APPENDIX G

SLOPE STABILITY ANALYSES FOR SCA DESIGN

GEOSYNTEC CONSULTANTS

COMPUTATION COVER SHEET

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SLOPE STABILITY ANALYSES FOR SCA DESIGN

INTRODUCTION

This package was prepared in support of the design of the Sediment Consolidation Area (SCA) for the Onondaga Lake Bottom Site, which will be constructed on Wastebed 13 (WB-13). Specifically, this package presents static slope stability analyses for the SCA, which will contain geotextile tubes (geo-tubes) filled with dredged material surrounded by a perimeter dike (SCA perimeter dike). For purposes of this calculation package, the SCA perimeter dike refers to the dike that will be constructed around the geo-tubes within WB-13; whereas, the WB-13 perimeter dike refers to the exterior perimeter dike around WB-13.

Seismic slope stability analyses were not performed because the site is not located in a seismic impact zone, as defined by New York State Department of Environmental Conservation (NYSDEC) Regulations Section 360-2.7(b)(7). A detailed explanation regarding the seismic impact zone assessment is presented in Attachment 1 of this package.

METHODOLOGY

Static Slope Stability

Static slope stability analyses were performed using Janbu's method and Spencer's method, using the computer program SLIDE version 5.043 [Rocscience, 2009]. Four potential slip modes were evaluated in the analyses: (i) block slip mode along geo-tube interfaces; (ii) block slip mode along the liner system; (iii) circular slip surfaces through dredge material contained in geo-tubes and WB-13 foundation materials; and (iv) circular slip surfaces through existing WB-13 perimeter dikes.

Spencer's method [Spencer, 1973] satisfies both force and moment equilibrium and is therefore considered more rigorous than other methods, such as Janbu's method [Janbu, 1973] and the simplified Bishop method [Bishop, 1955]. However, Spencer's method often encounters numerical convergence difficulties when considering block slip surfaces. Therefore, Spencer's method was used for the circular slip surfaces, while Janbu's method was used for block slip surfaces.

Information required for the static slope stability analyses included the slope geometry, the subsurface soil stratigraphy, the groundwater table elevation, the material properties of the subsurface soils, dredge material, liner and cover system materials, and the external surface loading, if any, at the selected cross section locations.

Target Factor of Safety

Target factors of safety (FSs) were considered for slope stability of the proposed SCA, one for the interim condition and one for the long-term condition. The interim condition is the condition during the SCA construction and dredge operation period and shortly after the SCA is capped with the final cover system. The long-term condition is the condition a relatively long time after the SCA is capped. In addition, both peak and residual shear strengths were considered in identifying the appropriate FSs for interim and final conditions, as appropriate for geosynthetic materials.

The target FS corresponding to the peak shear strength was considered to be 1.3 for the interim condition and 1.5 for the long-term condition according to U.S. Army Engineer Waterways Experiment Station Technical Report D-77-9 [Hammer and Blackburn, 1977] and U.S. Army Corps of Engineers Engineering Manual 1110-2-1902 [USACE, 2003]. The target FS corresponding to large displacement (i.e., residual) shear strength was considered to be 1.1 for the interim condition and 1.3 for the long-term condition, consistent with general engineering practice.

SUBSURFACE STRATIGRAPHY

Detailed information regarding the subsurface stratigraphy was presented in a calculation package titled "Subsurface Stratigraphy Model of Wastebed 13 for the Design of Sediment Consolidation Area" (referred to as the Data Package). In summary, the subsurface stratigraphy consists primarily of three types of material: the Solvay waste (SOLW), the existing WB-13 perimeter dike soil, and the foundation soil, as shown schematically in Figure 1. The SOLW was divided into three zones (i.e., Zone 1, Zone 2, and Zone 3, as shown in the figure) based on its distinct characteristics.

The groundwater table was found to be approximately 50 ft below ground surface (bgs) of the wastebed (or at approximately El. 375 ft) as presented in the Data Package. However, it is noted that "perched" water zones exist in WB-13 according to the site investigation results presented in the Data Package. These "perched" water zones vary spatially and seasonally according to the piezometer data presented in the Data Package but have an average elevation of approximately 15 ft bgs. The slope stability analysis presented in this package conservatively assumes the "perched" water zones are connected to the groundwater table. The groundwater table was, therefore, modeled using a single groundwater table 15 ft bgs. Additionally, within the gravel drainage layer in the liner system, a second water table one foot above the top of the liner layer was assumed in the model. This represents the one foot maximum allowable head within the gravel drainage layer. It should be noted that this water table is confined by the liner system and will only affect the gravel drainage layer in the slope stability analysis.

ANALYZED CROSS-SECTIONS

The proposed SCA consists of a single containment cell surrounded by the SCA perimeter dike as shown in Figure 2. Two cross sections (i.e., Cross-Section A-A and B-B, as shown in Figures 3 and 4) were analyzed for static slope stability. As can be seen in Figure 3, Cross-Section A-A has significantly more vertical interfaces to consider than Cross-Section B-B because of geo-tube orientation. The design height of the proposed SCA perimeter dikes is a minimum of 5 ft above the existing ground surface and a minimum of 2 ft above the top of the gravel at the same location. The elevations of the dikes will vary, as the existing ground elevations vary along the perimeter. The maximum dike height is approximately 10 ft, located near the western sump area. The SCA perimeter dikes are approximately 28 ft wide at the top and have a 2.5 horizontal:1 vertical (2.5H:1V) side slope. There is a 10 ft setback distance between the edge of the lowest geo-tube layer and the dikes.

Cross-Section A-A

Cross-Section A-A was selected because it follows the direction of minimum overlap between the geo-tube stacks, which is expected to result in the lowest FS for block slip mode stability. Cross-Section A-A runs approximately north-south through WB-13. The geo-tubes are assumed to be 40 ft in width and between 250 ft to 320 ft in length. In the direction of Cross-Section A-A, each additional stack of geo-tubes will straddle geo-tubes that are already in place. This results in each stack of geo-tubes being offset approximately 20 feet from the layer below.

The existing ground below the liner at Cross-Section A-A (i.e., top of existing SOLW elevation) is naturally sloped. The thickness of the SOLW underneath the liner varies, but typically is between 50 and 60 ft. Cross-Section A-A was extended to include the existing WB-13 perimeter dike.

Cross-Section B-B

Cross-Section B-B runs approximately east-west through WB-13. In this direction, the geo-tubes are assumed to be between 250 ft and 320 ft long for purposes of this analysis. At the edge of the geo-tube layers, tubes are offset approximately 20 ft. Through the interior of the SCA, the offsets between geo-tube layers vary because of the different lengths and number of geo-tubes per layer, but is planned to be a minimum of 20 ft.

MATERIAL PROPERTIES

Table 1 summarizes the material properties (i.e., unit weights and shear strengths) of the SOLW, the dike soil, the foundation soil, the dredged material, the final cover soil, and geosynthetic materials used in the slope stability analyses. The unit weight and the shear strength of the SOLW in WB-13 were considered to be the same for Zone 1, Zone 2, and Zone 3 according to the Data Package. In the stability models presented in this package, the existing WB-13 perimeter dike soil was treated the same as the base foundation material based on previous investigations indicating that these existing WB-13 perimeter dikes were constructed using the native foundation material from beneath WB-13. The term "dike soil" as used in this package therefore refers only to the SCA perimeter dikes that will be constructed. The interfaces between adjacent geo-tubes and between the bottom geo-tube and gravel drainage layer are modeled as thin layers of frictional material. For purposes of this analysis, the final cover is assumed to have a thickness of 3 ft. Figures 5 and 6 show a representation of the layers included in the model.

<u>Unit Weight</u>

The unit weights of the SOLW, the dike soil, and the foundation soil were considered to be 82 pcf, 120 pcf, and 120 pcf, respectively, according to the Data Package. The unit weights of the proposed liner soil and gravel drainage layer were assumed to be 100 pcf and 120 pcf, respectively. The unit weight of the interface between the gravel drainage layer and the geo-tubes was assumed to have the same calculated unit weight as the dredge material (i.e., 86 pcf). The unit weight of the dredged material was calculated to be approximately 86 pcf as presented in Attachment 2 to the package titled "Settlement Analyses for SCA" (Appendix H of the IDS). It is noted that the interfaces were required to be assigned material properties for numerical stability of the SLIDE program. The unit weight of horizontal interfaces between geo-tubes was assumed to be 86 pcf (i.e., the same as the dredge material) because there is no potential for a gap between two stacks of geo-tubes along a horizontal interface. However, due to the ellipsoidal shape of the filled geo-tubes, there is potential for gaps between two adjacent geo-tubes along a vertical interface. Therefore, vertical interfaces between geo-tubes were assumed to have a unit weight of 43 pcf (i.e., half of the dredge material). It is noted that the use of half of the unit weight versus the full unit weight along vertical interfaces is not expected to cause significant differences in the calculation results. The unit weight of the final cover soil was assumed to be 120 pcf.

Drained Shear Strength

The drained shear strength was used for the slope stability analyses under the long-term condition. The effective stress friction angles of the SOLW, the dike soil, and the foundation soil were considered to be 34 degrees, 35 degrees, and 37 degrees, respectively, according to the Data Package. For the liner system, laboratory interface direct shear testing was performed on four liner types (i.e., smooth and textured high density polyethylene [HDPE], ethylene propylene diene monomer [EPDM], and polypropylene [PP]), and the results are included in Attachment 2. The peak effective stress friction angle of the proposed liner system varied depending on the type of geomembrane (GM) chosen. Based on these results, smooth HDPE GM is not being considered for use on this project. Among the remaining GM options tested, the peak effective stress friction angle varied from 19 degrees to 27 degrees; therefore, 19 degrees was conservatively assumed in Table 1. The effective stress friction angle of the gravel layer was assumed to be 38 degrees.

The effective stress friction angle for the interface between the bottom geo-tube layer and the gravel drainage layer was considered to be 24 degrees, based on data presented by Koerner [1994] for the interface between woven geotextiles and sand. The geotextiles composing the geo-tubes are modeled as two-end anchored geotextile sheets. The ultimate tensile strength was assumed to be 4800 lb/ft based on standard strength parameters for commercially available geo-tubes. A reduction factor of 3.0 [GRI, 1992] was then applied to result in a design tensile strength of 1600 lb/ft. Current information indicates the dredge material from the In Lake Waste Deposit (ILWD) has a drained friction angle of 37 degrees and, as indicated previously, the existing SOLW in WB-13 has a drained friction angle of 34 degrees. Considering the dredge material as remolded SOLW, the long-term drained effective stress friction angle of the dredge material was conservatively assumed to be 30 degrees. Under short-term conditions, the dredge material was assumed to have half of the drained effective stress friction angle of the material under long-term conditions (i.e., 15 degrees).

The effective stress friction angle of the vertical geo-tube/geo-tube interface was assumed to be negligible due to gaps between the geo-tubes. A value of 0.1 degrees was chosen for this interface to maintain numerical stability of the SLIDE program. Using representative geo-tube samples, the peak effective stress friction angle of the horizontal geo-tube/geo-tube interface was measured to be 15 degrees in laboratory interface direct shear testing (see Attachment 2 for results), which is the assumed value provided in Table 1. The effective stress friction angle for the final cover was assumed to be 30 degrees.

At the time this package was initially prepared, the GM component in the final liner system had not been selected; therefore the minimum measured interface friction values of 19 degrees (peak) and 17 degrees (residual) were selected. Once the critical stability cases were established using the minimum value of liner system friction angle from laboratory testing, the critical cases were rerun using the maximum liner system friction angle (both peak and residual) from laboratory testing. These analyses were performed to provide an approximate range of FS values that may be expected. The peak and residual interface friction angles for linear low-density polyethylene (LLDPE) are generally close to the interface friction angles of HDPE. Therefore, the interface friction angle of LLDPE is expected to fall within the range shown in this package. The range of calculated FS values based on the variability in test results is discussed further in Attachment 3.

Stability analyses were also performed to back-calculate the range in effective stress friction angles that would be acceptable for a given target FS, thus providing a range in values that can be used to establish the acceptability of actual geo-tube and liner system components based on laboratory testing, without needing to perform additional analyses. The back-calculation of this range in values is described further in Attachment 4. In cases involving the drained shear strength, the effective stress cohesion intercept was conservatively assumed to be zero.

<u>Undrained Shear Strength</u>

The undrained shear strength (S_u) of the WB-13 SOLW was used for the slope stability analyses under the interim condition. It is noted that undrained shear strengths were not assigned to the dike soil, the foundation soil, and the proposed gravel drainage layer because they primarily consist of coarse soil particles and drain relatively quickly under loading. Undrained shear strengths were also not assigned to the models used to represent the vertical and horizontal interfaces between geo-tubes because these interfaces are extremely thin and also drain quickly under loading. For these layers, the drained shear strengths were used for the interim condition as well.

The S_u of SOLW was developed using the SHANSEP (i.e., stress history and normalized soil engineering properties) method developed by Ladd and Foott [1974], based on the results of the laboratory consolidated-undrained (CU) triaxial compression tests and consolidation tests as presented in the Data Package. The SHANSEP method can be expressed using the following equation:

$$S_u = S \times \sigma'_{vc} \times OCR^m \qquad (1)$$

where,

S = undrained shear strength ratio under normal consolidation, obtained from CU tests;

σ_{vc}' = effective vertical consolidation stress for a given loading;

OCR = over-consolidation ratio, obtained from consolidation tests which is the ratio of the preconsolidation pressure (p_c') to the in-situ vertical effective stress (σ_v'); and

m = SHANSEP modeling parameter (m = 0.8 for most cohesive soils and typical applications [Ladd and DeGroot, 2003]).

As presented in the Data Package, an S of 0.3 was established from CU tests on the WB-13 SOLW samples. Data of p_c', preconsolidation pressure, were obtained from the Data Package and are plotted in Figure 7 together with the profile of σ_v', the effective in-situ vertical stress. An initial OCR profile was also developed in the Data Package for the SOLW, as shown in Figure 8.

Due to the effective stress increase ($\Delta\sigma_v'$) imposed by the liner system and geo-tubes, the SOLW will gain additional undrained shear strength as indicated by Equation 1. However, the undrained shear strength gain will occur gradually as the SOLW consolidates over time. To consider the shear strength gain of SOLW during the process of consolidation under the geo-tube load, three S_u profiles were calculated and are described below.

Initial S_u profile: This S_u profile represents the in-situ shear strength of the SOLW before construction of the SCA liner system. The S_u was calculated by Equation 1 using the in-situ effective stress $\sigma_{v,}'_{initial}$ in the SOLW. The calculated initial S_u profile is presented in Figure 9 along with the S_u measured by the UU tests.

S_u profile for U_{avg} = 75%: This S_u profile corresponds to the shear strength of the SOLW after it achieves an average degree of consolidation (U_{avg}) of 75%. The S_u in the SOLW at U_{avg}=75% ($\sigma_v'_{75\%}$) was calculated as a four-step process. The time factor T_v necessary to reach an average degree of consolidation of 75% is 0.477 [Das, 2005]. This time factor was used to calculate the variation of the consolidation ratio with depth (U_z) for an average consolidation ratio of U_{avg}=75%, as shown in Figure 10 [Lambe and Whitman, 1969]. Next, $\sigma_v'_{75\%}$ was calculated using Equation 2.

$$\sigma'_{v75\%} = \sigma'_{v,initial} + U_z \times \Delta\sigma_v \qquad (2)$$

Third, the OCR at U_{avg} = 75% was back-calculated using the original preconsolidation pressure p_c' and the current effective stress $\sigma_v'_{75\%}$. Lastly, these OCR values are applied to the SHANSEP formula to derive the S_u profile when the SOLW achieves U_{avg}=75%. Note that to calculate the S_u profile for U_{avg} =75%, the additional effective stress $\Delta\sigma_v'$ was based on three layers (18 ft) of dredged material in geo-tubes, 1 ft of gravel, and 1 ft of low permeability soil. The actual thicknesses of gravel and low permeability soil are greater or equal to 1 ft, however, with regards to shear strength gain, this assumption is conservative. The selection of three layers of geo-tubes as additional loading was based on the minimum number of geo-tube layers that would likely be placed the first year and the required time to consolidate, which is explained in detail below.

S_u profile for U_{avg} = 100%: This S_u profile corresponds to the shear strength of the SOLW after it reaches full consolidation under the same loading conditions as the U_{avg} =75% condition (i.e., three layers [18 ft] of dredged material in geo-tubes, 1 ft of gravel, and 1 ft of low permeability soil). The effective stress after consolidation was calculated using Equation 3. Due to the large additional load of the geo-tubes, the OCR for SOLW when the soil is fully consolidated was assumed to be 1.0. The SHANSEP formula was applied to calculate the final S_u profile.

$$\sigma'_v = \sigma'_{v,initial} + \Delta\sigma_v \qquad (3)$$

Vertical effective stress profiles for these three stages of consolidation are shown in Figure 11. The resulting undrained shear strength profiles are shown in Figure 12.

Consolidation Rate

The time to achieve a U_{avg} of 75% can be calculated using Equation 4 below [Das, 2005]:

$$t = \frac{T_v H_{dr}^2}{c_v} \qquad (4)$$

where, c_v is the coefficient of consolidation, H_{dr} is the 50 ft distance to the drainage layer, and T_v is the time factor based on the required degree of consolidation. For U_{avg} of 75%, T_v equals

0.477 [Das, 2005]. Using a c_v of 0.009 cm^2/sec from the laboratory consolidation tests and a c_v of 0.14 cm^2/sec from the field test as presented in the Data Package, the time for the SOLW to achieve a U_{avg} of 75% was calculated to range from approximately 90 to 1420 days (3.9 years). As discussed in the Data Package, the consolidation rate in the field occurred at a much faster rate than in the lab due to lateral drainage. However, since the actual loaded area of the SCA is large enough that lateral drainage likely will not greatly affect the consolidation rate, the lab test rate of c_v = 0.009 cm^2/sec is considered more representative than the field test rate of actual conditions during SCA construction and operation. Therefore, it is conservatively assumed herein that the SOLW will require approximately 1420 days (3 years, 11 months) to reach the U_{avg} = 75% condition.

Based on the current phasing plan, the anticipated effective stress increase of the first year of construction was used to calculate the SOLW undrained shear strength at U_{avg} = 75%. The consolidation due to the first year of geo-tube placement will have adequate time to consolidate to be at or near a U_{avg} = 75% condition after placement of the final cover. However, consolidation due to years 2, 3, and 4 of geo-tube construction may not have sufficient time to reach U_{avg} = 75% conditions, therefore the additional strength gain from these stages of construction was conservatively ignored in calculation of the U_{avg} = 75% profile. Additionally, the edges of the geo-tube loaded area will not have the full $\Delta\sigma_v'$ load calculated above. Therefore, in calculation of the U_{avg} = 75% profile, undrained shear strength gain in locations under the side slopes of the SCA was conservatively ignored. A potential first-year geo-tube phasing plan is shown in Figure 13.

In summary, the following items should be noted regarding the incorporation of the S_u profiles into the slope stability analyses:

- The groundwater table was considered to be at 50 feet bgs (or at approximately El. 375 ft) in the calculation of the undrained shear strength. However, in the SLIDE program, the effect of the perched water zones was taken into account and modeled as a single groundwater table at 15 feet bgs as previously discussed.
- The S_u profile for U_{avg} = 100% was not used in the analyses. The maximum undrained shear strength that the SOLW can achieve under loading was considered to be the S_u profile for U_{avg} = 75% under three stacks of geo-tube loading.
- The initial S_u profile as a function of depth was input directly into the SLIDE program and used for calculations with the exception of calculating global stability after placement of the final cover, for which the S_u profile for U_{avg} = 75% was used.

- In order to facilitate the calculations of the undrained shear strength, the initial stepwise S_u profile of SOLW and the OCR profile recommended in the Data Package have been slightly modified to be smooth curves in this package.
- Due to the low permeability soil liner system, it was assumed that SOLW consolidation will occur in a single-drained state at the foundation soil layer at an average depth of 50 feet bgs.
- The computations for U_{avg}=75% and U_{avg}=100% are based on calculations of the expected required consolidation time. The actual field consolidation will be monitored through field instrumentation, and the construction will be adjusted accordingly if necessary.

ANALYZED CASES

Both Cross-Sections A-A and B-B were analyzed for conditions without the final cover and with the final cover for the four potential slip modes mentioned earlier. A more detailed discussion of the analyzed cases is presented below.

Geo-tube Slip Mode

The block slip of geo-tubes represents potential sliding within the interfaces between individual geo-tubes, resulting in multiple geo-tubes sliding off of the mass of geo-tubes. Computations were performed using short-term strength parameters, including the initial S_u profile (Figure 9) to represent the undrained shear strength of the underlying SOLW layer. Since the slip surfaces do not pass through the existing SOLW, the S_u values of SOLW do not affect the calculated FS. This mode was analyzed for 12 different cases for Cross-Section A-A and five different cases for Cross-Section B-B, as summarized on Tables 2 and 3, respectively. More cases were considered for Cross-Section A-A because of the higher number of vertical interfaces to be considered in that cross section, as compared to Cross-Section B-B, due to tube orientation/geometry. The number of stacks indicated in the tables represents the tiers, counting from the top downwards, involved in the potential slip. The number of columns represents the number of geo-tubes per stack involved in the potential slip. A conceptual illustration of "stacks" and "columns" is shown in Figure 14.

As indicated previously, establishing a range in friction angles that would be considered acceptable for the geo-tube/geo-tube interface is also a goal of the stability analyses presented herein. Therefore, based on the initial analyses using the friction angles established through laboratory testing, which yielded acceptable FS values, the most critical case for geo-tube slip was identified (i.e., Top 4 stacks; 1 column, as indicated on Table 2). This critical case is illustrated in Figure 15 without a final cover and in Figure 16 with a final cover.

In addition, this critical case was used to back-calculate the required effective stress friction angle of the horizontal geo-tube/geo-tube interface to achieve the target FS for both peak and residual conditions. This procedure was followed for Cross-Section A-A without the final cover (target peak FS=1.3, target residual FS=1.1) and for Cross-Section A-A with the final cover (target peak FS=1.5, target residual FS=1.3). Since the geo-tube slip mode is more critical for Cross-Section A-A due to the geometry involved (see results on Table 2 as compared to 3), the back-calculated values from Cross-Section A-A are also considered acceptable for Cross-Section B-B. This is discussed in more detail in Attachment 4.

Liner Stability

Block slip of the liner represents sliding along the proposed liner. Computations using this mode were performed using short-term strength parameters and the initial S_u profile (Figure 9) to represent the undrained shear strength of the SOLW layer. Since the slip surfaces do not pass through the existing SOLW, these S_u values do not affect the calculated FS.

Similar to the geo-tube slip mode analysis, first the most critical case for liner stability was identified using the minimum friction angle established during laboratory testing. For liner stability, the critical case involves the liner failing underneath the first column of geo-tubes, as illustrated in Figures 17 and 18 without and with final cover, respectively. Once the critical case was identified, the analysis was also performed using the maximum laboratory measured liner friction angle. Table 2 provides the results using the minimum liner friction angle established in the laboratory testing, and Attachment 3 provides the results (critical case only) using the maximum liner friction angle established in the laboratory testing.

As indicated previously, establishing a range in friction angles that would be considered acceptable for the liner system is also a goal of the stability analyses. Using the critical case identified above, the required effective stress friction angle of the proposed liner system to achieve the target FS could be back-calculated. To establish a range in friction angle values, the sensitivity of the liner friction angle to changes in the geo-tube/geo-tube horizontal interface friction angle was also evaluated. The geo-tube/geo-tube horizontal interface friction angle was changed, and the required liner friction angle to achieve the target FS against liner slip was back-calculated using SLIDE. Based on the results presented in Tables 2 and 3, the Cross-Section A-A geometry is considered to be more critical than the Cross-Section B-B geometry; therefore, the additional analyses were performed on Cross-Section A-A. The results of these calculations before and after placement of the final cover are shown and discussed further in Attachment 4.

Global Stability (Circular slip surfaces)

Global stability of the proposed SCA was evaluated with circular potential slip surfaces. The global stability through the foundation material prior to placement of the final cover was evaluated using undrained strength parameters (the initial S_u profile shown in Figure 9) to represent the undrained shear strength of the SOLW layer. The global stability after placement of the final cover was evaluated for three cases: (i) Interim stability with the initial S_u profile; (ii) Interim stability with U_{avg}=75%; and (iii) Long-term stability.

The interim global stability case immediately after placement of the final cover was evaluated using the initial S_u profile to represent the undrained shear strength of the SOLW layer. The interim global stability case immediately after placement of the final cover was also evaluated using the S_u profile after consolidation to U_{avg}=75% to represent the undrained shear strength of the SOLW layer.

The long-term global stability after cover placement was evaluated using drained strength parameters. This long-term global stability evaluation was performed by assuming that the geotextile support of the geo-tubes will be degraded and therefore have no shear strength. The long-term evaluation was performed by also assuming the effective stress friction angle of the dredge material will increase to 30 degrees due to consolidation of the material (i.e., the long-term value provided in Table 1).

Global Stability of WB-13 Perimeter Dikes (Circular slip surfaces)

Potential global stability for slip surfaces through the SCA and existing WB-13 perimeter dike was evaluated for Cross-Sections A-A and B-B. This slip mode was analyzed for three cases: (i) Interim stability before final cover placement; (ii) Interim stability after final cover placement; and (iii) Long-term global stability.

In addition, global stability of the WB-13 perimeter dike was considered by focusing on potential slip surfaces through the dike. For these analyses, the WB-13 perimeter dike was modeled with a 2-ft thick crusty surficial layer with a cohesion intercept of 50 psf and a friction angle of 37 degrees to represent the effects of desiccation and roots. The inner portion of the WB-13 perimeter dike was modeled only with a friction angle of 37 degrees, consistent with the other cases analyzed. Two cases were considered to model the groundwater table within the WB-13 perimeter dike. The first case considered a water table that varies from the conservatively assumed 15 feet below ground level at the dike-SOLW interface to the ground surface level at the toe of the dike. The second case considered a water table that varies from 15 feet below ground level at the dike-SOLW interface to a level at the outside dike face that is 10 feet above the ground surface level at the toe of the dike.

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RESULTS AND DISCUSSION

Slope Stability Analysis

The results of the slope stability analyses for Cross-Sections A-A and B-B are summarized in Tables 2, 3, and 4. The results of the analyses for the most important cases are also shown graphically in Figures 19 through 43. The associated SLIDE runs are presented in Attachment 5 of this package.

The calculation results for Cross-Section A-A are summarized in Table 2 and indicate that the calculated FS values for cases without and with the final cover satisfy the target FS of 1.3 and 1.5, respectively, for the geo-tube slip mode, liner stability, and global stability. Since the global stability case using the initial S_u profile achieved the interim FS=1.3 criterion, a check of global stability using the U_{avg} = 75% profile was not performed for Cross-Section A-A.

The calculation results for Cross-Section B-B are summarized in Table 3 and indicate that the calculated FS values for cases without and with the final cover satisfy the target FS of 1.3 and 1.5, respectively, for the slip modes evaluated (i.e., geo-tubes slip mode, liner stability, and global stability). Slope stability analyses performed to evaluate a potential global slip mechanism resulted in a calculated FS satisfying the interim target FS of 1.3 using the initial S_u profile. It is noted that the actual S_u profile will be greater than the initial due to consolidation of the foundation soils under the loading from the geo-tubes. When the U_{avg} = 75% S_u profile is used, the calculated FS is greater than when the initial S_u profile is used. The calculated FS for long-term global stability satisfies the target FS of 1.5.

Slope stability analyses performed to evaluate the potential global slip mechanisms through the SCA and existing WB-13 perimeter dikes resulted in FS values much greater than the target FS. Cross-Section A-A, as expected, has a lower factor of safety than for Cross-Section B-B with regards to global slip of existing WB-13 perimeter dikes, however, the calculated FS for Cross-Section A-A still greatly exceeds the target FS for both interim and long-term conditions.

Slope stability analyses were also performed for slip surfaces through the WB-13 perimeter dike that do not extend to the SCA (i.e., analyses focused on the dike only). For the case with the water table at the toe of the dike, minimum FS values of 3.0 for the critical global slip surface extending to the top of the WB-13 perimeter dike and 1.8 for the critical shallow slip surface within the slope were calculated, as shown in Figure 30. For the case with the water table at 10 feet above the toe of the dike, minimum FS values of 1.8 for the critical global slip surface extending to the top of the WB-13 perimeter dike and 1.1 for the critical shallow slip surface within the slope were calculated, as shown in Figure 31. This shallow slip surface is located near the toe under the estimated water table level within the WB-13 perimeter dike. A FS of 1.1 for shallow slip surfaces is indicative of the potential for surficial sloughing. Since dike stability is directly related to water level (i.e., pore water pressure) within the dike, it is recommended that instrumentation and monitoring be performed during operations, and remedial measures be implemented if appropriate.

FS values were also calculated using residual shear strengths for the geosynthetic components. For Cross-Section A-A, the critical geo-tube slip case of one column of four stacks of geo-tubes and the critical liner slip case of one column of geotubes before and after final cover placement were evaluated. The calculated FS values using residual shear strengths satisfy the target residual FS values for both interim and long-term conditions.

Additionally, the back-calculation presented in Attachment 4 indicates that the required values for the peak laboratory friction angles for the horizontal geo-tube/geo-tube interface and liner system are 13.8 degrees and 18.3 degrees, respectively (or alternative combinations as shown in Figure 44), to meet the target FS values. The required values for the residual laboratory friction angles for the horizontal geo-tube/geo-tube interface and liner system are 11.6 degrees and 16.1 degrees, respectively (or alternative combinations as shown in Figure 45), to meet the target FS values. The minimum required values of peak and residual effective stress friction angle to meet the target FS values are shown in Figures 44 and 45. It is recommended that site-specific testing be performed on the selected liner system to verify the strength parameters meet or exceed these back-calculated values.

SUMMARY AND CONCLUSIONS

This package evaluates the static slope stability of the proposed SCA. Four potential slip modes were evaluated using the computer computation program SLIDE: (i) block slip mode along geo-tube interfaces; (ii) block slip mode along the liner system, (iii) circular slip surfaces through dredge material contained in geo-tubes and WB-13 foundation materials; and (iv) circular slip surfaces through existing WB-13 perimeter dikes.

Analyses of two critical cross-sections indicate that the calculated FSs for the four potential slip modes meet the target FS for interim and long-term conditions. However, placement of five layers of geo-tubes and the final cover system within the same season results in a calculated FS that only slightly exceeds the target value, a limitation that should be considered during design of the phasing plan for geo-tube construction. Instrumentation to monitor the field consolidation is recommended to verify adequate strength gain occurs before placement of the final cover. In addition, piezometers to monitor the water levels in the dikes, and inclinometers near the SCA berms to monitor stability in the field are recommended. Details regarding this instrumentation are provided in Appendix N of the SCA Final Design, "Geotechnical Instrumentation and Monitoring Plan."

Minimum required parameters for the interface between geo-tubes and the liner system have been back-calculated. In order to meet the target factor of safety values against block slip, the peak effective stress friction angle for the interface between geo-tubes should be at least 13.8 degrees and the peak effective stress friction angle for the liner system should be at least 18.1 degrees. In order to meet the target factor of safety values against block slip, the residual effective stress friction angle for the interface between geo-tubes should be at least 11.6 degrees and the peak effective stress friction angle for the liner system should be at least 16.1 degrees. Alternative combinations of geo-tube friction angle and liner friction angle may also be acceptable, as shown in Figures 44 and 45. Laboratory testing indicates that these values are achievable with a variety of common commercially available geosynthetics. Testing of material delivered to the project during construction will be performed to verify components meet the specified strength.

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Tables

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Table 1. Summary of Material Properties for Slope Stability Analysis

Material	Unit Weight (pcf)	Undrained Shear Strength (psf)	Drained Shear Strength Effective Stress Friction Angle (degree)
SOLW	82	See Figures 7 through 12	34
SCA Perimeter Dike Soil	120	---	35
Foundation Soil (including WB-13 perimeter dike)	120	---	37
Liner	100	---	19[1]
Gravel Drainage	120	---	38
Geo-tube/Gravel Interface	86	---	24[2]
Geo-tube	---	Design Tensile Strength = 1600 lb/ft[3]	
Dredge Material (Short Term)	86	---	15[4]
Dredge Material (Long-Term)	86	---	30
Geo-tube/Geo-tube Interface (Vertical)	43[5]	---	0.1[6]
Geo-tube/Geo-tube Interface (Horizontal)	86	---	15[1]
Final Cover Soil	120	---	30

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Table 1. Summary of Material Properties for Slope Stability Analysis (Continued)

Notes:

1. The values presented in this table (i.e., 15 degrees and 19 degrees) are the measured peak effective friction angles for geo-tube/geo-tube interface and liner, respectively (see Attachment 2).
2. Taken from Koerner [1994]. A typical value of interface effective friction angle between woven geotextile and sand was assumed.
3. The design tensile strength was modeled using a two-end anchored geotextile sheet. Based on commercially available products, the ultimate tensile strength of geo-tubes was assumed to be 4800 lb/ft and a strength reduction factor of 3.0 was applied to calculate the design tensile strength, taking into account creep deformation, chemical degradation, and strength loss within seams, connections, and joints [GRI, 1992].
4. Under short-term conditions, the dredge material was assumed to have half of the friction angle of the material under long-term conditions.
5. The vertical interface was assumed to have a unit weight equal to half of the unit weight of the dredge material. This was based on the geometry of the geo-tubes after deformation. The volume of material in the vertical interface after deformation was assumed to be approximately half the total volume available if the geo-tubes could be placed in direct contact with each other along the entire interface.
6. The geo-tube/geo-tube vertical interface has insignificant side friction, but a small value of friction angle was necessary for numerical stability of the SLIDE calculation program.

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Table 2. Summary of Slope Stability Analysis: Cross-Section A-A

Case		Without Final Cover				With Final Cover			
		Calculated FS[1]		Figure Number	Target F.S.	Calculated FS[1]		Figure Number	Target F.S.
		Spencer's Method[2]	Janbu's Method[2]			Spencer's Method[2]	Janbu's Method[2]		
Slip of Geo-tubes (Block Mode)	Top 1 stack; 1 column	--	8.53	--	1.30	--	8.68	--	1.50
	Top 1 stack; 2 columns	--	26.71	--	1.30	--	-- [5]	--	--
	Top 2 stacks; 1 column	--	2.44	--	1.30	--	3.37	--	1.50
	Top 2 stacks; 2 columns	--	5.40	--	1.30	--	-- [5]	--	--
	Top 3 stacks; 1 column	--	1.73	--	1.30	--	2.02	--	1.50
	Top 3 stacks; 2 columns	--	3.50	--	1.30	--	3.81	--	1.50
	Top 4 stacks; 1 column	--	1.52	19	1.30	--	1.62	24	1.50
	Top 4 stacks; 2 columns	--	2.44	--	1.30	--	2.79	--	1.50
	Top 4 stacks; 3 columns	--	3.89	--	1.30	--	-- [5]	--	--
	5 stacks; 1 column	--	1.72	20	1.30	--	1.73	--	1.50
	5 stacks; 2 columns	--	2.69	--	1.30	--	2.89	--	1.50
	5 stacks; 3 columns	--	4.47	--	1.30	--	-- [5]	--	--
Liner Stability (Block Mode)	One column of geo-tubes	--	1.57	21	1.30	--	1.59	25	1.50
	Two columns of geo-tubes	--	2.24	--	1.30	--	2.48	--	1.50
Global Stability (Circular Mode)	Through Foundation Material (U_{avg}=0%) – Interim	1.66 [3]	--	22	1.30	1.45 [3]	--	26	1.30
	Through Foundation Material (U_{avg}=75%) – Interim	--	--	--	--	--[6]	--[6]	--	--
	Through Foundation Material – Long-Term	--	--	--	--	1.83[7]	--	27	1.50
Global Stability (Circular Mode)	Through SCA and Existing WB-13 Perimeter Dike – Interim	3.46 [4]	--	23	1.30	2.84[4]	--	28	1.30
	Through SCA and Existing WB-13 Perimeter Dike – Long Term	--	--	--	--	5.65	--	29	1.50

Table 2. Summary of Slope Stability Analysis: Cross-Section A-A (Continued)

Notes:

1. These values are calculated using the laboratory values of peak effective stress friction angle for the geo-tube/geo-tube horizontal interface (15 degrees) and the liner (19 degrees). The laboratory test data are shown in Figures 2-4 and 2-5 of Attachment 2.
2. Spencer’s method is considered more rigorous than Janbu’s method because Spencer’s method satisfies both force and moment equilibrium. However, Spencer's method often encounters numerical convergence difficulty when complicated block slip surfaces are considered, as in this analysis. Therefore, Spencer's method was used for the circular mode analysis, while Janbu's method was used for the block mode analysis
3. This calculation uses the initial S_u profile for the undrained shear strength of the existing SOLW.
4. This was modeled by forcing the slip circle to pass through the existing WB-13 perimeter dike.
5. This case was not analyzed due to the acceptable FS values found for similar cases.
6. The U_{avg}=75% case was not analyzed for Cross-Section A-A because the interim FS was acceptable using the initial S_u profile.
7. For long-term, the geotextile of the geo-tubes was assumed to be degraded and therefore have no shear strength. The dredge material was modeled with the long-term friction angle of 30 degrees.
8. Figures are only included for the most important cases.

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Table 3. Summary of Slope Stability Analysis: Cross-Section B-B

Case		Without Final Cover				With Final Cover			
		Calculated FS[1]		Figure Number	Target F.S.	Calculated FS[1]		Figure Number	Target F.S.
		Spencer's Method[2]	Janbu's Method[2]			Spencer's Method[2]	Janbu's Method[2]		
Slip of Geo-tubes[3] (Block Mode)	Top 1 stack; 1 column	--	46.93	--	1.30	--	21.73	--	1.50
	Top 2 stacks; 1 column	--	13.47	--	1.30	--	10.66	--	1.50
	Top 3 stacks; 1 column	--	10.73	--	1.30	--	9.04	--	1.50
	Top 4 stacks; 1 column	--	6.60	32	1.30	--	6.00	37	1.50
	5 stacks; 1 column	--	9.81	33	1.30	--	9.30	--	1.50
Liner Stability[3] (Block Mode)	One column of geo-tubes	--	1.86	34	1.30	--	1.81	38	1.50
Global Stability (Circular Mode)	Through Foundation Material (U_{avg}=0%) – Interim	1.36[3]	--	35	1.30	1.40[3]	--	39	1.30
	Through Foundation Material (U_{avg}=75%) – Interim	--	--	--	--	1.42[4]	--	40	1.30
	Through Foundation Material – Long-Term[5]	--	--	--	--	1.91	--	41	1.50
Global Stability (Circular Mode)	Through SCA and Existing WB-13 Perimeter Dike – Interim	8.39	--	36	1.30	7.07	--	42	1.30
	Through SCA and Existing WB-13 Perimeter Dike – Long-Term	--	--	--	--	11.96	--	43	1.50

Notes:
1. These values are calculated using the laboratory values of peak effective stress friction angle for the geo-tube/geo-tube horizontal interface (15 degrees) and the liner (19 degrees). The laboratory test data are shown in Figures 2-4 and 2-5 of Attachment 2.
2. Spencer's method is considered more rigorous than Janbu's method because Spencer's method satisfies both force and moment equilibrium. However, Spencer's method often encounters numerical convergence difficulty when complicated block slip surfaces are considered, as in this analysis. Therefore, Spencer's method was used for the circular mode analysis, while Janbu's method was used for the block mode analysis.
3. This calculation uses the initial S_u profile for the undrained shear strength of the existing SOLW.
4. This calculation uses the U_{avg}=75% profile for the undrained shear strength of the existing SOLW under the gravel, liner system, and three layers of geo-tubes.
5. For long-term, the geotextile of the geo-tubes was assumed to be degraded and therefore have no shear strength. The dredge material uses the long-term friction angle of 30 degrees.
6. Figures are only included for the most important cases.

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Table 4. Summary of Slope Stability Analysis: Residual Conditions for Cross-Section A-A

Case		Without Final Cover (Interim)		With Final Cover (Long-Term)	
		Calculated FS[1]	Target FS	Calculated FS[1]	Target FS
		Janbu's Method[2]		Janbu's Method[2]	
Slip of Geotubes (Block Mode)	Top 4 stacks; 1 column	1.21	1.10	1.34	1.30
Liner Stability (Block Mode)	One column of geo-tubes	1.33	1.10	1.36	1.30

Notes:
1. These values are calculated using the laboratory values of residual effective stress friction angle for the geo-tube/geo-tube horizontal interface (12 degrees) and the liner (17 degrees). The laboratory test data are shown in Figures 2-2 and 2-5 of Attachment 2.
2. The Janbu method was used for the block mode analyses presented here because Spencer's method often encounters numerical convergence difficulty with these types of analyses.
3. The target residual FS is 1.1 for the interim condition and 1.3 for long-term conditions.

Figures

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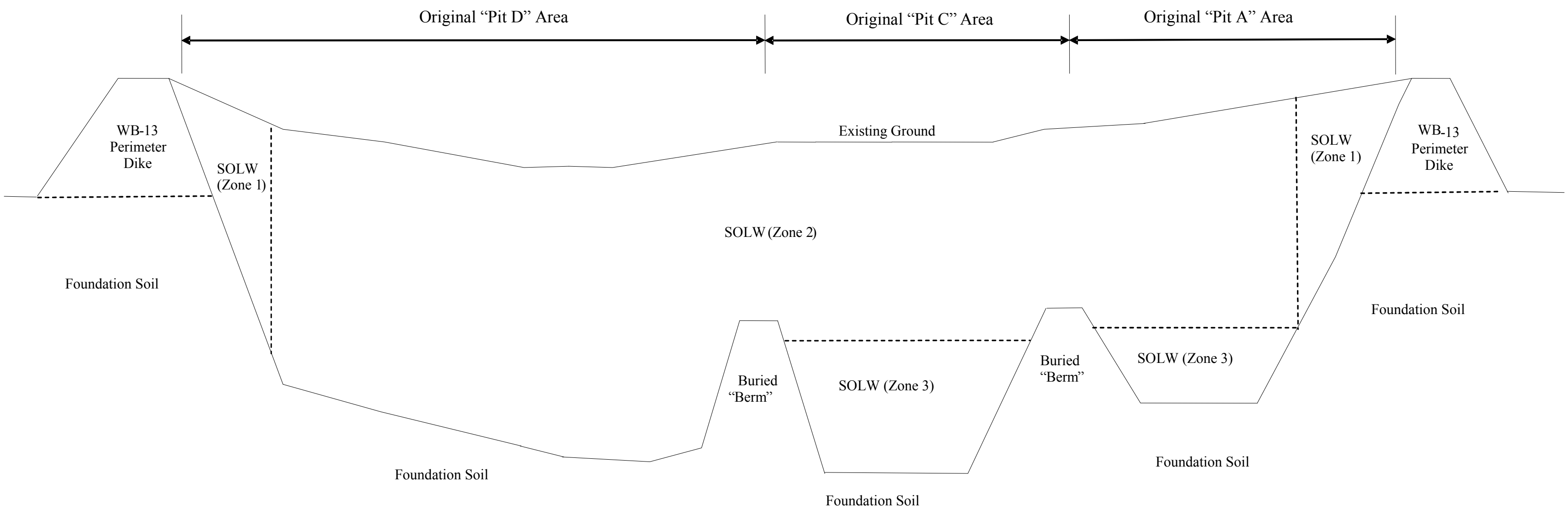
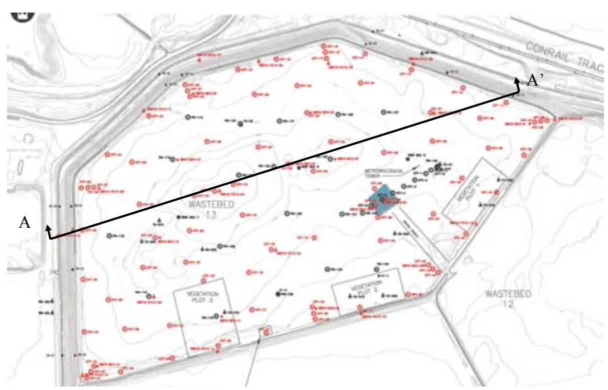


Figure 1. Schematic of Subsurface Profile

[not to scale; for purpose of showing subsurface stratigraphy only; location of the section is shown below]



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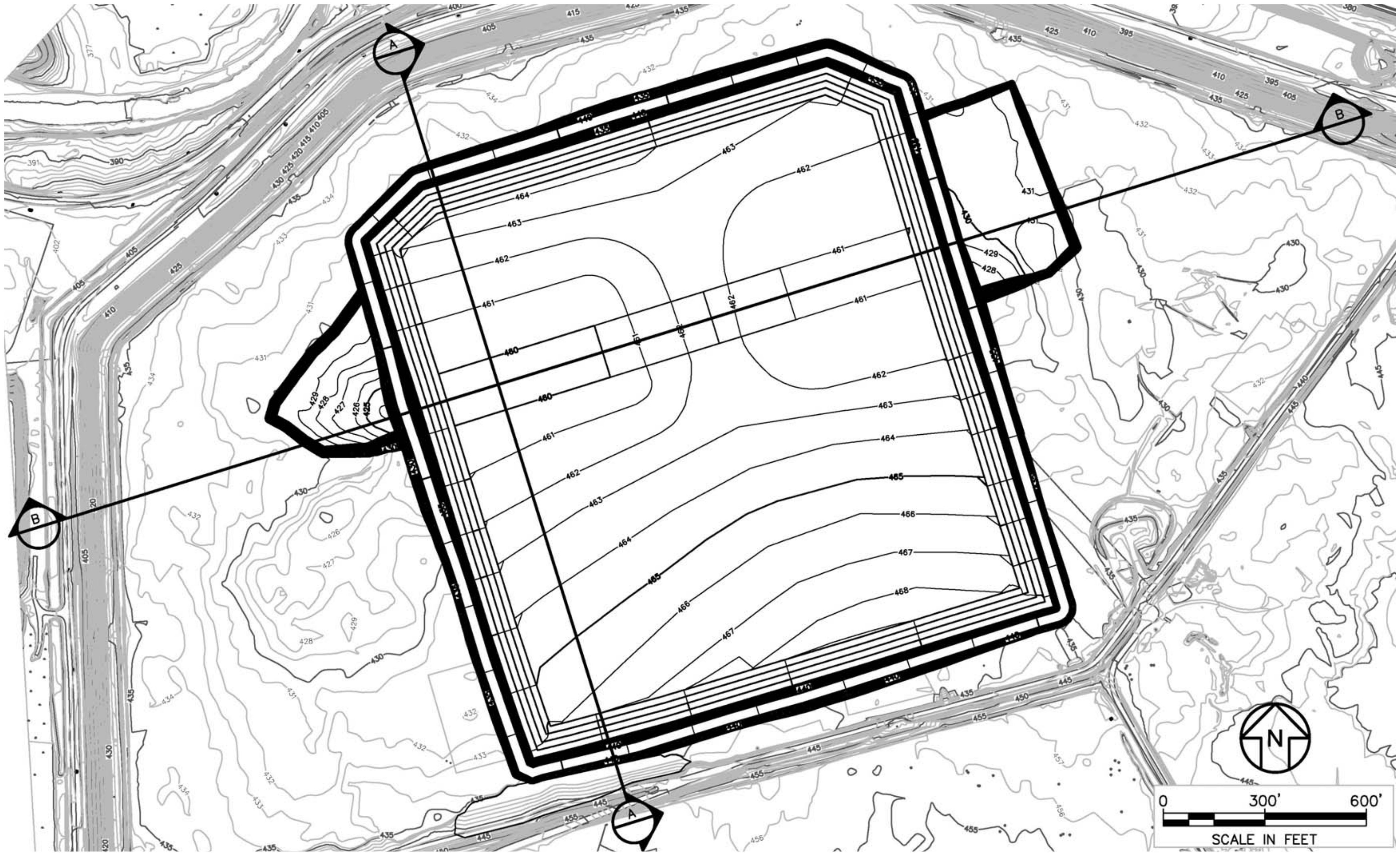

Figure 2. Locations of Analyzed Cross Sections

Note: This grading plan was prepared for the purpose of calculating the slope stability of the SCA and therefore settlement has not been accounted for in this figure.

