APPENDIX A

SLIDE 5.0 Slope Stability Analysis Data

Slide Analysis Information

Document Name

File Name: 11673.2 SLIDE Cut slope

Project Settings

Project Title: Artesa Reservoir
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Compacted Fill
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 117 lb/ft3
Saturated Unit Weight: 125 lb/ft3
Cohesion: 2000 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Hu value: automatically calculated

Material: Weak Top Soils
Strength Type: Undrained

Unsaturated Unit Weight: 110 lb/ft3
Saturated Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Material: Sandstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 125 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 350 psf
Friction Angle: 44 degrees
Water Surface: Water Table
Hu value: automatically calculated

Global Minimums

Method: bishop simplified
FS: 5.403660
Center: 485.300, 859.489
Radius: 64.495
Left Slip Surface Endpoint: 432.820, 822.000
Right Slip Surface Endpoint: 504.759, 798.000
Left Slope Intercept: 432.820 822.000
Right Slope Intercept: 504.759 820.000
Resisting Moment=5.85965e+006 lb-ft
Driving Moment=1.08438e+006 lb-ft

Method: janbu simplified
FS: 5.094740
Center: 485.300, 859.489
Radius: 64.495
Left Slip Surface Endpoint: 432.820, 822.000
Right Slip Surface Endpoint: 504.759, 798.000
Left Slope Intercept: 432.820 822.000
Right Slope Intercept: 504.759 820.000
Resisting Horizontal Force=80771.3 lb
Driving Horizontal Force=15853.9 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 42494
Number of Invalid Surfaces: 29677
Error Codes:
Error Code -103 reported for 11126 surfaces
Error Code -106 reported for 8 surfaces
Error Code -107 reported for 386 surfaces
Error Code -108 reported for 15732 surfaces
Error Code -112 reported for 2425 surfaces

Method: janbu simplified
Number of Valid Surfaces: 41824
Number of Invalid Surfaces: 30347
Error Codes:

Error Code -103 reported for 11126 surfaces
Error Code -106 reported for 8 surfaces
Error Code -107 reported for 386 surfaces
Error Code -108 reported for 16371 surfaces
Error Code -111 reported for 13 surfaces
Error Code -112 reported for 2443 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

