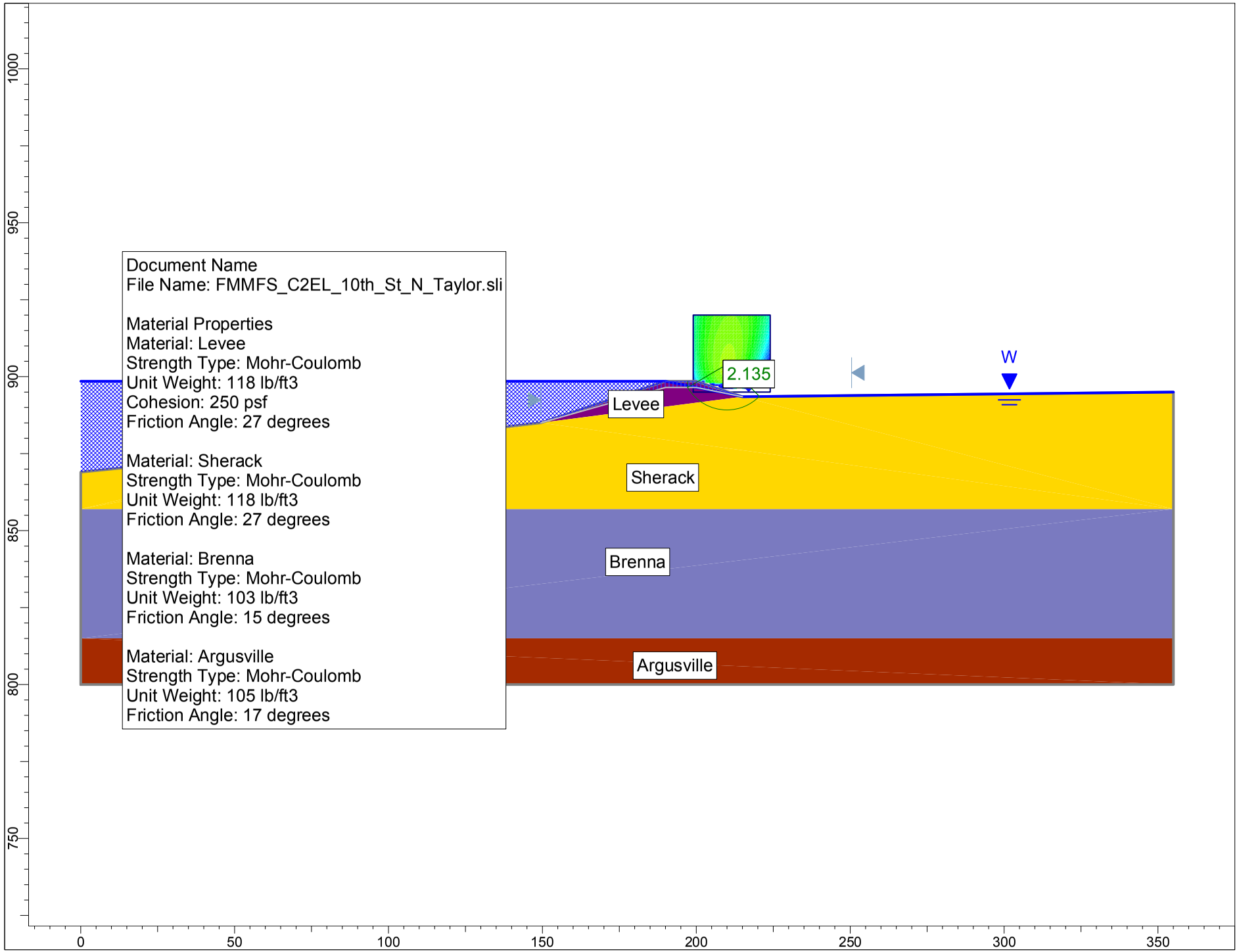
Attachment H-6: Slope Stability Models


Document Name
File Name: FMMFS_C2EL_10th_St_N_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees
2.135
W
Levee
Sherack
Brenna
Argusville
1000
950
900
850
800
750
0
50
100
150
200
250
300
350

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_10th_St_N_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Fargo - Lindenwood
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
355.000	857.000

Material Boundary

0.000	815.000
355.000	815.000

Material Boundary

149.500	885.000
215.000	893.500

External Boundary

0.000	800.000
355.000	800.000
355.000	815.000
355.000	857.000
355.000	895.000
215.000	893.500
200.000	898.500
190.000	898.500
149.500	885.000
90.000	878.000
0.000	869.000
0.000	857.000
0.000	815.000

Water Table

0.000	898.500
190.000	898.500

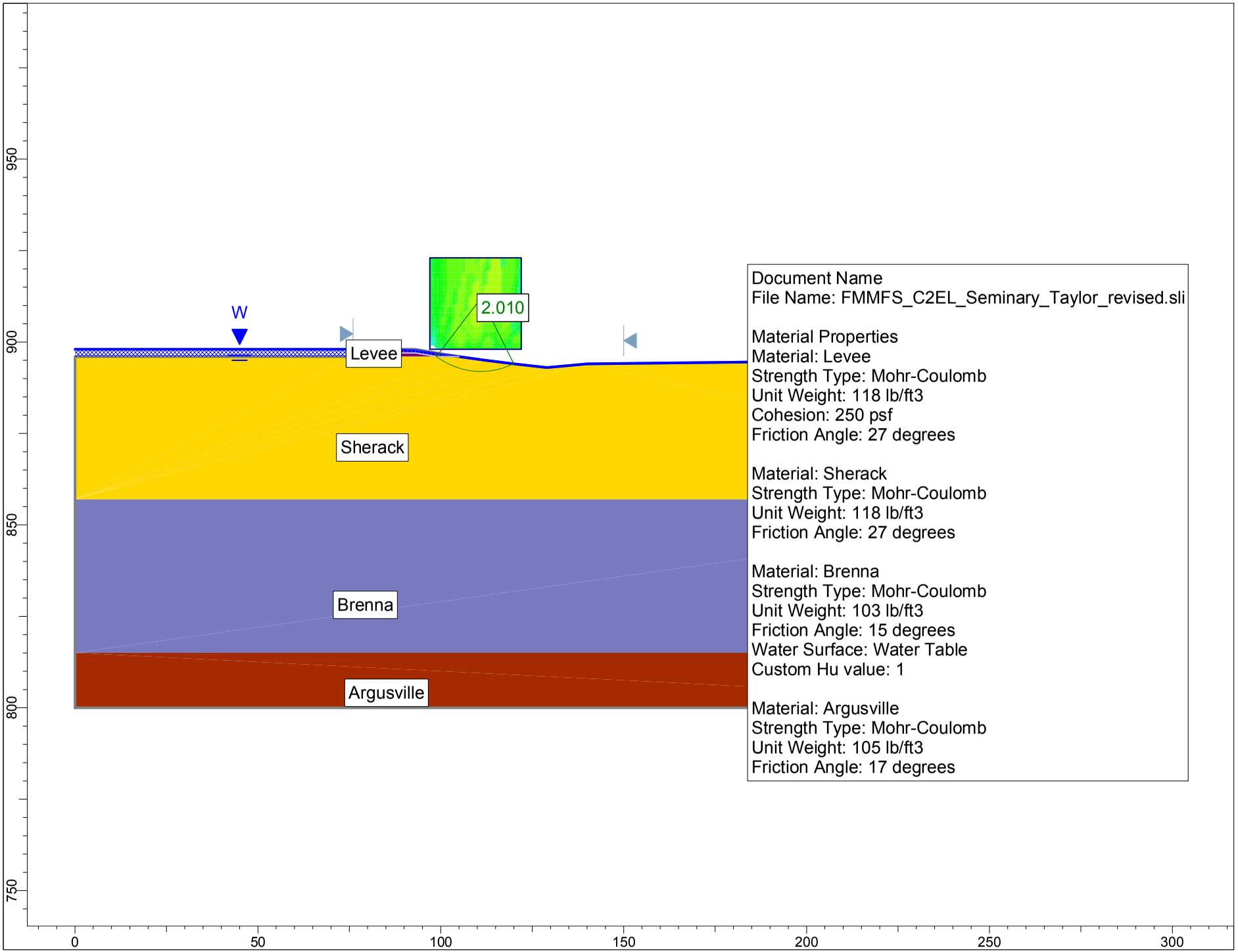
215.000	893.500
355.000	895.000

Tension Crack

149.500	885.000
190.000	896.500
200.000	896.500
215.000	893.500

Search Grid

199.000	895.000
224.000	895.000
224.000	920.000
199.000	920.000


W
2.010
Levee
Sherack
Brenna
Argusville
950
900
850
800
750
0
50
100
150
200
250
300
Document Name
File Name: FMMFS_C2EL_Seminary_Taylor_revised.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Seminary_Taylor_revised.sli

Project Settings

Project Title: FMMFS, C2EL: Fargo - Lindenwood
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: 3

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
300.000	857.000

Material Boundary

0.000	815.000
300.000	815.000

Material Boundary

76.000	896.000
105.000	896.000

External Boundary

0.000	800.000
300.000	800.000
300.000	815.000
300.000	857.000
300.000	896.000
230.000	895.000
140.000	894.000
129.000	893.000
120.000	894.000
112.000	895.000
105.000	896.000
93.000	898.000
88.000	898.000
76.000	896.000
0.000	896.000
0.000	857.000
0.000	815.000