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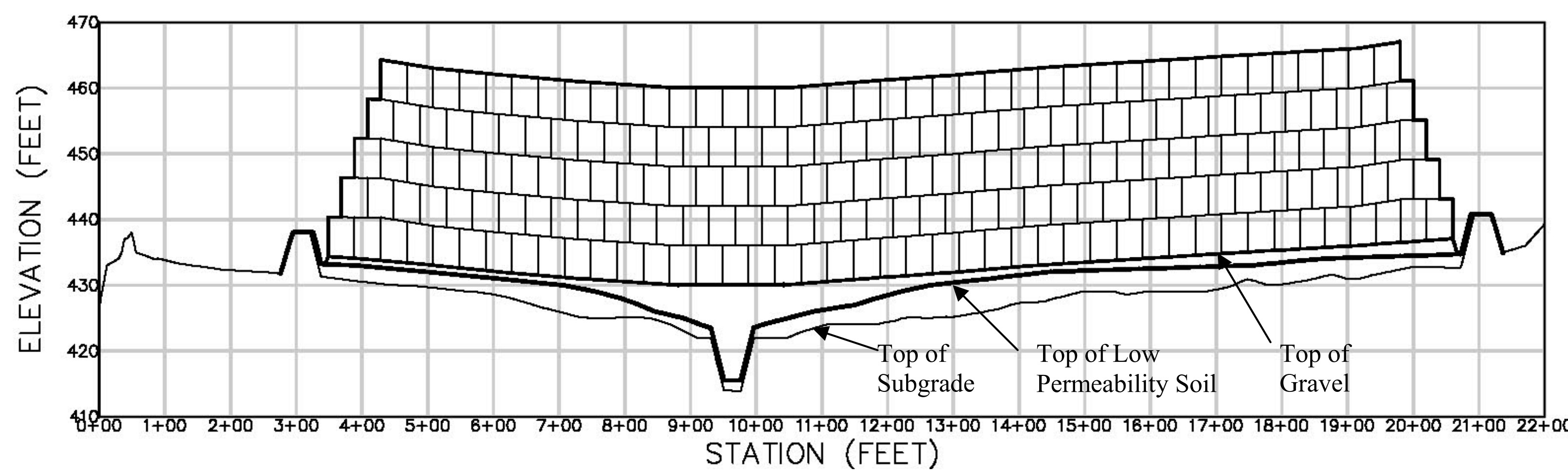

Figure 3. Layout of Cross-Section A-A

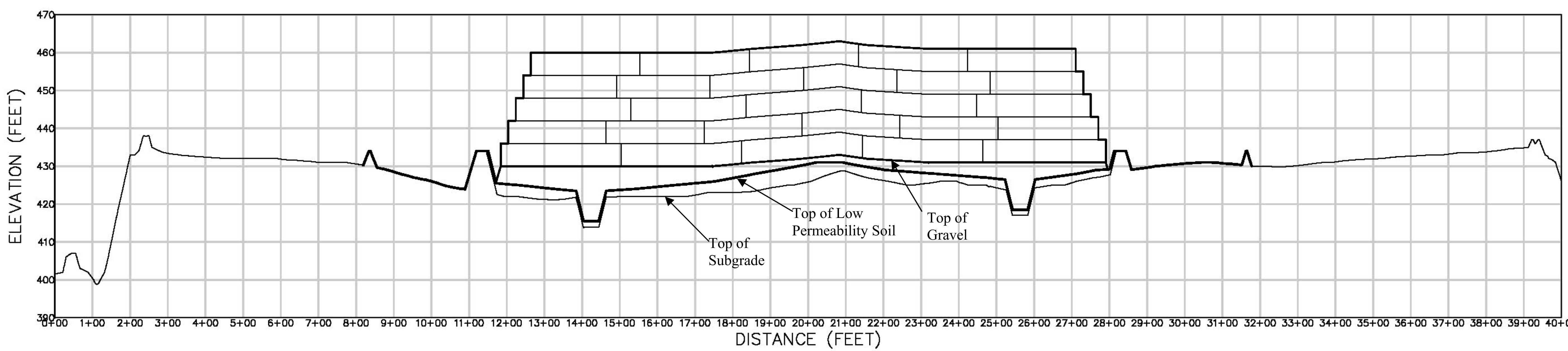

Figure 4. Layout of Cross-Section B-B

Note: Figures 3 and 4 have an exaggerated scale of 10x in the vertical direction (i.e., 100 ft horizontal=10 ft vertical)

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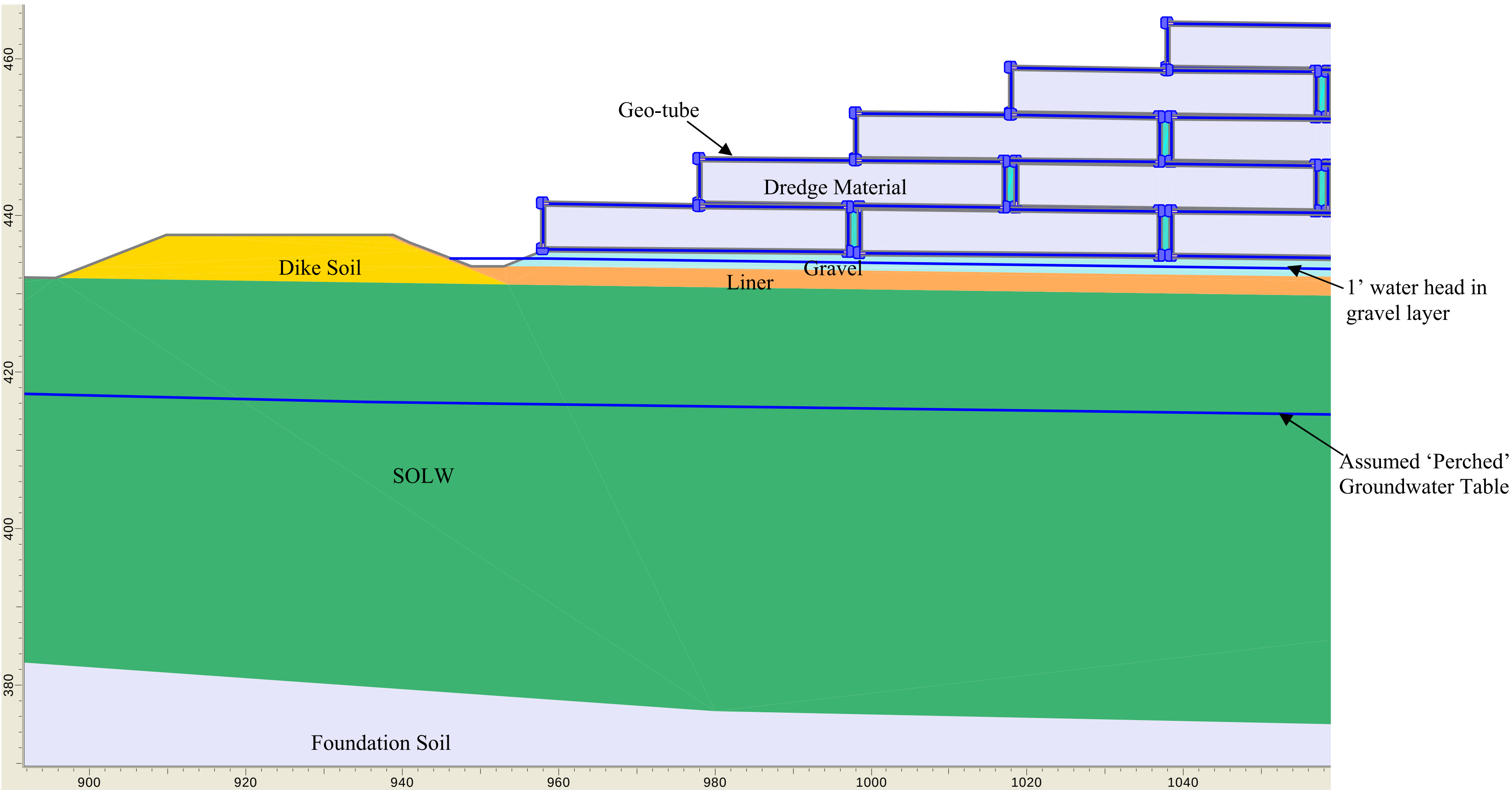

Figure 5. Layers included within the SLIDE Model

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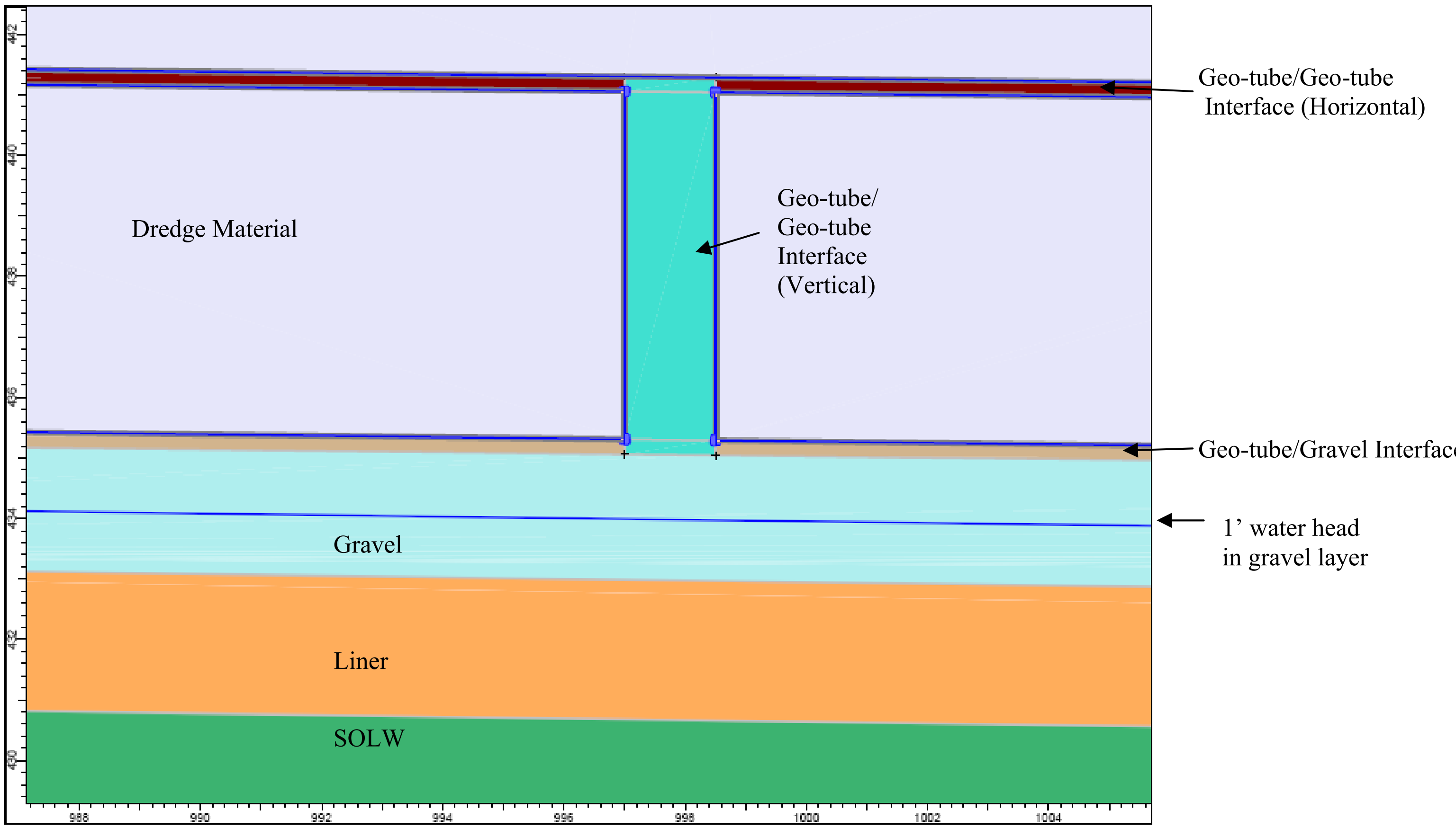

Figure 6. Close view of layers included within the SLIDE Model

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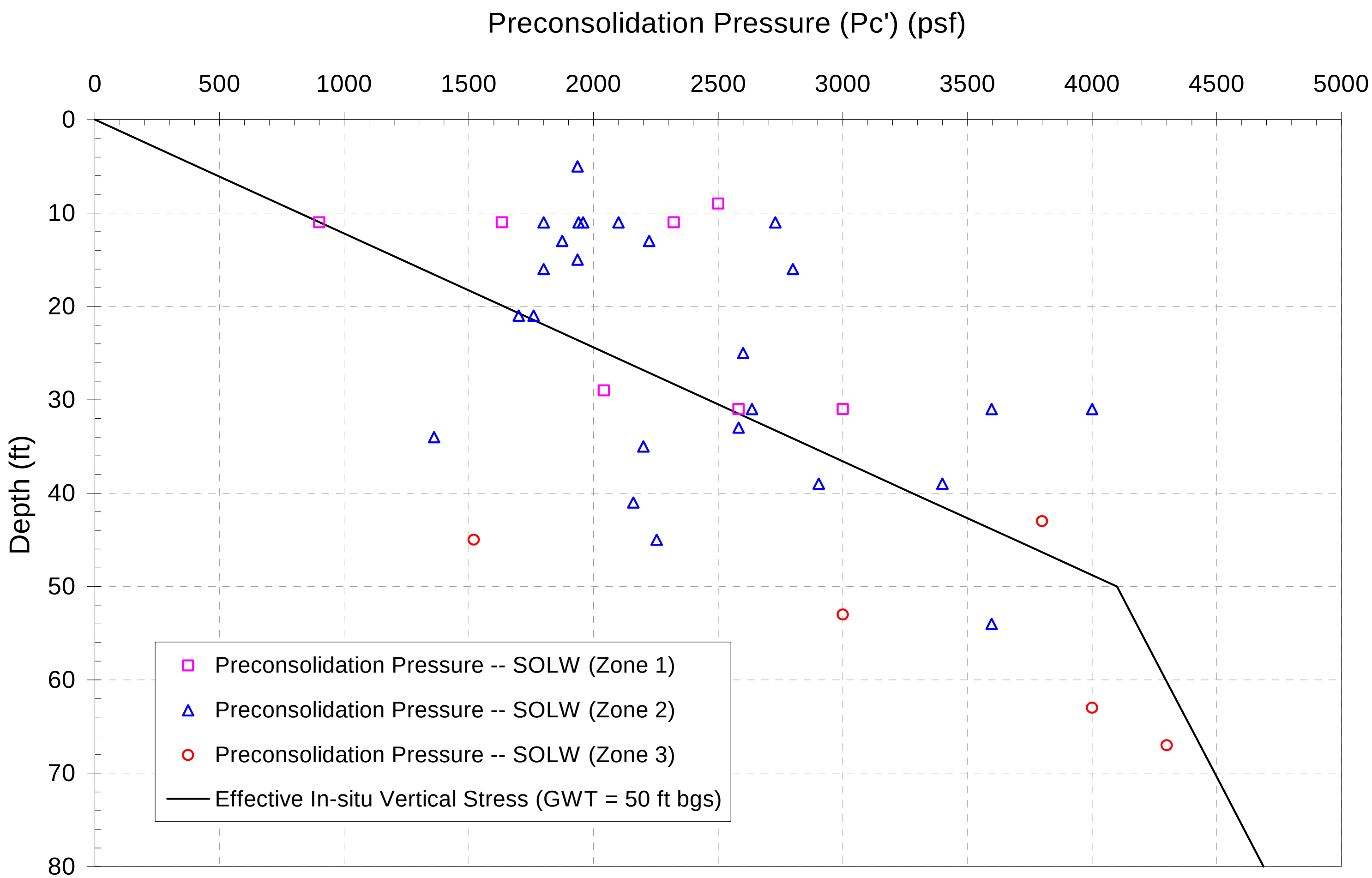

Figure 7. Preconsolidation Pressure of SOLW from Consolidation Tests

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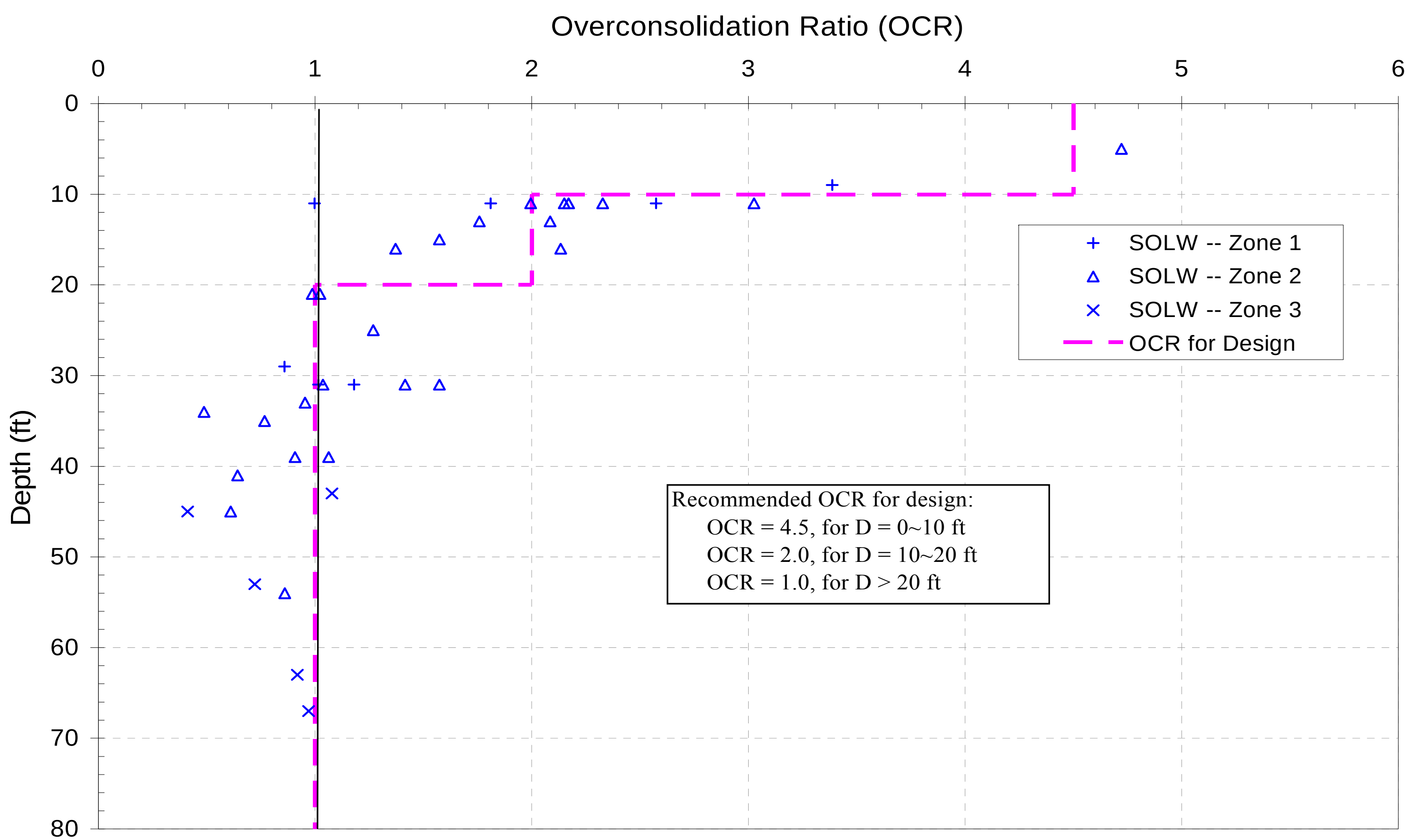

Figure 8. Overconsolidation Ratio of SOLW before Construction

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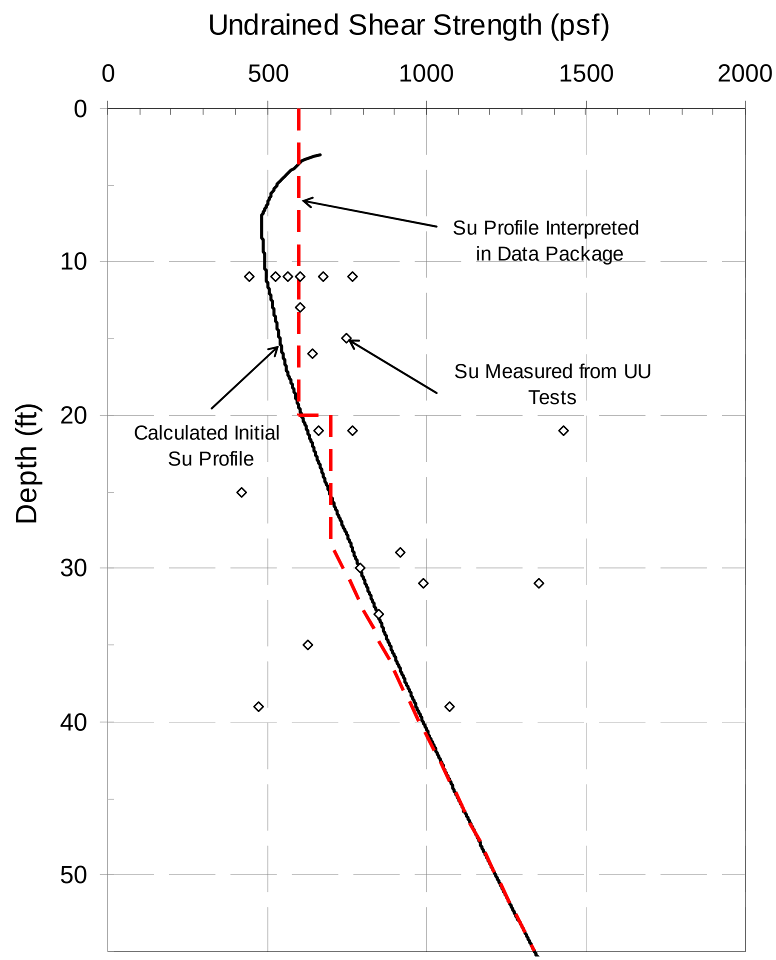

Figure 9. Initial S_U Profile of SOLW

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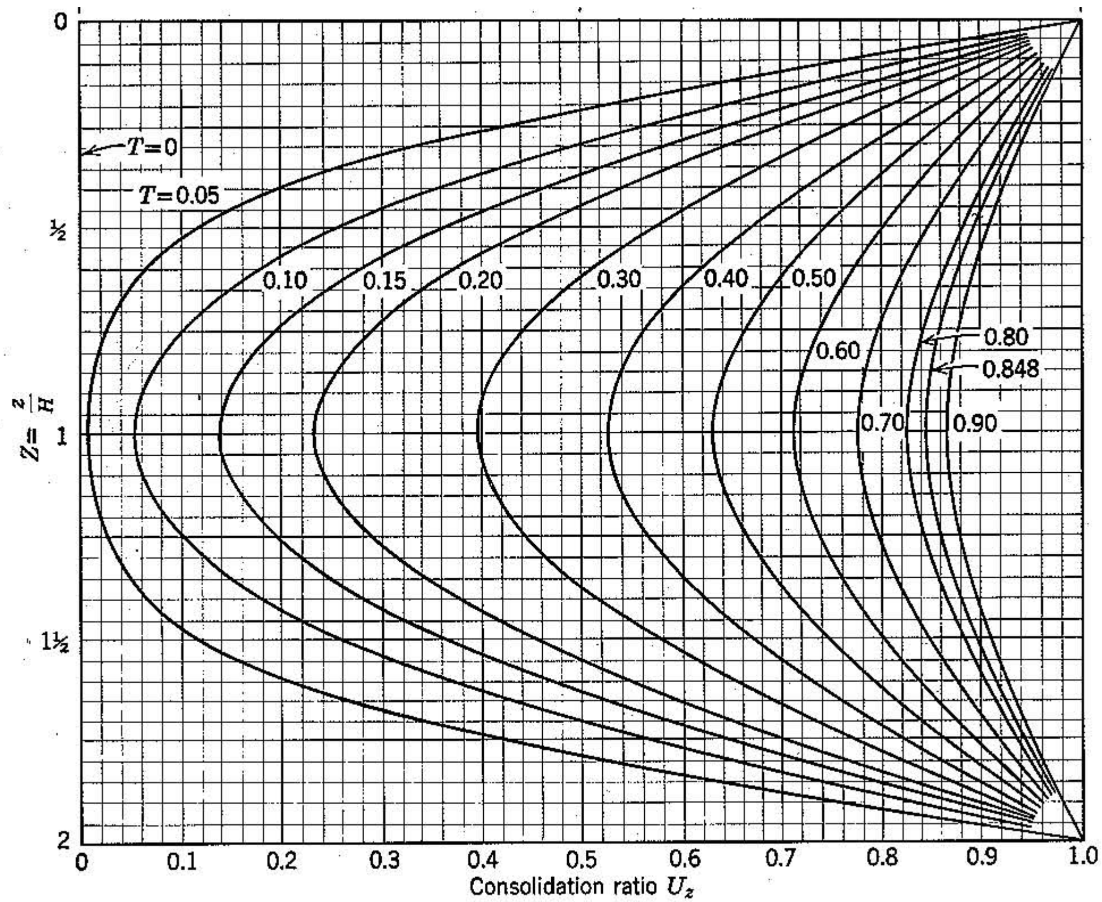

Figure 10. Consolidation Ratio as a Function of Depth [Lambe and Whitman, 1969]

Note: The thickness of the layer was assumed to be 50 ft based on the average depth of the existing SOLW.

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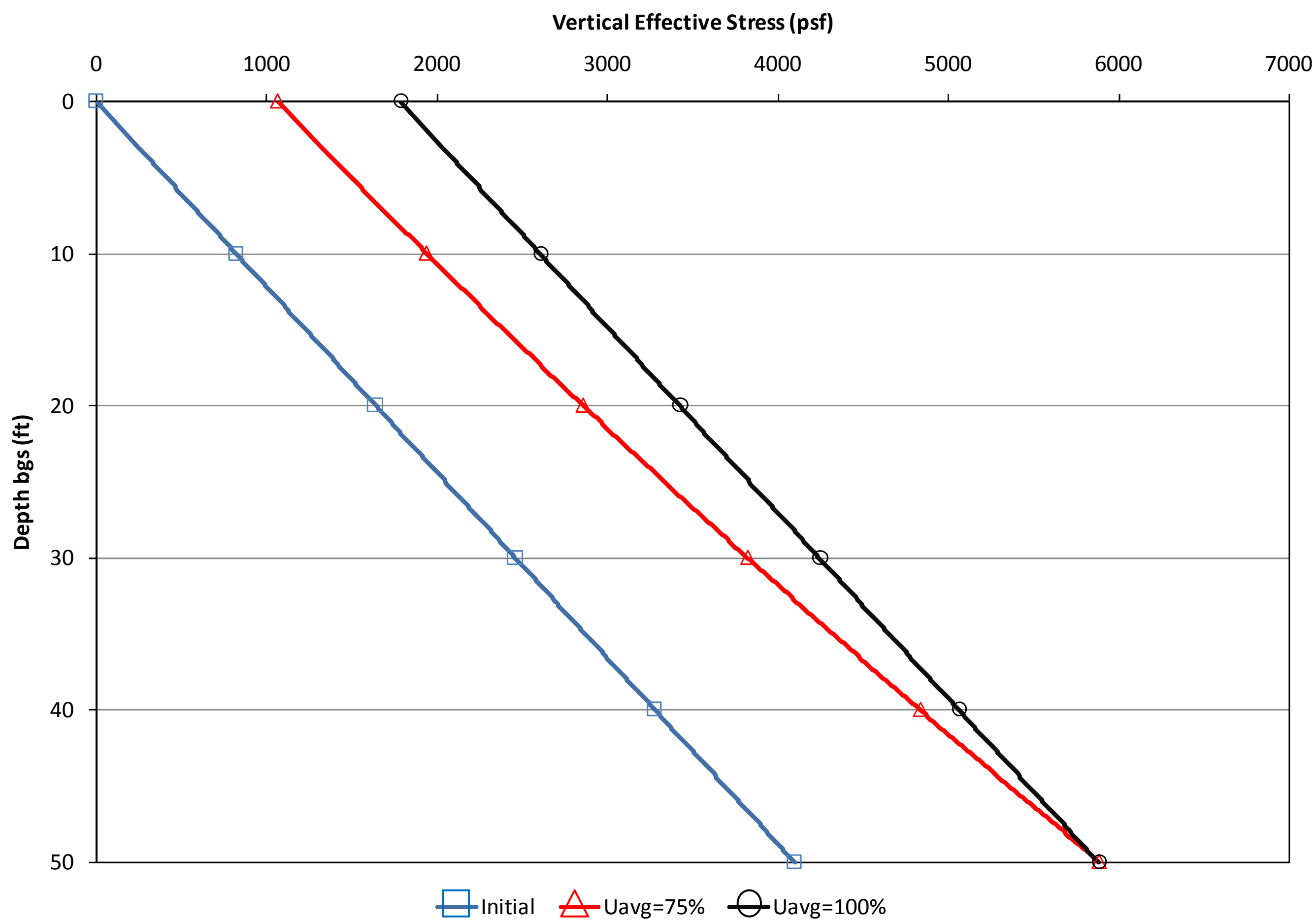

Figure 11. Vertical Effective Stress Profiles of SOLW

Note: Additional vertical effective stress is due to the loading from the liner system and three layers of geo-tubes.

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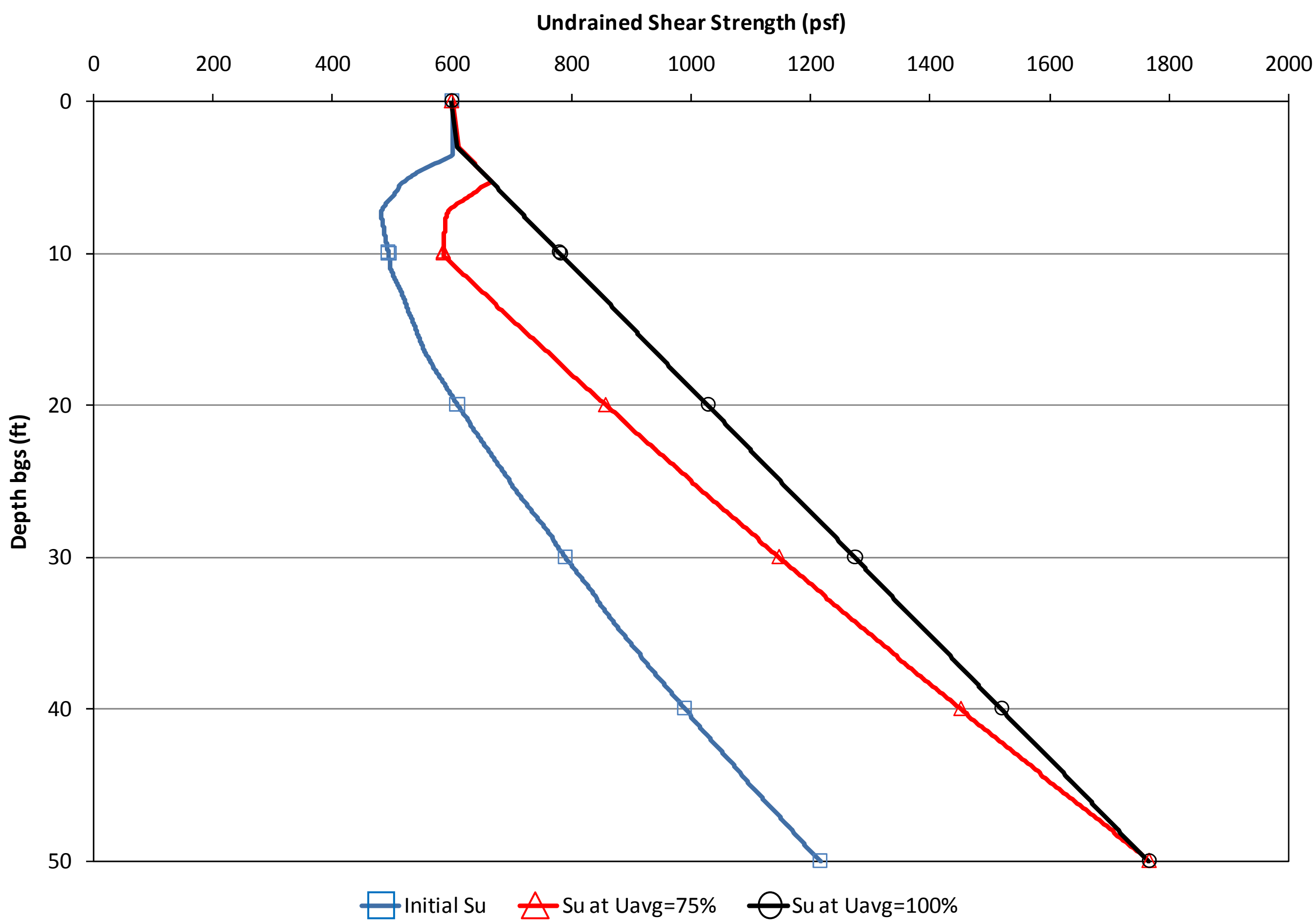

Figure 12. S_U Profiles of SOLW

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
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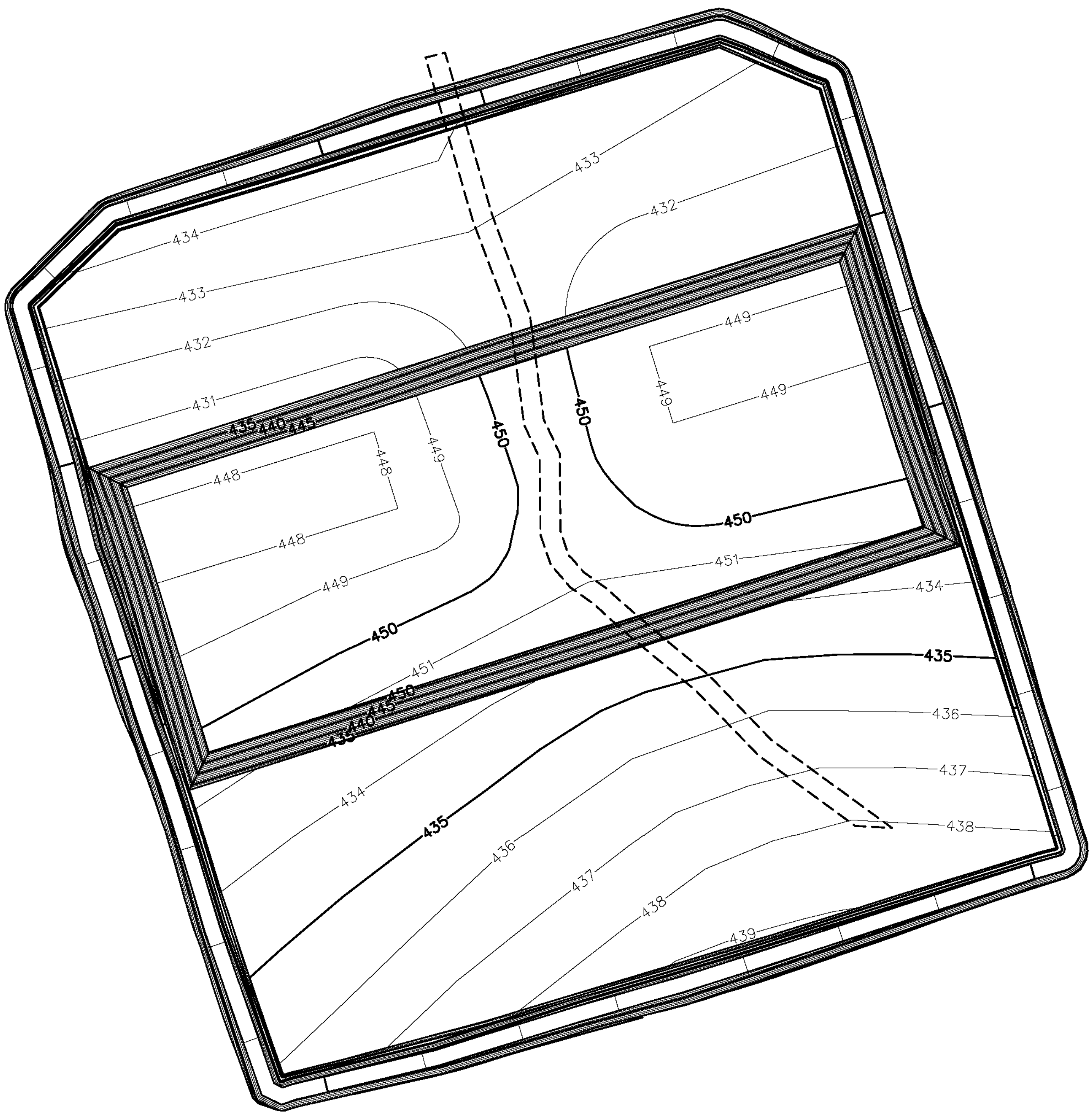

Figure 13: Potential First Year Geo-tube Phasing Plan

Note: This grading plan was prepared for the purpose of calculating the slope stability of the SCA and therefore settlement has not been accounted for in this figure.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

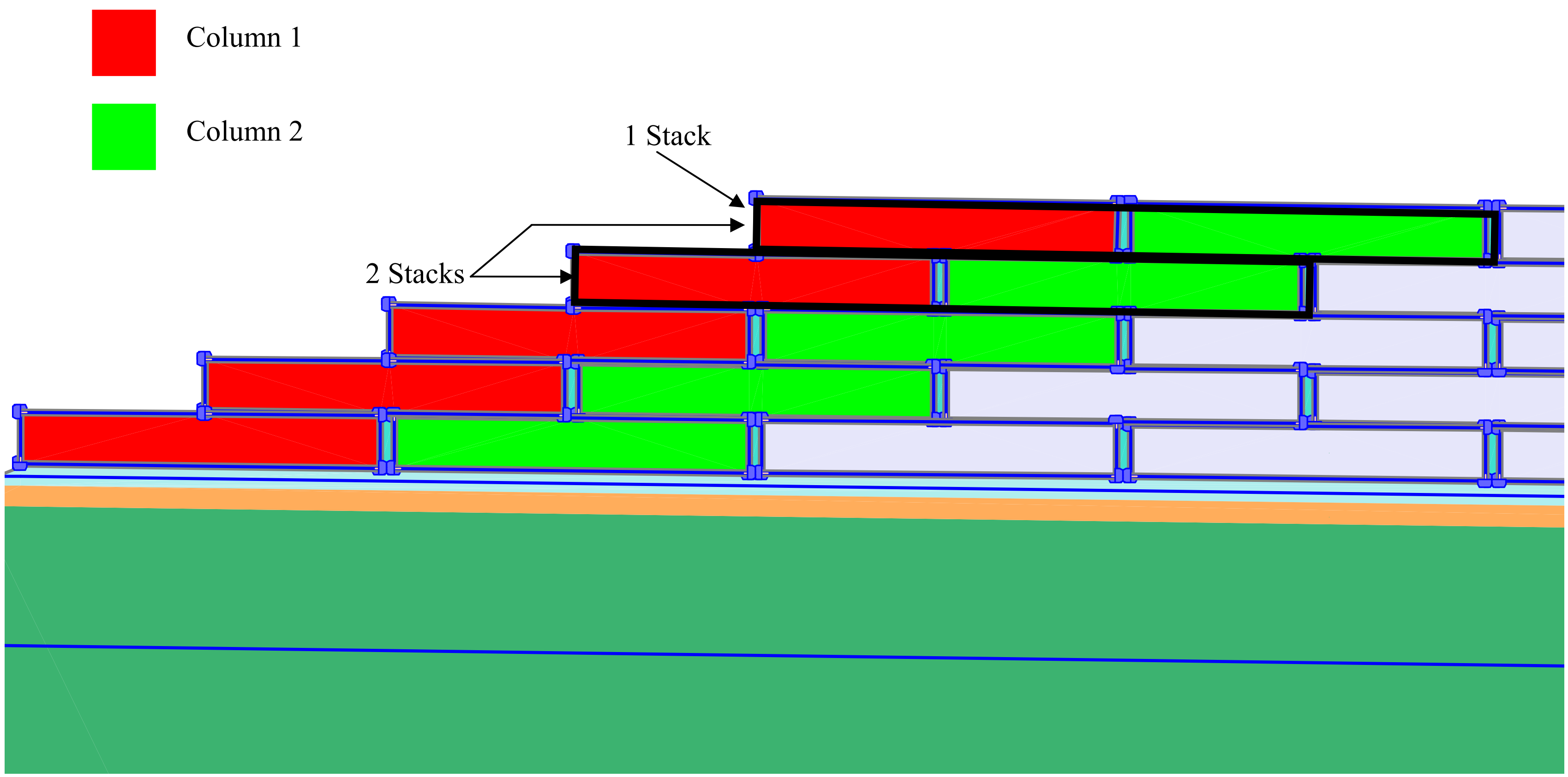

Figure 14: Conceptual Illustration of Stacks and Columns

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

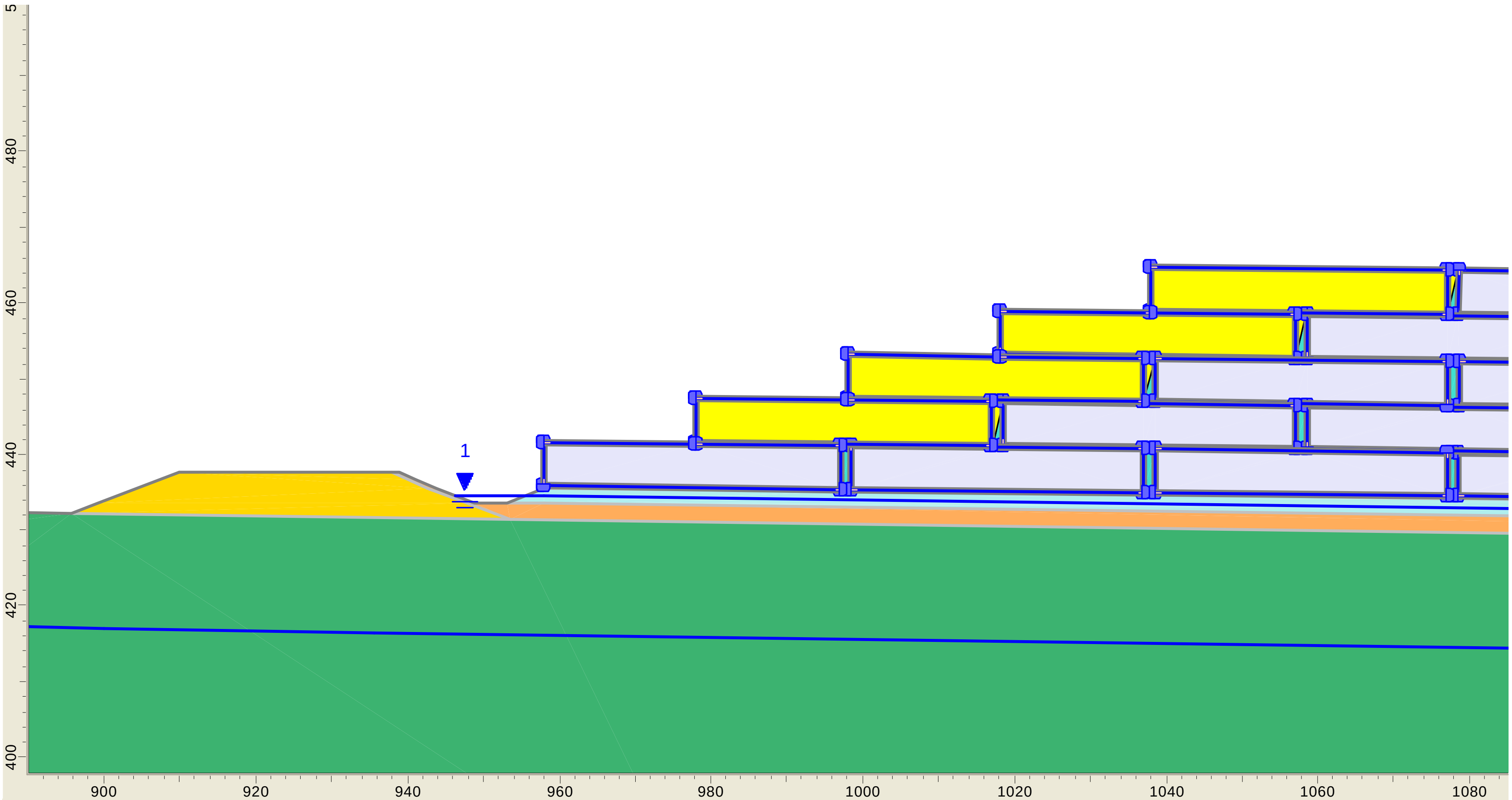

Figure 15. SLIDE Diagram of Critical Surface for Geo-tube Slip (4 stacks, 1 column) before Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

