DOMINION ENERGY

PERIODIC STRUCTURAL STABILITY ASSESSMENT

BREMO STATION INACTIVE CCR SURFACE IMPOUNDMENT: WEST POND

APRIL 2023

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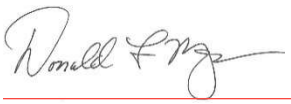
APPENDICES

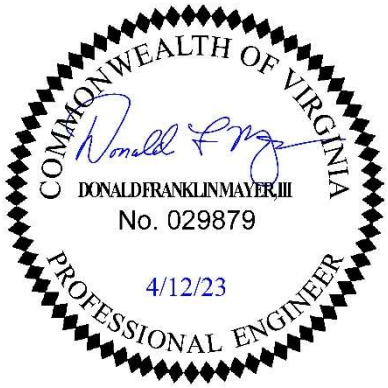
1 CERTIFICATION

This periodic Structural Stability Assessment for the Bremo Station's West Pond was prepared by WSP USA Inc. (WSP; formerly d/b/a Golder Associates USA Inc.). The document and Certification/Statement of Professional Opinion are based on and limited to information that WSP has relied on from Dominion Energy and others, but not independently verified, as well as work products previously produced by Golder.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that this document 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, at the same time, and in the same locale. It is my professional opinion that the document was prepared consistent with the requirements in 40 CFR §257.73(d) 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 [40 CFR §257.73(d)], as well as with the requirements in 40 CFR §257.100 resulting from the EPA's "Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities: Extension of Compliance Deadlines for Certain Inactive Surface Impoundments; Response to Partial Vacatur" published in the Federal Register on August 5, 2016, with an effective date of October 4, 2016 (40 CFR §257.100).

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

Donald Mayer, PE	Vice President
Print Name	Title
	4/12/2023
Signature	Date



2 INTRODUCTION

This periodic Structural Stability Assessment (Assessment) was prepared for the Bremo Station's (Station) existing Coal Combustion Residuals (CCR) inactive surface impoundment known as the West Pond. This periodic Structural Stability Assessment was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.73(d).

The Station, owned and operated by Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion Energy), is located in Fluvanna County at 1038 Bremo Road, east of Route 15 (James Madison Highway) and north of the James River. The Station includes an existing, inactive CCR surface impoundment, the West Pond, as defined by the Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule and Direct Final Rule (40 CFR §257; the CCR Rule). The West Pond is also regulated as a dam by the Virginia Department of Conservation and Recreation (DCR) with Inventory Number 065011 (DCR Dam Permit). Discharge from the West Pond is currently regulated by Virginia Department of Environmental Quality (DEQ) Virginia Pollutant Discharge Elimination System Permit No. VA0004138 (VPDES Permit).

Dominion Energy performed closure by removal activities in the West Pond by removing the stored CCR and over-excavating soil pursuant to its solid waste permit closure plan (SWP 618). The Virginia Department of Environmental Quality (DEQ) verified removal activities in April 2020. The Pond remains subject to the CCR Rule requirements due to observed groundwater impacts that prevent full closure of the unit under the rule even though the Pond no longer impounds CCR materials.

3 PURPOSE

This periodic Assessment is prepared pursuant to the requirements in the CCR Rule, 40 CFR §257.73(d)(1). The initial Structural Stability Assessment was completed in April 2018 and is required to be updated every five (5) years pursuant to 40 CFR §257.73(f)(3). The West Pond remains subject to the CCR Rule requirements, including this periodic structural stability assessment update, even though all CCR materials have been removed.

4 STRUCTURAL STABILITY ASSESSMENT REQUIREMENTS

In accordance with 40 CFR §257.73(d)(1), the owner or operator of a CCR surface impoundment must conduct periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR surface impoundment is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

- Stable foundations and abutments;
- Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;
- Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;
- Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;
- A single spillway or a combination of spillways that is designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the 100-year flood;
- All spillways must be either of non-erodible construction and designed to carry sustained flows or earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected;
- Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and
- For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

5 STRUCTURAL STABILITY ASSESSMENT

5.1 FOUNDATION AND ABUTMENTS

The Station lies on an alluvial terrace in a geologically stable area with no active (Holocene) faults, karst (limestone, dolomite, or marble) potential, or other geologic conditions of concern. The West Pond was constructed on the natural, alluvial soils generally consisting of clayey silts and locally-exposed underlying gravel channels or residual materials. The West Pond embankments were constructed of mostly alluvial soils excavated from within the footprint of the pond. Material properties within the West Pond abutments were interpreted based on subsurface data and site reconnaissance taken from previous investigations, analyses, and reports included in the March 2017 Virginia Department of Conservation and Recreation (DCR) Impounding Structure Geotechnical Design Report Supporting Documents (Golder, 2017)

WSP's assessment of embankment stability in the Periodic Safety Factor Assessment (WSP, 2023b) show that the West Pond meets the minimum factor of safety requirements in the CCR Rule §257.73(e)(1) except for one section in the southeast corner of the impoundment. Dominion Energy is currently evaluating options to mitigate this area.

Additionally, the West Pond has been routinely inspected and monitored by Station and Dominion Energy personnel in accordance with the requirements in the DCR Dam Permit. Areas of concern are evaluated by professional engineers with corrective actions implemented and documented.

5.2 SLOPE PROTECTION

The West Pond dike slopes are approximately 2 horizontal to 1 vertical (2H:1V), except for a short segment on the southeast, which is slightly steeper. The vegetation on the dike is maintained to prevent brush, trees, clumping of weeds, etc. that would concentrate flow and lead to the development of erosion rills. The interior and exterior slopes are maintained and protected against surface erosion by regular inspections and maintenance, as required, to prevent small erosion areas from developing into larger problem areas.

Dominion Energy performs annual inspections in accordance with the requirements of the DCR Dam Permit with the most recent inspections on June 17, 2021 (Virginia Electric and Power Company, 2021) and September 20, 2022 (Virginia Electric and Power Company, 2022). Dominion Energy evaluates the vegetation on the slopes of the impoundment embankment as part of the annual inspections. Current operations at the West Pond call for grass to be mowed 2-3 times per year to control vegetation height. Additionally, in accordance with 40 CFR Section §257.83, annual inspections are performed by a qualified professional engineer with the most recent inspection on June 16, 2022 (WSP, 2022).

5.3 COMPACTION OF DIKES

The following tables summarize the primary geotechnical laboratory results and basic cone penetrometer testing (CPT)-based interpretations (Table 1), and secondary laboratory data (Table 2) from the West Pond dike laboratory soil tests and CPTs completed during the 2015 geotechnical exploration program.

Table 1 Summary of Primary Geotechnical Testing Data for the West Pond Dike Soil Fills

PROPERTY	NUMBER OF TESTS	MINIMUM	MAXIMUM	AVERAGE	MEDIAN
Depth Range (feet)	-	9.5	34.5	22.3	22.9
Water Content (%)	6	22	26	24	23
Gravel (> 4.75 millimeters) (%)	2	0	0	0	0
Sand (%)	2	11	32	21	21
Fines (< 0.075 millimeters) (%)	4	59	90	75	75
Specific Gravity	1	2.72	2.72	2.72	2.72
Liquid Limit (LL) (%)	5	28	41	34	35
Plastic Limit (PL) (%)	5	19	25	22	23
Plasticity Index (PI)	5	8	17	11	11
Non-plastic Results	0	0 of 5			

Table 3 Summary of Secondary Geotechnical Data for the West Pond Dike Soil Fills

PROPERTY		NUMBER OF TESTS	MINIMUM	MAXIMUM	AVERAGE	MEDIAN
Drilling	Standard Penetration Test (SPT) N (blows per foot, bpf)	17	4	25	11	9
CPT Based	*Peak φ' (°)*	1213	26.0	47.5	34.8	34.3
	Su (ton per square foot, tsf)		0.4	4.7	1.7	1.7
	SPT N_{60} (bpf)		3	23	10	10
	Normalized CPT Tip Resistance (Qtn)		5.8	520.0	58.3	33.1

Embankment fills in the West Pond dikes generally consist of low-plasticity fines (CL and ML) with increasing amounts of sand with fines (SM and SC). The West Pond dikes were generally observed to contain well compacted materials. The structural integrity and water levels within the West Pond embankment fills showed good compaction and behavior in line with the visual observations of good performance.