Water Table

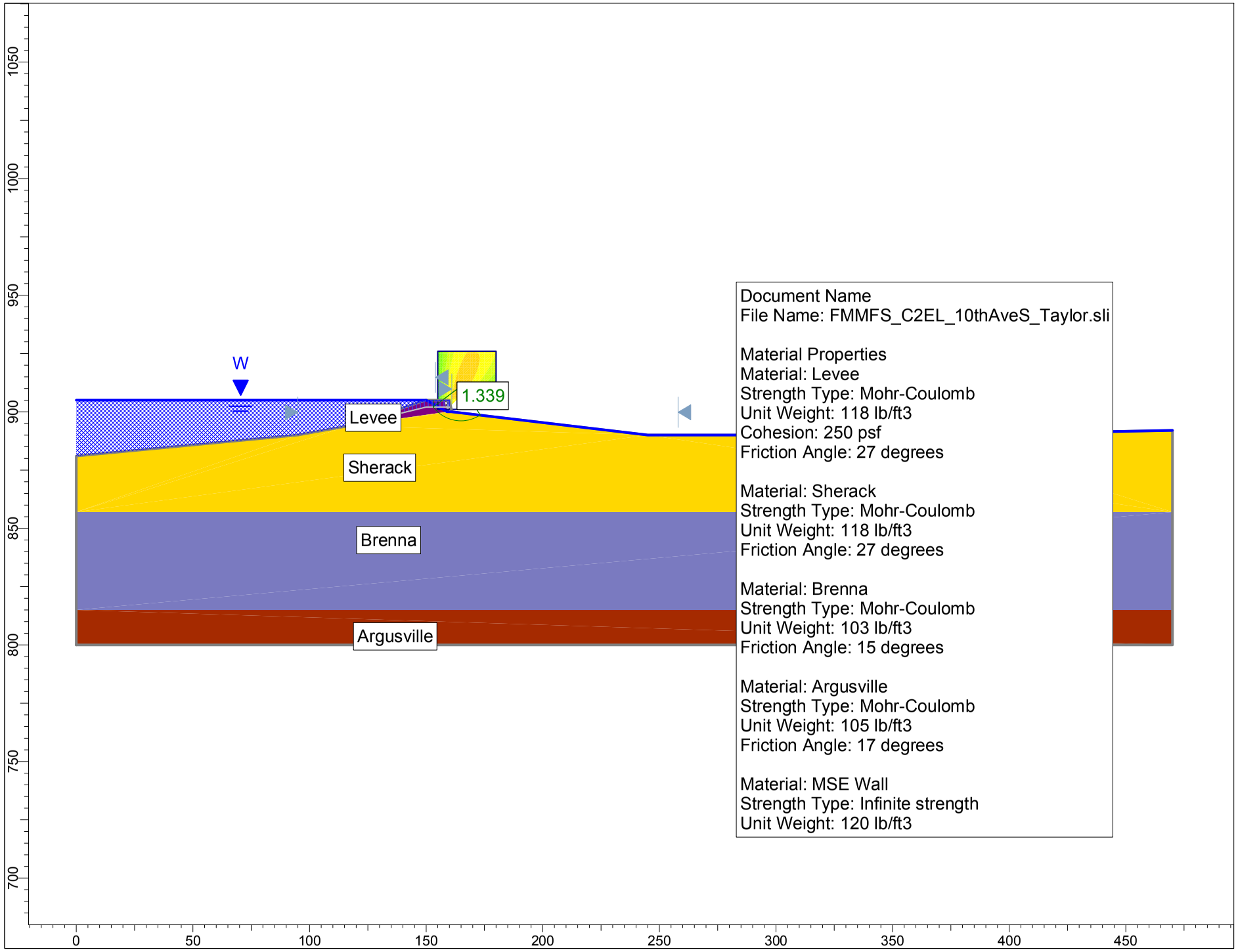
0.000	898.000
88.000	898.000
105.000	896.000
112.000	895.000
120.000	894.000
129.000	893.000
140.000	894.000
230.000	895.000
300.000	896.000

Tension Crack

76.000	896.000
88.000	897.000
93.000	897.000
99.000	896.000
105.000	896.000

Search Grid

97.000	898.000
122.000	898.000
122.000	923.000
97.000	923.000


1050
1000
950
900
850
800
750
700
0
50
100
150
200
250
300
350
400
450
W
1.339
Levee
Sherack
Brenna
Argusville
Document Name
File Name: FMMFS_C2EL_10thAveS_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees
Material: MSE Wall
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_10thAveS_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Moorhead - Horn Park
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: MSE Wall
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

List of All Coordinates

Material Boundary

0.000	857.000
470.000	857.000

Material Boundary

0.000	815.000
470.000	815.000

Material Boundary

117.000	894.000
159.000	900.000

Material Boundary

158.000	905.000
159.000	900.000
161.000	900.000

External Boundary

0.000	800.000
470.000	800.000
470.000	815.000
470.000	857.000
470.000	892.000
365.000	890.000
245.000	890.000
161.000	900.000

160.000	905.000
158.000	905.000
150.000	905.000
117.000	894.000
95.000	890.000
0.000	881.000
0.000	857.000
0.000	815.000

Water Table

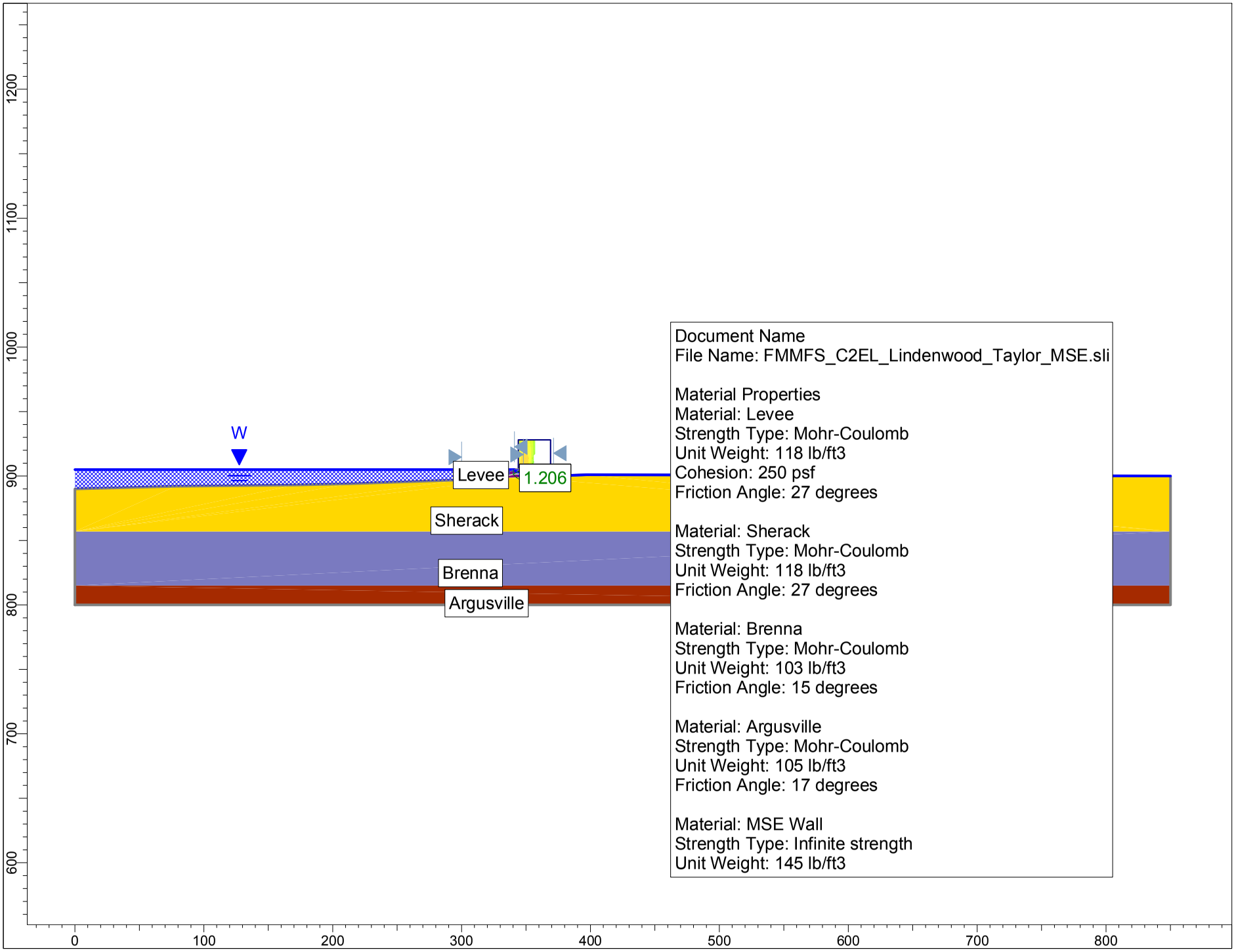
0.000	905.000
150.000	905.000
159.000	900.000
161.000	900.000
245.000	890.000
365.000	890.000
470.000	892.000

Tension Crack

117.000	894.000
150.000	902.000
160.000	902.000

Search Grid

155.000	901.000
180.000	901.000
180.000	926.000
155.000	926.000


1200
1100
1000
900
800
700
600
0
100
200
300
400
500
600
700
800
W
Levee
1.206
Sherack
Brenna
Argusville
Document Name
File Name: FMMFS_C2EL_Lindenwood_Taylor_MSE.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees
Material: MSE Wall
Strength Type: Infinite strength
Unit Weight: 145 lb/ft3

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Lindenwood_Taylor_MSE.sli

Project Settings

Project Title: FMMFS, C2EL: Fargo - Lindenwood
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: MSE Wall
Strength Type: Infinite strength
Unit Weight: 145 lb/ft3

List of All Coordinates

Material Boundary

0.000	857.000
850.000	857.000

Material Boundary

0.000	815.000
850.000	815.000

Material Boundary

344.500	905.000
345.500	899.000
347.000	899.000

Material Boundary

300.000	897.000
345.500	899.000

External Boundary

0.000	800.000
850.000	800.000
850.000	815.000
850.000	857.000
850.000	900.000
397.000	901.000
347.000	899.000
346.000	905.000

344.500	905.000
341.000	905.000
311.000	898.000
300.000	897.000
213.000	894.000
170.000	893.000
78.000	892.000
0.000	890.000
0.000	857.000
0.000	815.000

