COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

March 13, 2020

Mr. Brad Janes
Varra Companies, Inc.
8120 Gage Street
Fredrick, Colorado 80516

Re: Varra Companies, Inc., Parcel 122, File No. M-2015-033, Technical Revision No. 2 (TR-02) Second Adequacy Review

Mr. Janes:

The Division of Reclamation, Mining and Safety (Division/DRMS) reviewed the Slope Stability Analysis adequacy response by AWES, LLC dated March 11, 2020 for technical revision no. 2 (TR-02) for the Parcel 122 site.

The Division duplicated the Applicant's slope stability analysis using Clover Technology's Galena v7.2 slope stability software. A table of the Applicant's and the Division's analysis results are below:

Analysis Name	Applicant's FOS	DRMS FOS
Worst Case 1.25H:1V at 51 feet	1.41	1.41
Profile #1	1.47	1.41
Profile #2	1.58	1.79
Profile #3	1.71	1.78
Profile #4	1.33	1.32
Profile #5	1.98	2.09

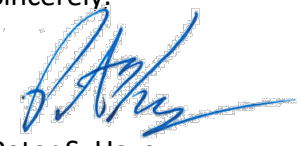
In accordance with Table 1 - Recommended Factors of Safety for Slope Stability Analysis for Operations and Reclamation within Section 30.4 of the Policies of the Mined Land Reclamation Board effective May 16, 2018, the Division will require the Applicant to comply with the factor of safety (FOS) of 1.25 for non-critical structures and a factor of safety of 1.3 for critical structures since the Applicant provided direct shear strength testing results for the on-site sand and gravel material.

The factors of safety produced by Galena were equal to or greater than the factors of safety provided by the Operator. Therefore, the accuracy of the Applicant's analysis is confirmed. A copy of the Galena models are attached.

The Division will accept and approve the updated stability analysis and perimeter grading plan for the Parcel 122 site. The perimeter slopes of the pit may not exceed a slope of 1.25H:1V at a maximum depth of 51 feet below original grade. The Applicant must understand any transgression of the sloping criteria will be considered a violation of the permit.

If you have any questions, please contact me at peter.hays@state.co.us or (303) 866-3567 Ext. 8124.

