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May 17, 2006

Via Certified Mail#70051820000773755630
Return Receipt Requested

Mr. David Oori
Mining and Minerals Division
1220 S. St Francis Drive
Santa Fe, New Mexico 87505

Via Certified Mail #70051820000773755647
Return Receipt Requested

Mr. Clint Marshall
Ground Water Quality Bureau
1190 St. Francis Dr. PO Box 26110
Santa Fe, New Mexico 87502-6110

Dear Messrs Oori and Marshall,

Re: Phelps Dodge Tyrone Inc. GR010RE L.2., DP 1341 Condition 78

Please find enclosed a copy of the Slope Stability Analysis of the 1C stockpile and 7A stockpiles of the Tyrone Mine. This analysis was conducted by Golder Associates for Phelps Dodge Tyrone, Inc. (PDTI). This report is in partial fulfillment of the above cited conditions in both GR010RE and DP-1341. PDTI will continue the process of completing the stability analyses for the remaining areas in an orderly sequence.

If you have any questions regarding this submittal, please contact Mr. Greg Schoen at (505) 574-6359 at your convenience.

Very truly yours,

Thomas L. Shelley, Manager
Environment, Land & Water

TLS:gs
Attachment
20060517-100

TECHNICAL MEMORANDUM



Golder Associates Inc.

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TO:	Greg Schoen – Phelps Dodge Tyrone, Inc.	DATE:	May 4, 2006
FROM:	Tom Wythes, P.E., R.G. and Eugene Muller, P.E. - Golder Associates Inc.	OUR REF.:	053-2550
RE:	TYRONE RECLAMATION NO. 1C STOCKPILE AND 7A WASTE STABILITY ANALYSIS		

1.0 INTRODUCTION

Golder Associates Inc. (Golder) is performing slope stability studies of waste rock and leached ore stockpiles at Phelps Dodge Tyrone, Inc.'s (PDTI) Tyrone Mine to address the supplemental stability analysis requirements of Condition 78 of the New Mexico Environment Department's Discharge Permit (DP)-1341. PDTI is currently conducting regrading and reclamation of ore and waste stockpiles in the Oak Grove Gulch Area. These facilities include portions of the 1C Ore Stockpile and the 7A East, 7A West, and 7A Far West Waste Rock Stockpiles.

This technical memorandum provides the results of stability analyses for the post-reclamation configurations of all stockpiles adjoining Oak Grove Gulch (Figure 1). At the 1C Stockpile, regrading included removal (re-mining) of leached ore previously placed over alluvium in Oak Grove Gulch. The toe of the stockpile has been moved northward, out of the drainage, 300 to 400 feet. The height of the stockpile has been reduced 200 feet, and more locally. An overall slope of 3.5 horizontal to 1 vertical (H:V) is planned during final grading, and the surface will be reclaimed with ridge and valley erosion control features and a cover system.

The 7A East and West Waste Rock Stockpiles have been regraded to approximately 3.5H:1V with erosion control benches in preparation for cover placement. As shown on Figure 2, regrading resulted in minor movement of the slope crests and toes, but no significant outward movement of the waste rock into Oak Grove Gulch.

The 7A Far West Waste Rock Stockpile has been regraded to an overall slope of approximately 3.5H:1V. The facility was regraded by cutting at the crest and advancing the toe outward over granitic bedrock as shown on Figure 2.

2.0 OBJECTIVE

The purpose of this technical memorandum is to document foundation conditions and evaluate the stability of the reclaimed configuration of the No. 1C Stockpile and the 7A East, 7A West, and 7A Far West Waste Rock Stockpiles. The following conditions were considered:

- the potential impact of long-term weathering and decrepitation of the leached ore and waste rock, and the resulting loss of strength; and
- the potential impact of weathering and decrepitation of the bedrock foundation interface beneath leached ore and waste rock piles, and the resulting loss of shear strength.

Previously completed stability analyses for the No. 1 Stockpile at Tyrone (Golder, 2006b) included an analysis of liquefaction potential in Brick Kiln Gulch. This analysis was performed because regrading the No. 1 Stockpile will result in some encroachment of leached ore over recent alluvium (Qal) in the natural drainage. In the 1C Stockpile Area, most of ore placed over Qal has been removed, and Qal in the foundation area adjacent to Oak Grove Gulch is limited to small local tributary drainages. These areas were previously buried by a greater depth of 1C Stockpile ore and have been pre-consolidated under overburden pressures of approximately 13 tons per square foot. Therefore, the alluvium in the local tributary drainages adjacent to the 1C Stockpile has been pre-consolidated under high surcharge loads and exists in a state of high relative density. While dense soils can liquefy when subjected to cyclic shear stresses, the potential for liquefaction is reduced relative to loose soils (Kramer, 1996). Liquefaction potential analyses have been completed for a localized area of the 7A East Stockpile where Qal occurs and has not been subjected to pre-consolidation pressures.

These stability analyses focus on the stockpile and waste rock pile outslopes into Oak Grove Gulch where PDTI's current reclamation activities are occurring. Internal waste rock and leached ore slopes near the open pits and the external slopes along the east, west, and north sides of the Tyrone property have not been evaluated yet. These areas will be addressed at a later date when a long-term plan for reclamation of these sites has been developed.

3.0 METHOD

Golder performed stability evaluations using a two-dimensional, limit equilibrium analysis using the computer program SLIDE (Rocscience, 2000) with application of Bishop's Method of Slices (Bishop, 1955) applying effective stress parameters.

The long-term effects of weathering and decrepitation on the strength of waste rock and leached ore at the Tyrone Mine are currently under investigation. EnviroGroup (2005a and 2005b) has completed supplemental materials characterization of the leached ore and waste rock stockpiles at the Tyrone Mine in fulfillment of the requirements of Condition 80 of DP-1341. The EnviroGroup studies supplement previous material characterization studies by Greystone and Daniel B. Stephens & Associates, Inc., which are referenced in EnviroGroup (2005a and 2005b). The EnviroGroup (2005a and 2005b) study was completed in part to support assessments of the long-term impacts of weathering and decrepitation of the stockpile materials. The results of the material characterization studies indicate that sulfide oxidation is occurring in the stockpiles, but at generally low rates due to the low sulfide concentrations. There is a weak correlation between the age of the stockpile materials and the sulfide concentration suggesting that sulfide is being consumed over time. There is no clear relationship between grain size, mineralogy, or clay content (or other factors that may influence shear strength) with the age of the stockpile. The variability of these factors is overwhelmingly attributable to variability in the lithology and hydrothermal alteration of the ore and overburden, and the mechanical segregation of the materials as they were originally placed in the stockpile rather than to post-placement weathering.

Currently, the geochemical characterization studies do not provide a direct means to assess the potential long-term strength reductions for the stockpile materials that may be attributable to weathering and chemical decrepitation. However, Condition 78 states that the stability analyses should account for changes in chemical and physical properties of the stockpile materials from the time of deposition to present day and to a specified time during post-closure. To address this requirement, we have performed back-analyses to determine the minimum shear strength that results in minimally acceptable factors of safety of 1.0 under pseudostatic loading while applying the design pseudostatic coefficient. Back-analyses were completed for the leached ore, waste rock, and bedrock-stockpile foundation interface.

4.0 DEVELOPMENT OF THE STABILITY MODEL

4.1 Geometry, Geology, Groundwater, and Modeling Assumptions

Stability section locations and foundation geology are shown on Figure 1. Stability sections (Figure 2) show pre-mine, pre-regrade, post-regrade, and post-cover surfaces where such information is available. Groundwater depths from selected local wells are also shown on Figure 2. Pertinent conditions for each facility and stability section are discussed below.

The cross-sections shown on Figure 2 illustrate Golder's understanding of the existing conditions and provide the basis for the models used to evaluate slope stability. The cross-sections were developed from pre-mine, current, and reclaimed topographic information and illustrate data and conditions determined from site inspection, monitoring well records, available geological maps, geotechnical test pits, drilling, laboratory testing,

and geophysical logging. The drillhole and sampling locations are illustrated on Figure 1. Slope stability analyses include sensitivity analyses and back-analyses that are intended to model potential future adverse conditions or unknown conditions. Examples of modeling assumptions would be a groundwater level that is elevated with respect to current conditions or reduced shear strengths to simulate potential long-term weathering.

Geotechnical information for the stockpile materials is available from test pits, bench mapping completed during re-mining of the 1C Stockpile, a Becker drillhole completed in the 7A Far West Waste Rock Stockpile, and from laboratory testing. The compositional models included in the material characterization studies (EnviroGroup, 2005a and 2005b) provide additional information regarding the character of the materials. In general, the stockpile materials consist of clayey gravel with sand and contain 10 to 50 percent cobbles and boulders. The materials are dominantly porphyry leach cap with minor oxide copper and sulfides.

Groundwater considered in the stability analyses is limited to local perched water in basal zones where such conditions can reasonably be expected to occur either regularly or intermittently. Information regarding moisture conditions in the stockpile is available from downhole geophysical information in two sonic drillholes completed in the No. 3A Leach Stockpile and the No. 5A Waste Stockpile. Testing of Rotosonic drillhole samples collected in October 2005 (Golder, 2006a) from the 1A Stockpile indicated moisture contents ranging from 4.3 to 22.5 percent, and averaging 10.1 percent. These data are consistent with EnviroGroup (2005a and 2005b) findings, which indicate that the stockpiles are drained and that moisture content correlates with the grain size of the materials with sands and gravels having low moisture content and zones with higher clay content having higher retained moisture. Geophysical data (EnviroGroup, 2005a) from actively leached stockpiles indicate moisture contents in the range of 3 to 19 percent, with average moisture contents in the range of 10 to 15 percent.

Elevated groundwater levels and local groundwater mounds in the stockpiles are not expected because of the drainage capacity of the waste rock and leached ore piles. In particular, the ore stockpiles have previously been leached at rates that exceed 100-year storm rainfall amounts on a daily basis. Under these conditions, saturation and instability did not occur. With the cessation of leaching operations, cover placement, and implementation of surface water management, the potential for elevated groundwater levels will be further reduced. The available information indicates that the stockpiles are currently drained and will remain drained in the long term.

4.2 7A Far West Waste Rock Stockpile

Two stockpile cross-sections, designated A and B, were prepared to illustrate conditions at the 7A Far West Waste Rock Stockpile (Figure 2). Section A is aligned north to south and

shows the inward sloping foundation that occurs along the northern and southern limits of the waste rock pile. Section B is aligned along the longitudinal axis of the waste rock pile and represents the longest slope, the greatest toe to crest height, and the steepest foundation outslope. The PDTI geology map indicates that the 7A Far West Waste Rock Stockpile lies over a foundation of granodiorite bedrock. No alluvium was included in the 7A Far West stability models. A 10-foot thick zone in the upper bedrock foundation was defined in the section models for the evaluation of the effects of a weakened foundation interface. Shear strength was varied within this zone to evaluate the sensitivity of the slope stability to interface shear strength or factor of safety with respect to slope stability to interface shear strength.

PDTI monitoring well data indicate that the local groundwater level is below the foundation of the waste rock pile. In the stability models, a 20-foot thick zone of groundwater is assumed to be perched on the competent bedrock foundation along the ancestral drainage channel and at the downslope toe of the waste rock pile. The basal stockpile and the bedrock interface zone are locally modeled as lying beneath a perched groundwater table.

4.2.1 1C Stockpile

Sections C and D illustrate conditions in the 1C Stockpile. These sections show preliminary subsurface information obtained from an engineering investigation for the modification of a local seepage collection system completed by Golder (report pending). As shown on Figure 1, Sections C and D overlie recent alluvium in natural drainages tributary to Oak Grove Gulch.

The alluvium in Section C is underlain by granodiorite bedrock, which occurs at a depth of 20 to 30 feet at the toe. Water was also encountered in Qal at a depth of approximately 15 feet. In the stability model for Section C, groundwater is modeled as the top of the Qal at the toe of the stockpile, and the zone of groundwater is modeled extending across the stockpile foundation. Up to 10 feet of the basal leached ore, all Qal and the bedrock interface zone are modeled as lying beneath the groundwater table. This groundwater is assumed to be perched on the underlying competent bedrock foundation.

In Section D, the alluvium appears to overlie both granodiorite and Gila Conglomerate (QTg) based on interpretation of the PDTI geology map. A seepage collection system borehole (BIC-10) encountered the QTg at a depth of 23 feet. During drilling near the toe at Section D, Golder staff noted seepage from the base of the stockpile. The stability analyses of Section D assume that the perched groundwater surface corresponds to the top of the Qal at the toe. Up to 20 feet of the basal leached ore, all Qal, the underlying Gila Conglomerate, and the foundation interface zone are modeled as lying beneath the groundwater table. Groundwater is assumed to be perched on competent bedrock.

The leached ore in the 1C Stockpile has been placed partially over alluvium and partially over granodiorite bedrock in both sections. A 10-foot thick zone in the upper bedrock foundation was defined in the stability sections for evaluation of a weakened bedrock interface. Shear strength was varied within this zone.

Leached ore previously placed in Oak Grove Gulch has been removed as part of PDTI re-mining and reclamation activities. At Section C, the toe of the 1C Stockpile has been moved approximately 400 feet north, and up to a 200-foot thickness of ore has been removed and relocated to operating leach stockpiles. A similar cut-back was performed at Section D. All alluvium beneath the reclaimed stockpile footprint was subject to overburden pressures that exceed those of current conditions. Alluvium has been over-consolidated and is not considered to be subject to liquefaction.

4.2.2 7A East

Section E on Figure 2 illustrates geological conditions beneath the 7A East Waste Rock Stockpile. Section E was selected for analysis because it overlies a small local tributary to Oak Grove Gulch. The slope has been regraded to an overall slope approaching 4H:1V, and horizontal erosion control benches have been constructed. The PDTI geology map indicates that Qal occurs in the channel bottom, otherwise, the waste rock is founded on granitic bedrock. Golder staff familiar with the area report that a relatively thin deposit of Qal is exposed at the waste rock stockpile toe. No local groundwater information was found for this section.

Golder estimated the groundwater condition along Section E based on available site-specific information for other areas of the stockpiles. The Qal, the foundation interface, and the bedrock interface zone beneath the toe of the waste rock pile are modeled as lying within a perched groundwater zone. The perched groundwater zone is assumed to extend inward to competent bedrock at a local topographic high on the granodiorite surface between the outslope toe and crest.

4.2.3 7A West

Section F represents the location of maximum slope height in the 7A West Waste Rock Stockpile. Pre-mine topography indicates a relatively irregular bedrock foundation surface in the section toe area with several local topographic lows and highs. The PDTI geology map indicates a granitic rock foundation. No local groundwater data are available for this location. We have applied a groundwater condition similar to other sites where site-specific information is available. The foundation interface and basal ore are modeled as lying within a perched groundwater zone that is up to 30-feet thick over the bedrock surface topographic lows in the toe area.

4.3 Material Properties

Materials considered in the stability analysis include leached ore, waste rock, Qal and QTg, bedrock, and foundation interface. Strength data have been determined through a number of geotechnical investigations and test programs, and the application of conservative assumptions. Analyses have been performed using effective stress strength parameters, and the effect of pore pressures was modeled by defining a static water table condition.

4.3.1 Leached Ore

Golder conducted strength tests on three samples collected from drillholes and test pits completed in the Tyrone Mine leached ore stockpiles. Results of triaxial and direct shear tests are reported in the *Tyrone Supplemental Stability Evaluation Interim Report* (Golder, 2006a). The average angle of internal friction (ϕ) measured in the leached ore samples was 35.5 degrees, while cohesion averaged 1.06 pounds per square inch. Leached ore cohesion has been ignored in these stability analyses, and an internal friction angle of 35.5 degrees was assumed for leached ore in all base case analyses.

To evaluate the potential impact of a decrease in leached ore strength due to long-term weathering and decrepitation, the internal friction of the ore was varied to produce a factor of safety of 1.0 under seismic loading. The back-analyzed strengths that yield a factor of safety of 1.0 under seismic loading are reported for each stability section.

Geophysical data (EnviroGroup, 2005a) indicate leached ore density from 100 to 150 pounds per cubic foot (pcf). The leached ore is assumed to have a moist unit weight of 120 pcf and a saturated unit weight of 133 pcf. These unit weights represent typical values for gravelly soils.

4.3.2 Waste Rock

Six waste rock samples from Tyrone were subjected to direct shear and staged triaxial testing (Golder, 2006a). The average angle of internal friction (32.6 degrees) was assumed for all base case analyses. The potential effects of waste rock weathering were investigated through back-analysis to obtain a factor of safety of 1.0 under seismic loading. The back-analyzed friction angle is reported on tables in Section 6.0 for each stability section.

4.3.3 Quaternary Alluvium

No strength testing has been performed on Qal samples in the 1C Stockpile Area. Triaxial testing of Qal samples performed under saturated, consolidated, undrained conditions with pore pressure measurements from the No. 1B Stockpile Area (Drillhole GA-05-02- 12'14') indicated an internal friction angle of 40.5 degrees. A detailed analysis of Qal samples in the

Brick Kiln Gulch Area (Golder, 2006b) indicated an internal friction angle of 29 degrees based on empirical correlation to Standard Penetration Test results. An internal friction angle of 29 degrees was applied to Qal for all base case analyses.

For analysis of liquefaction potential in Section E, where Qal has not been subject to over consolidation, the Qal shear strength required to maintain a static safety factor of 1.0 was back calculated.

4.3.4 Gila Conglomerate

Call and Nicolas Inc. (CNI, 1982) report a peak shear strength of 40.89 degrees from large-scale direct shear testing of disturbed samples of Gila Conglomerate. A sample from the 1B Stockpile Area had an angle of internal friction of 39.1 degrees. An internal friction angle of 39 degrees was applied for these stability analyses.

4.3.5 Granodiorite Bedrock

CNI (1982) reported estimated strengths for intact granitic rocks at the Tyrone project. The minimum reported cohesion is 669 pounds per square inch and the minimum reported internal friction angle is 43.41 degrees. A cohesion of 669 psi and internal friction angle of 43 degrees were applied for intact bedrock.

The potential for the loss of interface strength at the bedrock foundation interface was evaluated through block failure analyses. The analysis was performed by varying the shear strength in a 10-foot thick zone at the bedrock foundation through back analyses. The minimum strength required to maintain a safety factor of 1.0 under seismic loading conditions is reported for each stability section.

4.3.6 Summary of Material Properties

Material parameters applied in the stability models are summarized in Table 1. The leached ore, waste rock, alluvium, and Gila Conglomerate are assumed to have moist and saturated unit weights of 120 and 133 pcf, respectively. The granodiorite bedrock is assumed to have a moist and saturated unit weight of 160 pcf.

TABLE 1
SUMMARY OF MATERIAL PARAMETERS APPLIED IN THE STABILITY MODELS

Material	Unit Weight moist/sat (pcf)	Cohesion ©	Friction Angle (ϕ)
Leached Ore	120/133	0	35.5°
Leached Ore (decrepitated)	120/133	0	Solve for FOS=1.0
Waste Rock	120/133	0	32.6
Waste Rock (weathered)	120/133	0	Solve for FOS=1.0
Recent Alluvium (Qal, moist)	120/133	0	29°
Gila Conglomerate (QTg)	120/133	0	39°
Granodiorite Bedrock	160/160	669	43°
Granodiorite Interface	160/160	0	Solve for FOS=1.0

Notes:

pcf = pounds per cubic foot

FOS = factor of safety

4.4 Seismic Loading

Based on the seismic hazard analysis prepared by URS Corporation (2005), the peak ground acceleration for a 2,500-year return period at bedrock sites is between 0.08 and 0.09g. For sites underlain by local soils and Gila Conglomerate, magnification of bedrock acceleration was predicted to result in a peak acceleration of 0.18g at the ground surface. Hynes and Franklin (1984) discuss the selection of pseudostatic coefficients for use in dam design and recommend the use of one-half of the peak acceleration with a 20-percent reduction of the shear strength and a target factor of safety of 1.0. Bray et al. (1993) provides recommendations for seismic design of landfills and notes that “the normalized fundamental periods of many solid waste landfills are greater than two, and that for these cases, the maximum horizontal equivalent acceleration value used to represent the seismic loading will be less than one-half of the bedrock maximum horizontal acceleration.” Jansen (1985) states an acceleration of 0.4 to 0.7 times peak ground acceleration is typically suitable for computing the sustained effect of an earthquake on embankment stability.

While the waste rock piles and portions of the 1C Stockpile lie on a foundation of bedrock, a seismic acceleration equal to 0.66 times the amplified peak ground acceleration (i.e., 0.12g) for an event with a 2,500-year return period was used in pseudostatic analyses of all facilities in the Oak Grove Gulch Area. Golder believes this approach to be conservative and consistent with standard industry practice.

5.0 CALCULATIONS

Circular and block failure searches for critical failure surfaces were completed using SLIDE. Stability analyses were performed for existing base case conditions under static and pseudostatic conditions. In the block failure analyses, failure surface searches were

configured to incorporate all foundation layers. In circular failure analyses, failure surface search limits were set to eliminate minor local failure.

Base case analyses incorporate shear strengths measured or estimated based on current conditions and available test results. The results are reflective of conditions that we believe exist at present.

The weak interface and weathered ore and waste analyses were performed to evaluate the potential impacts of strength loss in the stockpiles and foundation interfaces. Weak ore analyses were primarily limited to the circular failure mode, while predominantly block failure searches were used to investigate the effects of a weakened interface. To evaluate a weak interface, the upper 10-foot thick zone in the bedrock foundation was assigned a lower shear strength as discussed above.

The reported factors of safety are based on Bishop's (1955) Method of Slices.

6.0 RESULTS

6.1 7A Far West Waste Rock Stockpile

Results of the stability analyses for the 7A Far West Waste Rock Stockpile are presented in Table 2. SLIDE computer output is provided in Attachment 1. The base cases incorporate ore and foundation strengths as determined through recent testing and analyses. Circular and block failure surface searches indicate factors of safety of approximately 2.2 to 2.4 under static conditions for Sections A and B. Under seismic loading conditions, predicted factors of safety range from 1.5 to 1.6.

To determine the extent of foundation weathering that would be required to induce instability under the design seismic event, the foundation interface internal friction angle was varied until a factor of safety of 1.0 was predicted. Minimum foundation interface friction angles of 7.5 degrees in Section A and 17 degrees in Section B produced this condition in block failure mode. The increase in strength required to maintain a safety factor of 1.0 in Section B results from a steeper foundation outslope. At Section A, foundation slopes are inward and they provide greater resistance to basal sliding block failure.

Varying waste rock strength to determine the extent of waste rock weathering required to induce instability under seismic loading conditions indicated that internal friction angles of 22.5 and 23 degrees are required to maintain a safety factor of 1.0. This analysis considered a circular failure mode with the failure surface constrained within the waste rock mass.

TABLE 2
STABILITY ANALYSIS SUMMARY 7A FAR WEST

Condition	Cross-section	Static Factor of Safety	Pseudostatic Factor of Safety (0.12g)	Failure Analysis	Comment
Post Regrade	A	2.3 ⁽¹⁾	1.5 ⁽²⁾	Circular	Base Case
	A	2.4 ⁽³⁾	1.6 ⁽⁴⁾	Block	Base Case
	A	NA	1.0 ⁽⁵⁾	Block	Weak Interface, Back-Analyzed $\phi = 7.5^\circ$ Right to Left
	A	NA	1.0 ⁽⁶⁾	Block	Weak Interface, Back-Analyzed $\phi = 10.5^\circ$ Left to Right
	A	NA	1.0 ⁽⁷⁾	Circular	Weathered Waste, Back-Analyzed $\phi = 22.5^\circ$
Post Regrade	B	2.2 ⁽⁸⁾	1.5 ⁽⁹⁾	Circular	Base Case
	B	2.3 ⁽¹⁰⁾	1.6 ⁽¹¹⁾	Block	Base Case
	B	NA	1.0 ⁽¹²⁾	Block	Weak Interface, Back-Analyzed $\phi = 17^\circ$
	B	NA	1.0 ⁽¹³⁾	Circular	Weathered Waste, Back-Analyzed $\phi = 23^\circ$

Note:

Numbers in parentheses indicate the numbered stability analysis output provided in Attachment 1.

6.2 1C Stockpile

Stability analysis results for the 1C Stockpile are contained in Attachment 2 and summarized in Table 3. For expected base case conditions, static stability safety factors range from 1.9 to 2.1. Under pseudostatic loading, factors of safety range from 1.2 to 1.4.

Analyses indicate minimum required internal friction angles of 15 and 9.5 degrees for the foundation interface in block failure mode at Sections C and D, respectively. In a circular failure analysis at Section D, a minimum interface friction angle of 15 degrees is required to maintain a minimum factor of safety of 1.0.

Evaluation of leached ore weathering and decrepitation indicates that minimum ore angles of internal friction of 22.5, and 24 degrees are required to maintain pseudostatic stability in Sections C and D, respectively.

TABLE 3
STABILITY ANALYSIS SUMMARY 1C STOCKPILE

Condition	Cross-section	Static Factor of Safety	Pseudostatic Factor of Safety (0.12g)	Failure Analysis	Comment
Post Regrade	C	1.9 ⁽¹⁾	1.2 ⁽²⁾	Circular	Base Case
	C	2.1 ⁽³⁾	1.4 ⁽⁴⁾	Block	Base Case
	C	NA	1.0 ⁽⁵⁾	Block	Weak Interface, Back Analyzed $\phi = 15^\circ$
	C	NA	1.0 ⁽⁶⁾	Circular	Ore Decrepitation, Back-Analyzed $\phi = 22.5^\circ$
Post Regrade	D	1.9 ⁽⁷⁾	1.3 ⁽⁸⁾	Circular	Base Case
	D	1.9 ⁽⁹⁾	1.3 ⁽¹⁰⁾	Block	Base Case
	D	NA	1.0 ⁽¹¹⁾	Block	Weak Interface, Back-Analyzed $\phi = 9.5^\circ$
	D	NA	1.0 ⁽¹²⁾	Circular	Weak Interface, Back-Analyzed $\phi = 15^\circ$
	D	NA	1.0 ⁽¹³⁾	Circular	Ore Decrepitation, Back-Analyzed $\phi = 24^\circ$

Note:

Numbers in parentheses indicate the numbered stability analysis output provided in Attachment 2.

6.3 7A East and 7A West

Stability model output for the 7A East and 7A West Waste Rock Stockpiles is contained in Attachment 3 and summarized in Table 4. Base case stability analyses of the waste rock piles returned similar results for static and pseudostatic loading conditions. Static factors of safety range from 1.8 to 2.0, while factors of safety are 1.3 to 1.4 under seismic loading conditions.

Back calculation of weathered waste rock strength returned a minimum waste rock internal friction angle of 26 degrees for a safety factor of 1.0 in Section F. This represents a somewhat higher shear strength requirement in comparison to the other sections evaluated and reflects a locally steeper slope beneath an erosion control bench. The strength required to maintain a factor of safety of 1.0 against block failure in Section E is also slightly higher than in other sections. This is caused by a relatively steep bedrock foundation outslope and consequently, a relatively steep foundation interface zone incorporated in the stability model.

TABLE 4
STABILITY ANALYSIS SUMMARY 7A EAST AND 7A WEST

Condition	Cross-section	Static Factor of Safety	Pseudostatic Factor of Safety (0.12g)	Failure Analysis	Comment
Post Regrade 7A East	E	1.9 ⁽¹⁾	1.3 ⁽²⁾	Circular	Base Case
	E	2.0 ⁽³⁾	1.4 ⁽⁴⁾	Block	Base Case
	E	NA	1.0 ⁽⁵⁾	Block	Weak Interface, Back-Analyzed $\phi = 20^\circ$
	E	NA	1.0 ⁽⁶⁾	Circular	Weathered Waste, Back-Analyzed $\phi = 24^\circ$
	E	1.0 ⁽⁷⁾		Circular	Liquefaction Analysis, Back-Analyzed Qal $\phi = 11^\circ$
Post Regrade 7A West	F	1.8 ⁽⁸⁾	1.3 ⁽⁹⁾	Circular	Base Case
	F	1.9 ⁽¹⁰⁾	1.4 ⁽¹¹⁾	Block	Base Case
	F	NA	1.0 ⁽¹²⁾	Block	Weak Interface, Back-Analyzed $\phi = 5^\circ$
	F	NA	1.0 ⁽¹³⁾	Circular	Weathered Waste, Back-Analyzed $\phi = 26^\circ$

Note:

Numbers in parentheses indicate the numbered stability analysis output provided in Attachment 3.

In the Section E liquefaction analysis, a minimum residual shear strength required for a static stability safety factor of 1.0 was back calculated. Vaid and Thomas (1994) found that the residual strength of sand samples subjected to extension tests ranged from 0.1 to 0.18 times the effective overburden stress ($\sigma_{vo'}$). This is approximately equivalent to an internal friction angle of 5 to 11 degrees. The minimum strength of 11 degrees determined by back calculation is within the range of reported values. It should be noted that the Qal in Section E occurs as a thin layer in a laterally confined zone. Three-dimensional effects (the shear resistance along the margins of the potentially liquefiable area and the higher shear strength associated with bedrock foundation surfaces adjacent to the Qal) are likely to alleviate the potential for slope displacement should liquefaction occur locally. Overburden pressures before and after regrading will be similar in this area, so it is unlikely that reclamation will result in a higher potential for liquefaction. If failure were to occur, the impacts would be relatively minor as the toe area is buttressed by an inward sloping foundation and there are no seepage collection works in the area.