Water Table

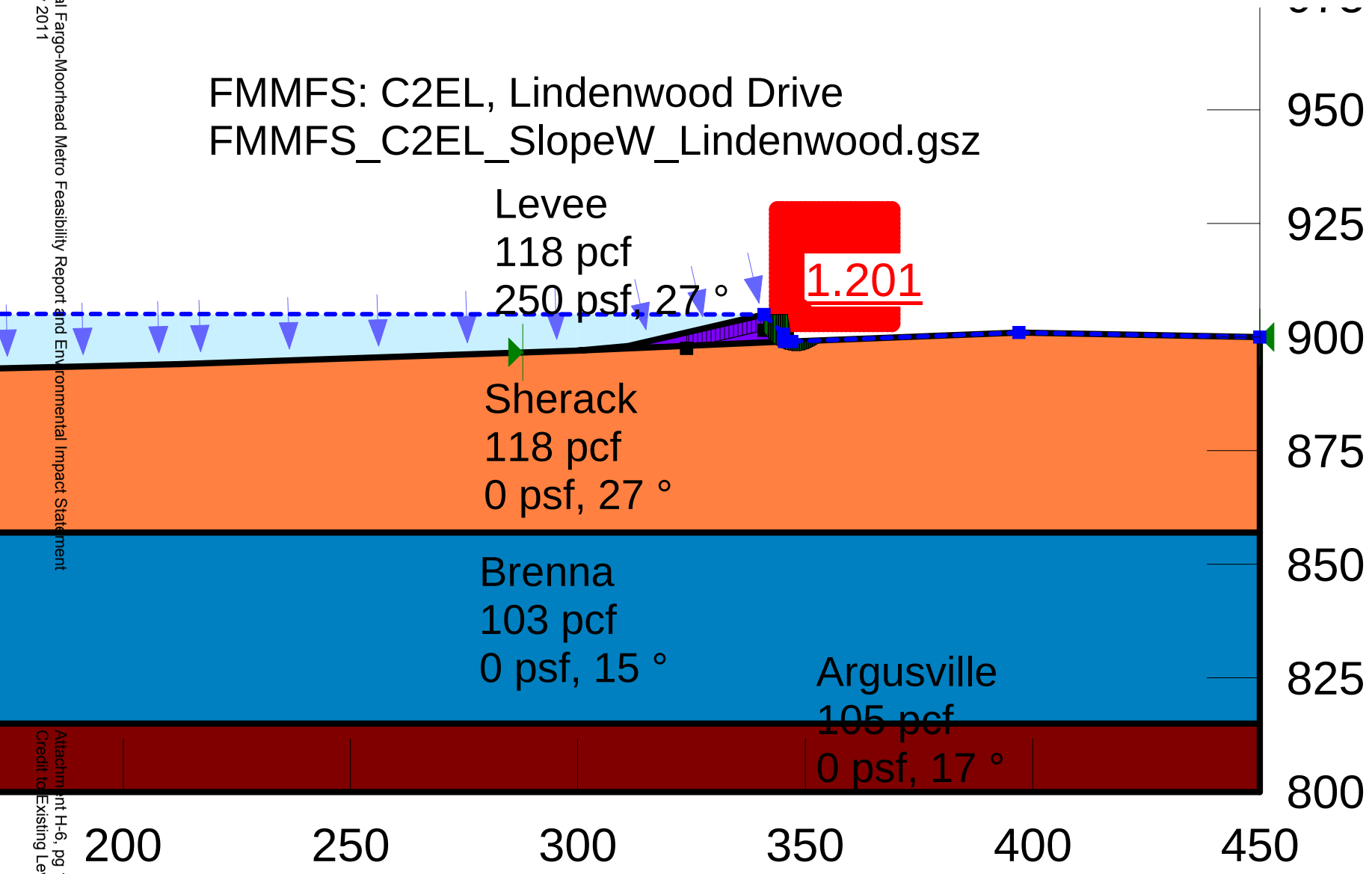
0.000	905.000
341.000	905.000
345.240	900.560
345.500	899.000
347.000	899.000
397.000	901.000
850.000	900.000

Tension Crack

324.000	897.500
341.000	901.500
346.500	901.500

Search Grid

344.000	903.000
369.000	903.000
369.000	928.000
344.000	928.000


FMMFS: C2EL, Lindenwood Drive
FMMFS_C2EL_SlopeW_Lindenwood.gsz
Levee
118 pcf
250 psf, 27 °
1.201
Sherack
118 pcf
0 psf, 27 °
Brenna
103 pcf
0 psf, 15 °
Argusville
105 pcf
0 psf, 17 °
950
925
900
875
850
825
800
200
250
300
350
400
450

Slope Stability

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

File Information

Created By: Heckendorf, Kurt A MVP
Revision Number: 2
Last Edited By: Heckendorf, Kurt A MVP
Date: 1/13/2009
Time: 8:53:41 AM
File Name: FMMFS_C2EL_SlopeW_Lindenwood.gsz
Directory: Q:\02FeasibilityFEA\Geotech\Credit_2_Existing_Levees\Slope_Stability\GeoStudio\
Last Solved Date: 1/13/2009
Last Solved Time: 8:53:56 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Slope Stability

Description: FMMFS: C2EL, Lindenwood Drive
Kind: SLOPE/W
Method: Spencer
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Left to Right
    Use Passive Mode: No
    Slip Surface Option: Grid and Radius
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: Tension Crack Line
        Percentage Wet: 1

Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution

FOS Calculation Option: Constant

Advanced

Number of Slices: 50
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 2000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Levee

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 250 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Sherack

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Brenna

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 15 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Argusville

Model: Mohr-Coulomb

Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 17 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Grid

Upper Left: (344, 928) ft
Lower Left: (344, 903) ft
Lower Right: (369, 903) ft
Grid Horizontal Increment: 25
Grid Vertical Increment: 25
Left Projection Angle: 0 °
Right Projection Angle: 0 °

Slip Surface Radius

Upper Left Coordinate: (340, 902) ft
Upper Right Coordinate: (363, 902) ft
Lower Left Coordinate: (340, 887) ft
Lower Right Coordinate: (363, 887) ft
Number of Increments: 15
Left Projection: No
Left Projection Angle: 135 °
Right Projection: No
Right Projection Angle: 45 °
UsePoints: 0

Slip Surface Limits

Left Coordinate: (287.9456, 896.58671) ft
Right Coordinate: (450, 900) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	905
	341	905
	345.25	900.56
	345.5	899
	347	899
	397	901
	450	900

Tension Crack Line

	X (ft)	Y (ft)
	324	897.5
	341	901.5
	346	901.5

Regions

	Material	Points	Area (ft²)
Region 1	Levee	5,6,7,8,19	128
Region 2	Wall	8,9,10,19	9
Region 3	Sherack	10,11,12,14,13,1,2,3,4,5,19	17222
Region 4	Brenna	13,14,16,15	18900
Region 5	Argusville	17,15,16,18	6750

Points

	X (ft)	Y (ft)
Point 1	0	890
Point 2	78	892
Point 3	170	893
Point 4	212.5	894

Point 5	300	897
Point 6	311	898
Point 7	341	905
Point 8	344.5	905
Point 9	346	905
Point 10	347	899
Point 11	397	901
Point 12	450	900
Point 13	0	857
Point 14	450	857
Point 15	0	815
Point 16	450	815
Point 17	0	800
Point 18	450	800
Point 19	345.5	899

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	902	1.201	(348, 905)	8	(340.826, 904.96)	(353.576, 899.263)

Slices of Slip Surface: 902

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	902	340.91315	901.29305	231.31114	-180.95071	-210.05791	250
2	902	341.1317	900.90605	246.8737	163.10847	-42.680517	250
3	902	341.3951	900.4921	255.52443	214.79889	-20.750701	250
4	902	341.6585	900.1277	261.10585	262.74802	0.83673002	250
5	902	341.92195	899.8023	264.24799	307.82053	22.20132	250
6	902	342.1854	899.5088	265.37042	350.62989	43.441869	250
7	902	342.4488	899.24235	264.83203	391.65647	64.620278	250
8	902	342.7122	898.9993	262.82682	431.16621	85.773203	250
9	902	342.9819	898.77205	259.42491	541.88737	143.92181	0
10	902	343.2579	898.55925	254.70995	573.17324	162.26515	0

11	902	343.53395	898.36475	248.85225	603.72901	180.81874	0
12	902	343.81	898.187	241.95318	633.66045	199.58482	0
13	902	344.086	898.02465	234.08802	663.06351	218.57393	0
14	902	344.362	897.87675	225.32471	692.02612	237.79624	0
15	902	344.623	897.749	216.28188	735.63259	264.62241	0
16	902	344.86895	897.6394	207.08774	795.12145	299.61814	0
17	902	345.12095	897.5373	197.02745	856.72597	336.13319	0
18	902	345.375	897.4441	145.76225	921.64575	395.33239	0
19	902	345.625	897.3618	102.22439	969.07486	441.68237	0
20	902	345.875	897.28845	106.79933	998.96613	454.58169	0
21	902	346.125	897.2239	110.82772	924.69851	414.68788	0
22	902	346.375	897.16785	114.32915	738.90372	318.23663	0
23	902	346.625	897.1201	117.30748	542.6407	216.7181	0
24	902	346.875	897.0805	119.77753	335.58301	109.95839	0
25	902	347.12645	897.04885	122.06563	232.14362	56.087538	0
26	902	347.37935	897.02515	124.18019	240.28301	59.157342	0
27	902	347.63225	897.00945	125.78671	247.75787	62.147411	0
28	902	347.88515	897.0018	126.89526	254.54567	65.04113	0
29	902	348.13805	897.0022	127.50223	260.64205	67.83813	0
30	902	348.39095	897.0106	127.61364	266.02072	70.521927	0
31	902	348.64385	897.027	127.2217	270.66141	73.086181	0
32	902	348.8968	897.05145	126.3243	274.54151	75.520442	0
33	902	349.14975	897.08405	124.91758	277.62506	77.808348	0
34	902	349.40265	897.12495	122.99956	279.8856	79.93743	0
35	902	349.65555	897.17425	120.55515	281.26827	81.887424	0
36	902	349.90845	897.23205	117.57966	281.7327	83.640154	0
37	902	350.16135	897.2986	114.05612	281.21534	85.171878	0
38	902	350.41425	897.37415	109.97503	279.64584	86.451594	0
39	902	350.66715	897.4589	105.31982	276.9263	87.437869	0
40	902	350.92005	897.5532	100.06424	272.94864	88.089005	0
41	902	351.17295	897.65745	94.192383	267.56865	88.339622	0
42	902	351.42585	897.772	87.674322	260.60047	88.110274	0
43	902	351.67875	897.8974	80.479492	251.78544	87.284739	0
44	902	351.93165	898.0343	72.56919	240.76787	85.70151	0
45	902	352.18455	898.1833	63.900487	227.02988	83.118575	0
46	902	352.4375	898.34525	54.428353	209.76546	79.148208	0