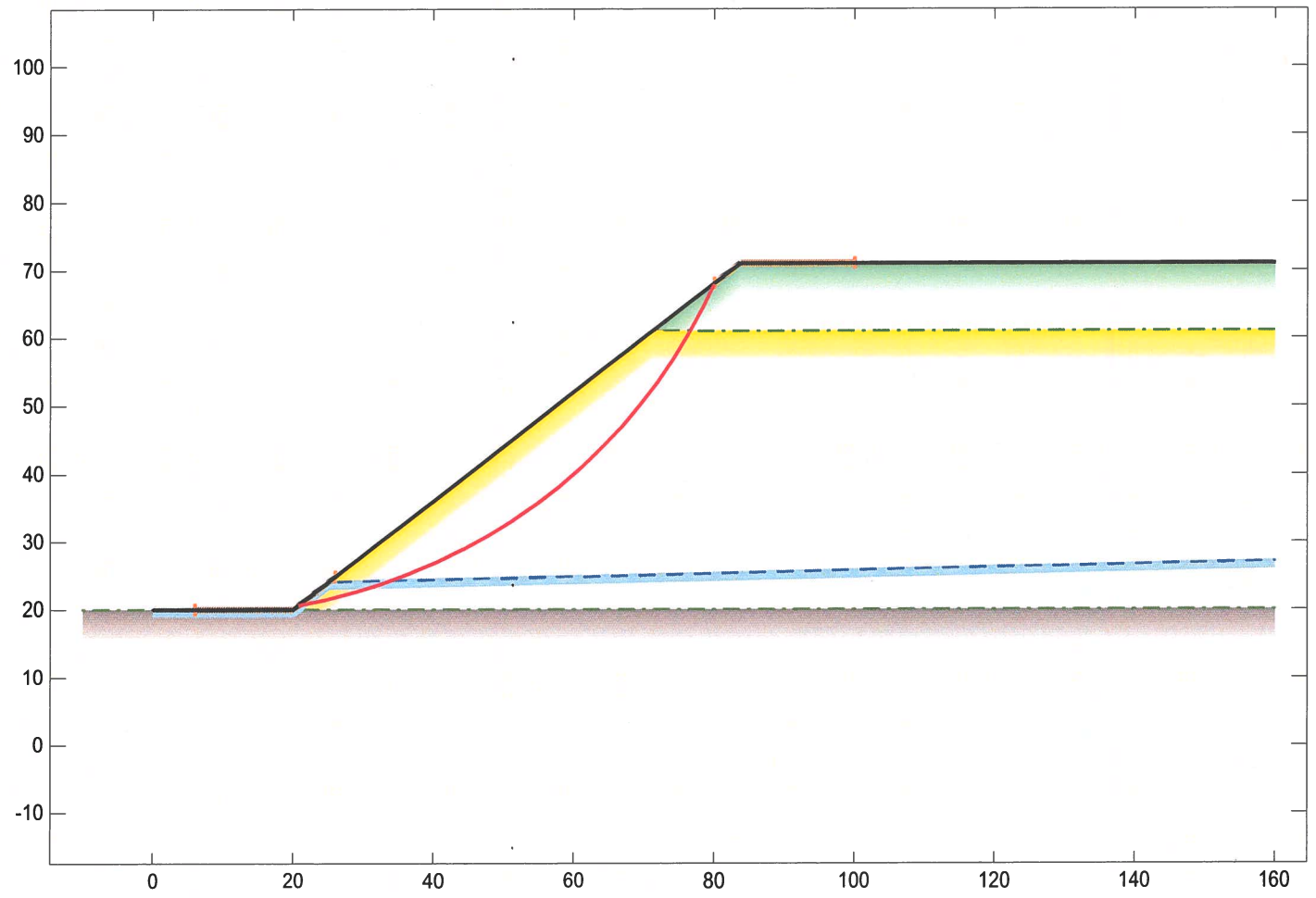
Sincerely,



Peter S. Hays
Environmental Protection Specialist

Enclosures: Galena Verification Models

Ec: Jared Ebert; DRMS



GALENA Version 7.2

Material Keys

1: Sandy Clay / Overburden

2: Sand and Gravel

3: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.41

Interslice Force (Final) Angle: 36.0 °

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

Project Varra / Parcel 122 / M2015033

Verification of Worst Case 1.25H:1V Slope at 51' Depth

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Worse Case.gmf

Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Worse Case.gmf
Processed: 13 Mar 2020 09:51:58

DATA: Analysis 1 - Verification of Worst Case 1.25H:1V Slope at 51' Depth

Material Properties (3 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sandy Clay / Overburden

Cohesion	Phi	UnitWeight	Ru
150.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (3 profiles)

Profile: 1 (2 points)	Material beneath:	1 - Sandy Clay / Overburden		
-10.00	71.00	160.00	71.00	
Profile: 2 (2 points)	Material beneath:	2 - Sand and Gravel		
-10.00	61.00	160.00	61.00	
Profile: 3 (2 points)	Material beneath:	3 - Claystone Bedrock		
-10.00	20.00	160.00	20.00	

Slope Surface (4 points)

0.00	20.00	20.00	20.00	83.75	71.00	160.00	71.00

Phreatic Surface (4 points)

0.00	20.00	20.00	20.00	24.75	24.00	160.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	16.00	YL:	20.00	XR:	90.00	YR: 71.00
Centre:	XC:	22.54	YC:	89.69	Radius:	R:	70.00