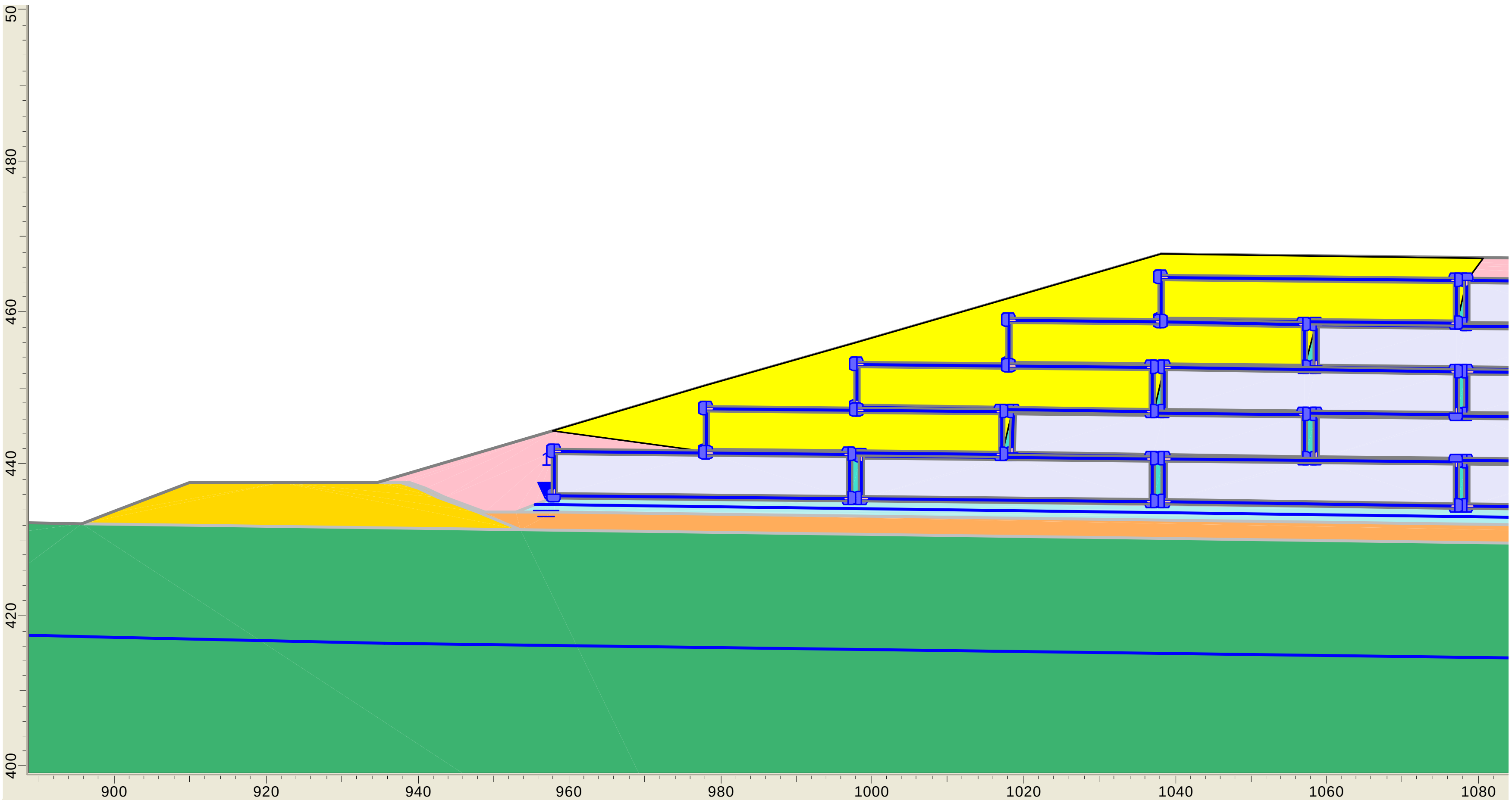

Figure 16. SLIDE Diagram of Critical Surface for Geo-tube Slip (4 stacks, 1 column) after Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

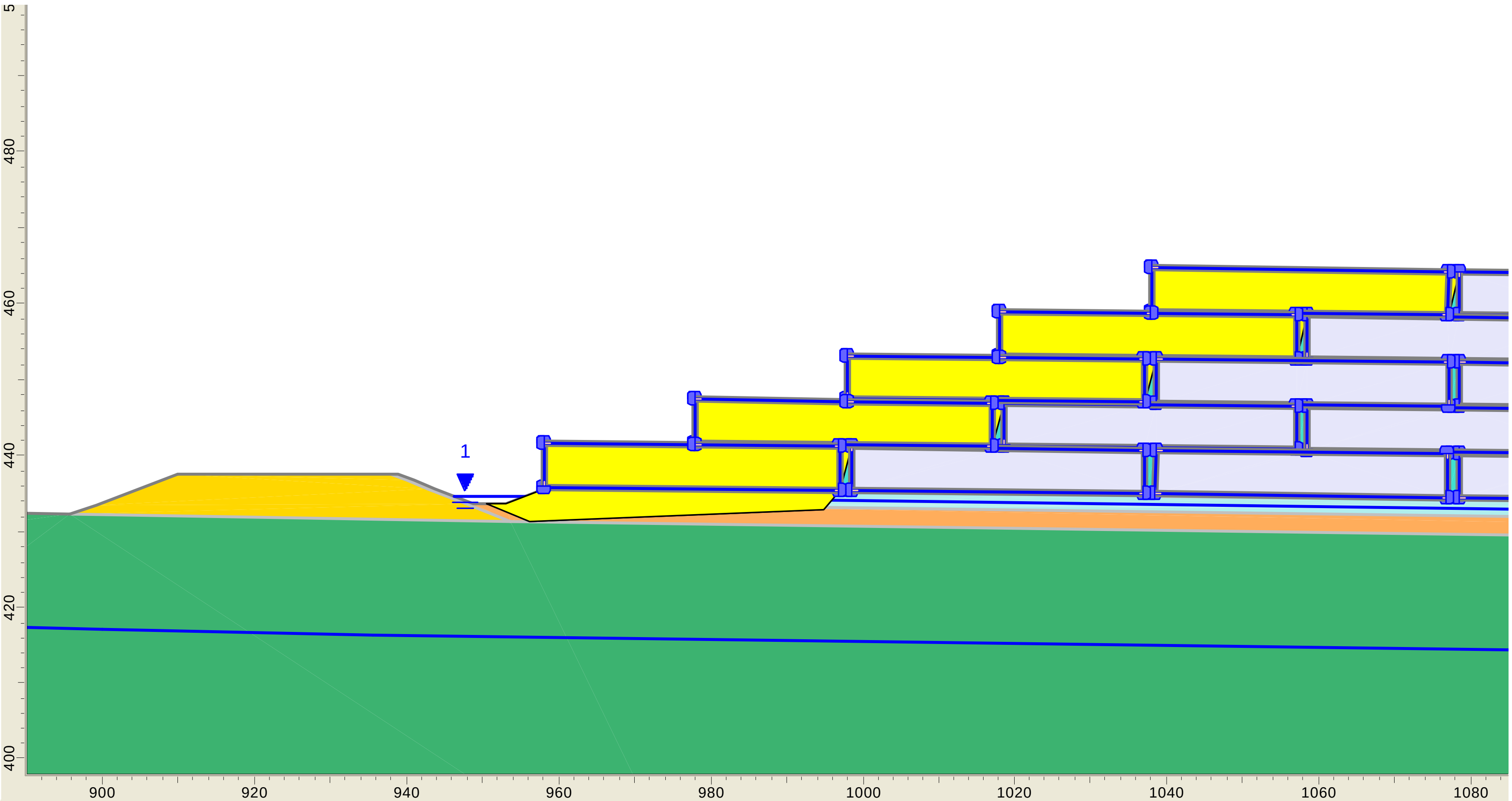

Figure 17. SLIDE Diagram of Critical Surface for Liner Stability (1 column) before Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

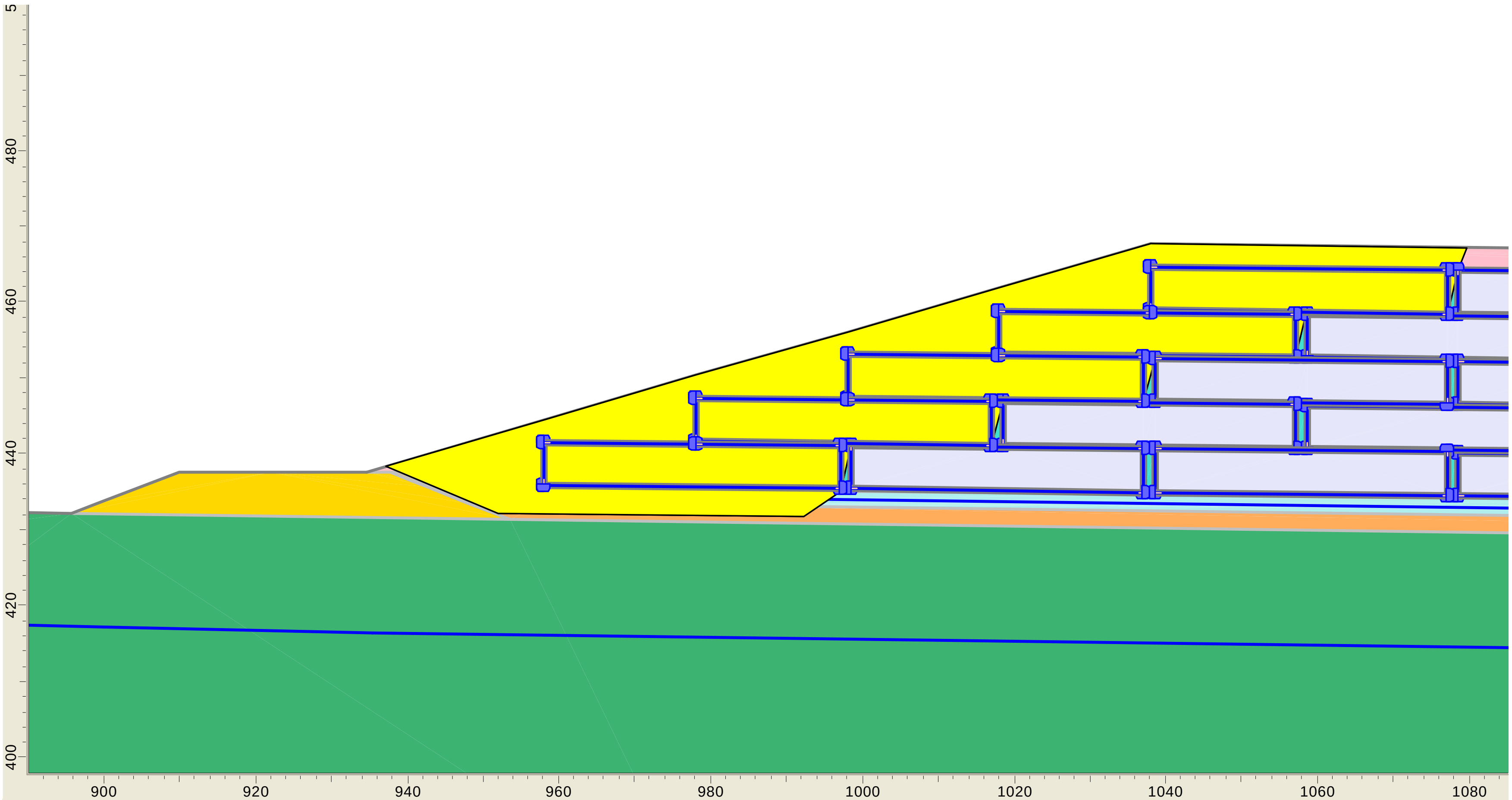

Figure 18. SLIDE Diagram of Critical Surface for Liner Stability (1 column) after Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

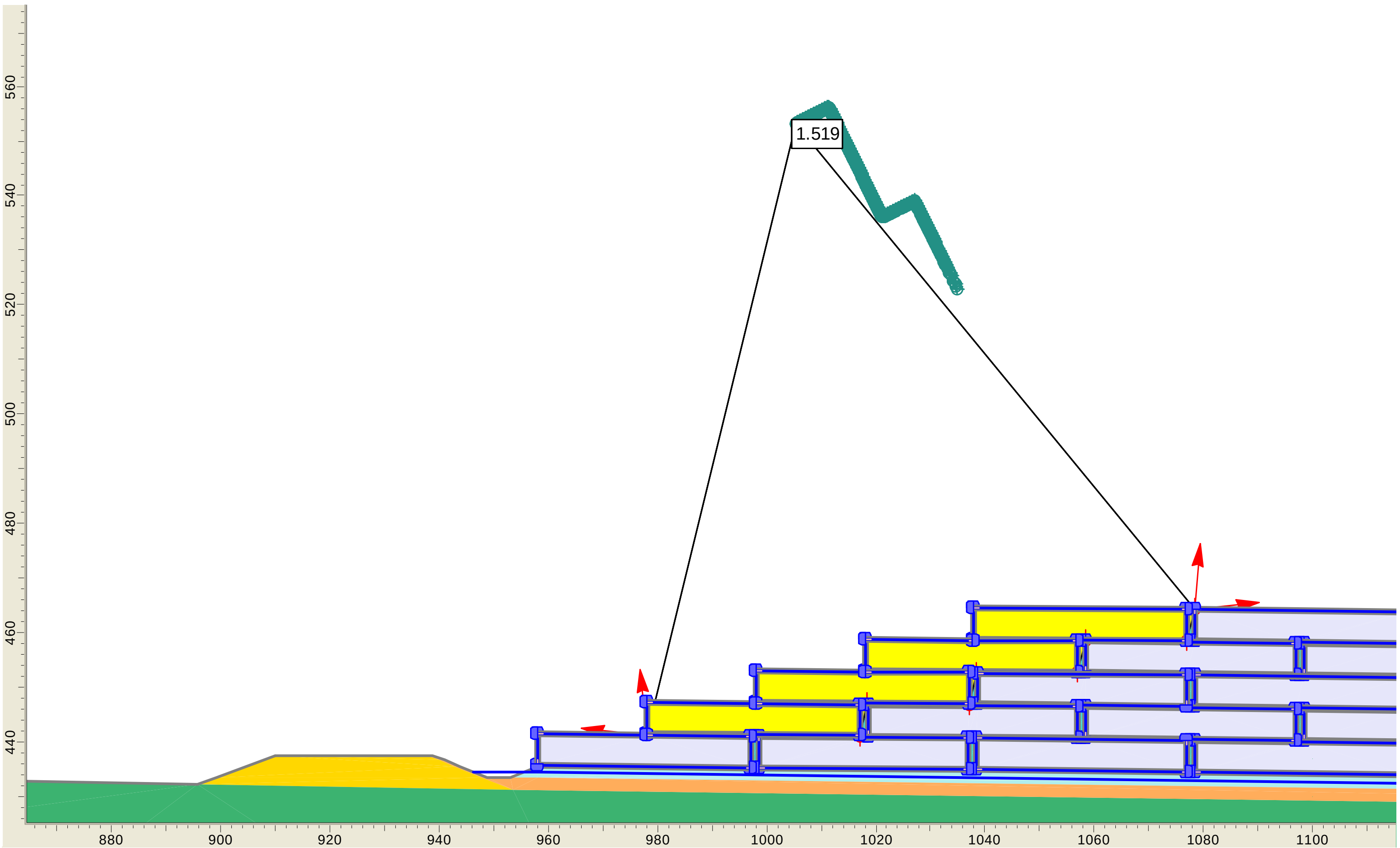

Figure 19. Slope Stability Analysis Result for Section A-A without Final Cover: NorthSide_NoCover_Tube_07_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

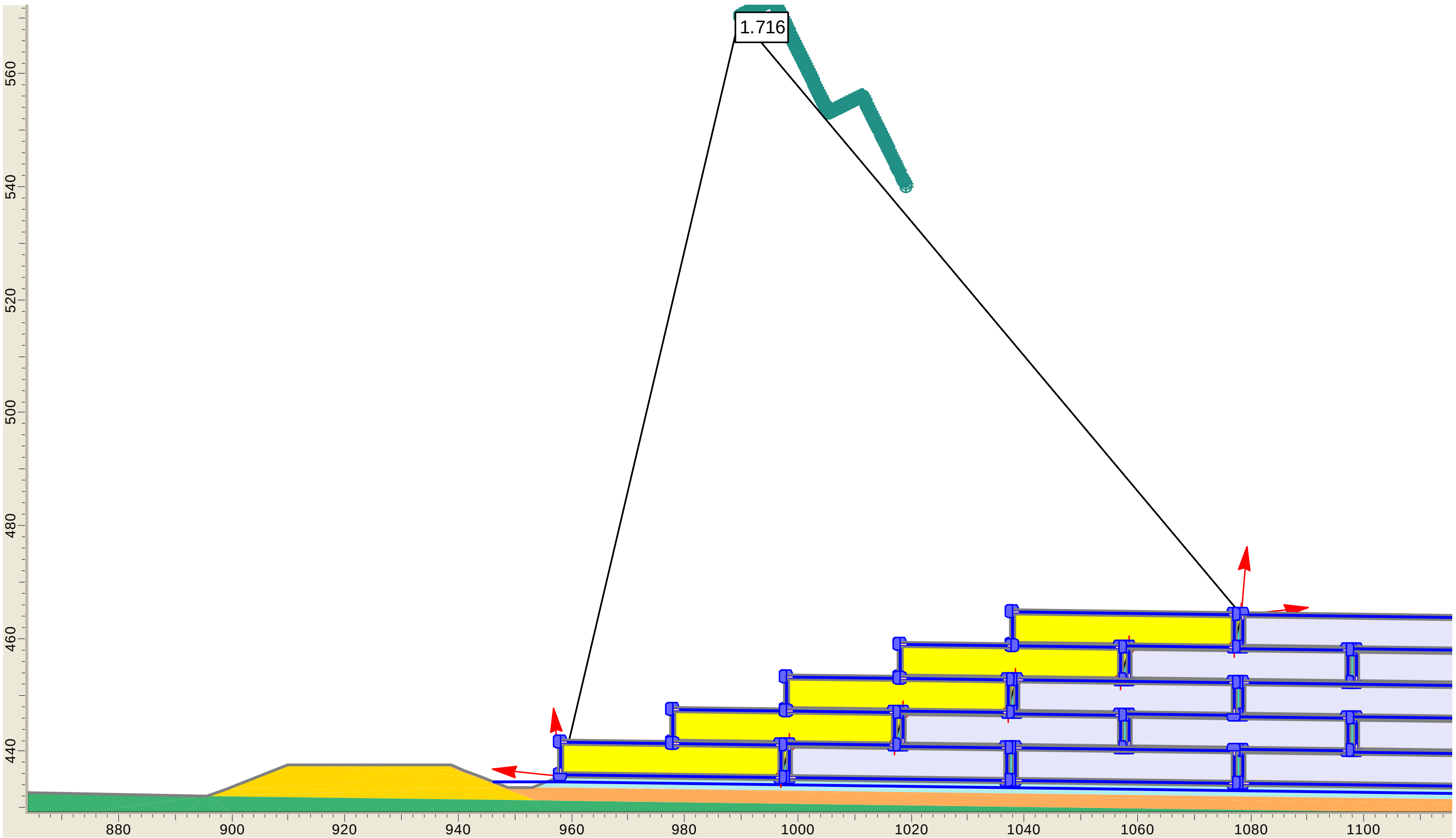

Figure 20. Slope Stability Analysis Result for Section A-A without Final Cover: NorthSide_NoCover_Tube_10_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

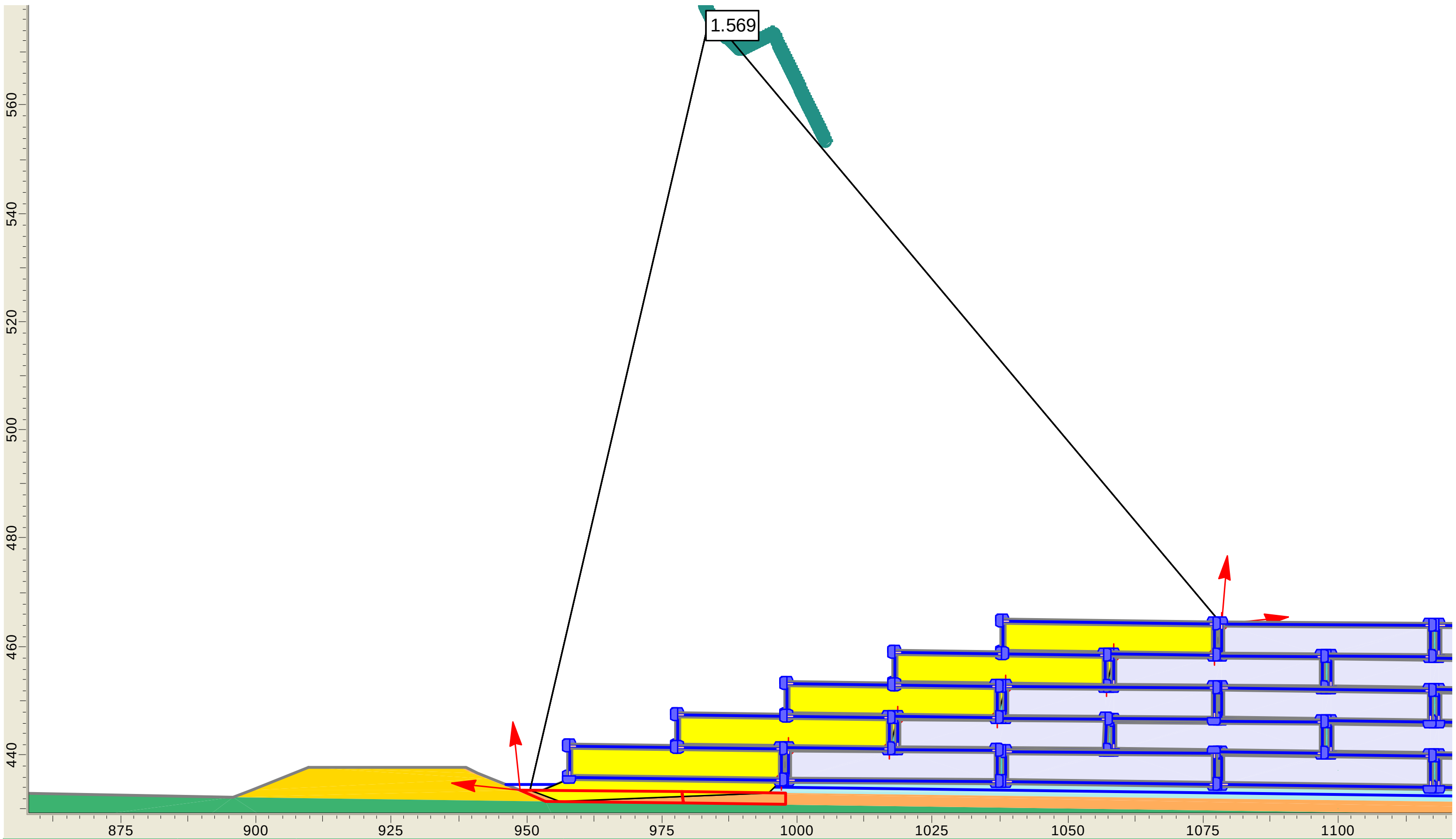

Figure 21. Slope Stability Analysis Result for Section A-A without Final Cover: NorthSide_NoCover_Liner_I_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

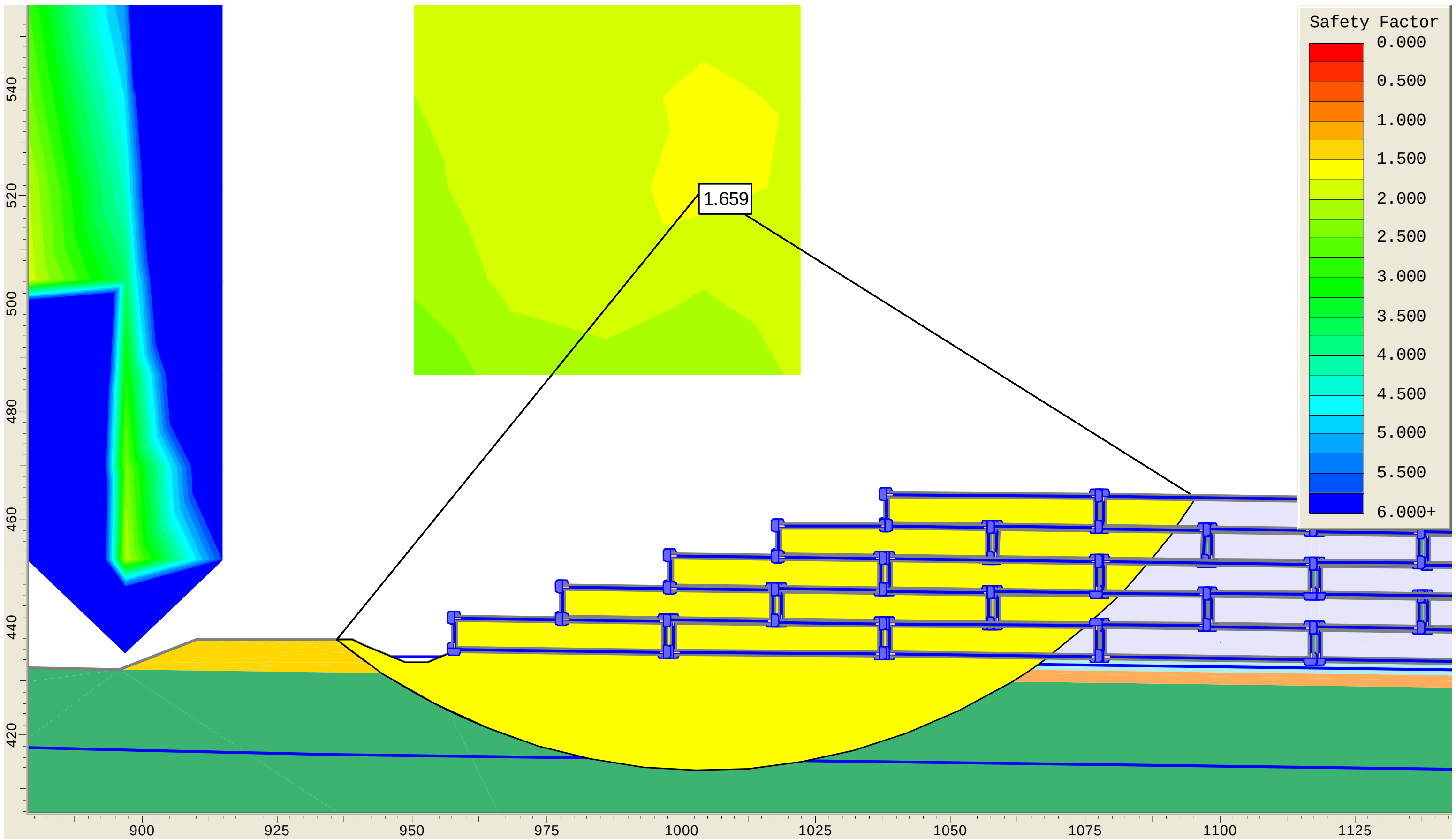

Figure 22. Slope Stability Analysis Result for Section A-A without Final Cover: NorthSide_NoCover_Global_Su_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

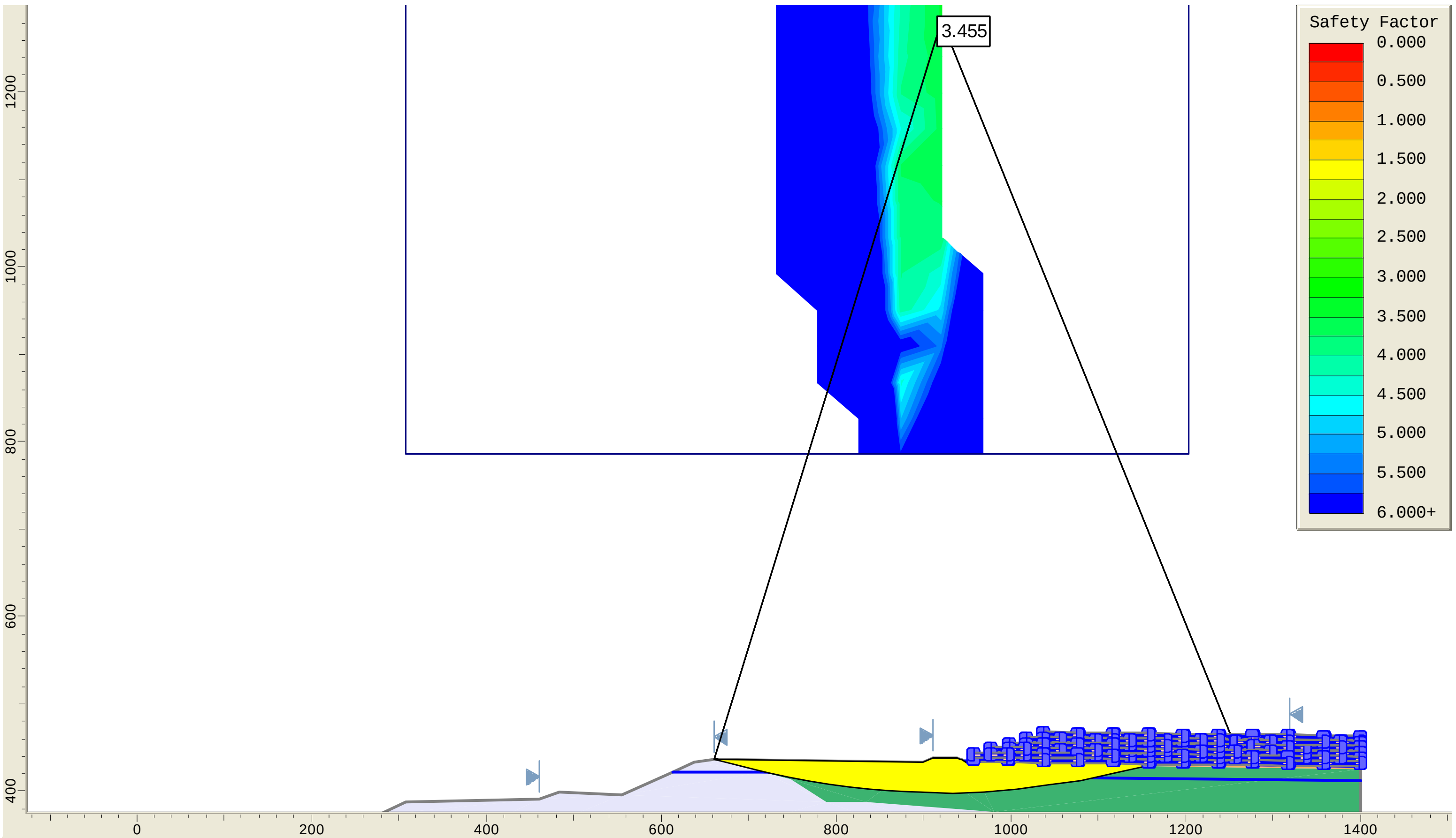

Figure 23. Slope Stability Analysis Result for Section A-A without Final Cover: NorthSide_NoCover_External_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

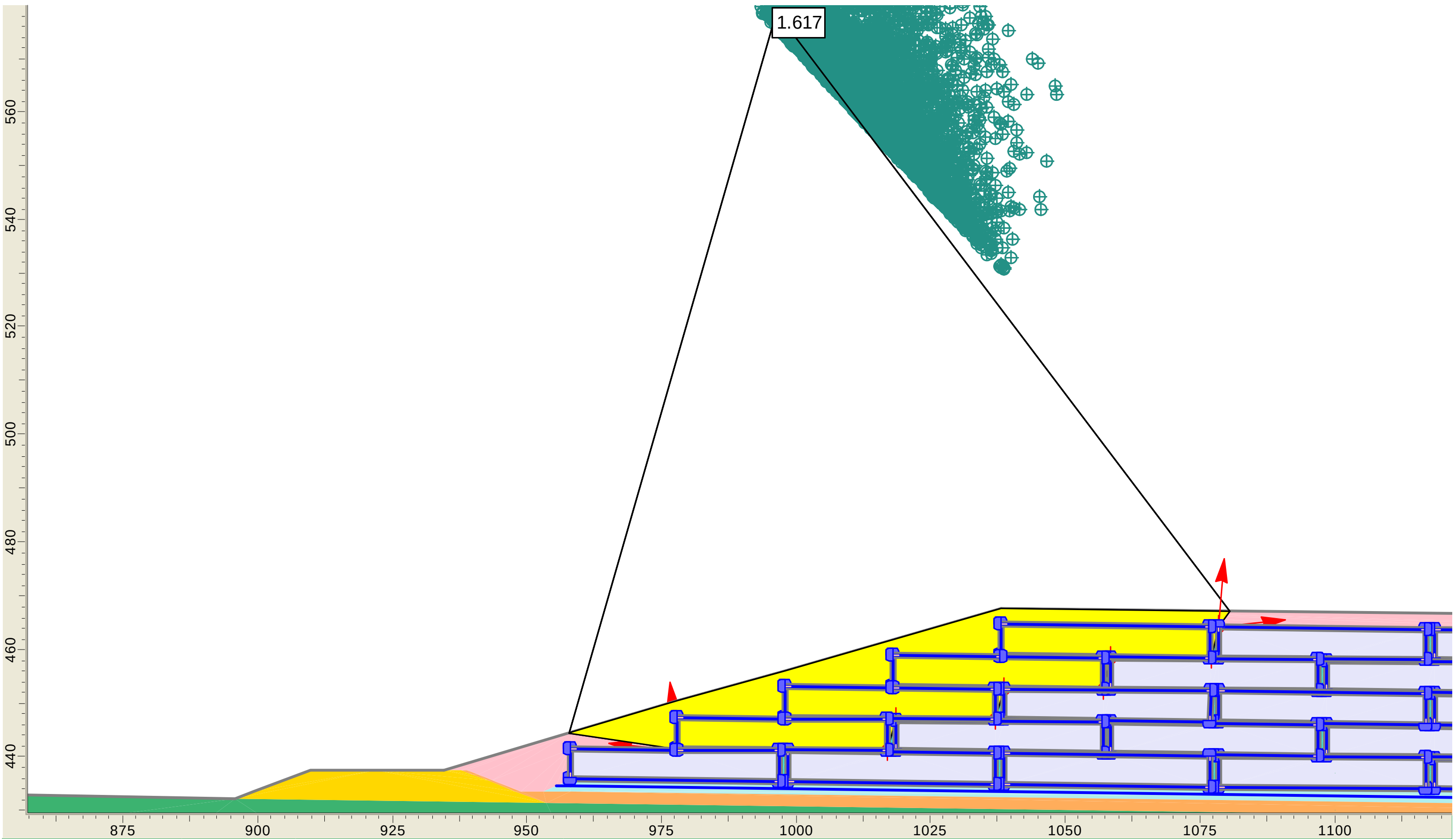

Figure 24. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_Tube_07_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

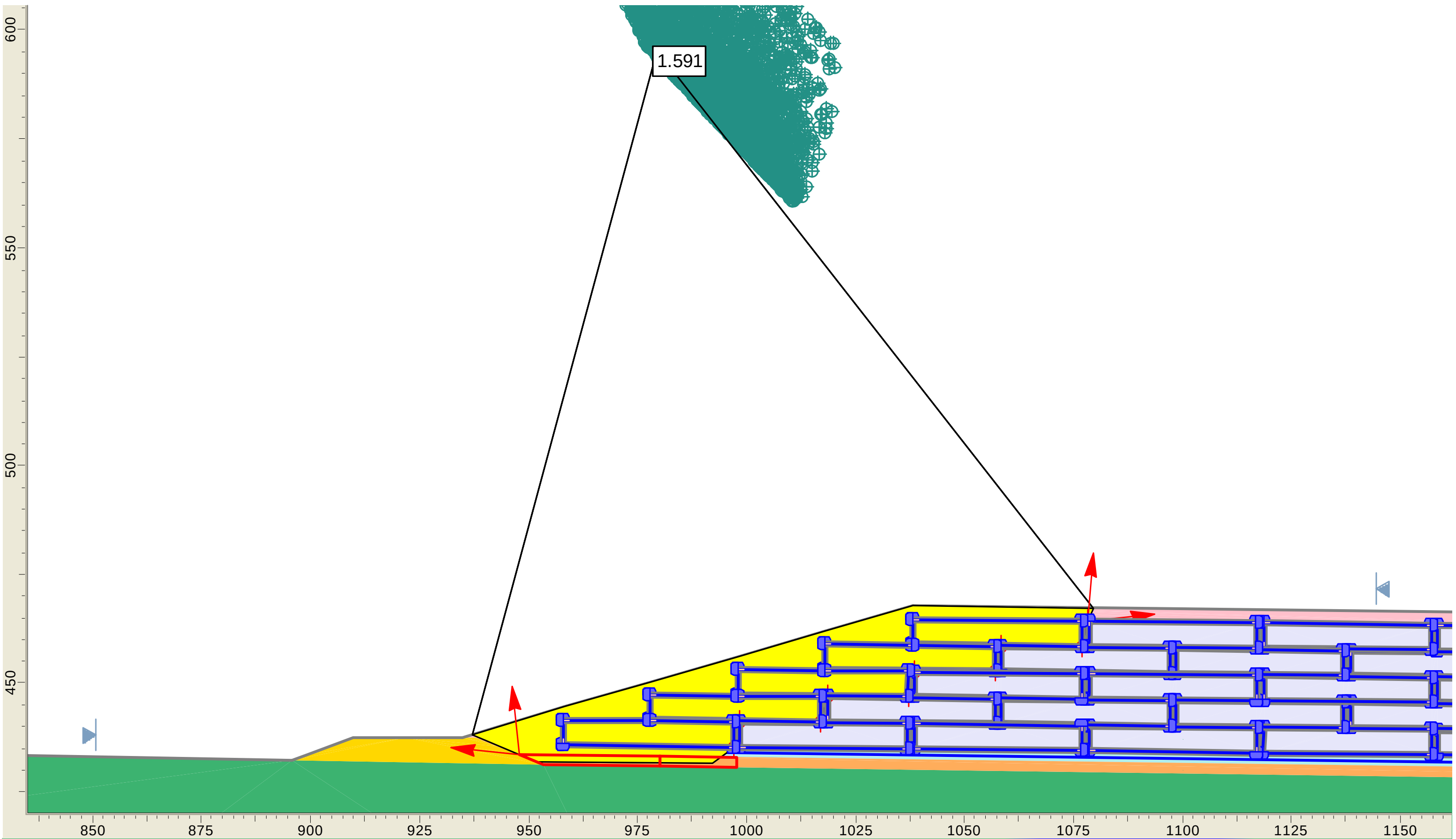

Figure 25. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_Liner_I_Lab

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

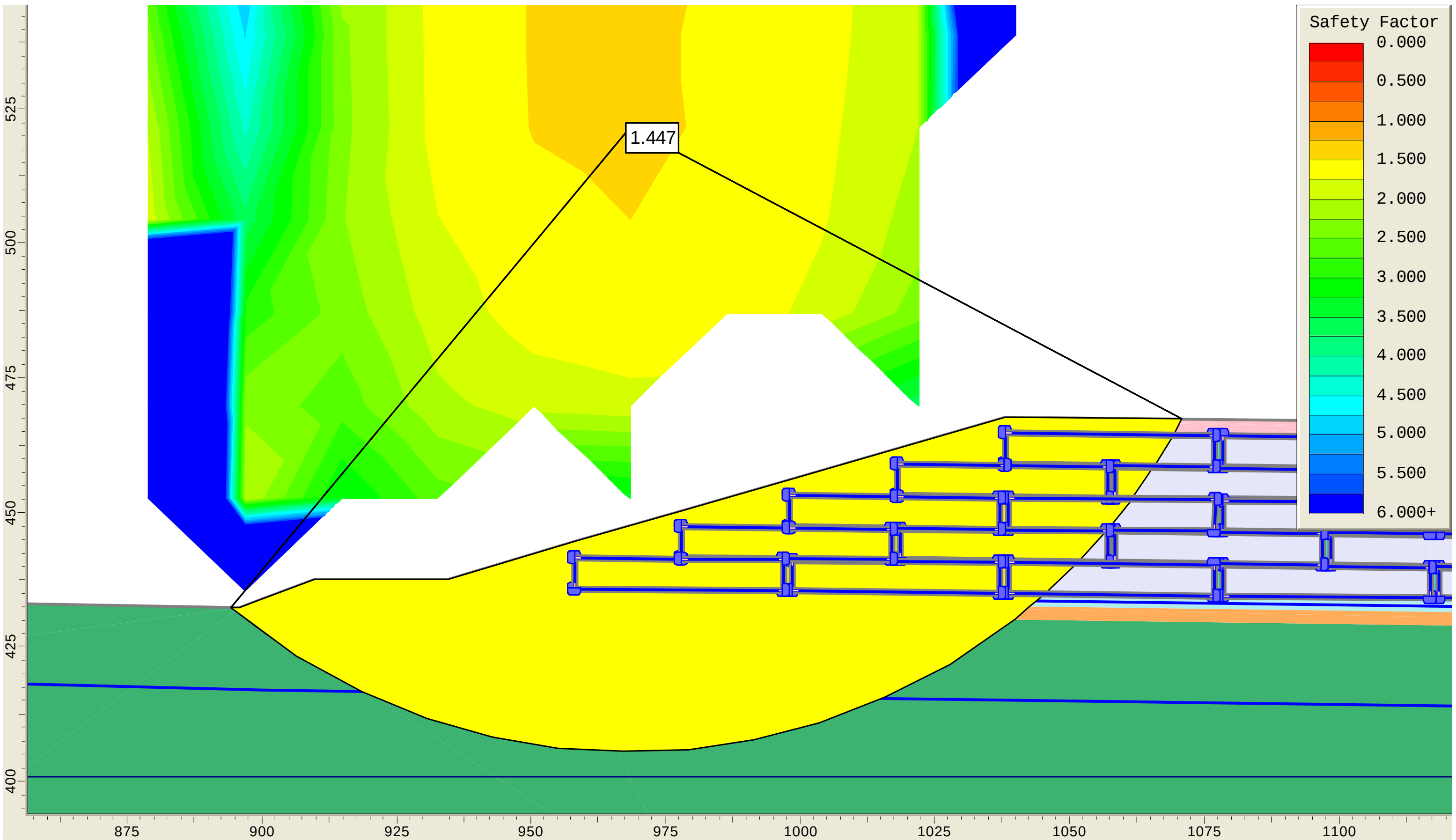

Figure 26. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_Global_Su_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

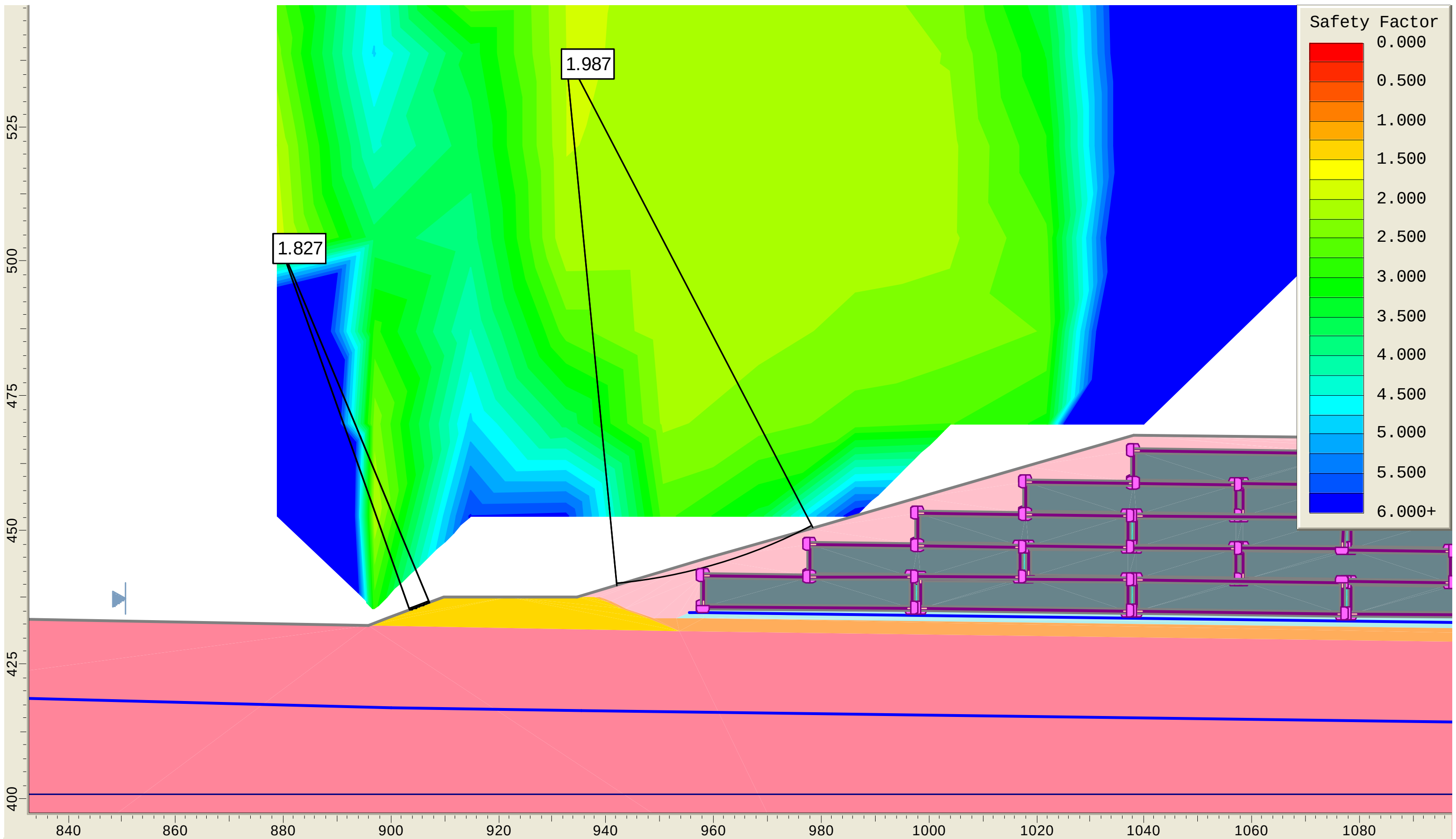

Figure 27. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_LongTerm_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