7.0 CONCLUSIONS

The base case strength properties used in these stability analyses are based primarily on recent and previously completed geotechnical testing. Base case properties represent the material strengths that we expect to exist under current conditions. Stability evaluations incorporating base case strength properties indicate that the 1C Stockpile and the 7A Far

West, the 7A East, and the 7A West Waste Rock Stockpiles will be stable under their post-reclamation configurations.

The effects of weathering and decrepitation on the grain-size distribution and strength of waste rock and leached ore have not been unequivocally determined on the basis of the material characterization studies completed for Tyrone. General conclusions suggest that little loss of strength should be anticipated given the lithology of the waste rock and ore, its current state of alteration, and the ambient conditions to which it is exposed. The effect of the loss of leached ore, waste rock, and foundation interface zone strength was evaluated indirectly by back calculation. Shear strengths were varied to determine minimum strengths required to maintain a pseudostatic factor of safety of 1.0. These analyses were performed to enable estimation of the extent of strength loss that can be tolerated before instability could occur.

PDTI is currently regrading waste rock and leached ore slopes to approximately 3.5H:1V. At this slope angle, a minimum internal friction angle of 22.5 to 23 degrees will be required to produce a pseudostatic factor of safety of 1.0. Where slopes are locally steeper, as on Section F, a slightly higher shear strength may be necessary to maintain the same factor of safety. The average measured internal friction angles of the sampled stockpile materials are 32.6 to 35.5 degrees, respectively, for waste rock and leached ore at Tyrone (Golder, 2006a). Therefore, a considerable change in the physical condition of the waste rock and ore will be required to enable a slope failure; however, material characterization studies do not predict significant changes in material properties over time.

In the base case analyses, the bedrock foundation interface zone was assigned the strength of intact foundation bedrock (669 psi cohesion, $\phi=43$ degrees, CNI, 1982). To evaluate tolerable strength loss in the foundation interface, the internal friction angle in the upper 10 feet of the bedrock foundation was varied until a safety factor of 1.0 was predicted under seismic loading conditions. The internal friction angle required for this condition is the minimum tolerable foundation interface strength for the group of assumptions and conditions considered in the stability models.

Section A in the 1C Stockpile and Section F at 7A West are relatively insensitive to interface shear strength. Interface friction angles of 5 to 10.5 degrees are required to resist basal sliding failure under the design seismic event. High resistance to basal block sliding failure at these locations is due to section geometry. Inward foundation slopes and/or tortuous surfaces enhance stability.

Where section geometry does not enhance stability, a basal interface internal friction angle of 15 to 20 degrees is required to maintain a factor of safety of 1.0 against basal sliding block failure under the design seismic event.

Based on back calculation, a considerable loss of strength will be required to induce instability in the long term. For waste rock and leached ore, a strength loss in excess of 30 to 35 percent will be required to induce a circular failure under seismic loading conditions. The interface shear strength that results in a factor of safety of 1.0 for basal sliding failure is considerably lower than the minimum measured intact rock strength (CNI, 1982) and is representative of a weak soil. Therefore, a long-term reduction in stability due to basal interface weathering is not expected.

The stability analyses completed for the 1C Stockpile and the 7A East, 7A West, and 7A Far West Waste Rock Stockpiles indicate that the stockpiles will be stable in their post-reclamation configurations. Evaluations of the potential impacts of long-term weathering indicate that a very significant change in the physical character of the stockpile material would be required to reduce the shear strength to the degree that would be required to lead to potential slope instability. Material characterization studies that have been completed do not support this expectation.

The potential for liquefaction of alluvium was considered. Where the alluvium has been pre-consolidated from the placement and then removal of approximately 200 feet of stockpile material, the alluvium is considered non-liquefiable for the design earthquake accelerations and durations. Where the alluvium underlying the stockpiles has not been pre-consolidated, a residual (liquefied) strength was back-calculated and was determined to be within the range of reported residual strengths for liquefied sands. Additionally, given the laterally and vertically restricted distribution of alluvium in this area and 3-dimensional effects, potential slope displacements will be small and the consequence of liquefaction will be minimal.

8.0 REFERENCES

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- Rocscience, 2000. *2D Limit Equilibrium Slope Stability for Soil and Rock Slopes*.
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- Vaid, Y.P. and J. Thomas, 1994. *Post Liquefaction Behavior of Sand*. In: *Proceedings, 13th International Conference on Soil Mechanics and Foundation Engineering*, New Delhi, India.

Attachments:

- Figures 1 and 2
- Attachment 1 - Stability Output, 7A Far West
- Attachment 2 - Stability Output, 1C Stockpile
- Attachment 3 - Stability Output, 7A East and 7A West

FIGURES

ATTACHMENT 1

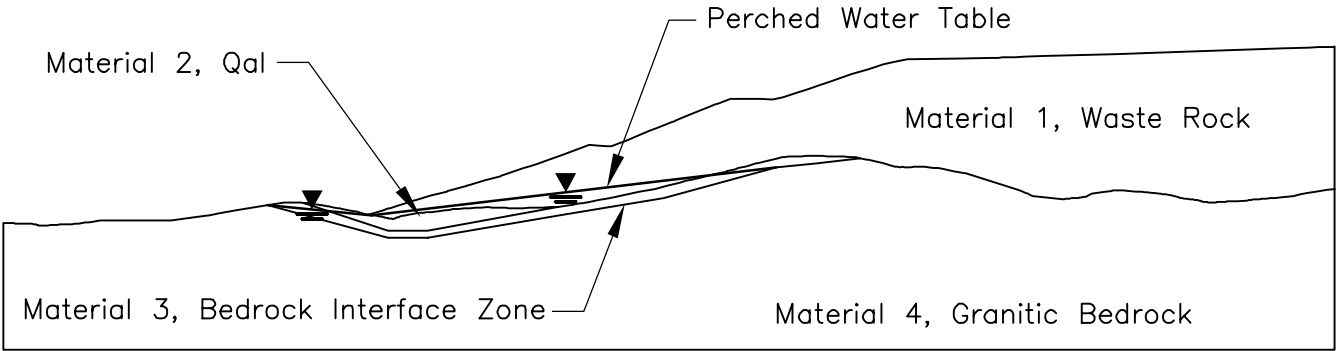
STABILITY OUTPUT - 7A FAR WEST

ATTACHMENT 2

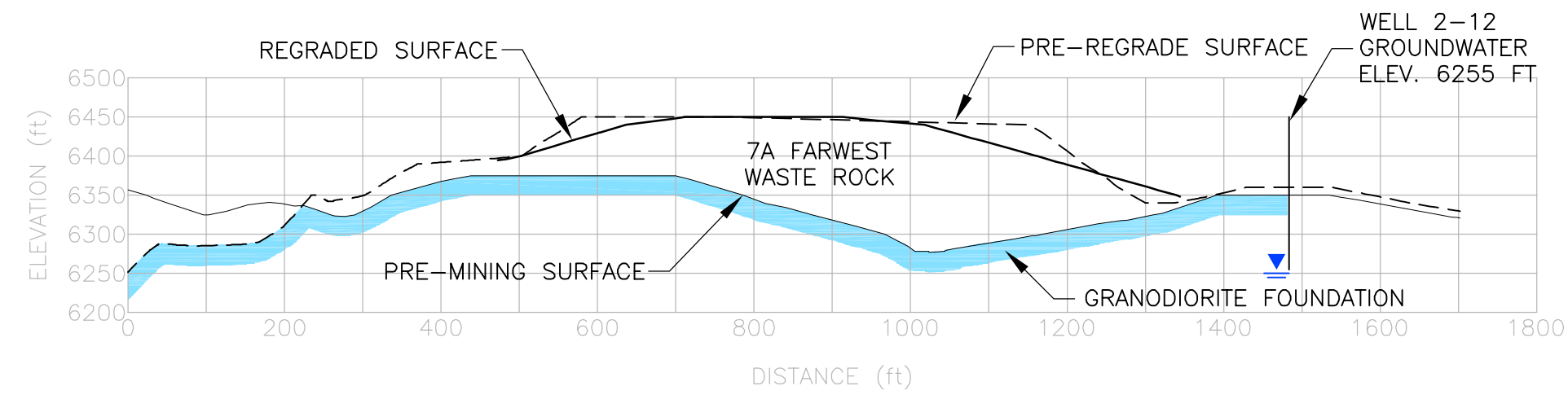
STABILITY OUTPUT - 1C STOCKPILE

ATTACHMENT 3

STABILITY OUTPUT - 7A EAST AND 7A WEST

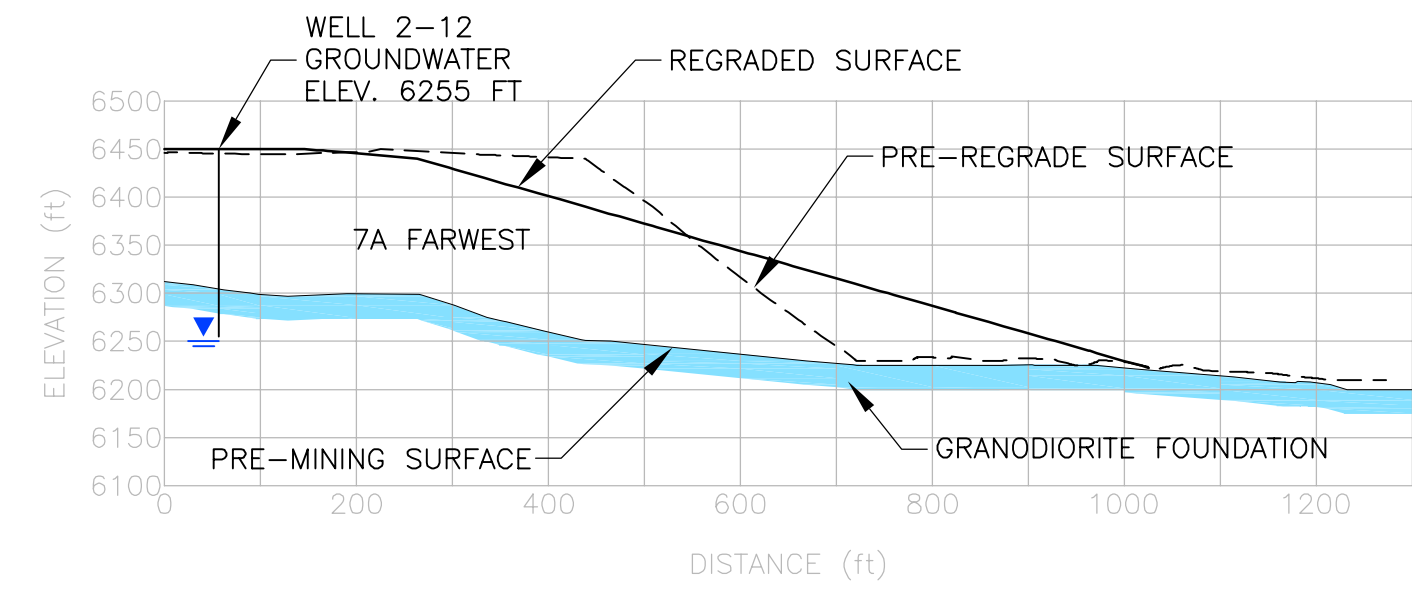


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REVIEW	DAK	05/04/06			



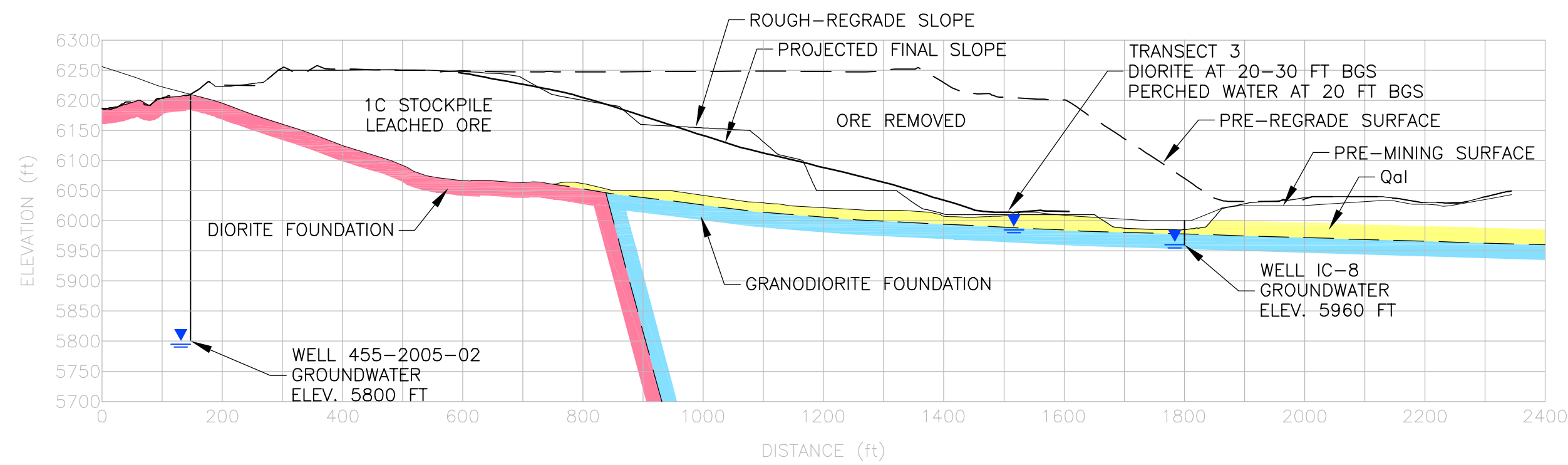
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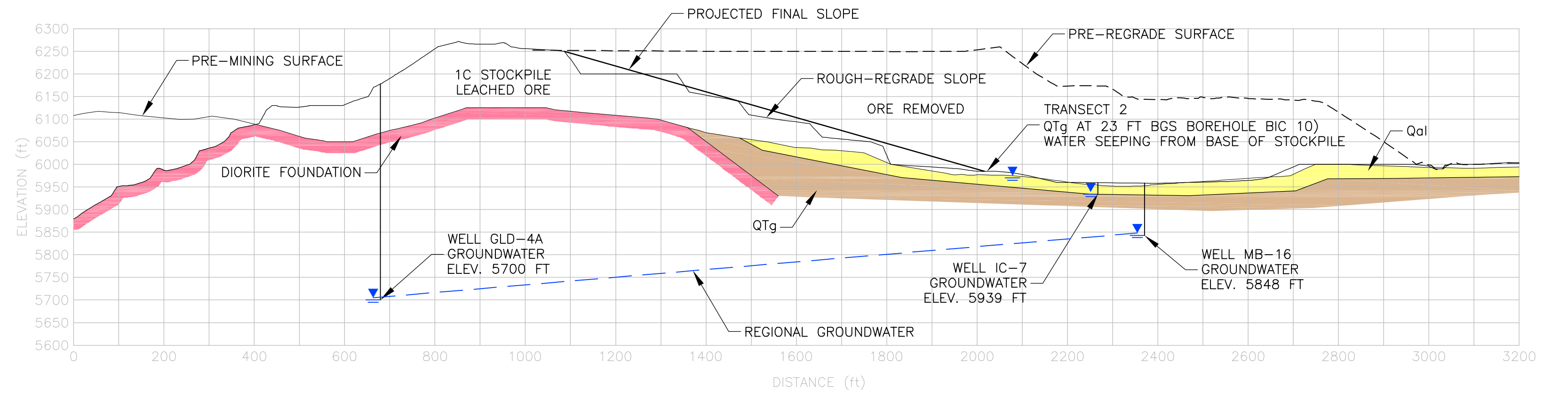
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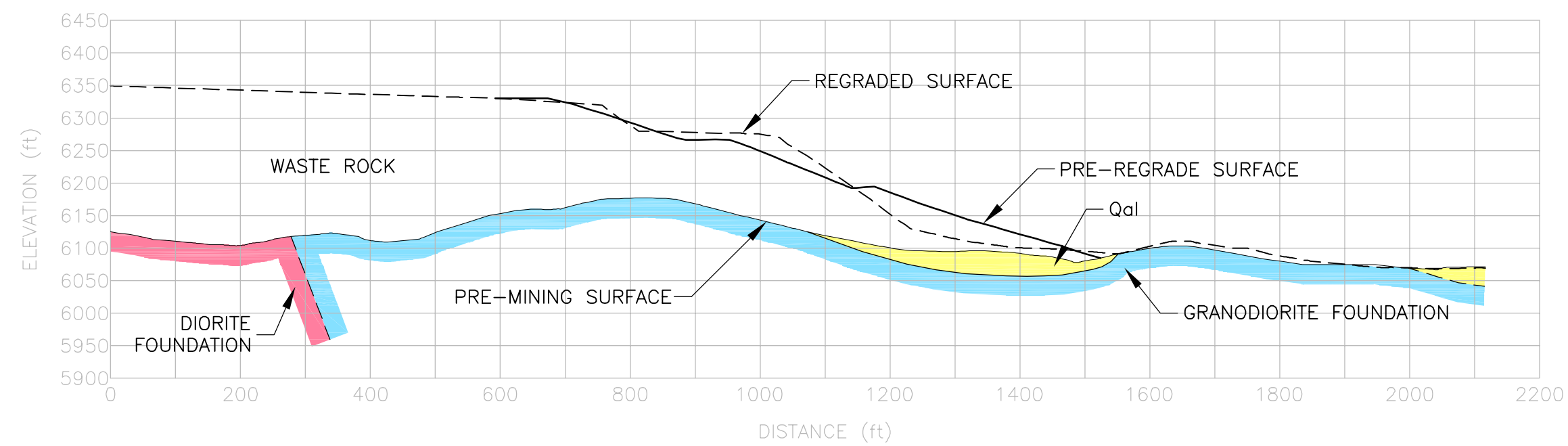
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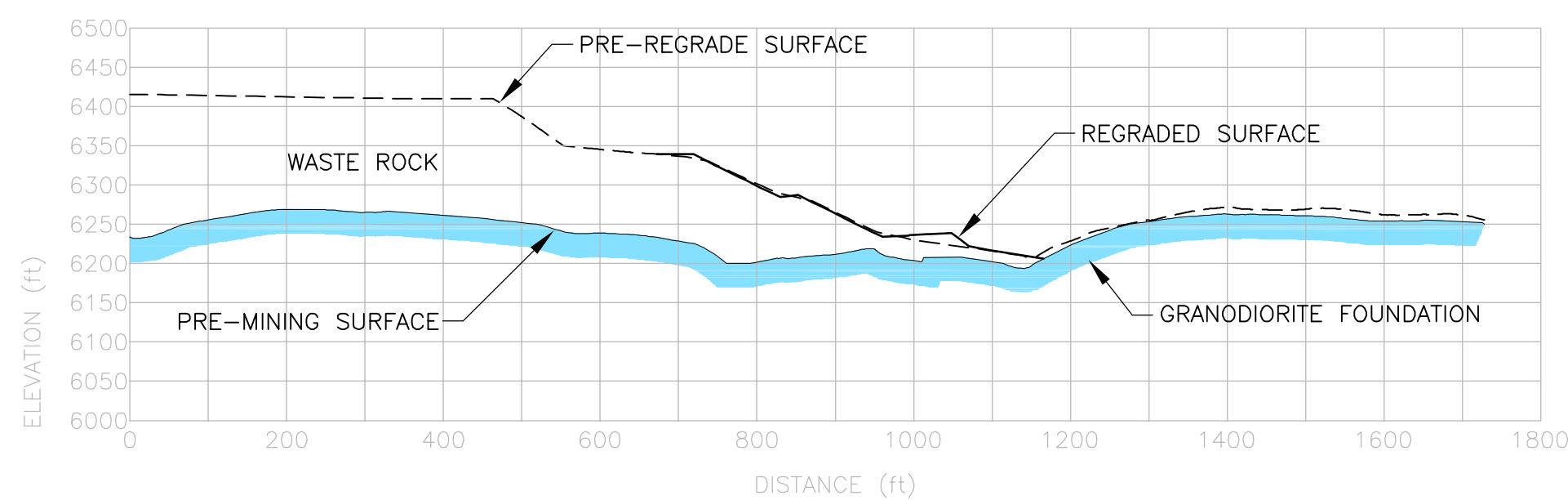
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E
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F
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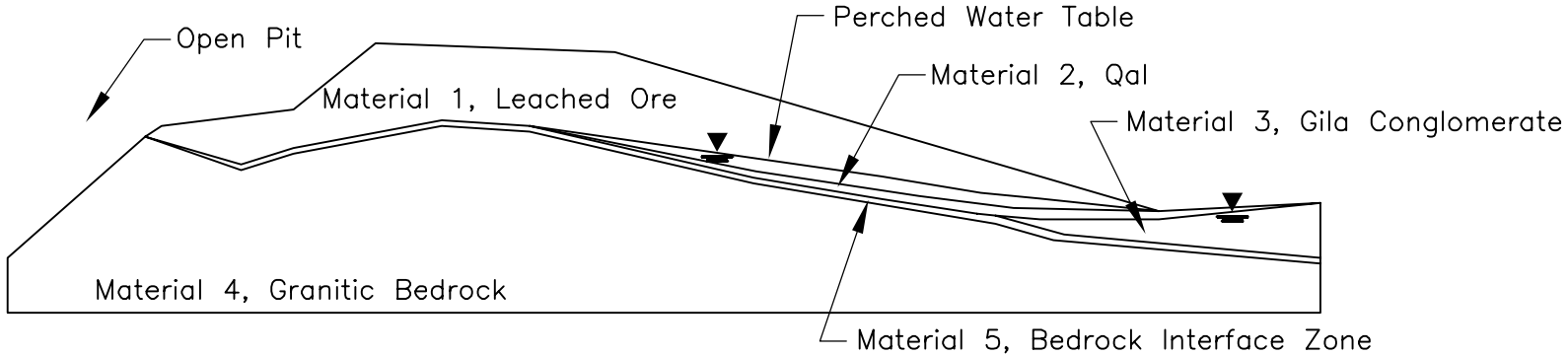
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LEGEND

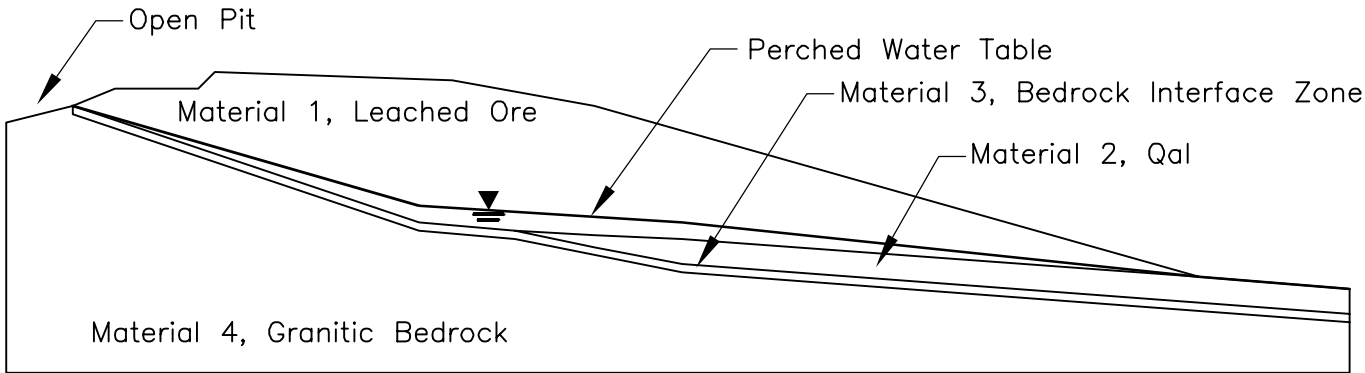
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	DIORITE/BIOTITE DIORITE
	GRANODIORITE-QUARTZ DIORITE
	ALLUVIUM
	UPPER MANGAS CONGLOMERATE/GILA CONGLOMERATE
	LOWER MANGAS CONGLOMERATE



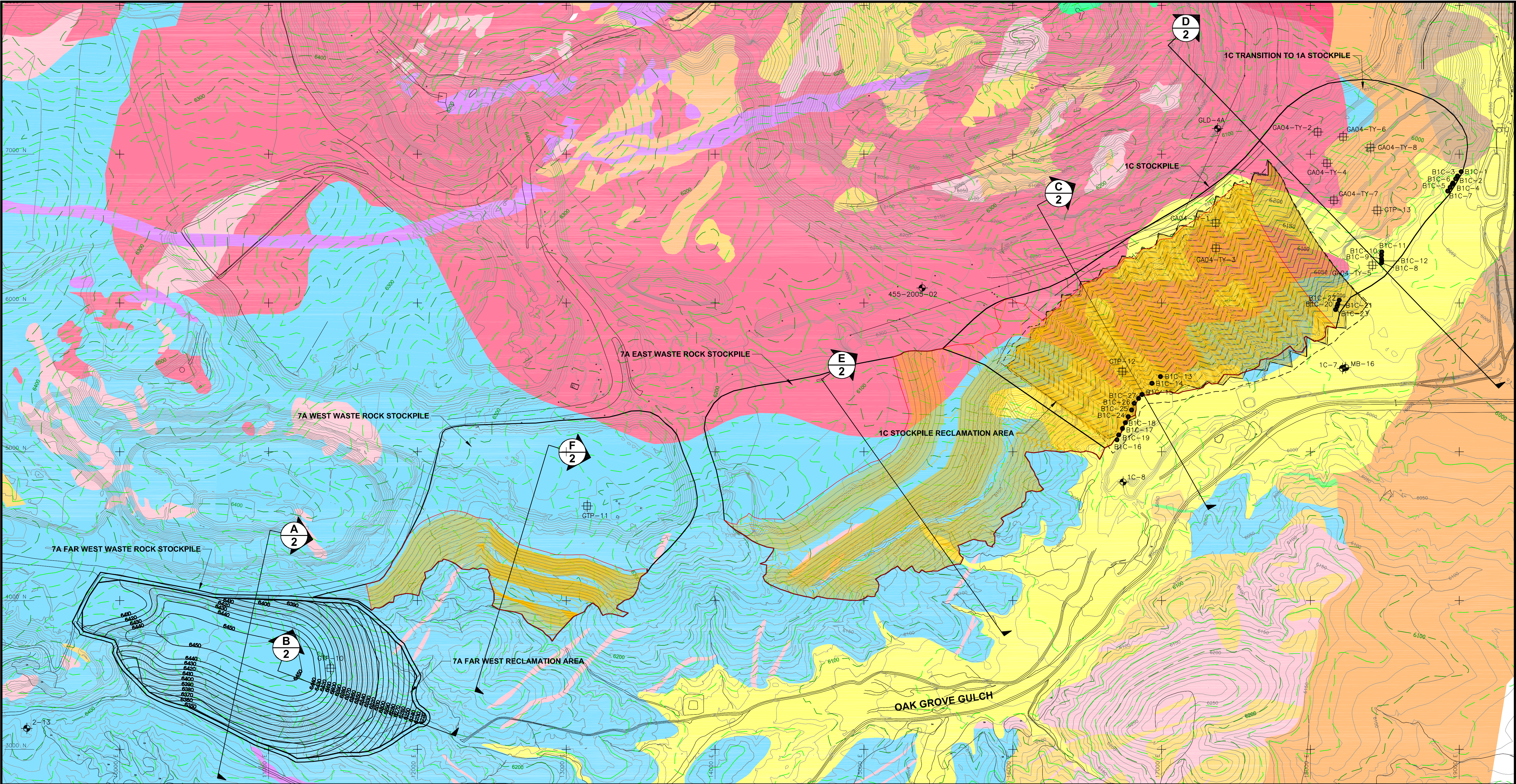
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TITLE 7A FAR WEST, 1C STOCKPILE, 7A EAST AND 7A WEST SUPPLEMENTAL STABILITY ANALYSIS STABILITY CROSS-SECTIONS						
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	REVIEW					



PROJECT		SUPPLEMENTAL STABILITY ANALYSIS TYRONE MINE, NEW MEXICO			
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REVIEW	DAK	05/04/06			



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	REVIEW	DAK	05/04/06				



LEGEND

	ANDESITE		TONALITE-DACITE
	BASAL VOLCANICS		DIORITE/BIOTITE DIORITE
	DIABASE		GRANODIORITE-QUARTZ DIORITE
	GRANITOID ROCKS		ALLUVIUM
	IGNEOUS BRECCIA		UPPER MANGAS CONGLOMERATE/GILA CONGLOMERATE
	GRANODIORITE-TONALITE-DAICITE		LOWER MANGAS CONGLOMERATE
	EXISTING TOPOGRAPHY		ROTOSONIC BOREHOLE LOCATION
	PRE-MINE TOPOGRAPHY		STOCKPILE TEST PIT LOCATION
	PROPOSED REGRADE SURFACE		MONITOR WELL LOCATION
			2005 EXPLORATION HOLES

REFERENCES

- 1.) EXISTING AND PRE-MINE TOPOGRAPHY AND GEOLOGY PROVIDED BY PHELPS DODGE TYRONE, INC.
- 2.) SLOPE CONFIGURATION AS PER STKPL1NEWSLOPE.dwg, M3 Engineering and Technology Corp., 01/23/2006.
- 3.) 7A EAST AND WEST SPOT ELEVATIONS AS PER STOCKPILE PRE-TOPO.dwg, M3 Engineering AND Technology Corp., 03/23/2006.
- 4.) SELECT MONITOR WELL LOCATIONS AND WATER LEVEL DATA FROM PDTI RECORDS.
- 5.) B1C SERIES HOLES FROM 2005 EXPLORATION (GOLDER ASSOCIATES).
- 6.) TEST PIT AND DRILLHOLE LOCATIONS FROM SUPPLEMENTAL STABILITY STUDY OF WASTE ROCK PILES AND LEACHED ORE STOCKPILES, INTERIM REPORT FOR DP1341 CONDITION 78 TYRONE MINE, GOLDER ASSOCIATES, JAN 13, 2005.)