199.981	682.652
816.886	682.652
816.886	1566.838
199.981	1566.838

Material Boundary

152.000	828.000

200.000	826.000
269.000	824.000
357.000	822.000
427.000	818.000
427.000	820.000

Material Boundary

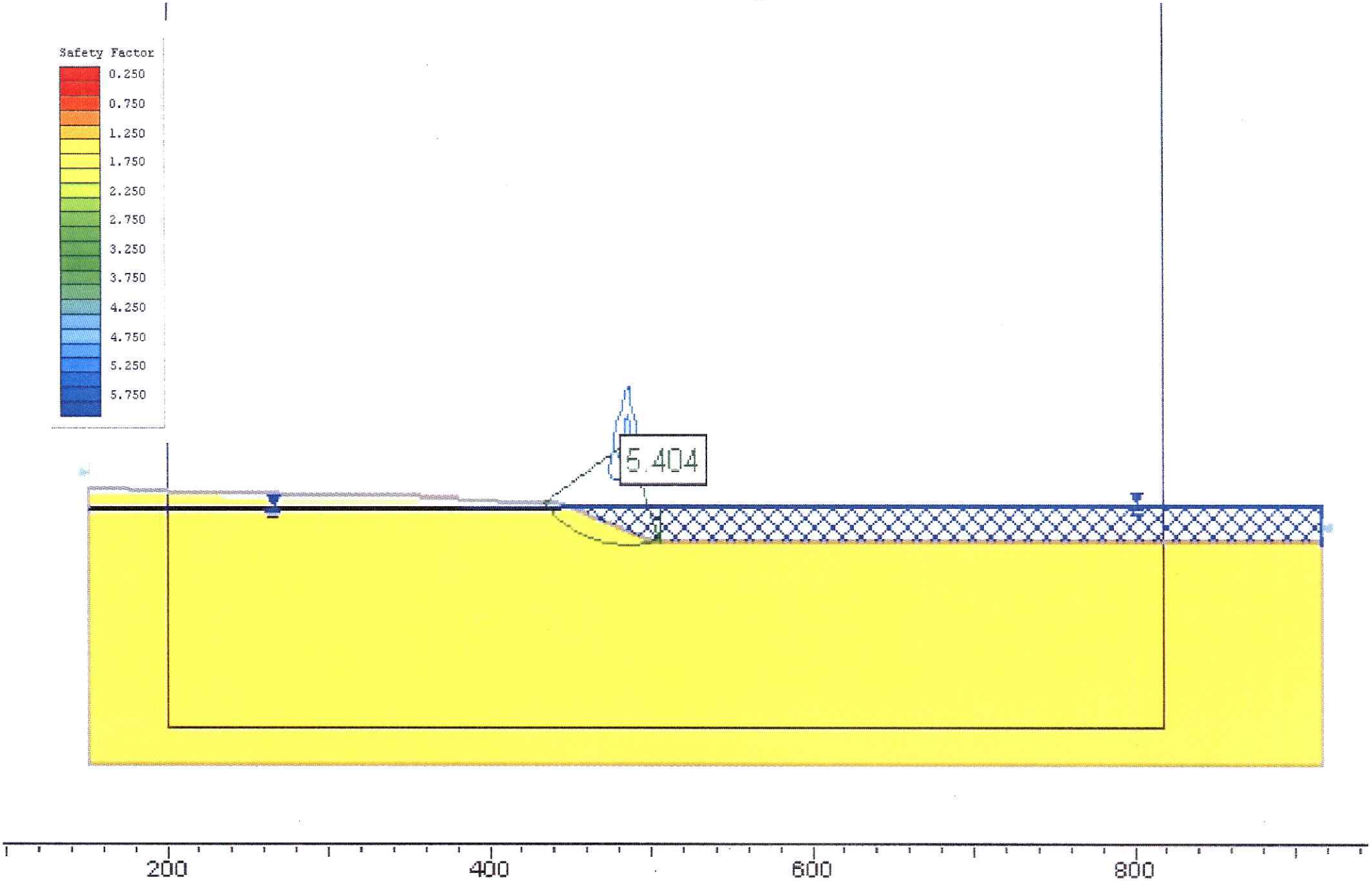
427.000	822.000
427.000	820.000
444.000	820.000
503.000	796.000
917.000	796.000

External Boundary

152.000	660.000
917.000	660.000
917.000	796.000
917.000	798.000
503.000	798.000
444.000	822.000
427.000	822.000
357.000	826.000
269.000	828.000
200.000	830.000
152.000	832.000
152.000	830.000
152.000	828.000

Water Table

152.000	817.814
427.000	818.000
444.000	820.000
448.917	820.000
916.495	820.000
917.000	796.000



APPROXIMATE SCALE (FEET)

0 40 80 160

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Appr.: KAC
Date: 10/29/09

STATIC SLOPE STABILITY CROSS SECTION B-B'
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RESERVOIR AND SUMP POND
35147 Annapolis Road
Annapolis, California

PLATE
A

Slide Analysis Information

Document Name

File Name: 11673.2 SLIDE Cut slope

Project Settings

Project Title: Artesa Reservoir
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.448

Material Properties

Material: Compacted Fill
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 117 lb/ft3
Saturated Unit Weight: 125 lb/ft3
Cohesion: 2000 psf
Friction Angle: 28 degrees
Water Surface: Water Table

Hu value: automatically calculated

Material: Weak Top Soils
Strength Type: Undrained
Unsaturated Unit Weight: 110 lb/ft3
Saturated Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Material: Sandstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 125 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 350 psf
Friction Angle: 44 degrees
Water Surface: Water Table
Hu value: automatically calculated

Global Minimums

Method: bishop simplified
FS: 1.283970
Center: 539.279, 1566.838
Radius: 826.658
Left Slip Surface Endpoint: 161.387, 831.609
Right Slip Surface Endpoint: 843.009, 798.000
Left Slope Intercept: 161.387 831.609
Right Slope Intercept: 843.009 820.000
Resisting Moment=2.0275e+009 lb-ft
Driving Moment=1.57909e+009 lb-ft