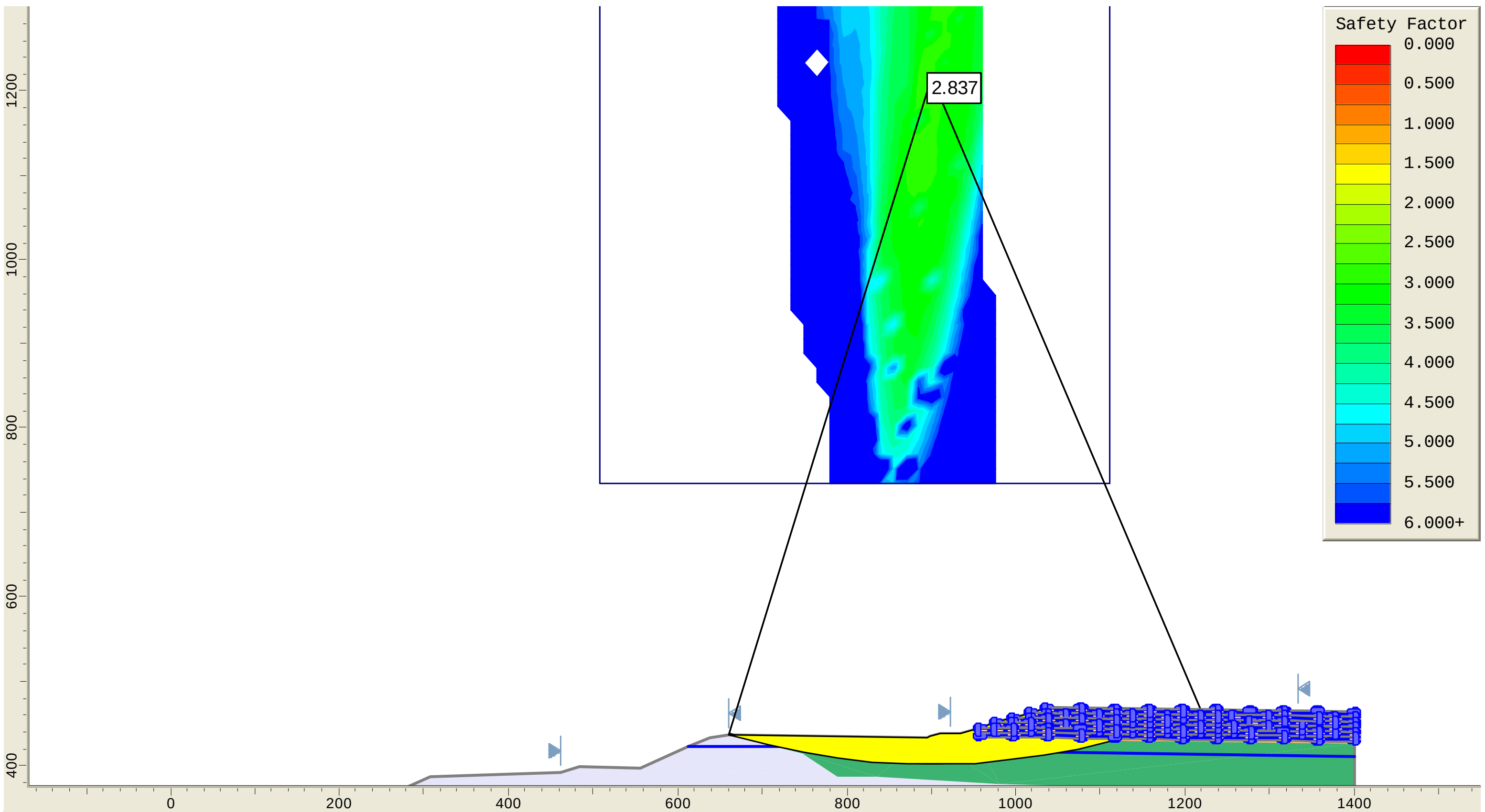

Figure 28. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_Global_External_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

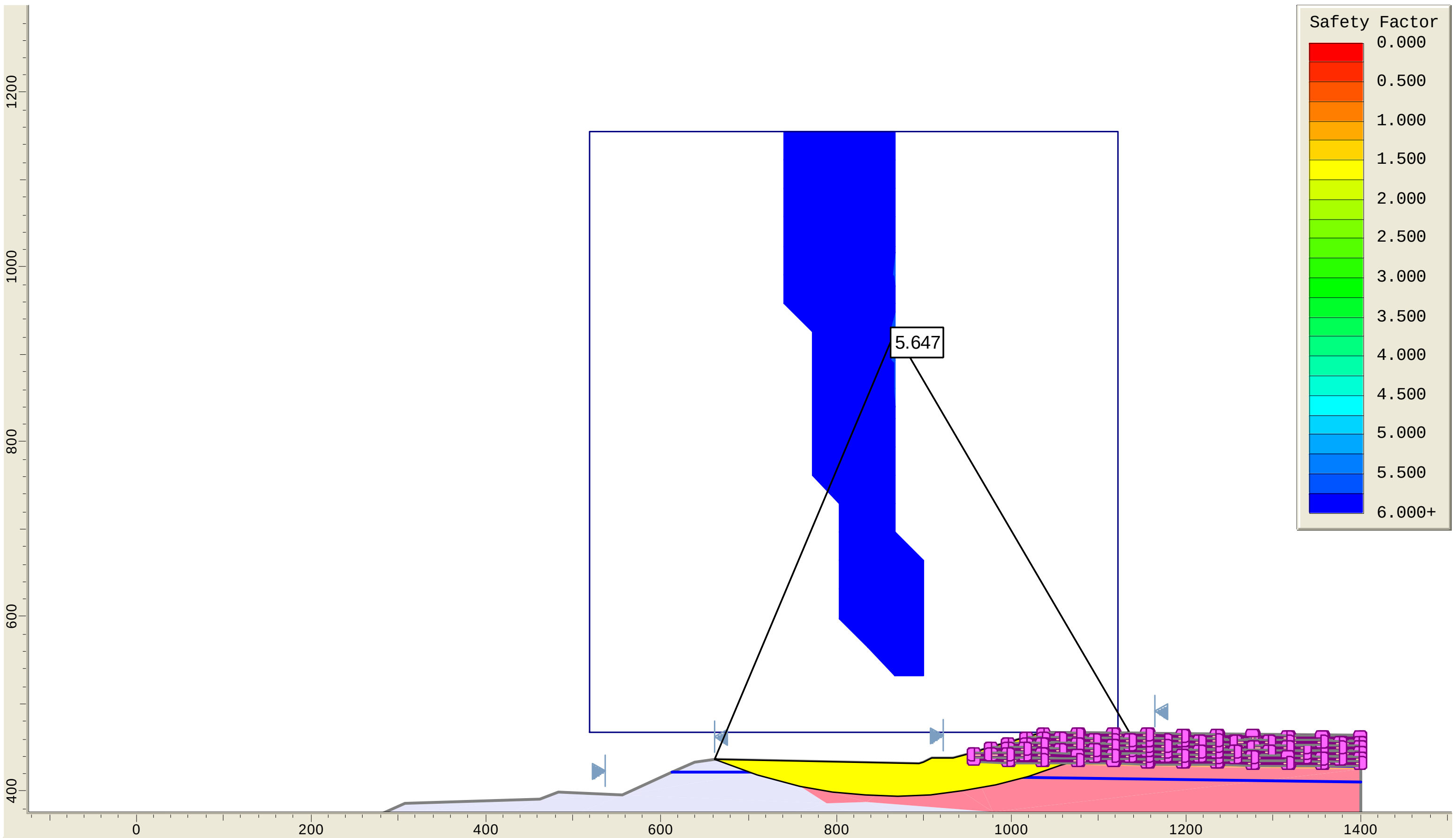

Figure 29. Slope Stability Analysis Result for Section A-A after Final Cover: NorthSide_Cover_Global_External_LongTerm_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

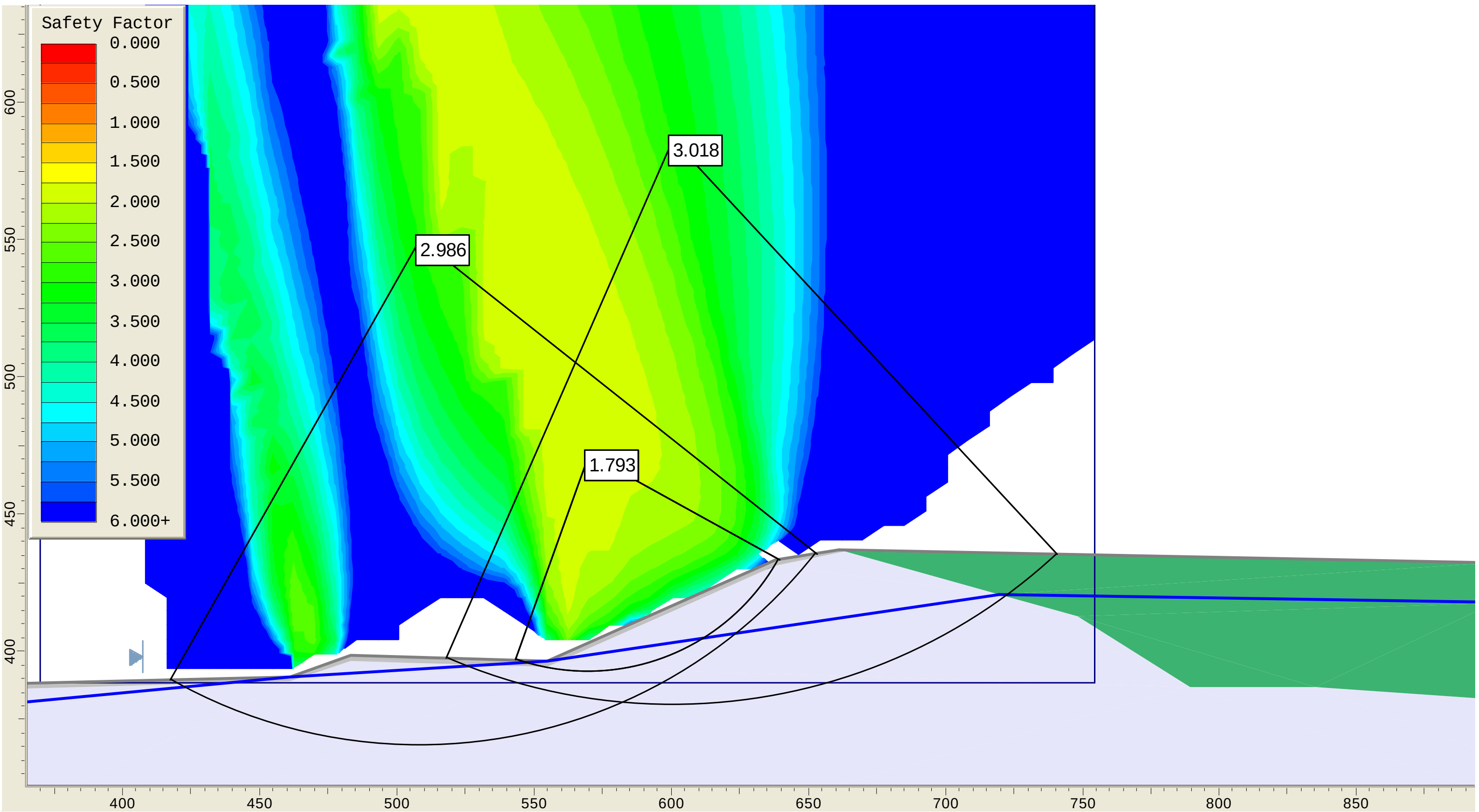

Figure 30. Slope Stability Analysis Result for WB-13 Perimeter Berm at Section A-A: NorthSide_Cover_External_Lab_GWT_15ft_Exit_at_Toe of Berm
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

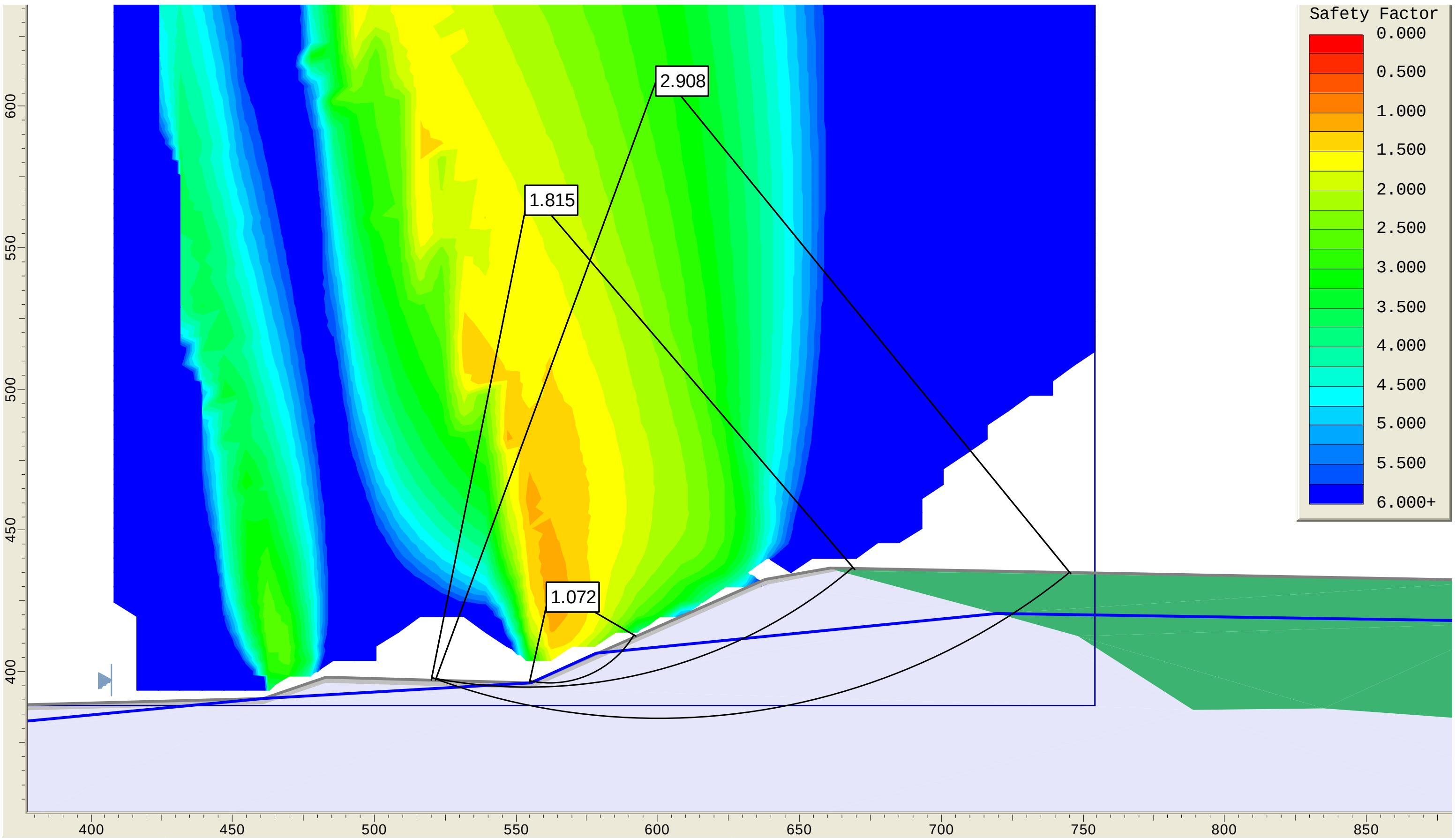

Figure 31. Slope Stability Analysis Result for WB-13 Perimeter Berm at Section A-A: NorthSide_Cover_External_Lab_GWT_15ft_Exit_10 ft_up_from Toe of Berm
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

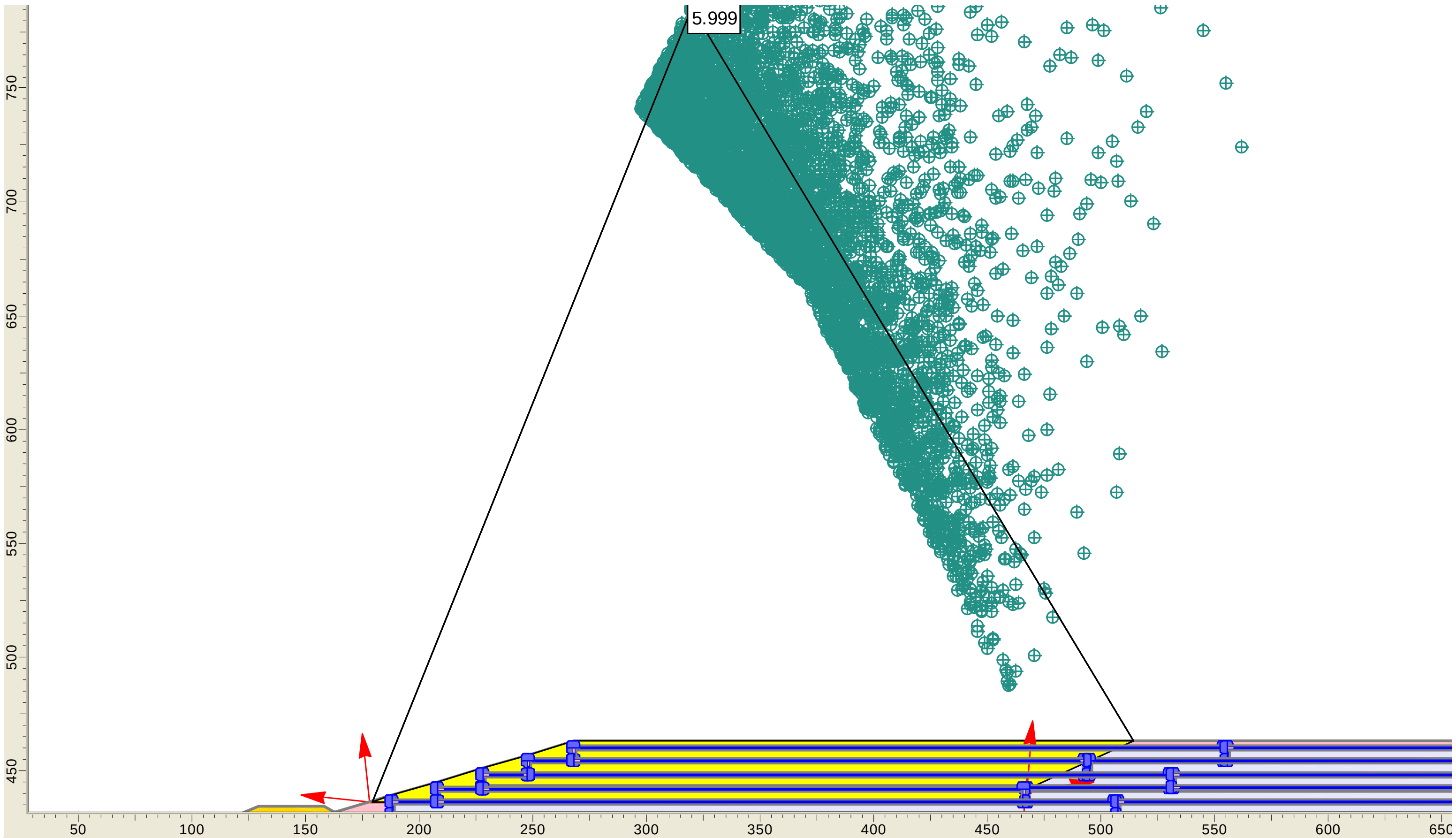

Figure 32. Slope Stability Analysis Result for Section B-B before Final Cover: EastWest_NoCover_Tube_04_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

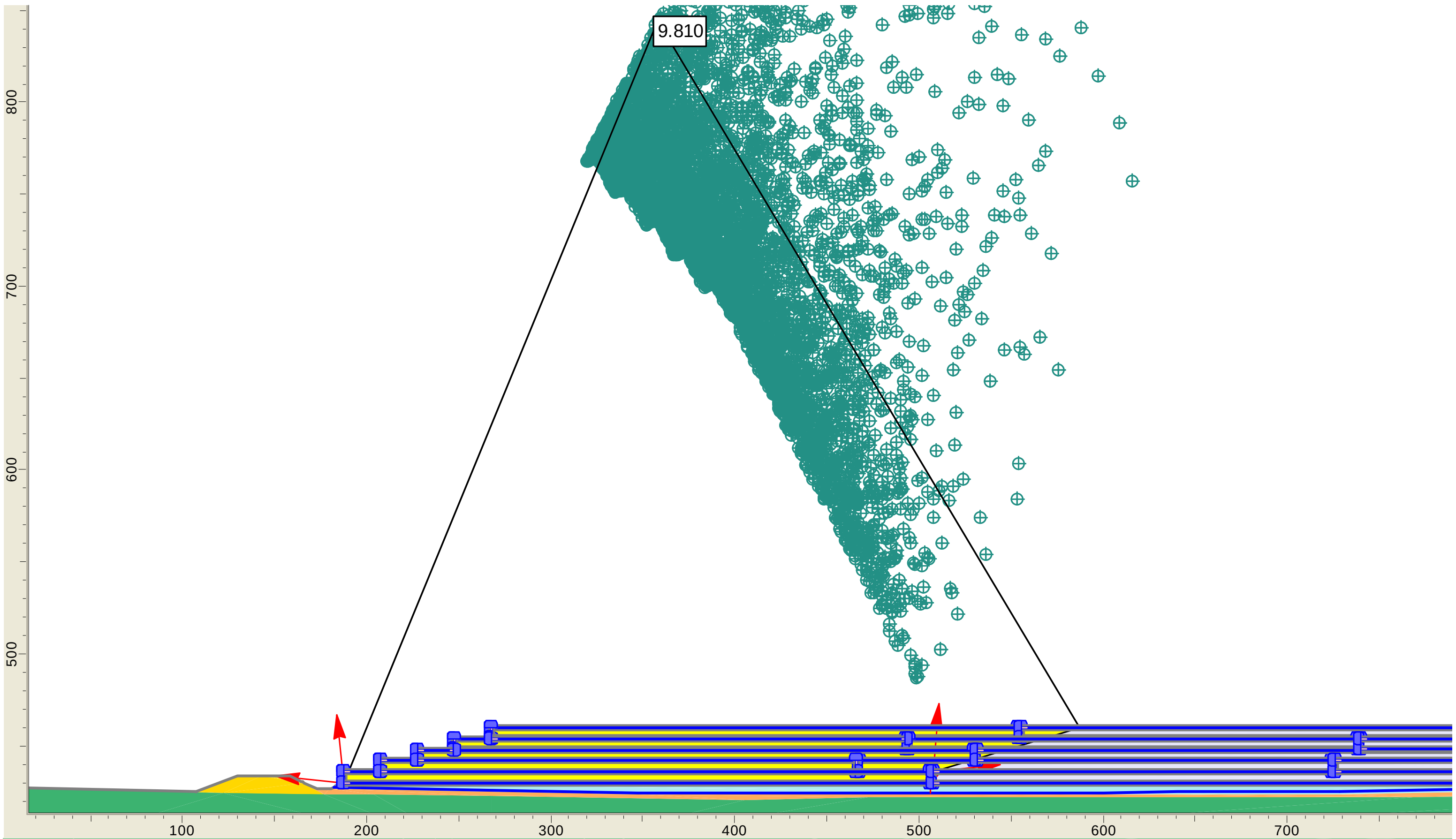

Figure 33. Slope Stability Analysis Result for Section B-B before Final Cover: EastWest_NoCover_Tube_05_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

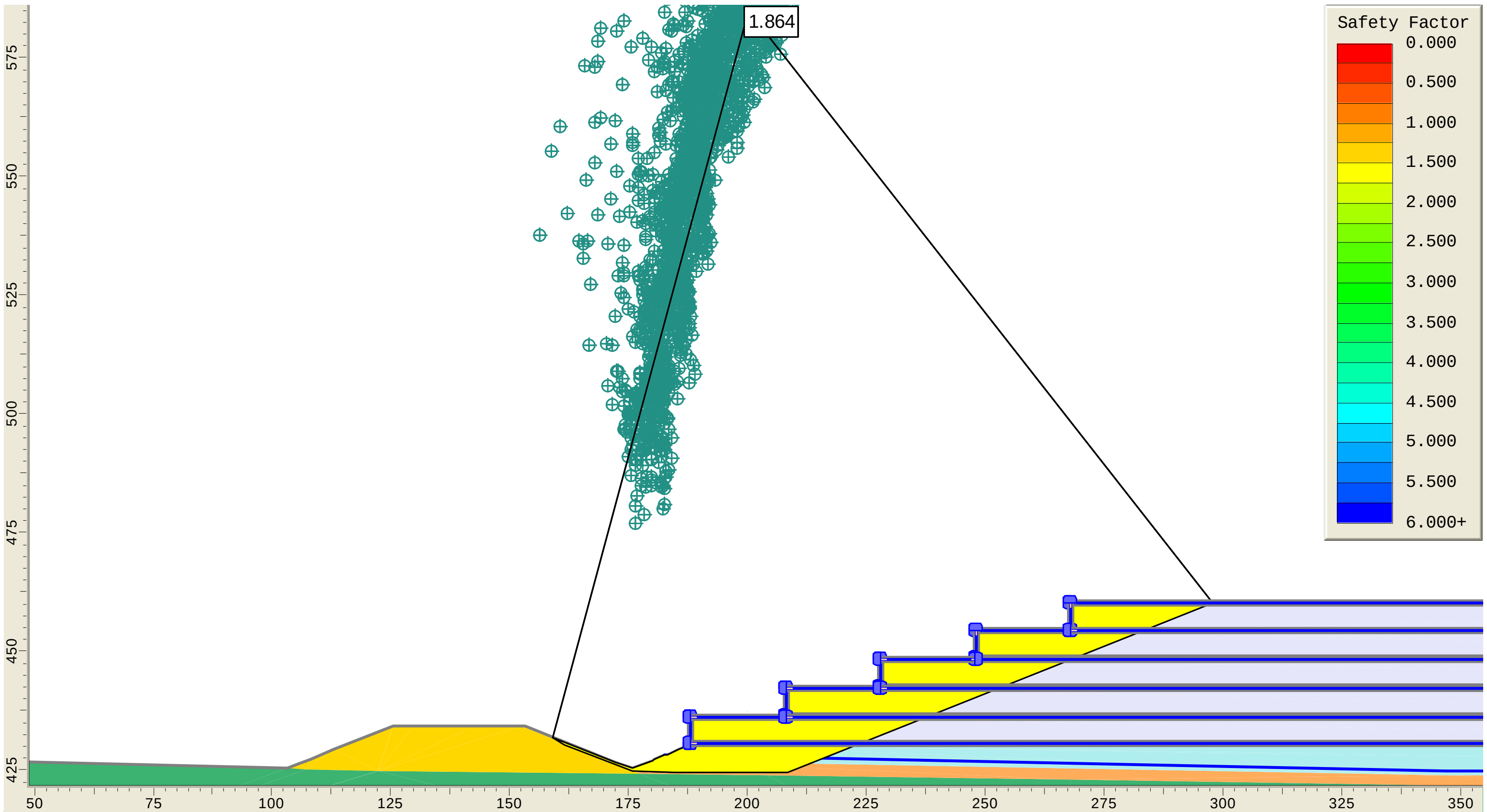

Figure 34. Slope Stability Analysis Result for Section B-B before Final Cover: EastWest_NoCover_Liner_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

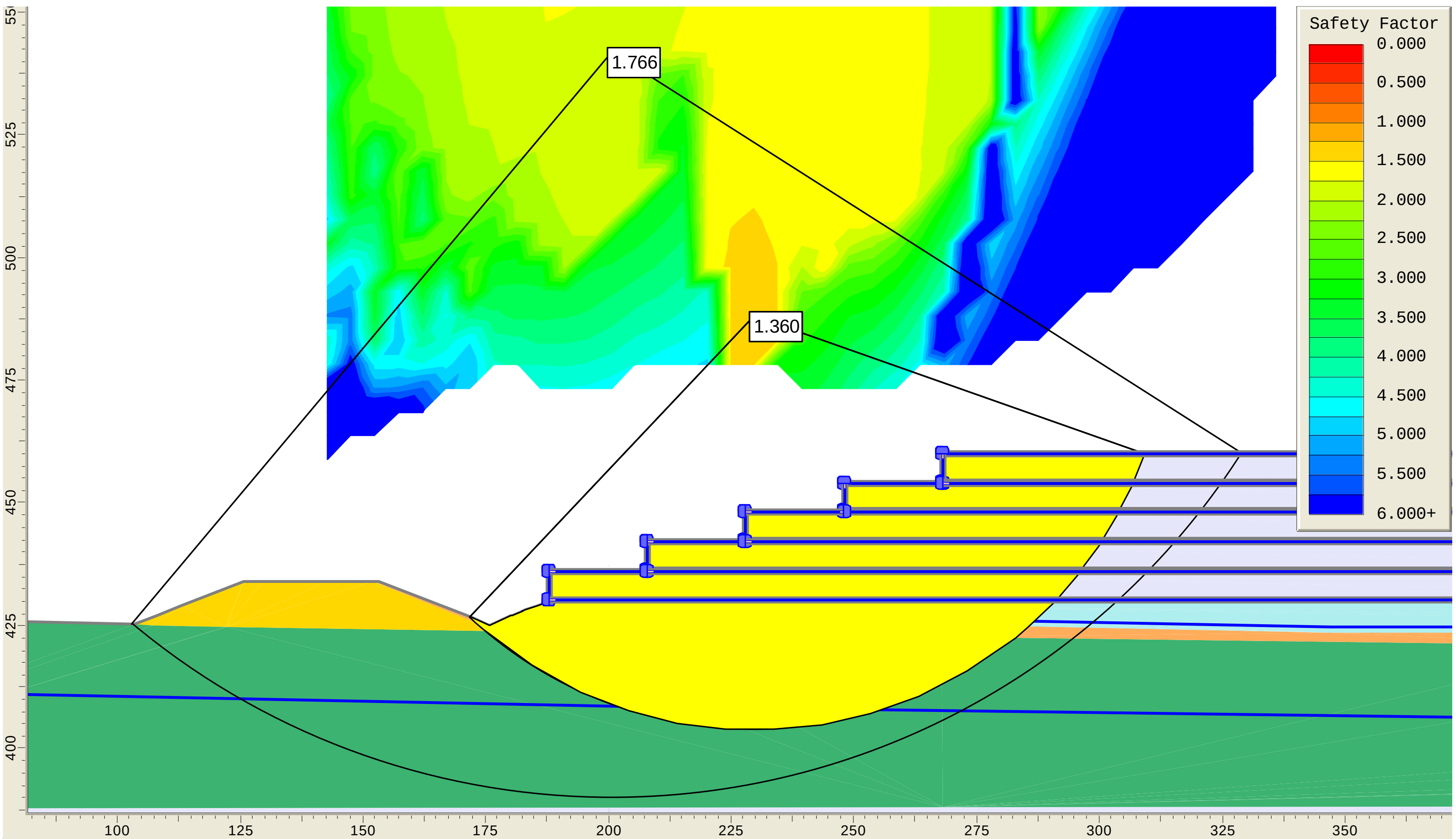

Figure 35. Slope Stability Analysis Result for Section B-B before Final Cover: EastWest_NoCover_Global_Su_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

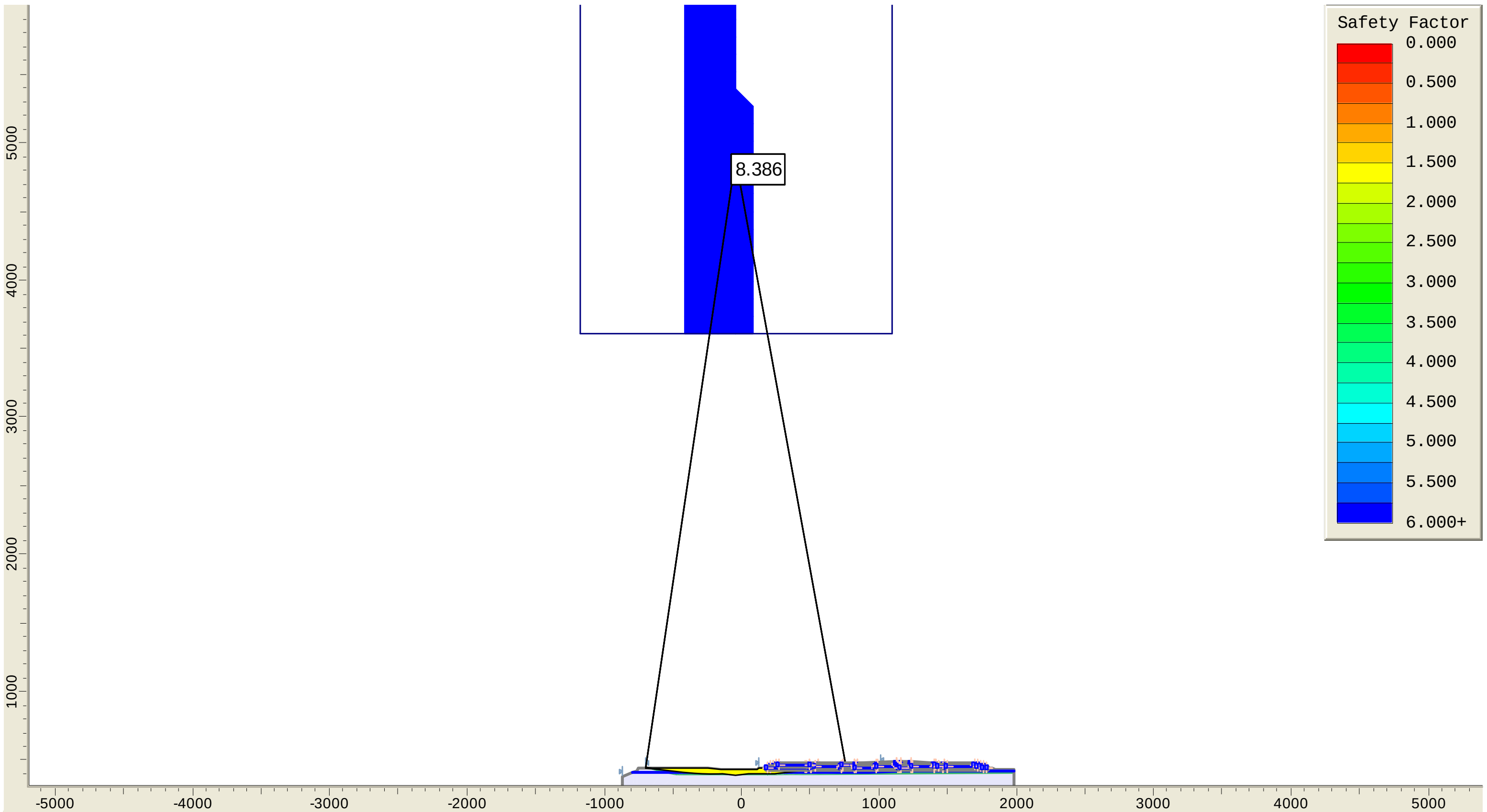

Figure 36. Slope Stability Analysis Result for Section B-B before Final Cover: EastWest_NoCover_External_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

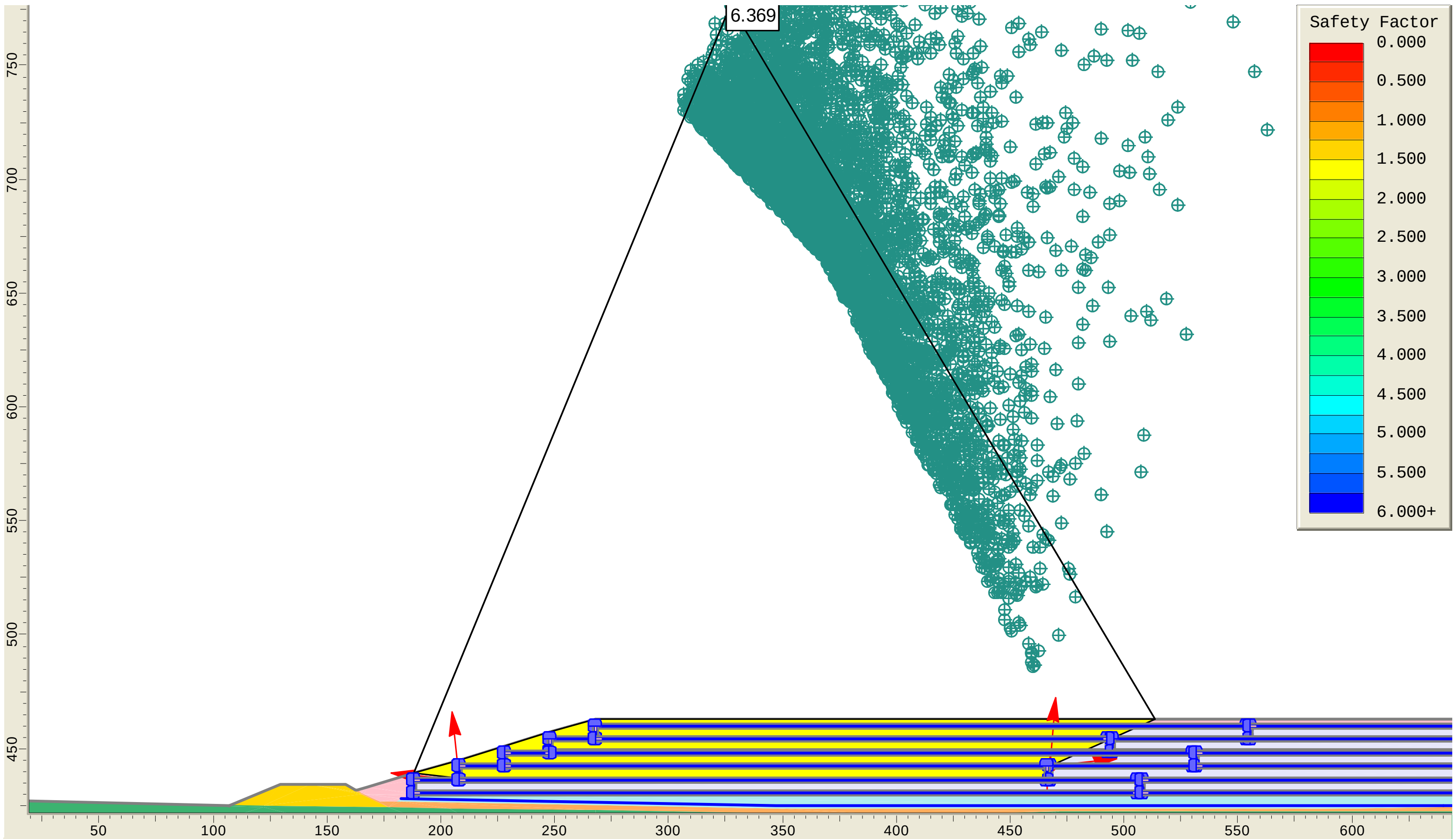

Figure 37. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_Tube_04_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

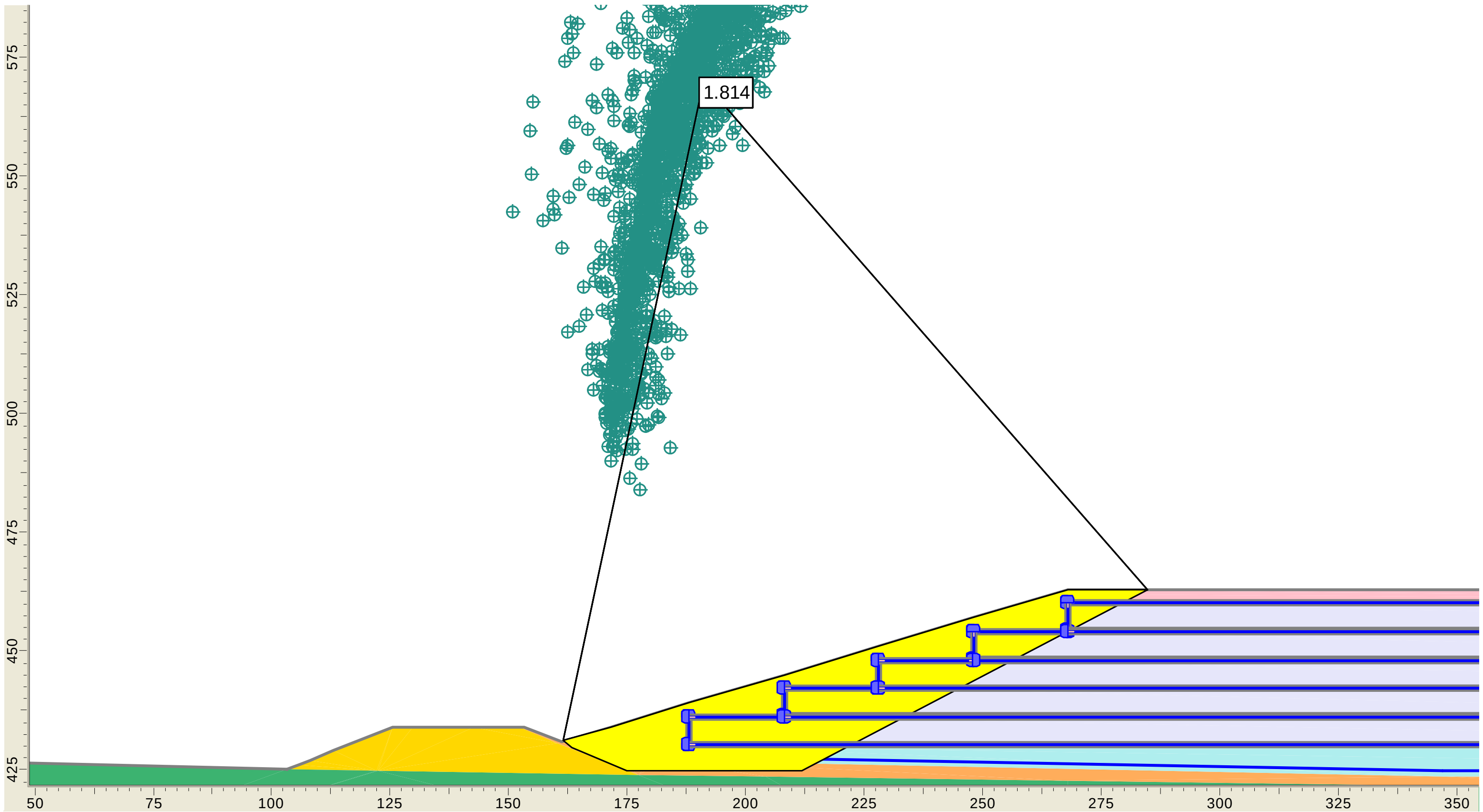

Figure 38. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_Liner_Lab

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

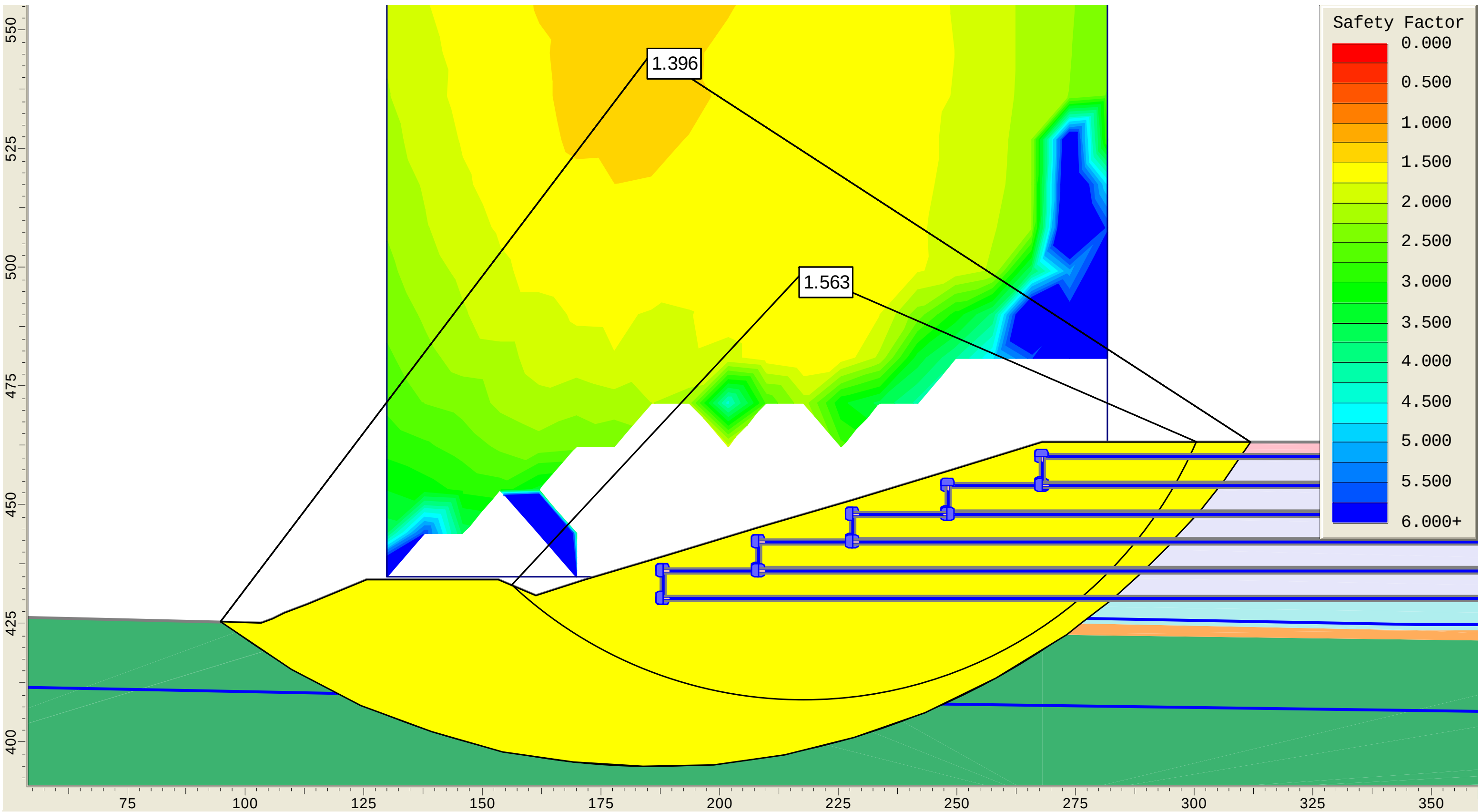

Figure 39. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_Global_Su_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

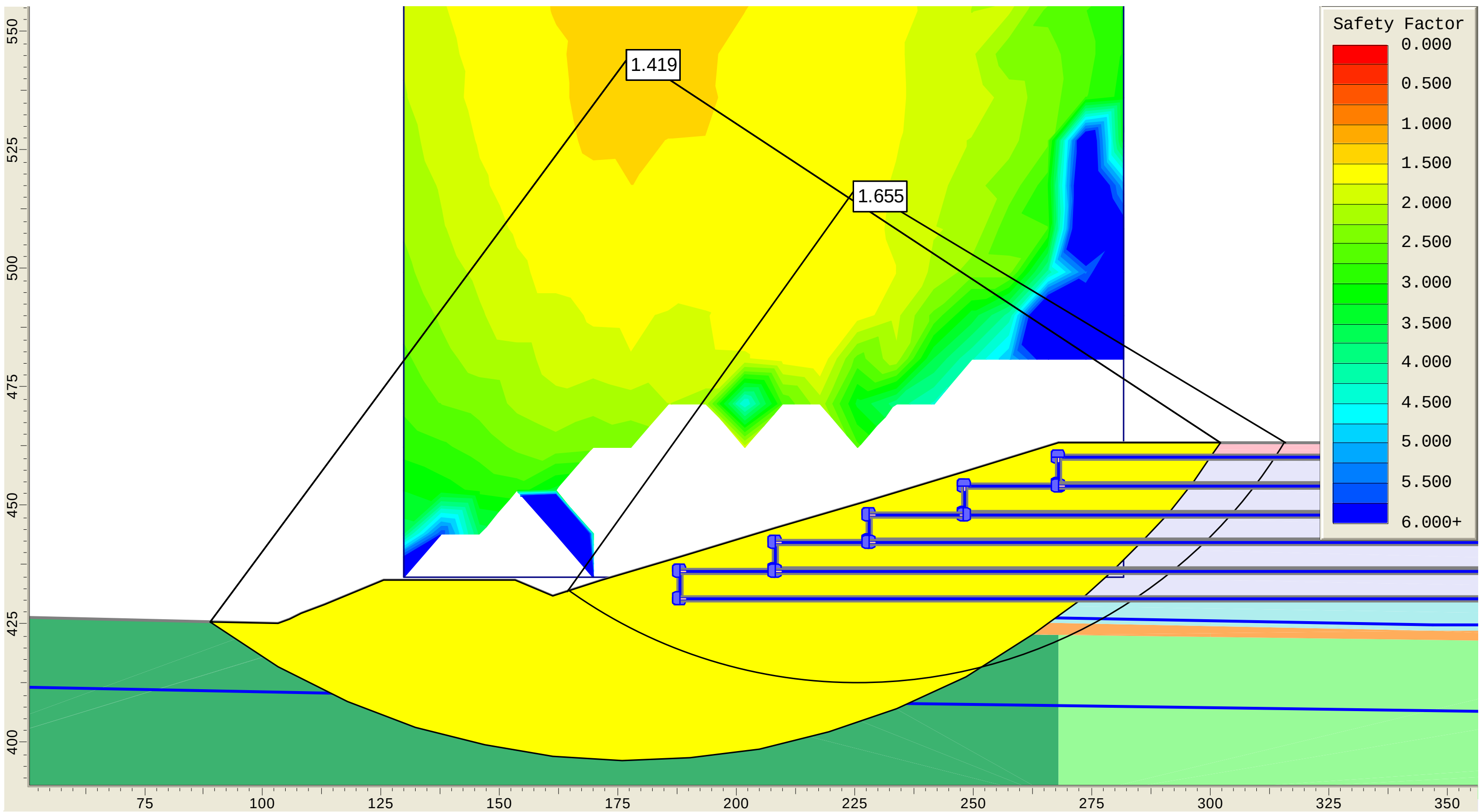

Figure 40. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_Global_U75_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