PROJECT
**phelps
dodge**
TYRONE INC.

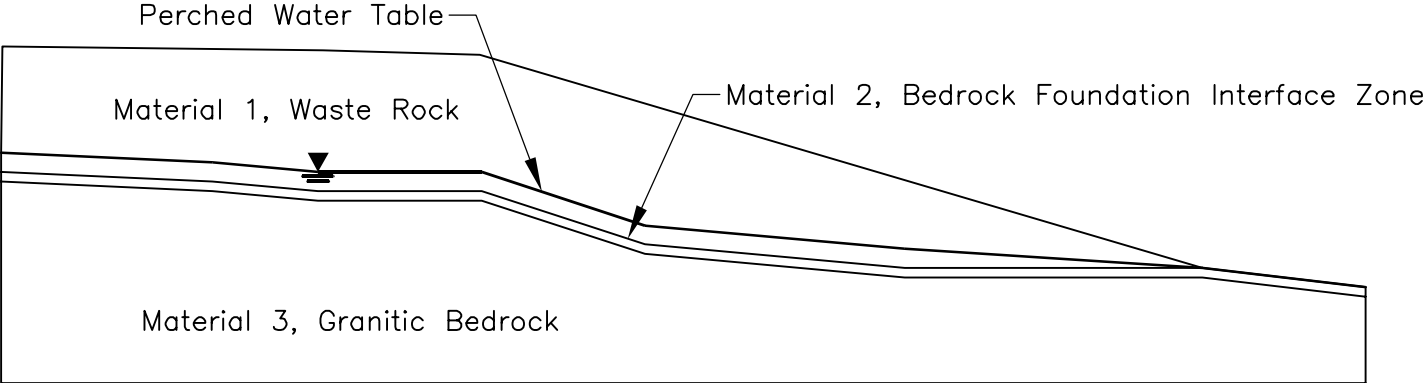
SUPPLEMENTAL STABILITY ANALYSIS
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7A FAR EAST AND 7A WEST
STABILITY ANALYSIS**

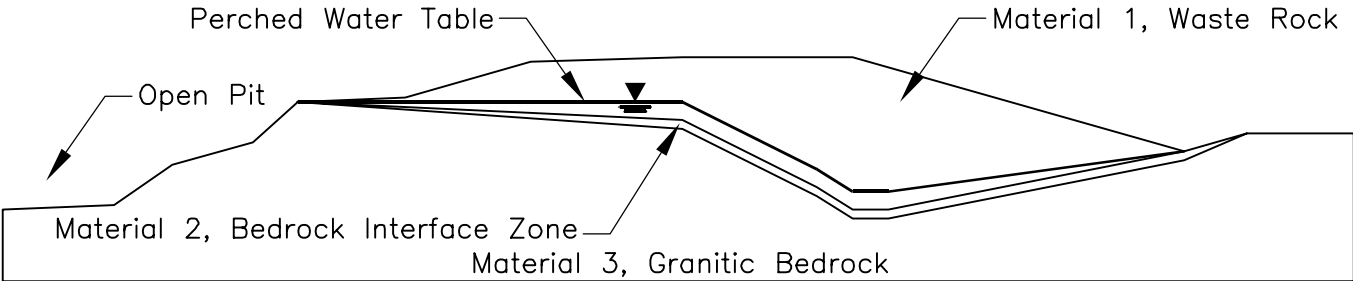
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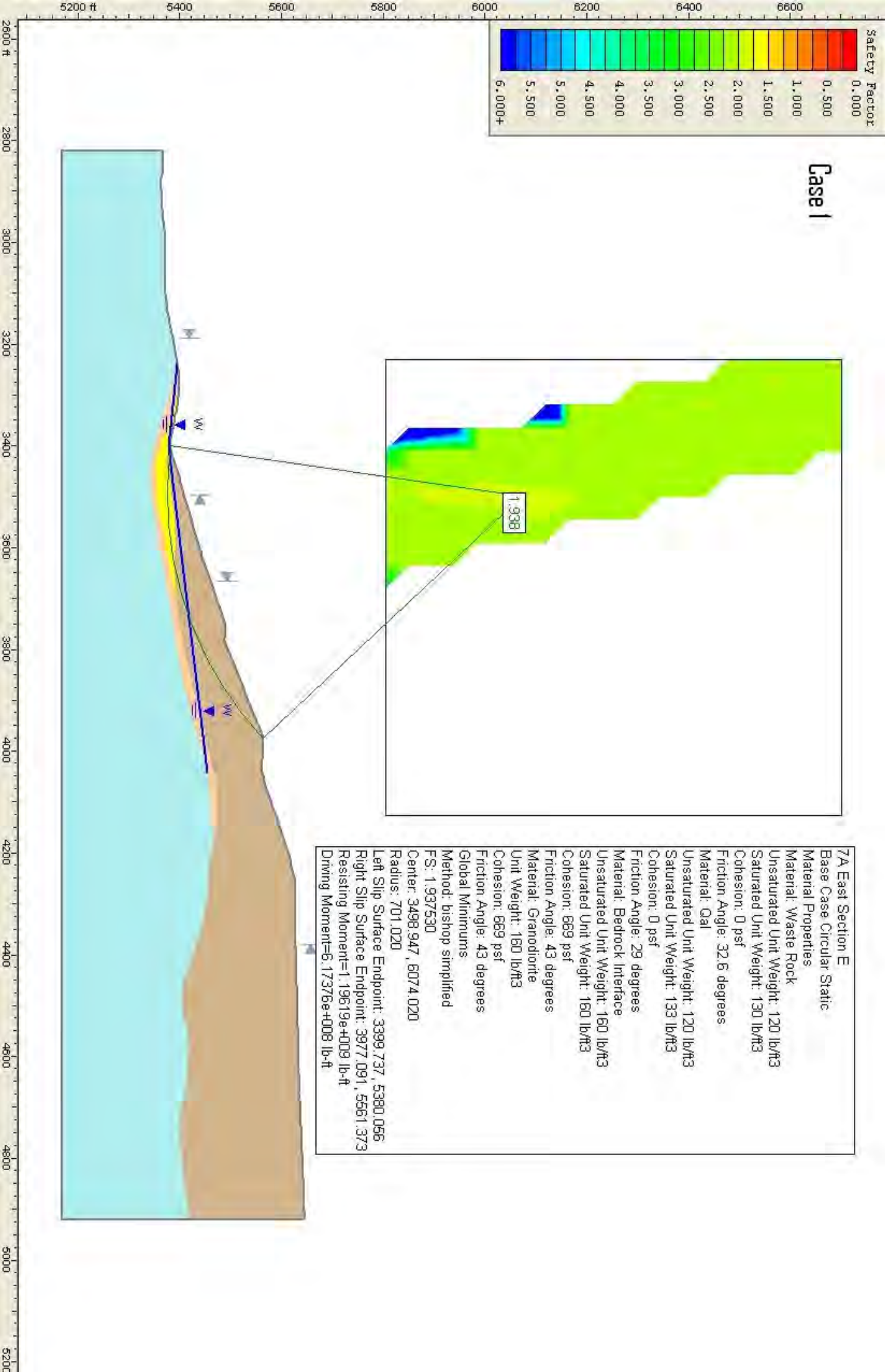
FIGURE
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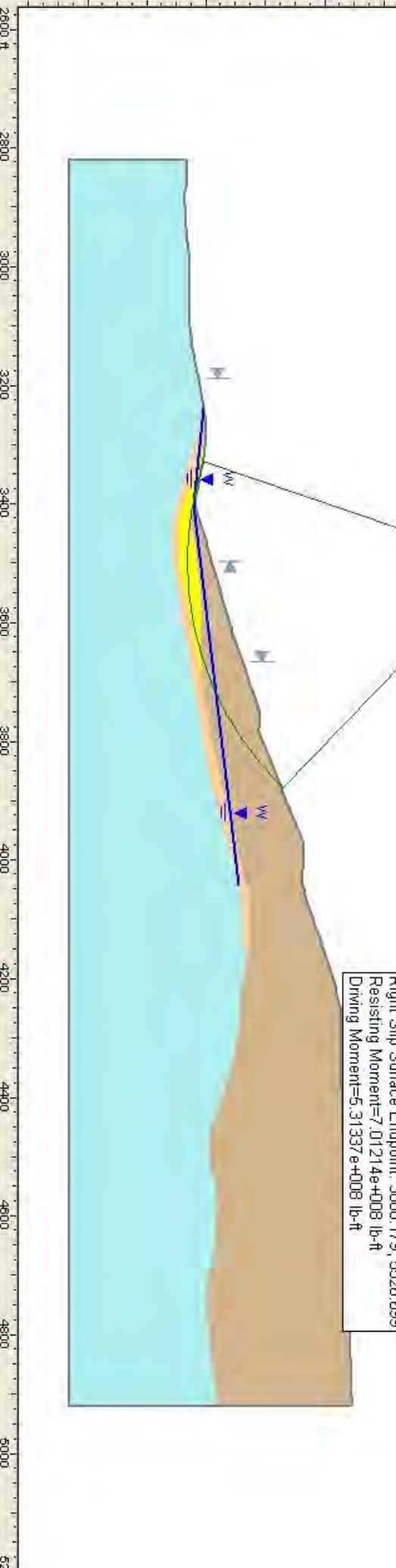
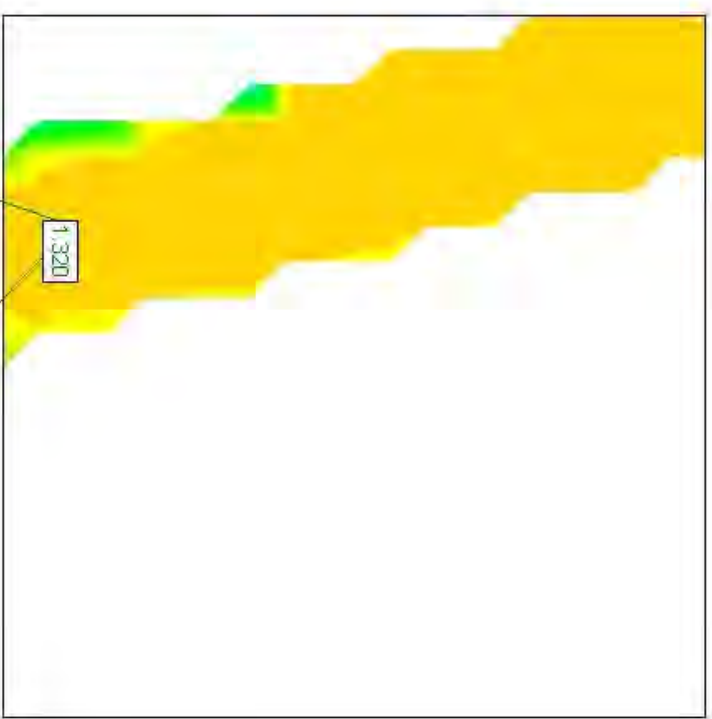
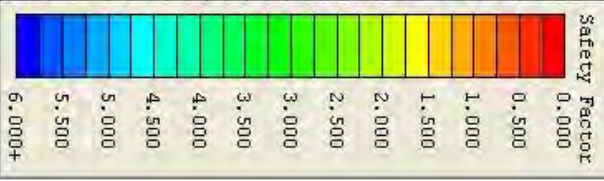
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						FIGURE 1-2		



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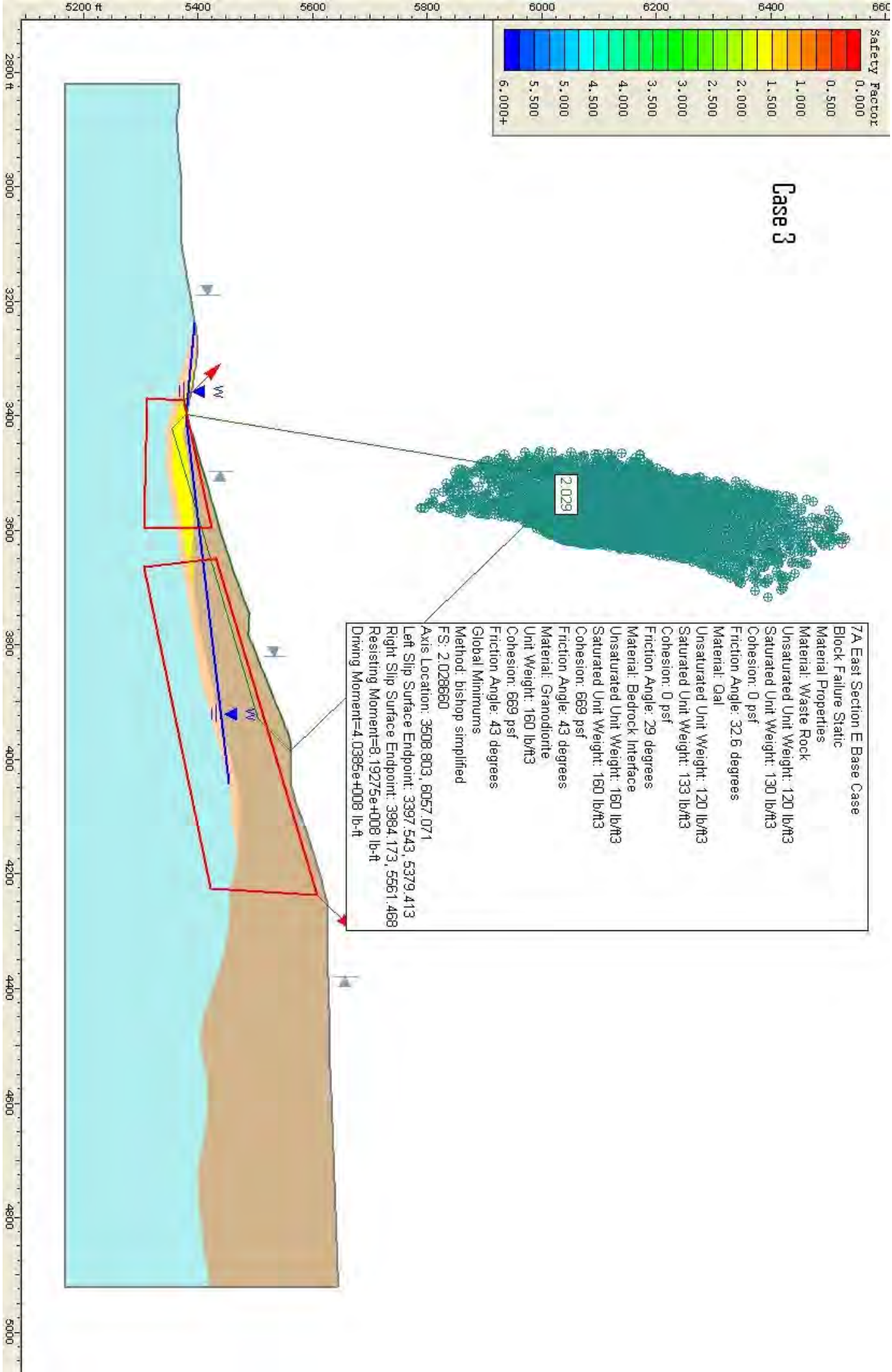


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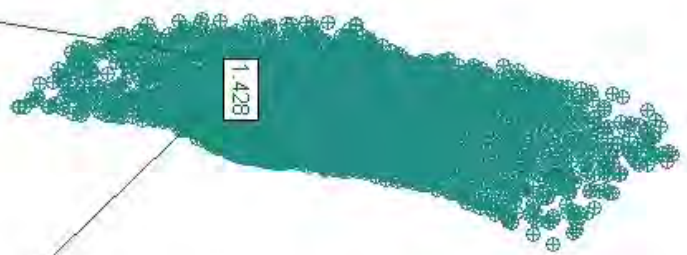
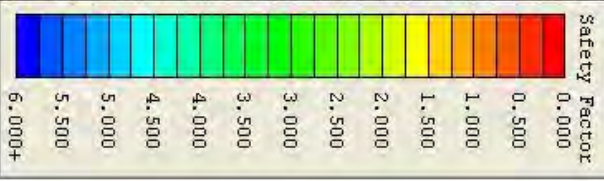


7A East Section E Base Case
Circular Failure
Loading
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 130 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Gai
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Granodiorite
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.319720
Center: 3498.947, 5694.748
Radius: 529.904
Left Slip Surface Endpoint: 3327.672, 5393.287
Right Slip Surface Endpoint: 3680.179, 5526.699
Resisting Moment=7.01214e+008 lb-ft
Driving Moment=5.31337e+008 lb-ft

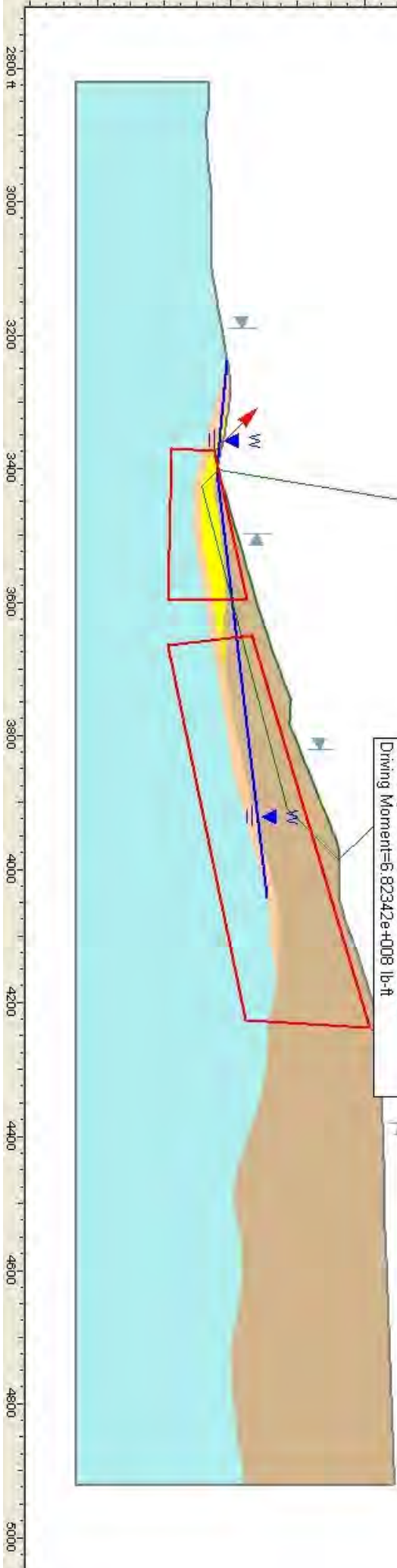




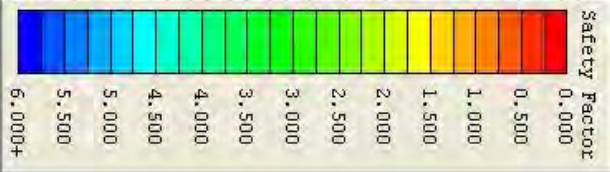
Case 4



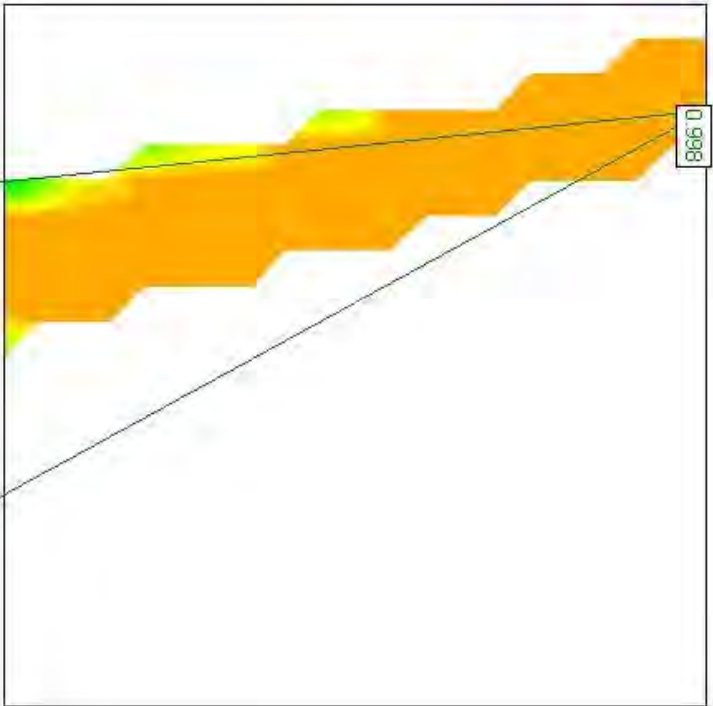
7A East Section E Base Case
Block Failure
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 130 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.5 degrees
Material: Gai
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Granodiorite
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.427600
Axis Location: 3511.840, 6055.062
Left Slip Surface Endpoint: 3400.866, 5380.387
Right Slip Surface Endpoint: 3984.996, 5561.479
Resisting Moment=9.74111e+008 lb-ft
Driving Moment=6.82342e+008 lb-ft



Case 6



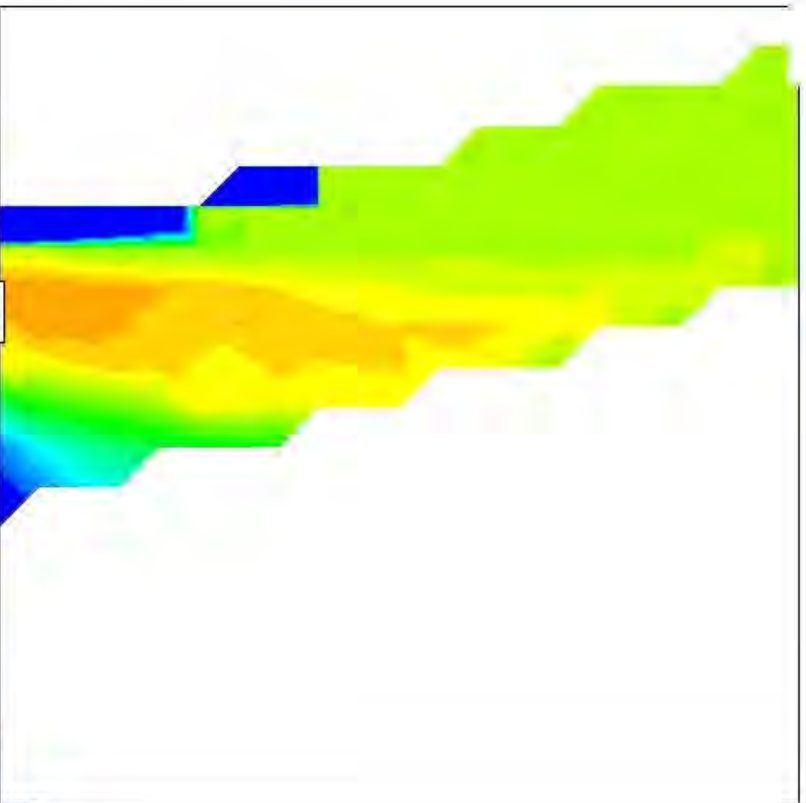
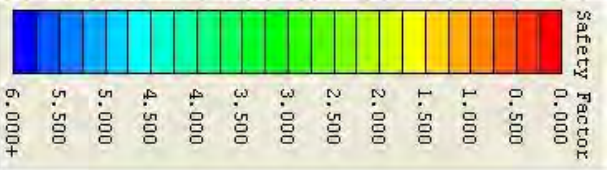
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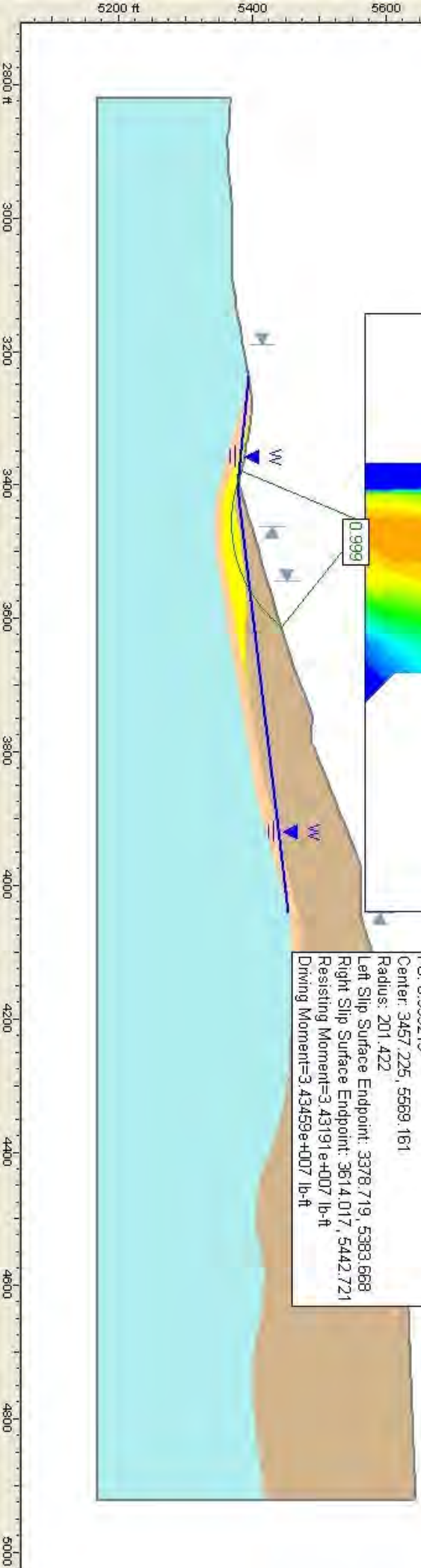
7A East Section E
Weathered Waste Rock Analysis
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 130 lb/ft³
Cohesion: 0 psf
Friction Angle: 24 degrees
Material: Gai
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Granodiorite
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 0.998354
Center: 3364.493, 6701.471
Radius: 1299.301
Left Slip Surface Endpoint: 3496.310, 5408.874
Right Slip Surface Endpoint: 3967.945, 5561.519
Resisting Moment=5.24035e+008 lb-ft
Driving Moment=5.24899e+008 lb-ft



Case 7

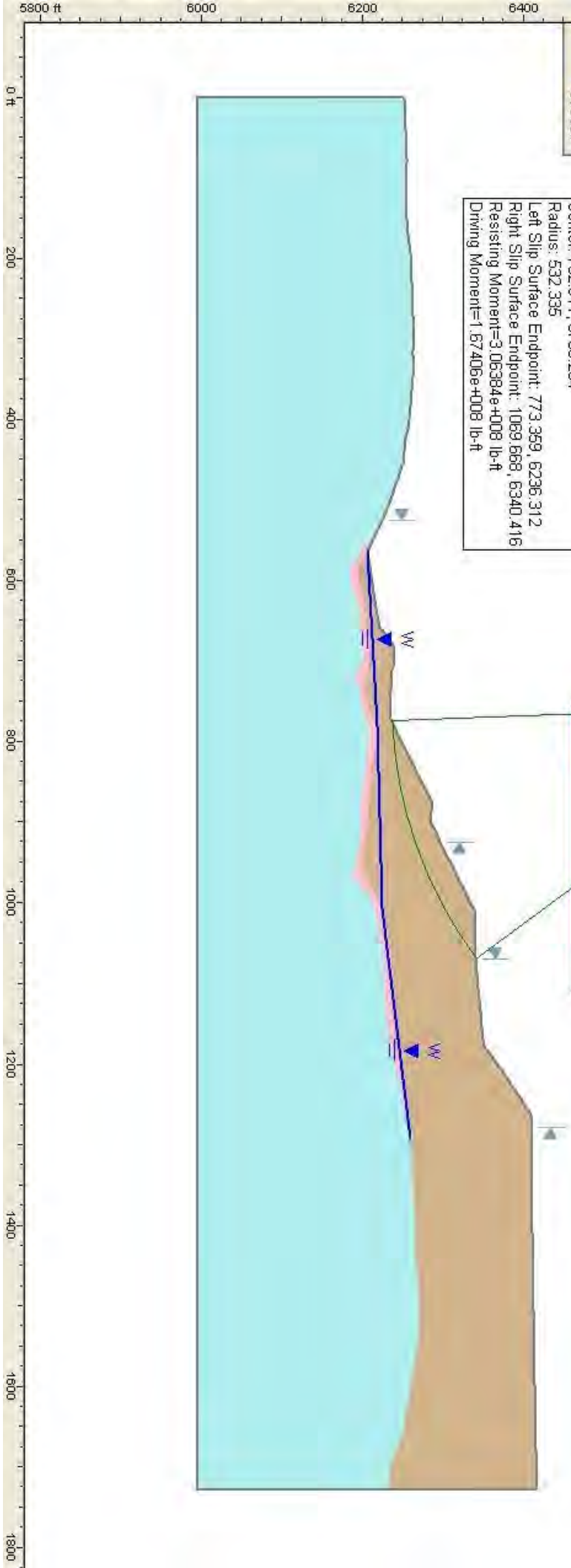
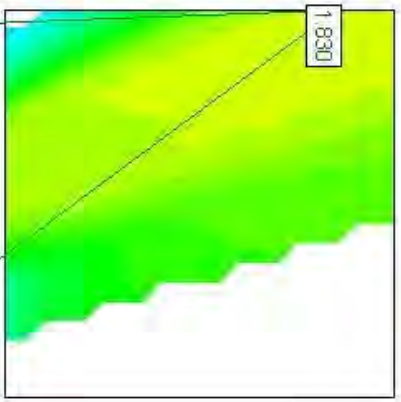
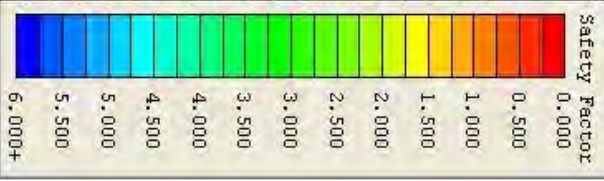