Method: janbu simplified
FS: 1.241130
Center: 500.722, 1390.001
Radius: 653.647
Left Slip Surface Endpoint: 160.905, 831.629
Right Slip Surface Endpoint: 777.832, 798.000
Left Slope Intercept: 160.905 831.629
Right Slope Intercept: 777.832 820.000
Resisting Horizontal Force=2.35563e+006 lb
Driving Horizontal Force=1.89798e+006 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 55541
Number of Invalid Surfaces: 16630
Error Codes:
Error Code -103 reported for 11126 surfaces
Error Code -106 reported for 8 surfaces
Error Code -107 reported for 212 surfaces
Error Code -112 reported for 5284 surfaces

Method: janbu simplified

Number of Valid Surfaces: 54254
Number of Invalid Surfaces: 17917
Error Codes:
Error Code -103 reported for 11126 surfaces
Error Code -106 reported for 8 surfaces
Error Code -107 reported for 212 surfaces
Error Code -108 reported for 31 surfaces
Error Code -111 reported for 42 surfaces
Error Code -112 reported for 6498 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

199.981	682.652
816.886	682.652
816.886	1566.838
199.981	1566.838

Material Boundary

152.000	828.000
200.000	826.000
269.000	824.000
357.000	822.000
427.000	818.000
427.000	820.000

Material Boundary

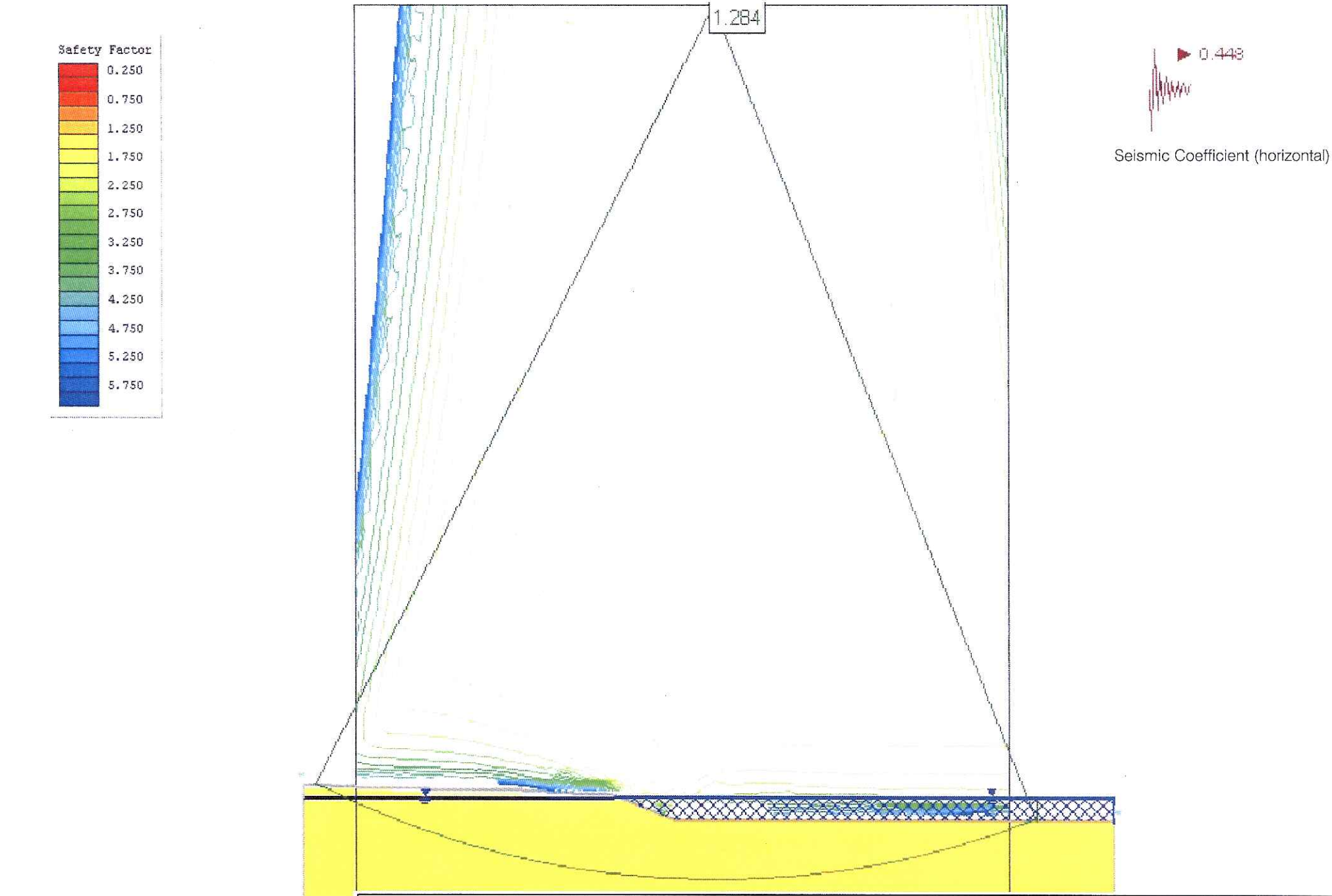
427.000	822.000
427.000	820.000
444.000	820.000
503.000	796.000
917.000	796.000

External Boundary

152.000	660.000
917.000	660.000
917.000	796.000
917.000	798.000
503.000	798.000
444.000	822.000
427.000	822.000
357.000	826.000
269.000	828.000
200.000	830.000
152.000	832.000
152.000	830.000
152.000	828.000

Water Table

152.000	817.814
427.000	818.000
444.000	820.000
448.917	820.000
916.495	820.000
917.000	796.000



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SEISMIC SLOPE STABILITY CROSS SECTION B-B'
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RESERVOIR AND SUMP POND
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Annapolis, California

PLATE
B

Slide Analysis Information

Document Name

File Name: 11673.2 SLIDE Embankment

Project Settings

Project Title: Artesa Reservoir
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 50
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Compacted Fill
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 117 lb/ft3
Saturated Unit Weight: 125 lb/ft3
Cohesion: 2000 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Hu value: automatically calculated

Material: Weak Top Soils
Strength Type: Undrained

Unsaturated Unit Weight: 110 lb/ft3
Saturated Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Material: Sandstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 125 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 350 psf
Friction Angle: 44 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 4.336050
Center: 701.547, 889.119
Radius: 116.715
Left Slip Surface Endpoint: 606.514, 821.363
Right Slip Surface Endpoint: 745.680, 781.070
Resisting Moment=4.50363e+007 lb-ft
Driving Moment=1.03865e+007 lb-ft

Method: janbu simplified
FS: 4.078830
Center: 692.111, 872.777
Radius: 100.923
Left Slip Surface Endpoint: 605.520, 820.937
Right Slip Surface Endpoint: 736.926, 782.350
Resisting Horizontal Force=357628 lb
Driving Horizontal Force=87679 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 45502
Number of Invalid Surfaces: 26669
Error Codes:
Error Code -103 reported for 13700 surfaces
Error Code -106 reported for 157 surfaces
Error Code -107 reported for 7185 surfaces
Error Code -108 reported for 38 surfaces
Error Code -112 reported for 4841 surfaces
Error Code -1000 reported for 748 surfaces

Method: janbu simplified
Number of Valid Surfaces: 44548
Number of Invalid Surfaces: 27623
Error Codes:
Error Code -103 reported for 13700 surfaces
Error Code -106 reported for 157 surfaces
Error Code -107 reported for 7185 surfaces
Error Code -108 reported for 1022 surfaces

Error Code -111 reported for 17 surfaces
Error Code -112 reported for 4794 surfaces
Error Code -1000 reported for 748 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

192.000	643.989
946.885	643.989
946.885	1297.670
192.000	1297.670

Material Boundary

192.000	813.000

217.000	812.000
232.000	811.000
270.000	810.000
324.000	796.000
537.000	796.000
546.000	796.000
608.000	788.000
616.000	787.500
692.324	782.213
696.000	773.000
712.000	773.000
715.709	782.271
716.000	783.000
716.787	785.294