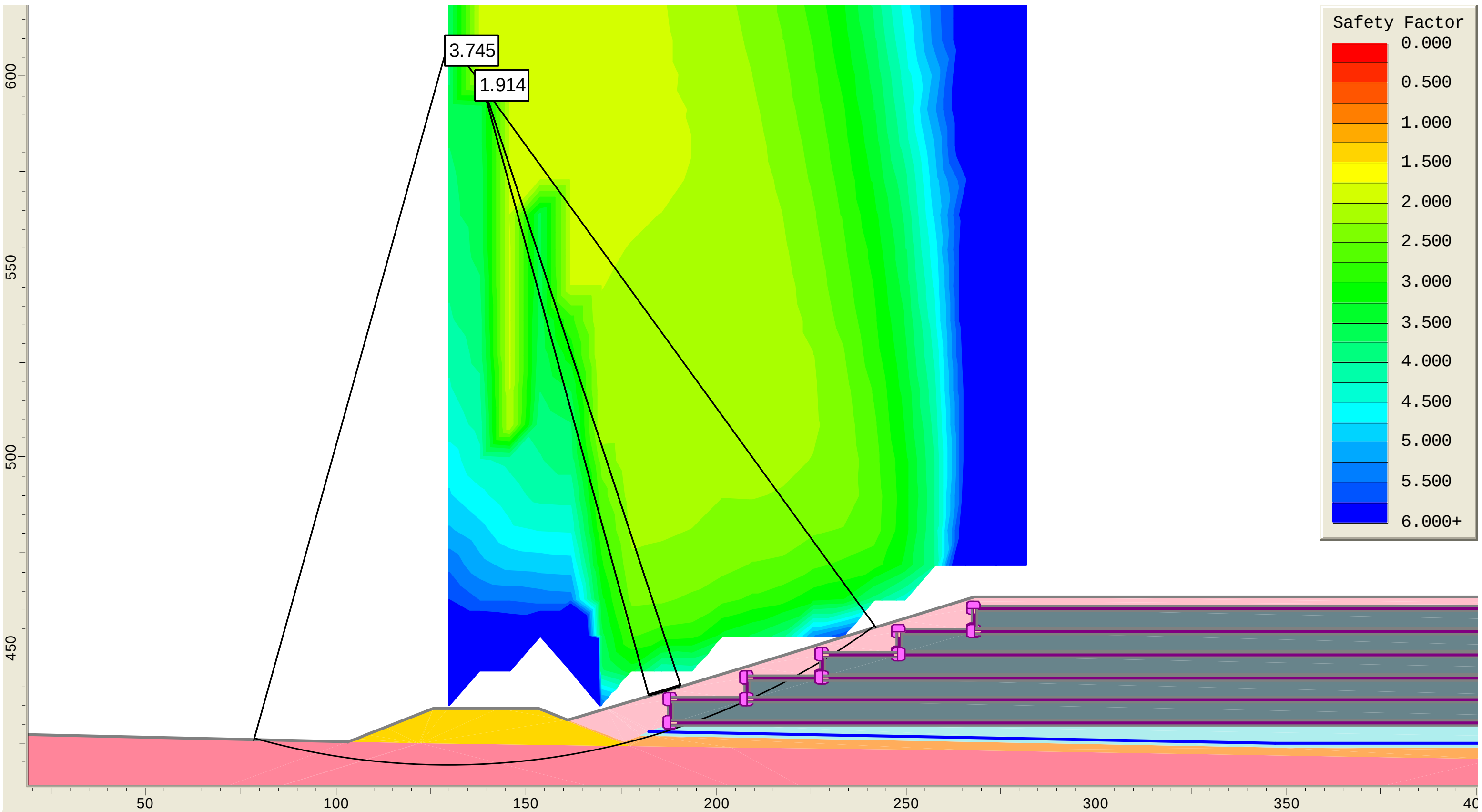

Figure 41. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_LongTerm_Lab
Note: This Figure shows the FS calculated using Spencer's Method.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

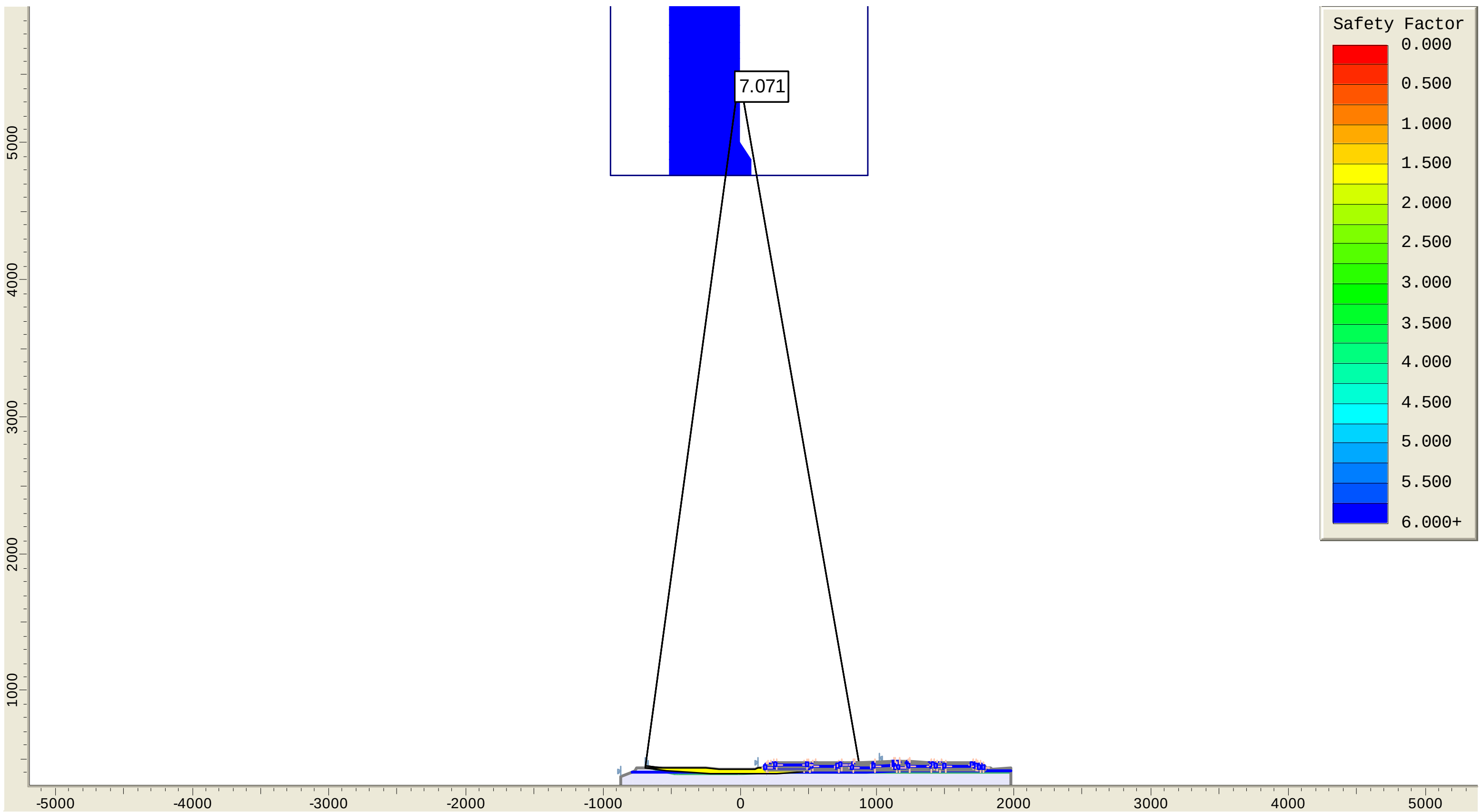

Figure 42. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_External_Lab
Note: This Figure shows the FS calculated using Spencer's Method

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

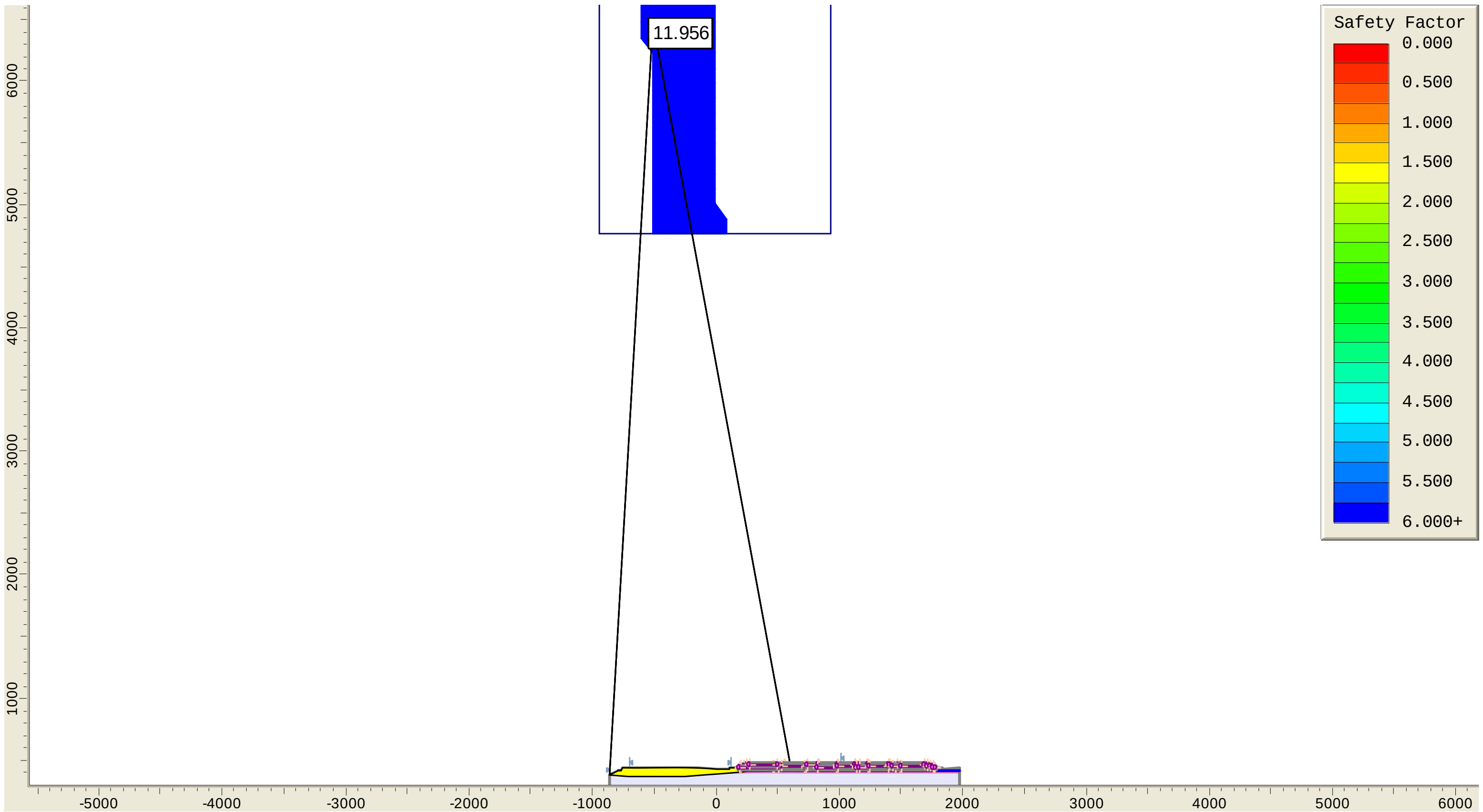

Figure 43. Slope Stability Analysis Result for Section B-B after Final Cover: EastWest_Cover_External_LongTerm_Lab
Note: This Figure shows the FS calculated using Spencer's Method

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

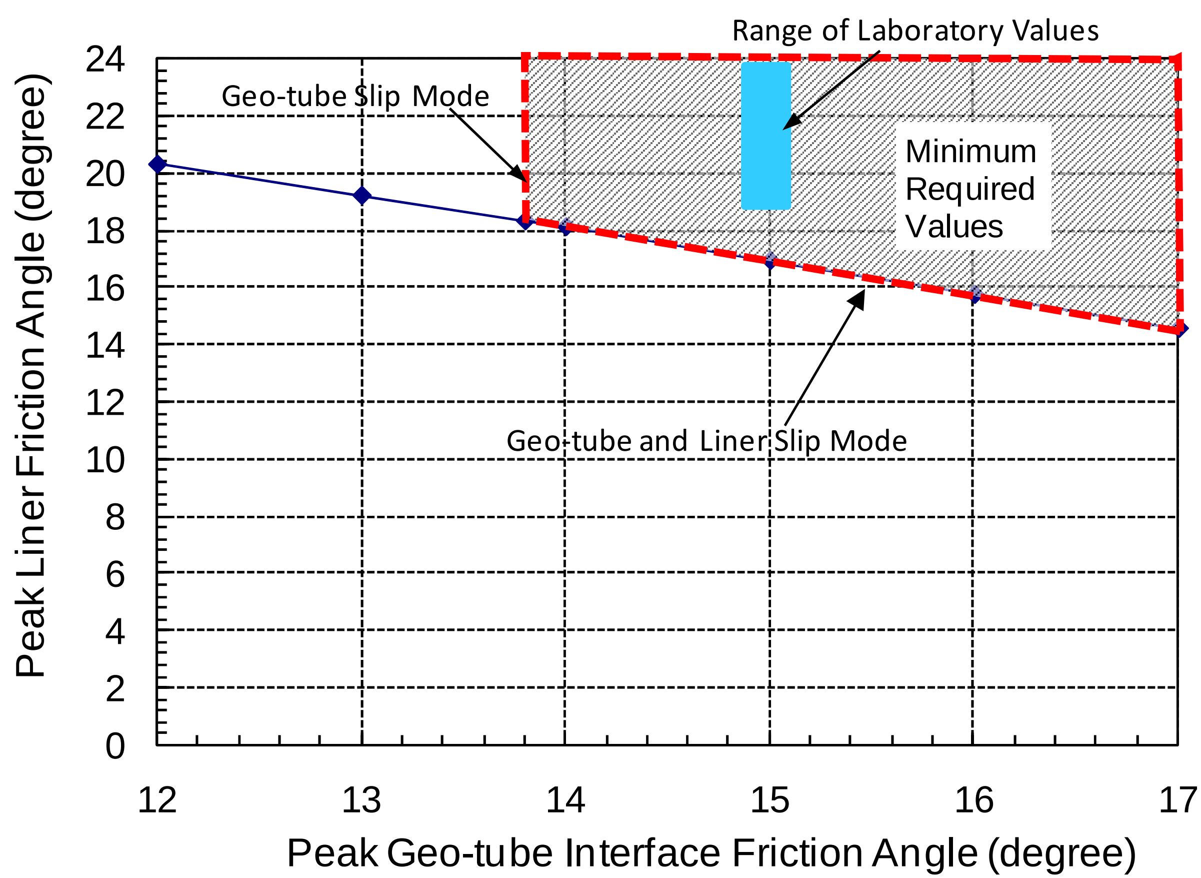

Figure 44. Sensitivity Analysis of Peak Liner Friction Angle: Minimum required values

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

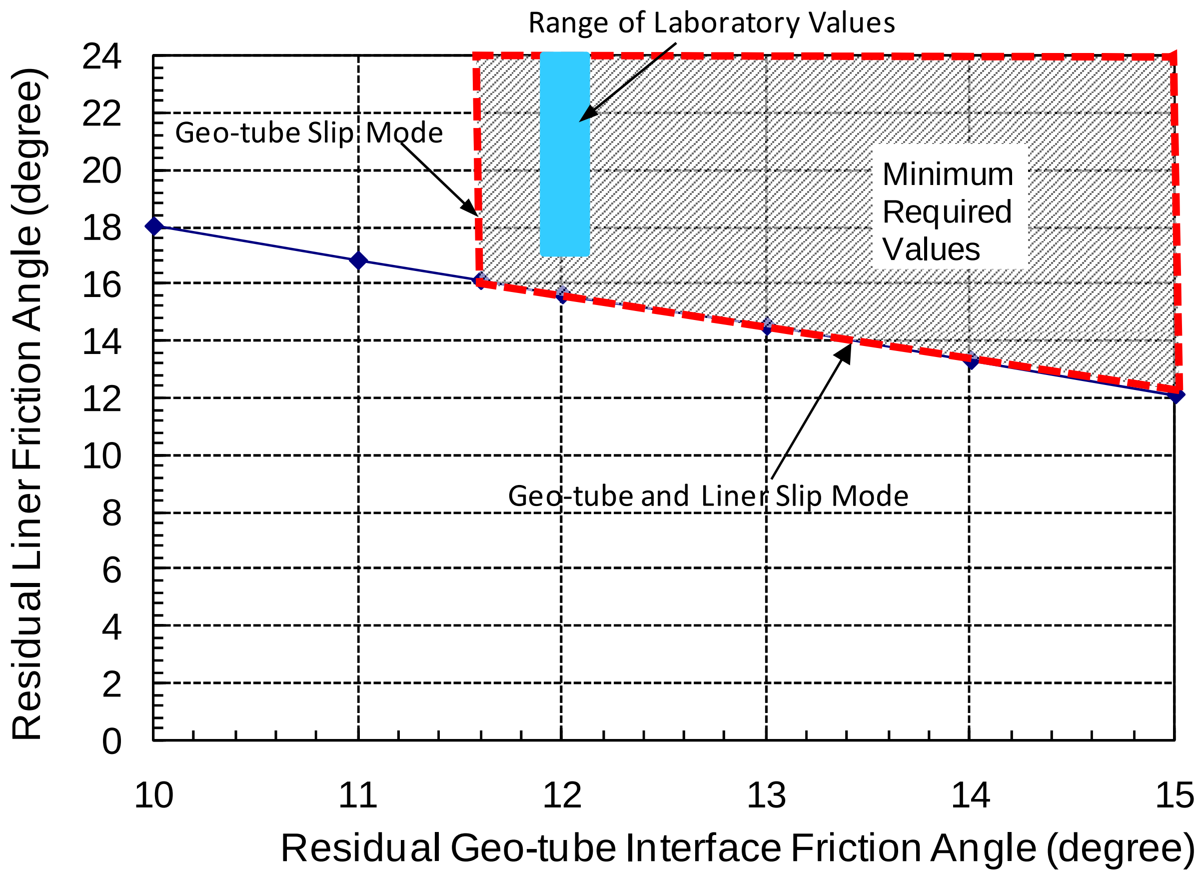

Figure 45. Sensitivity Analysis of Residual Liner Friction Angle: Minimum required values

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Attachment 1
Seismic Impact Zone

NYSDEC Regulations Section 360-2.7(b)(7) states that a seismic analysis is required "*for new landfills, lateral expansions of existing landfills, and subsequent development of any landfill permitted pursuant to these provisions located in a seismic impact zone.*" The seismic impact zone is defined as "*an area with a 10 percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.*"

According to the 2008 USGS National Seismic Hazard Map [Petersen et al, 2008], the SCA site falls within an area characterized by a peak ground acceleration (i.e., maximum horizontal acceleration in lithified earth material) of 0.0784g with 2 percent probability of exceedance in 50 years, which is approximately equivalent to 10 percent of exceedance in 250 years. The USGS Seismic Hazard Curves and Uniform Response Spectra computer analysis program was also used to calculate the peak ground acceleration with 10 percent of exceedance in 250 years directly, resulting in an estimated peak ground acceleration of 0.0765g. Table 1-1 presents the peak ground accelerations based on the site location, as calculated by the software, and Figure 1-1 shows the location of the SCA on the USGS National Seismic Hazard Map.

Therefore, based on the maximum horizontal acceleration, the SCA is not located in a seismic impact zone as defined by NYSDEC Regulations. As a result, a seismic slope stability analysis is not required.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Table 1-1. Peak Ground Accelerations Based on SCA Site Location

Hazard Curve for PGA, Latitude = 43.0600, Longitude = -76.2500

PGA (%g)	%PE	Time
7.84	2%	50 years
7.65	10%	250 years

Seismic Hazard Curves and Uniform Response Spectra. USGS, October 2008.

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

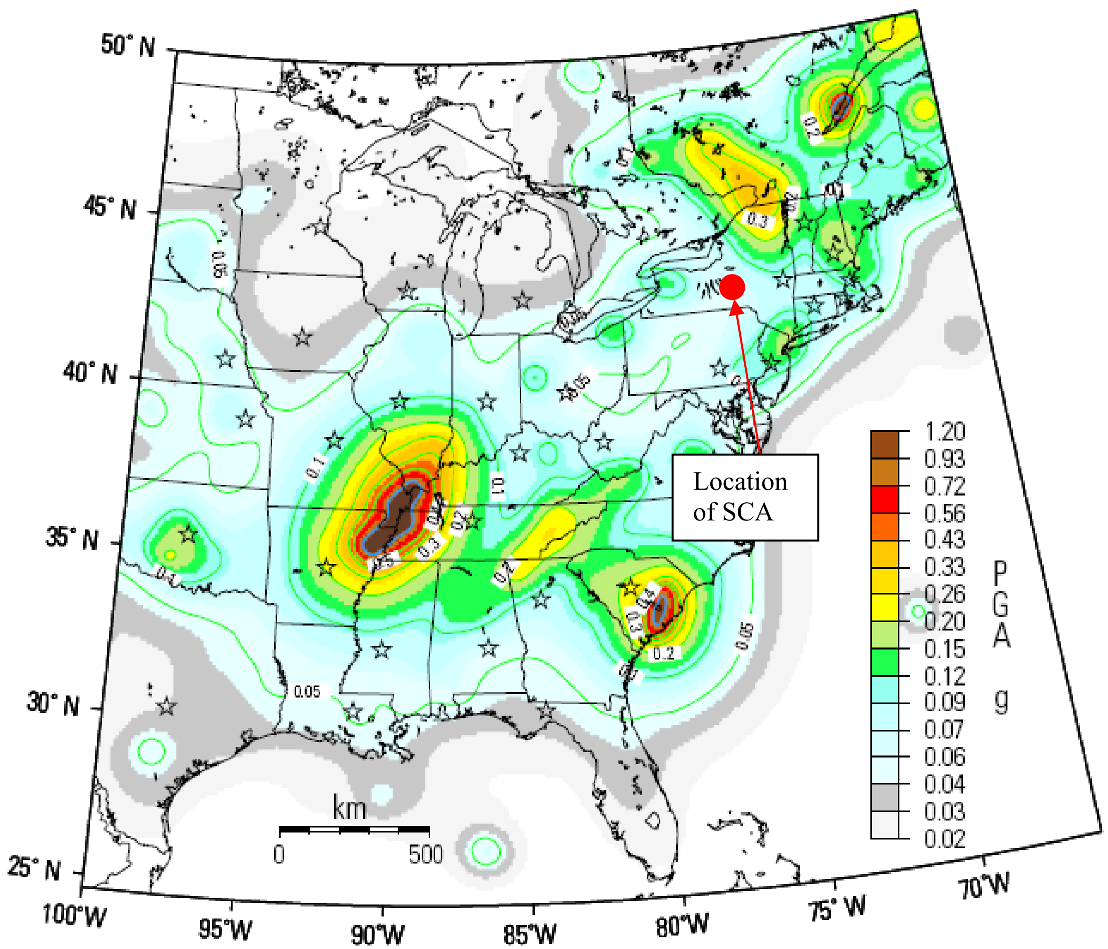

Figure 1-1. Location of the SCA on the USGS National Seismic Hazard Map

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Attachment 2
Interface Direct Shear Testing
(Results provided to Geosyntec by Parsons)

Attachment 2 Notes:

This attachment contains a summary of interface direct shear tests performed by SGI Testing Services at the request of Parsons. These tests focus on measuring shear strengths for several possible slip interfaces.

Test	Figure	Upper Shear Box	Top Liner	Bottom Liner	Lower Shear Box	Φ'_{PEAK} (°)[1]	c'_{PEAK} (psf)[2]	$\Phi'_{RESIDUAL}$ (°)[1]	$c'_{RESIDUAL}$ (psf)[2]	Figure Number
C-1	2-1	Concrete Sand	Non-Woven Geotextile	Smooth HDPE Geomembrane	Compacted Clay	13[3]	30[3]	9	25	2-1
C-2	2-2	Concrete Sand	Non-Woven Geotextile	Textured HDPE Geomembrane	Compacted Clay	27	225	17	130	2-2
C-3	2-3	Concrete Sand	Non-Woven Geotextile	EPDM Geomembrane	Compacted Clay	22	5	18	10	2-3
C-4	2-4	Concrete Sand	Non-Woven Geotextile	PP Geomembrane	Compacted Clay	19[4]	5	18	5	2-4
C-5	2-5	Rigid Substrate	Geo-tube Geotextile	Geo-tube Geotextile	Concrete Sand	15[5]	-5[6]	12	5	2-5

1. This is the friction angle. The laboratory designated the friction angle as δ, however in this table, it has been labeled Φ' for consistency with the rest of this package.
2. This is the cohesion intercept. The laboratory designated the cohesion intercept as α, however in this table, it has been labeled c' for consistency with the rest of this package. In stability calculations, this value was conservatively modeled to be zero.
3. Smooth HDPE Geomembrane is not considered for use in this project.
4. This peak effective stress friction angle between the geomembrane and compacted clay layer was used in the analyses presented herein because it had the lowest value of the three geomembrane types under consideration for this project. This liner friction angle value was input into SLIDE. Final selection of geomembrane will be made based on the results of ongoing chemical compatibility testing.
5. This peak effective stress friction angle for the geo-tube/geo-tube interface was input into SLIDE for calculation of FS values.
6. This negative value is due to the linear interpolation method used to interpret strength parameters.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

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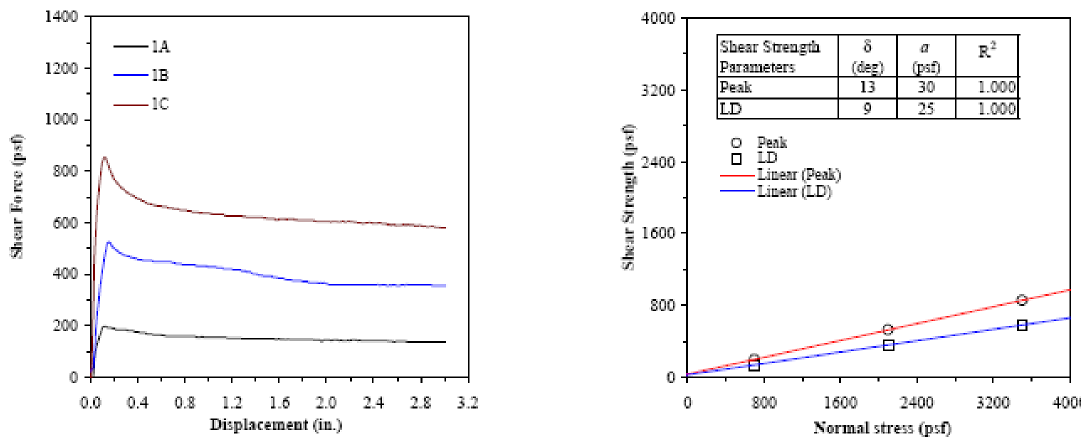
PARSONS

INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand
TenCate S1600 (16 oz) nonwoven geotextile #000167745 with non heat-treated side down/
GSE 40-mil double smooth HDPE geomembrane # 101130132/
Lower Shear Box: Clay soil compacted to approximately 95% of max modified Proctor density at 3% wet of optimum moisture content



Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	GCL Soaking Stress (psf)	GCL Soaking Time (hour)	Consolidation Stress (psf)	Consolidation Time (hour)	Clay Soil γ_d (pcf)	Clay Soil ω_i (%)	Clay Soil ω_f (%)	Upper Soil γ_d (pcf)	Upper Soil ω_i (%)	Upper Soil ω_f (%)	GCL ω_i (%)	GCL ω_f (%)	Shear Stress τ_p (psf)	Shear Stress τ_{LD} (psf)	Failure Mode
1A	12 x 12	700	0.04	-	-	-	-	118.6	13.9	13.1	-	-	-	-	-	196	135	(1)
1B	12 x 12	2100	0.04	-	-	-	-	118.9	13.6	12.5	-	-	-	-	-	526	355	(1)
1C	12 x 12	3500	0.04	-	-	-	-	119.3	13.2	12.7	-	-	-	-	-	855	580	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the non heat-treated side of 16 oz nonwoven geotextile and geomembrane.
(2) Each geosynthetic specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

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DATE OF REPORT:	2/2/2009
FIGURE NO.	C-1
PROJECT NO.	SGI9002
DOCUMENT NO.	
FILE NO.	

Figure 2-1: Direct Shear Testing of Geotextile/Smooth HDPE Geomembrane Interface

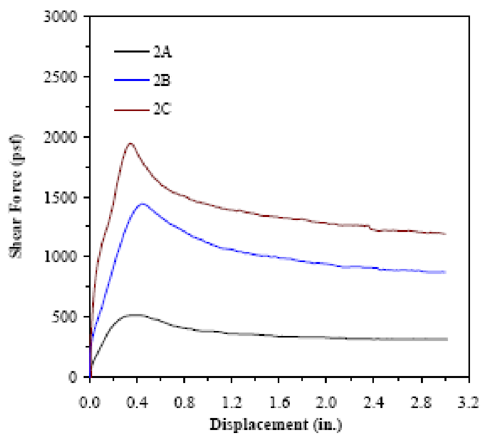
Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

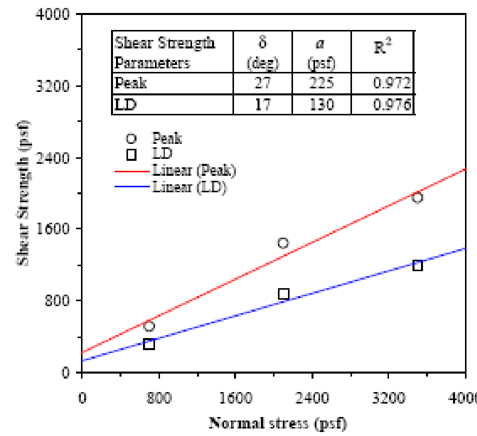
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

PARSONS

INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand
TenCate S1600 (16 oz) nonwoven geotextile #000167745 with non heat-treated side down/
GSE 40-mil double textured HDPE geomembrane # 105140273/
Lower Shear Box: Clay soil compacted to approximately 95% of max modified Proctor density at 3% wet of optimum moisture content





Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	GCL Soaking Stress (psf)	GCL Soaking Time (hour)	Consolidation Stress (psf)	Consolidation Time (hour)	Clay Soil γ_d (pcf)	Clay Soil ω_i (%)	Clay Soil ω_f (%)	Upper Soil γ_d (pcf)	Upper Soil ω_i (%)	Upper Soil ω_f (%)	GCL ω_i (%)	GCL ω_f (%)	Shear Stress τ_P (psf)	Shear Stress τ_{LD} (psf)	Failure Mode
2A	12 x 12	700	0.04	-	-	-	-	119.6	12.9	12.2	-	-	-	-	-	514	310	(1)
2B	12 x 12	2100	0.04	-	-	-	-	119.9	12.6	12.0	-	-	-	-	-	1441	870	(1)
2C	12 x 12	3500	0.04	-	-	-	-	118.9	13.6	12.9	-	-	-	-	-	1946	1189	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the non heat-treated side of 16 oz nonwoven geotextile and geomembrane.
(2) Each geosynthetic specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

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DATE OF REPORT:	2/2/2009
FIGURE NO.	C-2
PROJECT NO.	SGI9002
DOCUMENT NO.	
FILE NO.	

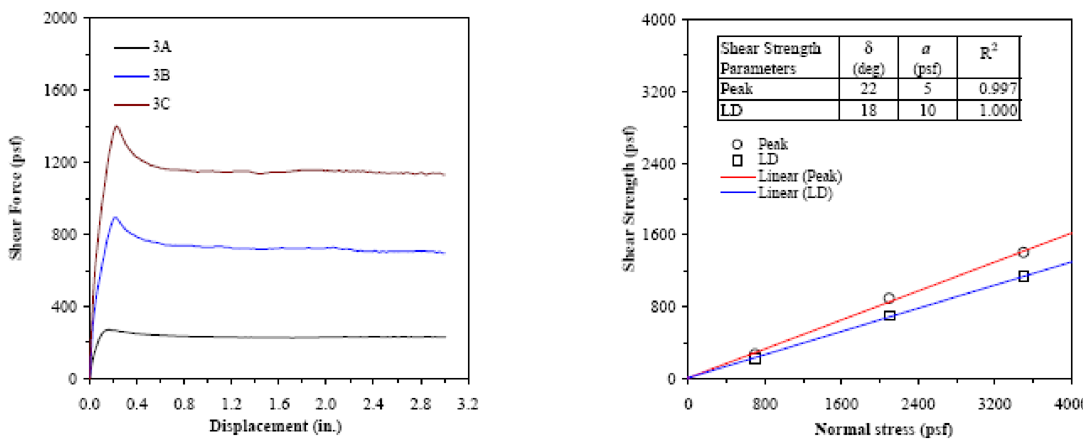
Figure 2-2: Direct Shear Testing of Geotextile/Textured HDPE Geomembrane Interface

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

PARSONS

INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand
TenCate S1600 (16 oz) nonwoven geotextile #000167745 with non heat-treated side down/
40-mil EPDM geomembrane # AZ 12343/
Lower Shear Box: Clay soil compacted to approximately 95% of max modified Proctor density at 3% wet of optimum moisture content



Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	GCL Soaking Stress (psf)	GCL Soaking Time (hour)	Consolidation Stress (psf)	Consolidation Time (hour)	Clay Soil γ_d (pcf)	Clay Soil ω_i (%)	Clay Soil ω_f (%)	Upper Soil γ_d (pcf)	Upper Soil ω_i (%)	Upper Soil ω_f (%)	GCL ω_i (%)	GCL ω_f (%)	Shear Stress τ_P (psf)	Shear Stress τ_{LD} (psf)	Failure Mode
3A	12 x 12	700	0.04	-	-	-	-	119.8	12.7	12.3	-	-	-	-	-	271	228	(1)
3B	12 x 12	2100	0.04	-	-	-	-	119.4	13.1	12.5	-	-	-	-	-	892	697	(1)
3C	12 x 12	3500	0.04	-	-	-	-	119.1	13.4	12.8	-	-	-	-	-	1402	1132	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the non heat-treated side of 16 oz nonwoven geotextile and geomembrane.
(2) Each geosynthetic specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

DATE OF REPORT:	2/4/2009
FIGURE NO.	C-3
PROJECT NO.	SGI9002
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

Figure 2-3: Direct Shear Testing of Geotextile/EPDM Geomembrane Interface

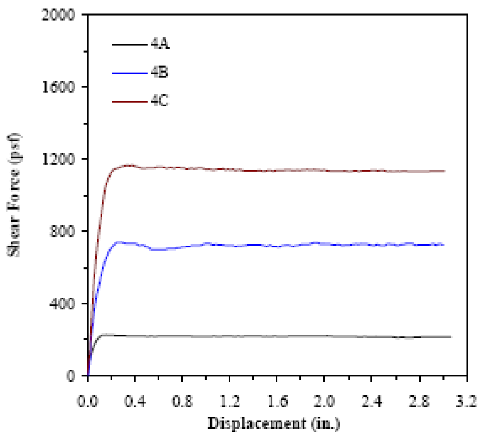
Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

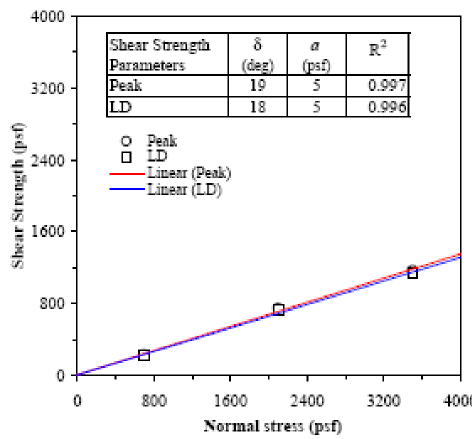
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

PARSONS

INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand
TenCate S1600 (16 oz) nonwoven geotextile #000167745 with non heat-treated side down/
40-mil PP geomembrane with rough side up to geotextile and smooth side down to clay soil/
Lower Shear Box: Clay soil compacted to approximately 95% of max modified Proctor density at 3% wet of optimum moisture content





Test No.	Shear Box Size	Normal Stress	Shear Rate	GCL Soaking		Consolidation		Clay Soil			Upper Soil			GCL		Shear Stress		Failure Mode
				Stress	Time	Stress	Time	γ_d	ω_i	ω_f	γ_d	ω_i	ω_f	ω_i	ω_f	τ_P	τ_{LD}	
	(in. x in.)	(psf)	(in./min)	(psf)	(hour)	(psf)	(hour)	(pcf)	(%)	(%)	(pcf)	(%)	(%)	(%)	(%)	(psf)	(psf)	
4A	12 x 12	700	0.04	-	-	-	-	118.6	13.9	13.3	-	-	-	-	-	226	215	(1)
4B	12 x 12	2100	0.04	-	-	-	-	119.0	13.5	12.9	-	-	-	-	-	742	726	(1)
4C	12 x 12	3500	0.04	-	-	-	-	118.8	13.7	12.5	-	-	-	-	-	1166	1133	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the non heat-treated side of 16 oz nonwoven geotextile and rough side of geomembrane.
(2) Each geosynthetic specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

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DATE OF REPORT:	2/4/2009
FIGURE NO.	C-4
PROJECT NO.	SGI9002
DOCUMENT NO.	
FILE NO.	

Figure 2-4: Direct Shear Testing of Geotextile/PP Geomembrane Interface

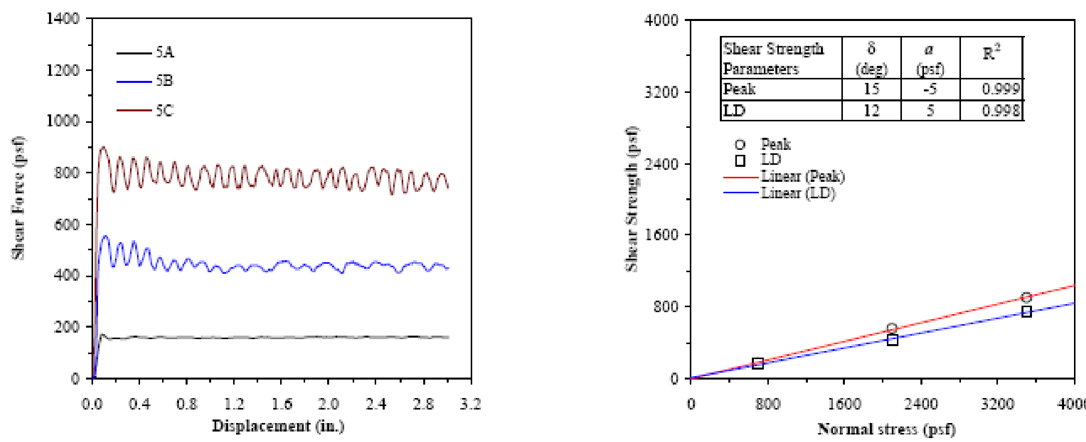
Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

PARSONS

INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Rigid substrate
TenCate GT500 geotextile #021812318 in the machine direction/
TenCate GT500 geotextile #021812318 in the machine direction
Lower Shear Box: Concrete sand



Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	GCL Soaking Stress (psf)	GCL Soaking Time (hour)	Consolidation Stress (psf)	Consolidation Time (hour)	Clay Soil γ_d (pcf)	Clay Soil ω_i (%)	Clay Soil ω_f (%)	Upper Soil γ_d (pcf)	Upper Soil ω_i (%)	Upper Soil ω_f (%)	GCL ω_i (%)	GCL ω_f (%)	Shear Stress τ_P (psf)	Shear Stress τ_{LD} (psf)	Failure Mode
5A	12 x 12	700	0.04	-	-	-	-	-	-	-	-	-	-	-	-	172	159	(1)
5B	12 x 12	2100	0.04	-	-	-	-	-	-	-	-	-	-	-	-	555	429	(1)
5C	12 x 12	3500	0.04	-	-	-	-	-	-	-	-	-	-	-	-	902	741	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the GT500 geotextile and GT500 geotextile.
(2) Each geosynthetic specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

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DATE OF REPORT:	2/2/2009
FIGURE NO.	C-5
PROJECT NO.	SGI9002
DOCUMENT NO.	
FILE NO.	

Figure 2-5: Direct Shear Testing of Geo-tube/Geo-tube Interface

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Attachment 3
Slope Stability Analyses Using the Maximum Laboratory Measured Liner Friction Angles

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slope stability analyses were performed for the critical cases of Cross-Section A-A using the maximum friction angles found from laboratory testing of possible liner system materials. This is intended to show an expected range of calculated FS values based on the laboratory variability in effective stress friction angle. The maximum liner effective stress peak and residual friction angles found in laboratory testing are 27 degrees and 18 degrees, respectively.

It is noted that the horizontal geo-tube/geo-tube interface has been modeled with peak and residual effective stress friction angles of 15 degrees and 12 degrees, respectively, in the following analyses, and other material properties are modeled as discussed in the main text.

Table 3-1 on the following page shows the FS for the critical liner case of one column of the liner slipping under one column geo-tubes. This case was evaluated using Janbu's method for peak and residual shear strengths before and after construction of the final cover. These cases can be compared with the equivalent Cross-Section A-A case from Table 2 for the minimum measured peak friction angle.

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Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Table 3-1: Critical Liner Case for Cross-Section A-A using the Maximum Laboratory Effective Stress Friction Angle

Case	Calculated FS	Target FS
Peak Friction Angle, without Final Cover[1]	1.88	1.3
Residual Friction Angle, without Final Cover[2]	1.36	1.1
Peak Friction Angle, with Final Cover[1]	1.94	1.5
Residual Friction Angle, with Final Cover[2]	1.40	1.3

Notes:

1. These FS values are calculated using the laboratory values of peak effective stress friction angle for the geo-tube/geo-tube horizontal interface (15 degrees) and maximum peak effective stress friction angle for the liner system (27 degrees). The laboratory test data are shown in Figures 2-2 and 2-5 of Attachment 2.
2. These FS values are calculated using the laboratory values of residual effective stress friction angle for the geo-tube/geo-tube horizontal interface (12 degrees) and maximum residual effective stress friction angle for the liner system (18 degrees). The laboratory test data are shown in Figures 2-4 and 2-5 of Attachment 2.
3. This table calculates the FS for the critical liner case of one column of geo-tubes.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Attachment 4
Back-Calculation of Required Geo-tube\Geo-tube and Liner System Interface Shear Strengths

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Notes:

The stability analyses discussed in the Results and Discussion section of this package were performed using friction angles from laboratory testing on materials that will likely be used for the geo-tubes and liner. Since the required FS values were met, the ability to achieve adequate stability using typical construction materials has been established. However, the use of different materials may be preferred; therefore, development of a range of acceptable parameters is required.

As described in the Analyzed Cases section, once the critical cases were identified for geo-tube and liner stability slip modes, peak and residual effective stress friction angles for the geo-tube interface and the proposed liner could be back-calculated. Since Cross-Section A-A was the more critical cross section of the two, the back-calculations were only performed on that cross section. These back-calculations indicated the following:

- For the interim condition before final cover placement, peak effective stress friction angles of 13 degrees for the horizontal geo-tube interface and 14.8 degrees for the proposed liner are required. In addition, residual effective stress friction angles of 11.0 degrees for the horizontal geo-tube interface and 12.4 degrees for the proposed liner are required.
- For the final condition after final cover placement, peak effective stress friction angles of 13.8 degrees for the horizontal geo-tube interface and 18.3 degrees for the proposed liner are required. In addition, residual effective stress friction angles of 11.6 degrees for the horizontal geo-tube interface and 16.1 degrees for the proposed liner are required.
- Therefore, the minimum required peak effective stress friction angles to meet the target FS values for both interim and final conditions are 13.8 degrees for the horizontal geo-tube interface and 18.3 degrees for the proposed liner system. The minimum required residual effective stress friction angles to meet the target FS values for both the interim and final conditions are 11.6 degrees for the horizontal geo-tube interface and 16.1 degrees for the proposed liner. Alternative combinations of horizontal geo-tube interface and liner interface strengths may be acceptable as shown in Figures 4-5 and 4-6.

These back-calculated friction angles for interim and final conditions are plotted in Figures 4-1 through 4-6. The blue boxes indicate the friction angles found from the laboratory testing of commercially available products, as shown in Attachment 2. The combinations of horizontal geo-tube and liner interface friction angles required to reach the target FS are shown in Tables 4-1 through 4-4.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

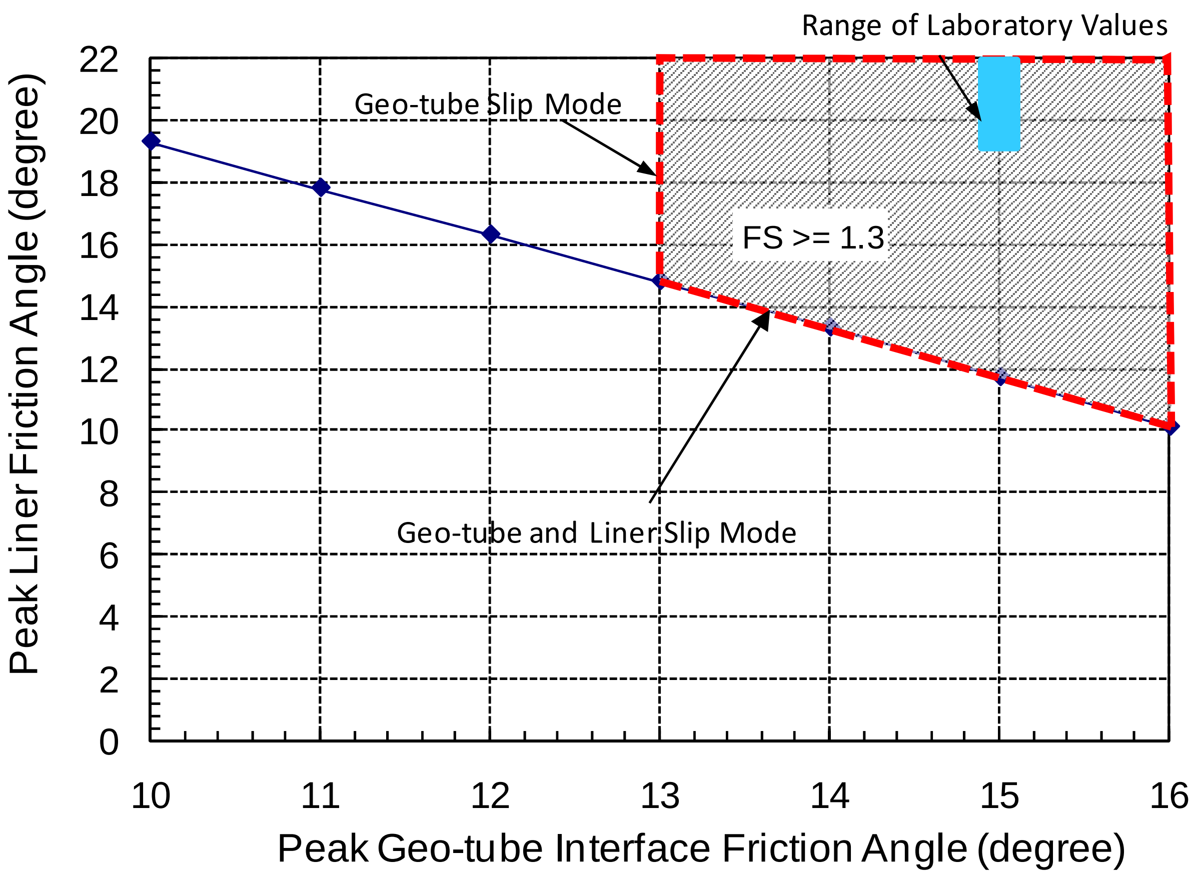

Figure 4-1: Sensitivity Analysis of Liner Interface Friction Angle Without Final Cover, using Peak Strengths

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

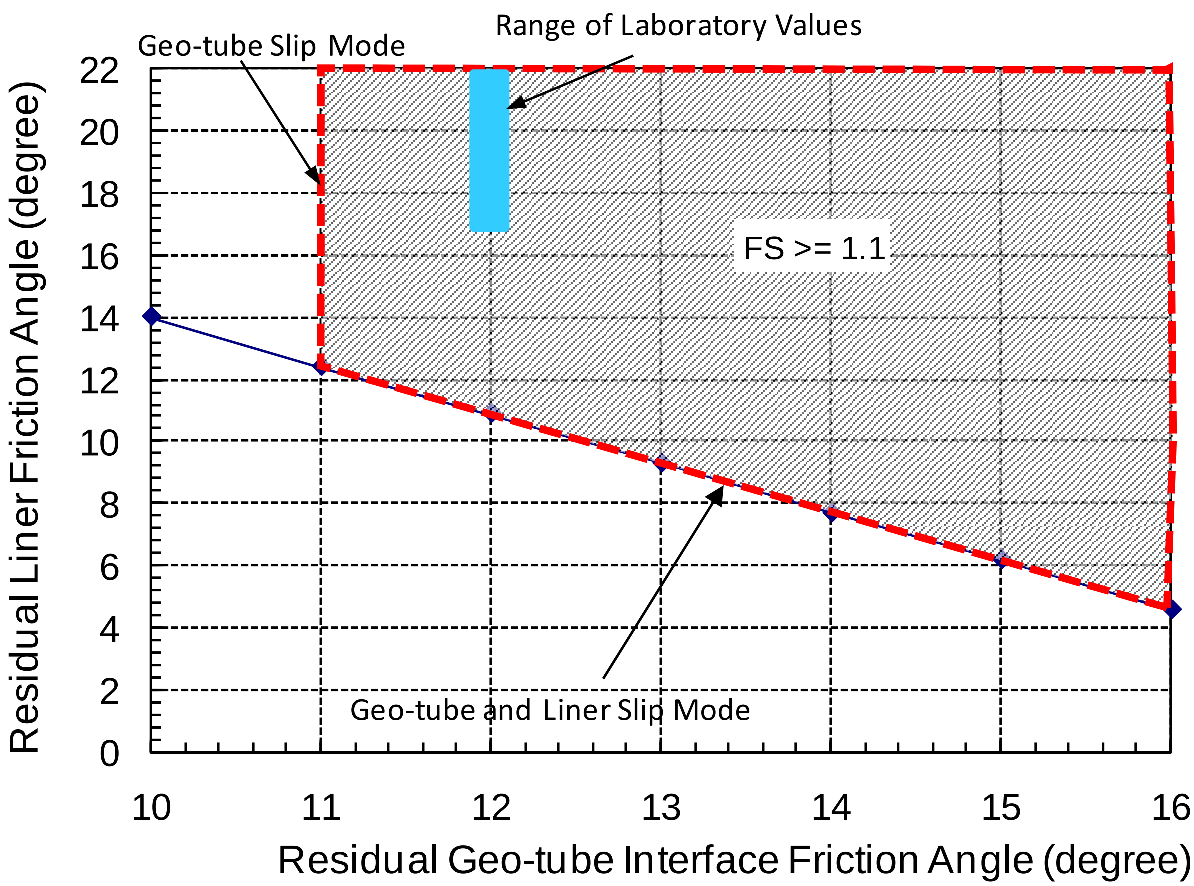

Figure 4-2: Sensitivity Analysis of Liner Interface Friction Angle Without Final Cover, using Residual Strengths

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

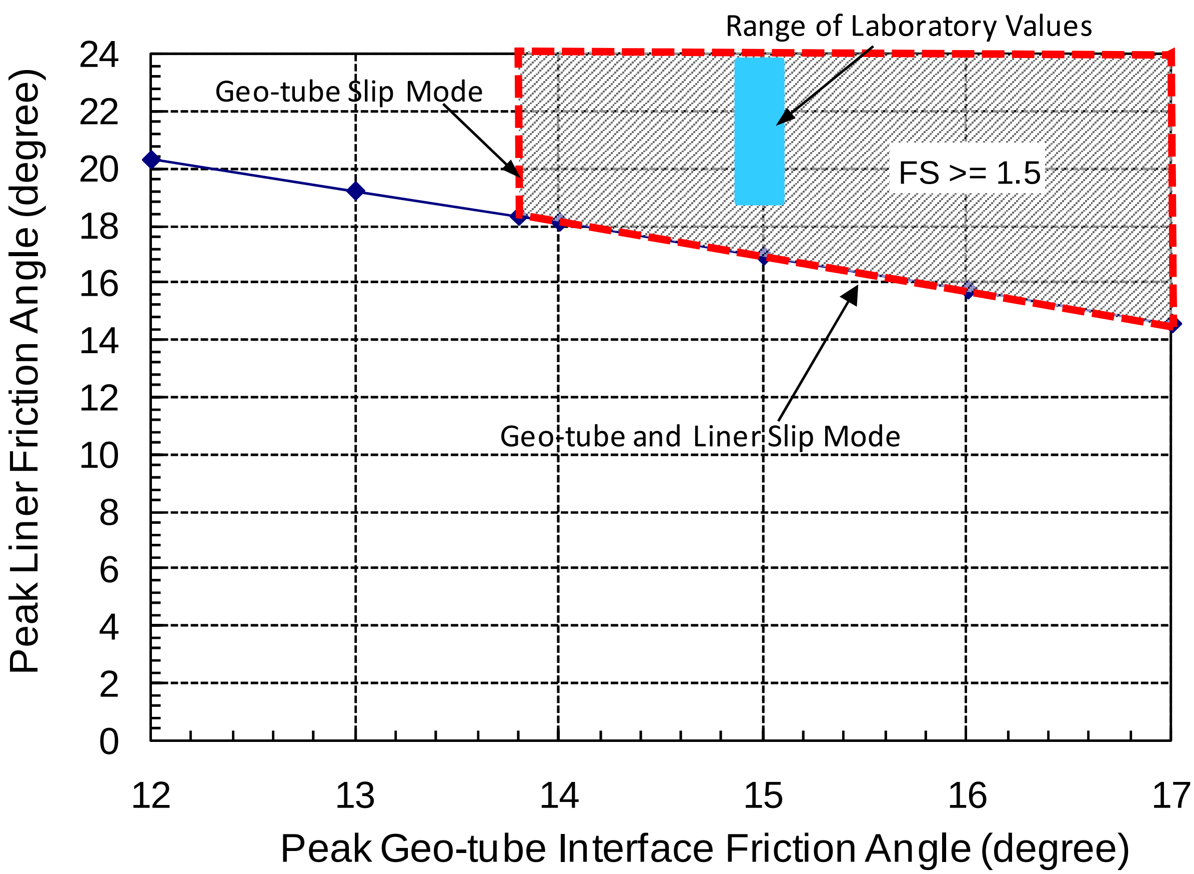

Figure 4-3: Sensitivity Analysis of Liner Interface Friction Angle after Final Cover Placement, using Peak Strengths

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

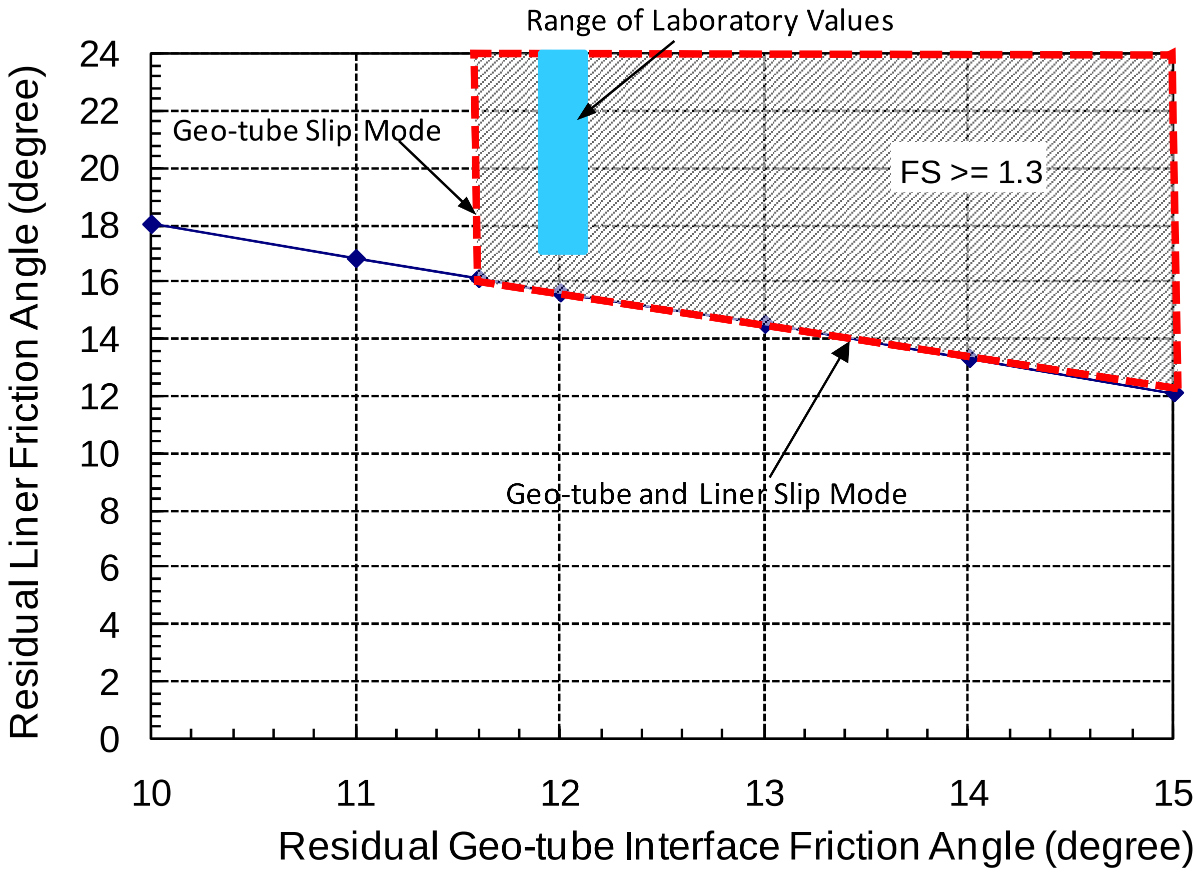

Figure 4-4: Sensitivity Analysis of Liner Interface Friction Angle after Final Cover Placement, using Residual Strengths

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

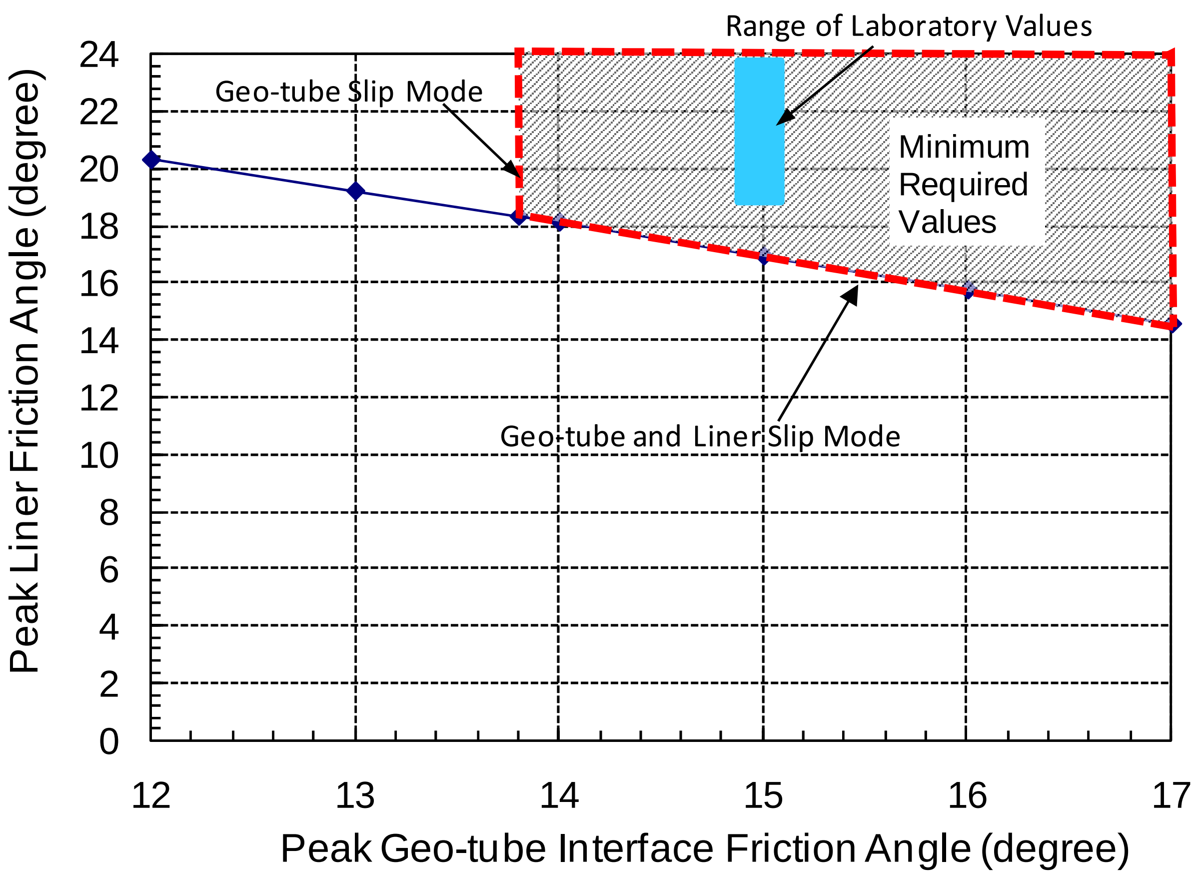

Figure 4-5: Sensitivity Analysis of Peak Liner Friction Angle: Minimum Required Values

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

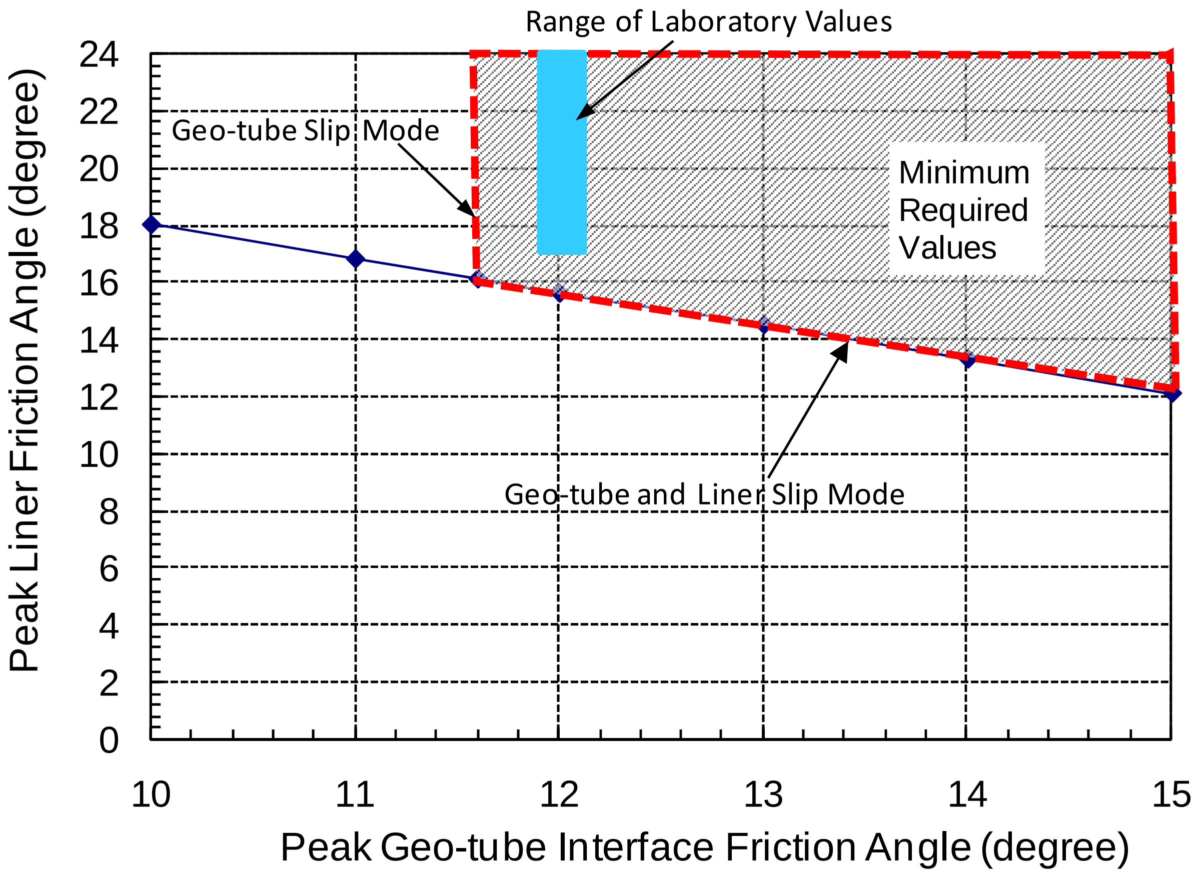

Figure 4-6: Sensitivity Analysis of Residual Liner Friction Angle: Minimum Required Values

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Table 4-1. Sensitivity Analysis of Liner Interface Friction Angle Without Final Cover, using Peak Strengths

Geotube interface friction angle (degree)	Liner friction angle (degree)
10	19.3
11	17.8
12	16.3
13	14.8
14	13.3
15	11.7
16	10.1

Notes:

1. For peak shear strengths, this table presents the minimum required liner friction angles and corresponding geo-tube/geo-tube interface friction angles to achieve the target FS of 1.3 for the liner slip mode.
2. These values were calculated using Cross-Section A-A without cover for the most critical liner slip case involving one column of geo-tubes.
3. These values are plotted graphically in Figure 4-1.
4. For peak shear strengths, in order to achieve the target FS of 1.3 for the geo-tube slip mode, the minimum required geo-tube/geo-tube horizontal interface friction angle was back-calculated to be 13.0 degrees, which corresponds to a minimum liner friction angle of 14.8 degrees.

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Table 4-2. Sensitivity Analysis of Liner Interface Friction Angle Without Final Cover, using Residual Strengths

Geotube interface friction angle (degree)	Liner friction angle (degree)
10	14
11	12.4
12	10.9
13	9.3
14	7.7
15	6.2
16	4.6

Notes:
1. For residual strengths, this table presents the minimum required liner friction angles and corresponding geo-tube/geo-tube interface friction angles to achieve the target FS of 1.1 for the liner slip mode.
2. These values were calculated using Cross-Section A-A without cover for the most critical liner slip case involving one column of geo-tubes.
3. These values are plotted graphically in Figure 4-2.
4. For residual strengths, in order to achieve the target FS of 1.1 for the geo-tube slip mode, the minimum required geo-tube/geo-tube horizontal interface friction angle was back-calculated to be 11.0 degrees, which corresponds to a minimum liner friction angle of 12.4 degrees.

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Table 4-3. Sensitivity Analysis of Liner Interface Friction Angle after Final Cover Placement, using Peak Strengths

Geotube interface friction angle (degree)	Liner friction angle (degree)
12	20.3
13	19.2
13.8	18.3
14	18.1
15	16.9
16	15.7
17	14.5

Notes:

1. For peak shear strengths, this table presents the minimum required liner friction angles and corresponding geo-tube/geo-tube interface friction angles to achieve the target FS of 1.5 for the liner slip mode.
2. These values were calculated using Cross-Section A-A without cover for the most critical liner slip case involving one column of geo-tubes.
3. These values are plotted graphically in Figure 4-3.
4. For peak shear strengths, in order to achieve the target FS of 1.5 for the geo-tube slip mode, the minimum required geo-tube/geo-tube horizontal interface friction angle was back-calculated to be 13.8 degrees, which corresponds to a minimum liner friction angle of 18.3 degrees.

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Table 4-4. Sensitivity Analysis of Liner Interface Friction Angle after Final Cover Placement, using Residual Strengths

Geotube interface friction angle (degree)	Liner friction angle (degree)
10	18
11	16.8
11.6	16.1
12	15.6
13	14.5
14	13.3
15	12.1

Notes:

1. For residual strengths, this table presents the minimum required liner friction angles and corresponding geo-tube/geo-tube interface friction angles to achieve the target FS of 1.3 for the liner slip mode.
2. These values were calculated using Cross-Section A-A without cover for the most critical liner slip case involving one column of geo-tubes.
3. These values are plotted graphically in Figure 4-4.
4. For residual strengths, in order to achieve the target FS of 1.3 for the geo-tube slip mode, the minimum required geo-tube/geo-tube horizontal interface friction angle was back-calculated to be 11.6 degrees, which corresponds to a minimum liner friction angle of 16.1 degrees.

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Attachment 5
SLIDE Output Files

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

Notes

1.) The error messages in the output files are a result of invalid slip surfaces generated by the SLIDE program during the automatic search for the most critical slip surface. The invalid slip surfaces included surfaces that are beyond the defined model boundaries, surfaces that are kinematically not feasible, and surfaces that mathematically do not converge to a solution. The invalid slip surfaces do not affect the valid slip surfaces from which the critical slip surface is identified. A list of error codes identifying the meaning of each message is included immediately after this notes page.

2.) In the SLIDE output files, the model boundaries and definitions are only included twice for each Cross-Section: once before placement of cover and once after the final cover placement, to avoid redundancy.

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List of Error Codes

-101 = Only one (or zero) surface/slope interactions.

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)< 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

-116 = Not enough slices to analyze the surface. Increase the number of slices in the job control in the modeler.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

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Cross-Section A-A: Before Placement of Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_nocover_tube_07_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf

Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.554920
Axis Location: 1005.384, 553.134
Left Slip Surface Endpoint: 978.000, 441.320
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 978.000 447.274
Right Slope Intercept: 1078.405 464.138
Resisting Moment=2.14281e+006 lb-ft
Driving Moment=1.37809e+006 lb-ft

Method: janbu simplified
FS: 1.518670
Axis Location: 1005.384, 553.134
Left Slip Surface Endpoint: 978.000, 441.320
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 978.000 447.274
Right Slope Intercept: 1078.405 464.138
Resisting Horizontal Force=20290 lb
Driving Horizontal Force=13360.4 lb

Method: spencer
FS: 2.310560
Axis Location: 1005.597, 553.240
Left Slip Surface Endpoint: 978.000, 441.533
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 978.000 447.274
Right Slope Intercept: 1078.405 464.138
Resisting Moment=2.56687e+006 lb-ft
Driving Moment=1.11093e+006 lb-ft
Resisting Horizontal Force=23758.7 lb
Driving Horizontal Force=10282.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4164
Number of Invalid Surfaces: 836
Error Codes:
Error Code -108 reported for 834 surfaces
Error Code -112 reported for 2 surfaces

Method: janbu simplified
Number of Valid Surfaces: 4147
Number of Invalid Surfaces: 853
Error Codes:
Error Code -108 reported for 851 surfaces
Error Code -112 reported for 2 surfaces

Method: spencer
Number of Valid Surfaces: 3193
Number of Invalid Surfaces: 1807
Error Codes:
Error Code -108 reported for 1754 surfaces
Error Code -111 reported for 51 surfaces
Error Code -112 reported for 2 surfaces

List of All Coordinates

Block Search Polyline

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

978.000	441.318
1017.040	441.054

Material Boundary

953.000	433.500
958.000	433.500
1400.000	427.700

Material Boundary

978.000	441.524
997.000	441.309
998.500	441.292
1017.009	441.083
1018.508	441.066
1037.000	440.856
1038.500	440.839
1057.015	440.630
1058.509	440.613
1096.999	440.178
1098.506	440.161
1117.012	439.951
1118.512	439.934
1137.006	439.725
1138.505	439.708
1157.006	439.499
1158.500	439.482
1176.999	439.273
1178.492	439.256
1197.013	439.046
1198.512	439.029
1217.005	438.820
1218.499	438.803
1237.000	438.594
1238.506	438.577
1257.010	438.368
1258.509	438.351
1277.013	438.141
1278.513	438.124
1296.975	437.915
1298.469	437.899
1317.013	437.689
1318.507	437.672
1336.969	437.463
1338.469	437.446
1357.000	437.236
1358.510	437.219
1376.969	437.011
1378.475	436.993
1400.000	436.750

Material Boundary

998.000	447.048
1017.014	446.832
1018.514	446.815
1037.015	446.606
1038.521	446.589
1057.021	446.380
1058.520	446.363
1077.016	446.154
1078.515	446.137
1097.005	445.928
1098.523	445.910
1117.022	445.701
1118.509	445.684
1137.023	445.475
1138.511	445.458
1157.009	445.249
1158.509	445.232
1177.011	445.023
1178.494	445.006
1197.022	444.796
1198.509	444.779
1217.011	444.570
1218.511	444.553
1237.016	444.344
1238.509	444.327
1257.015	444.117
1258.515	444.101
1277.009	443.891
1278.515	443.874
1296.975	443.665
1298.475	443.648
1317.016	443.439
1318.515	443.422
1336.981	443.213
1338.481	443.196
1357.016	442.986
1358.516	442.969
1376.981	442.760
1378.481	442.743
1400.000	442.500

Material Boundary

998.000	447.298
1017.014	447.082
1018.514	447.066

Written by: **Joseph Sura** Date: **12/4/2009** Reviewed by: **R. Kulasingam/Jay Beech** Date: **12/8/2009**

Client: **Honeywell** Project: **Onondaga Lake SCA Final Design** Project/ Proposal No.: **GJ4299** Task No.: **18**

1037.016	446.856
1038.521	446.839
1057.021	446.630
1058.521	446.613
1077.016	446.404
1078.516	446.387
1097.005	446.178
1098.524	446.160
1117.022	445.951
1118.510	445.934
1137.024	445.725
1138.511	445.708
1157.010	445.499
1158.510	445.482
1177.011	445.273
1178.494	445.256
1197.022	445.046
1198.510	445.029
1217.011	444.820
1218.511	444.803
1237.016	444.594
1238.509	444.577
1257.016	444.368
1258.515	444.351
1277.010	444.141
1278.516	444.124
1296.975	443.915
1298.475	443.898
1317.016	443.689
1318.516	443.672
1336.981	443.463
1338.481	443.446
1357.016	443.236
1358.516	443.219
1376.981	443.010
1378.481	442.993
1400.000	442.750

Material Boundary

1018.000	452.821
1037.021	452.606
1038.521	452.589
1057.007	452.380
1058.501	452.363
1077.021	452.154
1078.527	452.137
1096.995	451.928
1098.501	451.911
1117.028	451.701
1118.527	451.684
1137.001	451.475
1138.501	451.458
1157.027	451.249
1158.521	451.232
1176.995	451.023
1178.495	451.006
1197.028	450.796
1198.521	450.779
1217.001	450.570
1218.501	450.553
1237.022	450.344
1238.515	450.327
1257.007	450.118
1258.501	450.101
1277.021	449.891
1278.521	449.874
1297.001	449.665
1298.501	449.648
1317.028	449.439
1318.521	449.422
1337.008	449.213
1338.501	449.196
1357.022	448.986
1358.521	448.969
1377.008	448.760
1378.508	448.743
1400.000	448.500

Material Boundary

1018.000	453.071
1037.022	452.856
1038.521	452.839
1057.007	452.630
1058.501	452.613
1077.022	452.404
1078.528	452.387
1096.996	452.178
1098.501	452.161
1117.028	451.951
1118.528	451.934
1137.002	451.725
1138.501	451.708
1157.028	451.499
1158.522	451.482
1176.996	451.273
1178.496	451.256

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1197.028	451.046
1198.522	451.029
1217.001	450.820
1218.501	450.803
1237.022	450.594
1238.515	450.577
1257.007	450.368
1258.501	450.351
1277.022	450.141
1278.522	450.124
1297.002	449.915
1298.502	449.898
1317.028	449.689
1318.522	449.672
1337.008	449.463
1338.502	449.446
1357.022	449.236
1358.522	449.219
1377.008	449.010
1378.508	448.993
1400.000	448.750

Material Boundary

1038.000	458.595
1057.013	458.380
1058.512	458.363
1077.005	458.154
1078.505	458.137
1097.013	457.928
1098.513	457.911
1117.011	457.701
1118.498	457.685
1137.019	457.475
1138.507	457.458
1157.005	457.249
1158.498	457.232
1177.013	457.023
1178.518	457.006
1197.005	456.796
1198.498	456.779
1217.007	456.570
1218.501	456.553
1237.005	456.344
1238.511	456.327
1257.007	456.118
1258.507	456.101
1277.005	455.891
1278.505	455.874

1297.013	455.665
1298.513	455.648
1317.005	455.439
1318.505	455.422
1337.014	455.213
1338.507	455.196
1357.006	454.986
1358.511	454.969
1377.021	454.760
1378.513	454.743
1400.000	454.500

Material Boundary

1038.000	458.845
1057.013	458.630
1058.513	458.613
1077.006	458.404
1078.505	458.387
1097.013	458.178
1098.513	458.161
1117.011	457.951
1118.499	457.934
1137.020	457.725
1138.507	457.708
1157.005	457.499
1158.499	457.482
1177.013	457.273
1178.519	457.255
1197.006	457.046
1198.499	457.029
1217.007	456.820
1218.501	456.803
1237.006	456.594
1238.511	456.577
1257.007	456.368
1258.507	456.351
1277.005	456.141
1278.505	456.124
1297.014	455.915
1298.514	455.898
1317.005	455.689
1318.505	455.672
1337.014	455.463
1338.507	455.446
1357.006	455.236
1358.511	455.219
1377.021	455.010
1378.514	454.993

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1400.000	454.750

Material Boundary

958.000	435.500
997.000	435.059
998.500	435.042
1037.000	434.606
1038.494	434.589
1077.000	434.154
1078.500	434.137
1117.000	433.701
1118.494	433.684
1156.994	433.249
1158.494	433.232
1197.006	432.796
1198.500	432.779
1236.994	432.344
1238.494	432.327
1277.007	431.891
1278.507	431.874
1317.007	431.439
1318.507	431.422
1357.000	430.986
1358.499	430.969
1400.000	430.500

Material Boundary

978.000	441.274
997.000	441.059
998.500	441.042
1017.008	440.832
1018.508	440.816
1037.000	440.606
1038.500	440.589
1057.015	440.380
1058.508	440.363
1077.006	440.154
1078.494	440.137
1096.999	439.928
1098.505	439.911
1117.012	439.701
1118.511	439.684
1137.005	439.475
1138.505	439.458
1157.006	439.249
1158.500	439.232
1176.999	439.023
1178.492	439.006
1197.012	438.796
1198.512	438.779
1217.005	438.570
1218.499	438.553
1237.000	438.344
1238.506	438.327
1257.009	438.118
1258.509	438.101
1277.013	437.891
1278.512	437.874
1296.975	437.665
1298.469	437.649
1317.013	437.439
1318.507	437.422
1336.969	437.213
1338.469	437.196
1357.000	436.986
1358.510	436.969
1376.969	436.761
1378.475	436.743
1400.000	436.500

Material Boundary

958.000	435.750
997.000	435.309
998.500	435.292
1037.000	434.856
1038.494	434.839
1077.000	434.404
1078.500	434.387
1117.001	433.951
1118.494	433.934
1156.994	433.499
1158.494	433.482
1197.007	433.046
1198.500	433.029
1236.994	432.594
1238.494	432.577
1277.007	432.141
1278.507	432.124
1317.007	431.689
1318.507	431.672
1357.000	431.236
1358.500	431.219
1400.000	430.750

Material Boundary

895.681	432.081

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

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953.504 431.272
1400.000 425.200

Material Boundary
661.000 436.500
748.000 412.600
789.000 386.700
835.000 386.800
980.000 376.600
1400.000 367.800

Material Boundary
942.667 435.500
947.793 433.500
953.504 431.272

Material Boundary
1357.000 430.986
1357.000 431.236
1357.000 436.986
1357.000 437.236

Material Boundary
1358.499 430.969
1358.500 431.219
1358.510 436.969
1358.510 437.219

Material Boundary
1277.007 431.891
1277.007 432.141
1277.013 437.891
1277.013 438.141

Material Boundary
1278.507 431.874
1278.507 432.124
1278.512 437.874
1278.513 438.124

Material Boundary
1317.007 431.439
1317.007 431.689
1317.013 437.439
1317.013 437.689

Material Boundary
1318.507 431.422
1318.507 431.672
1318.507 437.422
1318.507 437.672

Material Boundary
1077.000 434.154
1077.000 434.404
1077.006 440.154

Material Boundary
1078.494 440.137
1078.500 434.387
1078.500 434.137

Material Boundary
1117.000 433.701
1117.001 433.951
1117.012 439.701
1117.012 439.951

Material Boundary
1118.494 433.684
1118.494 433.934
1118.511 439.684
1118.512 439.934

Material Boundary
1156.994 433.249
1156.994 433.499
1157.006 439.249
1157.006 439.499

Material Boundary
1158.494 433.232
1158.494 433.482
1158.500 439.232
1158.500 439.482

Material Boundary
1197.006 432.796
1197.007 433.046
1197.012 438.796
1197.013 439.046

Material Boundary
1198.500 432.779
1198.500 433.029
1198.512 438.779

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1198.512 439.029

Material Boundary
1236.994 432.344
1236.994 432.594
1237.000 438.344
1237.000 438.594

Material Boundary
1238.494 432.327
1238.494 432.577
1238.506 438.327
1238.506 438.577

Material Boundary
997.000 435.059
997.000 435.309
997.000 441.059
997.000 441.309

Material Boundary
998.500 435.042
998.500 435.292
998.500 441.042
998.500 441.292

Material Boundary
1037.000 434.606
1037.000 434.856
1037.000 440.606
1037.000 440.856

Material Boundary
1038.494 434.589
1038.494 434.839
1038.500 440.589
1038.500 440.839

Material Boundary
1296.975 437.665
1296.975 437.915
1296.975 443.665
1296.975 443.915

Material Boundary
1298.469 437.649
1298.469 437.899
1298.475 443.648

1298.475 443.898

Material Boundary
1336.969 437.213
1336.969 437.463
1336.981 443.213
1336.981 443.463

Material Boundary
1338.469 437.196
1338.469 437.446
1338.481 443.196
1338.481 443.446

Material Boundary
1376.969 436.761
1376.969 437.011
1376.981 442.760
1376.981 443.010

Material Boundary
1378.475 436.743
1378.475 436.993
1378.481 442.743
1378.481 442.993

Material Boundary
1257.009 438.118
1257.010 438.368
1257.015 444.117
1257.016 444.368

Material Boundary
1258.509 438.101
1258.509 438.351
1258.515 444.101
1258.515 444.351

Material Boundary
1096.999 439.928
1096.999 440.178
1097.005 445.928
1097.005 446.178

Material Boundary
1098.505 439.911
1098.506 440.161
1098.523 445.910

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1098.524 446.160

Material Boundary
1137.005 439.475
1137.006 439.725
1137.023 445.475
1137.024 445.725

Material Boundary
1138.505 439.458
1138.505 439.708
1138.511 445.458
1138.511 445.708

Material Boundary
1176.999 439.023
1176.999 439.273
1177.011 445.023
1177.011 445.273

Material Boundary
1178.492 439.006
1178.492 439.256
1178.494 445.006
1178.494 445.256

Material Boundary
1217.005 438.570
1217.005 438.820
1217.011 444.570
1217.011 444.820

Material Boundary
1218.499 438.553
1218.499 438.803
1218.511 444.553
1218.511 444.803

Material Boundary
1017.008 440.832
1017.009 441.083
1017.014 446.832
1017.014 447.082

Material Boundary
1018.508 440.816
1018.508 441.066
1018.514 446.815

1018.514 447.066

Material Boundary
1057.015 440.380
1057.015 440.630
1057.021 446.380
1057.021 446.630

Material Boundary
1058.508 440.363
1058.509 440.613
1058.520 446.363
1058.521 446.613

Material Boundary
1037.015 446.606
1037.016 446.856
1037.021 452.606
1037.022 452.856

Material Boundary
1038.521 446.589
1038.521 446.839
1038.521 452.589
1038.521 452.839

Material Boundary
1077.016 446.154
1077.016 446.404
1077.021 452.154
1077.022 452.404

Material Boundary
1078.515 446.137
1078.516 446.387
1078.527 452.137
1078.528 452.387

Material Boundary
1117.022 445.701
1117.022 445.951
1117.028 451.701
1117.028 451.951

Material Boundary
1118.509 445.684
1118.510 445.934
1118.527 451.684

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1118.528	451.934

Material Boundary

1157.009	445.249
1157.010	445.499
1157.027	451.249
1157.028	451.499

Material Boundary

1158.509	445.232
1158.510	445.482
1158.521	451.232
1158.522	451.482

Material Boundary

1197.022	444.796
1197.022	445.046
1197.028	450.796
1197.028	451.046

Material Boundary

1198.509	444.779
1198.510	445.029
1198.521	450.779
1198.522	451.029

Material Boundary

1237.016	444.344
1237.016	444.594
1237.022	450.344
1237.022	450.594

Material Boundary

1238.509	444.327
1238.509	444.577
1238.515	450.327
1238.515	450.577

Material Boundary

1277.009	443.891
1277.010	444.141
1277.021	449.891
1277.022	450.141

Material Boundary

1278.515	443.874
1278.516	444.124
1278.521	449.874

1278.522	450.124

Material Boundary

1317.016	443.439
1317.016	443.689
1317.028	449.439
1317.028	449.689

Material Boundary

1318.515	443.422
1318.516	443.672
1318.521	449.422
1318.522	449.672

Material Boundary

1357.016	442.986
1357.016	443.236
1357.022	448.986
1357.022	449.236

Material Boundary

1358.516	442.969
1358.516	443.219
1358.521	448.969
1358.522	449.219

Material Boundary

1057.007	452.380
1057.007	452.630
1057.013	458.380
1057.013	458.630

Material Boundary

1058.501	452.363
1058.501	452.613
1058.512	458.363
1058.513	458.613

Material Boundary

1098.501	451.911
1098.501	452.161
1098.513	457.911
1098.513	458.161

Material Boundary

1096.995	451.928
1096.996	452.178
1097.013	457.928

Written by: **Joseph Sura** Date: **12/4/2009** Reviewed by: **R. Kulasingam/Jay Beech** Date: **12/8/2009**

Client: **Honeywell** Project: **Onondaga Lake SCA Final Design** Project/ Proposal No.: **GJ4299** Task No.: **18**

1097.013 458.178

Material Boundary
1137.001 451.475
1137.002 451.725
1137.019 457.475
1137.020 457.725

Material Boundary
1138.501 451.458
1138.501 451.708
1138.507 457.458
1138.507 457.708

Material Boundary
1176.995 451.023
1176.996 451.273
1177.013 457.023
1177.013 457.273

Material Boundary
1178.495 451.006
1178.496 451.256
1178.518 457.006
1178.519 457.255

Material Boundary
1217.001 450.570
1217.001 450.820
1217.007 456.570
1217.007 456.820

Material Boundary
1218.501 450.553
1218.501 450.803
1218.501 456.553
1218.501 456.803

Material Boundary
1257.007 450.118
1257.007 450.368
1257.007 456.118
1257.007 456.368

Material Boundary
1258.501 450.101
1258.501 450.351
1258.507 456.101
1258.507 456.351

Material Boundary
1297.001 449.665
1297.002 449.915
1297.013 455.665
1297.014 455.915

Material Boundary
1298.501 449.648
1298.502 449.898
1298.513 455.648
1298.514 455.898

Material Boundary
1337.008 449.213
1337.008 449.463
1337.014 455.213
1337.014 455.463

Material Boundary
1338.501 449.196
1338.502 449.446
1338.507 455.196
1338.507 455.446

Material Boundary
1377.008 448.760
1377.008 449.010
1377.021 454.760
1377.021 455.010

Material Boundary
1378.508 448.743
1378.508 448.993
1378.513 454.743
1378.514 454.993

Material Boundary
1077.005 458.154
1077.006 458.404
1077.017 464.154

Material Boundary
1078.505 458.137
1078.505 458.387
1078.517 464.137

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material Boundary
1117.011 457.701
1117.011 457.951
1117.011 463.701

Material Boundary
1118.498 457.685
1118.499 457.934
1118.511 463.684

Material Boundary
1157.005 457.249
1157.005 457.499
1157.011 463.249

Material Boundary
1158.498 457.232
1158.499 457.482
1158.511 463.232

Material Boundary
1197.005 456.796
1197.006 457.046
1197.017 462.796

Material Boundary
1198.498 456.779
1198.499 457.029
1198.517 462.779

Material Boundary
1237.005 456.344
1237.006 456.594
1237.024 462.344

Material Boundary
1238.511 456.327
1238.511 456.577
1238.517 462.327

Material Boundary
1277.005 455.891
1277.005 456.141
1277.011 461.891

Material Boundary
1278.505 455.874
1278.505 456.124
1278.505 461.874

Material Boundary
1317.005 455.439
1317.005 455.689
1317.011 461.439

Material Boundary
1318.505 455.422
1318.505 455.672
1318.517 461.422

Material Boundary
1357.006 454.986
1357.006 455.236
1357.017 460.986

Material Boundary
1358.511 454.969
1358.511 455.219
1358.511 460.969

Material Boundary
937.818 437.500
940.000 436.600
942.667 435.500

External Boundary
909.818 437.500
899.186 433.425
895.681 432.081
661.000 436.500
638.000 432.900
555.000 396.200
483.000 398.300
461.000 390.500
307.000 386.700
277.000 373.000
1.726 374.590
1.726 167.800
1400.000 167.800
1400.000 367.800
1400.000 425.200
1400.000 427.700
1400.000 430.500
1400.000 430.750
1400.000 436.500
1400.000 436.750

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1400.000	442.500
1400.000	442.750
1400.000	448.500
1400.000	448.750
1400.000	454.500
1400.000	454.750
1400.000	460.500
1358.511	460.969
1357.017	460.986
1318.517	461.422
1317.011	461.439
1278.505	461.874
1277.011	461.891
1238.517	462.327
1237.024	462.344
1198.517	462.779
1197.017	462.796
1158.511	463.232
1157.011	463.249
1118.511	463.684
1117.011	463.701
1078.517	464.137
1077.017	464.154
1038.000	464.595
1038.000	458.845
1038.000	458.595
1018.000	458.821
1018.000	453.071
1018.000	452.821
998.000	453.048
998.000	447.298
998.000	447.048
978.000	447.274
978.000	441.524
978.000	441.274
958.000	441.500
958.000	435.750
958.000	435.500
953.000	433.500
948.793	433.500
943.667	435.500
941.000	436.600
938.818	437.500
937.818	437.500

Piezo Line

946.230	434.500
948.793	434.500
958.000	434.500
1400.000	428.700

Water Table

715.262	421.594
900.000	417.000
935.504	416.272
1400.000	410.200

Focus/Block Search Point

1017.040	441.054

Focus/Block Search Point

1018.472	446.848

Focus/Block Search Point

1037.037	446.830

Focus/Block Search Point

1038.507	452.594

Focus/Block Search Point

1057.020	452.618

Focus/Block Search Point

1058.459	458.411

Focus/Block Search Point

1077.037	458.372

Focus/Block Search Point

1078.405	464.138

Support

1358.511	460.969
1400.000	460.500

Support

1400.000	454.750
1400.000	460.500

Support

1400.000	454.750
1358.511	455.219

Support

1358.511	455.219
1358.511	460.969

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Support
1378.513 454.743
1378.508 448.993

Support
1378.508 448.993
1400.000 448.750

Support
1400.000 448.750
1400.000 454.500

Support
1400.000 454.500
1378.513 454.743

Support
1400.000 448.500
1400.000 442.750

Support
1400.000 442.750
1358.516 443.219

Support
1358.516 443.219
1358.521 448.969

Support
1358.521 448.969
1400.000 448.500

Support
1400.000 442.500
1400.000 436.750

Support
1400.000 436.750
1378.475 436.993

Support
1378.475 436.993
1378.481 442.743

Support
1378.481 442.743
1400.000 442.500

Support
1400.000 430.750
1400.000 436.500

Support
1400.000 436.500
1358.510 436.969

Support
1358.510 436.969
1358.500 431.219

Support
1358.500 431.219
1400.000 430.750

Support
1376.969 437.011
1376.981 442.760

Support
1377.021 454.760
1377.008 449.010

Support
1338.481 443.196
1376.981 442.760

Support
1376.969 437.011
1338.469 437.446

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_nocover_tube_10_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf

Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.773320
Axis Location: 989.581, 570.232
Left Slip Surface Endpoint: 958.000, 435.516
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 958.000 441.500
Right Slope Intercept: 1078.405 464.138
Resisting Moment=3.93512e+006 lb-ft
Driving Moment=2.21906e+006 lb-ft

Method: janbu simplified
FS: 1.715770
Axis Location: 989.581, 570.232
Left Slip Surface Endpoint: 958.000, 435.516
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 958.000 441.500
Right Slope Intercept: 1078.405 464.138
Resisting Horizontal Force=30889.6 lb
Driving Horizontal Force=18003.3 lb

Method: spencer
FS: 2.703180
Axis Location: 989.861, 570.372
Left Slip Surface Endpoint: 958.000, 435.797
Right Slip Surface Endpoint: 1078.405, 464.138
Left Slope Intercept: 958.000 441.500
Right Slope Intercept: 1078.405 464.138
Resisting Moment=4.47741e+006 lb-ft
Driving Moment=1.65635e+006 lb-ft
Resisting Horizontal Force=34692.6 lb
Driving Horizontal Force=12834 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4384
Number of Invalid Surfaces: 616
Error Codes:
Error Code -108 reported for 285 surfaces
Error Code -112 reported for 331 surfaces

Method: janbu simplified
Number of Valid Surfaces: 4364
Number of Invalid Surfaces: 636
Error Codes:
Error Code -108 reported for 287 surfaces
Error Code -111 reported for 2 surfaces
Error Code -112 reported for 347 surfaces

Method: spencer
Number of Valid Surfaces: 3072
Number of Invalid Surfaces: 1928
Error Codes:
Error Code -108 reported for 1465 surfaces
Error Code -111 reported for 26 surfaces
Error Code -112 reported for 437 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_nocover_liner_i_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.615880
Axis Location: 983.826, 576.701
Left Slip Surface Endpoint: 950.523, 433.500
Right Slip Surface Endpoint: 1078.405, 464.138
Resisting Moment=4.57396e+006 lb-ft
Driving Moment=2.83064e+006 lb-ft

Method: janbu simplified
FS: 1.568780
Axis Location: 983.826, 576.701
Left Slip Surface Endpoint: 950.523, 433.500
Right Slip Surface Endpoint: 1078.405, 464.138
Resisting Horizontal Force=33517.9 lb
Driving Horizontal Force=21365.6 lb

Method: spencer
FS: 2.582370
Axis Location: 984.608, 575.137
Left Slip Surface Endpoint: 952.087, 433.500
Right Slip Surface Endpoint: 1078.405, 464.138
Resisting Moment=4.88485e+006 lb-ft
Driving Moment=1.89161e+006 lb-ft
Resisting Horizontal Force=36073.5 lb
Driving Horizontal Force=13969.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3709
Number of Invalid Surfaces: 1291
Error Codes:
Error Code -108 reported for 21 surfaces
Error Code -111 reported for 18 surfaces
Error Code -112 reported for 1252 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3658
Number of Invalid Surfaces: 1342
Error Codes:
Error Code -108 reported for 15 surfaces
Error Code -111 reported for 30 surfaces
Error Code -112 reported for 1297 surfaces

Method: spencer
Number of Valid Surfaces: 1495
Number of Invalid Surfaces: 3505
Error Codes:
Error Code -108 reported for 1070 surfaces
Error Code -111 reported for 1080 surfaces
Error Code -112 reported for 1355 surfaces

Slide Analysis Information

Document Name

File Name: northside_nocover_global_su_lab

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.625930
Center: 1004.086, 486.952
Radius: 76.891
Left Slip Surface Endpoint: 948.812, 433.500
Right Slip Surface Endpoint: 1077.518, 464.148
Resisting Moment=7.29026e+006 lb-ft
Driving Moment=4.48376e+006 lb-ft

Method: janbu simplified
FS: 1.677300
Center: 1004.086, 521.413
Radius: 108.025
Left Slip Surface Endpoint: 936.056, 437.500
Right Slip Surface Endpoint: 1095.556, 463.944
Resisting Horizontal Force=91023.7 lb
Driving Horizontal Force=54268.1 lb

Method: spencer
FS: 1.659310
Center: 1004.086, 521.413
Radius: 108.025
Left Slip Surface Endpoint: 936.056, 437.500
Right Slip Surface Endpoint: 1095.556, 463.944
Resisting Moment=1.13708e+007 lb-ft
Driving Moment=6.85275e+006 lb-ft
Resisting Horizontal Force=91045 lb
Driving Horizontal Force=54869.3 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2115
Number of Invalid Surfaces: 2725
Error Codes:
Error Code -101 reported for 2 surfaces
Error Code -102 reported for 27 surfaces
Error Code -106 reported for 250 surfaces
Error Code -107 reported for 946 surfaces
Error Code -112 reported for 417 surfaces
Error Code -113 reported for 166 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 913 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1823
Number of Invalid Surfaces: 3017
Error Codes:
Error Code -101 reported for 2 surfaces
Error Code -102 reported for 27 surfaces
Error Code -106 reported for 250 surfaces
Error Code -107 reported for 946 surfaces
Error Code -108 reported for 287 surfaces
Error Code -111 reported for 3 surfaces
Error Code -112 reported for 419 surfaces
Error Code -113 reported for 166 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 913 surfaces

Method: spencer

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Number of Valid Surfaces: 627
Number of Invalid Surfaces: 4213
Error Codes:
Error Code -101 reported for 2 surfaces
Error Code -102 reported for 27 surfaces
Error Code -106 reported for 250 surfaces
Error Code -107 reported for 946 surfaces
Error Code -108 reported for 317 surfaces
Error Code -111 reported for 1164 surfaces
Error Code -112 reported for 424 surfaces
Error Code -113 reported for 166 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 913 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_nocover_external_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 3.454470
Center: 920.639, 1281.335
Radius: 883.832
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1252.489, 462.169
Resisting Moment=3.50544e+008 lb-ft
Driving Moment=1.01475e+008 lb-ft

Method: janbu simplified
FS: 3.448700
Center: 920.639, 1281.335
Radius: 883.832
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1252.489, 462.169
Resisting Horizontal Force=389737 lb
Driving Horizontal Force=113010 lb

Method: spencer
FS: 3.454580
Center: 920.639, 1281.335
Radius: 883.832
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1252.489, 462.169
Resisting Moment=3.50554e+008 lb-ft
Driving Moment=1.01475e+008 lb-ft
Resisting Horizontal Force=389751 lb
Driving Horizontal Force=112822 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 668
Number of Invalid Surfaces: 4172
Error Codes:
Error Code -101 reported for 48 surfaces
Error Code -107 reported for 17 surfaces
Error Code -110 reported for 875 surfaces
Error Code -113 reported for 207 surfaces
Error Code -1000 reported for 3025 surfaces

Method: janbu simplified
Number of Valid Surfaces: 668
Number of Invalid Surfaces: 4172
Error Codes:
Error Code -101 reported for 48 surfaces
Error Code -107 reported for 17 surfaces
Error Code -110 reported for 875 surfaces
Error Code -113 reported for 207 surfaces
Error Code -1000 reported for 3025 surfaces

Method: spencer
Number of Valid Surfaces: 602
Number of Invalid Surfaces: 4238
Error Codes:
Error Code -101 reported for 48 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 875 surfaces
Error Code -111 reported for 65 surfaces

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

Error Code -113 reported for 207 surfaces
Error Code -1000 reported for 3025 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Cross-Section A-A: After Placement of Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_tube_07_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.673550
Axis Location: 994.617, 580.470
Left Slip Surface Endpoint: 955.538, 443.647
Right Slip Surface Endpoint: 1080.628, 467.113
Resisting Moment=5.65391e+006 lb-ft
Driving Moment=3.3784e+006 lb-ft

Method: janbu simplified
FS: 1.616810
Axis Location: 996.469, 578.457
Left Slip Surface Endpoint: 957.879, 444.337
Right Slip Surface Endpoint: 1080.610, 467.113
Resisting Horizontal Force=41178.9 lb
Driving Horizontal Force=25469.3 lb

Method: spencer
FS: 2.508240
Axis Location: 1016.759, 590.998
Left Slip Surface Endpoint: 969.101, 447.648
Right Slip Surface Endpoint: 1102.844, 466.861
Resisting Moment=6.28706e+006 lb-ft
Driving Moment=2.50656e+006 lb-ft
Resisting Horizontal Force=42923.8 lb
Driving Horizontal Force=17113.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4114
Number of Invalid Surfaces: 886
Error Codes:
Error Code -107 reported for 59 surfaces
Error Code -108 reported for 226 surfaces
Error Code -111 reported for 21 surfaces
Error Code -112 reported for 580 surfaces

Method: janbu simplified
Number of Valid Surfaces: 4036
Number of Invalid Surfaces: 964
Error Codes:
Error Code -107 reported for 59 surfaces
Error Code -108 reported for 241 surfaces
Error Code -111 reported for 49 surfaces
Error Code -112 reported for 615 surfaces

Method: spencer
Number of Valid Surfaces: 2849
Number of Invalid Surfaces: 2151

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Codes:
Error Code -107 reported for 59 surfaces
Error Code -108 reported for 1358 surfaces
Error Code -111 reported for 95 surfaces
Error Code -112 reported for 639 surfaces

List of All Coordinates

Block Search Polyline

978.000	441.278
1017.040	441.054

Material Boundary

953.000	433.500
958.000	433.500
1400.000	427.700

Material Boundary

978.000	441.524
997.000	441.309
998.500	441.292
1017.009	441.083
1018.508	441.066
1037.000	440.856
1038.500	440.839
1057.015	440.630
1058.509	440.613
1096.999	440.178
1098.506	440.161
1117.012	439.951
1118.512	439.934
1137.006	439.725
1138.505	439.708
1157.006	439.499
1158.500	439.482
1176.999	439.273
1178.492	439.256
1197.013	439.046
1198.512	439.029
1217.005	438.820
1218.499	438.803
1237.000	438.594
1238.506	438.577
1257.010	438.368
1258.509	438.351
1277.013	438.141
1278.513	438.124
1296.975	437.915
1298.469	437.899
1317.013	437.689
1318.507	437.672
1336.969	437.463
1338.469	437.446
1357.000	437.236
1358.510	437.219
1376.969	437.011
1378.475	436.993
1400.000	436.750

Material Boundary

998.000	447.048
1017.014	446.832
1018.514	446.815
1037.015	446.606
1038.521	446.589
1057.021	446.380
1058.520	446.363
1077.016	446.154
1078.515	446.137
1097.005	445.928
1098.523	445.910
1117.022	445.701
1118.509	445.684
1137.023	445.475
1138.511	445.458
1157.009	445.249
1158.509	445.232
1177.011	445.023
1178.494	445.006
1197.022	444.796
1198.509	444.779
1217.011	444.570
1218.511	444.553
1237.016	444.344
1238.509	444.327
1257.015	444.117
1258.515	444.101
1277.009	443.891
1278.515	443.874
1296.975	443.665
1298.475	443.648
1317.016	443.439
1318.515	443.422
1336.981	443.213
1338.481	443.196
1357.016	442.986

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1358.516	442.969
1376.981	442.760
1378.481	442.743
1400.000	442.500

Material Boundary

998.000	447.298
1017.014	447.082
1018.514	447.066
1037.016	446.856
1038.521	446.839
1057.021	446.630
1058.521	446.613
1077.016	446.404
1078.516	446.387
1097.005	446.178
1098.524	446.160
1117.022	445.951
1118.510	445.934
1137.024	445.725
1138.511	445.708
1157.010	445.499
1158.510	445.482
1177.011	445.273
1178.494	445.256
1197.022	445.046
1198.510	445.029
1217.011	444.820
1218.511	444.803
1237.016	444.594
1238.509	444.577
1257.016	444.368
1258.515	444.351
1277.010	444.141
1278.516	444.124
1296.975	443.915
1298.475	443.898
1317.016	443.689
1318.516	443.672
1336.981	443.463
1338.481	443.446
1357.016	443.236
1358.516	443.219
1376.981	443.010
1378.481	442.993
1400.000	442.750

Material Boundary

1018.000	452.821
1037.021	452.606
1038.521	452.589
1057.007	452.380
1058.501	452.363
1077.021	452.154
1078.527	452.137
1096.995	451.928
1098.501	451.911
1117.028	451.701
1118.527	451.684
1137.001	451.475
1138.501	451.458
1157.027	451.249
1158.521	451.232
1176.995	451.023
1178.495	451.006
1197.028	450.796
1198.521	450.779
1217.001	450.570
1218.501	450.553
1237.022	450.344
1238.515	450.327
1257.007	450.118
1258.501	450.101
1277.021	449.891
1278.521	449.874
1297.001	449.665
1298.501	449.648
1317.028	449.439
1318.521	449.422
1337.008	449.213
1338.501	449.196
1357.022	448.986
1358.521	448.969
1377.008	448.760
1378.508	448.743
1400.000	448.500

Material Boundary

1018.000	453.071
1037.022	452.856
1038.521	452.839
1057.007	452.630
1058.501	452.613
1077.022	452.404
1078.528	452.387
1096.996	452.178

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1098.501	452.161
1117.028	451.951
1118.528	451.934
1137.002	451.725
1138.501	451.708
1157.028	451.499
1158.522	451.482
1176.996	451.273
1178.496	451.256
1197.028	451.046
1198.522	451.029
1217.001	450.820
1218.501	450.803
1237.022	450.594
1238.515	450.577
1257.007	450.368
1258.501	450.351
1277.022	450.141
1278.522	450.124
1297.002	449.915
1298.502	449.898
1317.028	449.689
1318.522	449.672
1337.008	449.463
1338.502	449.446
1357.022	449.236
1358.522	449.219
1377.008	449.010
1378.508	448.993
1400.000	448.750

Material Boundary

1038.000	458.595
1057.013	458.380
1058.512	458.363
1077.005	458.154
1078.505	458.137
1097.013	457.928
1098.513	457.911
1117.011	457.701
1118.498	457.685
1137.019	457.475
1138.507	457.458
1157.005	457.249
1158.498	457.232
1177.013	457.023
1178.518	457.006
1197.005	456.796
1198.498	456.779
1217.007	456.570
1218.501	456.553
1237.005	456.344
1238.511	456.327
1257.007	456.118
1258.507	456.101
1277.005	455.891
1278.505	455.874
1297.013	455.665
1298.513	455.648
1317.005	455.439
1318.505	455.422
1337.014	455.213
1338.507	455.196
1357.006	454.986
1358.511	454.969
1377.021	454.760
1378.513	454.743
1400.000	454.500

Material Boundary

1038.000	458.845
1057.013	458.630
1058.513	458.613
1077.006	458.404
1078.505	458.387
1097.013	458.178
1098.513	458.161
1117.011	457.951
1118.499	457.934
1137.020	457.725
1138.507	457.708
1157.005	457.499
1158.499	457.482
1177.013	457.273
1178.519	457.255
1197.006	457.046
1198.499	457.029
1217.007	456.820
1218.501	456.803
1237.006	456.594
1238.511	456.577
1257.007	456.368
1258.507	456.351
1277.005	456.141
1278.505	456.124
1297.014	455.915

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1298.514	455.898
1317.005	455.689
1318.505	455.672
1337.014	455.463
1338.507	455.446
1357.006	455.236
1358.511	455.219
1377.021	455.010
1378.514	454.993
1400.000	454.750

Material Boundary

958.000	435.500
997.000	435.059
998.500	435.042
1037.000	434.606
1038.494	434.589
1077.000	434.154
1078.500	434.137
1117.000	433.701
1118.494	433.684
1156.994	433.249
1158.494	433.232
1197.006	432.796
1198.500	432.779
1236.994	432.344
1238.494	432.327
1277.007	431.891
1278.507	431.874
1317.007	431.439
1318.507	431.422
1357.000	430.986
1358.499	430.969
1400.000	430.500

Material Boundary

978.000	441.274
997.000	441.059
998.500	441.042
1017.008	440.832
1018.508	440.816
1037.000	440.606
1038.500	440.589
1057.015	440.380
1058.508	440.363
1077.006	440.154
1078.494	440.137
1096.999	439.928
1098.505	439.911
1117.012	439.701
1118.511	439.684
1137.005	439.475
1138.505	439.458
1157.006	439.249
1158.500	439.232
1176.999	439.023
1178.492	439.006
1197.012	438.796
1198.512	438.779
1217.005	438.570
1218.499	438.553
1237.000	438.344
1238.506	438.327
1257.009	438.118
1258.509	438.101
1277.013	437.891
1278.512	437.874
1296.975	437.665
1298.469	437.649
1317.013	437.439
1318.507	437.422
1336.969	437.213
1338.469	437.196
1357.000	436.986
1358.510	436.969
1376.969	436.761
1378.475	436.743
1400.000	436.500

Material Boundary

958.000	435.750
997.000	435.309
998.500	435.292
1037.000	434.856
1038.494	434.839
1077.000	434.404
1078.500	434.387
1117.001	433.951
1118.494	433.934
1156.994	433.499
1158.494	433.482
1197.007	433.046
1198.500	433.029
1236.994	432.594
1238.494	432.577
1277.007	432.141

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1278.507 432.124
1317.007 431.689
1318.507 431.672
1357.000 431.236
1358.500 431.219
1400.000 430.750

Material Boundary
895.681 432.081
953.504 431.272
1400.000 425.200

Material Boundary
661.000 436.500
748.000 412.600
789.000 386.700
835.000 386.800
980.000 376.600
1400.000 367.800

Material Boundary
942.667 435.500
947.793 433.500
953.504 431.272

Material Boundary
1357.000 430.986
1357.000 431.236
1357.000 436.986
1357.000 437.236

Material Boundary
1358.499 430.969
1358.500 431.219
1358.510 436.969
1358.510 437.219

Material Boundary
1277.007 431.891
1277.007 432.141
1277.013 437.891
1277.013 438.141

Material Boundary
1278.507 431.874
1278.507 432.124
1278.512 437.874
1278.513 438.124

Material Boundary
1317.007 431.439
1317.007 431.689
1317.013 437.439
1317.013 437.689

Material Boundary
1318.507 431.422
1318.507 431.672
1318.507 437.422
1318.507 437.672

Material Boundary
1077.000 434.154
1077.000 434.404
1077.006 440.154

Material Boundary
1078.494 440.137
1078.500 434.387
1078.500 434.137

Material Boundary
1117.000 433.701
1117.001 433.951
1117.012 439.701
1117.012 439.951

Material Boundary
1118.494 433.684
1118.494 433.934
1118.511 439.684
1118.512 439.934

Material Boundary
1156.994 433.249
1156.994 433.499
1157.006 439.249
1157.006 439.499

Material Boundary
1158.494 433.232
1158.494 433.482
1158.500 439.232
1158.500 439.482

Material Boundary

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1197.006 432.796
1197.007 433.046
1197.012 438.796
1197.013 439.046

Material Boundary
1198.500 432.779
1198.500 433.029
1198.512 438.779
1198.512 439.029

Material Boundary
1236.994 432.344
1236.994 432.594
1237.000 438.344
1237.000 438.594

Material Boundary
1238.494 432.327
1238.494 432.577
1238.506 438.327
1238.506 438.577

Material Boundary
997.000 435.059
997.000 435.309
997.000 441.059
997.000 441.309

Material Boundary
998.500 435.042
998.500 435.292
998.500 441.042
998.500 441.292

Material Boundary
1037.000 434.606
1037.000 434.856
1037.000 440.606
1037.000 440.856

Material Boundary
1038.494 434.589
1038.494 434.839
1038.500 440.589
1038.500 440.839

Material Boundary

1296.975 437.665
1296.975 437.915
1296.975 443.665
1296.975 443.915

Material Boundary
1298.469 437.649
1298.469 437.899
1298.475 443.648
1298.475 443.898

Material Boundary
1336.969 437.213
1336.969 437.463
1336.981 443.213
1336.981 443.463

Material Boundary
1338.469 437.196
1338.469 437.446
1338.481 443.196
1338.481 443.446

Material Boundary
1376.969 436.761
1376.969 437.011
1376.981 442.760
1376.981 443.010

Material Boundary
1378.475 436.743
1378.475 436.993
1378.481 442.743
1378.481 442.993

Material Boundary
1257.009 438.118
1257.010 438.368
1257.015 444.117
1257.016 444.368

Material Boundary
1258.509 438.101
1258.509 438.351
1258.515 444.101
1258.515 444.351

Material Boundary

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1096.999 439.928
1096.999 440.178
1097.005 445.928
1097.005 446.178

Material Boundary
1098.505 439.911
1098.506 440.161
1098.523 445.910
1098.524 446.160

Material Boundary
1137.005 439.475
1137.006 439.725
1137.023 445.475
1137.024 445.725

Material Boundary
1138.505 439.458
1138.505 439.708
1138.511 445.458
1138.511 445.708

Material Boundary
1176.999 439.023
1176.999 439.273
1177.011 445.023
1177.011 445.273

Material Boundary
1178.492 439.006
1178.492 439.256
1178.494 445.006
1178.494 445.256

Material Boundary
1217.005 438.570
1217.005 438.820
1217.011 444.570
1217.011 444.820

Material Boundary
1218.499 438.553
1218.499 438.803
1218.511 444.553
1218.511 444.803

Material Boundary

1017.008 440.832
1017.009 441.083
1017.014 446.832
1017.014 447.082

Material Boundary
1018.508 440.816
1018.508 441.066
1018.514 446.815
1018.514 447.066

Material Boundary
1057.015 440.380
1057.015 440.630
1057.021 446.380
1057.021 446.630

Material Boundary
1058.508 440.363
1058.509 440.613
1058.520 446.363
1058.521 446.613

Material Boundary
1037.015 446.606
1037.016 446.856
1037.021 452.606
1037.022 452.856

Material Boundary
1038.521 446.589
1038.521 446.839
1038.521 452.589
1038.521 452.839

Material Boundary
1077.016 446.154
1077.016 446.404
1077.021 452.154
1077.022 452.404

Material Boundary
1078.515 446.137
1078.516 446.387
1078.527 452.137
1078.528 452.387

Material Boundary

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1117.022 445.701
1117.022 445.951
1117.028 451.701
1117.028 451.951

Material Boundary
1118.509 445.684
1118.510 445.934
1118.527 451.684
1118.528 451.934

Material Boundary
1157.009 445.249
1157.010 445.499
1157.027 451.249
1157.028 451.499

Material Boundary
1158.509 445.232
1158.510 445.482
1158.521 451.232
1158.522 451.482

Material Boundary
1197.022 444.796
1197.022 445.046
1197.028 450.796
1197.028 451.046

Material Boundary
1198.509 444.779
1198.510 445.029
1198.521 450.779
1198.522 451.029

Material Boundary
1237.016 444.344
1237.016 444.594
1237.022 450.344
1237.022 450.594

Material Boundary
1238.509 444.327
1238.509 444.577
1238.515 450.327
1238.515 450.577

Material Boundary

1277.009 443.891
1277.010 444.141
1277.021 449.891
1277.022 450.141

Material Boundary
1278.515 443.874
1278.516 444.124
1278.521 449.874
1278.522 450.124

Material Boundary
1317.016 443.439
1317.016 443.689
1317.028 449.439
1317.028 449.689

Material Boundary
1318.515 443.422
1318.516 443.672
1318.521 449.422
1318.522 449.672

Material Boundary
1357.016 442.986
1357.016 443.236
1357.022 448.986
1357.022 449.236

Material Boundary
1358.516 442.969
1358.516 443.219
1358.521 448.969
1358.522 449.219

Material Boundary
1057.007 452.380
1057.007 452.630
1057.013 458.380
1057.013 458.630

Material Boundary
1058.501 452.363
1058.501 452.613
1058.512 458.363
1058.513 458.613

Material Boundary

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1098.501	451.911
1098.501	452.161
1098.513	457.911
1098.513	458.161

Material Boundary

1096.995	451.928
1096.996	452.178
1097.013	457.928
1097.013	458.178

Material Boundary

1137.001	451.475
1137.002	451.725
1137.019	457.475
1137.020	457.725

Material Boundary

1138.501	451.458
1138.501	451.708
1138.507	457.458
1138.507	457.708

Material Boundary

1176.995	451.023
1176.996	451.273
1177.013	457.023
1177.013	457.273

Material Boundary

1178.495	451.006
1178.496	451.256
1178.518	457.006
1178.519	457.255

Material Boundary

1217.001	450.570
1217.001	450.820
1217.007	456.570
1217.007	456.820

Material Boundary

1218.501	450.553
1218.501	450.803
1218.501	456.553
1218.501	456.803

Material Boundary

1257.007	450.118
1257.007	450.368
1257.007	456.118
1257.007	456.368

Material Boundary

1258.501	450.101
1258.501	450.351
1258.507	456.101
1258.507	456.351

Material Boundary

1297.001	449.665
1297.002	449.915
1297.013	455.665
1297.014	455.915

Material Boundary

1298.501	449.648
1298.502	449.898
1298.513	455.648
1298.514	455.898

Material Boundary

1337.008	449.213
1337.008	449.463
1337.014	455.213
1337.014	455.463

Material Boundary

1338.501	449.196
1338.502	449.446
1338.507	455.196
1338.507	455.446

Material Boundary

1377.008	448.760
1377.008	449.010
1377.021	454.760
1377.021	455.010

Material Boundary

1378.508	448.743
1378.508	448.993
1378.513	454.743
1378.514	454.993

Material Boundary

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1077.005	458.154
1077.006	458.404
1077.017	464.154

Material Boundary

1078.505	458.137
1078.505	458.387
1078.517	464.137

Material Boundary

1117.011	457.701
1117.011	457.951
1117.011	463.701

Material Boundary

1118.498	457.685
1118.499	457.934
1118.511	463.684

Material Boundary

1157.005	457.249
1157.005	457.499
1157.011	463.249

Material Boundary

1158.498	457.232
1158.499	457.482
1158.511	463.232

Material Boundary

1197.005	456.796
1197.006	457.046
1197.017	462.796

Material Boundary

1198.498	456.779
1198.499	457.029
1198.517	462.779

Material Boundary

1237.005	456.344
1237.006	456.594
1237.024	462.344

Material Boundary

1238.511	456.327
1238.511	456.577
1238.517	462.327

Material Boundary

1277.005	455.891
1277.005	456.141
1277.011	461.891

Material Boundary

1278.505	455.874
1278.505	456.124
1278.505	461.874

Material Boundary

1317.005	455.439
1317.005	455.689
1317.011	461.439

Material Boundary

1318.505	455.422
1318.505	455.672
1318.517	461.422

Material Boundary

1357.006	454.986
1357.006	455.236
1357.017	460.986

Material Boundary

1358.511	454.969
1358.511	455.219
1358.511	460.969

Material Boundary

937.818	437.500
940.000	436.600
942.667	435.500

Material Boundary

934.712	437.500
937.818	437.500
938.818	437.500
941.000	436.600
943.667	435.500
948.793	433.500
953.000	433.500
955.504	434.501
958.000	435.500
958.000	435.750
958.000	441.500

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

978.000	441.274
978.000	441.524
978.000	447.274
998.000	447.048
998.000	447.298
998.000	453.048
1018.000	452.821
1018.000	453.071
1018.000	458.821
1038.000	458.595
1038.000	458.845
1038.000	464.595
1077.017	464.154
1078.517	464.137
1117.011	463.701
1118.511	463.684
1157.011	463.249
1158.511	463.232
1197.017	462.796
1198.517	462.779
1237.024	462.344
1238.517	462.327
1277.011	461.891
1278.505	461.874
1317.011	461.439
1318.517	461.422
1357.017	460.986
1358.511	460.969
1400.000	460.500

External Boundary

934.712	437.500
921.920	437.500
909.818	437.500
899.186	433.425
895.681	432.081
661.000	436.500
638.000	432.900
555.000	396.200
483.000	398.300
461.000	390.500
307.000	386.700
277.000	373.000
1.726	374.590
1.726	167.800
1400.000	167.800
1400.000	367.800
1400.000	425.200
1400.000	427.700
1400.000	430.500
1400.000	430.750
1400.000	436.500
1400.000	436.750
1400.000	442.500
1400.000	442.750
1400.000	448.500
1400.000	448.750
1400.000	454.500
1400.000	454.750
1400.000	460.500
1400.000	463.500
1038.000	467.595
1018.000	461.821
998.000	456.048
978.000	450.274
958.430	444.500

Piezo Line

955.504	434.501
958.000	434.500
1400.000	428.700

Water Table

715.262	421.594
900.000	417.000
935.504	416.272
1400.000	410.200

Focus/Block Search Point

1017.040 441.054

Focus/Block Search Point

1018.472 446.848

Focus/Block Search Point

1037.037 446.830

Focus/Block Search Point

1038.507 452.594

Focus/Block Search Point

1057.020 452.618

Focus/Block Search Point

1058.459 458.411

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Focus/Block Search Point
1077.037 458.372

Focus/Block Search Point
1078.405 464.138

Support
1358.511 460.969
1400.000 460.500

Support
1400.000 454.750
1400.000 460.500

Support
1400.000 454.750
1358.511 455.219

Support
1358.511 455.219
1358.511 460.969

Support
1378.513 454.743
1378.508 448.993

Support
1378.508 448.993
1400.000 448.750

Support
1400.000 448.750
1400.000 454.500

Support
1400.000 454.500
1378.513 454.743

Support
1400.000 448.500
1400.000 442.750

Support
1400.000 442.750
1358.516 443.219

Support
1358.516 443.219
1358.521 448.969

Support
1358.521 448.969
1400.000 448.500

Support
1400.000 442.500
1400.000 436.750

Support
1400.000 436.750
1378.475 436.993

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_liner_i_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.661010
Axis Location: 979.417, 595.121
Left Slip Surface Endpoint: 937.107, 438.207
Right Slip Surface Endpoint: 1079.562, 467.125
Resisting Moment=9.57242e+006 lb-ft
Driving Moment=5.76303e+006 lb-ft

Method: janbu simplified
FS: 1.590890
Axis Location: 979.417, 595.121
Left Slip Surface Endpoint: 937.107, 438.207
Right Slip Surface Endpoint: 1079.562, 467.125
Resisting Horizontal Force=60808.1 lb
Driving Horizontal Force=38222.6 lb

Method: spencer
FS: 2.775020
Axis Location: 971.117, 609.951
Left Slip Surface Endpoint: 921.922, 437.500
Right Slip Surface Endpoint: 1079.561, 467.125
Resisting Moment=1.14748e+007 lb-ft
Driving Moment=4.13504e+006 lb-ft
Resisting Horizontal Force=66582.4 lb
Driving Horizontal Force=23993.5 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3201
Number of Invalid Surfaces: 1799
Error Codes:
Error Code -108 reported for 3 surfaces
Error Code -110 reported for 467 surfaces
Error Code -111 reported for 39 surfaces
Error Code -112 reported for 1290 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3137
Number of Invalid Surfaces: 1863
Error Codes:
Error Code -108 reported for 3 surfaces
Error Code -110 reported for 467 surfaces
Error Code -111 reported for 66 surfaces
Error Code -112 reported for 1327 surfaces

Method: spencer
Number of Valid Surfaces: 2041
Number of Invalid Surfaces: 2959

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Codes:
Error Code -108 reported for 443 surfaces
Error Code -110 reported for 467 surfaces
Error Code -111 reported for 408 surfaces
Error Code -112 reported for 1641 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_global_su_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.452590
Center: 968.333, 521.413
Radius: 115.992
Left Slip Surface Endpoint: 894.314, 432.107
Right Slip Surface Endpoint: 1070.888, 467.223
Resisting Moment=1.51229e+007 lb-ft
Driving Moment=1.0411e+007 lb-ft

Method: janbu simplified
FS: 1.378860
Center: 968.333, 521.413
Radius: 122.851
Left Slip Surface Endpoint: 883.761, 432.306
Right Slip Surface Endpoint: 1078.544, 467.136
Resisting Horizontal Force=133358 lb
Driving Horizontal Force=96715.9 lb

Method: spencer
FS: 1.447420
Center: 968.333, 521.413
Radius: 115.992
Left Slip Surface Endpoint: 894.314, 432.107
Right Slip Surface Endpoint: 1070.888, 467.223
Resisting Moment=1.50691e+007 lb-ft
Driving Moment=1.0411e+007 lb-ft
Resisting Horizontal Force=111172 lb
Driving Horizontal Force=76807 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2232
Number of Invalid Surfaces: 2608
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -110 reported for 8 surfaces
Error Code -112 reported for 409 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

Method: janbu simplified
Number of Valid Surfaces: 2153
Number of Invalid Surfaces: 2687
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -108 reported for 75 surfaces
Error Code -110 reported for 8 surfaces

Error Code -111 reported for 9 surfaces
Error Code -112 reported for 404 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

<u>Method: spencer</u>
Number of Valid Surfaces: 1214
Number of Invalid Surfaces: 3626
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -108 reported for 103 surfaces
Error Code -110 reported for 8 surfaces
Error Code -111 reported for 906 surfaces
Error Code -112 reported for 418 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_longterm_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (Drained)
Strength Type: Mohr-Coulomb
Unit Weight: 82 lb/ft3
Cohesion: 0 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material (Long)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube (Long Term)
Geotube (Long Term)
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 0.1 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.826860
Center: 878.950, 504.182
Radius: 73.340
Left Slip Surface Endpoint: 903.345, 435.019
Right Slip Surface Endpoint: 907.036, 436.434
Resisting Moment=403.398 lb-ft
Driving Moment=220.815 lb-ft

Method: janbu simplified
FS: 1.826960
Center: 878.950, 504.182
Radius: 73.340
Left Slip Surface Endpoint: 903.345, 435.019
Right Slip Surface Endpoint: 907.036, 436.434
Resisting Horizontal Force=5.13684 lb
Driving Horizontal Force=2.81169 lb

Method: spencer
FS: 1.827030
Center: 878.950, 504.182
Radius: 73.340
Left Slip Surface Endpoint: 903.345, 435.019
Right Slip Surface Endpoint: 907.036, 436.434
Resisting Moment=403.436 lb-ft
Driving Moment=220.815 lb-ft
Resisting Horizontal Force=5.13679 lb
Driving Horizontal Force=2.81155 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2202
Number of Invalid Surfaces: 2638
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -110 reported for 8 surfaces
Error Code -112 reported for 439 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

Method: janbu simplified
Number of Valid Surfaces: 2209
Number of Invalid Surfaces: 2631
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -108 reported for 4 surfaces
Error Code -110 reported for 8 surfaces
Error Code -111 reported for 2 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -112 reported for 426 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

Method: spencer
Number of Valid Surfaces: 2190
Number of Invalid Surfaces: 2650
Error Codes:
Error Code -102 reported for 22 surfaces
Error Code -106 reported for 75 surfaces
Error Code -107 reported for 973 surfaces
Error Code -108 reported for 6 surfaces
Error Code -110 reported for 8 surfaces
Error Code -111 reported for 3 surfaces
Error Code -112 reported for 442 surfaces
Error Code -113 reported for 183 surfaces
Error Code -116 reported for 14 surfaces
Error Code -1000 reported for 924 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_external_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 2.836910
Center: 900.517, 1215.482
Radius: 814.973
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1219.532, 465.541
Resisting Moment=2.96961e+008 lb-ft
Driving Moment=1.04678e+008 lb-ft

Method: janbu simplified
FS: 2.825190
Center: 900.517, 1215.482
Radius: 814.973
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1219.532, 465.541
Resisting Horizontal Force=357282 lb
Driving Horizontal Force=126463 lb

Method: spencer
FS: 2.836810
Center: 900.517, 1215.482
Radius: 814.973
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1219.532, 465.541
Resisting Moment=2.96952e+008 lb-ft
Driving Moment=1.04678e+008 lb-ft
Resisting Horizontal Force=357290 lb
Driving Horizontal Force=125948 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4101
Number of Invalid Surfaces: 14390
Error Codes:
Error Code -101 reported for 229 surfaces
Error Code -107 reported for 114 surfaces
Error Code -110 reported for 5896 surfaces
Error Code -113 reported for 51 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 8096 surfaces

Method: janbu simplified
Number of Valid Surfaces: 4101
Number of Invalid Surfaces: 14390
Error Codes:
Error Code -101 reported for 229 surfaces
Error Code -107 reported for 114 surfaces
Error Code -110 reported for 5896 surfaces
Error Code -113 reported for 51 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 8096 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Method: spencer
Number of Valid Surfaces: 3925
Number of Invalid Surfaces: 14566
Error Codes:
Error Code -101 reported for 229 surfaces
Error Code -107 reported for 114 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 5896 surfaces
Error Code -111 reported for 175 surfaces
Error Code -113 reported for 51 surfaces
Error Code -116 reported for 4 surfaces
Error Code -1000 reported for 8096 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: northside_cover_external_longterm_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (Drained)
Strength Type: Mohr-Coulomb
Unit Weight: 82 lb/ft3
Cohesion: 0 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material (Long)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube (Long Term)
Geotube (Long Term)
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 0.1 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 5.637060
Center: 867.880, 925.386
Radius: 530.856
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1134.774, 466.500
Resisting Moment=3.56667e+008 lb-ft
Driving Moment=6.32717e+007 lb-ft

Method: janbu simplified
FS: 5.443350
Center: 867.880, 892.619
Radius: 500.843
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1131.132, 466.541
Resisting Horizontal Force=663124 lb
Driving Horizontal Force=121823 lb

Method: spencer
FS: 5.646630
Center: 867.880, 925.386
Radius: 530.856
Left Slip Surface Endpoint: 661.000, 436.500
Right Slip Surface Endpoint: 1134.774, 466.500
Resisting Moment=3.57272e+008 lb-ft
Driving Moment=6.32717e+007 lb-ft
Resisting Horizontal Force=650912 lb
Driving Horizontal Force=115274 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 634
Number of Invalid Surfaces: 4206
Error Codes:
Error Code -101 reported for 9 surfaces
Error Code -103 reported for 1 surface
Error Code -107 reported for 137 surfaces
Error Code -110 reported for 734 surfaces
Error Code -112 reported for 47 surfaces
Error Code -1000 reported for 3278 surfaces

Method: janbu simplified
Number of Valid Surfaces: 635
Number of Invalid Surfaces: 4205
Error Codes:
Error Code -101 reported for 9 surfaces
Error Code -103 reported for 1 surface
Error Code -107 reported for 137 surfaces
Error Code -110 reported for 734 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -112 reported for 46 surfaces
Error Code -1000 reported for 3278 surfaces

Method: spencer
Number of Valid Surfaces: 622
Number of Invalid Surfaces: 4218
Error Codes:
Error Code -101 reported for 9 surfaces
Error Code -103 reported for 1 surface
Error Code -107 reported for 137 surfaces
Error Code -108 reported for 12 surfaces
Error Code -110 reported for 734 surfaces
Error Code -112 reported for 47 surfaces
Error Code -1000 reported for 3278 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Cross-Section B-B: Before Placement of Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

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Slide Analysis Information

Document Name

File Name: eastwest_nocover_tube_04_lab

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

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Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 6.159960
Axis Location: 330.455, 740.615
Left Slip Surface Endpoint: 208.000, 436.197
Right Slip Surface Endpoint: 500.516, 460.000
Left Slope Intercept: 208.000 442.000
Right Slope Intercept: 500.516 460.000
Resisting Moment=4.34696e+007 lb-ft
Driving Moment=7.0568e+006 lb-ft

Method: janbu simplified
FS: 6.595000
Axis Location: 343.773, 767.305
Left Slip Surface Endpoint: 208.000, 436.161
Right Slip Surface Endpoint: 527.224, 460.000
Left Slope Intercept: 208.000 442.000
Right Slope Intercept: 527.224 460.000
Resisting Horizontal Force=148715 lb
Driving Horizontal Force=22549.7 lb

Method: spencer
Resisting Moment=0 lb-ft
Driving Moment=0 lb-ft
Resisting Horizontal Force=0 lb
Driving Horizontal Force=0 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1528
Number of Invalid Surfaces: 3472
Error Codes:
Error Code -107 reported for 1664 surfaces
Error Code -108 reported for 1772 surfaces
Error Code -112 reported for 36 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1256
Number of Invalid Surfaces: 3744
Error Codes:
Error Code -107 reported for 1664 surfaces
Error Code -108 reported for 2054 surfaces
Error Code -112 reported for 26 surfaces

Method: spencer
Number of Valid Surfaces: 0
Number of Invalid Surfaces: 5000
Error Codes:
Error Code -107 reported for 1664 surfaces
Error Code -108 reported for 2299 surfaces
Error Code -111 reported for 1001 surfaces
Error Code -112 reported for 36 surfaces

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List of All Coordinates

Block Search Polyline

208.000	436.003
466.201	436.248

Material Boundary

0.000	427.500
122.000	424.650
122.359	424.645
177.171	423.910
204.000	423.550
267.961	422.659
405.000	420.750
472.000	422.050
768.000	422.250
805.000	423.150
925.000	423.250
1165.000	428.350
1347.000	425.150
1436.000	426.150
1642.000	424.450
1786.163	426.261
1841.000	426.950
1841.123	426.953

Material Boundary

122.000	424.500
122.359	424.645

Material Boundary

180.062	426.825
347.000	423.600
600.000	423.600
640.000	424.000
728.000	424.000
1102.000	431.000
1176.000	431.000
1356.000	428.000
1474.000	427.500
1619.000	426.500
1689.000	426.500
1785.758	427.937

Material Boundary

1827.000	432.300
1841.123	426.953

Material Boundary

188.000	430.000
824.000	430.000
1161.000	433.000
1236.000	432.000
1400.000	431.000
1778.100	431.000

Material Boundary

188.000	430.250
506.200	430.250
507.700	430.250
824.000	430.250
824.200	430.252
825.700	430.265
1142.148	433.082
1143.812	433.097
1161.000	433.250
1236.000	432.250
1400.000	431.250
1460.199	431.250
1461.784	431.250
1778.100	431.250

Material Boundary

208.000	436.000
506.200	436.000
507.700	436.000
824.000	436.000
824.200	436.002
825.700	436.015
1142.148	438.832
1143.812	438.847
1161.000	439.000
1236.000	438.000
1400.000	437.000
1460.199	437.000
1461.784	437.000
1758.000	437.000

Material Boundary

208.000	436.250
466.200	436.250
467.700	436.250
724.201	436.250
725.697	436.250
824.000	436.250
982.197	437.658

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983.718	437.672
1161.000	439.250
1236.000	438.250
1240.193	438.224
1241.724	438.215
1400.000	437.250
1498.182	437.250
1499.766	437.250
1758.000	437.250

Material Boundary

228.000	442.000
466.200	442.000
467.700	442.000
724.201	442.000
725.697	442.000
824.000	442.000
982.197	443.408
983.718	443.422
1161.000	445.000
1236.000	444.000
1240.193	443.974
1241.724	443.965
1400.000	443.000
1498.182	443.000
1499.766	443.000
1738.000	443.000

Material Boundary

228.000	442.250
530.200	442.250
531.700	442.250
824.000	442.250
832.191	442.323
833.715	442.336
1134.188	445.011
1135.719	445.025
1161.000	445.250
1236.000	444.250
1400.000	443.250
1436.205	443.250
1437.780	443.250
1738.000	443.250

Material Boundary

248.000	448.000
530.200	448.000
531.700	448.000
824.000	448.000
832.191	448.073
833.715	448.086
1134.188	450.761
1135.719	450.775
1161.000	451.000
1236.000	450.000
1400.000	449.000
1436.205	449.000
1437.780	449.000
1718.000	449.000

Material Boundary

248.000	448.250
493.200	448.250
494.700	448.250
738.195	448.250
739.701	448.250
824.000	448.250
983.182	449.667
984.724	449.681
1161.000	451.250
1228.192	450.354
1229.723	450.334
1236.000	450.250
1400.000	449.250
1473.204	449.250
1474.788	449.250
1718.000	449.250

Material Boundary

268.000	454.000
493.200	454.000
494.700	454.000
738.195	454.000
739.701	454.000
824.000	454.000
983.182	455.417
984.724	455.431
1161.000	457.000
1228.192	456.104
1229.723	456.084
1236.000	456.000
1400.000	455.000
1473.204	455.000
1474.788	455.000
1698.000	455.000

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Material Boundary

268.000	454.250
554.200	454.250
555.700	454.250
824.000	454.250
840.193	454.394
841.706	454.408
1126.178	456.940
1127.707	456.954
1161.000	457.250
1236.000	456.250
1400.000	455.250
1412.195	455.250
1413.743	455.250
1698.000	455.250

Material Boundary

506.200	430.250
506.200	436.000

Material Boundary

507.700	430.250
507.700	436.000

Material Boundary

466.200	436.250
466.200	442.000

Material Boundary

467.700	436.250
467.700	442.000

Material Boundary

530.200	442.250
530.200	448.000

Material Boundary

531.700	442.250
531.700	448.000

Material Boundary

493.200	448.250
493.200	454.000

Material Boundary

494.700	448.250
494.700	454.000

Material Boundary

554.200	454.250
554.200	460.000

Material Boundary

555.700	454.250
555.700	460.000

Material Boundary

824.200	430.252
824.200	436.002

Material Boundary

825.700	430.265
825.700	436.015

Material Boundary

724.201	436.250
724.201	442.000

Material Boundary

725.697	436.250
725.697	442.000

Material Boundary

738.195	448.250
738.195	454.000

Material Boundary

739.701	448.250
739.701	454.000

Material Boundary

840.193	454.394
840.193	460.144

Material Boundary

841.706	454.408
841.706	460.158

Material Boundary

832.191	442.323
832.191	448.073

Material Boundary

833.715	442.336
833.715	448.086

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Client: **Honeywell** Project: **Onondaga Lake SCA Final Design** Project/ Proposal No.: **GJ4299** Task No.: **18**

