24	188.05	61.82
25	192.70	63.64
26	197.32	65.56
27	201.90	67.57
28	206.43	69.68
29	210.92	71.88
30	215.37	74.17
31	219.76	76.55
32	224.11	79.03
33	227.63	81.14

Circle Center At X = 102.6 ; Y = 287.2 and Radius, 241.0

*** 1.743 ***

Individual data on the 46 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.0	156.4	0.0	0.0	0.0	0.0	13.2	13.2	0.0
2	5.0	440.5	0.0	0.0	0.0	0.0	37.3	37.3	0.0
3	5.0	666.1	0.0	0.0	0.0	0.0	56.4	56.4	0.0
4	5.0	832.5	0.0	0.0	0.0	0.0	70.5	70.5	0.0
5	5.0	939.3	0.0	0.0	0.0	0.0	79.5	79.5	0.0
6	5.0	986.2	0.0	0.0	0.0	0.0	83.5	83.5	0.0
7	5.0	973.1	0.0	0.0	0.0	0.0	82.4	82.4	0.0
8	5.0	899.9	0.0	0.0	0.0	0.0	76.2	76.2	0.0
9	4.6	708.0	0.0	0.0	0.0	0.0	59.9	59.9	0.0
10	0.1	11.6	0.0	0.0	0.0	0.0	1.0	1.0	0.0
11	0.3	56.8	0.0	0.0	0.0	0.0	4.8	4.8	0.0
12	5.0	664.9	0.0	0.0	0.0	0.0	56.3	56.3	0.0
13	2.6	227.2	0.0	0.0	0.0	0.0	19.2	19.2	0.0
14	2.4	254.0	0.0	0.0	0.0	0.0	21.5	21.5	0.0
15	3.0	549.4	0.0	0.0	0.0	0.0	46.5	46.5	0.0
16	2.0	502.2	0.0	0.0	0.0	0.0	42.5	42.5	0.0
17	3.1	941.6	0.0	0.0	0.0	0.0	79.7	79.7	0.0
18	1.9	690.1	0.0	0.0	0.0	0.0	58.4	58.4	0.0
19	4.9	2190.5	0.0	0.0	0.0	0.0	185.5	185.5	0.0
20	4.9	2699.5	0.0	0.0	0.0	0.0	228.6	228.6	0.0
21	4.3	2712.7	0.0	0.0	0.0	0.0	229.7	229.7	0.0
22	0.3	203.0	0.0	0.0	0.0	0.0	17.2	17.2	0.0
23	0.3	226.2	0.0	0.0	0.0	0.0	19.2	19.2	0.0
24	0.3	184.5	0.0	0.0	0.0	0.0	15.6	15.6	0.0
25	0.4	276.9	0.0	0.0	0.0	0.0	23.4	23.4	0.0
26	3.2	2313.5	0.0	0.0	0.0	0.0	195.9	195.9	0.0
27	1.0	736.2	0.0	0.0	0.0	0.0	62.3	62.3	0.0
28	4.8	3773.1	0.0	0.0	0.0	0.0	319.5	319.5	0.0
29	4.8	3950.7	0.0	0.0	0.0	0.0	334.5	334.5	0.0
30	4.8	4058.9	0.0	0.0	0.0	0.0	343.7	343.7	0.0
31	4.8	4098.7	0.0	0.0	0.0	0.0	347.1	347.1	0.0
32	4.7	4071.3	0.0	0.0	0.0	0.0	344.8	344.8	0.0
33	4.7	3978.0	0.0	0.0	0.0	0.0	336.9	336.9	0.0
34	4.7	3820.4	0.0	0.0	0.0	0.0	323.5	323.5	0.0
35	4.6	3600.1	0.0	0.0	0.0	0.0	304.9	304.9	0.0
36	4.6	3319.2	0.0	0.0	0.0	0.0	281.1	281.1	0.0
37	4.5	2979.7	0.0	0.0	0.0	0.0	252.3	252.3	0.0

38	1.7	1032.1	0.0	0.0	0.0	0.0	87.4	87.4	0.0
39	2.8	1546.0	0.0	0.0	0.0	0.0	130.9	130.9	0.0
40	4.0	1910.3	0.0	0.0	0.0	0.0	161.8	161.8	0.0
41	0.4	187.7	0.0	0.0	0.0	0.0	15.9	15.9	0.0
42	4.4	1560.6	0.0	0.0	0.0	0.0	132.2	132.2	0.0
43	4.3	970.9	0.0	0.0	0.0	0.0	82.2	82.2	0.0
44	0.3	41.3	0.0	0.0	0.0	0.0	3.5	3.5	0.0
45	2.5	249.7	0.0	0.0	0.0	0.0	21.1	21.1	0.0
46	0.7	19.9	0.0	0.0	0.0	0.0	1.7	1.7	0.0

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.91	46.94
3	109.84	46.14
4	114.80	45.51
5	119.78	45.04
6	124.77	44.73
7	129.77	44.59
8	134.77	44.61
9	139.77	44.80
10	144.75	45.16
11	149.73	45.68
12	154.68	46.36
13	159.61	47.20
14	164.50	48.21
15	169.37	49.38
16	174.19	50.71
17	178.96	52.19
18	183.68	53.84
19	188.35	55.64
20	192.95	57.59
21	197.49	59.69
22	201.95	61.94
23	206.34	64.34
24	210.65	66.88
25	214.87	69.56
26	219.00	72.38
27	223.03	75.33
28	226.96	78.42
29	230.35	81.26

Circle Center At X = 131.5 ; Y = 196.0 and Radius, 151.4

*** 1.810 ***

1

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.86	46.71

3	109.75	45.70
4	114.68	44.86
5	119.64	44.20
6	124.62	43.72
7	129.61	43.42
8	134.61	43.30
9	139.60	43.36
10	144.60	43.60
11	149.58	44.01
12	154.55	44.61
13	159.49	45.38
14	164.39	46.33
15	169.27	47.46
16	174.09	48.76
17	178.87	50.24
18	183.59	51.88
19	188.25	53.70
20	192.84	55.68
21	197.36	57.82
22	201.80	60.13
23	206.15	62.59
24	210.41	65.21
25	214.57	67.98
26	218.63	70.90
27	222.58	73.96
28	226.42	77.16
29	230.15	80.50
30	230.96	81.28

Circle Center At X = 135.5 ; Y = 182.3 and Radius, 139.0

*** 1.830 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.82	46.56
3	109.68	45.40
4	114.58	44.42
5	119.52	43.63
6	124.49	43.04
7	129.47	42.62
8	134.46	42.40
9	139.46	42.37
10	144.46	42.53
11	149.45	42.88
12	154.42	43.42
13	159.37	44.15
14	164.28	45.07
15	169.16	46.17
16	173.99	47.46
17	178.77	48.92
18	183.49	50.57
19	188.14	52.40
20	192.72	54.41

21	197.23	56.58
22	201.64	58.93
23	205.96	61.44
24	210.19	64.12
25	214.31	66.95
26	218.32	69.94
27	222.21	73.08
28	225.98	76.36
29	229.62	79.79
30	231.10	81.29

Circle Center At X = 137.8 ; Y = 173.7 and Radius, 131.4

*** 1.842 ***

1

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.87	46.76
3	109.77	45.78
4	114.70	44.95
5	119.66	44.28
6	124.63	43.76
7	129.62	43.41
8	134.61	43.21
9	139.61	43.17
10	144.61	43.30
11	149.60	43.57
12	154.58	44.01
13	159.55	44.61
14	164.49	45.36
15	169.41	46.27
16	174.29	47.34
17	179.14	48.56
18	183.95	49.93
19	188.71	51.46
20	193.42	53.14
21	198.08	54.96
22	202.67	56.93
23	207.20	59.05
24	211.66	61.31
25	216.05	63.71
26	220.35	66.25
27	224.58	68.92
28	228.72	71.73
29	232.76	74.67
30	236.71	77.73
31	240.57	80.92
32	241.46	81.71

Circle Center At X = 138.3 ; Y = 200.5 and Radius, 157.3

*** 1.858 ***

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.50	45.72
3	109.10	43.75
4	113.78	41.99
5	118.53	40.45
6	123.35	39.12
7	128.23	38.02
8	133.15	37.14
9	138.11	36.48
10	143.09	36.05
11	148.09	35.85
12	153.09	35.88
13	158.08	36.13
14	163.06	36.61
15	168.01	37.32
16	172.92	38.25
17	177.78	39.41
18	182.59	40.78
19	187.33	42.38
20	191.99	44.18
21	196.57	46.20
22	201.04	48.43
23	205.41	50.85
24	209.67	53.48
25	213.80	56.29
26	217.80	59.29
27	221.66	62.47
28	225.37	65.82
29	228.93	69.34
30	232.32	73.01
31	235.54	76.84
32	238.58	80.81
33	239.14	81.61

Circle Center At X = 150.0 ; Y = 145.5 and Radius, 109.7

*** 1.860 ***

1

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.64	46.03
3	109.34	44.35
4	114.12	42.85

5	118.94	41.55
6	123.82	40.45
7	128.74	39.54
8	133.69	38.83
9	138.66	38.32
10	143.65	38.01
11	148.65	37.90
12	153.65	37.99
13	158.64	38.28
14	163.62	38.77
15	168.57	39.46
16	173.49	40.35
17	178.37	41.44
18	183.20	42.72
19	187.98	44.20
20	192.69	45.86
21	197.34	47.72
22	201.90	49.76
23	206.38	51.98
24	210.77	54.38
25	215.05	56.95
26	219.23	59.69
27	223.30	62.60
28	227.25	65.67
29	231.07	68.90
30	234.75	72.28
31	238.30	75.80
32	241.71	79.46
33	243.70	81.80

Circle Center At X = 148.9 ; Y = 162.3 and Radius, 124.4

*** 1.873 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.22	45.23
3	108.58	42.77
4	113.06	40.55
5	117.65	38.56
6	122.33	36.81
7	127.10	35.30
8	131.93	34.04
9	136.83	33.03
10	141.78	32.28
11	146.75	31.78
12	151.74	31.54
13	156.74	31.56
14	161.74	31.83
15	166.71	32.37
16	171.65	33.16
17	176.54	34.20
18	181.37	35.49
19	186.12	37.04

20	190.79	38.82
21	195.36	40.84
22	199.83	43.10
23	204.16	45.59
24	208.37	48.29
25	212.43	51.21
26	216.33	54.33
27	220.07	57.66
28	223.63	61.17
29	227.01	64.86
30	230.18	68.71
31	233.16	72.73
32	235.93	76.90
33	238.47	81.20
34	238.68	81.59

Circle Center At X = 153.9 ; Y = 128.3 and Radius, 96.8

*** 1.891 ***

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.63	46.01
3	109.33	44.30
4	114.09	42.77
5	118.90	41.42
6	123.77	40.27
7	128.67	39.31
8	133.61	38.53
9	138.58	37.95
10	143.56	37.56
11	148.56	37.37
12	153.56	37.37
13	158.56	37.57
14	163.54	37.96
15	168.51	38.54
16	173.45	39.32
17	178.35	40.28
18	183.22	41.44
19	188.03	42.78
20	192.79	44.31
21	197.49	46.03
22	202.12	47.93
23	206.67	50.00
24	211.13	52.25
25	215.51	54.67
26	219.78	57.26
27	223.96	60.01
28	228.02	62.93
29	231.97	66.00
30	235.79	69.22
31	239.49	72.59
32	243.05	76.09

33	246.47	79.74
34	248.43	81.99

Circle Center At X = 151.0 ; Y = 165.9 and Radius, 128.6

*** 1.892 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.28	45.31
3	108.67	42.92
4	113.17	40.75
5	117.77	38.80
6	122.47	37.07
7	127.23	35.56
8	132.07	34.29
9	136.96	33.25
10	141.89	32.44
11	146.86	31.88
12	151.85	31.55
13	156.85	31.46
14	161.85	31.61
15	166.83	32.00
16	171.79	32.63
17	176.72	33.50
18	181.59	34.60
19	186.41	35.93
20	191.16	37.50
21	195.83	39.29
22	200.41	41.30
23	204.88	43.53
24	209.25	45.97
25	213.49	48.62
26	217.60	51.46
27	221.57	54.50
28	225.39	57.73
29	229.05	61.14
30	232.54	64.72
31	235.85	68.46
32	238.98	72.36
33	241.93	76.40
34	244.67	80.58
35	245.43	81.87

Circle Center At X = 156.2 ; Y = 135.7 and Radius, 104.2

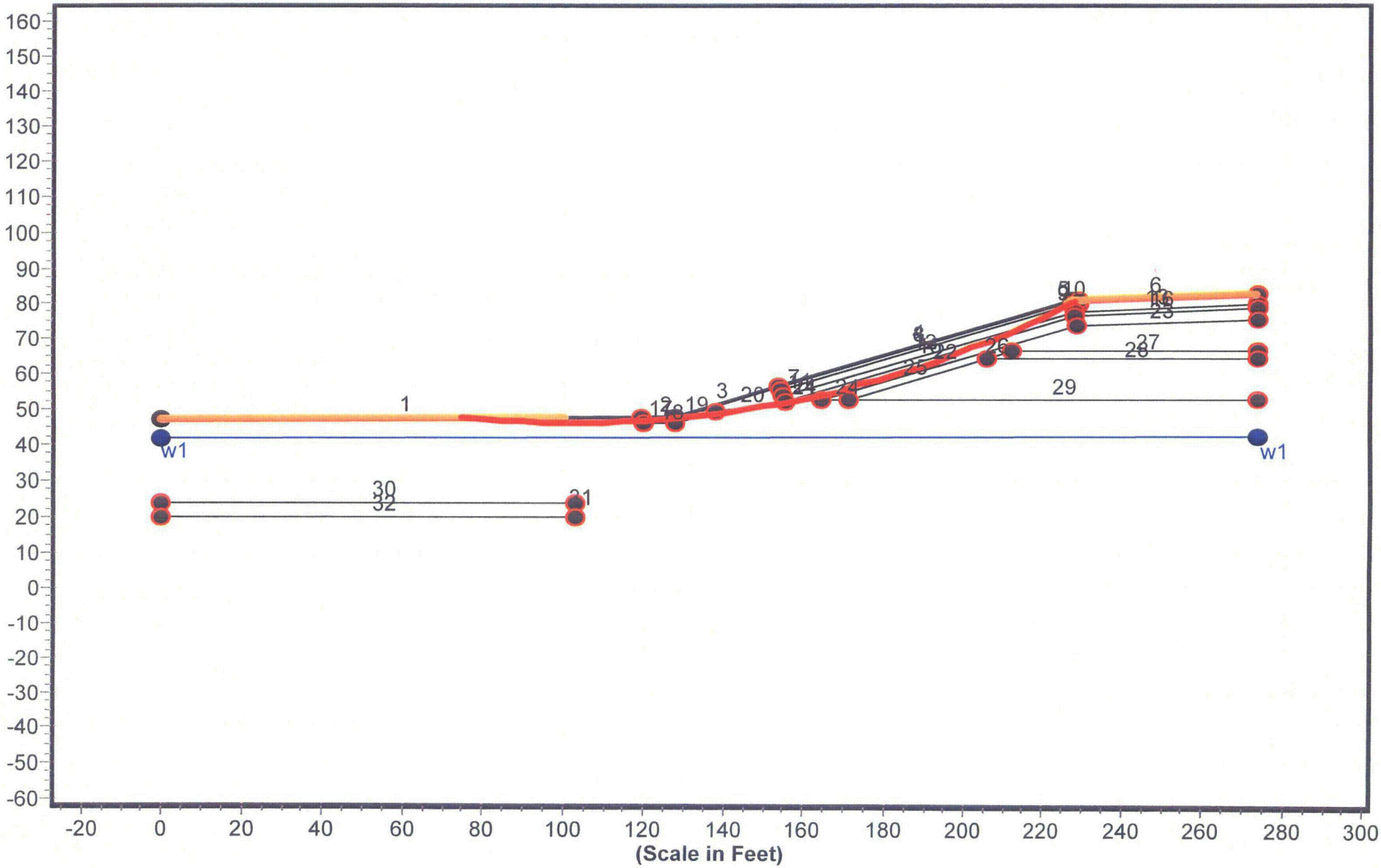
*** 1.901 ***

1

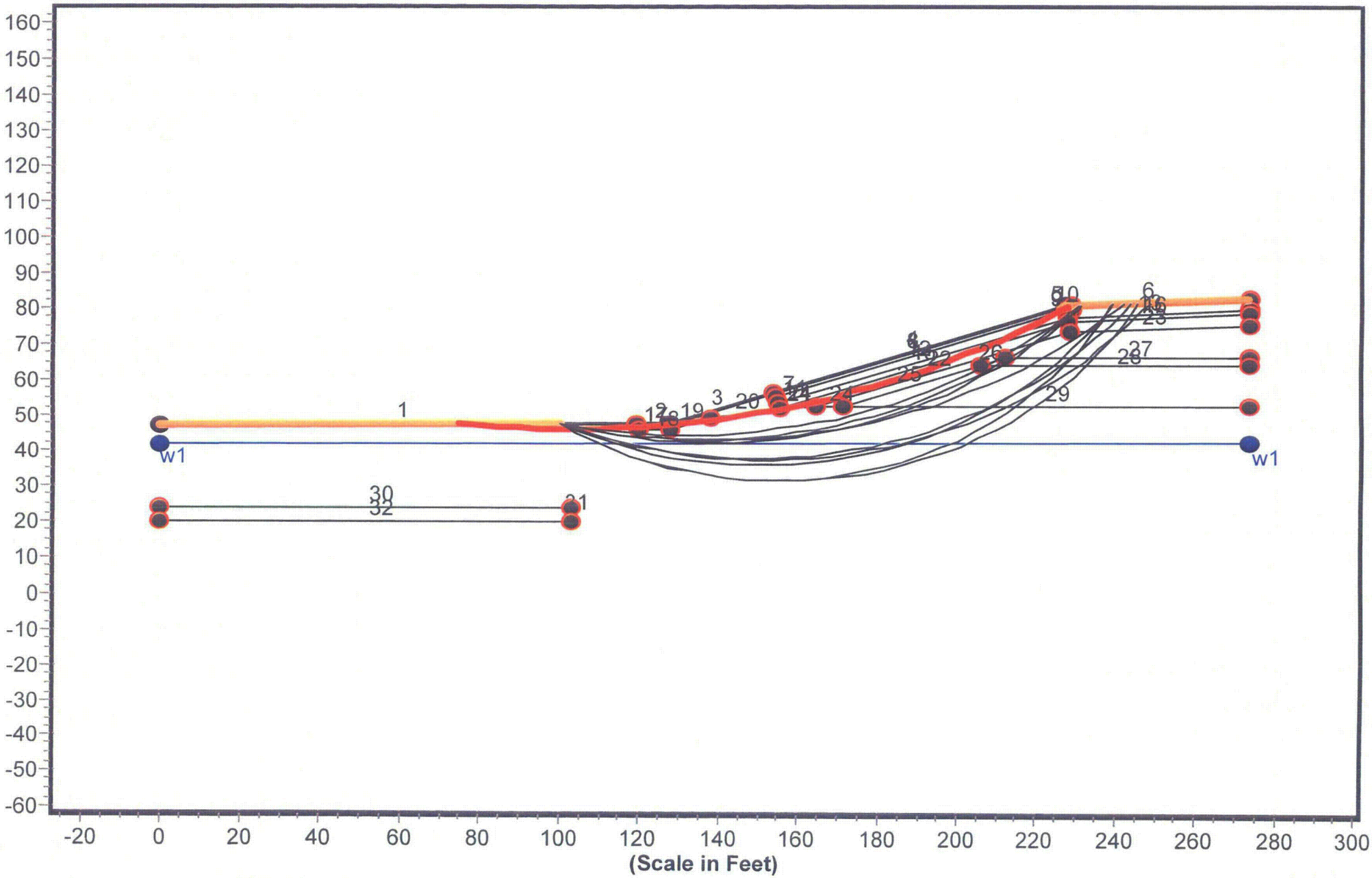
```
                0.00      34.20     68.40     102.60    136.80    171.00

X         0.00 +-----**--+-W-*-----+---------+---------+---------+
               -           ...
               -          ....
               -        .....
               -       .......
               -      ........
         34.20 +     .........
               -    .........
               -    .........
               -  ............
               -  ............
               - ............
A        68.40 + ............
               - ............1
               -.............1
               -.............1
               ..............1
               ..............1
X       102.60 ......**.....61
               .............21
               ............621
               ...........862*
               ..........8672*
               ..........86421
I       136.80 ..........86421*
               .........8.64211
               .........867.2.1
               -........867.32***
               -........8.6.321
               -........8.6.42*1
S       171.00 + ........86742*1
               - ........8.6.32.1
               - ........8.6..32.1
               -  ........867.42.1
               -  ........0866.32.1
               -   ........086752211
        205.20 +    ........8.6.53*1
               -     .......0886.5*21
               -     .........066.5221
               -      .........08655411
               -        ........09665***
               -         .........9765.3
F       239.40 +          ..........9755
               -            .........997
               -             ..........9
               -               .........
               -                .......
               -                  ....
T       273.60 +           W  *   *  ***
```

SPENCER #1 SEISMIC SLICES

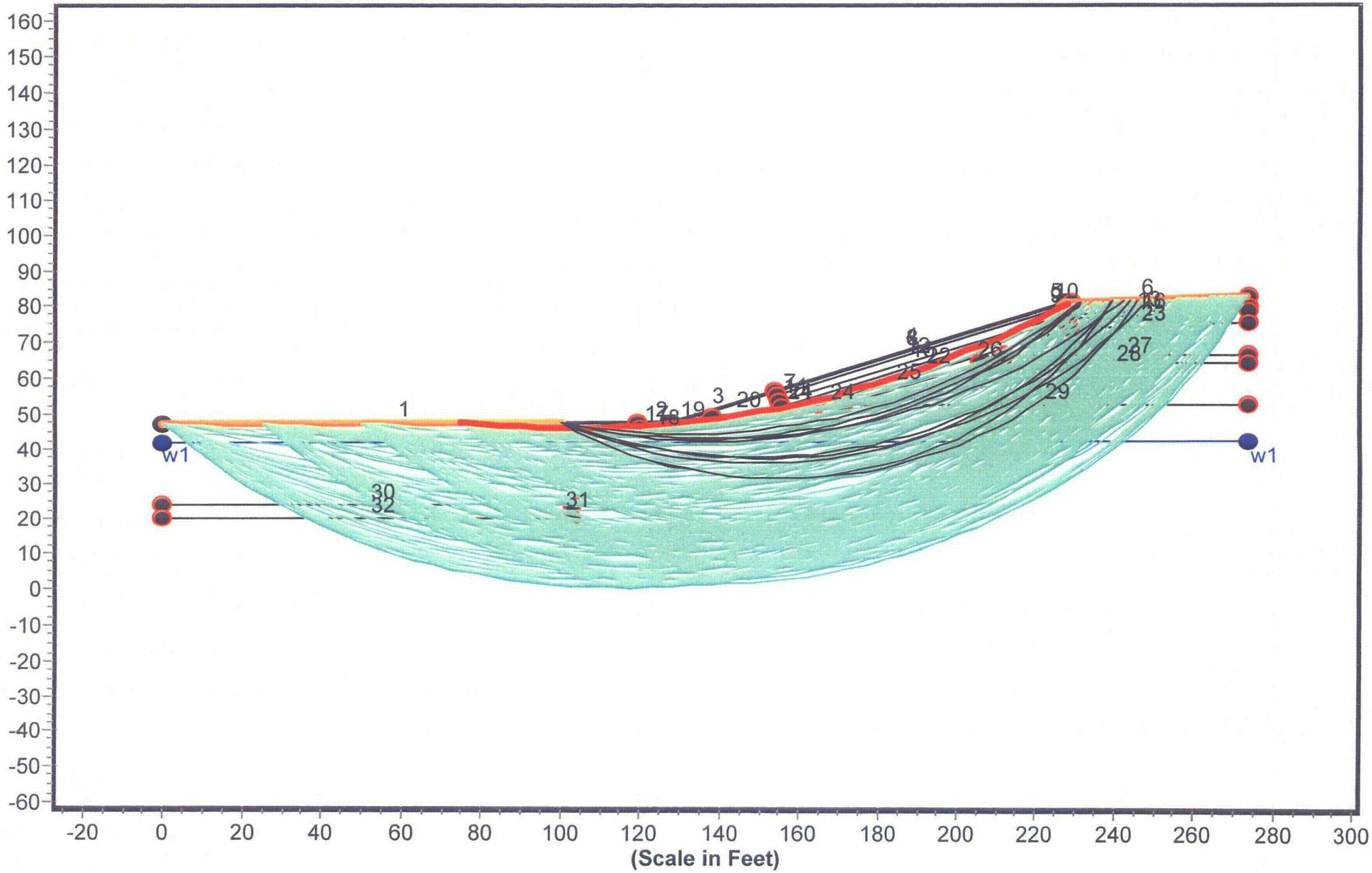
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.756

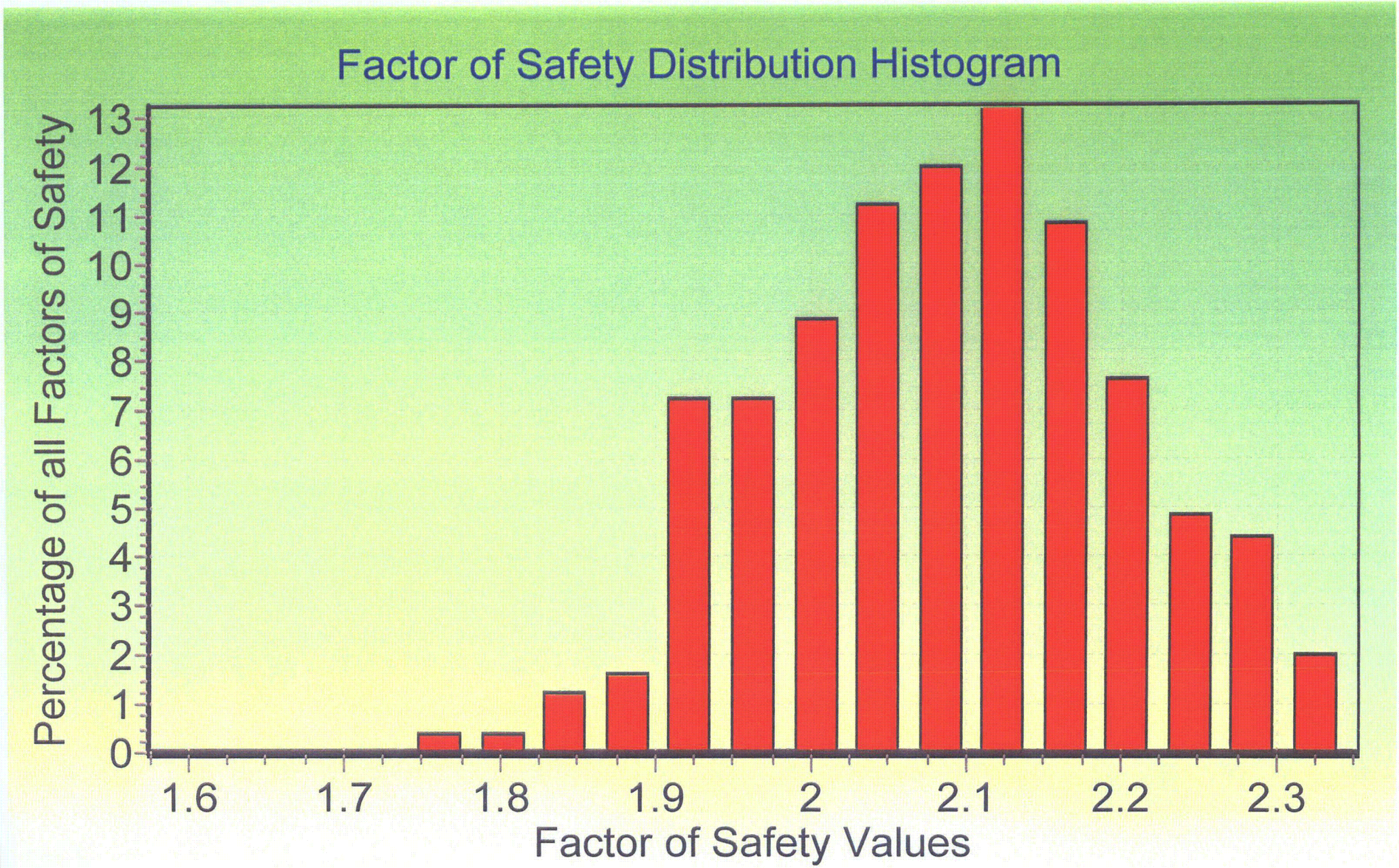


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.756



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.756




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
1
2
3
4
5
6
7
8
9
10
11
12
13
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
Factor of Safety Values

** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

22	178.62	58.48
23	183.35	60.10
24	188.04	61.83
25	192.70	63.65
26	197.32	65.56
27	201.90	67.57
28	206.43	69.68
29	210.92	71.88
30	215.37	74.17
31	219.76	76.56
32	224.10	79.03
33	227.62	81.14

*** Factor of Safety = 1.756 ***

Individual data on the 46 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.0	156.4	0.0	0.0	0.0	0.0	13.2	13.2	0.0
2	5.0	440.4	0.0	0.0	0.0	0.0	37.3	37.3	0.0
3	5.0	666.0	0.0	0.0	0.0	0.0	56.4	56.4	0.0
4	5.0	832.5	0.0	0.0	0.0	0.0	70.5	70.5	0.0
5	5.0	939.3	0.0	0.0	0.0	0.0	79.5	79.5	0.0
6	5.0	986.2	0.0	0.0	0.0	0.0	83.5	83.5	0.0
7	5.0	973.0	0.0	0.0	0.0	0.0	82.4	82.4	0.0
8	5.0	899.8	0.0	0.0	0.0	0.0	76.2	76.2	0.0
9	4.6	707.8	0.0	0.0	0.0	0.0	59.9	59.9	0.0
10	0.1	11.5	0.0	0.0	0.0	0.0	1.0	1.0	0.0
11	0.3	56.8	0.0	0.0	0.0	0.0	4.8	4.8	0.0
12	5.0	664.6	0.0	0.0	0.0	0.0	56.3	56.3	0.0
13	2.6	227.1	0.0	0.0	0.0	0.0	19.2	19.2	0.0
14	2.4	253.8	0.0	0.0	0.0	0.0	21.5	21.5	0.0
15	3.0	549.9	0.0	0.0	0.0	0.0	46.6	46.6	0.0
16	2.0	501.3	0.0	0.0	0.0	0.0	42.4	42.4	0.0
17	3.1	941.3	0.0	0.0	0.0	0.0	79.7	79.7	0.0
18	1.9	689.9	0.0	0.0	0.0	0.0	58.4	58.4	0.0
19	4.9	2190.0	0.0	0.0	0.0	0.0	185.4	185.4	0.0
20	4.9	2698.9	0.0	0.0	0.0	0.0	228.5	228.5	0.0
21	4.3	2712.2	0.0	0.0	0.0	0.0	229.7	229.7	0.0
22	0.3	203.0	0.0	0.0	0.0	0.0	17.2	17.2	0.0
23	0.3	226.1	0.0	0.0	0.0	0.0	19.1	19.1	0.0
24	0.3	184.5	0.0	0.0	0.0	0.0	15.6	15.6	0.0
25	0.4	276.9	0.0	0.0	0.0	0.0	23.4	23.4	0.0
26	3.2	2307.2	0.0	0.0	0.0	0.0	195.4	195.4	0.0
27	1.0	741.6	0.0	0.0	0.0	0.0	62.8	62.8	0.0
28	4.8	3772.1	0.0	0.0	0.0	0.0	319.4	319.4	0.0
29	4.8	3949.6	0.0	0.0	0.0	0.0	334.4	334.4	0.0
30	4.8	4057.6	0.0	0.0	0.0	0.0	343.6	343.6	0.0
31	4.8	4097.3	0.0	0.0	0.0	0.0	347.0	347.0	0.0
32	4.7	4069.8	0.0	0.0	0.0	0.0	344.6	344.6	0.0
33	4.7	3976.3	0.0	0.0	0.0	0.0	336.7	336.7	0.0
34	4.7	3818.6	0.0	0.0	0.0	0.0	323.4	323.4	0.0
35	4.6	3598.2	0.0	0.0	0.0	0.0	304.7	304.7	0.0
36	4.6	3317.1	0.0	0.0	0.0	0.0	280.9	280.9	0.0
37	4.5	2977.4	0.0	0.0	0.0	0.0	252.1	252.1	0.0

38	1.7	1015.4	0.0	0.0	0.0	0.0	86.0	86.0	0.0
39	2.8	1560.2	0.0	0.0	0.0	0.0	132.1	132.1	0.0
40	4.0	1897.2	0.0	0.0	0.0	0.0	160.7	160.7	0.0
41	0.5	198.1	0.0	0.0	0.0	0.0	16.8	16.8	0.0
42	4.4	1557.7	0.0	0.0	0.0	0.0	131.9	131.9	0.0
43	4.3	967.9	0.0	0.0	0.0	0.0	82.0	82.0	0.0
44	0.3	38.3	0.0	0.0	0.0	0.0	3.2	3.2	0.0
45	2.5	250.8	0.0	0.0	0.0	0.0	21.2	21.2	0.0
46	0.7	19.3	0.0	0.0	0.0	0.0	1.6	1.6	0.0

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.91	46.94
3	109.84	46.14
4	114.80	45.51
5	119.78	45.04
6	124.77	44.73
7	129.77	44.59
8	134.77	44.62
9	139.77	44.80
10	144.75	45.16
11	149.73	45.68
12	154.68	46.36
13	159.61	47.21
14	164.50	48.21
15	169.37	49.38
16	174.19	50.71
17	178.96	52.20
18	183.68	53.85
19	188.35	55.65
20	192.95	57.60
21	197.48	59.70
22	201.95	61.95
23	206.34	64.35
24	210.64	66.89
25	214.86	69.58
26	218.99	72.40
27	223.02	75.35
28	226.96	78.44
29	230.31	81.26

*** Factor of Safety = 1.813 ***

1

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.86	46.71
3	109.75	45.70
4	114.68	44.86

5	119.64	44.20
6	124.62	43.72
7	129.61	43.42
8	134.61	43.30
9	139.61	43.36
10	144.60	43.60
11	149.58	44.02
12	154.55	44.61
13	159.49	45.39
14	164.39	46.34
15	169.27	47.47
16	174.09	48.77
17	178.87	50.25
18	183.59	51.89
19	188.25	53.71
20	192.84	55.69
21	197.36	57.84
22	201.79	60.14
23	206.14	62.61
24	210.40	65.23
25	214.56	68.00
26	218.62	70.92
27	222.57	73.98
28	226.41	77.19
29	230.13	80.53
30	230.92	81.28

*** Factor of Safety = 1.831 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.82	46.56
3	109.68	45.40
4	114.58	44.42
5	119.52	43.63
6	124.49	43.04
7	129.47	42.63
8	134.46	42.41
9	139.46	42.38
10	144.46	42.54
11	149.45	42.89
12	154.42	43.43
13	159.37	44.16
14	164.28	45.07
15	169.16	46.18
16	173.99	47.46
17	178.77	48.93
18	183.49	50.59
19	188.14	52.42
20	192.72	54.42
21	197.22	56.60
22	201.64	58.95
23	205.96	61.46
24	210.18	64.14

25	214.30	66.97
26	218.31	69.96
27	222.20	73.10
28	225.97	76.39
29	229.61	79.81
30	231.06	81.29

*** Factor of Safety = 1.843 ***

1

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.87	46.76
3	109.77	45.78
4	114.70	44.95
5	119.66	44.28
6	124.63	43.77
7	129.62	43.41
8	134.61	43.22
9	139.61	43.18
10	144.61	43.30
11	149.60	43.59
12	154.59	44.03
13	159.55	44.62
14	164.49	45.38
15	169.41	46.29
16	174.29	47.36
17	179.14	48.59
18	183.95	49.96
19	188.71	51.49
20	193.42	53.17
21	198.07	55.00
22	202.66	56.98
23	207.19	59.10
24	211.65	61.37
25	216.03	63.77
26	220.34	66.31
27	224.56	68.99
28	228.69	71.81
29	232.73	74.75
30	236.68	77.82
31	240.53	81.01
32	241.31	81.70

*** Factor of Safety = 1.856 ***

Failure Surface Specified By 33 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	100.00	47.90
2	104.50	45.72
3	109.10	43.75
4	113.78	41.99
5	118.53	40.45
6	123.35	39.13
7	128.23	38.02
8	133.15	37.14
9	138.11	36.49
10	143.09	36.06
11	148.09	35.86
12	153.09	35.89
13	158.08	36.15
14	163.06	36.63
15	168.01	37.34
16	172.92	38.28
17	177.78	39.44
18	182.59	40.82
19	187.33	42.41
20	191.99	44.23
21	196.56	46.25
22	201.03	48.48
23	205.40	50.91
24	209.66	53.54
25	213.79	56.36
26	217.78	59.36
27	221.64	62.54
28	225.34	65.90
29	228.89	69.42
30	232.28	73.10
31	235.49	76.93
32	238.53	80.91
33	239.01	81.61

*** Factor of Safety = 1.864 ***

1

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.64	46.03
3	109.34	44.35
4	114.12	42.85
5	118.94	41.55
6	123.82	40.45
7	128.74	39.54
8	133.69	38.83
9	138.66	38.32
10	143.65	38.02
11	148.65	37.91
12	153.65	38.00
13	158.64	38.30
14	163.62	38.79

15	168.57	39.49
16	173.49	40.38
17	178.37	41.48
18	183.20	42.76
19	187.97	44.24
20	192.69	45.91
21	197.33	47.77
22	201.89	49.82
23	206.37	52.05
24	210.75	54.45
25	215.03	57.03
26	219.21	59.78
27	223.27	62.70
28	227.21	65.77
29	231.03	69.01
30	234.71	72.39
31	238.25	75.92
32	241.65	79.59
33	243.53	81.79

*** Factor of Safety = 1.873 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.63	46.01
3	109.33	44.30
4	114.09	42.77
5	118.90	41.43
6	123.77	40.27
7	128.67	39.31
8	133.62	38.54
9	138.58	37.96
10	143.57	37.58
11	148.56	37.39
12	153.56	37.39
13	158.56	37.59
14	163.54	37.99
15	168.51	38.57
16	173.45	39.36
17	178.35	40.33
18	183.22	41.49
19	188.03	42.84
20	192.79	44.38
21	197.48	46.10
22	202.10	48.00
23	206.65	50.09
24	211.11	52.34
25	215.48	54.77
26	219.76	57.37
27	223.92	60.13
28	227.98	63.05
29	231.92	66.13
30	235.74	69.36
31	239.43	72.73

32	242.98	76.25
33	246.40	79.90
34	248.19	81.98

*** Factor of Safety = 1.892 ***

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	47.90
2	104.22	45.23
3	108.58	42.77
4	113.06	40.55
5	117.65	38.56
6	122.33	36.81
7	127.10	35.30
8	131.94	34.04
9	136.83	33.04
10	141.78	32.29
11	146.75	31.79
12	151.75	31.55
13	156.75	31.57
14	161.74	31.85
15	166.71	32.39
16	171.65	33.18
17	176.54	34.23
18	181.36	35.53
19	186.12	37.08
20	190.79	38.87
21	195.36	40.89
22	199.82	43.16
23	204.15	45.65
24	208.36	48.36
25	212.41	51.28
26	216.31	54.41
27	220.04	57.74
28	223.60	61.25
29	226.97	64.94
30	230.14	68.81
31	233.11	72.83
32	235.87	77.00
33	238.41	81.31
34	238.56	81.59

*** Factor of Safety = 1.900 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	100.00	47.90
2	104.28	45.31
3	108.67	42.92
4	113.17	40.75
5	117.78	38.80
6	122.47	37.07
7	127.24	35.57
8	132.07	34.29
9	136.96	33.26
10	141.90	32.46
11	146.87	31.89
12	151.86	31.57
13	156.86	31.48
14	161.85	31.64
15	166.84	32.04
16	171.80	32.67
17	176.72	33.54
18	181.60	34.65
19	186.41	35.99
20	191.16	37.56
21	195.83	39.36
22	200.40	41.38
23	204.87	43.61
24	209.23	46.06
25	213.47	48.72
26	217.57	51.57
27	221.54	54.62
28	225.35	57.86
29	229.00	61.27
30	232.48	64.86
31	235.79	68.61
32	238.91	72.51
33	241.85	76.56
34	244.58	80.75
35	245.23	81.86

*** Factor of Safety = 1.908 ***

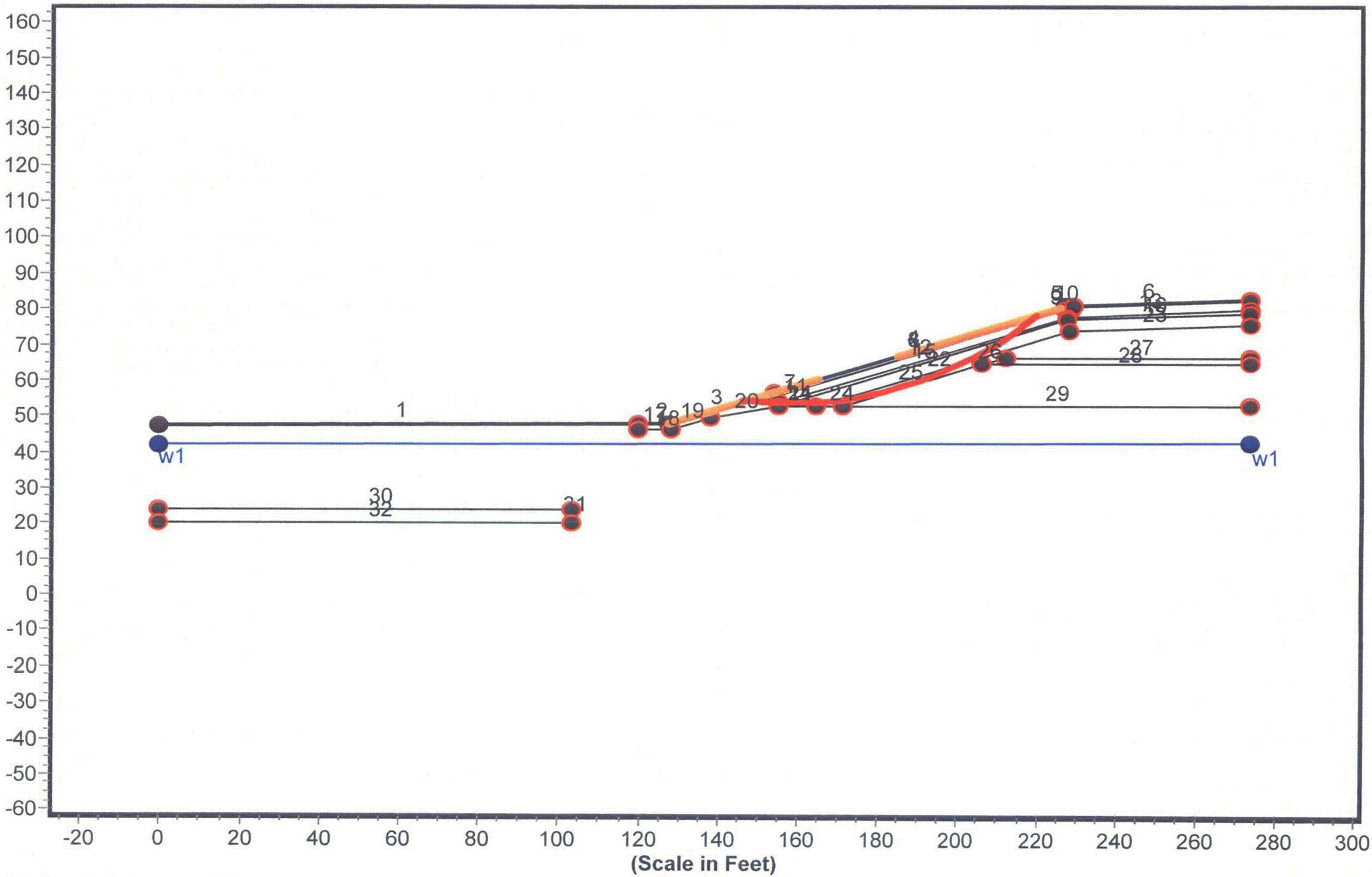
1

```
            Y            A     X     I     S            F     T

            0.00     34.20     68.40    102.60    136.80    171.00
X      0.00 +-----**--+-W-*-----+---------+---------+---------+
            -           ...
            -          ....
            -        .....
            -       .......
            -      ........
      34.20 +     .........
            -    .........
            -    .........
            -  .............
            -  .............
            - .............
A     68.40 + .............
            - .............1
```

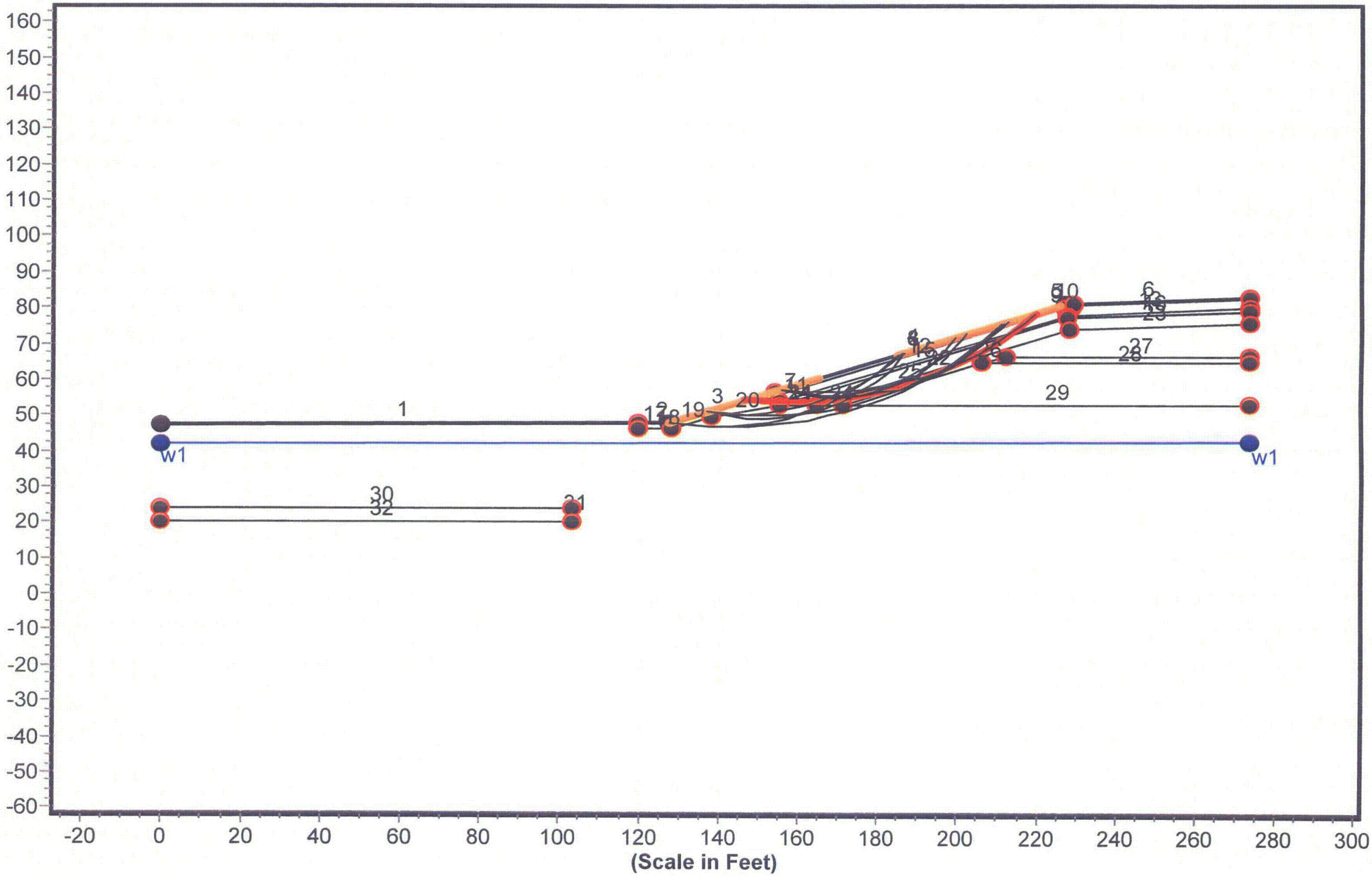
```
                 -.............1
                 -.............1
                 ..............1
                 ..............1
X     102.60     ......**.....61
                 .............21
                 ............621
                 ...........962*
                 ..........9672*
                 ..........96421
I     136.80     ..........96421*
                 .........9.64211
                 .........967.2.1
                 -........967.32***
                 -........9.6.321
                 -........9.6.42*1
S     171.00 +   ........967.2*1
             -   ........9.6.32.1
             -   ........9.67.32.1
             -    ........967.42.1
             -    ........0966.32.1
             -     ........086752211
      205.20 +      ........9.6.53*1
             -       .......0986.5*21
             -        ........066.5221
             -        .........08655411
             -          ........08665***
             -           .........876593
F     239.40 +            ..........8755
             -              .........887
             -               ..........8
             -                 .........
             -                   .......
             -                      ....
T     273.60 +             W  *   *  ***
```

JANBU #2 SEISMIC CIRCULAR

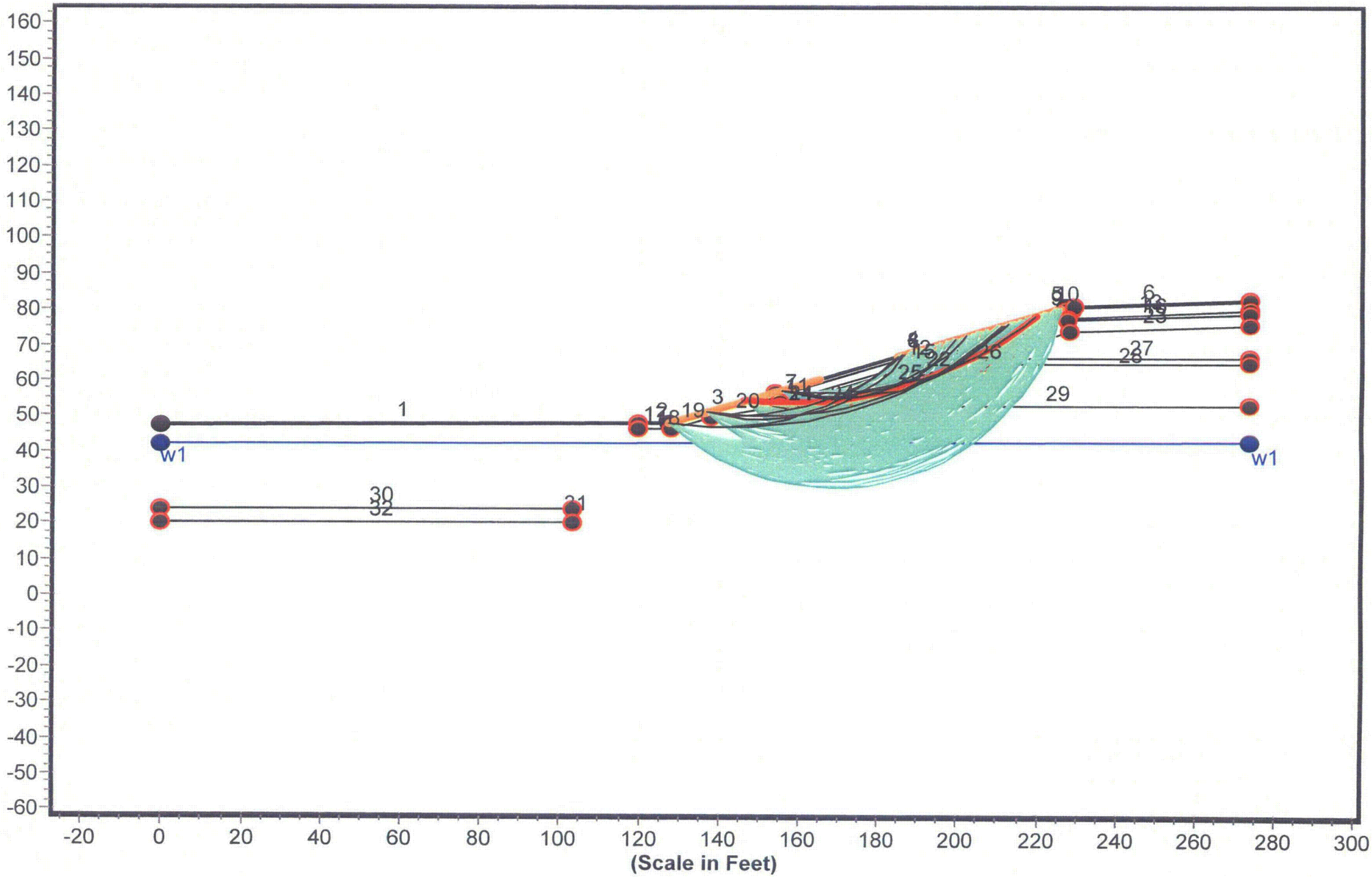
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.571

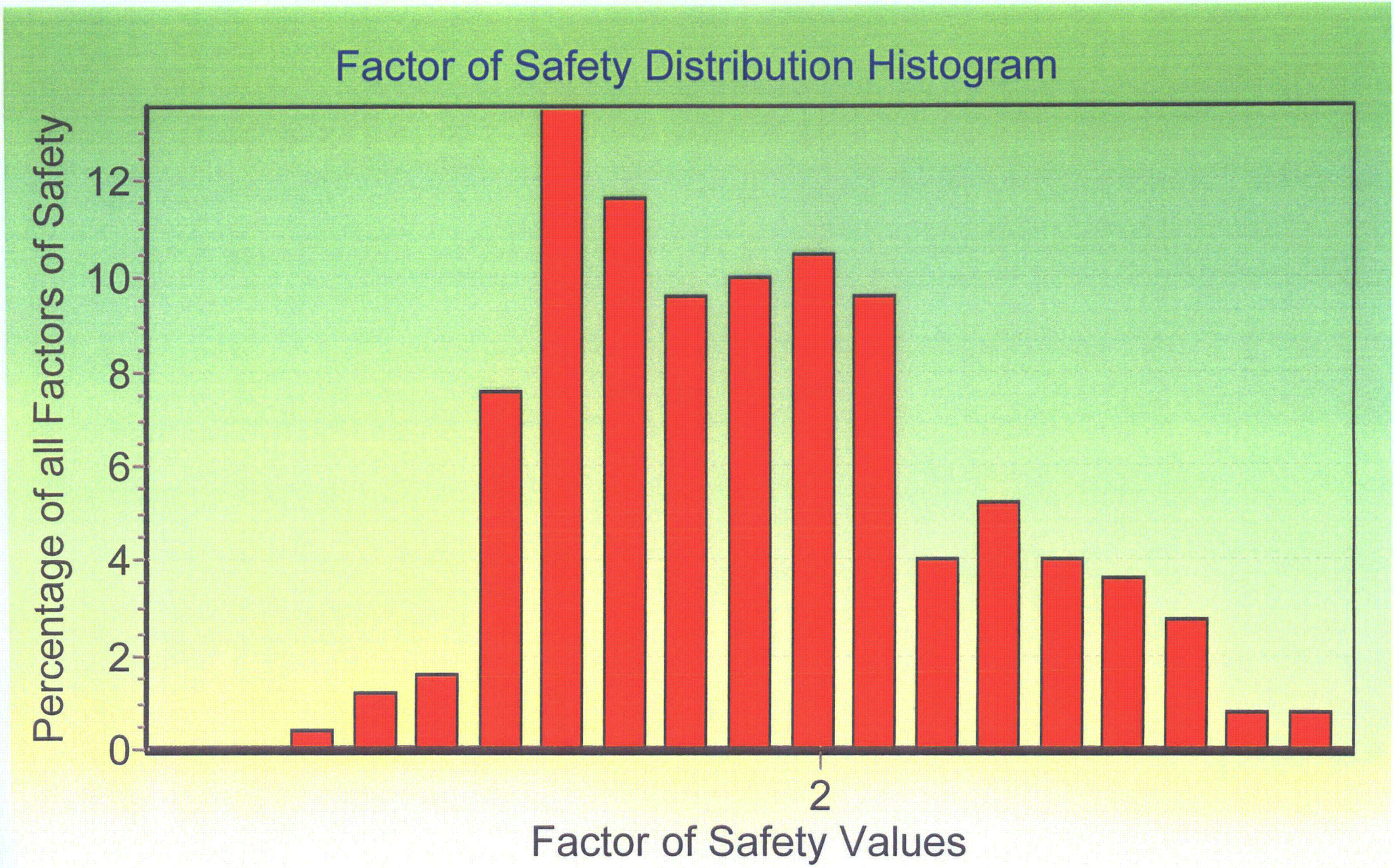


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.571



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.571




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
2
4
6
8
10
12
2
Factor of Safety Values

** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X = 127.50 ft.
and X = 165.00 ft.

Each Surface Terminates Between X = 185.00 ft.
and X = 226.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And -5.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.25	54.25
2	151.23	53.78
3	156.22	53.58
4	161.22	53.67
5	166.21	54.03
6	171.17	54.66
7	176.09	55.58
8	180.94	56.76
9	185.73	58.21
10	190.42	59.93
11	195.02	61.90
12	199.50	64.13
13	203.84	66.60
14	208.04	69.31
15	212.09	72.25
16	215.97	75.41
17	219.51	78.64

*** 1.571 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.0	716.2	0.0	0.0	0.0	0.0	60.7	60.7	0.0
2	2.7	948.4	0.0	0.0	0.0	0.0	80.3	80.3	0.0
3	0.3	128.9	0.0	0.0	0.0	0.0	10.9	10.9	0.0
4	0.6	271.3	0.0	0.0	0.0	0.0	23.0	23.0	0.0
5	0.1	38.3	0.0	0.0	0.0	0.0	3.2	3.2	0.0
6	1.3	678.2	0.0	0.0	0.0	0.0	57.4	57.4	0.0
7	2.0	1148.0	0.0	0.0	0.0	0.0	97.2	97.2	0.0
8	3.0	2064.6	0.0	0.0	0.0	0.0	174.8	174.8	0.0
9	5.0	4107.4	0.0	0.0	0.0	0.0	347.8	347.8	0.0
10	2.4	2262.8	0.0	0.0	0.0	0.0	191.6	191.6	0.0
11	2.5	2537.3	0.0	0.0	0.0	0.0	214.9	214.9	0.0
12	4.9	5291.2	0.0	0.0	0.0	0.0	448.1	448.1	0.0
13	4.9	5578.7	0.0	0.0	0.0	0.0	472.4	472.4	0.0
14	4.8	5665.0	0.0	0.0	0.0	0.0	479.7	479.7	0.0
15	4.7	5556.1	0.0	0.0	0.0	0.0	470.5	470.5	0.0
16	4.6	5262.1	0.0	0.0	0.0	0.0	445.6	445.6	0.0
17	4.5	4796.8	0.0	0.0	0.0	0.0	406.2	406.2	0.0
18	1.9	1897.4	0.0	0.0	0.0	0.0	160.7	160.7	0.0
19	2.4	2280.1	0.0	0.0	0.0	0.0	193.1	193.1	0.0
20	4.2	3424.7	0.0	0.0	0.0	0.0	290.0	290.0	0.0
21	3.0	1993.7	0.0	0.0	0.0	0.0	168.8	168.8	0.0
22	1.0	566.2	0.0	0.0	0.0	0.0	47.9	47.9	0.0
23	1.6	746.3	0.0	0.0	0.0	0.0	63.2	63.2	0.0
24	2.3	817.8	0.0	0.0	0.0	0.0	69.3	69.3	0.0
25	1.7	358.5	0.0	0.0	0.0	0.0	30.4	30.4	0.0
26	1.8	133.6	0.0	0.0	0.0	0.0	11.3	11.3	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.60	56.86
3	165.60	56.68
4	170.59	56.83
5	175.57	57.30
6	180.51	58.10
7	185.38	59.22
8	190.17	60.65
9	194.85	62.40
10	199.41	64.45
11	203.83	66.80
12	208.08	69.43
13	212.15	72.34
14	216.02	75.50
15	219.31	78.57

*** 1.583 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00
2	132.43	47.19
3	137.42	46.79
4	142.42	46.81
5	147.40	47.23
6	152.33	48.06
7	157.18	49.30
8	161.90	50.93
9	166.48	52.95
10	170.87	55.33
11	175.05	58.07
12	179.00	61.15
13	182.67	64.54
14	185.11	67.19

*** 1.594 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.84	50.55
3	146.84	50.41
4	151.83	50.73
5	156.77	51.49
6	161.63	52.68
7	166.36	54.31
8	170.92	56.35
9	175.28	58.79
10	179.41	61.61
11	183.27	64.79
12	186.01	67.49

*** 1.634 ***

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.72	49.91
3	146.68	49.24

4	151.68	49.12
5	156.66	49.56
6	161.56	50.54
7	166.32	52.07
8	170.88	54.12
9	175.19	56.65
10	179.19	59.66
11	182.83	63.08
12	186.07	66.89
13	186.60	67.69

*** 1.647 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.51	56.32
3	165.49	55.82
4	170.49	55.90
5	175.45	56.54
6	180.30	57.74
7	184.99	59.49
8	189.44	61.75
9	193.61	64.51
10	197.44	67.73
11	200.88	71.35
12	201.97	72.80

*** 1.649 ***

1

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00
2	132.45	47.32
3	137.44	46.90
4	142.43	46.74
5	147.43	46.84
6	152.42	47.19
7	157.38	47.81
8	162.31	48.68
9	167.18	49.81
10	171.98	51.18
11	176.71	52.81
12	181.35	54.67
13	185.89	56.78
14	190.31	59.12

15	194.60	61.68
16	198.75	64.46
17	202.76	67.46
18	206.60	70.65
19	210.27	74.05
20	212.47	76.30

*** 1.659 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.42	55.96
3	165.36	55.20
4	170.36	55.11
5	175.33	55.70
6	180.17	56.96
7	184.79	58.86
8	189.12	61.37
9	193.06	64.44
10	196.56	68.01
11	199.51	71.98

*** 1.680 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.49	56.21
3	165.44	55.52
4	170.44	55.32
5	175.43	55.60
6	180.37	56.36
7	185.22	57.60
8	189.92	59.30
9	194.43	61.44
10	198.72	64.02
11	202.74	66.99
12	206.45	70.34
13	209.82	74.04
14	211.19	75.87

*** 1.703 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.82	50.39
3	146.80	49.97
4	151.80	49.84
5	156.80	50.03
6	161.77	50.52
7	166.71	51.31
8	171.59	52.41
9	176.39	53.80
10	181.10	55.48
11	185.70	57.45
12	190.16	59.70
13	194.49	62.21
14	198.64	64.99
15	202.63	68.01
16	206.41	71.27
17	210.00	74.76
18	210.92	75.78

*** 1.706 ***

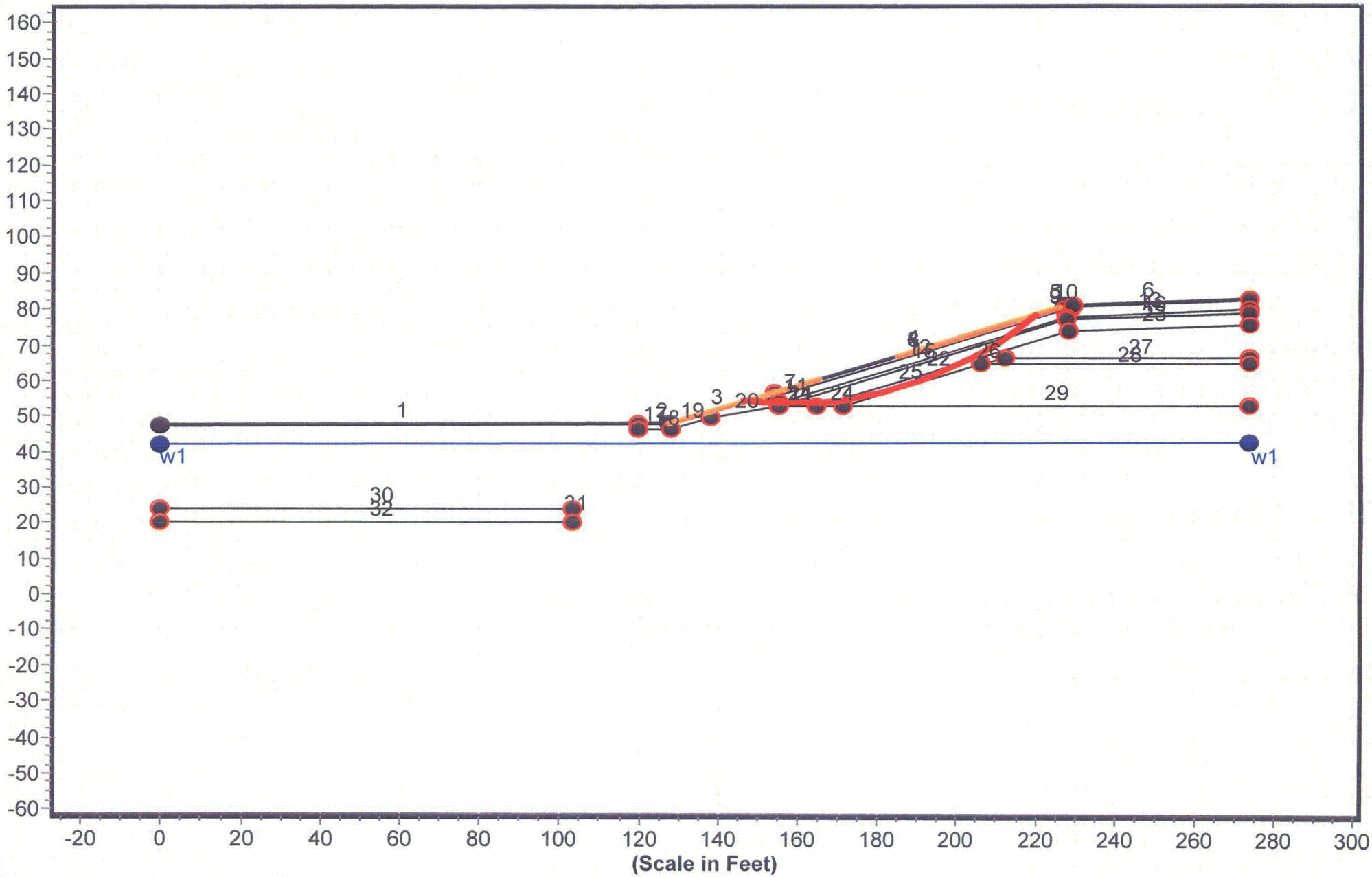
1

```
            Y            A     X     I     S           F     T

            0.00      34.20     68.40    102.60    136.80    171.00
X       0.00 +-----**--+-W-*-----+---------+---------+---------+
             -
             -
             -
             -
             -
       34.20 +
             -
             -
             -
             -
             -
A      68.40 +
             -
             -
             -
             -
             -
X     102.60 +     **
             -
             -
             -             *
             -             *
             -            .3
```

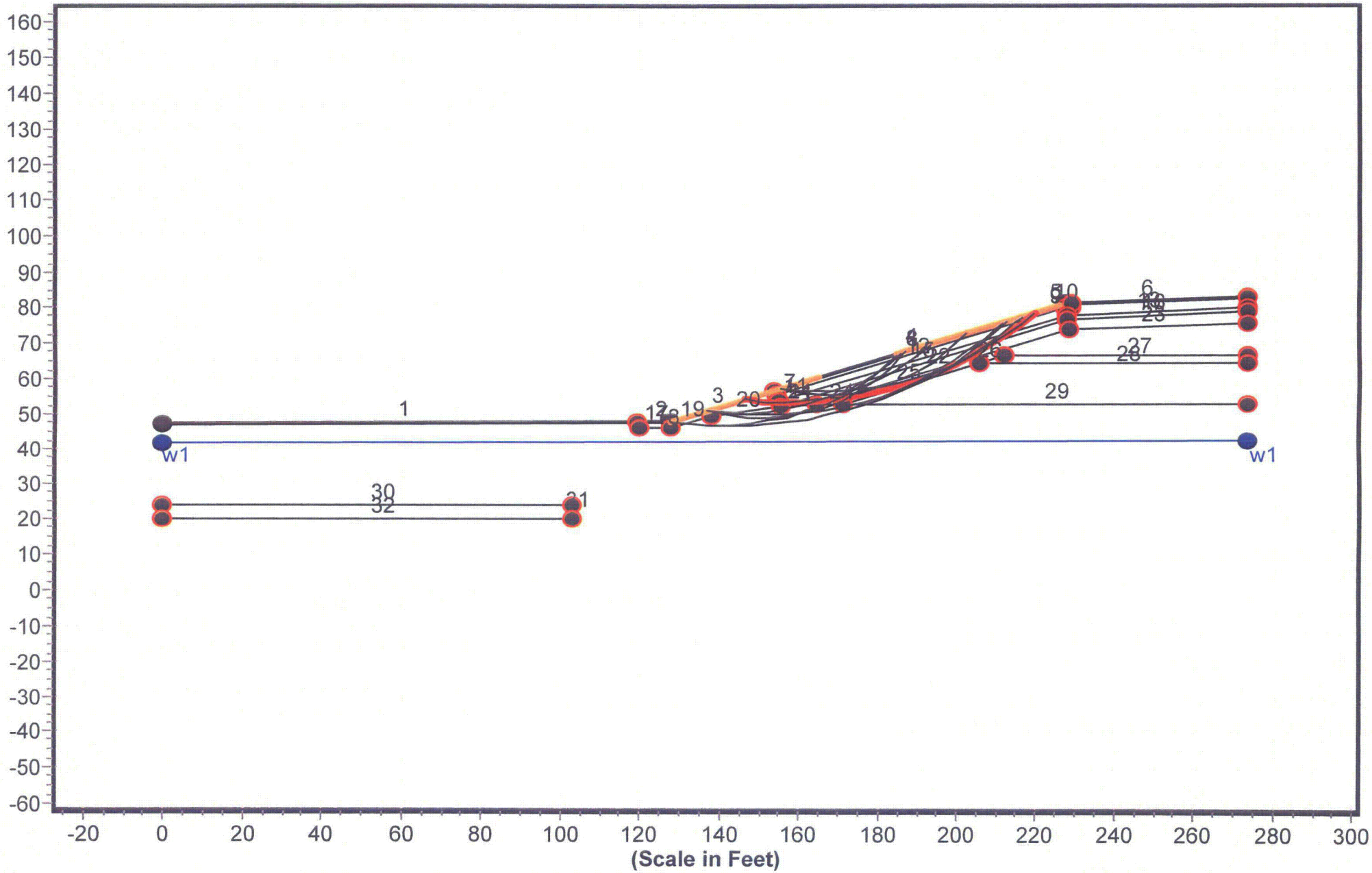
```
I     136.80 +          ...3*
             -          ...34
             -         ....341
             -        .....3***
             -        .....3312
             -        ......*12.
S     171.00 +        ......*12.
             -        ......7123
             -        .......71533
             -         .......11.4
             -         ........168.
             -           .......166
      205.20 +            ......*17.
             -             .....*217
             -               ......12
             -                 .....1.
             -                     ***
             -
F     239.40 +
             -
             -
             -
             -
             -
T     273.60 +           W  *   *  ***
```

BISHOP #2 SEISMIC CIRCULAR

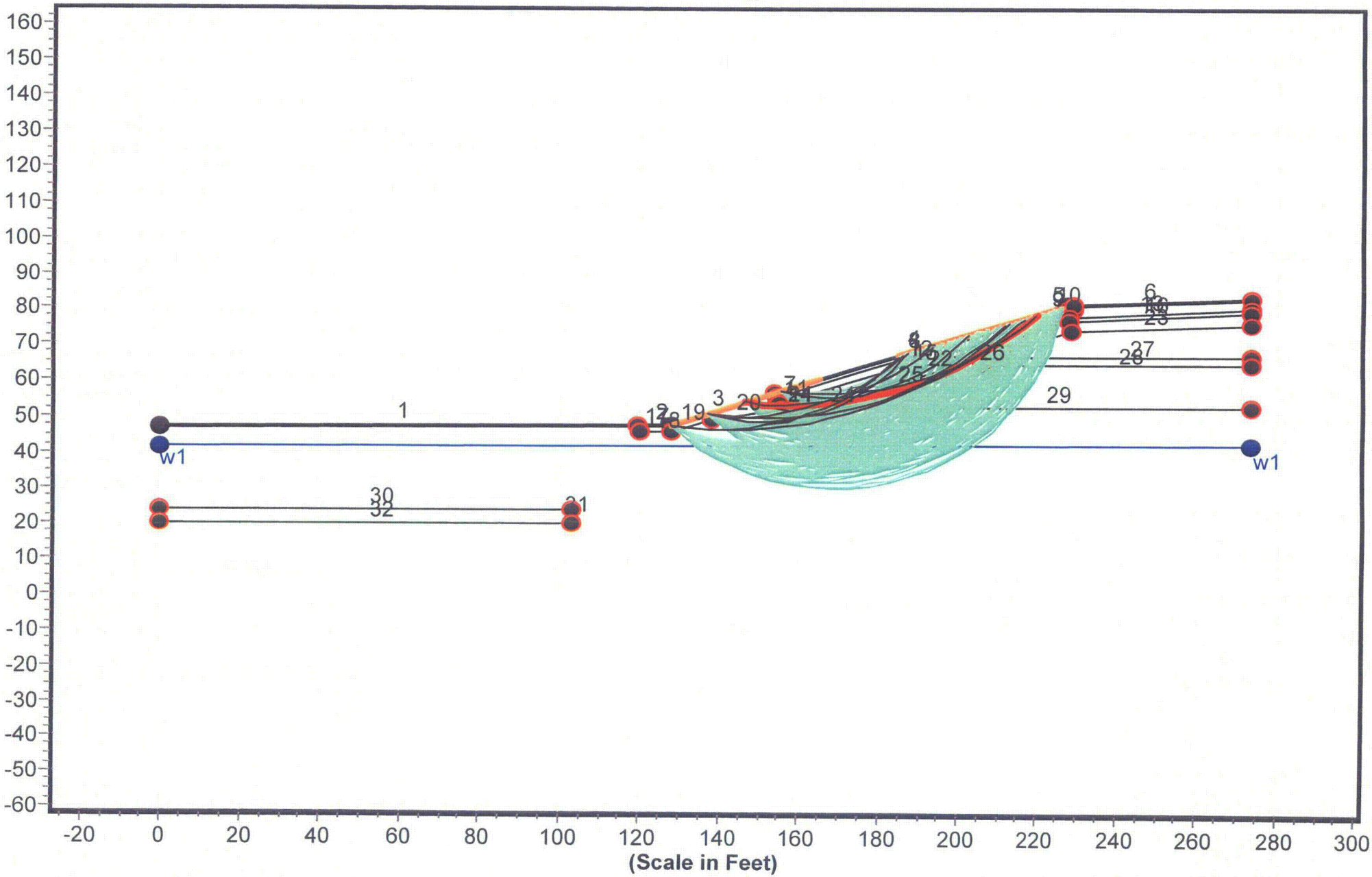
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.64

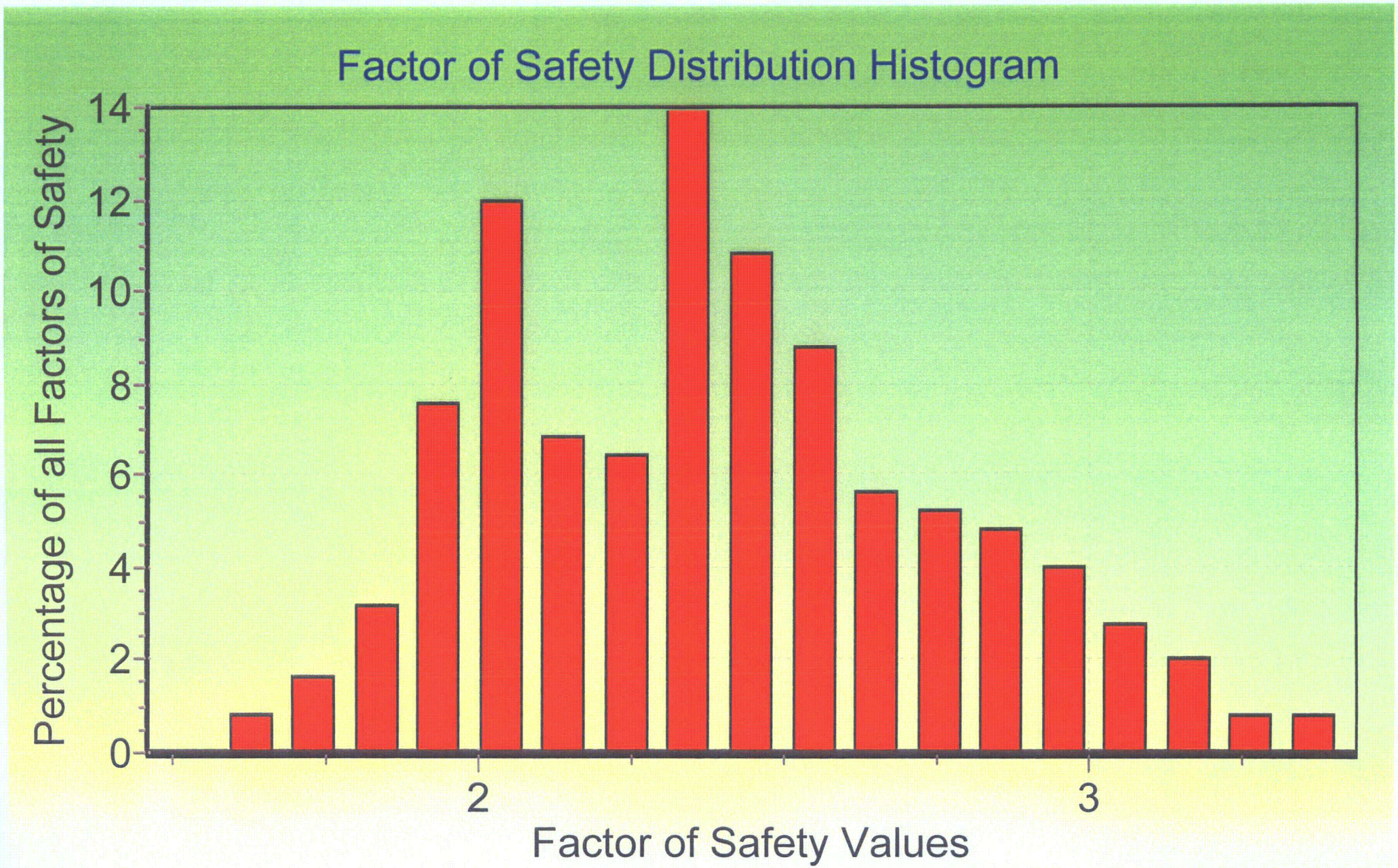


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.64



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.64




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
2
4
6
8
10
12
14
2
3
Factor of Safety Values

Bishop Circular #2 Seismic Results.txt
** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X = 127.50 ft.
and X = 165.00 ft.

Each Surface Terminates Between X = 185.00 ft.
and X = 226.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And -5.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.25	54.25
2	151.23	53.78
3	156.22	53.58
4	161.22	53.67
5	166.21	54.03
6	171.17	54.66
7	176.09	55.58
8	180.94	56.76
9	185.73	58.21
10	190.42	59.93
11	195.02	61.90
12	199.50	64.13
13	203.84	66.60
14	208.04	69.31
15	212.09	72.25
16	215.97	75.41
17	219.51	78.64

Circle Center At X = 157.2 ; Y = 143.5 and Radius, 89.9

*** 1.640 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.0	716.2	0.0	0.0	0.0	0.0	60.7	60.7	0.0
2	2.7	948.4	0.0	0.0	0.0	0.0	80.3	80.3	0.0
3	0.3	128.9	0.0	0.0	0.0	0.0	10.9	10.9	0.0
4	0.6	271.3	0.0	0.0	0.0	0.0	23.0	23.0	0.0
5	0.1	38.3	0.0	0.0	0.0	0.0	3.2	3.2	0.0
6	1.3	678.2	0.0	0.0	0.0	0.0	57.4	57.4	0.0
7	2.0	1148.0	0.0	0.0	0.0	0.0	97.2	97.2	0.0
8	3.0	2064.6	0.0	0.0	0.0	0.0	174.8	174.8	0.0
9	5.0	4107.4	0.0	0.0	0.0	0.0	347.8	347.8	0.0
10	2.4	2262.8	0.0	0.0	0.0	0.0	191.6	191.6	0.0
11	2.5	2537.3	0.0	0.0	0.0	0.0	214.9	214.9	0.0
12	4.9	5291.2	0.0	0.0	0.0	0.0	448.1	448.1	0.0
13	4.9	5578.7	0.0	0.0	0.0	0.0	472.4	472.4	0.0
14	4.8	5665.0	0.0	0.0	0.0	0.0	479.7	479.7	0.0
15	4.7	5556.1	0.0	0.0	0.0	0.0	470.5	470.5	0.0
16	4.6	5262.1	0.0	0.0	0.0	0.0	445.6	445.6	0.0
17	4.5	4796.8	0.0	0.0	0.0	0.0	406.2	406.2	0.0
18	1.9	1897.4	0.0	0.0	0.0	0.0	160.7	160.7	0.0
19	2.4	2280.1	0.0	0.0	0.0	0.0	193.1	193.1	0.0
20	4.2	3424.7	0.0	0.0	0.0	0.0	290.0	290.0	0.0
21	3.0	1993.7	0.0	0.0	0.0	0.0	168.8	168.8	0.0
22	1.0	566.2	0.0	0.0	0.0	0.0	47.9	47.9	0.0
23	1.6	746.3	0.0	0.0	0.0	0.0	63.2	63.2	0.0
24	2.3	817.8	0.0	0.0	0.0	0.0	69.3	69.3	0.0
25	1.7	358.5	0.0	0.0	0.0	0.0	30.4	30.4	0.0
26	1.8	133.6	0.0	0.0	0.0	0.0	11.3	11.3	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.60	56.86
3	165.60	56.68
4	170.59	56.83
5	175.57	57.30
6	180.51	58.10
7	185.38	59.22
8	190.17	60.65
9	194.85	62.40
10	199.41	64.45
11	203.83	66.80
12	208.08	69.43
13	212.15	72.34
14	216.02	75.50
15	219.31	78.57

Circle Center At X = 165.9 ; Y = 132.9 and Radius, 76.2

*** 1.656 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00
2	132.43	47.19
3	137.42	46.79
4	142.42	46.81
5	147.40	47.23
6	152.33	48.06
7	157.18	49.30
8	161.90	50.93
9	166.48	52.95
10	170.87	55.33
11	175.05	58.07
12	179.00	61.15
13	182.67	64.54
14	185.11	67.19

Circle Center At X = 139.8 ; Y = 107.2 and Radius, 60.5

*** 1.692 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.84	50.55
3	146.84	50.41
4	151.83	50.73
5	156.77	51.49
6	161.63	52.68
7	166.36	54.31
8	170.92	56.35
9	175.28	58.79
10	179.41	61.61
11	183.27	64.79
12	186.01	67.49

Circle Center At X = 145.8 ; Y = 106.2 and Radius, 55.8

*** 1.716 ***

1

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00
2	132.45	47.32
3	137.44	46.90
4	142.43	46.74
5	147.43	46.84
6	152.42	47.19
7	157.38	47.81
8	162.31	48.68
9	167.18	49.81
10	171.98	51.18
11	176.71	52.81
12	181.35	54.67
13	185.89	56.78
14	190.31	59.12
15	194.60	61.68
16	198.75	64.46
17	202.76	67.46
18	206.60	70.65
19	210.27	74.05
20	212.47	76.30

Circle Center At X = 143.1 ; Y = 143.0 and Radius, 96.3

*** 1.745 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.51	56.32
3	165.49	55.82
4	170.49	55.90
5	175.45	56.54
6	180.30	57.74
7	184.99	59.49
8	189.44	61.75
9	193.61	64.51
10	197.44	67.73
11	200.88	71.35
12	201.97	72.80

Circle Center At X = 167.3 ; Y = 99.5 and Radius, 43.7

*** 1.776 ***

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.72	49.91
3	146.68	49.24
4	151.68	49.12
5	156.66	49.56
6	161.56	50.54
7	166.32	52.07
8	170.88	54.12
9	175.19	56.65
10	179.19	59.66
11	182.83	63.08
12	186.07	66.89
13	186.60	67.69

Circle Center At X = 150.2 ; Y = 94.1 and Radius, 45.0

*** 1.791 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.82	50.39
3	146.80	49.97
4	151.80	49.84
5	156.80	50.03
6	161.77	50.52
7	166.71	51.31
8	171.59	52.41
9	176.39	53.80
10	181.10	55.48
11	185.70	57.45
12	190.16	59.70
13	194.49	62.21
14	198.64	64.99
15	202.63	68.01
16	206.41	71.27
17	210.00	74.76
18	210.92	75.78

Circle Center At X = 151.3 ; Y = 131.3 and Radius, 81.5

*** 1.804 ***

1

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.25	54.25
2	151.22	53.71
3	156.22	53.63
4	161.21	54.01
5	166.14	54.85
6	170.97	56.14
7	175.66	57.87
8	180.17	60.02
9	184.47	62.58
10	188.51	65.53
11	192.26	68.83
12	193.28	69.91

Circle Center At X = 154.6 ; Y = 107.6 and Radius, 54.0

*** 1.812 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.83	50.49
3	146.82	50.13
4	151.82	50.04
5	156.82	50.22
6	161.80	50.68
7	166.74	51.41
8	171.64	52.41
9	176.48	53.67
10	181.24	55.20
11	185.91	56.99
12	190.47	59.03
13	194.92	61.32
14	199.23	63.84
15	203.40	66.60
16	207.42	69.59
17	211.26	72.79
18	214.92	76.19
19	216.23	77.55

Circle Center At X = 151.0 ; Y = 141.3 and Radius, 91.3

*** 1.814 ***

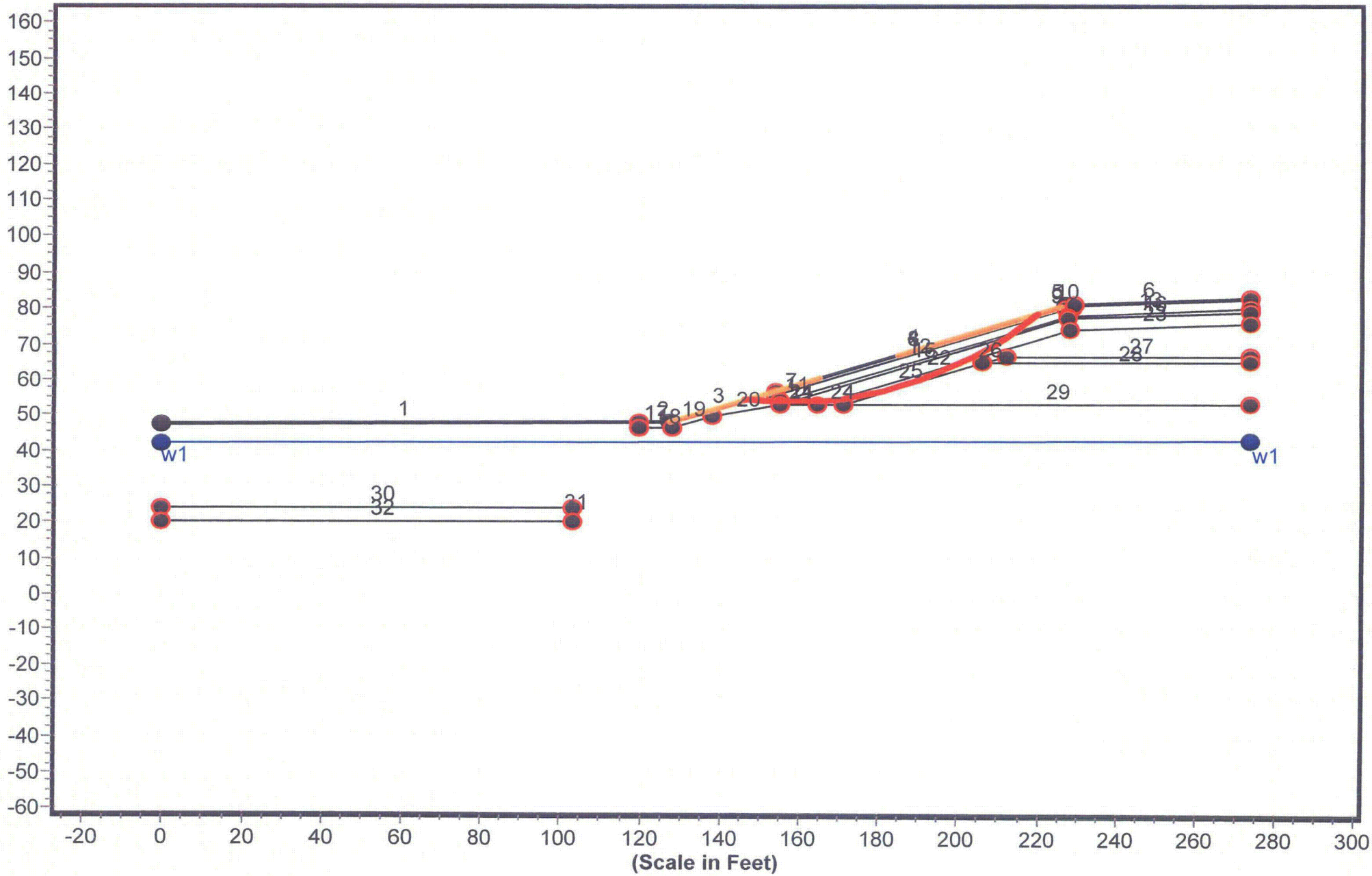
1

Y A X I S F T

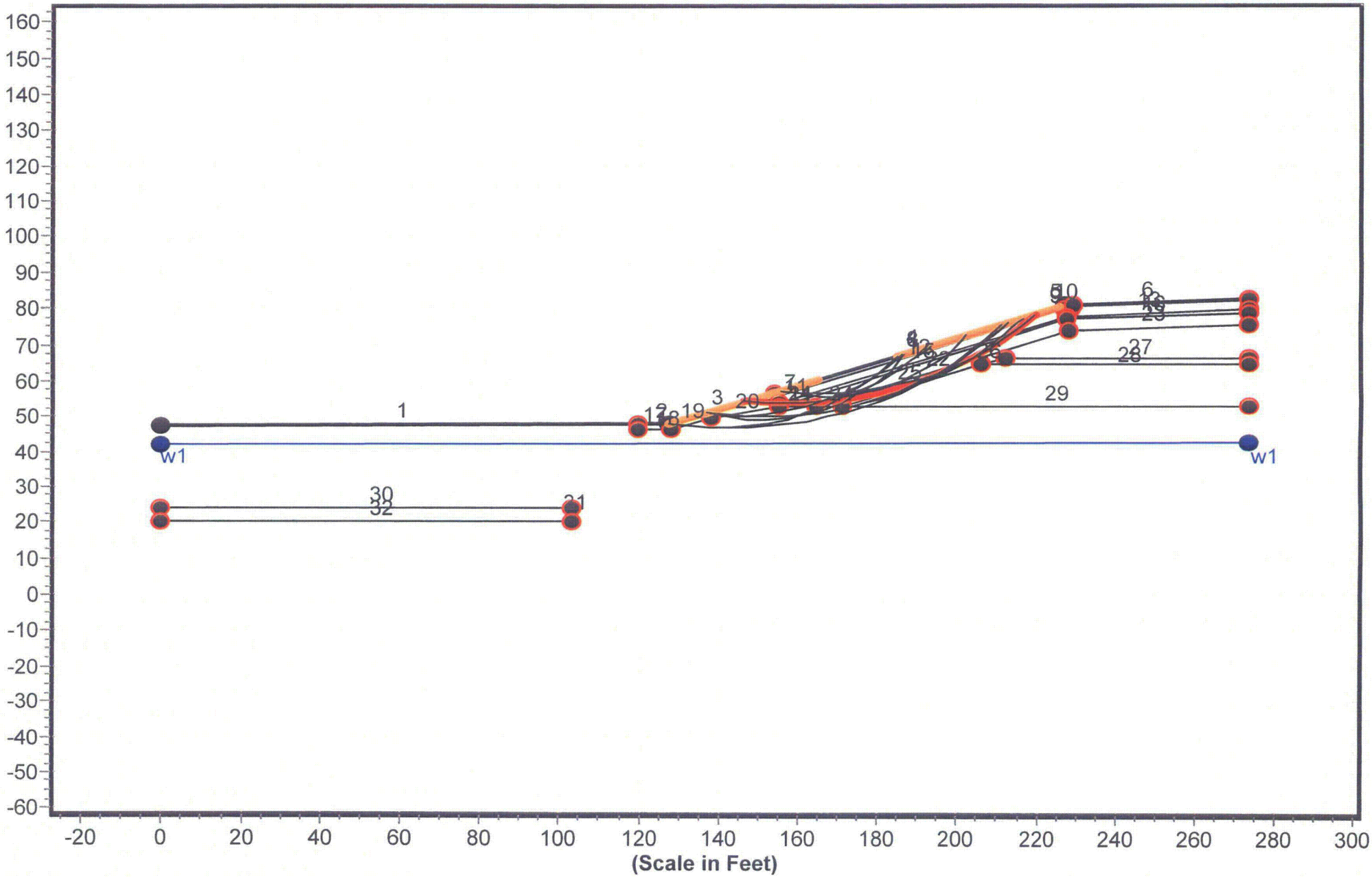
```
                0.00      34.20     68.40    102.60    136.80    171.00

X        0.00 +-----**--+-W-*-----+---------+---------+---------+
              -
              -
              -
              -
              -
       34.20 +
              -
              -
              -
              -
              -
A      68.40 +
              -
              -
              -
              -
              -
X     102.60 +     **
              -
              -
              -             *
              -             *
              -            .3
I     136.80 +          ...3*
              -         ...34
              -        ....341
              -      .....3***
              -      .....3312
              -      ......*12.
S     171.00 +       ......*12.
              -      ......5123
              -      .......51733
              -       .......1194
              -       ........169.
              -         .......166
      205.20 +          ......*15.
              -          .....*215
              -            ......12
              -              .....1.
              -                  ***
              -
F     239.40 +
              -
              -
              -
              -
              -
T     273.60 +          W  *   *  ***
```

SPENCER #2 SEISMIC SLICES

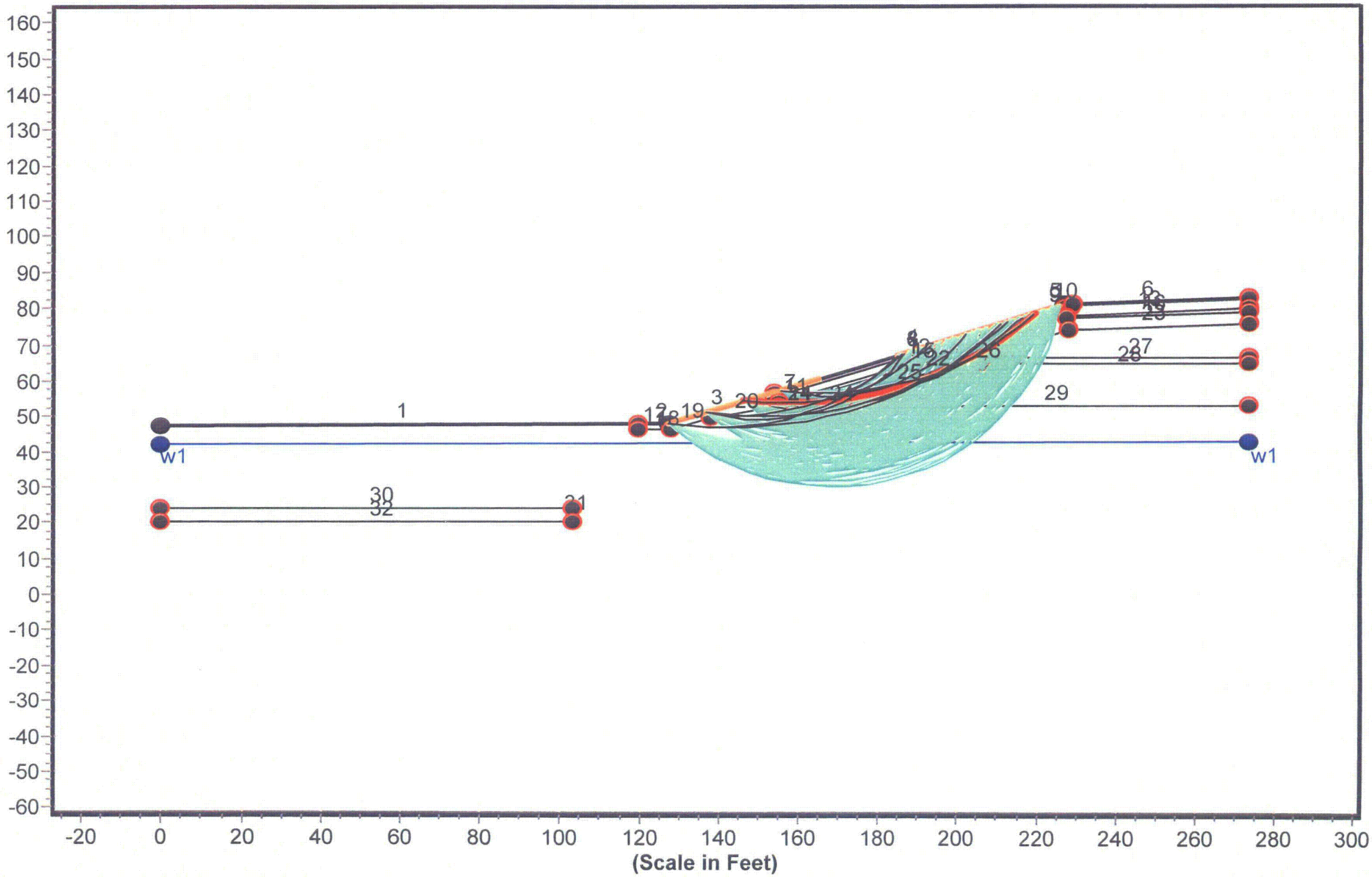
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.649

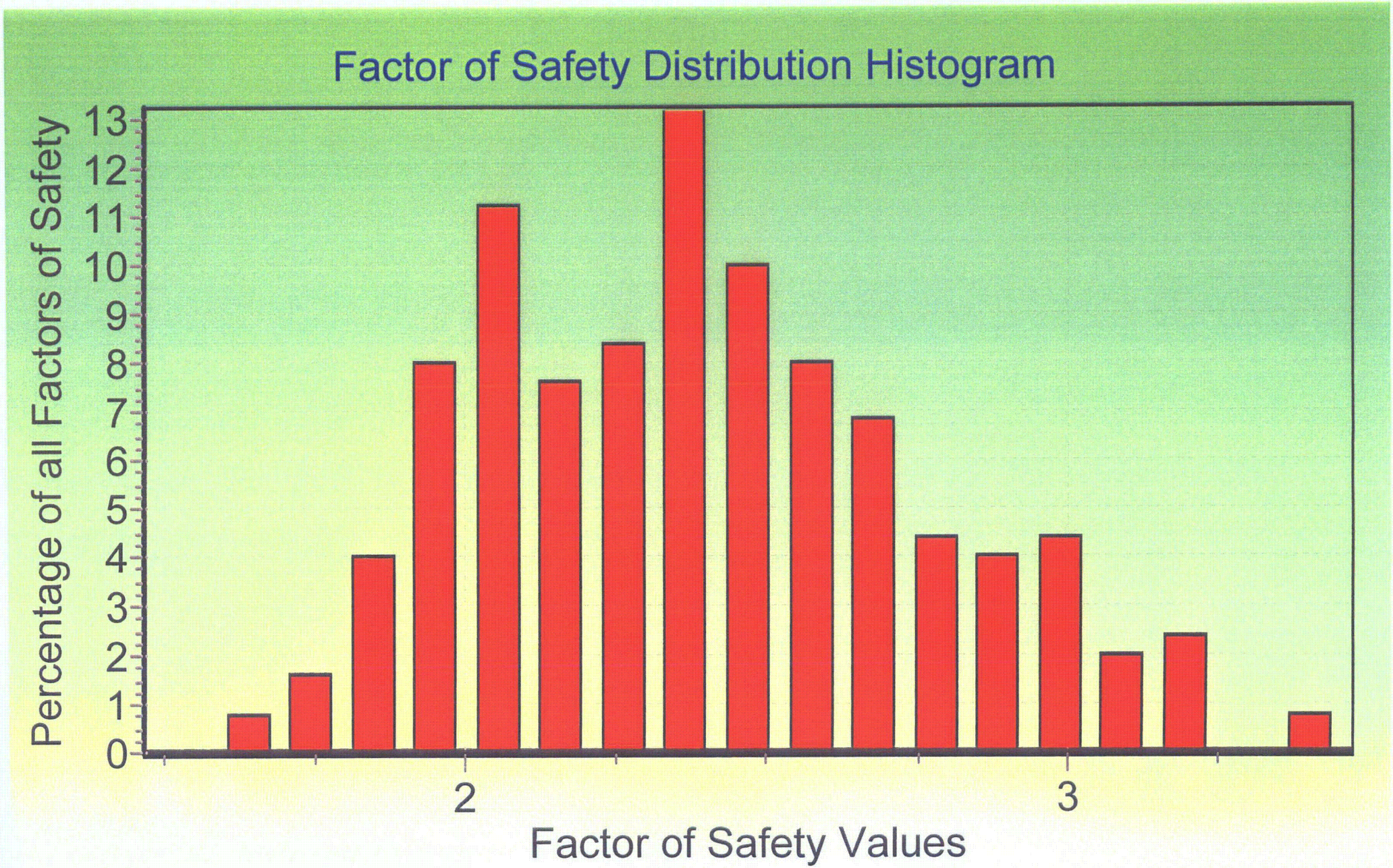


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.649



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.649




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
0
1
2
3
4
5
6
7
8
9
10
11
12
13
2
3
Factor of Safety Values

** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X = 127.50 ft.
and X = 165.00 ft.

Each Surface Terminates Between X = 185.00 ft.
and X = 226.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And -5.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By Spencer`s Method * *

Number of convergent trials 250
Number of non convergent trials 0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.25	54.25
2	151.23	53.78
3	156.22	53.58
4	161.22	53.67
5	166.21	54.03
6	171.17	54.66
7	176.09	55.58
8	180.94	56.76
9	185.73	58.21
10	190.42	59.93
11	195.02	61.90
12	199.50	64.13
13	203.84	66.60
14	208.04	69.31
15	212.09	72.25
16	215.97	75.41
17	219.51	78.64

*** Factor of Safety = 1.649 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.0	716.2	0.0	0.0	0.0	0.0	60.7	60.7	0.0
2	2.7	948.4	0.0	0.0	0.0	0.0	80.3	80.3	0.0
3	0.3	128.9	0.0	0.0	0.0	0.0	10.9	10.9	0.0
4	0.6	271.3	0.0	0.0	0.0	0.0	23.0	23.0	0.0
5	0.1	38.3	0.0	0.0	0.0	0.0	3.2	3.2	0.0
6	1.3	678.2	0.0	0.0	0.0	0.0	57.4	57.4	0.0
7	2.0	1148.0	0.0	0.0	0.0	0.0	97.2	97.2	0.0
8	3.0	2064.6	0.0	0.0	0.0	0.0	174.8	174.8	0.0
9	5.0	4107.4	0.0	0.0	0.0	0.0	347.8	347.8	0.0
10	2.4	2262.8	0.0	0.0	0.0	0.0	191.6	191.6	0.0
11	2.5	2537.3	0.0	0.0	0.0	0.0	214.9	214.9	0.0
12	4.9	5291.2	0.0	0.0	0.0	0.0	448.1	448.1	0.0
13	4.9	5578.7	0.0	0.0	0.0	0.0	472.4	472.4	0.0
14	4.8	5665.0	0.0	0.0	0.0	0.0	479.7	479.7	0.0
15	4.7	5556.1	0.0	0.0	0.0	0.0	470.5	470.5	0.0
16	4.6	5262.1	0.0	0.0	0.0	0.0	445.6	445.6	0.0
17	4.5	4796.8	0.0	0.0	0.0	0.0	406.2	406.2	0.0
18	1.9	1897.4	0.0	0.0	0.0	0.0	160.7	160.7	0.0
19	2.4	2280.1	0.0	0.0	0.0	0.0	193.1	193.1	0.0
20	4.2	3424.7	0.0	0.0	0.0	0.0	290.0	290.0	0.0
21	3.0	1993.7	0.0	0.0	0.0	0.0	168.8	168.8	0.0
22	1.0	566.2	0.0	0.0	0.0	0.0	47.9	47.9	0.0
23	1.6	746.3	0.0	0.0	0.0	0.0	63.2	63.2	0.0
24	2.3	817.8	0.0	0.0	0.0	0.0	69.3	69.3	0.0
25	1.7	358.5	0.0	0.0	0.0	0.0	30.4	30.4	0.0
26	1.8	133.6	0.0	0.0	0.0	0.0	11.3	11.3	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.60	56.86
3	165.60	56.68
4	170.59	56.83
5	175.57	57.30
6	180.51	58.10
7	185.38	59.22
8	190.17	60.65
9	194.85	62.40
10	199.41	64.45
11	203.83	66.80
12	208.08	69.43
13	212.15	72.34
14	216.02	75.50
15	219.31	78.57

*** Factor of Safety = 1.664 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00
2	132.43	47.19
3	137.42	46.79
4	142.42	46.81
5	147.40	47.23
6	152.33	48.06
7	157.18	49.30
8	161.90	50.93
9	166.48	52.95
10	170.87	55.33
11	175.05	58.07
12	179.00	61.15
13	182.67	64.54
14	185.11	67.19

*** Factor of Safety = 1.711 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.84	50.55
3	146.84	50.41
4	151.83	50.73
5	156.77	51.49
6	161.63	52.68
7	166.36	54.31
8	170.92	56.35
9	175.28	58.79
10	179.41	61.61
11	183.27	64.79
12	186.01	67.49

*** Factor of Safety = 1.741 ***

1

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.50	48.00

2	132.45	47.32
3	137.44	46.90
4	142.43	46.74
5	147.43	46.84
6	152.42	47.19
7	157.38	47.81
8	162.31	48.68
9	167.18	49.81
10	171.98	51.18
11	176.71	52.81
12	181.35	54.67
13	185.89	56.78
14	190.31	59.12
15	194.60	61.68
16	198.75	64.46
17	202.76	67.46
18	206.60	70.65
19	210.27	74.05
20	212.47	76.30

*** Factor of Safety = 1.752 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.63	57.37
2	160.51	56.32
3	165.49	55.82
4	170.49	55.90
5	175.45	56.54
6	180.30	57.74
7	184.99	59.49
8	189.44	61.75
9	193.61	64.51
10	197.44	67.73
11	200.88	71.35
12	201.97	72.80

*** Factor of Safety = 1.792 ***

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.72	49.91
3	146.68	49.24
4	151.68	49.12
5	156.66	49.56

6	161.56	50.54
7	166.32	52.07
8	170.88	54.12
9	175.19	56.65
10	179.19	59.66
11	182.83	63.08
12	186.07	66.89
13	186.60	67.69

*** Factor of Safety = 1.815 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.82	50.39
3	146.80	49.97
4	151.80	49.84
5	156.80	50.03
6	161.77	50.52
7	166.71	51.31
8	171.59	52.41
9	176.39	53.80
10	181.10	55.48
11	185.70	57.45
12	190.16	59.70
13	194.49	62.21
14	198.64	64.99
15	202.63	68.01
16	206.41	71.27
17	210.00	74.76
18	210.92	75.78

*** Factor of Safety = 1.816 ***

1

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.88	51.13
2	141.83	50.49
3	146.82	50.13
4	151.82	50.04
5	156.82	50.22
6	161.80	50.68
7	166.74	51.41
8	171.64	52.41
9	176.48	53.67
10	181.24	55.20

11	185.91	56.99
12	190.47	59.03
13	194.92	61.32
14	199.23	63.84
15	203.40	66.60
16	207.42	69.59
17	211.26	72.79
18	214.92	76.19
19	216.23	77.55

*** Factor of Safety = 1.826 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.25	54.25
2	151.22	53.71
3	156.22	53.63
4	161.21	54.01
5	166.14	54.85
6	170.97	56.14
7	175.66	57.87
8	180.17	60.02
9	184.47	62.58
10	188.51	65.53
11	192.26	68.83
12	193.28	69.91

*** Factor of Safety = 1.838 ***

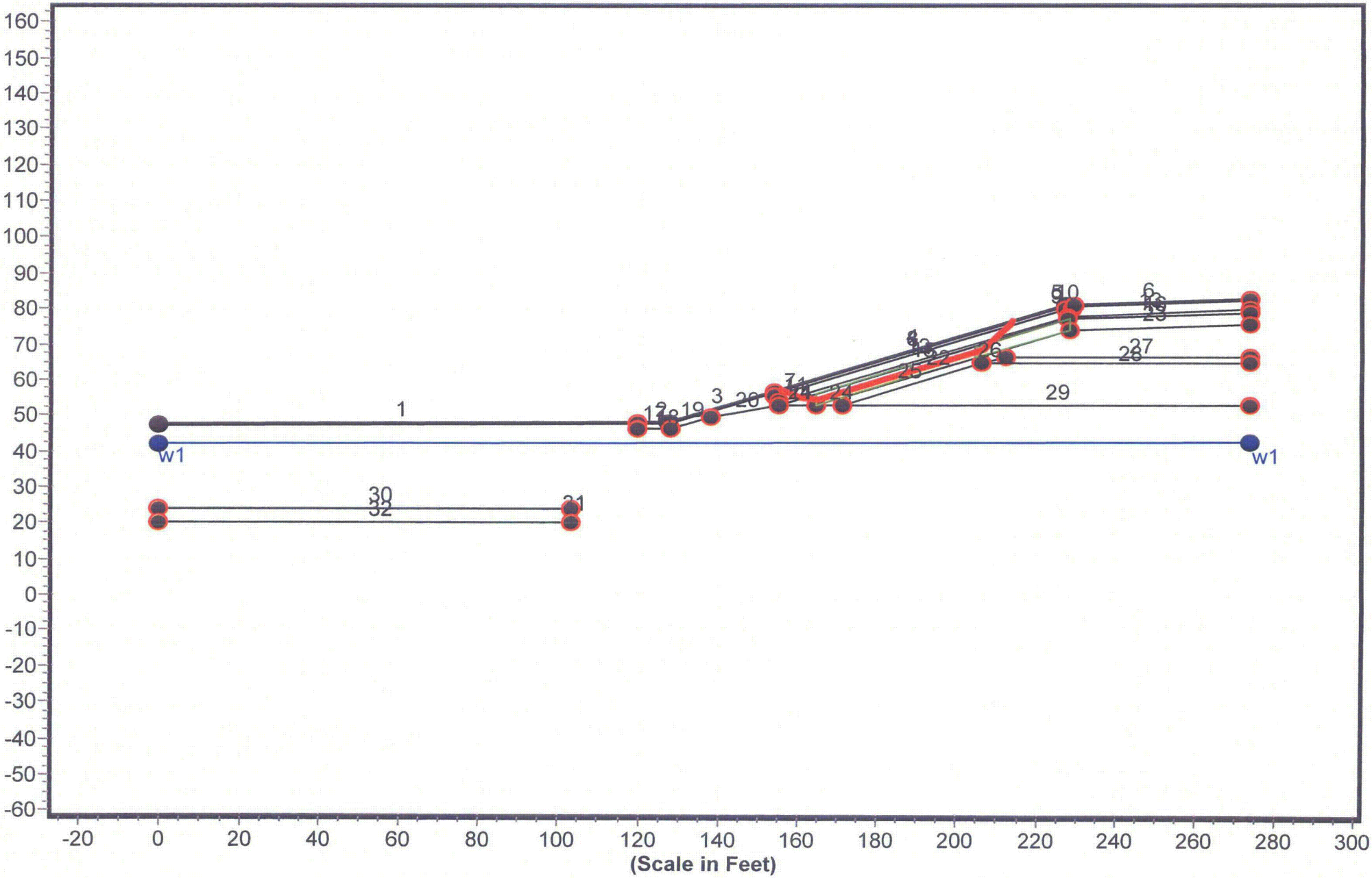
1

```
            Y            A     X     I     S            F     T

            0.00     34.20     68.40    102.60    136.80    171.00
X       0.00 +-----**--+-W-*-----+---------+---------+---------+
             -
             -
             -
             -
             -
       34.20 +
             -
             -
             -
             -
             -
A      68.40 +
             -
             -
             -
```

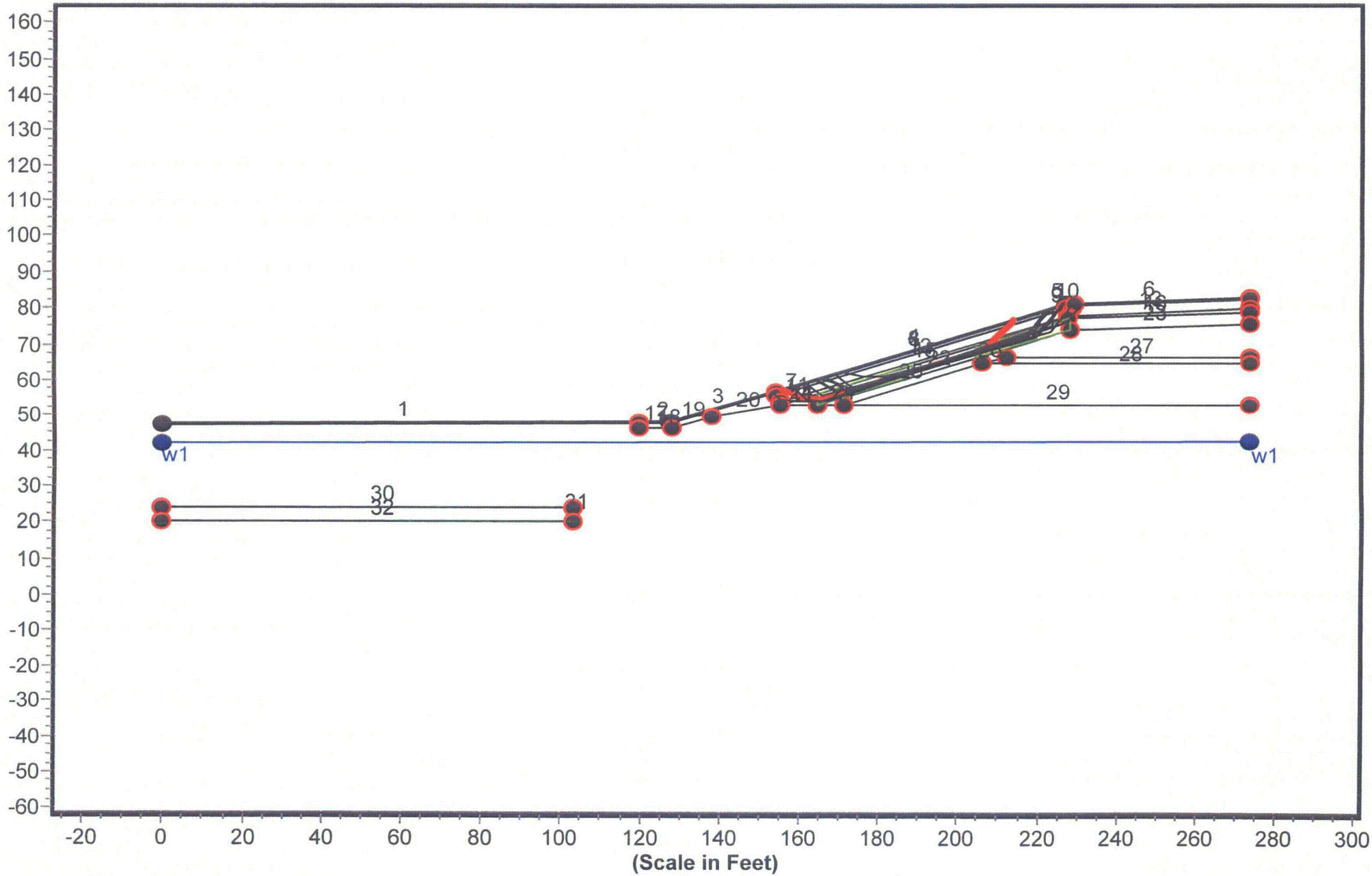
```
                -
                -
X     102.60 +     **
                -
                -
                -            *
                -            *
                -           .3
I     136.80 +          ...3*
                -         ...34
                -        ....341
                -       .....3***
                -       .....3312
                -       ......*12.
S     171.00 +          ......*12.
                -       ......5123
                -       .......51733
                -        .......1104
                -        ........160.
                -          .......166
      205.20 +            ......*15.
                -          .....*215
                -            ......12
                -              .....1.
                -                  ***
                -
F     239.40 +
                -
                -
                -
                -
                -
T     273.60 +          W  *   *  ***
```

JANBU #1 SEISMIC SLIDING BLOCK

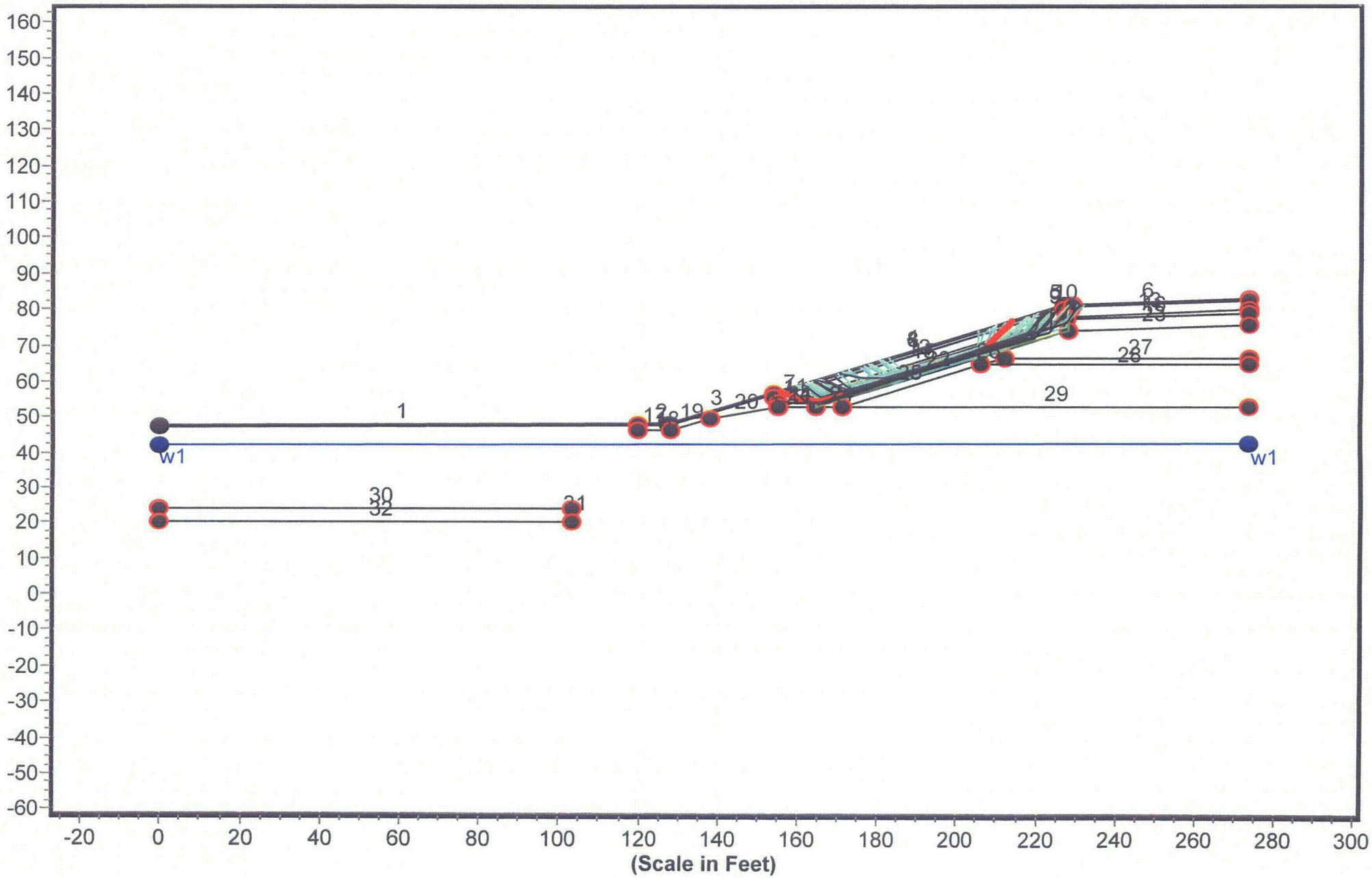
Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.766

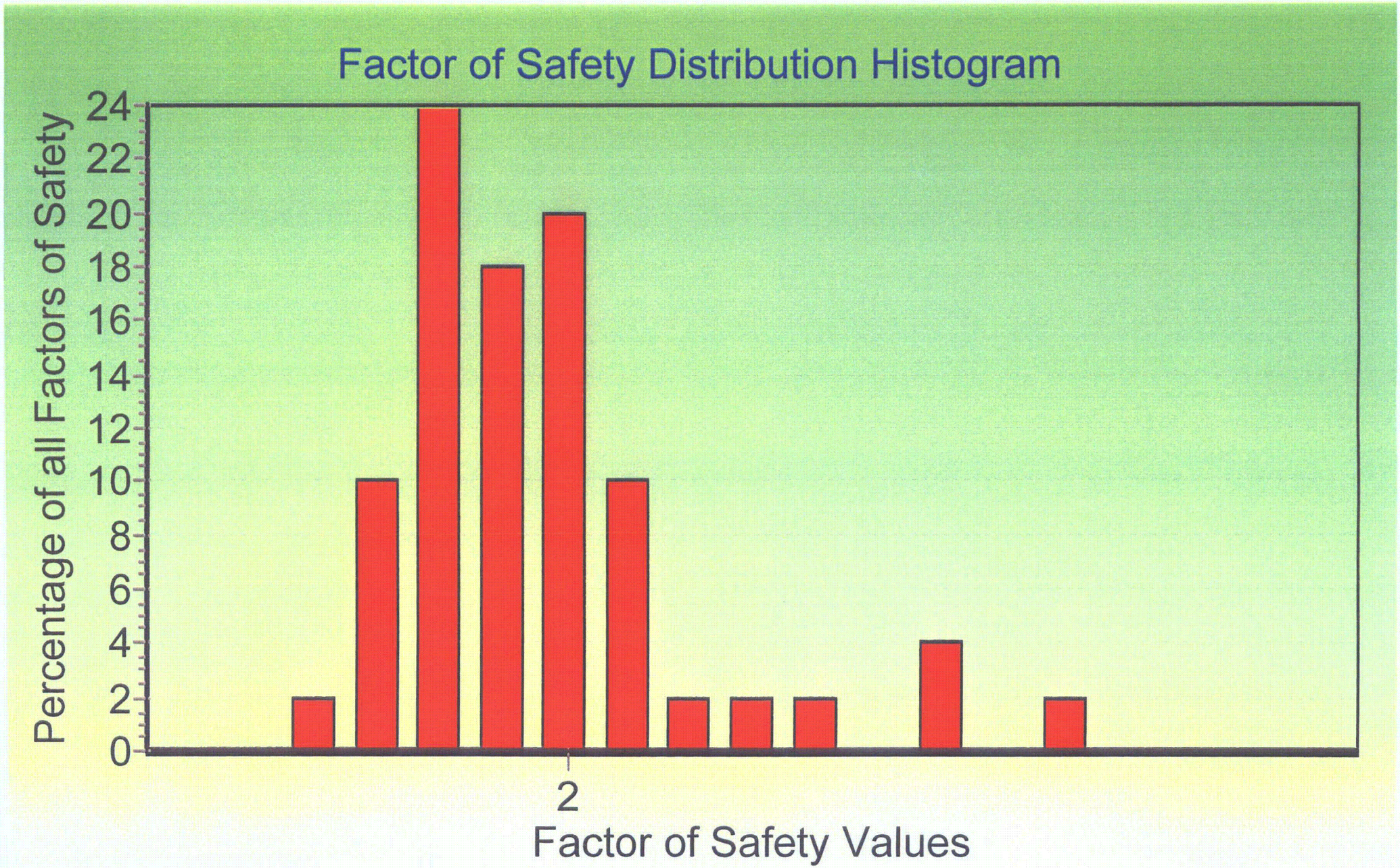


Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.766



Geometry and Boundary Conditions
Problem: SMC Newfield Decommissioning - Section A-A' - FS Min = 1.766




Factor of Safety Distribution Histogram
Percentage of all Factors of Safety
24
22
20
18
16
14
12
10
8
6
4
2
0
2
Factor of Safety Values

** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION SMC Newfield Decommissioning - Section A -A'

BOUNDARY COORDINATES

6 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.40	119.50	48.00	7
2	119.50	48.00	127.50	48.00	1
3	127.50	48.00	153.90	56.80	1
4	153.90	56.80	226.90	81.10	1
5	226.90	81.10	228.90	81.20	1
6	228.90	81.20	273.60	83.00	2
7	153.90	56.80	154.20	55.80	1
8	154.20	55.80	227.10	80.10	2
9	227.10	80.10	228.80	80.20	2
10	228.80	80.20	228.90	81.20	2
11	154.20	55.80	154.80	53.90	1
12	154.80	53.90	227.40	78.10	1
13	227.40	78.10	273.60	80.00	1
14	154.80	53.90	155.20	52.60	1
15	155.20	52.60	227.60	77.10	3
16	227.60	77.10	273.60	79.00	3
17	119.50	48.00	119.60	46.40	7
18	119.60	46.40	127.80	46.40	7
19	127.80	46.40	137.90	49.80	7
20	137.90	49.80	155.20	52.60	7
21	155.20	52.60	164.60	53.00	7
22	164.60	53.00	228.20	74.10	4
23	228.20	74.10	273.60	76.00	4
24	164.60	53.00	171.00	53.00	7
25	171.00	53.00	205.80	64.60	6
26	205.80	64.60	211.80	66.60	5

27	211.80	66.60	273.60	66.60	5
28	205.80	64.60	273.60	64.60	6
29	171.00	53.00	273.60	53.00	7
30	0.00	24.00	103.10	24.00	8
31	103.00	20.00	103.10	24.00	7
32	0.00	20.00	103.10	20.00	7

1

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	135.0	140.0	0.0	40.0	0.00	0.0	0
2	135.0	140.0	0.0	35.0	0.00	0.0	0
3	125.0	130.0	250.0	15.0	0.00	0.0	0
4	125.0	135.0	0.0	32.0	0.00	0.0	0
5	135.0	140.0	0.0	38.0	0.00	0.0	0
6	135.0	140.0	0.0	40.0	0.00	0.0	0
7	115.0	130.0	0.0	33.0	0.00	0.0	1
8	130.0	140.0	300.0	20.0	0.00	0.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	41.70
2	273.60	42.50

A Horizontal Earthquake Loading Coefficient
Of0.085 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.085 Has Been Assigned

Cavitation Pressure = 0.0 (psf)

Janbus Empirical Coef is being used for the case of c & phi both > 0

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.

50 Trial Surfaces Have Been Generated.

2 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 5.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	164.70	54.58	188.42	62.47	3.16
2	204.48	67.89	228.20	75.78	3.16

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.51	57.33
2	155.69	57.19
3	160.24	55.09
4	165.20	54.52
5	206.19	68.70
6	209.50	72.44
7	213.00	76.02
8	213.59	76.67

*** 1.766 ***

Individual data on the 13 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.2	2.7	0.0	0.0	0.0	0.0	0.2	0.2	0.0
2	1.1	98.8	0.0	0.0	0.0	0.0	8.4	8.4	0.0
3	2.6	766.7	0.0	0.0	0.0	0.0	64.9	64.9	0.0
4	0.8	369.2	0.0	0.0	0.0	0.0	31.3	31.3	0.0
5	1.7	985.4	0.0	0.0	0.0	0.0	83.4	83.4	0.0
6	3.2	2297.2	0.0	0.0	0.0	0.0	194.5	194.5	0.0
7	41.0	31419.8	0.0	0.0	0.0	0.0	2660.6	2660.6	0.0

8	1.5	961.5	0.0	0.0	0.0	0.0	81.4	81.4	0.0
9	1.5	744.2	0.0	0.0	0.0	0.0	63.0	63.0	0.0
10	0.4	158.5	0.0	0.0	0.0	0.0	13.4	13.4	0.0
11	2.6	689.4	0.0	0.0	0.0	0.0	58.4	58.4	0.0
12	0.9	92.7	0.0	0.0	0.0	0.0	7.8	7.8	0.0
13	0.6	17.9	0.0	0.0	0.0	0.0	1.5	1.5	0.0

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	157.93	58.14
2	158.28	57.89
3	161.85	54.39
4	166.84	54.12
5	227.30	76.12
6	230.16	80.22
7	231.12	81.29

*** 1.779 ***

1

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	164.63	60.37
2	168.22	59.43
3	172.34	56.61
4	216.84	71.33
5	219.30	75.68
6	222.01	79.47

*** 1.786 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	170.55	62.34
2	171.00	62.25
3	175.81	60.86
4	180.81	60.74
5	222.95	73.47
6	225.97	77.45
7	228.39	81.17

*** 1.790 ***

1

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	166.25	60.91
2	167.75	60.04
3	172.13	57.63
4	219.19	72.30
5	222.66	75.90
6	225.44	80.05
7	225.52	80.64

*** 1.795 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	163.78	60.09
2	165.00	59.66
3	169.10	56.80
4	215.82	70.74
5	218.88	74.70
6	221.92	78.67
7	223.07	79.83

*** 1.811 ***

1

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.76	56.42
2	154.87	54.34
3	159.82	53.64
4	164.82	53.53
5	223.59	75.18
6	223.68	80.03

*** 1.843 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	169.03	61.84
2	169.79	61.15
3	173.36	57.65
4	218.19	71.68
5	221.69	75.26
6	224.78	79.19
7	226.34	80.91

*** 1.846 ***

1

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	164.51	60.33
2	168.51	57.50
3	173.51	57.22
4	217.63	73.44
5	220.46	77.56
6	222.51	79.64

*** 1.852 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.91	59.13
2	161.75	58.87
3	165.36	55.42
4	215.90	70.97
5	219.39	74.54
6	221.22	79.20
7	221.22	79.21

*** 1.854 ***

1

```
                Y            A     X     I     S            F     T

                0.00     34.20     68.40    102.60    136.80    171.00

X         0.00 +-----**--+-W-*-----+---------+---------+---------+
               -
               -
               -
               -
               -
         34.20 +
               -
               -
               -
               -
               -
A        68.40 +
               -
               -
               -
               -
               -
X       102.60 +     **
               -
               -
               -            *
               -            *
               -
I       136.80 +             *
               -
               -
               -            ***
               -             12
               -            *163
S       171.00 +            *.34
               -              .4.
               -              .4.
               -               .
               -
               -
         205.20 +                 *1..
               -                  *.11
               -                    33.
               -                    453.
               -                     ***
               -                       .2
F       239.40 +
               -
               -
               -
               -
               -
T       273.60 +           W  *   *  ***
```

KOERNER & SOONG SEISMIC SLIDING BLOCK

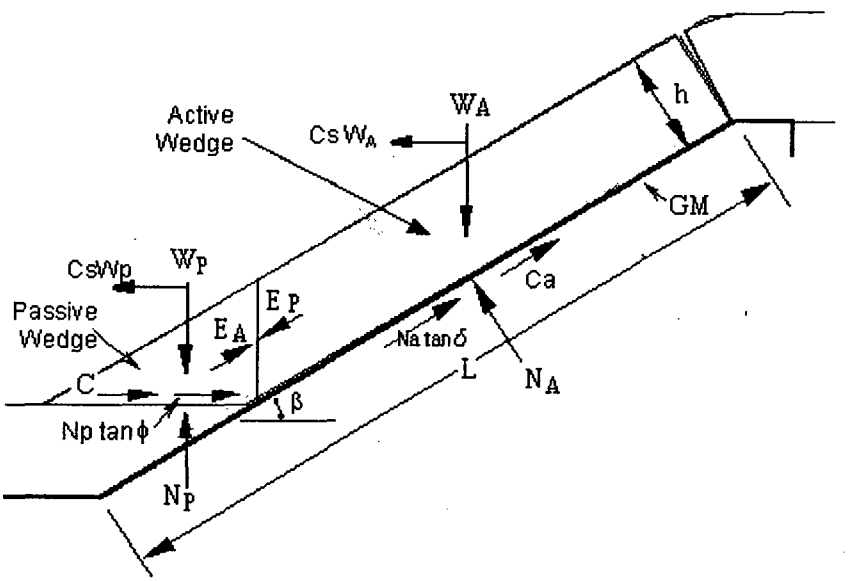
landfilldesign.com

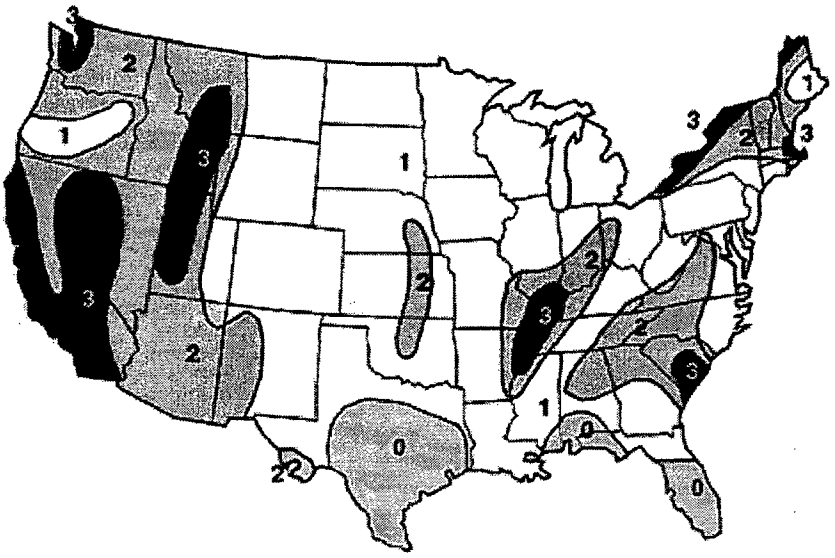
Slope Stability:Seismic Force - Design Calculator

Problem Statement

This slope stability calculator utilizes a pseudo-static analysis to determine the factor of safety (FS) of a geosynthetic lined slope. This calculator assumes that no seepage forces are present. The unit gradient calculator can be used to calculate the required transmissivity of the drainage geocomposite to assure adequate drainage.

Subtitle "D" of the U.S. EPA regulations requires a seismic analysis if the site has experienced a 0.1 g horizontal acceleration, or more, in the past 250 years. For the continental USA, this does not only include the western states, but major sections of the midwest and northeast as well. The map below shows the seismic coefficients for various zones in the USA.





Legend

Zone 0: No damage

Zone 1: Minor damage; corresponds to intensities V and VI on the modified Mercalli intensity scale

Zone 2: Moderate damage; corresponds to intensity VII on the modified Mercalli intensity scale

Zone 3: Major damage; corresponds to intensity VIII and higher on the modified Mercalli intensity scale

Seismic coefficients corresponding to each zone

Zone	Remark	Modified Mercalli Scale	Average Seismic Coefficient (Cs)
0	No damage	-	0
1	Minor damage	V and VI	0.03 to 0.07
2	Moderate damage	VII	0.13
3	Major damage	VIII and higher	0.27

Input Values

Design Inputs

Slope characteristics

Thickness of cover soil (h)	2.13	m
Slope angle (ß)	18.4	degrees
Lenght of slope measured along geomembrane (L)	22.5	m

Soil characteristics

Unit weight of the cover soil (g)	19.6	kN/m^3
Friction angle of the cover soil (F)	15	degrees
Cohesion of the cover soil (c)	11.97	kN/m^2
Interface friction(d)		degrees

	30	
Interface adhesion (Ca)	0	kN/m^2
Seismic characteristic		
Seismic coefficient (Cs)	.08468	g

Seismic Stability Calculation

Solution

Factor of Safety with seismic activity (FS) 1.772

Factor of Safety no seismic activity (FS) 2.386

Additional Assistance

If you would like to have Advanced Geotech Systems provide material specifications that meet your performance criteria, please fill in the following fields and click the submit button. All information is kept strictly confidential.

Name *

Company

Email Address *

Phone

Project Reference

Comments

*required fields

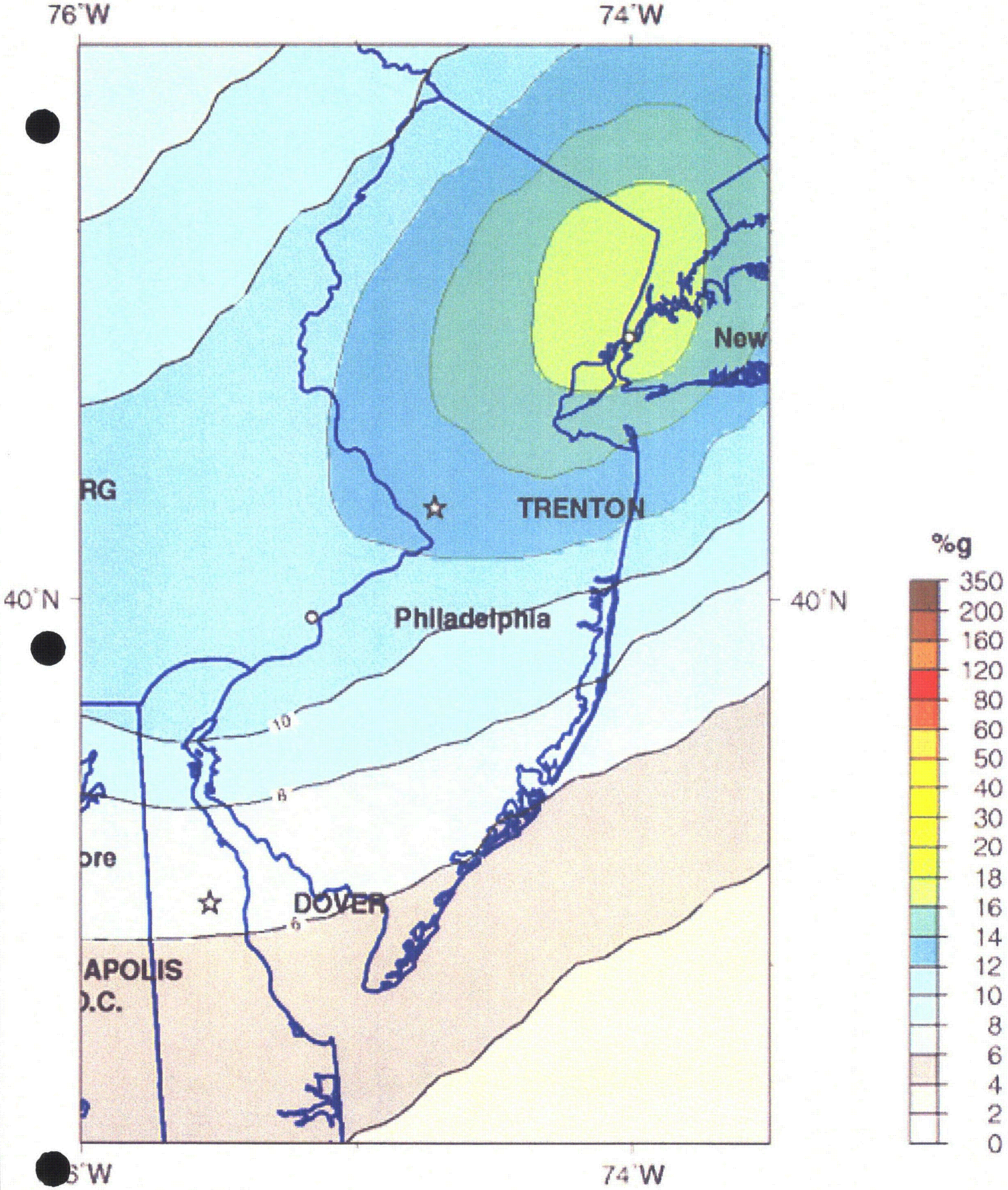
Submit Design Results

References

R. M. Koerner, and T-Y. Soong, 1998. "Analysis and Design of Veneer Cover Soils". Proceedings of 6th International Conference on Geosynthetics, Vol. 1, pp. 1-23, Atlanta, Georgia, USA.

Copyright 2001 Advanced Geotech Systems. All rights reserved.

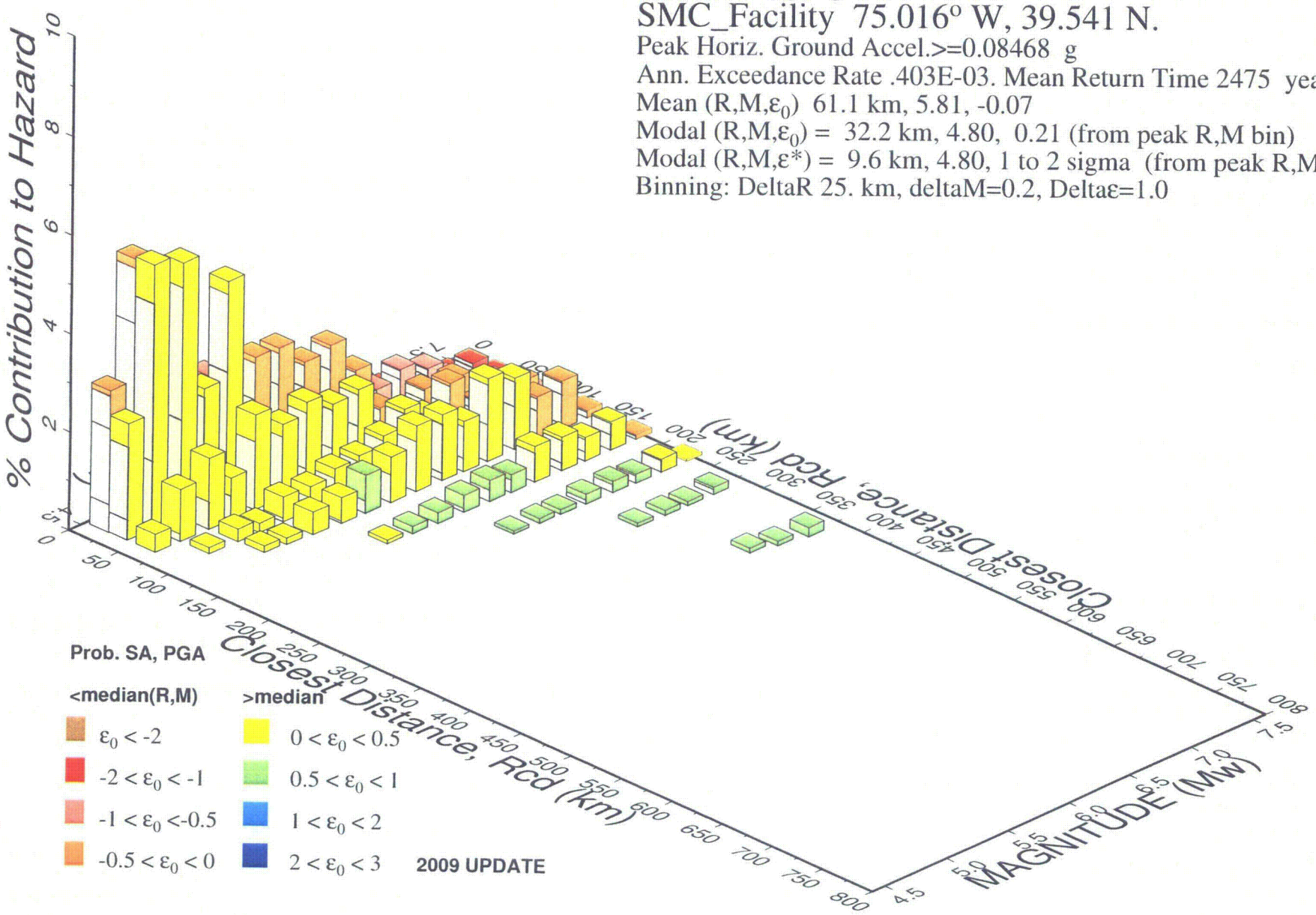
ATTACHMENT L
USGS PSH Deaggregation on NEHRP BC Rock
Seismic Hazard Data for SMC Site



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
site: NEHRP B-C boundary
National Seismic Hazard Mapping Project (2008)

PSH Deaggregation on NEHRP BC rock
SMC_Facility 75.016° W, 39.541 N.

Peak Horiz. Ground Accel.>=0.08468 g
Ann. Exceedance Rate .403E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 61.1 km, 5.81, -0.07
Modal (R,M,ε_0) = 32.2 km, 4.80, 0.21 (from peak R,M bin)
Modal (R,M,ε*) = 9.6 km, 4.80, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Aug 18 13:37:18 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.403E-03
r[at least one eq with median motion>=PGA in 50 yrs]=0.00935
#This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.5	4.60	2.901	0.113	0.676	1.554	0.531	0.027	0.000
31.7	4.61	2.375	0.482	1.492	0.402	0.000	0.000	0.000
59.4	4.61	0.367	0.361	0.006	0.000	0.000	0.000	0.000
13.8	4.80	5.352	0.186	1.113	2.782	1.162	0.109	0.000
32.2	4.80	5.399	0.793	3.215	1.391	0.000	0.000	0.000
60.0	4.81	1.064	0.908	0.157	0.000	0.000	0.000	0.000
88.3	4.82	0.125	0.125	0.000	0.000	0.000	0.000	0.000
14.1	5.03	3.923	0.120	0.718	1.804	1.143	0.136	0.000
33.0	5.03	5.190	0.512	2.696	1.956	0.026	0.000	0.000
60.8	5.04	1.447	0.890	0.556	0.000	0.000	0.000	0.000
89.1	5.04	0.257	0.257	0.000	0.000	0.000	0.000	0.000
114.1	5.05	0.131	0.131	0.000	0.000	0.000	0.000	0.000
14.3	5.21	1.519	0.043	0.257	0.646	0.508	0.063	0.001
33.6	5.21	2.434	0.183	1.071	1.121	0.059	0.000	0.000
61.3	5.21	0.857	0.374	0.483	0.000	0.000	0.000	0.000
89.3	5.21	0.188	0.188	0.000	0.000	0.000	0.000	0.000
116.5	5.21	0.132	0.132	0.000	0.000	0.000	0.000	0.000
14.4	5.39	2.331	0.062	0.373	0.936	0.841	0.116	0.002
34.1	5.40	4.418	0.266	1.586	2.318	0.248	0.000	0.000
61.7	5.40	1.940	0.549	1.368	0.022	0.000	0.000	0.000
89.5	5.40	0.511	0.429	0.081	0.000	0.000	0.000	0.000
118.5	5.41	0.460	0.460	0.000	0.000	0.000	0.000	0.000
14.5	5.61	1.160	0.029	0.175	0.441	0.440	0.071	0.003
34.7	5.61	2.638	0.125	0.747	1.476	0.290	0.000	0.000
62.3	5.62	1.508	0.259	1.074	0.175	0.000	0.000	0.000
89.7	5.62	0.482	0.226	0.256	0.000	0.000	0.000	0.000
119.8	5.62	0.522	0.469	0.053	0.000	0.000	0.000	0.000
165.1	5.63	0.074	0.074	0.000	0.000	0.000	0.000	0.000
14.6	5.80	1.030	0.025	0.151	0.380	0.380	0.089	0.004
35.1	5.80	2.613	0.108	0.644	1.455	0.406	0.000	0.000
62.6	5.81	1.755	0.223	1.147	0.384	0.000	0.000	0.000
89.9	5.81	0.634	0.195	0.439	0.000	0.000	0.000	0.000
120.5	5.81	0.782	0.534	0.248	0.000	0.000	0.000	0.000
166.5	5.82	0.146	0.146	0.000	0.000	0.000	0.000	0.000
13.4	6.01	0.706	0.017	0.100	0.250	0.250	0.084	0.004
35.5	6.01	2.106	0.075	0.446	1.098	0.480	0.007	0.000
63.3	6.01	1.496	0.131	0.779	0.586	0.000	0.000	0.000
89.6	6.01	0.676	0.121	0.544	0.012	0.000	0.000	0.000
121.1	6.01	0.936	0.368	0.568	0.000	0.000	0.000	0.000
168.0	6.01	0.217	0.209	0.008	0.000	0.000	0.000	0.000
13.1	6.21	0.673	0.016	0.094	0.235	0.235	0.087	0.006
36.2	6.21	2.224	0.073	0.433	1.088	0.607	0.023	0.000
63.8	6.21	1.569	0.108	0.645	0.813	0.004	0.000	0.000
88.9	6.22	0.849	0.105	0.607	0.137	0.000	0.000	0.000
121.1	6.22	1.346	0.327	1.017	0.002	0.000	0.000	0.000
168.9	6.22	0.354	0.272	0.082	0.000	0.000	0.000	0.000
217.9	6.22	0.066	0.066	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.453	0.010	0.062	0.157	0.157	0.061	0.005
36.2	6.42	1.486	0.044	0.261	0.655	0.492	0.033	0.000
60.3	6.42	0.934	0.044	0.264	0.583	0.044	0.000	0.000
84.5	6.42	1.118	0.086	0.517	0.515	0.000	0.000	0.000

122.0	6.42	1.345	0.197	0.998	0.150	0.000	0.000	0.000
169.4	6.43	0.434	0.200	0.234	0.000	0.000	0.000	0.000
218.8	6.43	0.101	0.099	0.002	0.000	0.000	0.000	0.000
13.1	6.59	0.274	0.006	0.038	0.095	0.095	0.038	0.004
35.8	6.59	0.899	0.025	0.149	0.374	0.321	0.030	0.000
60.0	6.59	0.631	0.026	0.155	0.377	0.074	0.000	0.000
84.6	6.59	0.809	0.050	0.302	0.457	0.000	0.000	0.000
122.8	6.59	1.026	0.111	0.643	0.273	0.000	0.000	0.000
169.9	6.60	0.369	0.111	0.258	0.000	0.000	0.000	0.000
219.5	6.60	0.100	0.085	0.016	0.000	0.000	0.000	0.000
16.3	6.80	0.512	0.012	0.071	0.177	0.177	0.068	0.006
37.3	6.77	1.118	0.030	0.179	0.450	0.416	0.043	0.000
60.1	6.78	0.910	0.033	0.197	0.494	0.186	0.000	0.000
85.3	6.78	1.258	0.064	0.383	0.797	0.014	0.000	0.000
123.4	6.79	1.697	0.136	0.811	0.751	0.000	0.000	0.000
170.0	6.79	0.724	0.139	0.558	0.028	0.000	0.000	0.000
220.5	6.79	0.211	0.121	0.090	0.000	0.000	0.000	0.000
271.7	6.79	0.080	0.079	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.284	0.006	0.039	0.097	0.097	0.039	0.005
36.6	7.00	0.872	0.022	0.132	0.332	0.328	0.057	0.000
65.0	7.00	0.938	0.032	0.188	0.473	0.245	0.000	0.000
89.7	7.00	0.666	0.028	0.167	0.418	0.053	0.000	0.000
123.3	7.00	1.459	0.083	0.498	0.872	0.005	0.000	0.000
170.9	7.00	0.690	0.082	0.459	0.150	0.000	0.000	0.000
221.0	7.01	0.238	0.074	0.164	0.000	0.000	0.000	0.000
272.4	7.01	0.105	0.082	0.024	0.000	0.000	0.000	0.000
356.6	7.01	0.097	0.097	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.163	0.004	0.022	0.056	0.056	0.022	0.003
36.4	7.19	0.479	0.012	0.071	0.178	0.178	0.040	0.000
60.6	7.19	0.379	0.011	0.068	0.170	0.130	0.000	0.000
85.3	7.19	0.561	0.020	0.122	0.305	0.114	0.000	0.000
123.6	7.19	0.881	0.042	0.251	0.557	0.031	0.000	0.000
171.4	7.19	0.479	0.042	0.250	0.186	0.000	0.000	0.000
221.6	7.19	0.183	0.037	0.143	0.002	0.000	0.000	0.000
272.9	7.19	0.090	0.045	0.045	0.000	0.000	0.000	0.000
362.9	7.19	0.099	0.095	0.003	0.000	0.000	0.000	0.000
14.5	7.38	0.160	0.004	0.022	0.055	0.055	0.022	0.003
35.7	7.38	0.544	0.013	0.079	0.197	0.197	0.057	0.001
60.2	7.39	0.411	0.012	0.069	0.174	0.154	0.002	0.000
85.5	7.39	0.638	0.021	0.125	0.315	0.176	0.000	0.000
124.0	7.38	0.986	0.040	0.241	0.595	0.110	0.000	0.000
172.1	7.39	0.585	0.039	0.231	0.315	0.000	0.000	0.000
222.0	7.39	0.269	0.036	0.195	0.038	0.000	0.000	0.000
273.1	7.40	0.152	0.045	0.107	0.000	0.000	0.000	0.000
368.3	7.40	0.189	0.152	0.037	0.000	0.000	0.000	0.000
35.6	7.59	0.081	0.002	0.011	0.029	0.029	0.010	0.000
64.8	7.59	0.090	0.002	0.015	0.037	0.034	0.001	0.000
89.5	7.59	0.066	0.002	0.012	0.030	0.022	0.000	0.000
123.7	7.59	0.151	0.005	0.032	0.080	0.033	0.000	0.000
172.5	7.59	0.097	0.005	0.030	0.061	0.001	0.000	0.000
222.6	7.59	0.052	0.005	0.028	0.019	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 100.0
Mean src-site R= 61.1 km; M= 5.81; eps0= -0.07. Mean calculated for all sources.
Modal src-site R= 32.2 km; M= 4.80; eps0= 0.21 from peak (R,M) bin
MODE R*= 33.6km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 3.215

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).

CEUS gridded 99.97 60.9 5.81 -0.07
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Mean Hazard w/all GMPEs *********#

A Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.110E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.02751
#This deaggregation corresponds to Toro et al. 1997

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.8	4.60	0.807	0.113	0.599	0.095	0.000	0.000	0.000
32.5	4.61	0.835	0.443	0.392	0.000	0.000	0.000	0.000
60.2	4.61	0.201	0.201	0.000	0.000	0.000	0.000	0.000
87.2	4.62	0.018	0.018	0.000	0.000	0.000	0.000	0.000
13.9	4.80	1.404	0.186	1.032	0.185	0.000	0.000	0.000
32.9	4.80	1.650	0.754	0.896	0.000	0.000	0.000	0.000
60.7	4.81	0.473	0.473	0.000	0.000	0.000	0.000	0.000
88.1	4.82	0.060	0.060	0.000	0.000	0.000	0.000	0.000
14.2	5.03	1.024	0.120	0.715	0.188	0.000	0.000	0.000
33.6	5.03	1.560	0.512	1.047	0.002	0.000	0.000	0.000
61.4	5.04	0.605	0.563	0.041	0.000	0.000	0.000	0.000
88.8	5.04	0.109	0.109	0.000	0.000	0.000	0.000	0.000
112.1	5.05	0.041	0.041	0.000	0.000	0.000	0.000	0.000
14.4	5.21	0.394	0.043	0.257	0.094	0.000	0.000	0.000
34.1	5.21	0.719	0.183	0.531	0.005	0.000	0.000	0.000
61.8	5.21	0.342	0.280	0.063	0.000	0.000	0.000	0.000
89.0	5.21	0.075	0.075	0.000	0.000	0.000	0.000	0.000
114.9	5.21	0.040	0.040	0.000	0.000	0.000	0.000	0.000
14.5	5.39	0.602	0.062	0.373	0.167	0.000	0.000	0.000
34.5	5.39	1.277	0.266	0.984	0.028	0.000	0.000	0.000
62.2	5.40	0.737	0.488	0.248	0.000	0.000	0.000	0.000
89.2	5.40	0.188	0.188	0.000	0.000	0.000	0.000	0.000
117.0	5.40	0.128	0.128	0.000	0.000	0.000	0.000	0.000
14.6	5.61	0.299	0.029	0.175	0.094	0.000	0.000	0.000
35.1	5.61	0.766	0.125	0.595	0.046	0.000	0.000	0.000
62.8	5.62	0.568	0.255	0.312	0.000	0.000	0.000	0.000
89.5	5.62	0.178	0.161	0.016	0.000	0.000	0.000	0.000
118.7	5.62	0.153	0.153	0.000	0.000	0.000	0.000	0.000
165.1	5.63	0.020	0.020	0.000	0.000	0.000	0.000	0.000
14.7	5.80	0.261	0.025	0.151	0.085	0.000	0.000	0.000
35.3	5.80	0.707	0.108	0.546	0.054	0.000	0.000	0.000
63.0	5.81	0.563	0.223	0.340	0.000	0.000	0.000	0.000
89.5	5.81	0.187	0.158	0.029	0.000	0.000	0.000	0.000
119.1	5.81	0.170	0.170	0.000	0.000	0.000	0.000	0.000
165.9	5.82	0.027	0.027	0.000	0.000	0.000	0.000	0.000
13.5	6.01	0.179	0.017	0.100	0.062	0.000	0.000	0.000
35.8	6.01	0.585	0.075	0.425	0.086	0.000	0.000	0.000
63.7	6.01	0.501	0.131	0.370	0.000	0.000	0.000	0.000
89.3	6.01	0.215	0.120	0.095	0.000	0.000	0.000	0.000
120.0	6.01	0.232	0.212	0.020	0.000	0.000	0.000	0.000
168.3	6.01	0.052	0.052	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.169	0.016	0.094	0.060	0.000	0.000	0.000
36.3	6.21	0.591	0.073	0.421	0.097	0.000	0.000	0.000
64.0	6.21	0.460	0.108	0.351	0.001	0.000	0.000	0.000
88.6	6.21	0.224	0.105	0.119	0.000	0.000	0.000	0.000
119.5	6.22	0.258	0.222	0.035	0.000	0.000	0.000	0.000
168.8	6.22	0.058	0.058	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.114	0.010	0.062	0.041	0.000	0.000	0.000

36.5	6.42	0.402	0.044	0.261	0.098	0.000	0.000	0.000
60.5	6.42	0.279	0.044	0.226	0.009	0.000	0.000	0.000
84.0	6.42	0.324	0.086	0.237	0.000	0.000	0.000	0.000
120.6	6.42	0.290	0.180	0.110	0.000	0.000	0.000	0.000
169.6	6.42	0.085	0.085	0.000	0.000	0.000	0.000	0.000
218.7	6.43	0.020	0.020	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.069	0.006	0.038	0.025	0.000	0.000	0.000
36.0	6.59	0.237	0.025	0.149	0.064	0.000	0.000	0.000
60.1	6.60	0.176	0.026	0.140	0.010	0.000	0.000	0.000
84.0	6.60	0.212	0.050	0.161	0.000	0.000	0.000	0.000
121.3	6.60	0.194	0.106	0.089	0.000	0.000	0.000	0.000
169.9	6.61	0.061	0.057	0.004	0.000	0.000	0.000	0.000
219.2	6.61	0.016	0.016	0.000	0.000	0.000	0.000	0.000
16.3	6.80	0.129	0.012	0.071	0.046	0.000	0.000	0.000
37.4	6.77	0.293	0.030	0.179	0.084	0.000	0.000	0.000
60.1	6.78	0.245	0.033	0.190	0.022	0.000	0.000	0.000
84.7	6.78	0.307	0.064	0.242	0.001	0.000	0.000	0.000
121.8	6.78	0.293	0.135	0.158	0.000	0.000	0.000	0.000
169.8	6.79	0.103	0.093	0.010	0.000	0.000	0.000	0.000
220.0	6.79	0.028	0.028	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.071	0.006	0.039	0.026	0.000	0.000	0.000
36.8	7.00	0.229	0.022	0.132	0.075	0.000	0.000	0.000
65.0	7.00	0.259	0.032	0.186	0.041	0.000	0.000	0.000
89.5	7.00	0.167	0.028	0.137	0.002	0.000	0.000	0.000
121.9	7.00	0.285	0.083	0.202	0.000	0.000	0.000	0.000
170.8	7.00	0.115	0.076	0.039	0.000	0.000	0.000	0.000
220.8	7.00	0.038	0.038	0.001	0.000	0.000	0.000	0.000
271.8	7.01	0.015	0.015	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.041	0.004	0.022	0.015	0.000	0.000	0.000
36.5	7.19	0.124	0.012	0.071	0.042	0.000	0.000	0.000
60.6	7.19	0.102	0.011	0.068	0.023	0.000	0.000	0.000
84.8	7.19	0.138	0.020	0.110	0.008	0.000	0.000	0.000
122.0	7.19	0.162	0.042	0.120	0.000	0.000	0.000	0.000
171.0	7.19	0.070	0.040	0.030	0.000	0.000	0.000	0.000
221.2	7.20	0.025	0.023	0.002	0.000	0.000	0.000	0.000
14.5	7.38	0.040	0.004	0.022	0.015	0.000	0.000	0.000
35.8	7.38	0.140	0.013	0.079	0.048	0.000	0.000	0.000
60.2	7.39	0.109	0.012	0.069	0.029	0.000	0.000	0.000
85.0	7.39	0.156	0.021	0.121	0.014	0.000	0.000	0.000
122.4	7.39	0.181	0.040	0.140	0.000	0.000	0.000	0.000
171.3	7.39	0.081	0.039	0.042	0.000	0.000	0.000	0.000
221.4	7.39	0.031	0.027	0.004	0.000	0.000	0.000	0.000
272.3	7.39	0.015	0.015	0.000	0.000	0.000	0.000	0.000
35.7	7.59	0.021	0.002	0.011	0.007	0.000	0.000	0.000
64.8	7.59	0.024	0.002	0.015	0.007	0.000	0.000	0.000
89.4	7.59	0.016	0.002	0.012	0.002	0.000	0.000	0.000
122.3	7.59	0.030	0.005	0.025	0.000	0.000	0.000	0.000
171.7	7.58	0.015	0.005	0.010	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 27.4
Mean src-site R= 54.2 km; M= 5.70; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 32.9 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 32.1km; M*= 5.03; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 1.047

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
CEUS gridded	27.40	54.2	5.70	0.00

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)

#*********End of deaggregation corresponding to Toro et al. 1997 *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.141E-04
[at least one eq with median motion>=PGA in 50 yrs]=0.00337
#This deaggregation corresponds to Atkinson-Boore06,140 bar

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
10.3	4.60	0.145	0.068	0.077	0.000	0.000	0.000	0.000
11.6	4.80	0.331	0.157	0.173	0.000	0.000	0.000	0.000
12.5	5.03	0.287	0.133	0.154	0.000	0.000	0.000	0.000
27.6	5.08	0.023	0.023	0.000	0.000	0.000	0.000	0.000
12.6	5.21	0.120	0.043	0.077	0.000	0.000	0.000	0.000
27.7	5.21	0.027	0.027	0.000	0.000	0.000	0.000	0.000
13.2	5.40	0.205	0.062	0.142	0.000	0.000	0.000	0.000
28.8	5.40	0.074	0.069	0.004	0.000	0.000	0.000	0.000
13.7	5.61	0.113	0.029	0.084	0.000	0.000	0.000	0.000
30.0	5.62	0.064	0.054	0.010	0.000	0.000	0.000	0.000
54.9	5.63	0.002	0.002	0.000	0.000	0.000	0.000	0.000
14.0	5.80	0.108	0.025	0.083	0.000	0.000	0.000	0.000
31.0	5.81	0.087	0.064	0.022	0.000	0.000	0.000	0.000
56.9	5.82	0.007	0.007	0.000	0.000	0.000	0.000	0.000
121.2	5.85	0.002	0.002	0.000	0.000	0.000	0.000	0.000
13.1	6.01	0.080	0.017	0.064	0.000	0.000	0.000	0.000
31.4	6.01	0.091	0.056	0.034	0.000	0.000	0.000	0.000
59.5	6.02	0.011	0.011	0.000	0.000	0.000	0.000	0.000
88.7	6.01	0.004	0.004	0.000	0.000	0.000	0.000	0.000
123.6	6.02	0.008	0.008	0.000	0.000	0.000	0.000	0.000
12.9	6.21	0.080	0.016	0.064	0.000	0.000	0.000	0.000
32.4	6.21	0.118	0.064	0.054	0.000	0.000	0.000	0.000
61.3	6.22	0.019	0.019	0.000	0.000	0.000	0.000	0.000
89.3	6.22	0.009	0.009	0.000	0.000	0.000	0.000	0.000
123.7	6.23	0.021	0.021	0.000	0.000	0.000	0.000	0.000
165.1	6.23	0.005	0.005	0.000	0.000	0.000	0.000	0.000
13.0	6.42	0.055	0.010	0.044	0.000	0.000	0.000	0.000
33.0	6.42	0.095	0.043	0.051	0.000	0.000	0.000	0.000
58.9	6.43	0.018	0.018	0.000	0.000	0.000	0.000	0.000
85.3	6.43	0.016	0.016	0.000	0.000	0.000	0.000	0.000
124.2	6.43	0.029	0.029	0.000	0.000	0.000	0.000	0.000
167.9	6.43	0.010	0.010	0.000	0.000	0.000	0.000	0.000
17.1	6.58	0.051	0.011	0.041	0.000	0.000	0.000	0.000
36.4	6.60	0.049	0.021	0.028	0.000	0.000	0.000	0.000
58.7	6.59	0.017	0.017	0.000	0.000	0.000	0.000	0.000
85.3	6.59	0.016	0.016	0.000	0.000	0.000	0.000	0.000
124.6	6.59	0.028	0.028	0.000	0.000	0.000	0.000	0.000
169.0	6.59	0.011	0.011	0.000	0.000	0.000	0.000	0.000
217.1	6.60	0.002	0.002	0.000	0.000	0.000	0.000	0.000
16.0	6.80	0.062	0.012	0.050	0.000	0.000	0.000	0.000
35.4	6.77	0.088	0.030	0.058	0.000	0.000	0.000	0.000
58.9	6.79	0.032	0.028	0.004	0.000	0.000	0.000	0.000
85.8	6.79	0.033	0.033	0.000	0.000	0.000	0.000	0.000
124.8	6.79	0.059	0.059	0.000	0.000	0.000	0.000	0.000
169.4	6.79	0.027	0.027	0.000	0.000	0.000	0.000	0.000
219.6	6.80	0.007	0.007	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.035	0.006	0.029	0.000	0.000	0.000	0.000
34.9	7.00	0.078	0.022	0.056	0.000	0.000	0.000	0.000
63.2	7.00	0.038	0.030	0.008	0.000	0.000	0.000	0.000
89.8	7.01	0.023	0.023	0.000	0.000	0.000	0.000	0.000
124.3	7.01	0.060	0.060	0.000	0.000	0.000	0.000	0.000

170.4	7.01	0.029	0.029	0.000	0.000	0.000	0.000	0.000
220.6	7.01	0.009	0.009	0.000	0.000	0.000	0.000	0.000
271.4	7.01	0.003	0.003	0.000	0.000	0.000	0.000	0.000
14.4	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
35.1	7.19	0.047	0.012	0.035	0.000	0.000	0.000	0.000
59.7	7.19	0.020	0.011	0.009	0.000	0.000	0.000	0.000
85.5	7.19	0.023	0.020	0.003	0.000	0.000	0.000	0.000
124.4	7.19	0.042	0.041	0.002	0.000	0.000	0.000	0.000
170.9	7.19	0.023	0.023	0.000	0.000	0.000	0.000	0.000
221.4	7.19	0.008	0.008	0.000	0.000	0.000	0.000	0.000
272.4	7.19	0.004	0.004	0.000	0.000	0.000	0.000	0.000
331.8	7.19	0.002	0.002	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
34.7	7.39	0.057	0.013	0.043	0.000	0.000	0.000	0.000
59.4	7.39	0.026	0.012	0.014	0.000	0.000	0.000	0.000
85.6	7.39	0.032	0.021	0.011	0.000	0.000	0.000	0.000
124.5	7.39	0.055	0.040	0.015	0.000	0.000	0.000	0.000
171.5	7.39	0.031	0.030	0.001	0.000	0.000	0.000	0.000
221.8	7.39	0.013	0.013	0.000	0.000	0.000	0.000	0.000
272.9	7.40	0.007	0.007	0.000	0.000	0.000	0.000	0.000
341.7	7.34	0.003	0.003	0.000	0.000	0.000	0.000	0.000
350.7	7.47	0.003	0.003	0.000	0.000	0.000	0.000	0.000
14.5	7.59	0.003	0.000	0.002	0.000	0.000	0.000	0.000
34.8	7.59	0.009	0.002	0.007	0.000	0.000	0.000	0.000
63.7	7.59	0.006	0.002	0.004	0.000	0.000	0.000	0.000
89.6	7.59	0.004	0.002	0.002	0.000	0.000	0.000	0.000
124.1	7.59	0.009	0.005	0.004	0.000	0.000	0.000	0.000
171.8	7.59	0.006	0.005	0.001	0.000	0.000	0.000	0.000
222.3	7.60	0.003	0.003	0.000	0.000	0.000	0.000	0.000
358.3	7.60	0.002	0.002	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 3.5
Mean src-site R= 45.1 km; M= 6.03; eps0= 0.01. Mean calculated for all sources.
Modal src-site R= 11.6 km; M= 4.80; eps0= -0.05 from peak (R,M) bin
MODE R*= 8.9km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.173

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 3.51 45.1 6.03 0.01
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Atkinson-Boore06,140 bar *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.769E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.03840
#This deaggregation corresponds to Frankel et al., 1996

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.1	4.60	0.454	0.113	0.341	0.000	0.000	0.000	0.000
31.8	4.61	0.447	0.331	0.116	0.000	0.000	0.000	0.000
59.1	4.61	0.062	0.062	0.000	0.000	0.000	0.000	0.000
14.3	4.80	0.825	0.186	0.638	0.000	0.000	0.000	0.000
32.6	4.80	1.069	0.677	0.391	0.000	0.000	0.000	0.000
60.1	4.81	0.227	0.227	0.000	0.000	0.000	0.000	0.000
89.0	4.81	0.035	0.035	0.000	0.000	0.000	0.000	0.000
110.5	4.83	0.013	0.013	0.000	0.000	0.000	0.000	0.000
14.5	5.03	0.579	0.120	0.459	0.000	0.000	0.000	0.000

33.5	5.03	0.988	0.502	0.486	0.000	0.000	0.000	0.000
61.0	5.04	0.324	0.324	0.000	0.000	0.000	0.000	0.000
89.6	5.04	0.073	0.073	0.000	0.000	0.000	0.000	0.000
116.5	5.05	0.059	0.059	0.000	0.000	0.000	0.000	0.000
14.6	5.21	0.217	0.043	0.174	0.000	0.000	0.000	0.000
34.1	5.21	0.447	0.183	0.264	0.000	0.000	0.000	0.000
61.7	5.21	0.193	0.193	0.000	0.000	0.000	0.000	0.000
89.8	5.21	0.053	0.053	0.000	0.000	0.000	0.000	0.000
118.8	5.21	0.054	0.054	0.000	0.000	0.000	0.000	0.000
14.7	5.39	0.324	0.062	0.262	0.000	0.000	0.000	0.000
34.7	5.40	0.784	0.265	0.519	0.000	0.000	0.000	0.000
62.2	5.40	0.430	0.388	0.042	0.000	0.000	0.000	0.000
89.9	5.40	0.143	0.143	0.000	0.000	0.000	0.000	0.000
120.2	5.41	0.176	0.176	0.000	0.000	0.000	0.000	0.000
164.3	5.42	0.027	0.027	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.156	0.029	0.127	0.000	0.000	0.000	0.000
35.2	5.61	0.440	0.125	0.315	0.000	0.000	0.000	0.000
62.9	5.62	0.315	0.241	0.074	0.000	0.000	0.000	0.000
90.0	5.62	0.127	0.127	0.000	0.000	0.000	0.000	0.000
121.1	5.62	0.177	0.177	0.000	0.000	0.000	0.000	0.000
167.1	5.62	0.040	0.040	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.136	0.025	0.111	0.000	0.000	0.000	0.000
35.6	5.80	0.427	0.108	0.319	0.000	0.000	0.000	0.000
63.3	5.81	0.372	0.223	0.149	0.000	0.000	0.000	0.000
90.2	5.81	0.172	0.168	0.004	0.000	0.000	0.000	0.000
121.7	5.81	0.264	0.264	0.000	0.000	0.000	0.000	0.000
168.3	5.81	0.075	0.075	0.000	0.000	0.000	0.000	0.000
216.5	5.82	0.011	0.011	0.000	0.000	0.000	0.000	0.000
13.5	6.01	0.091	0.017	0.074	0.000	0.000	0.000	0.000
36.0	6.01	0.325	0.075	0.250	0.000	0.000	0.000	0.000
63.9	6.01	0.288	0.131	0.157	0.000	0.000	0.000	0.000
89.8	6.01	0.159	0.121	0.039	0.000	0.000	0.000	0.000
122.1	6.01	0.271	0.266	0.005	0.000	0.000	0.000	0.000
169.5	6.01	0.088	0.088	0.000	0.000	0.000	0.000	0.000
218.8	6.02	0.019	0.019	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.086	0.016	0.070	0.000	0.000	0.000	0.000
36.7	6.21	0.336	0.073	0.263	0.000	0.000	0.000	0.000
64.4	6.21	0.295	0.108	0.187	0.000	0.000	0.000	0.000
89.1	6.21	0.192	0.105	0.087	0.000	0.000	0.000	0.000
122.2	6.22	0.370	0.305	0.065	0.000	0.000	0.000	0.000
170.3	6.22	0.138	0.138	0.000	0.000	0.000	0.000	0.000
219.4	6.22	0.038	0.038	0.000	0.000	0.000	0.000	0.000
269.7	6.23	0.010	0.010	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.057	0.010	0.047	0.000	0.000	0.000	0.000
36.7	6.42	0.214	0.044	0.170	0.000	0.000	0.000	0.000
60.5	6.42	0.155	0.044	0.111	0.000	0.000	0.000	0.000
84.8	6.42	0.215	0.086	0.128	0.000	0.000	0.000	0.000
123.0	6.42	0.316	0.196	0.119	0.000	0.000	0.000	0.000
170.7	6.42	0.141	0.139	0.002	0.000	0.000	0.000	0.000
220.0	6.43	0.045	0.045	0.000	0.000	0.000	0.000	0.000
271.4	6.43	0.015	0.015	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.035	0.006	0.028	0.000	0.000	0.000	0.000
36.3	6.59	0.127	0.025	0.102	0.000	0.000	0.000	0.000
60.2	6.59	0.102	0.026	0.076	0.000	0.000	0.000	0.000
84.9	6.59	0.149	0.050	0.098	0.000	0.000	0.000	0.000
123.7	6.59	0.224	0.111	0.114	0.000	0.000	0.000	0.000
171.2	6.59	0.111	0.099	0.012	0.000	0.000	0.000	0.000
220.7	6.59	0.042	0.042	0.000	0.000	0.000	0.000	0.000
271.9	6.59	0.017	0.017	0.000	0.000	0.000	0.000	0.000
333.7	6.60	0.010	0.010	0.000	0.000	0.000	0.000	0.000

16.3	6.80	0.065	0.012	0.053	0.000	0.000	0.000	0.000
37.6	6.77	0.156	0.030	0.126	0.000	0.000	0.000	0.000
60.3	6.78	0.142	0.033	0.109	0.000	0.000	0.000	0.000
85.6	6.78	0.220	0.064	0.156	0.000	0.000	0.000	0.000
124.1	6.78	0.341	0.136	0.206	0.000	0.000	0.000	0.000
171.4	6.79	0.195	0.138	0.057	0.000	0.000	0.000	0.000
221.6	6.79	0.079	0.079	0.000	0.000	0.000	0.000	0.000
272.5	6.79	0.038	0.038	0.000	0.000	0.000	0.000	0.000
344.8	6.80	0.031	0.031	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.036	0.006	0.029	0.000	0.000	0.000	0.000
36.9	7.00	0.118	0.022	0.096	0.000	0.000	0.000	0.000
65.2	7.00	0.142	0.032	0.110	0.000	0.000	0.000	0.000
89.8	7.00	0.108	0.028	0.080	0.000	0.000	0.000	0.000
123.8	7.00	0.260	0.083	0.176	0.000	0.000	0.000	0.000
172.1	7.00	0.157	0.082	0.075	0.000	0.000	0.000	0.000
222.1	7.01	0.074	0.067	0.007	0.000	0.000	0.000	0.000
273.2	7.01	0.041	0.041	0.000	0.000	0.000	0.000	0.000
356.2	7.01	0.045	0.045	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
36.6	7.19	0.064	0.012	0.052	0.000	0.000	0.000	0.000
60.7	7.19	0.055	0.011	0.044	0.000	0.000	0.000	0.000
85.4	7.18	0.088	0.020	0.067	0.000	0.000	0.000	0.000
124.1	7.18	0.150	0.042	0.108	0.000	0.000	0.000	0.000
172.6	7.18	0.101	0.042	0.059	0.000	0.000	0.000	0.000
222.7	7.19	0.052	0.037	0.015	0.000	0.000	0.000	0.000
273.6	7.19	0.033	0.033	0.000	0.000	0.000	0.000	0.000
362.8	7.19	0.042	0.042	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
35.9	7.38	0.071	0.013	0.058	0.000	0.000	0.000	0.000
60.3	7.39	0.059	0.012	0.047	0.000	0.000	0.000	0.000
85.6	7.39	0.097	0.021	0.076	0.000	0.000	0.000	0.000
124.4	7.38	0.162	0.040	0.121	0.000	0.000	0.000	0.000
173.1	7.39	0.113	0.039	0.074	0.000	0.000	0.000	0.000
223.0	7.39	0.067	0.036	0.031	0.000	0.000	0.000	0.000
273.9	7.39	0.048	0.042	0.006	0.000	0.000	0.000	0.000
369.2	7.39	0.072	0.072	0.000	0.000	0.000	0.000	0.000
35.7	7.59	0.010	0.002	0.009	0.000	0.000	0.000	0.000
65.0	7.59	0.013	0.002	0.010	0.000	0.000	0.000	0.000
89.6	7.59	0.010	0.002	0.008	0.000	0.000	0.000	0.000
124.0	7.59	0.024	0.005	0.018	0.000	0.000	0.000	0.000
173.2	7.59	0.017	0.005	0.012	0.000	0.000	0.000	0.000
223.5	7.59	0.011	0.005	0.006	0.000	0.000	0.000	0.000
373.9	7.60	0.016	0.016	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 19.1
Mean src-site R= 73.9 km; M= 5.82; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 32.6 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 35.2km; M*= 4.80; EPS.INTERVAL:> 2 sigma % CONTRIB.= 0.677

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 19.11 73.9 5.82 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Frankel et al., 1996 *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below

Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.659E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.03289
#This deaggregation corresponds to Campbell CEUS Hybrid

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.3	4.60	0.531	0.113	0.417	0.000	0.000	0.000	0.000
31.2	4.60	0.526	0.338	0.188	0.000	0.000	0.000	0.000
57.4	4.61	0.043	0.043	0.000	0.000	0.000	0.000	0.000
14.5	4.79	0.929	0.186	0.742	0.000	0.000	0.000	0.000
31.9	4.80	1.184	0.664	0.521	0.000	0.000	0.000	0.000
58.4	4.81	0.141	0.141	0.000	0.000	0.000	0.000	0.000
88.9	4.82	0.015	0.015	0.000	0.000	0.000	0.000	0.000
14.7	5.03	0.630	0.120	0.509	0.000	0.000	0.000	0.000
32.8	5.03	1.061	0.490	0.570	0.000	0.000	0.000	0.000
59.2	5.04	0.188	0.188	0.000	0.000	0.000	0.000	0.000
89.5	5.04	0.031	0.031	0.000	0.000	0.000	0.000	0.000
114.0	5.05	0.021	0.021	0.000	0.000	0.000	0.000	0.000
14.8	5.21	0.231	0.043	0.188	0.000	0.000	0.000	0.000
33.5	5.21	0.475	0.183	0.292	0.000	0.000	0.000	0.000
59.7	5.21	0.113	0.113	0.000	0.000	0.000	0.000	0.000
89.7	5.21	0.023	0.023	0.000	0.000	0.000	0.000	0.000
117.0	5.21	0.021	0.021	0.000	0.000	0.000	0.000	0.000
14.8	5.39	0.339	0.062	0.276	0.000	0.000	0.000	0.000
34.2	5.40	0.827	0.265	0.562	0.000	0.000	0.000	0.000
60.3	5.40	0.262	0.253	0.010	0.000	0.000	0.000	0.000
89.9	5.41	0.063	0.063	0.000	0.000	0.000	0.000	0.000
118.8	5.41	0.070	0.070	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.161	0.029	0.131	0.000	0.000	0.000	0.000
34.9	5.61	0.469	0.125	0.344	0.000	0.000	0.000	0.000
61.0	5.62	0.206	0.172	0.034	0.000	0.000	0.000	0.000
90.0	5.62	0.059	0.059	0.000	0.000	0.000	0.000	0.000
119.8	5.62	0.075	0.075	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.139	0.025	0.114	0.000	0.000	0.000	0.000
35.5	5.80	0.457	0.108	0.350	0.000	0.000	0.000	0.000
61.6	5.81	0.263	0.188	0.075	0.000	0.000	0.000	0.000
90.1	5.81	0.089	0.089	0.000	0.000	0.000	0.000	0.000
120.5	5.81	0.122	0.122	0.000	0.000	0.000	0.000	0.000
162.4	5.82	0.014	0.014	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.092	0.017	0.075	0.000	0.000	0.000	0.000
36.0	6.01	0.348	0.075	0.273	0.000	0.000	0.000	0.000
62.4	6.01	0.223	0.129	0.094	0.000	0.000	0.000	0.000
89.7	6.01	0.094	0.094	0.000	0.000	0.000	0.000	0.000
120.9	6.01	0.140	0.140	0.000	0.000	0.000	0.000	0.000
164.9	6.01	0.021	0.021	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.086	0.016	0.070	0.000	0.000	0.000	0.000
36.8	6.21	0.359	0.073	0.287	0.000	0.000	0.000	0.000
63.3	6.21	0.252	0.108	0.144	0.000	0.000	0.000	0.000
89.0	6.22	0.132	0.104	0.028	0.000	0.000	0.000	0.000
120.8	6.22	0.220	0.216	0.004	0.000	0.000	0.000	0.000
166.4	6.22	0.038	0.038	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.057	0.010	0.047	0.000	0.000	0.000	0.000
36.9	6.42	0.228	0.044	0.184	0.000	0.000	0.000	0.000
60.1	6.42	0.153	0.044	0.109	0.000	0.000	0.000	0.000
84.7	6.42	0.174	0.086	0.088	0.000	0.000	0.000	0.000
121.6	6.42	0.219	0.178	0.042	0.000	0.000	0.000	0.000
167.2	6.43	0.049	0.049	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.035	0.006	0.028	0.000	0.000	0.000	0.000
36.5	6.59	0.134	0.025	0.109	0.000	0.000	0.000	0.000
59.9	6.59	0.106	0.026	0.080	0.000	0.000	0.000	0.000
84.8	6.59	0.134	0.050	0.083	0.000	0.000	0.000	0.000
122.5	6.59	0.178	0.110	0.068	0.000	0.000	0.000	0.000

167.8	6.59	0.046	0.046	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.065	0.012	0.053	0.000	0.000	0.000	0.000
37.8	6.77	0.163	0.030	0.133	0.000	0.000	0.000	0.000
60.1	6.78	0.152	0.033	0.119	0.000	0.000	0.000	0.000
85.5	6.79	0.217	0.064	0.153	0.000	0.000	0.000	0.000
123.2	6.79	0.309	0.136	0.173	0.000	0.000	0.000	0.000
168.2	6.79	0.101	0.094	0.008	0.000	0.000	0.000	0.000
217.4	6.80	0.016	0.016	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.036	0.006	0.029	0.000	0.000	0.000	0.000
37.1	7.00	0.121	0.022	0.099	0.000	0.000	0.000	0.000
65.1	7.00	0.152	0.032	0.121	0.000	0.000	0.000	0.000
89.7	7.00	0.115	0.028	0.087	0.000	0.000	0.000	0.000
123.2	7.00	0.265	0.083	0.181	0.000	0.000	0.000	0.000
169.4	7.01	0.102	0.074	0.028	0.000	0.000	0.000	0.000
218.3	7.01	0.021	0.021	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
36.8	7.19	0.065	0.012	0.053	0.000	0.000	0.000	0.000
60.7	7.19	0.060	0.011	0.049	0.000	0.000	0.000	0.000
85.5	7.18	0.096	0.020	0.076	0.000	0.000	0.000	0.000
123.7	7.18	0.164	0.042	0.122	0.000	0.000	0.000	0.000
170.2	7.19	0.078	0.042	0.036	0.000	0.000	0.000	0.000
219.3	7.19	0.019	0.019	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
36.0	7.38	0.072	0.013	0.059	0.000	0.000	0.000	0.000
60.4	7.39	0.063	0.012	0.051	0.000	0.000	0.000	0.000
85.7	7.39	0.107	0.021	0.086	0.000	0.000	0.000	0.000
124.3	7.38	0.182	0.040	0.141	0.000	0.000	0.000	0.000
171.4	7.39	0.103	0.039	0.064	0.000	0.000	0.000	0.000
220.4	7.40	0.036	0.030	0.006	0.000	0.000	0.000	0.000
270.6	7.40	0.012	0.012	0.000	0.000	0.000	0.000	0.000
35.8	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
65.1	7.59	0.013	0.002	0.011	0.000	0.000	0.000	0.000
89.6	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
124.2	7.59	0.026	0.005	0.021	0.000	0.000	0.000	0.000
172.2	7.59	0.017	0.005	0.012	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 16.4
Mean src-site R= 55.7 km; M= 5.75; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 31.9 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 14.5km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.742

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 16.36 55.7 5.75 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Campbell CEUS Hybrid *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.559E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01164
#This deaggregation corresponds to Silva 1-corner

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.6	4.60	0.346	0.113	0.233	0.000	0.000	0.000	0.000
32.2	4.61	0.325	0.284	0.041	0.000	0.000	0.000	0.000
59.0	4.61	0.057	0.057	0.000	0.000	0.000	0.000	0.000
13.9	4.80	0.651	0.186	0.464	0.000	0.000	0.000	0.000

32.9	4.80	0.773	0.603	0.170	0.000	0.000	0.000	0.000
60.1	4.81	0.194	0.194	0.000	0.000	0.000	0.000	0.000
86.9	4.82	0.015	0.015	0.000	0.000	0.000	0.000	0.000
14.1	5.03	0.478	0.120	0.357	0.000	0.000	0.000	0.000
33.6	5.03	0.727	0.474	0.253	0.000	0.000	0.000	0.000
61.0	5.04	0.261	0.261	0.000	0.000	0.000	0.000	0.000
88.4	5.04	0.038	0.038	0.000	0.000	0.000	0.000	0.000
107.7	5.06	0.008	0.008	0.000	0.000	0.000	0.000	0.000
14.3	5.21	0.185	0.043	0.142	0.000	0.000	0.000	0.000
34.1	5.21	0.335	0.183	0.153	0.000	0.000	0.000	0.000
61.5	5.21	0.153	0.153	0.000	0.000	0.000	0.000	0.000
88.8	5.21	0.029	0.029	0.000	0.000	0.000	0.000	0.000
111.3	5.21	0.011	0.011	0.000	0.000	0.000	0.000	0.000
14.4	5.39	0.285	0.062	0.223	0.000	0.000	0.000	0.000
34.6	5.40	0.599	0.265	0.334	0.000	0.000	0.000	0.000
62.1	5.40	0.341	0.331	0.009	0.000	0.000	0.000	0.000
89.1	5.41	0.081	0.081	0.000	0.000	0.000	0.000	0.000
115.5	5.41	0.047	0.047	0.000	0.000	0.000	0.000	0.000
14.6	5.61	0.142	0.029	0.113	0.000	0.000	0.000	0.000
35.0	5.61	0.350	0.125	0.225	0.000	0.000	0.000	0.000
62.7	5.62	0.250	0.214	0.036	0.000	0.000	0.000	0.000
89.4	5.62	0.074	0.074	0.000	0.000	0.000	0.000	0.000
117.9	5.62	0.056	0.056	0.000	0.000	0.000	0.000	0.000
14.6	5.80	0.127	0.025	0.102	0.000	0.000	0.000	0.000
35.4	5.80	0.350	0.108	0.242	0.000	0.000	0.000	0.000
63.2	5.81	0.298	0.214	0.084	0.000	0.000	0.000	0.000
89.6	5.81	0.104	0.104	0.000	0.000	0.000	0.000	0.000
119.1	5.81	0.096	0.096	0.000	0.000	0.000	0.000	0.000
166.2	5.82	0.016	0.016	0.000	0.000	0.000	0.000	0.000
13.4	6.01	0.087	0.017	0.070	0.000	0.000	0.000	0.000
35.8	6.01	0.276	0.075	0.201	0.000	0.000	0.000	0.000
63.7	6.01	0.235	0.131	0.104	0.000	0.000	0.000	0.000
89.3	6.01	0.103	0.100	0.003	0.000	0.000	0.000	0.000
119.9	6.01	0.111	0.111	0.000	0.000	0.000	0.000	0.000
168.4	6.02	0.025	0.025	0.000	0.000	0.000	0.000	0.000
13.1	6.21	0.083	0.016	0.068	0.000	0.000	0.000	0.000
36.4	6.21	0.294	0.073	0.221	0.000	0.000	0.000	0.000
64.2	6.21	0.249	0.108	0.141	0.000	0.000	0.000	0.000
88.7	6.21	0.133	0.104	0.029	0.000	0.000	0.000	0.000
120.1	6.22	0.170	0.170	0.000	0.000	0.000	0.000	0.000
169.6	6.22	0.046	0.046	0.000	0.000	0.000	0.000	0.000
218.7	6.23	0.011	0.011	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.056	0.010	0.046	0.000	0.000	0.000	0.000
36.5	6.42	0.193	0.044	0.149	0.000	0.000	0.000	0.000
60.5	6.42	0.136	0.044	0.092	0.000	0.000	0.000	0.000
84.1	6.42	0.166	0.086	0.079	0.000	0.000	0.000	0.000
121.1	6.42	0.162	0.151	0.011	0.000	0.000	0.000	0.000
170.2	6.43	0.055	0.055	0.000	0.000	0.000	0.000	0.000
219.8	6.43	0.016	0.016	0.000	0.000	0.000	0.000	0.000
13.1	6.59	0.034	0.006	0.028	0.000	0.000	0.000	0.000
36.1	6.59	0.117	0.025	0.092	0.000	0.000	0.000	0.000
60.2	6.59	0.091	0.026	0.065	0.000	0.000	0.000	0.000
84.3	6.59	0.119	0.050	0.069	0.000	0.000	0.000	0.000
122.1	6.59	0.126	0.103	0.023	0.000	0.000	0.000	0.000
170.8	6.59	0.049	0.049	0.000	0.000	0.000	0.000	0.000
220.5	6.59	0.017	0.017	0.000	0.000	0.000	0.000	0.000
272.2	6.60	0.007	0.007	0.000	0.000	0.000	0.000	0.000
16.3	6.80	0.064	0.012	0.052	0.000	0.000	0.000	0.000
37.5	6.77	0.146	0.030	0.116	0.000	0.000	0.000	0.000
60.3	6.78	0.129	0.033	0.097	0.000	0.000	0.000	0.000

85.1	6.78	0.181	0.064	0.117	0.000	0.000	0.000	0.000
122.8	6.79	0.211	0.135	0.075	0.000	0.000	0.000	0.000
171.0	6.79	0.098	0.097	0.001	0.000	0.000	0.000	0.000
221.6	6.79	0.038	0.038	0.000	0.000	0.000	0.000	0.000
272.9	6.80	0.019	0.019	0.000	0.000	0.000	0.000	0.000
357.7	6.84	0.015	0.015	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.035	0.006	0.029	0.000	0.000	0.000	0.000
36.8	7.00	0.112	0.022	0.090	0.000	0.000	0.000	0.000
65.1	7.00	0.131	0.032	0.099	0.000	0.000	0.000	0.000
89.6	7.00	0.090	0.028	0.062	0.000	0.000	0.000	0.000
122.7	7.00	0.176	0.083	0.093	0.000	0.000	0.000	0.000
171.8	7.00	0.090	0.077	0.013	0.000	0.000	0.000	0.000
222.2	7.01	0.041	0.041	0.000	0.000	0.000	0.000	0.000
273.6	7.01	0.024	0.024	0.000	0.000	0.000	0.000	0.000
369.0	7.01	0.036	0.036	0.000	0.000	0.000	0.000	0.000
14.4	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
36.5	7.19	0.062	0.012	0.050	0.000	0.000	0.000	0.000
60.7	7.19	0.052	0.011	0.041	0.000	0.000	0.000	0.000
85.1	7.18	0.077	0.020	0.057	0.000	0.000	0.000	0.000
123.1	7.18	0.109	0.042	0.067	0.000	0.000	0.000	0.000
172.2	7.18	0.063	0.042	0.021	0.000	0.000	0.000	0.000
222.8	7.19	0.032	0.031	0.001	0.000	0.000	0.000	0.000
274.1	7.19	0.021	0.021	0.000	0.000	0.000	0.000	0.000
375.0	7.16	0.023	0.023	0.000	0.000	0.000	0.000	0.000
377.0	7.23	0.015	0.015	0.000	0.000	0.000	0.000	0.000
564.6	7.19	0.009	0.009	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
35.8	7.38	0.070	0.013	0.057	0.000	0.000	0.000	0.000
60.3	7.39	0.056	0.012	0.045	0.000	0.000	0.000	0.000
85.3	7.39	0.088	0.021	0.067	0.000	0.000	0.000	0.000
123.6	7.39	0.126	0.040	0.085	0.000	0.000	0.000	0.000
172.8	7.39	0.078	0.039	0.039	0.000	0.000	0.000	0.000
223.1	7.39	0.045	0.036	0.009	0.000	0.000	0.000	0.000
274.3	7.39	0.035	0.034	0.000	0.000	0.000	0.000	0.000
381.9	7.40	0.072	0.072	0.000	0.000	0.000	0.000	0.000
587.9	7.34	0.015	0.015	0.000	0.000	0.000	0.000	0.000
611.2	7.47	0.016	0.016	0.000	0.000	0.000	0.000	0.000
763.2	7.50	0.023	0.023	0.000	0.000	0.000	0.000	0.000
35.7	7.59	0.010	0.002	0.008	0.000	0.000	0.000	0.000
65.0	7.59	0.012	0.002	0.010	0.000	0.000	0.000	0.000
89.5	7.59	0.009	0.002	0.007	0.000	0.000	0.000	0.000
123.4	7.59	0.019	0.005	0.014	0.000	0.000	0.000	0.000
173.1	7.59	0.013	0.005	0.008	0.000	0.000	0.000	0.000
223.6	7.59	0.008	0.005	0.004	0.000	0.000	0.000	0.000
274.5	7.60	0.007	0.006	0.001	0.000	0.000	0.000	0.000
387.1	7.60	0.017	0.017	0.000	0.000	0.000	0.000	0.000
640.4	7.60	0.012	0.012	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 13.9
Mean src-site R= 68.4 km; M= 5.83; eps0= 0.20. Mean calculated for all sources.
Modal src-site R= 32.9 km; M= 4.80; eps0= 0.78 from peak (R,M) bin
MODE R*= 34.5km; M*= 4.80; EPS.INTERVAL:> 2 sigma % CONTRIB.= 0.603

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 13.85 67.0 5.83 0.19
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Silva 1-corner *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.08468 g. Weight * Computed_Rate_Ex 0.595E-04
Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01864
This deaggregation corresponds to Tavakoli and Pezeshk 05

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.7	4.60	0.440	0.113	0.327	0.000	0.000	0.000	0.000
29.4	4.61	0.229	0.190	0.040	0.000	0.000	0.000	0.000
14.2	4.80	0.837	0.186	0.650	0.000	0.000	0.000	0.000
30.4	4.80	0.662	0.458	0.204	0.000	0.000	0.000	0.000
55.3	4.82	0.029	0.029	0.000	0.000	0.000	0.000	0.000
14.6	5.03	0.603	0.120	0.483	0.000	0.000	0.000	0.000
31.7	5.03	0.742	0.411	0.331	0.000	0.000	0.000	0.000
57.7	5.04	0.069	0.069	0.000	0.000	0.000	0.000	0.000
14.7	5.21	0.227	0.043	0.184	0.000	0.000	0.000	0.000
32.6	5.21	0.379	0.174	0.205	0.000	0.000	0.000	0.000
58.7	5.21	0.056	0.056	0.000	0.000	0.000	0.000	0.000
89.7	5.21	0.009	0.009	0.000	0.000	0.000	0.000	0.000
14.8	5.39	0.337	0.062	0.274	0.000	0.000	0.000	0.000
33.6	5.40	0.725	0.265	0.460	0.000	0.000	0.000	0.000
59.5	5.41	0.165	0.165	0.000	0.000	0.000	0.000	0.000
89.9	5.41	0.035	0.035	0.000	0.000	0.000	0.000	0.000
118.4	5.42	0.039	0.039	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.161	0.029	0.131	0.000	0.000	0.000	0.000
34.6	5.61	0.444	0.125	0.319	0.000	0.000	0.000	0.000
60.4	5.62	0.158	0.141	0.017	0.000	0.000	0.000	0.000
90.1	5.62	0.043	0.043	0.000	0.000	0.000	0.000	0.000
120.1	5.62	0.058	0.058	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.139	0.025	0.114	0.000	0.000	0.000	0.000
35.3	5.80	0.451	0.108	0.343	0.000	0.000	0.000	0.000
61.2	5.81	0.231	0.171	0.060	0.000	0.000	0.000	0.000
90.2	5.81	0.076	0.076	0.000	0.000	0.000	0.000	0.000
120.9	5.81	0.114	0.114	0.000	0.000	0.000	0.000	0.000
163.0	5.82	0.014	0.014	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.092	0.017	0.075	0.000	0.000	0.000	0.000
36.0	6.01	0.351	0.075	0.276	0.000	0.000	0.000	0.000
62.2	6.01	0.214	0.127	0.087	0.000	0.000	0.000	0.000
89.8	6.01	0.092	0.091	0.000	0.000	0.000	0.000	0.000
121.4	6.01	0.150	0.150	0.000	0.000	0.000	0.000	0.000
165.6	6.02	0.025	0.025	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.086	0.016	0.070	0.000	0.000	0.000	0.000
36.9	6.21	0.365	0.073	0.292	0.000	0.000	0.000	0.000
63.2	6.21	0.257	0.108	0.149	0.000	0.000	0.000	0.000
89.1	6.22	0.140	0.105	0.035	0.000	0.000	0.000	0.000
121.4	6.22	0.256	0.244	0.012	0.000	0.000	0.000	0.000
167.0	6.22	0.052	0.052	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.057	0.010	0.047	0.000	0.000	0.000	0.000
37.0	6.42	0.231	0.044	0.187	0.000	0.000	0.000	0.000
60.1	6.42	0.160	0.044	0.116	0.000	0.000	0.000	0.000
84.9	6.42	0.191	0.086	0.104	0.000	0.000	0.000	0.000
122.2	6.42	0.267	0.189	0.078	0.000	0.000	0.000	0.000
167.8	6.43	0.069	0.069	0.000	0.000	0.000	0.000	0.000
215.5	6.43	0.009	0.009	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.035	0.006	0.028	0.000	0.000	0.000	0.000
36.6	6.59	0.135	0.025	0.110	0.000	0.000	0.000	0.000
60.0	6.59	0.111	0.026	0.085	0.000	0.000	0.000	0.000
85.0	6.59	0.149	0.050	0.099	0.000	0.000	0.000	0.000
123.1	6.59	0.220	0.111	0.109	0.000	0.000	0.000	0.000

168.4	6.59	0.067	0.065	0.001	0.000	0.000	0.000	0.000
216.6	6.59	0.011	0.011	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.065	0.012	0.053	0.000	0.000	0.000	0.000
37.8	6.77	0.164	0.030	0.134	0.000	0.000	0.000	0.000
60.2	6.78	0.159	0.033	0.126	0.000	0.000	0.000	0.000
85.7	6.79	0.241	0.064	0.177	0.000	0.000	0.000	0.000
123.8	6.79	0.378	0.136	0.242	0.000	0.000	0.000	0.000
168.9	6.79	0.146	0.117	0.029	0.000	0.000	0.000	0.000
218.2	6.80	0.027	0.027	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.036	0.006	0.029	0.000	0.000	0.000	0.000
37.1	7.00	0.122	0.022	0.099	0.000	0.000	0.000	0.000
65.3	7.00	0.159	0.032	0.127	0.000	0.000	0.000	0.000
89.8	7.00	0.126	0.028	0.098	0.000	0.000	0.000	0.000
123.8	7.00	0.314	0.083	0.230	0.000	0.000	0.000	0.000
170.1	7.01	0.144	0.081	0.063	0.000	0.000	0.000	0.000
219.0	7.01	0.035	0.035	0.000	0.000	0.000	0.000	0.000
268.9	7.01	0.008	0.008	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
36.8	7.19	0.065	0.012	0.053	0.000	0.000	0.000	0.000
60.8	7.19	0.061	0.011	0.050	0.000	0.000	0.000	0.000
85.6	7.18	0.102	0.020	0.082	0.000	0.000	0.000	0.000
124.3	7.18	0.187	0.042	0.145	0.000	0.000	0.000	0.000
170.9	7.19	0.105	0.042	0.063	0.000	0.000	0.000	0.000
219.9	7.19	0.031	0.028	0.003	0.000	0.000	0.000	0.000
269.9	7.19	0.009	0.009	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
36.0	7.38	0.072	0.013	0.059	0.000	0.000	0.000	0.000
60.5	7.39	0.063	0.012	0.052	0.000	0.000	0.000	0.000
85.7	7.38	0.111	0.021	0.090	0.000	0.000	0.000	0.000
124.7	7.38	0.199	0.040	0.159	0.000	0.000	0.000	0.000
172.1	7.39	0.130	0.039	0.091	0.000	0.000	0.000	0.000
220.9	7.39	0.053	0.035	0.018	0.000	0.000	0.000	0.000
271.0	7.40	0.020	0.020	0.000	0.000	0.000	0.000	0.000
35.8	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
65.2	7.59	0.013	0.002	0.011	0.000	0.000	0.000	0.000
89.6	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
124.5	7.59	0.028	0.005	0.023	0.000	0.000	0.000	0.000
172.9	7.59	0.021	0.005	0.016	0.000	0.000	0.000	0.000
222.0	7.60	0.011	0.005	0.006	0.000	0.000	0.000	0.000

```
Summary statistics for above PSHA PGA  deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%):   14.8
 Mean src-site R=   61.8 km; M= 5.92; eps0=  -0.65. Mean calculated for all sources.
Modal src-site R=   14.2 km; M= 4.80; eps0=  -1.29 from peak (R,M) bin
 MODE R*=  14.0km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma  % CONTRIB.=  0.650

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category:                  % contr.  R(km)    M   epsilon0 (mean values).
CEUS gridded                        14.79    61.8   5.92   -0.65
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID                          % contr.   Rcd(km)  M   epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Tavakoli and Pezeshk 05  *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long:  75.016 W., lat: 39.541 N.
 Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08  See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475  yrs. Exceedance PGA =0.08468  g. Weight * Computed_Rate_Ex 0.200E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00448
#This deaggregation corresponds to Atkinson-Boore06,200 bar
DIST(KM) MAG(MW) ALL_EPS EPSILON>2  1<EPS<2 0<EPS<1 -1<EPS<0 -2<EPS<-1 EPS<-2
```

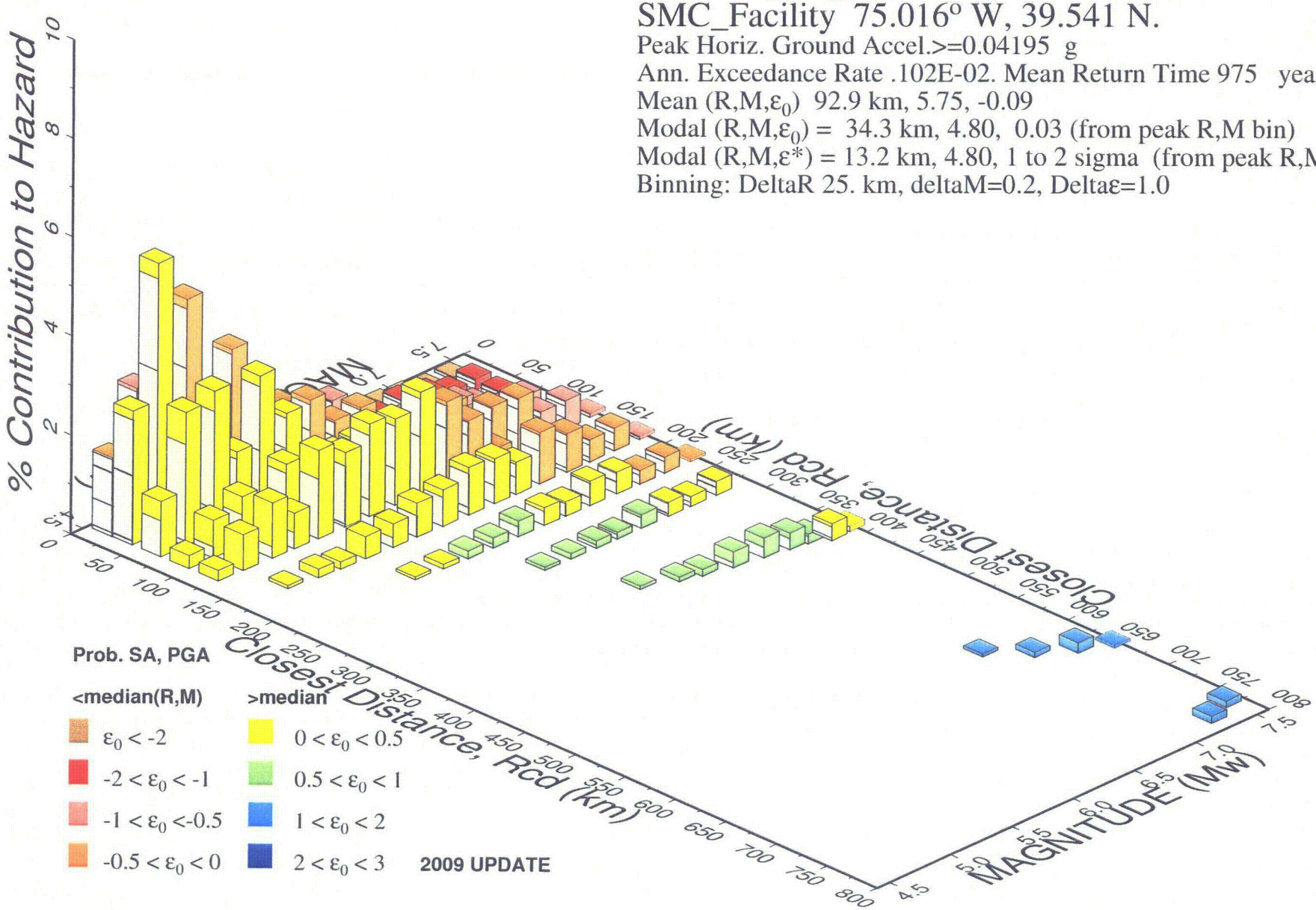
11.3	4.60	0.190	0.089	0.102	0.000	0.000	0.000	0.000
12.7	4.80	0.430	0.211	0.219	0.000	0.000	0.000	0.000
33.8	4.82	0.006	0.006	0.000	0.000	0.000	0.000	0.000
12.6	5.03	0.336	0.120	0.216	0.000	0.000	0.000	0.000
27.6	5.04	0.074	0.074	0.000	0.000	0.000	0.000	0.000
13.2	5.21	0.144	0.043	0.101	0.000	0.000	0.000	0.000
28.7	5.21	0.052	0.048	0.004	0.000	0.000	0.000	0.000
13.7	5.39	0.240	0.062	0.177	0.000	0.000	0.000	0.000
29.8	5.40	0.130	0.109	0.021	0.000	0.000	0.000	0.000
54.6	5.42	0.004	0.004	0.000	0.000	0.000	0.000	0.000
14.1	5.61	0.128	0.029	0.099	0.000	0.000	0.000	0.000
31.0	5.62	0.106	0.077	0.029	0.000	0.000	0.000	0.000
57.2	5.62	0.008	0.008	0.000	0.000	0.000	0.000	0.000
14.3	5.80	0.119	0.025	0.094	0.000	0.000	0.000	0.000
31.9	5.81	0.134	0.084	0.049	0.000	0.000	0.000	0.000
56.9	5.82	0.017	0.017	0.000	0.000	0.000	0.000	0.000
85.4	5.82	0.009	0.009	0.000	0.000	0.000	0.000	0.000
123.8	5.82	0.013	0.013	0.000	0.000	0.000	0.000	0.000
13.3	6.01	0.085	0.017	0.068	0.000	0.000	0.000	0.000
32.4	6.01	0.131	0.068	0.062	0.000	0.000	0.000	0.000
60.2	6.02	0.024	0.024	0.000	0.000	0.000	0.000	0.000
88.7	6.01	0.011	0.011	0.000	0.000	0.000	0.000	0.000
124.2	6.02	0.025	0.025	0.000	0.000	0.000	0.000	0.000
164.6	6.02	0.006	0.006	0.000	0.000	0.000	0.000	0.000
13.1	6.21	0.083	0.016	0.067	0.000	0.000	0.000	0.000
33.4	6.21	0.161	0.072	0.090	0.000	0.000	0.000	0.000
62.0	6.22	0.039	0.039	0.000	0.000	0.000	0.000	0.000
89.4	6.22	0.020	0.020	0.000	0.000	0.000	0.000	0.000
124.0	6.22	0.051	0.051	0.000	0.000	0.000	0.000	0.000
168.0	6.23	0.017	0.017	0.000	0.000	0.000	0.000	0.000
13.0	6.42	0.056	0.010	0.046	0.000	0.000	0.000	0.000
34.0	6.42	0.123	0.044	0.079	0.000	0.000	0.000	0.000
59.2	6.42	0.033	0.032	0.001	0.000	0.000	0.000	0.000
85.3	6.43	0.033	0.033	0.000	0.000	0.000	0.000	0.000
124.4	6.43	0.062	0.062	0.000	0.000	0.000	0.000	0.000
169.1	6.43	0.025	0.025	0.000	0.000	0.000	0.000	0.000
217.6	6.43	0.005	0.005	0.000	0.000	0.000	0.000	0.000
17.5	6.58	0.054	0.011	0.043	0.000	0.000	0.000	0.000
37.1	6.60	0.063	0.021	0.042	0.000	0.000	0.000	0.000
59.1	6.59	0.028	0.023	0.005	0.000	0.000	0.000	0.000
85.3	6.59	0.030	0.030	0.000	0.000	0.000	0.000	0.000
124.8	6.59	0.056	0.056	0.000	0.000	0.000	0.000	0.000
169.8	6.59	0.024	0.024	0.000	0.000	0.000	0.000	0.000
219.1	6.59	0.006	0.006	0.000	0.000	0.000	0.000	0.000
16.1	6.80	0.063	0.012	0.051	0.000	0.000	0.000	0.000
36.1	6.77	0.108	0.030	0.078	0.000	0.000	0.000	0.000
59.2	6.79	0.050	0.033	0.017	0.000	0.000	0.000	0.000
85.9	6.79	0.059	0.057	0.001	0.000	0.000	0.000	0.000
124.8	6.86	0.043	0.043	0.000	0.000	0.000	0.000	0.000
125.1	6.74	0.064	0.064	0.000	0.000	0.000	0.000	0.000
170.1	6.79	0.054	0.054	0.000	0.000	0.000	0.000	0.000
220.5	6.79	0.016	0.016	0.000	0.000	0.000	0.000	0.000
271.3	6.80	0.006	0.006	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.035	0.006	0.029	0.000	0.000	0.000	0.000
35.6	7.00	0.091	0.022	0.069	0.000	0.000	0.000	0.000
63.7	7.00	0.057	0.032	0.026	0.000	0.000	0.000	0.000
89.8	7.01	0.037	0.028	0.009	0.000	0.000	0.000	0.000
124.5	7.01	0.100	0.083	0.017	0.000	0.000	0.000	0.000
171.0	7.01	0.054	0.054	0.000	0.000	0.000	0.000	0.000
221.2	7.01	0.020	0.020	0.000	0.000	0.000	0.000	0.000

272.4	7.01	0.009	0.009	0.000	0.000	0.000	0.000	0.000
335.3	7.02	0.006	0.006	0.000	0.000	0.000	0.000	0.000
14.4	7.18	0.020	0.004	0.017	0.000	0.000	0.000	0.000
35.6	7.19	0.053	0.012	0.041	0.000	0.000	0.000	0.000
59.9	7.19	0.028	0.011	0.017	0.000	0.000	0.000	0.000
85.6	7.19	0.036	0.020	0.015	0.000	0.000	0.000	0.000
124.6	7.19	0.067	0.042	0.024	0.000	0.000	0.000	0.000
171.5	7.19	0.039	0.037	0.003	0.000	0.000	0.000	0.000
221.9	7.19	0.016	0.016	0.000	0.000	0.000	0.000	0.000
273.0	7.19	0.008	0.008	0.000	0.000	0.000	0.000	0.000
347.0	7.19	0.008	0.008	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.020	0.004	0.016	0.000	0.000	0.000	0.000
35.1	7.39	0.062	0.013	0.049	0.000	0.000	0.000	0.000
59.6	7.39	0.035	0.012	0.023	0.000	0.000	0.000	0.000
85.7	7.39	0.047	0.021	0.026	0.000	0.000	0.000	0.000
124.7	7.39	0.082	0.040	0.041	0.000	0.000	0.000	0.000
172.1	7.39	0.050	0.038	0.012	0.000	0.000	0.000	0.000
222.3	7.39	0.024	0.024	0.000	0.000	0.000	0.000	0.000
273.4	7.40	0.015	0.015	0.000	0.000	0.000	0.000	0.000
359.9	7.40	0.017	0.017	0.000	0.000	0.000	0.000	0.000
14.5	7.59	0.003	0.000	0.002	0.000	0.000	0.000	0.000
35.1	7.59	0.009	0.002	0.008	0.000	0.000	0.000	0.000
64.1	7.59	0.008	0.002	0.005	0.000	0.000	0.000	0.000
89.6	7.59	0.005	0.002	0.003	0.000	0.000	0.000	0.000
124.2	7.59	0.013	0.005	0.008	0.000	0.000	0.000	0.000
172.4	7.59	0.009	0.005	0.004	0.000	0.000	0.000	0.000
222.8	7.60	0.005	0.004	0.000	0.000	0.000	0.000	0.000
273.7	7.60	0.003	0.003	0.000	0.000	0.000	0.000	0.000
367.6	7.60	0.005	0.005	0.000	0.000	0.000	0.000	0.000

```
Summary statistics for above PSHA PGA  deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%):    5.0
 Mean src-site R=   56.4 km; M= 6.07; eps0=   0.02. Mean calculated for all sources.
Modal src-site R=   12.7 km; M= 4.80; eps0=  -0.15 from peak (R,M) bin
 MODE R*=   9.6km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma  % CONTRIB.=  0.219

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category:                  % contr.  R(km)    M   epsilon0 (mean values).
CEUS gridded                        4.96    56.4   6.07    0.02
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID                          % contr.   Rcd(km)  M   epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Atkinson-Boore06,200 bar *********#

********************Central or Eastern U.S. Site ********************************
```

PSH Deaggregation on NEHRP BC rock
SMC_Facility 75.016° W, 39.541 N.

Peak Horiz. Ground Accel.>=0.04195 g
Ann. Exceedance Rate .102E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 92.9 km, 5.75, -0.09
Modal (R,M,ε_0) = 34.3 km, 4.80, 0.03 (from peak R,M bin)
Modal (R,M,ε*) = 13.2 km, 4.80, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Aug 18 13:42:10 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.102E-02
[at least one eq with median motion>=PGA in 50 yrs]=0.02425
This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.3	4.60	1.591	0.045	0.266	0.669	0.538	0.072	0.002
33.9	4.60	2.711	0.190	1.126	1.319	0.076	0.000	0.000
61.6	4.61	1.121	0.393	0.728	0.000	0.000	0.000	0.000
89.4	4.61	0.270	0.258	0.012	0.000	0.000	0.000	0.000
117.6	4.61	0.213	0.213	0.000	0.000	0.000	0.000	0.000
14.4	4.80	2.776	0.073	0.438	1.101	1.012	0.147	0.005
34.3	4.80	5.471	0.312	1.865	2.952	0.341	0.000	0.000
61.9	4.80	2.706	0.646	1.963	0.098	0.000	0.000	0.000
89.6	4.81	0.761	0.542	0.219	0.000	0.000	0.000	0.000
119.0	4.81	0.730	0.722	0.008	0.000	0.000	0.000	0.000
162.1	4.82	0.067	0.067	0.000	0.000	0.000	0.000	0.000
14.6	5.03	1.899	0.047	0.283	0.711	0.711	0.139	0.008
34.9	5.03	4.489	0.202	1.204	2.529	0.555	0.000	0.000
62.5	5.03	2.875	0.417	1.974	0.484	0.000	0.000	0.000
89.8	5.04	0.977	0.364	0.613	0.000	0.000	0.000	0.000
120.1	5.04	1.120	0.889	0.231	0.000	0.000	0.000	0.000
165.5	5.05	0.178	0.178	0.000	0.000	0.000	0.000	0.000
14.7	5.21	0.702	0.017	0.101	0.254	0.254	0.071	0.004
35.3	5.21	1.876	0.072	0.431	1.031	0.342	0.000	0.000
62.9	5.21	1.442	0.149	0.860	0.432	0.000	0.000	0.000
89.9	5.21	0.560	0.130	0.429	0.000	0.000	0.000	0.000
120.8	5.21	0.721	0.393	0.328	0.000	0.000	0.000	0.000
167.0	5.21	0.149	0.149	0.000	0.000	0.000	0.000	0.000
14.7	5.39	1.039	0.025	0.147	0.369	0.369	0.124	0.007
35.6	5.39	3.067	0.105	0.625	1.559	0.764	0.015	0.000
63.4	5.40	2.777	0.216	1.293	1.268	0.000	0.000	0.000
90.1	5.40	1.228	0.189	0.978	0.061	0.000	0.000	0.000
121.6	5.40	1.788	0.582	1.206	0.000	0.000	0.000	0.000
168.0	5.41	0.455	0.411	0.045	0.000	0.000	0.000	0.000
216.3	5.41	0.063	0.063	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.498	0.012	0.069	0.174	0.174	0.066	0.004
35.9	5.61	1.627	0.049	0.294	0.739	0.521	0.024	0.000
63.9	5.62	1.775	0.102	0.609	1.027	0.038	0.000	0.000
90.2	5.62	0.909	0.089	0.531	0.289	0.000	0.000	0.000
122.3	5.62	1.504	0.274	1.169	0.061	0.000	0.000	0.000
168.8	5.62	0.473	0.279	0.194	0.000	0.000	0.000	0.000
218.3	5.62	0.092	0.092	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.433	0.010	0.060	0.150	0.150	0.059	0.004
36.1	5.80	1.501	0.042	0.254	0.637	0.528	0.040	0.000
64.2	5.80	1.832	0.088	0.525	1.102	0.117	0.000	0.000
90.3	5.81	1.030	0.077	0.458	0.495	0.000	0.000	0.000
122.9	5.81	1.874	0.236	1.295	0.343	0.000	0.000	0.000
169.4	5.81	0.685	0.255	0.431	0.000	0.000	0.000	0.000
219.0	5.81	0.159	0.148	0.010	0.000	0.000	0.000	0.000
13.5	6.01	0.288	0.007	0.039	0.099	0.099	0.039	0.005
36.5	6.01	1.111	0.029	0.176	0.442	0.412	0.052	0.000
63.5	6.01	1.182	0.045	0.271	0.673	0.192	0.000	0.000
88.0	6.00	1.006	0.054	0.320	0.630	0.001	0.000	0.000
123.3	6.01	1.748	0.145	0.866	0.737	0.000	0.000	0.000
170.4	6.01	0.739	0.153	0.570	0.016	0.000	0.000	0.000
220.0	6.01	0.207	0.131	0.076	0.000	0.000	0.000	0.000

270.8	6.02	0.063	0.063	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.271	0.006	0.037	0.093	0.093	0.037	0.005
37.0	6.21	1.119	0.029	0.171	0.429	0.419	0.071	0.001
64.9	6.21	1.225	0.043	0.254	0.638	0.290	0.000	0.000
89.2	6.21	0.930	0.041	0.247	0.597	0.045	0.000	0.000
123.3	6.21	2.060	0.129	0.770	1.161	0.000	0.000	0.000
171.0	6.22	0.961	0.130	0.682	0.150	0.000	0.000	0.000
220.1	6.22	0.318	0.117	0.201	0.000	0.000	0.000	0.000
271.5	6.22	0.115	0.102	0.013	0.000	0.000	0.000	0.000
340.5	6.23	0.066	0.066	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.181	0.004	0.025	0.062	0.062	0.025	0.004
36.9	6.42	0.702	0.017	0.103	0.258	0.258	0.064	0.001
60.8	6.42	0.589	0.017	0.104	0.261	0.207	0.001	0.000
85.1	6.42	0.957	0.034	0.204	0.511	0.208	0.000	0.000
124.0	6.42	1.637	0.077	0.463	1.033	0.065	0.000	0.000
171.5	6.42	0.911	0.079	0.471	0.362	0.000	0.000	0.000
220.7	6.42	0.355	0.072	0.277	0.006	0.000	0.000	0.000
272.3	6.43	0.148	0.079	0.069	0.000	0.000	0.000	0.000
351.8	6.45	0.093	0.090	0.003	0.000	0.000	0.000	0.000
13.2	6.59	0.109	0.002	0.015	0.037	0.037	0.015	0.002
36.4	6.59	0.410	0.010	0.059	0.147	0.147	0.045	0.001
60.4	6.59	0.366	0.010	0.061	0.153	0.139	0.003	0.000
85.2	6.59	0.613	0.020	0.119	0.298	0.176	0.000	0.000
124.6	6.59	1.069	0.044	0.261	0.641	0.123	0.000	0.000
172.0	6.59	0.650	0.044	0.260	0.346	0.000	0.000	0.000
221.2	6.59	0.292	0.040	0.214	0.037	0.000	0.000	0.000
272.6	6.60	0.135	0.044	0.091	0.000	0.000	0.000	0.000
357.3	6.60	0.135	0.116	0.019	0.000	0.000	0.000	0.000
16.3	6.80	0.204	0.005	0.028	0.070	0.070	0.028	0.004
37.7	6.77	0.499	0.012	0.071	0.177	0.177	0.060	0.002
60.4	6.78	0.490	0.013	0.078	0.195	0.190	0.015	0.000
85.8	6.78	0.845	0.025	0.151	0.379	0.290	0.000	0.000
124.9	6.78	1.142	0.041	0.247	0.621	0.232	0.000	0.000
125.2	6.78	0.352	0.012	0.072	0.181	0.088	0.000	0.000
172.3	6.78	1.040	0.055	0.328	0.640	0.017	0.000	0.000
222.2	6.79	0.502	0.048	0.287	0.167	0.000	0.000	0.000
273.1	6.79	0.277	0.056	0.218	0.003	0.000	0.000	0.000
363.6	6.79	0.330	0.223	0.108	0.000	0.000	0.000	0.000
14.0	7.00	0.112	0.003	0.015	0.038	0.038	0.015	0.003
37.0	7.00	0.375	0.009	0.052	0.131	0.131	0.049	0.003
65.4	7.00	0.483	0.012	0.074	0.186	0.186	0.023	0.000
89.8	7.00	0.398	0.011	0.066	0.166	0.155	0.001	0.000
124.6	7.00	1.059	0.033	0.196	0.493	0.337	0.000	0.000
173.0	7.00	0.781	0.032	0.193	0.471	0.085	0.000	0.000
222.7	7.00	0.444	0.029	0.173	0.242	0.000	0.000	0.000
273.7	7.01	0.289	0.034	0.199	0.055	0.000	0.000	0.000
368.1	7.01	0.409	0.192	0.217	0.000	0.000	0.000	0.000
588.5	6.98	0.054	0.054	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.064	0.001	0.009	0.022	0.022	0.009	0.001
36.7	7.19	0.202	0.005	0.028	0.070	0.070	0.027	0.002
60.7	7.19	0.182	0.004	0.027	0.067	0.067	0.016	0.000
85.6	7.18	0.305	0.008	0.048	0.120	0.120	0.009	0.000
124.7	7.18	0.571	0.017	0.099	0.249	0.206	0.001	0.000
173.4	7.19	0.454	0.017	0.099	0.248	0.091	0.000	0.000
223.4	7.19	0.282	0.015	0.088	0.176	0.003	0.000	0.000
274.2	7.19	0.207	0.018	0.106	0.084	0.000	0.000	0.000
371.8	7.19	0.338	0.114	0.215	0.010	0.000	0.000	0.000
615.5	7.19	0.096	0.096	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.063	0.001	0.009	0.022	0.022	0.009	0.001
35.9	7.38	0.225	0.005	0.031	0.078	0.078	0.031	0.003

60.4	7.39	0.190	0.005	0.027	0.069	0.069	0.021	0.000
85.7	7.39	0.327	0.008	0.049	0.124	0.124	0.021	0.000
124.8	7.38	0.581	0.016	0.095	0.239	0.225	0.007	0.000
173.7	7.39	0.466	0.015	0.091	0.229	0.131	0.000	0.000
223.7	7.39	0.328	0.014	0.085	0.204	0.025	0.000	0.000
274.5	7.39	0.279	0.018	0.105	0.156	0.000	0.000	0.000
374.4	7.32	0.193	0.049	0.129	0.015	0.000	0.000	0.000
377.8	7.44	0.343	0.063	0.224	0.056	0.000	0.000	0.000
632.7	7.40	0.203	0.189	0.015	0.000	0.000	0.000	0.000
767.3	7.50	0.125	0.125	0.000	0.000	0.000	0.000	0.000
777.2	7.30	0.139	0.139	0.000	0.000	0.000	0.000	0.000
124.4	7.59	0.081	0.002	0.013	0.032	0.031	0.004	0.000
173.9	7.59	0.066	0.002	0.012	0.029	0.023	0.000	0.000
224.2	7.59	0.051	0.002	0.011	0.028	0.010	0.000	0.000
381.8	7.59	0.112	0.015	0.068	0.030	0.000	0.000	0.000
645.8	7.60	0.055	0.042	0.013	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 100.0
Mean src-site R= 92.9 km; M= 5.75; eps0= -0.09. Mean calculated for all sources.
Modal src-site R= 34.3 km; M= 4.80; eps0= 0.03 from peak (R,M) bin
MODE R*= 33.5km; M*= 4.80; EPS.INTERVAL: 0 to 1 sigma % CONTRIB.= 2.952

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 99.72 90.9 5.74 -0.10
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Mean Hazard w/all GMPEs *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NEHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.276E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.06841
#This deaggregation corresponds to Toro et al. 1997

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.5	4.60	0.437	0.045	0.266	0.127	0.000	0.000	0.000
34.5	4.60	0.932	0.190	0.722	0.020	0.000	0.000	0.000
62.2	4.61	0.529	0.360	0.169	0.000	0.000	0.000	0.000
89.2	4.61	0.132	0.132	0.000	0.000	0.000	0.000	0.000
116.8	4.61	0.087	0.087	0.000	0.000	0.000	0.000	0.000
14.6	4.79	0.734	0.073	0.438	0.222	0.000	0.000	0.000
34.8	4.80	1.692	0.312	1.314	0.065	0.000	0.000	0.000
62.5	4.80	1.077	0.614	0.464	0.000	0.000	0.000	0.000
89.3	4.81	0.298	0.294	0.004	0.000	0.000	0.000	0.000
117.8	4.81	0.224	0.224	0.000	0.000	0.000	0.000	0.000
162.3	4.83	0.019	0.019	0.000	0.000	0.000	0.000	0.000
14.7	5.03	0.493	0.047	0.283	0.163	0.000	0.000	0.000
35.3	5.03	1.347	0.202	1.035	0.110	0.000	0.000	0.000
63.0	5.03	1.075	0.417	0.658	0.000	0.000	0.000	0.000
89.5	5.04	0.356	0.302	0.054	0.000	0.000	0.000	0.000
119.1	5.04	0.324	0.324	0.000	0.000	0.000	0.000	0.000
165.9	5.04	0.051	0.051	0.000	0.000	0.000	0.000	0.000
14.7	5.21	0.180	0.017	0.101	0.062	0.000	0.000	0.000
35.6	5.21	0.549	0.072	0.408	0.069	0.000	0.000	0.000
63.4	5.21	0.513	0.149	0.364	0.000	0.000	0.000	0.000
89.7	5.21	0.193	0.128	0.065	0.000	0.000	0.000	0.000
119.8	5.21	0.198	0.192	0.006	0.000	0.000	0.000	0.000
167.5	5.21	0.040	0.040	0.000	0.000	0.000	0.000	0.000

14.8	5.39	0.265	0.025	0.147	0.093	0.000	0.000	0.000
35.9	5.39	0.875	0.105	0.615	0.155	0.000	0.000	0.000
63.7	5.39	0.939	0.216	0.721	0.001	0.000	0.000	0.000
89.8	5.40	0.396	0.189	0.207	0.000	0.000	0.000	0.000
120.5	5.40	0.457	0.399	0.057	0.000	0.000	0.000	0.000
168.5	5.40	0.114	0.114	0.000	0.000	0.000	0.000	0.000
216.6	5.40	0.018	0.018	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.126	0.012	0.069	0.045	0.000	0.000	0.000
36.2	5.61	0.457	0.049	0.294	0.113	0.000	0.000	0.000
64.2	5.62	0.582	0.102	0.466	0.014	0.000	0.000	0.000
90.0	5.62	0.286	0.089	0.197	0.000	0.000	0.000	0.000
121.4	5.62	0.385	0.248	0.137	0.000	0.000	0.000	0.000
169.4	5.62	0.120	0.120	0.000	0.000	0.000	0.000	0.000
218.9	5.63	0.028	0.028	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.109	0.010	0.060	0.039	0.000	0.000	0.000
36.3	5.80	0.405	0.042	0.254	0.109	0.000	0.000	0.000
64.3	5.80	0.542	0.088	0.435	0.020	0.000	0.000	0.000
90.0	5.81	0.278	0.077	0.201	0.000	0.000	0.000	0.000
121.6	5.81	0.392	0.227	0.165	0.000	0.000	0.000	0.000
169.6	5.81	0.130	0.126	0.005	0.000	0.000	0.000	0.000
219.3	5.81	0.032	0.032	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.072	0.007	0.039	0.026	0.000	0.000	0.000
36.7	6.01	0.299	0.029	0.176	0.093	0.000	0.000	0.000
64.8	6.01	0.392	0.051	0.295	0.045	0.000	0.000	0.000
89.8	6.01	0.246	0.048	0.198	0.000	0.000	0.000	0.000
122.3	6.01	0.398	0.145	0.253	0.000	0.000	0.000	0.000
170.6	6.01	0.158	0.126	0.033	0.000	0.000	0.000	0.000
220.3	6.01	0.048	0.048	0.000	0.000	0.000	0.000	0.000
271.2	6.02	0.016	0.016	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.068	0.006	0.037	0.025	0.000	0.000	0.000
37.3	6.21	0.294	0.029	0.171	0.094	0.000	0.000	0.000
64.9	6.21	0.341	0.043	0.251	0.048	0.000	0.000	0.000
89.0	6.21	0.236	0.041	0.193	0.003	0.000	0.000	0.000
121.9	6.21	0.407	0.129	0.278	0.000	0.000	0.000	0.000
170.9	6.22	0.161	0.117	0.044	0.000	0.000	0.000	0.000
220.2	6.22	0.053	0.052	0.001	0.000	0.000	0.000	0.000
271.4	6.22	0.019	0.019	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.045	0.004	0.025	0.016	0.000	0.000	0.000
37.2	6.42	0.183	0.017	0.103	0.063	0.000	0.000	0.000
60.8	6.42	0.165	0.017	0.104	0.044	0.000	0.000	0.000
84.8	6.42	0.258	0.034	0.197	0.027	0.000	0.000	0.000
122.8	6.42	0.355	0.077	0.277	0.001	0.000	0.000	0.000
171.4	6.42	0.172	0.079	0.093	0.000	0.000	0.000	0.000
220.8	6.42	0.067	0.056	0.011	0.000	0.000	0.000	0.000
272.5	6.42	0.029	0.029	0.000	0.000	0.000	0.000	0.000
341.3	6.43	0.021	0.021	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.027	0.002	0.015	0.010	0.000	0.000	0.000
36.6	6.59	0.105	0.010	0.059	0.037	0.000	0.000	0.000
60.5	6.59	0.099	0.010	0.061	0.028	0.000	0.000	0.000
84.9	6.59	0.159	0.020	0.117	0.022	0.000	0.000	0.000
123.4	6.60	0.220	0.044	0.174	0.003	0.000	0.000	0.000
171.6	6.60	0.111	0.044	0.067	0.000	0.000	0.000	0.000
221.1	6.60	0.046	0.035	0.012	0.000	0.000	0.000	0.000
272.6	6.61	0.021	0.021	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.051	0.005	0.028	0.019	0.000	0.000	0.000
37.8	6.77	0.128	0.012	0.071	0.045	0.000	0.000	0.000
60.5	6.78	0.130	0.013	0.078	0.040	0.000	0.000	0.000
85.5	6.78	0.214	0.025	0.151	0.038	0.000	0.000	0.000
123.7	6.78	0.305	0.053	0.246	0.005	0.000	0.000	0.000
171.6	6.78	0.168	0.055	0.114	0.000	0.000	0.000	0.000

221.7	6.79	0.071	0.047	0.024	0.000	0.000	0.000	0.000
272.8	6.79	0.036	0.034	0.002	0.000	0.000	0.000	0.000
343.6	6.80	0.018	0.018	0.000	0.000	0.000	0.000	0.000
357.9	6.78	0.016	0.016	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.028	0.003	0.015	0.010	0.000	0.000	0.000
37.1	7.00	0.095	0.009	0.052	0.034	0.000	0.000	0.000
65.5	7.00	0.128	0.012	0.074	0.042	0.000	0.000	0.000
89.8	7.00	0.103	0.011	0.066	0.026	0.000	0.000	0.000
123.7	7.00	0.237	0.033	0.184	0.020	0.000	0.000	0.000
172.4	7.00	0.145	0.032	0.113	0.000	0.000	0.000	0.000
222.3	7.00	0.072	0.029	0.043	0.000	0.000	0.000	0.000
273.4	7.00	0.043	0.031	0.012	0.000	0.000	0.000	0.000
360.1	7.00	0.052	0.051	0.001	0.000	0.000	0.000	0.000
14.5	7.18	0.016	0.001	0.009	0.006	0.000	0.000	0.000
36.7	7.19	0.051	0.005	0.028	0.018	0.000	0.000	0.000
60.8	7.19	0.047	0.004	0.027	0.016	0.000	0.000	0.000
85.4	7.19	0.078	0.008	0.048	0.022	0.000	0.000	0.000
123.8	7.19	0.126	0.017	0.095	0.015	0.000	0.000	0.000
172.5	7.19	0.082	0.017	0.065	0.000	0.000	0.000	0.000
222.7	7.19	0.042	0.015	0.027	0.000	0.000	0.000	0.000
273.8	7.20	0.027	0.017	0.010	0.000	0.000	0.000	0.000
362.4	7.20	0.035	0.032	0.002	0.000	0.000	0.000	0.000
14.5	7.38	0.016	0.001	0.009	0.006	0.000	0.000	0.000
36.0	7.38	0.057	0.005	0.031	0.021	0.000	0.000	0.000
60.4	7.39	0.049	0.005	0.027	0.017	0.000	0.000	0.000
85.5	7.39	0.083	0.008	0.049	0.025	0.000	0.000	0.000
124.0	7.38	0.131	0.016	0.094	0.020	0.000	0.000	0.000
172.9	7.39	0.086	0.015	0.070	0.001	0.000	0.000	0.000
222.8	7.39	0.048	0.014	0.034	0.000	0.000	0.000	0.000
273.7	7.39	0.034	0.018	0.016	0.000	0.000	0.000	0.000
364.8	7.39	0.045	0.041	0.004	0.000	0.000	0.000	0.000
123.8	7.59	0.019	0.002	0.013	0.005	0.000	0.000	0.000

mmary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 27.0
Mean src-site R= 77.1 km; M= 5.59; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 34.8 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 34.7km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 1.314

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 26.95 77.1 5.59 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Toro et al. 1997 *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.404E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00889
#This deaggregation corresponds to Atkinson-Boore06,140 bar

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.1	4.60	0.126	0.052	0.074	0.000	0.000	0.000	0.000
28.1	4.64	0.013	0.013	0.000	0.000	0.000	0.000	0.000
13.1	4.80	0.240	0.073	0.166	0.000	0.000	0.000	0.000
28.3	4.81	0.074	0.071	0.004	0.000	0.000	0.000	0.000
13.8	5.03	0.187	0.047	0.140	0.000	0.000	0.000	0.000
29.7	5.04	0.102	0.084	0.018	0.000	0.000	0.000	0.000
54.4	5.06	0.003	0.003	0.000	0.000	0.000	0.000	0.000

14.1	5.21	0.075	0.017	0.058	0.000	0.000	0.000	0.000
30.7	5.21	0.060	0.043	0.016	0.000	0.000	0.000	0.000
57.0	5.21	0.004	0.004	0.000	0.000	0.000	0.000	0.000
14.4	5.39	0.117	0.025	0.092	0.000	0.000	0.000	0.000
31.7	5.40	0.129	0.080	0.049	0.000	0.000	0.000	0.000
56.7	5.41	0.014	0.014	0.000	0.000	0.000	0.000	0.000
85.4	5.42	0.007	0.007	0.000	0.000	0.000	0.000	0.000
123.5	5.42	0.010	0.010	0.000	0.000	0.000	0.000	0.000
14.6	5.61	0.059	0.012	0.047	0.000	0.000	0.000	0.000
32.8	5.62	0.090	0.046	0.044	0.000	0.000	0.000	0.000
57.3	5.62	0.016	0.016	0.000	0.000	0.000	0.000	0.000
85.5	5.62	0.011	0.011	0.000	0.000	0.000	0.000	0.000
124.4	5.62	0.018	0.018	0.000	0.000	0.000	0.000	0.000
163.7	5.63	0.004	0.004	0.000	0.000	0.000	0.000	0.000
14.7	5.80	0.052	0.010	0.042	0.000	0.000	0.000	0.000
33.7	5.81	0.101	0.042	0.059	0.000	0.000	0.000	0.000
57.7	5.81	0.027	0.027	0.000	0.000	0.000	0.000	0.000
85.6	5.81	0.022	0.022	0.000	0.000	0.000	0.000	0.000
124.7	5.82	0.037	0.037	0.000	0.000	0.000	0.000	0.000
167.2	5.82	0.012	0.012	0.000	0.000	0.000	0.000	0.000
13.5	6.01	0.035	0.007	0.029	0.000	0.000	0.000	0.000
34.3	6.01	0.088	0.029	0.059	0.000	0.000	0.000	0.000
61.4	6.01	0.033	0.031	0.002	0.000	0.000	0.000	0.000
88.7	6.01	0.021	0.021	0.000	0.000	0.000	0.000	0.000
124.8	6.01	0.048	0.048	0.000	0.000	0.000	0.000	0.000
168.9	6.01	0.019	0.019	0.000	0.000	0.000	0.000	0.000
217.6	6.02	0.003	0.003	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.027	0.000	0.000	0.000	0.000
35.2	6.21	0.100	0.029	0.071	0.000	0.000	0.000	0.000
63.1	6.22	0.046	0.037	0.008	0.000	0.000	0.000	0.000
89.4	6.22	0.029	0.029	0.000	0.000	0.000	0.000	0.000
124.5	6.22	0.079	0.079	0.000	0.000	0.000	0.000	0.000
170.0	6.22	0.035	0.035	0.000	0.000	0.000	0.000	0.000
219.1	6.23	0.009	0.009	0.000	0.000	0.000	0.000	0.000
269.0	6.24	0.002	0.002	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
35.6	6.42	0.069	0.017	0.052	0.000	0.000	0.000	0.000
59.8	6.42	0.032	0.017	0.014	0.000	0.000	0.000	0.000
85.4	6.42	0.039	0.034	0.005	0.000	0.000	0.000	0.000
124.8	6.42	0.078	0.073	0.005	0.000	0.000	0.000	0.000
170.5	6.43	0.040	0.040	0.000	0.000	0.000	0.000	0.000
220.0	6.43	0.013	0.013	0.000	0.000	0.000	0.000	0.000
271.5	6.43	0.004	0.004	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
35.5	6.59	0.043	0.010	0.034	0.000	0.000	0.000	0.000
59.6	6.59	0.024	0.010	0.014	0.000	0.000	0.000	0.000
85.4	6.59	0.032	0.020	0.012	0.000	0.000	0.000	0.000
125.2	6.59	0.062	0.044	0.018	0.000	0.000	0.000	0.000
171.1	6.59	0.034	0.033	0.001	0.000	0.000	0.000	0.000
220.6	6.59	0.013	0.013	0.000	0.000	0.000	0.000	0.000
272.2	6.59	0.005	0.005	0.000	0.000	0.000	0.000	0.000
334.7	6.60	0.003	0.003	0.000	0.000	0.000	0.000	0.000
16.3	6.80	0.025	0.005	0.021	0.000	0.000	0.000	0.000
37.1	6.77	0.055	0.012	0.043	0.000	0.000	0.000	0.000
59.7	6.79	0.037	0.013	0.025	0.000	0.000	0.000	0.000
86.0	6.79	0.053	0.025	0.028	0.000	0.000	0.000	0.000
125.3	6.78	0.102	0.053	0.048	0.000	0.000	0.000	0.000
171.4	6.79	0.064	0.052	0.012	0.000	0.000	0.000	0.000
221.7	6.79	0.026	0.026	0.000	0.000	0.000	0.000	0.000
272.8	6.79	0.013	0.013	0.000	0.000	0.000	0.000	0.000

