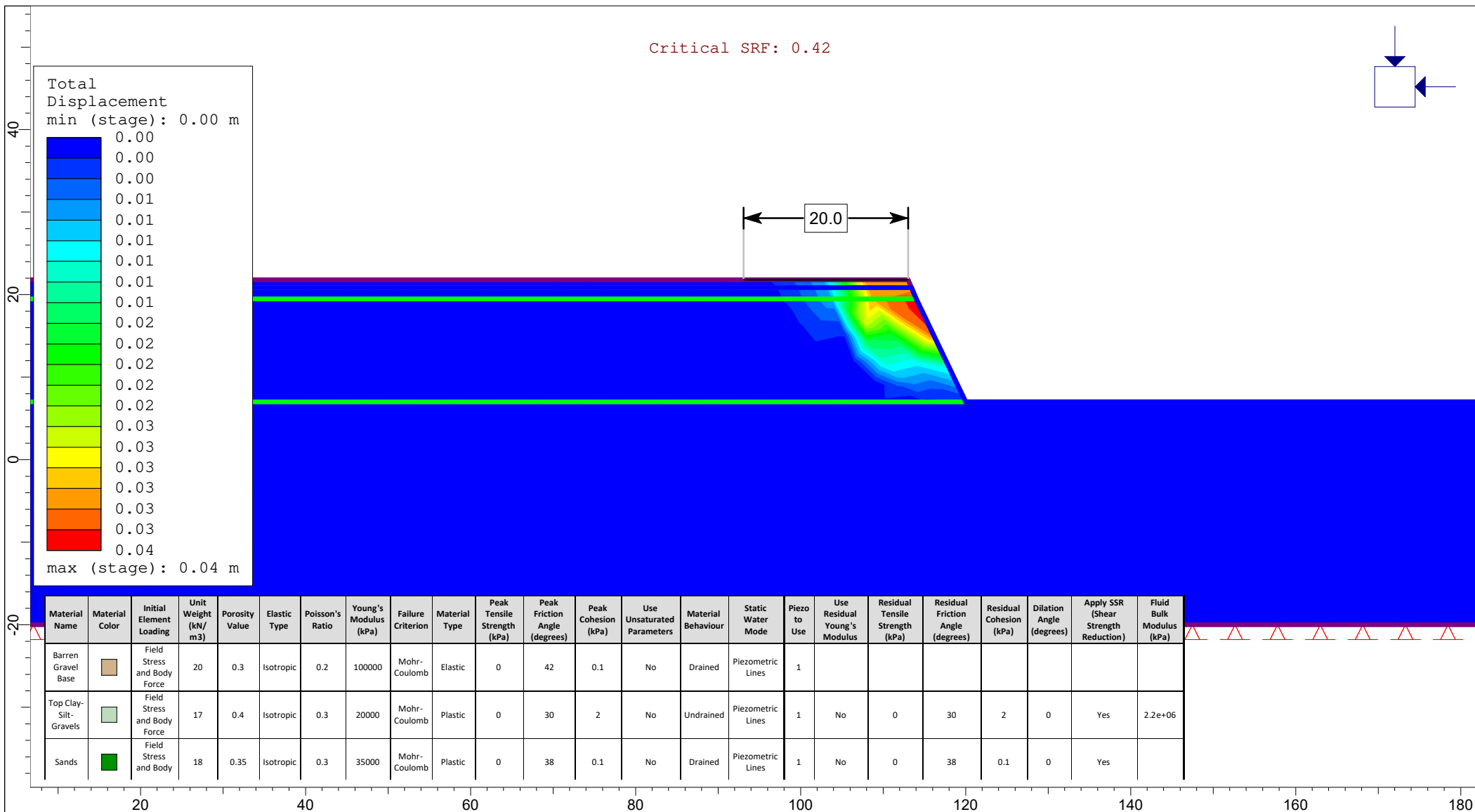


TiGa Barrytown Mine Consent APPLICATION - REQUEST FOR INFORMATION - GEOTECHNICAL

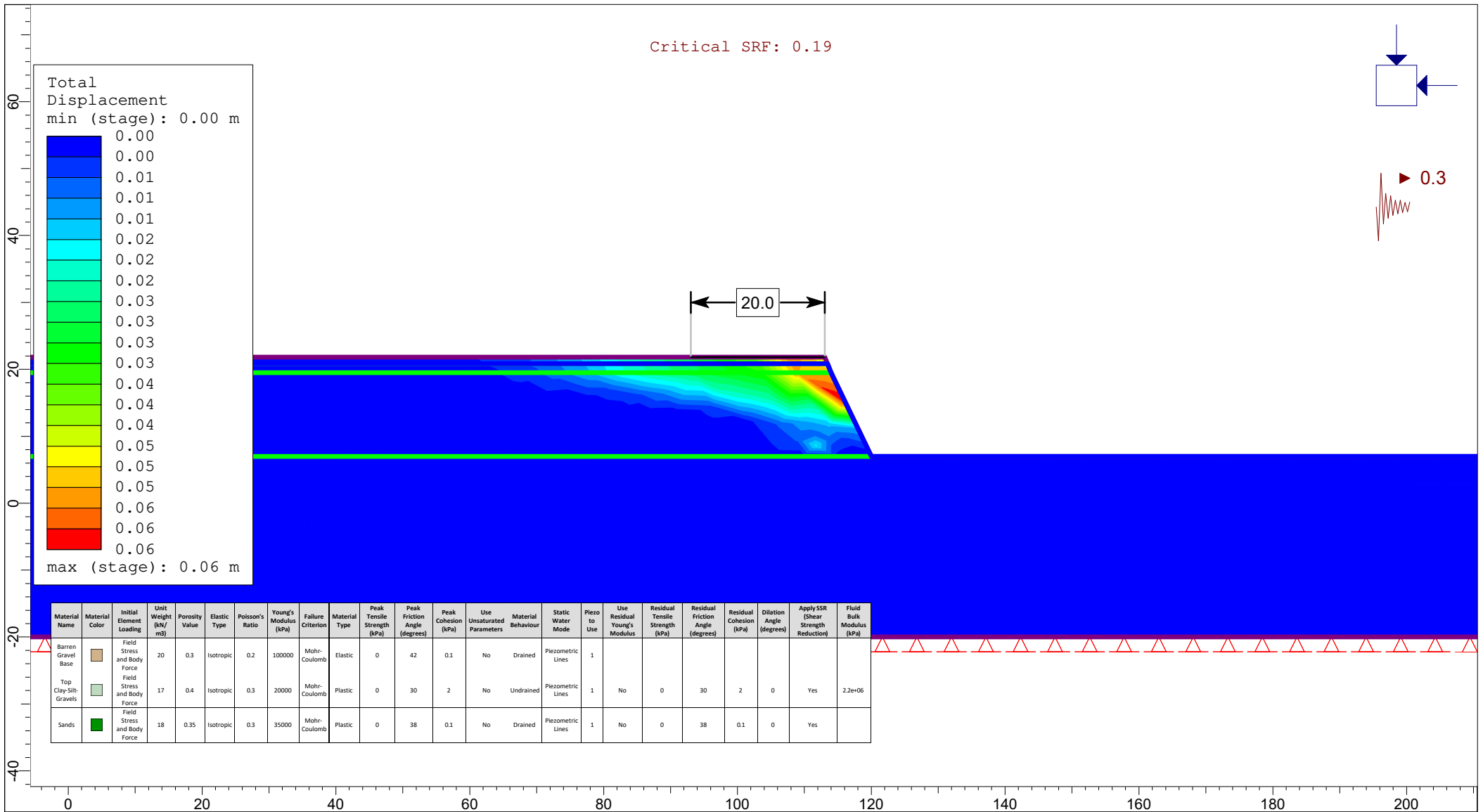
RFI #	Reference	Request for Information 1 17/07/2023	RDCL Response	Response
Reporting				
33.	Section 4.2	Please clarify if there may be any impacts of a shallower groundwater table on the proposed 20 m offset (considered further below) and what the potential impacts are. The concern is whether a shallower groundwater table would change the cut slope stability characteristics to the extent that a 20 m offset is insufficient to accommodate any potential slope failures.	The stability model currently assumes a groundwater level 1m below ground. A shallower groundwater table will not significantly change the cut slope stability. Additionally, stability (and deformation) has also been checked against a Maximum Credible Earthquake, assuming a 1m deep groundwater. This is a very conservative condition unlikely to be encountered due to the short time the pit perimeter is exposed in the mining cycle.	
34.	Section 6.1	In Section 6.1 of the report it states "Freeboard always > 3m to ground level from final tailings surface as ~30% of the material is extracted as ore." Please clarify if the freeboard referred to is measured from the original ground level or the final proposed ground level.	Freeboard of >3m is with reference to the original ground level. Freeboard is based on the assumption that 30% of the volume of material will be extracted as "ore". This means that there will always be a deficit in the volume of the backfill (tailings), resulting in freeboard. We understand that extraction is now more likely ~20%. At 10m depth of mining, freeboard will be ~2m, at 15m freeboard will be 3m.	
35.	Section 7.2 (Table 2)	Please confirm that the hydraulic conductivity values presented in Table 2 have been applied in the slope stability analyses documented in Appendix B of the same report.	Hydraulic Conductivity of Barren Gravel Base has been changed to 1×10^{-3} m/s to match the hydrogeological model. - Table 2 in Section 7.2 will be updated accordingly. - Slope Stability models in Appendix B will also be updated accordingly Adjusted outputs attached for information.	
36.	Section 7.2	If groundwater flows are simulated in the pit wall stability modelling, does this change the model outcomes with respect to the area potentially affected by ground failure?	No. Because of the high permeability of the insitu materials, drawdown is expected behind the pit crest in any case, but drawdown has not been modelled and groundwater levels in the model have been kept elevated (1m below surface) as an additional safety check. Groundwater flow has been modelled in the pit wall as per previous question with acceptable results. To be clear, stability models work on groundwater pressures to calculate effective strength parameters. Effective strength of geotechnical materials is reduced by elevated groundwater pressures and levels, generally reducing resistance to failure and Factor of Safety or deformation. Groundwater flow modelling produces a drawdown curve due to drainage which may be extensive (high permeability) or steep (low permeability), which impacts distribution of pore pressures.	
37.	Section 8.4	Please also confirm the aquifer parameters applied to the units simulated in the stability analysis. If the hydraulic conductivity applied to the basal gravel unit is not in accordance with the values provided in the Hydrology report, please adjust the value applied in the geotechnical model accordingly.	Hydraulic Conductivity of Barren Gravel Base updated to 1×10^{-3} m/s and applied to stability analysis (attached). Final report will include revised results.	
38.	Appendix B	The slope stability models documented in Appendix B indicate mineral sand extraction will extend to the top of the basal gravel layer. The basal gravel layer constitutes a more permeable aquifer that the overlying mineral sands, according to the Hydrology report. Additionally, it is not clear from either the Hydrology report or the Geotechnical report whether mineral sand extraction is to extend to the top of the basal gravel layer. Please confirm the slope stability models correctly represent the layout of the pit walls according to the current mine plan. If the model layout does not provide an appropriate conceptual representation of a pit wall under the current mine plan, please adjust the models to more accurately represent the of the pit shell layout with respect to the geological units simulated.	The slope stability models correctly represent the layout of the pit walls and sand extraction is extended to the top of the base layer in accordance with drawings from Palaris (as seen below):	

RFI #	Reference	Request for Information 1	17/07/2023	RDCL Response	Response
39.	Appendix B	The slope stability models documented in Appendix B to the report appear to support the above statements with respect to the pit slope stability. However, these models also appear to have been run with static groundwater levels applied, without groundwater flows being simulated. The concern is that a setback of 20 m may not be sufficient to ensure adjacent streams and drains are not impacted by ground settlement, with associated potential development of preferred seepage paths into the planned opencast pit and possible piping along any seepage paths. Please clarify if groundwater seepage flows have been taken into account in the slope stability analysis. If groundwater flows have not been taken into account, please run the models with seepage flows simulated to confirm the above statement regarding the limit of expected ground stability.		Models in RDCL report referenced R-220986-01 issued 13 April 2023 analysed static water only. Slide Models will be added to incorporate Groundwater flow Analysis: - Groundwater seepage flows have been taken into account. - Stability Analysis reanalysed under these conditions. From a geotechnical perspective, this is all the same question as it relates to Section 7.2, Table 2 and Appendix B. The updated models (Attached) will be updated in the final (revised report). Results of the stability analysis under groundwater analysis show the 20m offset is considered sufficient to protect the adjacent wetlands.	
40.	Appendix B	The slope stability models do not take into account the proposed reinjection of water pumped from the operational pit into the same aquifer to manage potential impacts on Collins Creek and the Northern Boundary Drain, as described in the Hydrological report (Kōmanawa 2023a). The Water Management Plan indicates reinjection bores are to be installed between the open pit and the adjacent surface water bodies. This reinjection may require injection heads and the development of groundwater heads around the injection bores that exceed ground level. Please run the slope stability models with the groundwater pressure effects of these reinjection bores taken into account and provide the model outcomes to confirm the stability of the proposed cut slopes and the appropriateness of the proposed setback.		As previously, groundwater levels have been modelled at 1m below surface. We do not anticipate artesian pressures (which we infer is the question) to develop as a result of injection due to the permeability of the existing materials and tailings.	
41.	Section 8.4.2	Please clarify if an engineered clay cap to the rehabilitated tailings is planned. If such a cap is planned, please clarify its intended purpose and verify that such a cap can be practically installed on a foundation of tailings backfill.		An “engineered clay cap” (taken to infer something like for a landfill) is not planned. The stripped overburden will be placed on the dried tailings as the beach front progresses. The tailings backfill will not be fluid and will drain with time so that equipment can be run on the surface. This is standard operating procedure for this style of mining.	

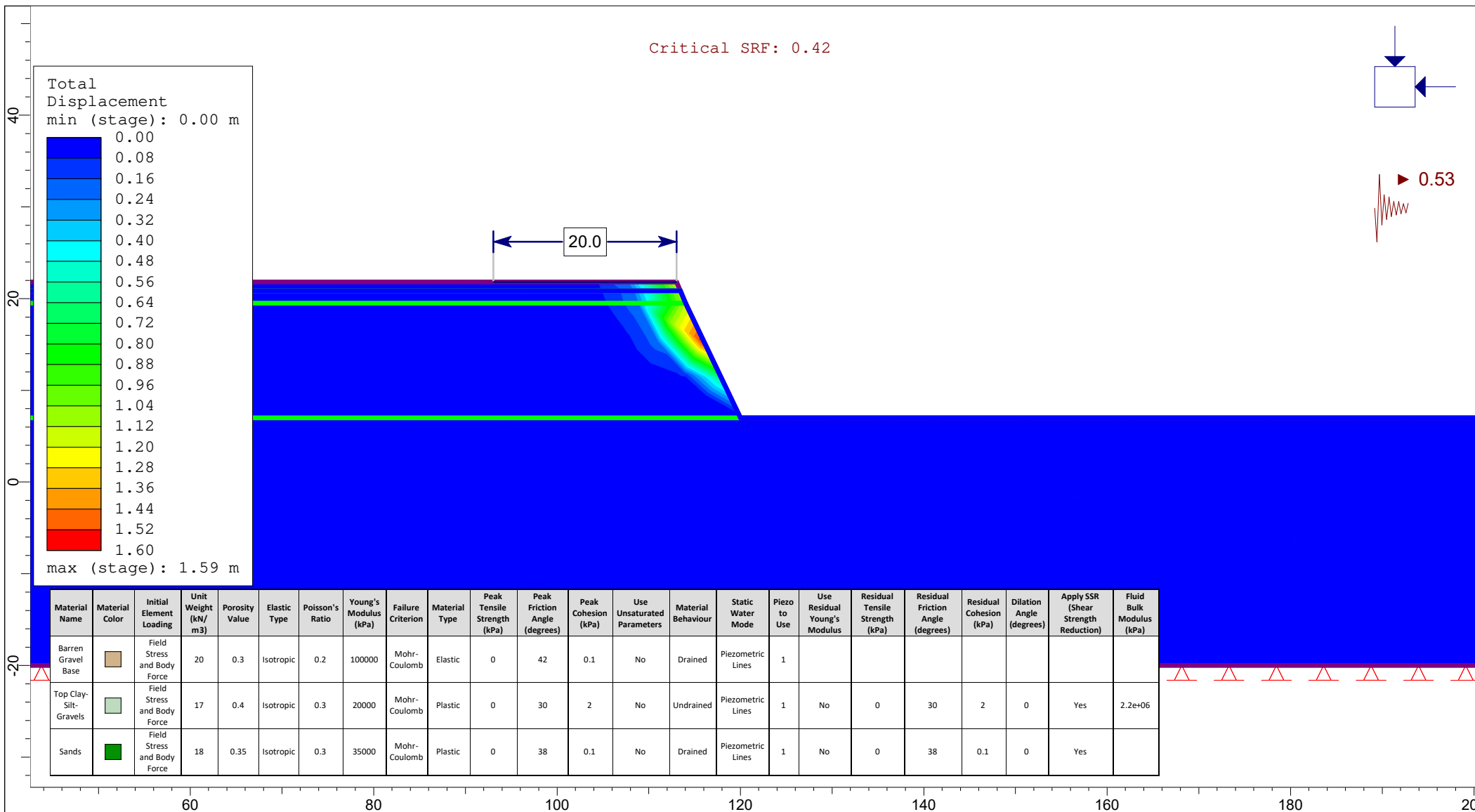
B.1 - Static Groundwater Analysis



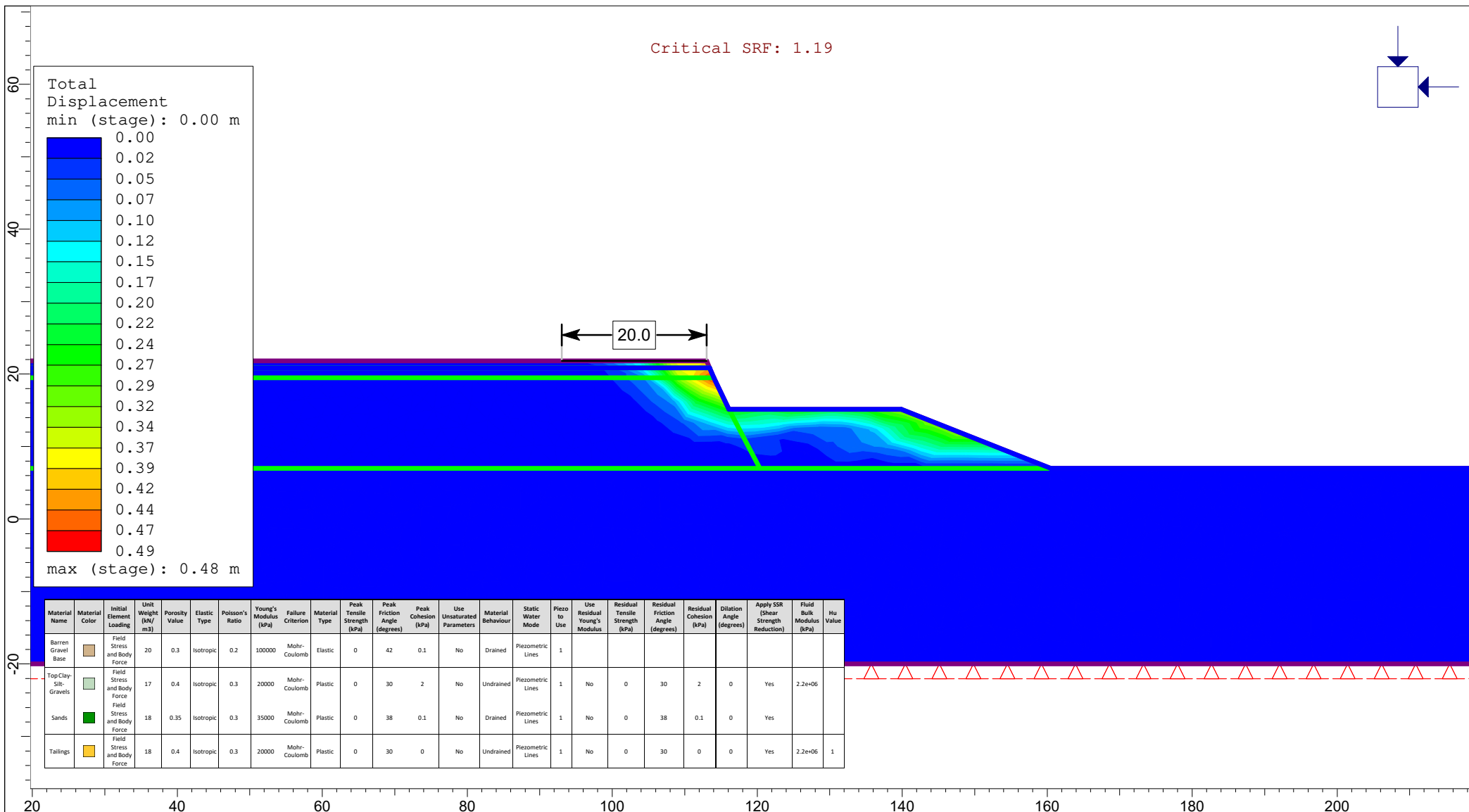
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	Date21/07/2023	CompanyResource Development Consultants Limited
		File NameRS2_Open Pit_Initial Cut_Static.fez



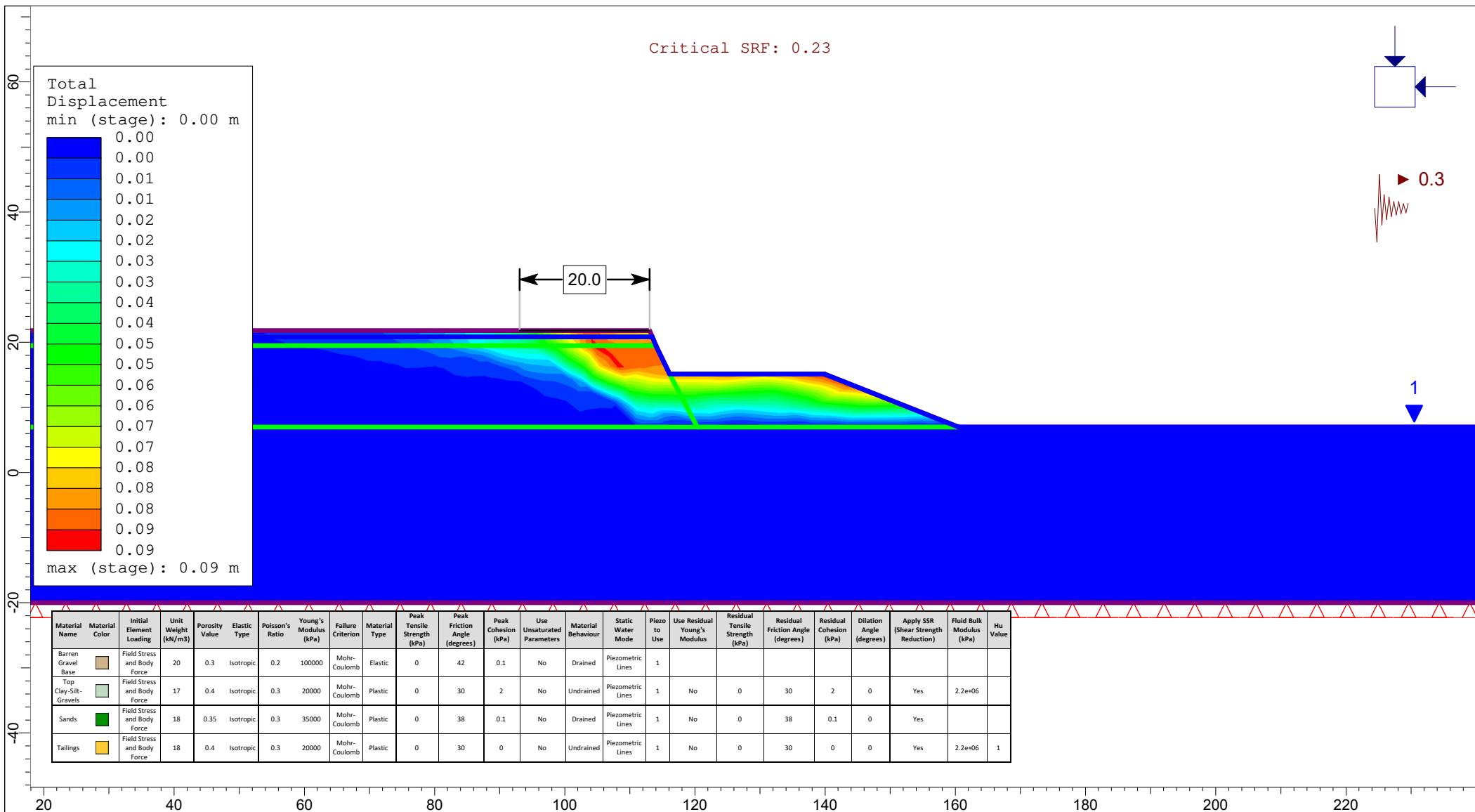
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	Date21/07/2023	CompanyResource Development Consultants Limited
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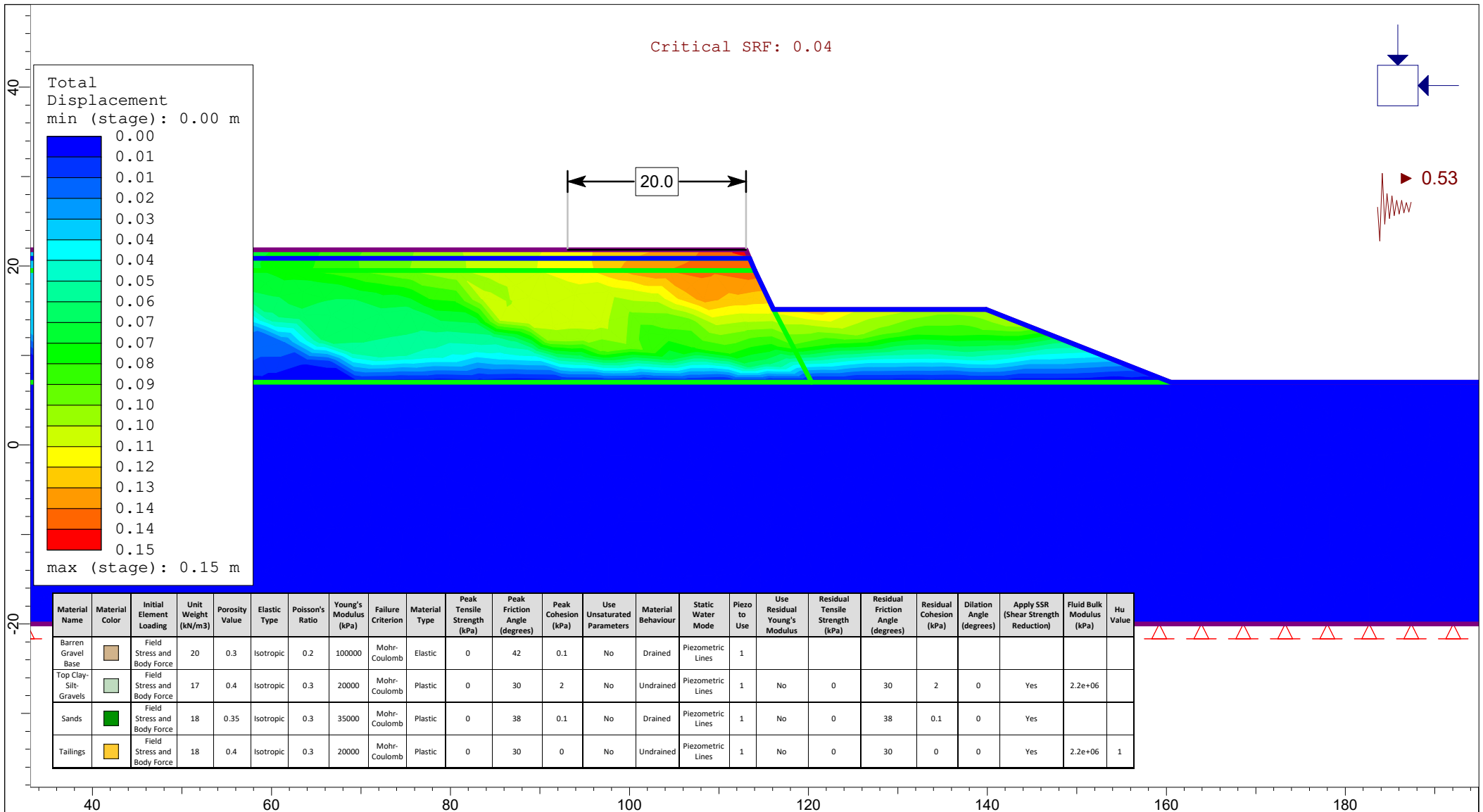
RDCL[®] INTERPRET 11.018	Project220986_Barrytown Mineral Sands Tailings	
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	Drawn ByHC	Scale1:579
	Date21/07/2023	CompanyResource Development Consultants Limited
		File NameRS2_Open Pit_Initial Cut_MCE_Parameter adjust.fez



RDCL[®] INTERPRET 11.018	Project	220986_Barrytown Mineral Sands Tailings		
	Analysis Description	Slope Stability Static - Displacement		
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	Date	21/07/2023	Company	Resource Development Consultants Limited
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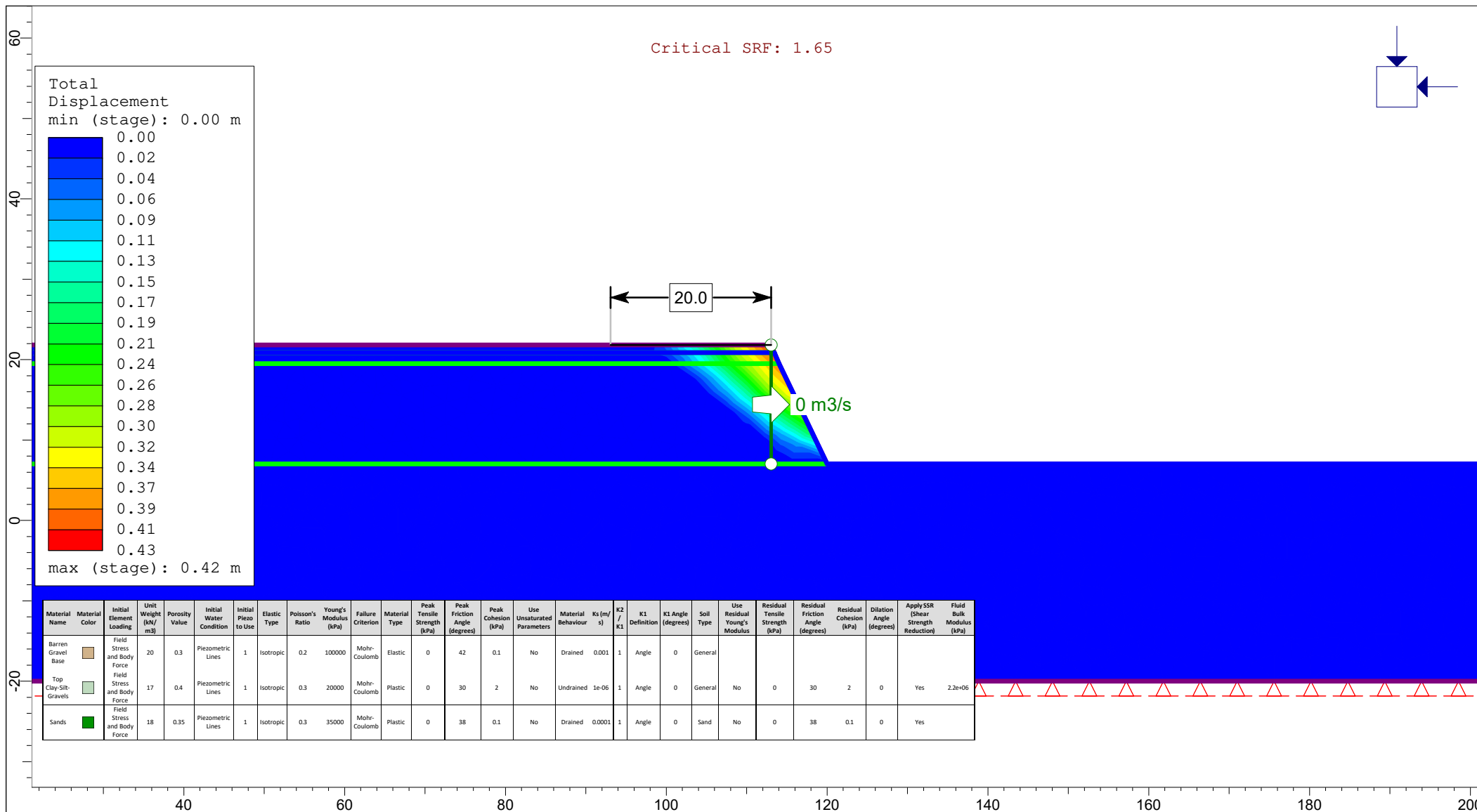


RDCL[®] INTERPRET 11.018	Project220986_Barrytown Mineral Sands Tailings	
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	Date21/07/2023	CompanyResource Development Consultants Limited
		File NameRS2_Open Pit_Tailings Supported_OBE.fez

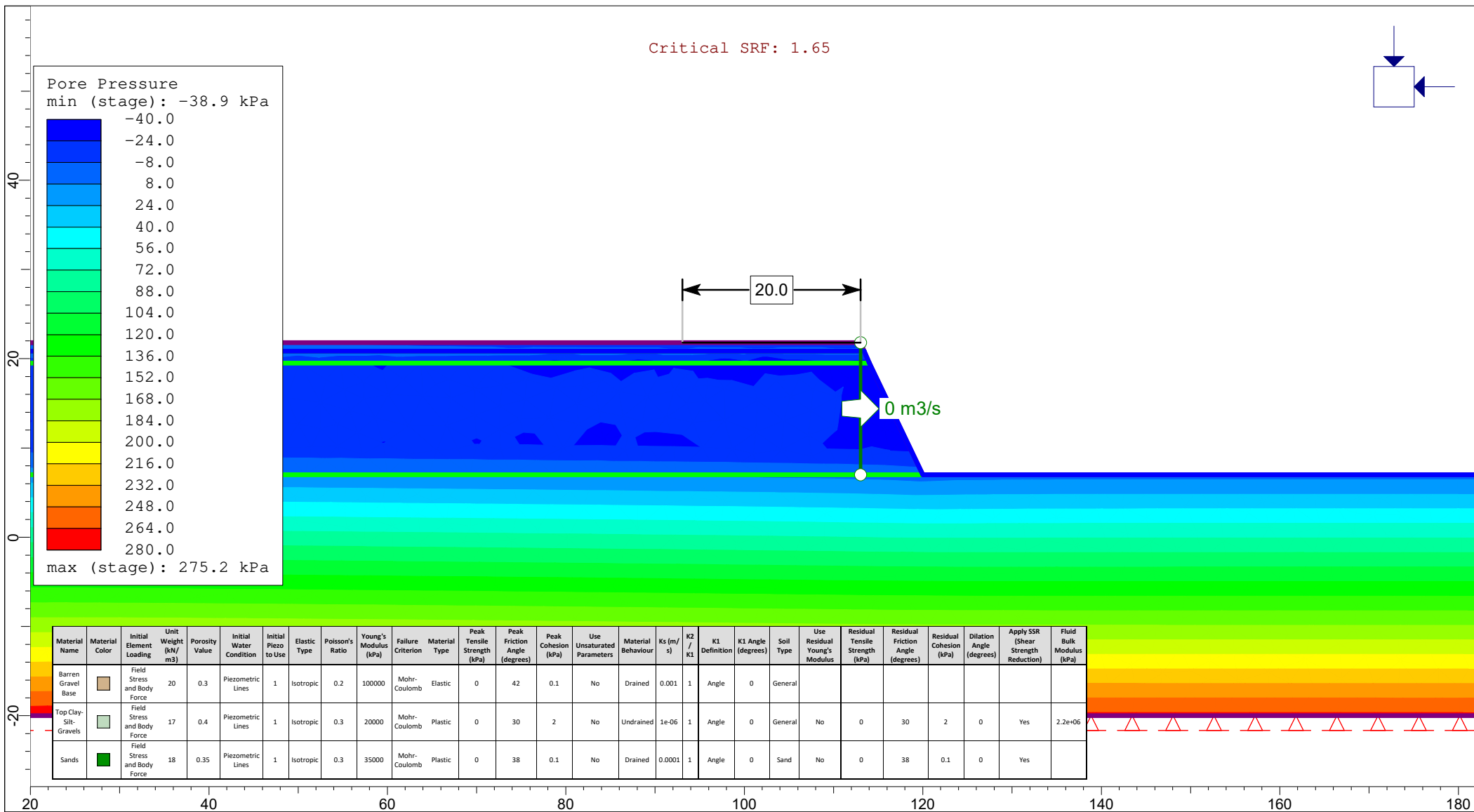


RDCL[®] INTERPRET 11.018	Project	220986_Barrytown Mineral Sands Tailings	
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	Drawn By	HC	Scale
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			Company
			Resource Development Consultants Limited
			File Name
			RS2_Open Pit_Tailings Supported_MCE.fez

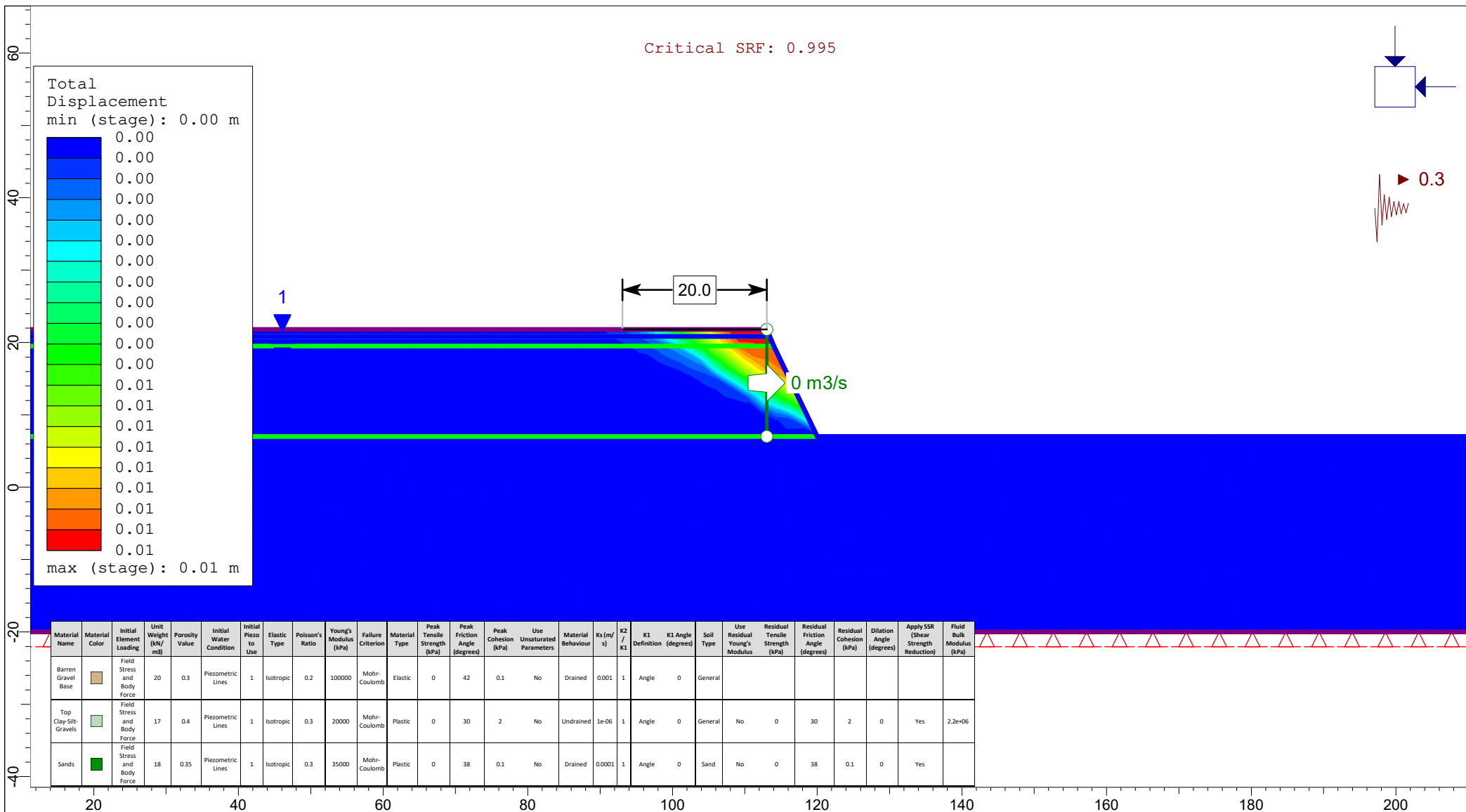
B.2 - Steady State Groundwater Analysis



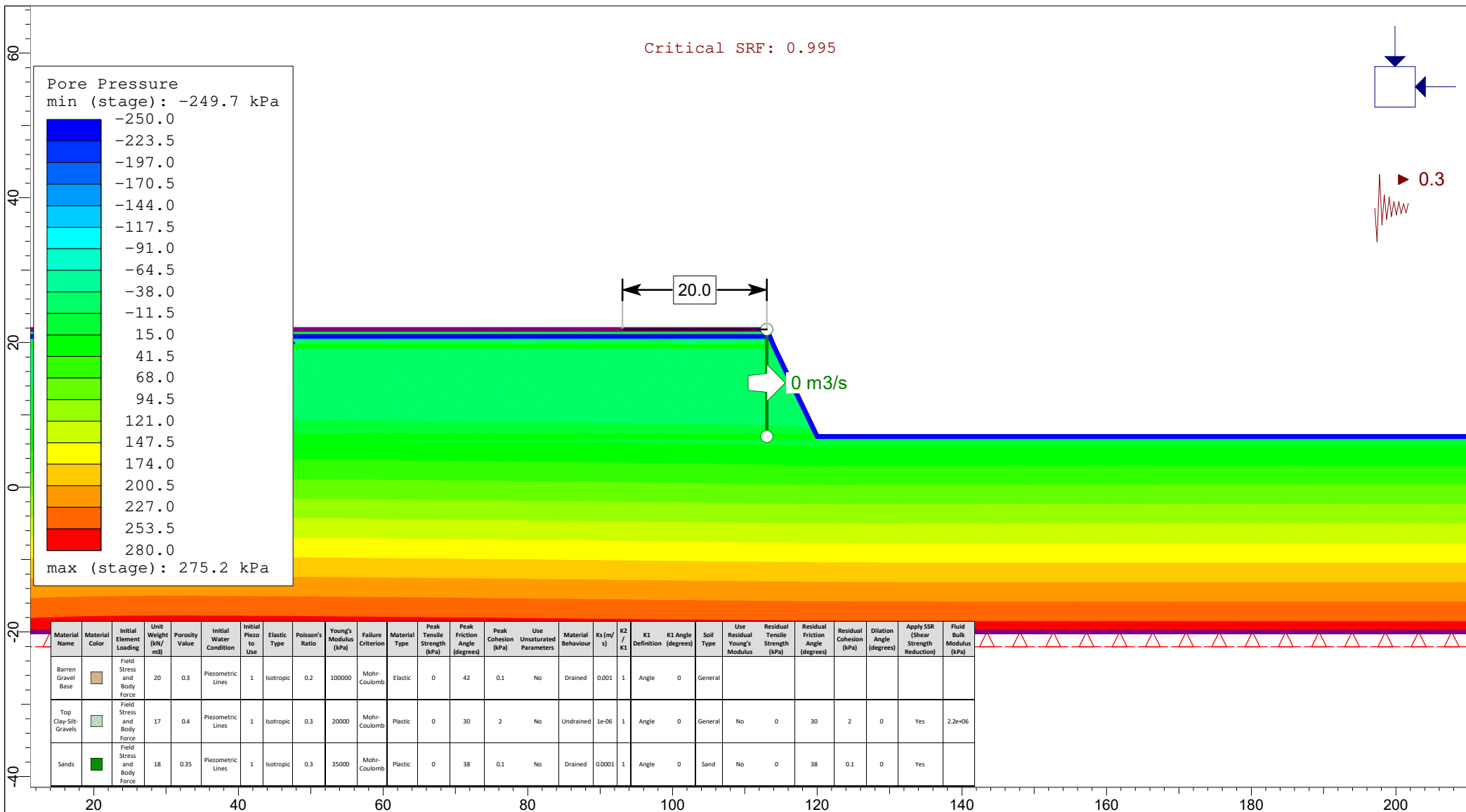
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	Date	21/07/2023	Company	Resource Development Consultants Limited
			File Name	RS2_Open Pit_Initial Cut_Static.fez



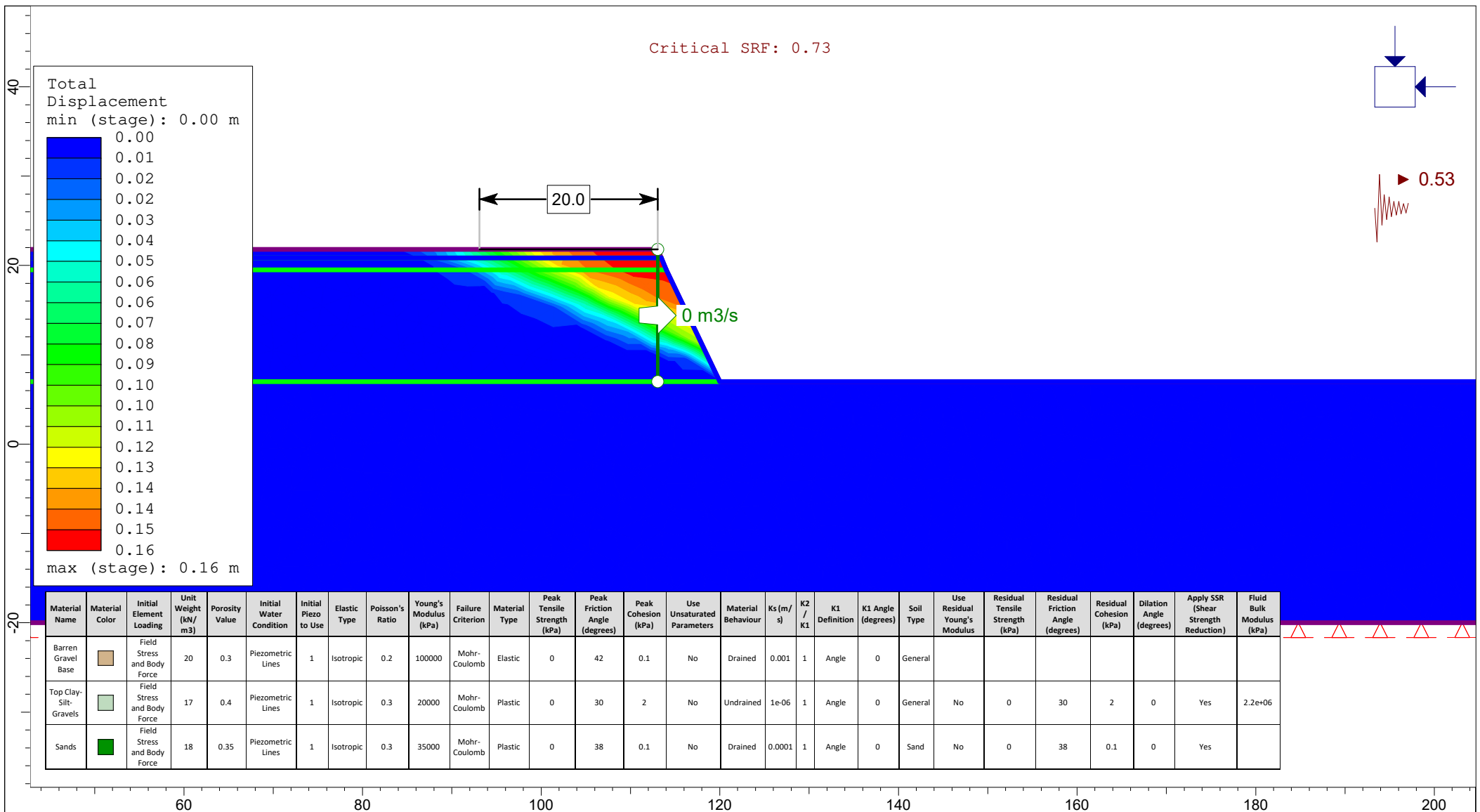
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	Date	21/07/2023	File Name
			Company
			Resource Development Consultants Limited
			File Name
			RS2_Open Pit_Initial Cut_Static.fez



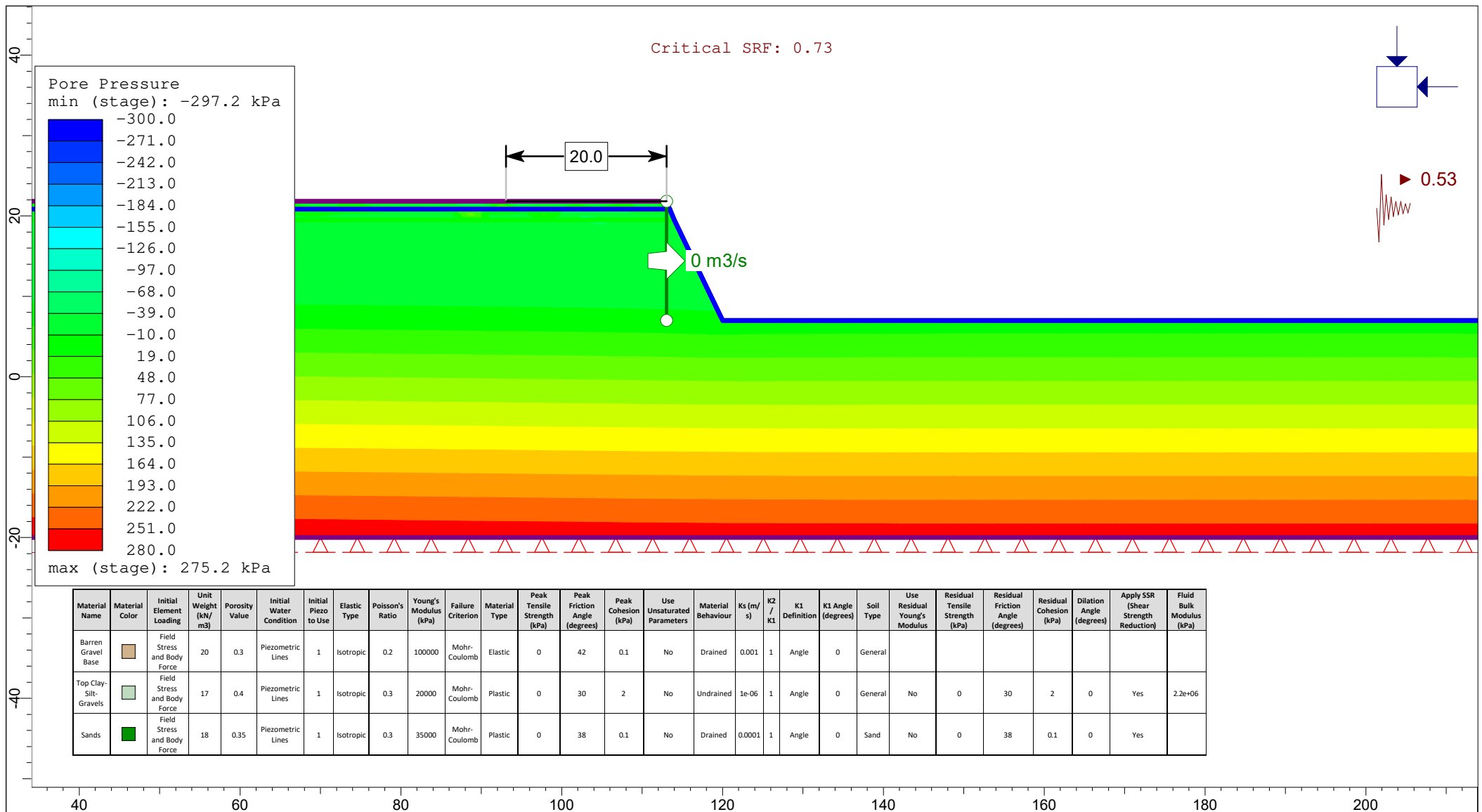
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	Drawn ByHC		Scale1:734		CompanyResource Development Consultants Limited
	Date21/07/2023		File NameRS2_Open Pit_Initial Cut_OBE.fez		



RDCL[®] INTERPRET 11.018	Project			220986_Barrytown Mineral Sands Tailings						
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	Date		21/07/2023			File Name		RS2_Open Pit_Initial Cut_OBE.fez		



RDCL[®] INTERPRET 11.018	Project220986_Barrytown Mineral Sands Tailings	
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	Date21/07/2023	CompanyResource Development Consultants Limited
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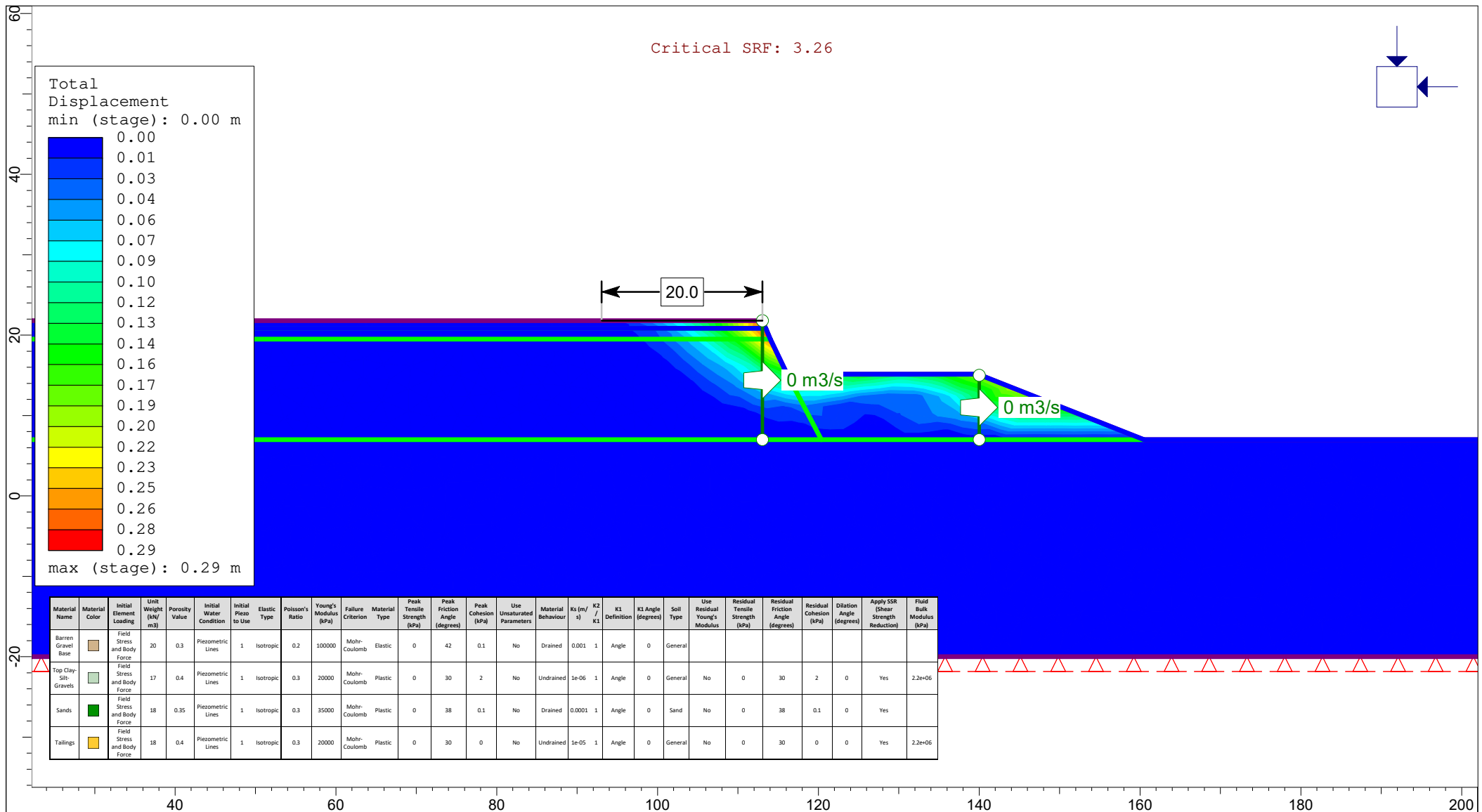


Material Name	Material Color	Initial Element Loading	Unit Weight (kN/m3)	Porosity Value	Initial Water Condition	Initial Piezo to Use	Elastic Type	Poisson's Ratio	Young's Modulus (kPa)	Failure Criterion	Material Type	Peak Tensile Strength (kPa)	Peak Friction Angle (degrees)	Peak Cohesion (kPa)	Use Unsaturated Parameters	Material Behaviour	Ks (m/s)	K2 / K1	K1 Definition	K1 Angle (degrees)	Soil Type	Use Residual Young's Modulus	Residual Tensile Strength (kPa)	Residual Friction Angle (degrees)	Residual Cohesion (kPa)	Dilation Angle (degrees)	Apply SSR (Shear Strength Reduction)	Fluid Bulk Modulus (kPa)
Barren Gravel Base		Field Stress and Body Force	20	0.3	Piezometric Lines	1	Isotropic	0.2	100000	Mohr-Coulomb	Elastic	0	42	0.1	No	Drained	0.001	1	Angle	0	General							
Top Clay-Silt-Gravels		Field Stress and Body Force	17	0.4	Piezometric Lines	1	Isotropic	0.3	20000	Mohr-Coulomb	Plastic	0	30	2	No	Undrained	1e-06	1	Angle	0	General	No	0	30	2	0	Yes	2.2e+06
Sands		Field Stress and Body Force	18	0.35	Piezometric Lines	1	Isotropic	0.3	35000	Mohr-Coulomb	Plastic	0	38	0.1	No	Drained	0.0001	1	Angle	0	Sand	No	0	38	0.1	0	Yes	

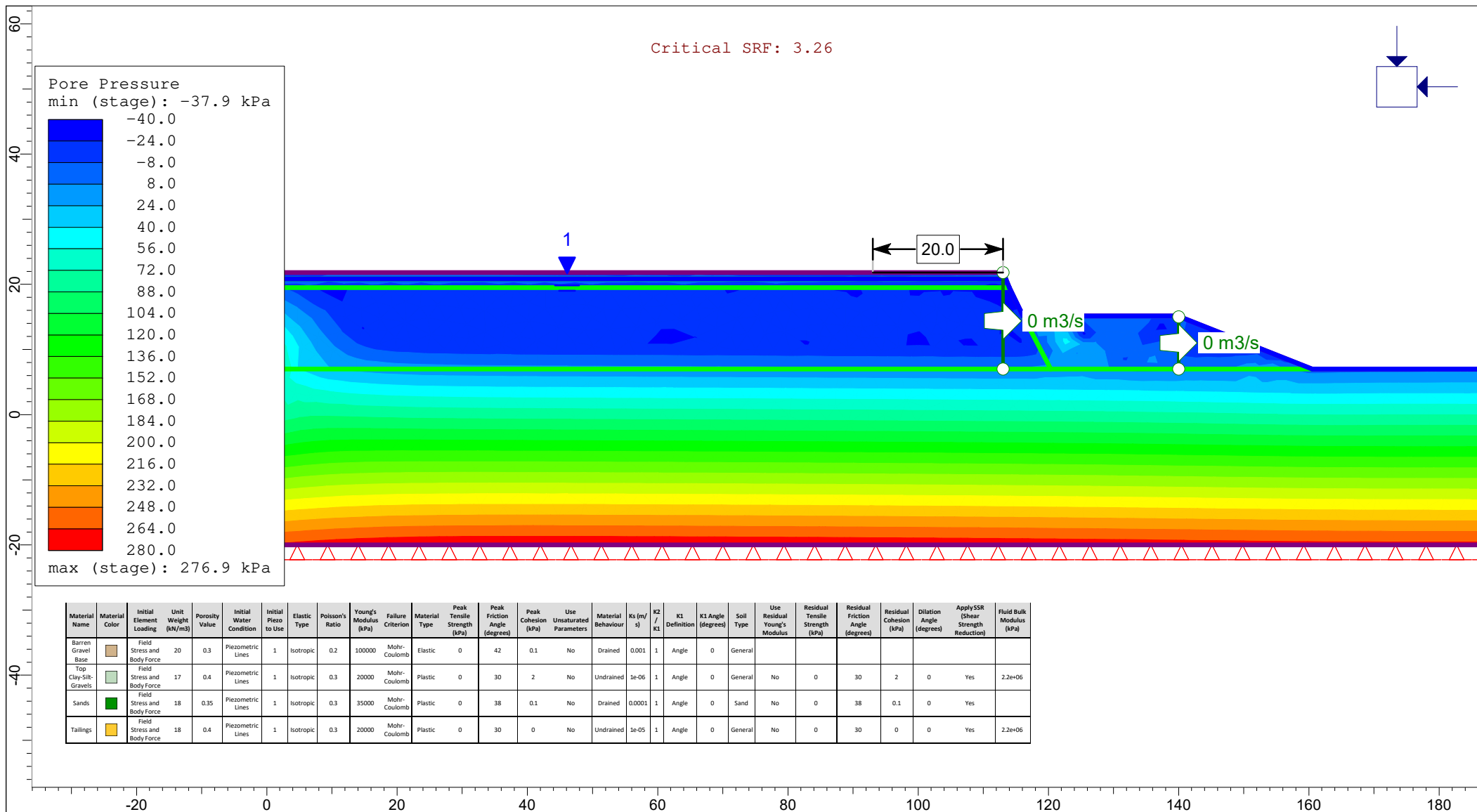


INTERPRET 11.018

Project	220986_Barrytown Mineral Sands Tailings		
Analysis Description	Slope Stability MCE - Pore Pressure		
Drawn By	HC	Scale	1:661
Company	Resource Development Consultants Limited		
Date	21/07/2023	File Name	RS2_Open Pit_Initial Cut_MCE.fez

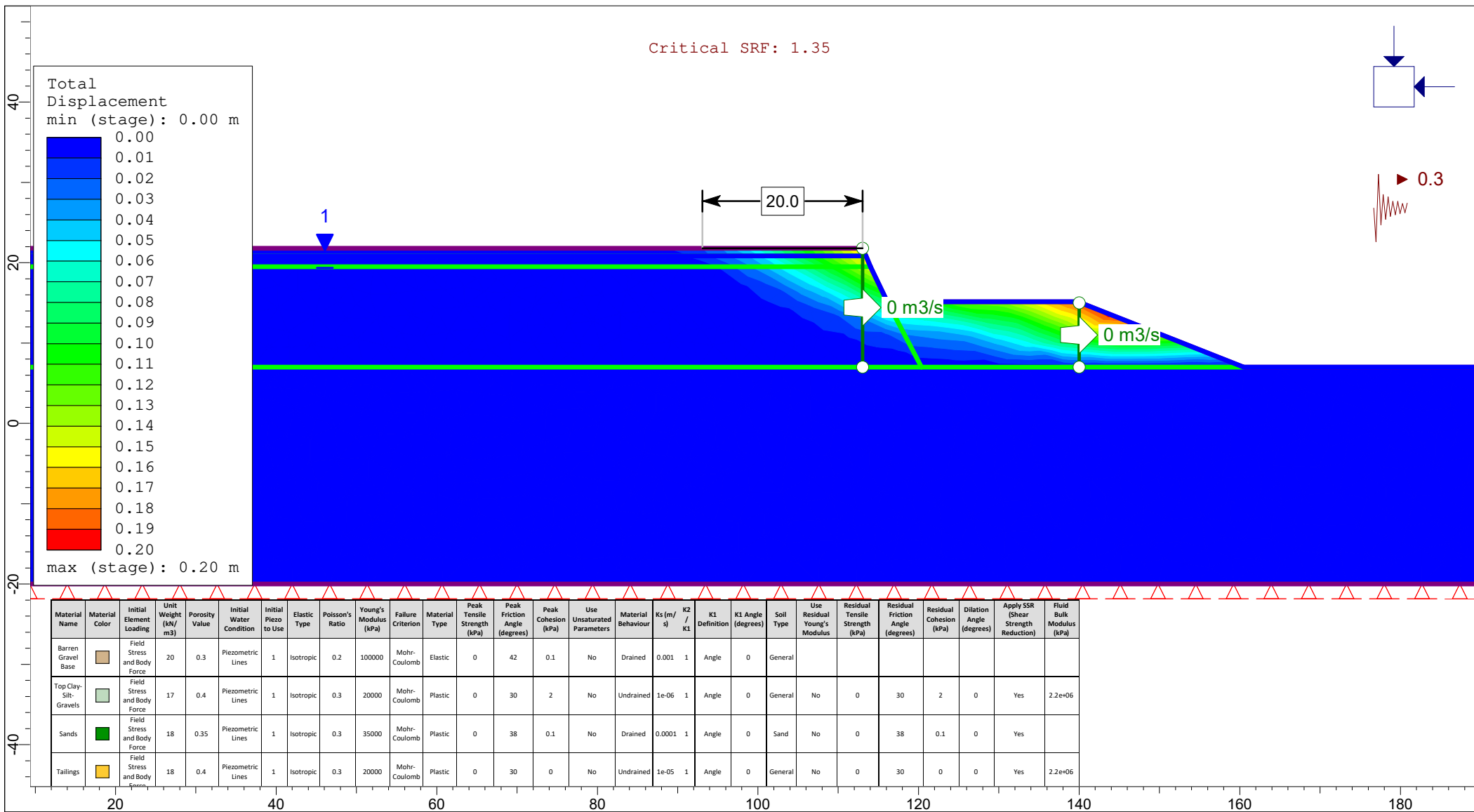


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	Analysis Description					Slope Stability Static - Displacement							
	Drawn By			HC		Scale		1:661		Company		Resource Development Consultants Limited	
	Date			21/07/2023				File Name		RS2_Open Pit_Tailings Supported_Static.fez			

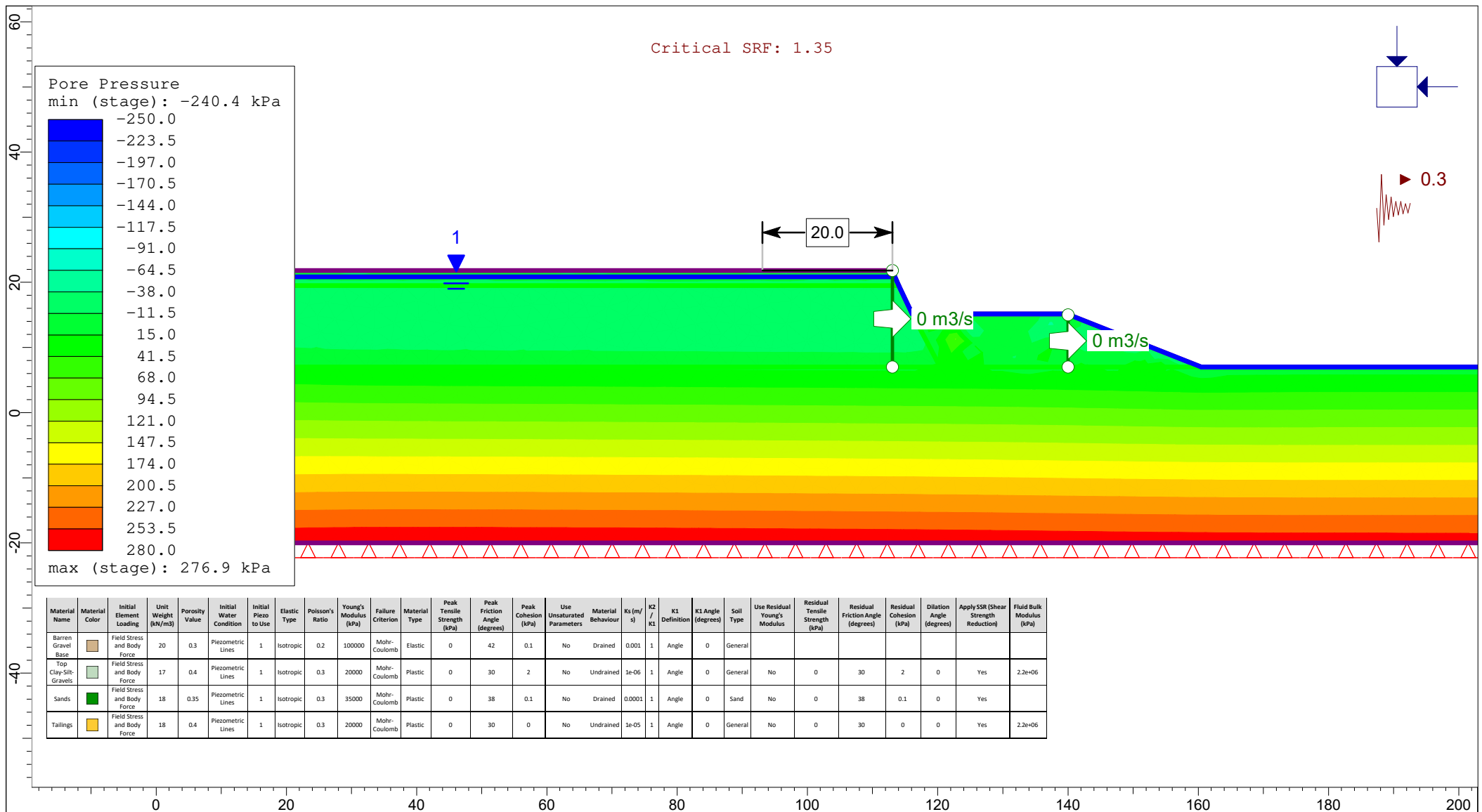


INTERPRET 11.018

Project			220986_Barrytown Mineral Sands Tailings				
Analysis Description			Slope Stability Static - Pore Pressure				
Drawn By		HC	Scale		1:816		
			Company			Resource Development Consultants Limited	
Date			21/07/2023		File Name		RS2_Open Pit_Tailings Supported_Static.fez



RDCL[®] INTERPRET 11.018	Project220986_Barrytown Mineral Sands Tailings	
	Analysis DescriptionSlope Stability OBE - Displacement	
	Drawn ByHC	Scale1:661
	Date21/07/2023	CompanyResource Development Consultants Limited
		File NameRS2_Open Pit_Tailings Supported_OBE.fez



INTERPRET 11.018

Project

220986_Barrytown Mineral Sands Tailings

Analysis Description

Slope Stability OBE - Pore Pressure

Drawn By

HC

Scale

1:816

Company

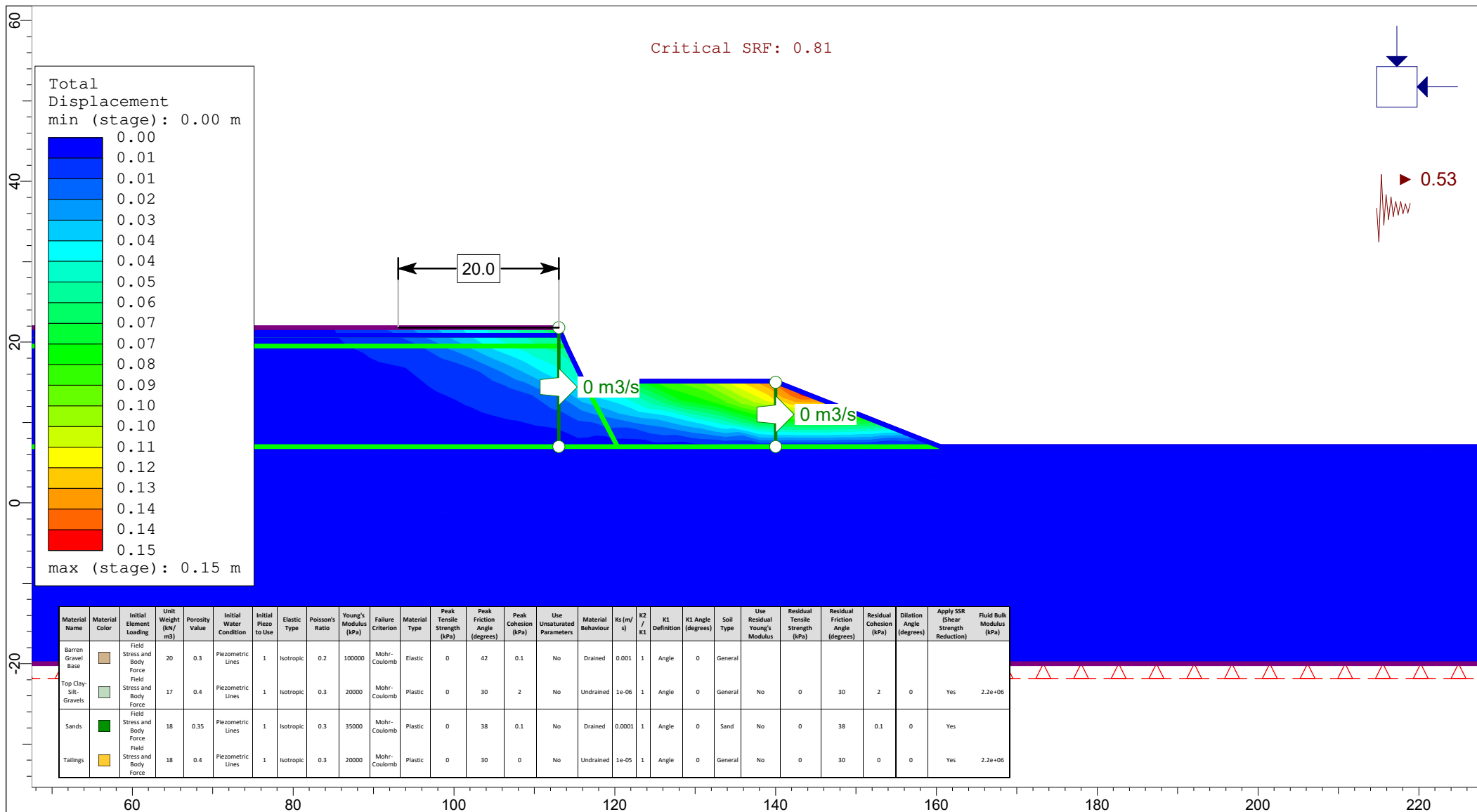
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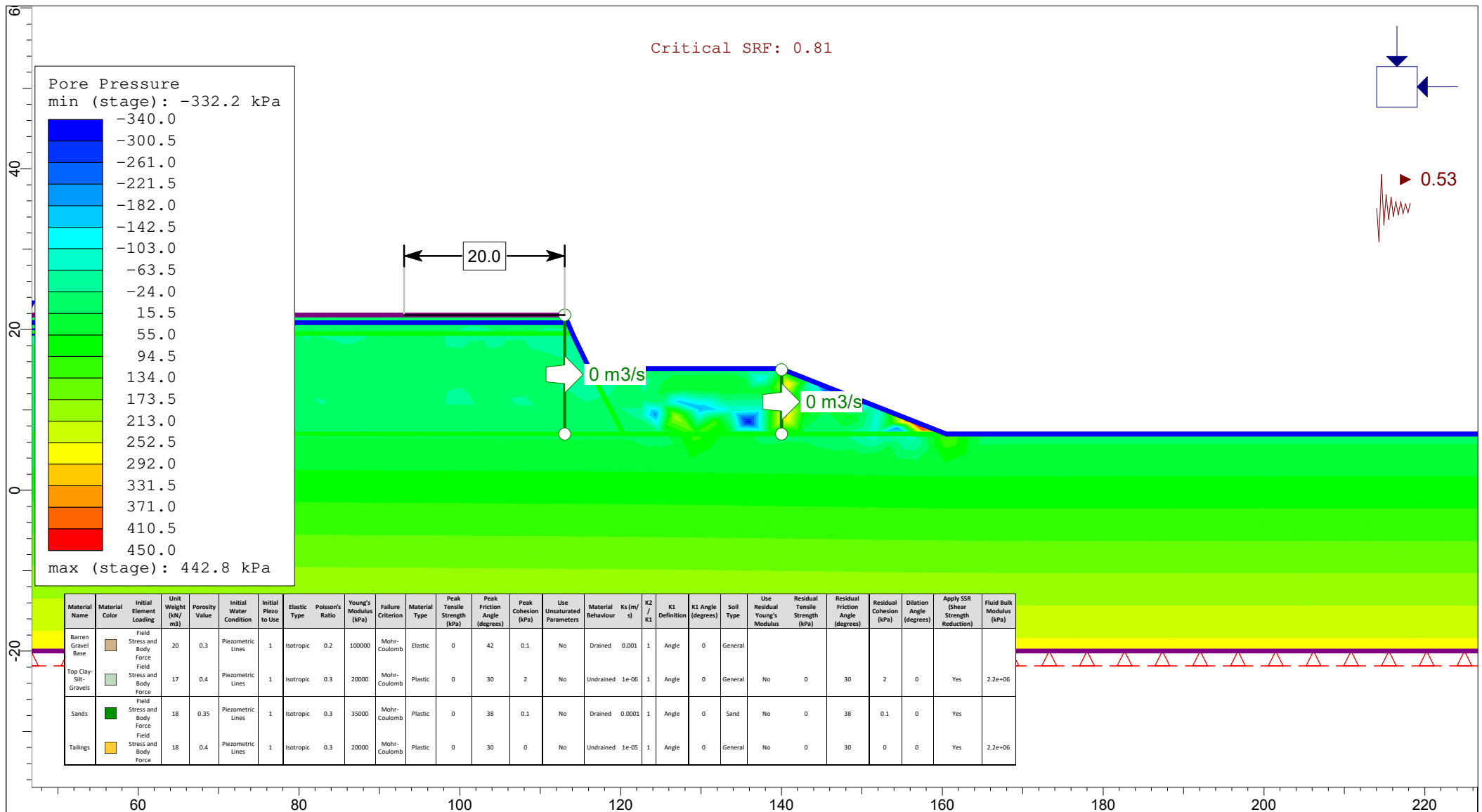
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INTERPRET 11.018

Project		220986_Barrytown Mineral Sands Tailings	
Analysis Description		Slope Stability MCE - Displacement	
Drawn By	HC	Scale	1:661
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RDCL[®] INTERPRET 11.018	Project	220986_Barrytown Mineral Sands Tailings		
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