7A East Section E
Liquefaction Analysis
Min residual strength for FS=1.0
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 130 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Gai
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 11 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Granodiorite
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 0.999219
Center: 3457.225, 5569.161
Radius: 201.422
Left Slip Surface Endpoint: 3378.719, 5383.668
Right Slip Surface Endpoint: 3614.017, 5442.721
Resisting Moment=3.43191e+007 lb-ft
Driving Moment=3.43459e+007 lb-ft



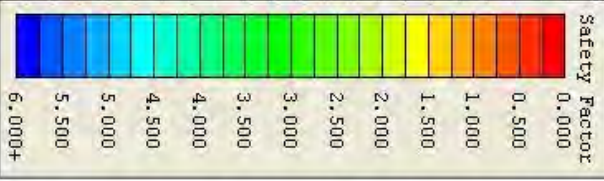
Case 8

7A West Section F Base Case
Circular Failure, Static
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Diorite Bedrock
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.830180
Center: 752,911, 6768,254
Radius: 532,335
Left Slip Surface Endpoint: 773,369, 6236,312
Right Slip Surface Endpoint: 1069,668, 6340,416
Resisting Moment=3.06384e+008 lb-ft
Driving Moment=1.67406e+008 lb-ft

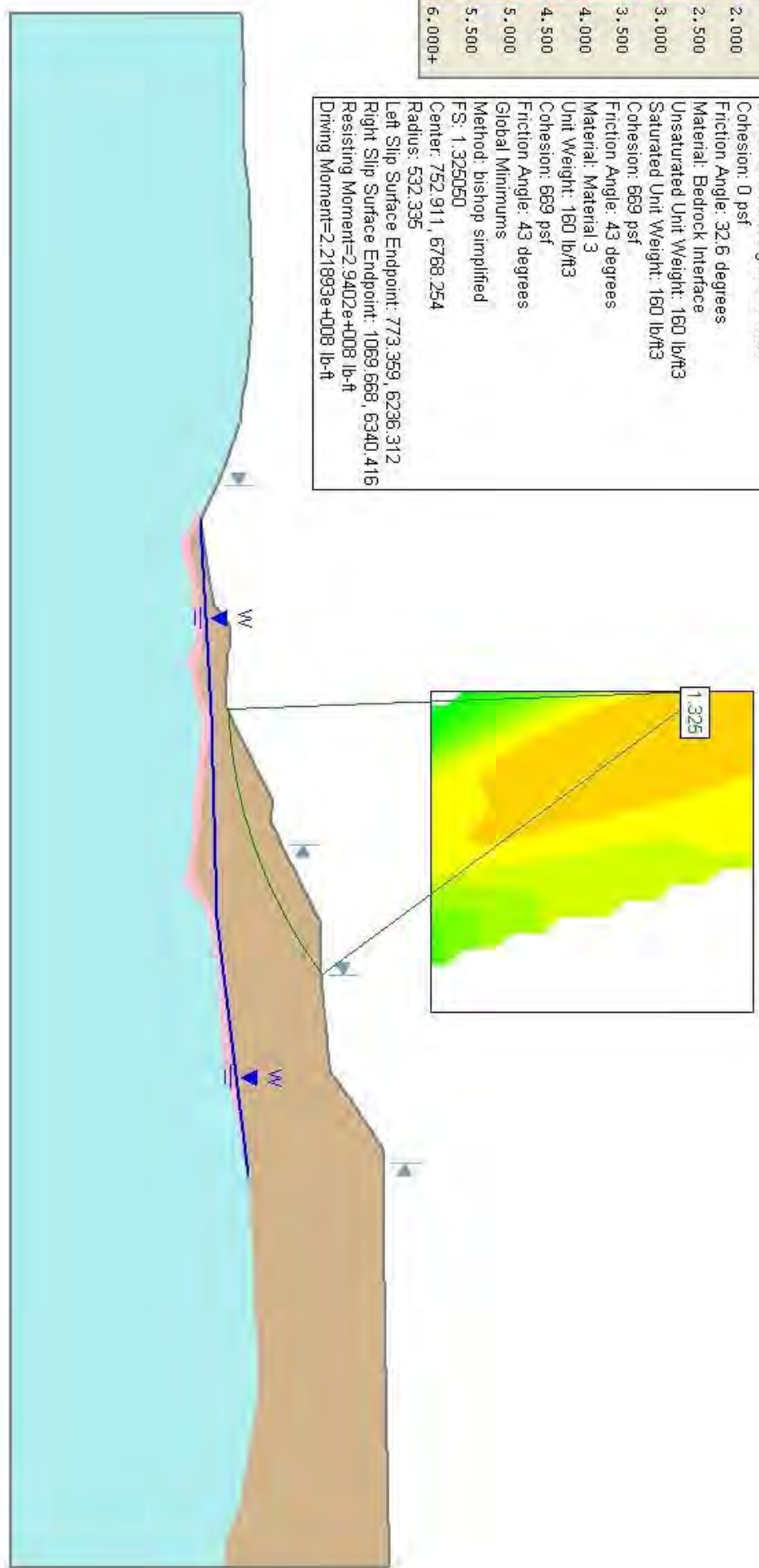




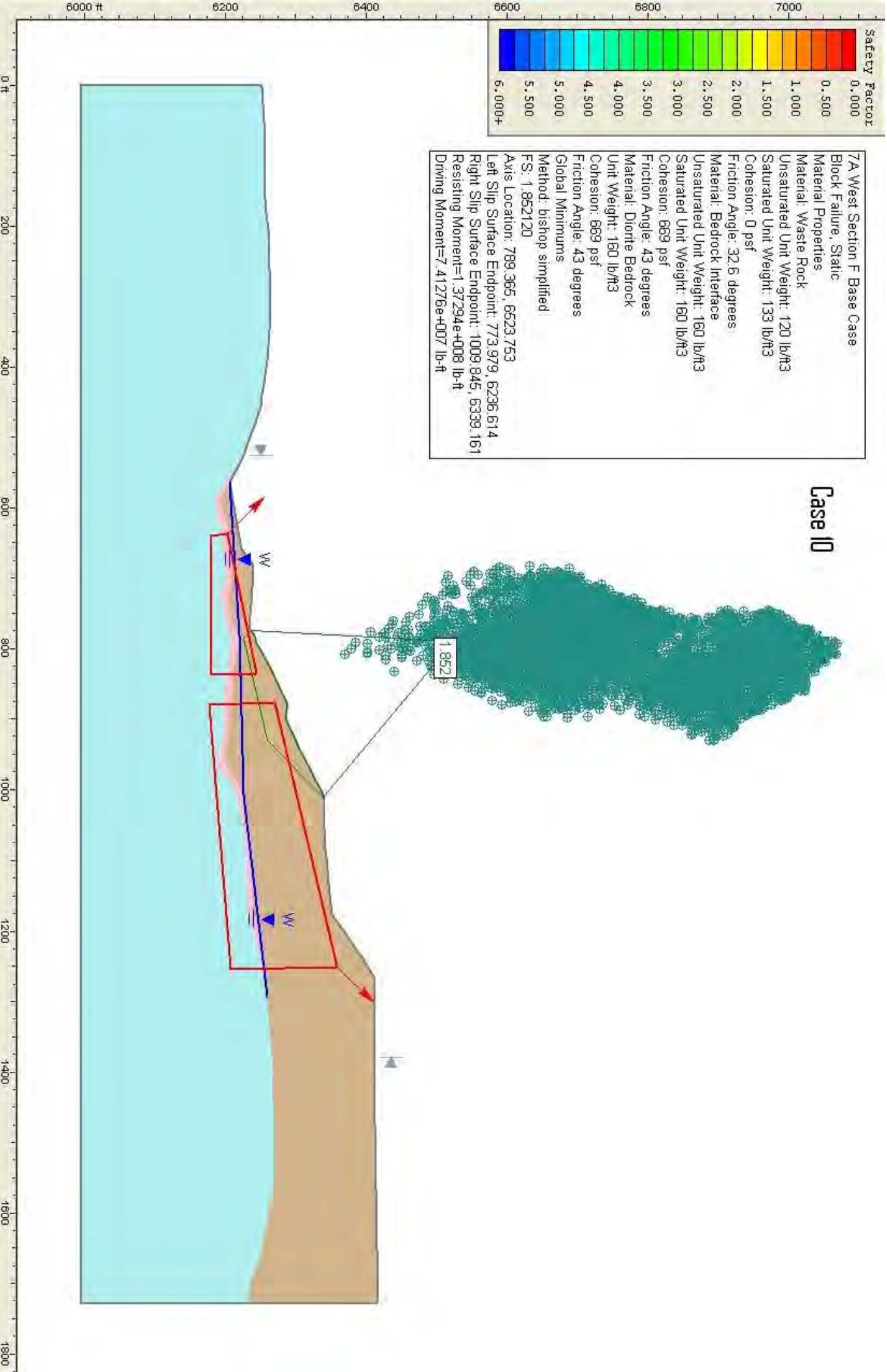
Case 9

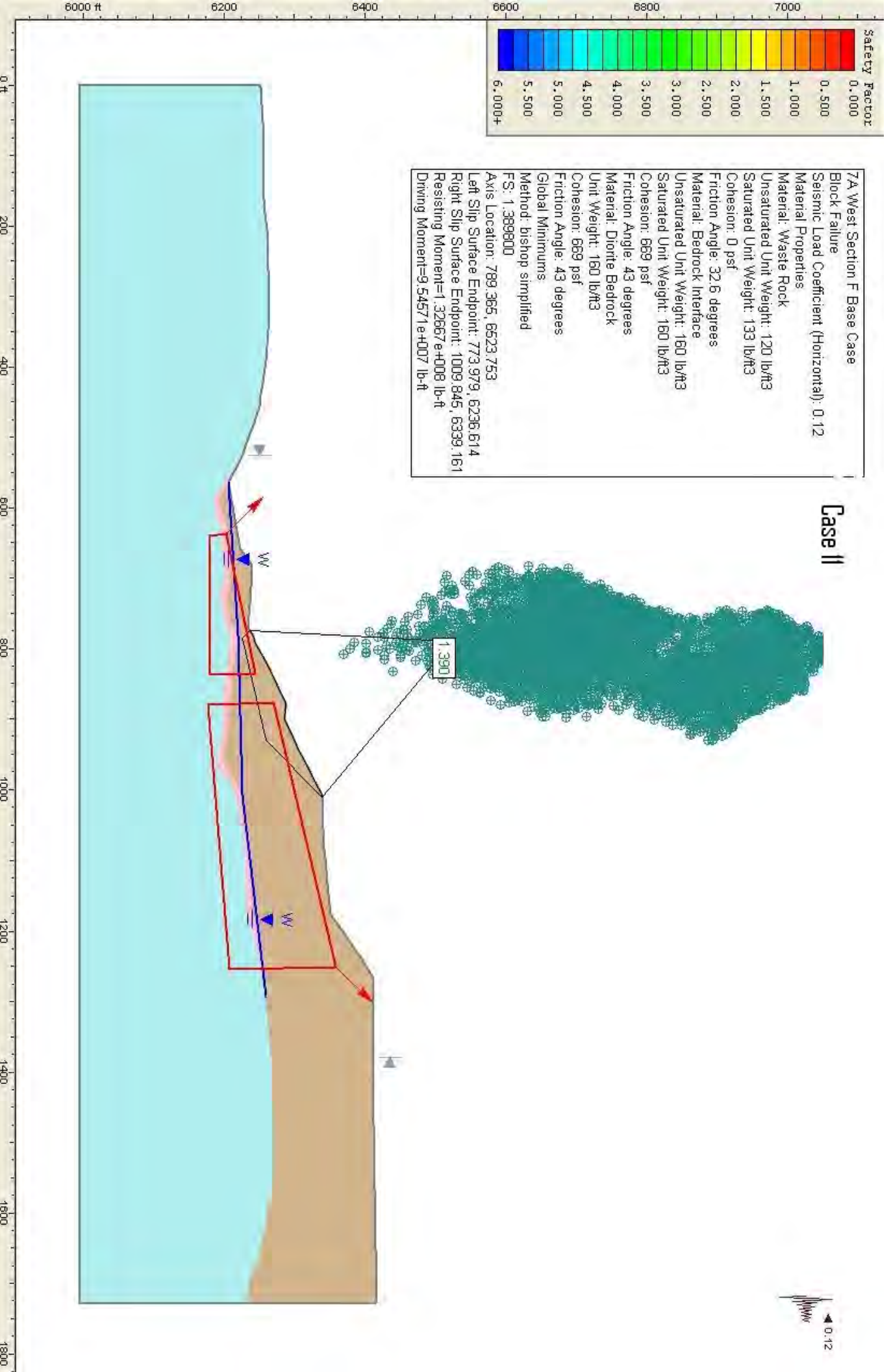


7A West, Section F Base Case
Circular Failure
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Waste Rock
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.325050
Center: 752.911, 6768.254
Radius: 532.335
Left Slip Surface Endpoint: 773.369, 6236.312
Right Slip Surface Endpoint: 1069.668, 6340.416
Resisting Moment=2.9402e+008 lb-ft
Driving Moment=2.21893e+008 lb-ft

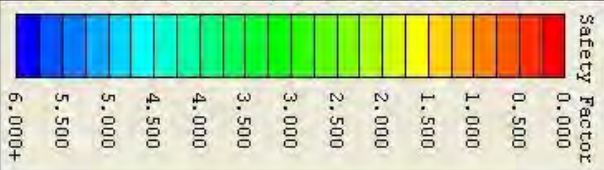


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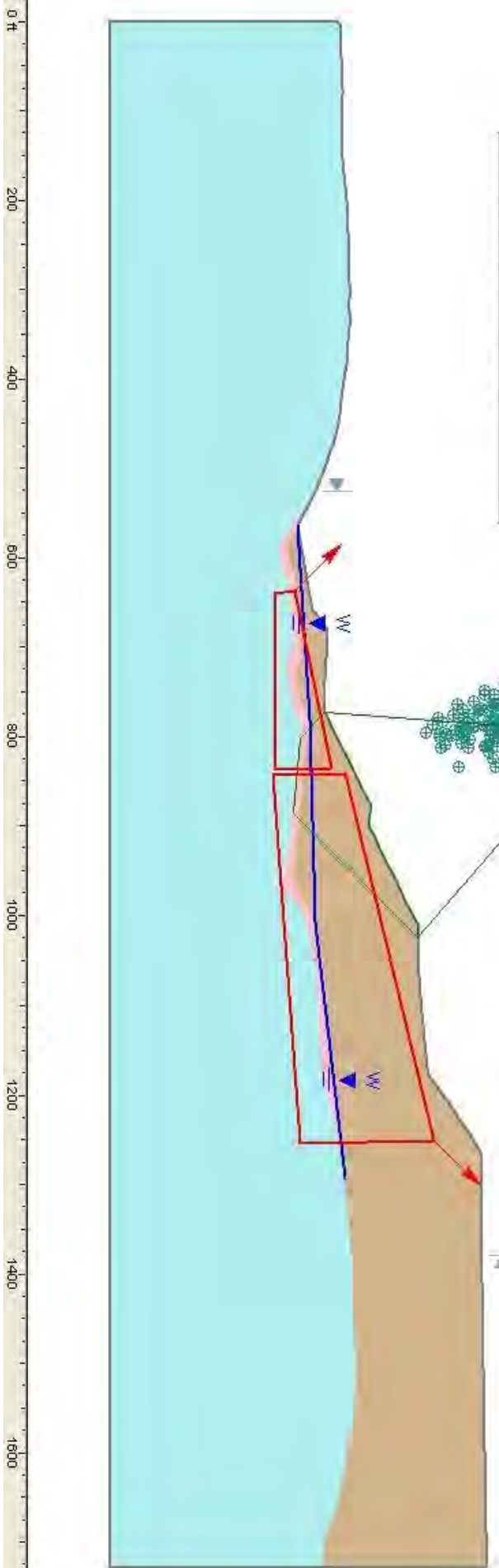




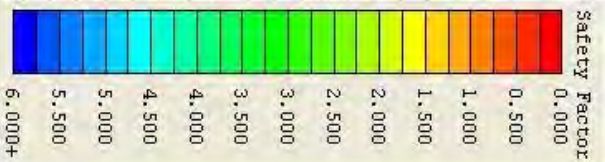
Case 12



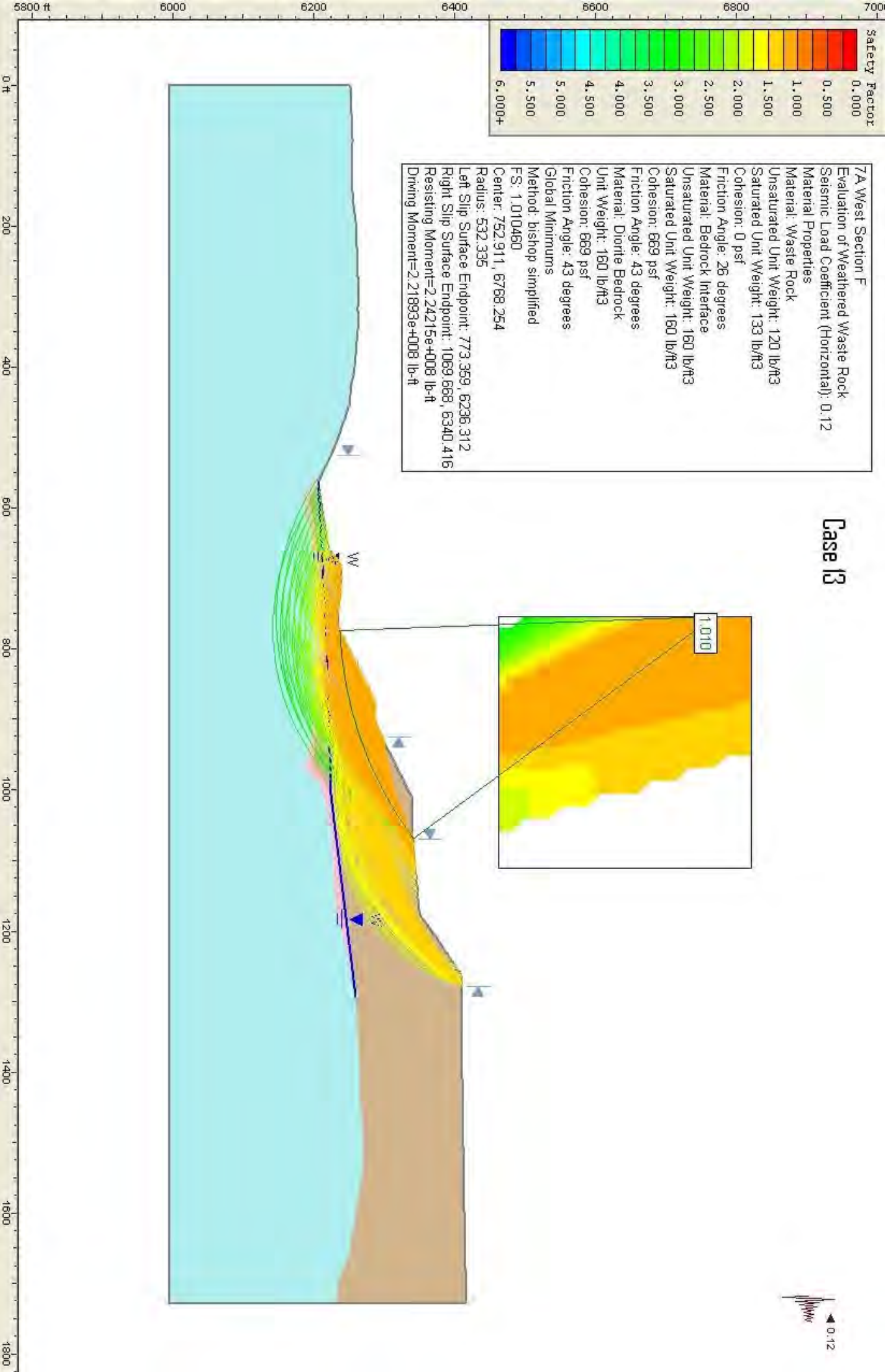
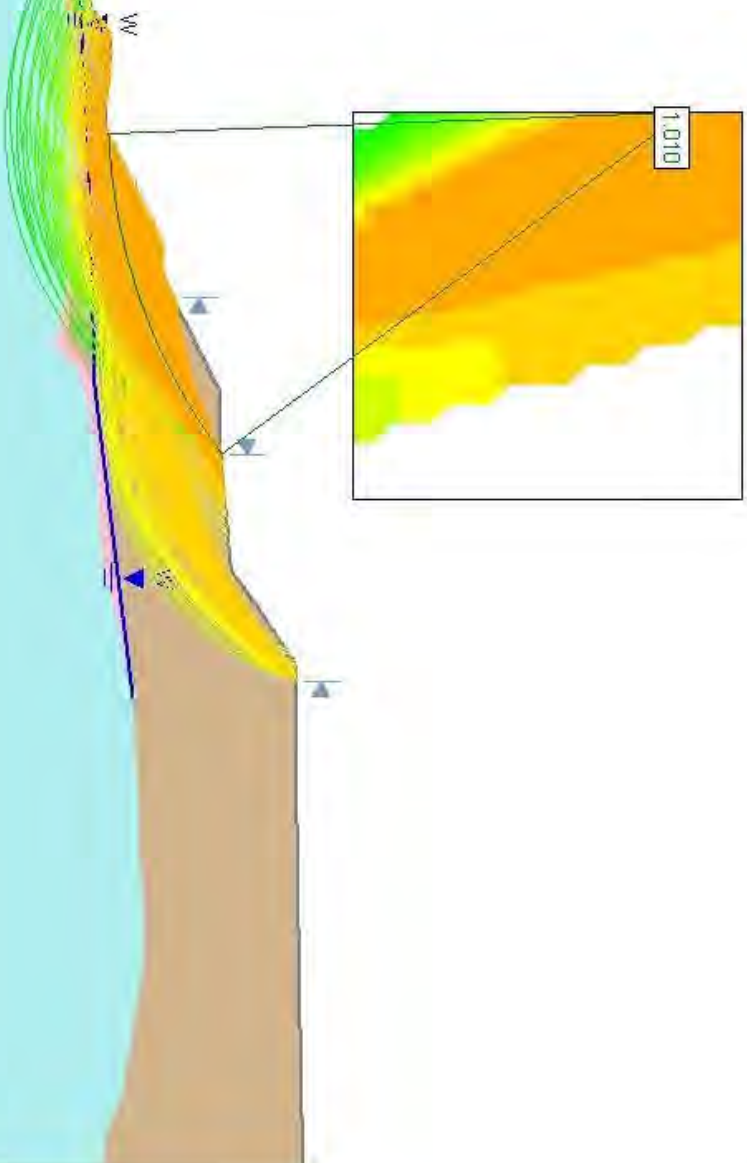
7A West Section F
 Weak Interface Analysis
 Global Failure, Block Mode
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Waste Rock
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 32.6 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 5 degrees
 Material: Diorite Bedrock
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 1.054210
 Axis Location: 794.159, 6538.189
 Left Slip Surface Endpoint: 772.252, 6235.773
 Right Slip Surface Endpoint: 1022.947, 6339.215
 Resisting Moment=1.65574e+008 lb-ft
 Driving Moment=1.5706e+008 lb-ft

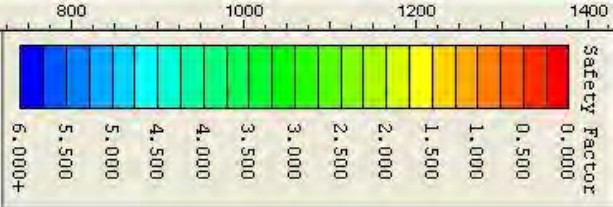


Case 13



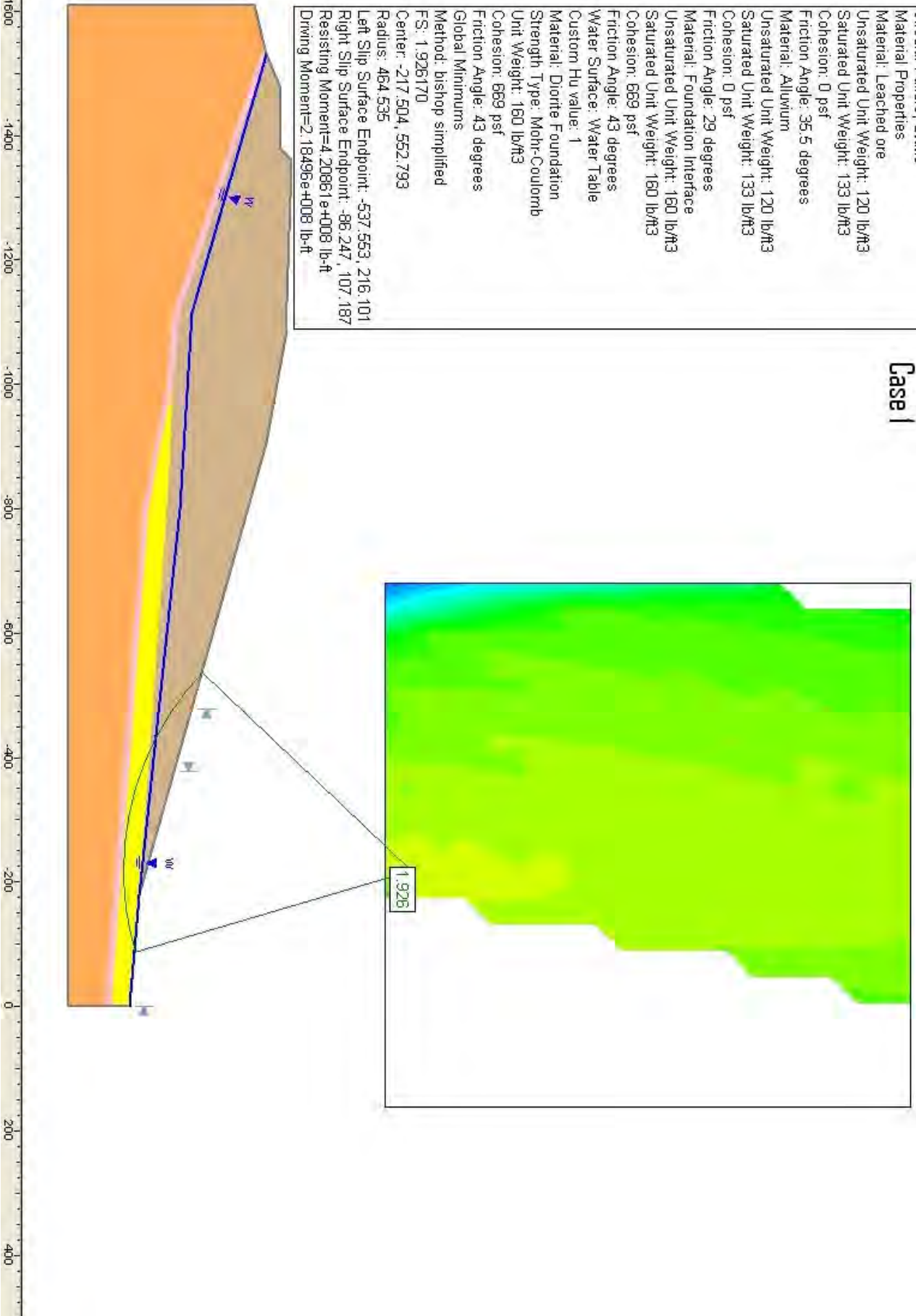
7A West Section F
 Evaluation of Weathered Waste Rock
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Waste Rock
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 26 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Diorite Bedrock
 Unit Weight: 160 lb/ft³
 Cohesion: 889 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 1.010460
 Center: 752,911, 6768,254
 Radius: 532,335
 Left Slip Surface Endpoint: 773,359, 6236,312
 Right Slip Surface Endpoint: 1069,668, 6340,416
 Resisting Moment=2,24215e+008 lb-ft
 Driving Moment=2,21893e+008 lb-ft