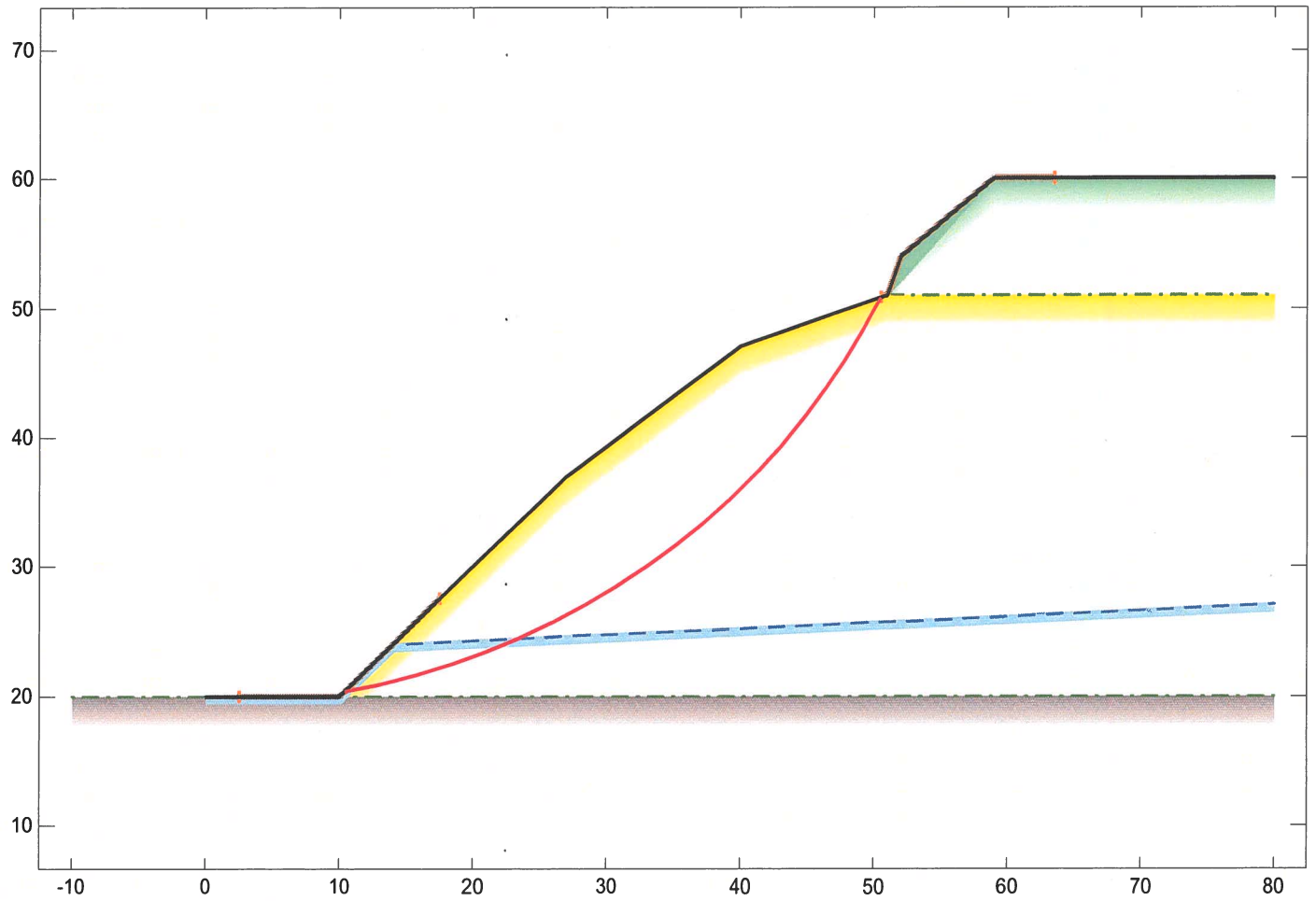
Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	20.00	20.00	20.00
Trial positions within range:	20	20	20

RESULTS: Analysis 1 - Verification of Worst Case 1.25H:1V Slope at 51' Depth

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques



GALENA Version 7.2

Material Keys

1: Sandy Clay / Overburden

2: Sand and Gravel

3: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.41

Interslice Force (Final) Angle: 36.5 °

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

Project Varra / Parcel 122 / M2015033
Verification of Profile #1

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 1.gmf

Dept of the Interior - Office of Surface Mining

GALENA 7.2 Analysis Results Version: 7.20.2.01 Licensee: Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 1.gmf
Processed: 13 Mar 2020 09:59:07

DATA: Analysis 1 - Verification of Profile #1

Material Properties (3 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sandy Clay / Overburden

Cohesion	Phi	UnitWeight	Ru
150.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (3 profiles)

Profile: 1 (2 points) Material beneath: 1 - Sandy Clay / Overburden

-10.00	60.00	80.00	60.00

Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel

-10.00	51.00	80.00	51.00

Profile: 3 (2 points) Material beneath: 3 - Claystone Bedrock

-10.00	20.00	80.00	20.00

Slope Surface (8 points)

0.00	20.00	10.00	20.00	27.00	37.00	40.00	47.00	51.00	51.00
52.00	54.00	59.00	60.00	80.00	60.00				

Phreatic Surface (4 points)

0.00	20.00	10.00	20.00	14.00	24.00	80.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	10.00	YL:	20.00	XR:	57.00	YR: 58.29
Centre:	XC:	11.65	YC:	65.97		Radius:	R: 46.00

