Chrin Landfill Stability Evaluation

Williams Township, Northampton County, Pennsylvania
EarthRes Project #081022.032

July 15, 2014

Prepared for:

Chrin Brothers Sanitary Landfill
1225 Industrial Drive
Easton, PA 18042

Prepared by:

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EarthRes

CHRIN LANDFILL STABILITY EVALUATION

Introduction

EarthRes Group, Inc. (EarthRes) completed a slope stability evaluation of the non-failed slopes at the Chrin Brothers Landfill (Chrin). The purpose of the analysis was to estimate slope stability factors of safety with respect to the liner system for landfill areas that did not exhibit movement during the March 12, 2013 landfill slide at Chrin. The analysis considered six (6) locations across the length of the landfill. The locations analyzed were selected to be representative of the variable characteristics of the landfill that are important in evaluating liner system strength and stability. These conditions include such factors as liner system components, waste depths and slope geometry.

Stability analyses were completed for both existing grade conditions and for proposed final grade conditions in areas where filling has not yet reached permitted final grades. EarthRes analyzed stability under static loading conditions and also considered stability under a range of seismic (earthquake) acceleration values at each location. The following report sections outline the analysis procedures and present the resulting factors of safety.

Analysis Method and Procedure

A total of six (6) representative cross-sections were selected for analysis based on the criteria discussed above. As is the case with most modern landfills, the Chrin landfill has been constructed in fill area increments or "stages" over its years of operation. During that time period, the geosynthetic materials used in the landfill liner system has changed, as have the manufacturers and configuration. As a result, any given stage of the landfill may have liner system materials that are somewhat different than those in other stages. Likewise, the landfill base grades and slope geometry also vary with each stage. This variability is primarily a result of the original topography of the property before the landfill was constructed. Each cross-section analyzed considered the stage-specific liner system(s) installed in that section.

Cross-section geometry and liner system components were determined based on Pennsylvania Department of Environmental Protection (PA DEP) permit application documents, as-built construction information and topographic mapping showing current fill grades. The section geometry was imported directly from AutoCAD into SLIDE® slope stability analysis software, an industry-accepted slope stability analysis program developed by Rocscience. The cross-section locations and respective liner systems are shown on Figures 1 and 2 respectively in Appendix A. Two-dimensional stability models were developed for each section and each case (static and seismic). The liner systems were input as a single soil layer in the model so that strength properties and other parameters could be assigned.

Based upon the configuration of the landfill slopes and the mode of slope movement in the March 2013 slide at Chrin, the analyses were focused on a sliding block failure mode within the landfill liner system. The liner system(s) in each section was modeled as a weak soil layer using the appropriate area-specific shear strength parameters for model input. Sliding block failure was analyzed using the Morgenstern-Price solution method in SLIDE®. Strength data from laboratory tests for the liner system was input into SLIDE® using the shear/normal function in the program to model the laboratory data strength envelope which accounts for shear strength varying with normal stress (waste depth on the liner system). Model input data for liner system shear strength is provided in Appendix B. Peak shear strengths were applied to base areas and residual (large displacement) shear strengths were applied to side slopes in the models.

Seismic stability analyses included evaluation under two different seismic loading conditions. The first analysis considered the estimated ground acceleration at Chrin during the 2011 earthquake centered near Mineral, Virginia. This earthquake has been identified by Tim Stark, PhD as the triggering event for the March 2013 landfill slide at Chrin. In his study of the slide at Chrin, Dr. Stark estimated a ground acceleration of 0.03g at the site. EarthRes applied this factor to the models for each section and calculated the resulting factors of safety. Additionally, EarthRes applied a much greater seismic acceleration, 0.11g, to the models to evaluate the factors of safety using current standards required for new landfill design. Results of the analyses are discussed below.

Analysis Results

The results of the analyses are summarized in Table 1 below. Static factors of safety range from 1.3 for Section A to 2.8 in Section F under existing grade conditions and a value of 2.7 under permitted final grade conditions. Under seismic loading, using the estimated 2011 Virginia earthquake acceleration of 0.03g, factors of safety range from 1.1 in Section A to 2.4 in Section F. When considering a landfill design earthquake acceleration of 0.11g, the calculated factor of safety for all sections are greater than 1.0, with the exception of Section A which yielded a factor of safety value of 0.9. Model output sheets for each section are provided in Appendix C.

	Factors of Safety					
	Static		2011 Virginia EQ Acceleration (.03g)		Landfill Design EQ Acceleration (.11g)	
SECTION	EXISTING GRADE	PERMITTED GRADE	EXISTING GRADE	PERMITTED GRADE	EXISTING GRADE	PERMITTED GRADE
A	1.3	N/A	1.1	N/A	0.9	N/A
B	1.7	N/A	1.5	N/A	1.1	N/A
C	1.7	N/A	1.5	N/A	1.2	N/A
D	1.6	1.5	1.4	1.4	1.0	1.0
E	1.5	1.7	1.4	1.5	1.0	1.2
F	2.8	2.7	2.4	2.3	1.7	1.6

Table 1 - Factors of Safety

Summary and Conclusions

Results from the analysis of the six (6) cross-sections indicate calculated static factors of safety greater than 1.3 for all six sections. Therefore, the liner systems in areas of the landfill that have not shown evidence of movement after the 2011 earthquake and 2013 slope failure are expected to remain stable under static conditions. Under seismic (earthquake) loading conditions, the analyses confirmed that these areas would be stable under seismic loading conditions of the same or lesser ground acceleration induced by the 2011 Virginia earthquake.

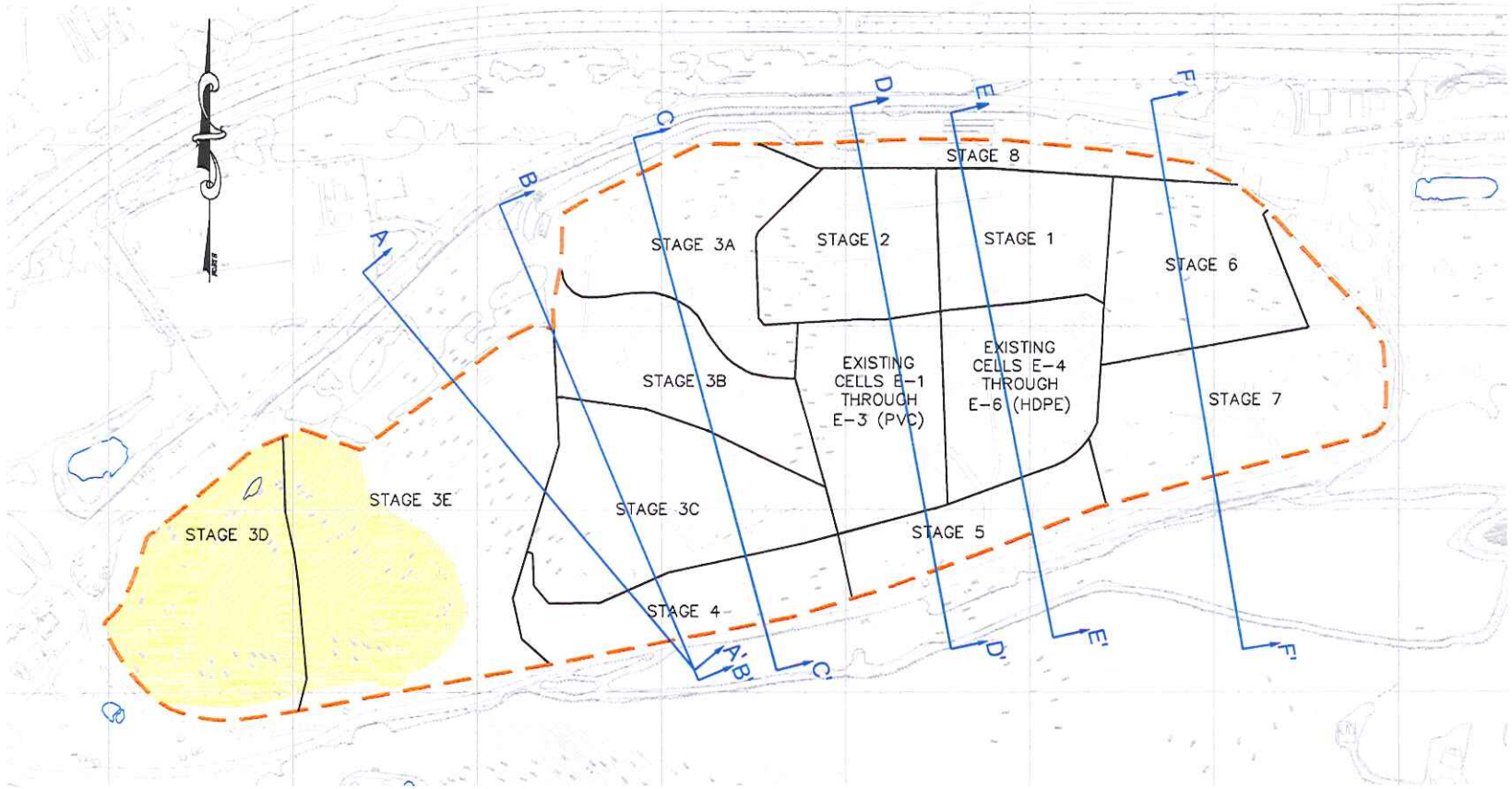
Using a design earthquake of 0.11g acceleration (roughly 3.5 times the acceleration estimated for the 2011 Virginia earthquake), as would be required for new landfill construction, the calculated factors of safety for all sections except section A are 1.0 or greater. The Section A model results indicate a factor of safety of 0.9 for this seismic condition. Based on sensitivity analyses performed by EarthRes on this particular cross-section using multiple seismic acceleration values with SLIDE®, the factor of safety for this section is greater than unity (1.0) for seismic events with ground accelerations up to approximately 0.09g, roughly three times the acceleration from the earthquake that triggered the 2013 slide.

Chrin should continue regular monitoring of the unaffected area in the vicinity of Section A using the current methods of field surveys and visual inspection for evidence of movement. More detailed and frequent inspections should be conducted immediately following any regional seismic (earthquake) events or if any evidence of ground cracking or movement is observed.

Limitations

Based on the observed mode of slope failure in Stages 3D and 3E (liner system failure), this analysis was limited to an evaluation of slope stability (potential for slope failure) due to inadequate strength of the liner system in the areas not affected by the 2013 slide. The evaluation of potential for slope failure in different modes or due to other conditions was not considered and is beyond the scope of this report. EarthRes has performed this evaluation in a professional manner using that degree of skill and care exercised for similar projects under similar conditions by reputable and competent consultants. The conclusions provided are based solely on the observations, references and methods described herein. In performing this analysis, EarthRes relied on data provided by others and made reasonable efforts to verify the accuracy of such data.

APPENDIX A



LEGEND

- EXISTING LANDFILL BOUNDARY
- STAGE BOUNDARIES
- C — C' CROSS-SECTION LOCATIONS
- SLIDE AREA

NOTE:
TOPOGRAPHY AND SITE FEATURES COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY EXPOSED 3/15/13.

FIGURE 1
CROSS SECTION LOCATIONS

SLOPE STABILITY EVALUATION
CHRIN BROTHERS SANITARY LANDFILL
WILLIAMS TOWNSHIP, NORTHAMPTON COUNTY
PENNSYLVANIA

DRAWN BY: JCHJ	CHECKED BY: JCH
DATE: 7/14/2014	PROJECT NO: 081022.020
DRAWING SCALE: 1" = 400'	

EarthRes
ENGINEERING AND SCIENCE
P.O. Box 468
6512 Old Easton Road
Pipersville, PA 18947 USA
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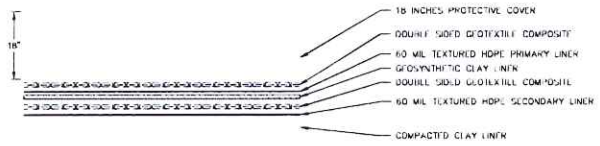
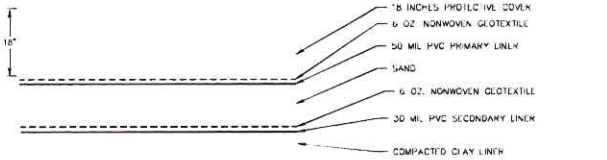
toll free 800.924.4553



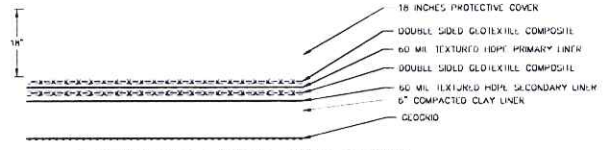
01 003 LANDFILL LINER SYSTEM
NOT TO SCALE

NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM THE STAGE 5 AS-BUILT LINER SYSTEM DETAILS, DRAWING NO. 2209496S, DATED 9/3/02, BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND STAGE 6 AS-BUILT LINER SYSTEM DETAILS, DRAWING NO. L4, DATED 11/23/07, BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



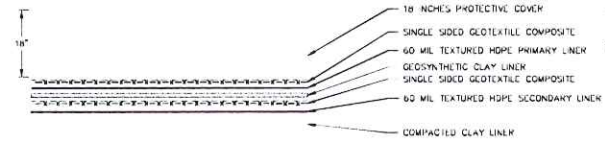
02 003 LANDFILL LINER SYSTEM
NOT TO SCALE

NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM THE CERTIFICATION DOCUMENTS PREPARED BY APPLIED GEOTECHNICAL & ENVIRONMENTAL SERVICES CORPORATION, PREPARED IN 1988 TO 1991.



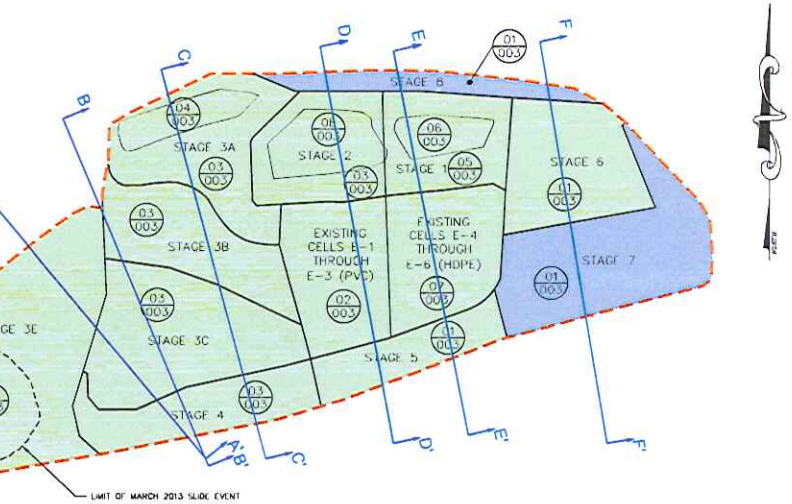
03 003 REINFORCED LANDFILL LINER SYSTEM
NOT TO SCALE

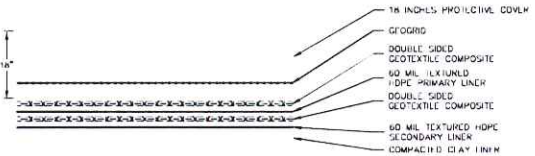
NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM STAGE 2 LINER INSTALLATION CERTIFICATION DOCUMENTATION DRAWING NO. 94-169-E2, DATED 9/29/94, STAGE 3A RECORD DRAWINGS, FIGURE 4, FIGURE 4 DRAWING NO. 99-662-ES, DATED 8/8/97, STAGE 3A RECORD DRAWINGS, FIGURE NO. 3 DRAWING NO. 98-202-E4, DATED 10/26/98, AND STAGE 3C RECORD DRAWINGS, DRAWING NO. 99-711-LS, BY ALMES & ASSOCIATES, INC. GEOGRID INSTALLATION WAS INDICATED IN THE SUBGRADE CERTIFICATION DOCUMENTS.



04 003 LANDFILL LINER SYSTEM
NOT TO SCALE

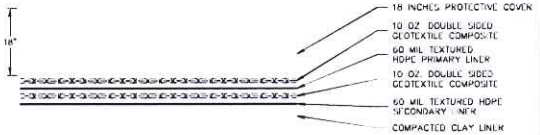
NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM STAGE 3A RECORD DRAWINGS, FIGURE 4 DRAWING NO. 99-662-ES, DATED 8/8/97, BY ALMES & ASSOCIATES, INC.



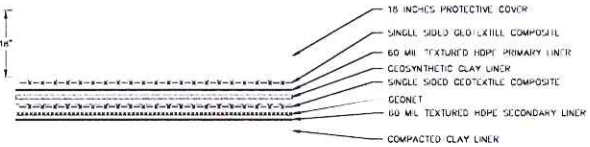


05 003 REINFORCED LANDFILL LINER SYSTEM
NOT TO SCALE

NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM THE STAGE 1 LINER INSTALLATION CERTIFICATION DOCUMENTATION DRAWING NO. 93-02-E15, DATED 9/2/93, BY AMES & ASSOCIATES, INC.



07 003 LANDFILL LINER SYSTEM
NOT TO SCALE



06 003 LANDFILL LINER SYSTEM
NOT TO SCALE

NOTE:
1. THE LINER SYSTEM ABOVE IS REFERENCED FROM THE STAGE 1 LINER INSTALLATION CERTIFICATION DOCUMENTATION DRAWING NO. 93-02-E15, DATED 9/2/93, BY ALMES & ASSOCIATES, INC. AND STAGE 2 LINER INSTALLATION CERTIFICATION DOCUMENTATION DRAWING NO. 94-169-E2, DATED 9/29/94, BY ALMES & ASSOCIATES, INC.

LEGEND
- EXISTING LANDFILL BOUNDARY
- STAGE BOUNDARIES
- BOTTOM LINER AREA
- C C' CROSS-SECTION LOCATIONS
- GSE GEOMEMBRANE
- AGRU GEOMEMBRANE

NO.	DATE	BY	REVISIONS

PREPARED FOR:

PREPARED BY:
EarthRes

LINER SYSTEM DETAILS

SLOPE STABILITY EVALUATION
OPEN BENCHES SANITARY LANDFILL
WILLIAMS TOWNSHIP, NORTHAMPTON COUNTY
PENNSYLVANIA

DRAWN BY:	CHECKED BY:
JDM	JDH
DATE: 7/14/2014	PROJECT NO: GE22-220
DRAWING NUMBER: FIGURE 2	SHEET 2 OF 2

APPENDIX B

Chrin Landfill Slope Stability Evaluation

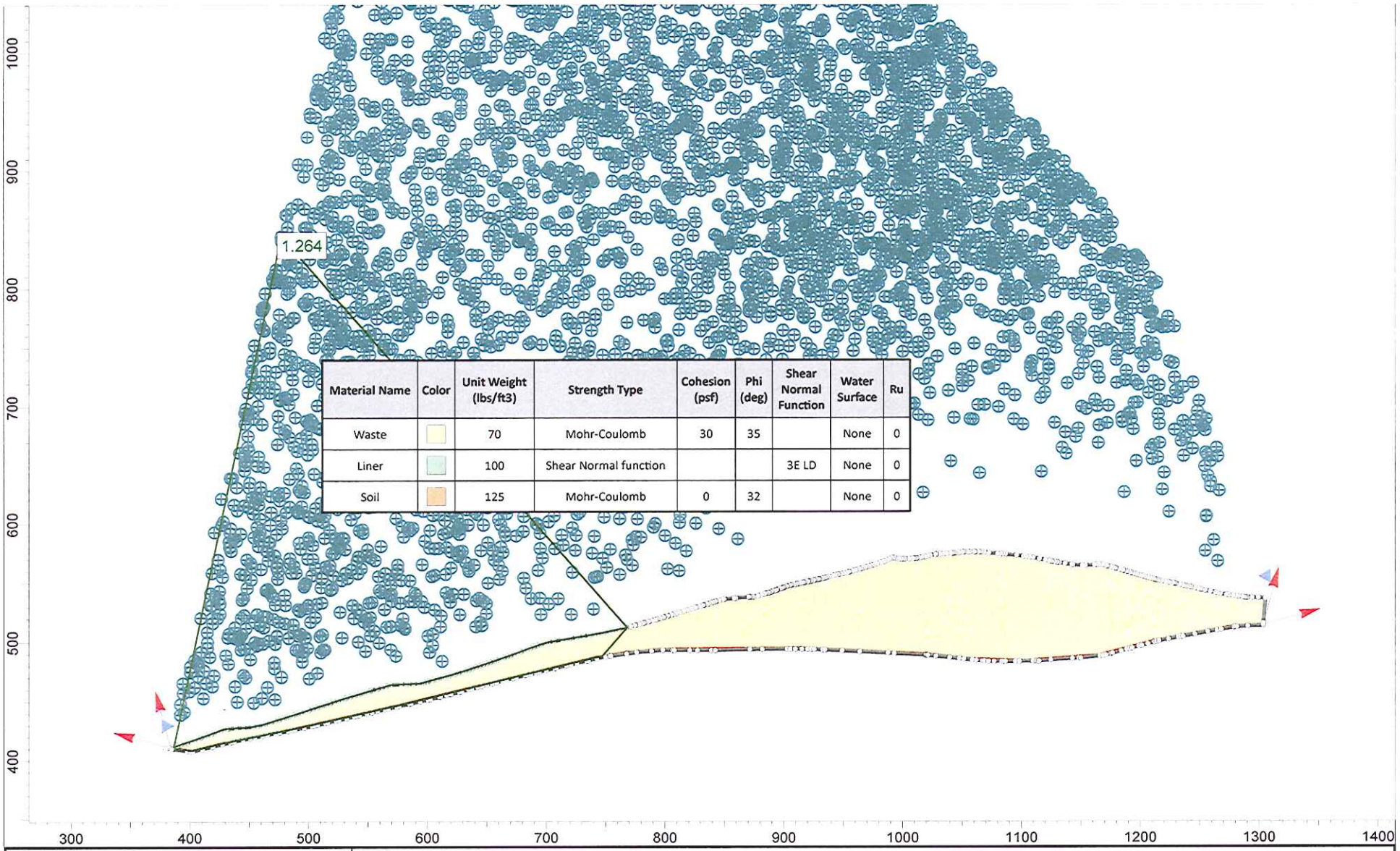
Shear/Normal Functions Used as Input in Stability Analyses

Stage 3E Large Displacement (residual)	
Normal Stress (psf)	Shear Strength (psf)
1000	305
2000	550
4000	994

Stage 6 (GSE Geomembrane) Large Displacement (residual)		Stage 6 (GSE Geomembrane) Peak	
Normal Stress (psf)	Shear Strength (psf)	Normal Stress (psf)	Shear Strength (psf)
4400	1709	4400	2503
8800	2488	8800	4392
13200	3687	13200	6029
17600	4345	17600	7720

Stage 7 (AGRU Geomembrane) Large Displacement (residual)	
Normal Stress (psf)	Shear Strength (psf)
4400	1580
8800	2860
13200	2895
17600	3429

APPENDIX C

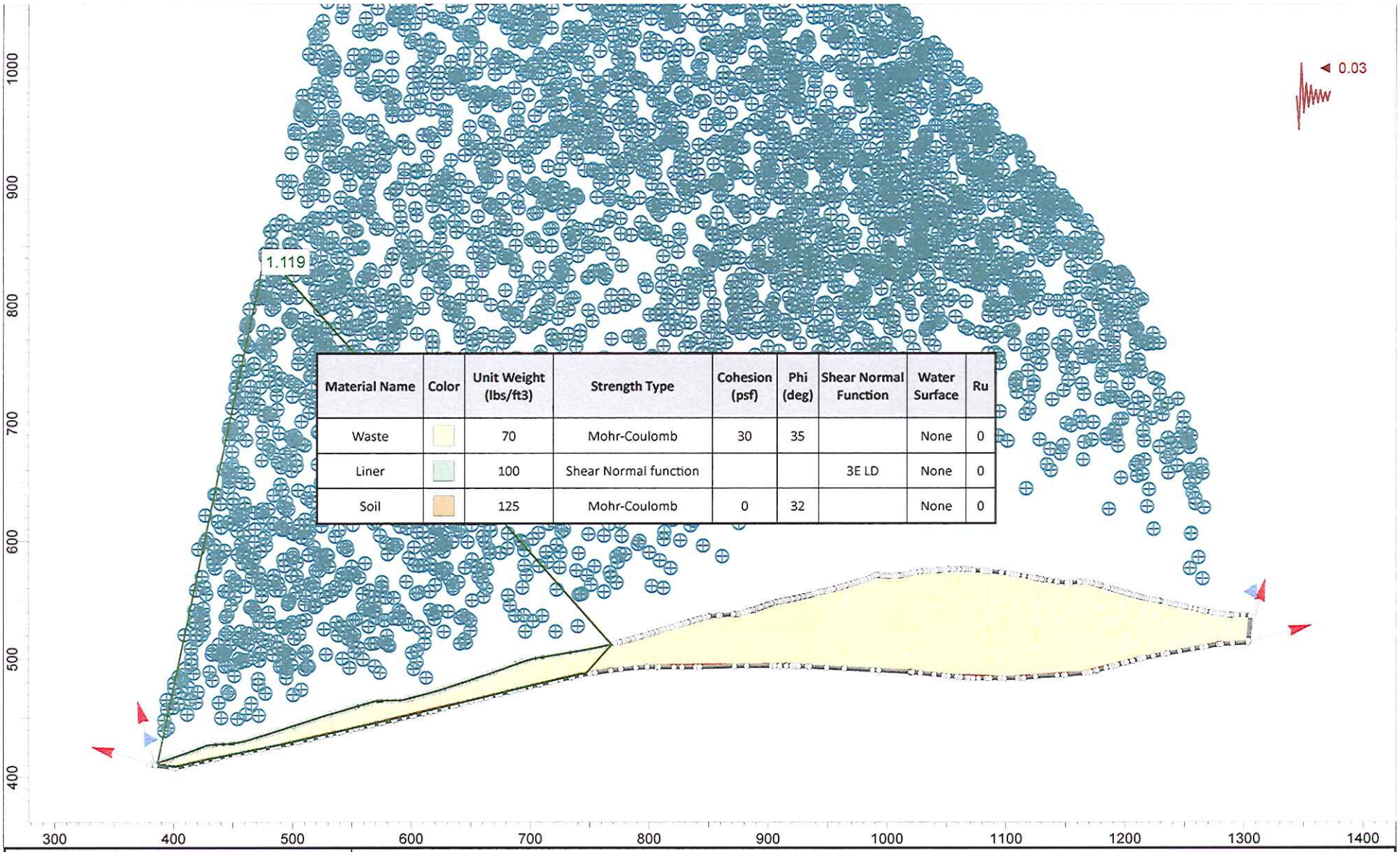


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		70	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			3E LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

rocscience

SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1339	Company EarthRes Group
Date	July 2, 2014		File Name Section A Existing (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		70	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			3E LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

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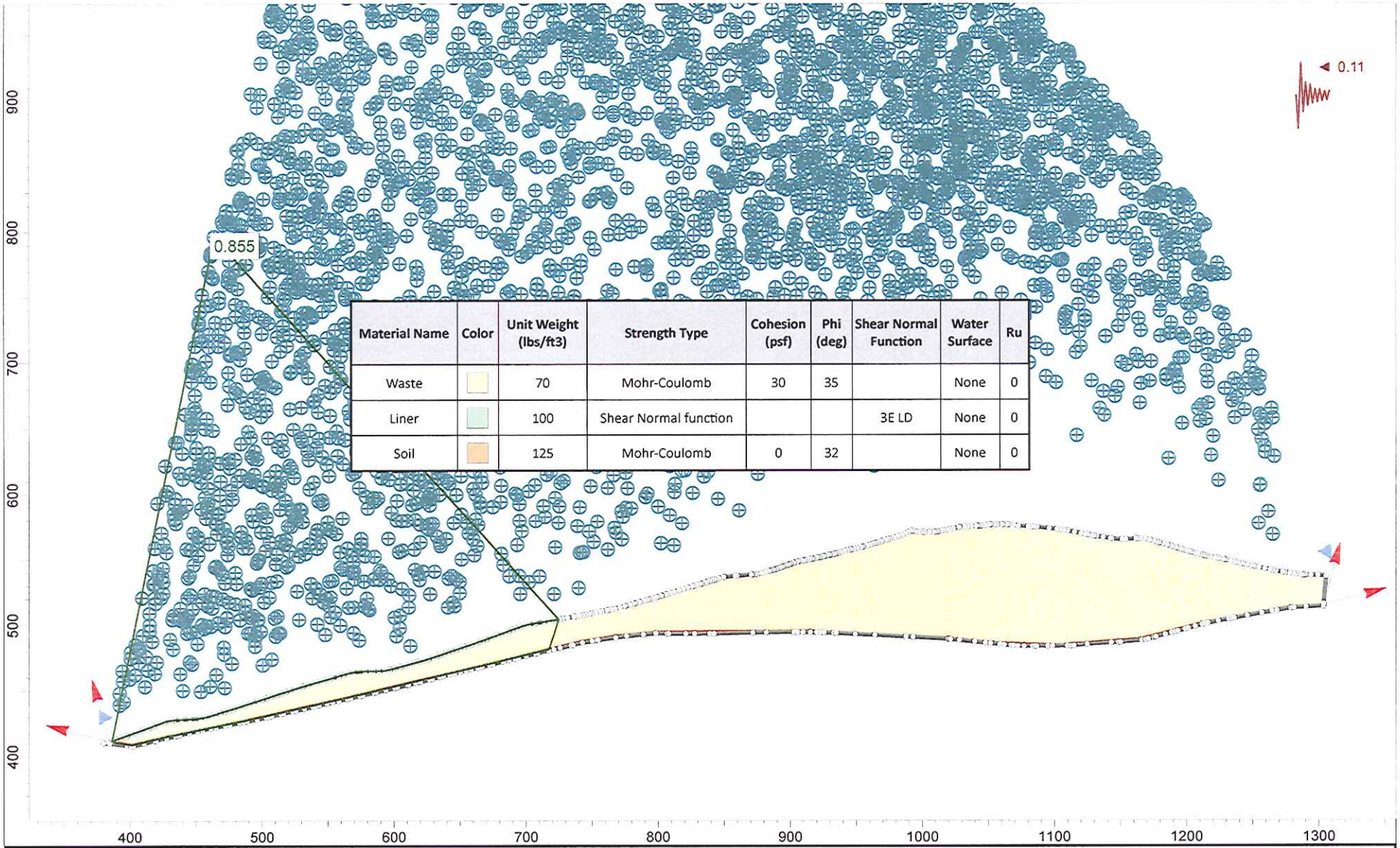
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1339	Company EarthRes Group
Date	July 2, 2014		File Name Section A Existing (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		70	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			3E LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