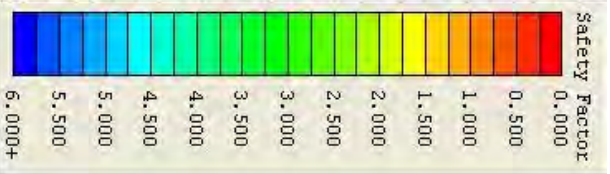


IC Stockpile Section C Base Case
Circular Failure, Static
Material Properties
Material: Leached ore
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Material: Alluvium
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Foundation Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Diorite Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.926170
Center: -217.504, 552.793
Radius: 464.535
Left Slip Surface Endpoint: -537.553, 216.101
Right Slip Surface Endpoint: -86.247, 107.187
Resisting Moment=4.20861e+008 lb-ft
Driving Moment=2.18496e+008 lb-ft

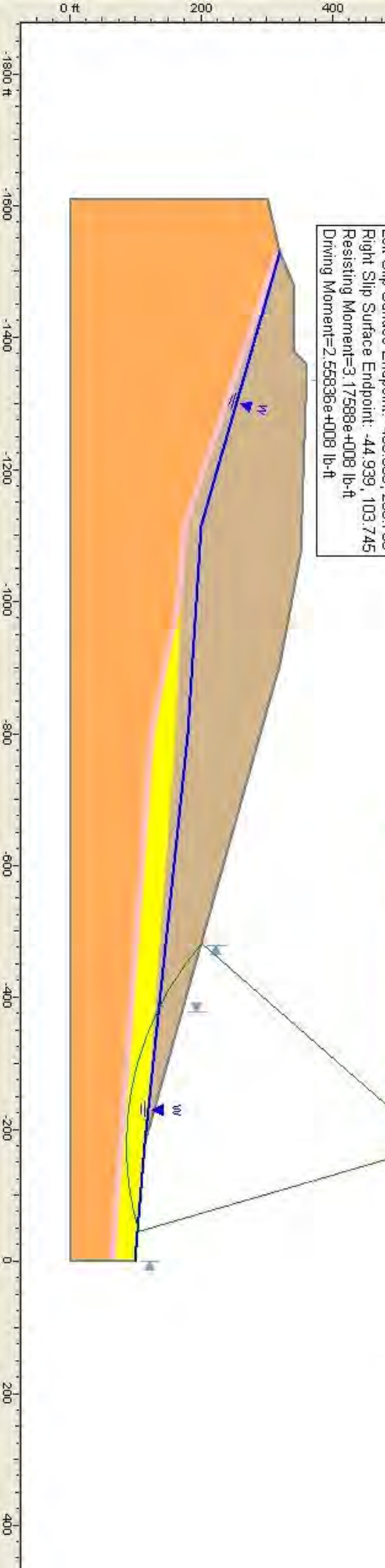
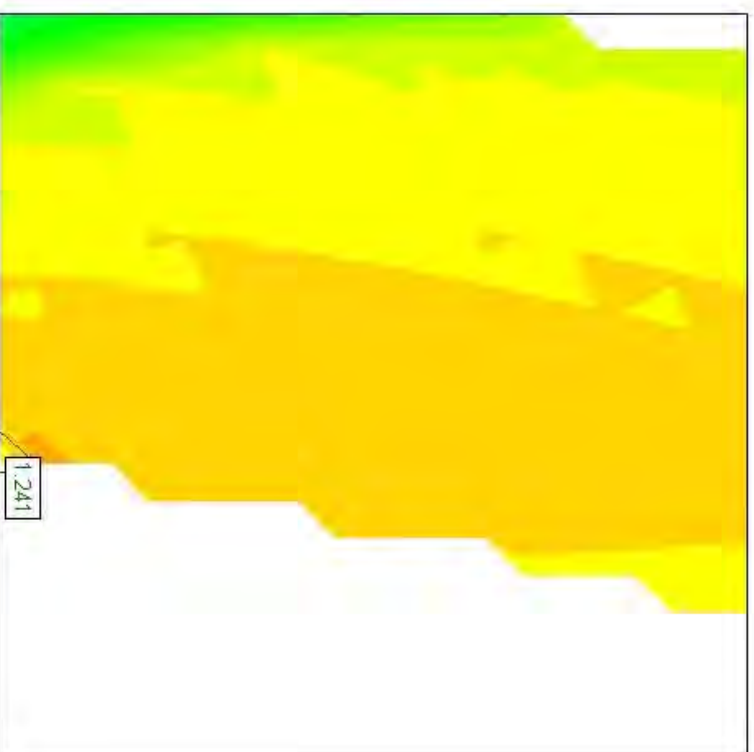
Case I



Case 2

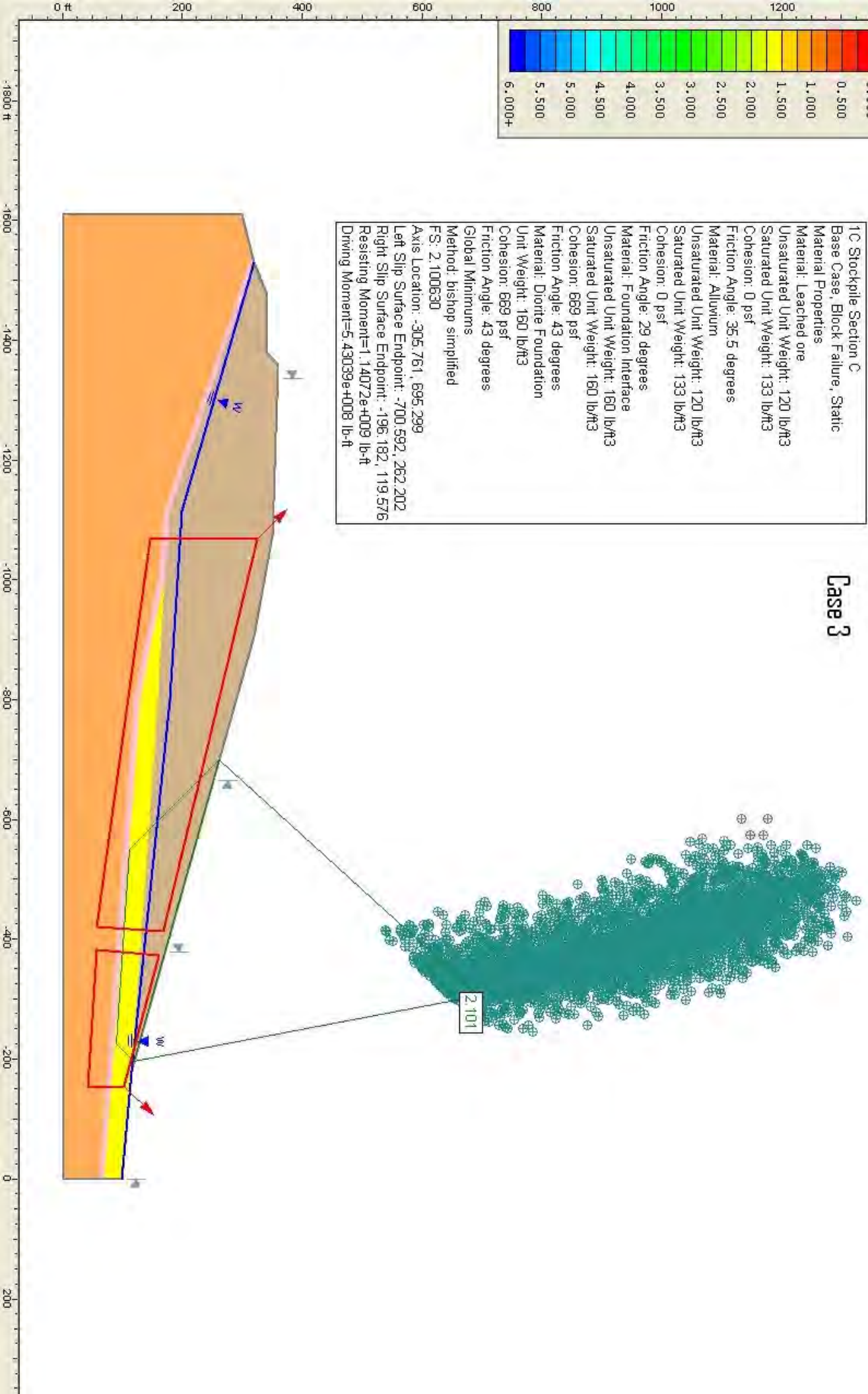
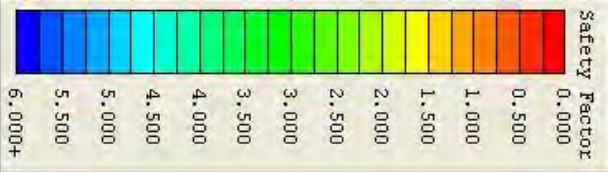


1C Stockpile, Base Case, Section C
 Circular Failure Mode
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Foundation Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 1.241370
 Center: -175.372, 552.793
 Radius: 467.608
 Left Slip Surface Endpoint: -483.085, 200.700
 Right Slip Surface Endpoint: -44.939, 103.745
 Resisting Moment=3.17588e+008 lb-ft
 Driving Moment=2.55836e+008 lb-ft

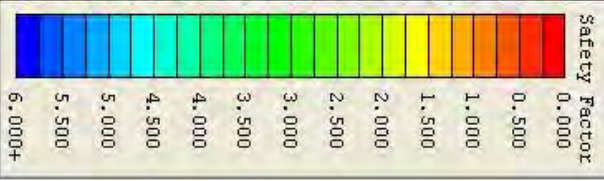


Case 3

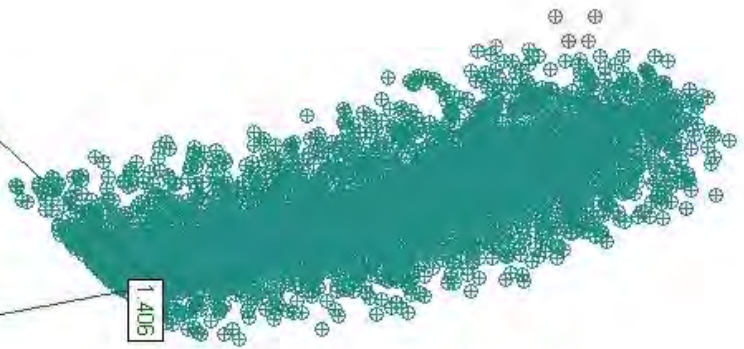
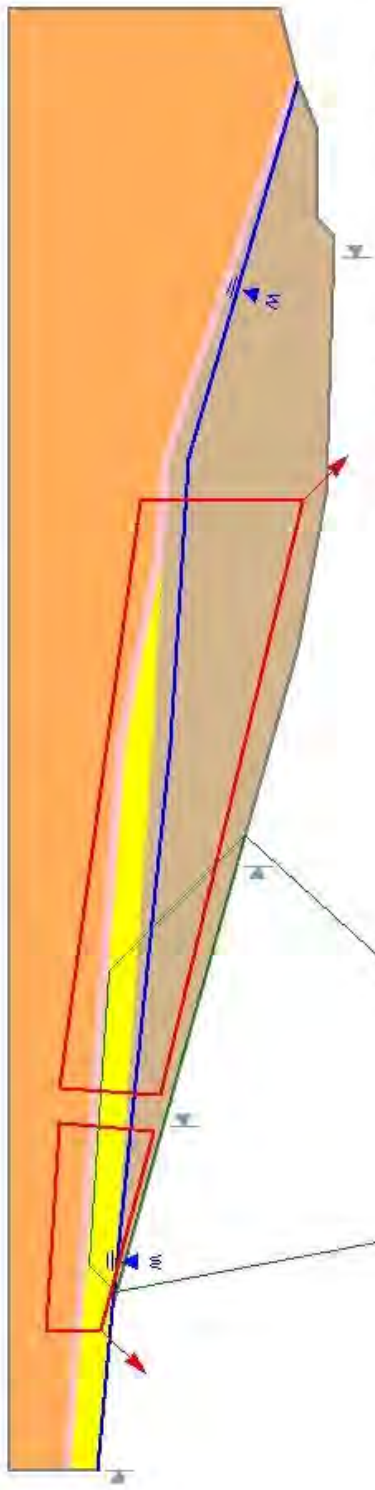
1C Stockpile Section C
Base Case, Block Failure, Static
Material Properties
Material: Leached ore
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Material: Alluvium
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Foundation Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Diorite Foundation
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 2.100630
Axis Location: -305.761, 695.299
Left Slip Surface Endpoint: -700.592, 262.202
Right Slip Surface Endpoint: -196.182, 119.576
Resisting Moment=1.14072e+009 lb-ft
Driving Moment=5.43039e+008 lb-ft



Case 4

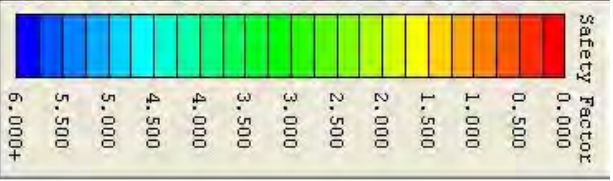


1) C Stockpile Section C Base Case
 Block Failure Mode
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Foundation Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Global Minimums
 Method: bishop simplified
 FS: 1.406120
 Axis Location: -305,761, 695,299
 Left Slip Surface Endpoint: -700,592, 262,202
 Right Slip Surface Endpoint: -196,182, 119,576
 Resisting Moment=1.0995e+009 lb-ft
 Driving Moment=7.81937 e+008 lb-ft

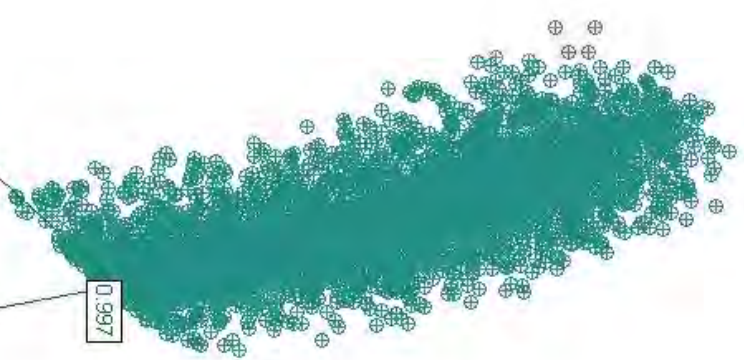
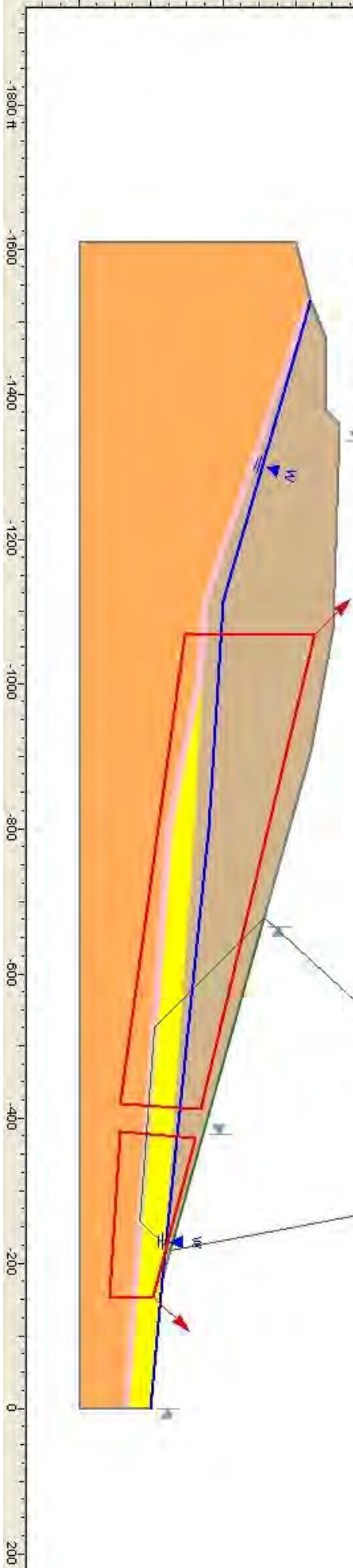


1.406

Case 5

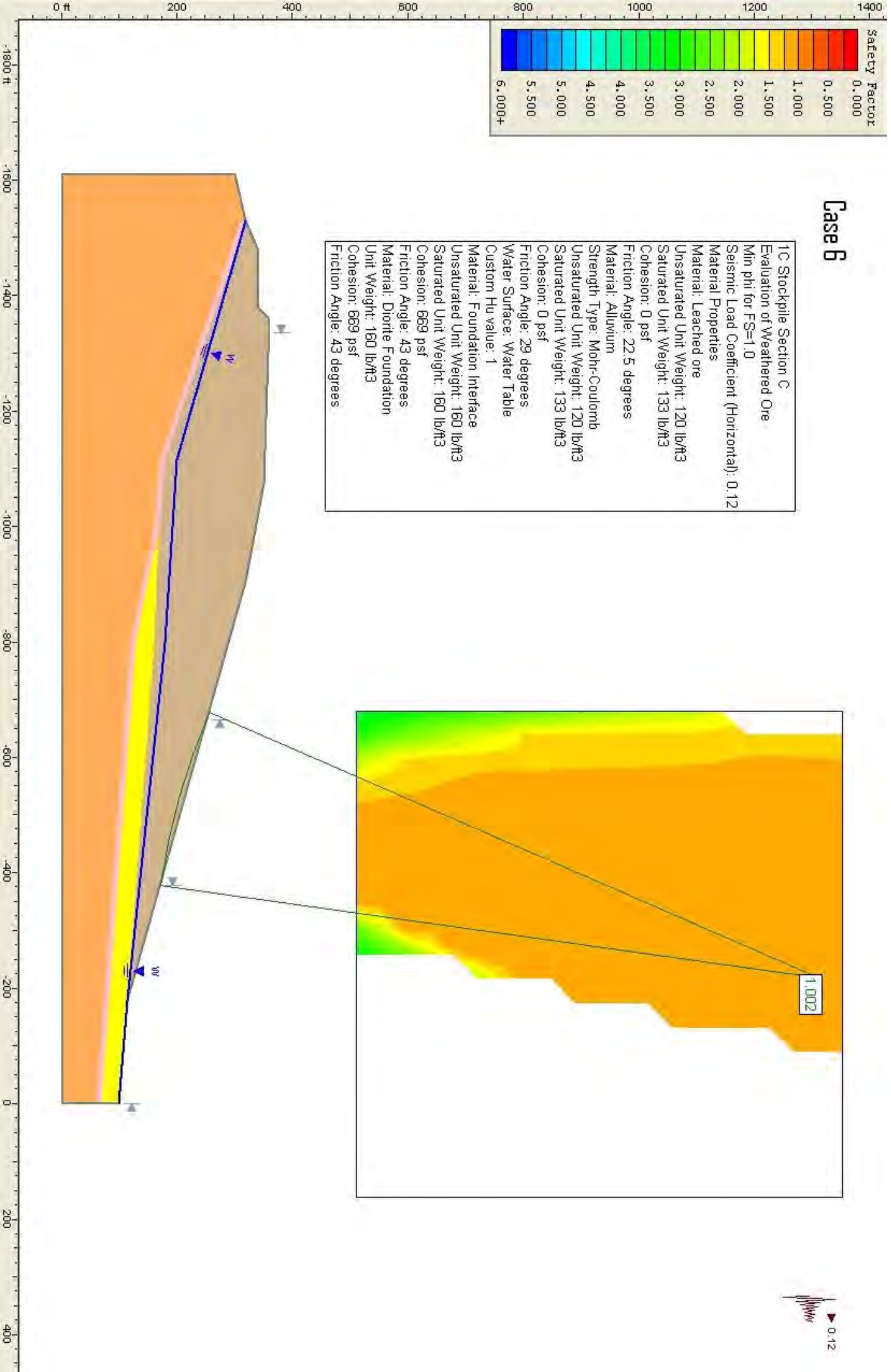
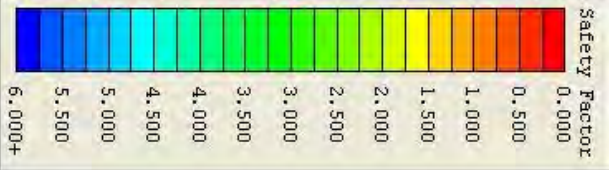


1C Stockpile Section C
 Evaluation of Weak Interface
 Min interface Phi for FS=1.0
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Foundation Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 15 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 0.997086
 Axis Location: -317.567, 650.065
 Left Slip Surface Endpoint: -677.193, 255.586
 Right Slip Surface Endpoint: -217.759, 125.677
 Resisting Moment=6.38908e+008 lb-ft
 Driving Moment=6.38782e+008 lb-ft

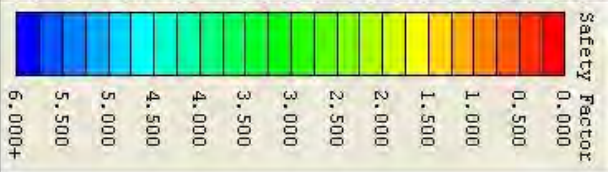


Case 6

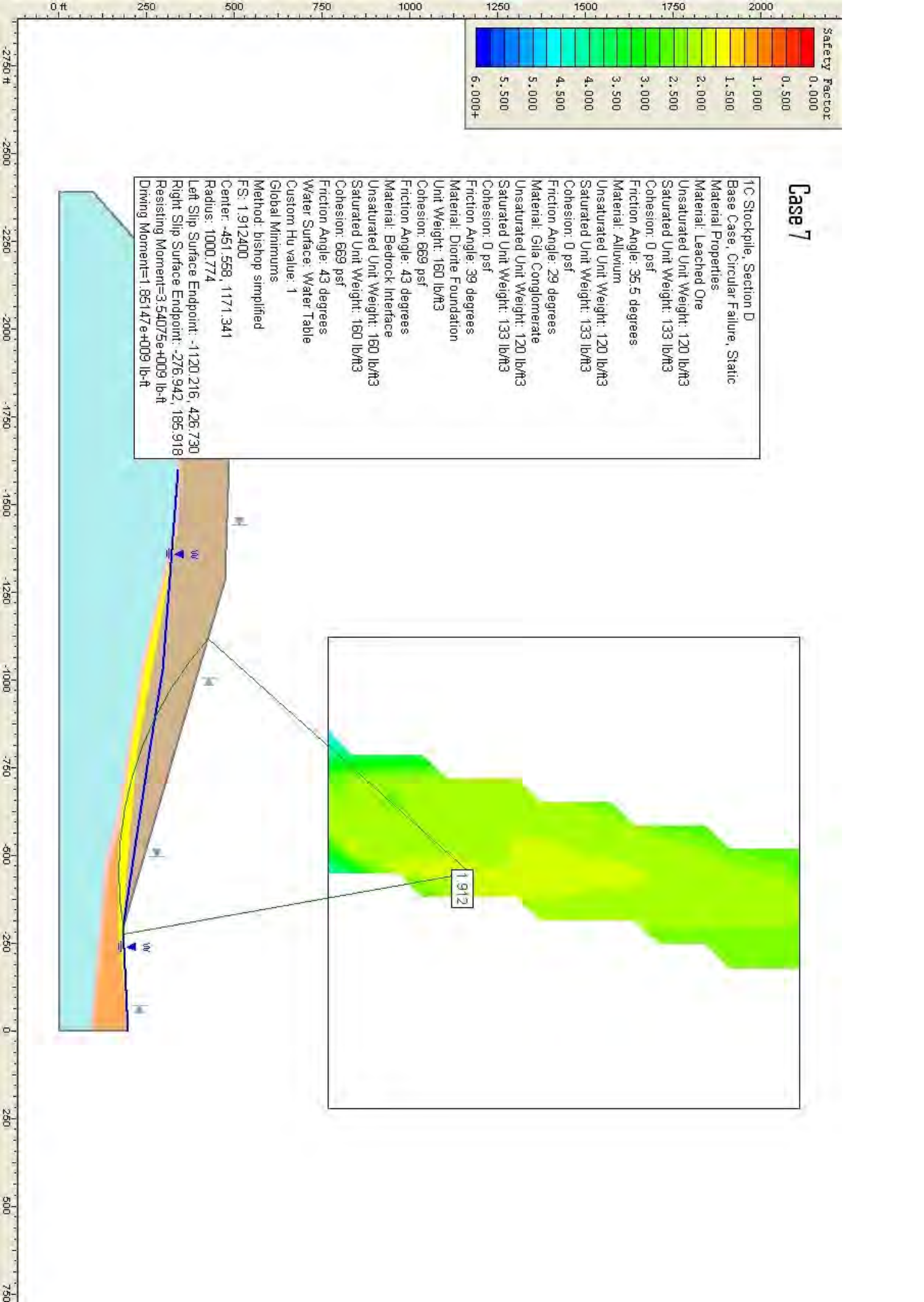
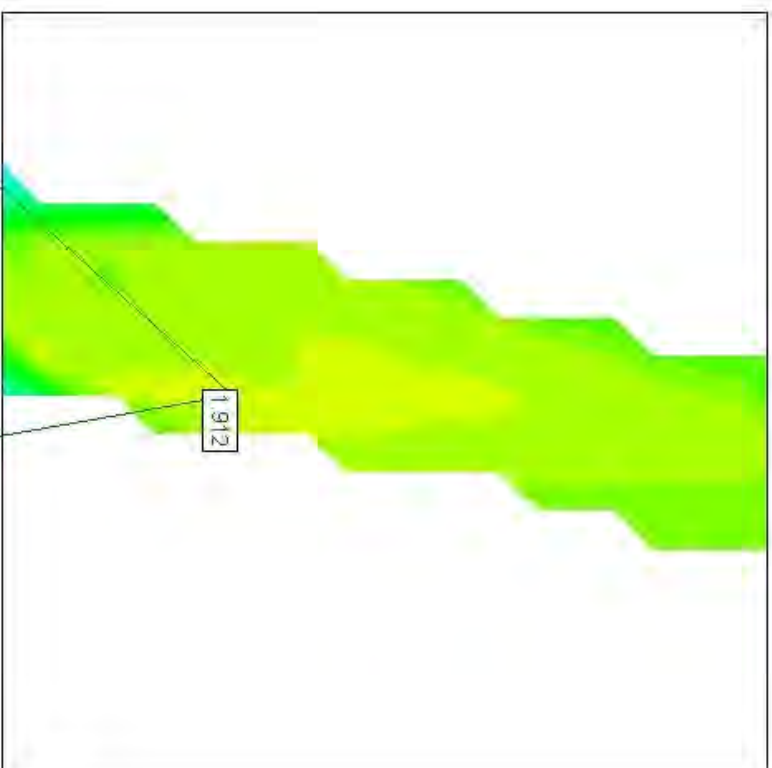
TC Stockpile Section C
 Evaluation of Weathered Ore
 Min phi for FS=1.0
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 22.5 degrees
 Material: Alluvium
 Strength Type: Mohr-Coulomb
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Water Surface: Water Table
 Custom Hu value: 1
 Material: Foundation Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees



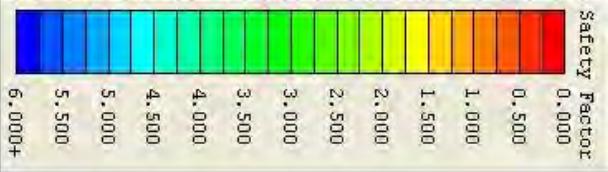
Case 7



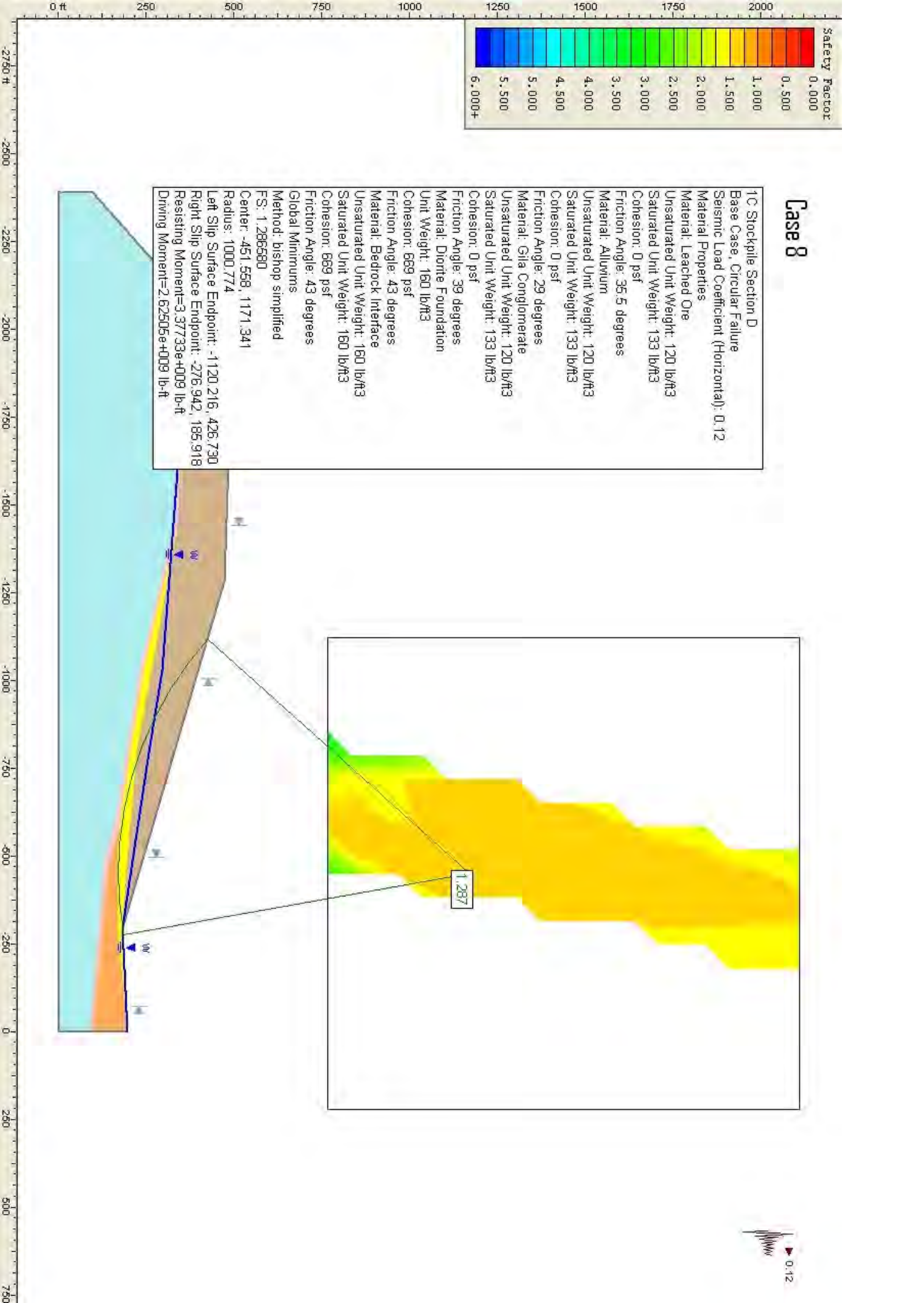
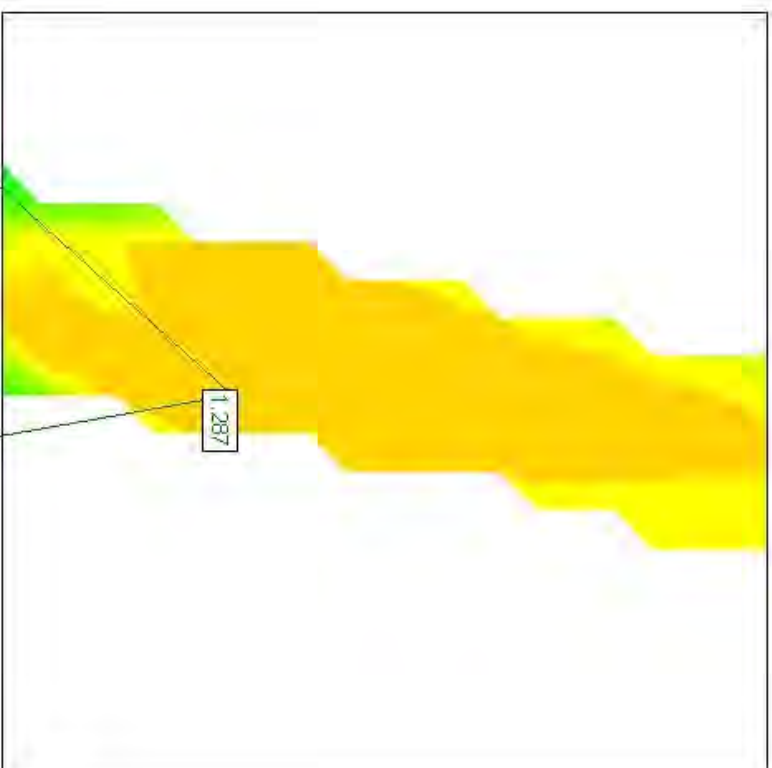
1C Stockpile, Section D
Base Case, Circular Failure, Static
Material Properties
Material: Leached Ore
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Material: Alluvium
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Gila Conglomerate
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 39 degrees
Material: Diorite Foundation
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Water Surface: Water Table
Custom Hu value: 1
Global Minimums
Method: bishop simplified
FS: 1.912400
Center: -451,558, 1171,341
Radius: 1000,774
Left Slip Surface Endpoint: -1120,216, 426,730
Right Slip Surface Endpoint: -276,942, 185,918
Resisting Moment=3,54075e+009 lb-ft
Driving Moment=1,85147e+009 lb-ft



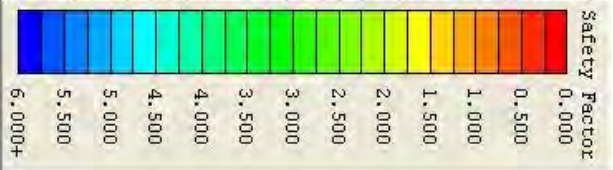
Case 8



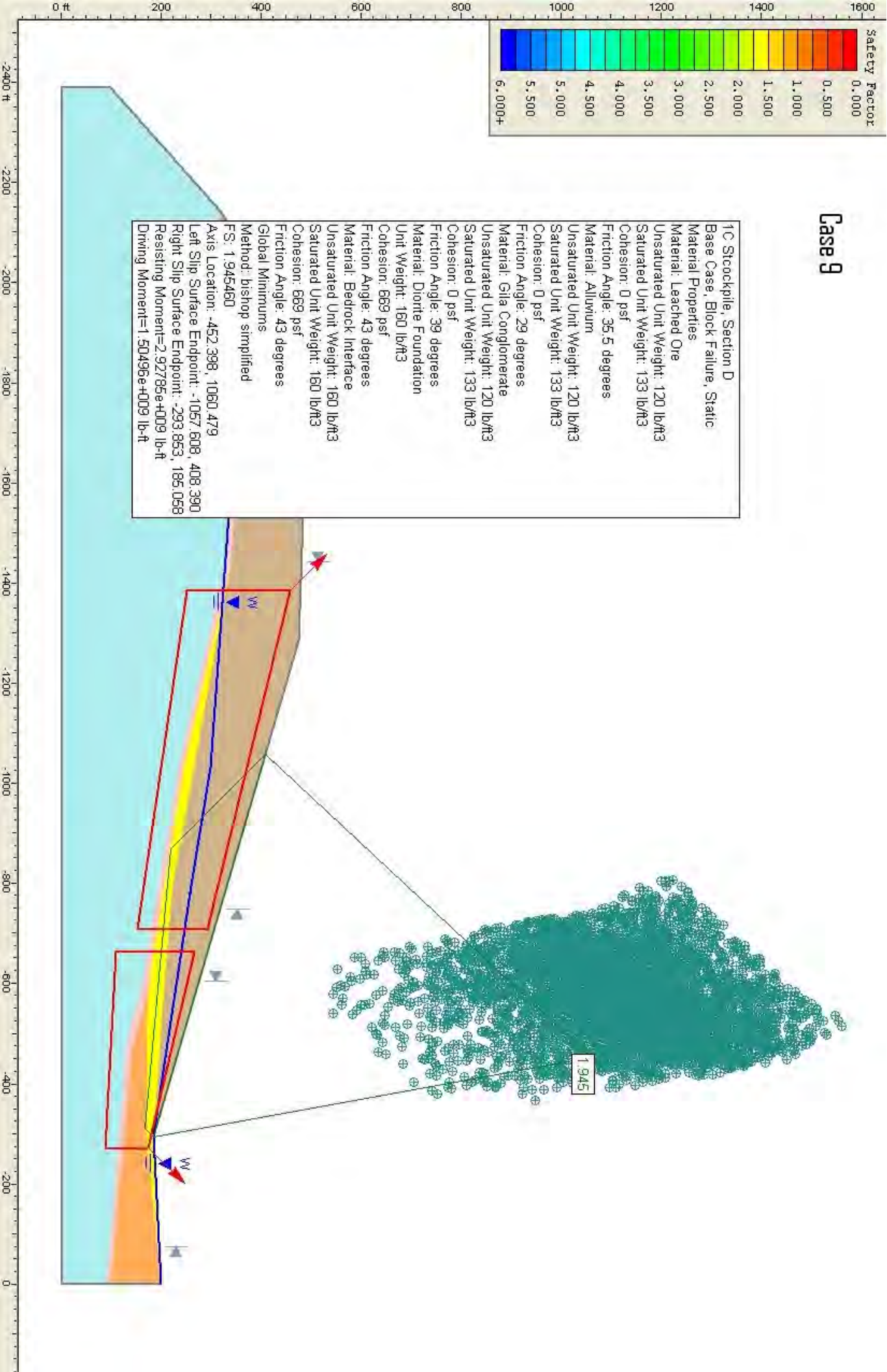
1C Stockpile Section D
 Base Case, Circular Failure
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached Ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Gila Conglomerate
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 39 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 1.286580
 Center: -451.558, 1171.341
 Radius: 1000.774
 Left Slip Surface Endpoint: -1120.216, 426.730
 Right Slip Surface Endpoint: -276.942, 185.918
 Resisting Moment=3.37733e+009 lb-ft
 Driving Moment=2.62505e+009 lb-ft



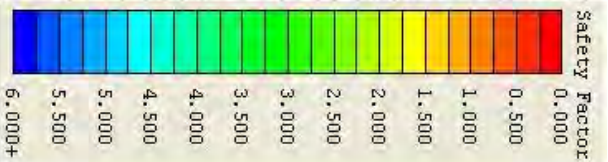
Case 9



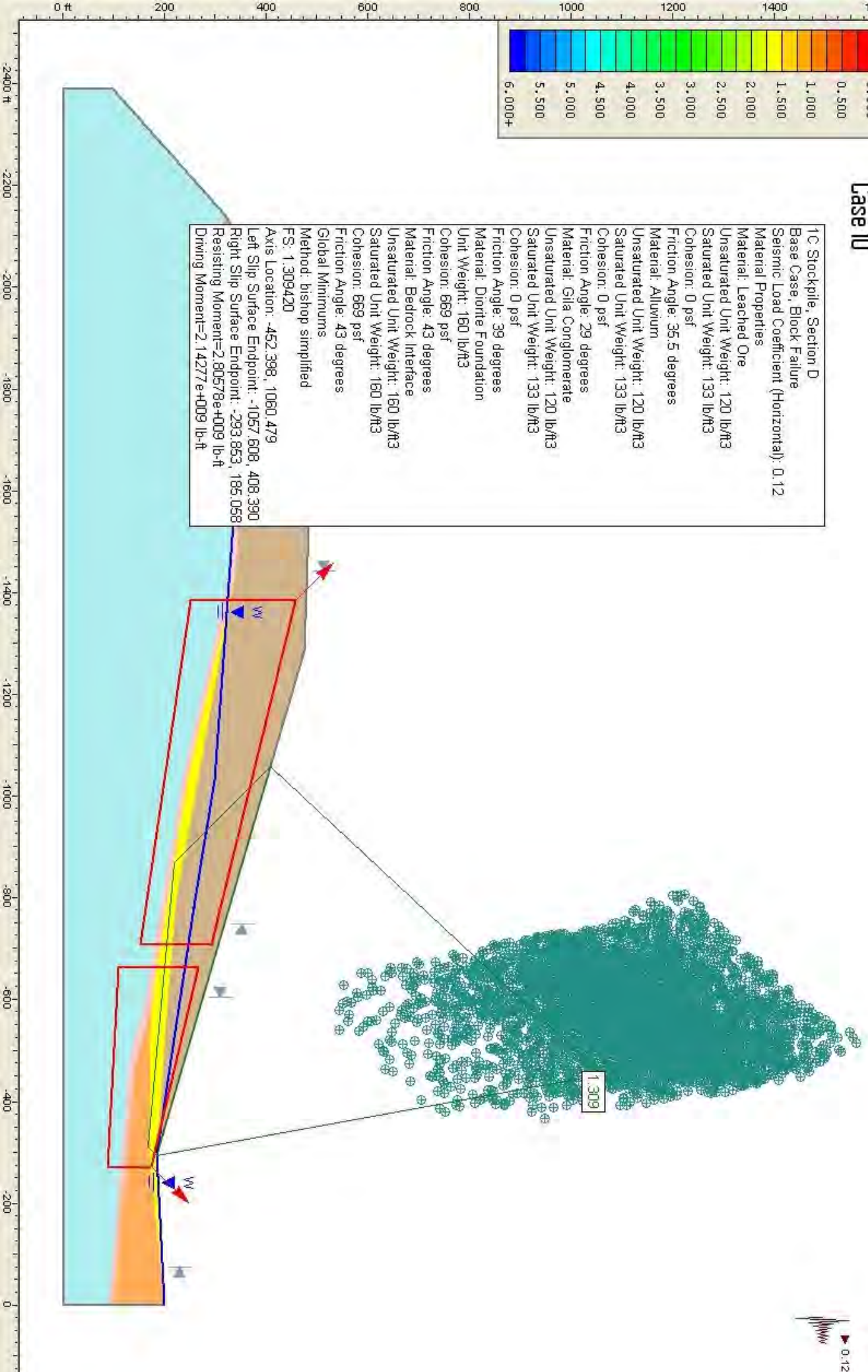
1C Stockpile, Section D
 Base Case, Block Failure, Static
 Material Properties
 Material: Leached Ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Gila Conglomerate
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 39 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Global Minimums
 Method: bishop simplified
 FS: 1.945460
 Axis Location: -452.398, 1060.479
 Left Slip Surface Endpoint: -1057.608, 408.390
 Right Slip Surface Endpoint: -293.863, 186.068
 Resisting Moment=2.92785e+009 lb-ft
 Driving Moment=1.50496e+009 lb-ft



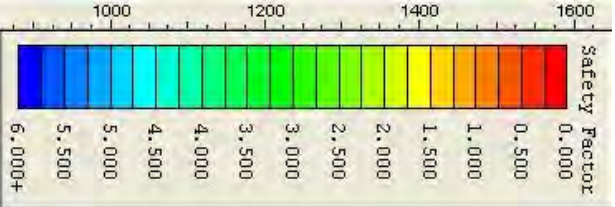
Case ID



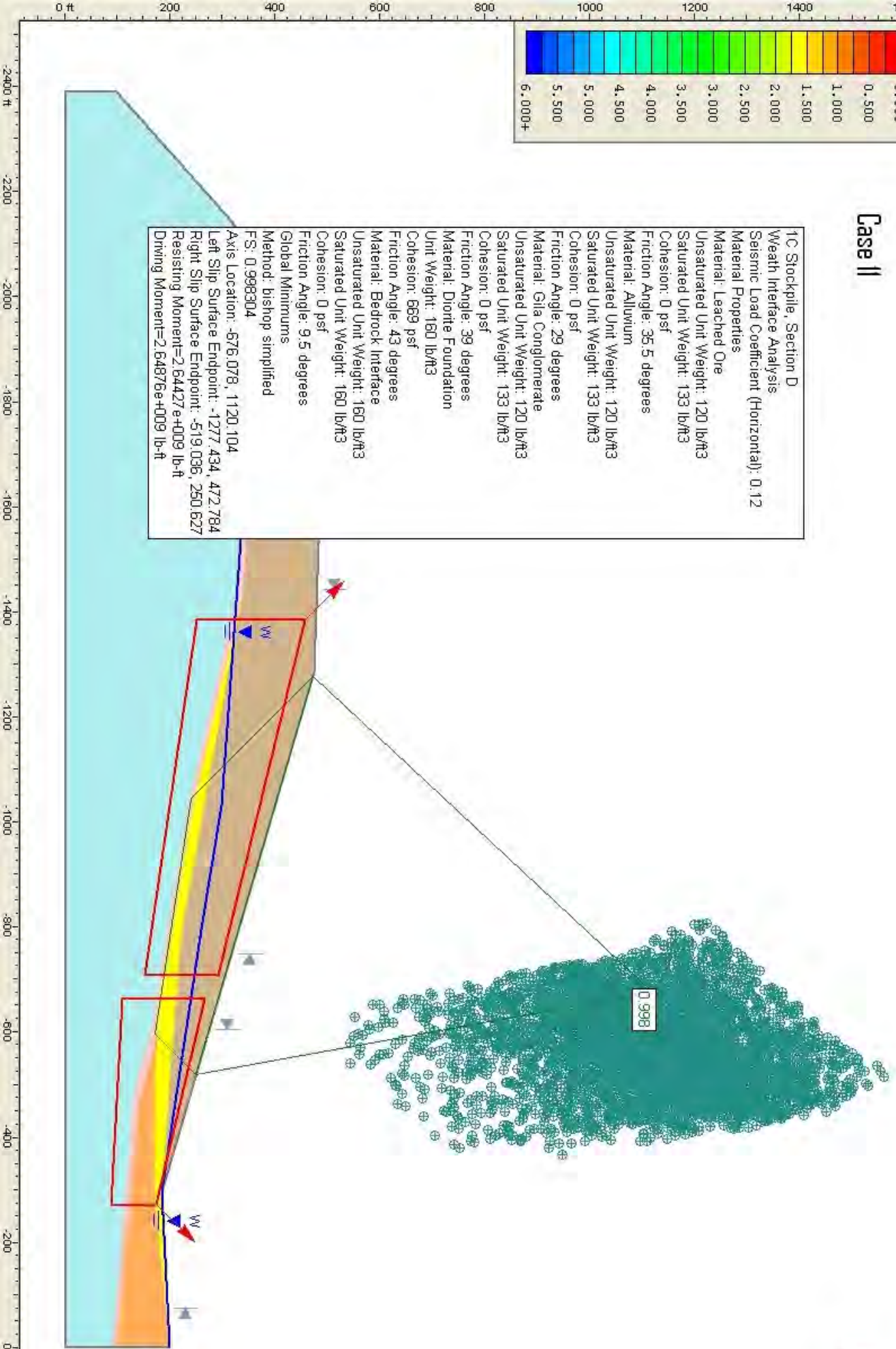
1C Stockpile, Section D
Base Case, Block Failure
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Leached Ore
Unsaturated Unit Weight: 120 lb/ft ³
Saturated Unit Weight: 133 lb/ft ³
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Material: Alluvium
Unsaturated Unit Weight: 120 lb/ft ³
Saturated Unit Weight: 133 lb/ft ³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Gila Conglomerate
Unsaturated Unit Weight: 120 lb/ft ³
Saturated Unit Weight: 133 lb/ft ³
Cohesion: 0 psf
Friction Angle: 39 degrees
Material: Diorite Foundation
Unit Weight: 160 lb/ft ³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft ³
Saturated Unit Weight: 160 lb/ft ³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.309420
Axis Location: -452.398, 1060.479
Left Slip Surface Endpoint: -1067.608, 408.390
Right Slip Surface Endpoint: -293.653, 185.058
Resisting Moment=2.80578e+009 lb-ft
Driving Moment=2.14277e+009 lb-ft



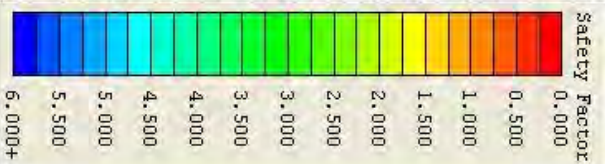
Case II



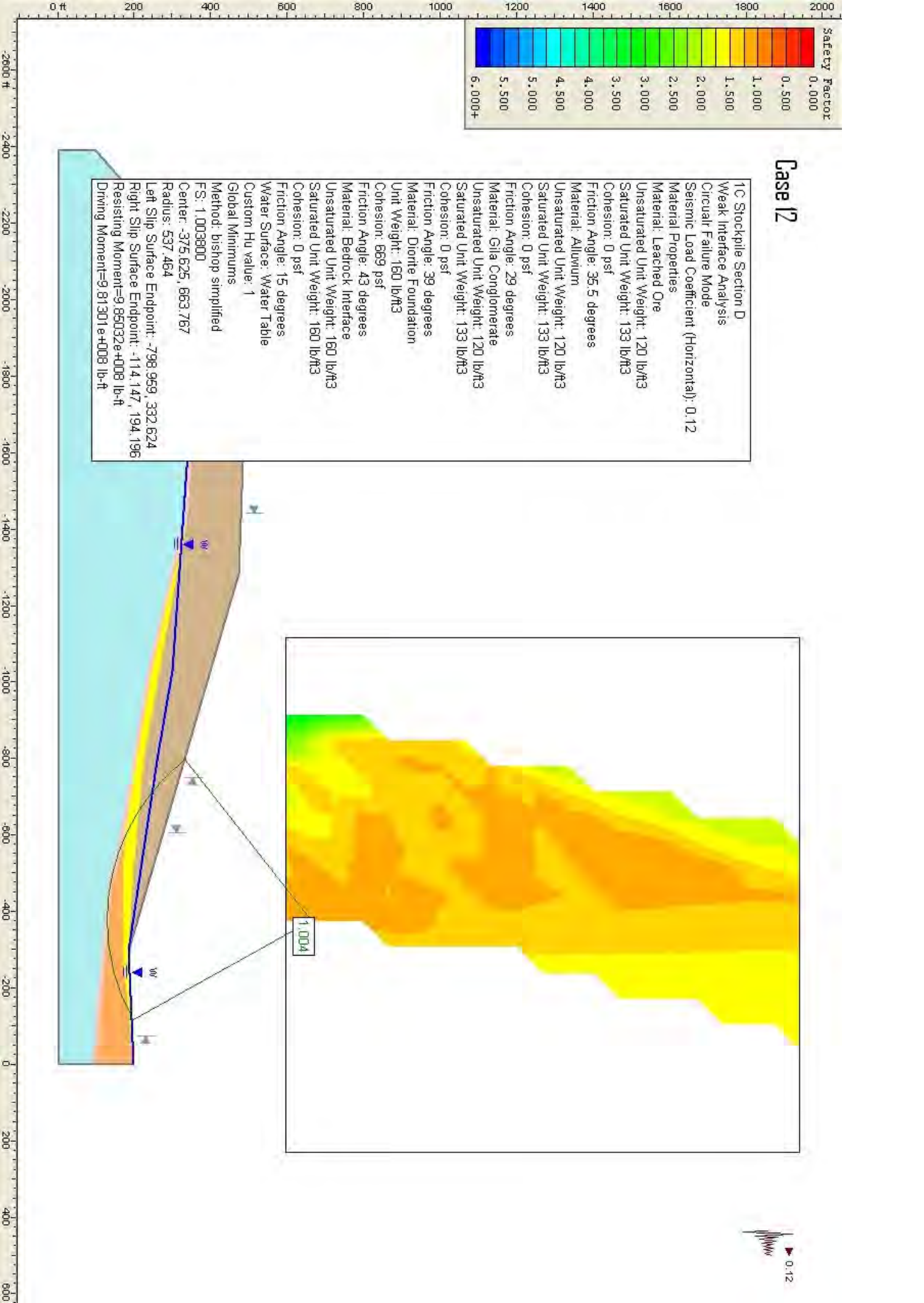
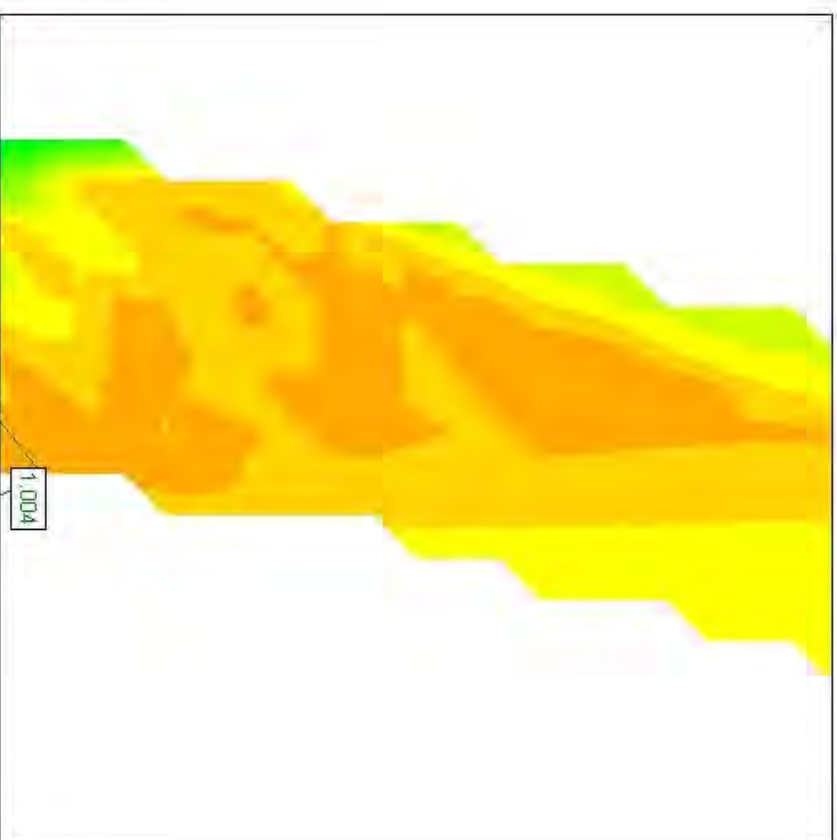
1C Stockpile, Section D
 Weath Interface Analysis
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached Ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Gila Conglomerate
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 39 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 9.5 degrees
 Global Minimums
 Method: bishop simplified
 FS: 0.998304
 Axis Location: -576.078, 1120.104
 Left Slip Surface Endpoint: -1277.434, 472.784
 Right Slip Surface Endpoint: -519.036, 250.627
 Resisting Moment=2.64427e+009 lb-ft
 Driving Moment=2.64876e+009 lb-ft



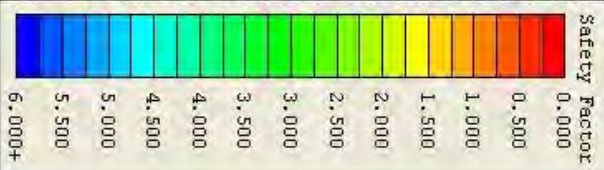
Case 12



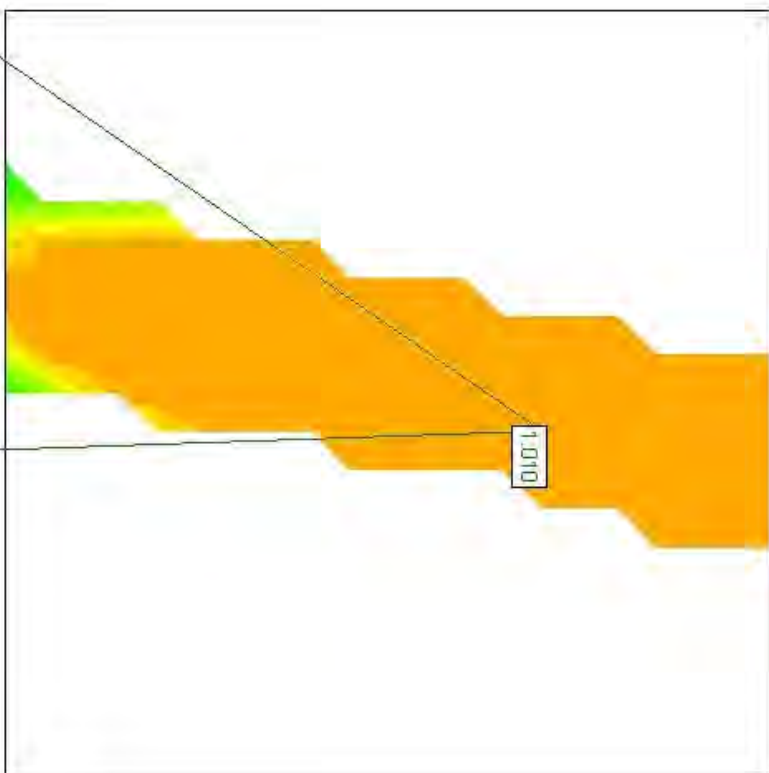
1C Stockpile Section D
 Weak Interface Analysis
 Circular Failure Mode
 Seismic Load Coefficient (Horizontal): 0.12
 Material Properties
 Material: Leached Ore
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 35.5 degrees
 Material: Alluvium
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 29 degrees
 Material: Gila Conglomerate
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 39 degrees
 Material: Diorite Foundation
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Bedrock Interface
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 15 degrees
 Water Surface: Water Table
 Custom Hu value: 1
 Global Minimums
 Method: bishop simplified
 FS: 1.003800
 Center: -375.625, 863.767
 Radius: 537.464
 Left Slip Surface Endpoint: -798.959, 332.624
 Right Slip Surface Endpoint: -114.147, 194.196
 Resisting Moment=9.85032e+008 lb-ft
 Driving Moment=9.81301e+008 lb-ft