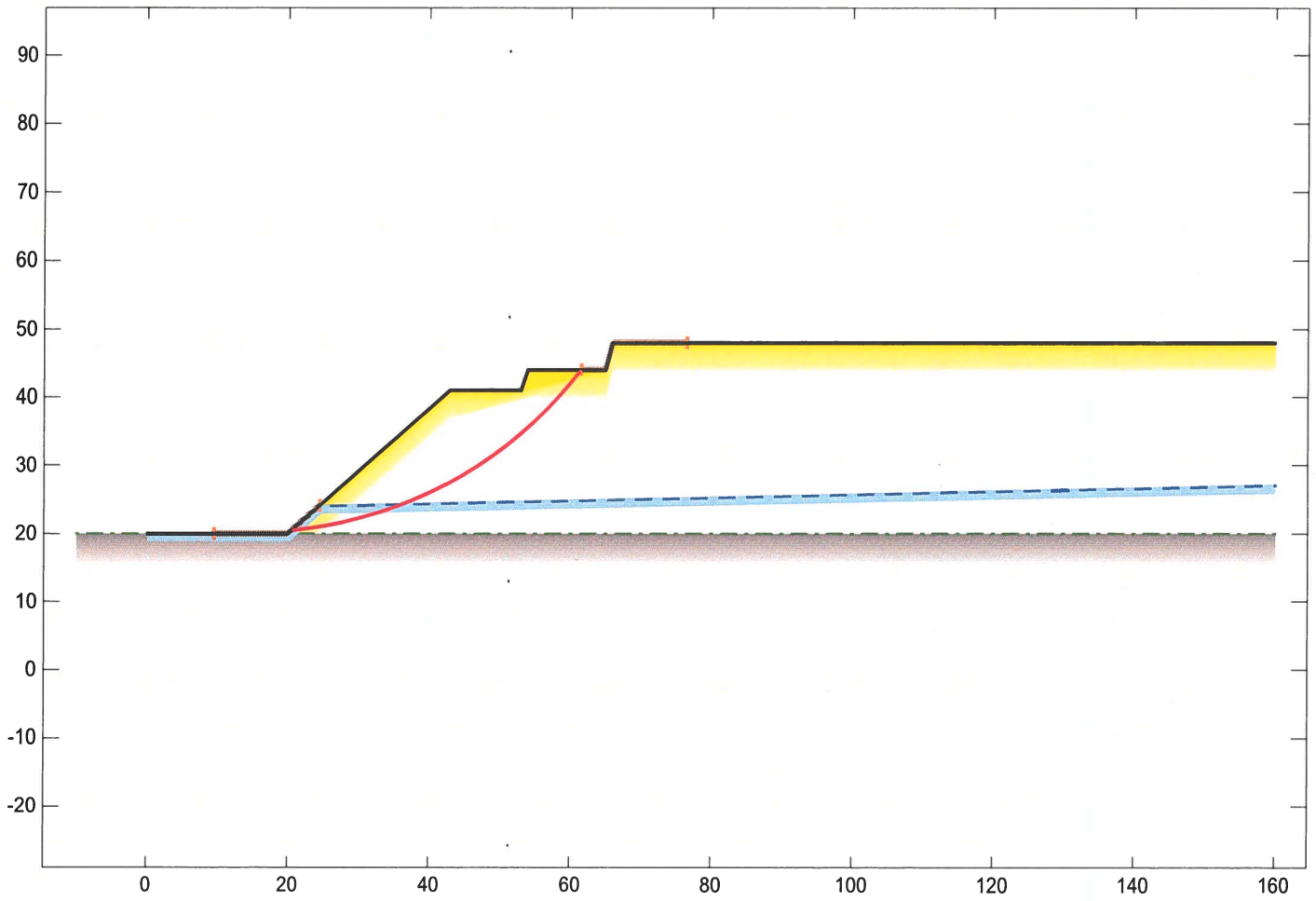
Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	15.00	13.00	19.00
Trial positions within range:	20	20	20

RESULTS: Analysis 1 - Verification of Profile #1

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques



GALENA Version 7.2

Material Keys

1: Sand and Gravel

2: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.79

Interslice Force (Final) Angle: 30.0°

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

Project Varra / Parcel 122 / M2015033
Verification of Profile #2

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 2.gmf

Dept of the Interior - Office of Surface Mining

GALENA 7.2 Analysis Results Version: 7.20.2.01 Licensee: Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 2.gmf
Processed: 13 Mar 2020 10:15:34