47	902	352.69045	898.52115	44.083466	187.63338	73.142333	0
48	902	352.94335	898.7121	32.800318	158.17947	63.883869	0
49	902	353.19625	898.91955	20.484747	116.35918	48.850464	0
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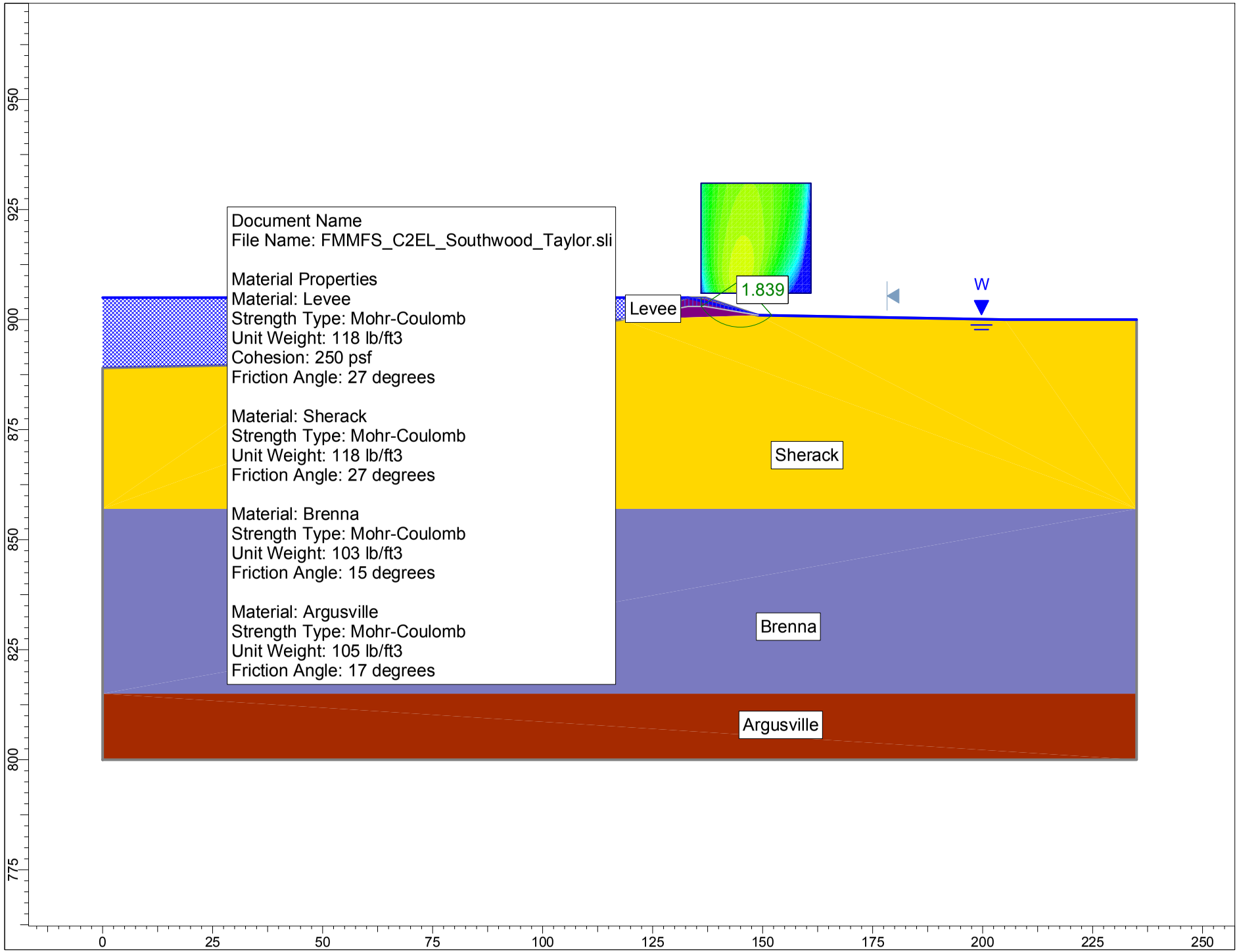

Document Name
File Name: FMMFS_C2EL_Southwood_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees
1.839
W
Levee
Sherack
Brenna
Argusville
950
925
900
875
850
825
800
775
0
25
50
75
100
125
150
175
200
225
250

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Southwood_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Fargo - Lindenwood
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
235.000	857.000

Material Boundary

0.000	815.000
235.000	815.000

Material Boundary

118.000	900.000
149.000	901.000

External Boundary

0.000	800.000
235.000	800.000
235.000	815.000
235.000	857.000
235.000	900.000
205.000	900.000
149.000	901.000
137.000	905.000
133.000	905.000
118.000	900.000
48.000	890.000
0.000	889.000
0.000	857.000
0.000	815.000

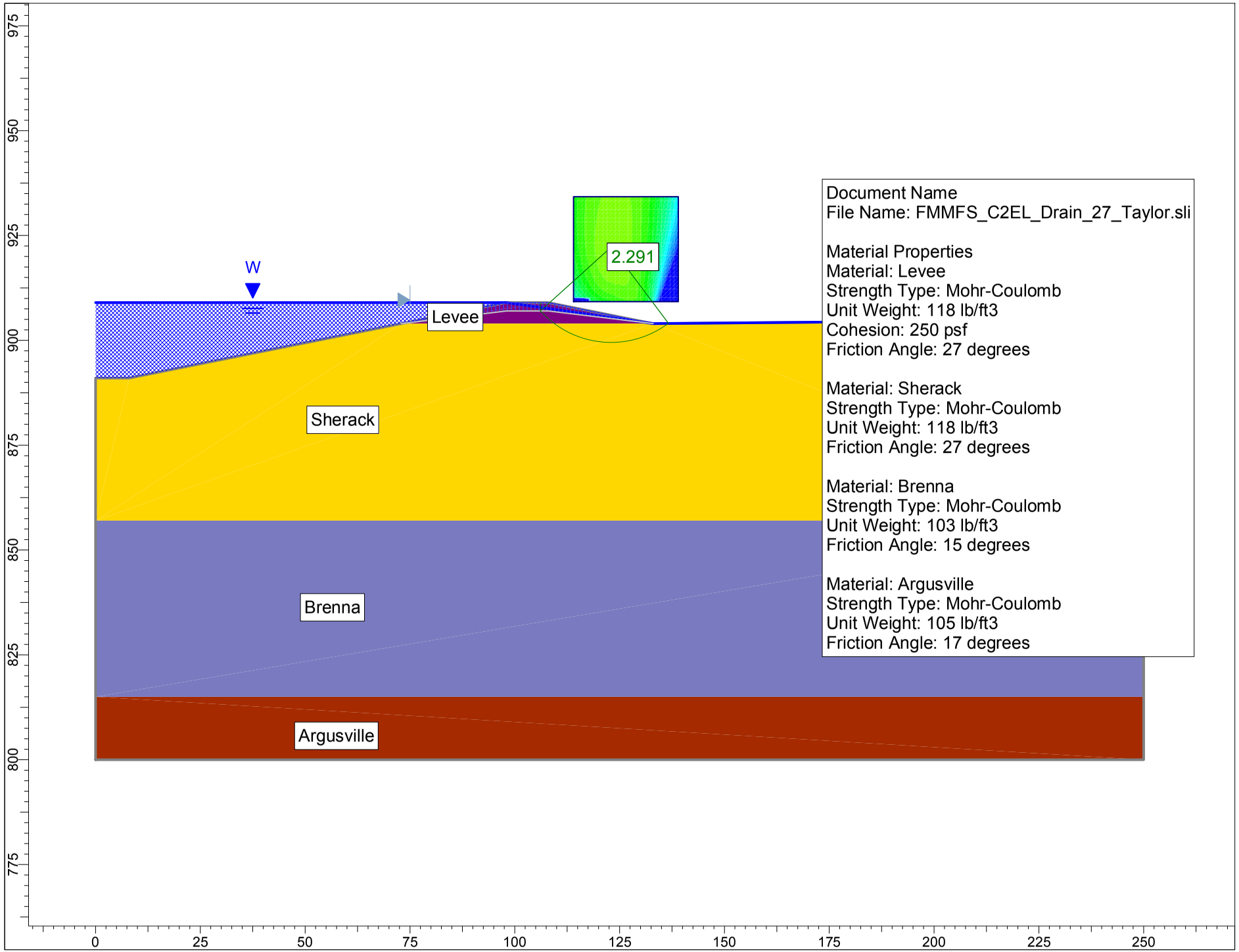
Water Table

0.000	905.000

133.000 905.000
149.000 901.000
205.000 900.000
235.000 900.000

Tension Crack
118.000 900.000
133.000 903.000
137.000 903.000
149.000 901.000

Search Grid
136.000 906.000
161.000 906.000
161.000 931.000
136.000 931.000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950
925
900
875
850
825
800
775
0
25
50
75
100
125
150
175
200
225
250
W
2.291
Levee
Sherack
Brenna
Argusville
Document Name
File Name: FMMFS_C2EL_Drain_27_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Drain_27_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Drain 27
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
250.000	857.000

