Former Milesburg Ash Disposal Basin
Initial Safety Factor Assessment Report

West Penn Power Company
Former Milesburg Power Station
Centre County, Pennsylvania

May 2026

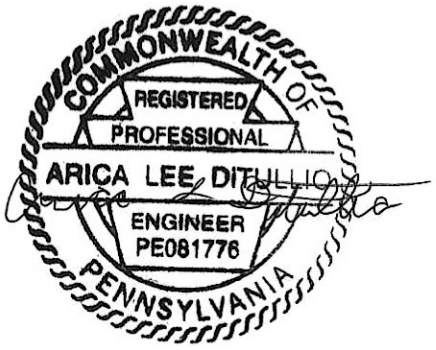
Table of Contents

Certification/Statement of Professional Opinion

The Initial Safety Factor Assessment Report (Report) for the former Milesburg Ash Disposal Basin was prepared by GAI Consultants, Inc. (GAI). The Report was based on certain information that, other than for information GAI originally prepared, GAI has relied on, but not independently verified. Therefore, this Certification/Statement of Professional Opinion is limited to the information available to GAI at the time the Report was written. On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Pennsylvania that the Report has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, and at the time, and in the same locale. It is my professional opinion that the Report was prepared consistent with the requirements of § 257.73(e) of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments", published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 and amended on May 8, 2024 with an effective date of November 8, 2024.

The use of the words "certification" and/or "certify" in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not to be interpreted or construed as a guarantee, warranty or legal opinion.

Arica L. DiTullio, P.E.
Engineering Director



1.0 Purpose

Pursuant to the Federal Coal Combustion Residuals (CCR) Rule 40 CFR § 257.73(e)(1) and 40 CFR § 257.100(f)(2)(iv), each legacy CCR surface impoundment is required to conduct initial and periodic safety factor assessments to determine whether the CCR unit achieves the minimum safety factors at the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations including loading conditions.

2.0 Introduction

The former Milesburg Ash Disposal Basin (Ash Disposal Basin) is a legacy CCR surface impoundment located in Centre County, Pennsylvania (PA) approximately 0.25 miles west of the former Milesburg Power Station (Station). The Station is an inactive electric utility also located in Centre County, PA. The former Ash Disposal Basin was used for the management, storage, and disposal of CCR when the former Station was operational. The former Station operated from approximately 1950 until 1984 and was demolished on or around 1999.

The former Ash Disposal Basin was constructed in 1968. In 1970, the embankment was raised ten feet to provide additional disposal volume. The former Ash Disposal Basin was used to manage CCR from approximately 1968 until 1974 when the fuel source was switched from coal to oil. After 1974, the former Ash Disposal Basin was used to manage wastewater from the former Station. Following shutdown of the facility, the former Ash Disposal Basin no longer was used for management of wastewater or CCR.

An inspection report by GAI Consultants, Inc. (GAI) from 1980 indicates that routine maintenance was completed at the former Ash Disposal Basin at that time, including control of tree growth on the embankment and cleaning of the overflow riser pipe. The embankments remain in place, and the former Ash Disposal Basin is not currently used for CCR management, and no CCR management is proposed to occur in the future. The former Ash Disposal Basin is currently vegetated.

The maximum embankment height is approximately 24 feet with an approximate crest elevation (El.) of 724 feet. The available storage capacity, assuming that the current topography represents an empty pond, is approximately 104 acre-feet (4,530,000 cubic feet). Some ponded water has been observed within the western portion during multiple site visits conducted between 2024 and 2026.

3.0 Background Information

As discussed in Section 2.0, the former Ash Disposal Basin is no longer used for the management of wastewater or CCR following the shutdown of the facility. Historical records containing data from subsurface explorations were not available for this Safety Factor Assessment. GAI performed a subsurface exploration in 2026 consisting of eight (8) borings and laboratory testing to characterize the subsurface conditions, and details of the investigation are provided in the Data Report, provided under a separate cover (Data Report*, Reference 1)*.

3.1 Summary of Parameters

Soil parameters used in stability analyses were estimated from soil boring blow count correlations, laboratory test data, literature review, and engineering judgment.

The soil parameters used in stability analyses are summarized in Table 1.

Table 1 – Summary of Parameters

Material	Drained Friction Angle, ϕ' (degrees)	Drained Cohesion, c' (psf)	Unit Weight γ (pcf)
Embankment Fill	32	50	120
CCR Fill	28	0	105
Rock Fill	42	0	115
Natural Soil	30	0	115
Weathered Rock / Bedrock	34	0	135

4.0 Factor of Safety Assessment

GAI reviewed the documents listed under the References (Section 6.0) in its assessment to determine if the former impoundment meets the following safety factors:

i. The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

ii. The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

iii. The calculated seismic factor of safety must equal or exceed 1.00.

iv. For dikes constructed of soils that are susceptible to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

The stability assessments were performed using the Slide2 software package (Rocscience 2024, version 9.034). The analyses were conducted using the Morgenstern-Price Method. The material strength parameters used in the analyses were developed based on subsurface exploration, laboratory testing, historical document review, and engineering judgement. The CCR Rule discusses development of “critical cross section(s)” that represent the most severe cases. These critical sections should produce the lowest factors of safety for a given loading condition. The cross sections used in the slope stability analyses are shown in plan on Figure A-1 in Appendix A. Phreatic surfaces were based on the riser (principal spillway) structure elevation and the 1,000-year flood event as described in the Inflow Design Flood Control System Plan (*Reference 3*). The downstream embankments were evaluated for the safety factor assessment as they represent the more critical case. Sections indicating the critical calculated failure surfaces and the corresponding factors of safety are included as Figures A-2 through A-13 in Appendix A.

4.1 Long-Term, Maximum Storage Pool Loading Condition

The long-term maximum storage pool condition considers slope stability with steady-state seepage under the maximum sustained operating pool. The long-term, maximum storage pool is defined as the maximum water level that can be regularly maintained and results in the full development of a steady

state seepage condition. Drained (effective) strength parameters are most applicable such analyses. The riser structure is a 6-foot diameter corrugated metal pipe (CMP) and skimmer with an estimated crest at El. 712.3 feet. Therefore, the long-term maximum storage pool loading condition will have a water elevation of 712.3 feet.

The results of the analysis of the long-term, maximum storage pool loading condition are summarized in Table 2.

Table 2 – Calculated Minimum Factors of Safety – Long-Term, Maximum Pool Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS DS Slope	Acceptable (Yes/No)
Section 1	1.5	1.6	Yes
Section 2	1.5	1.5	Yes
Section 3	1.5	1.5	Yes
Section 4	1.5	1.8	Yes

4.2 Maximum Surcharge Pool Loading Condition

The maximum surcharge pool loading condition considers slope stability under the maximum surcharge pool level. The maximum surcharge pool represents a temporary rise in pool elevation above the maximum storage pool in the event of an inflow design flood and spillway discharge condition. This condition allows the evaluation of the effects of a raised level, which is similar to the effects of a flood surcharge. The Inflow Design Flood Control System Plan *(Reference 3*) indicates that the pool from a 1,000-year flood, assuming the riser is functional, would attain an estimated water surface elevation of 717.4 feet. Therefore, the maximum surcharge pool loading condition will have a water elevation of 717.4 feet.

The results of the analysis of the maximum surcharge loading condition are summarized in Table 3.

Table 3 – Calculated Minimum Factors of Safety – Maximum Surcharge Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS DS Slope	Acceptable (Yes/No)
Section 1	1.4	1.6	Yes
Section 2	1.4	1.5	Yes
Section 3	1.4	1.4	Yes
Section 4	1.4	1.8	Yes

4.3 Seismic Loading Condition

The seismic loading condition considers slope stability as a result of the Maximum Design Earthquake (MDE) event. The MDE is defined by the CCR Rule as a seismic event with a 2 percent probability of exceedance in 50 years (*i.e.* earthquake of approximate 2,500-year return period). Pseudostatic analysis was used to evaluate slope stability under the seismic loading condition. The ground motion used in the analyses was a peak ground acceleration (PGA) of approximately 0.10 times the acceleration of gravity (g), or 0.10 g, obtained from the United States Geological Survey (USGS) seismic hazard tool using the latest 2023 National Seismic Hazard Model (NSHM). The seismic loading condition was evaluated using the long-term maximum storage pool loading condition.

The results of the analysis of the seismic loading condition are summarized in Table 4.

Table 4 – Calculated Minimum Factors of Safety – Seismic Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS DS Slope	Acceptable (Yes/No)
Section 1	1.2	1.3	Yes
Section 2	1.2	1.2	Yes
Section 3	1.2	1.2	Yes
Section 4	1.2	1.4	Yes

4.4 Liquefaction Factor of Safety

The liquefaction loading condition addresses the potential for loose, saturated, or partially saturated soils to undergo a loss of strength during seismic events. This reduction in strength can result in slope instability, settlement, subsidence, or other forms of embankment distress. The assessment of liquefaction potential generally involves evaluating the susceptibility of each material zone within the embankment and its foundation to liquefaction triggering. For materials identified as susceptible, the potential impacts on embankment stability are then evaluated by incorporating reduced shear strength parameters representative of post-liquefaction conditions.

Liquefaction analysis was performed using the “Simplified Procedure” for each SPT interval in every boring drilled within the former Ash Disposal Basin (Idriss and Boulanger, 2008). The ground motions used in the liquefaction analysis were based on the PGA described in Section 4.3. Results of the liquefaction evaluation indicate that no soils within the embankment or its foundation are susceptible to liquefaction under the CCR Rule criteria, as calculated liquefaction factors of safety were equal to or greater than 1.2. Accordingly, a separate post-earthquake stability analysis was not required.

5.0 Conclusion

Based on the analyses conducted for the conditions outlined in the CCR Rule, the former Ash Disposal Basin meets or exceeds the required factors of safety.

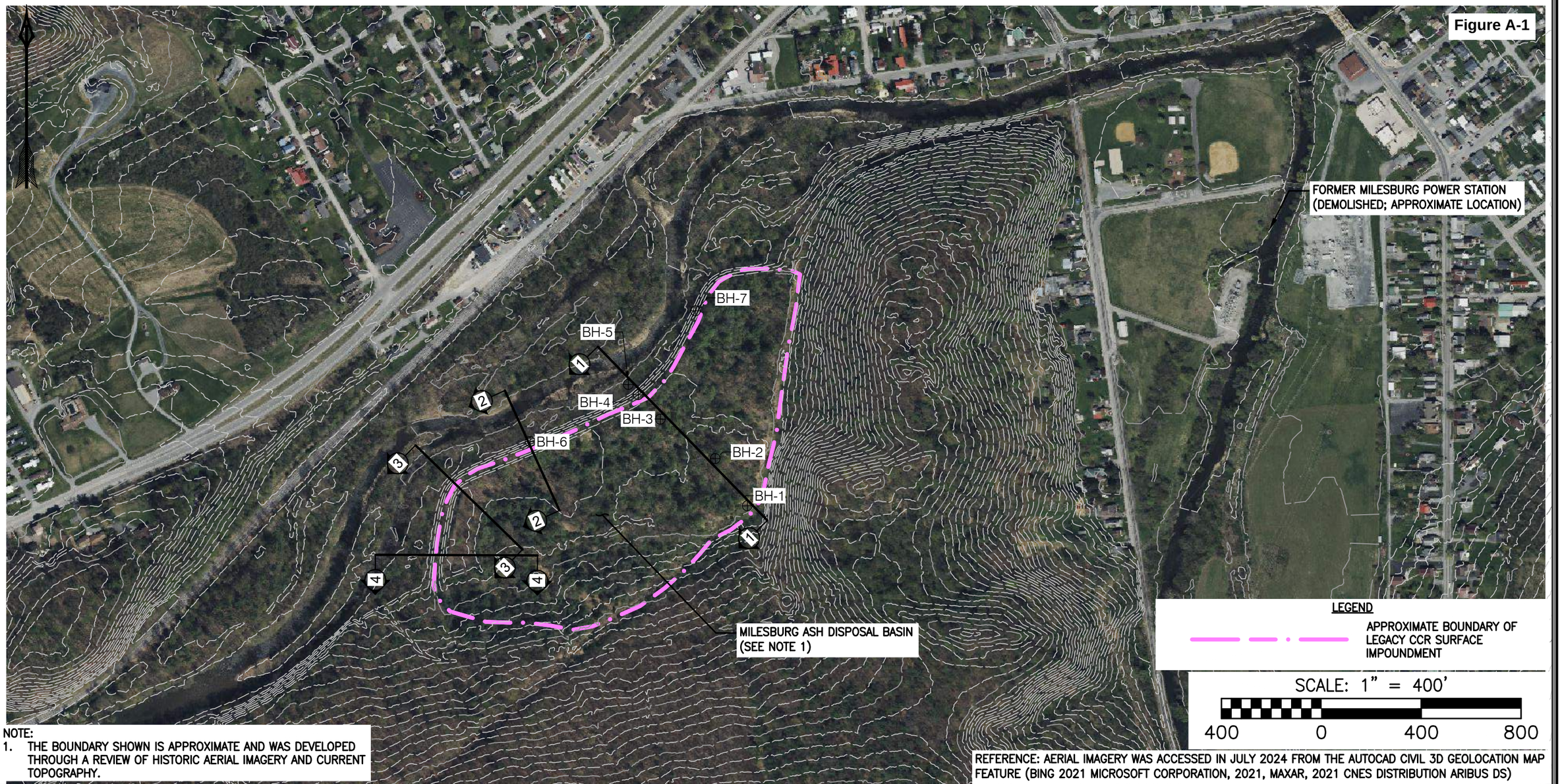
6.0 References

1. GAI Consultants. *Data Report – Former Milesburg Ash Disposal Basin.* May 2026.
2. GAI Consultants. *History of Construction Report – Former Milesburg Ash Disposal Basin.* February 2026.
3. GAI Consultants. *Initial Inflow Design Flood Control System Report – Former Milesburg Ash Disposal Basin.* May 2026.
4. GAI Consultants. *Initial Structural Stability Assessment Report – Former Milesburg Ash Disposal Basin.* May 2026.
5. *Soil Liquefaction during Earthquakes*, Idriss and Boulanger, EERI Monograph MNO-12, 2008.

APPENDIX A
Calculations

gai consultants
transforming ideas into reality®

Figure A-1



NOTE:
1. THE BOUNDARY SHOWN IS APPROXIMATE AND WAS DEVELOPED THROUGH A REVIEW OF HISTORIC AERIAL IMAGERY AND CURRENT TOPOGRAPHY.

REFERENCE: AERIAL IMAGERY WAS ACCESSED IN JULY 2024 FROM THE AUTOCAD CIVIL 3D GEOLOCATION MAP FEATURE (BING 2021 MICROSOFT CORPORATION, 2021, MAXAR, 2021 CNES DISTRIBUTION ARIBUS DS)

NO.:	DATE:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DESCRIPTION:

REVISION RECORD

DRAWING TITLE

FORMER MILESBURG POWER STATION - ASH DISPOSAL BASIN

PROJECT

7-DAY INSPECTIONS
LEGACY CCR SURFACE IMPOUNDMENT
FORMER MILESBURG POWER STATION
CENTRE COUNTY, PA

gai consultants

CLIENT

WEST PENN POWER COMPANY
800 CABIN HILL DRIVE
GREENSBURG, PA 15601

ISSUE DATE:	DRAWN BY:
10/29/2024	WOLFESM
SCALE:	CHECKED BY:
AS SHOWN	ROUNCLL
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	SHEET NO.: 001 OF 001

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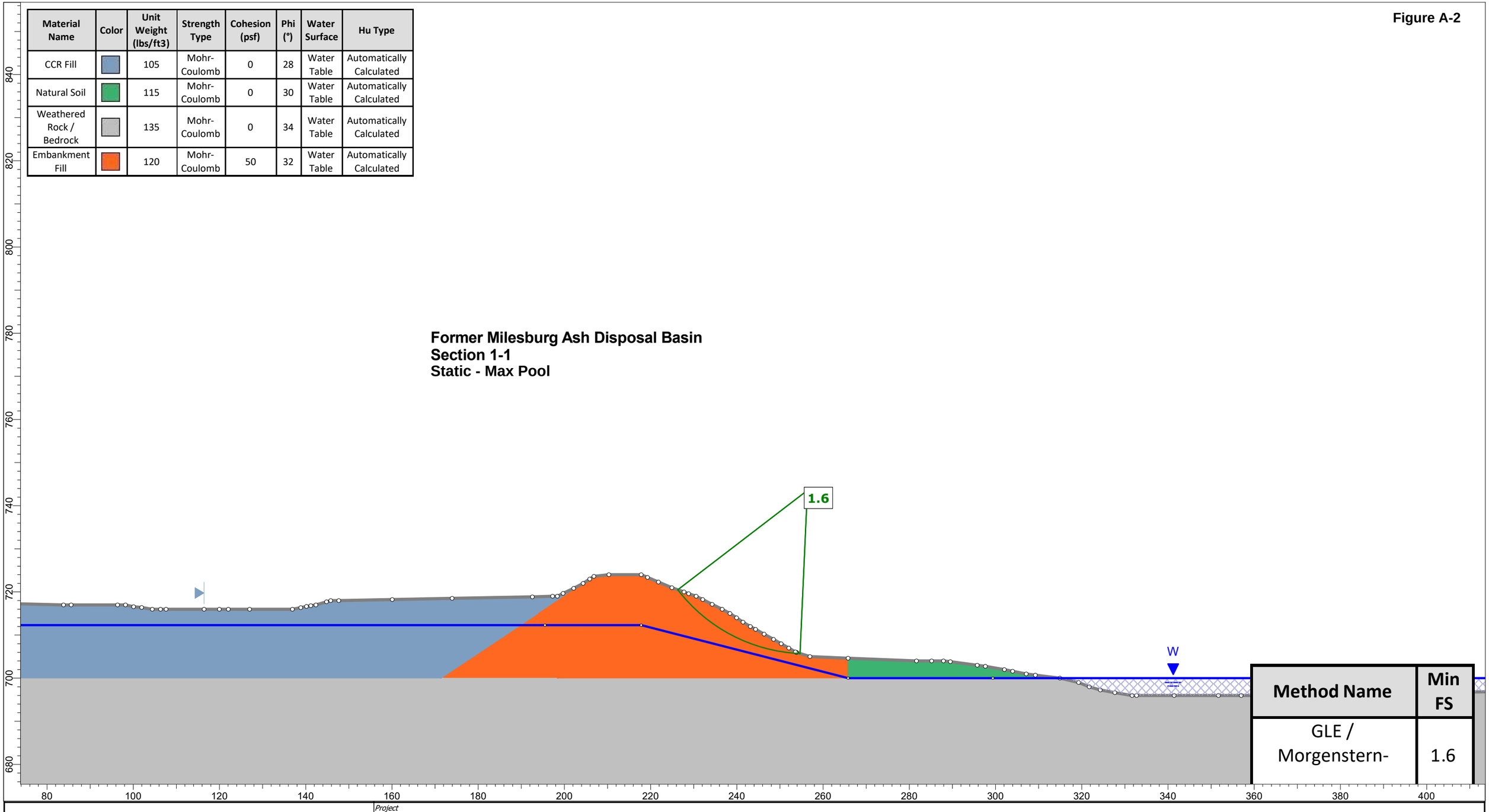
Figure A-2

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 1-1
Static - Max Pool



Method Name	Min FS
GLE / Morgenstern-	1.6

rocscience

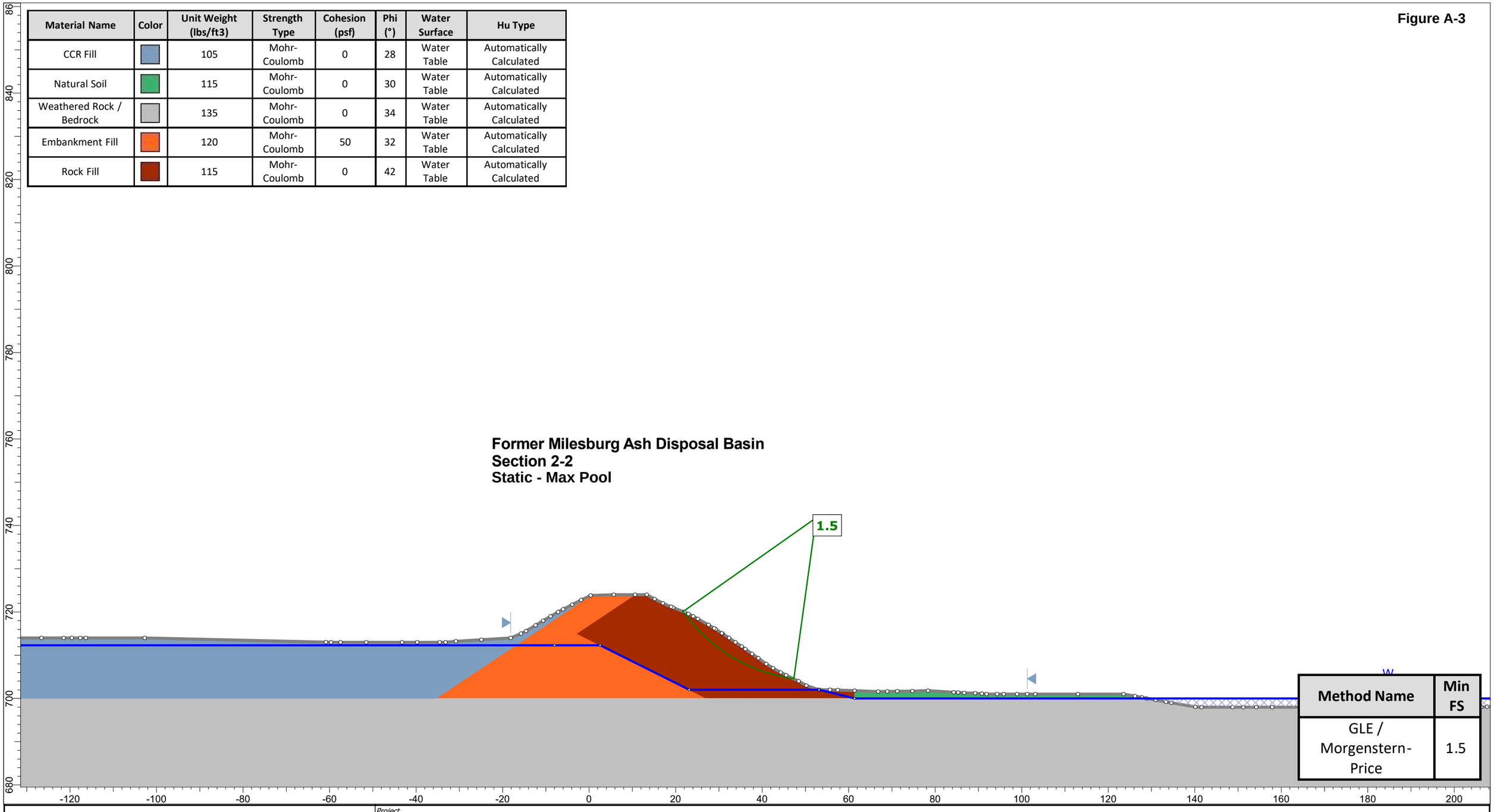
SLIDEINTERPRET 9.034

Project	FE CCR Legacy - Milesburg		
Group	Max Pool	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 1-1.slmd

Figure A-3

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated
Rock Fill		115	Mohr-Coulomb	0	42	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 2-2
Static - Max Pool



Method Name	Min FS
GLE / Morgenstern-Price	1.5

rocscience

SLIDEINTERPRET 9.034

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Group	Max Pool	Scenario	Master Scenario
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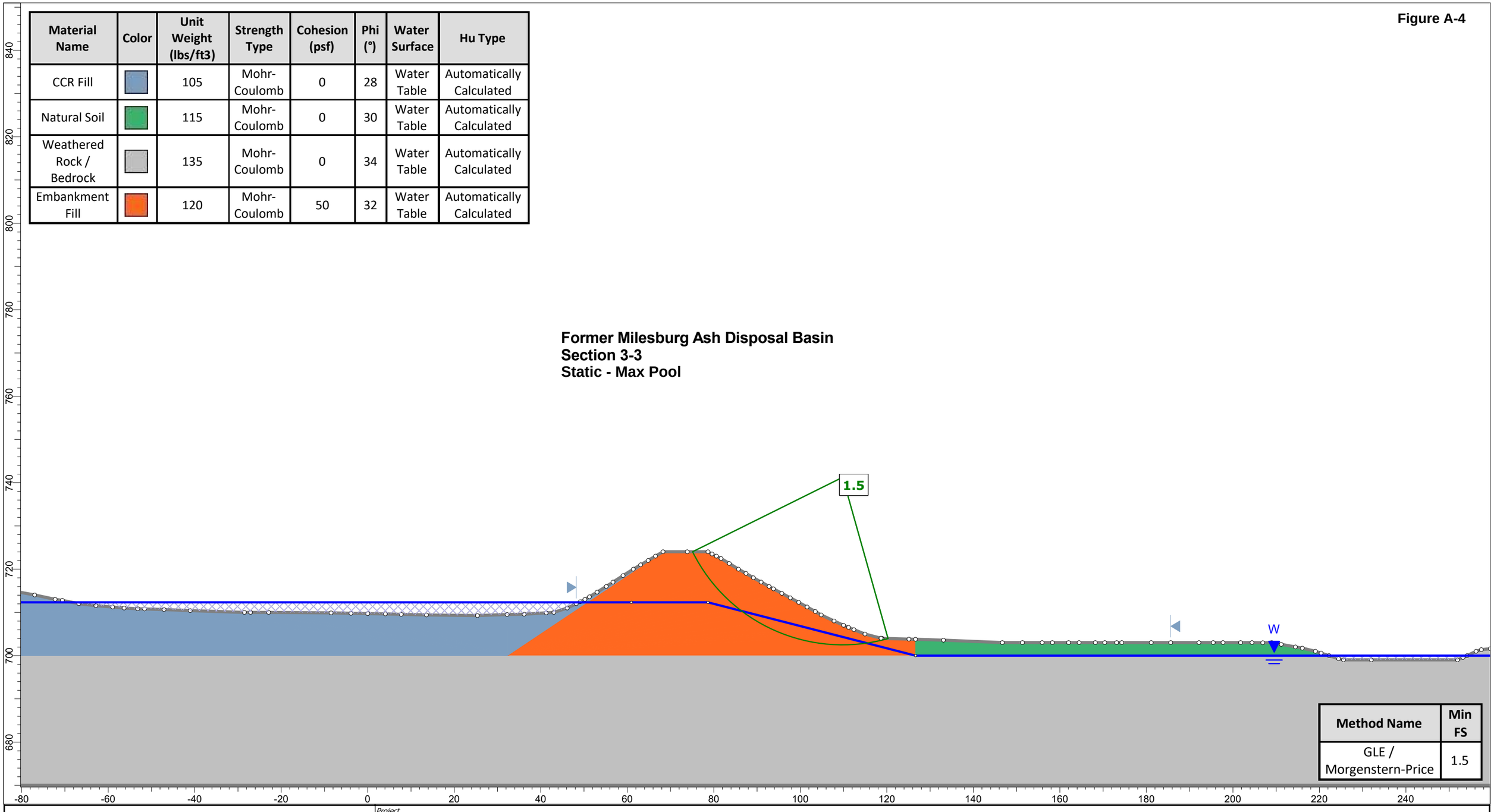
Figure A-4

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 3-3
Static - Max Pool



Method Name	Min FS
GLE / Morgenstern-Price	1.5

rocscience

SLIDEINTERPRET 9.034

Project	FE CCR Legacy - Milesburg		
Group	Max Pool	Scenario	Master Scenario
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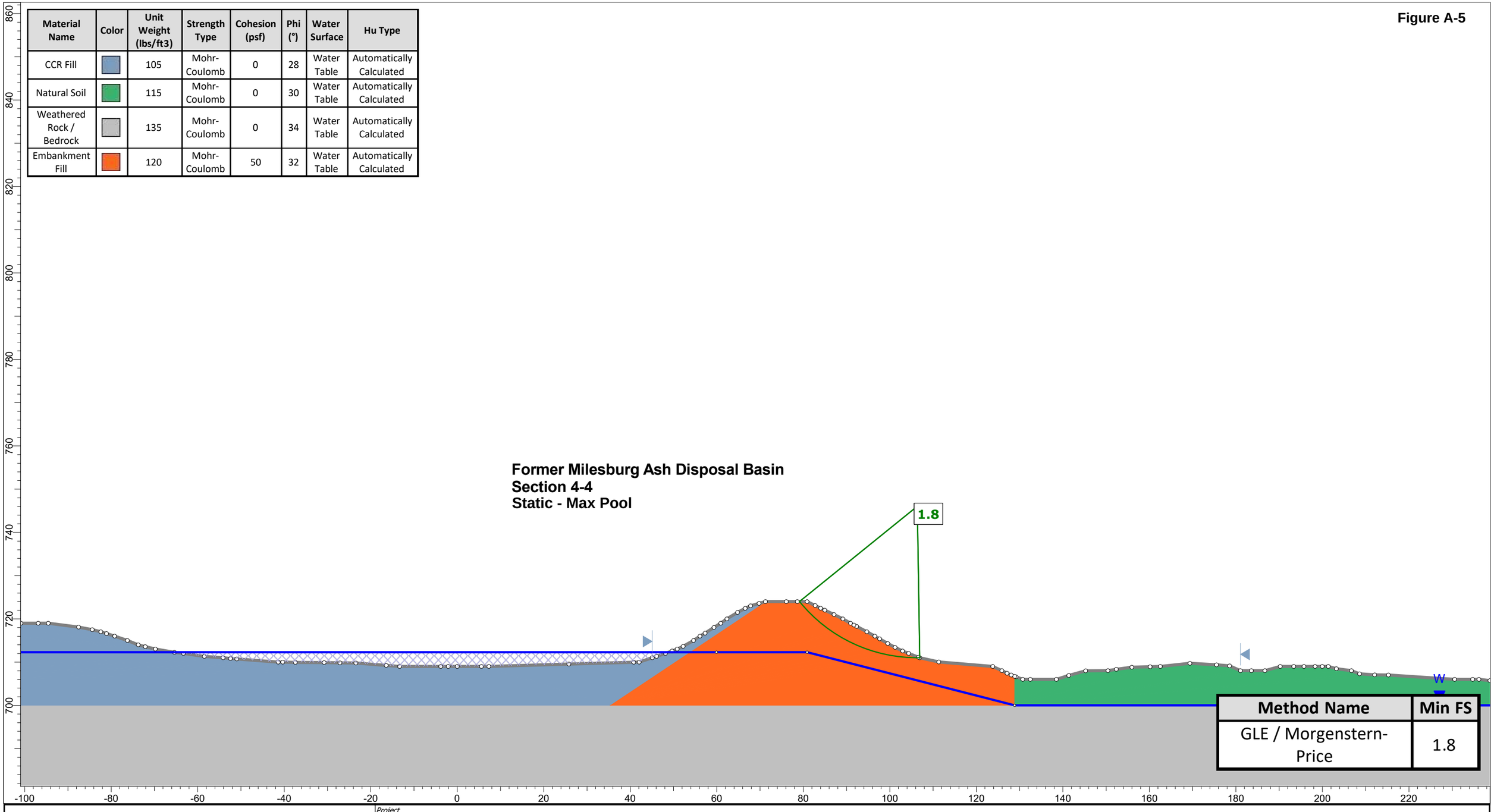
Figure A-5

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated



Method Name	Min FS
GLE / Morgenstern-Price	1.8

rocscience

SLIDEINTERPRET 9.034

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Group	Max Pool	Scenario	Master Scenario
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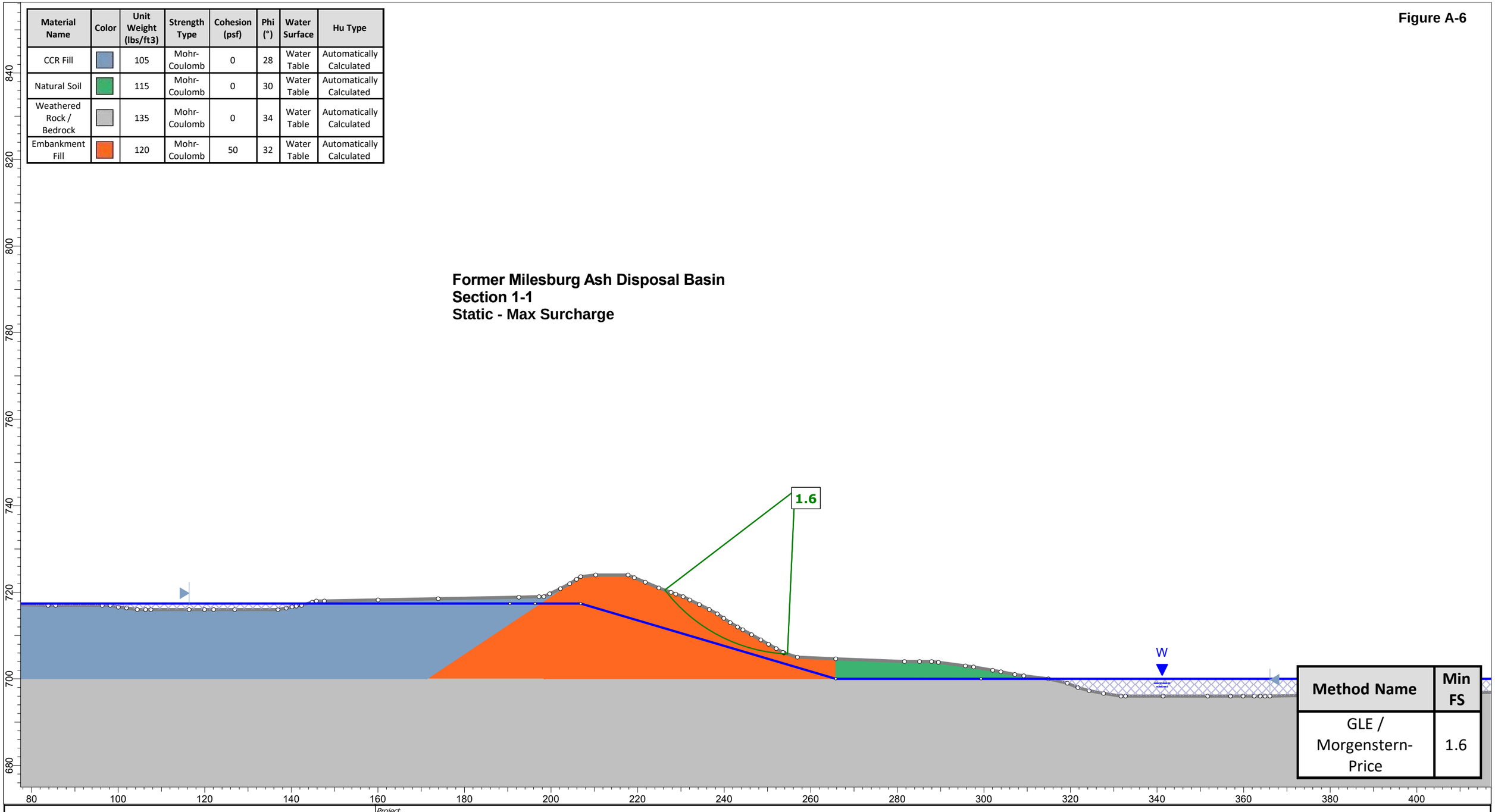
Figure A-6

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 1-1
Static - Max Surcharge



Method Name	Min FS
GLE / Morgenstern-Price	1.6

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SLIDEINTERPRET 9.034

Project	FE CCR Legacy - Milesburg		
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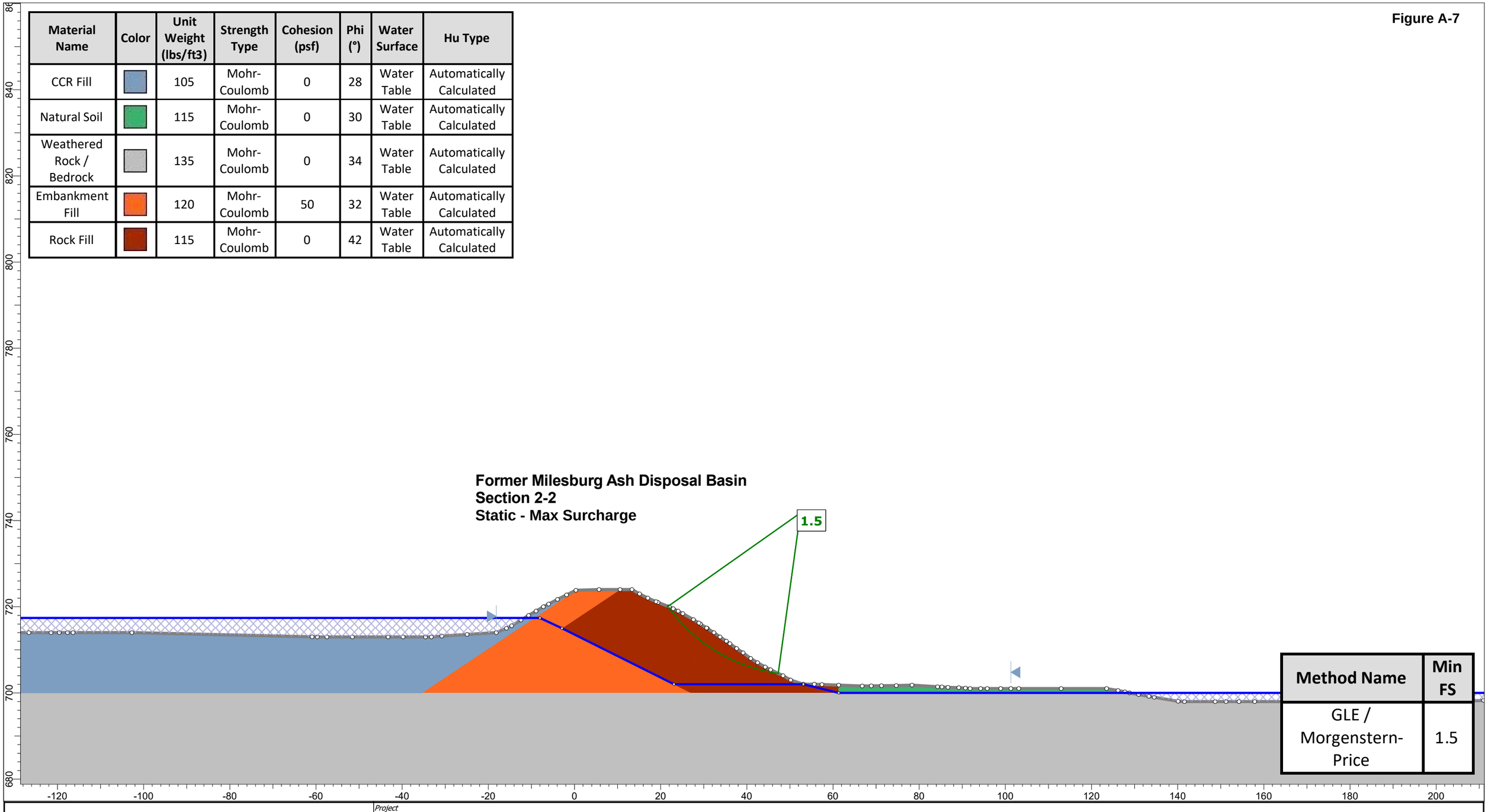
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 1-1.slmd

Figure A-7

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated
Rock Fill		115	Mohr-Coulomb	0	42	Water Table	Automatically Calculated



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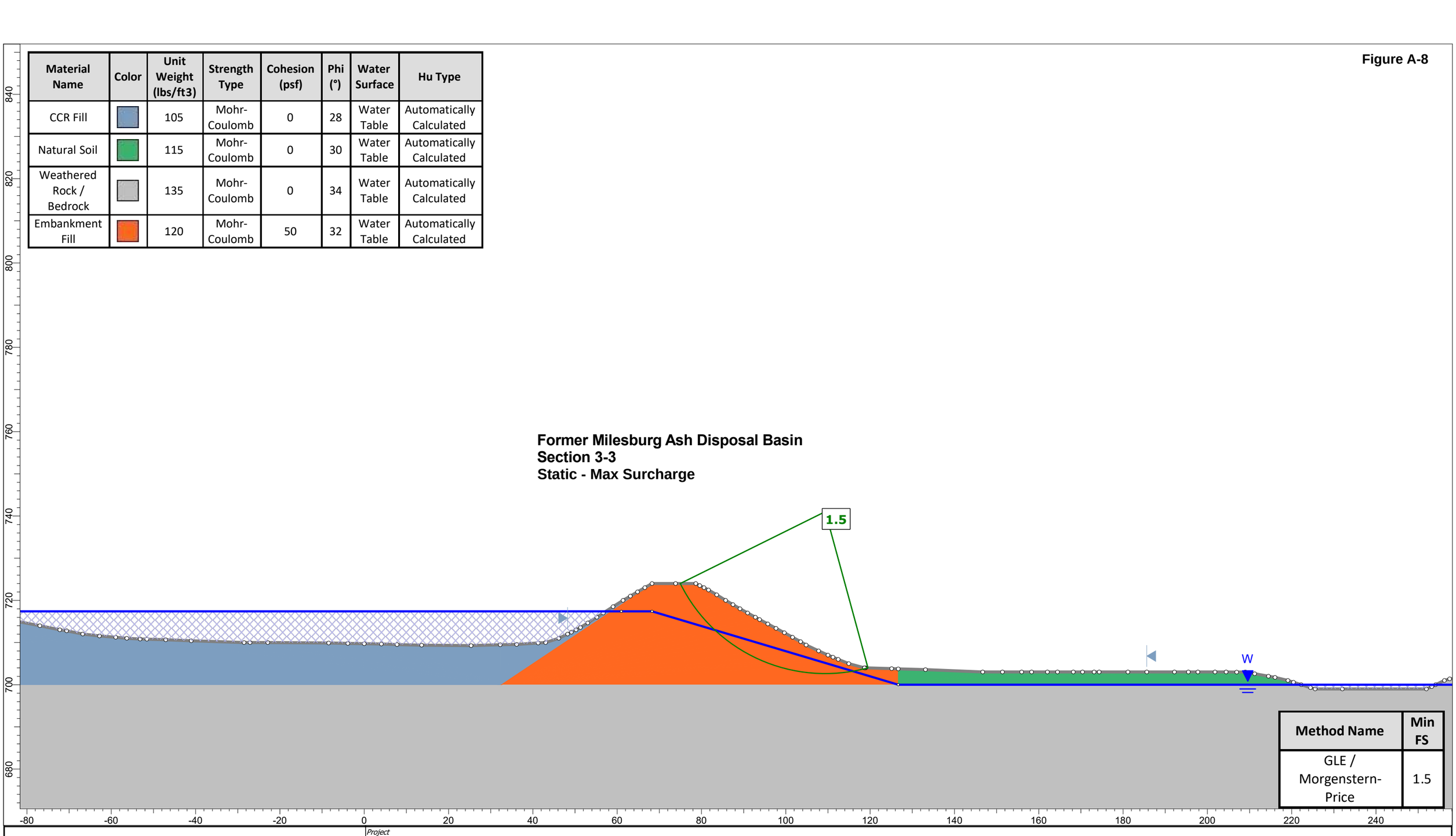
Project	FE CCR Legacy - Milesburg		
Group	Max Surcharge (717.4)	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 2-2.slmd

Figure A-8

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 3-3
Static - Max Surcharge



Method Name	Min FS
GLE / Morgenstern-Price	1.5

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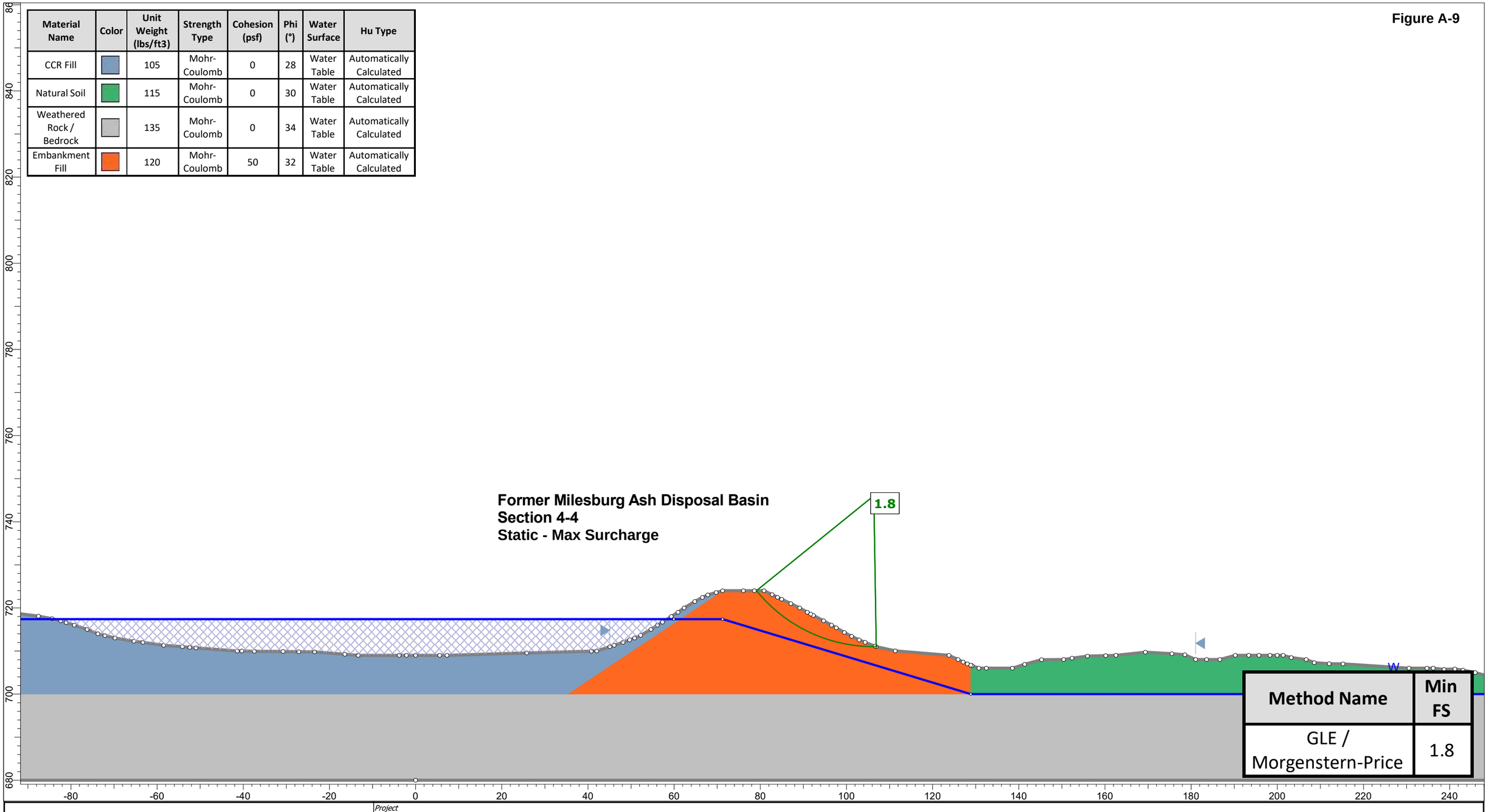
SLIDEINTERPRET 9.034

Project	FE CCR Legacy - Milesburg		
Group	Max Surcharge (717.4)	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 3-3.slmd

Figure A-9

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated



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Project	FE CCR Legacy - Milesburg		
Group	Max Surcharge (717.4)	Scenario	Master Scenario
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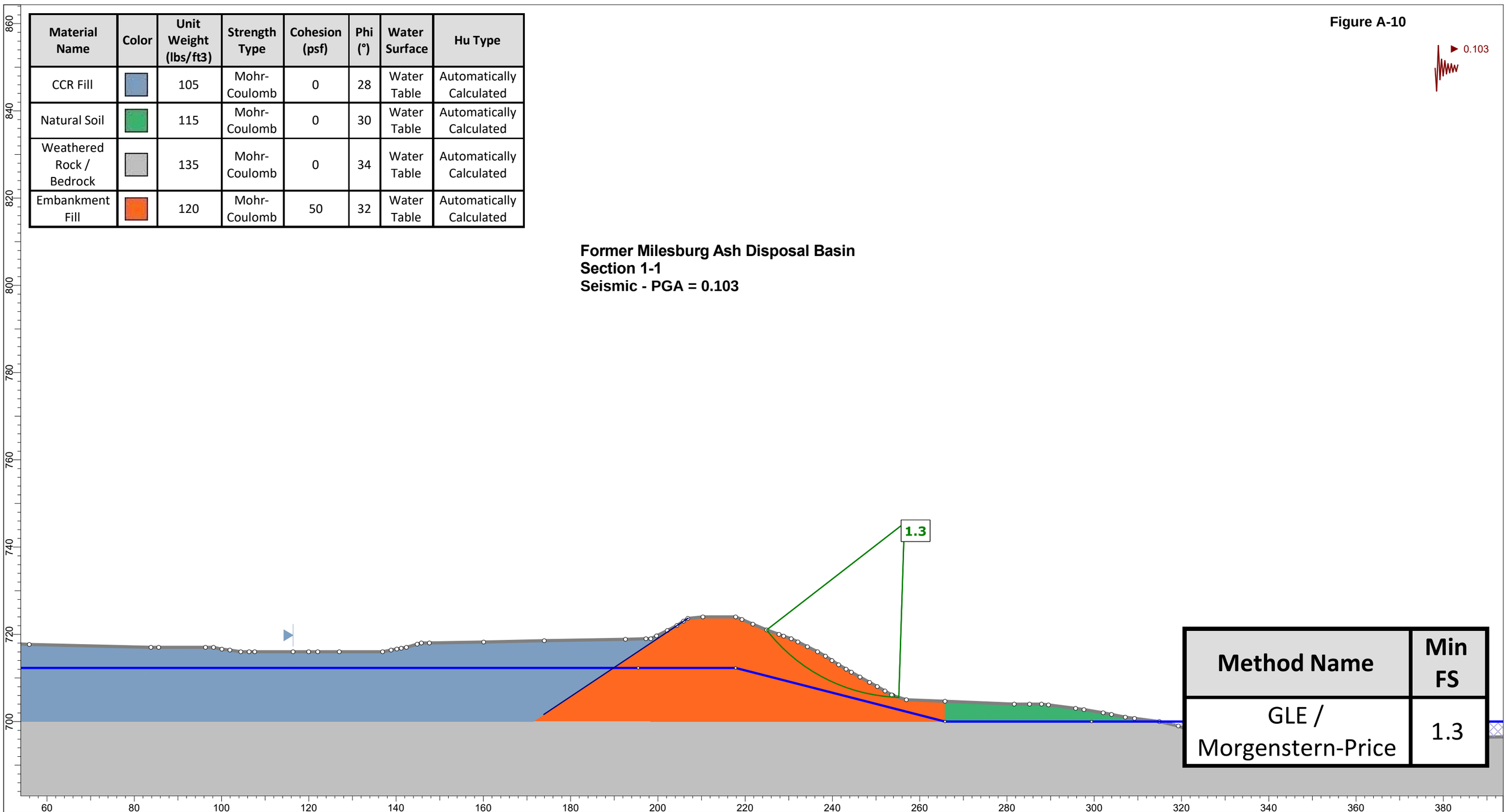
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 4-4.slmd

Figure A-10

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Former Milesburg Ash Disposal Basin
Section 1-1
Seismic - PGA = 0.103



Method Name	Min FS
GLE / Morgenstern-Price	1.3

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Project	FE CCR Legacy - Milesburg		
Group	Seismic	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
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Figure A-11

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated
Rock Fill		115	Mohr-Coulomb	0	42	Water Table	Automatically Calculated

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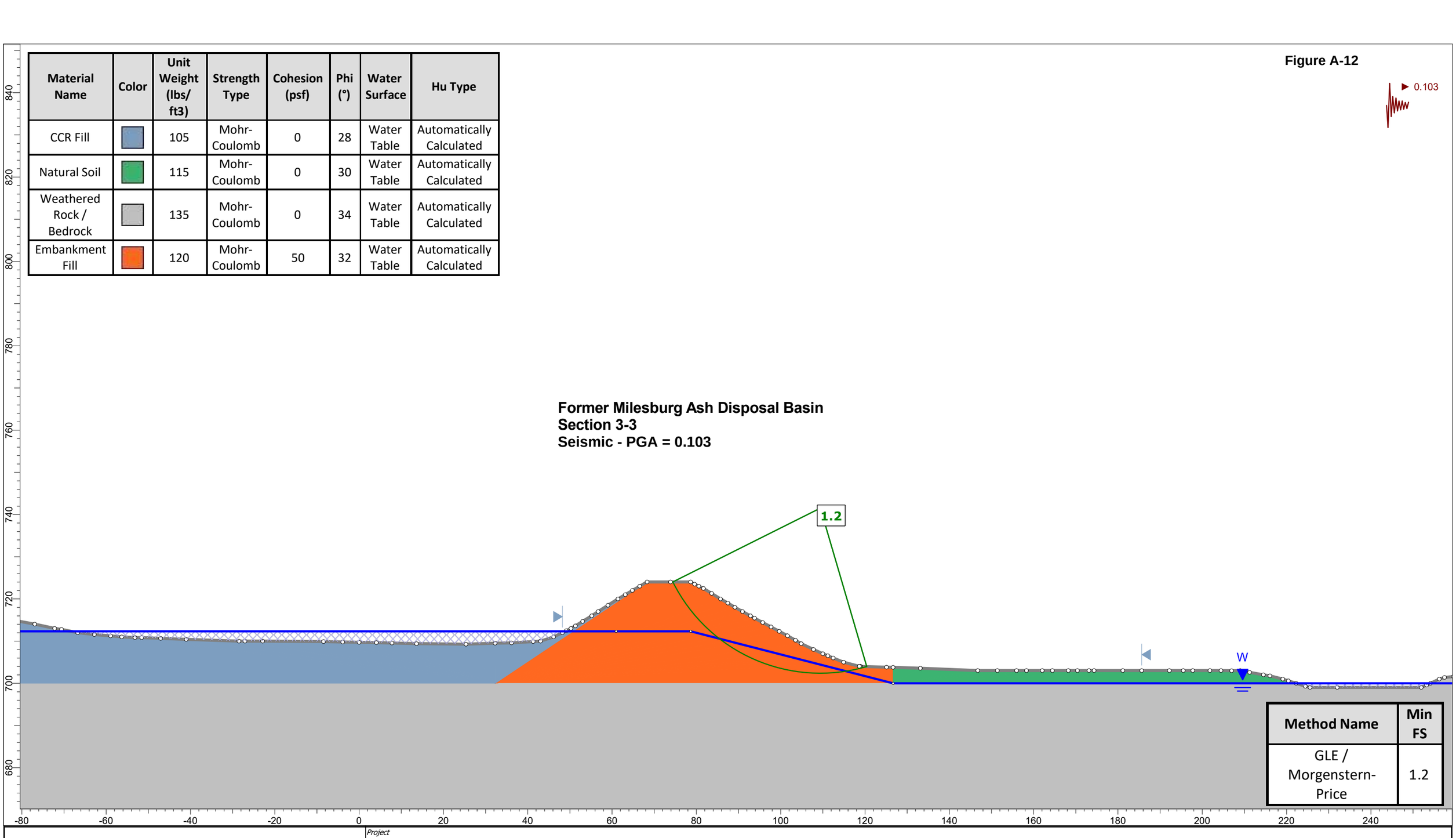
Project	FE CCR Legacy - Milesburg		
Group	Seismic	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 2-2.slmd

Figure A-12

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated



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	Drawn By	RRJ	Company: GAI Consultants, Inc
	Date	3/16/2026, 8:38:25 AM	File Name: FE Milesburg Section 3-3.slmd

SLIDEINTERPRET 9.034

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR Fill		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil		115	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Weathered Rock / Bedrock		135	Mohr-Coulomb	0	34	Water Table	Automatically Calculated
Embankment Fill		120	Mohr-Coulomb	50	32	Water Table	Automatically Calculated

Figure A-13

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SLIDEINTERPRET 9.034

Project	FE CCR Legacy - Milesburg		
Group	Seismic	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Milesburg Section 4-4.slmd

gai consultants

FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 725.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 725.0
Top Elev. = 725.0

Boring B-1

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	724.0	105.0	100.0	9.0	16	0.8	1.0	1.0	0.75	10	0.0500	0.0500	1.70	0.05	0.05	16	1	17	1.0041	0.0653	1.5	1.10	0.174276	0.284	-
0.9	3.0	722.0	105.0	100.0	9.0	31	0.8	1.0	1.0	0.75	19	0.1500	0.1500	1.70	0.15	0.15	32	1	32	0.9953	0.0647	1.5	1.10	0.679829	1.108	-
1.5	5.0	720.0	105.0	100.0	9.0	31	0.8	1.0	1.0	0.75	19	0.2500	0.2500	1.70	0.25	0.25	32	1	32	0.9857	0.0641	1.5	1.10	0.679829	1.108	-
2.1	7.0	718.0	105.0	100.0	9.0	45	0.8	1.0	1.0	0.75	27	0.3500	0.3500	1.70	0.35	0.35	46	1	47	0.9753	0.0634	1.5	1.10	2.000000	3.260	-
2.7	9.0	716.0	105.0	100.0	9.0	42	0.8	1.0	1.0	0.75	25	0.4500	0.4500	1.52	0.45	0.45	38	1	39	0.9643	0.0627	1.5	1.10	2.000000	3.260	-
3.4	11.0	714.0	105.0	100.0	9.0	36	0.8	1.0	1.0	0.80	23	0.5500	0.5500	1.38	0.55	0.55	32	1	32	0.9526	0.0619	1.5	1.10	0.694031	1.131	-
4.0	13.0	712.0	105.0	100.0	9.0	27	0.8	1.0	1.0	0.85	18	0.6508	0.6414	1.27	0.65	0.64	23	1	24	0.9404	0.0620	1.5	1.08	0.267958	0.427	6.88
4.6	15.0	710.0	105.0	100.0	9.0	23	0.8	1.0	1.0	0.85	16	0.7558	0.6840	1.18	0.76	0.68	18	1	19	0.9276	0.0666	1.5	1.05	0.196214	0.306	4.60
5.2	17.0	708.0	105.0	100.0	9.0	37	0.8	1.0	1.0	0.85	25	0.8608	0.7266	1.11	0.86	0.73	28	1	29	0.9143	0.0704	1.5	1.07	0.409950	0.649	9.21
5.8	19.0	706.0	105.0	100.0	9.0	29	0.8	1.0	1.0	0.85	20	0.9658	0.7692	1.05	0.97	0.77	21	1	21	0.9007	0.0735	1.5	1.04	0.224135	0.346	4.71
6.4	21.0	704.0	105.0	100.0	9.0	19	0.8	1.0	1.0	0.95	14	1.0708	0.8118	1.01	1.07	0.81	15	1	15	0.8866	0.0760	1.5	1.03	0.158838	0.242	3.18
7.0	23.0	702.0	105.0	100.0	9.0	9	0.8	1.0	1.0	0.95	7	1.1758	0.8544	0.99	1.18	0.85	7	1	7	0.8723	0.0780	1.5	1.02	0.101337	0.153	1.96
7.6	25.0	700.0	105.0	100.0	9.0	20	0.8	1.0	1.0	0.95	15	1.2808	0.8970	0.97	1.28	0.90	15	1	15	0.8577	0.0796	1.5	1.02	0.160255	0.241	3.03
8.2	27.0	698.0	105.0	100.0	9.0	48	0.8	1.0	1.0	0.95	36	1.3858	0.9396	0.95	1.39	0.94	35	1	35	0.8429	0.0808	1.5	1.03	1.231402	1.874	23.20
8.8	29.0	696.0	105.0	100.0	9.0	39	0.8	1.0	1.0	0.95	30	1.4908	0.9822	0.94	1.49	0.98	28	1	28	0.8279	0.0817	1.5	1.01	0.403514	0.604	7.40
10.4	34.0	691.0	105.0	100.0	9.0	25	0.8	1.0	1.0	1.00	20	1.7533	1.0887	0.90	1.75	1.09	18	1	19	0.7902	0.0827	1.5	0.99	0.190544	0.281	3.39
11.7	38.5	686.5	105.0	100.0	9.0	100	0.8	1.0	1.0	1.00	80	1.9895	1.1845	0.87	1.99	1.18	69	1	70	0.7563	0.0826	1.5	0.96	2.000000	2.849	34.51

FS_{min} 1.96

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

gai consultants

FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 719.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 719.0
Top Elev. = 719.0

Boring B-2

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	718.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.75	2	0.0500	0.0500	1.70	0.05	0.05	4	1	5	1.0041	0.0653	1.5	1.10	0.084981	0.138	-
0.9	3.0	716.0	105.0	100.0	9.0	6	0.8	1.0	1.0	0.75	4	0.1500	0.1500	1.70	0.15	0.15	6	1	7	0.9953	0.0647	1.5	1.10	0.097190	0.158	-
1.5	5.0	714.0	105.0	100.0	9.0	8	0.8	1.0	1.0	0.75	5	0.2500	0.2500	1.70	0.25	0.25	8	1	9	0.9857	0.0641	1.5	1.10	0.110401	0.180	-
2.1	7.0	712.0	105.0	100.0	9.0	9	0.8	1.0	1.0	0.75	5	0.3508	0.3414	1.70	0.35	0.34	9	1	10	0.9753	0.0651	1.5	1.10	0.117362	0.191	2.94
2.7	9.0	710.0	105.0	100.0	9.0	1	0.8	1.0	1.0	0.75	1	0.4558	0.3840	1.52	0.46	0.38	1	1	2	0.9643	0.0744	1.5	1.06	0.068267	0.108	1.45
3.4	11.0	708.0	105.0	100.0	9.0	2	0.8	1.0	1.0	0.8	1	0.5608	0.4266	1.44	0.56	0.43	2	1	3	0.9526	0.0814	1.5	1.06	0.072842	0.114	1.41
4.0	13.0	706.0	105.0	100.0	9.0	24	0.8	1.0	1.0	0.85	16	0.6658	0.4692	1.38	0.67	0.47	22	1	23	0.9404	0.0867	1.5	1.10	0.253203	0.413	4.76
4.6	15.0	704.0	105.0	100.0	9.0	24	0.8	1.0	1.0	0.85	16	0.7708	0.5118	1.33	0.77	0.51	22	1	22	0.9276	0.0908	1.5	1.10	0.239185	0.390	4.29
4.9	16.0	703.0	105.0	100.0	9.0	100	0.8	1.0	1.0	0.85	68	0.8233	0.5331	1.30	0.82	0.53	89	1	89	0.9210	0.0925	1.5	1.10	2.000000	3.260	35.26
5.0	16.5	702.5	105.0	100.0	9.0	100	0.8	1.0	1.0	0.85	68	0.8495	0.5437	1.29	0.85	0.54	88	1	89	0.9177	0.0932	1.5	1.10	2.000000	3.260	34.98

FS_{min} 1.41

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

gai consultants

FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 719.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 719.0
Top Elev. = 719.0

Boring B-3

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	718.0	105.0	100.0	9.0	100	0.8	1.0	1.0	0.75	60	0.0500	0.0500	1.70	0.05	0.05	102	1	103	1.0041	0.0653	1.5	1.10	2.000000	3.260	-
0.9	3.0	716.0	105.0	100.0	9.0	2	0.8	1.0	1.0	0.75	1	0.1500	0.1500	1.70	0.15	0.15	2	1	3	0.9953	0.0647	1.5	1.10	0.073881	0.120	-
1.5	5.0	714.0	105.0	100.0	9.0	3	0.8	1.0	1.0	0.75	2	0.2500	0.2500	1.70	0.25	0.25	3	1	4	0.9857	0.0641	1.5	1.10	0.079286	0.129	-
2.1	7.0	712.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.75	2	0.3508	0.3414	1.70	0.35	0.34	4	1	5	0.9753	0.0651	1.5	1.08	0.084981	0.136	2.09
2.7	9.0	710.0	105.0	100.0	9.0	5	0.8	1.0	1.0	0.75	3	0.4558	0.3840	1.52	0.46	0.38	5	1	5	0.9643	0.0744	1.5	1.08	0.087817	0.140	1.88
3.4	11.0	708.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.80	3	0.5608	0.4266	1.38	0.56	0.43	4	1	4	0.9526	0.0814	1.5	1.07	0.081861	0.129	1.59
4.0	13.0	706.0	105.0	100.0	9.0	7	0.8	1.0	1.0	0.85	5	0.6658	0.4692	1.27	0.67	0.47	6	1	7	0.9404	0.0867	1.5	1.06	0.096650	0.152	1.76
4.6	15.0	704.0	105.0	100.0	9.0	10	0.8	1.0	1.0	0.85	7	0.7708	0.5118	1.20	0.77	0.51	8	1	9	0.9276	0.0908	1.5	1.06	0.110549	0.174	1.92
4.9	16.0	703.0	105.0	100.0	9.0	22	0.8	1.0	1.0	0.85	15	0.8233	0.5331	1.19	0.82	0.53	18	1	18	0.9210	0.0925	1.5	1.08	0.188446	0.303	3.27

FS_{min} 1.59

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

gai consultants

FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 719.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 719.0
Top Elev. = 719.0

Boring B-4

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	718.0	105.0	100.0	9.0	5	0.8	1.0	1.0	0.75	3	0.0500	0.0500	1.70	0.05	0.05	5	1	6	1.0041	0.0653	1.5	1.10	0.090954	0.148	-
0.9	3.0	716.0	105.0	100.0	9.0	8	0.8	1.0	1.0	0.75	5	0.1500	0.1500	1.70	0.15	0.15	8	1	9	0.9953	0.0647	1.5	1.10	0.110401	0.180	-
1.5	5.0	714.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.75	2	0.2500	0.2500	1.70	0.25	0.25	4	1	5	0.9857	0.0641	1.5	1.10	0.084981	0.138	-
2.1	7.0	712.0	105.0	100.0	9.0	3	0.8	1.0	1.0	0.75	2	0.3508	0.3414	1.70	0.35	0.34	3	1	4	0.9753	0.0651	1.5	1.08	0.079286	0.127	1.95
2.7	9.0	710.0	105.0	100.0	9.0	6	0.8	1.0	1.0	0.75	4	0.4558	0.3840	1.52	0.46	0.38	5	1	6	0.9643	0.0744	1.5	1.08	0.093272	0.149	2.01
3.4	11.0	708.0	105.0	100.0	9.0	28	0.8	1.0	1.0	0.80	18	0.5608	0.4266	1.38	0.56	0.43	25	1	25	0.9526	0.0814	1.5	1.10	0.300087	0.489	6.01
4.0	13.0	706.0	105.0	100.0	9.0	26	0.8	1.0	1.0	0.85	18	0.6658	0.4692	1.27	0.67	0.47	22	1	23	0.9404	0.0867	1.5	1.10	0.251639	0.410	4.73
4.6	15.0	704.0	105.0	100.0	9.0	18	0.8	1.0	1.0	0.85	12	0.7708	0.5118	1.18	0.77	0.51	14	1	15	0.9276	0.0908	1.5	1.08	0.157488	0.252	2.77
5.2	17.0	702.0	105.0	100.0	9.0	20	0.8	1.0	1.0	0.85	14	0.8758	0.5544	1.11	0.88	0.55	15	1	16	0.9143	0.0939	1.5	1.07	0.162932	0.259	2.76
5.5	18.0	701.0	105.0	100.0	9.0	100	0.8	1.0	1.0	0.85	68	0.9283	0.5757	1.08	0.93	0.58	73	1	74	0.9076	0.0951	1.5	1.10	2.000000	3.260	34.27

FS_{min} 1.95

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

gai consultants

FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 704.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 704.0
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 704.0
Top Elev. = 704.0

Boring B-5

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	703.0	105.0	100.0	21.0	6	0.8	1.0	1.0	0.75	4	0.0525	0.0213	1.70	0.05	0.02	6	5	11	1.0041	0.1609	1.5	1.10	0.123373	0.201	1.25
0.9	3.0	701.0	105.0	100.0	9.0	14	0.8	1.0	1.0	0.75	8	0.1575	0.0639	1.70	0.16	0.06	14	1	15	0.9953	0.1595	1.5	1.10	0.156111	0.254	1.60
1.5	5.0	699.0	105.0	100.0	9.0	27	0.8	1.0	1.0	0.75	16	0.2625	0.1065	1.70	0.26	0.11	28	1	28	0.9857	0.1579	1.5	1.10	0.394458	0.643	4.07
2.1	7.0	697.0	105.0	100.0	9.0	46	0.8	1.0	1.0	0.75	28	0.3675	0.1491	1.70	0.37	0.15	47	1	48	0.9753	0.1563	1.5	1.10	2.000000	3.260	20.86
2.7	9.0	695.0	105.0	100.0	9.0	51	0.8	1.0	1.0	0.75	31	0.4725	0.1917	1.52	0.47	0.19	47	1	47	0.9643	0.1545	1.5	1.10	2.000000	3.260	21.10
3.2	10.5	693.5	105.0	100.0	9.0	100	0.8	1.0	1.0	0.80	64	0.5513	0.2237	1.41	0.55	0.22	90	1	91	0.9556	0.1531	1.5	1.10	2.000000	3.260	21.29
4.0	13.0	691.0	105.0	100.0	9.0	61	0.8	1.0	1.0	0.85	41	0.6825	0.2769	1.27	0.68	0.28	53	1	53	0.9404	0.1507	1.5	1.10	2.000000	3.260	21.64
4.4	14.5	689.5	105.0	100.0	9.0	100	0.8	1.0	1.0	0.85	68	0.7613	0.3089	1.20	0.76	0.31	82	1	82	0.9308	0.1491	1.5	1.10	2.000000	3.260	21.86

FS_{min} 1.25

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

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FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 719.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 719.0
Top Elev. = 719.0

Boring B-6

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	718.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.75	2	0.0500	0.0500	1.70	0.05	0.05	4	1	5	1.0041	0.0653	1.5	1.10	0.084981	0.138	-
0.9	3.0	716.0	105.0	100.0	9.0	5	0.8	1.0	1.0	0.75	3	0.1500	0.1500	1.70	0.15	0.15	5	1	6	0.9953	0.0647	1.5	1.10	0.090954	0.148	-
1.5	5.0	714.0	105.0	100.0	9.0	3	0.8	1.0	1.0	0.75	2	0.2500	0.2500	1.70	0.25	0.25	3	1	4	0.9857	0.0641	1.5	1.10	0.079286	0.129	-
2.1	7.0	712.0	105.0	100.0	9.0	3	0.8	1.0	1.0	0.75	2	0.3508	0.3414	1.70	0.35	0.34	3	1	4	0.9753	0.0651	1.5	1.08	0.079286	0.127	1.95
2.7	9.0	710.0	105.0	100.0	9.0	10	0.8	1.0	1.0	0.75	6	0.4558	0.3840	1.52	0.46	0.38	9	1	10	0.9643	0.0744	1.5	1.09	0.117085	0.189	2.55
3.4	11.0	708.0	105.0	100.0	9.0	19	0.8	1.0	1.0	0.80	12	0.5608	0.4266	1.38	0.56	0.43	17	1	17	0.9526	0.0814	1.5	1.10	0.178464	0.291	3.57
4.0	13.0	706.0	105.0	100.0	9.0	29	0.8	1.0	1.0	0.85	20	0.6658	0.4692	1.27	0.67	0.47	25	1	26	0.9404	0.0867	1.5	1.10	0.307961	0.502	5.79
4.4	14.5	704.5	105.0	100.0	9.0	43	0.8	1.0	1.0	0.85	29	0.7445	0.5011	1.20	0.74	0.50	35	1	36	0.9308	0.0899	1.5	1.10	1.320498	2.152	23.94

FS_{min} 1.95

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

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FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 719.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 712.3
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 719.0
Top Elev. = 719.0

Boring B-7

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	718.0	105.0	100.0	9.0	4	0.8	1.0	1.0	0.75	2	0.0500	0.0500	1.70	0.05	0.05	4	1	5	1.0041	0.0653	1.5	1.10	0.084981	0.138	-
0.9	3.0	716.0	105.0	100.0	9.0	6	0.8	1.0	1.0	0.75	4	0.1500	0.1500	1.70	0.15	0.15	6	1	7	0.9953	0.0647	1.5	1.10	0.097190	0.158	-
1.5	5.0	714.0	105.0	100.0	9.0	7	0.8	1.0	1.0	0.75	4	0.2500	0.2500	1.70	0.25	0.25	7	1	8	0.9857	0.0641	1.5	1.10	0.103675	0.169	-
2.1	7.0	712.0	105.0	100.0	9.0	11	0.8	1.0	1.0	0.75	7	0.3508	0.3414	1.70	0.35	0.34	11	1	12	0.9753	0.0651	1.5	1.10	0.132002	0.215	3.30
2.7	9.0	710.0	105.0	100.0	9.0	15	0.8	1.0	1.0	0.75	9	0.4558	0.3840	1.52	0.46	0.38	14	1	14	0.9643	0.0744	1.5	1.10	0.151383	0.247	3.32
3.5	11.5	707.5	105.0	100.0	9.0	14	0.8	1.0	1.0	0.80	9	0.5870	0.4372	1.35	0.59	0.44	12	1	13	0.9496	0.0829	1.5	1.09	0.138446	0.223	2.69
4.0	13.0	706.0	105.0	100.0	9.0	20	0.8	1.0	1.0	0.85	14	0.6658	0.4692	1.27	0.67	0.47	17	1	18	0.9404	0.0867	1.5	1.10	0.183260	0.298	3.44
4.6	15.0	704.0	105.0	100.0	9.0	21	0.8	1.0	1.0	0.85	14	0.7708	0.5118	1.18	0.77	0.51	17	1	18	0.9276	0.0908	1.5	1.09	0.179391	0.289	3.18
5.0	16.5	702.5	105.0	100.0	9.0	26	0.8	1.0	1.0	0.85	18	0.8495	0.5437	1.13	0.85	0.54	20	1	21	0.9177	0.0932	1.5	1.09	0.213510	0.344	3.69

FS_{min} 2.69

Notes:

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

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FE Milesburg
Former Ash Disposal Basin
Liquefaction Analysis

By: RRJ 4/1/26
Checked by: AB 4/8/26

G.S. Elev. = 725.0
$\gamma_{overburden}$ = 100.0 (pcf)

W.T. Elev. = 719.2
a_{max} 0.10
Est. EQ Mag 6

Bottom Elev. = 725.0
Top Elev. = 725.0

Boring B-8

																		Idriss and Boulanger (2008)								
Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C_E	C_B	C_S	C_R	N_{60}	Existing σ_{vo} (tsf)	Existing σ'_{vo} (tsf)	C_N	Design σ_{vo} (tsf)	Design σ_{vo}' (tsf)	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60cs}$	r_d	CSR	MSF	K_σ	CRR for M=7.5 and σ_{vc}'=1atm	CRR	Factor of Safety
0.3	1.0	724.0	105.0	100.0	9.0	8	0.8	1.0	1.0	0.75	5	0.0500	0.0500	1.70	0.05	0.05	8	1	9	1.0041	0.0653	1.5	1.10	0.110401	0.180	-
0.9	3.0	722.0	105.0	100.0	9.0	12	0.8	1.0	1.0	0.75	7	0.1500	0.1500	1.70	0.15	0.15	12	1	13	0.9953	0.0647	1.5	1.10	0.139715	0.228	-
1.5	5.0	720.0	105.0	100.0	9.0	6	0.8	1.0	1.0	0.75	4	0.2500	0.2500	1.70	0.25	0.25	6	1	7	0.9857	0.0641	1.5	1.10	0.097190	0.158	-
2.1	7.0	718.0	105.0	100.0	9.0	9	0.8	1.0	1.0	0.75	5	0.3530	0.3156	1.70	0.35	0.32	9	1	10	0.9753	0.0709	1.5	1.10	0.117362	0.191	2.70
2.7	9.0	716.0	105.0	100.0	9.0	28	0.8	1.0	1.0	0.75	17	0.4580	0.3582	1.70	0.46	0.36	29	1	29	0.9643	0.0801	1.5	1.10	0.443334	0.723	9.01
3.4	11.0	714.0	105.0	100.0	9.0	38	0.8	1.0	1.0	0.80	24	0.5630	0.4008	1.61	0.56	0.40	39	1	40	0.9526	0.0870	1.5	1.10	2.000000	3.260	37.47
3.7	12.0	713.0	105.0	100.0	9.0	100	0.8	1.0	1.0	0.80	64	0.6155	0.4221	1.57	0.62	0.42	101	1	101	0.9466	0.0897	1.5	1.10	2.000000	3.260	36.33

Notes:

FS_{min} 2.70

σ'_{vo}	Vertical Effective Stress (tons/ft^2)
$(N_1)_{60}$	Standardized and Normalized SPT blow counts (blows/foot)
r_d	Stress Reduction Factor (dimensionless)
a_{max}	Peak horizontal ground surface acceleration (in g)
CSR	Cyclic stress ratio based on design earthquake (dimensionless)
$CRR_{7.5}$	Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
MSF	Magnitude scaling factor (dimensionless)
K_σ	High overburden stress correction factor (dimensionless)
K_α	Ground slope correction factor (dimensionless) [advised not to be used by reference]
CRR	Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR7.5 * Kσ * Kα
FS_L	Factor of safety against liquefaction (dimensionless)

References:

(1) 1. Idriss, I. M., and Boulanger, R. W. (2008).Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.