DATA: Analysis 1 - Verification of Profile #2

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (2 profiles)

Profile: 1 (2 points) Material beneath: 1 - Sand and Gravel

-10.00	48.00	160.00	48.00

Profile: 2 (2 points) Material beneath: 2 - Claystone Bedrock

-10.00	20.00	160.00	20.00

Slope Surface (8 points)

0.00	20.00	20.00	20.00	43.00	41.00	53.00	41.00	54.00	44.00
65.00	44.00	66.00	48.00	160.00	48.00				

Phreatic Surface (4 points)

0.00	20.00	20.00	20.00	24.50	24.00	160.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	17.00	YL:	20.00	XR:	69.00	YR: 48.00
Centre:	XC:	25.06	YC:	67.32	Radius:	R:	48.00

Variable Restraints

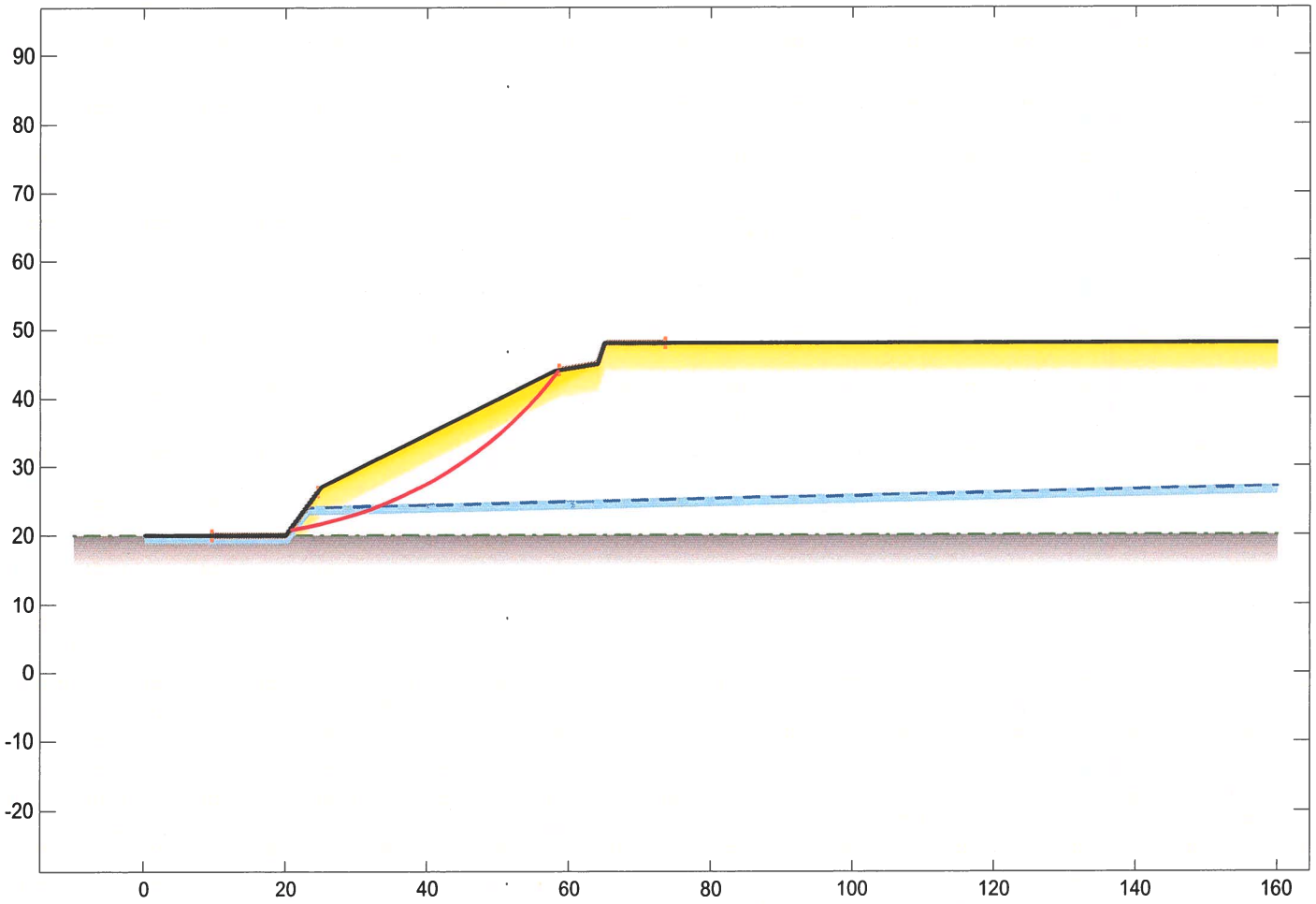
Parameter descriptor:	XL	XR	R
Range of variation:	15.00	15.00	19.00
Trial positions within range:	20	20	20