Material Boundary

0.000	815.000
250.000	815.000

Material Boundary

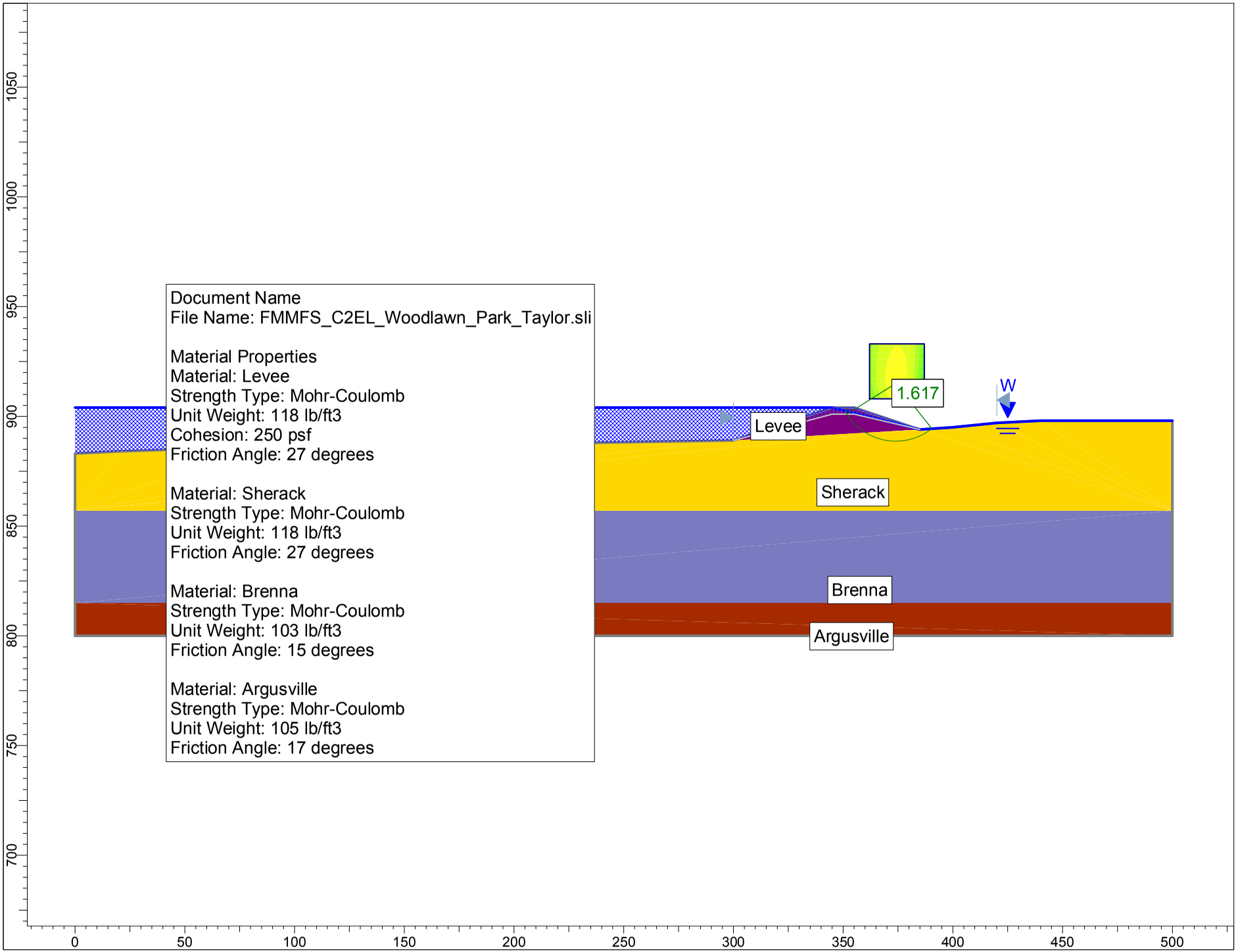
73.000	904.000
133.000	904.000

External Boundary

0.000	800.000
250.000	800.000
250.000	815.000
250.000	857.000
250.000	905.000
133.000	904.000
108.000	909.000
98.000	909.000
73.000	904.000
8.000	891.000
0.000	891.000
0.000	857.000
0.000	815.000

Water Table

0.000	909.000
98.000	909.000


Document Name
File Name: FMMFS_C2EL_Woodlawn_Park_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees
1.617
W
Levee
Sherack
Brenna
Argusville
1050
1000
950
900
850
800
750
700
0
50
100
150
200
250
300
350
400
450
500

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Woodlawn_Park_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Moorhead - Woodlawn Park
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
500.000	857.000

Material Boundary

0.000	815.000
500.000	815.000

Material Boundary

300.000	889.000
385.000	894.000

External Boundary

0.000	800.000
500.000	800.000
500.000	815.000
500.000	857.000
500.000	898.000
440.000	898.000
420.000	897.000
400.000	895.000
385.000	894.000
355.000	904.000
345.000	904.000
300.000	889.000
180.000	887.000
80.000	886.000
20.000	884.000
0.000	883.000
0.000	857.000

0.000	815.000

Water Table

0.000	904.000
345.000	904.000
385.000	894.000
400.000	895.000
420.000	897.000
440.000	898.000
500.000	898.000

