CARTLEDGE
MINING AND GEOTECHNICS

Middlemount Coal Mine

Geotechnical - Final Void Study

Report No.: MMC010006-BI_Rev 1

October 2021

MIDDLEMOUNT COAL MINE

GEOTECHNICAL - FINAL VOID STUDY

Cartledge Mining and Geotechnics

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Rev	Date	Author	RPEQ No.	Reviewer	RPEQ No.	Comment
A	27/10/2020	Dennis Alazigha	22169	Tim Cartledge	16952	DRAFT for Comment
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1	29/10/2020	Dennis Alazigha	22169	Tim Cartledge	16952	Update Fig 1

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1 Introduction

Middlemount Coal Mine (MMC) is located approximately 16 kilometres south west of Middlemount; Figure 1. The operations at the northern and southern voids has now entered an interim monitoring period whilst the final Closure Plan is being developed prior to implementation.

At the completion of open cut coal mining, the open cut pit may remain, becoming a final void. Middlemount Coal Mine has a legislative requirement to manage and ensure geotechnical risks related to the mine are minimised to acceptable standards. Thus, the Technical Service department of Middlemount Coal (MMC) requested Cartledge Mining and Geotechnics (CM&G) to undertake a final geotechnical void study of the Northern and Southern Voids at MMC.

This report provides a geotechnical stability assessment of the voids that will remain as permanent depressions following the completion of mining operations within the project area, including stability assessment of the low walls, the endwalls, and the highwalls.

Two final voids will be created by the project herein known as the Northern and the Southern Voids. The location of the voids is shown on Figure 1.

1.1 Background

As part of a Closure Plan, the final landform at the cessation of mining should comprise a final lake void surrounded by safe and stable batters and revegetated areas.

With the operation shutdown, the closure concept for the Mine Closure Plan now requires technical specification, and therefore a technical study of the proposed geotechnical and slope stability aspects is required.

Through separate technical studies, the hydrological aspect of the final Mine Closure Plan is available hence, mine water levels for the Geotechnical and Slope Stability Investigation was based on data presented in the hydrology report of the voids.

1.1.1 Environmental Authority

This Final Void Study has been carried out as per the requirements set out in MIiddlemount Coal Mine Environmental Authority which requires that scheduled geotechnical study dealing with residual voids be undertaken.

1.1.2 Pits History

In recent years, Middlemount mine was experienced incidences of significant pit wall instability. During this period, the mine has moved from relatively benign ground conditions to highly structurally complex ground conditions as it approaches the Jellinbah fault. The Jellinbah fault is a regional scale structure that has upthrown the eastern limb by up to 200 m. The Girrah seam of the Fort Cooper measures have been exposed above the Rangal coal measures in the eastern economic limit of the pit.

Improved structural geological modelling and geotechnical analysis have reduced the frequency of slope failures. The ongoing development of the mine will continue to encounter complex ground conditions and ongoing interpretation and analysis are required to mitigate this risk.

1.2 Purpose

The purpose of this report is to provide a comprehensive analysis is to provide geotechnical advice for the creation of long-term stable slopes for the final void for Middlemount to use as part of their Mine Closure Plan.

1.3 Relevant Information

CM&G have completed the following reports associated with the Final Void at Middlemount Coal Mine and should be read in conjunction with this report:

- Southern Extension Project – Environmental Values Assessment, Report No.: 0469-29-J4, dated 03 September 2020.
- Report by CM&G, 'Geotechnical Review of Residual Void and East Pit Stand-off', document reference: CMG-MC-LET-0001 Rev 0, dated April 23, 2018

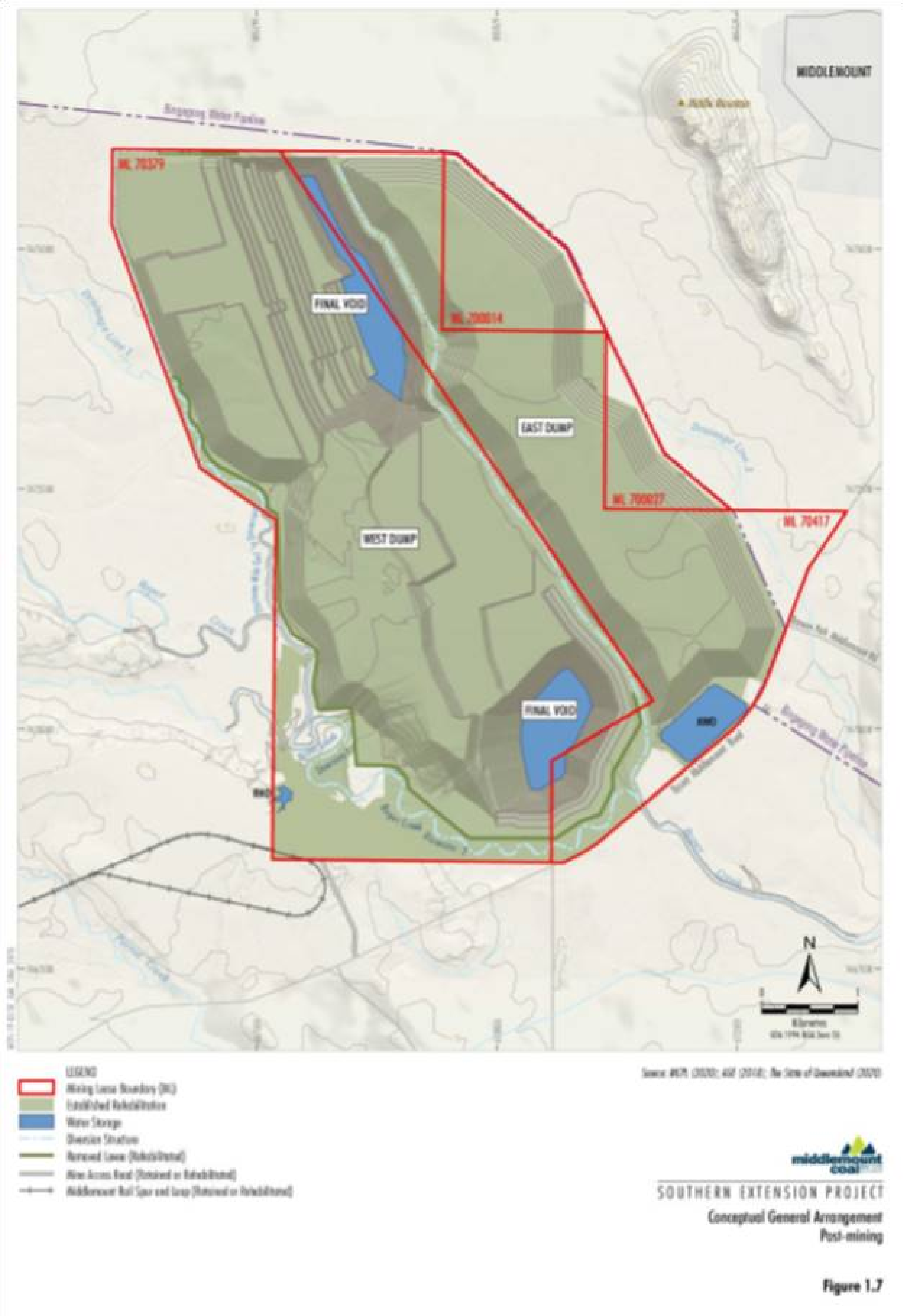


Figure 1 Geographical Location of Middlemount Coal Mine, Bowen Basin QLD

- Report by CM&G, 'Structural Model Update', document reference: MMC010001-AX Rev 1, dated June 2021

1.4 Information Provided

The following information was provided by Middlemount as part of this study:

- Base of Weathering (BoW) and Base of Tertiary (BoT) surfaces received on 07 September 2021 in *dtm* format;
- Final Landform 2502_2020 v8 received on 14 October 2021 in *dtm* format;
- Seam contours received 19 July 2021 in *dxf* format, including Yarrabee Tuff contours in *dtm* format.

2 Methodology

A geotechnical slope stability analysis was conducted to provide a report detailing potential impacts on pit walls if the mine sump level is allowed to recover and eventually reach a theoretical final level. The theoretical maximum level of the final mine lake has been reported to be RL 10.5 mAHD in the Northern Void and RL 35.1 mAHD in the Southern Void.

The methodology includes the followings:

- Undertaking a desktop study by reviewing geological and structural data and plans;
- Structural Geology Assessment;
- Development of geotechnical models;
- Undertake geotechnical stability analyses of the potential failure mechanisms; and,
- Re-evaluation of the tertiary deposits to allows for stability analyses to be carried out and the subsequent assessment of new slope geometries to minimise the failures of the tertiary formation.

2.1 Structural Geology Assessment

Geotechnical failures in coal measure rocks is predominantly controlled by geological structure, e.g. faults and joints. Rarely, if ever, does a slope failure occur due to failure through the rock mass. Hence, assessment and understanding of geological structure in the assessment of known faults is critical to understanding and predicting slope stability.

As the final voids are located at the extent of the reserves, there is limited data available to accurately assess the expected structure contained and daylighting in the final wall. A review of the current structural geology interpretations was completed to assess potential.

2.2 Geotechnical Stability Analyses

Stability analyses were conducted as part of this assessment. Limit equilibrium analysis was carried out on the lowwalls and highwalls in both the Northern and Southern Voids. The following cross-sections were taken in each pit:

- Northern Void
  - 3 No. cross-sections across the lowwall
  - 2 No. cross-sections across the highwall
- Southern Void
  - 1 No. cross-sections across the lowwall
  - 2 No. cross-sections across the highwall

A total of eight (8) cross-sections were taken and assessed for stability.

- Tertiary Deposit
  - Stability analysis of the re-evaluated designs of the tertiary profile was carried out at 30 m and 45 m thicknesses. It is assumed that below 45 m depth, weathered Permian aged material will be present.

  The following overall slope angles (OSA) for the tertiary deposit were investigated:

    - OSA at 20° for 30 thick tertiary deposit;
    - OSA at 20° for 45 thick tertiary deposit;
    - OSA at 25° for 30 m thick tertiary deposit;
    - OSA at 25° for 45 m thick tertiary deposit;
    - OSA at 27° for 30 m thick tertiary deposit; and
    - OSA at 27° for 45 m thick tertiary deposit.

3 Analyses

3.1 Structural Geology Assessment

A structural geology assessment is conducted annually as part of the design process, see report MMC010001-AX by CM&G. This assessment forms part of the mid-term design process for selecting recommended pit slope geometry. This methodology and pit design template is the Geotechnical Reference Report that the mining engineers to select the mid-term and short-term designs.

3.2 Design Assumptions

The following design assumptions were adopted for this analysis:

- Failure surface was assumed to develop along or in the vicinity of weak planes in the area. The validity of slip surfaces was tested by deploying the Cuckoo function for each scenario;
- Factor of Safety (FoS) was computed assuming partially saturated ground conditions;
- GSI value of 70 was adopted;
- Spil Category 3 was adopted to allow for long-term creep consolidation of the spoil,
- It is assumed that the Yarrabee Tuff has been ripped and pushed up to the lowwall, in compliance with site procedures
- Other material strengths were adopted from the Middlemount Coal Mine; Ground Control Management Plan, and the BMA Shear Strength Parameters, which are commonly used in the Bowen Basin.

3.3 Material Strength Parameters

Material strength parameters have been taken from the Middlemount Coal; Ground Control Management Plan (GCMP) dated March 2021.

The material strength parameters tabulated in Table 1 were adopted for these analyses.

3.4 Slope Geometries

3.4.1 Northern Void - Highwalls

Middlemount Coal provided the following slope geometries for the final northern highwall, see Figure 5:

- *For Tertiary stratum:*
    - 45 m maximum slope height
    - 45° batter angle
    - 25 m wide berm at the Base of Tertiary
- *For Weathered stratum:*
    - 30 m maximum slope height
    - 65° batter angle
    - 25 m wide berm at the Base of Weathering
- *For fresh (Permian) stratum:*
    - 50 m high benches
    - 65° batter angle
    - 25 m wide berms

- 49^0 maximumOSA
- 250^o Slope Dip Direction.

Table 1 Material strength parameters used in limit equilibrium analysis

Material	Strength Type	Unit Weight (kN/m^3)	Cohesion (kPa)	Phi (°)	UCS (KPa)	GSI	mi	D
Dump – Unsaturated Cat 3	Mohr-Coulomb	18	50	30				
Spoil – Saturated Cat 3	Mohr-Coulomb	20	20	25				
Spoil – Unsaturated Cat 2.5	Mohr-Coulomb	18	40	29				
Spoil – Saturated Cat 2.5	Mohr-Coulomb	20	17.5	24				
Alluvium	Shear-Normal	Shear-Normal Function for Fully Softened and Peak Strengths						
Tertiary Clay	Shear-Normal	Shear-Normal Function for Fully Softened and Peak Strengths						
Weathered Permian	Mohr-Coulomb	20	35	23				
MMCM Interburden	Generalised Hoek-Brown	22			11890	70	42.49	0
Coal – MMCM	Mohr-Coulomb	15	30	35				
MMCP1 Interburden	Generalised Hoek-Brown	22			10850	70	35.88	0
Coal – MMCP1	Mohr-Coulomb	15	30	35				
MMCP2 Interburden	Generalised Hoek-Brown	22			10850	70	35.88	0
Coal – MMCP2	Mohr-Coulomb	15	30	35				
YBT	Mohr-Coulomb	24	15	15				
MMCP2 - Underburden	Generalised Hoek-Brown	20			10850	70	35.88	0

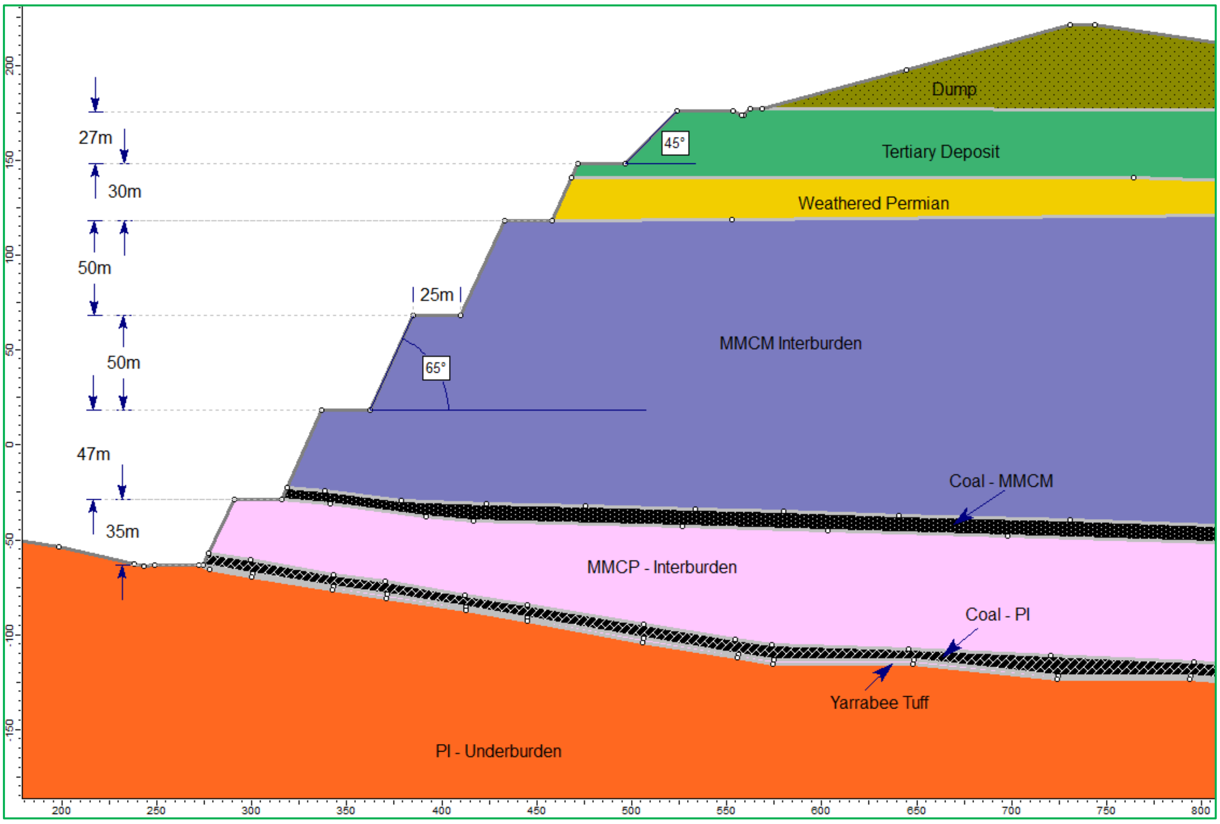


Figure 2 Schematic showing typical slope geometry for the Northern Highwall

3.4.2 Northern Void - Lowwalls

The floor angles at the four different cross-section locations range from 10° to approximately 20°. The maximum floor dip is at cross-section A as represented in Figure 3.

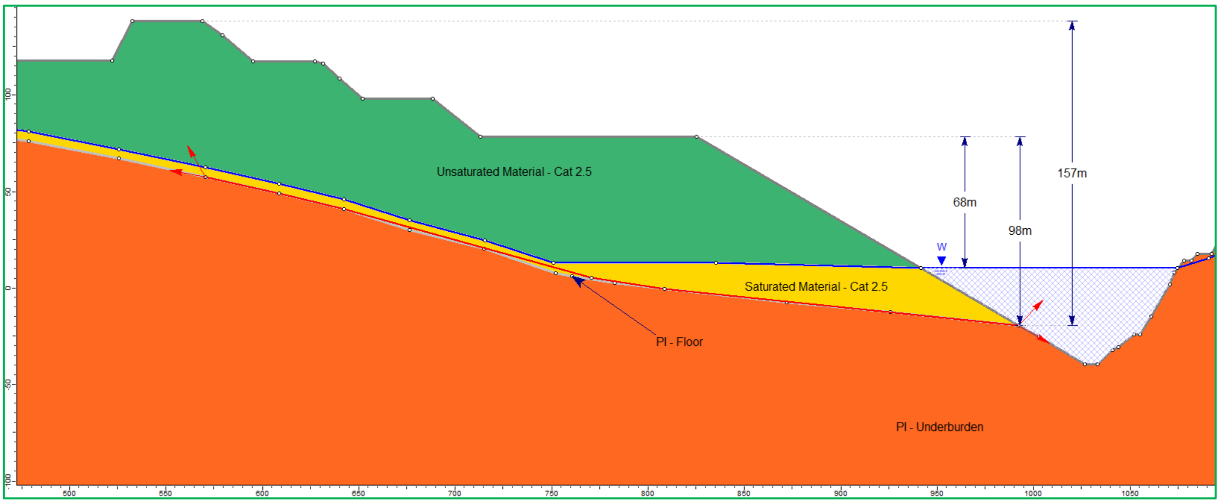


Figure 3 Schematic showing typical slope geometry for the Northern Highwall

3.4.3 Southern Void - Highwalls

The geometry provided by Middlemount Coal Mine is as shown in Figure 4. Category 2.5 spoil parameters were adopted for the dozer pushed profile. The original slope profile was adopted behind the dozer push for conservatism. It is expected that the final geometry will be a partial intact slope and partial dozer push.

Two scenarios were analysed:

- Dozer pushed slope (see Figure 4), and
- Intact slope, where no slope geometry modification is adopted.

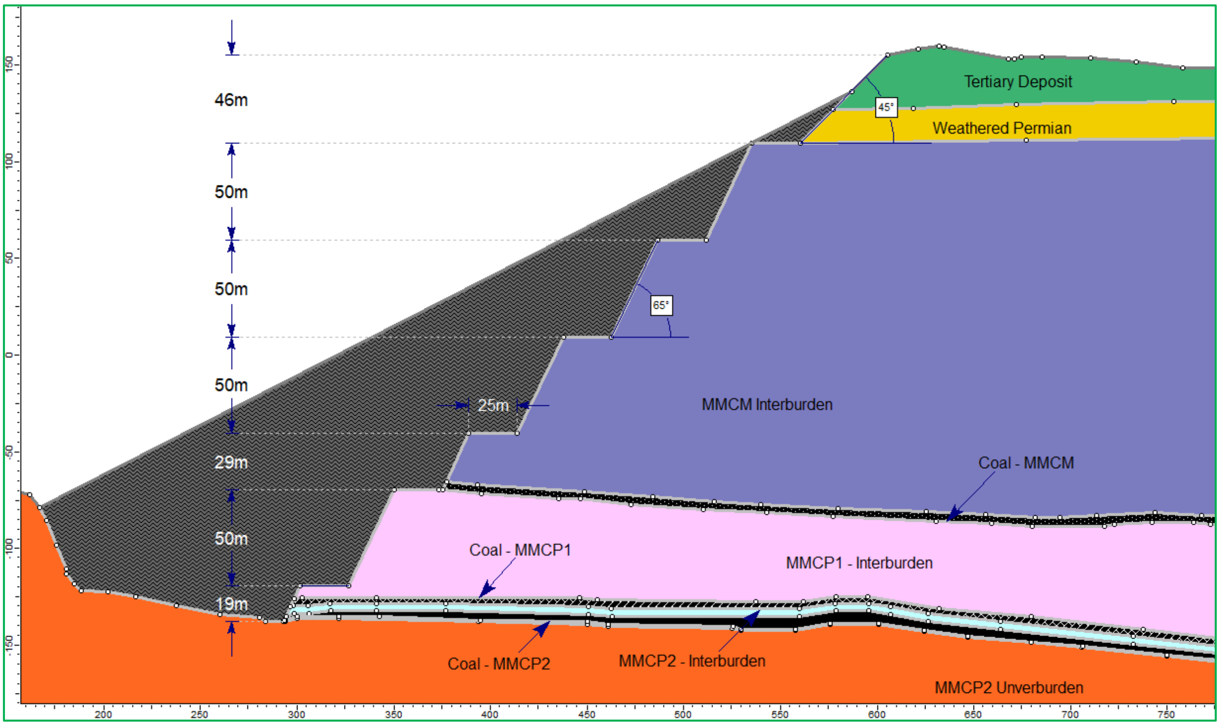


Figure 4 Dozer pushed slope geometry at Southern Void

3.4.4 Tertiary Deposit - Design

A desktop study of the Northern and Southern Voids shows that the tertiary deposit is predominantly about 30 m thick below ground level. However, midway west of the Northern Void shows Tertiary deposit depth of up to 45 m below ground level. Both cases were analysed with corresponding degrees of overall slope cut angles, as shown in Figure 6 and Figure 7.