- -

RESULTS: Analysis 1 - Verification of Profile #2

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques



GALENA Version 7.2

Material Keys

1: Sand and Gravel

2: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.78

Interslice Force (Final) Angle: 30.4 °

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

Project Varra / Parcel 122 / M2015033
Verification of Profile #3

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 3.gmf

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GALENA 7.2 Analysis Results Version: 7.20.2.01 Licensee: Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 3.gmf
Processed: 13 Mar 2020 09:51:03

DATA: Analysis 1 - Verification of Profile #3

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (2 profiles)

Profile: 1 (2 points) Material beneath: 1 - Sand and Gravel

-10.00	48.00	160.00	48.00

Profile: 2 (2 points) Material beneath: 2 - Claystone Bedrock

-10.00	20.00	160.00	20.00

Slope Surface (7 points)

0.00	20.00	20.00	20.00	25.00	27.00	58.00	44.00	64.00	45.00
65.00	48.00	160.00	48.00						

Phreatic Surface (4 points)

0.00	20.00	20.00	20.00	23.00	24.00	160.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	17.00	YL:	20.00	XR:	66.00	YR: 48.00
Centre:	XC:	22.24	YC:	67.71	Radius:	R:	48.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	15.00	15.00	19.00
Trial positions within range:	20	20	20

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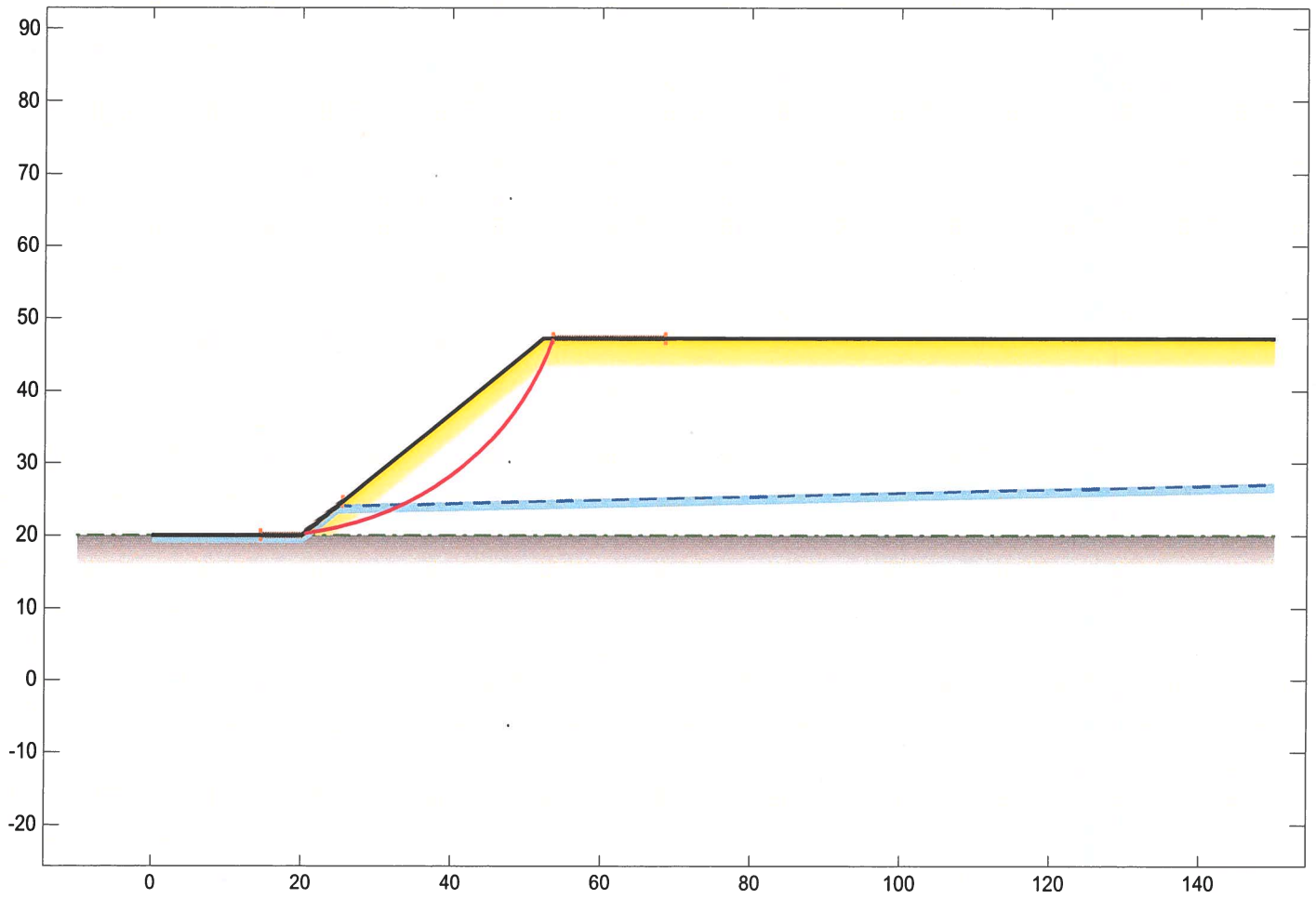
RESULTS: Analysis 1 - Verification of Profile #3