Tension Crack

300.000	889.000
345.000	901.000
355.000	901.000
385.000	894.000

Search Grid

362.000	908.000
387.000	908.000
387.000	933.000
362.000	933.000

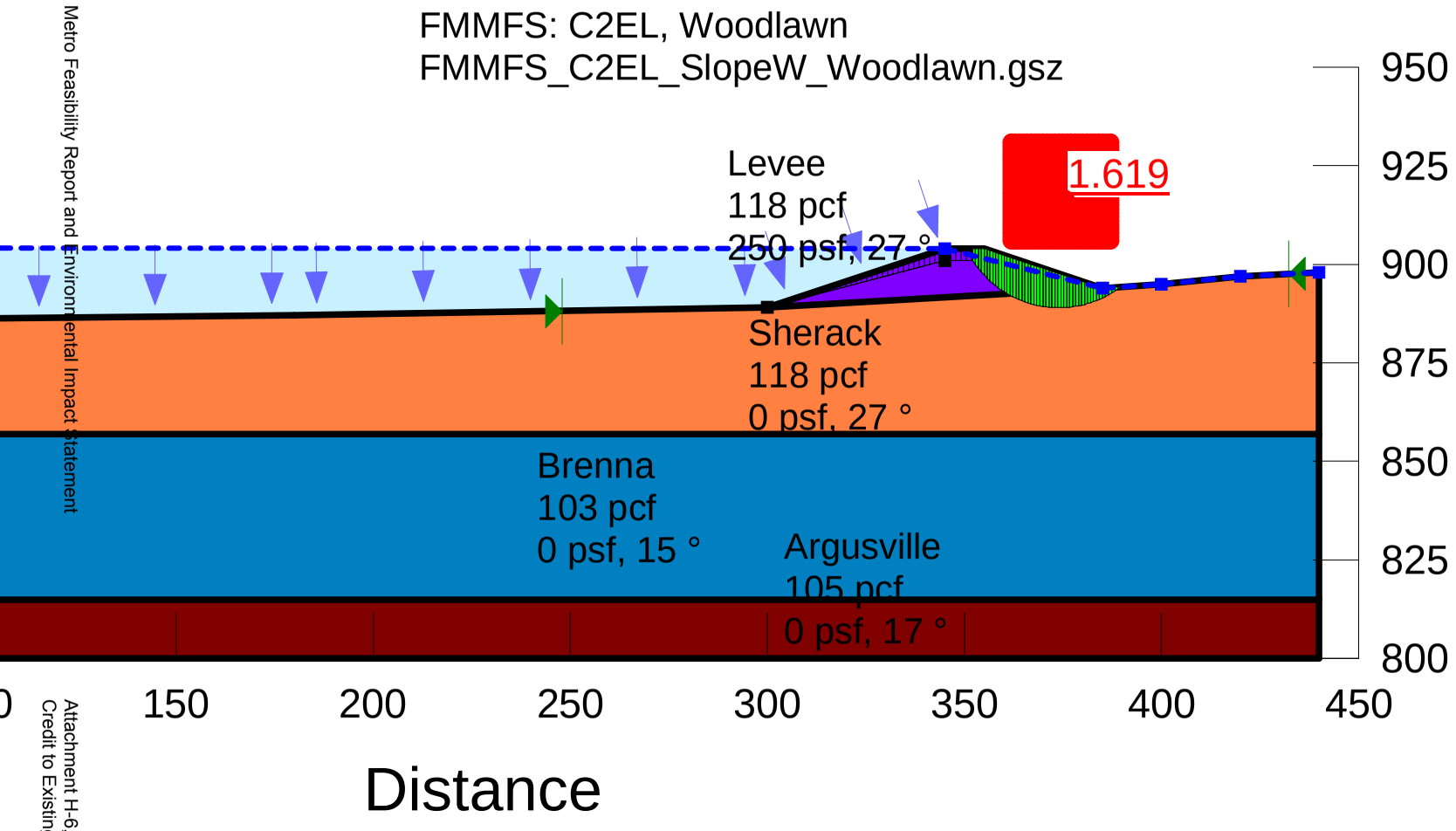
133.000	904.000
250.000	905.000

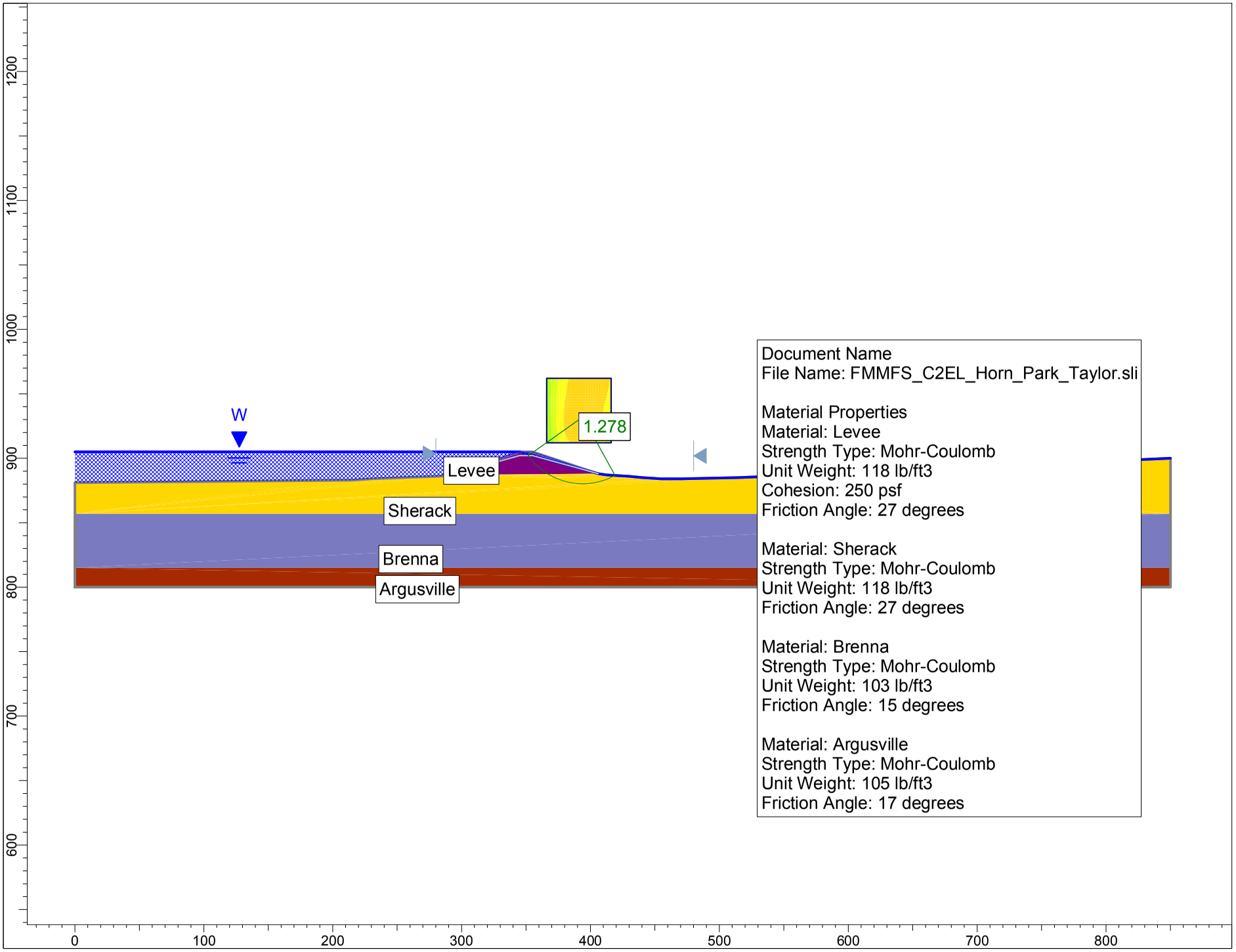
Tension Crack

73.000	904.000
98.000	907.000
108.000	907.000
133.000	904.000

Search Grid

114.000	909.234
139.000	909.234
139.000	934.234
114.000	934.234


FMMFS: C2EL, Woodlawn
FMMFS_C2EL_SlopeW_Woodlawn.gsz
Levee
118 pcf
250 psf, 27 °
1.619
Sherack
118 pcf
0 psf, 27 °
Brenna
103 pcf
0 psf, 15 °
Argusville
105 pcf
0 psf, 17 °
950
925
900
875
850
825
800
150
200
250
300
350
400
450
Distance


1200
1100
1000
900
800
700
600
0
100
200
300
400
500
600
700
800
W
1.278
Levee
Sherack
Brenna
Argusville
Document Name
File Name: FMMFS_C2EL_Horn_Park_Taylor.sli
Material Properties
Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Friction Angle: 27 degrees
Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Friction Angle: 15 degrees
Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Friction Angle: 17 degrees

Slope Stability

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File Information

Created By: Heckendorf, Kurt A MVP
Revision Number: 16
Last Edited By: Heckendorf, Kurt A MVP
Date: 11/30/2009
Time: 8:56:38 AM
File Name: FMMFS_C2EL_SlopeW_Woodlawn.gsz
Directory: Q:\02FeasibilityFEA\Geotech\Credit_2_Existing_Levees\Slope_Stability\GeoStudio\
Last Solved Date: 11/30/2009
Last Solved Time: 8:56:56 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Slope Stability

Description: FMMFS: C2EL, Woodlawn
Kind: SLOPE/W
Method: Spencer
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Left to Right
    Use Passive Mode: No
    Slip Surface Option: Grid and Radius
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: Tension Crack Line
        Percentage Wet: 1

Tension Crack Fluid Unit Weight: 62.4 pcf
FOS Distribution
FOS Calculation Option: Constant
Advanced
Number of Slices: 50
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 2000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Levee

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 250 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sherack

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Brenna

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 15 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Argusville

Model: Mohr-Coulomb

Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 17 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Grid

Upper Left: (362, 931) ft
Lower Left: (362, 906) ft
Lower Right: (387, 906) ft
Grid Horizontal Increment: 25
Grid Vertical Increment: 25
Left Projection Angle: 0 °
Right Projection Angle: 0 °

Slip Surface Radius

Upper Left Coordinate: (351, 900) ft
Upper Right Coordinate: (391, 900) ft
Lower Left Coordinate: (351, 885) ft
Lower Right Coordinate: (391, 885) ft
Number of Increments: 15
Left Projection: No
Left Projection Angle: 135 °
Right Projection: No
Right Projection Angle: 45 °
UsePoints: 0

Slip Surface Limits

Left Coordinate: (248.01444, 888.13357) ft
Right Coordinate: (432.26548, 897.61327) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	904
	345	904

	385	894
	400	895
	420	897
	440	898

Tension Crack Line

	X (ft)	Y (ft)
	300	889
	345	901
	355	901
	385	894

Regions

	Material	Points	Area (ft²)
Region 1	Levee	5,6,7,8	575
Region 2	Sherack	5,8,9,10,11,13,12,1,18,3,4	13962
Region 3	Brenna	14,12,13,15	18480
Region 4	Argusville	16,14,15,17	6600

Points

	X (ft)	Y (ft)
Point 1	0	883
Point 2	20	884
Point 3	80	886
Point 4	180	887
Point 5	300	889
Point 6	345	904
Point 7	355	904
Point 8	385	894
Point 9	400	895
Point 10	420	897
Point 11	440	898
Point 12	0	857
Point 13	440	857

Point 14	0	815
Point 15	440	815
Point 16	0	800
Point 17	440	800
Point 18	22	884

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	3948	1.619	(374, 915)	26	(352.091, 904)	(389.755, 894.317)

Slices of Slip Surface: 3948

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	3948	352.4547	900.46115	104.53042	111.35297	3.4762639	250
2	3948	353.1819	899.43595	157.1579	259.01783	51.900224	250
3	3948	353.90915	898.50665	203.80136	357.45073	78.288264	250
4	3948	354.6364	897.65775	245.43181	450.50723	104.49115	250
5	3948	355.36475	896.8767	282.8061	529.06807	125.47674	250
6	3948	356.0943	896.155	316.45085	592.81621	140.81518	250
7	3948	356.82385	895.4873	346.73411	651.63377	155.35414	250
8	3948	357.5534	894.8682	373.99384	705.90913	169.11929	250
9	3948	358.28295	894.29335	398.48154	755.98708	182.15817	250
10	3948	359.0125	893.7591	420.44115	802.13092	194.48066	250
11	3948	359.74205	893.26245	440.04553	844.583	206.12213	250
12	3948	360.4716	892.8009	457.4629	883.52154	217.08772	250
13	3948	361.21395	892.36535	473.06269	967.20316	251.77715	0
14	3948	361.96905	891.95495	486.89664	995.96924	259.38544	0
15	3948	362.72415	891.57605	498.75324	1021.5385	266.37238	0
16	3948	363.47925	891.22725	508.74629	1043.9774	272.71388	0
17	3948	364.23435	890.90715	516.93315	1063.371	278.42398	0
18	3948	364.98945	890.6146	523.4196	1079.7952	283.4875	0
19	3948	365.7446	890.34865	528.23505	1093.3141	287.92214	0
20	3948	366.49975	890.10845	531.44095	1103.9522	291.70904	0
21	3948	367.25485	889.89325	533.09282	1111.7547	294.84296	0

22	3948	368.00995	889.7024	533.21344	1116.7366	297.3199	0
23	3948	368.76505	889.5354	531.85562	1118.9191	299.12379	0
24	3948	369.52015	889.39175	529.03751	1118.3035	300.24602	0
25	3948	370.27525	889.27105	524.79393	1114.884	300.66591	0
26	3948	371.0304	889.17295	519.13685	1108.6339	300.36376	0
27	3948	371.78555	889.09725	512.08119	1099.5581	299.33443	0
28	3948	372.54065	889.04375	503.63206	1087.6152	297.55426	0
29	3948	373.29575	889.0123	493.82386	1072.7427	294.97391	0
30	3948	374.05085	889.0028	482.62847	1054.9122	291.59311	0
31	3948	374.80595	889.01525	470.07406	1034.0359	287.35289	0
32	3948	375.56105	889.0497	456.15302	1010.0484	282.22379	0
33	3948	376.3162	889.10615	440.84875	982.85449	276.16572	0
34	3948	377.07135	889.18485	424.14979	952.33161	269.12208	0
35	3948	377.82645	889.28595	406.06307	918.37058	261.03371	0
36	3948	378.58155	889.4097	386.56273	880.80092	251.82694	0
37	3948	379.33665	889.5565	365.61718	839.44585	241.42777	0
38	3948	380.09175	889.7267	343.21687	794.11468	229.74391	0
39	3948	380.84685	889.9208	319.33617	744.5556	216.66012	0
40	3948	381.60195	890.13935	293.91066	690.4773	202.06079	0
41	3948	382.3571	890.38295	266.92901	631.54555	185.78141	0
42	3948	383.11225	890.6524	238.33373	567.34491	167.63957	0
43	3948	383.86735	890.9486	208.07622	497.39565	147.41561	0
44	3948	384.62245	891.27255	176.0843	421.08902	124.83614	0
45	3948	385.39625	891.63485	149.23459	359.97542	107.37782	0
46	3948	386.1887	892.0384	127.35291	314.48122	95.346634	0
47	3948	386.98115	892.4771	103.26983	261.69227	80.720264	0
48	3948	387.7736	892.95305	76.869665	200.47093	62.977992	0
49	3948	388.56605	893.46865	47.992846	129.26859	41.412061	0
50	3948	389.35855	894.02685	16.457559	45.999719	15.052482	0

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Horn_Park_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Moorhead - Horn Park
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 250 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sherack
Strength Type: Mohr-Coulomb
Unit Weight: 118 lb/ft3
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Brenna
Strength Type: Mohr-Coulomb
Unit Weight: 103 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Argusville
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	857.000
850.000	857.000

Material Boundary

0.000	815.000
850.000	815.000

Material Boundary

291.000	887.000
406.000	888.000

External Boundary

0.000	800.000
850.000	800.000
850.000	815.000
850.000	857.000
850.000	900.000
540.000	886.000
515.000	885.000
470.000	884.000
455.000	884.000
440.000	885.000
430.000	886.000
412.500	887.000
406.000	888.000
355.000	905.000
345.000	905.000
291.000	887.000
282.500	886.000

255.000	885.000
230.000	884.000
215.000	883.000
0.000	881.000
0.000	857.000
0.000	815.000

Water Table

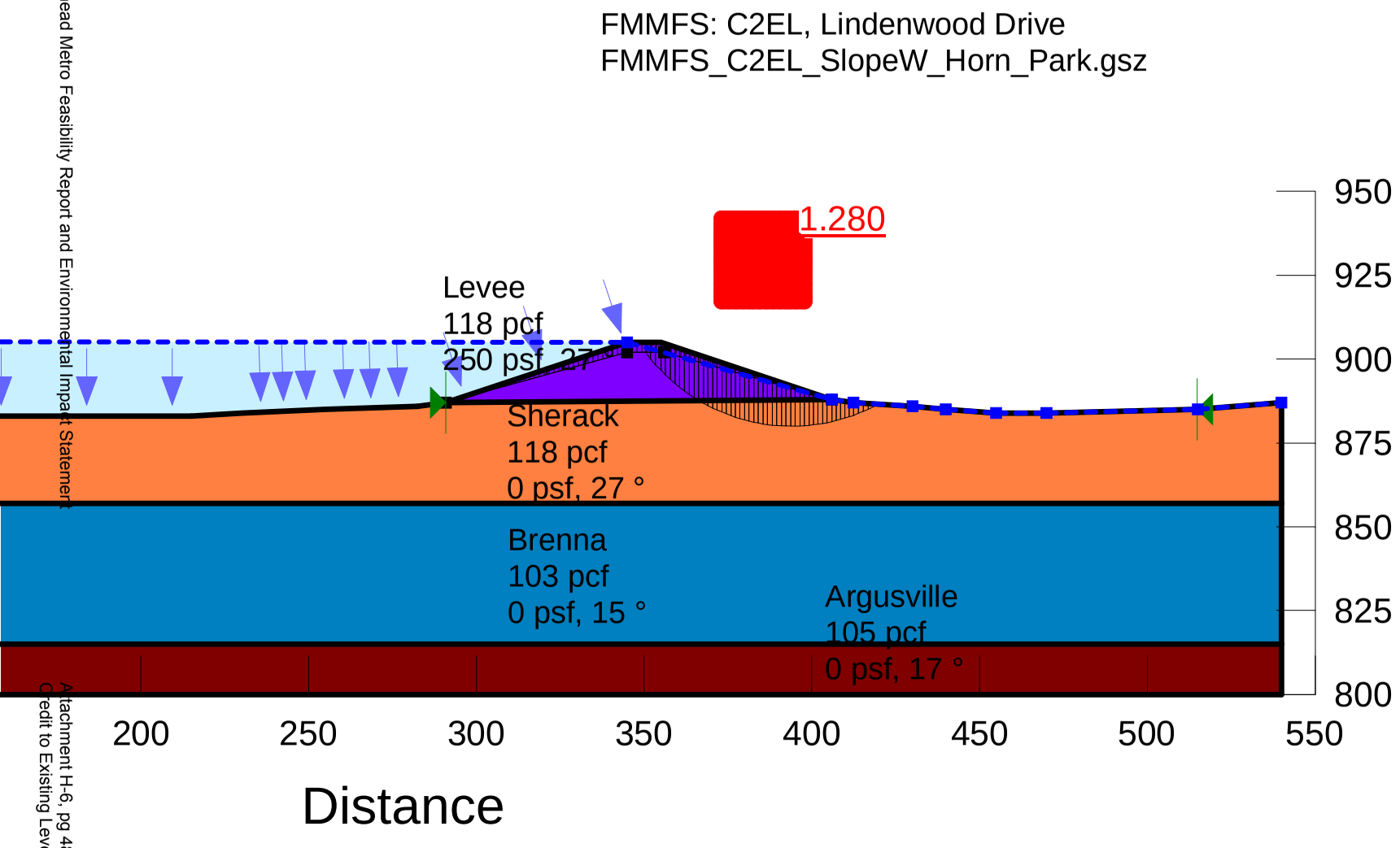
0.000	905.000
345.000	905.000
406.000	888.000
412.500	887.000
430.000	886.000
440.000	885.000
455.000	884.000
470.000	884.000
515.000	885.000
540.000	886.000
850.000	900.000

Tension Crack

291.000	887.000
345.000	902.000
355.000	902.000
406.000	888.000

Search Grid

366.000	912.000
416.000	912.000
416.000	962.000
366.000	962.000


FMMFS: C2EL, Lindenwood Drive
FMMFS_C2EL_SlopeW_Horn_Park.gsz
1.280
Levee
118 pcf
250 psf, 27
Sherack
118 pcf
0 psf, 27 °
Brenna
103 pcf
0 psf, 15 °
Argusville
105 pcf
0 psf, 17 °
950
925
900
875
850
825
800
200
250
300
350
400
450
500
550
Distance

Slope Stability

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File Information

Created By: Heckendorf, Kurt A MVP
Revision Number: 17
Last Edited By: Heckendorf, Kurt A MVP
Date: 1/13/2009
Time: 9:38:35 AM
File Name: FMMFS_C2EL_SlopeW_Horn_Park.gsz
Directory: Q:\02FeasibilityFEA\Geotech\Credit_2_Existing_Levees\Slope_Stability\GeoStudio\
Last Solved Date: 1/13/2009
Last Solved Time: 9:38:52 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Slope Stability

Description: FMMFS: C2EL, Lindenwood Drive
Kind: SLOPE/W
Method: Spencer
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Left to Right
    Use Passive Mode: No
    Slip Surface Option: Grid and Radius
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: Tension Crack Line
        Percentage Wet: 1

Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution

FOS Calculation Option: Constant

Advanced

Number of Slices: 50
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 2000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Levee

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 250 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Sherack

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Brenna

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 15 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Argusville

Model: Mohr-Coulomb

Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 17 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Grid

Upper Left: (373, 942) ft
Lower Left: (373, 917) ft
Lower Right: (398, 917) ft
Grid Horizontal Increment: 25
Grid Vertical Increment: 25
Left Projection Angle: 0 °
Right Projection Angle: 0 °

Slip Surface Radius

Upper Left Coordinate: (358, 894) ft
Upper Right Coordinate: (398, 894) ft
Lower Left Coordinate: (358, 879) ft
Lower Right Coordinate: (398, 879) ft
Number of Increments: 15
Left Projection: No
Left Projection Angle: 135 °
Right Projection: No
Right Projection Angle: 45 °
UsePoints: 0

Slip Surface Limits

Left Coordinate: (291, 887) ft
Right Coordinate: (514.86673, 884.99704) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	905
	345	905

	406	888
	412.5	887
	430	886
	440	885
	455	884
	470	884
	515	885
	540	887

Tension Crack Line

	X (ft)	Y (ft)
	291	887
	345	902
	356	902
	406	888

Regions

	Material	Points	Area (ft^2)
Region 1	Levee	6,7,8,9	1093
Region 2	Sherack	5,6,9,10,11,12,13,14,15,18,16,17,1,2,3,4	14996.5
Region 3	Brenna	17,16,20,19	22680
Region 4	Argusville	21,19,20,22	8100

Points

	X (ft)	Y (ft)
Point 1	0	883
Point 2	215	883
Point 3	230	884
Point 4	255	885
Point 5	282.5	886
Point 6	291	887
Point 7	345	905
Point 8	355	905
Point 9	406	888

Point 10	412.5	887
Point 11	430	886
Point 12	440	885
Point 13	455	884
Point 14	470	884
Point 15	515	885
Point 16	540	857
Point 17	0	857
Point 18	540	887
Point 19	0	815
Point 20	540	815
Point 21	0	800
Point 22	540	800