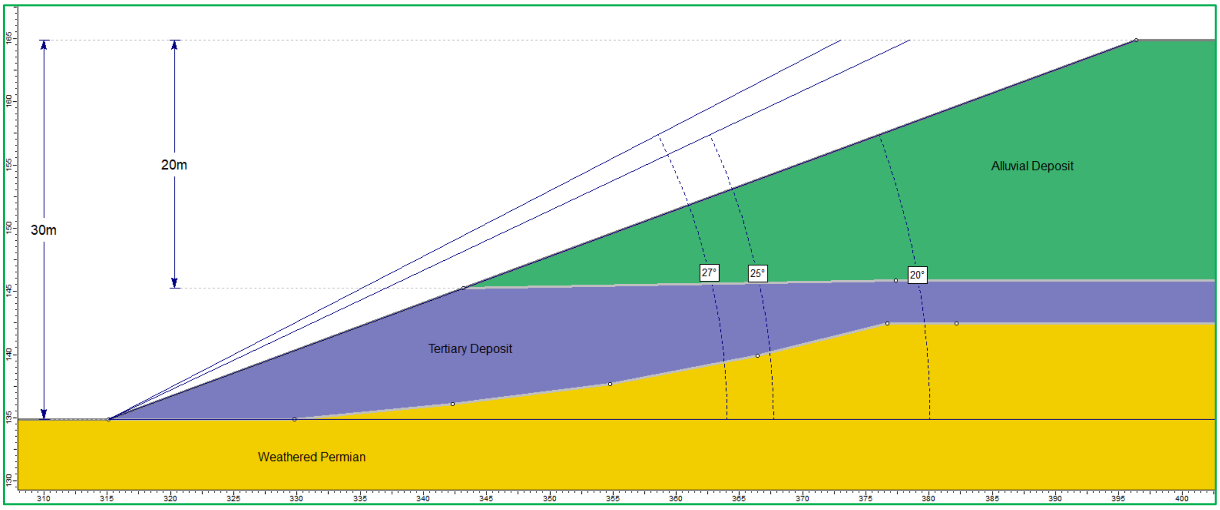


Figure 5 Schematic showing tertiary deposit of 30 m thick profile with various overall slope cut angles

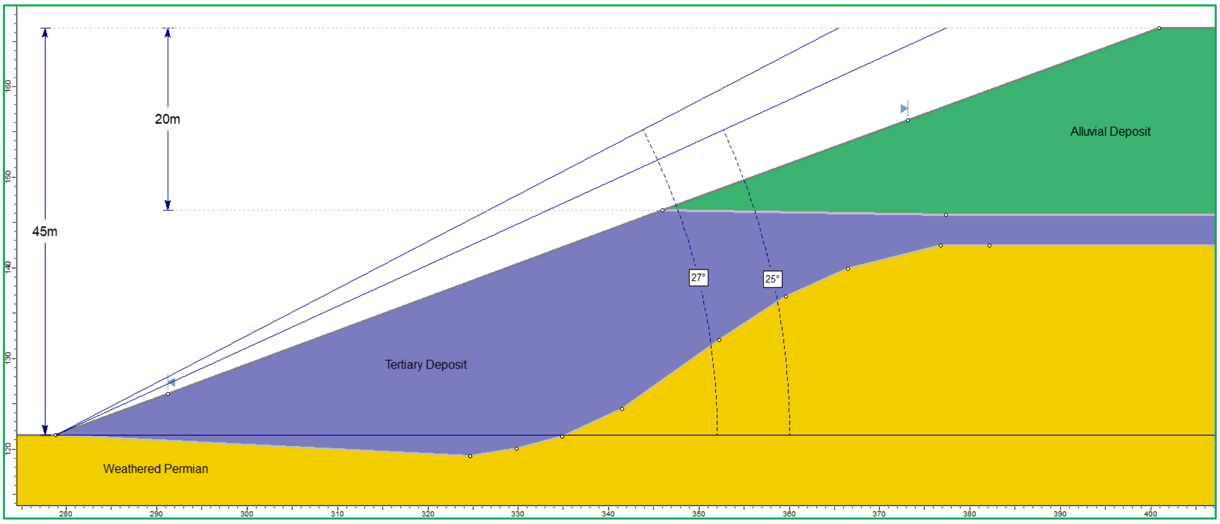


Figure 6 Schematic showing tertiary deposit of 45 m thick profile with various overall slope cut angles

3.5 Limit Equilibrium Analysis

Limit equilibrium analyses were undertaken on the Northern and Southern Highwalls and lowwalls. Stability analysis was undertaken using Rocscience Slide2 2019.011. Spencer and Morgenstern-Price methods were adopted as the most appropriate for the highwalls whereas, the Sarma nopn-vertical slices search function was adopted for the lowwalls.

As part of the progressive reharbitation and closure plan (PRCP), geotechnical analysis is required to ascertain the minimum required factor of safety (FoS) of 1.5.

3.5.1 Northern Void

3.5.1.1 Highwalls

Stability analyses have been carried out with the consideration of a possible deep-seated failure through the Yarrabee Tuff floor. Failures through the coal seam floors were also analysed. Two cross-section were taken along the highwall in the Northern Void as per Figure 8.

To validate the results, the 'line-of-thrust' (LOT) was calculated and assessed. The calculated LOT should be just above the failure surface, about one-third the height of the analysed slice. If the LOT does not satisfy this condition by being above the topographic surface or below the failure surface, the failure surface is considered invalid. The introduction of a tension crack is the most common method to improve the validity of the surface, but where a valid surface cannot be obtained, the Janbu method is adopted, which is considered more conservative than the Morgenstern-Price or Spencer methods.

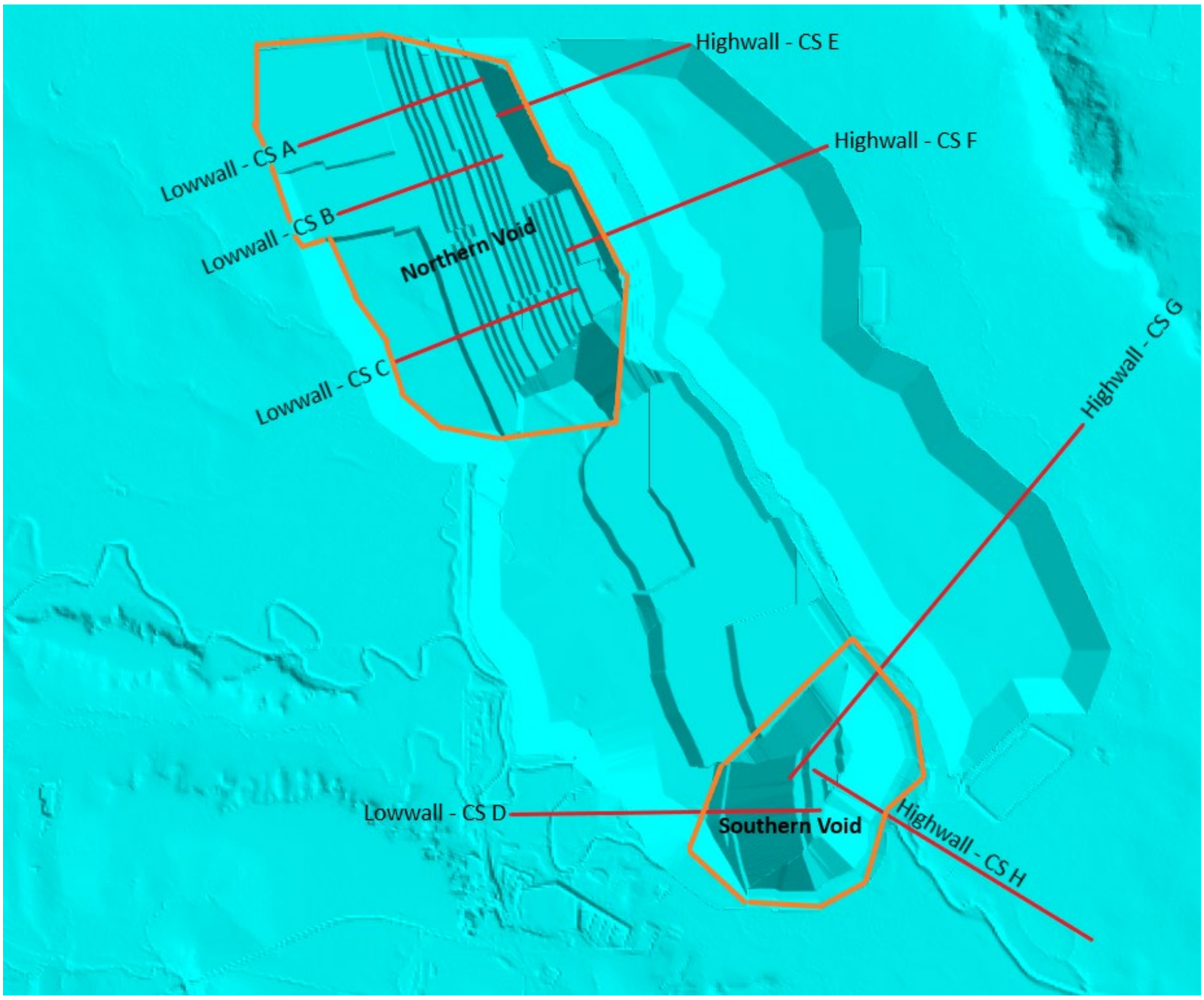


Figure 7 Plan layout showing the location of cross-section for each void

3.5.1.2 Lowwalls

Stability analysis for the Northern Void lowwalls were undertaken to understand the influence of floor cut angle on potential failure mechanisms. Four cross-sections were cut through the lowwalls, refer to Figure 8.

The Sarma non-vertical slice method was used to conduct the limit equilibrium analysis. This method is recommended for lowwall analysis as it mimics the non-vertical slice boundaries that are observed in actual failures (Simmons & McManus, 2004). In addition, the User Defined, Bi-section option was used to define the slice angles. Finally, for the models, a Block Search Polyline was defined to perform a non-circular slip surface search along a known weak layer whereby the failure must occur at set angles. The entry angle was set between 61-64°.

To validate the results, the base normal stress along the slices was calculated and assessed. Negative values indicate that the model is not fully resolved and that the results are invalid. If negative values are produced by the model, tension cracks will be added to the models to resolve the negative normal stress. The model will be re-run and the same process repeated until the results are valid.

3.5.2 Southern Void

3.5.2.1 Highwalls

Two cross-sections were taken in the Southern Void, as shown in Figure 8. The procedure described in Section 3.5.1.1 was adopted in carrying out the stability analysis.

3.5.2.2 Lowall

One cross-section was taken along the lowwall in the Southern Void for stability analysis (Figure 8). The analysis conducted was similar to that described in Section 3.5.1.2.

3.5.3 Summary of Results

3.5.3.1 Northern Void

A summary of the calculated FoS for each scenario and failure mechanism is provided in Table 2. A screenshot of the model with the lowest FoS (Highwall - CS F)) showing the global failure mode is presented in Figure 9. A copy of all results outputs is attached in Appendix A.

The results indicate that all calculated FoS is greater than equal to 1.50.

Table 2 Summary of calculated Factors of Safety for the Northern Void Highwalls and Lowwalls

Wall Type	Cross-section ID	Scale	Search Method (Cuckoo function)	Recommended Minimum (FoS)	FoS
Lowwall	CS - A	Global	Sarma	1.5	1.9
Lowwall	CS - B		Sarma		1.5
Lowwall	CS - C		Sarma		2.5
Highwall	CS - E		Spencer		2.0
			GLE/ Morgenstern- Price		2.0
Highwall	CS - F		Spencer		1.4
			GLE/ Morgenstern- Price		1.5

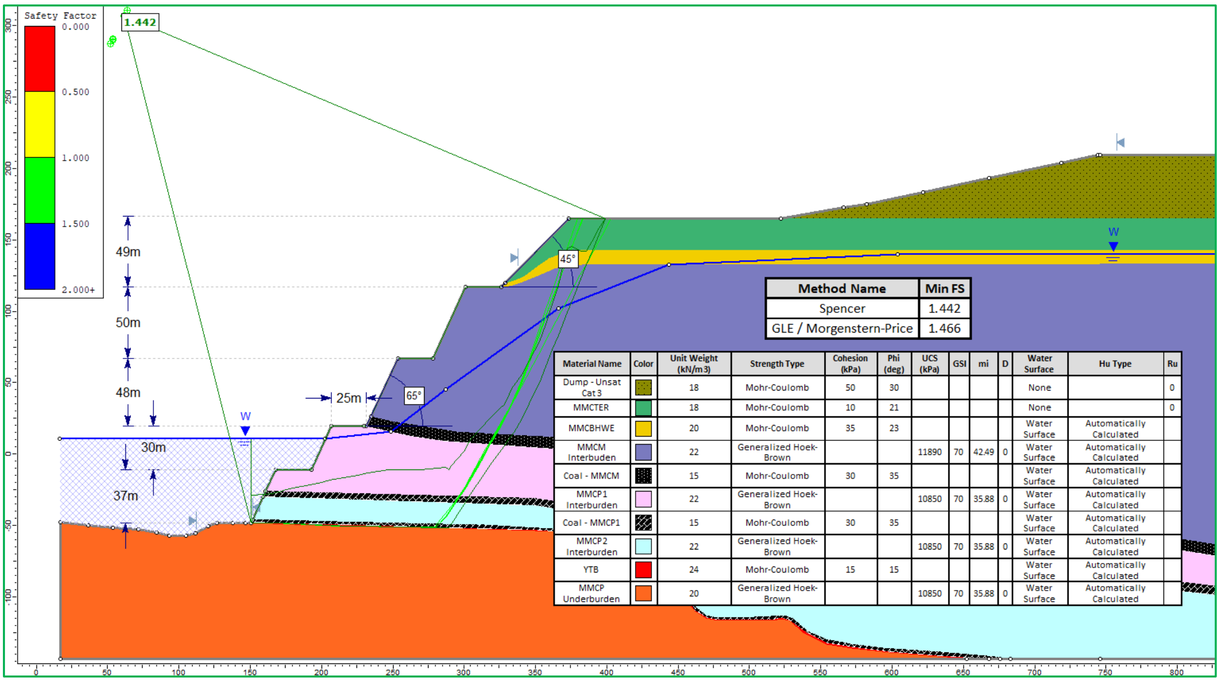


Figure 8 Screenshot of global failure results with 65° cut slope geometry showing failure surfaces with FoS ≥ 1.5 – Cross-section F; Highwwall.

3.5.3.2 Southern Void

A summary of the calculated FoS for each scenario and failure mechanism at the Southern Void is provided in Table 3. The detailed limit state analyses output is attached in Appendix A. A screenshot of the model with the lowest FoS (Lowwall - CS D) showing the global failure mode is presented in Figure 10.

The results indicate that not all calculated FoS is greater than equal to 1.50.

Table 3 Factors of Safety (FoS) for the Southern Void highwalls and lowwall

Wall Type	Cross-section ID	Design	Scale	Search Method (Cuckoo function)	Recomm. Min. (FoS)	FoS
Lowwall	CS - D	NA	Global	Sarma	1.5	1.5
Highwall	CS – G	Intact		GLE/ Morgenstern- Price		1.7
				Spencer		1.6
Highwall	CS – H	Intact		GLE/ Morgenstern- Price		1.6
				Spencer		1.6
Highwall	CS - G	Dozer Pushed		GLE/ Morgenstern- Price		1.4
				Spencer		1.4
Highwall	CS - H	Dozer Pushed		GLE/ Morgenstern- Price		1.3
				Spencer		1.3

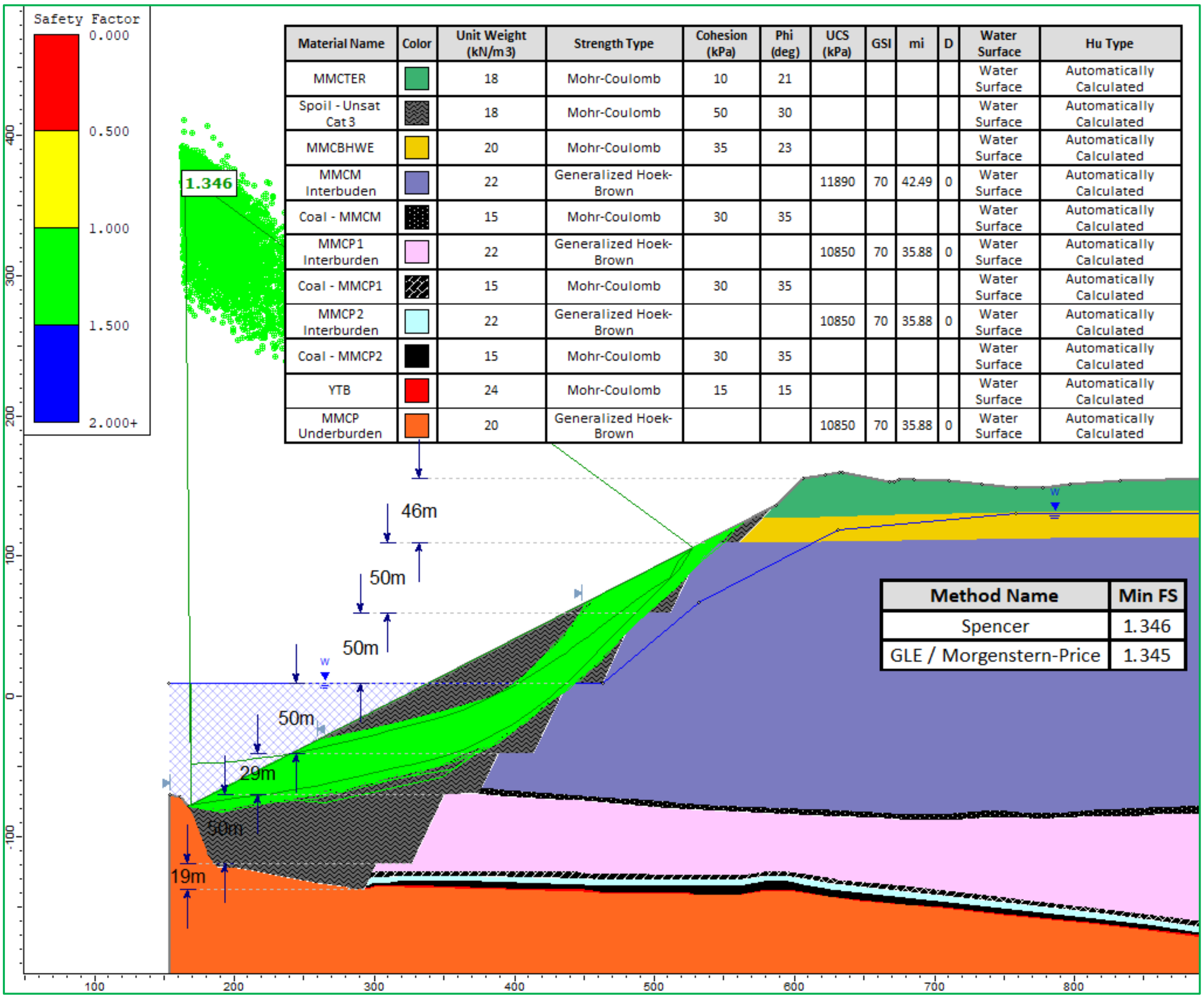


Figure 9 Screenshot of global failure result for the original design highwall slope in the Southern Void with FoS < 1.5 - Section H.

3.5.3.3 Tertiary Slope Design

This study re-evaluated the design for the Tertiary deposit within the Northern and Southern Voids. This re-evaluation allows for stability analyses to be carried out and the subsequent assessment of new slope geometries.

Stability analyses of the new tertiary materials at thicknesses of 30 m and 45 m were carried out. It is assumed that below 45 m depth, fresh Permian aged material will be present.

The results of the various stability analyses in terms of Factor of Safety (FoS) are presented in Table 4 below.

Table 4 Factors of Safety (FoS) for global stability of the surficial soils

Tertiary Thickness (m)	Overall Slope Angle within the Tertiary (deg)	Search Method (Cuckoo function)	Recommended Minimum (FoS)	Achieved FoS - SWL @ 15m bgl	Achieved FoS - SWL @ 20m bgl
30	20	Spencer	1.50	1.5	1.7
		GLE/Morgentern-Price		1.5	1.7
45		Spencer		1.3	1.5
		GLE/Morgentern-Price		1.3	1.5
30	25	Spencer		1.4	1.5
		GLE/Morgentern-Price		1.4	1.7
45		Spencer		1.3	1.5
		GLE/Morgentern-Price		1.3	1.5
30	27	Spencer		1.4	1.6
		GLE/Morgentern-Price		1.4	1.6
45		Spencer		1.2	1.4
		GLE/Morgentern-Price		1.2	1.4

3.6 Recommended Slope Geometry

The results indicate that the intact slopes return a higher FoS than the blasted and flattened slopes, which do not satisfy the minimum FoS requirements. This is expected as the blasted and dozed material will settle and consolidate and variable load conditions, e.g. changes in water level. As discussed in Section 3.1, geotechnical highwall failures in coal measure rocks are predominantly controlled by geological structure. Therefore, where no unfavourable geological structure occurs, then the intact slope will perform adequately in the long-term.

The recommended slope geometries for highwalls and lowwall is provided in Table 5 and Table 6.

Table 5 Recommended slope geometry for the final voids

Material	Overall Slope Angle (°)	Bench Height (m)	Berm Width (m)	Batter Angle (°)
Surficial Soils	20	NA	NA	NA
Weathered Permian	NA	30	25	55
Fresh Permian	NA	60	60	60

Table 6 Recommended slope geometry for lowwalls

Material	Overall Slope Angle (°)~	Max. Bench Height (m)	Berm Width (m)*	Batter Angle (°)
Lowwall CAT3 Spoil	27	40	12 to 25	37

~This is the maximumOSA allowed for lowwall designs

*The bench geometries maybe changed to satisfy the OSA, this include bench height and berm width

4 Discussion

4.1 Structural Geology Complexity

As discussed in Section 3.1, the site is structurally complex due to the proximity to the regional scale Jellinbah fault. The structural geology model is updated annually as part of the mid-term design process. Current there is little structural geology data for the final void areas. Therefore, recommendations for the suitable final void design should be updated as additional data become available.

It is recommended that targeted geotechnical investigations be undertaken to acquire structural geology data. These investigations should include Acoustic Televiewer (ATV) and Optical Televiewer (OTV) scans to obtained oriented core data. Seam and cross-section analyses can be updated as additional resource drilling occurs in these areas to increase the drill hole density.

4.2 Surface Water Management

Management of surface water is critical in preventing ponding water near slope crests. Ponding facilitates the infiltration of meteoric waters into the subsurface, resulting in slope instability within the surficial soil units (e.g. Tertiary clays and Alluvium) due to the temporary reduction of shear strength of the critical unit.

Sloughing failures are shallow surficial failures caused by saturation of these layers due to rainfall. Construction of surface water drainage is critical to reducing the likelihood that such failures will occur by reducing the volume of water moving across the slopes.

Surface water management is critical to ensure the long-term stability of the soil slope and minimisation of erosion and deterioration of the slope condition.

5 Recommendations

Based on the above results and discussion, the following recommendations are provided:

- For future geotechnical and geological drilling campaigns, target select boreholes near the final voids to collect structural geology information (e.g. ATV and OTV scans) and increase resource drilling density.
- Update structural geology model for the pit shells as new data becomes available.
- Update geotechnical model based on new structural model and carry out stability analyses of the highwalls and lowwalls.
- Monitor groundwater levels in the vicinity of the Northern and Southern Voids.
- Develop a surface water management plan to ensure water is not allowed to pond on or near final void crests and drainage on the slope face prevents scour.

6 Conclusion

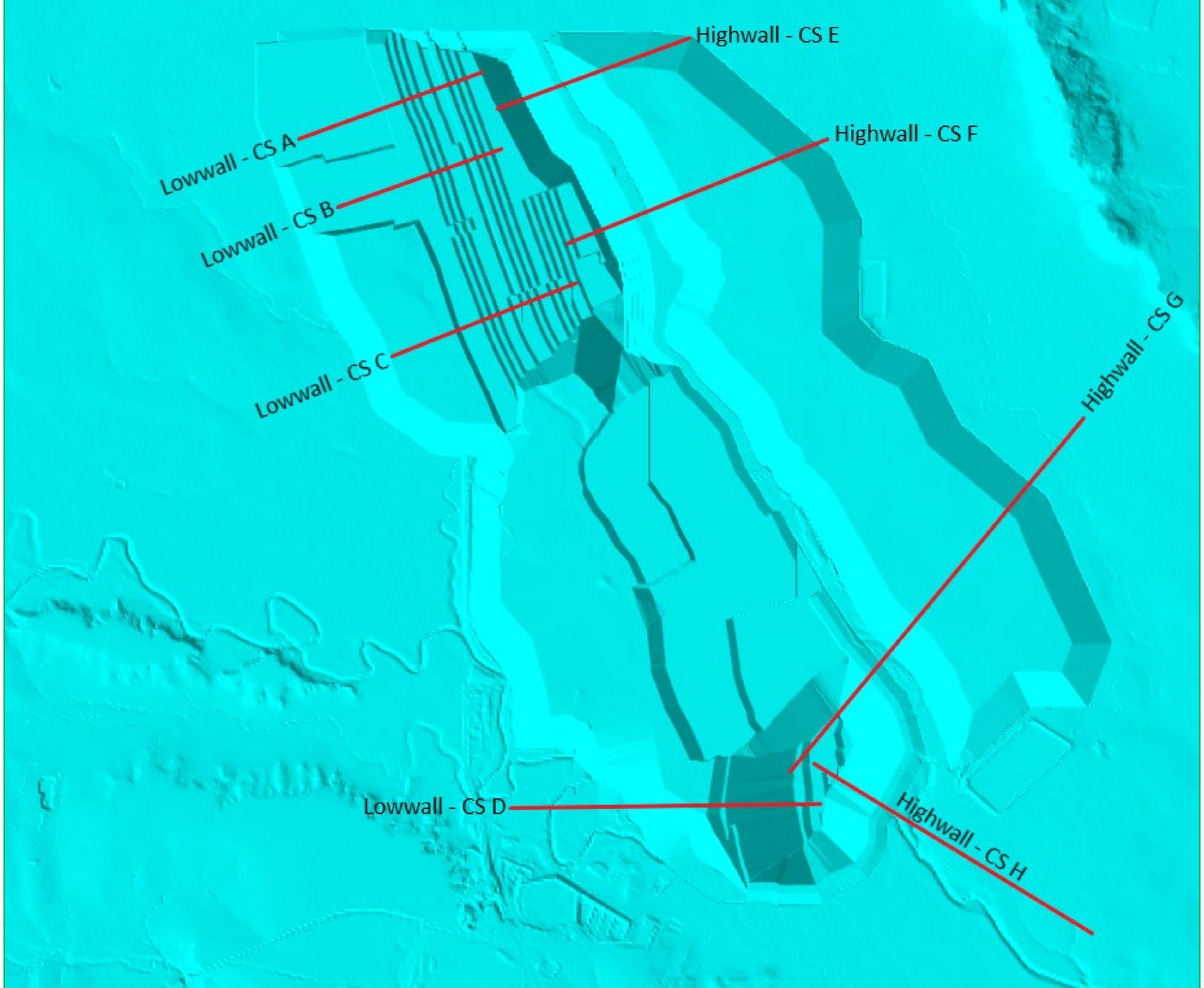
The results indicate that the intact pit slope is suitable for the final void where no unfavourably oriented structure exists. The current mid-term geotechnical design process at Middlemount will provide updates to the structural geology model to improve confidence in the model and confirm the suitability of adopting intact walls prior to the final void exposure.

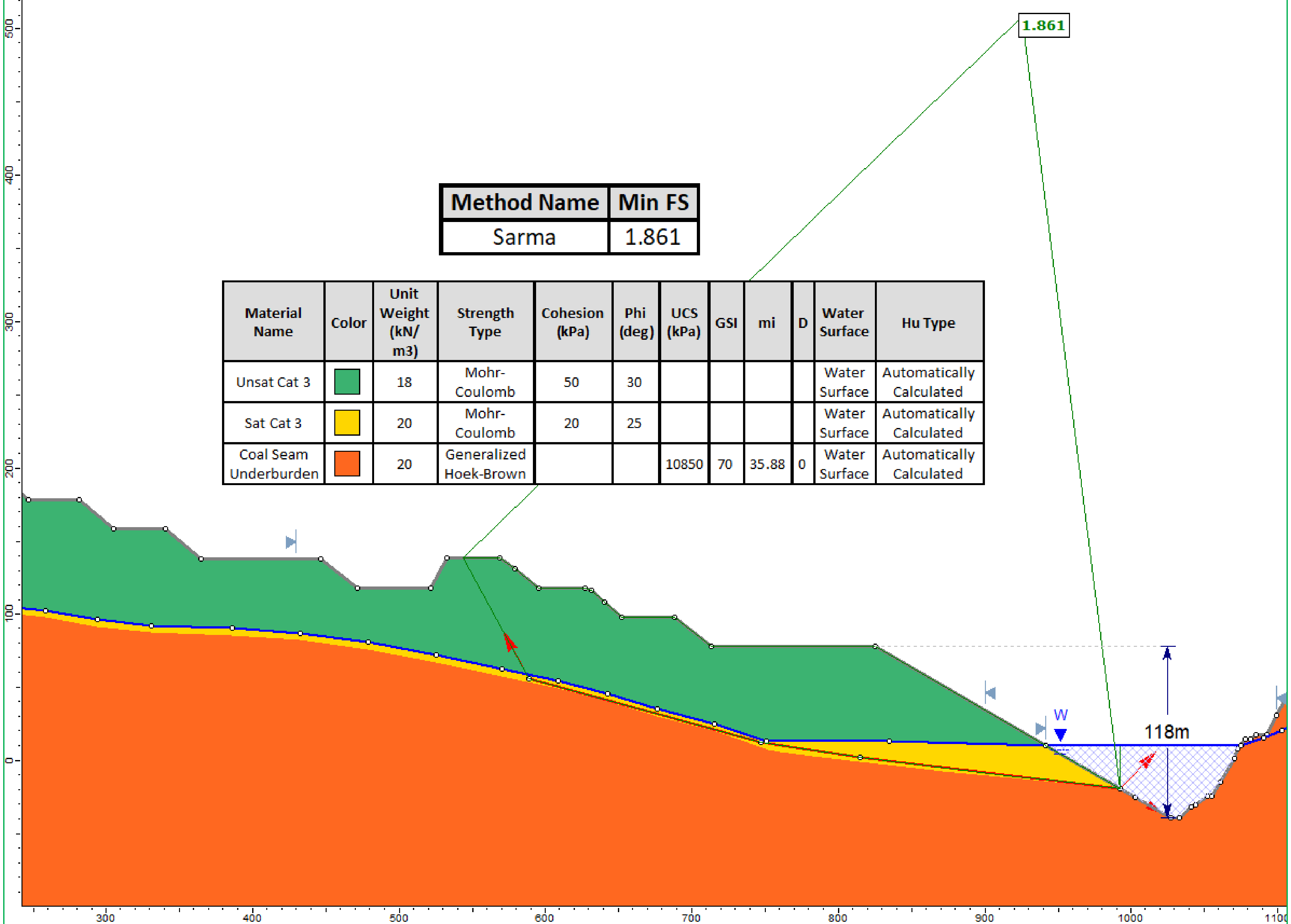
TheOSA in the alluvium needs to be reduced to 20^{o} due to the thickness of soils and groundwater level. Surface water management will also be critical in managing the stability of the soils slopes in the final void.

Appendix A: Limit Equilibrium Slope Stability Analyses Results

Lowwall

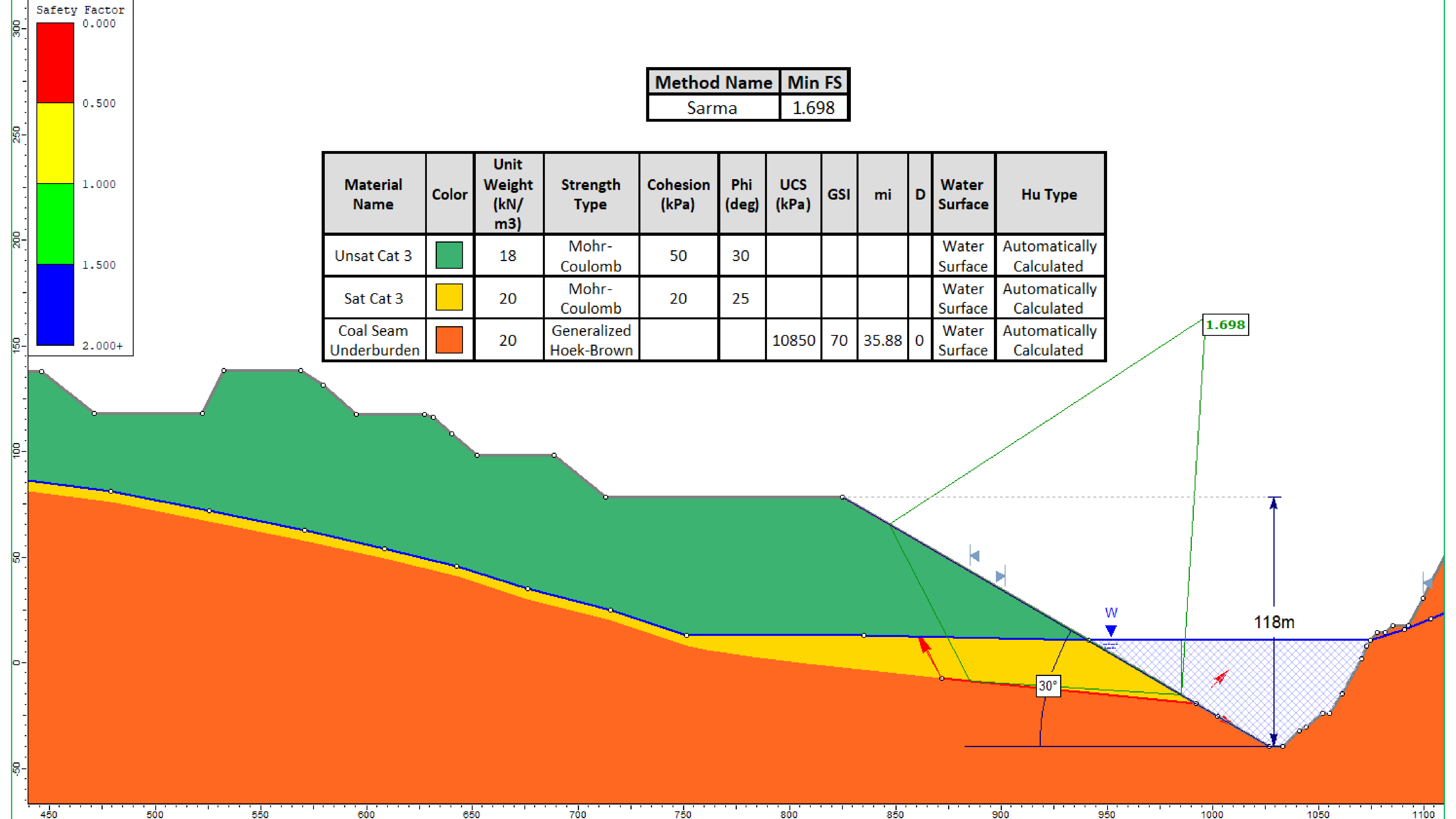
Cross Section A


Highwall - CS E
Highwall - CS F
Lowwall - CS A
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H



Method Name	Min FS
Sarma	1.861

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

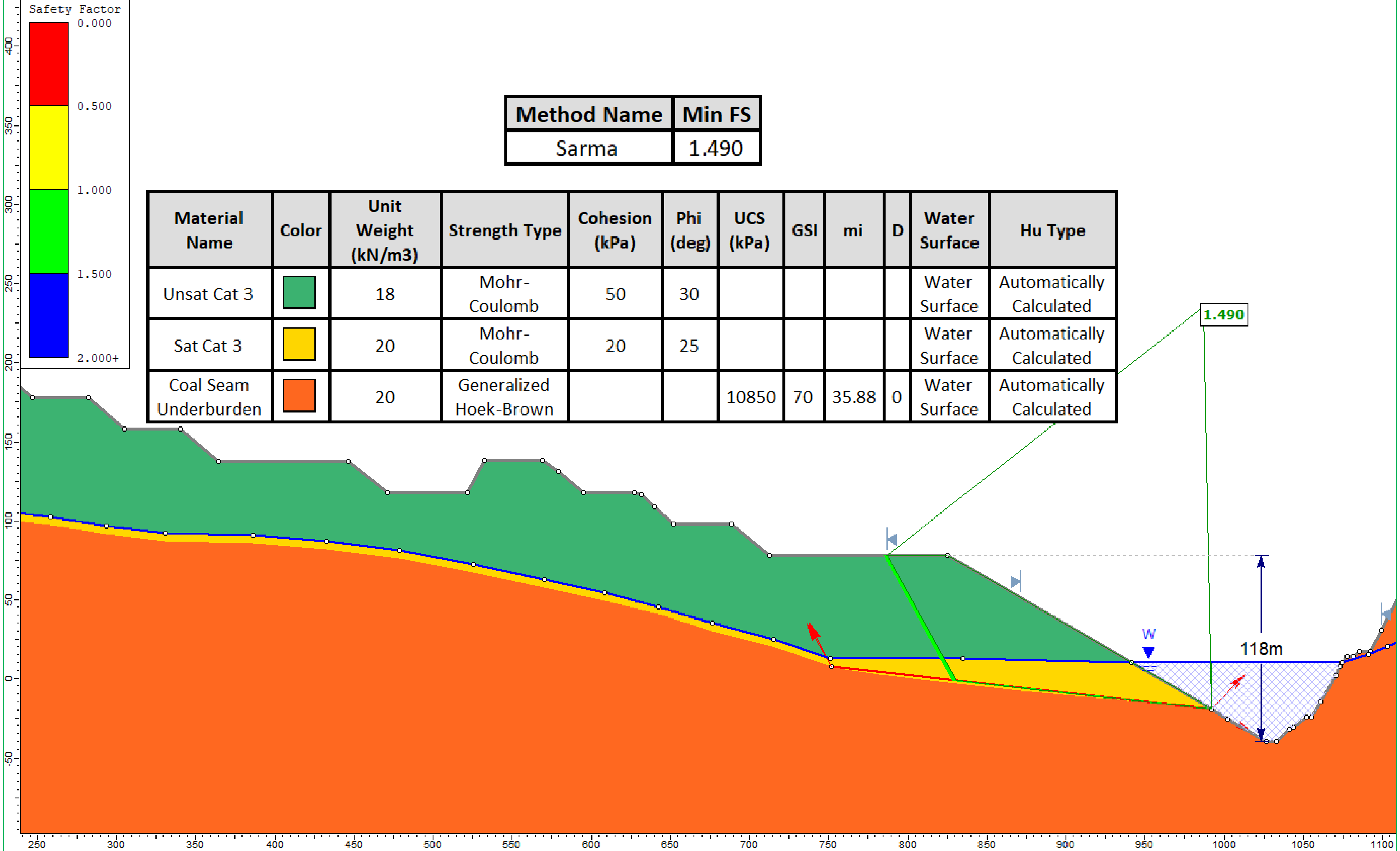


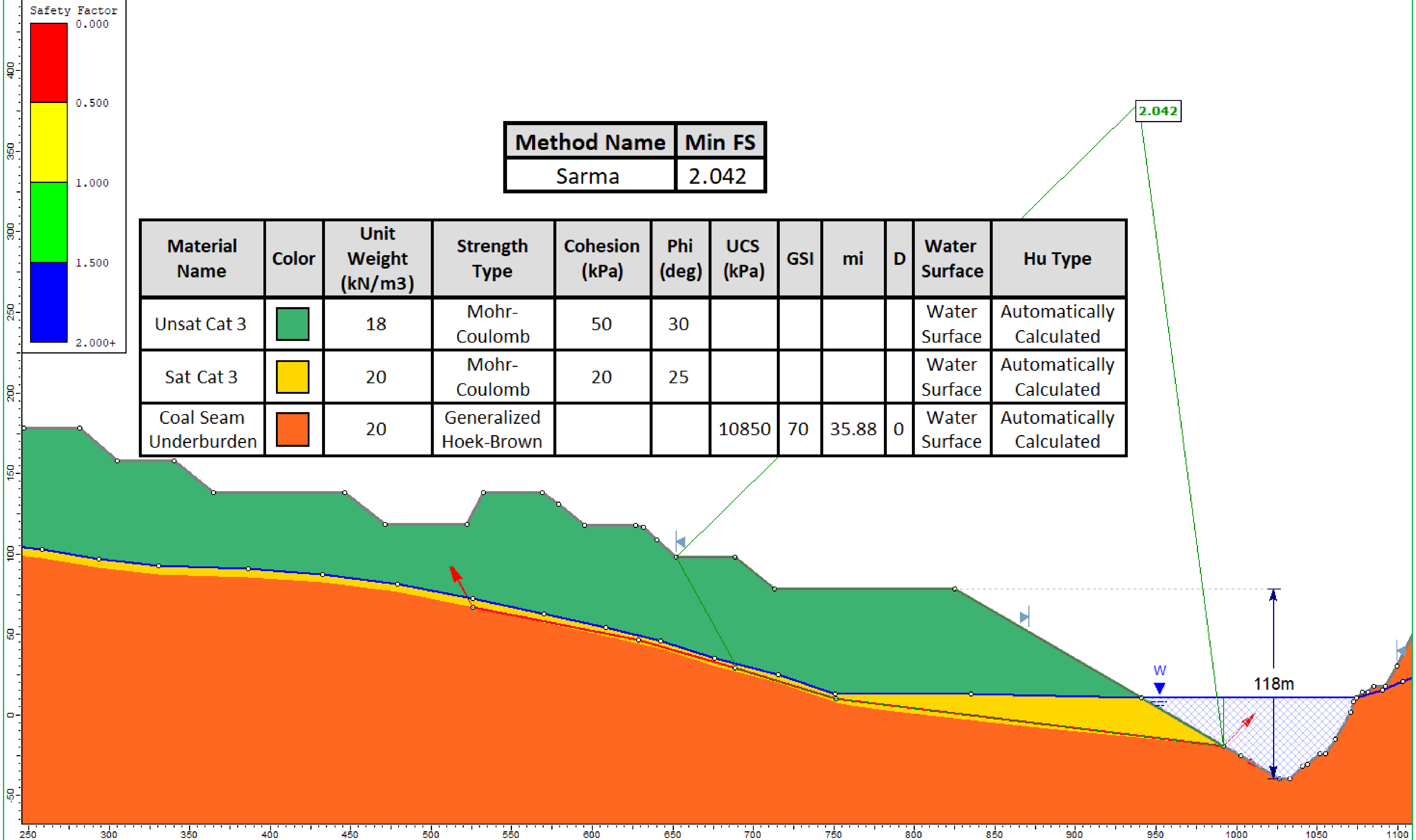
Method Name	Min FS
Sarma	1.698

Material Name	Color	Unit Weight (kN/ m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Sarma	1.490

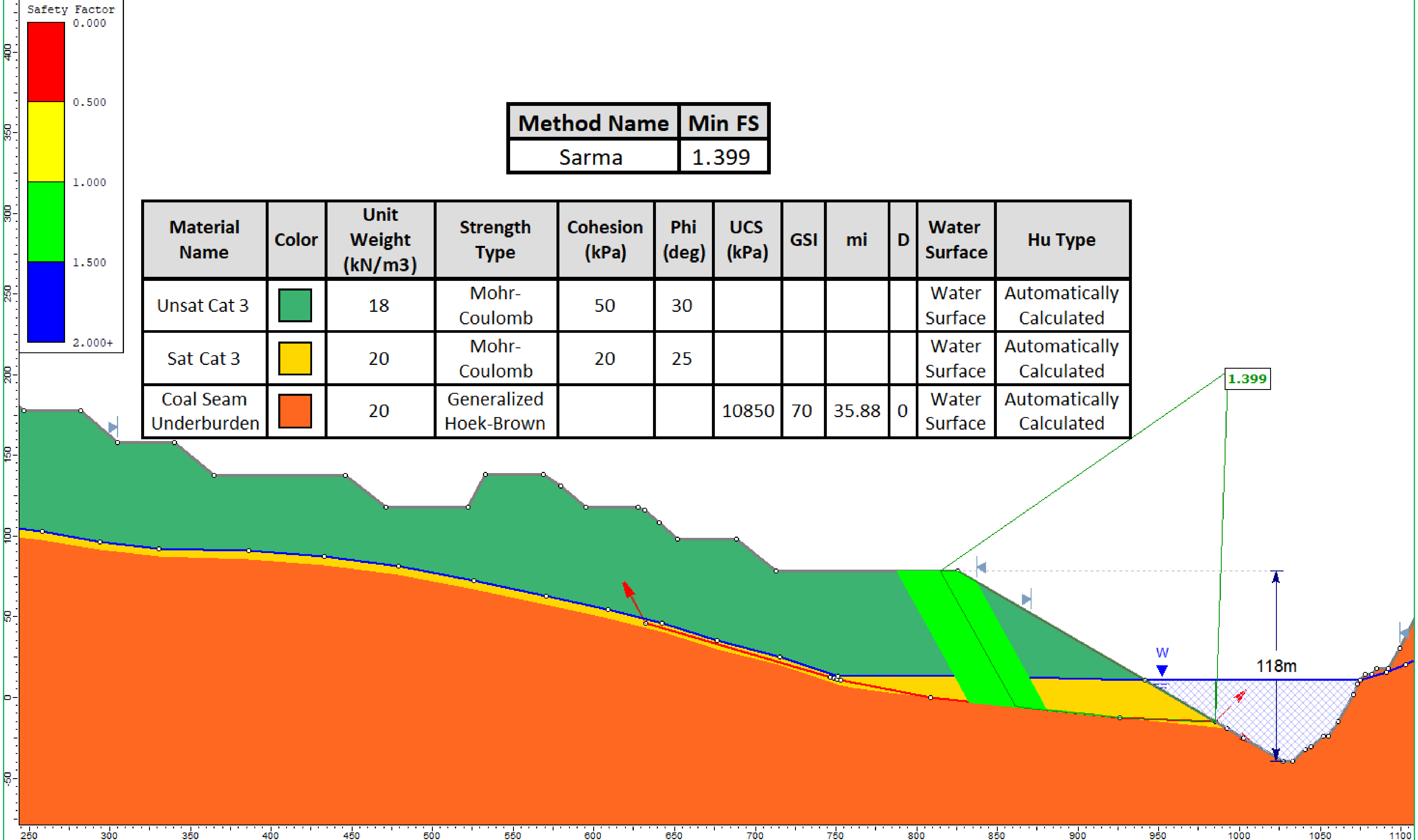
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated





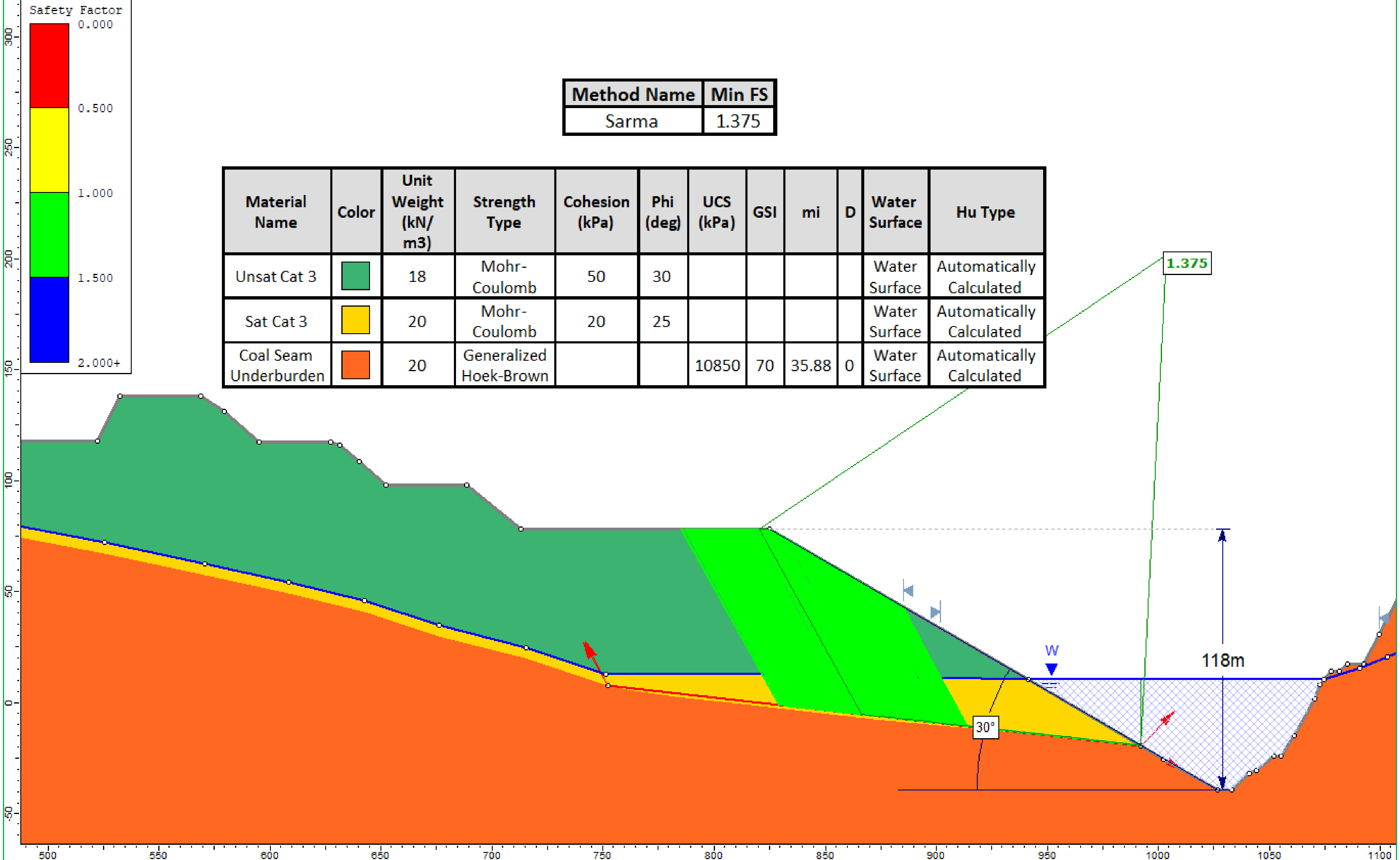
Method Name	Min FS
Sarma	2.042

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated



Method Name	Min FS
Sarma	1.399

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

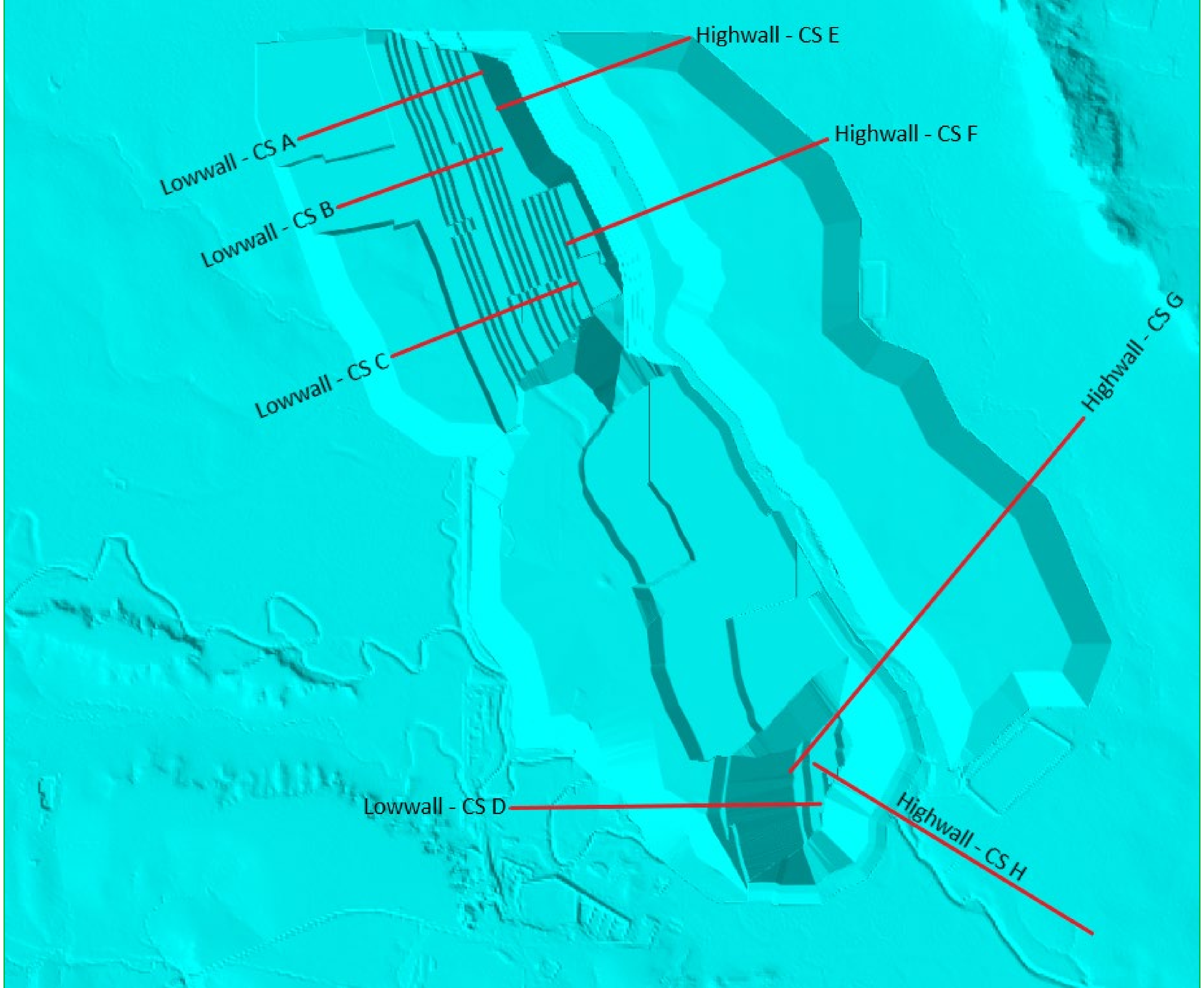


Method Name	Min FS
Sarma	1.375

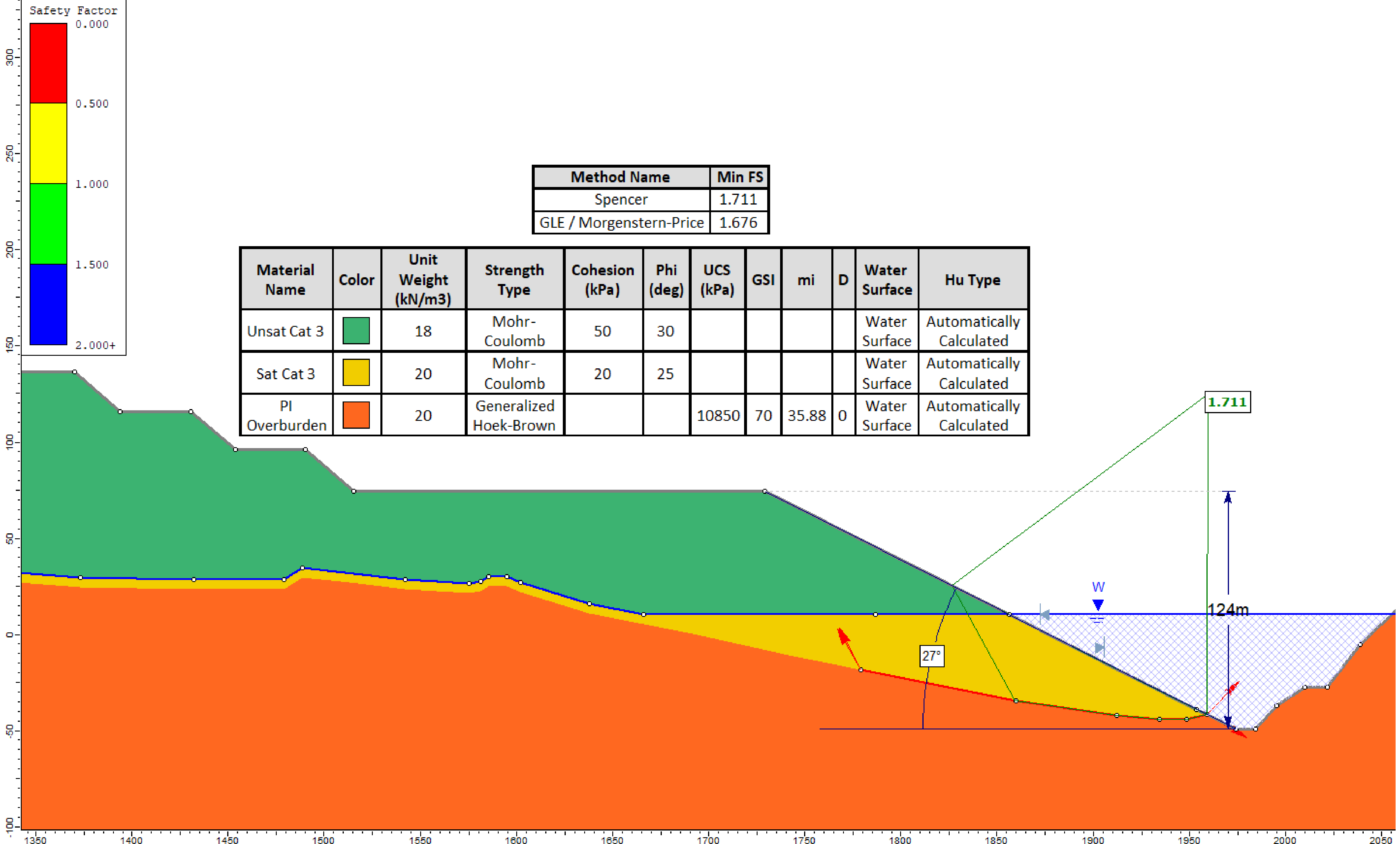
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
Coal Seam Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Lowwall

Cross Section B

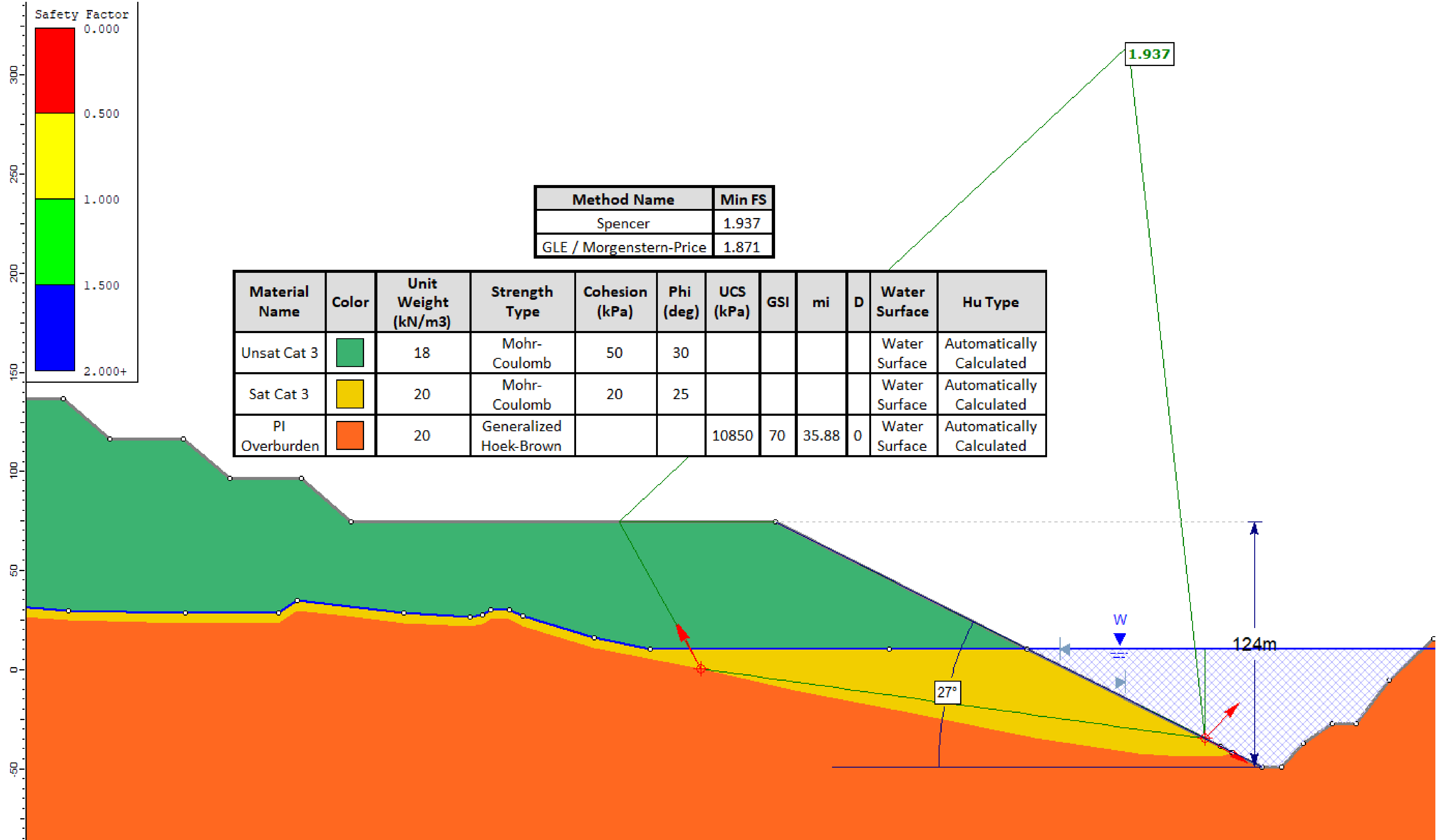


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Highwall - CS G
Lowwall - CS C
Lowwall - CS D
Highwall - CS H



Method Name	Min FS
Spencer	1.711
GLE / Morgenstern-Price	1.676

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
PI Overburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated



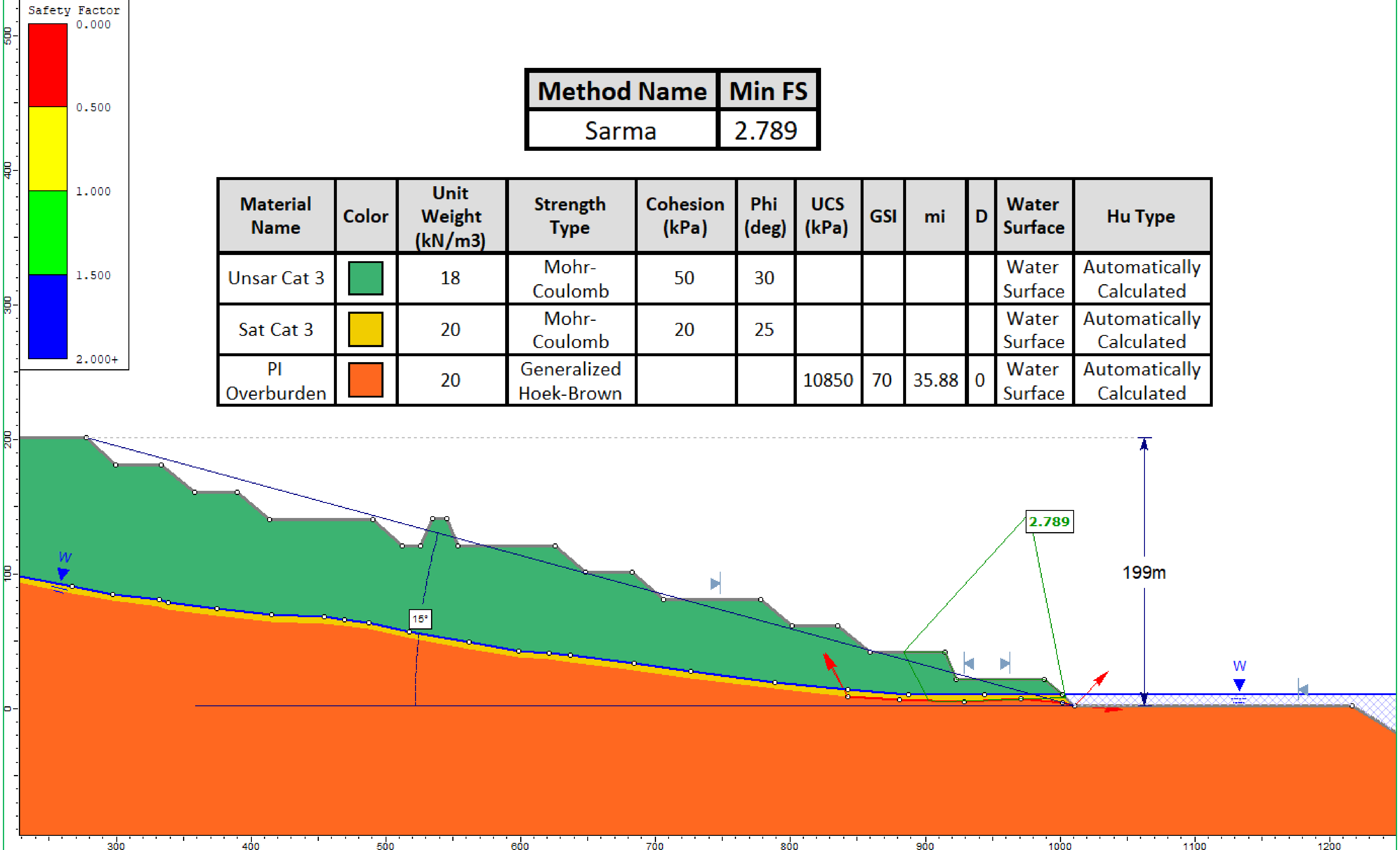
Method Name	Min FS
Spencer	1.937
GLE / Morgenstern-Price	1.871

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
PI Overburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Lowwall

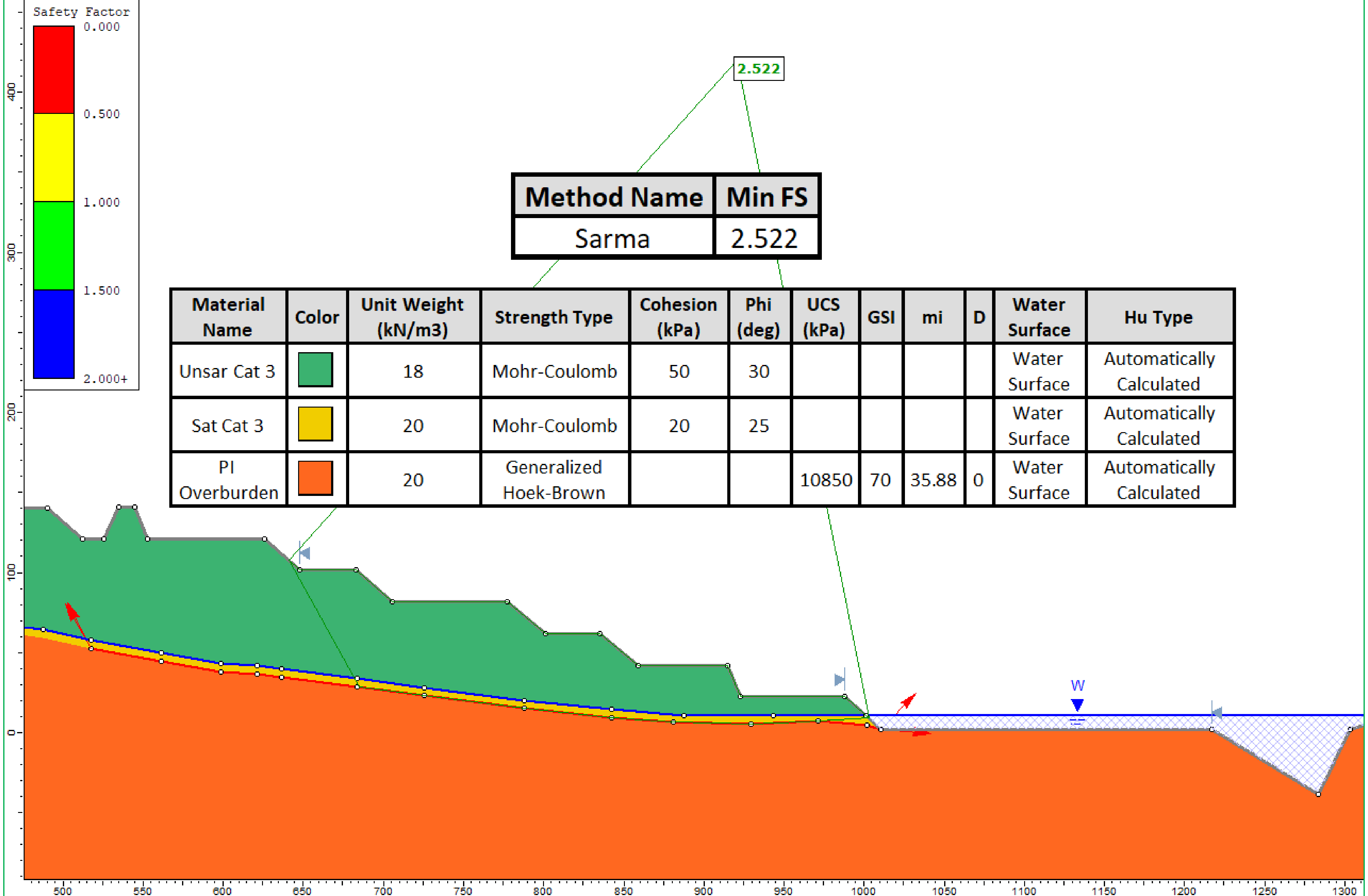
Cross Section C


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H



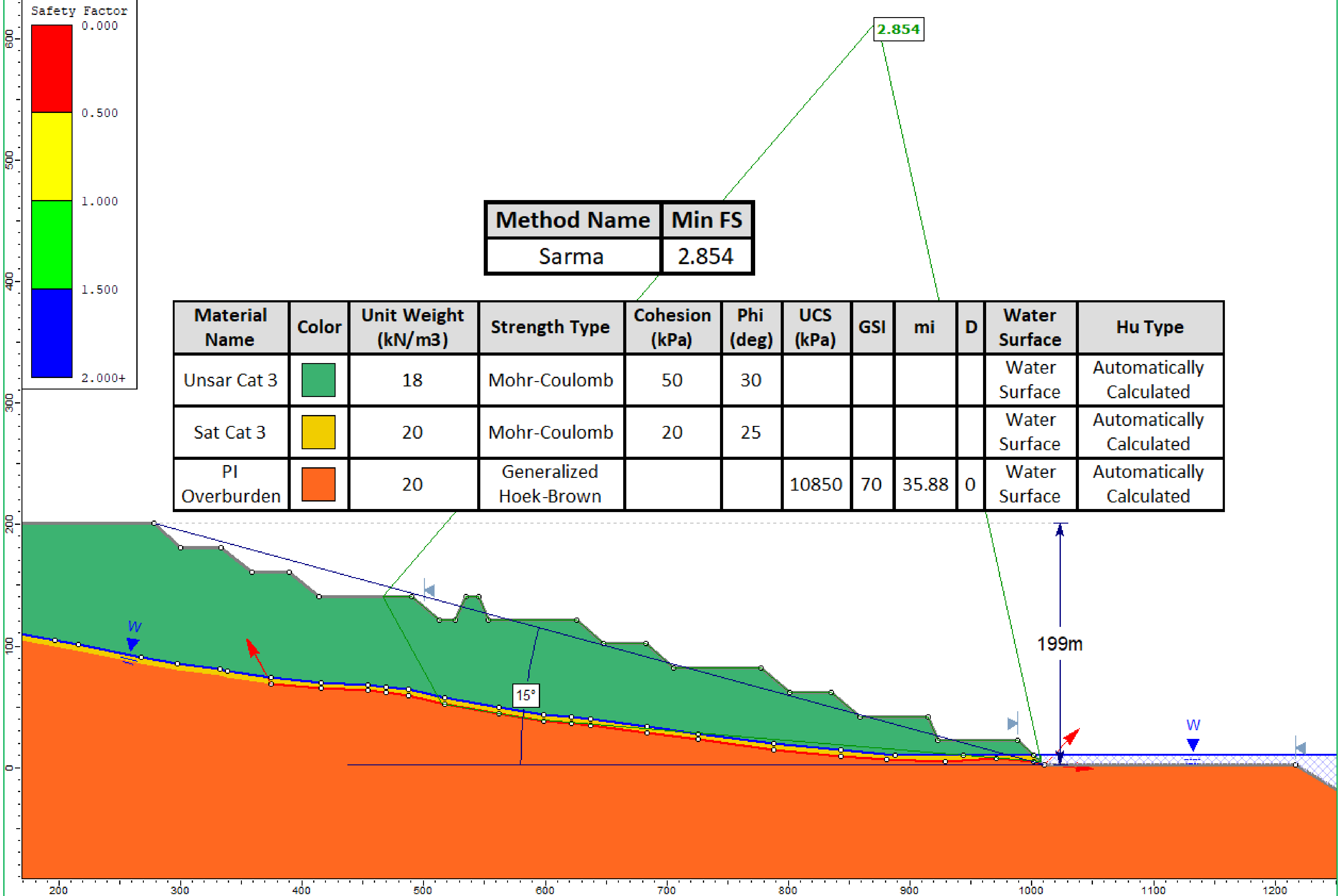
Method Name	Min FS
Sarma	2.789

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsar Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
PI Overburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated



Method Name	Min FS
Sarma	2.522

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsar Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
PI Overburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated



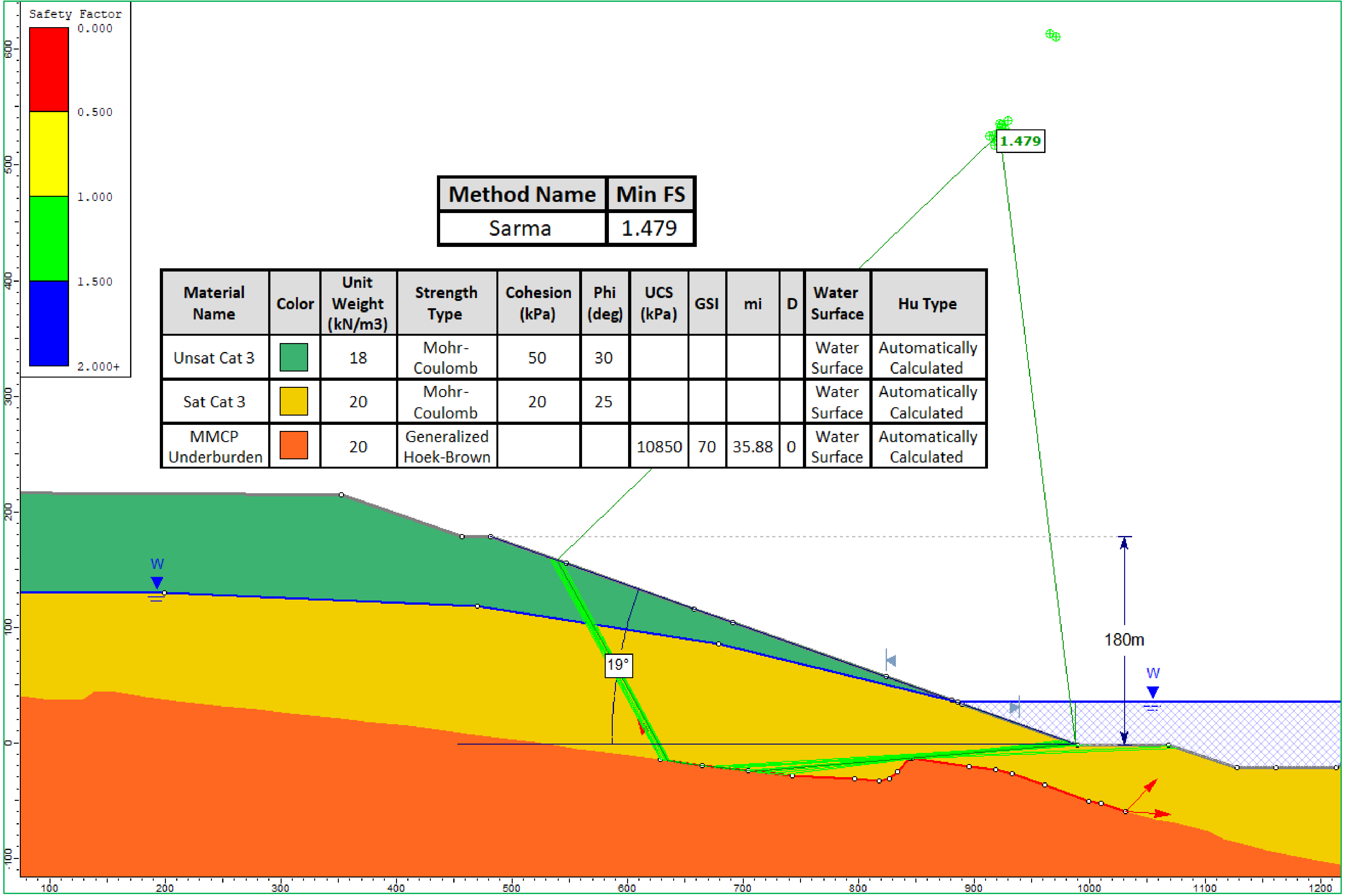
Method Name	Min FS
Sarma	2.854

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsar Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
PI Overburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Lowwall

Cross Section D


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H

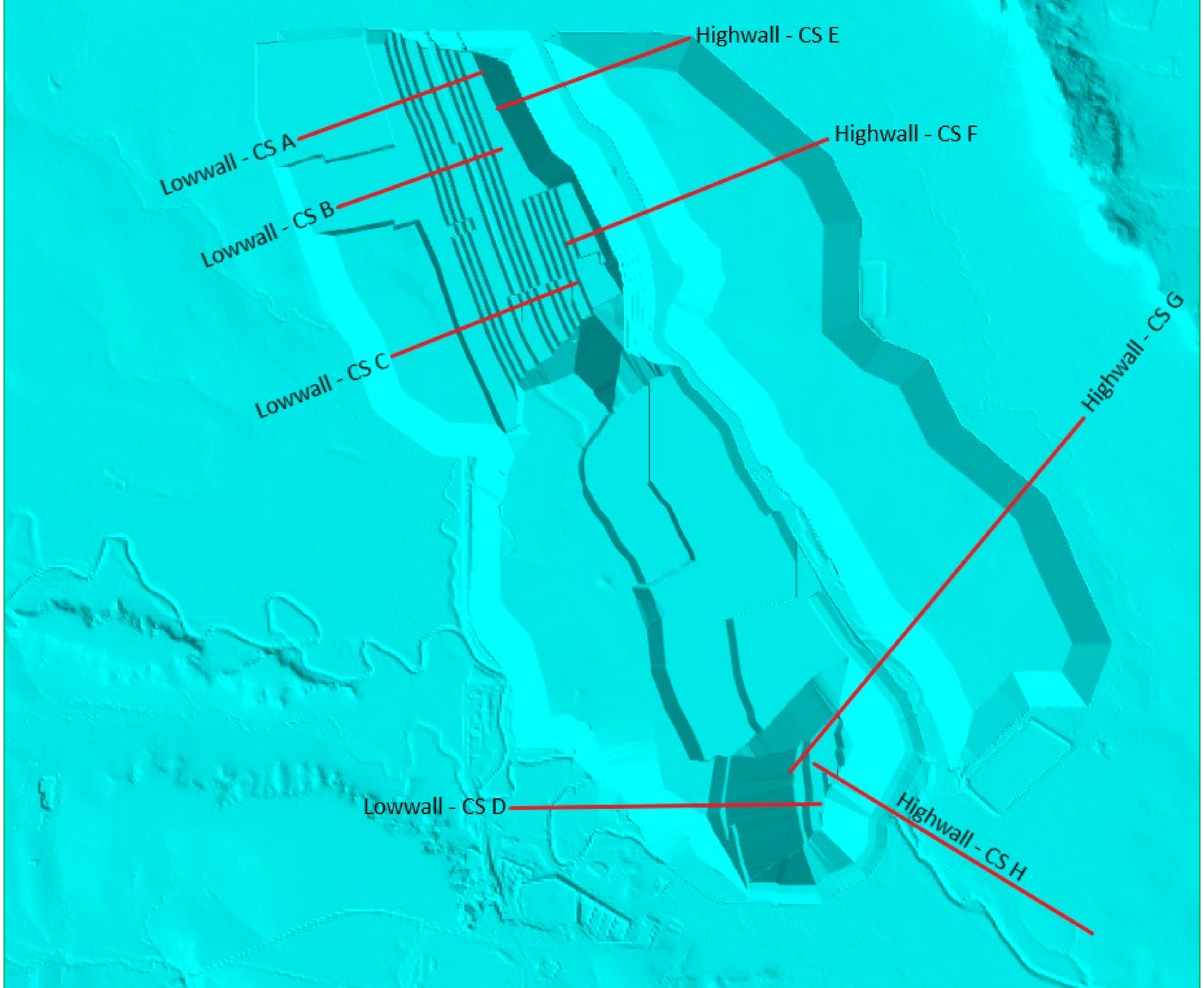


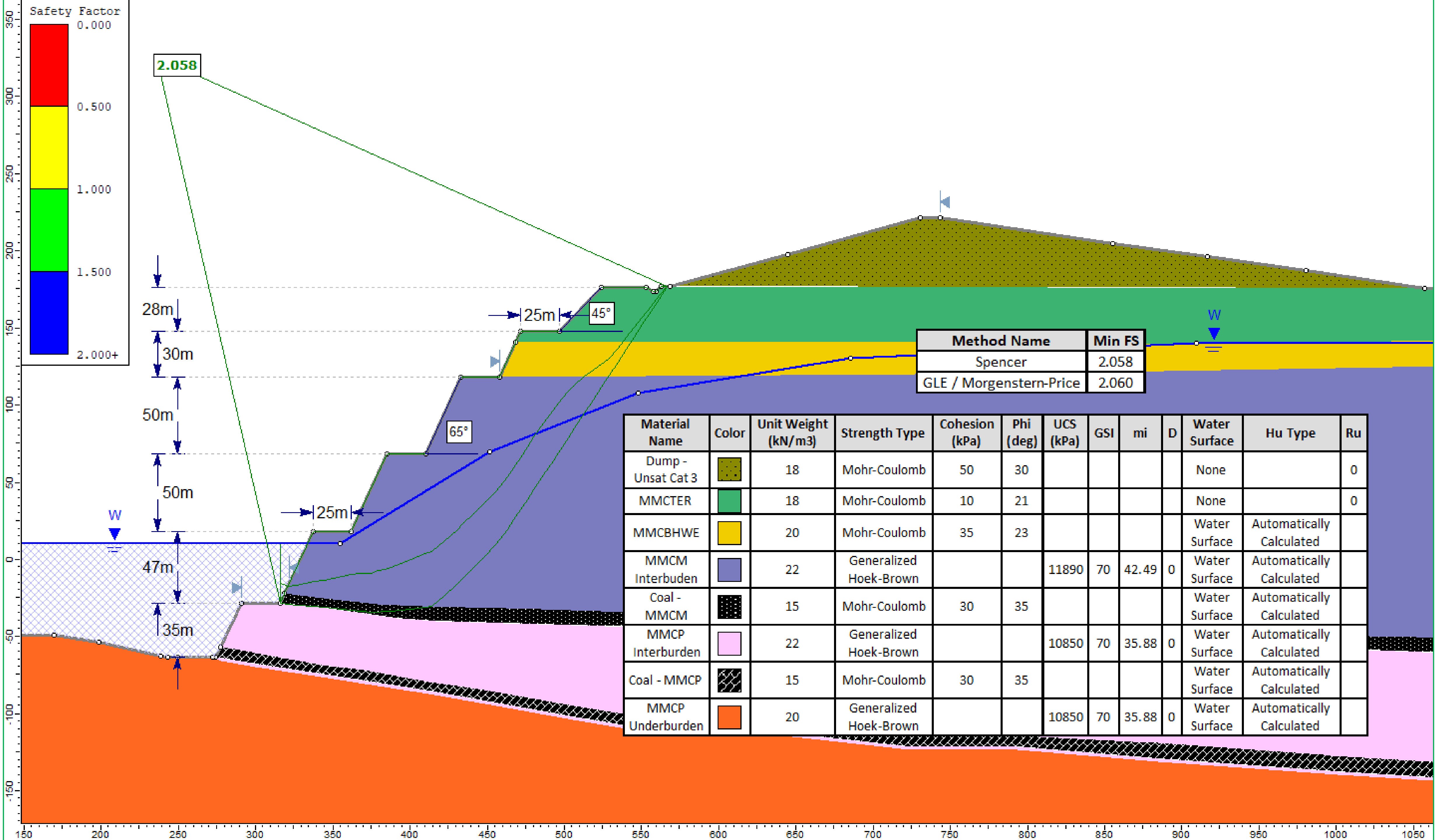
Method Name	Min FS
Sarma	1.479

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
Sat Cat 3		20	Mohr-Coulomb	20	25					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Highwall

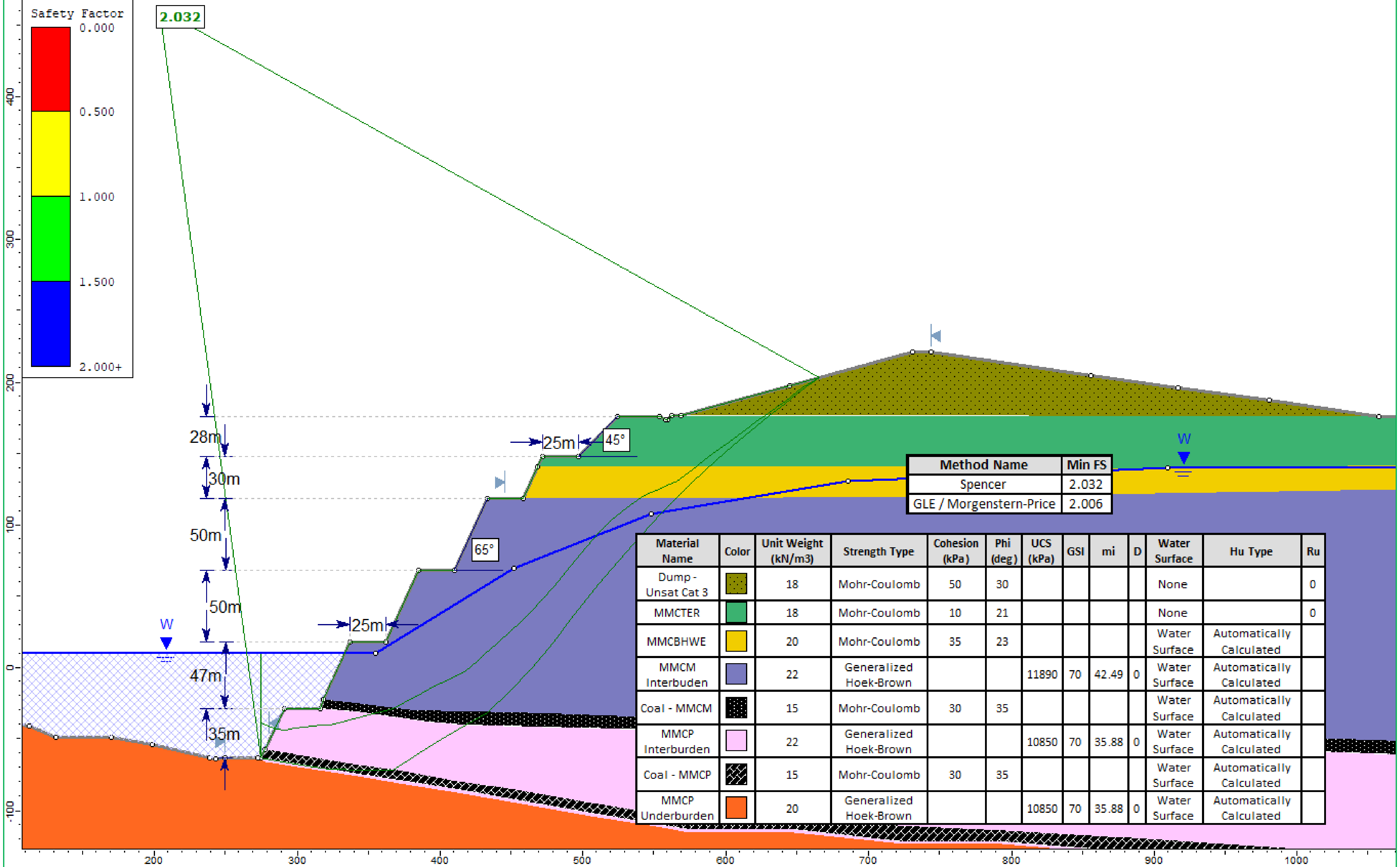
Cross Section E


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H



Method Name	Min FS
Spencer	2.058
GLE / Morgenstern-Price	2.060

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					None		0
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

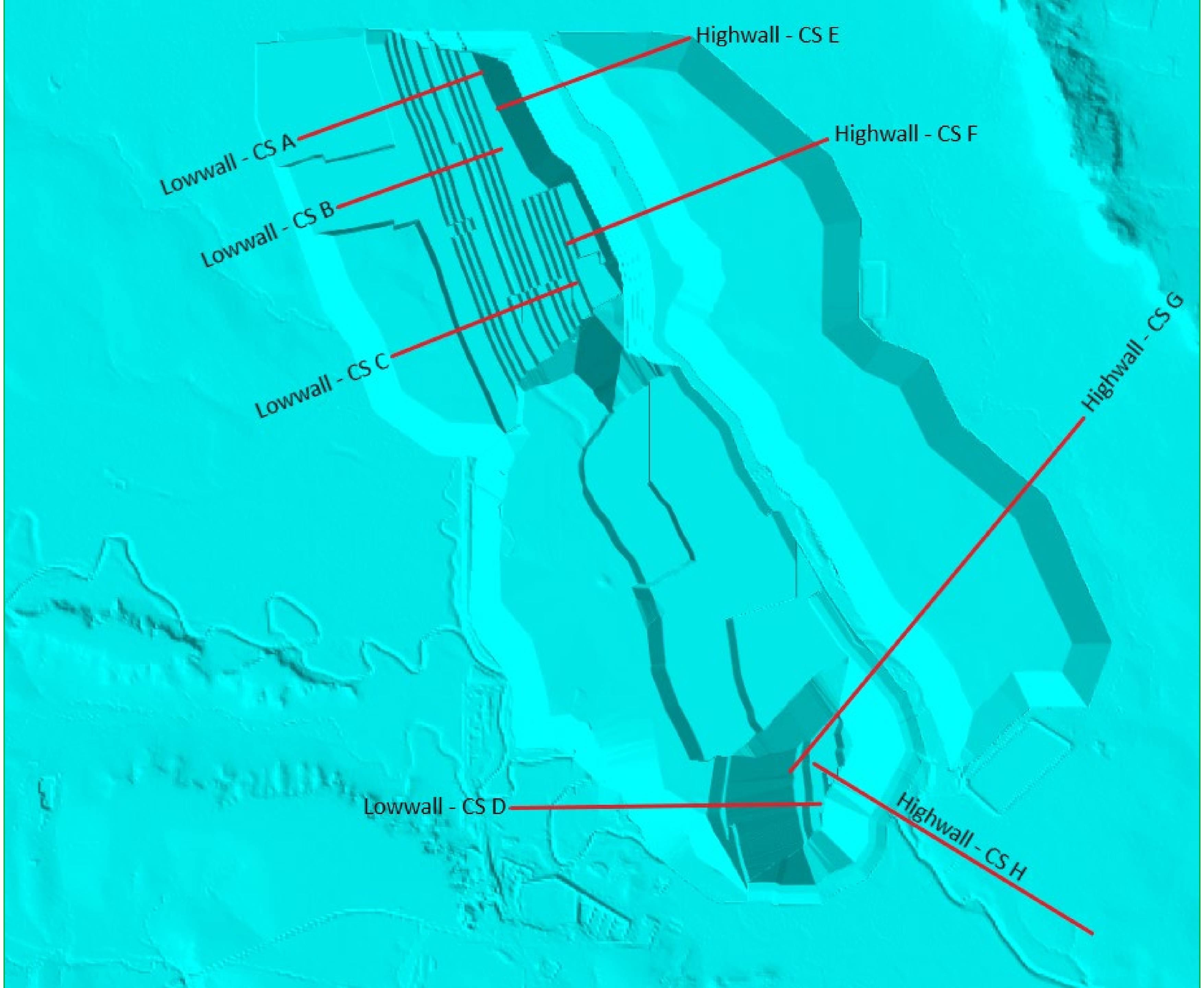


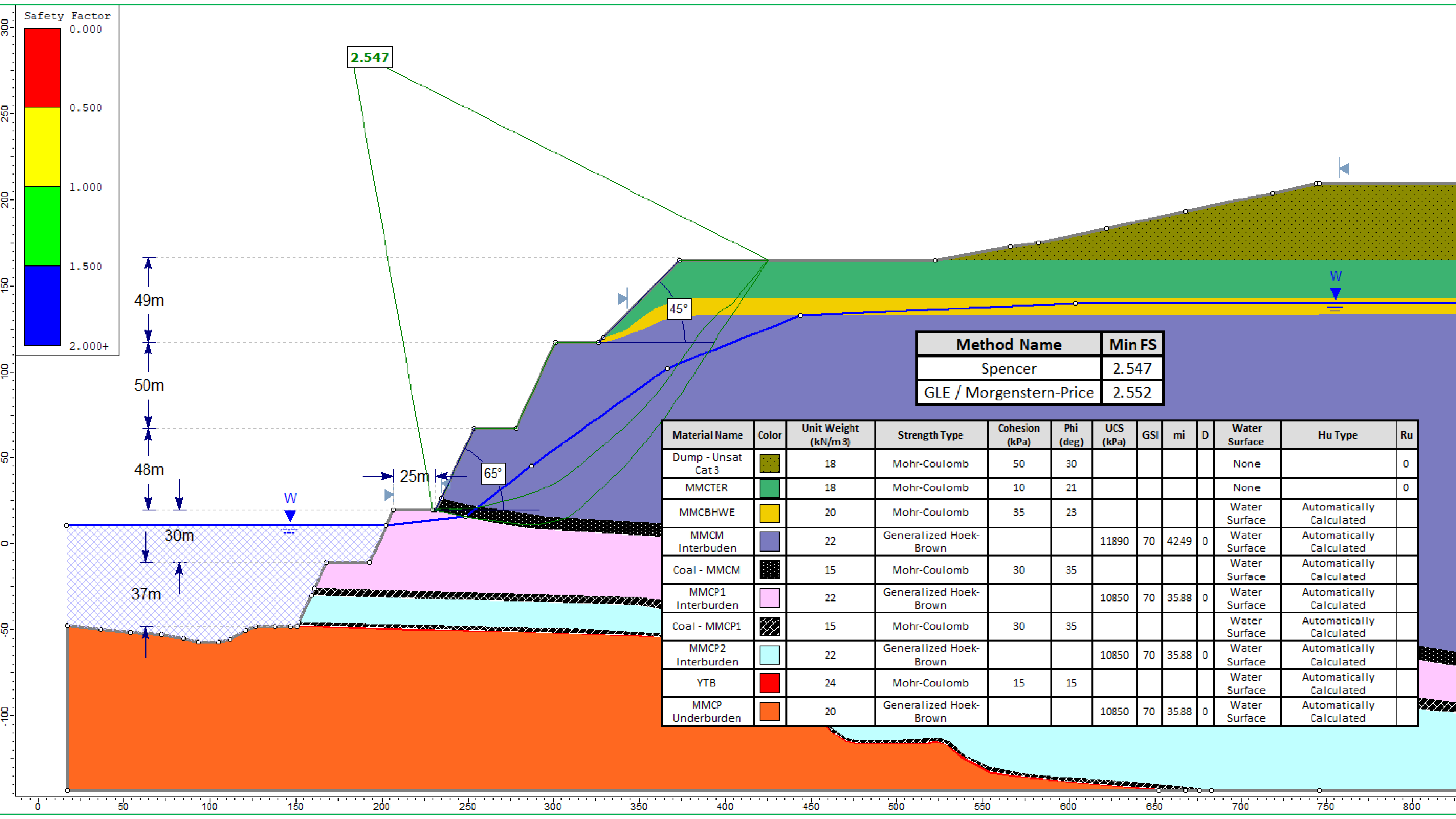
Method Name	Min FS
Spencer	2.032
GLE / Morgenstern-Price	2.006

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					None		0
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

Highwall

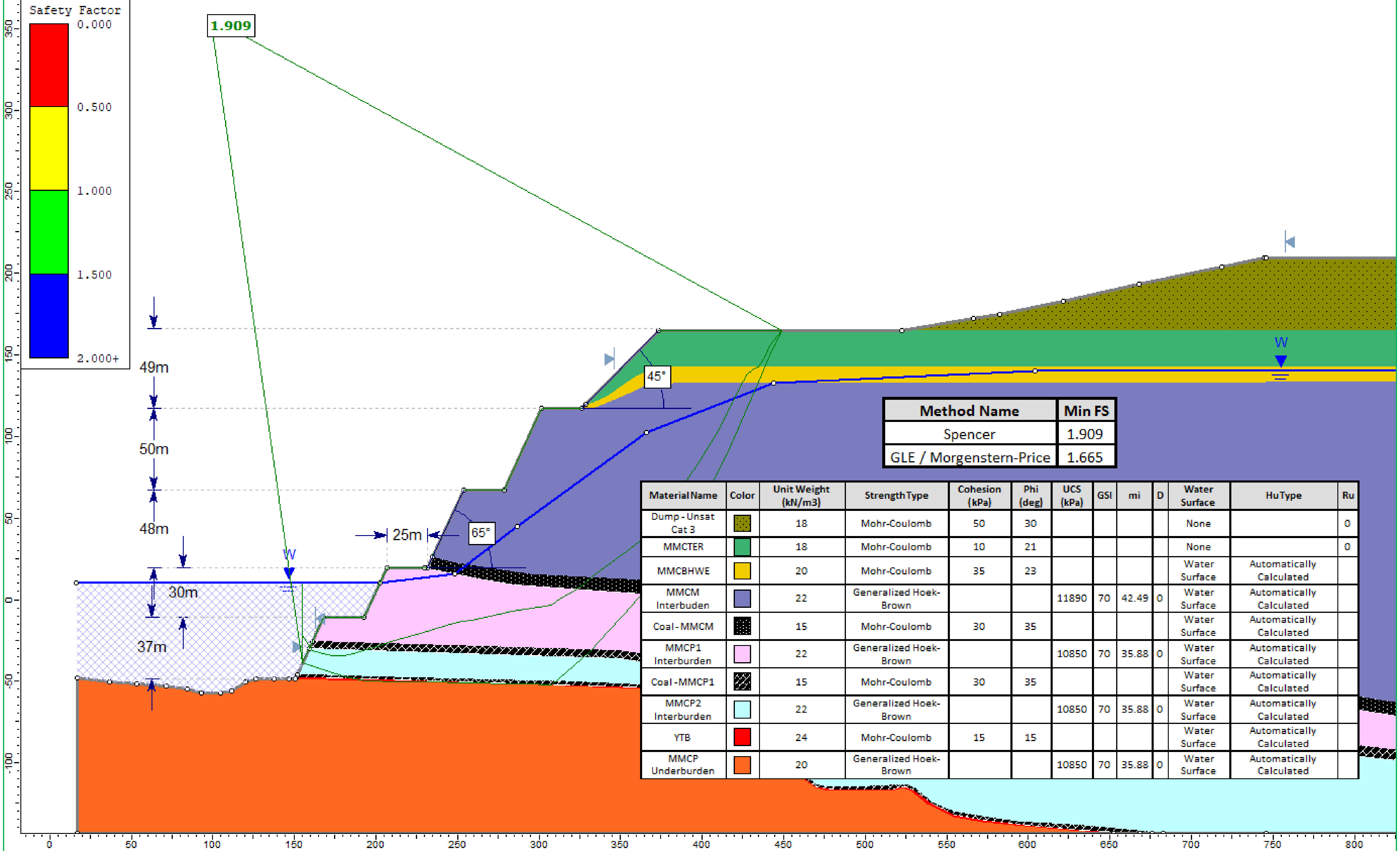
Cross Section F


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H



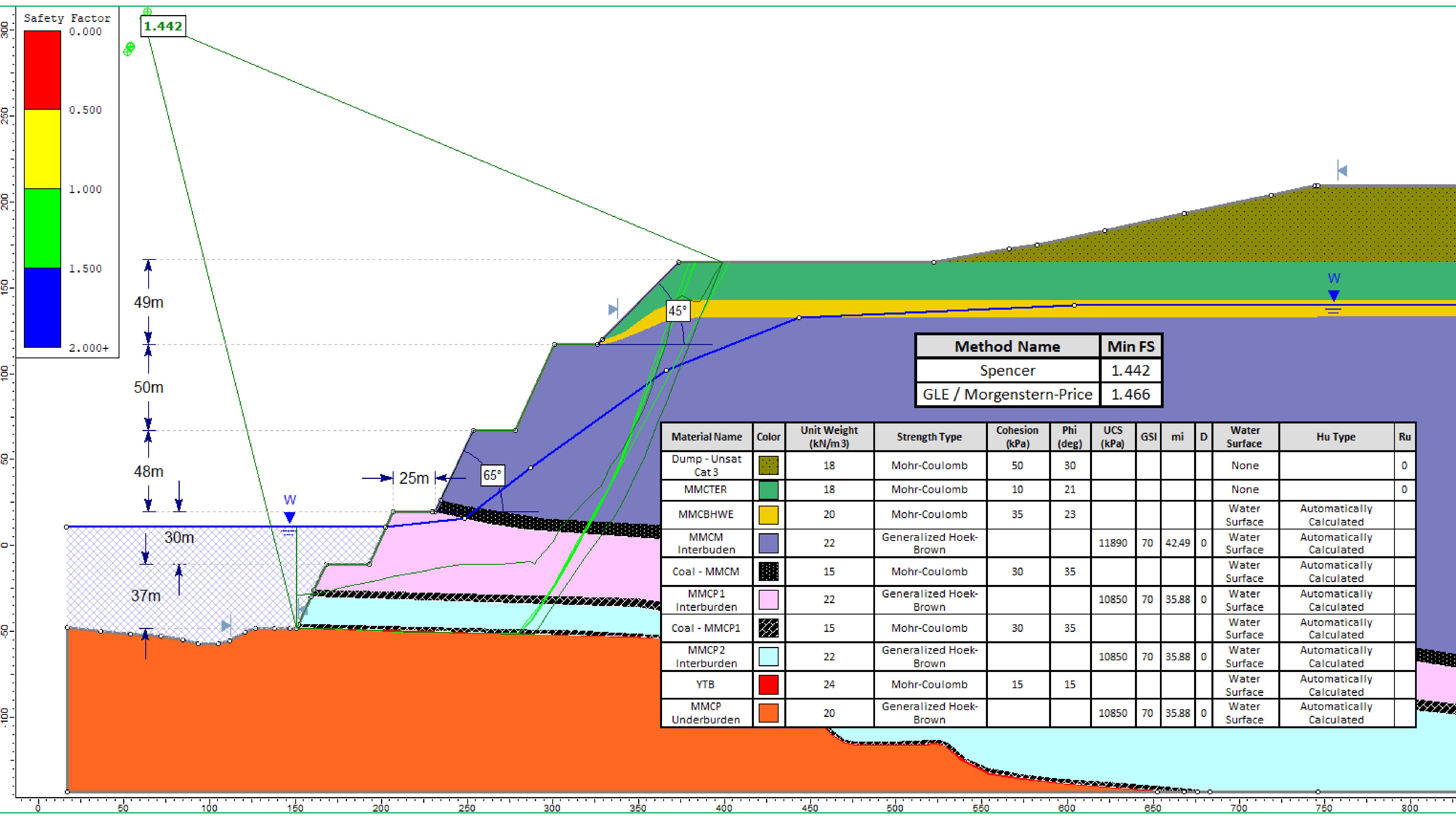
Method Name	Min FS
Spencer	2.547
GLE / Morgenstern-Price	2.552

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					None		0
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	



Method Name	Min FS
Spencer	1.909
GLE / Morgenstern-Price	1.665

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					None		0
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

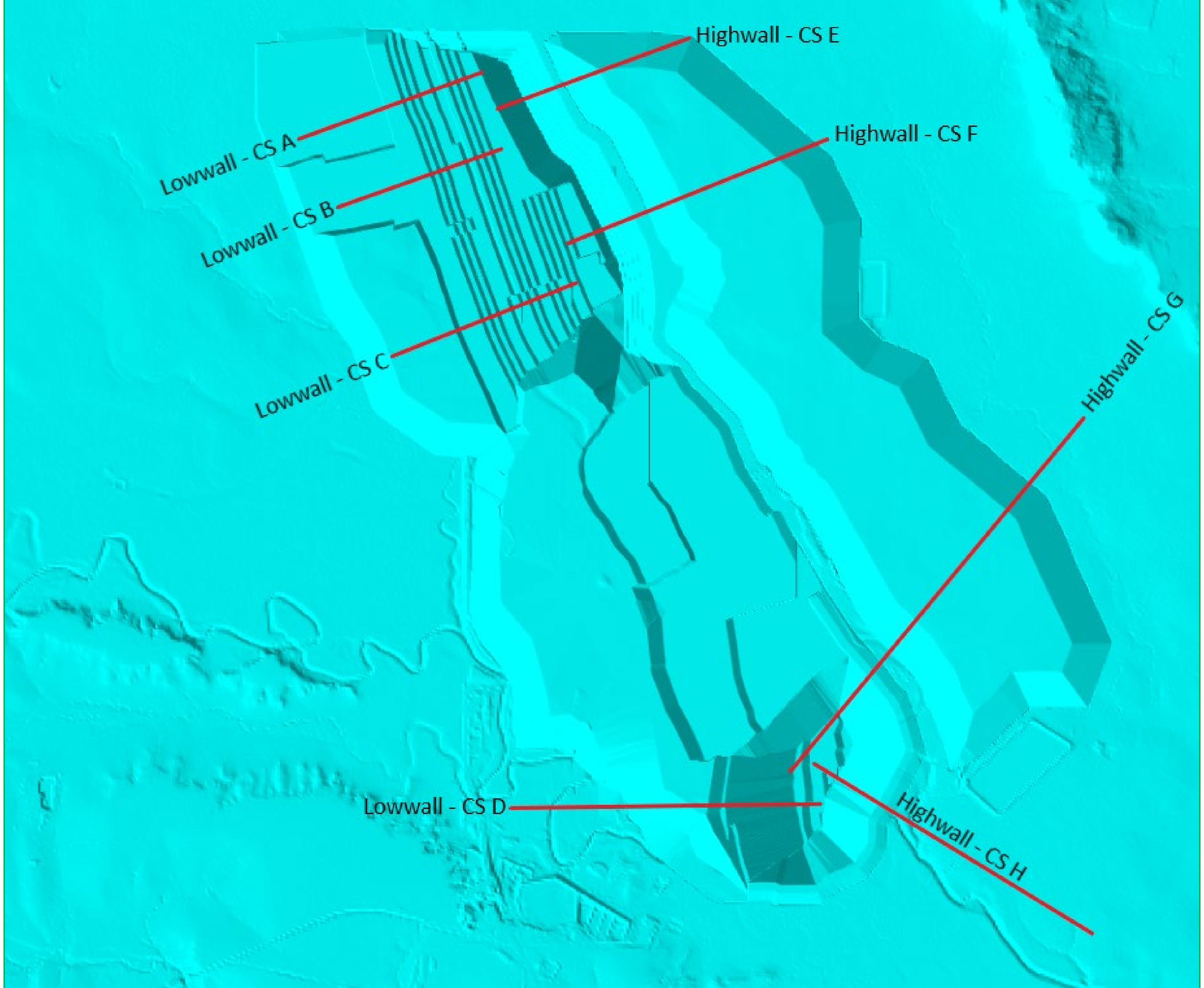


Method Name	Min FS
Spencer	1.442
GLE / Morgenstern-Price	1.466

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					None		0
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

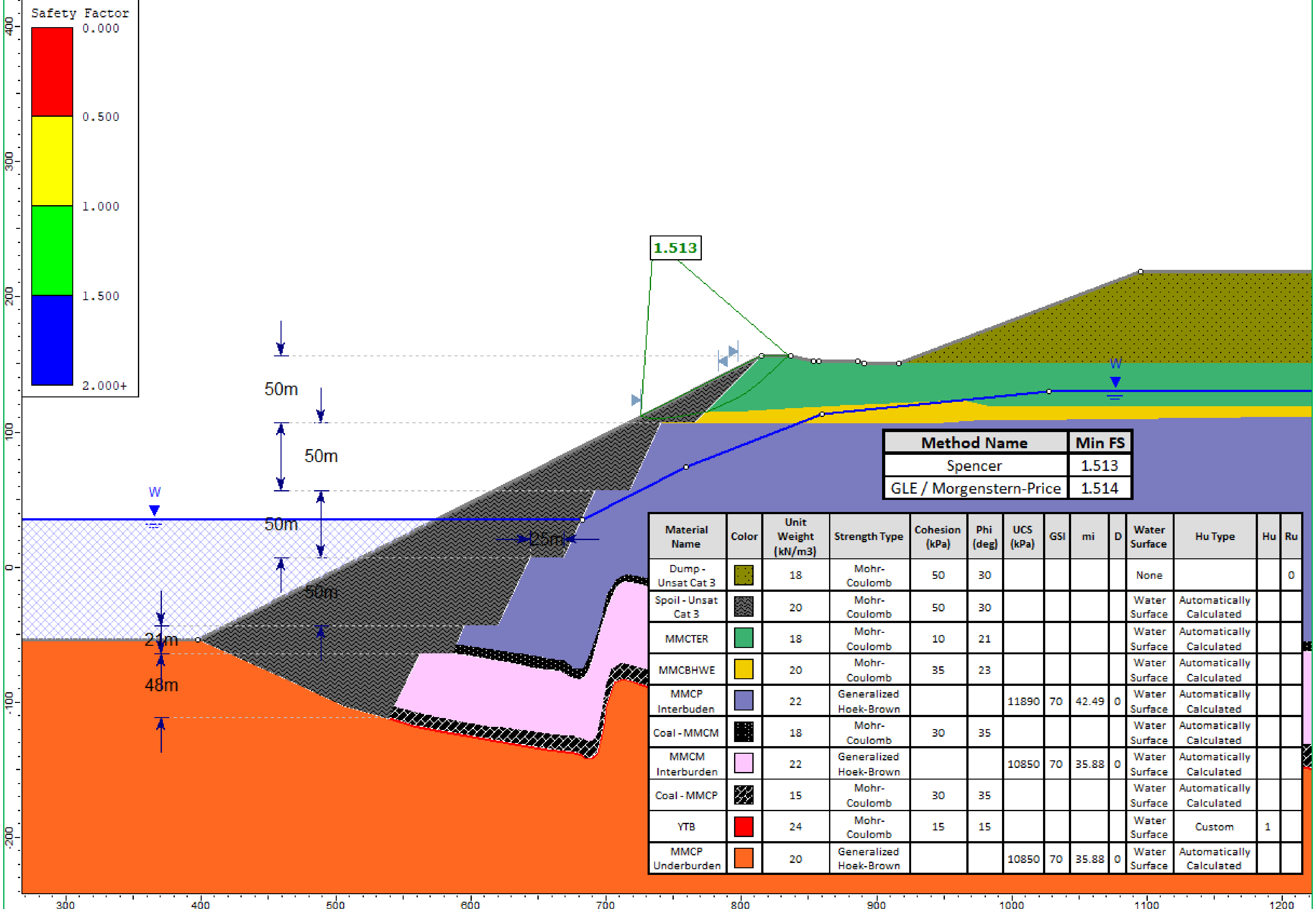
Highwall

Cross Section G


Highwall - CS E
Highwall - CS F
Lowwall - CS A
Lowwall - CS B
Lowwall - CS C
Highwall - CS G
Lowwall - CS D
Highwall - CS H

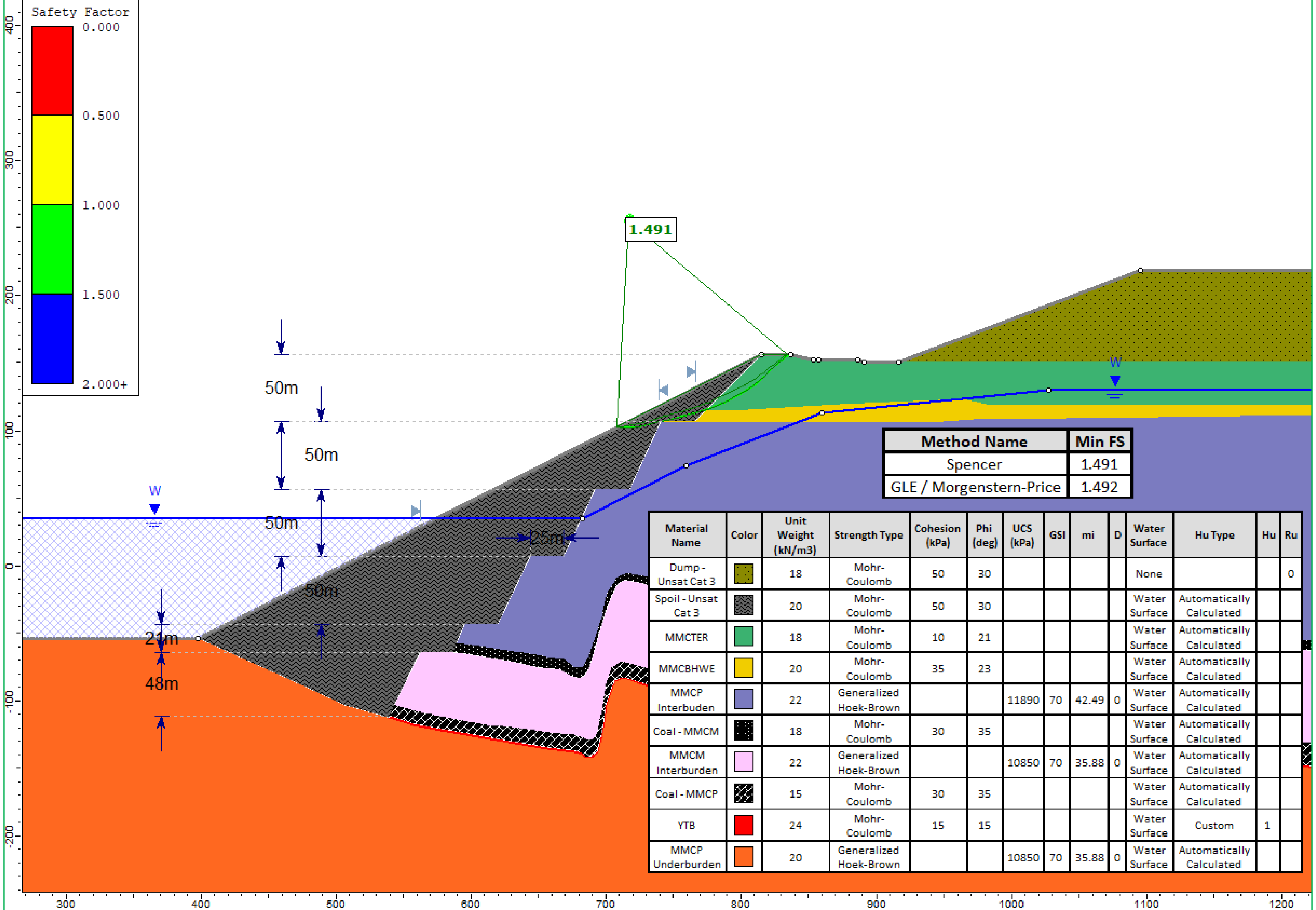
Highwall

Cross Section G – with Spoil



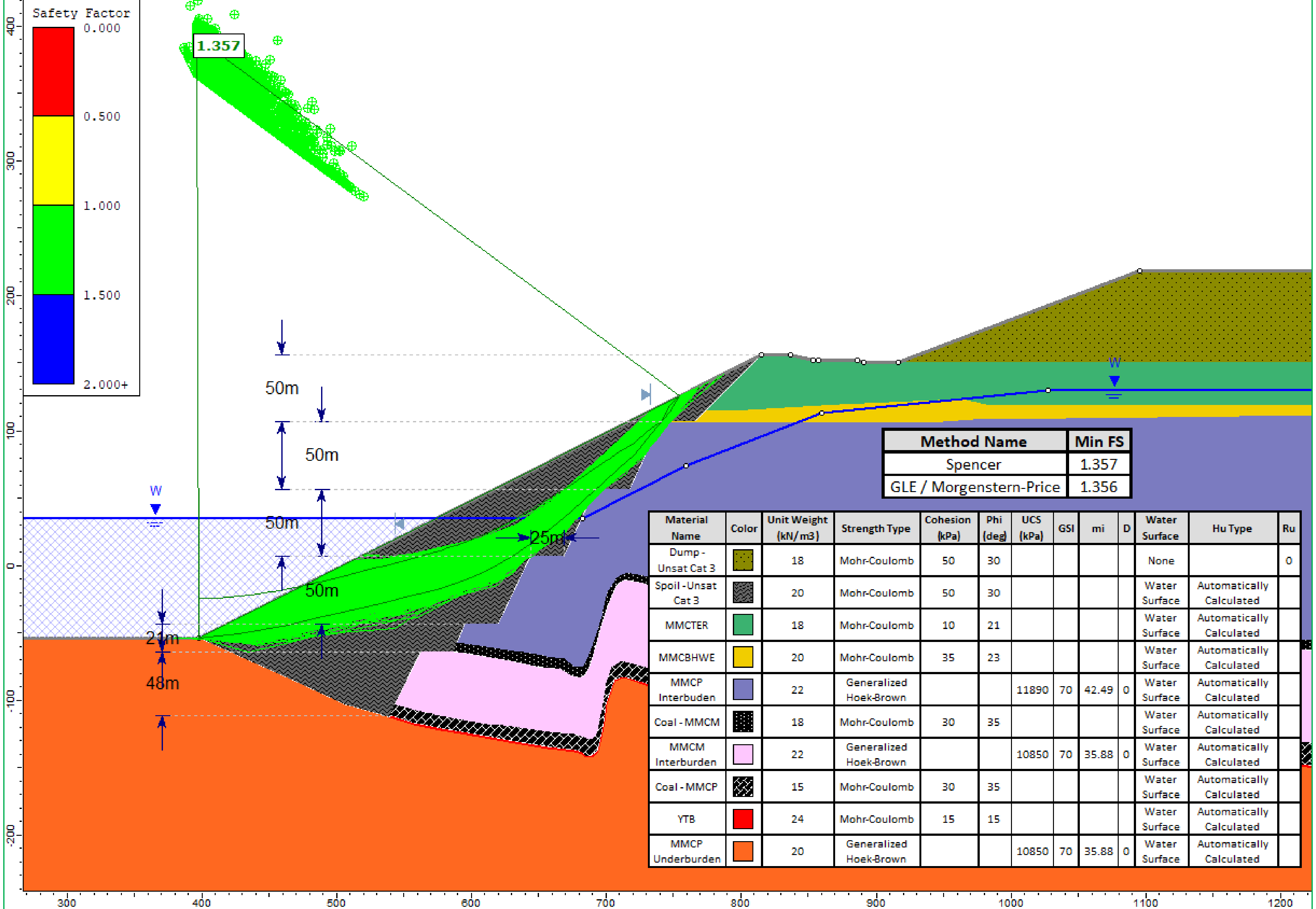
Method Name	Min FS
Spencer	1.513
GLE / Morgenstern-Price	1.514

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Hu	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None			0
Spoil - Unsat Cat 3		20	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated		
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated		
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated		
MMCP Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated		
Coal - MMCM		18	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated		
MMCM Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated		
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated		
YTB		24	Mohr-Coulomb	15	15					Water Surface	Custom	1	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated		



Method Name	Min FS
Spencer	1.491
GLE / Morgenstern-Price	1.492

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Hu	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None			0
Spoil - Unsat Cat 3		20	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated		
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated		
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated		
MMCP Interburden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated		
Coal - MMCM		18	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated		
MMCM Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated		
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated		
YTB		24	Mohr-Coulomb	15	15					Water Surface	Custom	1	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated		

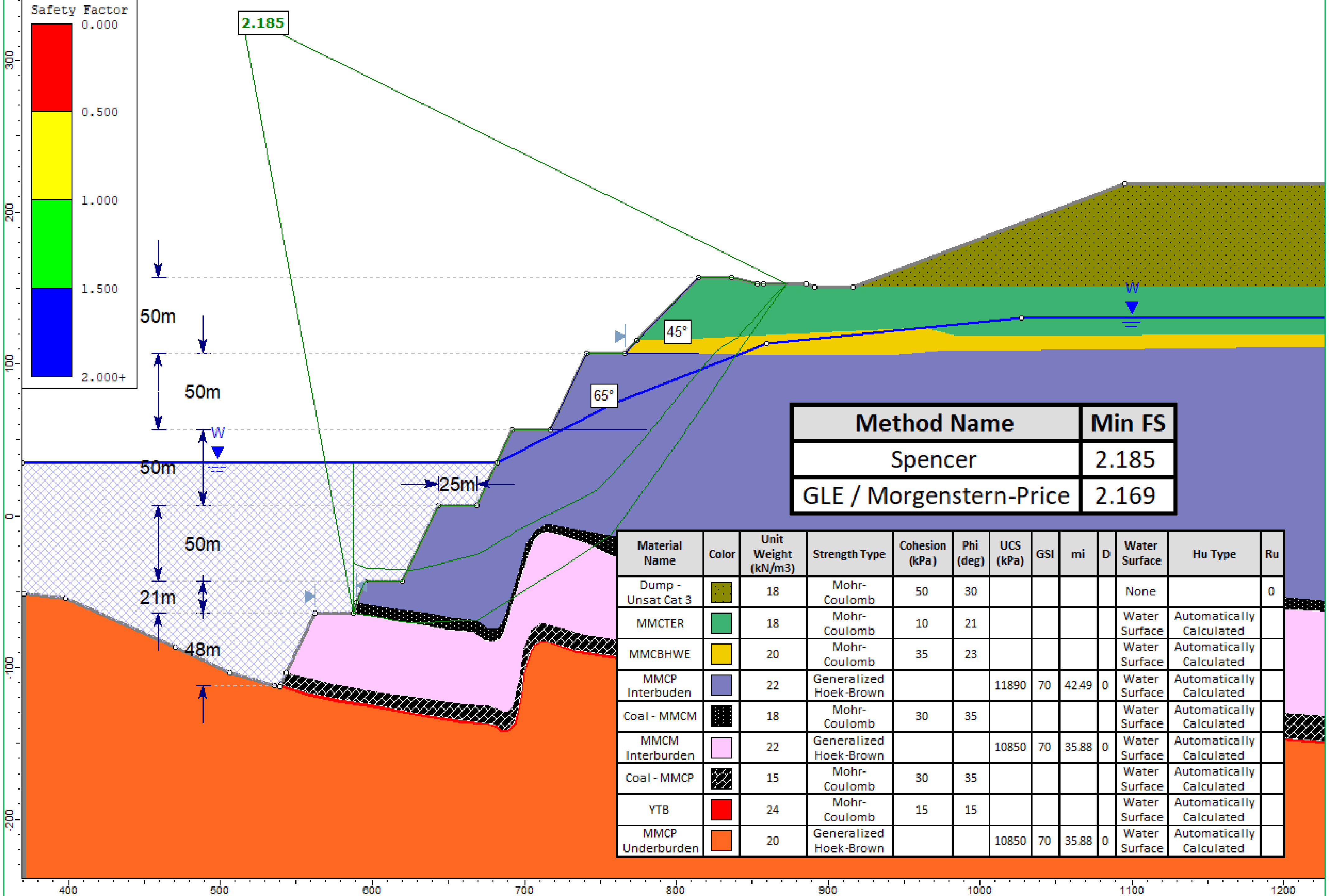


Method Name	Min FS
Spencer	1.357
GLE / Morgenstern-Price	1.356

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
Spoil - Unsat Cat 3		20	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated	
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated	
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCP Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		18	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCM Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

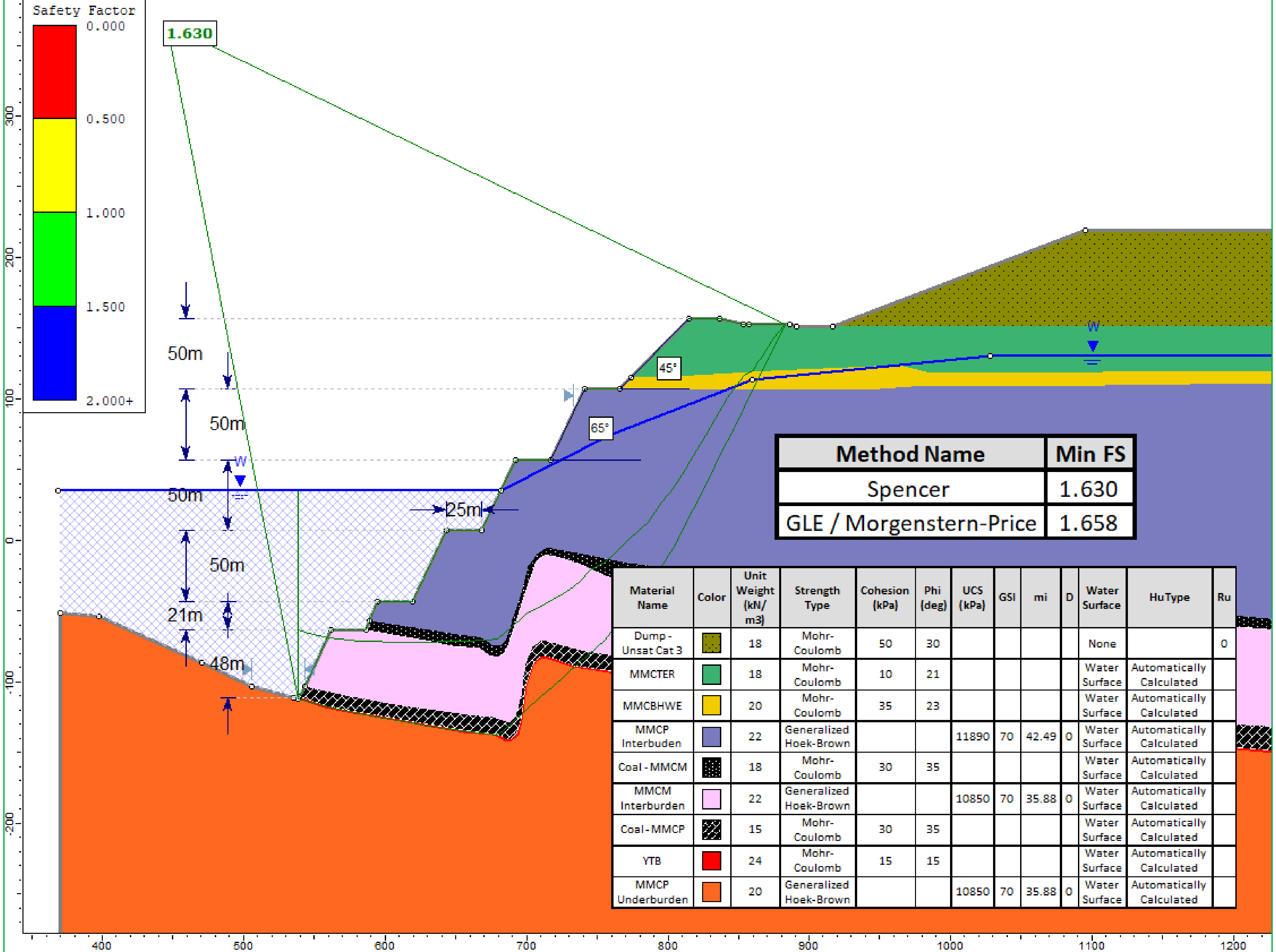
Highwall

Cross Section G – without Spoil



Method Name	Min FS
Spencer	2.185
GLE / Morgenstern-Price	2.169

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated	
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCP Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		18	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCM Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

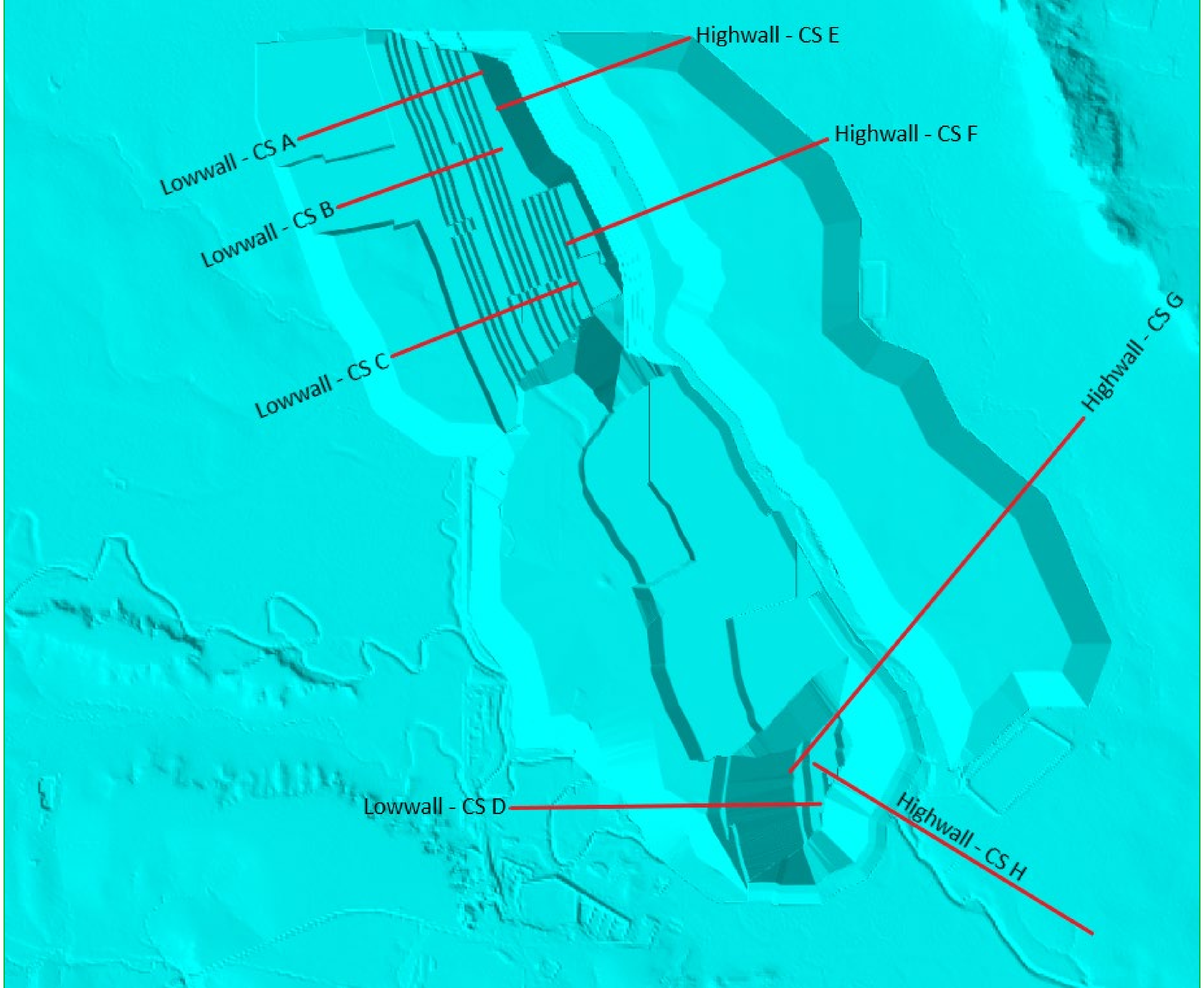


Method Name	Min FS
Spencer	1.630
GLE / Morgenstern-Price	1.658

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	HuType	Ru
Dump - Unsat Cat 3		18	Mohr-Coulomb	50	30					None		0
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated	
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated	
MMCP Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated	
Coal - MMCM		18	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
MMCM Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	
Coal - MMCP		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated	
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated	
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated	

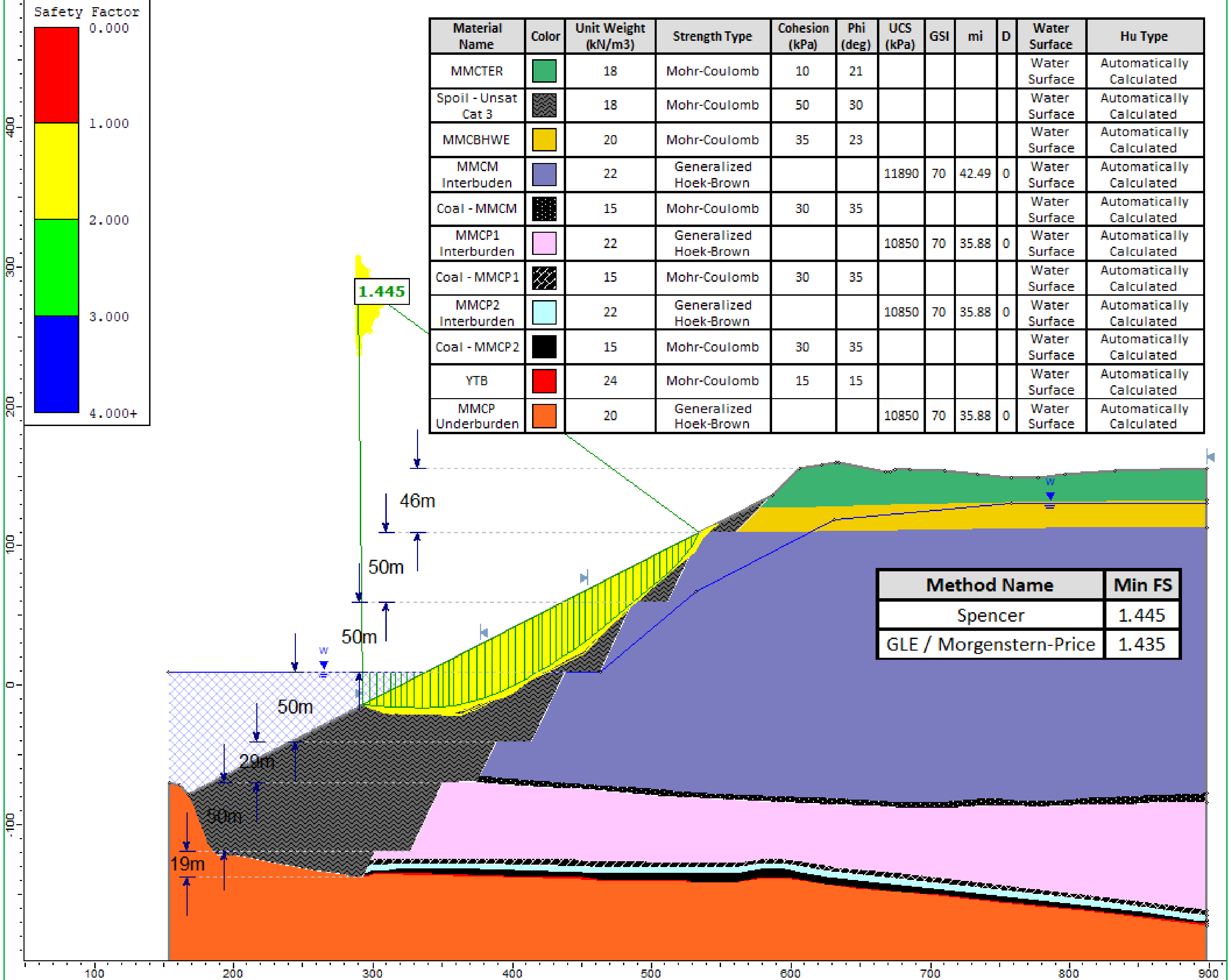
Highwall

Cross Section H


Highwall - CS E
Lowwall - CS A
Highwall - CS F
Lowwall - CS B
Highwall - CS G
Lowwall - CS C
Lowwall - CS D
Highwall - CS H

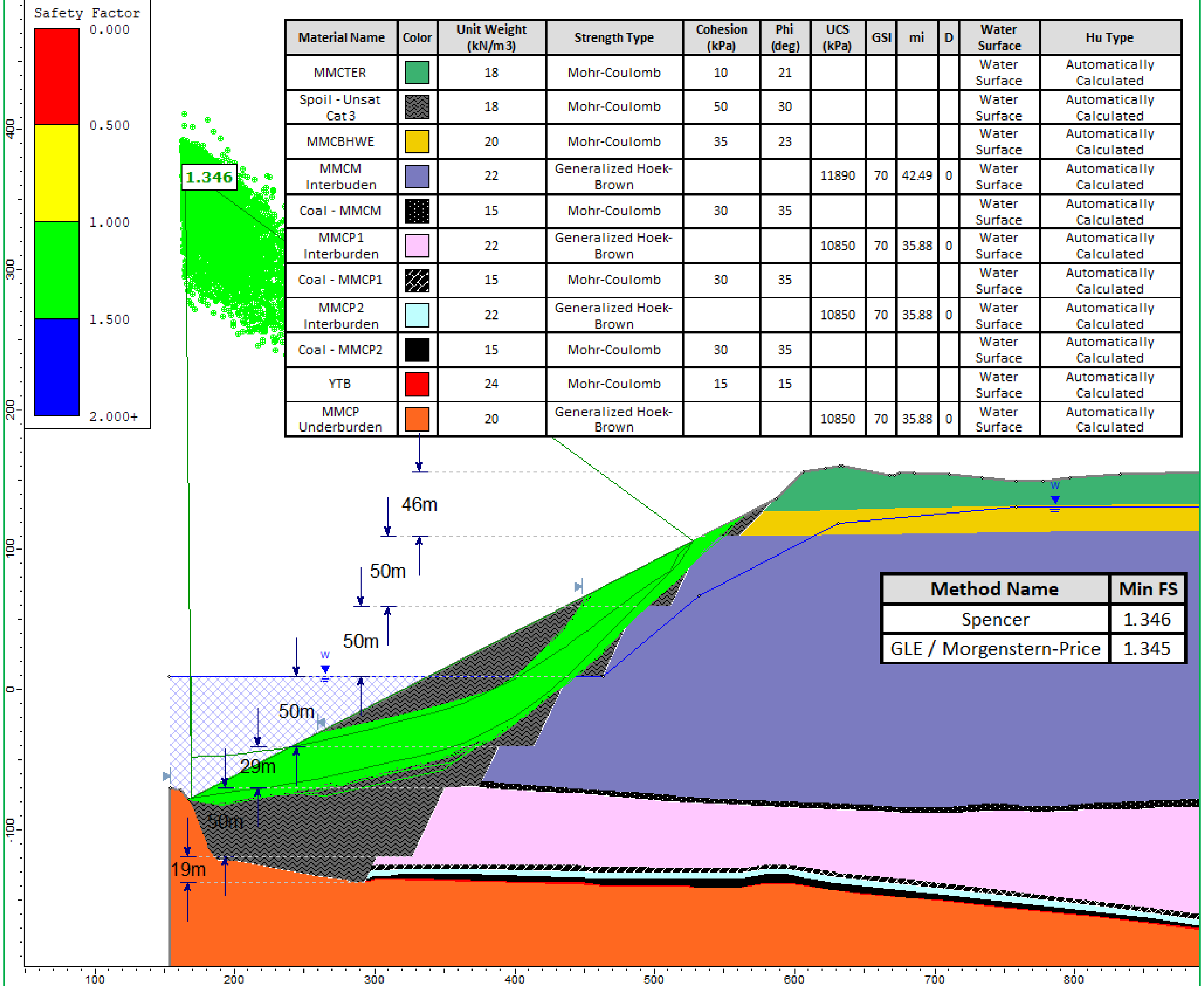
Highwall

Cross Section H – with Spoil



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated
Spoil - Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP2		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Spencer	1.445
GLE / Morgenstern-Price	1.435

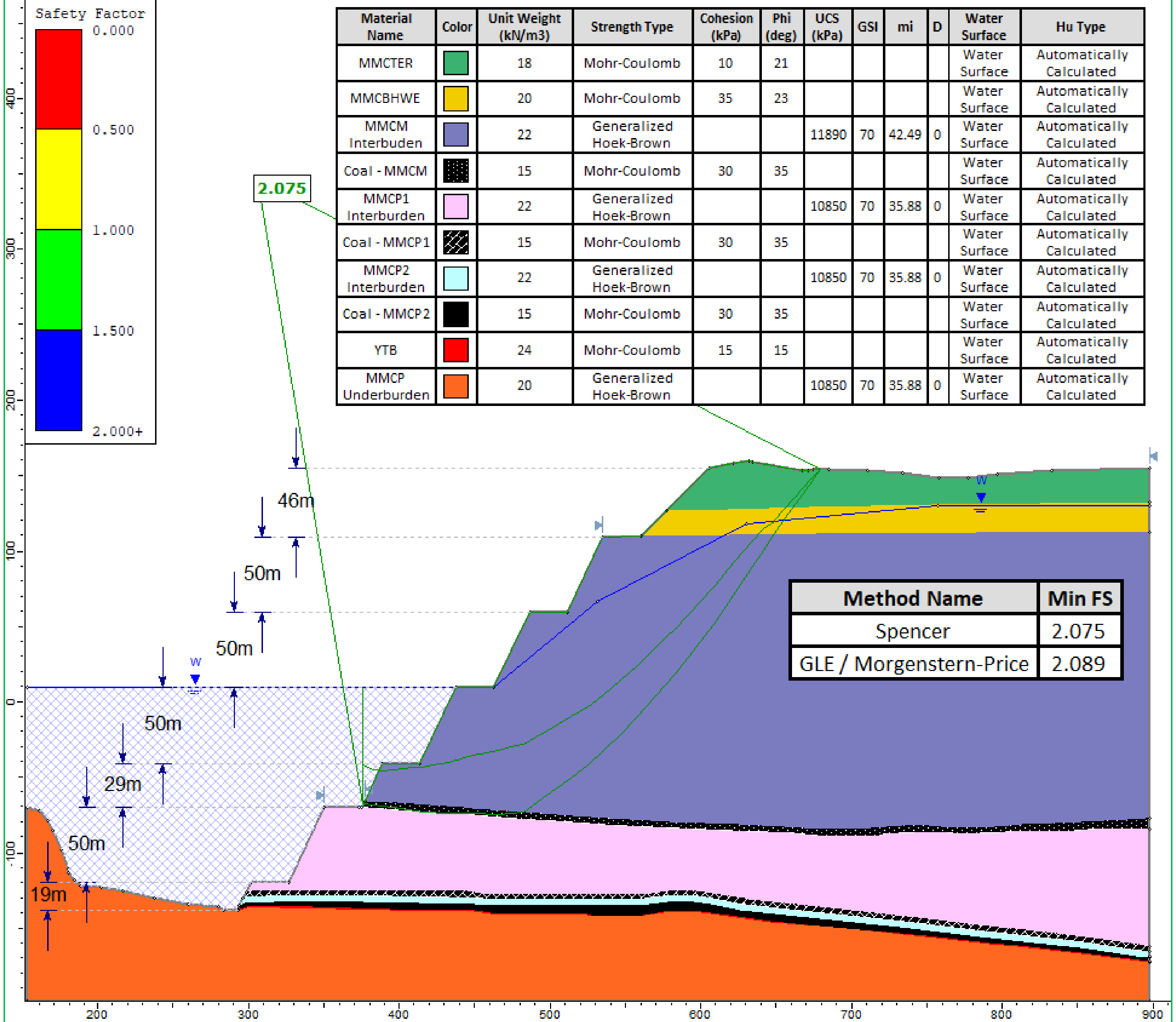


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated
Spoil - Unsat Cat 3		18	Mohr-Coulomb	50	30					Water Surface	Automatically Calculated
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP2		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Spencer	1.346
GLE / Morgenstern-Price	1.345

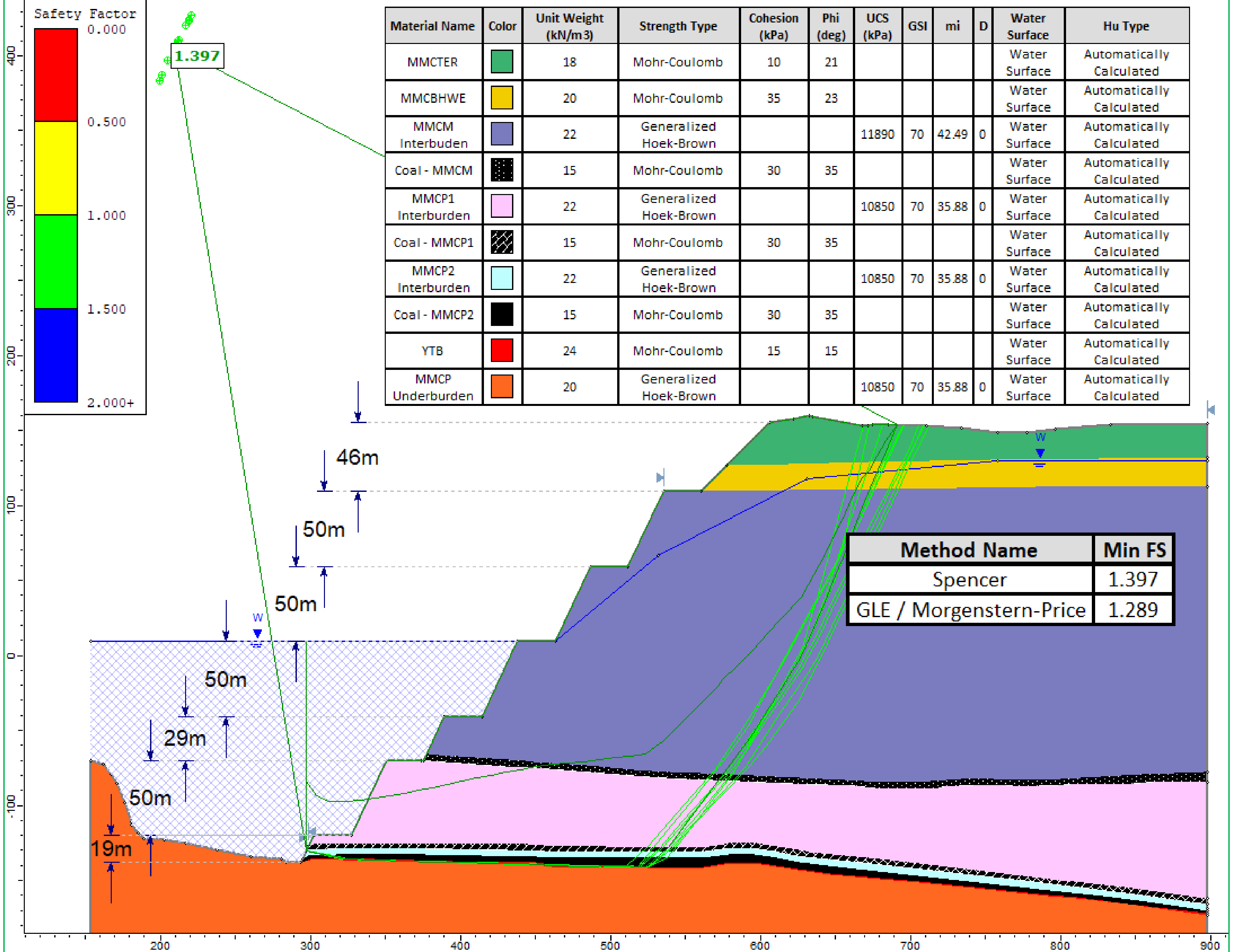
Highwall

Cross Section H – without Spoil



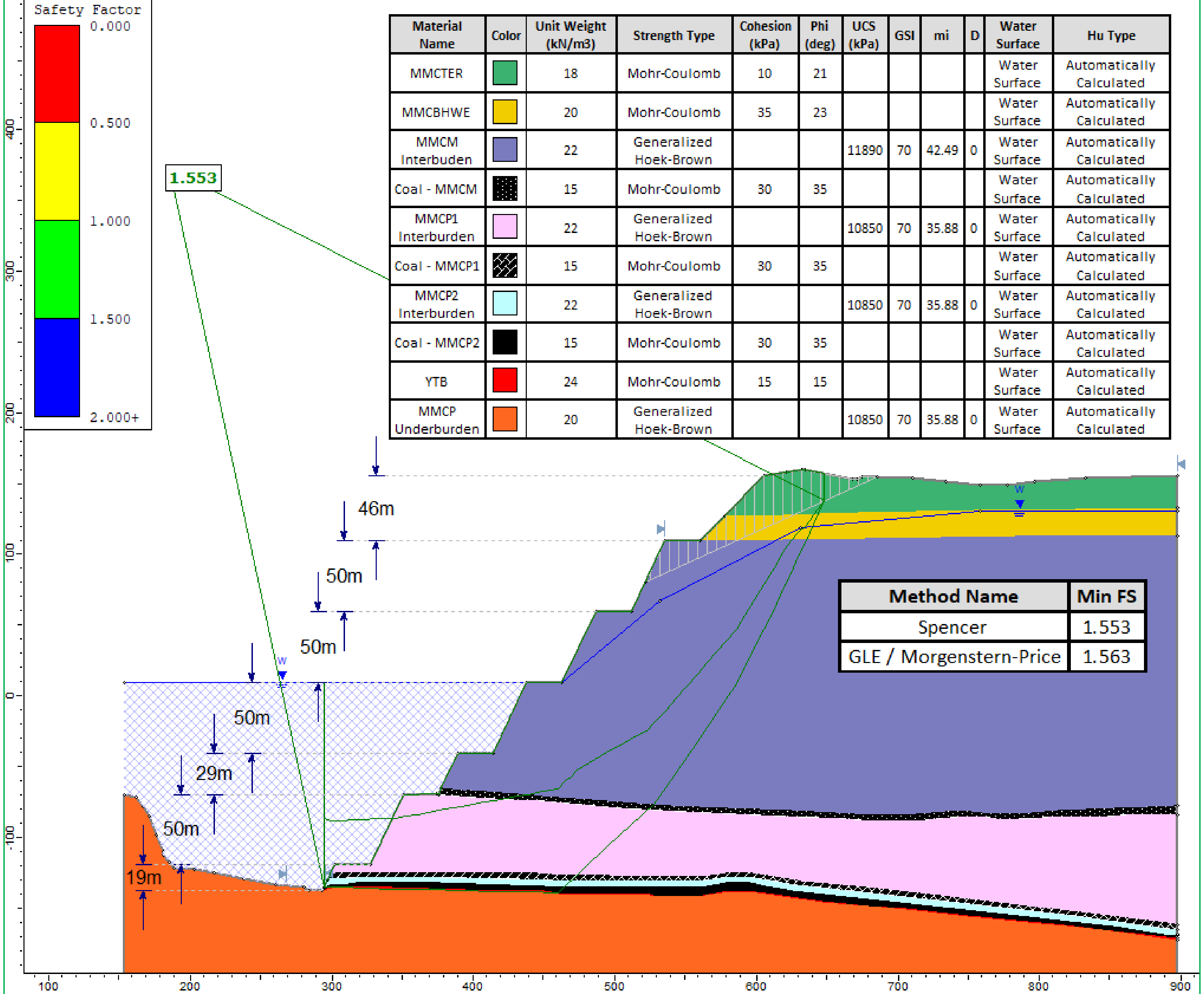
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP2		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Spencer	2.075
GLE / Morgenstern-Price	2.089



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP2		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Spencer	1.397
GLE / Morgenstern-Price	1.289



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Water Surface	Hu Type
MMCTER		18	Mohr-Coulomb	10	21					Water Surface	Automatically Calculated
MMCBHWE		20	Mohr-Coulomb	35	23					Water Surface	Automatically Calculated
MMCM Interbuden		22	Generalized Hoek-Brown			11890	70	42.49	0	Water Surface	Automatically Calculated
Coal - MMCM		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP1 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP1		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
MMCP2 Interburden		22	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated
Coal - MMCP2		15	Mohr-Coulomb	30	35					Water Surface	Automatically Calculated
YTB		24	Mohr-Coulomb	15	15					Water Surface	Automatically Calculated
MMCP Underburden		20	Generalized Hoek-Brown			10850	70	35.88	0	Water Surface	Automatically Calculated

Method Name	Min FS
Spencer	1.553
GLE / Morgenstern-Price	1.563