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques



GALENA Version 7.2

Material Keys

1: Sand and Gravel

2: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.32

Project Varra / Parcel 122 / M2015033
Verification of Profile #4

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 4.gmf

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

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GALENA 7.2 Analysis Results Version: 7.20.2.01 Licensee: Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 4.gmf
Processed: 13 Mar 2020 10:20:25

DATA: Analysis 1 - Verification of Profile #4

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (2 profiles)

Profile: 1 (2 points) Material beneath: 1 - Sand and Gravel

-10.00	47.20	150.00	47.20

Profile: 2 (2 points) Material beneath: 2 - Claystone Bedrock

-10.00	20.00	150.00	20.00

Slope Surface (4 points)

0.00	20.00	20.00	20.00	52.20	47.20	150.00	47.20

Phreatic Surface (4 points)

0.00	20.00	20.00	20.00	24.75	24.00	150.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	20.00	YL:	20.00	XR:	61.00	YR: 47.20
Centre:	XC:	23.06	YC:	59.88	Radius:	R:	40.00

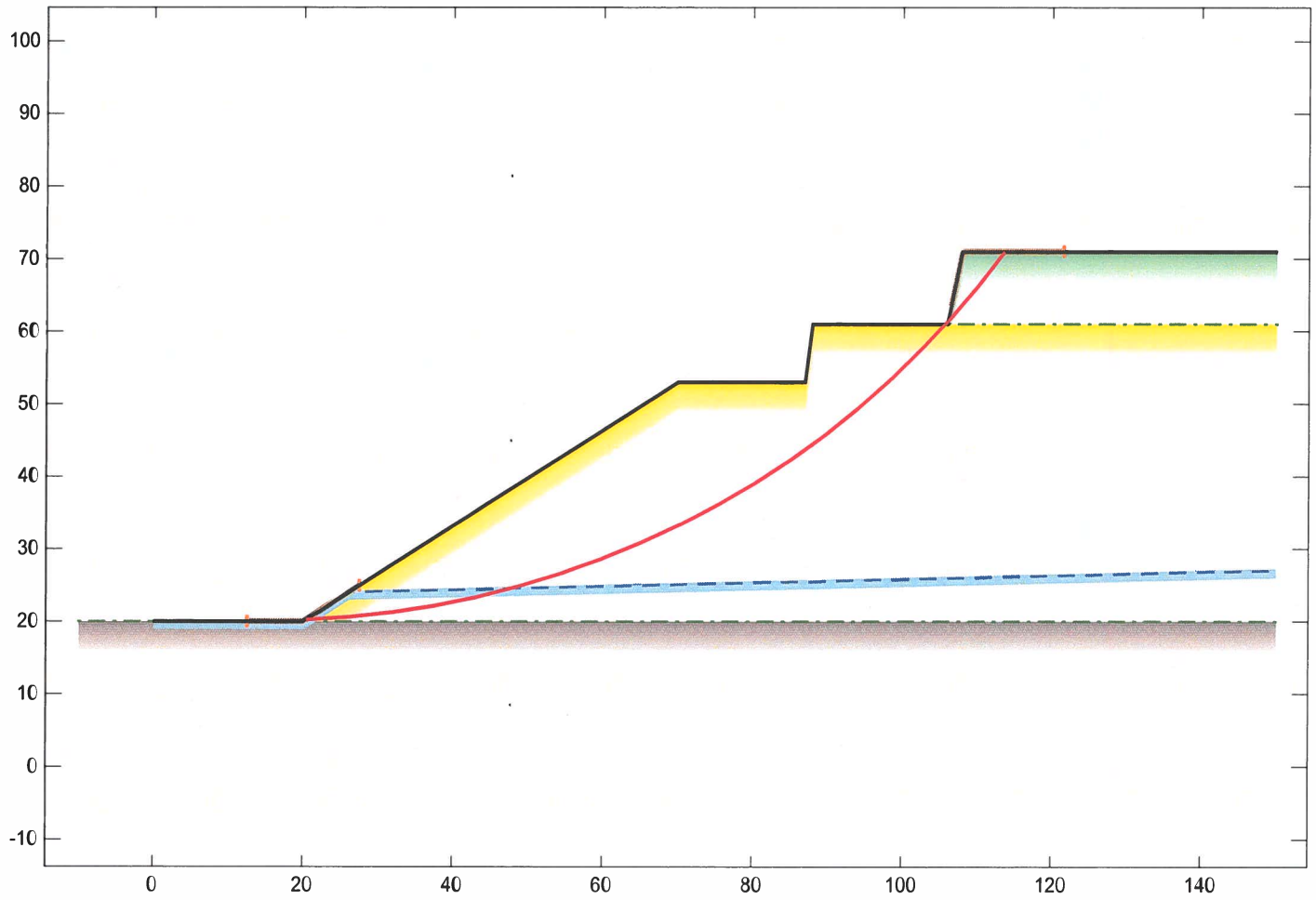
Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	11.00	15.00	0.00
Trial positions within range:	20	20	1

RESULTS: Analysis 1 - Verification of Profile #4

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques



GALENA Version 7.2

Material Keys

1: Sandy Clay / Overburden

2: Sand and Gravel

3: Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 2.09

Interslice Force (Final) Angle: 26.9°

Edited: 13 Mar 2020 *Processed:* 13 Mar 2020

Project Varra / Parcel 122 / M2015033