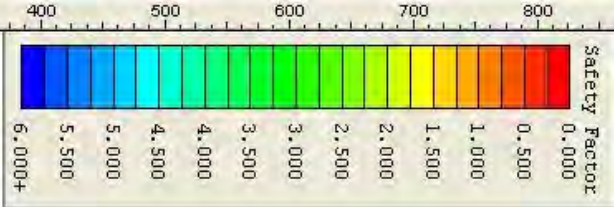


Case 13



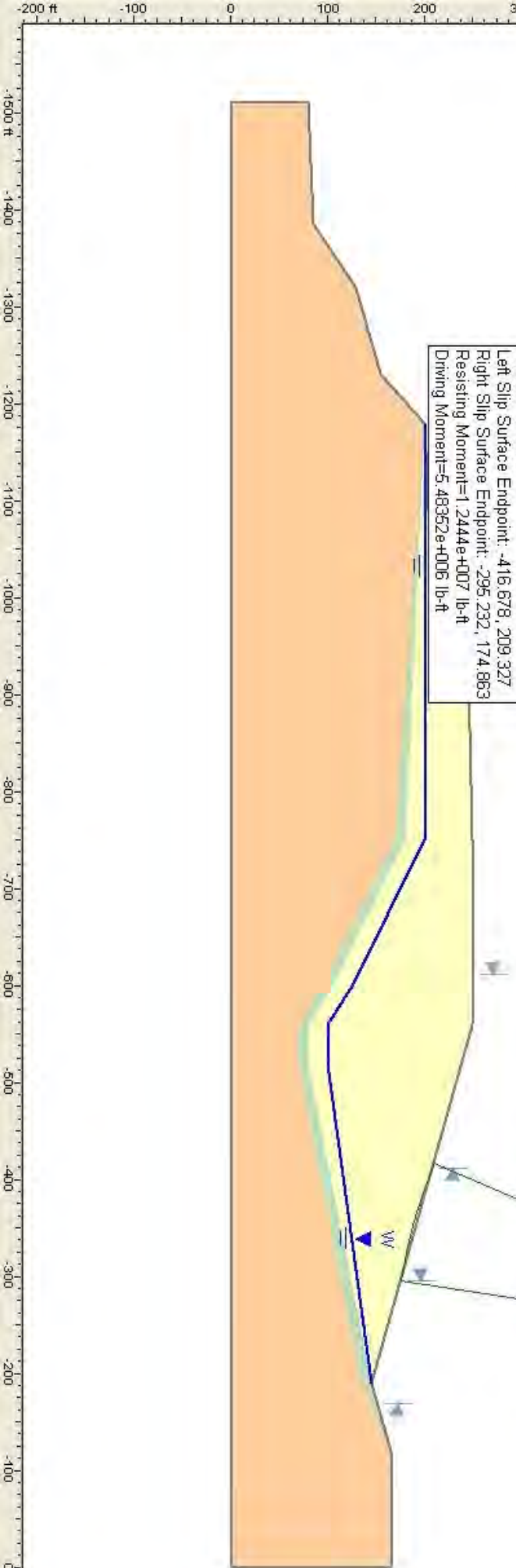
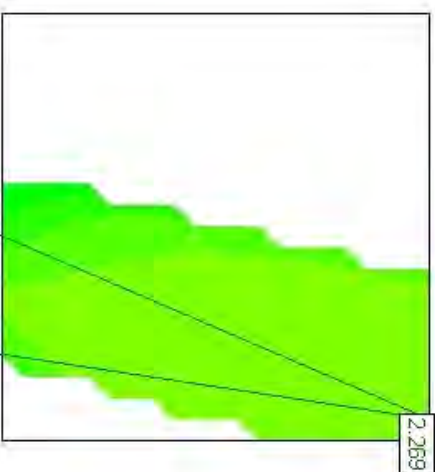
1C Stockpile, Section D
Weathered Ore Evaluation
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Leached Ore
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 24 degrees
Material: Alluvium
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 29 degrees
Material: Gila Conglomerate
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 39 degrees
Material: Diorite Foundation
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Bedrock Interface
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.009920
Center: -384.346, 1709.044
Radius: 1514.116
Left Slip Surface Endpoint: -1244.900, 463.253
Right Slip Surface Endpoint: -331.983, 195.834
Resisting Moment=3.47398e+009 lb-ft
Driving Moment=3.43985e+009 lb-ft



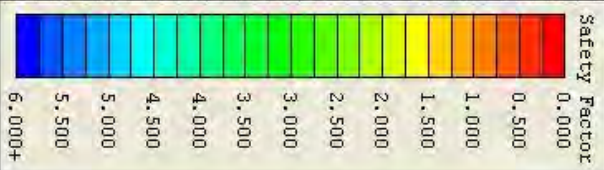


Case I

7A Far West, Section A, Base Case
Circular Failure, Static
Material Properties
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 689 psf
Friction Angle: 43 degrees
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 689 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 2.269340
Center: -221.126, 667.207
Radius: 497.890
Left Slip Surface Endpoint: -416.678, 209.327
Right Slip Surface Endpoint: -295.232, 174.863
Resisting Moment=1.2444e+007 lb-ft
Driving Moment=5.48352e+006 lb-ft



Case 2



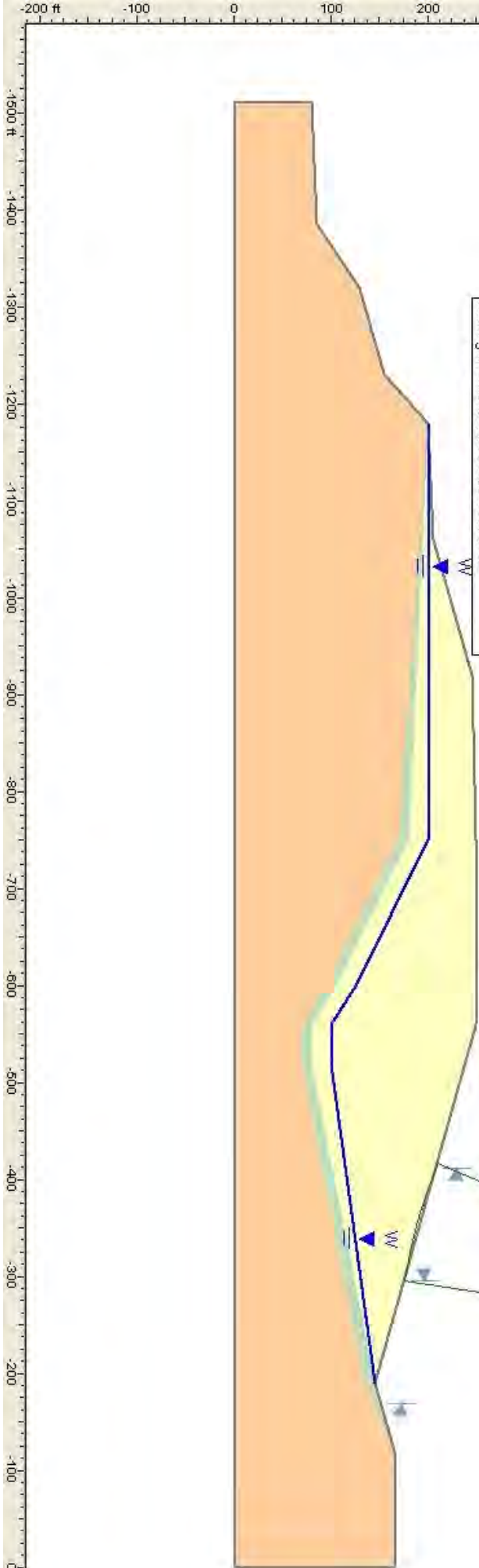
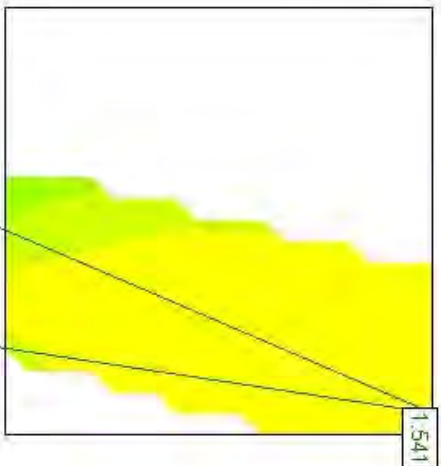
Section A, 7A Far West
Base Case, Circular Failure Mode
Seismic Load Coefficient (Horizontal): 0.12

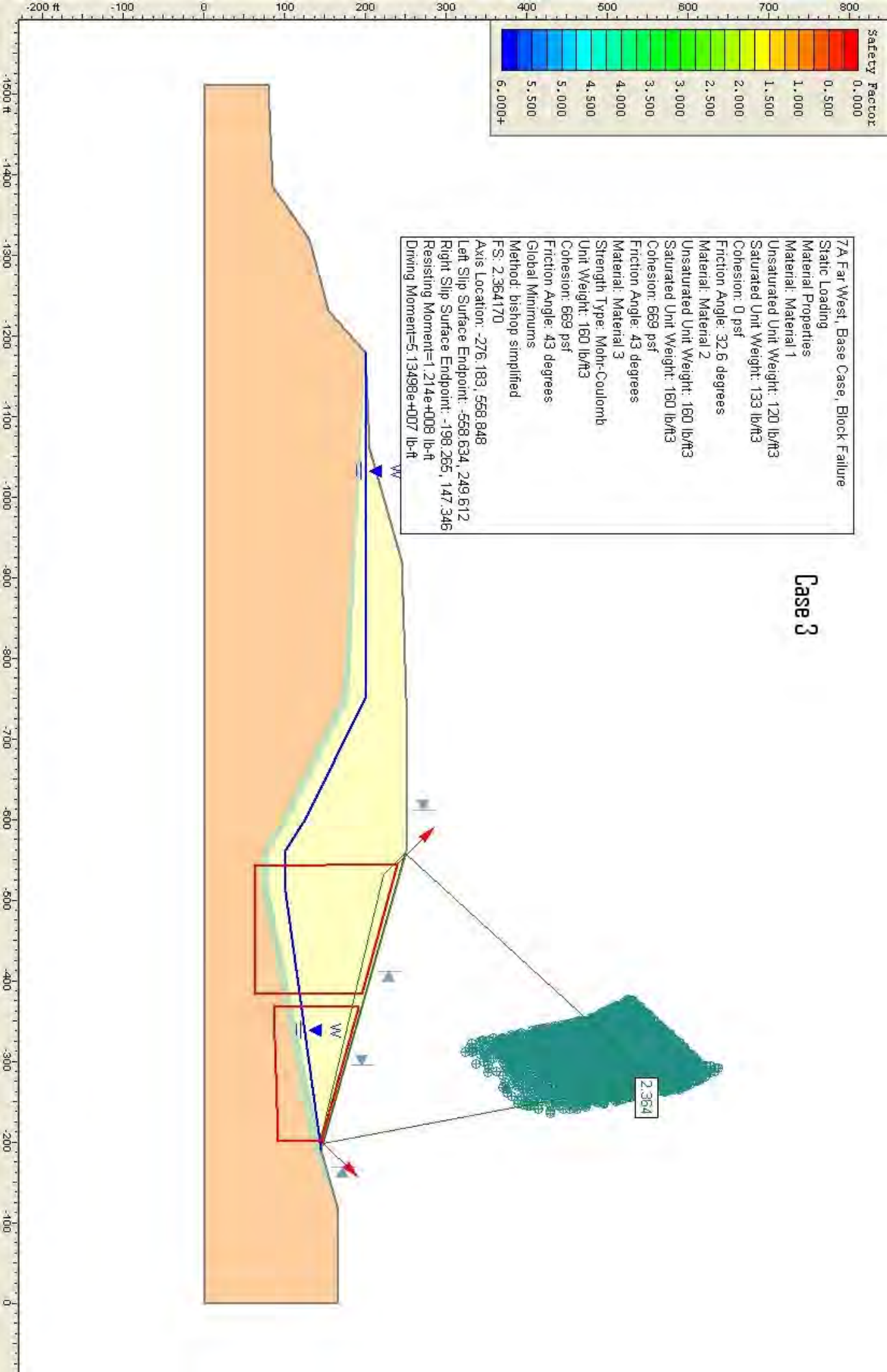
Material Properties
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees

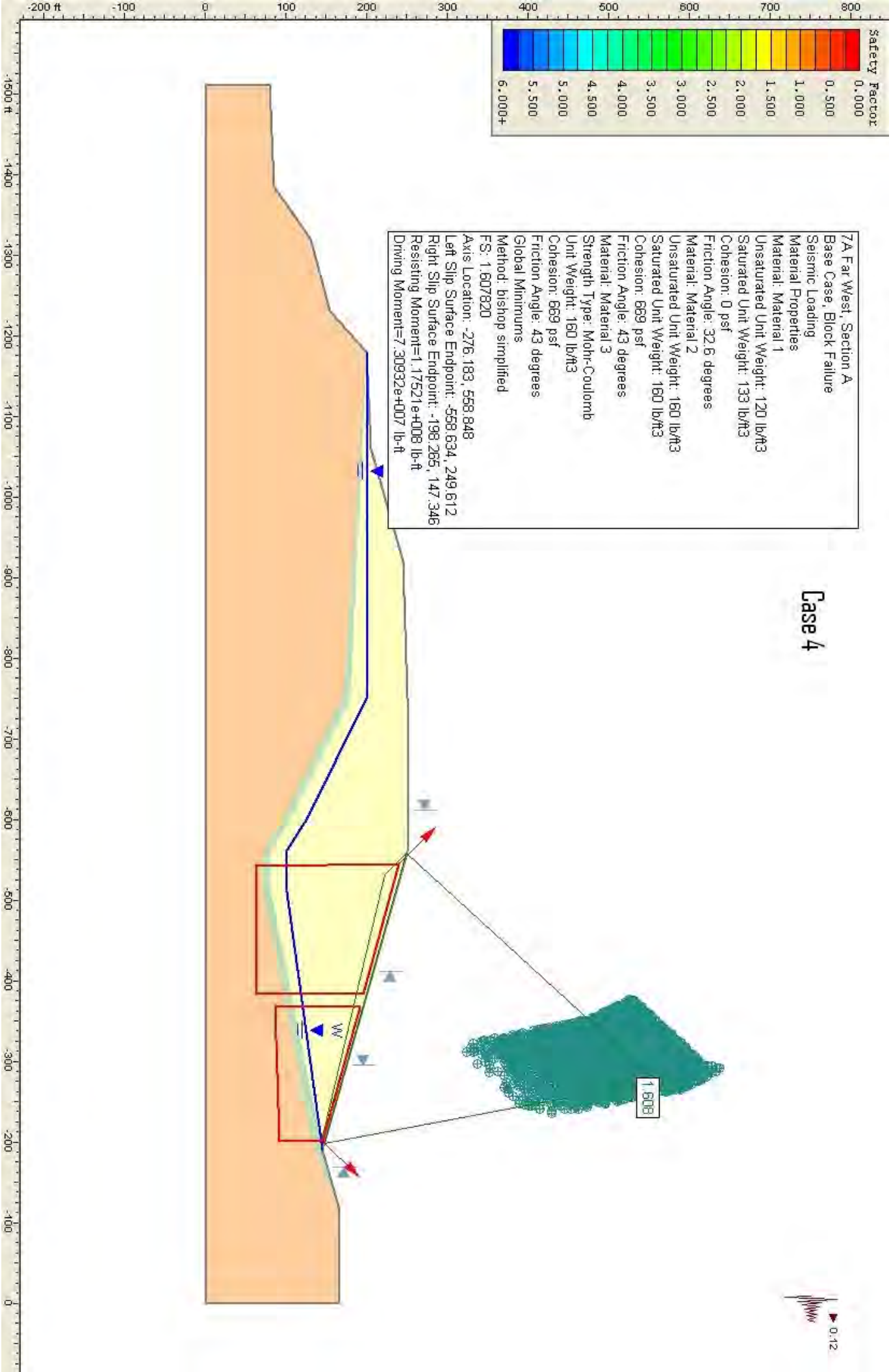
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees

Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees

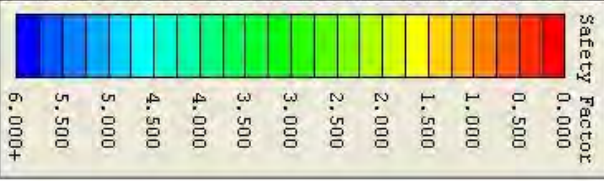
Global Minimums
Method: bishop simplified
FS: 1.541200
Center: -221.126, 667.207
Radius: 497.890
Left Slip Surface Endpoint: -416.678, 209.327
Right Slip Surface Endpoint: -295.232, 174.863
Resisting Moment=1.20249e+007 lb-ft
Driving Moment=7.80232e+006 lb-ft



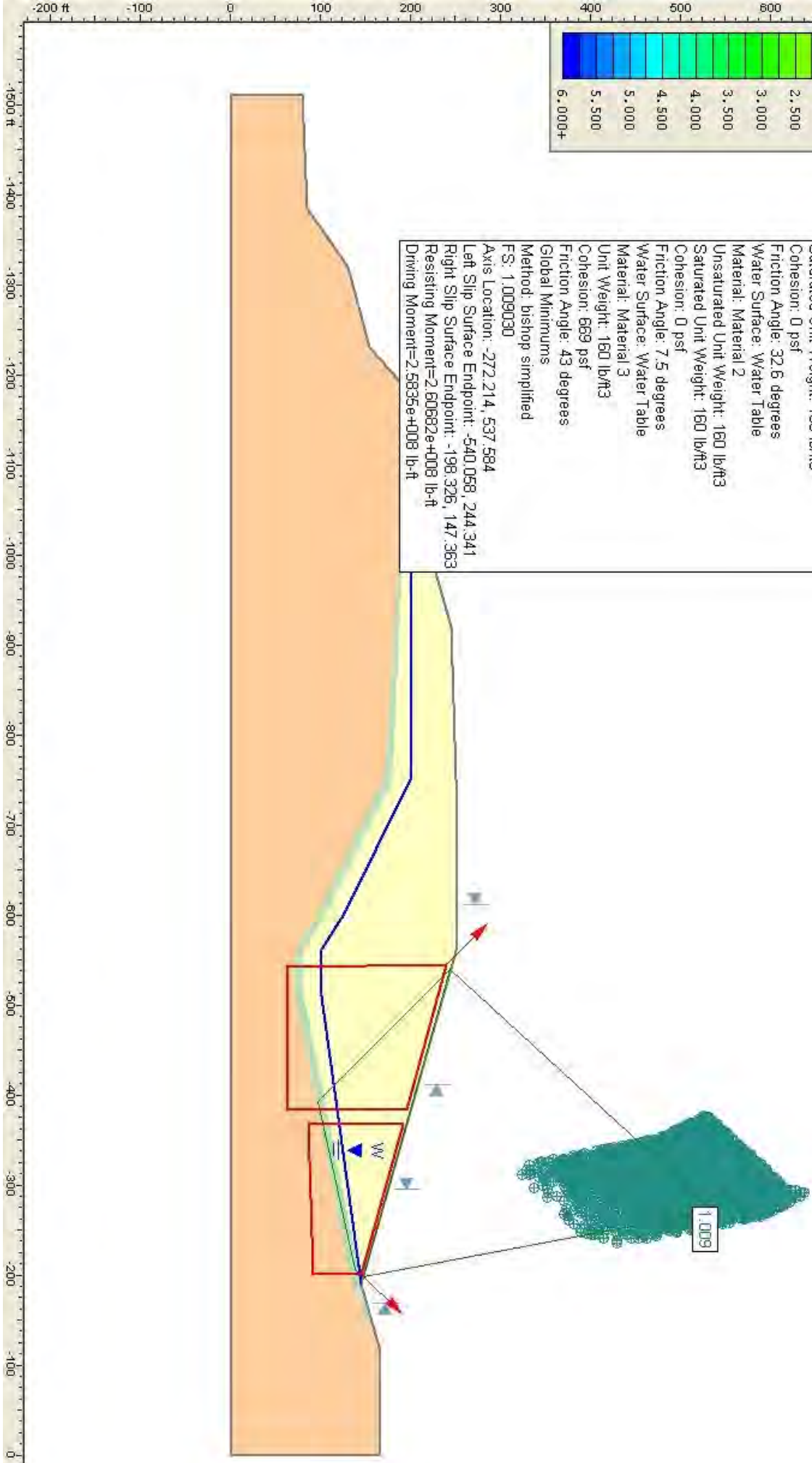




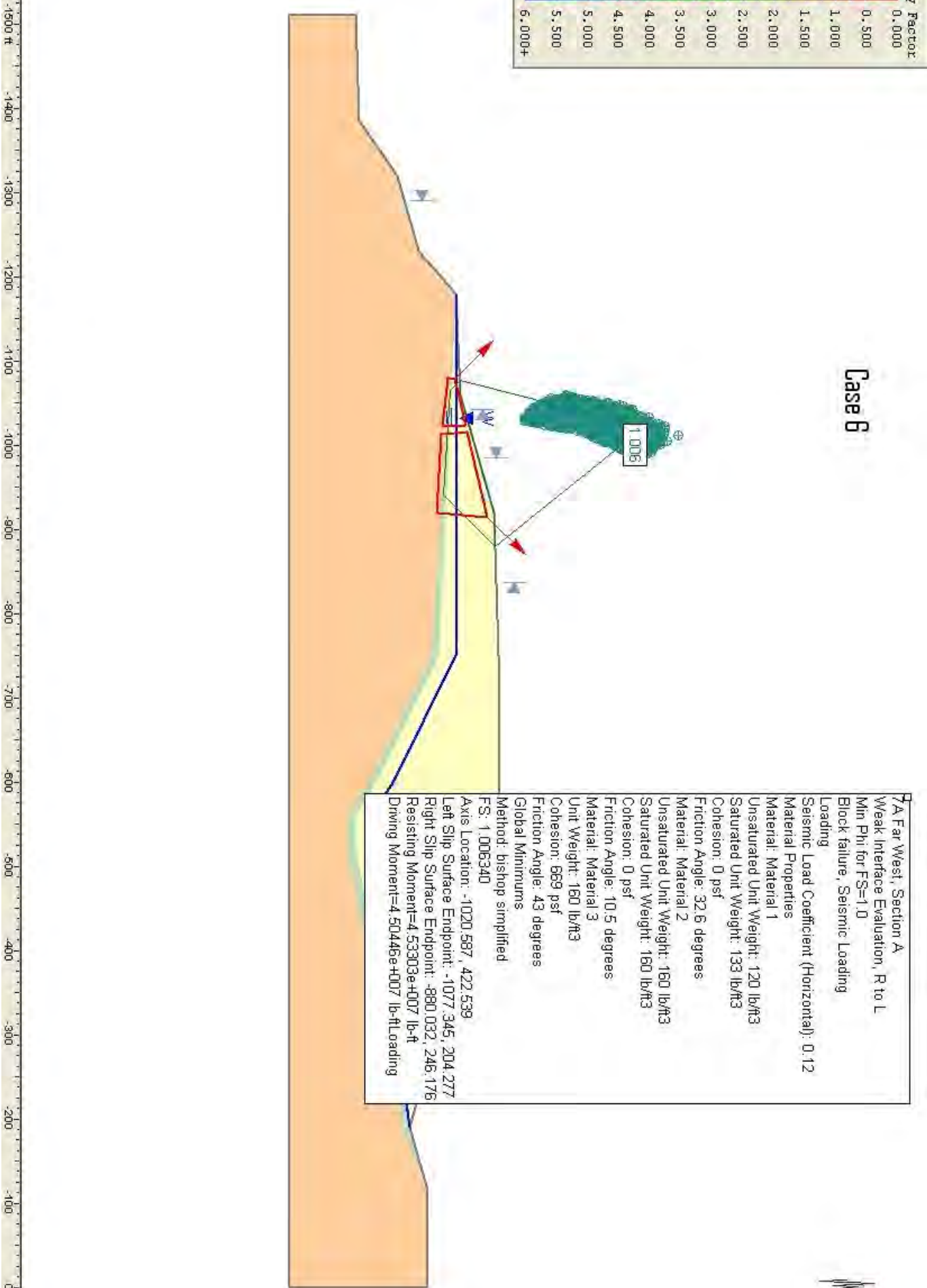
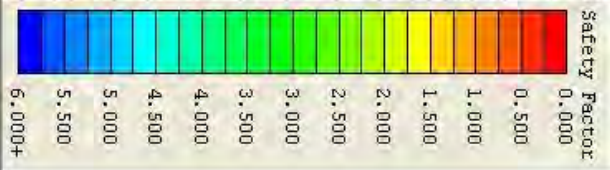
Case 5



7A Far West, Section A
Evaluation of Weak Interface
Min Phi for FS=1.0
Block Failure, Seismic Loading
Material Properties
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Water Surface: Water Table
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 0 psf
Friction Angle: 7.5 degrees
Water Surface: Water Table
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.009030
Axis Location: -272.214, 537.584
Left Slip Surface Endpoint: -540.058, 244.341
Right Slip Surface Endpoint: -198.326, 147.363
Resisting Moment=2.60682e+008 lb-ft
Driving Moment=2.5835e+008 lb-ft

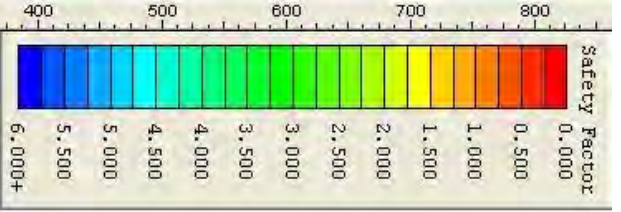


Case 6

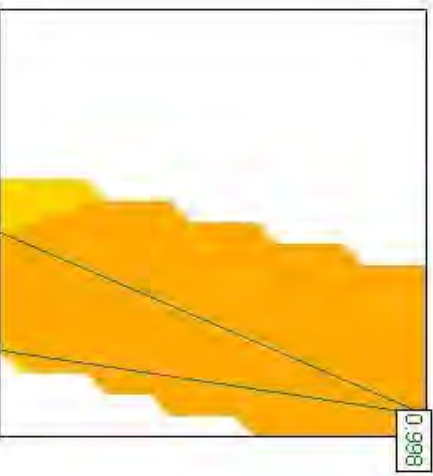
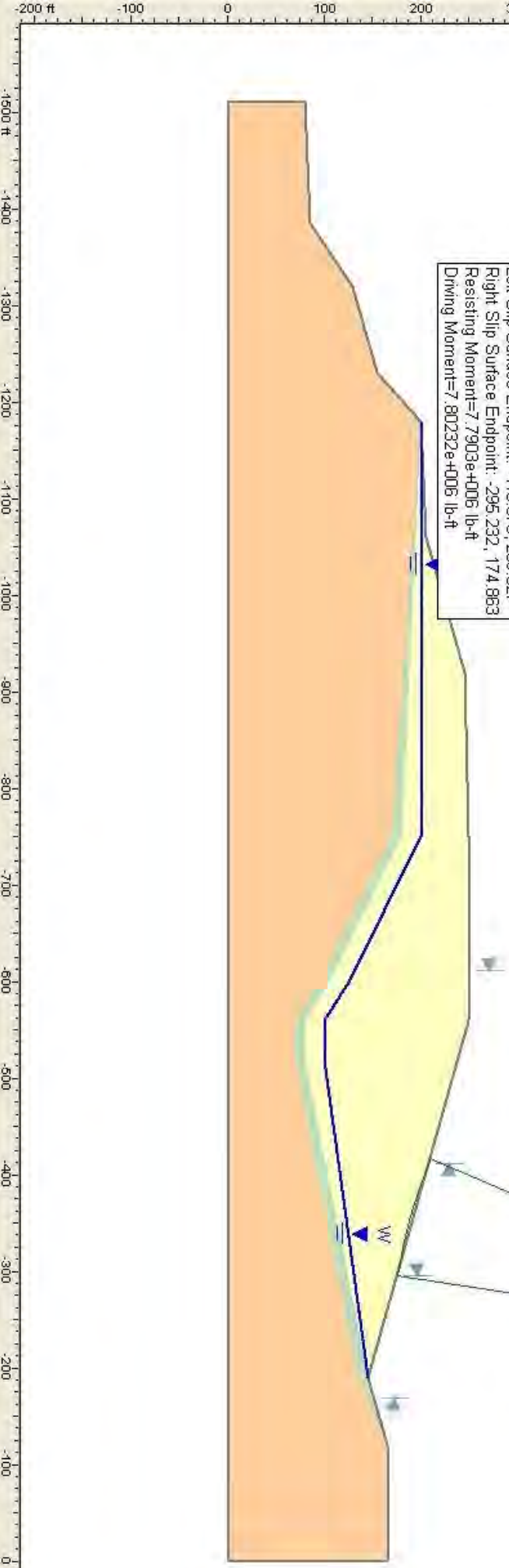


7A Far West, Section A
Weak Interface Evaluation, R to L
Min Phi for FS=1.0
Block failure, Seismic Loading
Loading
Seismic Load Coefficient (Horizontal): 0.12
Material Properties
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 0 psf
Friction Angle: 10.5 degrees
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.006340
Axis Location: -1020.587, 422.539
Left Slip Surface Endpoint: -1077.345, 204.277
Right Slip Surface Endpoint: -880.032, 246.176
Resisting Moment=4.53303e+007 lb-ft
Driving Moment=4.50446e+007 lb-ft Loading

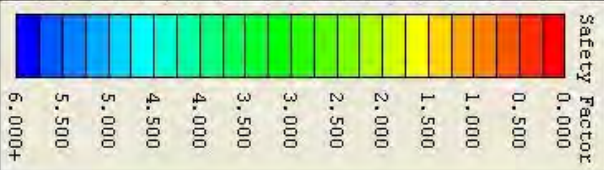
Case 7



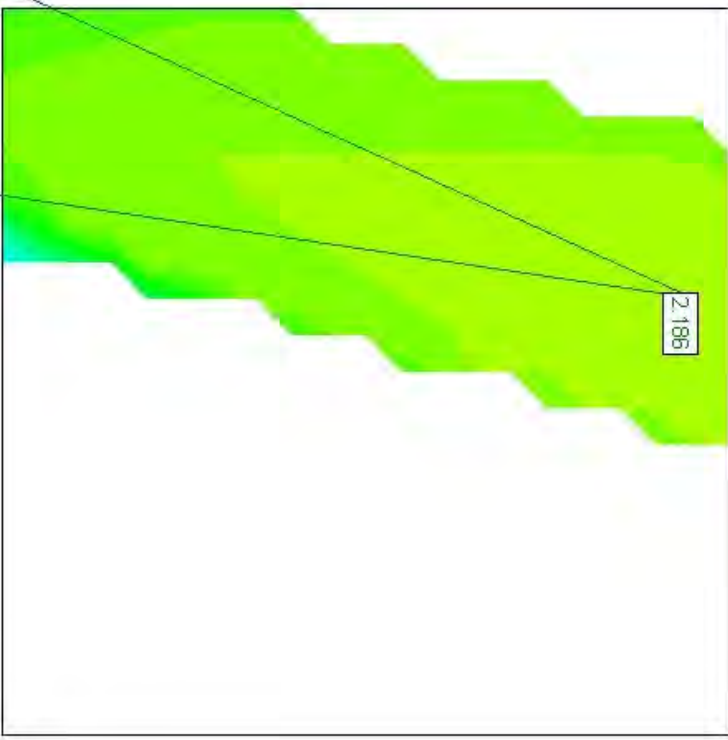
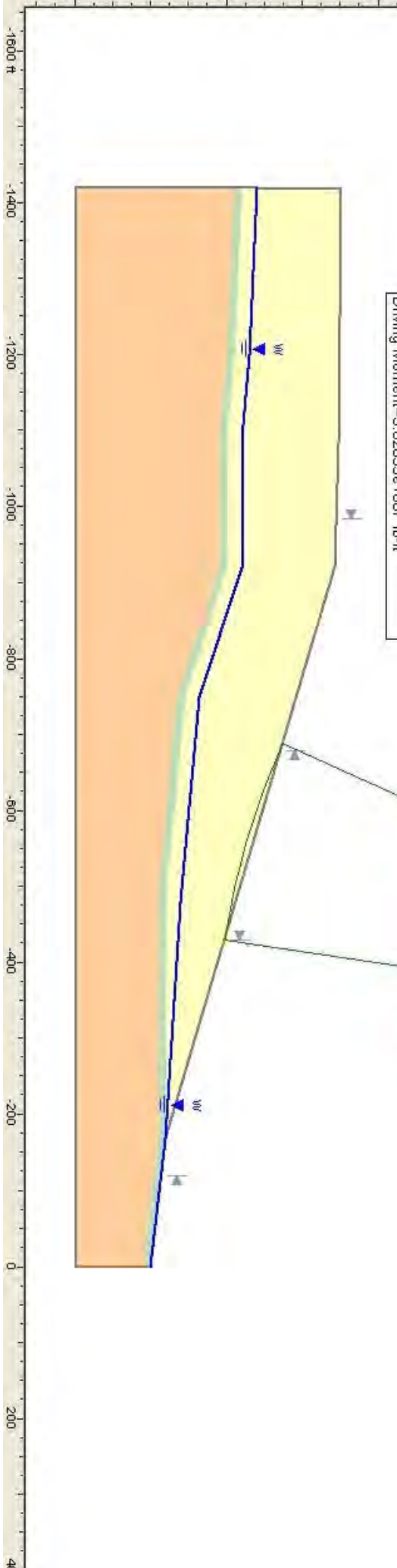
Far West Section A
Weathered Waste Rock Analysis
Min Phi for FS=1.0
Seismic loading
Material Properties
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 22.5 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Material 3
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 0.998459
Center: -221.126, 667.207
Radius: 497.890
Left Slip Surface Endpoint: -416.678, 209.327
Right Slip Surface Endpoint: -296.232, 174.863
Resisting Moment=7.7903e+006 lb-ft
Driving Moment=7.80232e+006 lb-ft



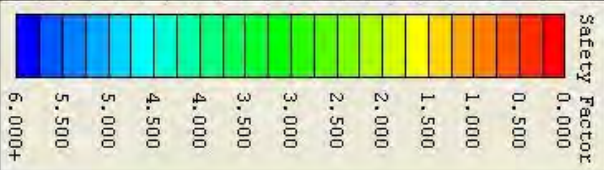
Case 8



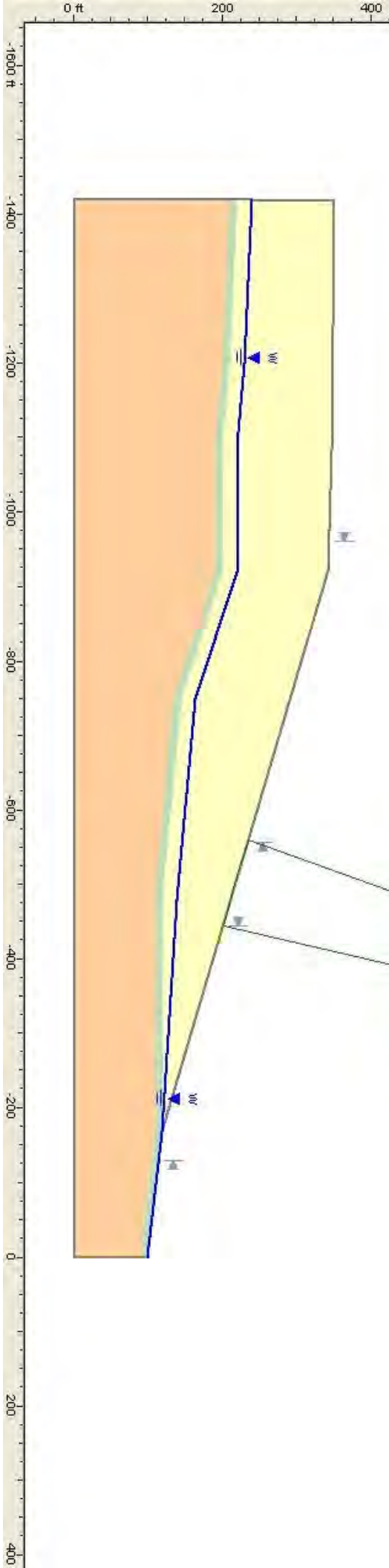
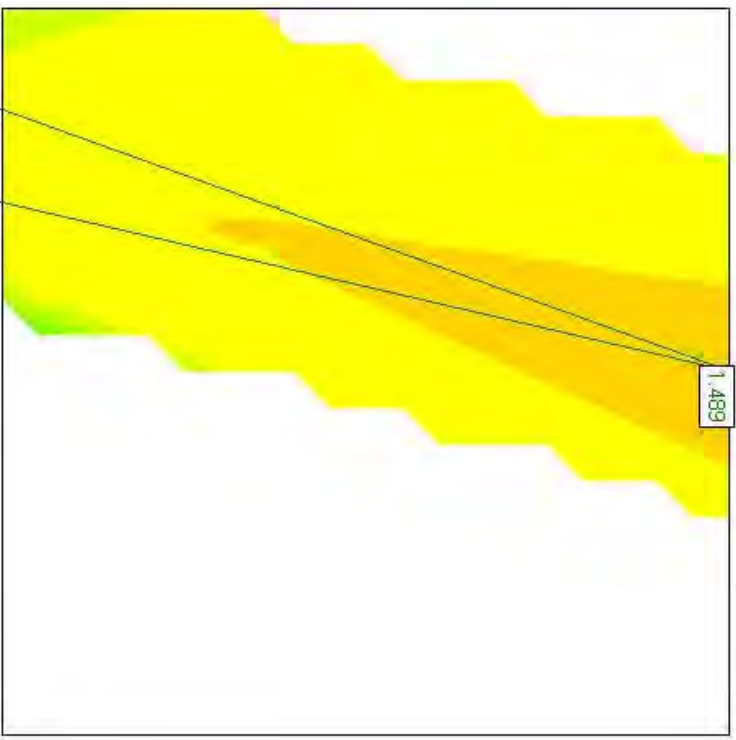
Base Case Section B Far West
Static Loading
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Water Surface: None
Global Minimums
Method: bishop simplified
FS: 2.186020
Center: -285.836, 1162.323
Radius: 976.399
Left Slip Surface Endpoint: -689.459, 273.254
Right Slip Surface Endpoint: -429.443, 196.542
Resisting Moment=1.23041e+008 lb-ft
Driving Moment=5.62855e+007 lb-ft



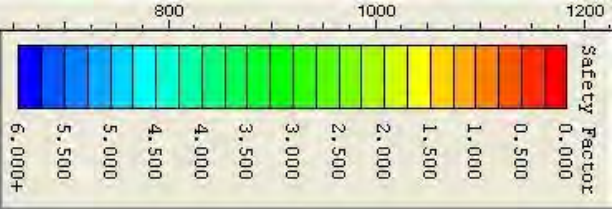
Case 9



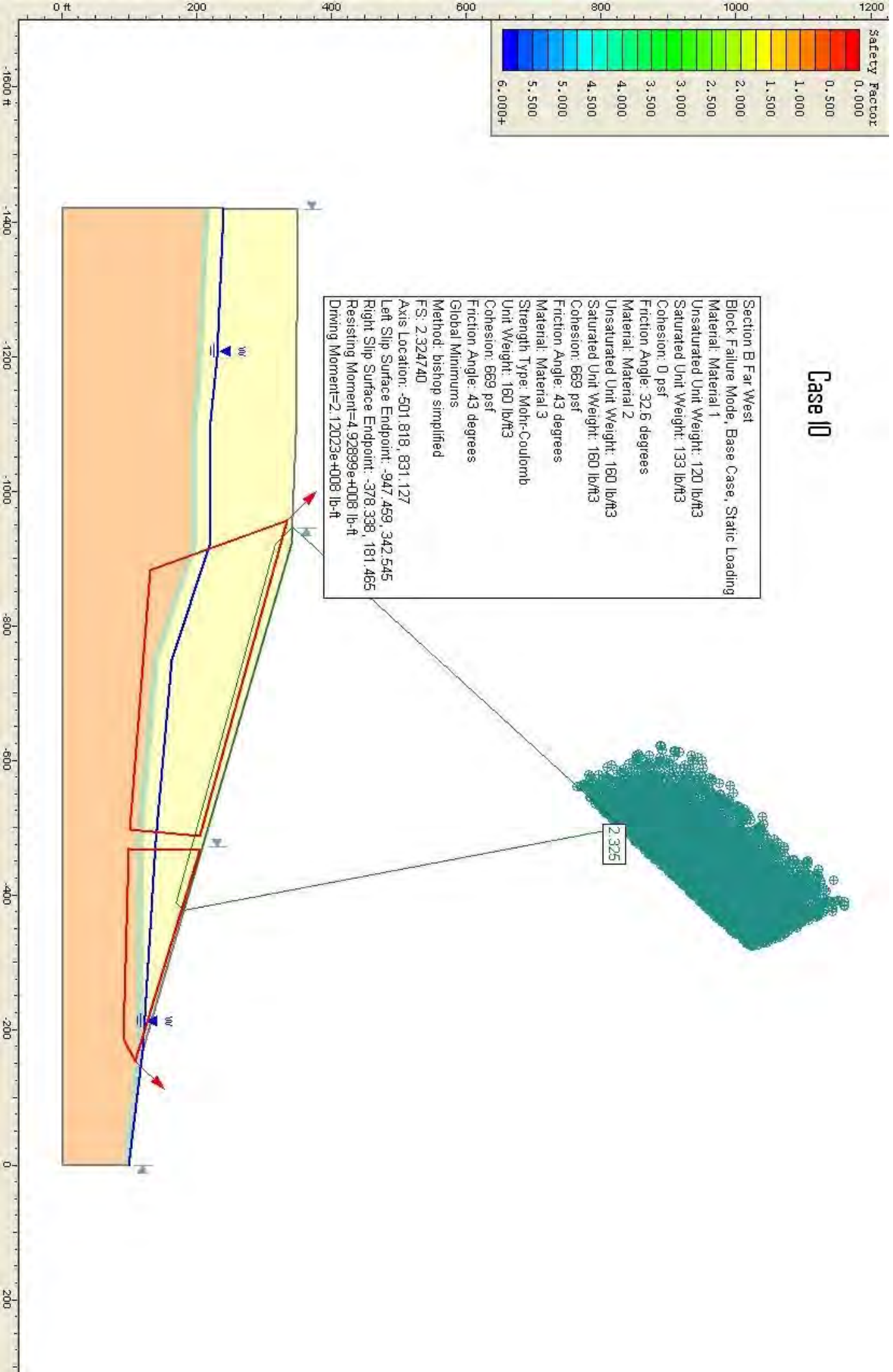
Base Case, Circular Failure, Seismic Loading
 File Name: Section B 7A Farwest.sli
 Analysis Methods
 Analysis Methods used:
 Bishop simplified
 Number of slices: 25
 Tolerance: 0.005
 Maximum number of iterations: 50
 Seismic Load Coefficient (Horizontal): 0.12
 Material: Material 1
 Unsaturated Unit Weight: 120 lb/ft³
 Saturated Unit Weight: 133 lb/ft³
 Cohesion: 0 psf
 Friction Angle: 32.6 degrees
 Material: Material 2
 Unsaturated Unit Weight: 160 lb/ft³
 Saturated Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees
 Material: Material 3
 Unit Weight: 160 lb/ft³
 Cohesion: 669 psf
 Friction Angle: 43 degrees



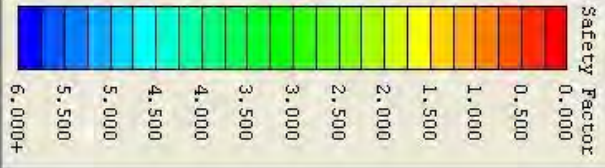
Case 10



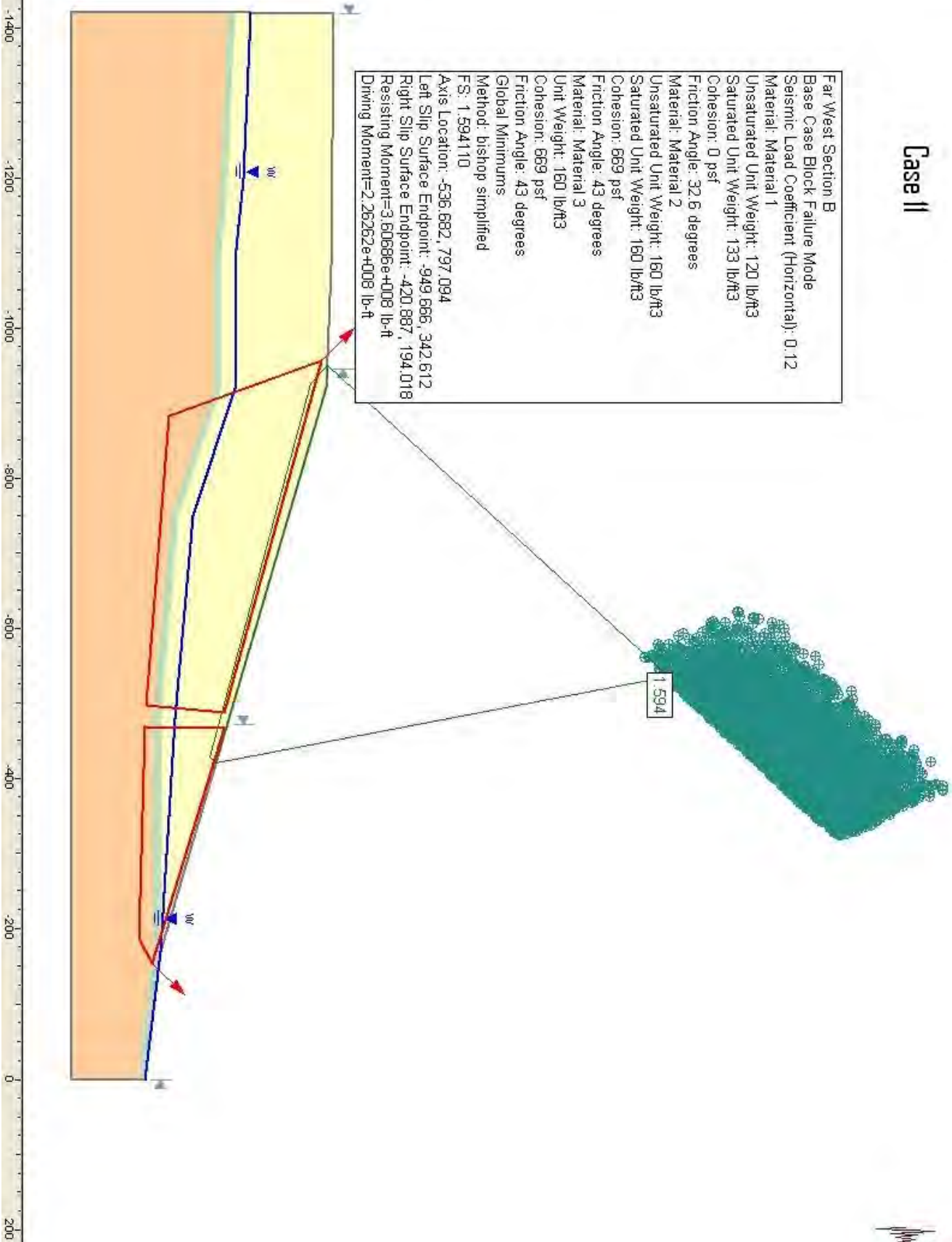
Section B Far West
Block Failure Mode, Base Case, Static Loading
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Material 3
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
F.S.: 2.324740
Axis Location: -501.818, 831.127
Left Slip Surface Endpoint: -947.459, 342.545
Right Slip Surface Endpoint: -378.338, 181.465
Resisting Moment=4.92899e+008 lb-ft
Driving Moment=2.12023e+008 lb-ft



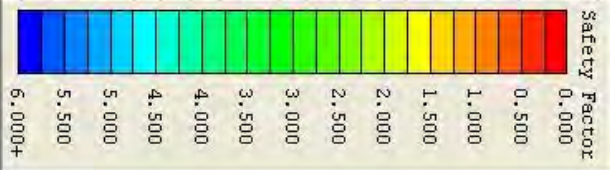
Case II



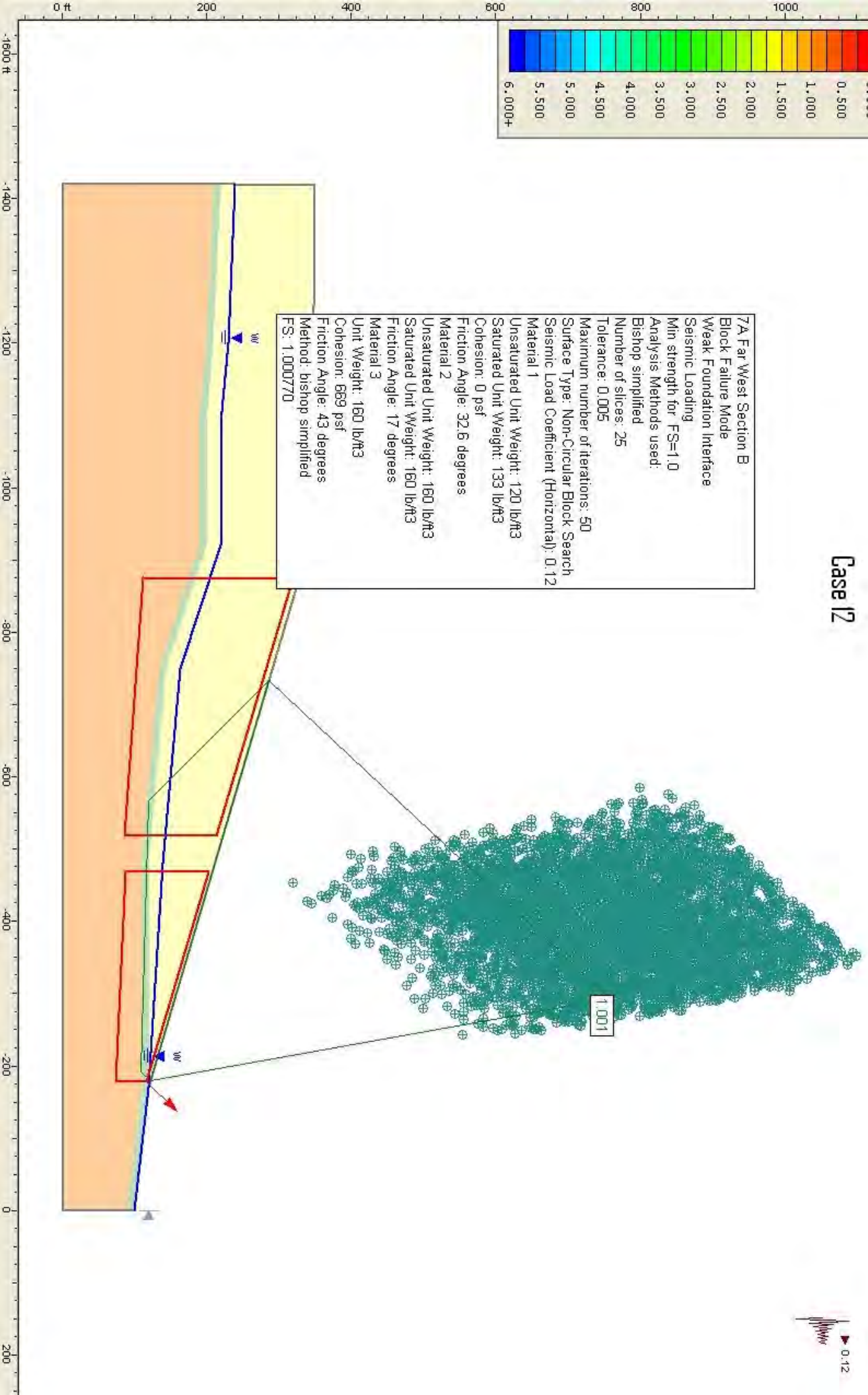
Far West Section B
Base Case Block Failure Mode
Seismic Load Coefficient (Horizontal): 0.12
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Material: Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.594110
Axis Location: -536.682, 797.094
Left Slip Surface Endpoint: -949.666, 342.612
Right Slip Surface Endpoint: -420.887, 194.018
Resisting Moment=3.60686e+008 lb-ft
Driving Moment=2.26262e+008 lb-ft



Case 12

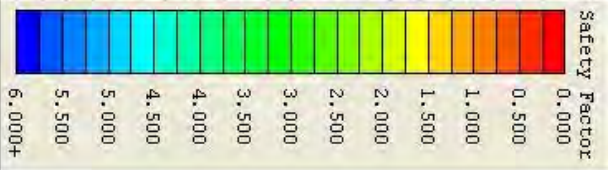


7A Far West Section B
Block Failure Mode
Weak Foundation Interface
Seismic Loading
Min strength for FS=1.0
Analysis Methods used:
Bishop simplified
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Surface Type: Non-Circular Block Search
Seismic Load Coefficient (Horizontal): 0.12
Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 32.6 degrees
Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Friction Angle: 17 degrees
Material 3
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Method: bishop simplified
FS: 1.000770

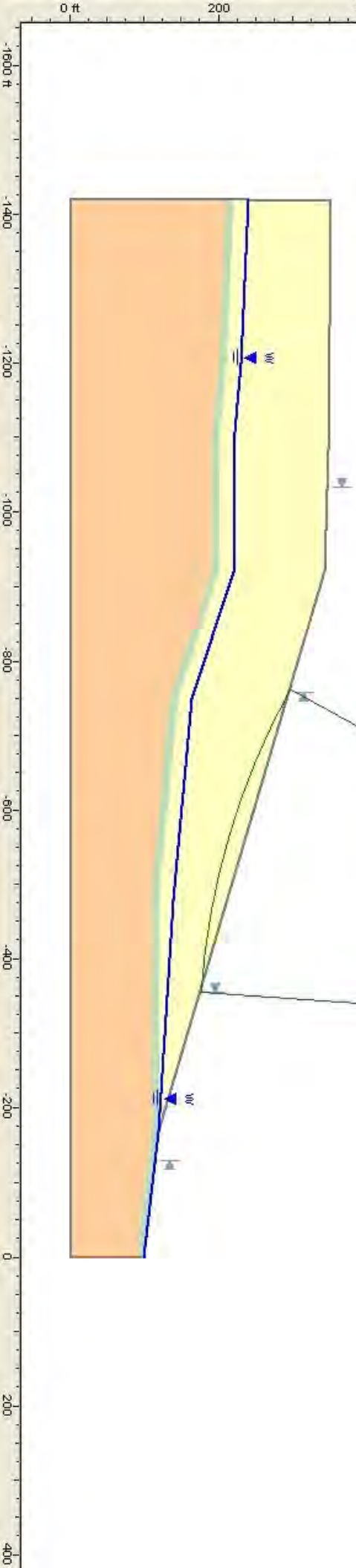
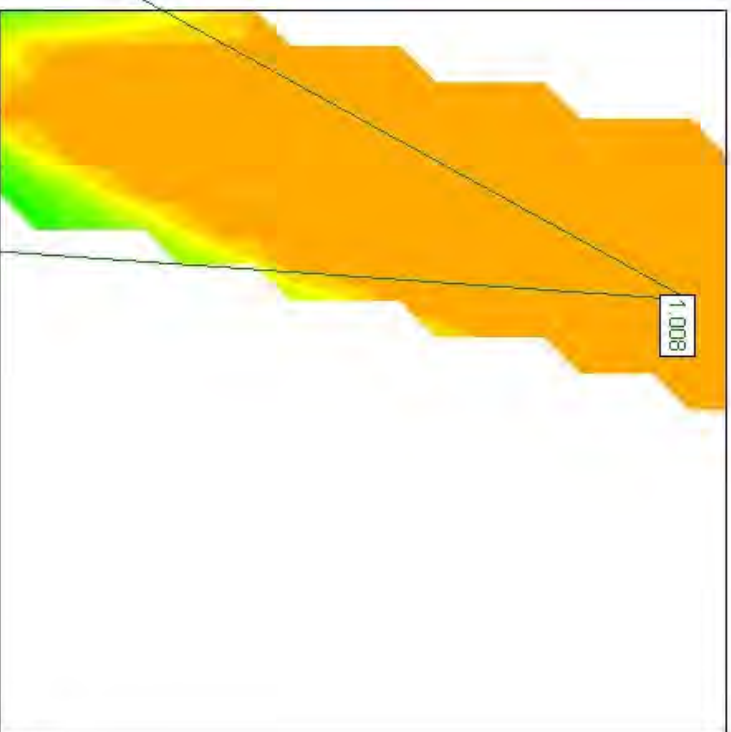


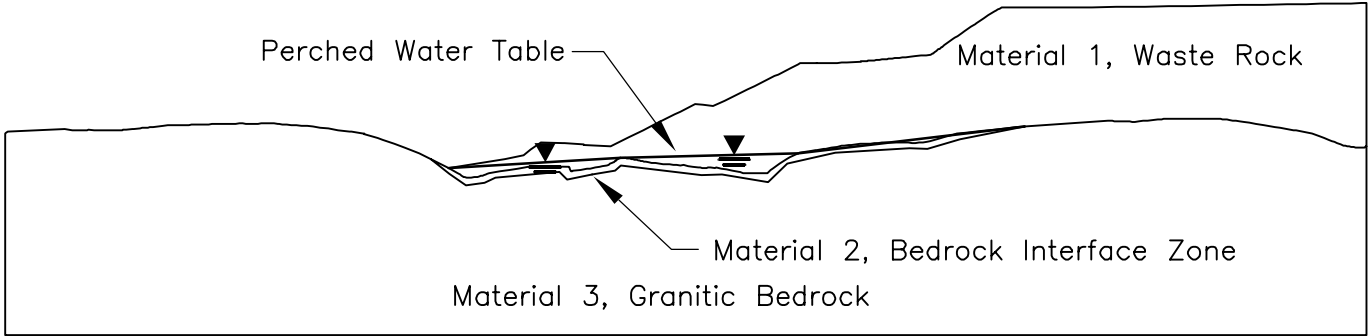
Case 13

0.12



7A West, Section B, Weathered Waste Rock
Min Strength for FS=1.0
Analysis Methods
Analysis Methods used:
Bishop simplified
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Seismic Load Coefficient (Horizontal): 0.12
Material: Material 1
Unsaturated Unit Weight: 120 lb/ft³
Saturated Unit Weight: 133 lb/ft³
Cohesion: 0 psf
Friction Angle: 23 degrees
Material: Material 2
Unsaturated Unit Weight: 160 lb/ft³
Saturated Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Unit Weight: 160 lb/ft³
Cohesion: 669 psf
Friction Angle: 43 degrees
Global Minimums
Method: bishop simplified
FS: 1.008060





PROJECT		SUPPLEMENTAL STABILITY ANALYSIS TYRONE MINE, NEW MEXICO			
TITLE		7A WEST WRDF SECTION F MATERIAL IDENTIFICATION			
	PROJECT No.	053-2550	FILE No.	0532550B003	
	DESIGN	GM	04/11/06	SCALE	AS SHOWN
	CADD	ANV	04/12/06	REV.	A
	CHECK	GM	04/12/06	FIGURE 3-2	
REVIEW	DAK	05/04/06			