No visible indications of weakened embankment (e.g., tension cracks, elevated groundwater, groundwater seeps, sinkholes, etc.) have been observed at the West Pond over the past five years during routine and annual inspections. Slope stability analyses presented in the Safety Factor Assessment (WSP, 2023b) present the embankment to be stable. Note that one section on the Southeast of the West Pond did not meet the target factor of safety for normal storage pool; mitigation options for this area are currently being evaluated by Dominion Energy.

5.4 VEGETATED SLOPES

As required by §257.73(d)(1)(iv), vegetation on slopes and surrounding areas are not to exceed a height of six inches above the slope of the dike. Current operations at the West Pond call for grass to be mowed 2-3 times per year to control vegetation height. The vegetated slopes are operated and maintained to be stable and to provide for visual observation of any instability. The 2021 and 2022 annual DCR inspections (Virginia Electric and Power Company, 2021; Virginia Electric and Power Company, 2022) noted that the upstream and downstream slopes of the embankment have been mowed.

5.5 SPILLWAYS

The West Pond's primary spillway, an intake tower and 42-inch diameter corrugated metal pipe, regulated the West Pond pool elevation prior to pond closure activities. The intake tower, in the southeast corner of the impoundment area at approximately 30 feet in height, is constructed of concrete and regulated by wooden baffles (stop logs). In

mid-2016, the West Pond was dewatered for closure activities, and water has not overtopped the stop logs since that time.

As shown in the Periodic Inflow Design Flood Control System Plan for the West Pond, the pond structure has adequate capacity to store the flow from the design storm event. The analysis of the spillway capacity is included in Appendix A of the Periodic Inflow Design Flood Control System Plan for the West Pond (WSP, 2023a).

5.6 HYDRAULIC STRUCTURES

The primary spillway passes under the dike of the West Pond. The primary spillway is a 42-inch diameter pipe connected to a concrete riser structure that is anchored within the footprint of the pond. There is no record or knowledge of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris associated with the primary spillway. In accordance with 40 CFR §257.83, the hydraulic structure is monitored and inspected periodically for clogging, leaks, erosion around the pipe, movements, and other issues.

5.7 ADJACENT WATER BODIES

The West Pond dike is located approximately 280 feet north of the James River. The elevation of the toe of the dike is approximately elevation 216 ft above mean sea level (amsl) and the top of the dike is elevation 234 ft amsl. The mapped 100-year flood Zone AE elevation is approximately 228 ft amsl, so significant inundation of the exterior slopes of the West Pond can be expected during a 100-year flood event in the James River. Evaluation of the slope stability under rapid drawdown conditions after a 100-year flood event shows that the embankments exhibit satisfactory factors of safety. Analysis of the rapid drawdown conditions in included as Appendix A.

6 CORRECTIVE MEASURES

Results of the safety factor assessment referenced in this structural stability assessment indicate that the embankment surrounding the West Pond meets the minimum requirements as outlined in the CCR Rule §257.73(e)(1) except for one area on the outboard slope of the southeastern portion of the impoundment. Dominion Energy is currently evaluating mitigation options for this area.

7 CONCLUSIONS

The West Pond is subject to a periodic structural stability assessment update (due every 5 years from the original assessment performed in April 2018). The pond remains subject to the CCR Rule requirements, even though it no longer impounds CCR materials, due to observed groundwater impacts that prevent full closure of the unit under the CCR Rule.

Based on known site conditions, review of available information, and the current analyses performed for the West Pond embankment, the West Pond surface impoundment design, construction, operations, and maintenance procedures are consistent with good engineering practices for the volume of CCR wastewater that is impounded and meets the requirements of 40 CFR 257.73(d)(1)(ii), (iii), (iv), (v) (vi), and (vii). Due to the conditions described in previous sections of this assessment, the West Pond meets the requirements of 40 CFR 257.73(d)(1)(i) except for one area on the outboard slope of the southeastern portion of the impoundment. Dominion Energy is currently evaluating mitigation options for this area.

REFERENCES

- Golder Associates. Virginia Department of Conservation and Recreation Impounding Structure Geotechnical Design Report. March 2017.
- Virginia DCR Dam Permit, Inventory No. 065011.
- Virginia Electric and Power Company. Annual Inspection Report for Virginia Regulated Impounding Structures, Bremo Power Station West Ash Pond Dam. June 2021.
- Virginia Electric and Power Company. Annual Inspection Report for Virginia Regulated Impounding Structures, Bremo Power Station West Ash Pond Dam. September 2022.
- WSP USA Inc. Annual Inspection Report for Existing CCR Surface Impoundment, Bremo Power Station West Ash Pond Dam. July 2022.
- WSP USA Inc. Periodic Inflow Design Flood Control System Plan, Bremo Power Station Inactive CCR Surface Impoundment: West Ash Pond. April 2023a.
- WSP USA Inc. Periodic Safety Factor Assessment, Bremo Power Station Inactive Surface Impoundment: West Ash Pond. April 2023b.

APPENDIX

A Rapid Drawdown Methodology Package

CALCULATIONS

Date:	April 2023	**Made by:**	W. Foong
Project No.:	GL21466315	**Checked by:**	S. Secara
Subject:	Rapid Drawdown Methodology Package	**Reviewed by:**	G. Hebeler
Project Title:	**BREMO STATION – WEST POND**		

1.0 INTRODUCTION

This document describes the methodology WSP USA Inc. (WSP, formerly operating as Golder) used to evaluate the stability of West Pond dike slopes under rapid drawdown conditions at Dominion Energy's Bremo Station.

Rapid drawdown takes place when free water outside a slope draws down quickly such that the pore pressure in the slope does not have sufficient time to dissipate. The water level drop removes a stabilizing force outside the slope and reduces the stability factor of safety from steady-state conditions.

2.0 METHODOLOGY AND ASSUMPTIONS

WSP used the design procedures and criteria described in the Engineer Manual (EM) 1110-2-1902 from the United States Army Corps of Engineers (USACE, 2003) to evaluate stability under rapid drawdown conditions. For the conditions considered in this package, the USACE lists a minimum target factor of safety of 1.1. Thus, a minimum target factor of safety of 1.1 was adopted for this analysis.

Additionally, the following has been assumed for this analysis:

- The slope is subject to an elevated water level long enough to become saturated
- Drawdown from the elevated water level is rapid
- No drainage occurs out of the slope when the water level drops

USACE lists two methods for performing rapid drawdown analysis but identifies one as the recommended method. Golder used the recommended method for analysis which was developed by Lowe and Karafiath (1959) and later modified by Wright and Duncan (1987) and by Duncan, Wright, and Wong (1990). These procedures are described in whole in the book *Soil Strength and Slope Stability* (Duncan et al., 2014). Golder used the computer program SLIDE2's built-in rapid drawdown tool which includes the reference method (Rocscience, 2023).

Factors of safety were calculated using the general limit equilibrium (GLE) method developed by Morgenstern and Price (Abramson et al., 2002). The factor of safety is calculated by dividing the resisting forces by the driving forces along the critical slip surface.

The rapid drawdown method differs from steady-state stability analyses in the application of material strengths. The rapid drawdown method uses two strength envelopes.

The first strength envelope represents the isotropic consolidation condition where the stress ratio is one (Kc = 1) and is determined from isotropically consolidated-undrained triaxial shear tests by plotting the undrained shear strength (τ_{ff}) versus the effective stress on the failure plane at consolidation (σ'_{fc}). The slope and intercept of the shear strength envelope are $\psi_{Kc=1}$ and $d_{Kc=1}$ as shown below in Figure 1.

The second strength envelope used in rapid drawdown analysis represents the effective shear strength at the maximum effective principal stress ratio ($Kc = K_{failure} = K_f$). The slope and intercept of the strength envelope are the defined by the effective friction angle (ϕ') and the effective cohesion (c') determined from isotropically consolidated-undrained triaxial shear tests as shown in Figure 2.

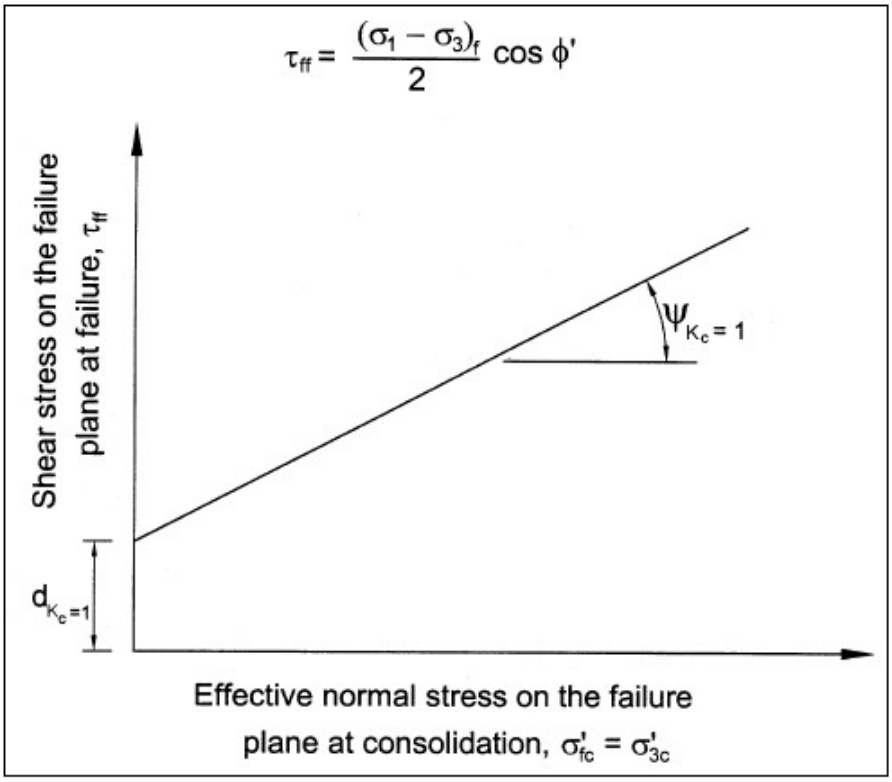


Figure 1. Estimation of Undrained Shear Strength Kc = 1

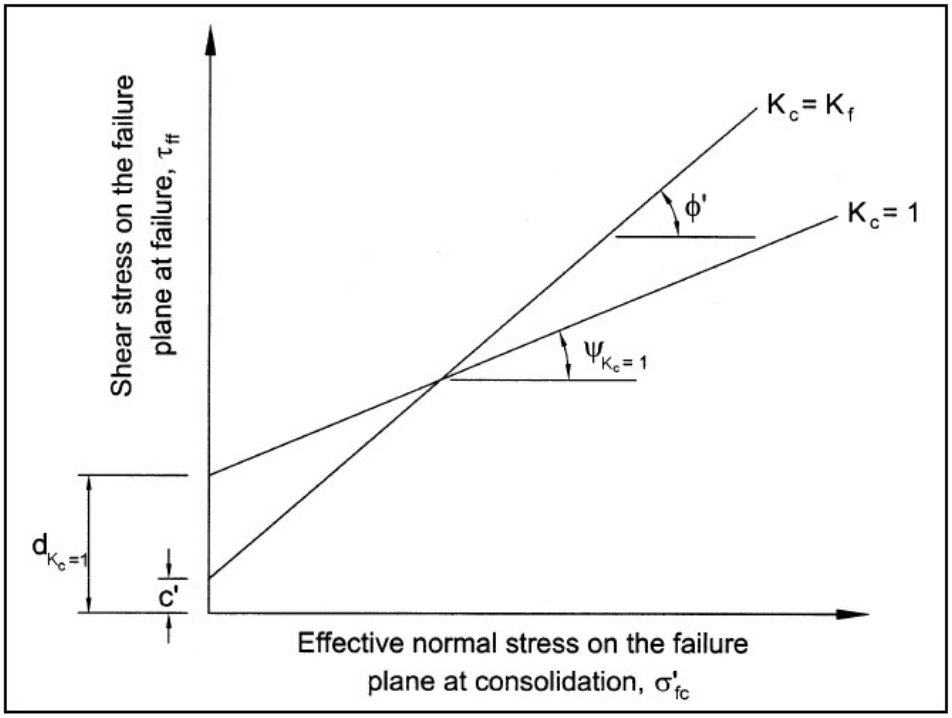


Figure 2. Shear Strength Envelopes for Rapid Drawdown Computations

3.0 SITE-SPECIFIC ANALYSIS

Based on the geotechnical exploration at the site, the East Pond and West Pond dikes at Bremo Station are composed of alluvial soils excavated from the interior portions of the ponds. These materials are primarily described as a mix of fine sandy silt and sandy clay (ML and CL) and silty fine sand (SM) (Golder, 2016).

3.1 Shear Strength of Embankment Fill

For the rapid drawdown analysis, results from isotropically consolidated undrained triaxial compression tests (CIU) are needed to develop the two strength envelopes described above. Two samples of East Pond dike fill material and one sample of West Pond dike fill material were subjected to such testing (summarized in Table 1).

Table 1: Summary of Dike Sample Subject to CIU Testing

Sample ID	Sample Depth (ft)	Pond	USCS	Liquid Limit	Plasticity Index	Fines Content (%)
WB-01 UD-01	20.6 – 21.9	West	ML	36	11	90
GB-2 UD-01	8 – 10	East	CL	38	13	82
GB-3 UD-01	16 - 18	East	CL-ML	19	4	51

Data from the samples have been synthesized to estimate the shear strength envelopes of the dike under rapid drawdown conditions since the material for the dikes was obtained from the site and belongs to the same general soil unit. Table 2 lists the results of the triaxial tests and the calculated stresses.

Table 2: Summary of CIU Triaxial Results

Sample ID	σ'_{fc} (psi)	σ_{1f} (psi)	σ_{3f} (psi)	u_f (psi)	σ'_{1f} (psi)	σ'_{3f} (psi)	ϕ' (deg)	σ'_f (psi)	τ_{ff} (psi)
WB-1 UD-1	7.4	16.481	7.4	3.660	12.821	3.740	33.3	5.791	3.797
	14.8	31.806	14.8	6.592	25.214	8.208	30.6	12.384	7.320
	29.6	69.222	29.6	8.926	60.296	20.674	29.3	30.791	17.277
GB-2 UD-01	4.0	15.405	4.0	1.329	14.076	2.671	42.9	4.490	4.176
	8.0	19.835	8.0	3.840	15.995	4.160	36.0	6.603	4.790
	16.0	38.850	16.0	6.490	32.360	9.510	33.1	14.700	9.574
GB-3 UD-01	7.0	17.038	7.0	3.008	14.030	3.992	33.8	6.215	4.168
	15.0	28.801	15.0	5.984	22.817	9.016	25.7	12.925	6.218
	30.0	59.343	30.0	13.378	45.966	16.622	28.0	24.415	12.959

Strength envelopes were developed for the undrained (K_c = 1) condition and the effective strength condition (K_c = K_f) by fitting lines to the data as shown in Figure 3 and 4, respectively.

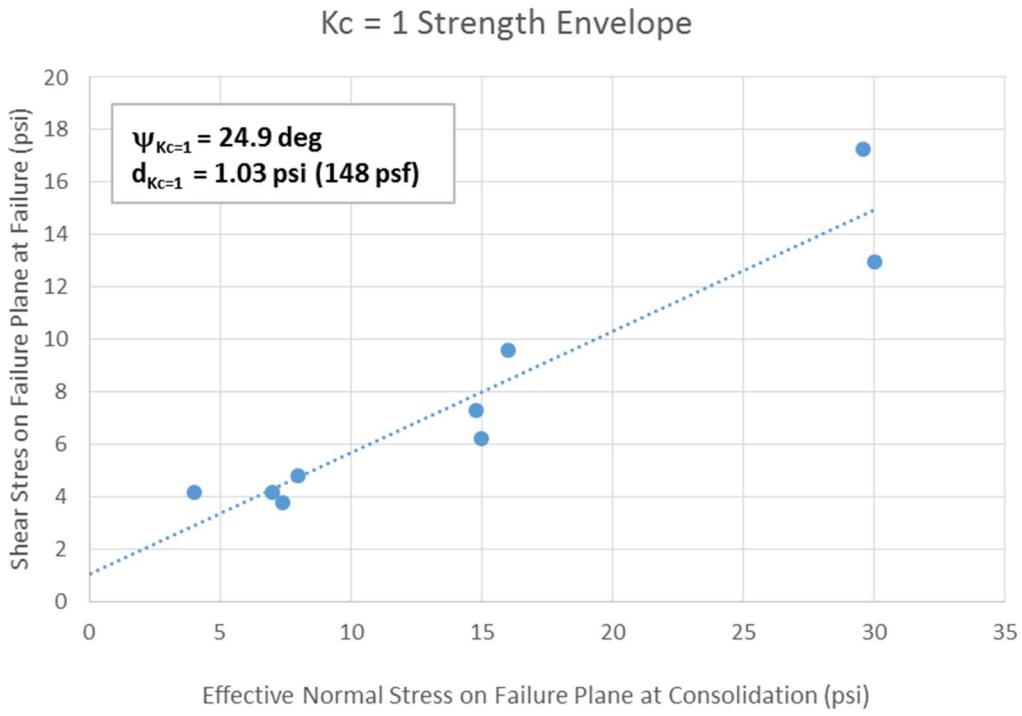


Figure 3. K_c = 1 Shear Strength Envelope for Rapid Drawdown Computations

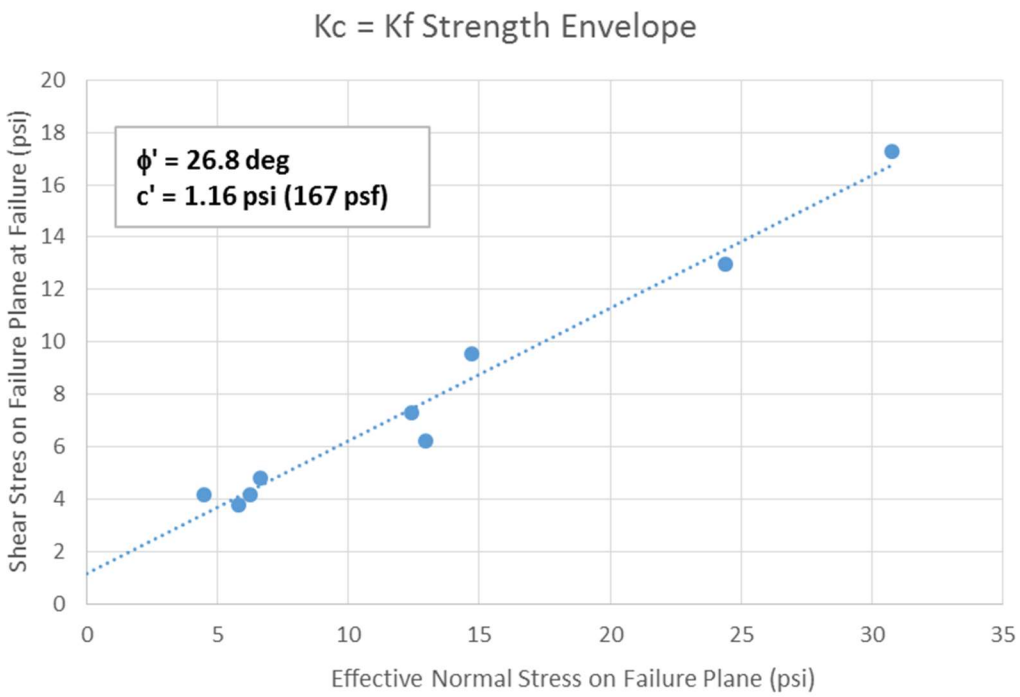


Figure 4. $K_c = K_f$ Shear Strength Envelope for Rapid Drawdown Computations

3.2 Water Levels

The initial (pre-drawdown) water level was set at 228.2 feet above mean sea level (ft-msl) which corresponds to the 100-year flood event. WSP conservatively assumes that the rapid drawdown condition would occur until the water level reached the toe of the dike.

4.0 CONCLUSIONS

Using the process described above, WSP evaluated the stability of the West Pond dikes under rapid drawdown conditions resulting from the site 100-year flood event. The table below presents the results of the analysis of the dikes surrounding the West Pond. For all sections analyzed, the calculated factors of safety meet or exceed the requirements. The detailed stability result figures are provided in the pages following this text.

Table 3: Rapid Drawdown Analysis Results

Cross-Sections	Factor of Safety
A-A' (East)	1.2
A-A' (West)	1.6
B-B' (North)	1.3
B-B' (South)	1.2
C-C' (North)	1.3
C-C' (South)	1.1

5.0 REFERENCES

Abramson, L.W., Lee, T.S., Sharma, S., and Boyce, G.M. (2002) Slope Stability and Stabilization Methods, 2nd Edition, John Wiley & Sons, Inc.

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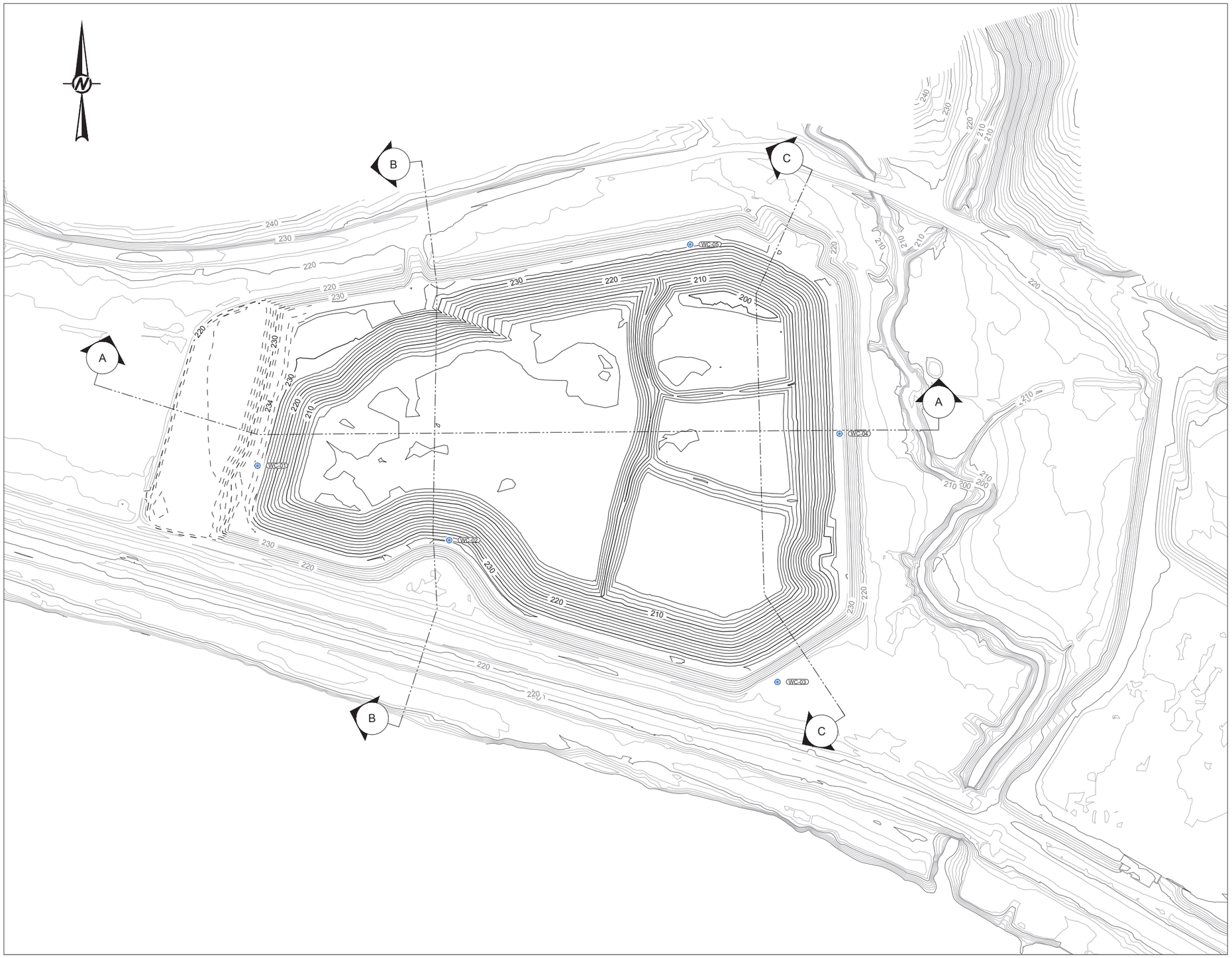


LEGEND

- EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS)
- UPDATED SURVEY CONTOURS (2' INTERVALS)
- METAL POND DECOMMISSIONING CONTOURS (2' INTERVALS)
- GOLDER CONE PENETRATION TEST (CPT)
- A — SLOPE STABILITY SECTIONS

REFERENCE(S)

1. SURROUNDING EXISTING TOPOGRAPHY DATED 2017, FROM DRAWING 1520347QA-N42.DWG.
2. UPDATED TOPOGRAPHY PER SURVEY FROM H&B SURVEYING & MAPPING, DATED FEBRUARY 3, 2020.
3. METALS POND DECOMMISSIONING SURFACE TOPOGRAPHY PER SURVEY FROM H&B SURVEY & MAPPING, DATED JANUARY 25, 2021. TOPOGRAPHY IS APPROXIMATE.

0 100 200
1" = 100' FEET

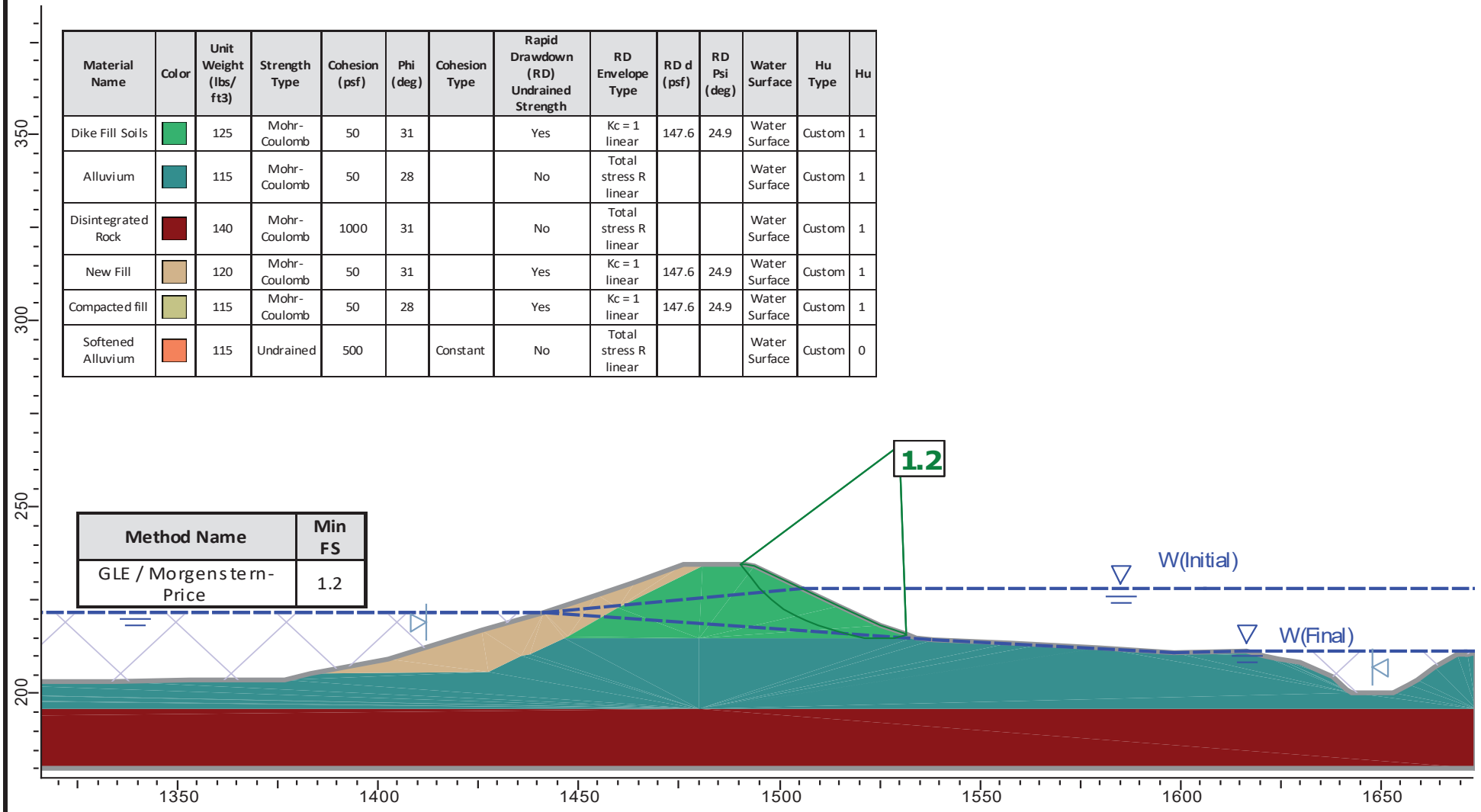
wsp

DOMINION ENERGY - BREMO STATION
CCR IMPOUNDMENT CLOSURE, FLUVANNA COUNTY, VIRGINIA
SAFETY FACTOR ASSESSMENT - WEST POND PLAN VIEW

FIGURE 1

Path: C:\Users\KCernik\Downloads\ | File Name: Bremo Sections.dwg

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28		No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31		No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Compacted fill		115	Mohr-Coulomb	50	28		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Softened Alluvium		115	Undrained	500		Constant	No	Total stress R linear			Water Surface	Custom	0

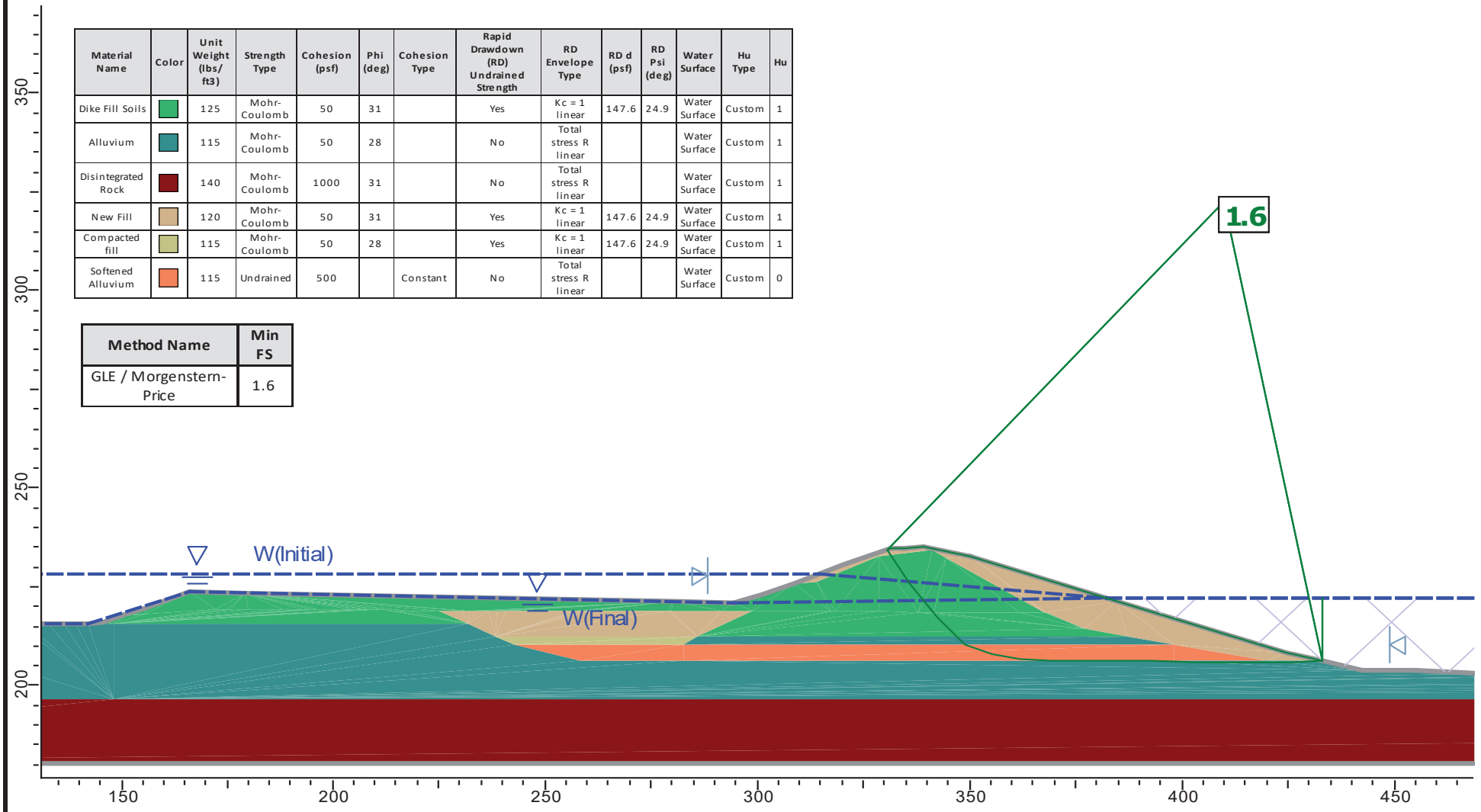


Method Name	Min FS
GLE / Morgenstern-Price	1.2

wsp	SCALE	AS SHOWN	PROJECT: Bremo West Pond - 2023 Safety Factor Assessment
	DATE	April 2023	TITLE: Section A-A (East) Rapid Drawdown
	MADE BY	WJF	
	CAD	-	
FILE: STABILITY	CHECK	SSS	CLIENT: Dominion Energy
PROJECT No.: GL21466315 REV.: 0	REVIEW	GLH	FIGURE: 2(d)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28		No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31		No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Compacted fill		115	Mohr-Coulomb	50	28		Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Softened Alluvium		115	Undrained	500		Constant	No	Total stress R linear			Water Surface	Custom	0

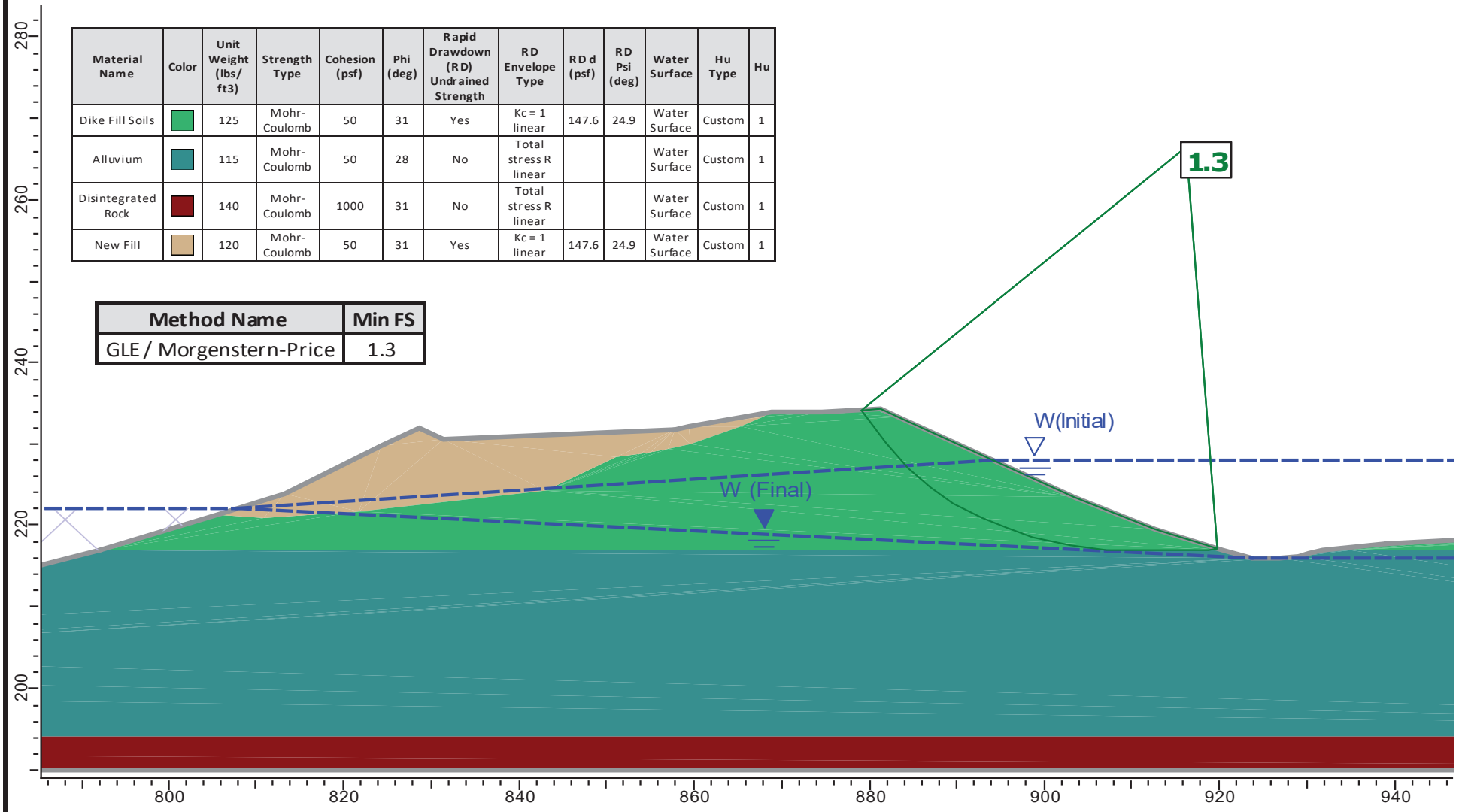
Method Name	Min FS
GLE / Morgenstern-Price	1.6



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section A-A (West) Rapid Drawdown
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	3(d)

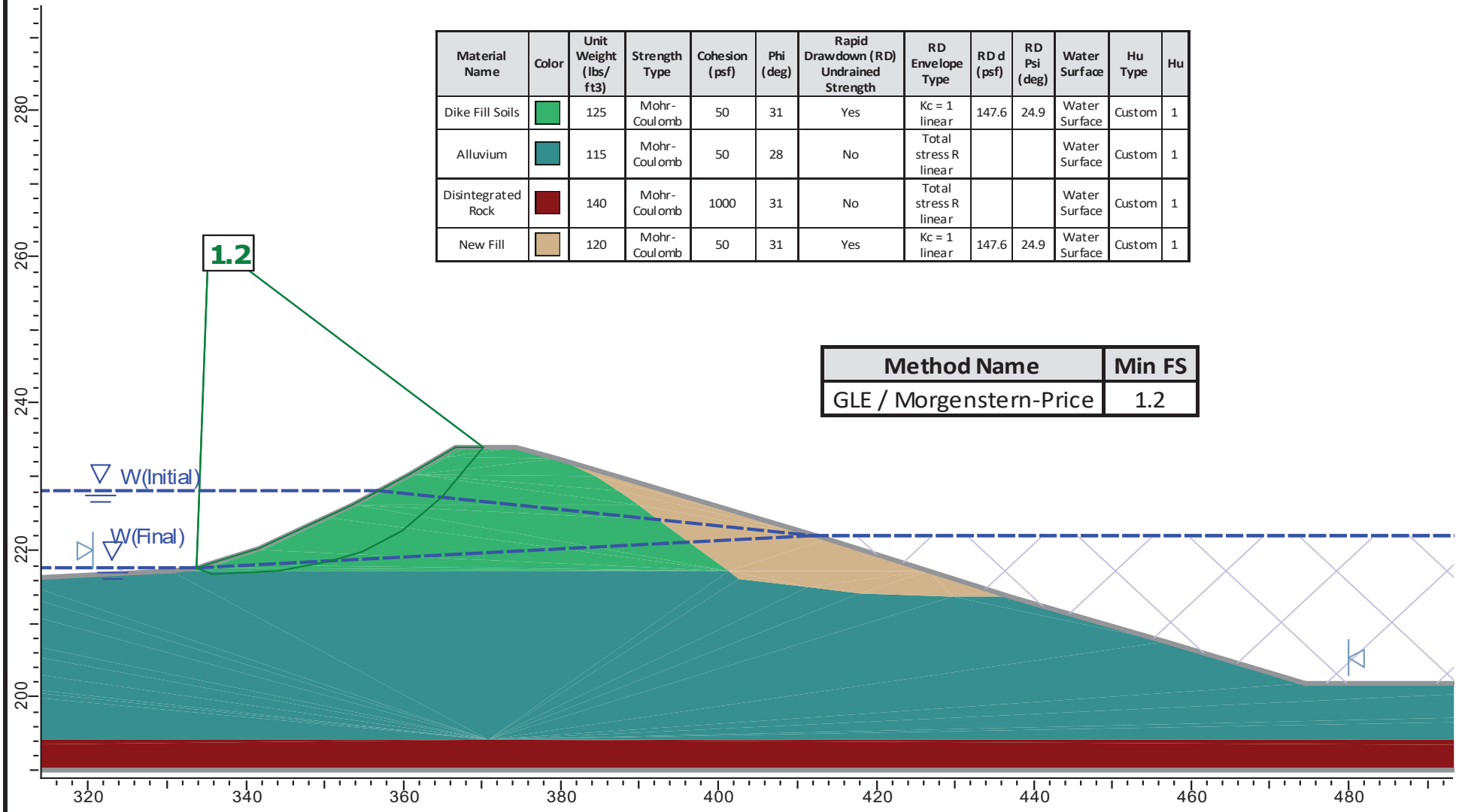
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1

Method Name	Min FS
GLE / Morgenstern-Price	1.3



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section B-B (North) Rapid Drawdown
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	4(d)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1

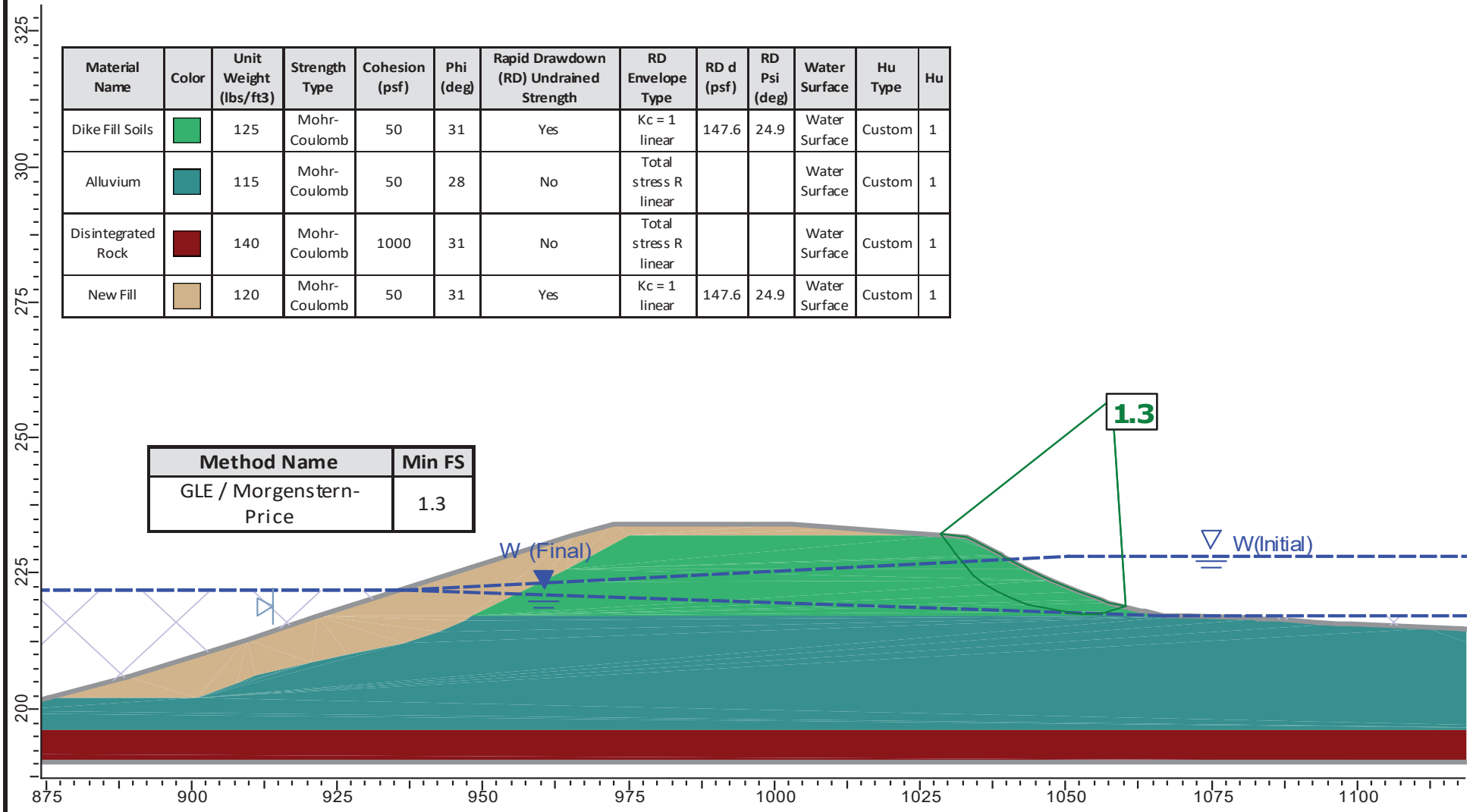


Method Name	Min FS
GLE / Morgenstern-Price	1.2

SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section B-B (South) Rapid Drawdown
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	5(d)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1

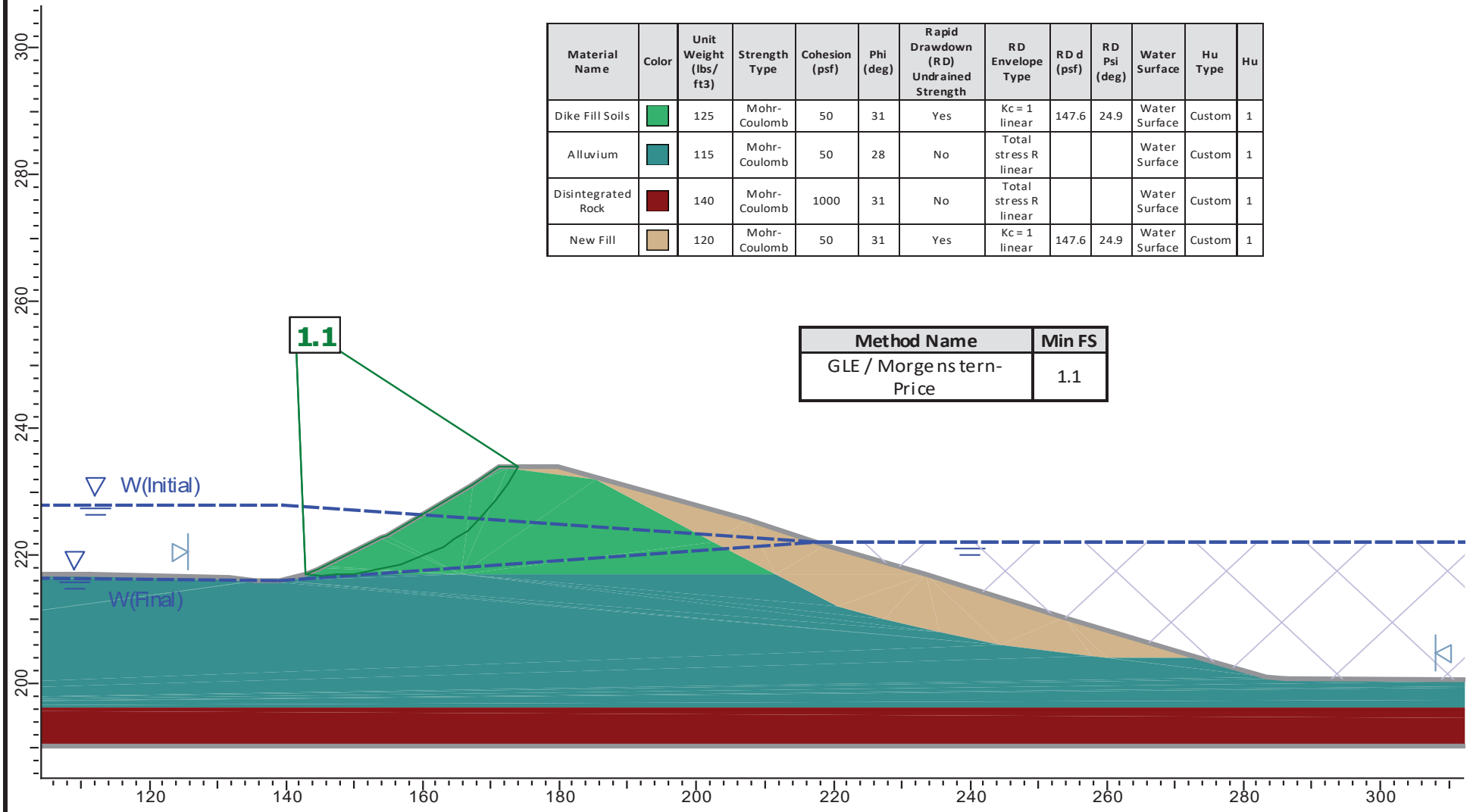
Method Name	Min FS
GLE / Morgenstern-Price	1.3



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section C-C (North) Rapid Drawdown
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	6(d)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1

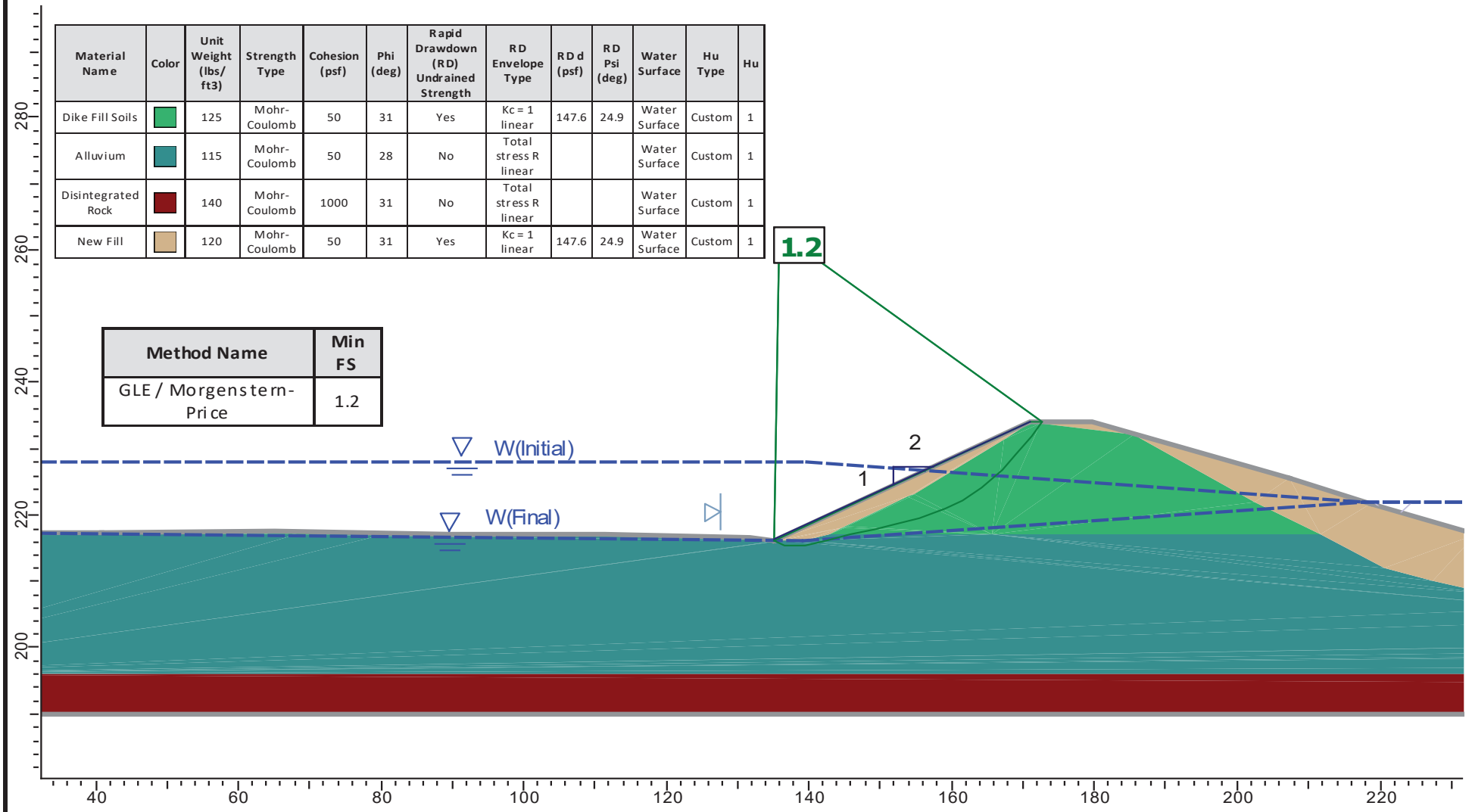
Method Name	Min FS
GLE / Morgenstern-Price	1.1



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section C-C (South) Rapid Drawdown
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	7(d)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1

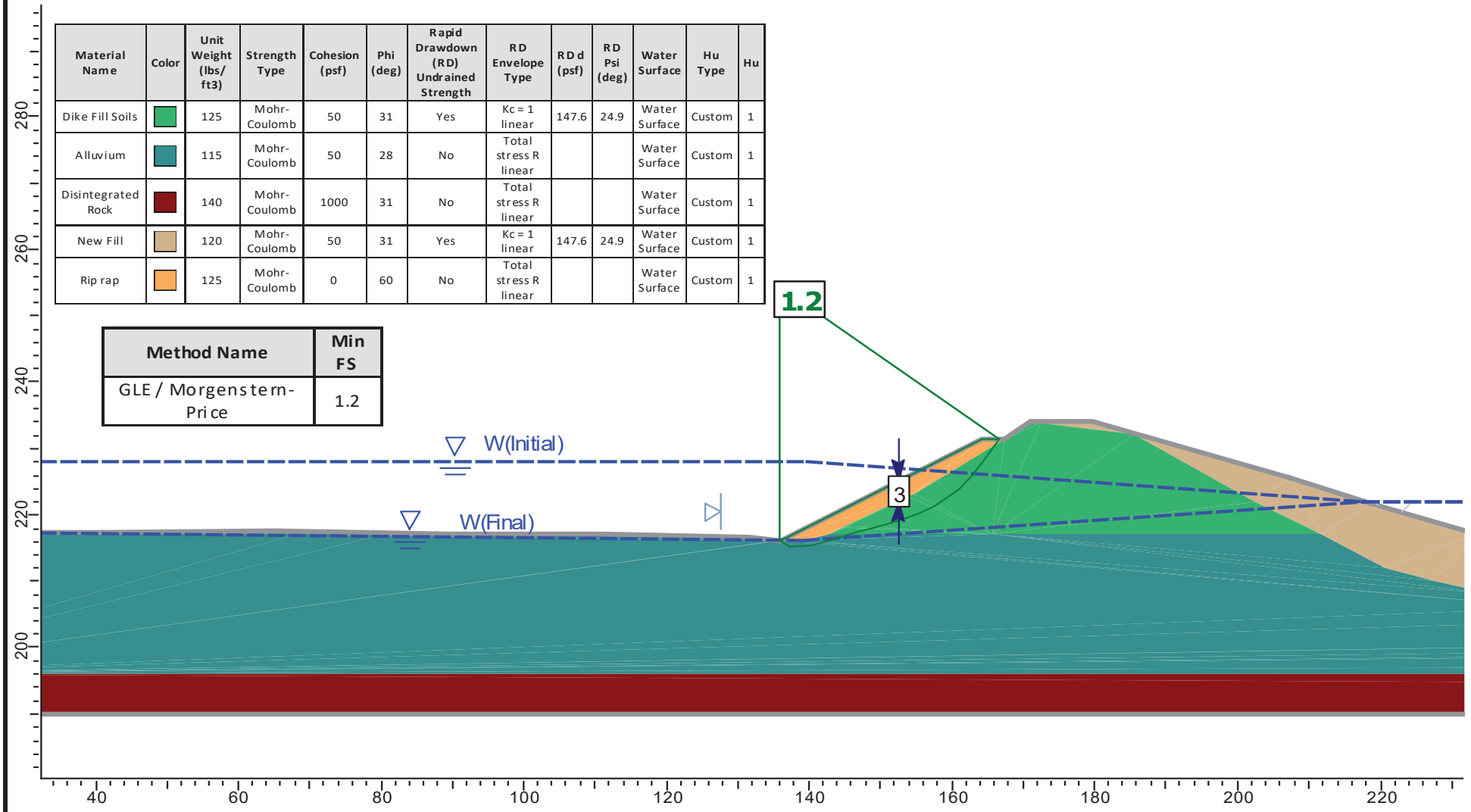
Method Name	Min FS
GLE / Morgenstern-Price	1.2



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section C-C (South) Rapid Drawdown Mitigation Option 1
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	8(d)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD d (psf)	RD Psi (deg)	Water Surface	Hu Type	Hu
Dike Fill Soils		125	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Alluvium		115	Mohr-Coulomb	50	28	No	Total stress R linear			Water Surface	Custom	1
Disintegrated Rock		140	Mohr-Coulomb	1000	31	No	Total stress R linear			Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	31	Yes	Kc = 1 linear	147.6	24.9	Water Surface	Custom	1
Rip rap		125	Mohr-Coulomb	0	60	No	Total stress R linear			Water Surface	Custom	1

Method Name	Min FS
GLE / Morgenstern-Price	1.2



SCALE	AS SHOWN	PROJECT	Bremo West Pond - 2023 Safety Factor Assessment
DATE	April 2023	TITLE	Section C-C (South) Rapid Drawdown Mitigation Option 2
MADE BY	WJF		
CAD	-		
FILE	STABILITY	CHECK	SSS
PROJECT No.	GL21466315	REV. 0	REVIEW GLH
CLIENT	Dominion Energy	FIGURE	9(d)