Verification of Profile #5

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 5.gmf

Dept of the Interior - Office of Surface Mining

GALENA 7.2 Analysis Results Version: 7.20.2.01 Licensee: Dept of the Interior - Office of Surface Mining

Project: Varra / Parcel 122 / M2015033
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Varra Parcel 122 TR02\Profile 5.gmf
Processed: 13 Mar 2020 10:11:30

DATA: Analysis 1 - Verification of Profile #5

Material Properties (3 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sandy Clay / Overburden

Cohesion	Phi	UnitWeight	Ru
150.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	44.6	118.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Claystone Bedrock

Cohesion	Phi	UnitWeight	Ru
500.00	22.0	124.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (3 profiles)

Profile: 1 (2 points)	Material beneath:	1 - Sandy Clay / Overburden		
-10.00	71.00	150.00	71.00	
Profile: 2 (2 points)	Material beneath:	2 - Sand and Gravel		
-10.00	61.00	150.00	61.00	
Profile: 3 (2 points)	Material beneath:	3 - Claystone Bedrock		
-10.00	20.00	150.00	20.00	

Slope Surface (8 points)

0.00	20.00	20.00	20.00	70.00	53.00	87.00	53.00	88.00	61.00
106.00	61.00	108.00	71.00	150.00	71.00				

Phreatic Surface (4 points)

0.00	20.00	20.00	20.00	25.75	24.00	150.00	27.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	20.00	YL:	20.00	XR:	114.00	YR: 71.00
Centre:	XC:	21.16	YC:	129.99	Radius:	R:	110.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	15.00	15.00	19.00
Trial positions within range:	20	20	20

RESULTS: Analysis 1 - Verification of Profile #5

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques