

October 26, 2017

Rich Combe  
 6140 Sharon Circle  
 Ogden, Utah 84403

**Subject: Geotechnical Consultation  
 Cedar Cove Lot 12  
 Weber County, Utah  
 CG Project No.: 130-001**

Mr. Combe,

At your request, the Christensen Geotechnical has reviewed the geotechnical engineering report “Geotechnical Study, Cedar Cove Lot 12, Weber County, Utah” by Earthtec Testing & Engineering (Earthtec) dated September 19, 2007. The purpose of the review was to assess whether the existing report is adequate for the design and construction of a proposed single family residence on the subject lot. This letter was prepared this to present our opinion regarding the review of this report.

In general, it is our opinion that the existing Earthtec report is adequate and may be used for design and construction of the proposed single family residence; however, the seismic criteria presented in the Earthtec report are based on 2006 IRC values. The seismic design values and the slope stability assessment which used the peak ground acceleration (PGA) have therefore been updated in this letter.

The State of Utah and Utah municipalities have adopted the 2015 International Building Code (IBC) for seismic design. The IBC seismic design is based on seismic hazard maps depicting probabilistic ground motions and spectral response which has been developed by United States Geological Survey (USGS). Seismic design values, including the design spectral response, may be calculated for a specific site using the USGS Seismic Design Maps web-based application and the project site’s approximate latitude and longitude and Site Class. Based on the field exploration presented in the Earthtec report, it is our opinion that this location is best described as a Site Class D which represents a “stiff soil” profile. The spectral acceleration values obtained from the USGS web-based application are shown below.

**Table 2: IBC Seismic Response Spectrum Values**

Site Location: Latitude = 41.14298° N Longitude = -111.91251° W			
Spectral Period (sec)	Response Spectrum Spectral Acceleration (g)		
0.2	S <sub>s</sub> =1.266g	S <sub>M5</sub> =1.266g	S <sub>D5</sub> =0.844g
1.0	S <sub>1</sub> = 0.479g	S <sub>M1</sub> =0.728g	S <sub>D1</sub> =0.486g

Using these values, the peak ground acceleration (PGA) is estimated to be 0.51g.

Based on conversations with you, we understand a retaining wall on the order of 4 feet in height will be constructed at the toe of the existing slope on the lot. No other significant changes to the slope are planned. The global stability of the slope was assessed with the Slide computer program by Rocscience and the bishops simplified method of slices. The soil strength used in our analyses was based on a direct shear test performed on a soil sample collected from the slope. The profile used was based on the Earthtec profile presented in their geotechnical report. The slope was assessed under static and pseudo static conditions. The pseudo static condition is used to assess stability during a seismic event. As indicated above, the peak ground acceleration at the site is estimated to be 0.51g. As is common practice, half of the PGA was used in our analysis. Factors of safety of 1.5 and 1.0 are typically considered acceptable for residential construction. The results of our analyses indicate a static factor of safety greater than 1.5. The pseudo static stability of the slope was assessed to be less than 1.0. Due to the low factor of safety, a deformation analysis was performed using the Bray and Tavasrou 2007 method. This analysis estimated 9 inches of slope deformation during a large seismic event. Given the estimated 9 inches of deformation, it is our opinion that the 20 foot setback from the toe of the slope as recommended in the Earthtec geotechnical report is adequate and should be followed. The results of our slope stability assessment may be found on Plates 3 and 4.

Based on our review and analyses, it is our opinion that Earthtec 2007 geotechnical report for the subject lot is adequate and may be used for design and construction of the proposed single family residence. For seismic design, the updated IBC values presented in this letter should be used. This letter was prepared in accordance with the generally accepted standard of practice at the time this letter was written. No other warranty, expressed or implied, is made.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

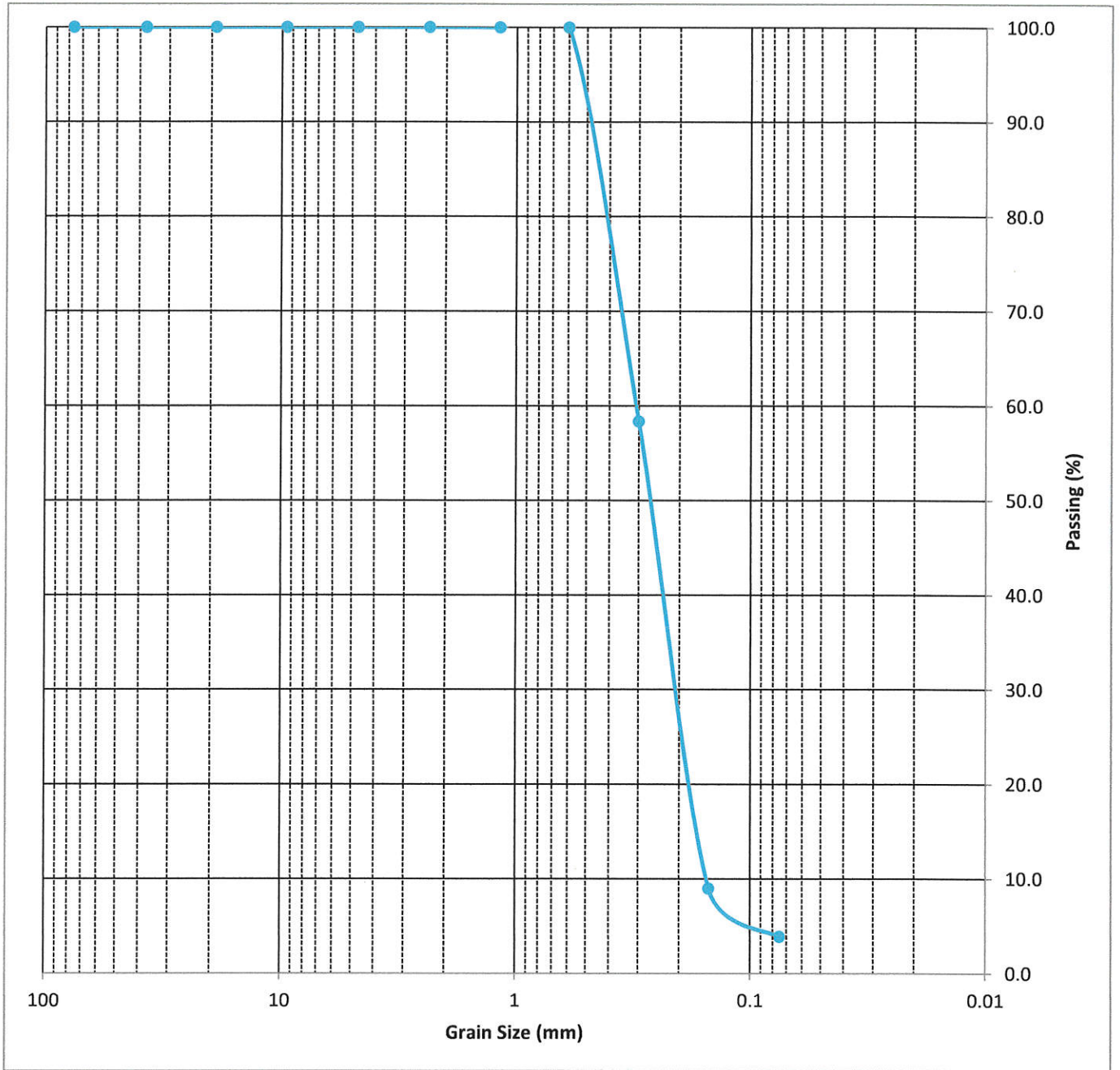
Sincerely,  
Christensen Geotechnical




Mark I. Christensen, P.E.  
Principal

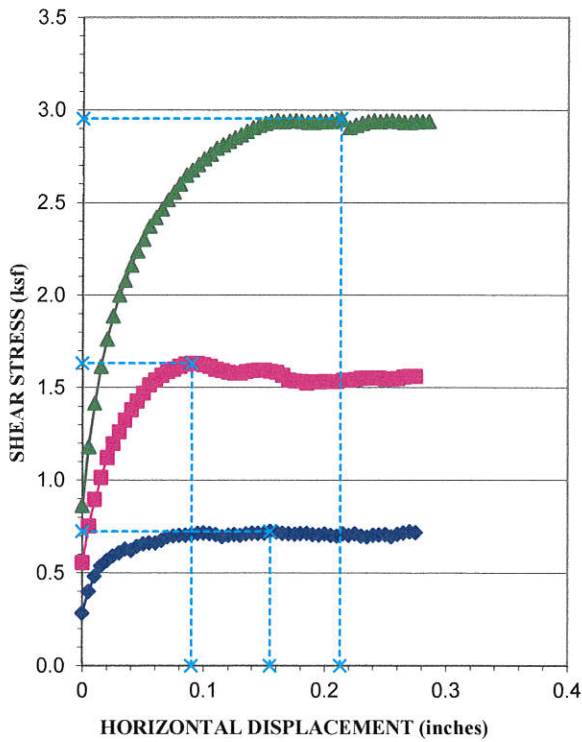
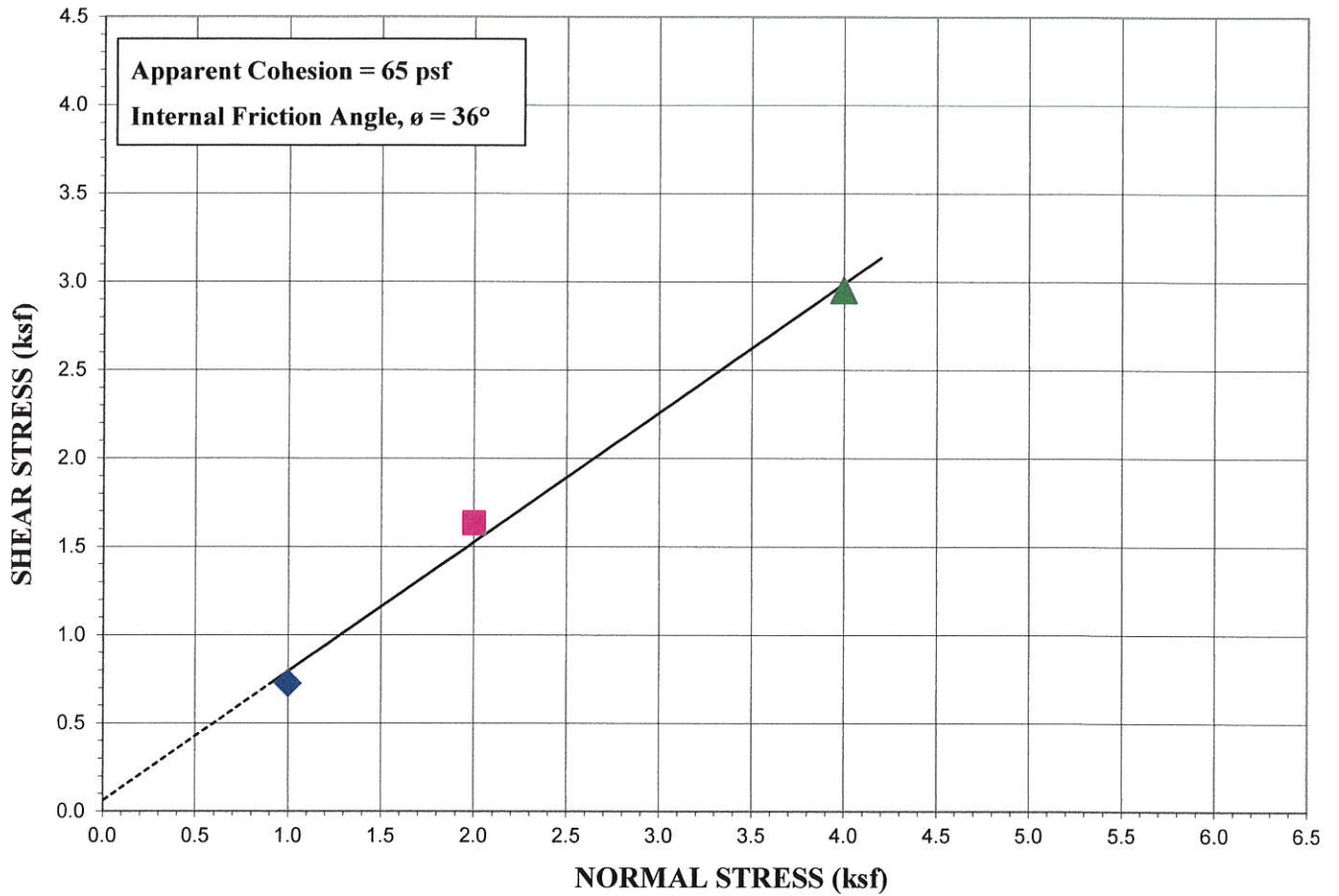


# Grain Size Distribution



Location	Depth		Classification	% Gravel	% Sand	% Silt and Clay
Site Slope	1 ft	●	Poorly Graded SAND (SP)	0.0	96.1	3.9

	Rich Combe Cedar Cove Lot 12 Weber County, Utah Project No.: 130-001	Plate  <b style="font-size: 2em;">1</b>
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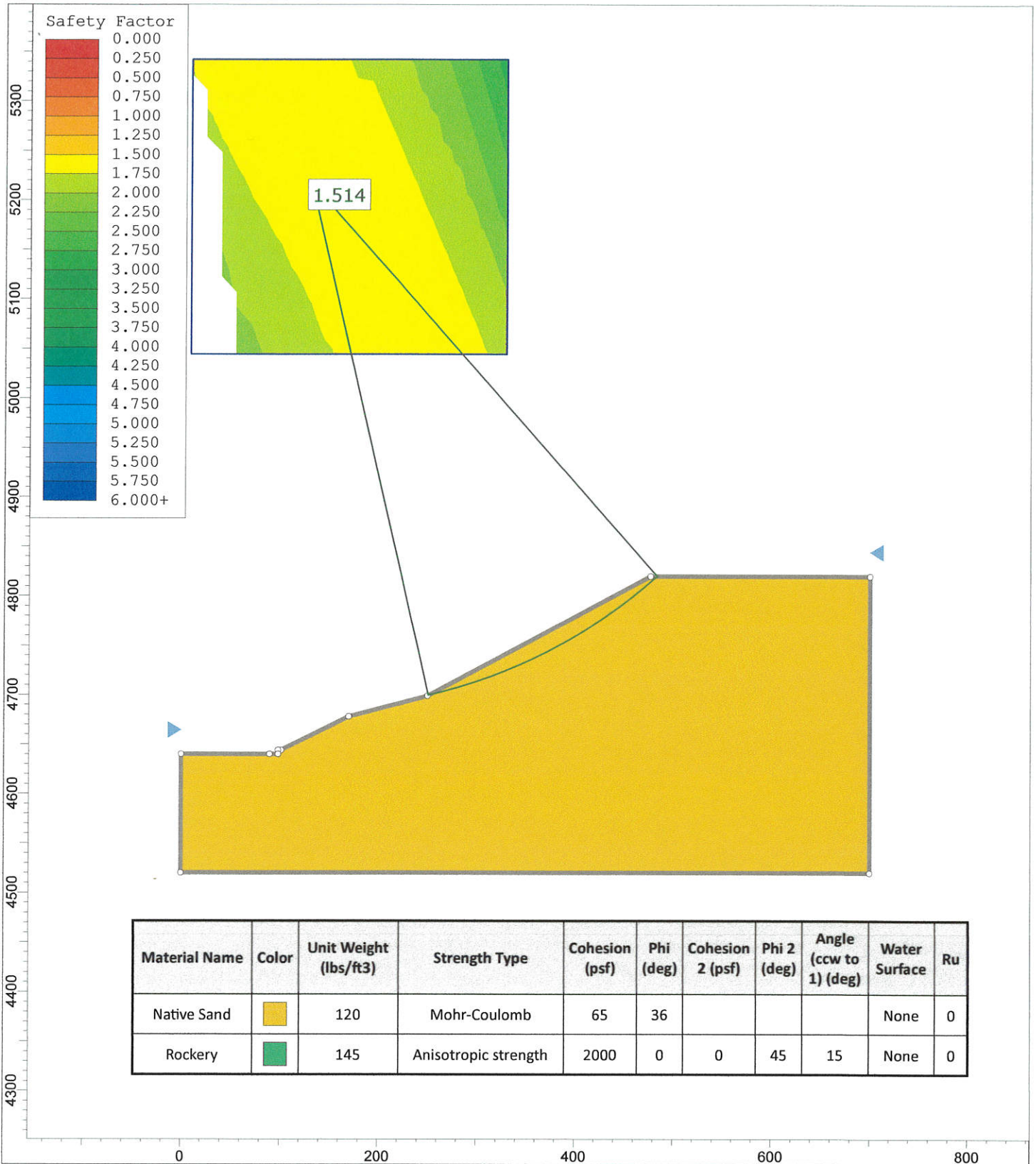
Location:	TP-1	Depth:	6.0 ft
Type of Test:	Consolidated Drained/Saturated		
Test No. (Symbol)	1 (◆)	2 (■)	3 (▲)
Sample Type:	Undisturbed		
Initial Height, in.	1	1	1
Diameter, in.	2.4	2.4	2.4
Dry Density Before, pcf	114.6	114.7	115.0
Dry Density After, pcf	112.8	113.5	113.3
Moisture % Before	4.7	4.7	4.7
Moisture % After	23.6	22.2	22.8
Normal Load, ksf	1.0	2.0	4.0
Shear Stress, ksf	0.72	1.63	2.95
Strain Rate	0.00007685		
Sample Properties			
Cohesion, psf	65		
Friction Angle, $\phi$	36		
Liquid Limit, %	NP		
Plasticity Index, %	NP		
Percent Gravel	0		
Percent Sand	96.1		
Percent Passing No. 200 sieve	3.9		
Classification	SP		



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Plate  
**2**



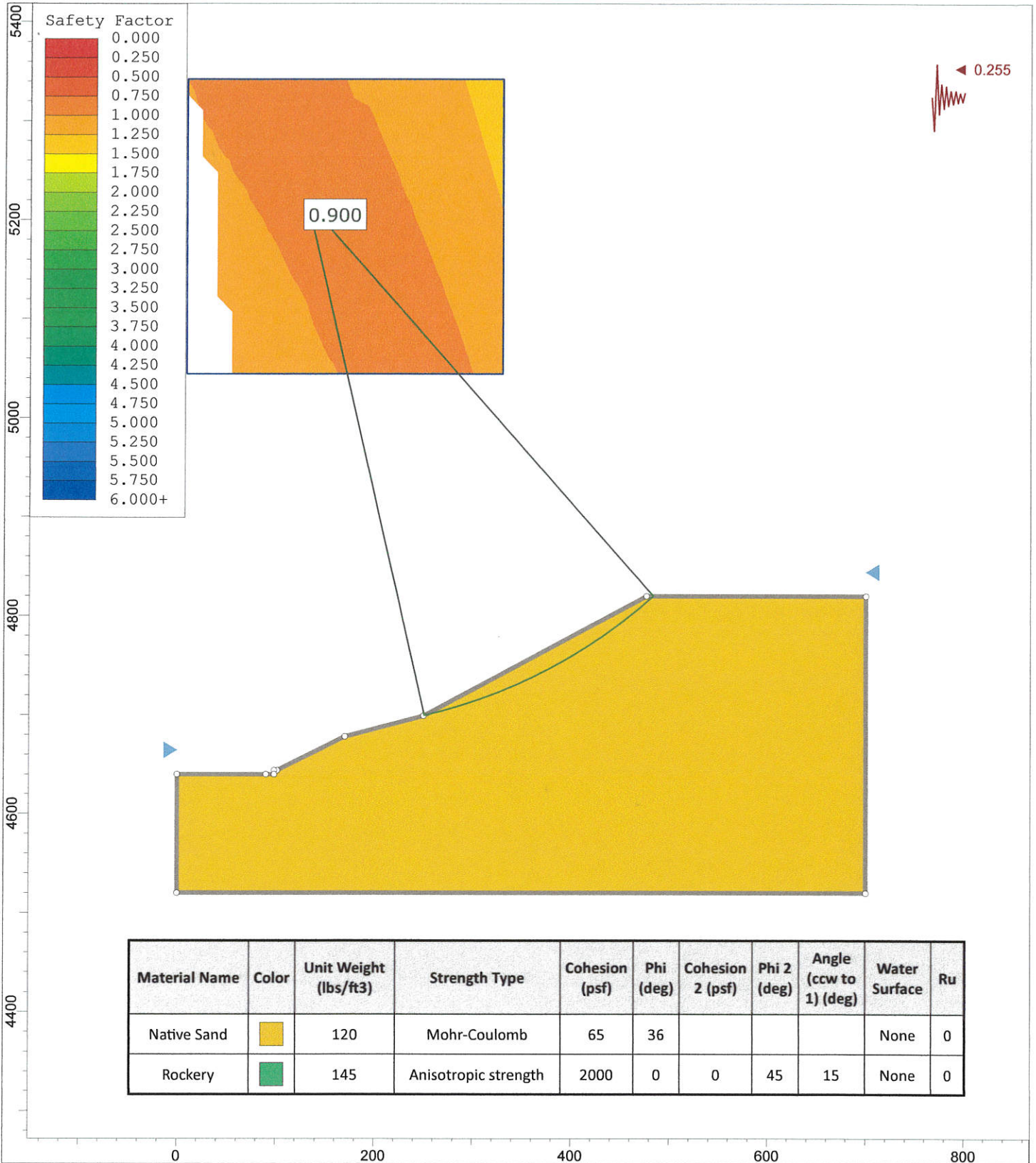


### Static Stability



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Plate  
**3**



### Pseudo Static Stability



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Plate  
**4**



8143 S 2475 E  
South Weber, UT 84405

# Invoice

Date	Invoice #
10/26/2017	179

Bill To
Rich Combe 6140 Sharon Circle Ogden, Utah 84403

Project No.	Terms	Project
130-001	Due on receipt	Cedar Cove Lot 12 Weber County, Utah

Description	Quantity	Rate	Amount
Engineering Consultation - Cedar Cove Lot 12	1	1,400.00	1,400.00
<b>Total</b>			\$1,400.00