Material Boundary

715.709	782.271
752.911	776.622
774.125	774.375
804.114	772.134
947.000	766.184

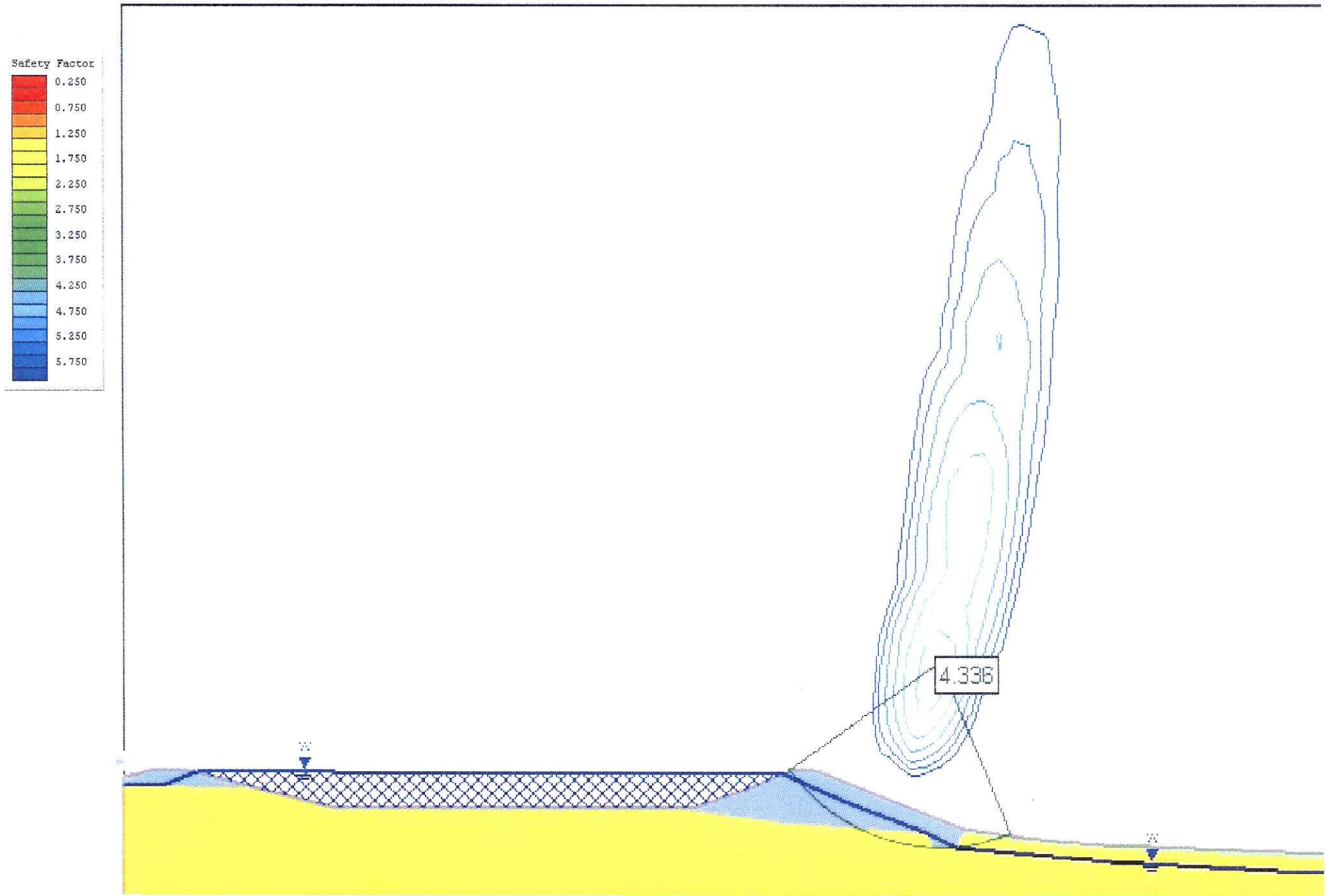
External Boundary

947.000	620.000
947.000	766.184
947.000	770.000
804.000	776.000
774.000	778.000
753.000	780.000
716.787	785.294
713.000	786.000
624.000	822.000
608.000	822.000
580.000	810.000
546.000	798.000
324.000	798.000
278.000	810.000
270.000	812.000
232.000	822.000
208.000	822.000
200.000	820.000
192.000	818.000
192.000	813.000
192.000	620.000

Water Table

192.000	812.542
215.953	811.946
237.534	820.544
269.133	820.544
322.624	820.544
547.611	820.000
576.951	820.000
603.333	820.000
619.918	812.551
646.993	800.603

691.277	782.764
710.953	773.551
808.282	765.103
933.684	758.859
947.000	758.859



APPROXIMATE SCALE (FEET)

0 40 80 160

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Date: 10/29/09

STATIC SLOPE STABILITY CROSS SECTION C-C'
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35147 Annapolis Road
Annapolis, California

PLATE
C

Slide Analysis Information

Document Name

File Name: 11673.2 SLIDE Embankment

Project Settings

Project Title: Artesa Reservoir
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 50
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.448

Material Properties

Material: Compacted Fill
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 117 lb/ft3
Saturated Unit Weight: 125 lb/ft3
Cohesion: 2000 psf
Friction Angle: 28 degrees
Water Surface: Water Table

Hu value: automatically calculated

Material: Weak Top Soils
Strength Type: Undrained
Unsaturated Unit Weight: 110 lb/ft3
Saturated Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Material: Sandstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 125 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 350 psf
Friction Angle: 44 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.641580
Center: 710.983, 995.343
Radius: 223.903
Left Slip Surface Endpoint: 583.301, 811.415
Right Slip Surface Endpoint: 767.300, 778.638
Left Slope Intercept: 583.301 820.000
Right Slope Intercept: 767.300 778.638
Resisting Moment=1.05326e+008 lb-ft
Driving Moment=6.41615e+007 lb-ft

Method: janbu simplified
FS: 1.552800
Center: 710.983, 970.830
Radius: 202.628
Left Slip Surface Endpoint: 584.987, 812.137
Right Slip Surface Endpoint: 773.407, 778.056
Left Slope Intercept: 584.987 820.000
Right Slope Intercept: 773.407 778.056
Resisting Horizontal Force=491912 lb
Driving Horizontal Force=316791 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 51431
Number of Invalid Surfaces: 20740
Error Codes:
Error Code -103 reported for 13700 surfaces
Error Code -106 reported for 157 surfaces
Error Code -107 reported for 334 surfaces
Error Code -112 reported for 5801 surfaces
Error Code -1000 reported for 748 surfaces

Method: janbu simplified

Number of Valid Surfaces: 50514
Number of Invalid Surfaces: 21657
Error Codes:
Error Code -103 reported for 13700 surfaces
Error Code -106 reported for 157 surfaces
Error Code -107 reported for 334 surfaces
Error Code -108 reported for 50 surfaces
Error Code -111 reported for 41 surfaces
Error Code -112 reported for 6627 surfaces
Error Code -1000 reported for 748 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-106 = Average slice width is less than
0.0001 * (maximum horizontal extent of soil region).
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)
< 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in
particular, deep seated slip surfaces with many high negative base angle
slices in the passive zone.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

192.000	643.989
946.885	643.989
946.885	1297.670
192.000	1297.670

Material Boundary

192.000	813.000
217.000	812.000
232.000	811.000
270.000	810.000
324.000	796.000
537.000	796.000
546.000	796.000
608.000	788.000
616.000	787.500
692.324	782.213
696.000	773.000
712.000	773.000
715.709	782.271
716.000	783.000
716.787	785.294