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SLIDEINTERPRET 6.029

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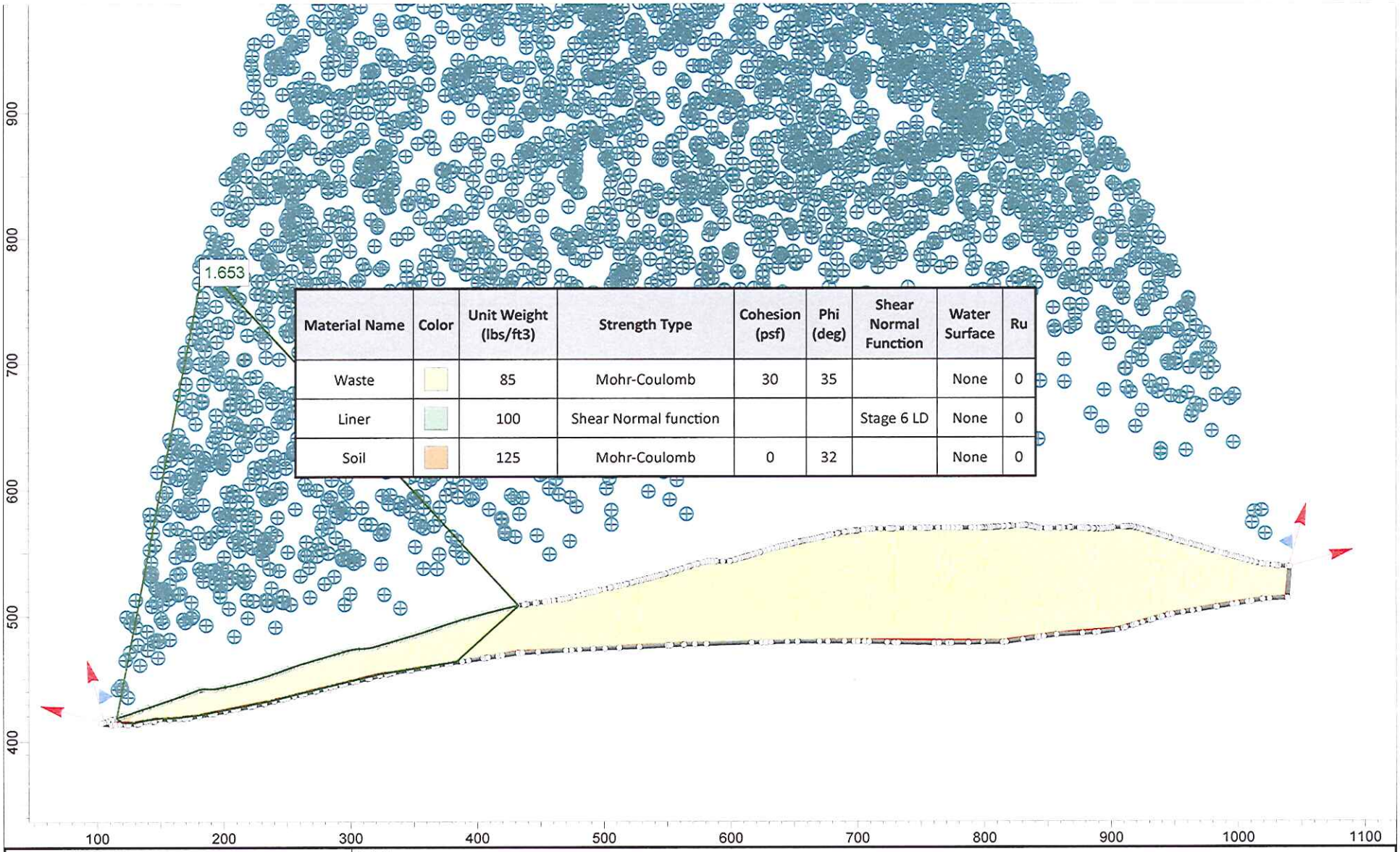

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

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SLIDEINTERPRET 6.029

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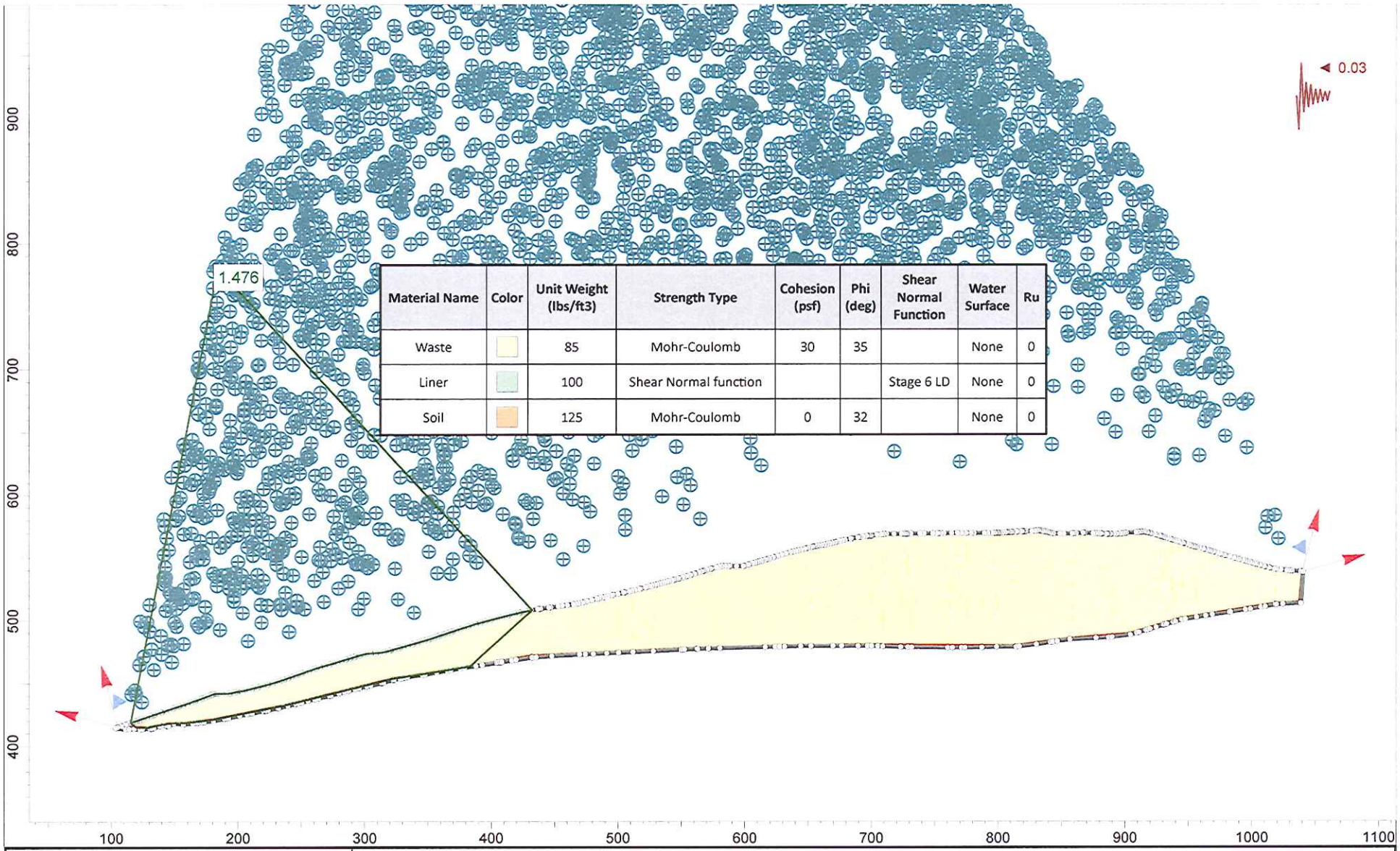
Date	July 2, 2014		File Name Section B Existing (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

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SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
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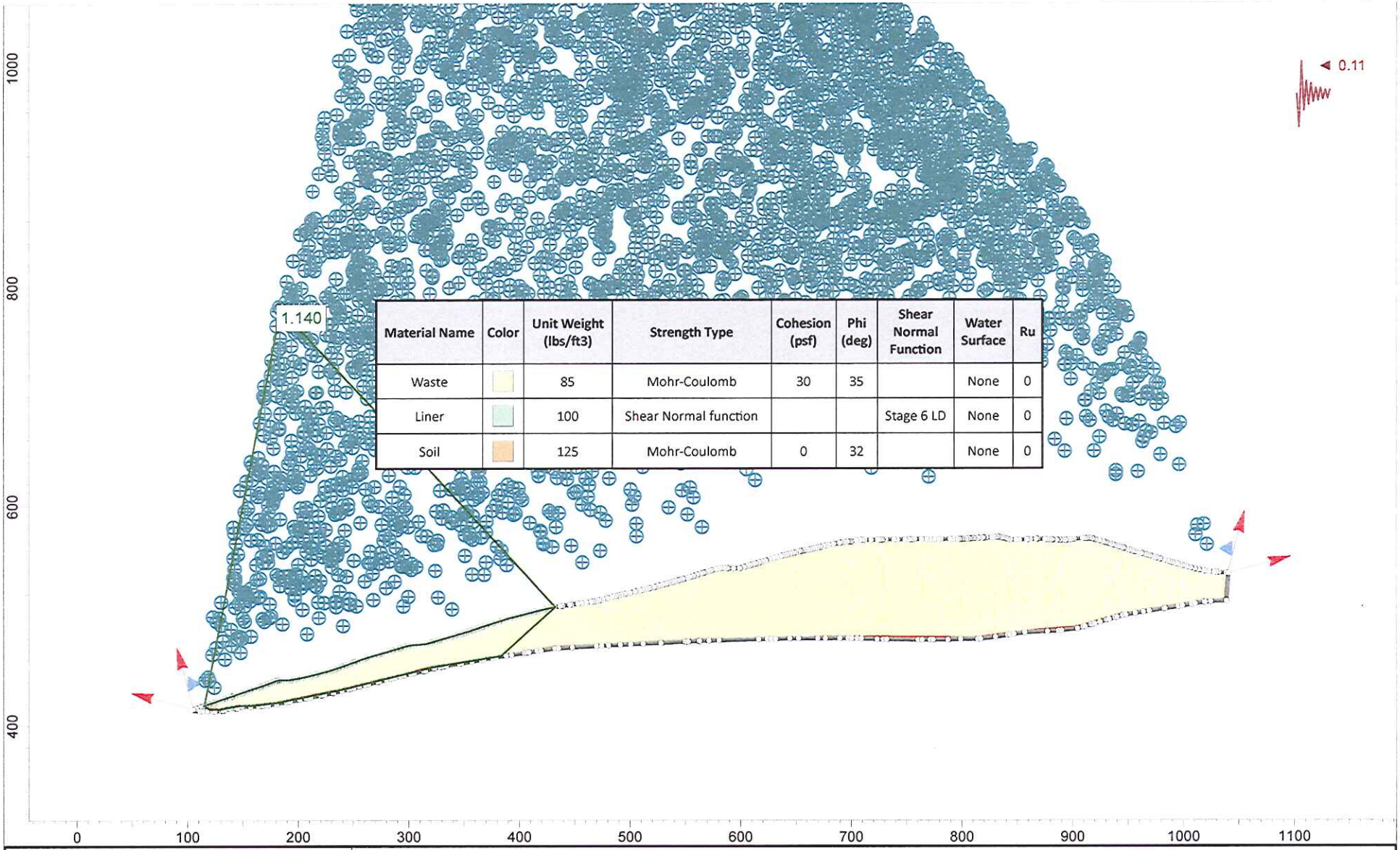
Date	July 2, 2014	File Name	Section B Existing (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0

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SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
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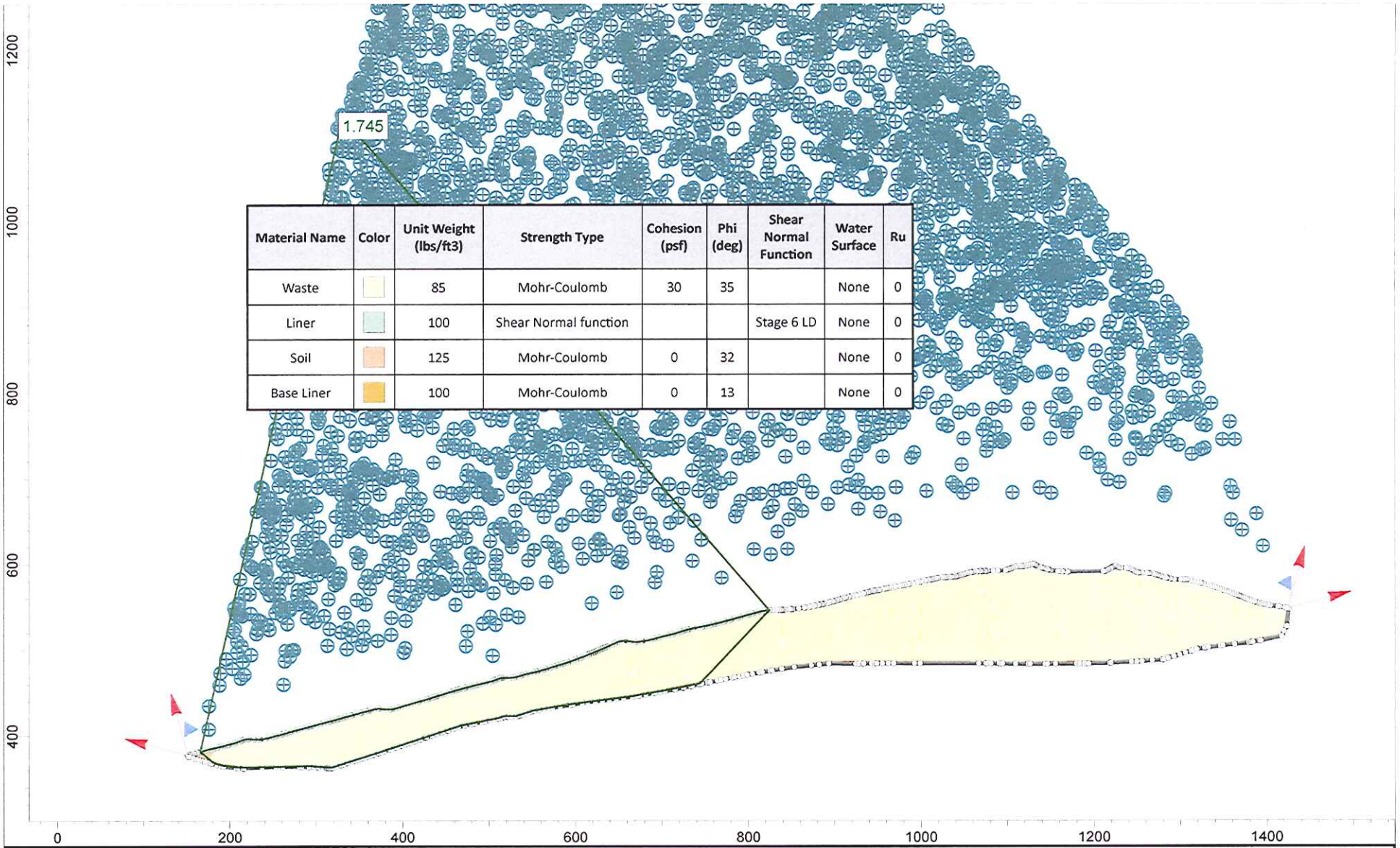
Date	July 2, 2014		File Name Section B Existing (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Base Liner		100	Mohr-Coulomb	0	13		None	0

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SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
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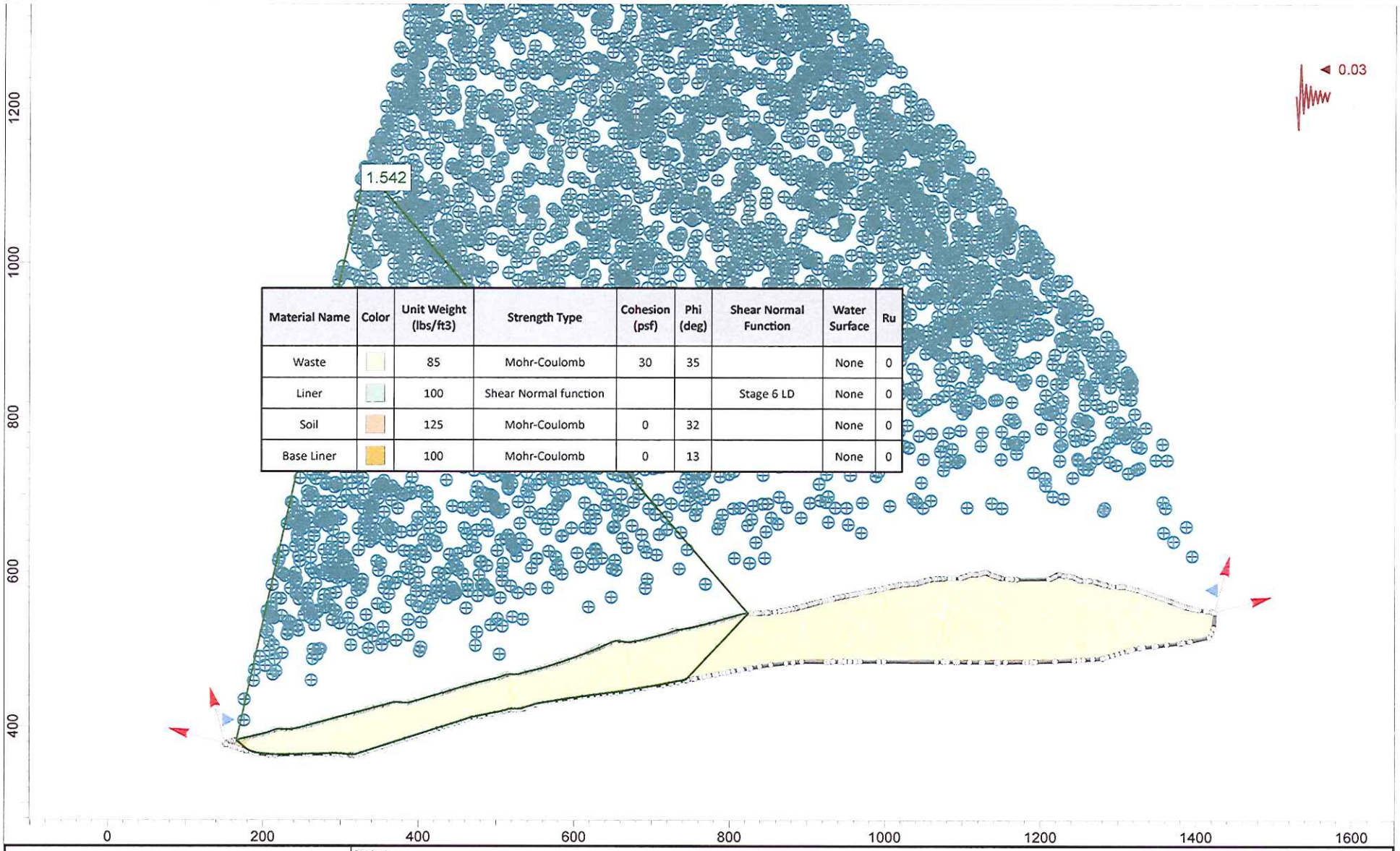
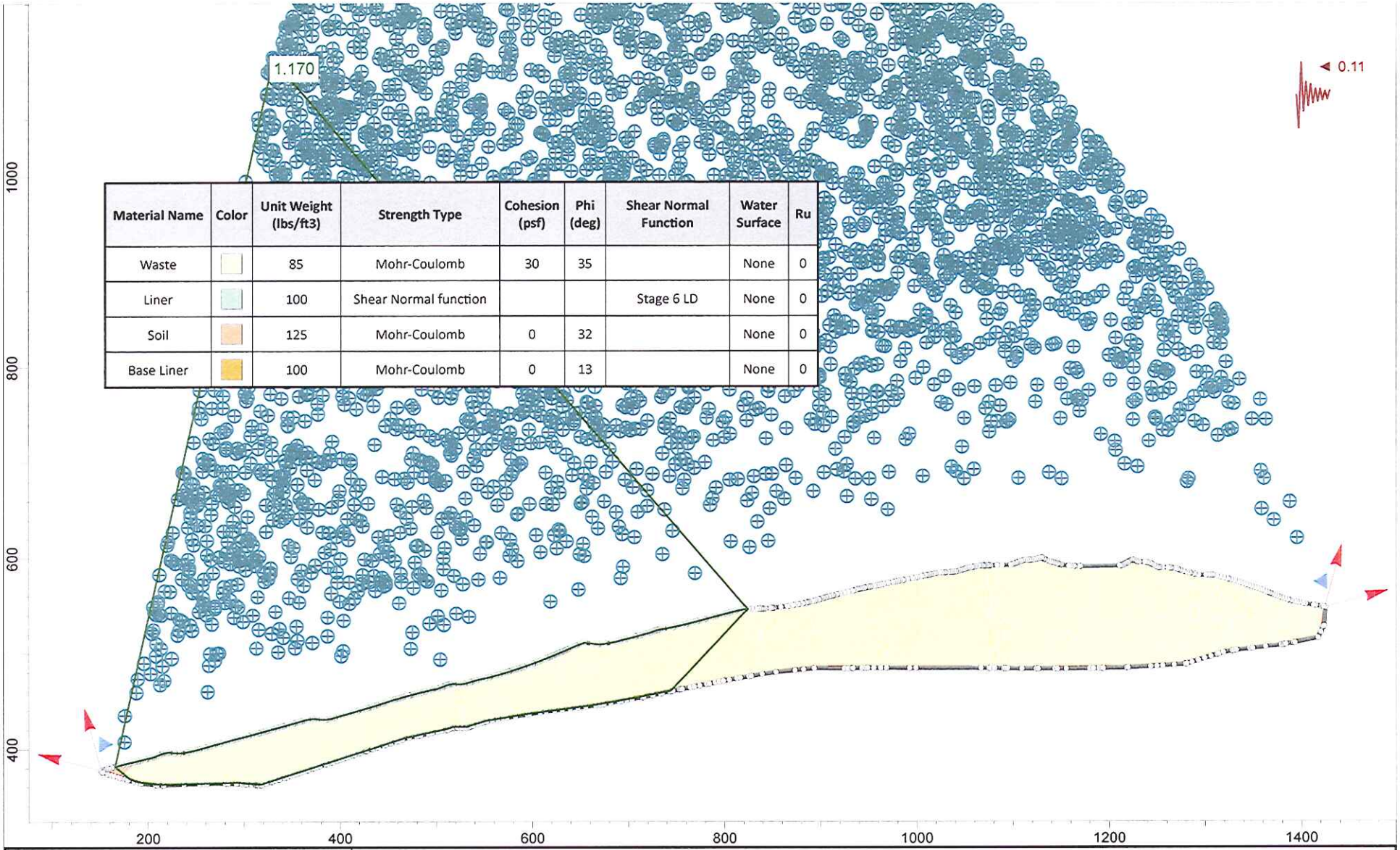
Date	July 2, 2014		File Name Section C Existing (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Base Liner		100	Mohr-Coulomb	0	13		None	0

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:2045	Company EarthRes Group
Date	July 2, 2014		File Name Section C Existing (Virginia Seismic).slim

SLIDEINTERPRET 6.029



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Base Liner		100	Mohr-Coulomb	0	13		None	0

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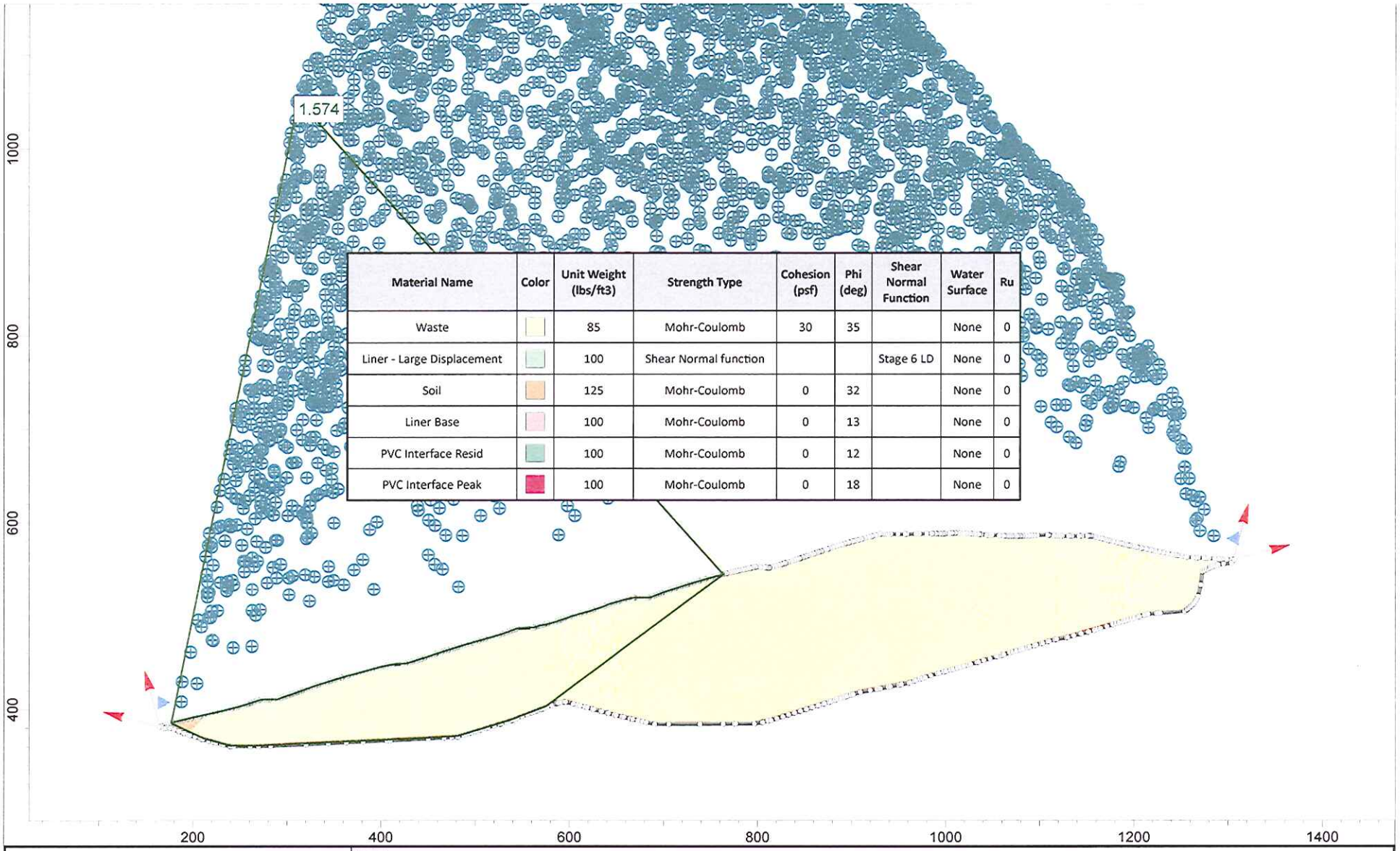
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1656	Company EarthRes Group
Date	July 2, 2014		File Name Section C Existing (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

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SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
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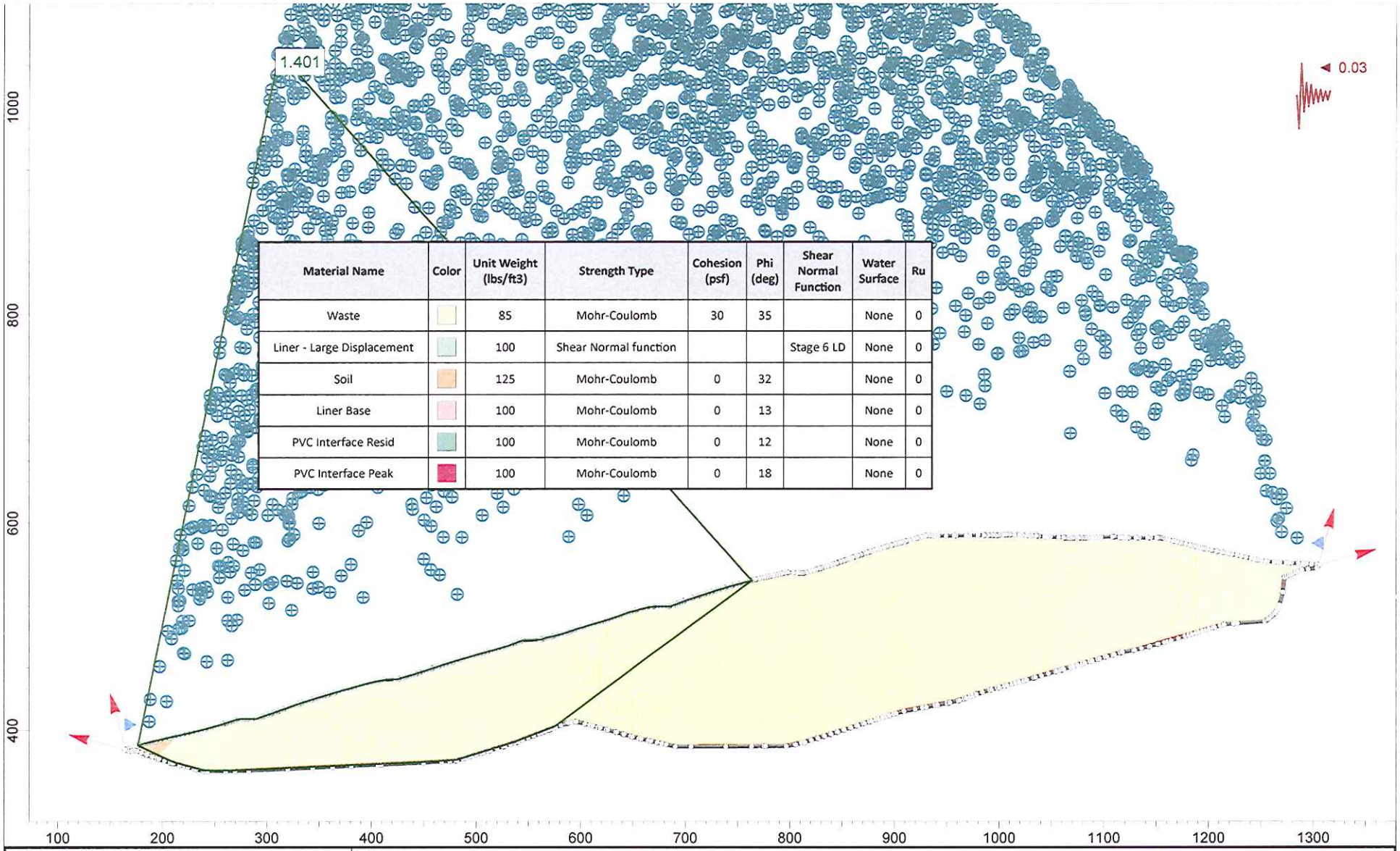
Date	July 2, 2014		File Name Section D Existing (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

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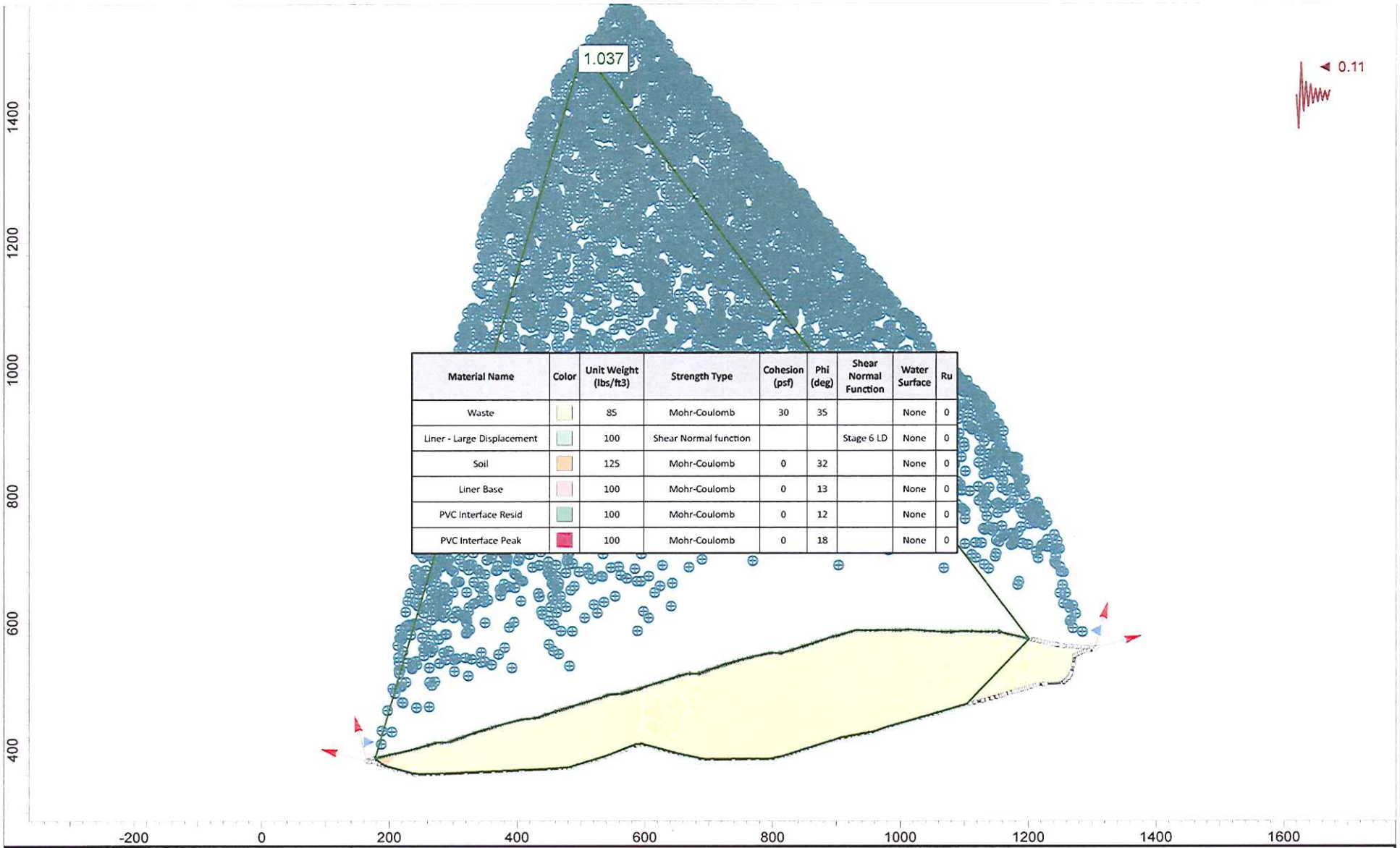
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	Scale 1:1521	Company	EarthRes Group
Date	July 2, 2014	File Name	Section D Existing (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

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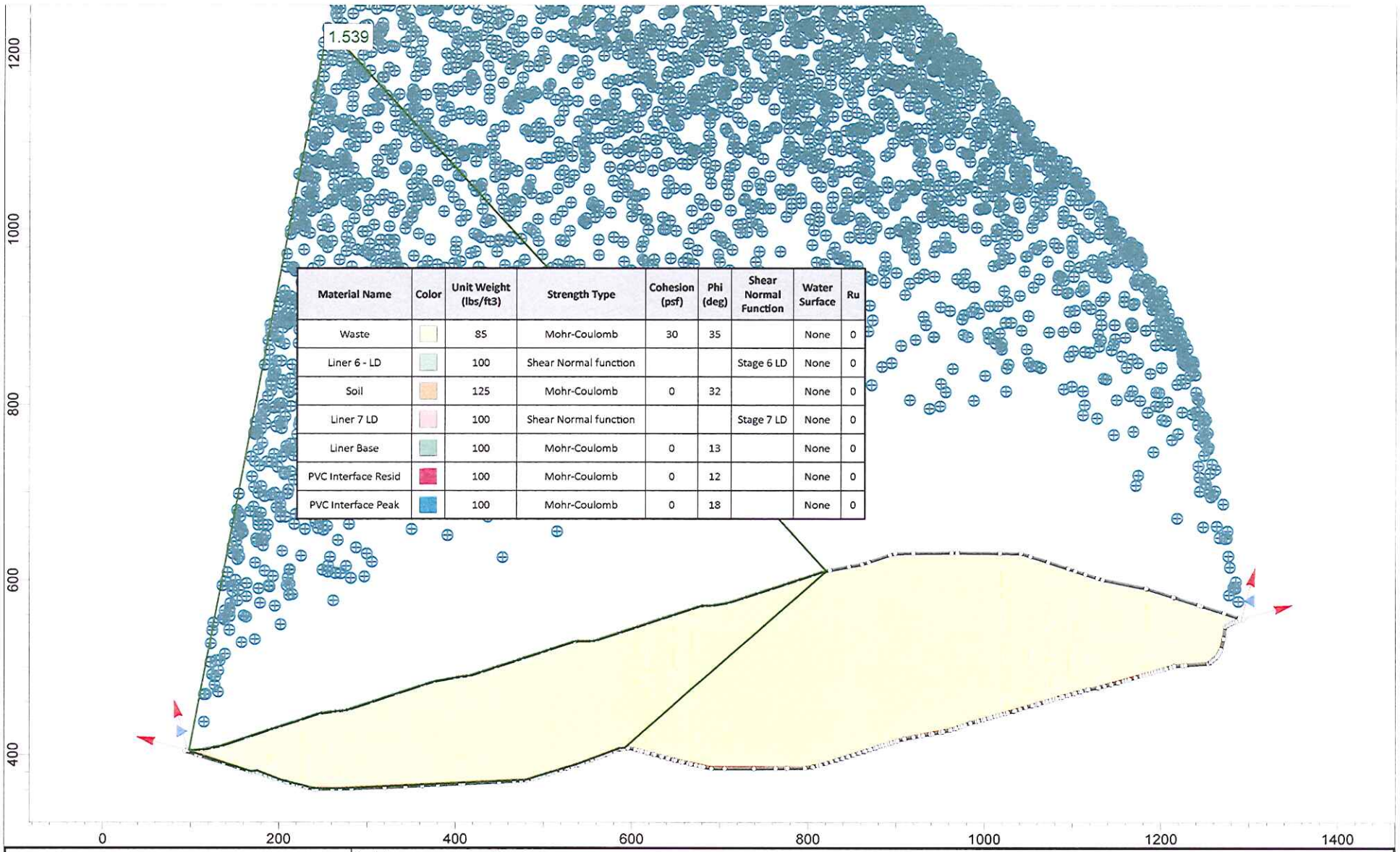
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:2491	Company EarthRes Group
Date	July 2, 2014		File Name Section D Existing (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner 6 - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

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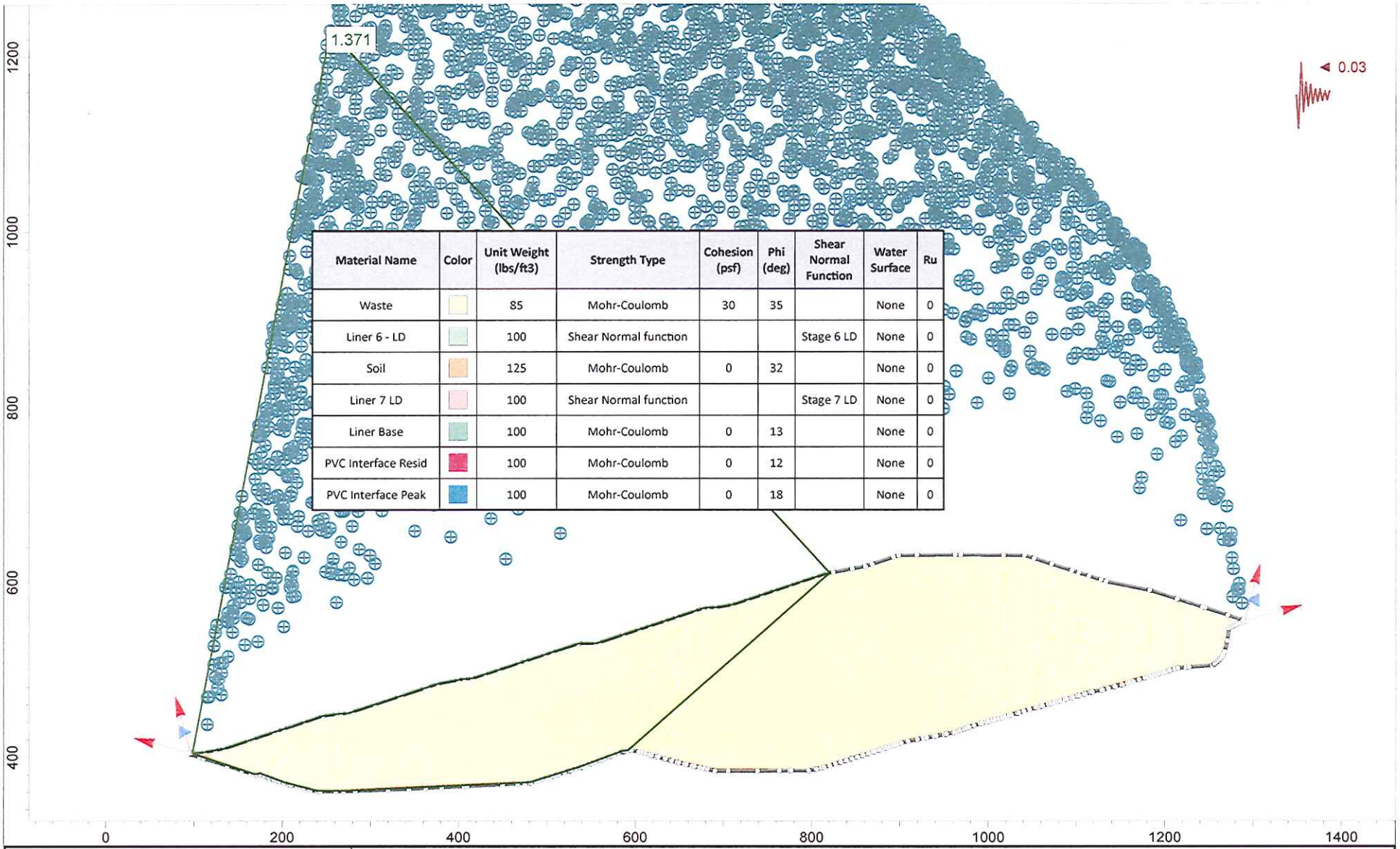
SLIDEINTERPRET 6.029

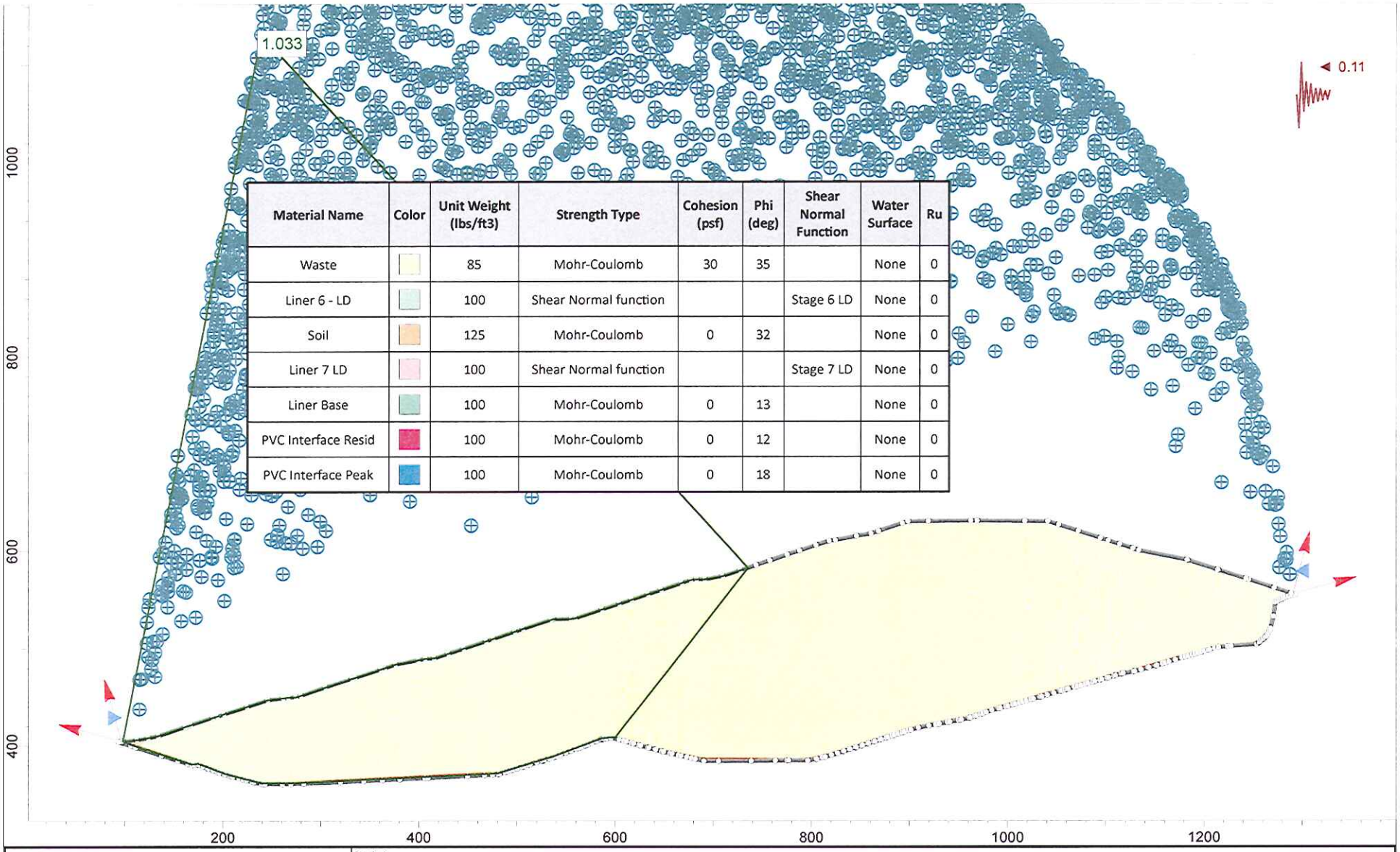
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1803	Company EarthRes Group
Date	July 2, 2014		File Name Section D Permitted (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner 6 - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

Rocscience	Project: SLIDE - An Interactive Slope Stability Program		
	Analysis Description:		
	Drawn By:	Scale: 1:1803	Company: EarthRes Group
	Date: July 2, 2014		File Name: Section D Permitted (Virginia Seismic).slim

SLIDEINTERPRET 6.029



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner 6 - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner Base		100	Mohr-Coulomb	0	13		None	0
PVC Interface Resid		100	Mohr-Coulomb	0	12		None	0
PVC Interface Peak		100	Mohr-Coulomb	0	18		None	0

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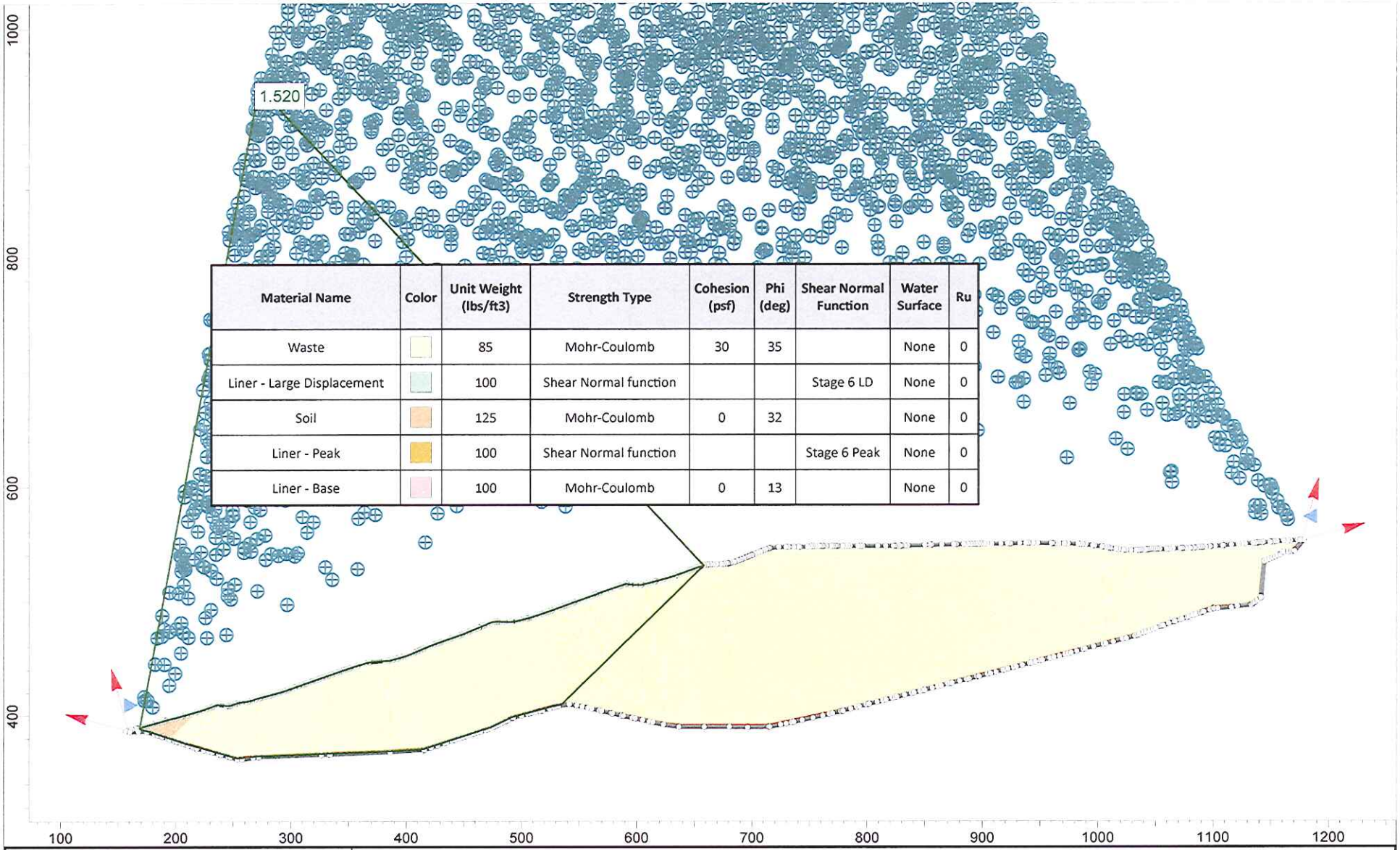
SLIDEINTERPRET 6.029

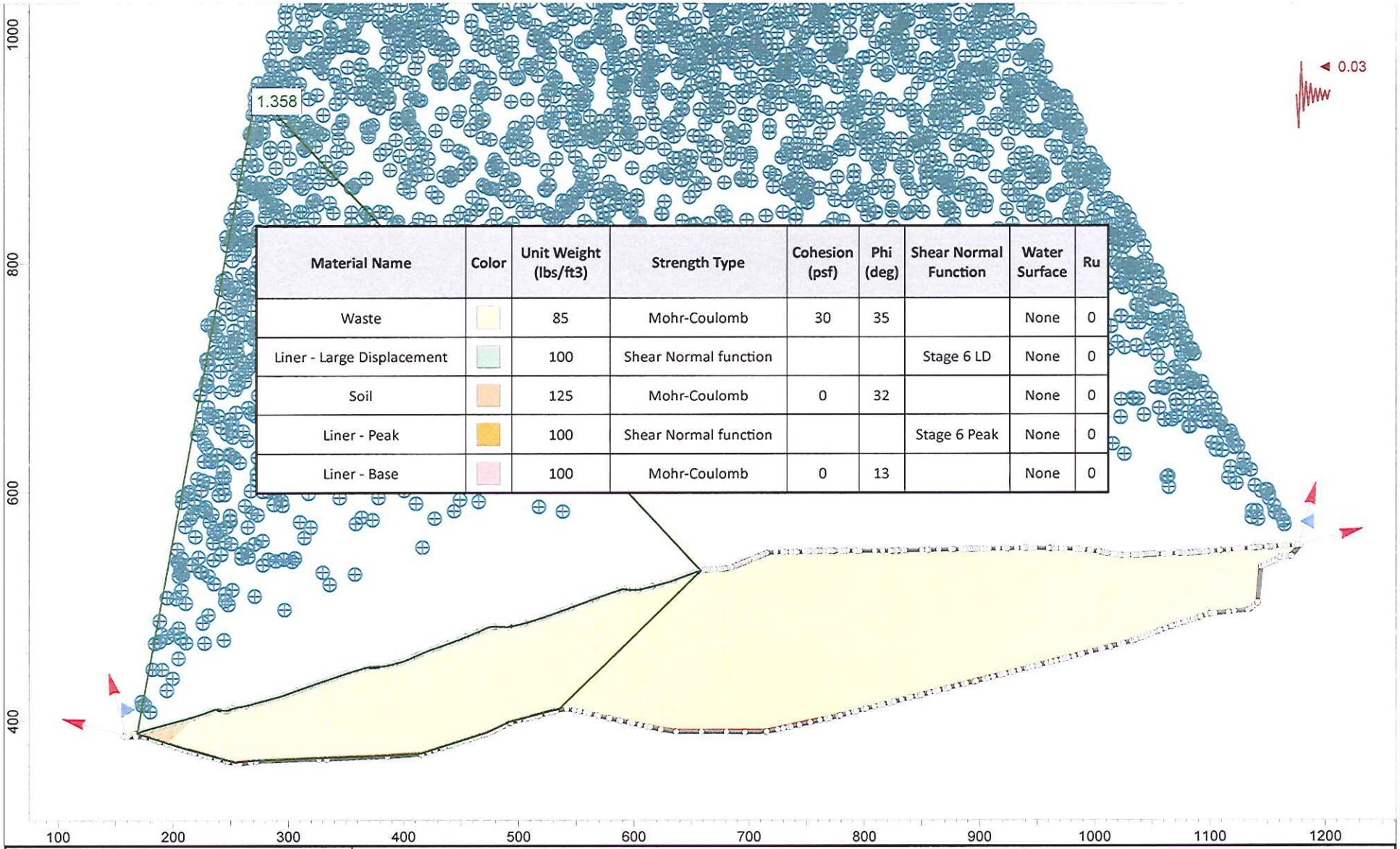
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1622	Company EarthRes Group
Date	July 2, 2014		File Name Section D Permitted (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

rocscience	Project	SLIDE - An Interactive Slope Stability Program		
	Analysis Description			
	Drawn By	Scale 1:1381	Company	EarthRes Group
	Date	July 2, 2014	File Name	Section E Existing (Static).slim

SLIDEINTERPRET 6.029



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

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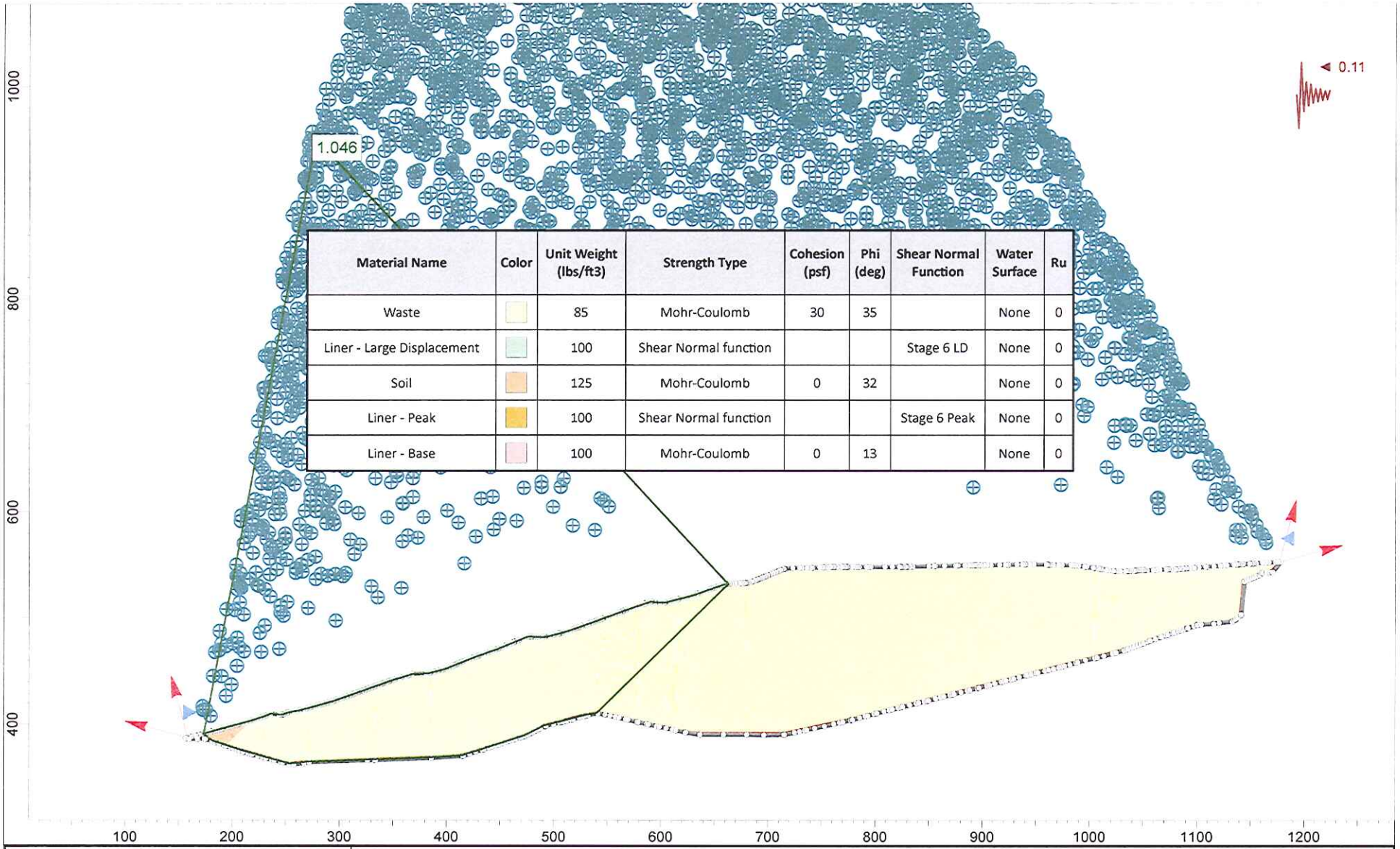
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1381	Company EarthRes Group
Date	July 2, 2014		File Name Section E Existing (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Liner - Large Displacement		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

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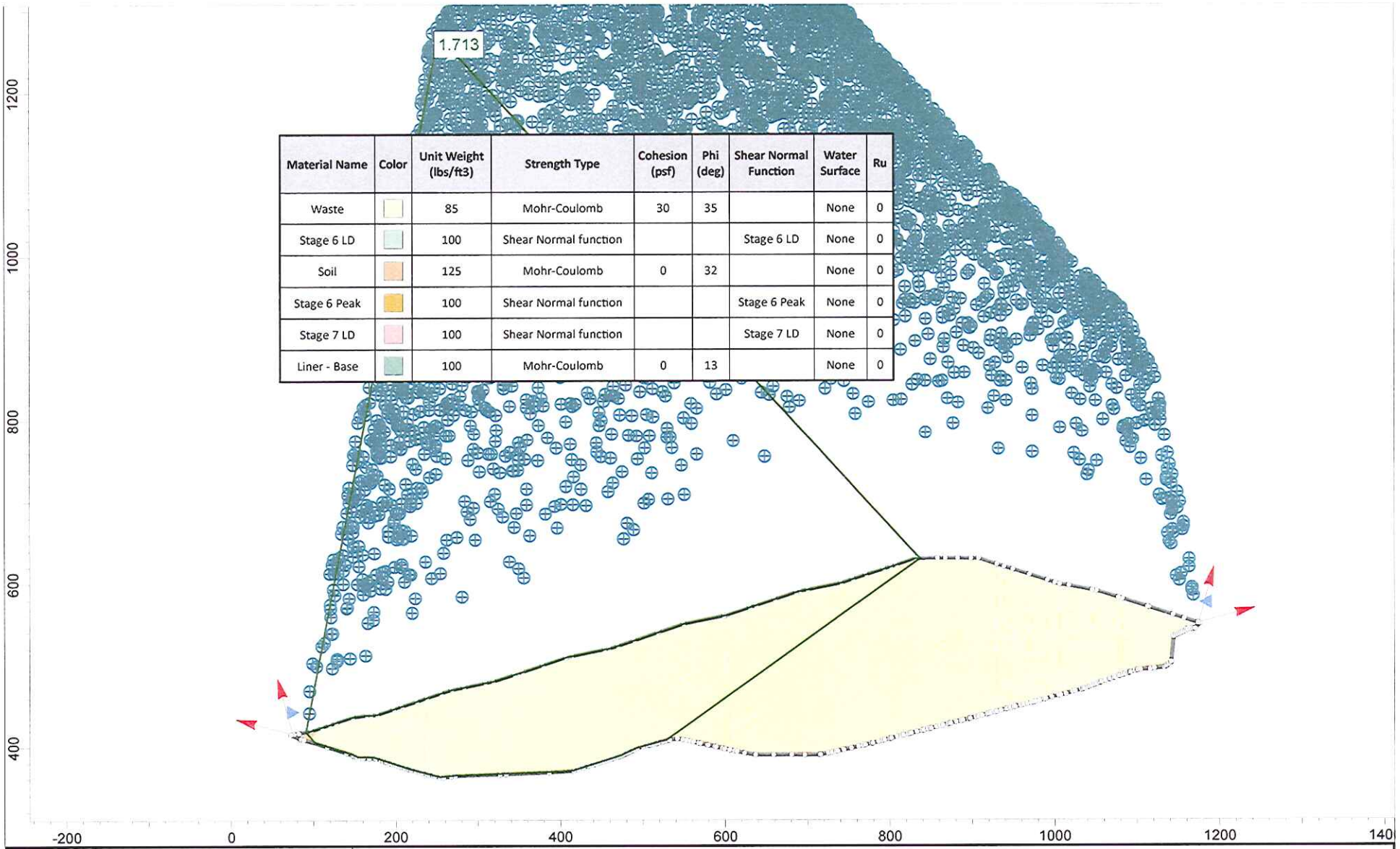
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1484	Company EarthRes Group
Date	July 2, 2014		File Name Section E Existing (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 6 Peak		100	Shear Normal function			Stage 6 Peak	None	0
Stage 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

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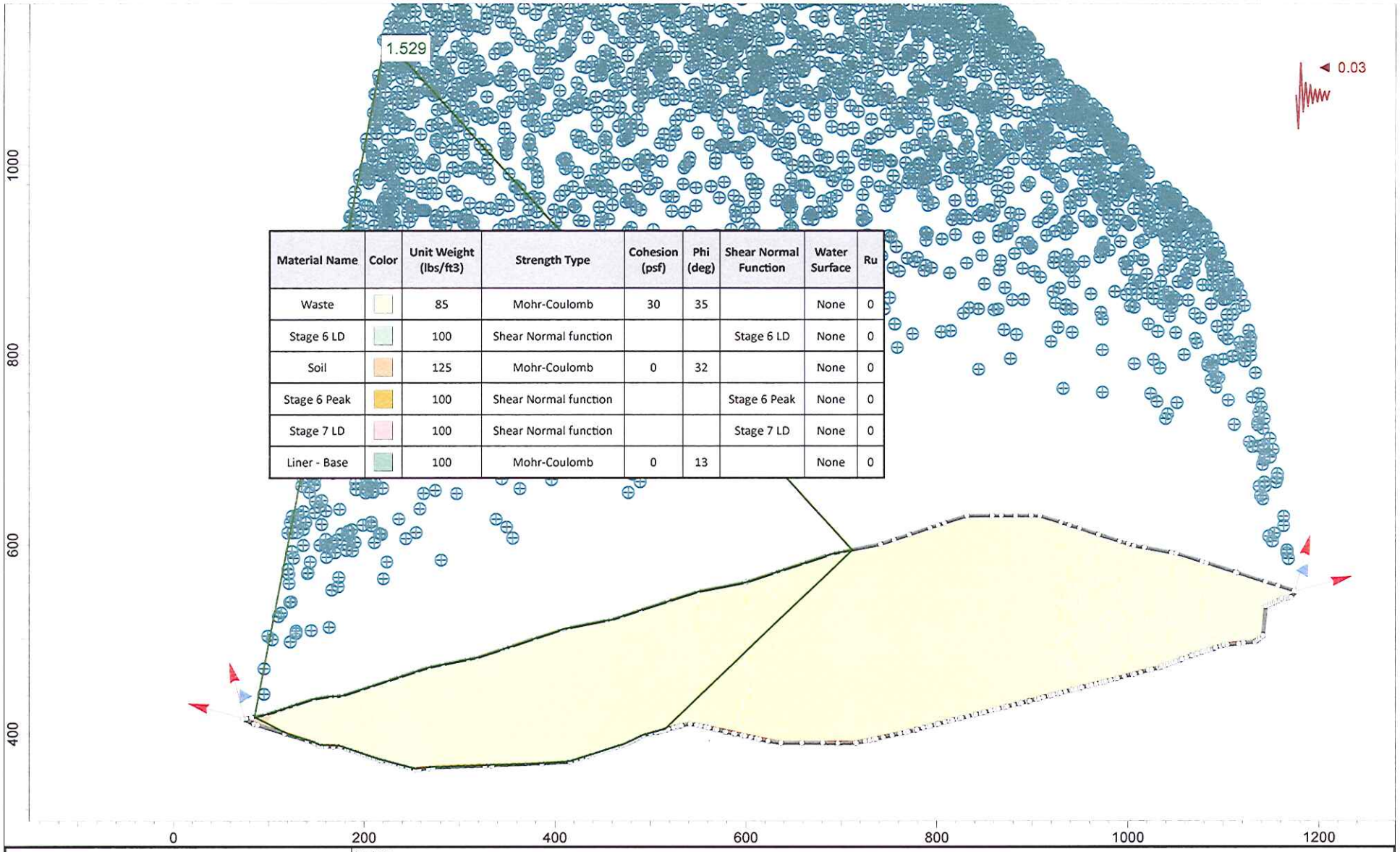
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1929	Company EarthRes Group
Date	July 2, 2014		File Name Section E Permitted (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 6 Peak		100	Shear Normal function			Stage 6 Peak	None	0
Stage 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

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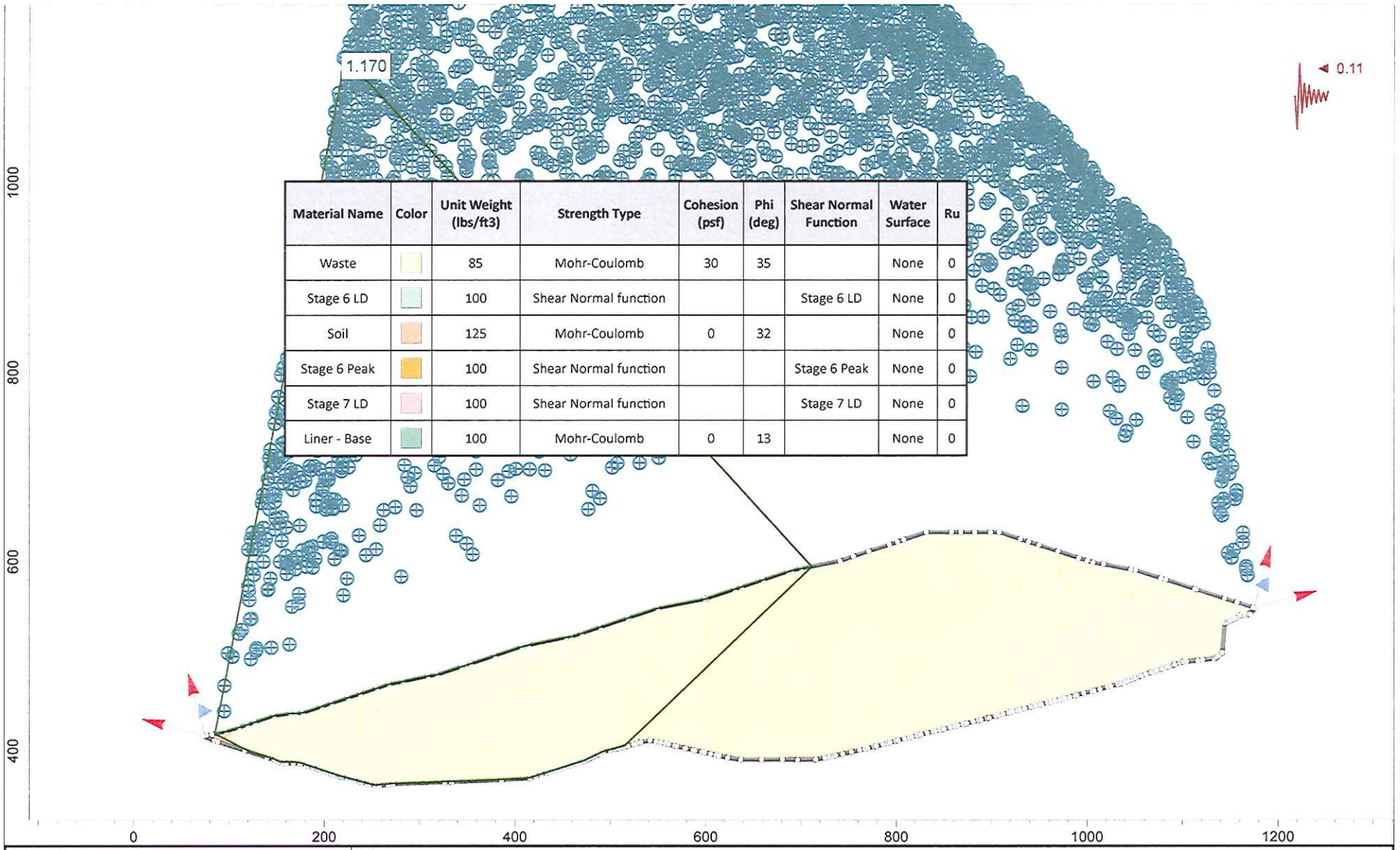
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	Scale 1:1666	Company	EarthRes Group
Date	July 2, 2014	File Name	Section E Permitted (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 6 Peak		100	Shear Normal function			Stage 6 Peak	None	0
Stage 7 LD		100	Shear Normal function			Stage 7 LD	None	0
Liner - Base		100	Mohr-Coulomb	0	13		None	0

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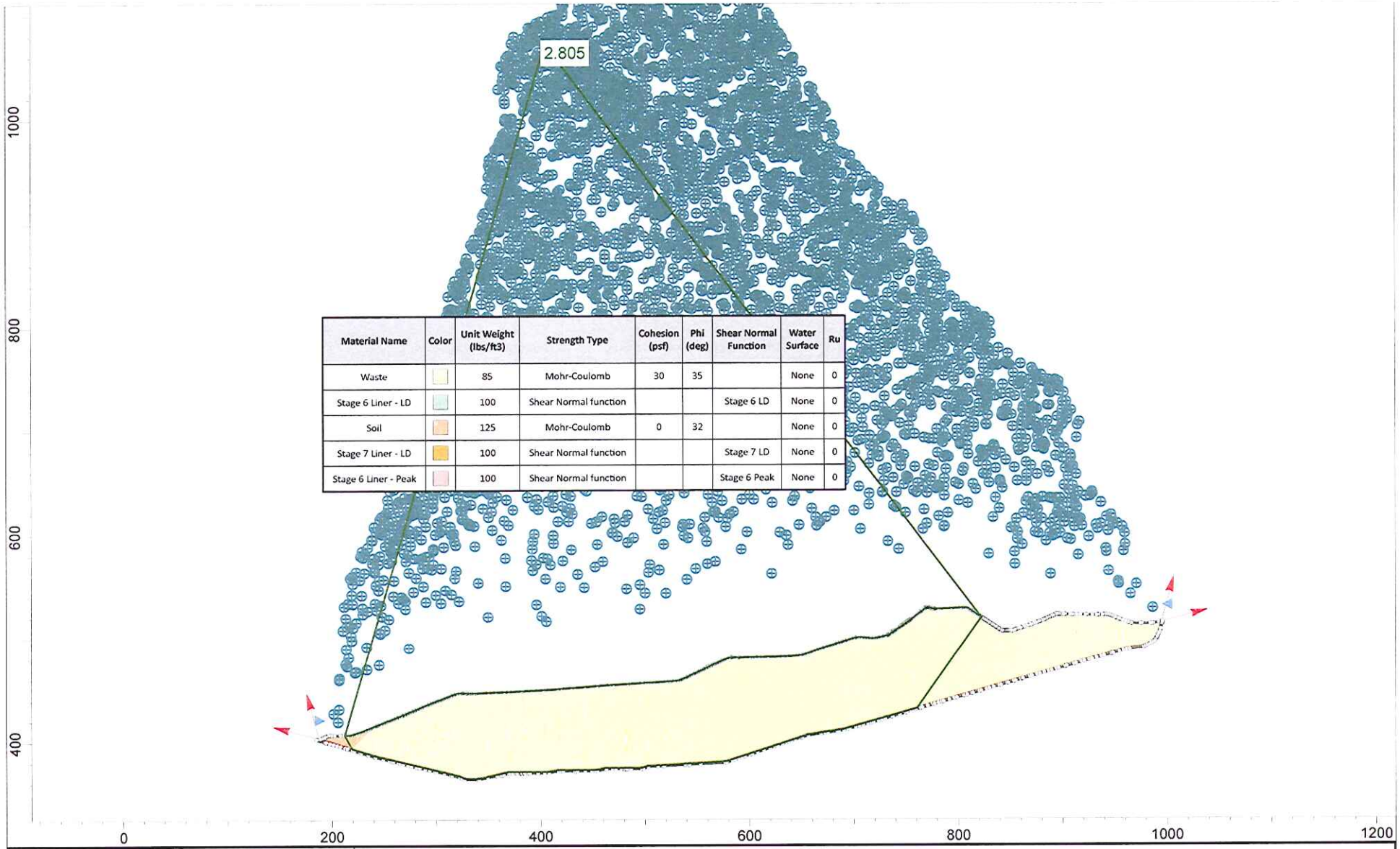
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	Scale 1:1666	Company	EarthRes Group
Date	July 2, 2014	File Name	Section E Permitted (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

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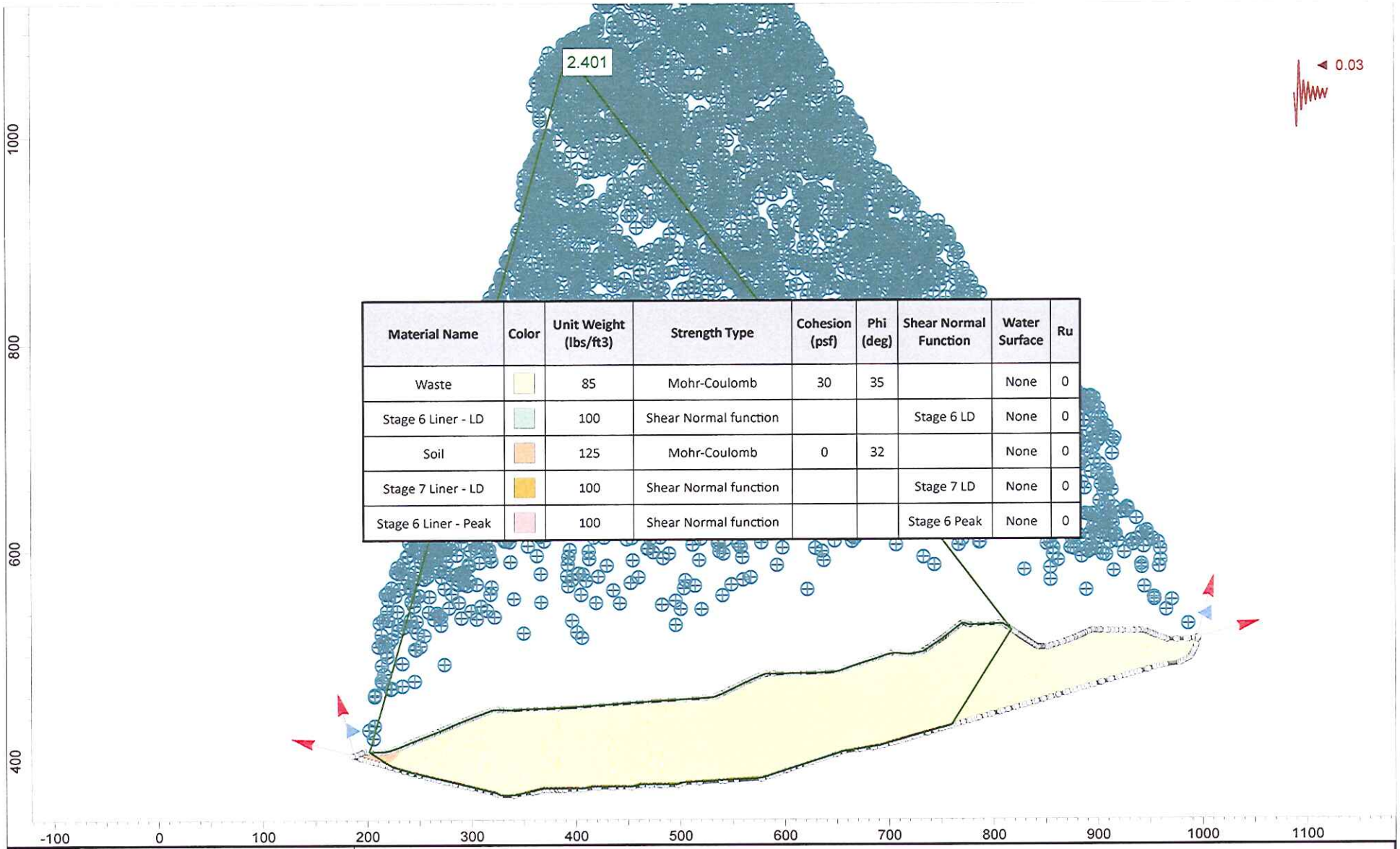
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	Scale 1:1521	Company	EarthRes Group
Date	July 2, 2014	File Name	Section F Existing (Static).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

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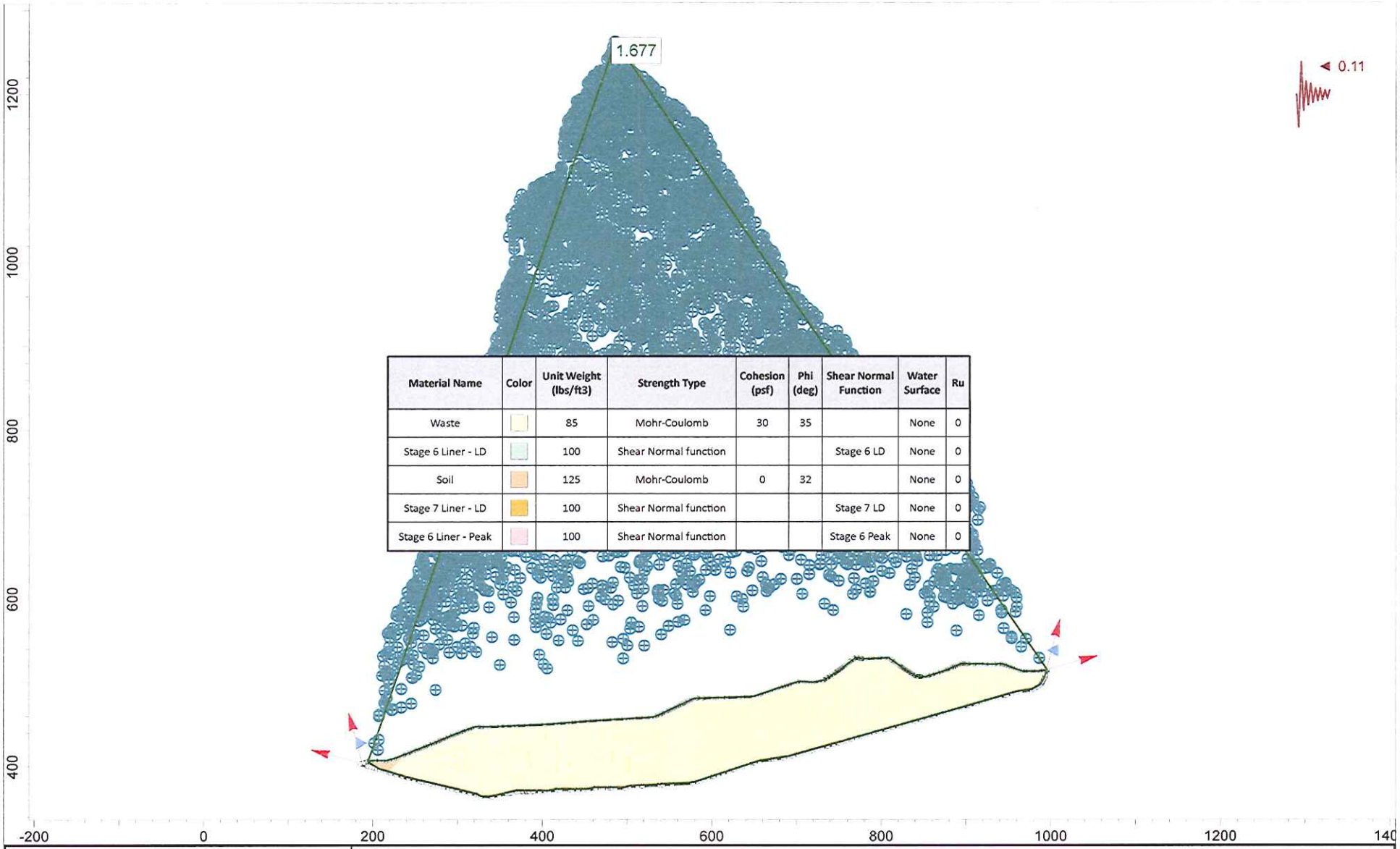
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1521	Company EarthRes Group
Date	July 2, 2014		File Name Section F Existing (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

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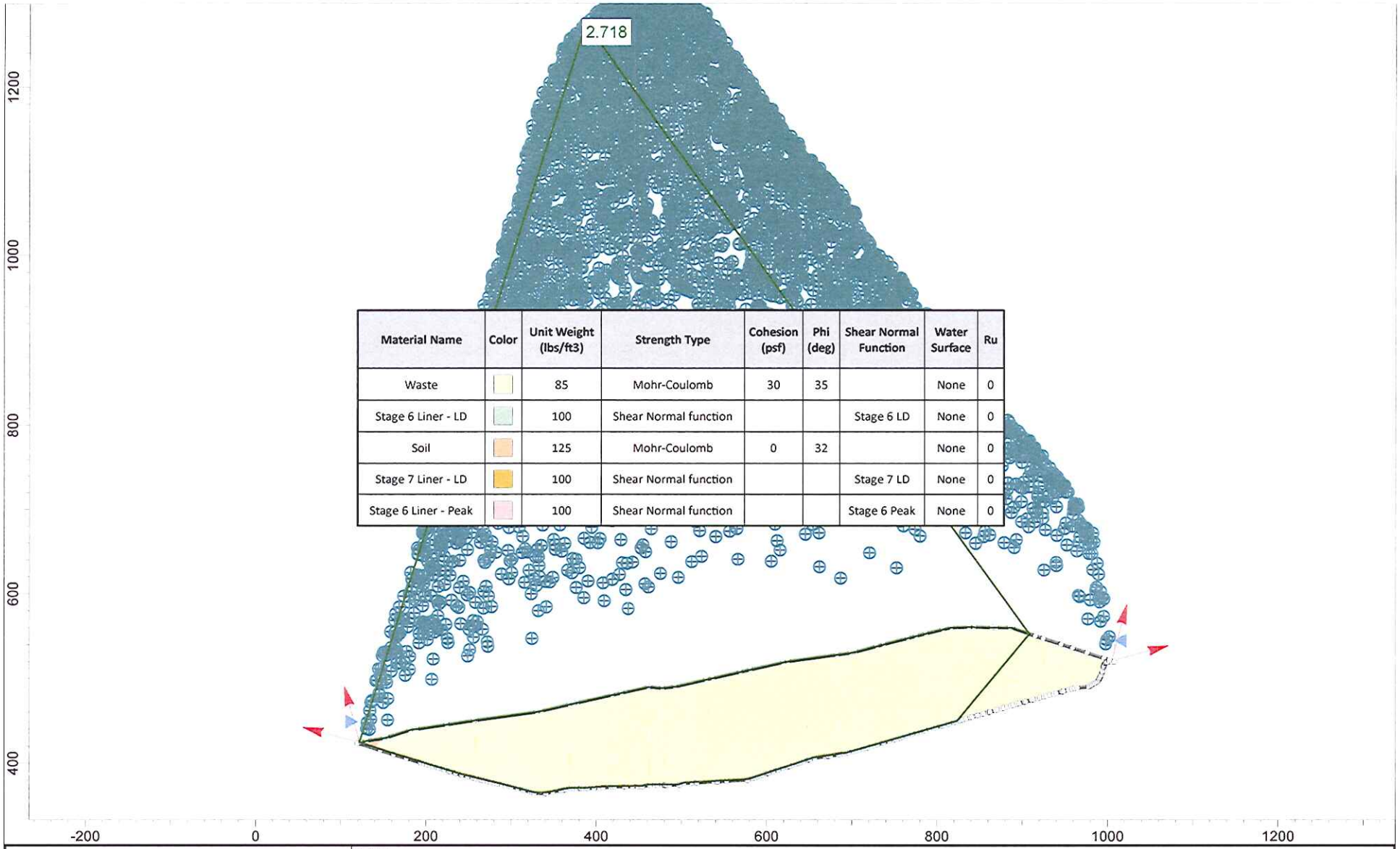
SLIDEINTERPRET 6.029

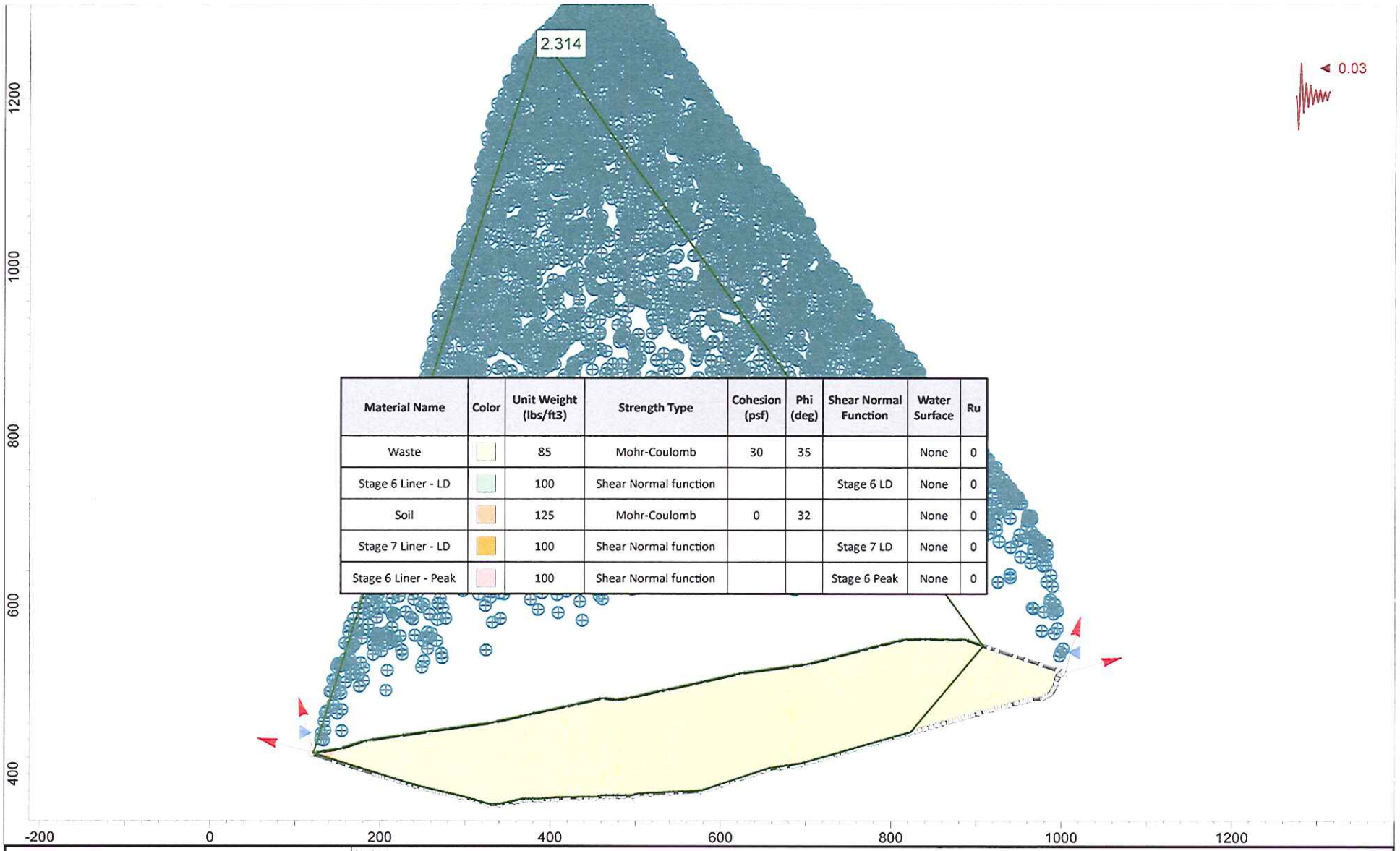
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1877	Company EarthRes Group
Date	July 2, 2014		File Name Section F Existing (Design Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

rocscience	Project	SLIDE - An Interactive Slope Stability Program		
	Analysis Description			
	Drawn By	Scale 1:1867	Company	EarthRes Group
	Date	July 2, 2014	File Name	Section F Permitted (Static).slim

SLIDEINTERPRET 6.029



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

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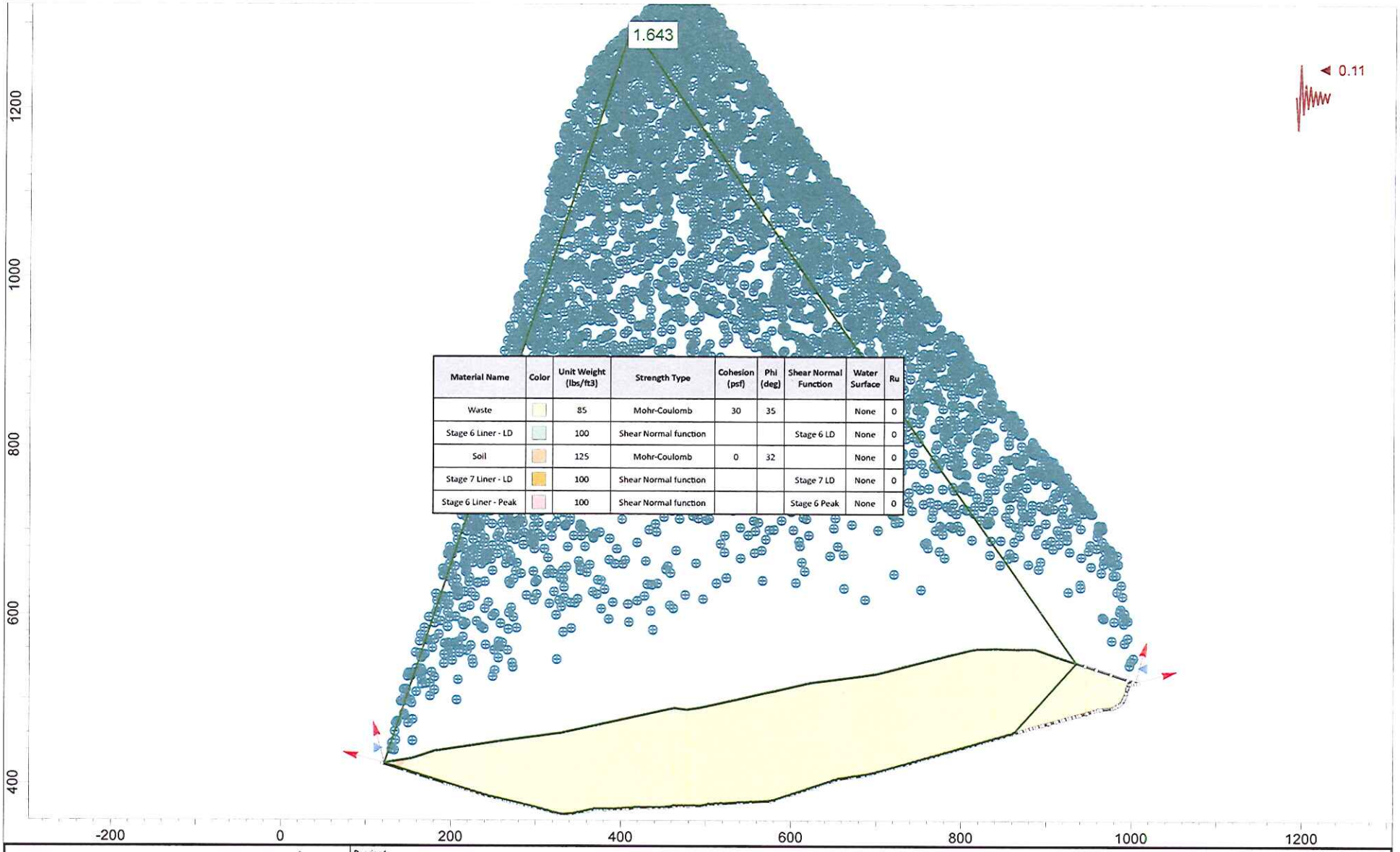
SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	Scale 1:1867	Company	EarthRes Group
Date	July 2, 2014	File Name	Section F Permitted (Virginia Seismic).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		85	Mohr-Coulomb	30	35		None	0
Stage 6 Liner - LD		100	Shear Normal function			Stage 6 LD	None	0
Soil		125	Mohr-Coulomb	0	32		None	0
Stage 7 Liner - LD		100	Shear Normal function			Stage 7 LD	None	0
Stage 6 Liner - Peak		100	Shear Normal function			Stage 6 Peak	None	0

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SLIDEINTERPRET 6.029

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:1867	Company EarthRes Group
Date	July 2, 2014		File Name Section F Permitted (Design Seismic).slim