Critical Slip Surfaces

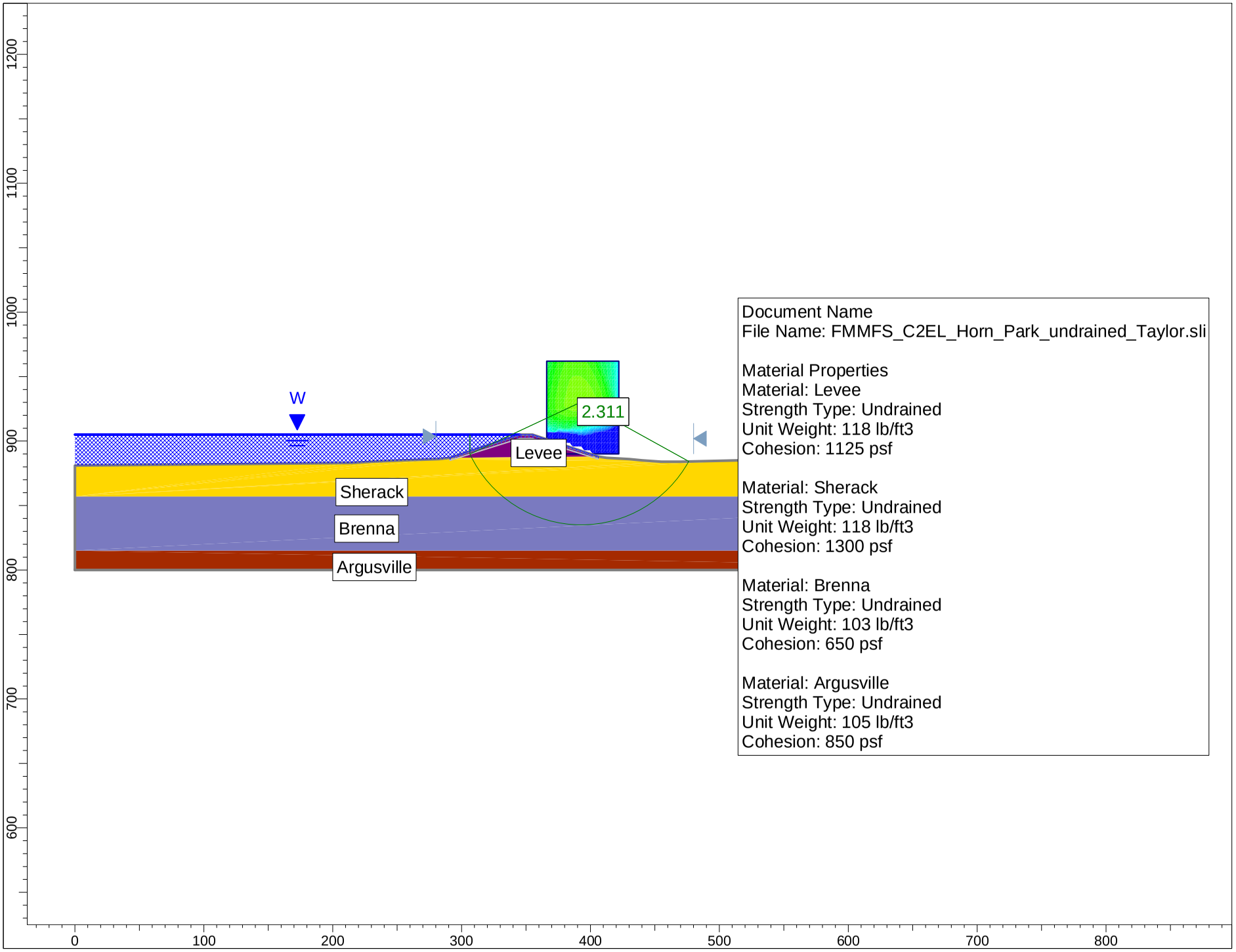
	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	7423	1.280	(394, 934)	54	(350.503, 905)	(419.835, 886.581)

Slices of Slip Surface: 7423

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	7423	351.2524	901.02825	139.10675	162.3951	11.866008	250
2	7423	352.75145	899.1689	229.06119	358.20776	65.803467	250
3	7423	354.2505	897.4658	309.26979	522.83793	108.81841	250
4	7423	355.70535	895.9406	379.13889	657.77507	141.97222	250
5	7423	357.116	894.5711	440.0626	762.19536	164.13484	250
6	7423	358.52665	893.2966	495.05876	859.18495	185.53156	250
7	7423	359.9373	892.1084	544.67442	949.27101	206.15226	250
8	7423	361.34795	890.9993	589.35747	1032.7164	225.90267	250
9	7423	362.7586	889.96335	629.45444	1109.9721	244.83598	250
10	7423	364.16925	888.99545	665.32577	1181.2782	262.89091	250
11	7423	365.5799	888.0913	697.19321	1246.8951	280.08711	250
12	7423	366.96995	887.2587	724.97848	1362.7876	324.97998	0
13	7423	368.33945	886.49285	748.99726	1411.1962	337.40719	0

14	7423	369.7089	885.77805	769.78559	1454.8582	349.06195	0
15	7423	371.07835	885.11205	787.48903	1493.7895	359.87808	0
16	7423	372.44785	884.49295	802.34759	1528.1026	369.79064	0
17	7423	373.81735	883.91895	814.29055	1557.8733	378.87436	0
18	7423	375.1868	883.38845	823.59818	1583.1319	387.00175	0
19	7423	376.55625	882.90015	830.22936	1603.9998	394.25573	0
20	7423	377.92575	882.4529	834.35807	1620.4769	400.54754	0
21	7423	379.29525	882.0456	835.96167	1632.5071	405.86016	0
22	7423	380.6647	881.67725	835.09405	1640.1864	410.21505	0
23	7423	382.03415	881.3471	831.88906	1643.4847	413.52862	0
24	7423	383.40365	881.05445	826.3445	1642.4501	415.82657	0
25	7423	384.77315	880.79865	818.53691	1636.9299	416.99207	0
26	7423	386.1426	880.5792	808.40393	1626.9942	417.09257	0
27	7423	387.51205	880.3956	796.03094	1612.5045	416.01407	0
28	7423	388.88155	880.2475	781.43741	1593.4781	413.75539	0
29	7423	390.25105	880.13465	764.64829	1569.7981	410.24432	0
30	7423	391.6205	880.0568	745.69214	1541.4278	405.44757	0
31	7423	392.98995	880.0138	724.58869	1508.124	399.23116	0
32	7423	394.35945	880.00555	701.28258	1469.8742	391.61697	0
33	7423	395.72895	880.03205	675.8173	1426.53	382.50722	0
34	7423	397.0984	880.09335	648.17913	1377.89	371.80628	0
35	7423	398.46785	880.18955	618.3579	1323.6908	359.38506	0
36	7423	399.83735	880.32085	586.34575	1263.8389	345.2	0
37	7423	401.20685	880.48755	552.13379	1198.0412	329.10625	0
38	7423	402.5763	880.68995	515.68614	1125.8871	310.91292	0
39	7423	403.94575	880.9284	476.99158	1047.1422	290.50626	0
40	7423	405.31525	881.20345	436.01409	961.46294	267.72956	0
41	7423	406.65	881.50685	398.9336	887.51622	248.94528	0
42	7423	407.95	881.83735	365.82856	826.19632	234.56909	0
43	7423	409.25	882.20255	330.56321	758.35392	217.97026	0
44	7423	410.55	882.6032	293.08028	683.58796	198.9736	0
45	7423	411.85	883.0402	253.33153	601.29486	177.29617	0
46	7423	413.23345	883.5475	212.82247	515.2239	154.08122	0
47	7423	414.70035	884.13155	171.14708	423.72801	128.69641	0
48	7423	416.1673	884.76625	126.30901	320.39101	98.889718	0
49	7423	417.63425	885.45355	78.19065	203.61931	63.909096	0

50	7423	419.10115	886.19575	26.646951	71.418656	22.812323	0


1200
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1000
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2.311
Levee
Sherack
Brenna
Argusville
Document Name
File Name: FMMFS_C2EL_Horn_Park_undrained_Taylor.sli
Material Properties
Material: Levee
Strength Type: Undrained
Unit Weight: 118 lb/ft3
Cohesion: 1125 psf
Material: Sherack
Strength Type: Undrained
Unit Weight: 118 lb/ft3
Cohesion: 1300 psf
Material: Brenna
Strength Type: Undrained
Unit Weight: 103 lb/ft3
Cohesion: 650 psf
Material: Argusville
Strength Type: Undrained
Unit Weight: 105 lb/ft3
Cohesion: 850 psf

Slide Analysis Information

Document Name

File Name: FMMFS_C2EL_Horn_Park_undrained_Taylor.sli

Project Settings

Project Title: FMMFS, C2EL: Moorhead - Horn Park
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
Spencer

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

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 25
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Tension Crack

Tension crackWater level: filled with water

Material Properties

Material: Levee
Strength Type: Undrained
Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 1125 psf
Water Surface: None

Material: Sherack

Strength Type: Undrained
Unit Weight: 118 lb/ft3
Cohesion Type: Constant
Cohesion: 1300 psf
Water Surface: None

Material: Brenna
Strength Type: Undrained
Unit Weight: 103 lb/ft3
Cohesion Type: Constant
Cohesion: 650 psf
Water Surface: None

Material: Argusville
Strength Type: Undrained
Unit Weight: 105 lb/ft3
Cohesion Type: Constant
Cohesion: 850 psf
Water Surface: None

List of All Coordinates

Material Boundary

0.000	857.000
850.000	857.000

Material Boundary

0.000	815.000
850.000	815.000

Material Boundary

291.000	887.000
406.000	888.000

External Boundary

0.000	800.000
850.000	800.000
850.000	815.000
850.000	857.000
850.000	900.000
540.000	886.000
515.000	885.000
470.000	884.000
455.000	884.000
440.000	885.000
430.000	886.000
412.500	887.000
406.000	888.000
355.000	905.000
345.000	905.000
291.000	887.000
282.500	886.000
255.000	885.000
230.000	884.000
215.000	883.000
0.000	881.000

0.000	857.000
0.000	815.000

Water Table

0.000	905.000
345.000	905.000

Tension Crack

291.000	885.000
345.000	902.000
355.000	902.000
406.000	886.000

Search Grid

366.000	890.000
422.000	890.000
422.000	962.000
366.000	962.000