345.0	6.74	0.006	0.006	0.000	0.000	0.000	0.000	0.000
354.4	6.86	0.006	0.006	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
36.5	7.00	0.043	0.009	0.034	0.000	0.000	0.000	0.000
64.6	7.00	0.040	0.012	0.027	0.000	0.000	0.000	0.000
89.9	7.00	0.030	0.011	0.019	0.000	0.000	0.000	0.000
124.6	7.03	0.060	0.023	0.037	0.000	0.000	0.000	0.000
125.2	6.92	0.022	0.010	0.013	0.000	0.000	0.000	0.000
172.1	7.00	0.054	0.032	0.022	0.000	0.000	0.000	0.000
222.3	7.01	0.026	0.025	0.001	0.000	0.000	0.000	0.000
273.5	7.01	0.015	0.015	0.000	0.000	0.000	0.000	0.000
361.7	7.01	0.019	0.019	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.008	0.001	0.007	0.000	0.000	0.000	0.000
36.3	7.19	0.024	0.005	0.019	0.000	0.000	0.000	0.000
60.4	7.19	0.017	0.004	0.013	0.000	0.000	0.000	0.000
85.6	7.18	0.026	0.008	0.018	0.000	0.000	0.000	0.000
124.4	7.23	0.017	0.006	0.012	0.000	0.000	0.000	0.000
125.1	7.16	0.032	0.011	0.021	0.000	0.000	0.000	0.000
172.5	7.18	0.035	0.017	0.019	0.000	0.000	0.000	0.000
222.9	7.19	0.018	0.015	0.004	0.000	0.000	0.000	0.000
273.9	7.19	0.012	0.012	0.000	0.000	0.000	0.000	0.000
368.0	7.19	0.019	0.019	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.008	0.001	0.006	0.000	0.000	0.000	0.000
35.7	7.38	0.027	0.005	0.022	0.000	0.000	0.000	0.000
60.0	7.39	0.020	0.005	0.015	0.000	0.000	0.000	0.000
85.7	7.39	0.030	0.008	0.022	0.000	0.000	0.000	0.000
124.9	7.38	0.055	0.016	0.039	0.000	0.000	0.000	0.000
173.0	7.39	0.040	0.015	0.025	0.000	0.000	0.000	0.000
223.2	7.39	0.024	0.014	0.010	0.000	0.000	0.000	0.000
274.2	7.39	0.018	0.017	0.002	0.000	0.000	0.000	0.000
372.4	7.34	0.019	0.019	0.000	0.000	0.000	0.000	0.000
376.4	7.47	0.014	0.014	0.000	0.000	0.000	0.000	0.000
557.4	7.41	0.006	0.006	0.000	0.000	0.000	0.000	0.000
35.6	7.59	0.004	0.001	0.003	0.000	0.000	0.000	0.000
64.7	7.59	0.004	0.001	0.003	0.000	0.000	0.000	0.000
89.6	7.59	0.003	0.001	0.002	0.000	0.000	0.000	0.000
124.5	7.59	0.008	0.002	0.006	0.000	0.000	0.000	0.000
173.2	7.59	0.006	0.002	0.004	0.000	0.000	0.000	0.000
223.6	7.59	0.004	0.002	0.002	0.000	0.000	0.000	0.000
274.4	7.59	0.003	0.002	0.001	0.000	0.000	0.000	0.000
379.4	7.60	0.007	0.007	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 4.0
Mean src-site R= 81.6 km; M= 6.10; eps0= 0.01. Mean calculated for all sources.
Modal src-site R= 13.1 km; M= 4.80; eps0= -0.74 from peak (R,M) bin
MODE R*= 12.5km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.166

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
CEUS gridded	3.95	81.5	6.10	0.01

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)

#*********End of deaggregation corresponding to Atkinson-Boore06,140 bar *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.187E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.09311

#This deaggregation corresponds to Frankel et al., 1996

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.6	4.60	0.228	0.045	0.183	0.000	0.000	0.000	0.000
34.1	4.60	0.473	0.190	0.283	0.000	0.000	0.000	0.000
61.5	4.61	0.192	0.189	0.002	0.000	0.000	0.000	0.000
89.6	4.61	0.049	0.049	0.000	0.000	0.000	0.000	0.000
117.8	4.62	0.044	0.044	0.000	0.000	0.000	0.000	0.000
14.7	4.79	0.386	0.073	0.313	0.000	0.000	0.000	0.000
34.7	4.80	0.965	0.312	0.653	0.000	0.000	0.000	0.000
62.1	4.80	0.528	0.467	0.060	0.000	0.000	0.000	0.000
89.8	4.81	0.168	0.168	0.000	0.000	0.000	0.000	0.000
119.6	4.81	0.188	0.188	0.000	0.000	0.000	0.000	0.000
162.8	4.82	0.023	0.023	0.000	0.000	0.000	0.000	0.000
14.8	5.03	0.255	0.047	0.207	0.000	0.000	0.000	0.000
35.4	5.03	0.755	0.202	0.553	0.000	0.000	0.000	0.000
62.8	5.03	0.565	0.398	0.167	0.000	0.000	0.000	0.000
90.0	5.04	0.219	0.219	0.000	0.000	0.000	0.000	0.000
120.8	5.04	0.296	0.296	0.000	0.000	0.000	0.000	0.000
167.0	5.04	0.062	0.062	0.000	0.000	0.000	0.000	0.000
14.8	5.21	0.092	0.017	0.075	0.000	0.000	0.000	0.000
35.7	5.21	0.303	0.072	0.231	0.000	0.000	0.000	0.000
63.4	5.21	0.278	0.149	0.128	0.000	0.000	0.000	0.000
90.1	5.21	0.123	0.120	0.003	0.000	0.000	0.000	0.000
121.6	5.21	0.185	0.185	0.000	0.000	0.000	0.000	0.000
168.2	5.21	0.050	0.050	0.000	0.000	0.000	0.000	0.000
14.8	5.39	0.134	0.025	0.110	0.000	0.000	0.000	0.000
36.1	5.39	0.477	0.105	0.373	0.000	0.000	0.000	0.000
63.8	5.40	0.517	0.216	0.301	0.000	0.000	0.000	0.000
90.2	5.40	0.262	0.189	0.073	0.000	0.000	0.000	0.000
122.4	5.40	0.445	0.429	0.015	0.000	0.000	0.000	0.000
169.1	5.41	0.148	0.148	0.000	0.000	0.000	0.000	0.000
217.9	5.41	0.029	0.029	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.063	0.012	0.052	0.000	0.000	0.000	0.000
36.4	5.61	0.241	0.049	0.192	0.000	0.000	0.000	0.000
64.3	5.61	0.311	0.102	0.209	0.000	0.000	0.000	0.000
90.4	5.62	0.180	0.089	0.092	0.000	0.000	0.000	0.000
123.0	5.62	0.341	0.264	0.077	0.000	0.000	0.000	0.000
169.8	5.62	0.136	0.136	0.000	0.000	0.000	0.000	0.000
219.4	5.62	0.035	0.035	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.055	0.010	0.045	0.000	0.000	0.000	0.000
36.6	5.80	0.216	0.042	0.174	0.000	0.000	0.000	0.000
64.6	5.80	0.315	0.088	0.227	0.000	0.000	0.000	0.000
90.5	5.80	0.201	0.077	0.124	0.000	0.000	0.000	0.000
123.5	5.81	0.409	0.236	0.173	0.000	0.000	0.000	0.000
170.5	5.81	0.191	0.185	0.006	0.000	0.000	0.000	0.000
220.3	5.81	0.060	0.060	0.000	0.000	0.000	0.000	0.000
271.2	5.82	0.019	0.019	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.036	0.007	0.030	0.000	0.000	0.000	0.000
36.9	6.01	0.154	0.029	0.125	0.000	0.000	0.000	0.000
63.9	6.01	0.189	0.045	0.144	0.000	0.000	0.000	0.000
88.2	6.00	0.176	0.054	0.122	0.000	0.000	0.000	0.000
123.8	6.01	0.340	0.145	0.195	0.000	0.000	0.000	0.000
171.4	6.01	0.177	0.144	0.032	0.000	0.000	0.000	0.000
221.0	6.01	0.065	0.065	0.000	0.000	0.000	0.000	0.000
271.8	6.01	0.026	0.026	0.000	0.000	0.000	0.000	0.000
334.2	6.02	0.015	0.015	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.028	0.000	0.000	0.000	0.000
37.4	6.21	0.152	0.029	0.124	0.000	0.000	0.000	0.000
65.2	6.21	0.191	0.043	0.148	0.000	0.000	0.000	0.000
89.3	6.21	0.157	0.041	0.116	0.000	0.000	0.000	0.000

123.8	6.21	0.382	0.129	0.253	0.000	0.000	0.000	0.000
172.1	6.21	0.219	0.130	0.089	0.000	0.000	0.000	0.000
221.2	6.22	0.095	0.091	0.003	0.000	0.000	0.000	0.000
272.4	6.22	0.044	0.044	0.000	0.000	0.000	0.000	0.000
343.7	6.17	0.019	0.019	0.000	0.000	0.000	0.000	0.000
350.6	6.28	0.017	0.017	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
37.2	6.42	0.093	0.017	0.076	0.000	0.000	0.000	0.000
60.9	6.42	0.086	0.017	0.069	0.000	0.000	0.000	0.000
85.3	6.42	0.148	0.034	0.114	0.000	0.000	0.000	0.000
124.4	6.42	0.275	0.077	0.198	0.000	0.000	0.000	0.000
172.3	6.42	0.180	0.079	0.101	0.000	0.000	0.000	0.000
221.7	6.42	0.088	0.070	0.018	0.000	0.000	0.000	0.000
273.2	6.42	0.047	0.047	0.000	0.000	0.000	0.000	0.000
357.7	6.43	0.052	0.052	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
36.6	6.59	0.053	0.010	0.044	0.000	0.000	0.000	0.000
60.6	6.59	0.052	0.010	0.042	0.000	0.000	0.000	0.000
85.3	6.59	0.093	0.020	0.073	0.000	0.000	0.000	0.000
124.9	6.63	0.061	0.015	0.046	0.000	0.000	0.000	0.000
125.0	6.57	0.112	0.029	0.084	0.000	0.000	0.000	0.000
172.8	6.59	0.122	0.044	0.078	0.000	0.000	0.000	0.000
222.2	6.59	0.067	0.040	0.027	0.000	0.000	0.000	0.000
273.5	6.59	0.040	0.038	0.002	0.000	0.000	0.000	0.000
364.5	6.59	0.054	0.054	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.026	0.005	0.021	0.000	0.000	0.000	0.000
37.8	6.77	0.065	0.012	0.053	0.000	0.000	0.000	0.000
60.6	6.78	0.068	0.013	0.055	0.000	0.000	0.000	0.000
85.9	6.78	0.124	0.025	0.099	0.000	0.000	0.000	0.000
125.0	6.86	0.082	0.018	0.064	0.000	0.000	0.000	0.000
125.3	6.74	0.151	0.035	0.115	0.000	0.000	0.000	0.000
172.9	6.78	0.182	0.055	0.127	0.000	0.000	0.000	0.000
223.0	6.78	0.106	0.048	0.057	0.000	0.000	0.000	0.000
273.9	6.79	0.073	0.055	0.017	0.000	0.000	0.000	0.000
371.0	6.79	0.119	0.118	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
37.1	7.00	0.048	0.009	0.039	0.000	0.000	0.000	0.000
65.6	7.00	0.066	0.012	0.054	0.000	0.000	0.000	0.000
89.9	7.00	0.056	0.011	0.045	0.000	0.000	0.000	0.000
124.7	7.03	0.111	0.023	0.088	0.000	0.000	0.000	0.000
125.1	6.92	0.045	0.010	0.035	0.000	0.000	0.000	0.000
173.4	7.00	0.125	0.032	0.092	0.000	0.000	0.000	0.000
223.4	7.00	0.081	0.029	0.052	0.000	0.000	0.000	0.000
274.5	7.00	0.063	0.034	0.029	0.000	0.000	0.000	0.000
375.0	7.01	0.058	0.055	0.004	0.000	0.000	0.000	0.000
375.9	7.00	0.065	0.061	0.004	0.000	0.000	0.000	0.000
565.4	7.01	0.025	0.025	0.000	0.000	0.000	0.000	0.000
36.8	7.19	0.026	0.005	0.021	0.000	0.000	0.000	0.000
60.8	7.18	0.024	0.004	0.020	0.000	0.000	0.000	0.000
85.7	7.18	0.042	0.008	0.034	0.000	0.000	0.000	0.000
124.5	7.23	0.028	0.006	0.022	0.000	0.000	0.000	0.000
125.2	7.16	0.054	0.011	0.043	0.000	0.000	0.000	0.000
173.7	7.18	0.071	0.017	0.054	0.000	0.000	0.000	0.000
224.0	7.18	0.049	0.015	0.034	0.000	0.000	0.000	0.000
274.5	7.16	0.026	0.012	0.015	0.000	0.000	0.000	0.000
275.3	7.23	0.015	0.006	0.009	0.000	0.000	0.000	0.000
379.7	7.19	0.093	0.079	0.015	0.000	0.000	0.000	0.000
577.5	7.19	0.027	0.027	0.000	0.000	0.000	0.000	0.000
36.0	7.38	0.028	0.005	0.023	0.000	0.000	0.000	0.000
60.5	7.39	0.025	0.005	0.020	0.000	0.000	0.000	0.000

85.8	7.38	0.044	0.008	0.036	0.000	0.000	0.000	0.000
125.0	7.38	0.082	0.016	0.066	0.000	0.000	0.000	0.000
174.1	7.38	0.071	0.015	0.055	0.000	0.000	0.000	0.000
224.1	7.38	0.054	0.014	0.040	0.000	0.000	0.000	0.000
274.8	7.34	0.032	0.011	0.020	0.000	0.000	0.000	0.000
275.3	7.47	0.019	0.006	0.013	0.000	0.000	0.000	0.000
384.7	7.39	0.130	0.094	0.036	0.000	0.000	0.000	0.000
591.2	7.40	0.052	0.052	0.000	0.000	0.000	0.000	0.000
758.8	7.41	0.040	0.040	0.000	0.000	0.000	0.000	0.000
124.6	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
174.1	7.59	0.010	0.002	0.008	0.000	0.000	0.000	0.000
389.2	7.59	0.024	0.014	0.009	0.000	0.000	0.000	0.000
609.4	7.60	0.013	0.013	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 18.3
Mean src-site R= 106.5 km; M= 5.74; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 34.7 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 33.8km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.653

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 18.26 105.1 5.73 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Frankel et al., 1996 *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.181E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.09009
#This deaggregation corresponds to Campbell CEUS Hybrid

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.8	4.60	0.240	0.045	0.196	0.000	0.000	0.000	0.000
34.2	4.60	0.565	0.190	0.375	0.000	0.000	0.000	0.000
60.9	4.61	0.204	0.197	0.007	0.000	0.000	0.000	0.000
89.9	4.61	0.058	0.058	0.000	0.000	0.000	0.000	0.000
119.7	4.61	0.070	0.070	0.000	0.000	0.000	0.000	0.000
14.8	4.79	0.400	0.073	0.326	0.000	0.000	0.000	0.000
34.8	4.80	1.105	0.312	0.793	0.000	0.000	0.000	0.000
61.4	4.80	0.521	0.444	0.076	0.000	0.000	0.000	0.000
90.0	4.80	0.169	0.169	0.000	0.000	0.000	0.000	0.000
120.4	4.81	0.229	0.229	0.000	0.000	0.000	0.000	0.000
161.7	4.81	0.025	0.025	0.000	0.000	0.000	0.000	0.000
14.8	5.03	0.260	0.047	0.212	0.000	0.000	0.000	0.000
35.5	5.03	0.839	0.202	0.637	0.000	0.000	0.000	0.000
62.1	5.03	0.536	0.375	0.161	0.000	0.000	0.000	0.000
90.1	5.04	0.204	0.204	0.000	0.000	0.000	0.000	0.000
121.1	5.04	0.305	0.305	0.000	0.000	0.000	0.000	0.000
165.0	5.04	0.049	0.049	0.000	0.000	0.000	0.000	0.000
14.8	5.21	0.093	0.017	0.076	0.000	0.000	0.000	0.000
35.9	5.21	0.331	0.072	0.259	0.000	0.000	0.000	0.000
62.6	5.21	0.265	0.149	0.116	0.000	0.000	0.000	0.000
90.2	5.21	0.114	0.113	0.000	0.000	0.000	0.000	0.000
121.6	5.21	0.183	0.183	0.000	0.000	0.000	0.000	0.000
166.2	5.21	0.036	0.036	0.000	0.000	0.000	0.000	0.000
14.8	5.39	0.135	0.025	0.110	0.000	0.000	0.000	0.000
36.2	5.39	0.513	0.105	0.409	0.000	0.000	0.000	0.000
63.1	5.40	0.504	0.216	0.287	0.000	0.000	0.000	0.000

90.3	5.40	0.244	0.189	0.055	0.000	0.000	0.000	0.000
122.1	5.40	0.423	0.413	0.011	0.000	0.000	0.000	0.000
167.1	5.41	0.099	0.099	0.000	0.000	0.000	0.000	0.000
213.8	5.42	0.010	0.010	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.064	0.012	0.052	0.000	0.000	0.000	0.000
36.6	5.61	0.256	0.049	0.206	0.000	0.000	0.000	0.000
62.8	5.61	0.288	0.092	0.195	0.000	0.000	0.000	0.000
88.5	5.63	0.197	0.098	0.099	0.000	0.000	0.000	0.000
122.7	5.62	0.328	0.257	0.071	0.000	0.000	0.000	0.000
167.9	5.62	0.093	0.093	0.000	0.000	0.000	0.000	0.000
216.4	5.62	0.013	0.013	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.055	0.010	0.045	0.000	0.000	0.000	0.000
36.7	5.80	0.227	0.042	0.184	0.000	0.000	0.000	0.000
59.3	5.80	0.222	0.054	0.168	0.000	0.000	0.000	0.000
85.2	5.81	0.303	0.111	0.192	0.000	0.000	0.000	0.000
123.2	5.81	0.411	0.236	0.175	0.000	0.000	0.000	0.000
168.6	5.81	0.139	0.138	0.001	0.000	0.000	0.000	0.000
217.6	5.81	0.024	0.024	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.036	0.007	0.030	0.000	0.000	0.000	0.000
37.0	6.01	0.160	0.029	0.130	0.000	0.000	0.000	0.000
63.7	6.01	0.200	0.045	0.155	0.000	0.000	0.000	0.000
88.3	6.00	0.182	0.054	0.129	0.000	0.000	0.000	0.000
123.6	6.01	0.355	0.145	0.210	0.000	0.000	0.000	0.000
169.6	6.01	0.139	0.122	0.017	0.000	0.000	0.000	0.000
218.5	6.01	0.030	0.030	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.028	0.000	0.000	0.000	0.000
37.6	6.21	0.156	0.029	0.128	0.000	0.000	0.000	0.000
65.2	6.21	0.204	0.043	0.162	0.000	0.000	0.000	0.000
89.3	6.21	0.170	0.041	0.128	0.000	0.000	0.000	0.000
123.7	6.21	0.416	0.129	0.287	0.000	0.000	0.000	0.000
170.5	6.22	0.187	0.125	0.062	0.000	0.000	0.000	0.000
218.9	6.22	0.050	0.050	0.000	0.000	0.000	0.000	0.000
269.5	6.22	0.012	0.012	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
37.3	6.42	0.094	0.017	0.077	0.000	0.000	0.000	0.000
60.9	6.42	0.092	0.017	0.074	0.000	0.000	0.000	0.000
85.4	6.42	0.162	0.034	0.128	0.000	0.000	0.000	0.000
124.4	6.42	0.309	0.077	0.232	0.000	0.000	0.000	0.000
171.1	6.42	0.170	0.079	0.091	0.000	0.000	0.000	0.000
219.6	6.43	0.055	0.052	0.003	0.000	0.000	0.000	0.000
270.6	6.43	0.016	0.016	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
36.7	6.59	0.054	0.010	0.044	0.000	0.000	0.000	0.000
60.6	6.59	0.055	0.010	0.045	0.000	0.000	0.000	0.000
85.4	6.59	0.101	0.020	0.082	0.000	0.000	0.000	0.000
125.1	6.59	0.198	0.044	0.154	0.000	0.000	0.000	0.000
171.8	6.59	0.123	0.044	0.079	0.000	0.000	0.000	0.000
220.2	6.59	0.048	0.038	0.011	0.000	0.000	0.000	0.000
271.1	6.59	0.016	0.016	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.026	0.005	0.021	0.000	0.000	0.000	0.000
37.9	6.77	0.065	0.012	0.053	0.000	0.000	0.000	0.000
60.6	6.78	0.071	0.013	0.058	0.000	0.000	0.000	0.000
86.0	6.78	0.134	0.025	0.109	0.000	0.000	0.000	0.000
125.4	6.78	0.265	0.053	0.212	0.000	0.000	0.000	0.000
172.2	6.78	0.197	0.055	0.142	0.000	0.000	0.000	0.000
221.5	6.79	0.087	0.048	0.039	0.000	0.000	0.000	0.000
271.8	6.79	0.038	0.037	0.001	0.000	0.000	0.000	0.000
334.9	6.80	0.021	0.021	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
37.1	7.00	0.048	0.009	0.039	0.000	0.000	0.000	0.000

65.7	7.00	0.068	0.012	0.056	0.000	0.000	0.000	0.000
89.9	7.00	0.060	0.011	0.049	0.000	0.000	0.000	0.000
125.0	7.03	0.123	0.023	0.100	0.000	0.000	0.000	0.000
125.4	6.92	0.051	0.010	0.041	0.000	0.000	0.000	0.000
173.2	7.00	0.141	0.032	0.109	0.000	0.000	0.000	0.000
222.3	7.00	0.078	0.029	0.049	0.000	0.000	0.000	0.000
272.7	7.01	0.043	0.033	0.010	0.000	0.000	0.000	0.000
342.0	7.01	0.031	0.031	0.000	0.000	0.000	0.000	0.000
36.8	7.19	0.026	0.005	0.021	0.000	0.000	0.000	0.000
60.9	7.18	0.025	0.004	0.020	0.000	0.000	0.000	0.000
85.7	7.18	0.044	0.008	0.036	0.000	0.000	0.000	0.000
124.8	7.23	0.030	0.006	0.025	0.000	0.000	0.000	0.000
125.5	7.16	0.060	0.011	0.049	0.000	0.000	0.000	0.000
173.7	7.18	0.080	0.017	0.064	0.000	0.000	0.000	0.000
223.2	7.19	0.051	0.015	0.036	0.000	0.000	0.000	0.000
273.4	7.19	0.034	0.018	0.016	0.000	0.000	0.000	0.000
347.3	7.16	0.019	0.019	0.000	0.000	0.000	0.000	0.000
350.7	7.23	0.012	0.012	0.001	0.000	0.000	0.000	0.000
36.0	7.38	0.028	0.005	0.023	0.000	0.000	0.000	0.000
60.5	7.39	0.025	0.005	0.021	0.000	0.000	0.000	0.000
85.8	7.38	0.045	0.008	0.037	0.000	0.000	0.000	0.000
125.3	7.38	0.087	0.016	0.071	0.000	0.000	0.000	0.000
174.2	7.38	0.079	0.015	0.064	0.000	0.000	0.000	0.000
223.8	7.39	0.060	0.014	0.046	0.000	0.000	0.000	0.000
274.2	7.39	0.049	0.018	0.031	0.000	0.000	0.000	0.000
359.0	7.40	0.063	0.051	0.012	0.000	0.000	0.000	0.000
124.8	7.59	0.012	0.002	0.009	0.000	0.000	0.000	0.000
174.4	7.59	0.010	0.002	0.009	0.000	0.000	0.000	0.000
224.5	7.59	0.009	0.002	0.007	0.000	0.000	0.000	0.000
368.9	7.60	0.015	0.010	0.005	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 17.7
Mean src-site R= 88.1 km; M= 5.67; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 34.8 km; M= 4.80; eps0= 0.00 from peak (R,M) bin
MODE R*= 34.0km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.793

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 17.71 88.1 5.67 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Campbell CEUS Hybrid *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.133E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.03123
#This deaggregation corresponds to Silva 1-corner

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.4	4.60	0.200	0.045	0.156	0.000	0.000	0.000	0.000
34.0	4.60	0.364	0.188	0.176	0.000	0.000	0.000	0.000
61.2	4.61	0.150	0.150	0.000	0.000	0.000	0.000	0.000
88.6	4.61	0.024	0.024	0.000	0.000	0.000	0.000	0.000
109.4	4.62	0.007	0.007	0.000	0.000	0.000	0.000	0.000
14.5	4.79	0.350	0.073	0.277	0.000	0.000	0.000	0.000
34.5	4.80	0.755	0.312	0.443	0.000	0.000	0.000	0.000
61.8	4.80	0.404	0.389	0.014	0.000	0.000	0.000	0.000
89.0	4.81	0.085	0.085	0.000	0.000	0.000	0.000	0.000

113.8	4.81	0.040	0.040	0.000	0.000	0.000	0.000	0.000
14.6	5.03	0.238	0.047	0.191	0.000	0.000	0.000	0.000
35.1	5.03	0.611	0.202	0.410	0.000	0.000	0.000	0.000
62.5	5.03	0.428	0.352	0.076	0.000	0.000	0.000	0.000
89.3	5.04	0.117	0.117	0.000	0.000	0.000	0.000	0.000
117.0	5.04	0.080	0.080	0.000	0.000	0.000	0.000	0.000
14.7	5.21	0.088	0.017	0.071	0.000	0.000	0.000	0.000
35.5	5.21	0.253	0.072	0.181	0.000	0.000	0.000	0.000
63.0	5.21	0.214	0.146	0.068	0.000	0.000	0.000	0.000
89.5	5.21	0.070	0.070	0.000	0.000	0.000	0.000	0.000
118.4	5.21	0.058	0.058	0.000	0.000	0.000	0.000	0.000
164.1	5.21	0.007	0.007	0.000	0.000	0.000	0.000	0.000
14.7	5.39	0.130	0.025	0.105	0.000	0.000	0.000	0.000
35.8	5.39	0.409	0.105	0.304	0.000	0.000	0.000	0.000
63.5	5.40	0.407	0.216	0.190	0.000	0.000	0.000	0.000
89.7	5.40	0.156	0.151	0.005	0.000	0.000	0.000	0.000
119.5	5.40	0.154	0.154	0.000	0.000	0.000	0.000	0.000
167.2	5.41	0.029	0.029	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.062	0.012	0.050	0.000	0.000	0.000	0.000
36.1	5.61	0.214	0.049	0.165	0.000	0.000	0.000	0.000
64.0	5.61	0.252	0.102	0.150	0.000	0.000	0.000	0.000
89.9	5.62	0.114	0.088	0.025	0.000	0.000	0.000	0.000
120.6	5.62	0.135	0.135	0.000	0.000	0.000	0.000	0.000
168.7	5.62	0.034	0.034	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.054	0.010	0.044	0.000	0.000	0.000	0.000
36.3	5.80	0.197	0.042	0.155	0.000	0.000	0.000	0.000
64.3	5.80	0.263	0.088	0.175	0.000	0.000	0.000	0.000
90.0	5.81	0.134	0.077	0.057	0.000	0.000	0.000	0.000
121.4	5.81	0.184	0.173	0.011	0.000	0.000	0.000	0.000
169.5	5.81	0.059	0.059	0.000	0.000	0.000	0.000	0.000
219.3	5.82	0.014	0.014	0.000	0.000	0.000	0.000	0.000
13.5	6.01	0.036	0.007	0.029	0.000	0.000	0.000	0.000
36.7	6.01	0.144	0.029	0.115	0.000	0.000	0.000	0.000
64.7	6.01	0.181	0.051	0.130	0.000	0.000	0.000	0.000
89.7	6.01	0.111	0.048	0.063	0.000	0.000	0.000	0.000
122.0	6.01	0.172	0.135	0.037	0.000	0.000	0.000	0.000
170.5	6.01	0.065	0.065	0.000	0.000	0.000	0.000	0.000
220.5	6.01	0.020	0.020	0.000	0.000	0.000	0.000	0.000
271.5	6.02	0.007	0.007	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.028	0.000	0.000	0.000	0.000
37.2	6.21	0.145	0.029	0.116	0.000	0.000	0.000	0.000
65.0	6.21	0.170	0.043	0.128	0.000	0.000	0.000	0.000
89.0	6.21	0.121	0.041	0.080	0.000	0.000	0.000	0.000
122.1	6.21	0.218	0.129	0.089	0.000	0.000	0.000	0.000
171.3	6.22	0.093	0.092	0.002	0.000	0.000	0.000	0.000
220.8	6.22	0.035	0.035	0.000	0.000	0.000	0.000	0.000
272.5	6.22	0.015	0.015	0.000	0.000	0.000	0.000	0.000
344.1	6.23	0.012	0.012	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
37.1	6.42	0.090	0.017	0.073	0.000	0.000	0.000	0.000
60.8	6.42	0.080	0.017	0.062	0.000	0.000	0.000	0.000
84.8	6.42	0.125	0.034	0.091	0.000	0.000	0.000	0.000
123.0	6.42	0.175	0.077	0.098	0.000	0.000	0.000	0.000
171.7	6.42	0.089	0.075	0.015	0.000	0.000	0.000	0.000
221.4	6.43	0.039	0.039	0.000	0.000	0.000	0.000	0.000
273.2	6.43	0.020	0.020	0.000	0.000	0.000	0.000	0.000
363.1	6.43	0.025	0.025	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
36.5	6.59	0.052	0.010	0.042	0.000	0.000	0.000	0.000
60.5	6.59	0.049	0.010	0.039	0.000	0.000	0.000	0.000

85.0	6.59	0.081	0.020	0.061	0.000	0.000	0.000	0.000
123.8	6.59	0.120	0.044	0.076	0.000	0.000	0.000	0.000
172.2	6.59	0.067	0.044	0.024	0.000	0.000	0.000	0.000
221.8	6.59	0.033	0.033	0.001	0.000	0.000	0.000	0.000
273.6	6.59	0.019	0.019	0.000	0.000	0.000	0.000	0.000
372.3	6.59	0.030	0.030	0.000	0.000	0.000	0.000	0.000
16.3	6.80	0.026	0.005	0.021	0.000	0.000	0.000	0.000
37.8	6.77	0.063	0.012	0.052	0.000	0.000	0.000	0.000
60.5	6.78	0.065	0.013	0.052	0.000	0.000	0.000	0.000
85.7	6.78	0.112	0.025	0.086	0.000	0.000	0.000	0.000
124.3	6.78	0.174	0.053	0.121	0.000	0.000	0.000	0.000
172.3	6.79	0.114	0.055	0.059	0.000	0.000	0.000	0.000
222.7	6.79	0.059	0.047	0.012	0.000	0.000	0.000	0.000
274.0	6.79	0.040	0.040	0.000	0.000	0.000	0.000	0.000
379.7	6.79	0.078	0.078	0.000	0.000	0.000	0.000	0.000
566.8	6.74	0.012	0.012	0.000	0.000	0.000	0.000	0.000
586.9	6.86	0.014	0.014	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
37.1	7.00	0.047	0.009	0.039	0.000	0.000	0.000	0.000
65.5	7.00	0.064	0.012	0.051	0.000	0.000	0.000	0.000
89.8	7.00	0.052	0.011	0.041	0.000	0.000	0.000	0.000
124.1	7.00	0.126	0.033	0.093	0.000	0.000	0.000	0.000
173.0	7.00	0.087	0.032	0.055	0.000	0.000	0.000	0.000
223.2	7.00	0.052	0.029	0.023	0.000	0.000	0.000	0.000
274.5	7.01	0.040	0.034	0.006	0.000	0.000	0.000	0.000
384.0	7.01	0.093	0.093	0.000	0.000	0.000	0.000	0.000
598.5	6.92	0.010	0.010	0.000	0.000	0.000	0.000	0.000
612.1	7.01	0.023	0.023	0.000	0.000	0.000	0.000	0.000
626.7	7.07	0.016	0.016	0.000	0.000	0.000	0.000	0.000
785.3	7.10	0.017	0.017	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.008	0.001	0.007	0.000	0.000	0.000	0.000
36.7	7.19	0.025	0.005	0.021	0.000	0.000	0.000	0.000
60.8	7.18	0.024	0.004	0.019	0.000	0.000	0.000	0.000
85.5	7.18	0.040	0.008	0.032	0.000	0.000	0.000	0.000
124.3	7.18	0.070	0.017	0.054	0.000	0.000	0.000	0.000
173.3	7.18	0.053	0.017	0.037	0.000	0.000	0.000	0.000
223.8	7.19	0.034	0.015	0.019	0.000	0.000	0.000	0.000
274.6	7.16	0.018	0.012	0.007	0.000	0.000	0.000	0.000
275.4	7.23	0.011	0.006	0.005	0.000	0.000	0.000	0.000
387.8	7.19	0.077	0.074	0.003	0.000	0.000	0.000	0.000
642.6	7.16	0.036	0.036	0.000	0.000	0.000	0.000	0.000
650.5	7.23	0.022	0.022	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.008	0.001	0.006	0.000	0.000	0.000	0.000
36.0	7.38	0.028	0.005	0.023	0.000	0.000	0.000	0.000
60.5	7.39	0.025	0.005	0.020	0.000	0.000	0.000	0.000
85.7	7.38	0.043	0.008	0.034	0.000	0.000	0.000	0.000
124.6	7.38	0.073	0.016	0.057	0.000	0.000	0.000	0.000
173.7	7.39	0.057	0.015	0.042	0.000	0.000	0.000	0.000
224.0	7.39	0.041	0.014	0.027	0.000	0.000	0.000	0.000
274.9	7.34	0.024	0.011	0.012	0.000	0.000	0.000	0.000
275.4	7.47	0.015	0.006	0.009	0.000	0.000	0.000	0.000
392.3	7.39	0.118	0.096	0.021	0.000	0.000	0.000	0.000
663.8	7.34	0.066	0.066	0.000	0.000	0.000	0.000	0.000
675.3	7.47	0.055	0.055	0.000	0.000	0.000	0.000	0.000
770.5	7.50	0.099	0.099	0.000	0.000	0.000	0.000	0.000
780.5	7.30	0.119	0.119	0.000	0.000	0.000	0.000	0.000
124.3	7.59	0.010	0.002	0.008	0.000	0.000	0.000	0.000
173.9	7.59	0.008	0.002	0.006	0.000	0.000	0.000	0.000
224.4	7.59	0.006	0.002	0.005	0.000	0.000	0.000	0.000
275.2	7.59	0.007	0.002	0.004	0.000	0.000	0.000	0.000

396.7	7.60	0.023	0.015	0.008	0.000	0.000	0.000	0.000
687.8	7.60	0.032	0.032	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 13.0
Mean src-site R= 113.4 km; M= 5.80; eps0= 0.05. Mean calculated for all sources.
Modal src-site R= 34.5 km; M= 4.80; eps0= 0.03 from peak (R,M) bin
MODE R*= 33.0km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.443

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 12.73 101.1 5.78 0.01
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Silva 1-corner *********#

PSHA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.149E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.04671
#This deaggregation corresponds to Tavakoli and Pezeshk 05

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
14.6	4.60	0.226	0.045	0.181	0.000	0.000	0.000	0.000
32.3	4.61	0.319	0.169	0.150	0.000	0.000	0.000	0.000
59.0	4.61	0.046	0.046	0.000	0.000	0.000	0.000	0.000
89.7	4.62	0.008	0.008	0.000	0.000	0.000	0.000	0.000
14.7	4.79	0.390	0.073	0.316	0.000	0.000	0.000	0.000
33.3	4.80	0.753	0.308	0.445	0.000	0.000	0.000	0.000
59.9	4.81	0.175	0.175	0.000	0.000	0.000	0.000	0.000
89.9	4.81	0.041	0.041	0.000	0.000	0.000	0.000	0.000
118.9	4.82	0.049	0.049	0.000	0.000	0.000	0.000	0.000
14.8	5.03	0.258	0.047	0.210	0.000	0.000	0.000	0.000
34.5	5.03	0.674	0.202	0.473	0.000	0.000	0.000	0.000
60.8	5.04	0.258	0.234	0.024	0.000	0.000	0.000	0.000
90.1	5.04	0.079	0.079	0.000	0.000	0.000	0.000	0.000
120.7	5.04	0.114	0.114	0.000	0.000	0.000	0.000	0.000
161.4	5.06	0.012	0.012	0.000	0.000	0.000	0.000	0.000
14.8	5.21	0.093	0.017	0.076	0.000	0.000	0.000	0.000
35.3	5.21	0.292	0.072	0.220	0.000	0.000	0.000	0.000
61.6	5.21	0.158	0.120	0.038	0.000	0.000	0.000	0.000
90.2	5.21	0.057	0.057	0.000	0.000	0.000	0.000	0.000
121.4	5.21	0.091	0.091	0.000	0.000	0.000	0.000	0.000
165.0	5.21	0.015	0.015	0.000	0.000	0.000	0.000	0.000
14.8	5.39	0.135	0.025	0.110	0.000	0.000	0.000	0.000
35.9	5.39	0.479	0.105	0.374	0.000	0.000	0.000	0.000
62.3	5.40	0.357	0.210	0.147	0.000	0.000	0.000	0.000
90.3	5.40	0.154	0.151	0.003	0.000	0.000	0.000	0.000
122.0	5.41	0.268	0.268	0.000	0.000	0.000	0.000	0.000
166.7	5.41	0.059	0.059	0.000	0.000	0.000	0.000	0.000
14.8	5.61	0.064	0.012	0.052	0.000	0.000	0.000	0.000
36.4	5.61	0.249	0.049	0.200	0.000	0.000	0.000	0.000
62.2	5.61	0.238	0.092	0.145	0.000	0.000	0.000	0.000
88.4	5.63	0.152	0.098	0.054	0.000	0.000	0.000	0.000
122.7	5.62	0.254	0.233	0.021	0.000	0.000	0.000	0.000
167.8	5.62	0.071	0.071	0.000	0.000	0.000	0.000	0.000
216.2	5.63	0.010	0.010	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.055	0.010	0.045	0.000	0.000	0.000	0.000
36.7	5.80	0.225	0.042	0.182	0.000	0.000	0.000	0.000
59.1	5.80	0.204	0.054	0.150	0.000	0.000	0.000	0.000

85.2	5.81	0.261	0.111	0.150	0.000	0.000	0.000	0.000
123.3	5.81	0.362	0.233	0.129	0.000	0.000	0.000	0.000
168.7	5.81	0.123	0.123	0.000	0.000	0.000	0.000	0.000
217.7	5.82	0.022	0.022	0.000	0.000	0.000	0.000	0.000
13.6	6.01	0.036	0.007	0.030	0.000	0.000	0.000	0.000
37.0	6.01	0.159	0.029	0.130	0.000	0.000	0.000	0.000
63.5	6.01	0.193	0.045	0.147	0.000	0.000	0.000	0.000
88.3	6.00	0.171	0.054	0.118	0.000	0.000	0.000	0.000
123.8	6.01	0.344	0.145	0.199	0.000	0.000	0.000	0.000
169.8	6.01	0.139	0.122	0.017	0.000	0.000	0.000	0.000
218.8	6.01	0.031	0.031	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.028	0.000	0.000	0.000	0.000
37.6	6.21	0.156	0.029	0.128	0.000	0.000	0.000	0.000
65.1	6.21	0.202	0.043	0.159	0.000	0.000	0.000	0.000
89.4	6.21	0.168	0.041	0.126	0.000	0.000	0.000	0.000
123.9	6.21	0.423	0.129	0.294	0.000	0.000	0.000	0.000
170.7	6.22	0.200	0.127	0.074	0.000	0.000	0.000	0.000
219.2	6.22	0.057	0.057	0.000	0.000	0.000	0.000	0.000
269.9	6.23	0.015	0.015	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
37.3	6.42	0.094	0.017	0.077	0.000	0.000	0.000	0.000
60.9	6.42	0.092	0.017	0.074	0.000	0.000	0.000	0.000
85.4	6.42	0.164	0.034	0.130	0.000	0.000	0.000	0.000
124.6	6.42	0.322	0.077	0.244	0.000	0.000	0.000	0.000
171.4	6.42	0.189	0.079	0.111	0.000	0.000	0.000	0.000
220.0	6.43	0.067	0.059	0.008	0.000	0.000	0.000	0.000
271.0	6.43	0.021	0.021	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
36.7	6.59	0.054	0.010	0.044	0.000	0.000	0.000	0.000
60.6	6.59	0.055	0.010	0.045	0.000	0.000	0.000	0.000
85.5	6.59	0.103	0.020	0.083	0.000	0.000	0.000	0.000
125.3	6.59	0.206	0.044	0.162	0.000	0.000	0.000	0.000
172.2	6.59	0.138	0.044	0.095	0.000	0.000	0.000	0.000
220.6	6.59	0.059	0.040	0.020	0.000	0.000	0.000	0.000
271.5	6.59	0.022	0.022	0.000	0.000	0.000	0.000	0.000
331.7	6.60	0.011	0.011	0.000	0.000	0.000	0.000	0.000
16.4	6.80	0.026	0.005	0.021	0.000	0.000	0.000	0.000
37.9	6.77	0.065	0.012	0.053	0.000	0.000	0.000	0.000
60.6	6.78	0.071	0.013	0.058	0.000	0.000	0.000	0.000
86.1	6.78	0.136	0.025	0.110	0.000	0.000	0.000	0.000
125.6	6.78	0.274	0.053	0.221	0.000	0.000	0.000	0.000
172.7	6.78	0.218	0.055	0.163	0.000	0.000	0.000	0.000
221.9	6.79	0.108	0.048	0.059	0.000	0.000	0.000	0.000
272.2	6.79	0.052	0.046	0.006	0.000	0.000	0.000	0.000
338.3	6.80	0.033	0.033	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
37.1	7.00	0.048	0.009	0.039	0.000	0.000	0.000	0.000
65.7	7.00	0.068	0.012	0.056	0.000	0.000	0.000	0.000
89.9	7.00	0.060	0.011	0.049	0.000	0.000	0.000	0.000
125.0	7.07	0.042	0.008	0.034	0.000	0.000	0.000	0.000
125.3	6.98	0.135	0.025	0.110	0.000	0.000	0.000	0.000
173.6	7.00	0.153	0.032	0.120	0.000	0.000	0.000	0.000
222.8	7.00	0.094	0.029	0.065	0.000	0.000	0.000	0.000
273.1	7.01	0.057	0.034	0.023	0.000	0.000	0.000	0.000
345.2	7.01	0.047	0.047	0.001	0.000	0.000	0.000	0.000
14.5	7.18	0.008	0.001	0.007	0.000	0.000	0.000	0.000
36.8	7.19	0.026	0.005	0.021	0.000	0.000	0.000	0.000
60.9	7.18	0.025	0.004	0.020	0.000	0.000	0.000	0.000
85.7	7.18	0.044	0.008	0.036	0.000	0.000	0.000	0.000
124.8	7.23	0.030	0.006	0.025	0.000	0.000	0.000	0.000

125.5	7.16	0.060	0.011	0.049	0.000	0.000	0.000	0.000
174.0	7.18	0.085	0.016	0.068	0.000	0.000	0.000	0.000
223.7	7.19	0.059	0.015	0.045	0.000	0.000	0.000	0.000
273.8	7.19	0.043	0.018	0.026	0.000	0.000	0.000	0.000
349.9	7.16	0.028	0.025	0.003	0.000	0.000	0.000	0.000
352.4	7.23	0.017	0.015	0.003	0.000	0.000	0.000	0.000
14.5	7.38	0.008	0.001	0.006	0.000	0.000	0.000	0.000
36.0	7.38	0.028	0.005	0.023	0.000	0.000	0.000	0.000
60.5	7.39	0.025	0.005	0.021	0.000	0.000	0.000	0.000
85.8	7.38	0.045	0.008	0.037	0.000	0.000	0.000	0.000
125.3	7.38	0.087	0.016	0.071	0.000	0.000	0.000	0.000
174.4	7.38	0.081	0.015	0.066	0.000	0.000	0.000	0.000
224.2	7.38	0.066	0.014	0.052	0.000	0.000	0.000	0.000
274.5	7.39	0.059	0.018	0.042	0.000	0.000	0.000	0.000
360.9	7.40	0.086	0.061	0.025	0.000	0.000	0.000	0.000
124.8	7.59	0.012	0.002	0.009	0.000	0.000	0.000	0.000
174.5	7.59	0.011	0.002	0.009	0.000	0.000	0.000	0.000
224.7	7.59	0.009	0.002	0.008	0.000	0.000	0.000	0.000
371.1	7.60	0.020	0.011	0.008	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 14.5
Mean src-site R= 93.9 km; M= 5.86; eps0= -0.70. Mean calculated for all sources.
Modal src-site R= 33.3 km; M= 4.80; eps0= -0.13 from peak (R,M) bin
MODE R*= 33.5km; M*= 5.03; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.473

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 14.54 93.9 5.86 -0.70
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Tavakoli and Pezeshk 05 *********#

PGA Deaggregation. %contributions. site: SMC_Facility long: 75.016 W., lat: 39.541 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 975 yrs. Exceedance PGA =0.04195 g. Weight * Computed_Rate_Ex 0.571E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01311
#This deaggregation corresponds to Atkinson-Boore06,200 bar

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
12.9	4.60	0.141	0.045	0.096	0.000	0.000	0.000	0.000
27.9	4.61	0.038	0.037	0.001	0.000	0.000	0.000	0.000
13.6	4.80	0.277	0.073	0.203	0.000	0.000	0.000	0.000
29.2	4.81	0.126	0.109	0.017	0.000	0.000	0.000	0.000
14.1	5.03	0.209	0.047	0.161	0.000	0.000	0.000	0.000
30.6	5.04	0.162	0.116	0.045	0.000	0.000	0.000	0.000
56.8	5.05	0.010	0.010	0.000	0.000	0.000	0.000	0.000
14.4	5.21	0.081	0.017	0.064	0.000	0.000	0.000	0.000
31.7	5.21	0.090	0.056	0.034	0.000	0.000	0.000	0.000
56.6	5.21	0.009	0.009	0.000	0.000	0.000	0.000	0.000
85.3	5.21	0.004	0.004	0.000	0.000	0.000	0.000	0.000
123.2	5.21	0.006	0.006	0.000	0.000	0.000	0.000	0.000
14.6	5.39	0.124	0.025	0.100	0.000	0.000	0.000	0.000
32.7	5.40	0.184	0.096	0.088	0.000	0.000	0.000	0.000
57.2	5.41	0.031	0.031	0.000	0.000	0.000	0.000	0.000
85.5	5.41	0.019	0.019	0.000	0.000	0.000	0.000	0.000
124.3	5.42	0.032	0.032	0.000	0.000	0.000	0.000	0.000
162.8	5.43	0.006	0.006	0.000	0.000	0.000	0.000	0.000
14.7	5.61	0.061	0.012	0.049	0.000	0.000	0.000	0.000
33.7	5.62	0.121	0.049	0.072	0.000	0.000	0.000	0.000

57.6	5.62	0.032	0.032	0.000	0.000	0.000	0.000	0.000
85.6	5.62	0.025	0.025	0.000	0.000	0.000	0.000	0.000
124.7	5.62	0.043	0.043	0.000	0.000	0.000	0.000	0.000
167.0	5.63	0.014	0.014	0.000	0.000	0.000	0.000	0.000
14.8	5.80	0.054	0.010	0.044	0.000	0.000	0.000	0.000
34.4	5.80	0.130	0.042	0.087	0.000	0.000	0.000	0.000
58.0	5.81	0.046	0.042	0.005	0.000	0.000	0.000	0.000
85.7	5.81	0.044	0.044	0.000	0.000	0.000	0.000	0.000
124.9	5.81	0.078	0.078	0.000	0.000	0.000	0.000	0.000
168.5	5.82	0.031	0.031	0.000	0.000	0.000	0.000	0.000
217.1	5.82	0.005	0.005	0.000	0.000	0.000	0.000	0.000
13.5	6.01	0.036	0.007	0.029	0.000	0.000	0.000	0.000
35.0	6.01	0.107	0.029	0.077	0.000	0.000	0.000	0.000
62.0	6.01	0.054	0.042	0.012	0.000	0.000	0.000	0.000
88.7	6.01	0.038	0.038	0.000	0.000	0.000	0.000	0.000
124.9	6.03	0.069	0.069	0.000	0.000	0.000	0.000	0.000
125.1	5.95	0.022	0.022	0.000	0.000	0.000	0.000	0.000
169.8	6.01	0.041	0.041	0.000	0.000	0.000	0.000	0.000
219.3	6.02	0.010	0.010	0.000	0.000	0.000	0.000	0.000
13.2	6.21	0.034	0.006	0.028	0.000	0.000	0.000	0.000
35.9	6.21	0.116	0.029	0.088	0.000	0.000	0.000	0.000
63.6	6.21	0.070	0.043	0.028	0.000	0.000	0.000	0.000
89.4	6.22	0.049	0.041	0.008	0.000	0.000	0.000	0.000
124.7	6.22	0.135	0.123	0.012	0.000	0.000	0.000	0.000
170.7	6.22	0.067	0.067	0.000	0.000	0.000	0.000	0.000
220.0	6.22	0.021	0.021	0.000	0.000	0.000	0.000	0.000
271.1	6.23	0.007	0.007	0.000	0.000	0.000	0.000	0.000
13.1	6.42	0.023	0.004	0.018	0.000	0.000	0.000	0.000
36.2	6.42	0.078	0.017	0.061	0.000	0.000	0.000	0.000
60.1	6.42	0.044	0.017	0.026	0.000	0.000	0.000	0.000
85.4	6.42	0.060	0.034	0.026	0.000	0.000	0.000	0.000
124.9	6.40	0.090	0.059	0.031	0.000	0.000	0.000	0.000
125.0	6.49	0.033	0.019	0.015	0.000	0.000	0.000	0.000
171.2	6.42	0.070	0.066	0.004	0.000	0.000	0.000	0.000
220.7	6.43	0.026	0.026	0.000	0.000	0.000	0.000	0.000
272.3	6.43	0.011	0.011	0.000	0.000	0.000	0.000	0.000
337.0	6.43	0.007	0.007	0.000	0.000	0.000	0.000	0.000
13.2	6.59	0.014	0.002	0.011	0.000	0.000	0.000	0.000
35.9	6.59	0.047	0.010	0.038	0.000	0.000	0.000	0.000
59.9	6.59	0.031	0.010	0.021	0.000	0.000	0.000	0.000
85.4	6.59	0.045	0.020	0.026	0.000	0.000	0.000	0.000
125.3	6.59	0.091	0.044	0.047	0.000	0.000	0.000	0.000
171.7	6.59	0.056	0.043	0.013	0.000	0.000	0.000	0.000
221.2	6.59	0.024	0.024	0.000	0.000	0.000	0.000	0.000
272.8	6.59	0.012	0.012	0.000	0.000	0.000	0.000	0.000
347.0	6.57	0.006	0.006	0.000	0.000	0.000	0.000	0.000
351.7	6.63	0.005	0.005	0.000	0.000	0.000	0.000	0.000
16.3	6.80	0.026	0.005	0.021	0.000	0.000	0.000	0.000
37.4	6.77	0.059	0.012	0.047	0.000	0.000	0.000	0.000
60.0	6.78	0.047	0.013	0.034	0.000	0.000	0.000	0.000
86.0	6.78	0.072	0.025	0.047	0.000	0.000	0.000	0.000
125.5	6.78	0.141	0.053	0.087	0.000	0.000	0.000	0.000
171.9	6.79	0.097	0.055	0.042	0.000	0.000	0.000	0.000
222.2	6.79	0.045	0.042	0.003	0.000	0.000	0.000	0.000
273.3	6.79	0.026	0.026	0.000	0.000	0.000	0.000	0.000
362.0	6.80	0.033	0.033	0.000	0.000	0.000	0.000	0.000
14.0	7.00	0.014	0.003	0.011	0.000	0.000	0.000	0.000
36.8	7.00	0.045	0.009	0.037	0.000	0.000	0.000	0.000
64.9	7.00	0.048	0.012	0.036	0.000	0.000	0.000	0.000
89.9	7.00	0.038	0.011	0.027	0.000	0.000	0.000	0.000

124.8	7.03	0.077	0.023	0.054	0.000	0.000	0.000	0.000
125.3	6.92	0.030	0.010	0.020	0.000	0.000	0.000	0.000
172.6	7.00	0.077	0.032	0.044	0.000	0.000	0.000	0.000
222.7	7.01	0.041	0.029	0.012	0.000	0.000	0.000	0.000
273.9	7.01	0.028	0.027	0.000	0.000	0.000	0.000	0.000
369.3	7.01	0.043	0.043	0.000	0.000	0.000	0.000	0.000
541.8	7.02	0.004	0.004	0.000	0.000	0.000	0.000	0.000
14.5	7.18	0.008	0.001	0.007	0.000	0.000	0.000	0.000
36.5	7.19	0.025	0.005	0.020	0.000	0.000	0.000	0.000
60.5	7.19	0.020	0.004	0.015	0.000	0.000	0.000	0.000
85.7	7.18	0.031	0.008	0.023	0.000	0.000	0.000	0.000
124.5	7.23	0.021	0.006	0.016	0.000	0.000	0.000	0.000
125.2	7.16	0.040	0.011	0.029	0.000	0.000	0.000	0.000
173.0	7.18	0.047	0.017	0.031	0.000	0.000	0.000	0.000
223.4	7.19	0.028	0.015	0.013	0.000	0.000	0.000	0.000
274.4	7.19	0.021	0.017	0.003	0.000	0.000	0.000	0.000
373.6	7.16	0.024	0.024	0.000	0.000	0.000	0.000	0.000
375.2	7.23	0.014	0.014	0.000	0.000	0.000	0.000	0.000
557.7	7.19	0.007	0.007	0.000	0.000	0.000	0.000	0.000
14.5	7.38	0.008	0.001	0.006	0.000	0.000	0.000	0.000
35.8	7.38	0.028	0.005	0.023	0.000	0.000	0.000	0.000
60.2	7.39	0.022	0.005	0.017	0.000	0.000	0.000	0.000
85.8	7.39	0.035	0.008	0.027	0.000	0.000	0.000	0.000
125.1	7.38	0.066	0.016	0.050	0.000	0.000	0.000	0.000
173.4	7.39	0.051	0.015	0.036	0.000	0.000	0.000	0.000
223.6	7.39	0.034	0.014	0.020	0.000	0.000	0.000	0.000
274.6	7.39	0.029	0.018	0.011	0.000	0.000	0.000	0.000
379.6	7.39	0.061	0.058	0.003	0.000	0.000	0.000	0.000
569.0	7.34	0.009	0.009	0.000	0.000	0.000	0.000	0.000
576.2	7.47	0.008	0.008	0.000	0.000	0.000	0.000	0.000
738.8	7.50	0.004	0.004	0.000	0.000	0.000	0.000	0.000
35.7	7.59	0.004	0.001	0.003	0.000	0.000	0.000	0.000
64.9	7.59	0.005	0.001	0.004	0.000	0.000	0.000	0.000
89.6	7.59	0.004	0.001	0.003	0.000	0.000	0.000	0.000
124.6	7.59	0.009	0.002	0.007	0.000	0.000	0.000	0.000
173.6	7.59	0.008	0.002	0.006	0.000	0.000	0.000	0.000
224.0	7.59	0.005	0.002	0.004	0.000	0.000	0.000	0.000
274.7	7.59	0.005	0.002	0.003	0.000	0.000	0.000	0.000
384.6	7.60	0.012	0.011	0.002	0.000	0.000	0.000	0.000
585.0	7.60	0.005	0.005	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 5.6
Mean src-site R= 97.0 km; M= 6.11; eps0= 0.00. Mean calculated for all sources.
Modal src-site R= 13.6 km; M= 4.80; eps0= -0.95 from peak (R,M) bin
MODE R*= 13.2km; M*= 4.80; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 0.203

Principal sources (faults, subduction, random seismicity having > 3% contribution)
Source Category: % contr. R(km) M epsilon0 (mean values).
CEUS gridded 5.58 96.4 6.11 0.00
Individual fault hazard details if its contribution to mean hazard > 2%:
Fault ID % contr. Rcd(km) M epsilon0 Site-to-src azimuth(d)
#*********End of deaggregation corresponding to Atkinson-Boore06,200 bar *********#

**********Central or Eastern U.S. Site **********

ATTACHMENT M
Liquefaction Analyses

Shieldalloy Metallurgical Corporation - Newfield, New Jersey Facility - Decommissioning

Liquefaction Analysis Resulting from the Design Earthquake - 4.8 Magnitude Event with a PHGA of 0.1535g and Mean Return Time = 2,475 years

Location: Boring GB-1

ELEVATION (ft.)	DEPTH (ft.)	Vertical Stress (TSF)	Eff. Vertical Stress (TSF)	Stress Reduction Factor - r_d	CSR_{EQ}	BLOWS/ft $(N_1)_{60}$	Fines Content (%)	N_{CORR} Fines	$(N_1)_{60CS}$	$CSR_{7.5}$	Mag. Scale Factor (K_m)	Stress Cor. Factor (K_σ)	CSR_L	Factor of Safety
110														
108														
106														
104														
102	0	0.00	0.00											
100	2	0.12	0.12	1.00		20								
98	4	0.24	0.24	0.99		13								
96	6	0.36	0.36	0.99		4	9.6							
94	8	0.48	0.48	0.98		10								
92	10	0.60	0.60	0.98		12	14.2							
90	12	0.72	0.72	0.97		10	12.7							
88	14	0.84	0.78	0.97	0.10	8	11.1	1	9	0.12	3.1	1	0.37	3.57
86	16	0.96	0.84	0.96	0.11	16	11.3	1	17	0.21	3.1	1	0.65	5.90
84	18	1.08	0.89	0.96	0.12	24		1	25	0.36	3.1	1	1.12	9.65
82	20	1.20	0.95	0.95	0.12	21		1	22	0.29	3.1	1	0.90	7.49
80	22	1.32	1.01	0.95	0.12	17	12.7	1	18	0.22	3.1	1	0.68	5.50
78	24	1.44	1.07	0.94	0.13	30		1	30	1	3.1	0.99	3.07	24.11
76	26	1.56	1.12	0.94	0.13	20	12.1	1	21	0.28	3.1	0.98	0.85	6.53
74	28	1.68	1.18	0.93	0.13	5	1.5	0	5	0.06	3.1	0.97	0.18	1.36
72	30	1.80	1.24	0.93	0.13	5	17.8	1.5	6.5	0.11	3.1	0.96	0.33	2.43
70	32	1.92	1.30	0.91	0.14	4	86	5	9	1	3.1	0.95	2.95	21.81
68	34	2.04	1.35	0.90	0.13	13	19.3	1.5	14.5	0.21	3.1	0.94	0.61	4.54

AVERAGE FACTOR OF SAFETY 8.443507

Shieldalloy Metallurgical Corporation - Newfield, New Jersey Facility - Decommissioning

Liquefaction Analysis Resulting from the Design Earthquake - 4.8 Magnitude Event with a PHGA of 0.1535g and Mean Return Time = 2,475 years

Location: Boring GB-2

ELEVATION (ft.)	DEPTH (ft.)	Vertical Stress (TSF)	Eff. Vertical Stress (TSF)	Stress Reduction Factor - r_d	CSR_{EQ}	BLOWS/ft $(N_1)_{60}$	Fines Content (%)	N_{CORR} Fines	$(N_1)_{60CS}$	$CSR_{7.5}$	Mag. Scale Factor (K_m)	Stress Cor. Factor (K_σ)	CSR_L	Factor of Safety
110														
108														
106	0	0.00	0.00											
104	2	0.12	0.12	1.00		27	18.9							
102	4	0.24	0.24	0.99		9	27.2							
100	6	0.36	0.36	0.99		8								
98	8	0.48	0.48	0.98		9	13.1							
96	10	0.60	0.60	0.98		9	10.2							
94	12	0.72	0.72	0.97		2	10.2							
92	14	0.84	0.78	0.97	0.10	43	20.2	1	44	1	3.1	1	3.10	29.73
90	16	0.96	0.84	0.96	0.11	16		1	17	0.22	3.1	1	0.68	6.18
88	18	1.08	0.89	0.96	0.12	19		1	20	0.27	3.1	1	0.84	7.24
86	20	1.20	0.95	0.95	0.12	10	12.4	1	11	0.15	3.1	1	0.47	3.87
84	22	1.32	1.01	0.95	0.12	8		1	9	0.12	3.1	1	0.37	3.00
82	24	1.44	1.07	0.94	0.13	14	10.4	1	15	0.19	3.1	1	0.59	4.63
80	26	1.56	1.12	0.94	0.13	13		1	14	0.17	3.1	0.99	0.52	4.01
78	28	1.68	1.18	0.93	0.13	9	9.7	1	10	0.13	3.1	0.98	0.39	2.98
76	30	1.80	1.24	0.93	0.13	21		1	22	0.28	3.1	0.97	0.84	6.24
74	32	1.92	1.30	0.91	0.14	8	10.3	1	9	0.12	3.1	0.96	0.36	2.64
72	34	2.04	1.35	0.90	0.13	10	6.8	1	11	0.13	3.1	0.95	0.38	2.84
70	36	2.16	1.41	0.88	0.13									
68	38	2.28	1.47	0.86	0.13									

AVERAGE FACTOR OF SAFETY 6.67

Shieldalloy Metallurgical Corporation - Newfield, New Jersey Facility - Decommissioning

Liquefaction Analysis Resulting from the Design Earthquake - 4.8 Magnitude Event with a PHGA of 0.1535g and Mean Return Time = 2,475 years

Location: Boring GB-3

ELEVATION (ft.)	DEPTH (ft.)	Vertical Stress (TSF)	Eff. Vertical Stress (TSF)	Stress Reduction Factor - r_d	CSR_{EQ}	BLOWS/ft $(N_1)_{60}$	Fines Content (%)	N_{CORR} Fines	$(N_1)_{60CS}$	$CSR_{7.5}$	Mag. Scale Factor (K_m)	Stress Cor. Factor (K_σ)	CSR_L	Factor of Safety
110	0													
108	2	0.00	0.00	1.00		18	10.2							
106	4	0.12	0.12	0.99		21								
104	6	0.24	0.24	0.99		24	23.3							
102	8	0.36	0.36	0.98		30	21.7							
100	10	0.48	0.48	0.98		24								
98	12	0.60	0.60	0.97		13	17.8							
96	14	0.72	0.72	0.97		22								
94	16	0.84	0.84	0.96		18								
92	18	0.96	0.90	0.96	0.10	13	13.1	1	14	0.19	3.1	1	0.59	5.76
90	20	1.08	0.96	0.95	0.11	15		1	16	0.22	3.1	1	0.68	6.34
88	22	1.20	1.01	0.95	0.11	10	15.2	1	11	0.16	3.1	1	0.50	4.42
86	24	1.32	1.07	0.94	0.12	19		1	20	0.29	3.1	1	0.90	7.74
84	26	1.44	1.13	0.94	0.12	14	6.8	0	14	0.16	3.1	0.99	0.49	4.10
82	28	1.56	1.19	0.93	0.12	18		0	18	0.21	3.1	0.98	0.64	5.20
80	30	1.68	1.24	0.93	0.13	18	7	0	18	0.21	3.1	0.97	0.63	5.04
78	32	1.80	1.30	0.91	0.13	14		0	14	0.16	3.1	0.96	0.48	3.78
76	34	1.92	1.36	0.90	0.13	13	5.6	0	13	0.14	3.1	0.95	0.41	3.26
74	36	2.04	1.42	0.88	0.13	24		0	24	0.27	3.1	0.94	0.79	6.21
72	38	2.16	1.47	0.86	0.13	17	6.4	0	17	0.18	3.1	0.93	0.52	4.10
70	40	2.28	1.53	0.85	0.13									
68	42	2.40	1.59	0.83	0.13									

AVERAGE FACTOR OF SAFETY 5.09

Shieldalloy Metallurgical Corporation - Newfield, New Jersey Facility - Decommissioning

Liquefaction Analysis Resulting from the Design Earthquake - 4.8 Magnitude Event with a PHGA of 0.1535g and Mean Return Time = 2,475 years

Location: Boring GB-4

ELEVATION (ft.)	DEPTH (ft.)	Vertical Stress (TSF)	Eff. Vertical Stress (TSF)	Stress Reduction Factor - r_d	CSR_{EQ}	BLOWS/ft $(N_1)_{60}$	Fines Content (%)	N_{CORR} Fines	$(N_1)_{60CS}$	$CSR_{7.5}$	Mag. Scale Factor (K_m)	Stress Cor. Factor (K_σ)	CSR_L	Factor of Safety
110														
108	0	0.00	0.00	1.00										
106	2	0.12	0.12	1.00		Refusal	24.2							
104	4	0.24	0.24	0.99		Refusal								
102	6	0.36	0.36	0.99		10	22.3							
100	8	0.48	0.48	0.98		5								
98	10	0.60	0.60	0.98		6	15.5							
96	12	0.72	0.66	0.97	0.11	3	14.7	1	4	0.07	3.1	1	0.22	2.04
94	14	0.84	0.72	0.97	0.11	13		1	14	0.2	3.1	1	0.62	5.47
92	16	0.96	0.77	0.96	0.12	10	13.4	1	11	0.16	3.1	1	0.50	4.16
90	18	1.08	0.83	0.96	0.12	13		1	14	0.19	3.1	1	0.59	4.74
88	20	1.20	0.89	0.95	0.13	10	11.2	1	11	0.14	3.1	1	0.43	3.38
86	22	1.32	0.95	0.95	0.13	8		1	9	0.12	3.1	1	0.37	2.82
84	24	1.44	1.00	0.94	0.14	8	7.6	0	8	0.1	3.1	1	0.31	2.29
82	26	1.56	1.06	0.94	0.14	11		0	11	0.13	3.1	0.99	0.40	2.89
80	28	1.68	1.12	0.93	0.14	13	6	0	13	0.14	3.1	0.98	0.43	3.04
78	30	1.80	1.18	0.93	0.14	8		0	8	0.1	3.1	0.97	0.30	2.12
76	32	1.92	1.23	0.91	0.14	9	6.9	0	9	0.12	3.1	0.96	0.36	2.52
74	34	2.04	1.29	0.90	0.14	20		0	20	0.23	3.1	0.95	0.68	4.79
72	36	2.16	1.35	0.88	0.14	4	14.4	1	5	0.08	3.1	0.94	0.23	1.66
70	38	2.28	1.41	0.86	0.14									
68	40	2.40	1.46	0.85	0.14									

AVERAGE FACTOR OF SAFETY 3.22

Shieldalloy Metallurgical Corporation - Newfield, New Jersey Facility - Decommissioning

Liquefaction Analysis Resulting from the Design Earthquake - 4.8 Magnitude Event with a PHGA of 0.1535g and Mean Return Time = 2,475 years

Location: Boring GB-5

ELEVATION (ft.)	DEPTH (ft.)	Vertical Stress (TSF)	Eff. Vertical Stress (TSF)	Stress Reduction Factor - r_d	CSR_{EQ}	BLOWS/ft $(N_1)_{60}$	Fines Content (%)	N_{CORR} Fines	$(N_1)_{60CS}$	$CSR_{7.5}$	Mag. Scale Factor (K_m)	Stress Cor. Factor (K_σ)	CSR_L	Factor of Safety
110														
108														
106														
104														
102	0	0.00	0.00	1.00										
100	2	0.12	0.12	1.00		Refusal								
98	4	0.24	0.24	0.99		Refusal	10.8							
96	6	0.36	0.36	0.99		Refusal								
94	8	0.48	0.48	0.98		4	23.1							
92	10	0.60	0.54	0.98	0.11	18	15.8	1	19	0.28	3.1	1	0.87	7.98
90	12	0.72	0.60	0.97	0.12	11		1	12	0.18	3.1	1	0.56	4.76
88	14	0.84	0.65	0.97	0.12	10	10.4	1	11	0.14	3.1	1	0.43	3.49
86	16	0.96	0.71	0.96	0.13	9		1	10	0.13	3.1	1	0.40	3.10
84	18	1.08	0.77	0.96	0.13	13		1	14	0.17	3.1	1	0.53	3.92
82	20	1.20	0.83	0.95	0.14	12		1	13	0.16	3.1	1	0.50	3.59
80	22	1.32	0.88	0.95	0.14	12	10.8	1	13	0.16	3.1	1	0.50	3.51
78	24	1.44	0.94	0.98	0.15	16	14.2	1	17	0.24	3.1	1	0.74	4.98
76	26	1.56	1.00	0.96	0.15	12		1	13	0.19	3.1	1	0.59	3.93
74	28	1.68	1.06	0.95	0.15	18	16.4	1	19	0.28	3.1	1	0.87	5.78
72	30	1.80	1.11	0.93	0.15	13		1	14	0.21	3.1	0.99	0.64	4.30
70	32	1.92	1.17	0.91	0.15	11	81.1	5	16	0.9	3.1	0.98	2.73	18.30
68	34	2.04	1.23	0.90	0.15									

AVERAGE FACTOR OF SAFETY 5.64

ATTACHMENT N
Erosion Protection Design

Erosion Protection Design

The design of the long term erosion protection measures for the engineered barrier was performed using the techniques recommended in NUREG-1623 – Design of Erosion Protection for Long-Term Stabilization. The design precipitation event utilized as the basis for the engineered barrier design was the Probable Maximum Precipitation (PMP). The PMP design criteria were established by the US Army Corps of Engineers (USACOE), with the PMP defined in NUREG-1623 as "the estimated depth of rainfall for a given duration, drainage area, and time of year for which there is virtually no risk of exceedance." The goal of the design process was to identify appropriate ground cover methods for the engineered barrier to ensure long term stabilization of its surface.

PMP Analysis

The first step in the design process was to identify the appropriate PMP for the site using USACOE Hydrometeorological Report (HMR) 51 – Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, and HMR 52 – Application of Probable Maximum Precipitation Estimates, United States East of the 105th Meridian. To determine maximum flow rates at various locations on the engineered barrier, the calculated PMP was converted into a rainfall intensity using the methodology prescribed in NUREG-4620 – Methodologies for Evaluating Long Term Stabilization Designs of Uranium Mill Tailings Impoundments. In accordance with NUREG-1623, based upon the calculated rainfall intensity and utilizing the rational method, the maximum flow rates along the top slopes and side slopes were calculated. In order to determine if vegetative cover was suitable to ensure long term stabilization, the maximum runoff flow velocity along the top slopes was calculated using the methodology stipulated in NUREG-1623. The calculations show that a vegetative cover would provide suitable long term erosion protection on the top slopes of the proposed landform. However, in order to provide more robust erosion protection, crushed angular stone will be placed on both the top slopes and side slopes.

Calculations were performed, in accordance with the procedures stipulated in NUREG-1623, to determine both the required minimum stone size and minimum stone depth at the following locations on the engineered barrier: top slopes, side slopes, and at the toe of the side slopes. The calculations utilized the Abt and Johnson method, using a conservative flow concentration value of 3. The calculations show the following minimum 50th percentile stone diameters (d_{50}): Top Slopes – 0.50 inches, Side Slopes – 2.31 inches, Toe of Side Slopes – 4.63 inches. The following stone gradations will be utilized: Top Slopes – ½" to 1 ½" (d_{50} = 1"), Side Slopes – 2" to 4" (d_{50} = 3"), Toe of Side Slopes – 4" to 6" (d_{50} = 5").

The required minimum stone layer depth was then calculated in accordance with the procedures stipulated in NUREG-1623 and based upon the proposed d_{50} for each stone size. The calculated minimum stone layer depths are as follows: Top Slope – 2", Side Slopes – 6", Toe of Side Slopes – 15". To facilitate ease of installation, a 3" thickness of stone will be placed on the top of the

landform rather than the minimum 2". Finally, the width of the riprap layer at the toe of the side slopes was calculated, in accordance with NUREG-1623, to be 6.25 feet. As designed, a greater width of riprap is provided along the southerly edge of the engineered barrier and the provision of drainage channels faced with larger riprap along the westerly, northerly and easterly edges of the engineered barrier more than satisfies the NUREG-1623 requirements.

The importance of a stable base for the angular stone erosion protection layer on the side slopes of the engineered barrier has been enhanced by the addition of a finer aggregate filter bedding layer directly beneath the erosion protection. Even though a non-woven geotextile is being used as a filter layer to separate the cover stone from the cover soil, it was determined that due to the higher erosion potential on the side slopes, an intermediate filter bedding layer will increase protection for cover stone and cover soil. The selection of a suitable material for the filter bedding layer is based upon the Bureau of Reclamation criteria for graded filters of angular particles, as follows:

$$R_{50} = D_{50} \text{ coarser material}/D_{50} \text{ finer material} = 9 \text{ to } 30$$

The D_{50} for the cover stone is 3 inches, so a D_{50} for the filter material of 0.25 inches yields an $R_{50} = 12$, which is in the acceptable range.

Probable Maximum Flood Evaluation

The impact of a probable maximum flood (PMF) event on the proposed plan for consolidating/capping the NRC-regulated material was evaluated. The PMF is defined as the hypothetical flood (peak discharge, volume and hydrograph shape) that is considered to be the most severe reasonably possible, based on hydrometeorological application of the PMP and other hydrologic factors favorable for maximum flood runoff, such as sequential storms and snowmelt.

The SMC facility lies in an upland area of the site. The Hudson Branch runs east to west along the southern boundary of the property. Under the LTC Alternative, the Hudson Branch stream is 260 feet from the engineered barrier at its closest point. The Hudson Branch watershed upstream from the Storage Yard area measures approximately 370 acres and is mostly relatively flat undeveloped woodland and farmland. The Hudson Branch has its headwaters immediately upstream of the SMC facility and, through this reach, it is a poorly defined stream channel that is dry during several months of the year. A culvert pipe, which carries storm water from the more developed Newfield center north of the facility, from north to south beneath the site, discharges into the Hudson Branch downstream of the facility. The Hudson Branch leaves the site at the southwest corner of the property, flowing in a culvert pipe beneath an elevated railroad embankment and West Boulevard. The watershed area upstream from the embankment measures approximately 700 acres.

During a PMF storm event, it is anticipated that the culvert pipe carrying the Hudson Branch beneath the railroad embankment and West Boulevard will be significantly obstructed and will

pass an insignificant portion of the PMF flow. The result will be the overtopping of the railroad embankment and West Boulevard.

The railroad embankment is relatively flat, with its low point at the stream crossing over 500 feet long at approximately elevation 100 feet (NAD 83). Within any flood event having broad overbank flow, there is a region at the outer portion that is considered ineffective flow. The outer area of overbank flow is moving so slowly that it only provides dead storage and does not cause erosion. The demarcation between effective and ineffective flow is determined by the stream channel, overbank topography, vegetative cover, obstructions and water depth. The swiftest velocities will be predominately within a relatively narrow zone centered on the main stream channel, with the velocity decreasing further away from the main channel as the depth of flow decreases. A cross-section of the Hudson Branch and the overbank at the proposed capped pile shows the stream bottom elevation at approximately 90 feet.

A PMF event peak flow could range as high as 4,000 cubic feet per second (cfs) at the point where the stream intersects the railroad embankment. This flow is based upon the Probable Maximum Precipitation (PMP) with a time of concentration of one hour. For conservatism, the PMF estimate did not take into account any effect that storage and flood routing would have on reducing the peak flow. The depth of flow over the railroad embankment, acting as a broad crested weir (500 feet long), with no conveyance in the pipe culvert, is approximately 1.9 feet. Assuming a worst case elevation of 102 feet (weir flow = 4,365 cfs) at the railroad embankment, the water elevation at the proposed engineered barrier 1500 feet upstream from the railroad embankment is anticipated to rise no more than three feet to an approximate elevation of 105 feet.

This scenario would place the peak water surface elevation approximately seven feet above the toe of the slope along the southerly edge of the engineered barrier but only two feet above the lowest elevation of the controlled material and engineered barrier. As the existing ground elevations rise to the north, the depths of water would be less along the westerly and easterly faces of the engineered barrier. The topography along the base of the upstream face of the pile has the effect of deflecting the slow moving overbank flow away from the pile. This, combined with the fact that the average velocity of the PMF flow in the combined channel and overbank is less than 1 foot per second and the velocity in the overbank area 260 feet away from the main channel will be negligible, is sufficient to support the conclusion that the protection offered by the riprap apron at the base of the slopes, as shown in the engineering design drawings, will protect the barrier from the effects of the PMF without the need for additional stone riprap or other protection below the approximate flood elevation of 105 feet.

Engineered Barrier
Erosion Protection Calculations

ENGINEERED BARRIER
SURFACE EROSION PROTECTION CALCULATIONS

PREPARED FOR:

SHEILDALLOY METALLURGICAL CORPORATION
NEWFIELD, NJ

STORAGE YARD
ENGINEERED BARRIER DESIGN

PREPARED BY:

Sean W. Lorden, P.E.
Senior Project Engineer

Carl N. Stopper, P.E.
Vice President

TRC Project No. 105106.00100.00000
August 2009

TRC
21 Griffin Road North
Windsor, Connecticut 06095
Ph: (860) 298-9692
Fax: (860) 298-6399

PROJECT NO. SMC

DATE 8/20/09

BY SWL

SUBJECT Erosion Protection Calcs.

CHK'D

Determine 5-MIN. Rainfall Intensity (I) for PMP

1-Hr/1 mi² PMP for SITE = 18.0" (USACOE HMR-52, Fig. 24)

Per Figure 36 of USACOE HMR-52, multiply 1-Hr PMP by 0.335 to determine 5-min. PMP for site.

$\therefore$ 5-min. PMP = 18.0 in. · (0.335) = 6.03 in.

$$I = \frac{6.03 \text{ in}}{5 \text{ min.}} \cdot \frac{60 \text{ min}}{\text{hr}} = \boxed{72.36 \text{ in/hr}}$$ (NUREG 4620, Eq 2.2)

Determine Maximum Unit Flow from Top of Landform - Grass

$Q = F \cdot C \cdot I \cdot A$ where: F = Flow Concentration Factor = 3 (NUREG-1623, App A., Sec. 2.2.2)

C = Runoff Coefficient = 0.7 (Upper range for steep, grass slopes, USDA 2003)

A = Area = 45' × 1' wide = 45 ft²

I = 72.36 in/hr (see above)

$$Q = 3 \cdot (0.7) \cdot (72.36 \text{ in/hr})(45 \text{ ft}^2) \cdot \frac{1 \text{ ac}}{43{,}560 \text{ ft}^2}$$

$$\boxed{Q = 0.157 \text{ cfs per foot}}$$

A

TRC

SUBJECT Erosion Protection Calcs.

Determine Depth of Flow on Top of Landform - Grass

$$y^{5/3} = \frac{Qn}{1.486 \cdot S^{1/2}}$$ (NUREG 1623, EQN A-3)

Q = Flow Rate = 0.157 cfs (see previous calc.)
n = 0.04 (Chow, 1959 and TRC communications w/ Ted Johnson of NRC)
S = slope = 4% = 0.04

$$y^{5/3} = \frac{(0.157\ ft^3/s)(0.04)}{1.486 \cdot (0.04)^{1/2}}$$

$$y^{5/3} = 0.0211$$

$$y = 0.0988' \approx \boxed{0.1\ ft}$$

Determine Maximum Permissible Velocity for Vegetative Cover

Unadjusted max. permissible velocity (MPV) = 3 ft/s (USACOE EM-1110-2-1601 Table 2-5, and TRC communications w/ Ted Johnson of NRC)

Per NUREG 1623, App A, Sec. 2.2.2,
Adjustment Factor = 0.5

Adjusted MPV = 3 ft/s · 0.5 = $\boxed{1.5\ ft/s}$

Determine Velocity of Flow at Top of Landform

$$V = Q/y = \frac{0.157\ ft^2/s}{0.1\ ft} = 1.57\ ft/s$$

Actual Velocity > Adjusted MPV

∴ Vegetation is NOT adequate erosion protection

A

TRC

SUBJECT Erosion Protection Calcs.

Determine Flow at Toe of Sideslopes - Stone

$Q = F \cdot C \cdot I \cdot A$ (see previous calcs.)

$F = 3$
$C = 0.8$ (NUREG 1623, Sec D-2.4.1)
$I = 72.36$ in/hr
$A = 45\ ft + 102\ ft = 147\ ft \times 1\ ft$ wide
$= 147\ ft^2$ (longest slope, south side)

$$Q = 3(0.8)(72.36\ in/hr)\left(\frac{147\ ft^2}{43{,}560\ ft^2/ac}\right)$$

$$\boxed{Q = 0.586\ ft^3/s \text{ per } ft}$$

Determine Size of Stone on Side Slopes

Assuming stone meets criteria in NUREG-1623, App. D, Sec 2.2.2

$$\text{minimum } d_{50} = (5.23) \cdot slope^{0.43} \times Q^{0.56}$$
$$\text{min } d_{50} = (5.23)(0.33)^{0.43}(0.586)^{0.56}$$
$$\text{min } d_{50} = 2.41 \text{ inches}$$

$$\boxed{\therefore \text{ Use } 2'' - 4'' \text{ stone with } d_{50} = 3''}$$

Determine Depth of Stone on Side Slope

Per NUREG 1623, App. D, Sec. 2.2.2

$$\text{Min. Depth of Stone} = 2 \cdot d_{50}$$

$$\text{Min. Depth} = 2 \cdot 3 = \boxed{6''}$$

A

TRC

SUBJECT Erosion Protection Calcs.

Determine Size of Stone For Riprap Apron (Toe of Slope)

Per NUREG-1623, App. D, Sec. 6.1

$$d_{50} = 10.46 \times S^{0.43} \times Q^{0.56}$$

$$d_{50} = (10.46)(0.33)^{0.43}(0.586)^{0.56}$$

$$= 4.8 \text{ inches}$$

$\boxed{\therefore \text{ Use } 4'' - 6'' \text{ stone with } d_{50} = 5''}$

Determine Min. Width of Apron

Per NUREG-1623, App. D, Sec. 6.3

$$\text{Min. Width} = 15 \cdot d_{50}$$

$$= 15 \cdot 5'' = 75'' = 6.25'$$

$\boxed{\therefore \text{ USE APRON w/ MIN. WIDTH of 7 feet}}$

Determine Min. Thickness of Riprap Apron

Per NUREG 1623, App. D, Sec 6.3

$$\text{Min. Thickness} = 3 \cdot d_{50}$$

$$= 3 \cdot 5'' = 15''$$

$\boxed{\therefore \text{ USE apron w/ min. thickness of } 15''}$

A

PROJECT NO. SMC

DATE 8/20/09

BY SWL

SUBJECT Erosion Protection Calcs.

CHK'D CMO

Determine Maximum Unit Flow from Top of Landform - stone

$Q = F \cdot C \cdot I \cdot A$ (see page 1 of calcs.)

$F = 3$

$C = 0.8$ (NUREG 1623, Sec. D-2.4.1)

$I = 72.36$ in/hr

$A = 45$ ft^2

$$Q = 3\,(0.8)\cdot(72.36\ \text{in/hr})\cdot\left(\frac{45\ \text{ft}^2}{43{,}560\ \text{ft}^2/\text{ac}}\right)$$

$$\boxed{Q = 0.18\ \text{cfs per ft}}$$

Determine Min. Size of Stone on Top Slopes

Assuming stone meets criteria in NUREG-1623, App D, Sec. 2.2.2

$$\text{Minimum } d_{50} = 5.23 \times \text{slope}^{0.43} \times Q^{0.56}$$

$$\text{min } d_{50} = (5.23)(0.04)^{0.43}(0.18\ \text{ft}^3/\text{s})^{0.56}$$

$$\text{min } d_{50} = 0.50 \text{ inches}$$

$$\boxed{\therefore \text{ use } 0.5'' - 1.5'' \text{ stone with } d_{50} = 1''}$$

Determine Min. Thickness of Stone on Top Slopes

Per NUREG-1623, App. D, Sec. 2.2.2

$$\text{Min. Depth of Stone} = 2 \cdot d_{50} = 2 \cdot 1'' = 2''$$

$$\boxed{\therefore \text{ Use top slope stone thickness of } 3'' \text{ for ease of installation}}$$

A

2.2 Procedures

Procedures have been developed to (a) design a stable unprotected soil cover (or vegetated soil cover with no credit given for vegetation) using the allowable shear stress method, as modified and developed in the Horton/NRC Method and (b) design a stable vegetated section using the permissible velocity method for areas where vegetation can be effective. These procedures provide two acceptable methods for designing stable covers. It is recognized that in many cases, specific values of parameters may be difficult to justify. In those cases where licensees can justify values of individual parameters that depart from the values given by suggested references, the resulting designs will be considered on a case-by-case basis.

2.2.1 Unprotected Soil Cover

Step-by-step procedures for implementing the allowable shear stress method for an unprotected soil cover are presented below:

Step 1. Determine maximum allowable shear stress for bare soil using procedures developed by Temple et al. (1987). The staff considers Temple's method to be an accurate method for determining shear stresses because it is related to the Unified Soil Classification System and can be applied for specific soil types and degrees of cohesiveness. In general, the Temple procedure for determining allowable shear stress is based primarily on the soil particle size and the soil cohesiveness. The amount of resistance for granular non-cohesive soils, including rocky soils, is principally a function of the D_{75} grain size, where the allowable tractive force is equal to $0.4 \times D_{75}$ (Temple et al., 1987). For granular soils, the increase in shear resistance due to cohesiveness is minimal. For cohesive soils where the particle size is smaller, the amount of resistance is principally a function of the soil cohesiveness and not the particle size.

Step 2. Determine slope and slope length to be considered, as developed in the preliminary reclamation design.

Step 3. Determine flow concentration factor (F). Documentation of the occurrence of flow concentrations and the ability of an individual rock or soil particle to resist given flow rates is discussed further by Abt et al. (1987). The actual value of F will depend on several factors, including grading practices during cover construction, cover slope, and potential for differential settlement. The staff recommends a default value of 3, for most soil slopes; other values may be used, if properly justified.

Step 4. Estimate Manning's "n" value using general procedures given by Temple et al. (1987); by Nelson et al. (1986); or by Chow (1959).

Step 5. Determine the rainfall intensity using the procedures given by Nelson et al. (1986) and determine the peak runoff rate using the Rational Formula.

Step 6. Solve for stable slope, using the Horton/NRC equation. If the computed slope is different from that assumed, return to Step 2 with new values of slope and/or slope length.

2.2.2 Vegetated Soil Cover

Step 1. Maximum permissible velocities (MPVs) should be estimated using data developed by the U.S. Soil Conservation Service (SCS, 1984); or by Nelson et al., 1986). Based on these data, maximum MPVs should generally range from about 2½ to 3½ ft per second for any vegetation other than dense grasses. These velocities need to be further reduced, as discussed in Step 6.

Step 2. Determine slope and slope length.

Step 3. Determine flow concentration (F). See Step 3 in Section 2.2.1, above for additional information.

Step 4. Estimate Manning's "n" value using procedures recommended by Chow (1959, Table 7.6) for very low vegetal retardance (Fig. 7.14).

Step 5. Determine rainfall intensity and runoff rate using procedures discussed in Step 5 in Section 2.2.1.

Step 6. Determine the flow depth (y) by solving the Manning Equation for normal depth on a one-foot-wide strip. This equation can be solved directly in this case using the following derivation:

$$y^{5/3} = Qn/ (1.486\ S^{1/2}). \qquad \text{(A-3)}$$

Step 7. Determine the permissible velocity for the slope, based on the computed depth of flow. Chow has developed correction factors that may be applied to determine the permissible velocity. The permissible velocity is multiplied by the following correction factors, depending on the depth of flow.

Depth of Flow (ft)	Correction Factor
3.0 or greater	1.0
1.9	0.9
1.0	0.8
0.65	0.7
0.4	0.6
0.25 or less	0.5

Step 8. For the assumed one-foot-wide strip, determine the actual flow velocity (V_a) by dividing the discharge by the flow depth:

Step 7. Determine Riprap Layer Thickness

In accordance with Section 2.1.2, the layer thickness should be a minimum of 1.5 times the D_{50} determined in Step 5 or equal to the D_{100}, whichever is greater.

2.2.2 Design Procedure Using Abt/Johnson Method

Based on flume studies performed at Colorado State University, a simple method for rock sizing on top and side slopes was developed by Abt and Johnson (1991) (See Equation D-7). The staff considers that this method may be used for riprap design, if the following conditions are met:

1) The PMP/PMF is used
2) The rock is angular
3) The rock has a specific gravity $\gamma_s \geq 2.65$
4) The rock thickness will be at least 2 times the D_{50} size
5) The licensee will adopt a testing and inspection program similar to the program provided in Appendix F, with regard to rock placement and verification procedures.

2.3 Recommendations

Since it is likely that clogging of the riprap voids will occur over a long period of time, it is suggested that no credit be taken for flow through the riprap voids. Even if the voids become clogged, it is unlikely that stability will be affected, as indicated by tests performed by Abt et al. (1987).

If rounded rather than angular rock is used, some increase in the average rock size may be necessary, since the rock will not be as stable. Computational models, such as the Safety Factors Method, provide stability coefficients for different angles of repose of the material. The need for oversizing of rounded rock is further discussed by Abt et al. (1987) and Abt and Johnson (1991).

2.4 Example of Procedure Application

2.4.1 Safety Factors and Stephenson Method

Determine the riprap requirements for a tailings pile top slope with a length of 1,000 ft and a slope of 0.02 and for the side slope with an additional length of 250 ft and a slope of 0.2 (20 percent).

Step 1. The drainage areas for the top slope (Al) and the side slope (A2) on a unit-width basis are computed as follows:

$$A1 = (1000)\ (1)\ /\ 43560 = 0.023 \text{ acres} \qquad \text{(D-2)}$$

$$A2 = (1000 + 250)\ (1)\ /\ 43560 = 0.029 \text{ acres} \qquad \text{(D-3)}$$

Step 2. The t_cs are individually computed for the top and side slopes, using the Kirpich Method.

$$t_c = [(11.9)(L)^3/H]^{.385} \qquad \text{(D-4)}$$

For L = 1,000 ft and H = 20 ft,

t_c = 0.12 hours = 7.2 minutes for the top slope

For L = 250 ft and H = 50 ft,

t_c = 1.0 minute for the side slope.

Therefore, the total t_c for the side slope is equal to 7.2 + 1.0, or 8.2 minutes.

Step 3. The rainfall intensity is determined using procedures discussed by Nelson et al. (1986), based on a 7.2-minute PMP of 4.2 inches for the top slope and an 8.2-minute PMP of approximately 4.5 inches for the side slope. These incremental PMPs are based on a one-hour PMP of 8.0 inches for northwestern New Mexico and were derived using procedures discussed by Nelson et al. (1986).

Rainfall intensities, for use in the Rational Formula, are computed as follows:

i_1 = (60)(4.2)/7.2 = 35 inches/hr for the top slope

i_2 = (60)(4.5)/8.2 = 33 inches/hr for the side slope.

Step 4. Assuming a runoff coefficient (C) of 0.8, the peak flow rates are calculated using the Rational Formula, as follows:

$$Q1 = (0.8)(35)(0.023) = 0.64 \text{ cfs/ft, for the top slope, and} \qquad \text{(D-5)}$$

$$Q2 = (0.8)\ (33)\ (0.029) = 0.77 \text{ cfs/ft, for the side slope.} \qquad \text{(D-6)}$$

Step 5. Using the Safety Factors Method, the required rock size for the pile top slope is calculated to be:

D_{50} = 0.6 inches.

6 RIPRAP SIZING AT TOE OF EMBANKMENT SLOPES

Rock toes, or toe basins, are often placed at the base of sloped embankments to: stabilize and/or anchor rock placed on the side slope; serve as a toe drainage channel, serve as an impact basin and provide for energy dissipation from tributary flow; provide erosion protection at the toe; transition flow from the side slope to adjacent properties; and/or provide gully intrusion protection to the embankment. Therefore, proper rock sizing is an imperative element of the design process to meet the project stability requirements.

6.1 Technical Basis

Rock sizing procedures have been developed by the U.S. Bureau of Reclamation (USBR) for stilling basins founded, based on the work of Berry (1948) and as presented by the Department of the Interior (DOI, 1978). The procedure estimates the median stone size as a function of localized bottom velocity (V_b) at the location where the flow transitions onto a stone-filled basin. If the bottom velocity cannot be determined, the local average velocity may be substituted where the local average velocity can be determined using the U.S. Army Corps of Engineers procedures (ACE, 1994). Campbell (1966) presented a velocity-based riprap design procedure for stone placed in stilling basins. Both the USBR and Campbell rock sizing procedures were developed to dissipate energy and provide a stable toe as flow transitioned onto a rock basin or apron. These procedures are difficult to apply for relatively small rock requirements (less than 0.3 m) and yield conservative rock sizes.

To better understand the phenomena and mechanisms affecting the design of riprap to prevent erosion by overtopping flow as it transitions from the side slope to the embankment toe and/or apron, the U.S. Nuclear Regulatory Commission staff sponsored technical assistance efforts. As a result of these efforts, an alternative method of sizing the median stone size (D_{50}) for riprap placed at the toe of the slope was developed.

Abt et al. (1998) empirically derived an equation to compute the median stone size for riprap used to prevent erosion from flow transitioning off an embankment side slope onto the toe region. The relationship is expressed in English units as

$$D_{50} = 10.46 * S^{0.43} * (C_f * q_d)^{0.56} \qquad \text{(D-18)}$$

where: D_{50} = the median stone diameter in inches,

S = the embankment side slope in decimal form,

C_f = the flow concentration factor,

q_d = the design unit discharge in cubic ft per second.

USACOE HMR-52

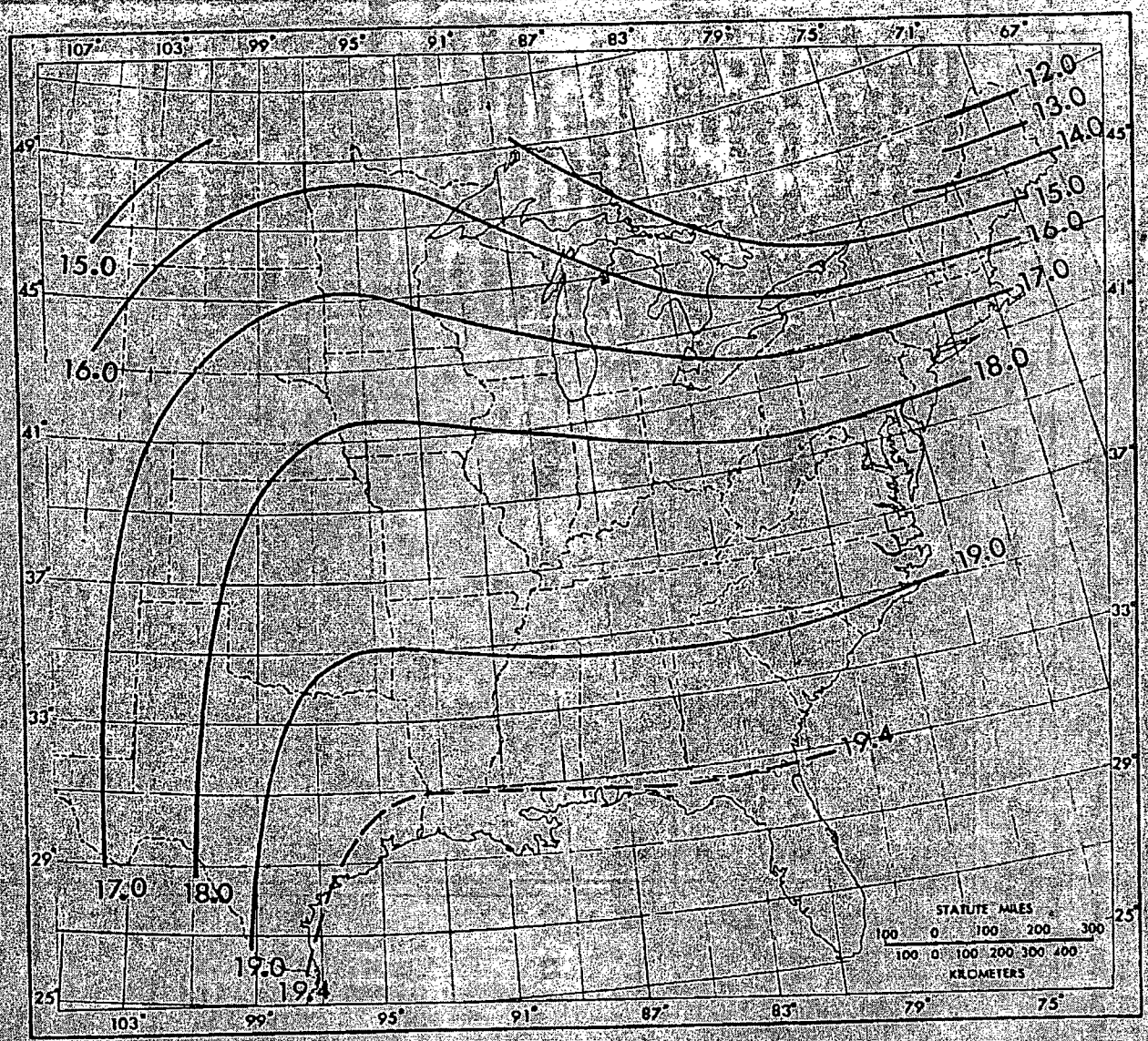


Figure 24.—1-hr 1-mi^2 PMP analysis based on figure 23 and 6-hr 10-mi^2 precipitation from HMR No. 51.

transposition limits. Comparison of this 18.3-in. value with the 1-hr 1-mi^2 PMP from figure 24 shows a difference of 0.6 in. We consider this a reasonable envelopment of a moisture maximized transposed amount.

6.3.3 Depth-area ratios

Preparation of 1-hr PMP values over the range of area sizes of interest required development of depth-area reduction ratios. A primary basis for such reduction ratios is the list in table 19 of 12 extreme storms (those noted by asterisks) for which point or 1-mi^2 data are available at 1 hr. A problem with the data from these 12 storms is the limited area of most storms. Nearly 60 percent have an areal extent of less than 240 mi^2, while one fourth of them

USACOE HMR-52

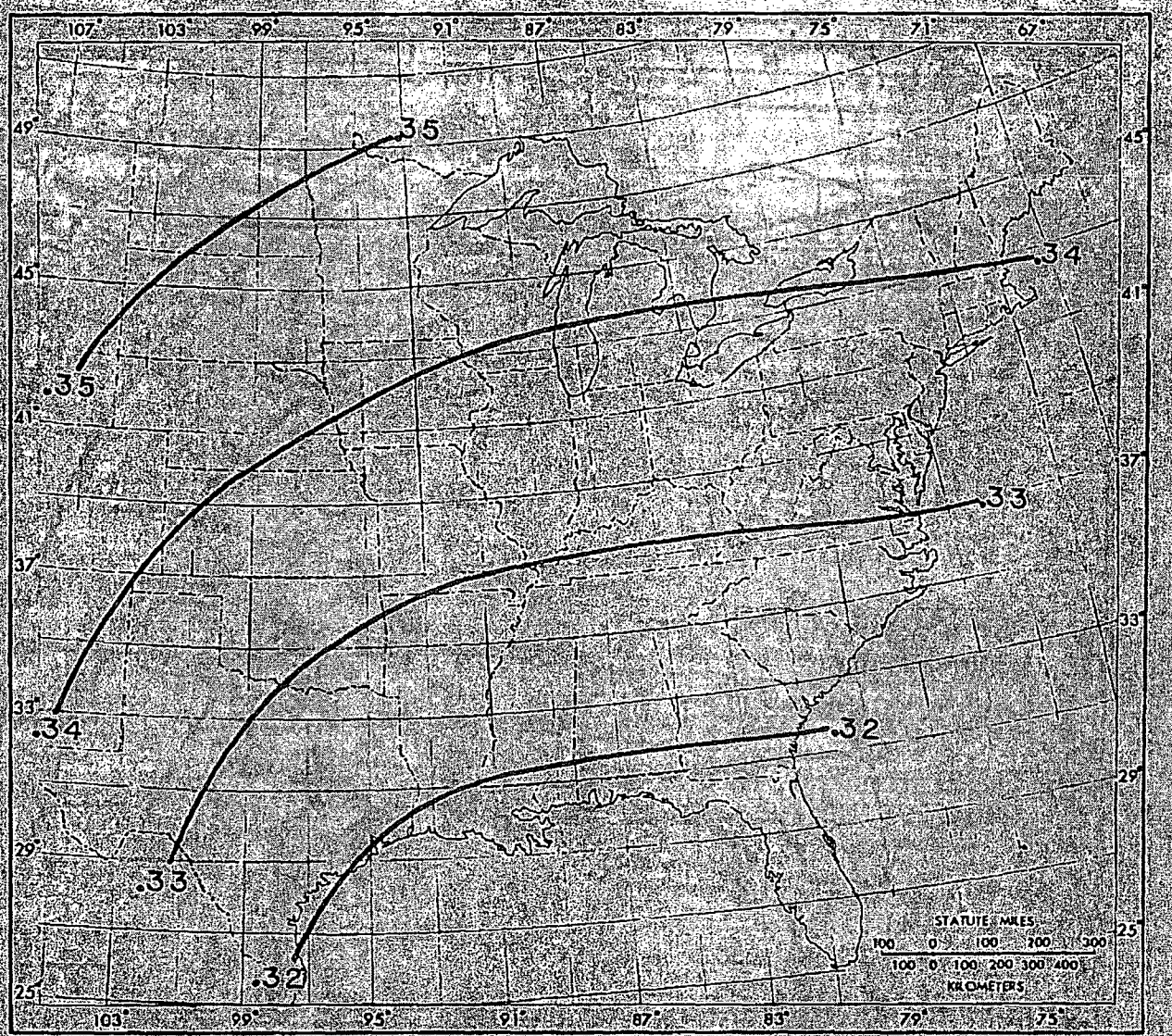


Figure 36.—Ratio analysis of 5- to 60-min precipitation used to obtain 5-min PMP. (Applicable to area sizes < 200 mi^2.)

The rainfall depth for a specific site is estimated by determining the rainfall duration and/or appropriate time of concentration. The resulting rainfall depth in inches, is

$$\text{PMP rainfall depth} = (\%\ \text{PMP}) \times (\text{PMP}) \tag{2.1}$$

where the percent PMP is obtained from Table 2.1 and the PMP is obtained from the appropriate PMP design storm presented in Section 2.1.1.

The rainfall intensity, i, in inches per hour can be computed as

$$i = \text{rainfall depth (inches)} \times \frac{60}{\text{rainfall duration (minutes)}} \tag{2.2}$$

The rainfall intensity determined from Equation 2.2 is generally a conservative value and represents the peak rainfall intensity of the design storm.

To compute the rainfall intensity for any rainfall duration, it is recommended that a rainfall intensity versus rainfall duration curve be plotted on semilogarithmic paper. Because of the extremely conservative rainfall intensity values obtained for short durations, it is recommended that the minimum rainfall duration be 2.5 minutes. Rainfall depths should be extracted from the appropriate Hydrometeorological Report.

2.2 PMP COMPARISON STORMS

A comparison of estimates of the PMP with greatest observed rainfall and estimates of the 100-year events for areas both east and west of the 105° meridian was prepared (NWS, 1980). Information from 6500 precipitation reporting stations in the eastern U.S. and about 2100 stations in the west was used. Including storm durations of 6 to 72 hours, the study indicated that 177 separate storm events have been recorded in which the rainfall was greater than or equal to 50 percent of the PMP for stations east of the 105° meridian. Only 65 separate storm events were recorded west of the 105° meridian where rainfalls were greater than or equal to 50 percent of the PMP.

The National Weather Service also reported the number of storm events which met or exceeded the 100-year rainfall values and compared them with the regional PMP values (NWS, 1980). Table 2.2 summarizes these rainfall events for 6 and 24-hour storms occurring over a 10 square mile area. It is interesting to note that a storm has not been officially recorded west of the Continental Divide that exceeds 90% of the PMP value. However, it is evident that a number of storms approach the PMP values, thereby substantiating that the prescribed PMP values are not extremely conservative.

FROM: LOW-VOLUME ROADS ENGINEERING
BEST MANAGEMENT PRACTICES FIELD GUIDE
BY
GORDON KELLER & JAMES SHERAR
USDA, FOREST SERVICE, JULY 2003

RECOMMENDED PRACTICES

- Use the best available hydrologic methods to determine design flows.
- Where appropriate, use drainage structures that are not sensitive to exact flow predictions, such as low water crossings (fords) and drivable dips versus culvert pipes.
- Add freeboard or extra capacity to structures in drainages with uncertain flow or for debris passage in watersheds with changing land uses, usually on the order of 120% to 150%.
- To minimize risk to structures, the recommended storm frequency (return period) for design of culverts is 20 to 50 years, and 100 to 200 years is recommended for bridges or drainages with sensitive environmental concerns.
- For culverts installed in areas with limited or inadequate hydrologic data or designs, include overflow (overtopping) protection to reduce risk of total failure or stream diversion (see Figure 7.10).
- Involve hydrologists, fisheries biologists and engineers in the process of hydrologic and hydraulic design.

PRACTICES TO AVOID

- Installing drainage structures without some rational or statistical assessment of the expected flow.

Table 5.1

DESIGN FLOW ANALYSIS METHODS FOR VARIOUS WATERSHED SIZES

Watershed Size	Typical Type of Analysis
Small (to 120 ha) (300 acres)	Rational Method, Talbot Method, Local Experience
Medium (to 4,000 ha) (10,000 acres)	Regression Analysis, High Water Marks + Manning, Local Experience
Large (over 4,000 ha)	Gauging Data, High Water Marks, Statistical or Regression Analysis

Table 5.2

RATIONAL METHOD VALUES OF "C"

Land Use or Type	"C" Value
Agriculture	
Bare Soil	0.20-0.60
Cultivated Fields (sandy soil)	0.20-0.40
Cultivated Fields (clay soil)	0.30-0.50
Grass	
Turf, Meadows	0.10-0.40
Steep Grassed Areas	0.50-0.70
Woodland/Forest	
Wooded Areas with Level Ground	0.05-0.25
Forested Areas with Steep Slopes	0.15-0.40
Bare Areas, Steep and Rocky	0.50-0.90
Roads	
Asphalt Pavement	0.80-0.90
Cobblestone or Concrete Pavement	0.60-0.85
Gravel Surface	0.40-0.80
Native Soil Surface	0.30-0.80
Urban Areas	
Residential, Flat	0.40-0.55
Residential, Moderately Steep	0.50-0.65
Commercial or Downtown	0.70-0.95

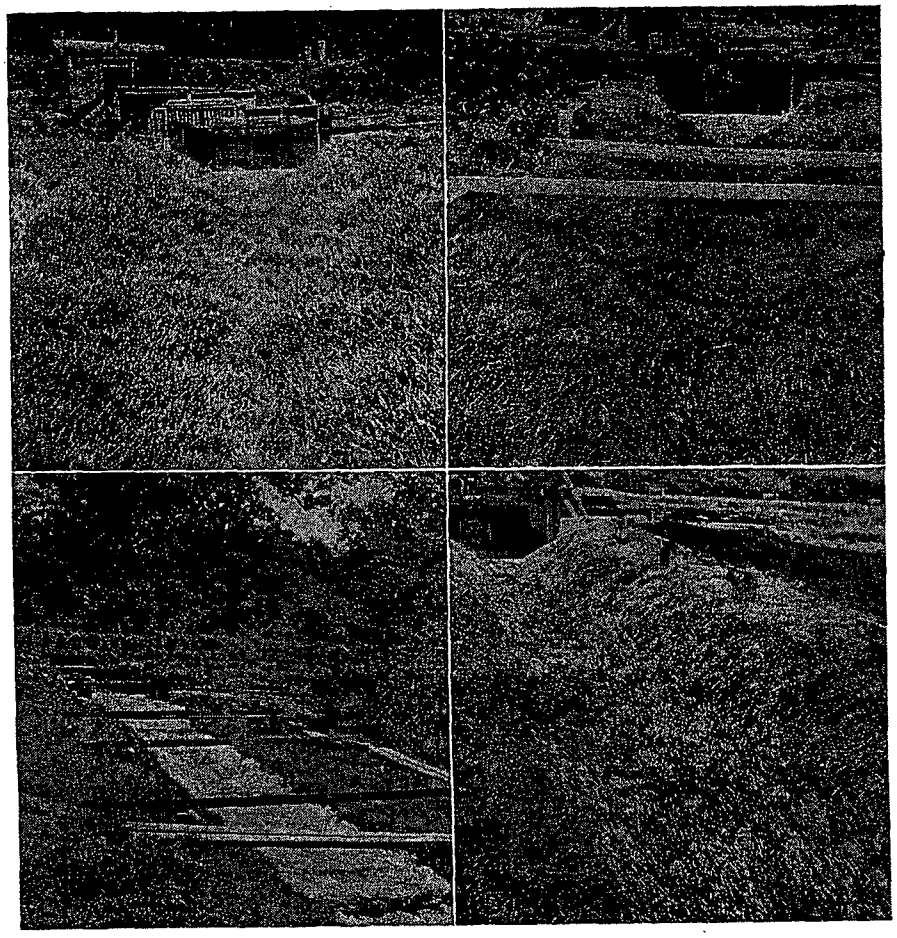


FIG. 7-13. Centipede grassed channel. (*Courtesy of W. O. Ree, U.S. Agricultural Research Service.*) (*A*) Before experiment; (*B*) after test at a flow equal to 15 cfs for 40 min; (*C*) during test at a flow equal to 30 cfs; (*D*) at completion of the whole experiment.

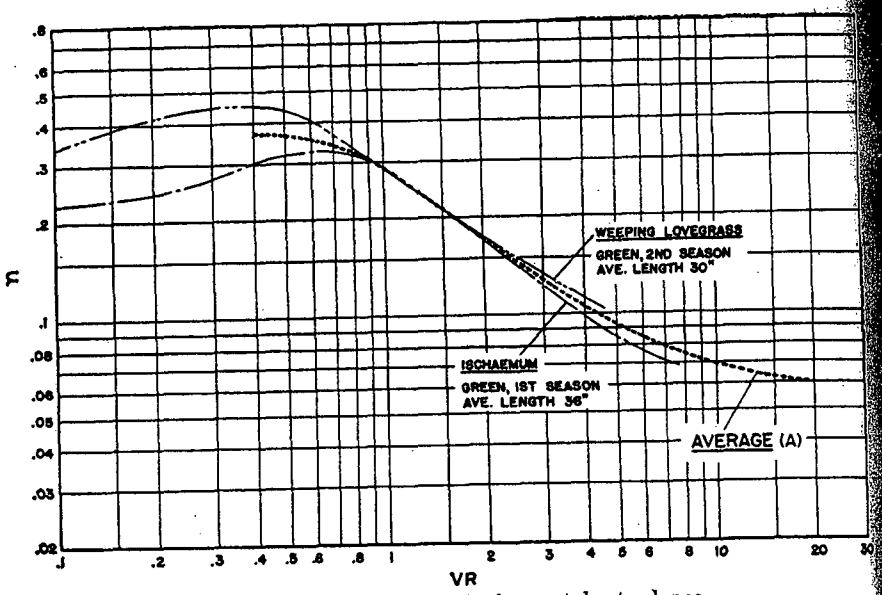
only the average curve is shown, together with the curves for low retardance. The classification of degree of retardance is based on the kind of vegetation and the condition of growth, as described in Table 7-4. The term "stand" used in the table refers to the density of grass, or the count of vegetation, which is sometimes expressed as the number of stems per square foot. The *n-VR* curves thus developed may also be applied to other kinds of grass, provided that their characteristics and degree of retardance can be identified. For this purpose, Table 7-5 is provided as a guide in the selection of the vegetal retardance for different conditions of stand and average length of the grass.

TABLE 7-4. CLASSIFICATION OF DEGREE OF RETARDANCE FOR VARIOUS KINDS OF GRASS*

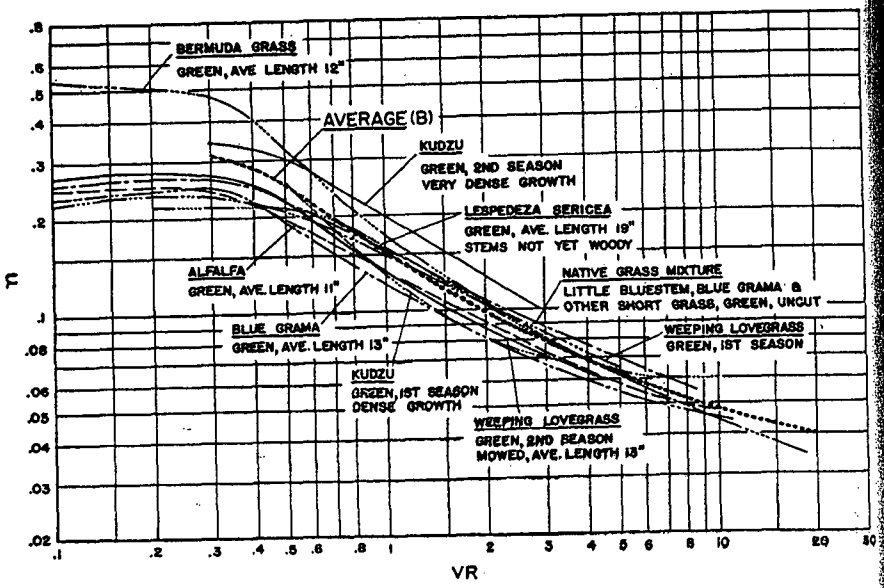
Retardance	Cover	Condition
A Very high	Weeping love grass	Excellent stand, tall (av 30 in.)
	Yellow bluestem ischaemum	Excellent stand, tall (av 36 in.)
B High	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (av 12 in.)
	Native grass mixture (little bluestem, blue grama, and other long and short Midwest grasses)	Good stand, unmowed
	Weeping love grass	Good stand, tall (av 24 in.)
	Lespedeza sericea	Good stand, not woody, tall (av. 19 in.)
	Alfalfa	Good stand, uncut (av 11 in.)
	Weeping love grass	Good stand, mowed (av 13 in.)
	Kudzu	Dense growth, uncut
	Blue grama	Good stand, uncut (av 13 in.)
C Moderate	Crab grass	Fair stand, uncut (10 to 48 in.)
	Bermuda grass	Good stand, mowed (av 6 in.)
	Common lespedeza	Good stand, uncut (av 11 in.)
	Grass-legume mixture—summer (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (6 to 8 in.)
	Centipede grass	Very dense cover (av 6 in.)
	Kentucky bluegrass	Good stand, headed (6 to 12 in.)
D Low	Bermuda grass	Good stand, cut to 2.5 in. height
	Common lespedeza	Excellent stand, uncut (av 4.5 in.)
	Buffalo grass	Good stand, uncut (3 to 6 in.)
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (4 to 5 in.)
	Lespedeza sericea	After cutting to 2 in. height, very good stand before cutting
E Very low	Bermuda grass	Good stand, cut to 1.5 in. height
	Bermuda grass	Burned stubble

* U.S. Soil Conservation Service [41].

Chow (1959)

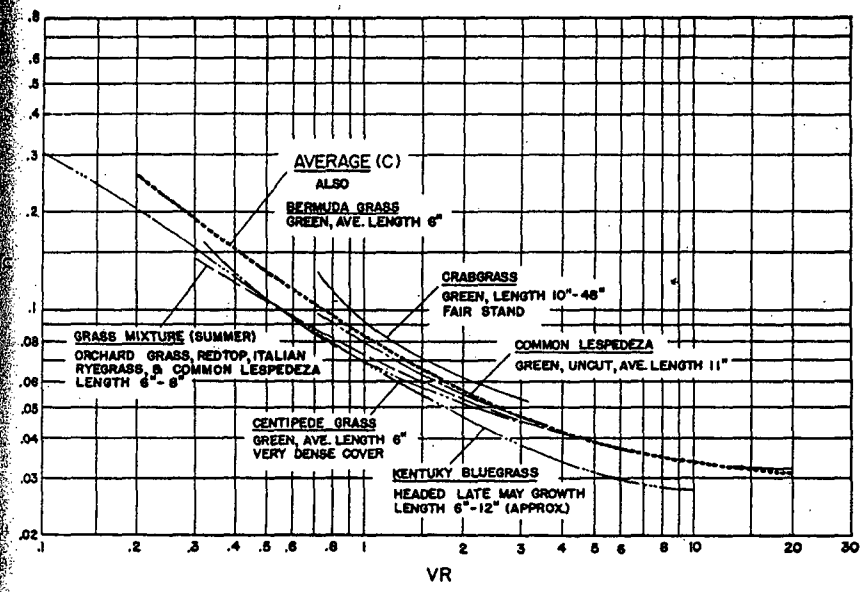


(*a*) Curves for A or very high vegetal retardance.

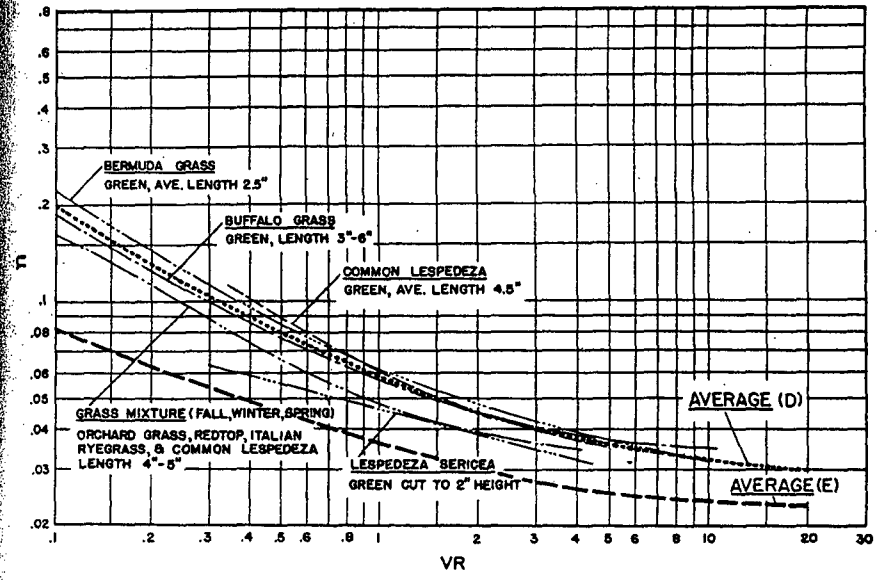


(*b*) Curves for B or high vegetal retardance.

Fig. 7-14. Experimental *n-VR* curves. (*U.S. Soil Conservation Service.*)



(*c*) Curves for C or moderate vegetal retardance.



(*d*) Curves for D or low vegetal retardance, and an average curve for E or very low vegetal retardance.

Fig. 7-14 (*Continued*).

Chow (1959)

TABLE 7-5. GUIDE IN SELECTION OF VEGETAL RETARDANCE*

Stand	Average length of grass, in.	Degree of retardance
Good	>30	A Very high
	11–24	B High
	6–10	C Moderate
	2–6	D Low
	<2	E Very low
Fair	>30	B High
	11–24	C Moderate
	6–10	D Low
	2–6	D Low
	<2	E Very low

* U.S. Soil Conservation Service [41].

7-18. The Permissible Velocity. The permissible velocity of flow in a grassed channel is the velocity that will prevent severe erosion in the channel for a reasonable length of time. Permissible velocities for different vegetal covers, channel slopes, and soil conditions, recommended on the basis of investigation by the Soil Conservation Service, are shown in Table 7-6.

7-19. Selection of Grass. The selection of grass for the channel lining depends mainly on the climate and soil in which the plant will grow and survive under the given conditions. From the hydraulic viewpoint, stability and other factors should also be considered. In general, a higher discharge requires a stronger or better lining. On steep slopes, bunch grasses, such as alfalfa, lespedeza, and kudzu, will develop channeling of the flow and, hence, are unsatisfactory for lining. For slopes greater than 5%, only fine and uniformly distributed sod-forming grasses, such as Bermuda grass, Kentucky bluegrass, and smooth brome, are recommended for lining where the main flow occurs. Because of the objectionable spreading nature of sod-forming grasses, the top portion of the sides and the berm may be planted with grasses that do not spread easily, such as weeping love grass. For fast establishment of the lining, Bermuda grass and weeping love grass are recommended. Sometimes annuals are used as temporary protection until permanent covers by native grasses are established. Silt deposition in channels may be controlled by lining with bunch grasses, which will develop channeled flow, increase velocity, and thus reduce silting.

7-20. Procedure of Design. After the kind of grass for channel lining is selected, the degree of retardance can be determined from the condition of the stem length and the density of growth. During the period of

establishment, the grass will grow and the channel will be stabilized under a condition of low degree of retardance. The channel will not reach its maximum capacity until the grass cover is fully developed and well established. Therefore, it is suggested that the hydraulic design of a grassed channel consist of two stages. The first stage (*A*) is to design the channel for stability, that is, to determine the channel dimensions under the condition of a *lower* degree of retardance. The second stage

TABLE 7-6. PERMISSIBLE VELOCITIES FOR CHANNELS LINED WITH GRASS*

Cover	Slope range, %	Permissible velocity, fps: Erosion-resistant soils	Permissible velocity, fps: Easily eroded soils
Bermuda grass	0–5	8	6
	5–10	7	5
	>10	6	4
Buffalo grass, Kentucky bluegrass, smooth brome, blue grama	0–5	7	5
	5–10	6	4
	>10	5	3
Grass mixture	0–5	5	4
	5–10	4	3
	Do not use on slopes steeper than 10%		
Lespedeza sericea, weeping love grass, ischaemum (yellow bluestem), kudzu, alfalfa, crabgrass	0–5	3.5	2.5
	Do not use on slopes steeper than 5%, except for side slopes in a combination channel		
Annuals—used on mild slopes or as temporary protection until permanent covers are established, common lespedeza, Sudan grass	0–5	3.5	2.5
	Use on slopes steeper than 5% is not recommended		

REMARKS. The values apply to average, uniform stands of each type of cover. Use velocities exceeding 5 fps only where good covers and proper maintenance can be obtained.

* U.S. Soil Conservation Service [41].

(*B*) is to review the design for maximum capacity, that is, to determine the increase in depth of flow necessary to maintain a maximum capacity under the condition of a *higher* degree of retardance. For instance, if common lespedeza is selected as the grass for lining, the common lespedeza of low vegetal retardance (green, average length 4.5 in.) is used for the first stage in design. Then, in the second stage, the common lespedeza of moderate vegetal retardance (green, uncut, average length 11 in.) should be used. Finally, a proper freeboard is added to the computed

Chow (1959)

USACOE

Critical scour velocities is given by the Task Committee on Preparation of Sedimentation Manual (1966). Table 2-5 gives a set of permissible velocities that can be used as a guide to design nonscouring flood control channels. Lane (1955) presents curves showing permissible channel shear stress to be used for design, and the Soil Conservation Service (1954) presents information on grass-lined channels. Departures from suggested permissible velocity or shear values should be based on reliable field experience or laboratory tests. Channels whose velocities and/or shear exceed permissible values will require paving or bank revetment. The permissible values of velocity and/or shear should be determined so that damage exceeding normal maintenance will not result from any flood that could be reasonably expected to occur during the service life of the channel.

Table 2-5
Suggested Maximum Permissible Mean Channel Velocities

Channel Material	Mean Channel Velocity, fps
Fine Sand	2.0
Coarse Sand	4.0
Fine Gravel[1]	6.0
Earth	
Sandy Silt	2.0
Silt Clay	3.5
Clay	6.0
Grass-lined Earth (slopes less than 5%)[2]	
Bermuda Grass	
Sandy Silt	6.0
Silt Clay	8.0
Kentucky Blue Grass	
Sandy Silt	5.0
Silt Clay	7.0
Poor Rock (usually sedimentary)	10.0
Soft Sandstone	8.0
Soft Shale	3.5
Good Rock (usually igneous or hard metamorphic)	20.0

Notes:
1. For particles larger than fine gravel (about 20 millimetres (mm) = 3/4 in.), see Plates 29 and 30.
2. Keep velocities less than 5.0 fps unless good cover and proper maintenance can be obtained.

PROJECT NO. 26770-0100
DATE 3/2/06
BY MNB
CHK'D JMO

TRC
Customer-Focused Solutions

SUBJECT HUDSON BRANCH - FLOOD ELEVATION DETERMINATION
SMC

Determine Flow of PMF and depth over Road

Flow Calculations

Rational Method → $Q = CIA$

A = Drainage Area = 30,000,000 sf = 688.7 acres = 1.07 mi^2

C = Coefficient of Imperviousness

Assume 75% wooded + Level Ground (C = 0.25 conservatively)
25% Flat Residentia (C = 0.55 conservatively)

$C = (0.75)(0.25) + (0.55)(0.25) = 0.325$

I = intensity, based upon T_c (Assume 60 min conservatively)

1hr - 1 mi^2 PMP = 18.0 inches (ACOE HMR 52, Figure 24)

$I = PMP \times \frac{60\,min}{duration\ of\ PMP} = 18.0 \times \frac{60\,min}{60\,min} = 18.0\ inches/hr$

$Q = CIA = 688.7 \times 0.325 \times 18 = 4029$ cfs

Depth over Road

Assume Railroad/Roadway is acting as a broad crested weir

$Q = C_w \times 2/3 \times \sqrt{2g} \times B \times H^{3/2}$ solve for H

C_w = weir discharge coefficient = 0.577 (Daugherty and Fonzini 1965)
g = gravity = 32.2
B = width = 500' (conservative estimate)

$4000\ cfs = 0.577\,(2/3)\sqrt{2(32.2)} \cdot 500 \cdot H^{3/2}$

$H^{3/2} = 4000 \div 1543.47$

$\boxed{H = 1.89\ ft}$ → see note on next page

A

PROJECT NO. 26770

DATE 3/2/06

BY MNB

CHK'D JMO

TRC
Customer-Focused Solutions

SUBJECT HUDSON BRANCH- FLOOD ELEVATION DETERMINATION
SMC

Determine avg flow velocity of PMF at pile.

Avg Velocity = total Flow ÷ cross Sectional Area of Flow

= 4029* cfs ÷ 5675 sf (see attached figures)

= 0.71 ft/sec

As velocity at outer limits of flow will be significantly less than that in the area of "effective flow" around the center of the channel, the velocity at the pile is expected to be much less than 0.71 ft/sec, well below even the vegetative adjusted MPV of ~~2.5~~ 1.5 ft/sec MB 6/1/06

* this calculation proves to be extremely conservative, as it assumes all flow crossing road downstream passes by pile. In fact, only approx ½ of the total watershed leading to the roadway crossing lies upgradient of the proposed pile location.

Note: Depth over road is calculated to be 1.89 ft. Assuming a worse case of approximately 2 ft, and taking into account the railroad embankment's low point is at elev = 100 ft, the water elevation at the railroad embankment would equal 102 ft. The proposed engineered barrier is 1500 ft. upstream. If we conservatively estimate a water surface profile with a slope of 0.2%, the water surface elevation at the engineered barrier would equal 105 ft.

A

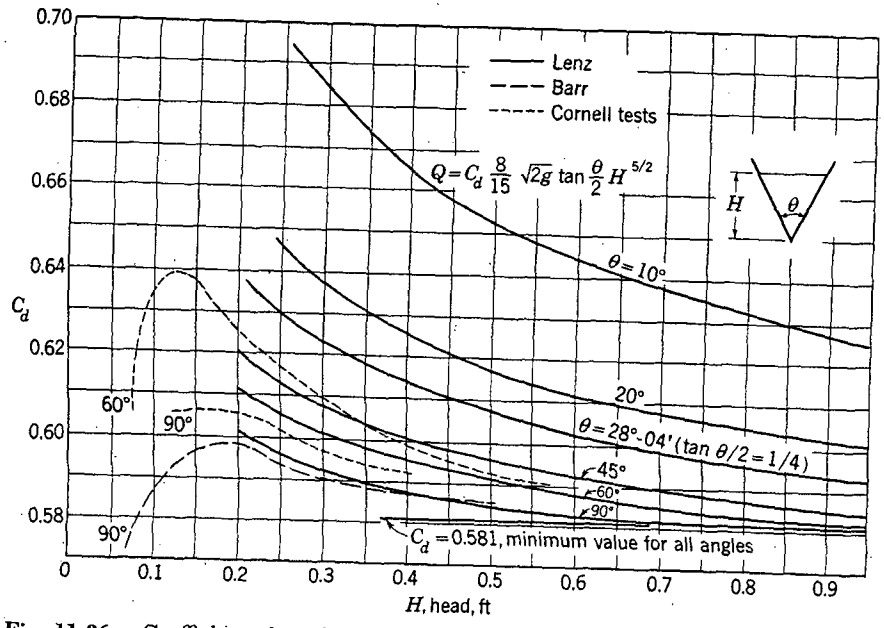


Fig. 11.36. Coefficients for triangular weirs.

In Fig. 11.36 are presented experimental values of C_d for water flowing over V-notch weirs with central angles varying from 10 to 90°. The solid lines represent tests by Lenz;[1] the dotted lines are from data taken at Cornell University;[2] the dashed line represents a 90° weir with a fine sharp edge, reported by Barr.[3] The rise in C_d at heads less than 0.5 ft is due to incomplete contraction. At lower heads the frictional effects reduce the coefficient. At very low heads, when the nappe clings to the weir plate, the phenomenon can no longer be classed as weir flow and Eq. (11.44) is inapplicable.

11.23. BROAD-CRESTED WEIR

Another type of weir is the broad-crested weir (Fig. 11.37), which is usually built of concrete. One of its advantages is that it is rugged and can stand up well under field conditions.

[1] Arno T. Lenz, Viscosity and Surface Tension Effects on V-notch Weir Coefficients, *Trans. ASCE*, vol. 108, pp. 759–802, 1943.

[2] *Eng. News*, vol. 73, p. 636, 1915.

[3] James Barr, Experiments upon the Flow of Water over Triangular Notches, *Engineering*, Apr. 8–15, 1910.

The broad-crested weir, as mentioned in Illustrative Example 10.3, is a critical-depth meter; that is, critical depth occurs on the crest of the weir. In Eq. (10.16) it was shown that, for a rectangular channel, $E = \frac{3}{2}y_c$, while Eq. (10.19) stated that $y_c = (q^2/g)^{1/3}$. Employing these relations, we can write for the flow over a broad-crested weir:

$$Q = B\sqrt{gy_c^3} = B\sqrt{g(\tfrac{2}{3}E)^3} = B(\tfrac{2}{3})^{3/2}\sqrt{g}\,E^{3/2} \qquad (11.46)$$

Let us now substitute this expression into Eq. (11.39), which is applicable to broad-crested weirs as well as sharp-crested ones, since both have rectangular flow cross sections. This yields

$$C_W = \frac{1}{\sqrt{3}}\left(\frac{E}{H}\right)^{3/2} \qquad (11.47)$$

For very high weirs (that is, P/H large) the velocity of approach becomes small, so that $H \to E$, and thus $C_W \to 1/\sqrt{3} = 0.577$. Hence it is seen that C_W depends on the P/H ratio. When P/H is small, C_W is large, and vice versa.

11.24. SLUICE GATE

The sluice gate shown in Fig. 11.38 is a device used to control the passage of water in an open channel. When properly calibrated, it may also serve as a means of flow measurement. As the lower edge of the gate opening is flush with the floor of the channel, contraction of the bottom side of the issuing stream is entirely suppressed. Side contractions will of course depend on the extent to which the opening spans the width of the channel. The complete contraction on the top side, however, because of the larger velocity components parallel to the face of the gate, will offset the suppressed bottom contraction, resulting in a coefficient of

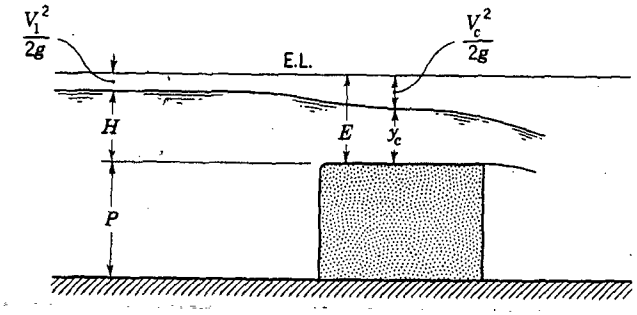
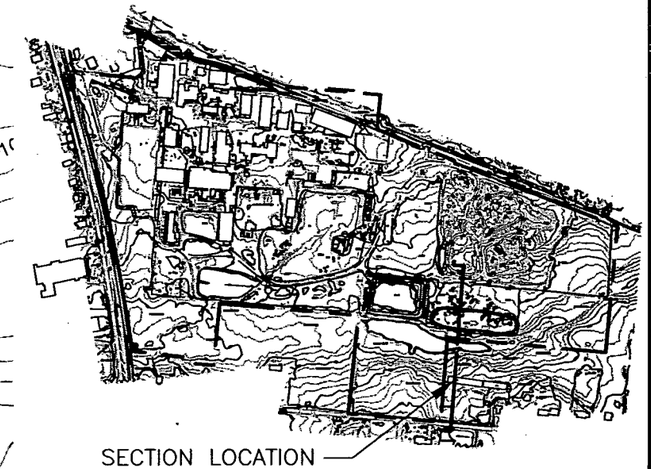


Fig. 11.37. Broad-crested weir.



SITE PLAN

SCALE: 1"=800'

SOURCE:
PHOTOMETRIC SURVEY BY PROMAPS
DATED JANUARY 18, 2005.

NOTE:
HORIZONTAL DATUM IS NEW JERSEY
STATE PLANE COORDINATES NAD '83.

VERTICAL DATUM IS NAVD 88.

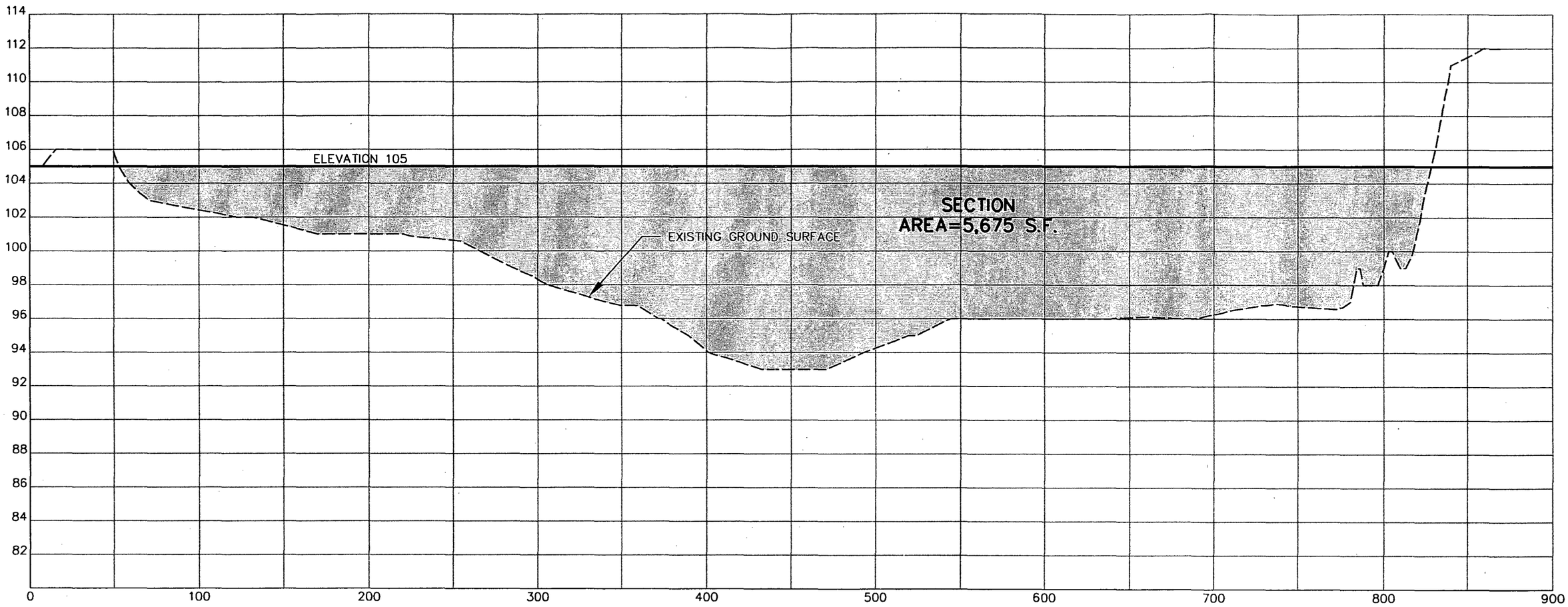
TRC
Customer-Focused Solutions
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 1
SECTION LOCATION PLAN

Date: 03/06 | Project No. 26770-0100-00000

J:\Cad\26770\0100\
Plate-A.dwg Layout:FIGURE 1 August 21, 2008-8:52AM khollenbeck



SECTION A-A

0 60' 120'
HORIZ. GRAPHIC SCALE

0 6' 12'
VERT. GRAPHIC SCALE

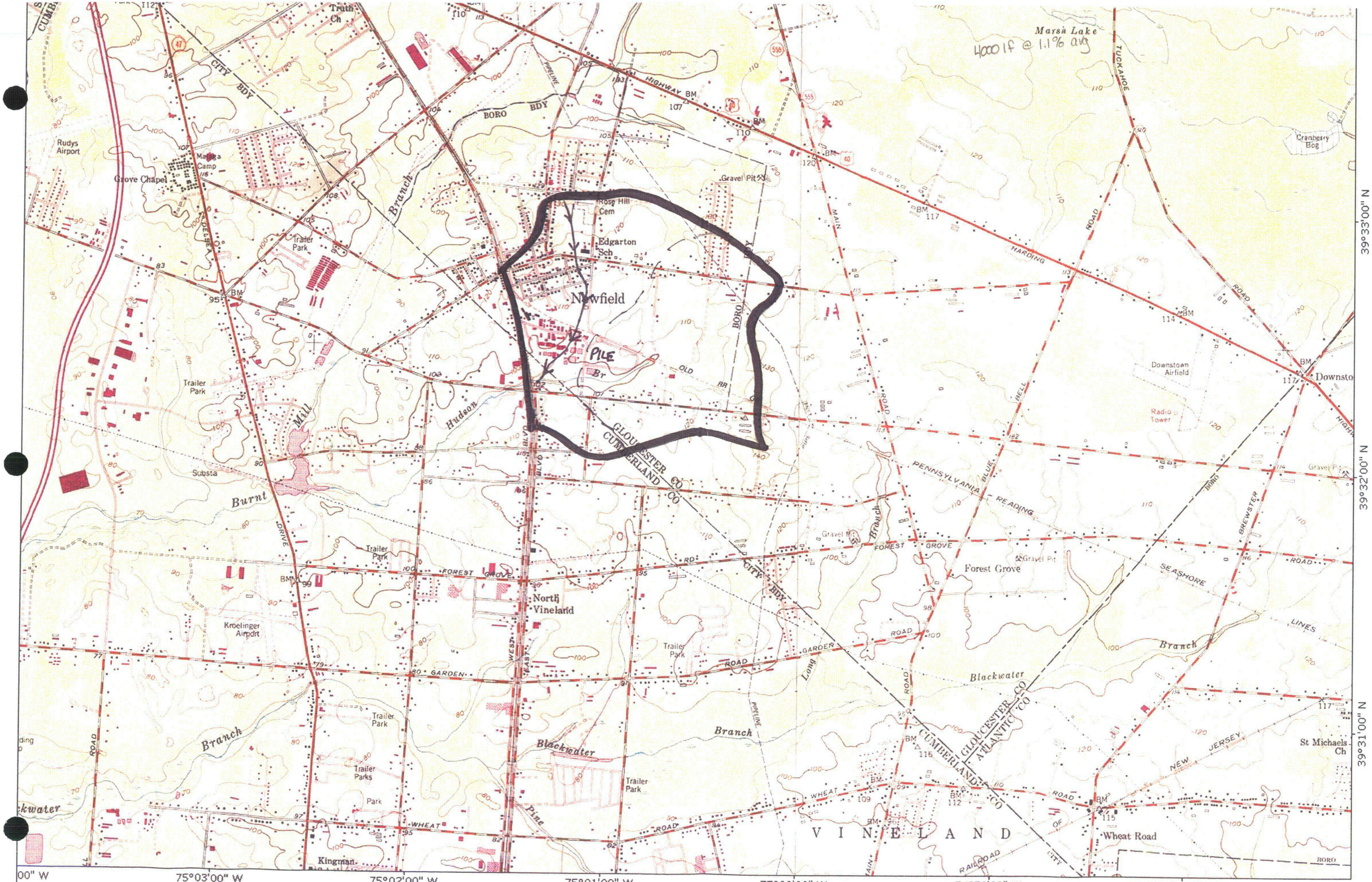
TRC
Customer-Focused Solutions
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2
SECTION A-A

Date: 03/06 | Project No. 26770-0100-00000

J:\Cad\26770\0100\
Plate-A.dwg Layout:FIGURE 2 August 21, 2008-8:52AM khollenbeck



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

ATTACHMENT O
Durable Rock Cover Selection Report

Selection of Durable Rock Cover Material
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Purpose

The selection of the durable rock cover material for theShieldalloy Metallurgical Corporation (SMC) Storage Yard materials was based on the US Nuclear Regulatory Commission's (NRC's) procedures and guidelines outlined in NUREG-1623 (Appendix D) (NRC, 2002) and NUREG-1757 (Appendix P) (NRC, 2006). The main purpose of selecting a durable rock material is to withstand the forces of weathering (known as rock durability) for a period of at least 1,000 years. The primary factors that affect rock durability include: chemical reactions with water; saturation time; temperature of the water; scour by sediments; windblown scour; wetting and drying; and freezing and thawing.

For a rock to remain effective in controlling erosion of underlying materials, the rock material selected and emplaced should not be reduced in size by weathering processes during the 1,000-year compliance time period. Since uncertainties exist with estimating future rock durability, the NRC has developed three different evaluations of rock durability that should be performed to provide multiple and complementary lines of evidence and greater confidence in the future durability of the selected rock source. The rock durability evaluations include the following: 1) implementation of rock durability testing and scoring; 2) determination of absence of adverse minerals and heterogeneities; and 3) development of evidence of resistance to weathering.

Rock Durability Testing and Scoring

The NRC has developed a procedure for determining the durability of a rock source for erosion covers for uranium mill tailing sites. This procedure provides a consistent and quantitative method to evaluate rock sources using standard parameters that are good indicators of rock durability.

The test procedure follows scoring criteria outlined in NUREG-1623 (Table D-1) which utilizes test results of five parameters including: Specific Gravity, Absorption, Sodium Sulfate Soundness, Los Angeles Abrasion, and Schmidt Hammer. For each rock source under consideration, the quality ratings should be based on the results of three to five of the different durability test methods for initial screening and five test methods for final sizing of the rock selected for inclusion in the design. Each test method parameter score is multiplied by a specific weighting factor which is assigned to a specific rock type (i.e., limestone,

sandstone, igneous). The weighting scores are totaled, divided by the maximum possible score, and multiplied by 100 to determine the rock durability rating percentage. Rocks exhibiting scores of 80% or higher indicate a high quality rock that can be used for most applications with no oversizing of the rock needed. Rock scores between 65-80% indicate less durable rock that can be used for most applications but may need oversizing in critical areas. Rock scores between 50-65% cannot be used for critical areas such as diversion ditches or poorly drained toes and aprons but can be used on well-drained side slopes provided it is over-sized. Rock scores of less than 50% indicate the rock cannot be used for any erosion application.

Absence of Adverse Minerals and Heterogeneities

The second rock durability evaluation involves petrographic examination of a representative rock from the potential rock source to support the absence of adverse minerals such as smectite, expanding lattice clay minerals, olivine, or calcite cement. These minerals or minerals that rapidly degrade to expansive clays could cause rapid degradation of the rock due to moisture or freeze-thaw cycles.

Heterogeneities within the rock source such as clay or shale partings, interbeds, fractures, alteration zones, or vein deposits can also adversely affect the durability of the rock source. The rock source should be evaluated for the presence of these heterogeneities and implementation of procedures to avoid these heterogeneities when removing the rock from its source (i.e., quarry).

Evidence of Resistance to Weathering

The third and final rock durability evaluation involves providing direct and/or indirect evidence that the selected rock source is resistant to weathering. Such evidence includes regional or local geomorphic evidence of slow weathering of the same rock source that outcrops in other locations (e.g., does the rock stand out higher in vertical relief relative to adjacent different rock types?). Other examples of relevant evidence include rounded boulders or thin weathering rinds on the surface of the rock. Weathering rind thickness and alteration of minerals and rock properties from exposures of the weathered selected rock source could provide insights on the extent and nature of future weathering of the selected rock source from fresh quarry exposures.

Indirect evidence can also be used from other locations where the general rock type is similar to the selected rock source. For example, evidence of durability from a diabase igneous rock found in Europe could be used to provide insights on a diabase rock source in the United States because the general

mineralogy of diabase is similar, regardless of the location. Another example involves age-dated glacial erratics and glacial scour or striations that could be used to show that the particular rock type has been resistant to weathering for over 10,000 years. This approach allows the use of datable natural or archaeological/historical rock sites (called analog sites), that could provide general evidence on rock weathering rates or time periods during which rock types have remained resistant to weathering.

Approach for Selecting Durable Rock Cover Material

As previously mentioned, TRC has utilized the guidance provided in NUREG-1623 (NRC, 2002) and NUREG-1757 (NRC, 2006) to select and analyze available rock material for use as rock cover for the materials to be consolidated in the Storage Yard at the SMC facility. Since there are numerous rock quarries located within a 100-mile radius of the SMC facility, TRC focused on rock quarries that typically quarry very hard and durable rock types (i.e., igneous and metamorphic rocks). Initially, TRC narrowed the potential quarries down to three candidates: two located in southeastern Pennsylvania and one in northern Maryland. Prior to visiting each quarry, TRC obtained durability testing information from each quarry with rock durability testing scores ranging from 87.4% to 95.7%, indicating that each quarry could potentially be suitable for rock source selection.

On March 27, 2008, representatives from the NRC, SMC and TRC visited each rock quarry, inspected quarry operations and geologic features observed in the quarry face, and discussed quarry operations/procedures with representatives from each quarry. Representatives of the New Jersey Department of Environmental Protection (NJDEP) were also invited to participate but did not attend. Although each quarry exhibited rock types that appeared to be very hard and durable (i.e., quartz schist, granodiorite and granite), the geology of each quarry exhibited numerous heterogeneities (e.g., mineralization veins and pegmatites, alteration zones, numerous fractures and jointing, etc.). During the quarry visit, representatives from the NRC indicated that they were in the final process of approving a Completion Report for a similar rock cover site located in Reading, Pennsylvania (known as the Cabot site). The approved rock source for the Cabot site was a diabase rock quarry (Dyer Quarry) located in Birdsboro, Pennsylvania, about 10 miles southeast of Reading. Since the NRC had already approved the diabase rock source at the Dyer Quarry for the Cabot site, it was agreed that SMC would focus the rock selection process on the Dyer Quarry and would plan a subsequent visit to the quarry.

On April 22, 2008, TRC's geologist visited the Dyer Quarry. Representatives from the NRC were invited to the quarry visit but could not attend. TRC met with quarry representatives who provided a thorough

tour of the quarry and processing operations. On the date of the visit, TRC collected representative rock samples for petrographic analysis and durability testing. Details on the site visit and results of the testing are provided below.

Description of Rock Source

As mentioned above, TRC's review resulted in the selection of the Dyer Quarry located in Berks County, Birdsboro, Pennsylvania as the preferred source for the rock cover material. The Dyer Quarry is located approximately 80 miles northwest of the SMC facility and is shown on Figure 1. There are seven levels in the quarry, with each level face approximately 50 feet high. The diabase was observed to be generally massive and uniform with moderate to slight jointing (greater than 1 foot and up to several tens of feet of spacing). There was one area of the quarry (northeast corner) that displayed closer parallel jointing (less than 1 foot) apparently due to either flow structure or a fracture zone. The contacts with the country rock consist of a finer grained chill zone. The country rock consists of the Triassic-aged Passaic Formation (a shale/mudstone) on the northeast margin of the quarry and the Triassic-aged Hammer Creek Formation (a quartz pebble conglomerate/sandstone and sandstone/shale sequence) on the southwest margin. Exposures of the country rock were only observed in the furthest lateral extending, uppermost benches (Levels 6 and 7). The country rock is not present in the lesser laterally extending, lower benches as the diabase unit dips nearly vertically.

In the uppermost level (Level 7), remnant residual soil and diabase boulders were present. It was reported that the current quarrying of Level 7 was nearly complete as the diabase at this level was diminished due to the steep surface topography created by the Seidel Creek valley, located to the northwest of the quarry. The boulders observed in Level 7 had only a very thin (mm scale) weathering rind beneath which the rock was unweathered and hard. Nearly all the quarried rock displayed clean, unweathered surfaces. Lower benches (down to Level 1) displayed little to no indications of weathering on rock and quarried boulder faces. The quarry personnel indicated that the country rock, consisting of the Passaic and Hammer Creek Formations, is not quarried as per standard quarry operations. Quarry personnel indicated that the quarry's primary customers, including the Pennsylvania Department of Transportation (PennDOT), Maryland State Highway Administration (MSHA) and Norfolk Southern Railroad, are very particular about the high durability of the rock. The quarry personnel indicated that the Norfolk Southern Railroad shipped the Dyer Quarry material as far as Illinois for use as railroad

ballast. The additional cost to purchase and ship was justified by the ability of the diabase to hold up under the constant impact from railroad operations.

Currently, the quarry operation processes approximately 7,000 tons of rock per day. Quarry personnel indicated that there are still about 20 years of life left in the present quarry location with their permit allowing them to quarry down an additional 200 feet. In addition, the owner of the quarry recently purchased property immediately to the southeast of the current quarry within the same diabase unit, giving them the ability to continue quarry operations many years into the future.

The TRC geologist collected a representative rock sample from Level 5 for petrographic analysis. The quarry manager had indicated that they will be quarrying in Level 5 in approximately one year. TRC also collected representative rock samples from the processed "R3" (4- to 6-inch diameter) pile for rock durability testing. The testing laboratory, Geotesting Express, had recommended that the durability testing should be done on the largest size rock (4- to 6-inch diameter, D_{50} – 5 inches) that will be used in the rock cover for the engineered barrier at the SMC facility.

Description of Rock Type

Regional Distribution and Descriptions of Pennsylvania Diabase

Diabase is a massive, phaneritic, mafic, intrusive, igneous rock of basaltic composition, consisting essentially of labradorite and pyroxene and characterized by an ophitic texture. It lacks bedding planes or foliation. Some anisotropy may be present due to chilled margins and occasional flow structure. Joints, induced by cooling or post emplacement stress, may also be present. The characteristics of early Mesozoic (late Triassic to early Jurassic age) diabase sheets, in southeast Pennsylvania in general and the intrusive body mined at the Dyer Quarry in particular, are described in various references. Froelich, in Shultz, 1999 and others have identified three distinct types of early Mesozoic intrusives in southeast Pennsylvania: York Haven, Rossville, and Quarryville. These types are characterized as high titanium (Ti) quartz-normative, low Ti quartz-normative and olivine-normative tholeiite, respectively. The York Haven type is the diabase unit found at the Dyer Quarry. The type example of the York Haven diabase is located in Gettysburg, Pennsylvania. This diabase produces the highest hills surrounding the Gettysburg battlefield (e.g., Big Roundtop, Little Roundtop, Devil's Den, Cemetery Hill, etc.) and was used strategically by the Union army during the Civil War (Inners, et. al, 2006).

Local Description of Dyer Quarry Diabase

The location of the Dyer Quarry is depicted on the local geologic map of the Reading and Birdsboro quadrangles (MacLachlan, 1992), as illustrated on Figure 2. The intrusive diabase body quarried at the Dyer Quarry consists of a nearly vertical unit over 1,000 feet thick. The associated geologic cross section (Figure 3) depicts the sheet extending vertically downward for nearly four thousand feet before becoming nearly horizontal.

The description of diabase in Pennsylvania by Geyer, 1982 provides insight into its durability:

> **DIABASE** (Trd)
>
> DESCRIPTION: Diabase occurs in Pennsylvania primarily as dikes and sheets; the dikes are generally 5 to 100 feet thick and the sheets much thicker; in most places, the rock is dark gray to black, dense, and very fine grained, and consists of 90 to 95 percent labradorite and augite; reference section is at Devil's Den in Gettysburg National Park, Adams County.
>
> BEDDING: None.
>
> FRACTURING: Joints have a blocky pattern; well developed; moderate distance between fractures; open and steeply dipping.
>
> WEATHERING: Highly resistant; slightly weathered to a shallow depth; weathering produces large rounded boulders mixed with thin soil mantle.
>
> TOPOGRAPHY: Undulating hills of medium relief; natural slopes are moderately steep and stable; dikes form ridges.
>
> CONSTRUCTION MATERIALS: Good source of riprap, embankment facing, fill, and building stone.

The characteristics of diabase in the area containing the Dyer Quarry are also described by MacLachlan, 1992:

> All diabase is dark gray, fine-grained in dikes, and medium-grained to locally pegmatitic in major bodies. Fresh rock is predominantly plagioclase and greenish-black pyroxene.

As described in MacLachlan, 1992, the Dyer Quarry is located within the York Haven type diabase (high Ti quartz-normative) and is Jurassic-aged:

> *York Haven Type* (Jdyh) is chemically a normal continental tholeiite (lacking olivine) and forms the major sheets and some dikes. Slices of metamorphosed sediment are encountered in the

main sheet, and metamorphic effects may be observed extending several hundred feet into invaded sediments near the major bodies. Chill zones are characteristically uniformly microcrystalline. Maximum thickness of main sheet is probably in excess of 300 meters (1,000 feet). The diabase is an excellent source of road material, riprap, railway ballast, building stone, embankment facing, and fill.

Mineralogy and Chemical Composition

The mineralogical compositions of samples from the Dyer Quarry were provided by the quarry (Attachment 1) and petrographic analyses were performed on an additional sample for TRC (Attachment 2). The quarry results indicated that the diabase consists of 51% - 56% plagioclase feldspar, 17% - 36% pyroxene, 3% - 10% hornblende, 2% - 6% graphic quartz, 4% - 7% quartz, and 4% magnetite. The representative sample collected by TRC was analyzed by Construction Materials Consultants, Inc. (Attachment 2). Based on detailed petrographic examinations and x-ray diffraction, the rock was described as consisting primarily of calcic-plagioclase feldspar (labradorite – 60%) and ortho- and clino-pyroxenes (hypersthene and augite – 30%) with minor amounts of opaque minerals (5%), actinolite (4%) and biotite (1%) and the feldspar alteration mineral sericite. The petrographer classified the sample as a plagioclase-pyroxene bearing diabase which is a mafic (basic) igneous rock of hypabassal to plutonic origin, belonging to the gabbro-norite family. This classification is consistent with the diabase classification described by other researchers of the York Haven type unit.

Three sources of chemical composition results were compared:

- Analyses of samples from the Dyer Quarry (Attachment 1)
- Analyses of five samples from the same diabase sheet near the quarry (Gottfried, 1991)
- The median for analyses of York Haven type diabase sheets (Froelich, 1999)

Table 1 provides a summary of the above-referenced analytical results. Evaluation of the results indicated that the results for the Dyer Quarry samples are quite comparable to the Gottfried samples and those results from the median values for the York Haven type sheet. The chemical composition results confirm the York Haven type diabase classification of the Dyer Quarry as indicated in Shultz, 1999. Review of the chemical analyses indicated that the diabase is also low in natural uranium and thorium. Based on the average results in Table 1, the total uranium and thorium activity in the diabase is approximately 1.2 pCi/g, which is considerably lower than the average radionuclide concentration in

the Storage Yard of 182 picocuries of uranium, thorium and all progeny, per gram of material (the derived source term shown in Table 17.7 of the "Decommissioning Plan for the Newfield Facility", Rev. 1, page 212, October 21, 2005). Placement of the rock cover will reduce the exposure at the SMC facility both through shielding of the underlying low-level radioactive materials and by lowering the average near-surface background activity. Furthermore, at the Index House in Berks County, Pennsylvania, the York Haven type diabase was reported to be used to shield basement walls from a high gamma flux from daughters of thorium and uranium generated from the rocks of the Reading Prong (Smith et al., 1987).

Physical Characteristics

The physical properties of the diabase were provided by the quarry and independent tests performed by TRC. The properties reported by the quarry (Attachment 1) included an average specific gravity of 2.97 and a compressive strength of 30,000 lb/in^2. The durability test results performed for TRC (Attachment 3) reported a specific gravity (saturated surface dry basis) of 3.00. The petrographic report stated: "The rock shows a dense, intermediate to coarse-grained equigranular texture where plagioclase and pyroxene grains show an interlocking arrangement. The rock does not show any fault, cracking, or porosity. The rock is very dense and hard. The rock is determined to be sound and of good quality, suitable to use for any construction purposes."

Evaluation of Acceptable Rock Quality for Long-Term Durability

Rock Durability Analysis and Score

The diabase rock has been well characterized by physical testing, inspection, and current uses. This includes 12 years of testing performed by the quarry and the quarry's primary customers (PennDOT and MSHA), tests performed for the Cabot project (STEP, 2006), and tests performed by TRC for the SMC facility. Based on the durability parameters reported by the quarry and independent laboratory tests, the diabase rock at the Dyer Quarry is uniformly and consistently of high quality, as indicated on Table 2. Durability test results conducted for TRC are summarized in Attachment 3. Testing data from 1996 through 2008 are summarized on Table 2 with the following mean values calculated:

- Specific Gravity – 2.96
- Absorption – 0.58%
- Sodium Sulfate Soundness – 0.59%
- L.A. Abrasion – 15.52

These values were then incorporated into the scoring table in NUREG-1623, Table D-1 to determine the rock durability score. As indicated in Table 2, the resulting rock score was 94.7% which is significantly above the 80% rock score referenced in NUREG-1623, indicating a high quality rock that can be used for most applications with no oversizing of the rock needed. TRC also evaluated a very conservative, worst case scenario in which a two standard deviation difference from the historical mean was calculated. The resulting rock score (89.8%) was still well above the NRC threshold of 80%.

Absence of Adverse Minerals and Heterogeneities

The mineral composition of a rock has a bearing on the susceptibility to weathering that would lead to a reduction in the size of the riprap within the 1,000 year period of interest. The primary adverse minerals of concern include:

- The existence (interstitial or in veins) of expanding lattice clay minerals such as smectite
- Minerals that would rapidly weather to clay minerals such as olivine
- Carbonate mineral veins that could dissolve

Based on published literature, the York Haven type diabase contains little or no olivine as would be expected for a quartz-normative tholeiite. Olivine was not identified in the petrographic analysis of the Dyer Quarry samples for the Cabot site (STEP, 2006) or for the SMC facility (Attachment 2). Each of those reports also noted the absence of clay minerals and very little weathering of the plagioclase feldspar grains. A trace amount of sericite was noted in the petrographic analysis conducted on the Dyer Quarry diabase by PENNDOT (Attachment 1) and for SMC (Attachment 2). Sericite is a common alteration mineral of orthoclase or plagioclase feldspars in diabase rock that have been subjected to hydrothermal alteration. The petrographic analysis of the rock sample indicated that the sericitic alterations have not affected the overall integrity, density, and good quality of the rock material. This conclusion is supported by the rock durability testing results and diabase analogues. Furthermore, it would be expected that, given the age of the Dyer quarry diabase (i.e., York Haven diabase of Triassic age – 200 to 250 million years old), the trace amount of sericite will not adversely affect the quality of the rock over the next 1,000 years. No carbonate minerals or veins were reported by the quarry analysis, the independent Cabot and SMC analyses, or observed during the quarry visit.

Heterogeneities in the rock can be planes of weakness or develop into planes of weakness. Potential adverse heterogeneities in the diabase include joints, fractures, flow zones, chilled margins, alteration zones, zones of higher porosity, and xenoliths. Some of these features have been noted in the literature

or observed during the quarry visit. However, these features comprise only an insignificant fraction of the overall rock mass and are easily recognizable and not all will actually be detrimental. For example, only joints that remain within individual pieces after the quarrying and placement operations will have a potential impact on the durability of the durable rock cover.

At the Dyer Quarry, the diabase consists of a massive dike approximately 1,000 feet thick. Observations during the quarry visit indicated that the typical joint spacing ranges from several feet to greater than 10 feet. The smaller joint spacing of less than a foot was present in one apparent flow zone located in the northeast corner of the quarry. Other than in the upper bench, nearly all joints and fractures appeared to be unweathered. It did not appear that joints remained in individual pieces of rock after being quarried or processed. The generally large joint spacing and lack of incipient joints is indicated by the difficulties experienced by the quarrying operations. Even after blasting and removal from the quarry face, large impact hammers mounted on hydraulic excavators are needed to break the very large boulders into pieces small enough to be managed by conventional equipment. The excellent performance of the Dyer diabase as railroad ballast exposed to constant impact also indicates a lack of incipient joints or unexpressed planes of weakness. The size requirements for the durable rock cover material (i.e., largest size R3 or 4- to 6-inch diameter – D_{50}-5 inches) will preclude material from zones of closer joint spacing.

Chill zones are restricted to the contacts with the adjoining country rock and are avoided during quarrying operations as part of standard operations. Xenoliths were not observed during the quarry visit and are not believed to be common in the diabase. If present, xenoliths can be identified and avoided or rejected for use as the durable rock cover material. Alteration zones occur only in the surrounding country rock that will not be quarried for the durable rock cover.

The diabase has essentially no primary porosity and a very low secondary porosity due to widely spaced joints and fractures. These characteristics produce low hydraulic conductivity values resulting in poor aquifer performance with reported well yields ranging from 3 to 15 gallons per minute (MacLachlan, 1992).

The diabase formations in southeast Pennsylvania are notorious for their poor aquifer characteristics and are often inadequate for an individual domestic supply. The hydraulic properties of the diabase

limit the rate and volume of ground water flow through the diabase and limit the rate of weathering. Fracture of flow zones with higher hydraulic conductivity are uncommon and only one was observed in the quarry. That zone did not exhibit noticeable weathering, indicating that even the closer spaced joints may not be sufficiently open to allow significant ground water flow.

Direct and Indirect Evidence of Resistance to Weathering

The slow weathering of diabase has been described in detail above and is based on the observations of thin soils, rounded boulders, thin weathering rind, and topographic ridges. There are several natural analogs that provide additional assurance of the durability of diabase. Long-term investigations of the Coweeta basin in North Carolina have determined the rate of weathering of crystalline rocks composed of primarily quartz, biotite and muscovite micas, plagioclase feldspar, and almandine garnet to be approximately 3.8 cm/1,000 years (Swank, 1988). The average temperature and rainfall in the Coweeta basin are greater than in the Newfield, New Jersey area and consequently, weathering in the southern New Jersey area would be expected to be slower than in North Carolina.

A graveyard located in the same diabase dike as the Dyer Quarry (Figure 2) was surveyed by TRC on April 22, 2008. The St. John's graveyard, located within one mile of the quarry, contained a number of gravestones made from what appeared to be the local diabase. A representative photograph of one of these gravestones (Figure 4) demonstrates the slow rate of weathering of this diabase. After 113 years of weather exposure, the lettering and edges of the gravestones are still sharp with only a slight staining visible.

An additional natural analog was also obtained as an example of the general durability of diabase igneous rocks. Figures 5 and 6 represent photographs of glacial erratic diabase boulders found in the western United States and in the central Taurus mountains of Turkey, respectively. The photographs show how the large glacial erratic boulders have withstood glaciations from thousands of years ago. The diabase boulder from Turkey exhibits distinct glacial striations and polish that have withstood approximately 10,000 years of exposure. Although the glacial erratic diabase analogs from the western United States and Turkey are from more arid climates than that in the Eastern United States, the fact that these erratics have withstood weathering and erosional forces for approximately 10,000 years is significant. Figure 7 represents a glacial erratic boulder of the Palisades Sill diabase which was transported during the last glaciation period, across the Hudson River, to the Inwood section of upper

Manhattan, New York City. This area of New York has a very similar climate to the climate of southern New Jersey. The presence of this glacial erratic represents strong evidence of the durability of diabase-type rocks by clearly withstanding over 10,000 years of post-glaciation weathering in a humid, temperate climate.

Conclusions

The diabase rock chosen for the durable rock cover material was selected due to its favorable physical properties, long-term durability, inherent resistance to weathering and its ability to protect the underlying materials if properly designed. Rock covers require little to no maintenance and the high density of the diabase material provides attenuation of low-level radioactive releases.

Continued performance through the 1,000 year period of interest requires that the rock cover material maintains its favorable characteristics, primarily its strength and size gradation. Degradation of the rock performance would occur if the diabase weathers and forms a soil or if the individual pieces of rock broke down into smaller fragments. Geologic references, physical testing, direct quarry observations, and direct and indirect natural analogs provide confirmation that the diabase will remain stable and continue to meet the design criteria for the 1,000 year period of interest.

References

Froelich, A. J., Gottfried, David, 1999, "Early Mesozoic-Igneous and Contact Metamorphic Rocks" in Shultz, The Geology of Pennsylvania, Pennsylvania Department of Conservation and Natural Resources, 1999

Geyer, Alan R., Wilshusen, J. Peter, 1982, "Engineering Characteristics of the Rocks of Pennsylvania", Environmental Geology Report 1, Pennsylvania Department of Environmental Resources, 1982

Gottfried, David, Froelich, Albert J., and Grossman, J. N., 1991, "Geochemical Data for Jurassic Diabase Associated With Early Mesozoic Basins in the Eastern United States; Western Newark Basin, Pennsylvania and New Jersey", USGS Open File Report 91-322-D, 1991

Inners, J.D., Cuffey, R. J., Smith, II, R.C., Neubaum, J.C., Keen, R.C., Fleeger, G.M., Butts, L., Delano, H.L., Neubaum, V.A., and Howe, R.H., "Rifts, Diabase, and the Topographic "Fishhook": Terrain and Military Geology of the Battle of Gettysburg", Pennsylvania Geological Survey, Open File Report 06-02, October 26, 2006

MacLachlan, David B., 1992, "Geology and Mineral Resources of the Reading and Birdsboro Quadrangles, Berks County, Pennsylvania", PADER, Atlas 187cd, 1983, revised 1992

NRC, 2002, "Design of Erosion Protection for Long Term Stabilization", NUREG-1623, US Nuclear Regulatory Commission, September 2002

NRC, 2006, "Characterization, Survey, and Determination of Radiological Criteria", NUREG-1757, Vol. 2, Revision 1, Appendix P, US Nuclear Regulatory Commission, September 2006

Smith, II, R.C., Reilly, M. A., Rose, A. W., Barnes, J. H., and Berkheiser, S. W., April 1987, Radon: A profound case, *Pennsylvania Geology*, vol. 18, no. 2, p 3-7.

STEP, 2006, "Addendum 1 to Reading Slag Pile Site, Decommissioning Plan (Revision 4), Design of Riprap Cover, for Cabot Corporation, ST Environmental Professionals, Inc., August 2006.

Swank, 1988, "Forest Hydrology and Ecology at Coweeta", Springer-Verlag, 1988

TABLE 1
Chemical Analyses - Diabase
SMC Decommissioning Plan

UNITS	CONSTITUENT	Dyer Quarry Analysis	Average of Five Gottfried Samples (Pbl-1, Pbl-2A, Pbl-2B, Pbl-3, Pbl-4)	Froelich - York Haven Diabase Median
%	SiO_2	52.10	53.02	51.84
	TiO_2	1.50	1.45	1.09
	Al_2O_3	14.70	15.60	14.34
	Fe_2O_3	13.10	2.78	1.18
	FeO		8.54	8.75
	MnO	0.19	0.17	0.20
	MgO	4.83	4.26	7.72
	CaO	9.60	9.46	10.73
	Na_2O	2.52	2.93	1.96
	K_2O	0.87	1.05	0.60
	P_2O_5	0.18	0.22	0.12
	H_2O^+		1.17	0.23
	H_2O-		0.31	
	CO_2		0.05	0.08
	LOI	0.32		
	Cr_2O2	0.01		
	S		0.03	
	F		0.03	
	Cl		0.09	
	Total %	99.92	101.18	98.84
ppm	Sc		31.20	
	Crt		36.34	
	Co		40.40	
	Ni		43.40	
	Zn		82.00	
	Ga		21.80	
	As		2.03	
	Rb		39.60	
	Sr		214.00	
	Sb		0.23	
	Cs		1.14	
	Ba		250.00	
	Y		27.20	
	La		16.14	
	Ce		33.68	
	Nd		17.80	
	Sm		4.80	
	Eu		1.44	
	Tb		0.85	
	Yb		2.80	
	Lu		0.40	
	Hf		3.60	
	Nb		10.82	
	Ta		0.83	
	Th		3.36	
	U		0.69	
ppb	Pd		11.32	
	Pt		7.42	
	Rh		0.50	
	Ru		<0.50	
	Ir		<0.50	
	Au		10.00	

PERS/JW/HAZ/105106 SMC/Decomissioning Table 1.h10

Gottfried Gottfried, David, Froelich, Albert J., and Grossman, J. N., 1991, "Geochemical Data for Jurassic Diabase Associated with Early Mesozoic Basins in the Easter United States: Western Newark Basin, Pennsylvania and New Jersey", USGS Open File Report 91-322-D
These samples were located within 1 mile of the Dyer Quarry and from the same diabase sheet.

Froelich Froelich, A. J., and Gottfried, David, 1999, "Early Mesozoic - Igneous and Contact Metamorphic Rocks", in "The Geology of Pennsylvania "Edited by Charles H. Shultz

TABLE 2
Dyer Quarry Rock Durability Testing Results (1996-2008)
SMC Decommissioning Plan

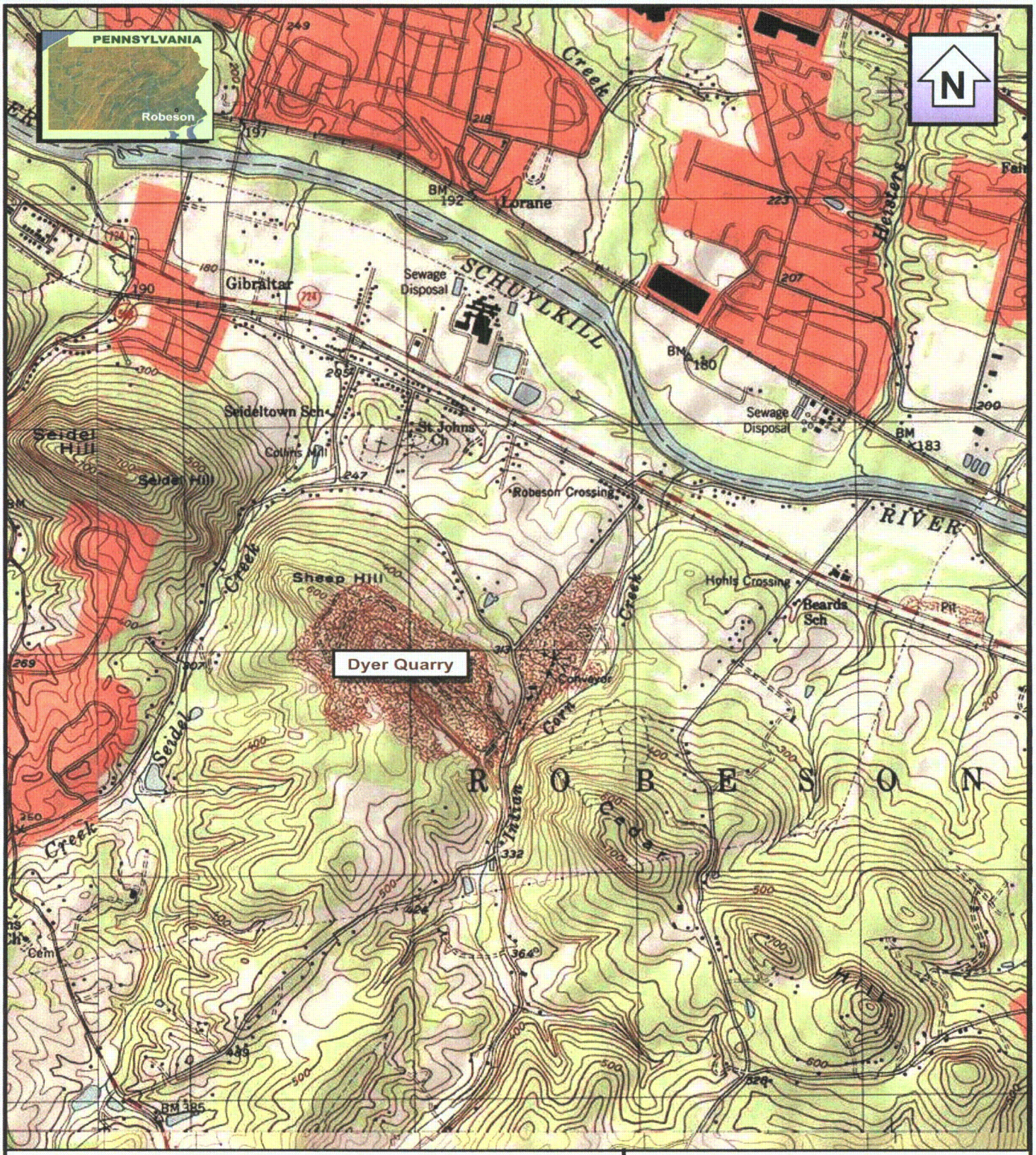
Date	Tested By	Specific Gravity	Absorption %	Sodium Sulfate Soundness %	L.A. Abrasion
6/28/1996	Maryland SHA	2.92	1.0	0.30	15.00
6/25/1998	Maryland SHA	2.93	0.8	0.30	15.00
1/23/2003	Penn DOT	2.98	0.5	0.5	16.00
1/23/2003	Penn DOT	2.92	0.95	2.00	
8/20/2004	Penn DOT	2.95	0.58	0.25	13.71
4/27/2005	Maryland SHA	2.99	0.9	0.20	17.00
2005	Cabot	2.97	0.4	1.95	17.00
2005	Cabot	3.00	0.22	0.18	12.80
4/7/2006	Maryland SHA	2.95	0.06	0.20	16.00
6/9/2006	Penn DOT	2.97	0.56		16.35
5/1/2007	Agg. & Soils Testing				17.70
5/1/2007	Agg. & Soils Testing				17.70
5/1/2007	Agg. & Soils Testing				15.80
5/3/2007	Agg. & Soils Testing			0.70	
5/3/2007	Agg. & Soils Testing			0.50	
5/7/2007	Agg. & Soils Testing			0.50	
6/1/2007	Penn DOT	2.97	0.56	0.50	16.00
6/1/2007	Penn DOT	2.97	0.88	0.50	20.00
5/9/2008	Geotesting Express for SMC	3.00	0.18	0.24	6.70

Mean (1996-2008)	2.96	0.58	0.59	15.52
Standard Deviation	0.03	0.31	0.58	2.98
Mean ±2 Std. Dev.	2.91	1.20	1.76	21.48
Maximum	3.00	1.00	2.00	20.00
Minimum	2.92	0.06	0.18	6.70

Lab Test	Mean Result	Score[1]	Weight Factor[2]	Score Weight	Max Score
Specific Gravity	2.96	10	9	90	90
Absorption (%)	0.58	7.5	2	15	20
Sodium Sulfate (%)	0.59	10	11	110	110
L.A. Abrasion (%)	15.52	2.9	1	2.9	10
			Total:	217.9	230
			Rock Score (Mean Values):	94.7%	

Lab Test	Mean ±2 Std. Dev. Result	Score[1]	Weight Factor[2]	Score Weight	Max Score
Specific Gravity	2.91	10	9	90	90
Absorption (%)	1.20	4.6	2	9.2	20
Sodium Sulfate (%)	1.76	9.6	11	105.6	110
L.A. Abrasion (%)	21.48	1.7	1	1.7	10
			Total:	206.5	230
			Rock Score (Mean ±2 Standard Deviation Values):	89.8%	

Notes: [1] - Score based on Table D-1 in NUREG-1623.
[2] - Weight factor based on Table D-1 in NUREG-1623 for an igneous rock (diabase).