Material Boundary

715.709	782.271
752.911	776.622
774.125	774.375
804.114	772.134
947.000	766.184

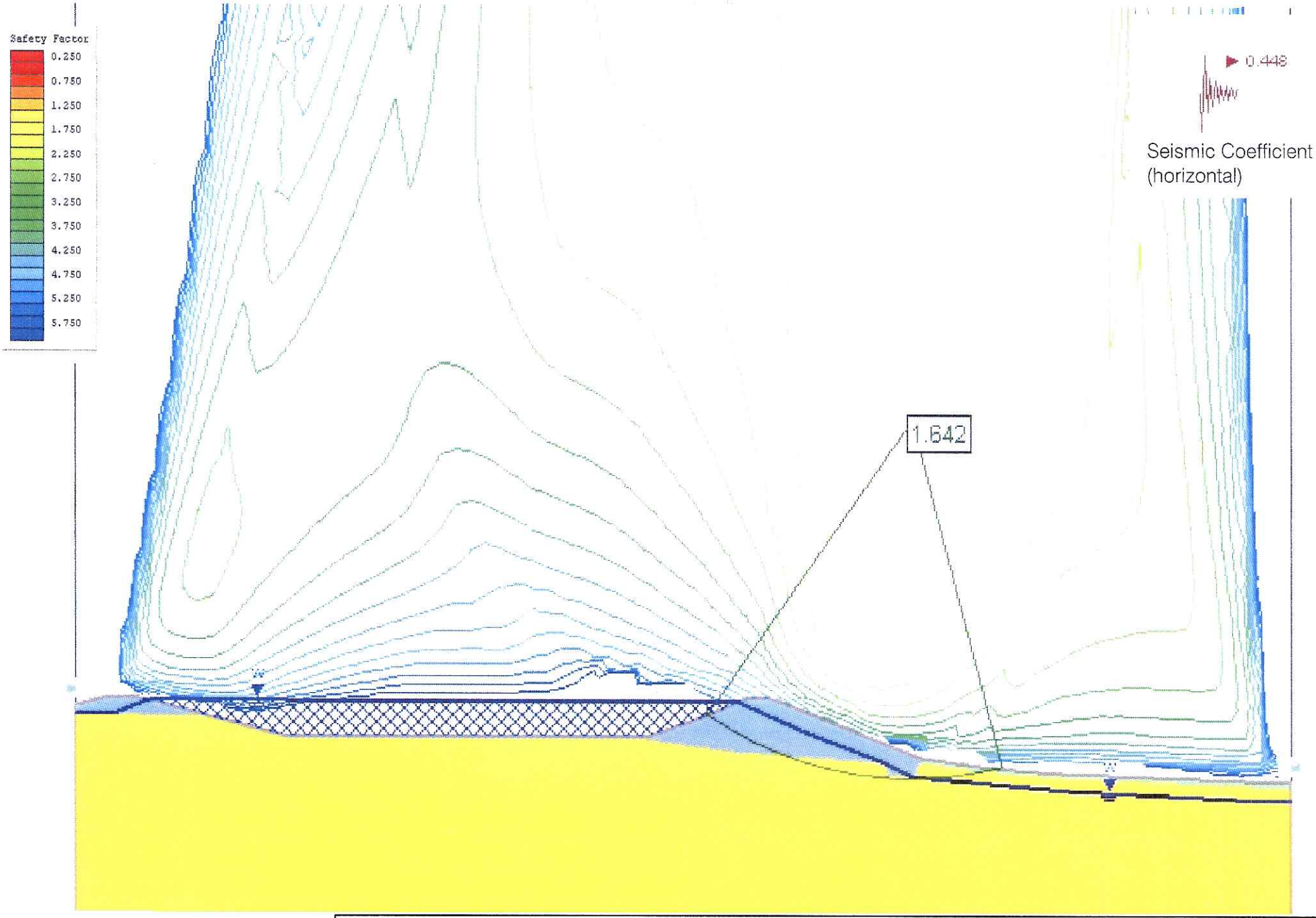
External Boundary

947.000	620.000
947.000	766.184
947.000	770.000
804.000	776.000
774.000	778.000
753.000	780.000
716.787	785.294
713.000	786.000
624.000	822.000
608.000	822.000
580.000	810.000
546.000	798.000
324.000	798.000
278.000	810.000
270.000	812.000
232.000	822.000
208.000	822.000
200.000	820.000
192.000	818.000
192.000	813.000
192.000	620.000

Water Table

192.000	812.542
215.953	811.946
237.534	820.544

269.133	820.544
322.624	820.544
547.611	820.000
576.951	820.000
603.333	820.000
619.918	812.551
646.993	800.603
691.277	782.764
710.953	773.551
808.282	765.103
933.684	758.859
947.000	758.859



APPROXIMATE SCALE (FEET)

0 40 80 160

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Appr.: KAC
Date: 10/29/09

SEISMIC SLOPE STABILITY CROSS SECTION C-C'
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Annapolis, California

PLATE
D