0 2000
SCALE FEET

0 1
SCALE MILE

1:24000

BASE CREATED WITH TOPO™ © 1996 WILDFLOWERS PRODUCTIONS, www.topo.com
7.5' USGS TOPOGRAPHIC MAP

TRC

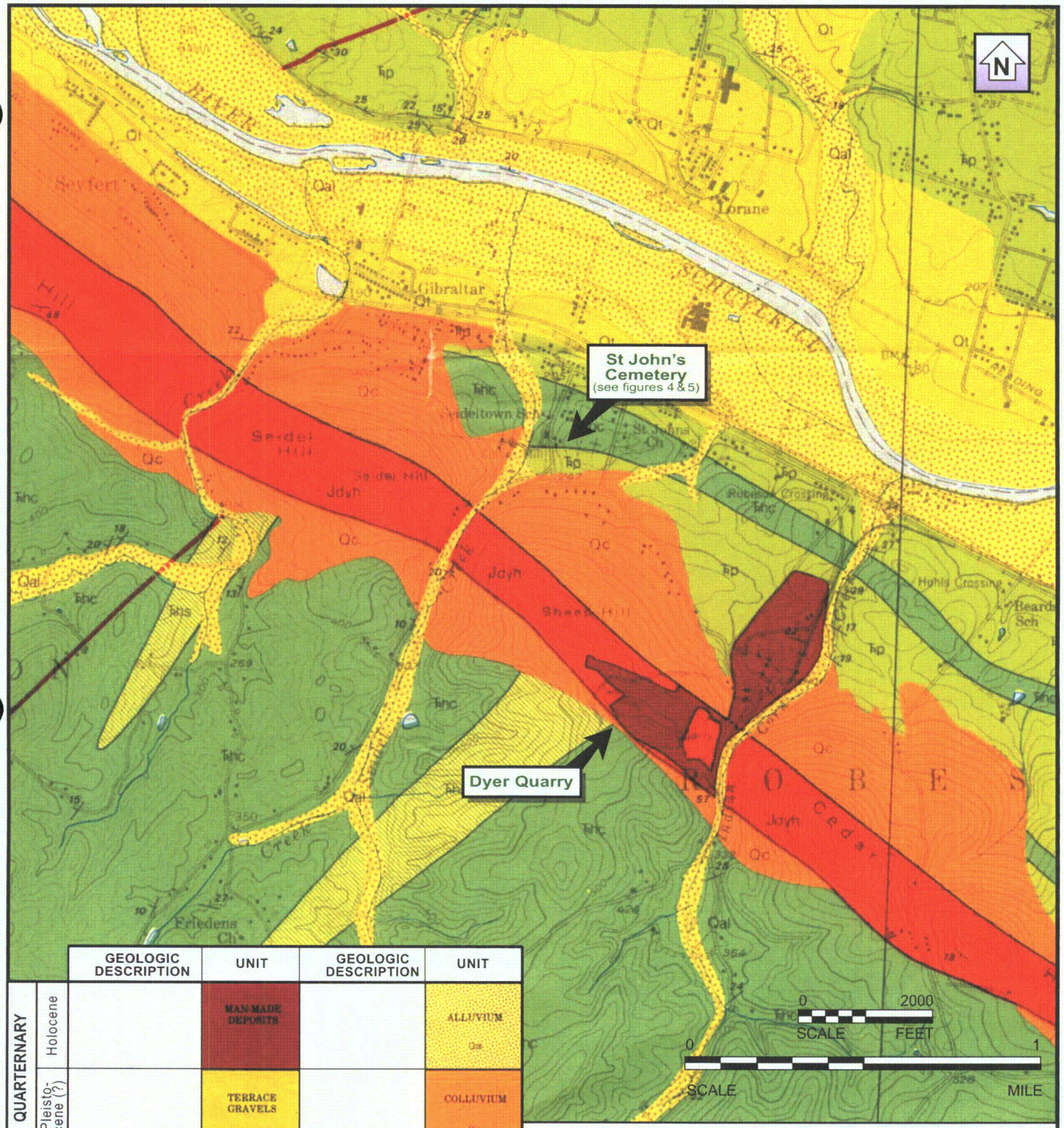
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 1
DYER QUARRY SITE LOCATION MAP

Date: 05/08 | **Project No.** 105106.000100.000000

PERS/JW/HAZ/105106 SMC/Decomissioning Fig 1.fh10



		GEOLOGIC DESCRIPTION	UNIT	GEOLOGIC DESCRIPTION	UNIT
QUARTERNARY	Holocene		MAN-MADE DEPOSITS		ALLUVIUM Qal
QUARTERNARY	Pleistocene (?)		TERRACE GRAVELS Qt		COLLUVIUM Qc
JURASSIC	Lower	Passaic Formation (Ŧp)-Predominantly reddish-brown shale and mudstone.	PASSAIC FORMATION Ŧp	York Haven type (Jdyh)	DIABASE Jdr Jdyh
TRIASSIC	Upper	(Ŧhc)-Quartz-pebble conglomerate and coarse-grained sandstone.		(Ŧhs)-Red sandstone and shale containing little or no conglomerate.	HAMMER CREEK FORMATION Ŧhc Ŧhs

SOURCE: GEOLOGY & MINERAL RESOURCES OF THE READING & BIRDSBORO QUADRANGLES, 1968, BERKS COUNTY, PA, MACLACHLAN, 1992

TRC

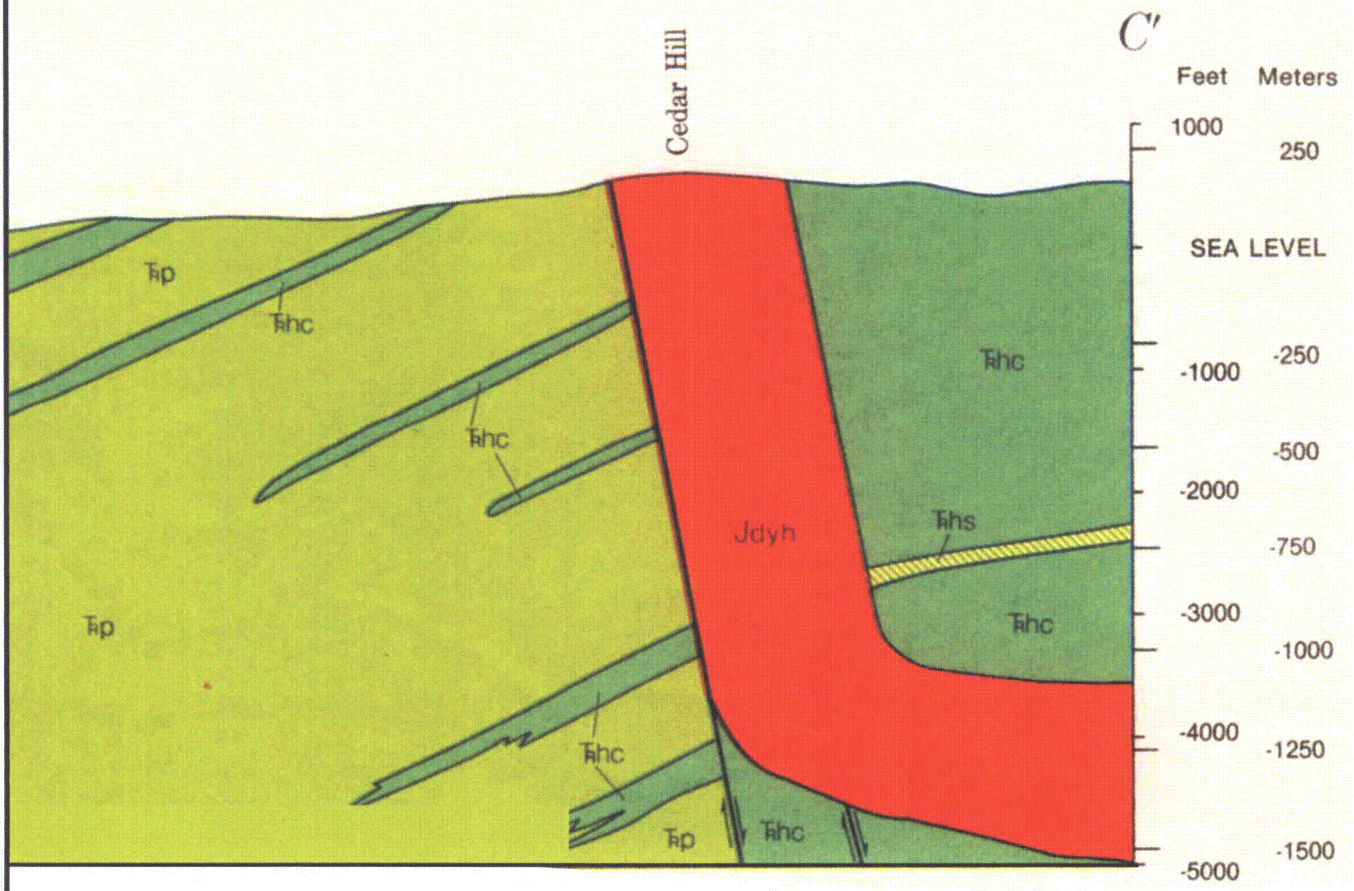
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2
GEOLOGIC MAP
DYER QUARRY AREA

Date: 05/08 | **Project No.** 105106.000100.000000

PERS/JW/HAZ/105106 SMC/Decomissioning Fig 1.fh10



		GEOLOGIC DESCRIPTION	UNIT	GEOLOGIC DESCRIPTION	UNIT
QUARTERNARY	Holocene		MAN-MADE DEPOSITS		ALLUVIUM Qa
QUARTERNARY	Pleistocene (?)		TERRACE GRAVELS Qt		COLLUVIUM Qc
JURASSIC		Passaic Formation (Ŧp)-Predominantly reddish-brown shale and mudstone.	PASSAIC FORMATION Ŧp	York Haven type (Jdyh)	DIABASE Jdr, Jdyh, Jdy
TRIASSIC		(Ŧhc)-Quartz-pebble conglomerate and coarse-grained sandstone.		(Ŧhs)-Red sandstone and shale containing little or no conglomerate.	HAMMER CREEK FORMATION Ŧhs, Ŧhc, Ŧhc

0 2000
SCALE FEET

0 1
SCALE MILE

SOURCE: GEOLOGY & MINERAL RESOURCES OF THE READING & BIRDSBORO QUADRANGLES, 1968, BERKS COUNTY, PA, MACLACHLAN, 1992

TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 3
GEOLOGIC CROSS SECTION
DYER QUARRY AREA

Date: 05/08 | **Project No.** 105106.000100.000000

PERS/JW/HAZ/105106 SMC/Decomissioning Fig 1.fh10

Figure 4. Diabase gravestone located in the St. John's Cemetery located approximately 0.5 mile from the Dyer Quarry. Note sharp lettering and edges on 113-year old gravestone.

Figure 5. Glacial (diabase) boulder (erratic) on Diversion Ridge south of Sun River. Hammer for scale. Sun River Canyon project. Lewis and Clark County, Montana. (http://geoinfo.amu.edu.pl/wpk/pe/a/harbbook/c_viii/chap08.html)

Figure 6. Glacial striations and polish on a diabase erratic boulder, Bolkardağ, Central Taurus Mountains. Hammer for scale. (from : **www.erudit.org/.../2003/v57/n2-3/011314ar.html**)

Figure 7. Palisades Sill diabase glacial erratic bolder located in the Inwood section of Upper Manhattan, New York City, New York.
(from: http://geowords.org/qc/tryon_inwood_fieldtrip/shorakkopoch.htm)

ATTACHMENT 1

DYER QUARRY ROCK CHEMICAL ANALYSIS AND DURABILITY TESTING RESULTS

FAX

DYER QUARRY INC.
(A JAMES J. ANDERSON CO.)
P. O. BOX 188
BIRDSBORO, PA 19508

Date 4/9/08
Number of pages including cover sheet 18

To: Matthew Panciera
TRC
Phone (860) 298-6364
Fax Phone (860) 298-6380

From: LARRY KELLY
Phone 610-582-6010
Fax Phone 610-582-2304

REMARKS:

☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

Dyer Quarry test results.

DYER QUARRY INC.

1275 ROCK HOLLOW ROAD
BIRDSBORO PA, 19508
PHONE: 1.610.582.6010
FAX: 1.610.582.2304

DIABASE PROPERTIES

	LOWER	UPPER	
1. LABRADORITE	51%	56%	PLAGIOCLASE FELDSPAR
2. AUGITE	36%	17%	MINERAL OF THE PYROXENE GRP.
3. HORNBLENDE	3%	10%	SILICATE MINERAL
4. QUARTZ (GRAPHIC)	2%	6%	CRYSTALLINE MINERAL CONTAINING CRYSTALS LIKE LETTERS
5. QUARTZ	4%	7%	A HARD CRYSTALLINE MINERAL
6. MAGNETITE	4%	4%	BLACK MINERAL ORE OF IRON

PHYSICAL PROPERTIES

1. ANTI SKID RATING	H
2. COMPRESSIVE STRENGTH	30,000 LBS SQ/INCH
3. L.A. ABRASION LOSS	17 AVG
4. DEVAL ABRASION LOSS	2.0 AVG
5. SODIUM SULFATE LOSS	1.95 AVG
6. SPECIFIC GRAVITY	2.97
7. ABSORPTION	0.4% AVG
8. CEMENTING VALUE	170 AVG
9. SOLID VOLUME - LBS/CU.FT.	185.3
10. SOLID VOLUME - LBS/CU.YD.	5,003.90

CHEMICAL WHOLE ROCK ANALYSIS

1. SILICON DIOXIDE	SiO_2	52.10%
2. TITANIUM DIOXIDE	TiO_2	1.50%
3. ALUMINUM HYDROXIDE	Al_2O_3	14.70%
4. IRON OXIDE	Fe_2O_3	13.10%
5. MANGANATE	MnO	0.19%
6. MAGNESIUM OXIDE	MgO	4.83%
7. CALCIUM OXIDE	CaO	9.60%
8. SODIUM OXIDE	Na_2O	2.52%
9. POTASSIUM OXIDE	K_2O	0.87%
10. PHOSPHORUS PENTOXIDE	P_2O_5	0.18%
11. CHROMIUM DIOXIDE	Cr_2O_2	0.01%
12 LOSS ON IGNITION	LOI	0.32%

DYER QUARRY
1275 ROCK HOLLOW ROAD
BIRDSBORO, PA 19508

RE: Test results

Allowable limits: **L.A. Abrasion: 0 to 45%**
Sodium Soundness: 0 to 10%

Date	Tested by	L.A. Abrasion	Sodium Soundness
6/28/1996	Maryland SHA	15.00	0.30
6/25/1998	Maryland SHA	15.00	0.30
8/20/2004	Penn DOT	13.71	0.25
4/27/2005	Maryland SHA	17.00	0.20
4/7/2006	Maryland SHA	16.00	0.20
6/9/2006	Penn DOT	16.35	
5/1/2007	Agg. & Soils Testing	17.70	
5/1/2007	Agg. & Soils Testing	17.70	
5/1/2007	Agg. & Soils Testing	15.80	
5/3/2007	Agg. & Soils Testing		0.70
5/3/2007	Agg. & Soils Testing		0.50
5/7/2007	Agg. & Soils Testing		0.50

GENERAL AGGREGATE TESTING

Sample ID:

Company: J. T. Dyer

Source Location: Birdsboro, Pennsylvania

Maryland SHA

Tract Series: 45-10

Report Issuance Date: 06/28/96

The following test results were obtained from the Maryland SHA Laboratory testing records:

1. Specific Gravity 2.92 ; by AASHTO T85
2. Absorption, % 1.0 ; by AASHTO T85
3. Los Angeles Abrasion, % Loss 15 ; by AASHTO T96
4. Sodium Sulfate Soundness, % Loss 0.3 ; by AASHTO T104
5. Unit Weight (lbs/ft^3)
   a. Loose 91.6
   b. Rodded 100.6

GENERAL AGGREGATE TESTING

Sample ID:

Company: J. T. Dyer

Source Location: Birdsboro, Pennsylvania

Maryland SHA

Track Series: Comparison to: 45-10

Report Issuance Date: June 25, 1998

The following test results were obtained from the Maryland SHA Laboratory testing records:

1. Specific Gravity 2.93 ; by AASHTO T85
2. Absorption, % 0.8 ; by AASHTO T85
3. Los Angeles Abrasion, % Loss 15 ; by AASHTO T96
4. Sodium Sulfate Soundness, % Loss 0.3 ; by AASHTO T104
5. Unit Weight (lbs/ft³)
   a. Loose 97.3
   b. Rodded 103.2
6. ASR 0.03 alkali Silica Reactivity
7. Polish Value 7
8. BPN 20

PROGRAM: S4285100 PENNDOT CAMMS TESTING REPORT Page
REPORT : CAMLR510 AGGREGATE 8/20/200
LIBRARY: CAMSPROD 0:17:5
FINAL REPORT Ref#:A288762 Lab#: 04030244 Pass/Fail: P ENGLIS

IC #:		QA Rtng:	Cntrctr:
St P N:	00500109QRY 0510 711 9998	Smp Cls: RS	Suplier: DYR06A14
Pr O #:		Orgnztn: 0510	Lctn Cd: DYR06A14
Mtl Cd:	203 A57	State R:	JMF Y/#: /
Mtl Ds:	AGGRGT,COARSE	Section: 0000	L/C XRf:
408Y/S:	2000 703	Station:	Colcted: 3/18/200
Supl #:		Prt Tkt:	SetUp: 3/23/200
Plc Cl:	QUARRY STOCKPILE	Lot Nbr:	RcvDock: 4/13/200
Smp By:	B.BOYER	# Incrm: 4	RcvdLab: 4/13/2004
		447 XRf:	Releasd: 8/20/2004

TR-447 Remarks: 4 SAMPLES- 3 FOR REQUALIFICATION & 1 FOR MICRO-DEVAL TEST.

SCREEN LIMITS			RL	-1-
2"				100
1 1/2"	100	100	0	100
1"	95	100	5	100
5/8"				78
1/2"	25	60	35	45
#4	0	10	10	2
#8	0	5	5	2

PERCENT ABSORPTION
-1-
0.58

) SPECIFIC GRAVITY
-1-
2.95

BULK SPECIFIC GRAVITY
-1-
2.930

APPARENT SPECIFIC GRAVITY
-1-
2.980

A ABRASION LOSS %
-1-
13.71

IMITS: 0 - 45 R(L): 45

ICRO DEVAL LOSS %
-1-
4.57

HIN & ELONGATED PIECES %
-1-
0.80

MITS: 0 - 15 R(L): 15

IUM SULFATE - TOTAL % LOSS
-1-
0.25

LIMITS: 0 - 10 R(L): 10

PERCENT LOSS BY WASH
-1-
0.09

LIMITS: 0 - 1 R(L): 1

PETROGRAPHIC DESCRIPTION

The sample is composed of medium light gray to dark gray (weathered to white to very light gray, and light brown), coarsely to very coarsely crystalline, with occasional moderately and extremely coarsely crystalline, DIABASE to QUARTZ DIABASE (100%), which is slightly to heavily altered, and chiefly comprised of plagioclase feldspar (labradorite) and clinopyroxene, with trace to some orthopyroxene, sericite, amphibole (hornblende and uralite), opaque minerals (pyrite, magnetite, and iron oxyhydroxides), quartz-alkali feldspar graphic intergrowths, quartz, biotite, chlorite, and calcite.

Alteration processes observed in thin section included plagioclase feldspar (labradorite) to sericite and calcite, and clinopyroxene and orthopyroxene to iron oxyhydroxides, amphibole (hornblende and uralite), biotite, and chlorite. Less than 5% of the particles in this sample exhibited heavy alteration to soft minerals (i.e., sericite, biotite, chlorite, and calcite).

SAMPLE SUBMITTED MEETS SPECIFICATION REQUIREMENTS FOR #57 Type A COARSE AGGREGATE.

*** CORRECTED COPY OF SAMPLE ***

This report is authorized by William J. Miller, Engineer of Tests.

********* ********** ***** end of 02 page report ****** ********** **********

GENERAL AGGREGATE TESTING

Sample ID:

Company: Dyer Quarry, Inc.

Source Location: Birdsboro, PA

Maryland SHA

Track Series: 68-5

Report Issuance Date: April 27, 2005 (2004 Sample)

The following test results were obtained from the Maryland SHA Laboratory testing records:

1. Specific Gravity 2.99 ; by AASHTO T85
2. Absorption, % 0.9 ; by AASHTO T85
3. Los Angeles Abrasion, % Loss 17 ; by AASHTO T96
4. Sodium Sulfate Soundness, % Loss 0.2 ; by AASHTO T104
5. Unit Weight (lbs/ft^3)
   a. Loose 95.1
   b. Rodded 100.8
6. ASR 0.06
7. Polish Value 9
8. BPN 22

GENERAL AGGREGATE TESTING

Sample ID: MA-141

Company: Dyer Quarry

Source Location: Birdsboro, PA

Maryland SHA

Track Series: Comparison to: 68

Report Issuance Date: April 7, 2006

The following test results were obtained from the Maryland SHA Laboratory testing records:

1. Specific Gravity 2.95 ; by AASHTO T85
2. Absorption, % 0.06 ; by AASHTO T85
3. Los Angeles Abrasion, % Loss 16 ; by AASHTO T96
4. Sodium Sulfate Soundness, % Loss 0.2 ; by AASHTO T104
5. Unit Weight (lbs/ft³)
   a. Loose 93.3
   b. Rodded 100.5
6. ASR 0.06
7. Polish Value 6
8. BPN 23

PROGRAM: S4285100 PENNDOT CAMMS TESTING REPORT Page
REPORT : CAMLR510 AGGREGATE /01/200
LIBRARY: CAMSPROD 8:14:5.
FINAL REPORT Ref#:A414000 Lab#: 06030174 Pass/Fail: P ENGLISI

Cont #:	QA Rtng:	Cntrctr:
St P N:00500109QRY 0510 711 9998	Smp Cls:RS	Suplier:D R06A14
Pr O #:	Orgnztn:0510	Lctn Cd:D R06A14
Mtl Cd:203 A57	State R:	JMF Y/#: /
Mtl Ds:AGGRGT,COARSE	Section: 0000	L/C XRf:
408Y/S:2000 703	Station:	Colcted: /21/200
Supl #:	Prt Tkt:	SetUp: /23/200
Plc Cl:QUARRY STOCKPILE	Lot Nbr:	RcvDock: /23/200
Smp By:STEVEN FARRELL	# Incrm: 4	RcvdLab: /24/200
PE/PEQ:	447 XRf:	Releasd: /09/200

TR-447 Remarks:

SCREEN LIMITS			RL	-1-
2"				100
1 1/2"	100	100	0	100
1"	95	100	5	100
5/8"				70
1/2"	25	60	35	41
3/8"	0	60	60	11
#4	0	10	10	1
#8	0	5	5	0

PERCENT ABSORPTION
-1-
0.56

SSD SPECIFIC GRAVITY
-1-
2.97

BULK SPECIFIC GRAVITY
-1-
2.950

APPARENT SPECIFIC GRAVITY
-1-
3.000

LA ABRASION LOSS %
-1-
16.35

LIMITS: 0 - 45 R(L): 45

MICRO DEVAL LOSS %
-1-
3.95

THIN & ELONGATED PIECES %
-1-
4.50

LIMITS: 0 - 15 R(L): 15

AGGREGATES & SOILS TESTING
PHYSICAL TESTING OF CRUSHED STONE AND SOILS
AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS
200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8308-3
RECEIVED: April 27, 2007
TESTED: May 1, 2007
SUBMITTED BY CLIENT

LOS ANGELES ABRASION - AASHTO T 96
#57 #1

B GRADING

SIZE FRACTION	MASS	TOTAL MASS	MASS (+#12) AFTER	MASS LOSS	PERCENT LOSS
3/4" x 1/2"	2502.5				
		5002.5	4116.3	886.2	17.7
1/2" x 3/8"	2500.0				

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

AGGREGATES & SOILS TESTING
PHYSICAL TESTING OF CRUSHED STONE AND SOILS
AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS
200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8309-3
RECEIVED: April 27, 2007
TESTED: May 1, 2007
SUBMITTED BY CLIENT

LOS ANGELES ABRASION - AASHTO T 96
#57 #2

B GRADING

SIZE FRACTION	MASS	TOTAL MASS	MASS (+#12) AFTER	MASS LOSS	PERCENT LOSS
3/4" x 1/2"	2500.4				
		5000.5	4117.2	883.3	17.7
1/2" x 3/8"	2500.1				

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

AGGREGATES & SOILS TESTING
PHYSICAL TESTING OF CRUSHED STONE AND SOILS
AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS
200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8310-3
RECEIVED: April 27, 2007
TESTED: May 1, 2007
SUBMITTED BY CLIENT

LOS ANGELES ABRASION - AASHTO T-96
#57 #3

B GRADING

SIZE FRACTION	MASS	TOTAL MASS	MASS (+#12) AFTER	MASS LOSS	PERCENT LOSS
3/4" x 1/2"	2500.4				
		5000.2	4211.0	789.2	15.8
1/2" x 3/8"	2499.8				

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

AGGREGATES & SOILS TESTING
PHYSICAL TESTING OF CRUSHED STONE AND SOILS
AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS
200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8308-2
RECEIVED: April 27, 2007
TESTED: May 3 - 14, 2007
SUBMITTED BY CLIENT

SODIUM SULFATE SOUNDNESS - PTM 510
#57 #1

SIZE FRACTION	MASS BEFORE	# OF PCS	MASS AFTER	# OF PCS	PERCENT LOSS	STANDARD GRADING	CORRECTED LOSS
1" x 3/4"	1308.8	78	1302.1	78	0.5	0.368	0.2
3/4" x 3/8"	1002.0		994.3		0.8	0.369	0.3
3/8" x #4	302.4		299.6		0.9	0.263	0.2

TOTAL PERCENT LOSS 0.7

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

AGGREGATES & SOILS TESTING

PHYSICAL TESTING OF CRUSHED STONE AND SOILS

AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS

200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8309-2
RECEIVED: April 27, 2007
TESTED: May 3 - 14, 2007
SUBMITTED BY CLIENT

SODIUM SULFATE SOUNDNESS - PTM 510
#57 #2

SIZE FRACTION	MASS BEFORE	# OF PCS	MASS AFTER	# OF PCS	PERCENT LOSS	STANDARD GRADING	CORRECTED LOSS
1" x 3/4"	1514.0	88	1509.8	88	0.3	0.368	0.1
3/4" x 3/8"	1001.6		993.9		0.8	0.369	0.3
3/8" x #4	300.8		299.9		0.3	0.263	0.1

TOTAL PERCENT LOSS 0.5

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

AGGREGATES & SOILS TESTING

PHYSICAL TESTING OF CRUSHED STONE AND SOILS

AASHTO ACCREDITED • PENNDOT / ASTM / AASHTO METHODS

200 Gale Street • Mechanicsburg, PA 17055 • 717-697-1060

Mr. Bill Lantz
Dyer Quarry, Inc.
1275 Rock Hollow Rd., PO Box 188
Birdsboro, PA 19508

AST# 8310-2
RECEIVED: April 27, 2007
TESTED: May 7 - 16, 2007
SUBMITTED BY CLIENT

SODIUM SULFATE SOUNDNESS - PTM 510
#57 #3

SIZE FRACTION	MASS BEFORE	# OF PCS	MASS AFTER	# OF PCS	PERCENT LOSS	STANDARD GRADING	CORRECTED LOSS
1" x 3/4"	1171.4	74	1167.0	75	0.4	0.368	0.1
3/4" x 3/8"	1002.0		996.2		0.6	0.369	0.2
3/8" x #4	302.4		300.5		0.6	0.263	0.2

TOTAL PERCENT LOSS 0.5

SUBMITTED BY: Ken McNulty
Ken McNulty, Laboratory Manager

DATE: 5/17/07

SUPPLIER ADDRESS	QUARRY LOCATION	SUPPLIER CODE	MATERIAL CODE	CLASS	LAB NUMBER	SPGR	BSPGR	ABS	SOUS	SRL	ROCK TYPES	ASR	UNCOMP VOIDS	ABRASION	USAGE REQUIREMENTS
DAILEY, WILLIAM, INC.	SHAFTSBURY	DWIVTA14													
RR1A BOXSIDE 51			203	A57GL	95030596	2.69	2.678	0.57	03%	H	GL	0.08%			
SHAFTSBURY, VT. 05262			203	A67GL	07030035	2.73	2.708	0.80	01%	H	GL			27%	
			207	A2	95036402	2.70	2.687	0.42	03%		GL	0.15%			
DYER, JOHN T., QUARRY CO.	CLINGAN-ROBESON TWP	DYR06A14													
P. O. BOX 188			203	A57	06030174	2.97	2.950	0.56	00%	H	DI			16%	SEE INDEX
BIRDSBORO, PA. 19508			203	A8	06030175	2.97	2.946	0.88	00%	H	DI	0.06%		20%	SEE INDEX
			203	C2A	06030072				04%		DI			18%	SEE INDEX
			207	B3	06036035		2.880	1.19	07%		DI		49%		SEE INDEX
			249	2											
EASTERN INDUSTRIES, WEST	EVILLE, WASH TWP	EAF22A14													
P O BOX 177			203	A57	05030035	2.69	2.669	0.89	02%	E	SS,SL			15%	
MINFIELD, PA. 17889			203	A8	05030034	2.68	2.648	1.40	08%	E	SS,SL	0.46%		21%	
			203	C2A	05030024				07%		SS,SH			29%	
			207	B1	07036116		2.544	1.96	04%		SS		49%		
			249	AS2											
			249	2	05036032									37%	
			249	3	05036091										
			249	6S	07036149									23%	
	NAGINEY	EAF44B14													
			203	A57	05030933	2.71	2.698	0.38	01%	L	LS			20%	
			203	A8	05030931	2.70	2.688	0.52	02%	L	LS	0.33%		23%	
			203	C2A	05030935				02%		LS			27%	
			207	B3	07036097		2.570	1.93	05%		LS		48%		
			249	AS2	07036099						LS			24%	
			249	6S	07036100									23%	
	NAGINEY #2	EAF44D14													
			203	A57	05030934	2.75	2.737	0.43	01%	L	LS			21%	
			203	A8	05030932	2.74	2.730	0.52	02%	L	LS	0.11%		22%	
			207	B3	07036098		2.673	1.25	03%		LS.DO		49%		
	COAL TOWNSHIP #1	EAF49A14													
			203	A57	06031008	2.64	2.608	1.20	02%	E	SS,SL			22%	
			203	A8	06031011	2.65	2.607	1.59	02%	E	SS,SL	0.53%		25%	
			203	C2A	06031007				06%		SS,SL			19%	
			207	B3	06036508		2.568	1.60	08%		SS		49%		
			249	AS2											
			249	2	06036510									19%	
			249	6S	06036609									23%	
	COAL TOWNSHIP #2	EAF49B14													
			203	A57	02031112	2.66	2.643	0.82	01%	E	SS			19%	
			203	A8	02031113	2.64	2.605	1.47	05%	E	SS				
			203	C2A	02031097				05%		SS			23%	
			207	B3	02036548		2.583	1.37	07%		SS,SL		49%		

017/018
04/09/2008 08:58 FAX B105822304

SUPPLIER ADDRESS	QUARRY LOCATION	SUPPLIER CODE	MATERIAL CODE	CLASS	LAB NUMBER	SPGR	BSPGR	ABS	SODS	SRL	ROCK TYPES	ASR	UNCOMP VOIDS	ABRASION	USAGE REQUIREMENTS
DYER, JOHN T...QUARRY CO.	CLINGAN ROBESON TWP	DYR05A14													
P. O. BOX 188			203	A57	02030178	2.98	2.963	0.50	00%	H	DI			16%	
BIRDSBORO, PA. 19508			203	A8	02030179	2.92	2.892	0.95	02%	H	DI	0.06%			
			203	C2A	02030175				02%		DI			17%	
			207	B3	02036072		2.909	0.90	10%		DI		48%		
			249	2											
EASTERN INDUSTRIES, WEST	EVILLE, WASH TWP	EAF22A14													
P O BOX 177			203	A57	01030077	2.63	2.592	1.38	10%	E	SS			30%	
WINFIELD, PA. 17889			203	A8	01030076	2.65	2.621	1.21	05%	E	SS	0.46%		25%	
			203	C2A	01030071				11%		SS,SH			27%	
			207	B1	01036037		2.627	0.16	08%		SS		49%		
			249	2											
			249	3											
			249	6S	98036110										
	NAGINEY	EAF44B14													
			203	A57	02030043	2.70	2.688	0.40	02%	L	LS			21%	
			203	A8	02030044	2.70	2.682	0.51	02%	L	LS	0.33%			
			203	C2A	02030042				03%		LS			23%	
			207	B3	02036025		2.645	1.09	05%		LS		44%		
			249	2											
			249	6S	02036028									26%	
	NAGINEY #2	EAF44D14													
			203	A57	02030048	2.76	2.749	0.39	01%	L	LS			18%	
			203	A8	02030046	2.75	2.740	0.48	01%	L	DO,LS	0.11%			
			207	B3	02036023		2.711	0.66	03%		LS,DO		49%		
	COAL TOWNSHIP #1	EAF49A14													
			203	A57	98030992	2.66	2.633	0.96	01%	E	SS				
			203	A8	01031207	2.65	2.615	1.15	02%	E	SS,SL	0.53%			
			203	C2A	01031223				06%		SS,SH			30%	
			207	B3	01036567		2.622	0.89	14%		SS		50%		
			249	2	98036586										
			249	6S	01036569									28%	
	COAL TOWNSHIP #2	EAF49B14													
			203	A57	99030200	2.66	2.642	0.72	01%	E	SS,SL				
			203	A8	99030201	2.65	2.629	0.83	01%	E	SS				
			203	C2A	99030212				02%		SS				
			207	B3	99036124		2.639	0.31	03%		SS,SL		49%		
	LIVERPOOL	EAF60A14													
			203	A57	02030127	2.63	2.601	1.03	04%	E	SS	0.35%		32%	
			203	A8	02030128	2.62	2.590	1.25	03%	E	SS				
			203	C2A	02030137				06%		SS			31%	

ATTACHMENT 2

PETROGRAPHIC ANALYSIS - DYER QUARRY ROCK SAMPLE

CONSTRUCTION MATERIALS CONSULTANTS, INC.

April 28, 2008
CMC 0408160

Petrographic Examinations Of A Quarried Rock

Active Quarry
Birdsboro, Pennsylvania

Prepared for TRC Environmental Corporation

By Dipayan Jana
Construction Materials Consultants, Inc.

Cover Photo – Lapped cross section of the rock sample

Construction Materials Consultants, Inc.

Berkshire Center, Suite 104
4727 Route 30
Greensburg, PA 15601 USA
Phone: 724-834-3551
Fax: 724-834-3556
www.cmc-concrete.com

PETROGRAPHIC EXAMINATIONS OF A QUARRIED ROCK

FOR

TRC ENVIRONMENTAL CORPORATION

(Active Quarry Located in Birdsboro, Pennsylvania)

CMC 0408160
04/28/2008

Construction Materials Consultants, Inc.

Berkshire Center, Suite 104
4727 Route 30
Greensburg, PA 15601 USA
Phone: 724-834-3551
Fax: 724-834-3556
www.cmc-concrete.com

REPORT OF PETROGRAPHIC EXAMINATIONS OF A ROCK SAMPLE

Purpose & Background – Reported herein are the results of detailed petrographic examinations of a rock sample received from Larry Butlien of TRC Environmental Corporation. The sample, measuring approximately $2^1/_2 \times 3 \times 6^1/_4$ in., reportedly came from an active quarry in Birdsboro, Pennsylvania.

The purposes of the investigation are to determine detailed mineralogy, texture, microstructure, evidence of any alteration and other features from a detailed petrographic examination.

Mineralogy – Based on detailed petrographic examinations and x-ray diffraction, the rock is determined to be a dense, hard, dark colored, mafic igneous rock made using abundant plagioclase and ferromagnesian (mafic) minerals (pyroxenes), and minor amounts of dark opaque grains (and some alteration products of plagioclase), with an estimated modal (volumetric) proportion given below:

Minerals	Estimated Modal Proportion	Shape	Size (mm)	Alterations	Comments
Essential Minerals					
Calcic-plagioclase (Labradorite, including altered grains)	60	Lath-shaped, prismatic, euhedral to subhedral	0.2 – 0.4	Some	Abundant and interlocked with pyroxene
Ortho-pyroxene (Hypersthene)	20	Equant, subhedral	0.6 – 0.8	None	Subordinate to plagioclase
Clino-pyroxene (Augite)	10	Equant, subhedral	0.6 – 0.8	None	Less than orthopyroxene
Accessory Minerals					
Opaque	5	Equant, subhedral	0.4 – 0.6	None	Uniformly distributed
Amphibole (Actinolite)	4	Prismatic, subhedral	0.2 – 0.4	None	Rare
Mica (Biotite)	1	Lath-shaped, subhedral	0.2 – 0.4	None	Rare
Secondary Minerals					
Sericite	10-15 (of total plagioclase)	Fine, acicular	< 0.1	From plagioclase	Rare

Texture, Porosity, and Microstructure – The rock shows a dense, intermediate to coarse-grained equigranular texture where plagioclase and pyroxene grains show an interlocking arrangement, defining an ophitic to subophitic texture. The rock does not show any fault, cracking, or porosity. The rock is very dense and hard.

Alterations and Secondary Minerals – The plagioclase grains in the rock show some sericitic alterations, which did not affect the overall integrity, density, and good quality of the rock. Some actinolite and biotite grains detected in rare amounts are judged to be the alteration products of pyroxenes.

Classification – Based on detailed mineralogy and texture, the rock is determined to be a mafic (basic) igneous rock of hypabassal to plutonic origin, belonging to the gabbro-norite family, and specifically identified as a plagioclase-pyroxene bearing diabase. This is a medium-grained variety of a noritic gabbro intrusive mafic igneous rock.

Overall Quality – The rock is determine to be sound and of good quality, suitable to use for any construction purposes.

Photographs and Photomicrographs – Figure 1 shows the sample, as received. Figure 2 shows lapped cross section of the sample, where its dense, hard, dark, uniform appearance is visible. Figure 3 shows photomicrographs of lapped section taken by using a stereomicroscope, showing the light-colored plagioclase and dark-colored ferromagnesian minerals. Figure 4 shows thin section photomicrographs where detailed mineralogy and ophitic texture of rock is shown. Figure 5 shows x-ray diffraction pattern of the rock, showing its detailed mineralogical compositions.

CONSTRUCTION MATERIALS CONSULTANTS, INC.

Dipayan Jana, PG
President, Petrographer

DJ:jlh

Samples will be discarded two weeks after submission of the report unless otherwise requested in writing. ~~All reports are the confidential property of clients, and information contained herein may not be published or reproduced pending our written approval~~. The opinions expressed in this report are based on information available at this time. We reserve the right to modify the report as additional information becomes available. Neither CMC nor its employees assume any obligation or liability for damages, including, but not limited to, consequential damages arising out of, or, in conjunction with the use, or inability to use this resulting information.

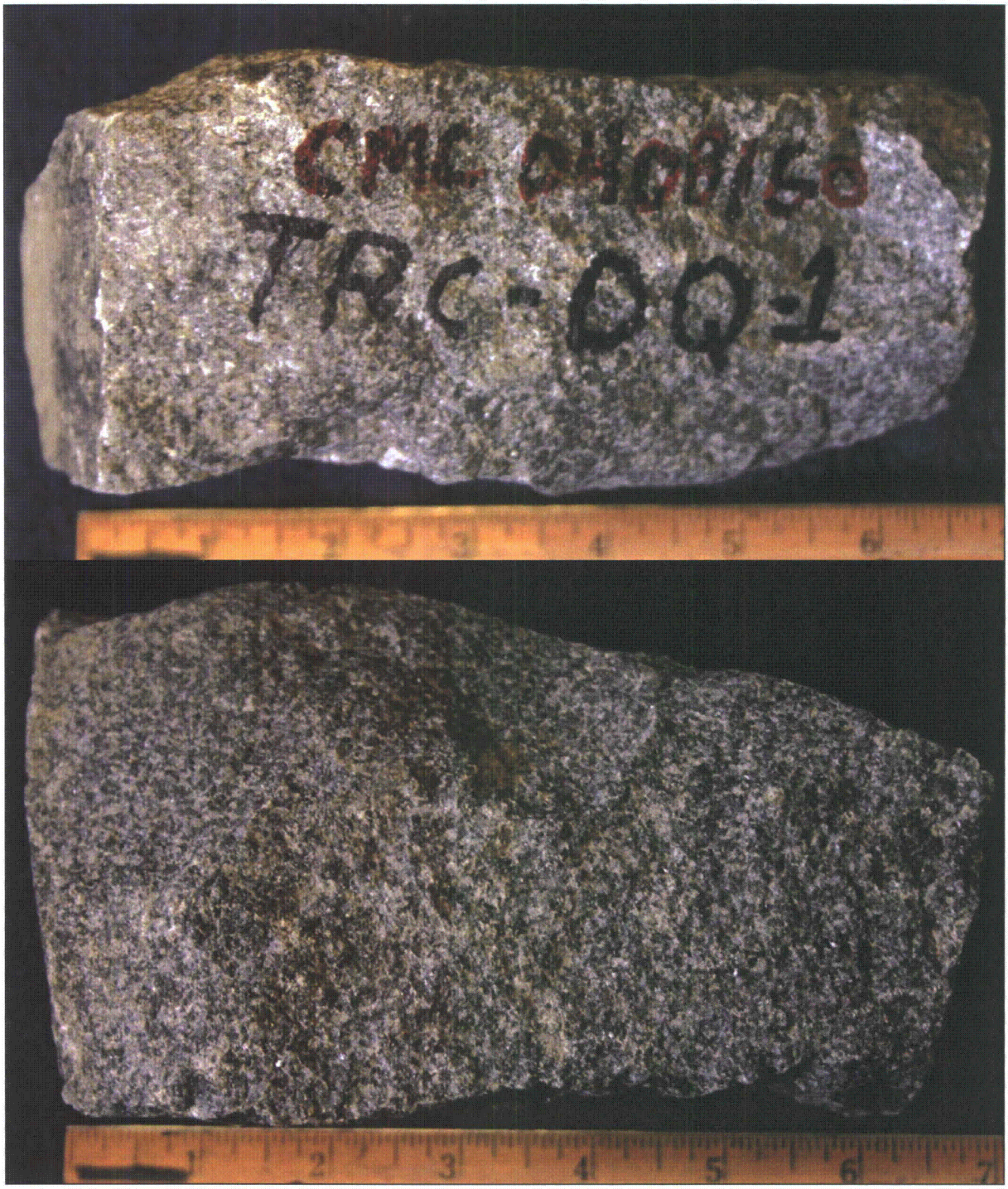


Figure 1: Shown are two sides of the rock sample as received in the laboratory.

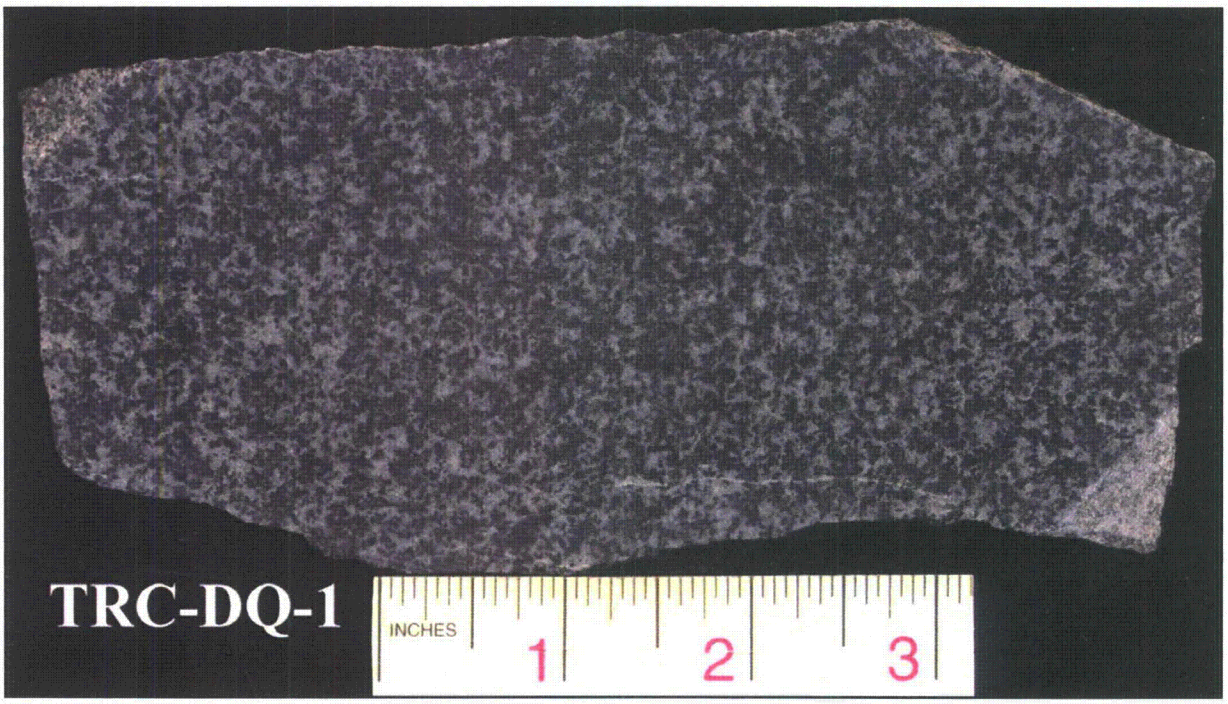


Figure 2: Lapped cross section of the rock showing the hard, dense, uniform appearance of the rock where the light color areas are plagioclase feldspar and the dark areas are mafic (ferromagnesian) minerals.

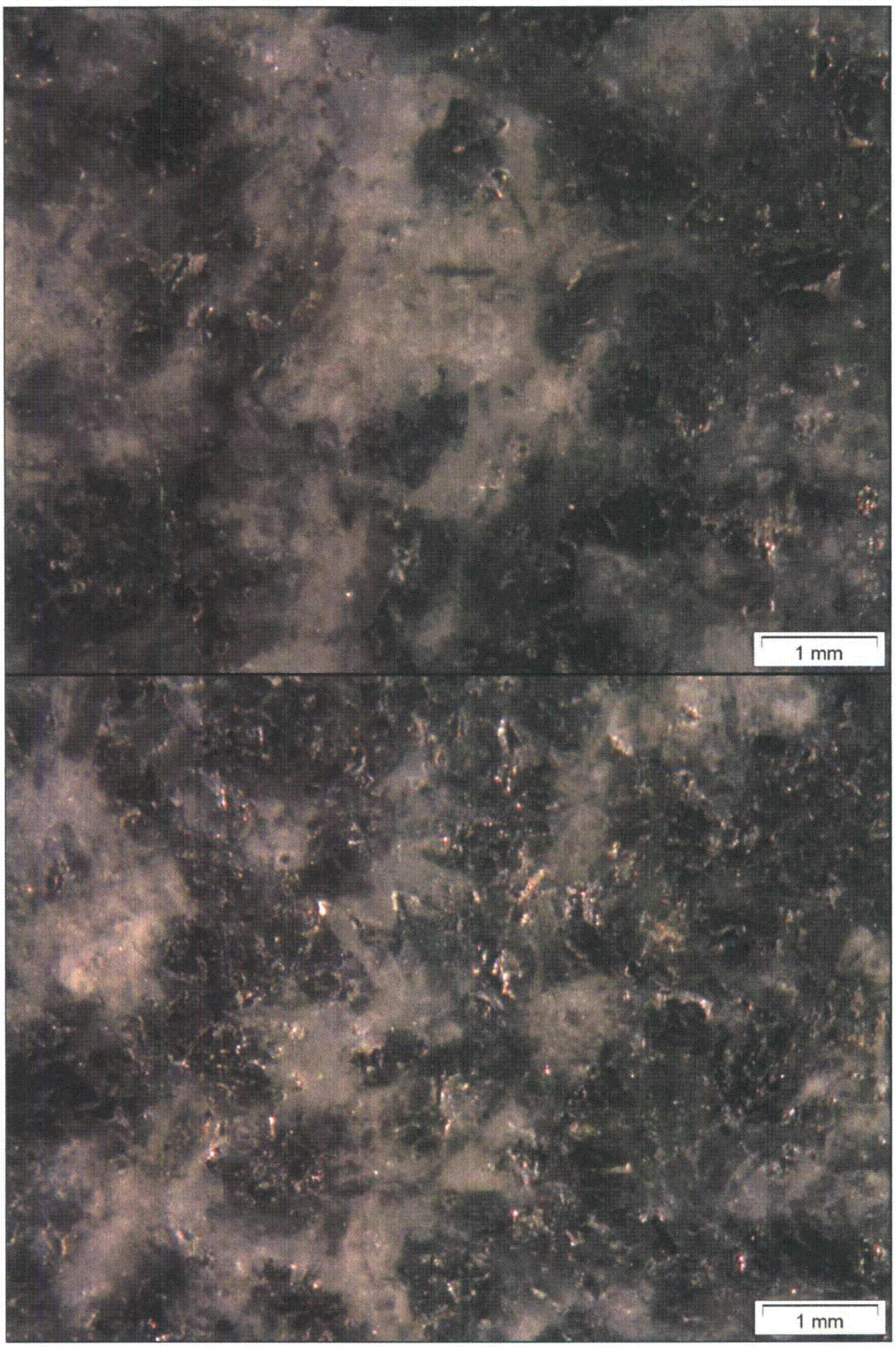


Figure 3: Phoptomicroghraphs of lapped cross section of the rock showing the hard, dense, uniform appearance of the rock where the light color areas are plagioclase feldspar and the dark areas are mafic (ferromagnesian) minerals.

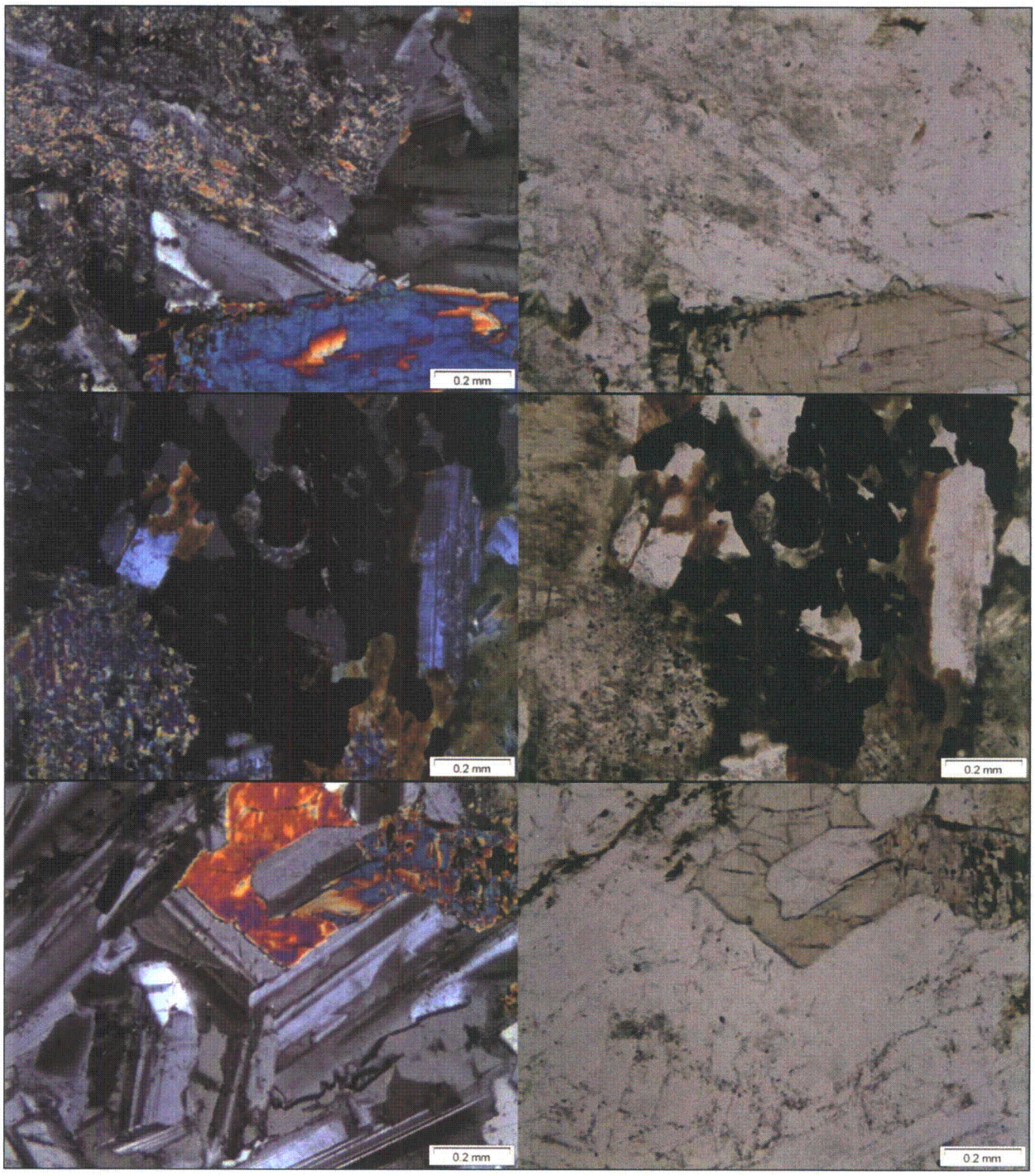


Figure 4: Phoptomicroghraphs of thin section of the rock showing detailed mineralogy and texture. Left coloum photos were taken at the cross-polarized light mode and right column photos were taken at the plane polarized light mode of the same areas in a petrographic microscope. All photos show: (a) the presence of plagioclase feldspar and pyroxene (orthopyroxene and some clinopyroxene) as the principal minerals, and dark opaque grains as accessory minerals; (b) alteration of plagioclase as fine sericitic mica (top and middle leftt photos); and (c) equigranular and ophitic texture showing interlocking arrangemetns of plagioclase and pyroxene of equal grain sizes.

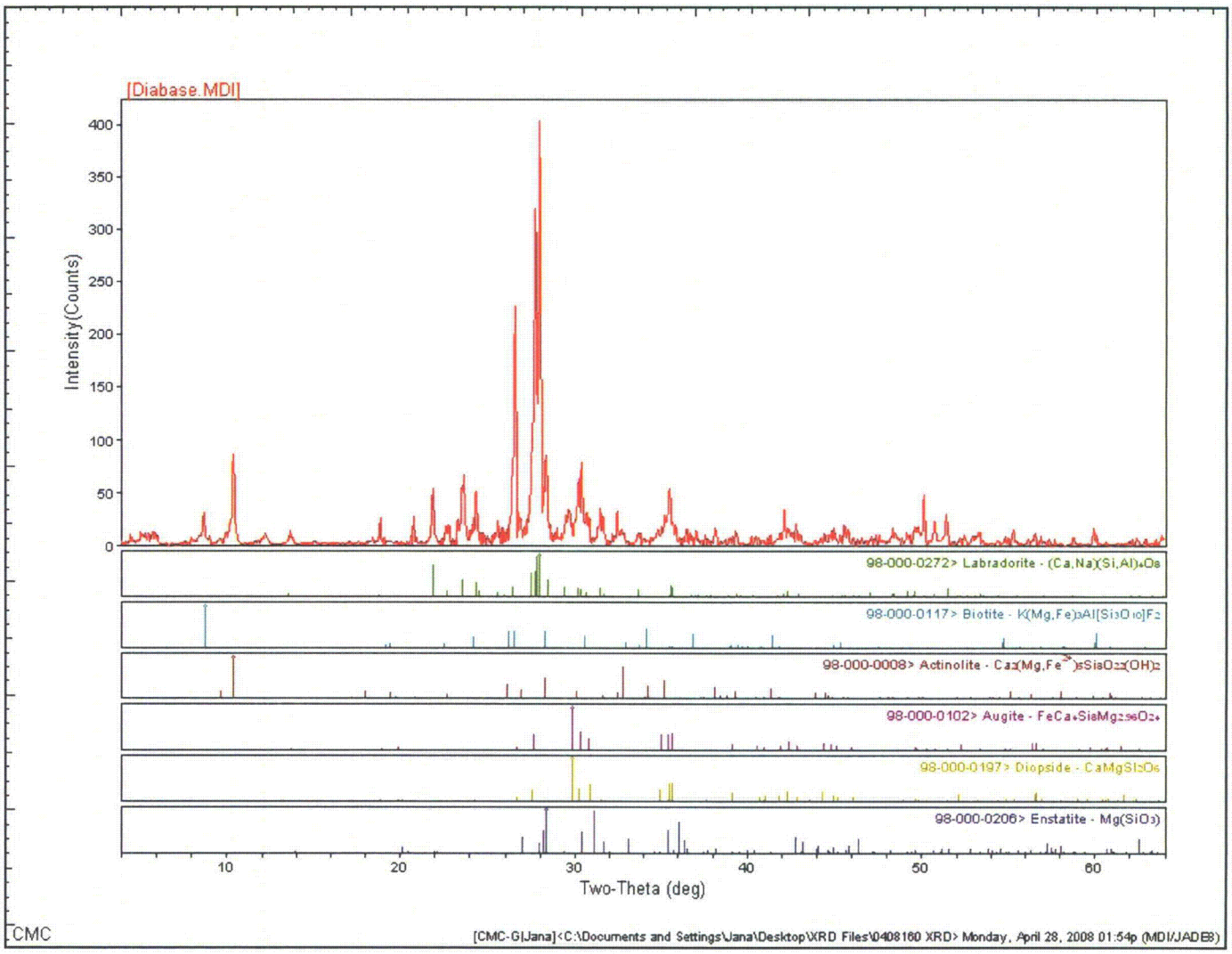


Figure 5: X-ray diffraction pattern of pulverized sample of the rock showing the presence of calcic plagioclase (labradorite), orthopyroxene (enstatite), clinopyroxene (augite, diopside), and accessory minerals (actinolite and biotite). Sercitic alreations are shown by very low angle peaks, opaeque grains are not shown in the pattern.

Butlien, Larry (Windsor,CT-US)

From: DIPAYAN JANA [jana@cmc-concrete.com]
Sent: Tuesday, April 29, 2008 5:48 PM
To: Butlien, Larry (Windsor,CT-US)
Subject: Re: Dyer Quarry Petrographic Analysis

There is no evidence of any clay mineral or olivine found in the rock. With natural conditions of weathering and erosion, however, all minerals in any rock can degrade to clay minerals, which is the natural product of weathering of any rock, diabase is no exception. There is evidence of limited alteration in the rock, as mentioned in the report, with some sericite formation within plagioclase grains, but no evidence of separate clay minerals, or olivine, as requested.

Best Regards,

Dipayan Jana, PhD, PG
President
Construction Materials Consultants, Inc., and
Applied Petrographic Services, Inc.
Berkshire Center, Suite 104
4727 Rt 30
Greensburg, PA 15601
724-834-3551 (Tel)
724-834-3556 (Fax)
www.cmc-concrete.com
www.petrography.net

On Tue Apr 29 10:45 , 'Butlien, Larry \(Windsor,CT-US\)' sent:

Mr. Jana:

Thank you for your petrographic analysis report for the Dyer quarry rock sample. Can you please indicate whether or not any clay minerals or minerals that could degrade into a clay mineral (e.g., olivine) were present in the rock sample from your petrographic and x-ray diffraction evaluation of the sample.

Thank you.

Larry Butlien, L.E.P.
Sr. Project Manager/Hydrogeologist

21 Griffin Road North
Windsor, CT 06095

(860) 298-9692 main phone
(860) 298-6225 direct line
(860) 298-6399 fax
butlien@trcsolutions.com

ATTACHMENT 3

ROCK DURABILITY TESTING RESULTS

GEOTESTING EXPRESS, INC.

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	TRC Environmental Corp.
Project Name:	SMC-NRC Rock Cover
Project Location:	Dyer Quarry, Birdsboro, PA
GTX:	8156
Date:	5/9/2008
Tested By:	bfs
Checked By:	rmt
Sample ID:	TRC-DQ-1
Sample Description:	Dry, gray gravel (stone)

Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine ASTM C 535

Sieve Size		Weight of indicated size, g		
		Grading		
Passing	Retained on	1	2	3
3	2 1/2	2500 ± 50	---	---
2 1/2	2	2500 ± 50	---	---
2	1 1/2	5000 ± 50	5000 ± 50	---
1 1/2	1	---	5000 ± 25	5000 ± 25
1	3/4	---	---	5000 ± 25
Total		10000 ± 100	10000 ± 75	10000 ± 75

Grading:	2
Dry Weight of Sample before test, g (a)	10039
Dry Weight of Sample after test, g (b)	9365
Weight loss, g (a-b) (c)	674
Percent Loss (c/a)	6.7%

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

Testing express
a subsidiary of Geocomp Corporation

Client:	TRC Environmental Corp.
Project:	SMC-NRC Rock Cover
Location:	Dyer Quarry, Birdsboro, PA
GTX No.:	8156
Tested By:	5/9/2008
Checked By:	bfs
Date:	rmt
Sample ID:	TRC-DQ-1
Sample Description:	Dry, gray gravel (stone)

Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate ASTM C 88

Sample Type:	---	Date Solution Prepared:	4/28/2008
Salt Solution:	Sodium Sulfate	No. of Cycles Required:	5

Quantitative Examination - Fine & Course Aggregate Soundness

Sieve Size	Grading of Original Sample (T27), %	Initial Mass of Individual Fractions, grams	Initial Mass of Combined Fractions, grams	Final Mass of Individual Fractions, grams	Final Mass of Combined Fractions, grams	Percent Passing Designated Sieve after Test, %	Weighted Percent Loss, %
4.0 - 3.5 inch	9.1	6107	---	6095	---	0.20	0.02
3.5 - 3.0 inch	23.3	7192	---	7180	---	0.17	0.04
3.0 - 2.5 inch	36.6	7069	---	7058	---	0.16	0.06
2.5 - 2.0 inch	17.3	5118	---	5084	---	0.66	0.11
2.0 - 1.5 inch	1.7	---	---	---	---	0.66	0.01
smaller than 1.5 inch	0.3	---	---	---	---	0.66	0.00
Total							0.24

Notes: Grading portion not tested if less than 5% of the entire dry weight is available. For those gradings, weighted percent loss is calculated using the percent passing of the next grading available.

express

a subsidiary of Geocomp Corporation

Client:	TRC Environmental Corp.
Project Name:	SMC-NRC Rock Cover
Project Location:	Dyer Quarry, Birdsboro, PA
GTX #:	8156
Test Date:	5/9/2008
Tested By:	bfs
Checked By:	rmt

Specific Gravity and Absorption of Coarse Aggregate by ASTM C 127

Sample ID	Visual Description	Bulk Specific Gravity, 23/23°C	Bulk Specific Gravity (Saturated-Surface-Dry), 23/23°C	Apparent Specific Gravity, 23/23°C	Absorption, %
TRC-DQ-1	Dry, gray gravel (stone)	2.99	3.00	3.01	0.18