Material Boundary
982.197 437.658
982.197 443.408

Material Boundary
983.182 449.667
983.182 455.417

Material Boundary
983.718 437.672
983.718 443.422

Material Boundary
984.724 449.681
984.724 455.431

Material Boundary
1134.188 445.011
1134.188 450.761

Material Boundary
1135.719 445.025
1135.719 450.775

Material Boundary
1436.205 443.250
1436.205 449.000

Material Boundary
1437.780 443.250
1437.780 449.000

Material Boundary
1126.178 456.940
1126.178 462.690

Material Boundary
1127.707 456.954
1127.707 462.704

Material Boundary
1142.148 433.082
1142.148 438.832

Material Boundary
1143.812 433.097
1143.812 438.847

Material Boundary
1228.192 450.354
1228.192 456.104

Material Boundary
1229.723 450.334
1229.723 456.084

Material Boundary
1240.193 438.224
1240.193 443.974

Material Boundary
1241.724 438.215
1241.724 443.965

Material Boundary
1412.195 455.250
1412.195 461.000

Material Boundary
1413.743 455.250
1413.743 461.000

Material Boundary
1460.199 431.250
1460.199 437.000

Material Boundary
1461.784 431.250
1461.784 437.000

Material Boundary
1498.182 437.250
1498.182 443.000

Material Boundary
1499.766 437.250
1499.766 443.000

Material Boundary
1473.204 449.250
1473.204 455.000

Material Boundary
1474.788 449.250
1474.788 455.000

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Material Boundary

165.176	430.000
177.171	423.910

Material Boundary

0.000	387.500
268.000	387.845
1979.000	390.050

Material Boundary

1786.163	426.261
1799.372	431.000

Material Boundary

164.400	430.400
165.176	430.000

Material Boundary

1799.372	431.000
1803.000	432.300

Material Boundary

164.400	430.400
165.257	430.401

Material Boundary

267.961	422.659
268.000	387.845

Material Boundary

157.414	434.000
162.619	431.318
164.400	430.400

External Boundary

107.318	424.996
0.000	427.500
0.000	387.500
0.000	347.500
1979.000	350.000
1979.000	390.050
1979.000	430.050
1841.123	426.953
1841.000	427.000
1827.000	432.300
1803.000	432.300
1801.461	432.301
1798.000	431.000
1792.668	429.000
1790.000	428.000
1785.758	427.937
1785.600	428.000
1783.100	429.000
1780.600	430.000
1778.100	431.000
1778.100	431.250
1778.100	437.000
1758.000	437.000
1758.000	437.250
1758.000	443.000
1738.000	443.000
1738.000	443.250
1738.000	449.000
1718.000	449.000
1718.000	449.250
1718.000	455.000
1698.000	455.000
1698.000	455.250
1698.000	461.000
1413.743	461.000
1412.195	461.000
1400.000	461.000
1236.000	462.000
1161.000	463.000
1127.707	462.704
1126.178	462.690
841.706	460.158
840.193	460.144
824.000	460.000
555.700	460.000
554.200	460.000
268.000	460.000
268.000	454.250
268.000	454.000
248.000	454.000
248.000	448.250
248.000	448.000
228.000	448.000
228.000	442.250
228.000	442.000
208.000	442.000
208.000	436.250
208.000	436.000
188.000	436.000
188.000	430.250
188.000	430.000

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185.500	429.000
183.000	428.000
182.450	427.779
180.500	427.000
180.062	426.825
173.133	426.959
166.176	430.000
165.257	430.401
164.289	430.900
163.062	431.533
162.619	431.761
158.274	434.000
157.414	434.000
142.619	434.000
129.614	434.000

Piezo Line

182.450	427.779
347.000	424.600
600.000	424.600
640.000	425.000
728.000	425.000
1102.000	432.000
1176.000	432.000
1356.000	429.000
1474.000	428.500
1619.000	427.500
1689.000	427.500
1790.000	429.000
1792.668	429.000

Water Table

0.000	412.500
204.000	408.550
405.000	405.750
472.000	407.050
557.156	407.108
768.000	407.250
805.000	408.150
925.000	408.250
1165.000	413.350
1347.000	410.150
1436.000	411.150
1642.000	409.450
1768.160	411.260
1841.123	411.953
1979.000	415.050

Focus/Block Search Point

467.696	442.004

Focus/Block Search Point

466.201	436.248

Support

554.200	454.250
554.200	460.000

Support

554.200	460.000
268.000	460.000

Support

268.000	454.000
248.000	454.000

Support

248.000	454.000
248.000	448.250

Support

248.000	448.250
493.200	448.250

Support

493.200	454.000
493.200	448.250

Support

268.000	460.000
268.000	454.250

Support

268.000	454.250
554.200	454.250

Support

555.700	454.250
555.700	460.000

Support

555.700	460.000
824.000	460.000

Support

824.000	460.000

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840.193 460.144

Support
840.193 460.144
840.193 454.394

Support
840.193 454.394
824.000 454.250

Support
824.000 454.250
555.700 454.250

Support
738.195 454.000
738.195 448.250

Support
739.701 454.000
739.701 448.250

Support
738.195 454.000
494.700 454.000

Support
494.700 454.000
494.700 448.250

Support
494.700 448.250
738.195 448.250

Support
724.201 442.000
724.201 436.250

Support
724.201 436.250
467.700 436.250

Support
467.700 436.250
467.700 442.000

Support
467.700 442.000

724.201 442.000

Support
228.000 448.000
228.000 442.250

Support
248.000 448.000
530.200 448.000

Support
530.200 448.000
530.200 442.250

Support
531.700 442.250
531.700 448.000

Support
530.200 442.250
228.000 442.250

Support
228.000 448.000
248.000 448.000

Support
208.000 436.250
208.000 442.000

Support
208.000 442.000
228.000 442.000

Support
228.000 442.000
466.200 442.000

Support
466.200 442.000
466.200 436.250

Support
466.200 436.250
208.000 436.250

Support
188.000 430.250

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188.000 436.000

Support
188.000 436.000
208.000 436.000

Support
208.000 436.000
506.200 436.000

Support
507.700 436.000
507.700 430.250

Support
506.200 436.000
506.200 430.250

Support
506.200 430.250
188.000 430.250

Support
507.700 430.250
824.200 430.252

Support
824.200 430.252
824.200 436.002

Support
824.200 436.002
507.700 436.000

Support
832.191 442.323
832.191 448.073

Support
833.715 442.336
833.715 448.086

Support
832.191 448.073
824.000 448.000

Support
824.000 448.000

531.700 448.000

Support
531.700 442.250
824.000 442.250

Support
824.000 442.250
832.191 442.323

Support
841.706 460.158
841.706 454.408

Support
825.700 436.015
825.700 430.265

Support
725.697 442.000
725.697 436.250

Support
725.697 436.250
824.000 436.250

Support
824.000 436.250
982.197 437.658

Support
982.197 437.658
982.197 443.408

Support
982.197 443.408
824.000 442.000

Support
824.000 442.000
725.697 442.000

Support
739.701 448.250
824.000 448.250

Support
824.000 448.250

983.182 449.667

Support
983.182 449.667
983.182 455.417

Support
983.182 455.417
824.000 454.000

Support
824.000 454.000
739.701 454.000

Support
841.706 454.408
1126.178 456.940

Support
1126.178 456.940
1126.178 462.690

Support
1126.178 462.690
841.706 460.158

Support
833.715 448.086
1134.188 450.761

Support
1134.188 450.761
1134.188 445.011

Support
1134.188 445.011
833.715 442.336

Support
825.700 436.015
1142.148 438.832

Support
1142.148 438.832
1142.148 433.082

Support
1142.148 433.082

825.700 430.265

Support
984.724 455.431
984.724 449.681

Support
983.718 443.422
983.718 437.672

Support
983.718 437.672
1161.000 439.250

Support
1161.000 439.250
1236.000 438.250

Support
1236.000 438.250
1240.193 438.224

Support
1240.193 438.224
1240.193 443.974

Support
1240.193 443.974
1236.000 444.000

Support
1236.000 444.000
1161.000 445.000

Support
1161.000 445.000
983.718 443.422

Support
984.724 455.431
1161.000 457.000

Support
1161.000 457.000
1228.192 456.104

Support
1228.192 456.104

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1228.192 450.354

Support
1228.192 450.354
1161.000 451.250

Support
1161.000 451.250
984.724 449.681

Support
268.000 454.000
493.200 454.000

Support
1127.707 462.704
1127.707 456.954

Support
1127.707 462.704
1161.000 463.000

Support
1161.000 463.000
1236.000 462.000

Support
1236.000 462.000
1400.000 461.000

Support
1400.000 461.000
1412.195 461.000

Support
1412.195 461.000
1412.195 455.250

Support
1412.195 455.250
1400.000 455.250

Support
1400.000 455.250
1236.000 456.250

Support
1236.000 456.250

1161.000 457.250

Support
1161.000 457.250
1127.707 456.954

Support
1135.719 450.775
1135.719 445.025

Support
1135.719 450.775
1161.000 451.000

Support
1161.000 445.250
1135.719 445.025

Support
1161.000 445.250
1236.000 444.250

Support
1236.000 444.250
1400.000 443.250

Support
1400.000 443.250
1436.205 443.250

Support
1436.205 443.250
1436.205 449.000

Support
1437.780 449.000
1437.780 443.250

Support
1436.205 449.000
1400.000 449.000

Support
1400.000 449.000
1236.000 450.000

Support
1236.000 450.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1161.000 451.000

Support
1229.723 456.084
1229.723 450.334

Support
1229.723 450.334
1236.000 450.250

Support
1236.000 456.000
1229.723 456.084

Support
1236.000 456.000
1400.000 455.000

Support
1400.000 455.000
1473.204 455.000

Support
1473.204 455.000
1473.204 449.250

Support
1474.788 449.250
1474.788 455.000

Support
1473.204 449.250
1400.000 449.250

Support
1400.000 449.250
1236.000 450.250

Support
1241.724 438.215
1241.724 443.965

Support
1143.812 438.847
1143.812 433.097

Support
1143.812 433.097

1161.000 433.250

Support
1161.000 439.000
1143.812 438.847

Support
1161.000 439.000
1236.000 438.000

Support
1236.000 438.000
1400.000 437.000

Support
1400.000 437.000
1460.199 437.000

Support
1460.199 437.000
1460.199 431.250

Support
1461.784 431.250
1461.784 437.000

Support
1460.199 431.250
1400.000 431.250

Support
1400.000 431.250
1236.000 432.250

Support
1236.000 432.250
1161.000 433.250

Support
1241.724 438.215
1400.000 437.250

Support
1400.000 437.250
1498.182 437.250

Support
1498.182 443.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1498.182 437.250

Support
1499.766 437.250
1499.766 443.000

Support
1498.182 443.000
1400.000 443.000

Support
1400.000 443.000
1241.724 443.965

Support
1413.743 461.000
1413.743 455.250

Support
1413.743 461.000
1698.000 461.000

Support
1698.000 461.000
1698.000 455.250

Support
1698.000 455.250
1413.743 455.250

Support
1474.788 449.250
1718.000 449.250

Support
1718.000 449.250
1718.000 455.000

Support
1698.000 455.000
1474.788 455.000

Support
1461.784 431.250
1778.100 431.250

Support
1778.100 431.250

1778.100 437.000

Support
1758.000 437.000
1461.784 437.000

Support
1437.780 443.250
1738.000 443.250

Support
1738.000 443.250
1738.000 449.000

Support
1718.000 449.000
1437.780 449.000

Support
1499.766 437.250
1758.000 437.250

Support
1758.000 437.250
1758.000 443.000

Support
1738.000 443.000
1499.766 443.000

Support
1718.000 455.000
1698.000 455.000

Support
1718.000 449.000
1738.000 449.000

Support
1738.000 443.000
1758.000 443.000

Support
1758.000 437.000
1778.100 437.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name

File Name: eastwest_nocover_tube_05_lab

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 9.403780
Axis Location: 339.979, 808.592
Left Slip Surface Endpoint: 188.000, 430.244
Right Slip Surface Endpoint: 551.470, 460.000
Left Slope Intercept: 188.000 436.000
Right Slope Intercept: 551.470 460.000
Resisting Moment=1.30382e+008 lb-ft
Driving Moment=1.38649e+007 lb-ft

Method: janbu simplified
FS: 9.809610
Axis Location: 357.745, 844.189
Left Slip Surface Endpoint: 188.000, 430.200
Right Slip Surface Endpoint: 587.089, 460.000
Left Slope Intercept: 188.000 436.000
Right Slope Intercept: 587.089 460.000
Resisting Horizontal Force=353073 lb
Driving Horizontal Force=35992.6 lb

Method: spencer
Resisting Moment=0 lb-ft
Driving Moment=0 lb-ft
Resisting Horizontal Force=0 lb
Driving Horizontal Force=0 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1648
Number of Invalid Surfaces: 3352
Error Codes:
Error Code -107 reported for 1640 surfaces
Error Code -108 reported for 1654 surfaces
Error Code -112 reported for 58 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1420
Number of Invalid Surfaces: 3580
Error Codes:
Error Code -107 reported for 1640 surfaces
Error Code -108 reported for 1906 surfaces
Error Code -112 reported for 34 surfaces

Method: spencer
Number of Valid Surfaces: 0
Number of Invalid Surfaces: 5000
Error Codes:
Error Code -107 reported for 1640 surfaces
Error Code -108 reported for 2152 surfaces
Error Code -111 reported for 1149 surfaces
Error Code -112 reported for 59 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name

File Name: eastwest_nocover_liner_lab

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.808920
Axis Location: 200.120, 584.614
Left Slip Surface Endpoint: 159.018, 431.727
Right Slip Surface Endpoint: 297.768, 460.000
Resisting Moment=7.93133e+006 lb-ft
Driving Moment=4.38456e+006 lb-ft

Method: janbu simplified
FS: 1.863770
Axis Location: 200.120, 584.614
Left Slip Surface Endpoint: 159.018, 431.727
Right Slip Surface Endpoint: 297.768, 460.000
Resisting Horizontal Force=48680.7 lb
Driving Horizontal Force=26119.5 lb

Method: spencer
FS: 1.909240
Axis Location: 214.140, 607.141
Left Slip Surface Endpoint: 162.955, 430.152
Right Slip Surface Endpoint: 325.020, 460.000
Resisting Moment=1.42301e+007 lb-ft
Driving Moment=7.4533e+006 lb-ft
Resisting Horizontal Force=75987 lb
Driving Horizontal Force=39799.6 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 798
Number of Invalid Surfaces: 4202
Error Codes:
Error Code -105 reported for 3904 surfaces
Error Code -107 reported for 27 surfaces
Error Code -108 reported for 128 surfaces
Error Code -112 reported for 143 surfaces

Method: janbu simplified
Number of Valid Surfaces: 762
Number of Invalid Surfaces: 4238
Error Codes:
Error Code -105 reported for 3904 surfaces
Error Code -107 reported for 27 surfaces
Error Code -108 reported for 172 surfaces
Error Code -112 reported for 135 surfaces

Method: spencer
Number of Valid Surfaces: 246
Number of Invalid Surfaces: 4754
Error Codes:
Error Code -105 reported for 3904 surfaces
Error Code -107 reported for 27 surfaces
Error Code -108 reported for 171 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -111 reported for 508 surfaces
Error Code -112 reported for 144 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_nocover_global_su_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.360620
Center: 229.669, 488.062
Radius: 84.414
Left Slip Surface Endpoint: 171.784, 426.621
Right Slip Surface Endpoint: 309.282, 460.000
Resisting Moment=8.19054e+006 lb-ft
Driving Moment=6.01973e+006 lb-ft

Method: janbu simplified
FS: 1.339970
Center: 229.669, 488.062
Radius: 84.414
Left Slip Surface Endpoint: 171.784, 426.621
Right Slip Surface Endpoint: 309.282, 460.000
Resisting Horizontal Force=77760.4 lb
Driving Horizontal Force=58031.5 lb

Method: spencer
FS: 1.359710
Center: 229.669, 488.062
Radius: 84.414
Left Slip Surface Endpoint: 171.784, 426.621
Right Slip Surface Endpoint: 309.282, 460.000
Resisting Moment=8.18509e+006 lb-ft
Driving Moment=6.01973e+006 lb-ft
Resisting Horizontal Force=77704.5 lb
Driving Horizontal Force=57147.8 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 9250
Number of Invalid Surfaces: 9241
Error Codes:
Error Code -103 reported for 7193 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 551 surfaces
Error Code -107 reported for 239 surfaces
Error Code -108 reported for 136 surfaces
Error Code -110 reported for 79 surfaces
Error Code -112 reported for 1042 surfaces

Method: janbu simplified
Number of Valid Surfaces: 8601
Number of Invalid Surfaces: 9890
Error Codes:
Error Code -103 reported for 7193 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 551 surfaces
Error Code -107 reported for 239 surfaces
Error Code -108 reported for 743 surfaces
Error Code -110 reported for 79 surfaces
Error Code -112 reported for 1084 surfaces

Method: spencer

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Number of Valid Surfaces: 5324
Number of Invalid Surfaces: 13167
Error Codes:
Error Code -103 reported for 7193 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 551 surfaces
Error Code -107 reported for 239 surfaces
Error Code -108 reported for 876 surfaces
Error Code -110 reported for 79 surfaces
Error Code -111 reported for 3126 surfaces
Error Code -112 reported for 1102 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_nocover_external_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 8.385650
Center: -41.981, 4880.403
Radius: 4492.873
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 761.724, 460.000
Resisting Moment=4.66372e+009 lb-ft
Driving Moment=5.56154e+008 lb-ft

Method: janbu simplified
FS: 8.383790
Center: -41.981, 4880.403
Radius: 4492.873
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 761.724, 460.000
Resisting Horizontal Force=1.0337e+006 lb
Driving Horizontal Force=123298 lb

Method: spencer
FS: 8.385530
Center: -41.981, 4880.403
Radius: 4492.873
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 761.724, 460.000
Resisting Moment=4.66365e+009 lb-ft
Driving Moment=5.56154e+008 lb-ft
Resisting Horizontal Force=1.03369e+006 lb
Driving Horizontal Force=123271 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 944
Number of Invalid Surfaces: 3863
Error Codes:
Error Code -101 reported for 38 surfaces
Error Code -110 reported for 247 surfaces
Error Code -113 reported for 212 surfaces
Error Code -1000 reported for 3366 surfaces

Method: janbu simplified
Number of Valid Surfaces: 944
Number of Invalid Surfaces: 3863
Error Codes:
Error Code -101 reported for 38 surfaces
Error Code -110 reported for 247 surfaces
Error Code -113 reported for 212 surfaces
Error Code -1000 reported for 3366 surfaces

Method: spencer
Number of Valid Surfaces: 939
Number of Invalid Surfaces: 3868
Error Codes:
Error Code -101 reported for 38 surfaces
Error Code -110 reported for 247 surfaces
Error Code -111 reported for 5 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -113 reported for 212 surfaces
Error Code -1000 reported for 3366 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
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Cross-Section B-B: After Placement of Final Cover

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_cover_tube_04_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf

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Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties
Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums
Method: bishop simplified
FS: 5.823670
Axis Location: 320.318, 784.965
Left Slip Surface Endpoint: 179.292, 436.392
Right Slip Surface Endpoint: 514.560, 463.000
Resisting Moment=6.58126e+007 lb-ft
Driving Moment=1.13009e+007 lb-ft

Method: janbu simplified
FS: 5.999280
Axis Location: 320.318, 784.965
Left Slip Surface Endpoint: 179.292, 436.392
Right Slip Surface Endpoint: 514.560, 463.000
Resisting Horizontal Force=185215 lb
Driving Horizontal Force=30872.8 lb

Method: spencer
FS: 6.014270
Axis Location: 343.614, 829.987
Left Slip Surface Endpoint: 179.933, 436.584
Right Slip Surface Endpoint: 560.127, 463.000
Resisting Moment=7.91383e+007 lb-ft
Driving Moment=1.31584e+007 lb-ft
Resisting Horizontal Force=198854 lb
Driving Horizontal Force=33063.8 lb

Valid / Invalid Surfaces
Method: bishop simplified
Number of Valid Surfaces: 1873
Number of Invalid Surfaces: 3127
Error Codes:
Error Code -107 reported for 1503 surfaces
Error Code -108 reported for 1466 surfaces
Error Code -112 reported for 158 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1695
Number of Invalid Surfaces: 3305
Error Codes:
Error Code -107 reported for 1503 surfaces
Error Code -108 reported for 1665 surfaces
Error Code -112 reported for 137 surfaces

Method: spencer
Number of Valid Surfaces: 14
Number of Invalid Surfaces: 4986
Error Codes:
Error Code -107 reported for 1503 surfaces
Error Code -108 reported for 1922 surfaces
Error Code -111 reported for 1394 surfaces
Error Code -112 reported for 167 surfaces

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Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

List of All Coordinates

Block Search Polyline

178.169	436.056
466.208	436.240

Material Boundary

0.000	427.500
122.000	424.650
122.359	424.645
177.171	423.910
204.000	423.550
267.961	422.659
405.000	420.750
472.000	422.050
768.000	422.250
805.000	423.150
925.000	423.250
1165.000	428.350
1347.000	425.150
1436.000	426.150
1642.000	424.450
1786.163	426.261
1841.000	426.950
1841.123	426.953

Material Boundary

122.000	424.500
122.359	424.645

Material Boundary

166.176	430.000
173.133	426.959
180.062	426.825
182.423	426.779
347.000	423.600
600.000	423.600
640.000	424.000
728.000	424.000
1102.000	431.000
1176.000	431.000
1356.000	428.000
1474.000	427.500
1619.000	426.500
1689.000	426.500
1785.758	427.937
1790.000	428.000
1798.000	431.000

Material Boundary

1827.000	432.300
1841.123	426.953

Material Boundary

188.000	430.000
824.000	430.000
1161.000	433.000
1236.000	432.000
1400.000	431.000
1778.100	431.000

Material Boundary

188.000	430.250
506.200	430.250
507.700	430.250
824.000	430.250
824.200	430.252
825.700	430.265
1142.148	433.082
1143.812	433.097
1161.000	433.250
1236.000	432.250
1400.000	431.250
1460.199	431.250
1461.784	431.250
1778.100	431.250

Material Boundary

208.000	436.000
506.200	436.000
507.700	436.000
824.000	436.000
824.200	436.002
825.700	436.015
1142.148	438.832
1143.812	438.847
1161.000	439.000
1236.000	438.000
1400.000	437.000
1460.199	437.000
1461.784	437.000
1758.000	437.000

Material Boundary

208.000	436.250
466.200	436.250

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467.700	436.250
724.201	436.250
725.697	436.250
824.000	436.250
982.197	437.658
983.718	437.672
1161.000	439.250
1236.000	438.250
1240.193	438.224
1241.724	438.215
1400.000	437.250
1498.182	437.250
1499.766	437.250
1758.000	437.250

Material Boundary

228.000	442.000
466.200	442.000
467.700	442.000
724.201	442.000
725.697	442.000
824.000	442.000
982.197	443.408
983.718	443.422
1161.000	445.000
1236.000	444.000
1240.193	443.974
1241.724	443.965
1400.000	443.000
1498.182	443.000
1499.766	443.000
1738.000	443.000

Material Boundary

228.000	442.250
530.200	442.250
531.700	442.250
824.000	442.250
832.191	442.323
833.715	442.336
1134.188	445.011
1135.719	445.025
1161.000	445.250
1236.000	444.250
1400.000	443.250
1436.205	443.250
1437.780	443.250
1738.000	443.250

Material Boundary

248.000	448.000
530.200	448.000
531.700	448.000
824.000	448.000
832.191	448.073
833.715	448.086
1134.188	450.761
1135.719	450.775
1161.000	451.000
1236.000	450.000
1400.000	449.000
1436.205	449.000
1437.780	449.000
1718.000	449.000

Material Boundary

248.000	448.250
493.200	448.250
494.700	448.250
738.195	448.250
739.701	448.250
824.000	448.250
983.182	449.667
984.724	449.681
1161.000	451.250
1228.192	450.354
1229.723	450.334
1236.000	450.250
1400.000	449.250
1473.204	449.250
1474.788	449.250
1718.000	449.250

Material Boundary

268.000	454.000
493.200	454.000
494.700	454.000
738.195	454.000
739.701	454.000
824.000	454.000
983.182	455.417
984.724	455.431
1161.000	457.000
1228.192	456.104
1229.723	456.084
1236.000	456.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1400.000 455.000
1473.204 455.000
1474.788 455.000
1698.000 455.000

Material Boundary
268.000 454.250
554.200 454.250
555.700 454.250
824.000 454.250
840.193 454.394
841.706 454.408
1126.178 456.940
1127.707 456.954
1161.000 457.250
1236.000 456.250
1400.000 455.250
1412.195 455.250
1413.743 455.250
1698.000 455.250

Material Boundary
506.200 430.250
506.200 436.000

Material Boundary
507.700 430.250
507.700 436.000

Material Boundary
466.200 436.250
466.200 442.000

Material Boundary
467.700 436.250
467.700 442.000

Material Boundary
530.200 442.250
530.200 448.000

Material Boundary
531.700 442.250
531.700 448.000

Material Boundary
493.200 448.250
493.200 454.000

Material Boundary
494.700 448.250
494.700 454.000

Material Boundary
554.200 454.250
554.200 460.000

Material Boundary
555.700 454.250
555.700 460.000

Material Boundary
824.200 430.252
824.200 436.002

Material Boundary
825.700 430.265
825.700 436.015

Material Boundary
724.201 436.250
724.201 442.000

Material Boundary
725.697 436.250
725.697 442.000

Material Boundary
738.195 448.250
738.195 454.000

Material Boundary
739.701 448.250
739.701 454.000

Material Boundary
840.193 454.394
840.193 460.144

Material Boundary
841.706 454.408
841.706 460.158

Material Boundary
832.191 442.323
832.191 448.073

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material Boundary
833.715 442.336
833.715 448.086

Material Boundary
982.197 437.658
982.197 443.408

Material Boundary
983.182 449.667
983.182 455.417

Material Boundary
983.718 437.672
983.718 443.422

Material Boundary
984.724 449.681
984.724 455.431

Material Boundary
1134.188 445.011
1134.188 450.761

Material Boundary
1135.719 445.025
1135.719 450.775

Material Boundary
1436.205 443.250
1436.205 449.000

Material Boundary
1437.780 443.250
1437.780 449.000

Material Boundary
1126.178 456.940
1126.178 462.690

Material Boundary
1127.707 456.954
1127.707 462.704

Material Boundary
1142.148 433.082
1142.148 438.832

Material Boundary
1143.812 433.097
1143.812 438.847

Material Boundary
1228.192 450.354
1228.192 456.104

Material Boundary
1229.723 450.334
1229.723 456.084

Material Boundary
1240.193 438.224
1240.193 443.974

Material Boundary
1241.724 438.215
1241.724 443.965

Material Boundary
1412.195 455.250
1412.195 461.000

Material Boundary
1413.743 455.250
1413.743 461.000

Material Boundary
1460.199 431.250
1460.199 437.000

Material Boundary
1461.784 431.250
1461.784 437.000

Material Boundary
1498.182 437.250
1498.182 443.000

Material Boundary
1499.766 437.250
1499.766 443.000

Material Boundary
1473.204 449.250
1473.204 455.000

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Material Boundary

1474.788	449.250
1474.788	455.000

Material Boundary

165.176	430.000
177.171	423.910

Material Boundary

0.000	387.500
268.000	387.845
1979.000	390.050

Material Boundary

1786.163	426.261
1799.372	431.000

Material Boundary

164.400	430.400
165.176	430.000

Material Boundary

1799.372	431.000
1803.000	432.300

Material Boundary

164.400	430.400
165.257	430.401
166.176	430.000
188.000	430.000
188.000	430.250
188.000	436.000
208.000	436.000
208.000	436.250
208.000	442.000
228.000	442.000
228.000	442.250
228.000	448.000
248.000	448.000
248.000	448.250
248.000	454.000
268.000	454.000
268.000	454.250
268.000	460.000

Material Boundary

268.000	462.000
268.000	460.000
554.200	460.000
555.700	460.000
824.000	460.000
840.193	460.144
841.706	460.158
1126.178	462.690
1127.707	462.704
1161.000	463.000
1236.000	462.000
1400.000	461.000
1412.195	461.000
1413.743	461.000
1698.000	461.000

Material Boundary

1698.000	463.000
1698.000	461.000
1698.000	455.250
1698.000	455.000
1718.000	455.000
1718.000	449.250
1718.000	449.000
1738.000	449.000
1738.000	443.250
1738.000	443.000
1758.000	443.000
1758.000	437.250
1758.000	437.000
1778.100	437.000
1778.100	431.250
1778.100	431.000
1798.000	431.000
1801.461	432.301

Material Boundary

180.062	426.825
180.500	427.000
182.423	427.769
183.000	428.000
185.500	429.000
188.000	430.000

Material Boundary

1778.100	431.000
1780.600	430.000
1783.100	429.000
1785.600	428.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1785.758 427.937

Material Boundary
267.961 422.659
268.000 387.845

Material Boundary
157.414 434.000
162.619 431.318
164.400 430.400

Material Boundary
163.062 431.533
164.289 430.900
165.257 430.401

External Boundary
107.318 424.996
0.000 427.500
0.000 387.500
0.000 347.500
1979.000 350.000
1979.000 390.050
1979.000 430.050
1841.123 426.953
1841.000 427.000
1827.000 432.300
1803.000 432.300
1801.461 432.301
1801.461 433.301
1778.100 440.000
1758.000 446.000
1738.000 452.000
1718.000 458.000
1698.000 464.000
1400.000 464.000
1236.000 465.000
1161.000 466.000
824.000 463.000
268.000 463.000
248.000 457.000
228.000 451.000
208.000 445.000
188.000 439.000
167.871 432.972
163.062 431.533
162.619 431.761
158.274 434.000
157.414 434.000
142.619 434.000
129.614 434.000

Piezo Line
182.423 427.779
347.000 424.600
600.000 424.600
640.000 425.000
728.000 425.000
1102.000 432.000
1176.000 432.000
1356.000 429.000
1474.000 428.500
1619.000 427.500
1689.000 427.500
1790.000 429.000
1792.668 429.000

Water Table
0.000 412.500
204.000 408.550
405.000 405.750
472.000 407.050
557.156 407.108
768.000 407.250
805.000 408.150
925.000 408.250
1165.000 413.350
1347.000 410.150
1436.000 411.150
1642.000 409.450
1768.160 411.260
1841.123 411.953
1979.000 415.050

Focus/Block Search Point
467.689 442.010

Focus/Block Search Point
466.208 436.240

Support
554.200 454.250
554.200 460.000

Support
554.200 460.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

268.000 460.000

Support
268.000 454.000
248.000 454.000

Support
248.000 454.000
248.000 448.250

Support
248.000 448.250
493.200 448.250

Support
493.200 454.000
493.200 448.250

Support
268.000 460.000
268.000 454.250

Support
268.000 454.250
554.200 454.250

Support
555.700 454.250
555.700 460.000

Support
555.700 460.000
824.000 460.000

Support
824.000 460.000
840.193 460.144

Support
840.193 460.144
840.193 454.394

Support
840.193 454.394
824.000 454.250

Support
824.000 454.250

555.700 454.250

Support
738.195 454.000
738.195 448.250

Support
739.701 454.000
739.701 448.250

Support
738.195 454.000
494.700 454.000

Support
494.700 454.000
494.700 448.250

Support
494.700 448.250
738.195 448.250

Support
724.201 442.000
724.201 436.250

Support
724.201 436.250
467.700 436.250

Support
467.700 436.250
467.700 442.000

Support
467.700 442.000
724.201 442.000

Support
228.000 448.000
228.000 442.250

Support
248.000 448.000
530.200 448.000

Support
530.200 448.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

530.200 442.250

Support
531.700 442.250
531.700 448.000

Support
530.200 442.250
228.000 442.250

Support
228.000 448.000
248.000 448.000

Support
208.000 436.250
208.000 442.000

Support
208.000 442.000
228.000 442.000

Support
228.000 442.000
466.200 442.000

Support
466.200 442.000
466.200 436.250

Support
466.200 436.250
208.000 436.250

Support
188.000 430.250
188.000 436.000

Support
188.000 436.000
208.000 436.000

Support
208.000 436.000
506.200 436.000

Support
507.700 436.000

507.700 430.250

Support
506.200 436.000
506.200 430.250

Support
506.200 430.250
188.000 430.250

Support
507.700 430.250
824.200 430.252

Support
824.200 430.252
824.200 436.002

Support
824.200 436.002
507.700 436.000

Support
832.191 442.323
832.191 448.073

Support
833.715 442.336
833.715 448.086

Support
832.191 448.073
824.000 448.000

Support
824.000 448.000
531.700 448.000

Support
531.700 442.250
824.000 442.250

Support
824.000 442.250
832.191 442.323

Support
841.706 460.158

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

841.706 454.408

Support
825.700 436.015
825.700 430.265

Support
725.697 442.000
725.697 436.250

Support
725.697 436.250
824.000 436.250

Support
824.000 436.250
982.197 437.658

Support
982.197 437.658
982.197 443.408

Support
982.197 443.408
824.000 442.000

Support
824.000 442.000
725.697 442.000

Support
739.701 448.250
824.000 448.250

Support
824.000 448.250
983.182 449.667

Support
983.182 449.667
983.182 455.417

Support
983.182 455.417
824.000 454.000

Support
824.000 454.000

739.701 454.000

Support
841.706 454.408
1126.178 456.940

Support
1126.178 456.940
1126.178 462.690

Support
1126.178 462.690
841.706 460.158

Support
833.715 448.086
1134.188 450.761

Support
1134.188 450.761
1134.188 445.011

Support
1134.188 445.011
833.715 442.336

Support
825.700 436.015
1142.148 438.832

Support
1142.148 438.832
1142.148 433.082

Support
1142.148 433.082
825.700 430.265

Support
984.724 455.431
984.724 449.681

Support
983.718 443.422
983.718 437.672

Support
983.718 437.672

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1161.000 439.250

Support
1161.000 439.250
1236.000 438.250

Support
1236.000 438.250
1240.193 438.224

Support
1240.193 438.224
1240.193 443.974

Support
1240.193 443.974
1236.000 444.000

Support
1236.000 444.000
1161.000 445.000

Support
1161.000 445.000
983.718 443.422

Support
984.724 455.431
1161.000 457.000

Support
1161.000 457.000
1228.192 456.104

Support
1228.192 456.104
1228.192 450.354

Support
1228.192 450.354
1161.000 451.250

Support
1161.000 451.250
984.724 449.681

Support
268.000 454.000

493.200 454.000

Support
1127.707 462.704
1127.707 456.954

Support
1127.707 462.704
1161.000 463.000

Support
1161.000 463.000
1236.000 462.000

Support
1236.000 462.000
1400.000 461.000

Support
1400.000 461.000
1412.195 461.000

Support
1412.195 461.000
1412.195 455.250

Support
1412.195 455.250
1400.000 455.250

Support
1400.000 455.250
1236.000 456.250

Support
1236.000 456.250
1161.000 457.250

Support
1161.000 457.250
1127.707 456.954

Support
1135.719 450.775
1135.719 445.025

Support
1135.719 450.775

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1161.000 451.000

Support
1161.000 445.250
1135.719 445.025

Support
1161.000 445.250
1236.000 444.250

Support
1236.000 444.250
1400.000 443.250

Support
1400.000 443.250
1436.205 443.250

Support
1436.205 443.250
1436.205 449.000

Support
1437.780 449.000
1437.780 443.250

Support
1436.205 449.000
1400.000 449.000

Support
1400.000 449.000
1236.000 450.000

Support
1236.000 450.000
1161.000 451.000

Support
1229.723 456.084
1229.723 450.334

Support
1229.723 450.334
1236.000 450.250

Support
1236.000 456.000

1229.723 456.084

Support
1236.000 456.000
1400.000 455.000

Support
1400.000 455.000
1473.204 455.000

Support
1473.204 455.000
1473.204 449.250

Support
1474.788 449.250
1474.788 455.000

Support
1473.204 449.250
1400.000 449.250

Support
1400.000 449.250
1236.000 450.250

Support
1241.724 438.215
1241.724 443.965

Support
1143.812 438.847
1143.812 433.097

Support
1143.812 433.097
1161.000 433.250

Support
1161.000 439.000
1143.812 438.847

Support
1161.000 439.000
1236.000 438.000

Support
1236.000 438.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1400.000 437.000

Support
1400.000 437.000
1460.199 437.000

Support
1460.199 437.000
1460.199 431.250

Support
1461.784 431.250
1461.784 437.000

Support
1460.199 431.250
1400.000 431.250

Support
1400.000 431.250
1236.000 432.250

Support
1236.000 432.250
1161.000 433.250

Support
1241.724 438.215
1400.000 437.250

Support
1400.000 437.250
1498.182 437.250

Support
1498.182 443.000
1498.182 437.250

Support
1499.766 437.250
1499.766 443.000

Support
1498.182 443.000
1400.000 443.000

Support
1400.000 443.000

1241.724 443.965

Support
1413.743 461.000
1413.743 455.250

Support
1413.743 461.000
1698.000 461.000

Support
1698.000 461.000
1698.000 455.250

Support
1698.000 455.250
1413.743 455.250

Support
1474.788 449.250
1718.000 449.250

Support
1718.000 449.250
1718.000 455.000

Support
1698.000 455.000
1474.788 455.000

Support
1461.784 431.250
1778.100 431.250

Support
1778.100 431.250
1778.100 437.000

Support
1758.000 437.000
1461.784 437.000

Support
1437.780 443.250
1738.000 443.250

Support
1738.000 443.250

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

1738.000 449.000

Support
1718.000 449.000
1437.780 449.000

Support
1499.766 437.250
1758.000 437.250

Support
1758.000 437.250
1758.000 443.000

Support
1738.000 443.000
1499.766 443.000

Support
1718.000 455.000
1698.000 455.000

Support
1718.000 449.000
1738.000 449.000

Support
1738.000 443.000
1758.000 443.000

Support
1758.000 437.000
1778.100 437.000

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_cover_liner_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 5
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.819170
Axis Location: 191.041, 570.041
Left Slip Surface Endpoint: 161.508, 431.016
Right Slip Surface Endpoint: 284.542, 463.000
Resisting Moment=1.01275e+007 lb-ft
Driving Moment=5.56707e+006 lb-ft

Method: janbu simplified
FS: 1.813810
Axis Location: 191.041, 570.041
Left Slip Surface Endpoint: 161.508, 431.016
Right Slip Surface Endpoint: 284.542, 463.000
Resisting Horizontal Force=66479.5 lb
Driving Horizontal Force=36651.9 lb

Method: spencer
FS: 1.511940
Axis Location: 180.031, 558.609
Left Slip Surface Endpoint: 152.083, 434.000
Right Slip Surface Endpoint: 262.949, 461.485
Resisting Moment=3.88774e+007 lb-ft
Driving Moment=2.57136e+007 lb-ft
Resisting Horizontal Force=176559 lb
Driving Horizontal Force=116776 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3139
Number of Invalid Surfaces: 1861
Error Codes:
Error Code -105 reported for 357 surfaces
Error Code -107 reported for 186 surfaces
Error Code -108 reported for 379 surfaces
Error Code -110 reported for 285 surfaces
Error Code -112 reported for 654 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3045
Number of Invalid Surfaces: 1955
Error Codes:
Error Code -105 reported for 357 surfaces
Error Code -107 reported for 186 surfaces
Error Code -108 reported for 507 surfaces
Error Code -110 reported for 285 surfaces
Error Code -112 reported for 620 surfaces

Method: spencer
Number of Valid Surfaces: 1412
Number of Invalid Surfaces: 3588
Error Codes:

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009
Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -105 reported for 357 surfaces
Error Code -107 reported for 186 surfaces
Error Code -108 reported for 521 surfaces
Error Code -110 reported for 285 surfaces
Error Code -111 reported for 1573 surfaces
Error Code -112 reported for 666 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name

File Name: eastwest_cover_global_su_lab

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.401700
Center: 185.620, 545.117
Radius: 150.468
Left Slip Surface Endpoint: 94.610, 425.293
Right Slip Surface Endpoint: 311.705, 463.000
Resisting Moment=2.36525e+007 lb-ft
Driving Moment=1.68741e+007 lb-ft

Method: janbu simplified
FS: 1.322780
Center: 185.620, 545.117
Radius: 150.468
Left Slip Surface Endpoint: 94.610, 425.293
Right Slip Surface Endpoint: 311.705, 463.000
Resisting Horizontal Force=137554 lb
Driving Horizontal Force=103988 lb

Method: spencer
FS: 1.396240
Center: 185.620, 545.117
Radius: 150.468
Left Slip Surface Endpoint: 94.610, 425.293
Right Slip Surface Endpoint: 311.705, 463.000
Resisting Moment=2.35602e+007 lb-ft
Driving Moment=1.68741e+007 lb-ft
Resisting Horizontal Force=137283 lb
Driving Horizontal Force=98323.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3054
Number of Invalid Surfaces: 1786
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 23 surfaces
Error Code -112 reported for 302 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3031
Number of Invalid Surfaces: 1809
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 17 surfaces
Error Code -110 reported for 23 surfaces
Error Code -111 reported for 1 surface
Error Code -112 reported for 308 surfaces

Method: spencer
Number of Valid Surfaces: 2417
Number of Invalid Surfaces: 2423
Error Codes:

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 23 surfaces
Error Code -110 reported for 23 surfaces
Error Code -111 reported for 596 surfaces
Error Code -112 reported for 321 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_cover_global_u75_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: SOLW U=75%
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.425720
Center: 177.623, 545.117
Radius: 149.072
Left Slip Surface Endpoint: 88.756, 425.429
Right Slip Surface Endpoint: 302.039, 463.000
Resisting Moment=2.27764e+007 lb-ft
Driving Moment=1.59753e+007 lb-ft

Method: janbu simplified
FS: 1.340700
Center: 177.623, 535.909
Radius: 141.842
Left Slip Surface Endpoint: 88.663, 425.431
Right Slip Surface Endpoint: 299.292, 463.000
Resisting Horizontal Force=134615 lb
Driving Horizontal Force=100407 lb

Method: spencer
FS: 1.419040
Center: 177.623, 545.117
Radius: 149.072
Left Slip Surface Endpoint: 88.756, 425.429
Right Slip Surface Endpoint: 302.039, 463.000
Resisting Moment=2.26697e+007 lb-ft
Driving Moment=1.59753e+007 lb-ft
Resisting Horizontal Force=133379 lb
Driving Horizontal Force=93992.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3053
Number of Invalid Surfaces: 1787
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 23 surfaces
Error Code -112 reported for 303 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3029
Number of Invalid Surfaces: 1811
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 17 surfaces
Error Code -110 reported for 23 surfaces
Error Code -111 reported for 1 surface

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Error Code -112 reported for 310 surfaces

Method: spencer
Number of Valid Surfaces: 2416
Number of Invalid Surfaces: 2424
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 23 surfaces
Error Code -110 reported for 23 surfaces
Error Code -111 reported for 597 surfaces
Error Code -112 reported for 321 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_cover_longterm_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (Drained)
Strength Type: Mohr-Coulomb
Unit Weight: 82 lb/ft3
Cohesion: 0 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material (Long)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube (Long Term)
Geotube (Long Term)
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 0.1 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 1.914240
Center: 137.637, 600.367
Radius: 169.097
Left Slip Surface Endpoint: 182.213, 437.251
Right Slip Surface Endpoint: 190.658, 439.797
Resisting Moment=3978.07 lb-ft
Driving Moment=2078.14 lb-ft

Method: janbu simplified
FS: 1.914040
Center: 137.637, 600.367
Radius: 169.097
Left Slip Surface Endpoint: 182.213, 437.251
Right Slip Surface Endpoint: 190.658, 439.797
Resisting Horizontal Force=22.5224 lb
Driving Horizontal Force=11.7669 lb

Method: spencer
FS: 1.914150
Center: 137.637, 600.367
Radius: 169.097
Left Slip Surface Endpoint: 182.213, 437.251
Right Slip Surface Endpoint: 190.658, 439.797
Resisting Moment=3977.88 lb-ft
Driving Moment=2078.14 lb-ft
Resisting Horizontal Force=22.5223 lb
Driving Horizontal Force=11.7662 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3024
Number of Invalid Surfaces: 1816
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 23 surfaces
Error Code -112 reported for 332 surfaces

Method: janbu simplified
Number of Valid Surfaces: 3064
Number of Invalid Surfaces: 1776
Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 2 surfaces
Error Code -110 reported for 23 surfaces
Error Code -112 reported for 291 surfaces

Method: spencer
Number of Valid Surfaces: 3017
Number of Invalid Surfaces: 1823

Written by:	**Joseph Sura**	Date:	**12/4/2009**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**12/8/2009**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Design**	Project/ Proposal No.:	**GJ4299**	Task No.:	**18**

Error Codes:
Error Code -103 reported for 1443 surfaces
Error Code -107 reported for 17 surfaces
Error Code -108 reported for 6 surfaces
Error Code -110 reported for 23 surfaces
Error Code -111 reported for 2 surfaces
Error Code -112 reported for 332 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name: eastwest_cover_external_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (undrained)
Strength Type: Discrete function
Unit Weight: 82 lb/ft3
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees
Water Surface: Water Table
Custom Hu value: 1

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube
Geotube
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 1600 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 7.070290
Center: -4.256, 5490.384
Radius: 5102.085
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 867.871, 463.391
Resisting Moment=5.67039e+009 lb-ft
Driving Moment=8.02003e+008 lb-ft

Method: janbu simplified
FS: 7.073590
Center: -4.256, 5490.384
Radius: 5102.085
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 867.871, 463.391
Resisting Horizontal Force=1.1071e+006 lb
Driving Horizontal Force=156511 lb

Method: spencer
FS: 7.070600
Center: -4.256, 5490.384
Radius: 5102.085
Left Slip Surface Endpoint: -698.188, 435.710
Right Slip Surface Endpoint: 867.871, 463.391
Resisting Moment=5.67065e+009 lb-ft
Driving Moment=8.02003e+008 lb-ft
Resisting Horizontal Force=1.10715e+006 lb
Driving Horizontal Force=156585 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1229
Number of Invalid Surfaces: 3578
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -1000 reported for 3069 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1229
Number of Invalid Surfaces: 3578
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -1000 reported for 3069 surfaces

Method: spencer
Number of Valid Surfaces: 1228
Number of Invalid Surfaces: 3579
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -111 reported for 1 surface
Error Code -1000 reported for 3069 surfaces

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Slide Analysis Information

Document Name
File Name:
eastwest_cover_external_longterm_lab

Project Settings
Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties
Material: Final Cover Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dike Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gravel
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 38 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: SOLW (Drained)
Strength Type: Mohr-Coulomb
Unit Weight: 82 lb/ft3
Cohesion: 0 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Dredge Material (Long)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Tube Interface (Horizontal)
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Tub-Tube Interface (Vertical)
Strength Type: Mohr-Coulomb
Unit Weight: 43 lb/ft3
Cohesion: 0 psf
Friction Angle: 0.1 degrees

Written by:	Joseph Sura	Date:	12/4/2009	Reviewed by:	R. Kulasingam/Jay Beech	Date:	12/8/2009

Client:	Honeywell	Project:	Onondaga Lake SCA Final Design	Project/ Proposal No.:	GJ4299	Task No.:	18

Water Surface: Water Table
Custom Hu value: 1

Material: Tube-Gravel Interface
Strength Type: Mohr-Coulomb
Unit Weight: 86 lb/ft3
Cohesion: 0 psf
Friction Angle: 24 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Liner
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 37 degrees
Water Surface: Water Table
Custom Hu value: 1

Support Properties

Support: Geotube (Long Term)
Geotube (Long Term)
Support Type: GeoTextile
Force Application: Passive
Force Orientation: Tangent to Slip Surface
Anchorage: Both Ends
Shear Strength Model: Linear
Strip Coverage: 100 percent
Tensile Strength: 0.1 lb/ft
Pullout Strength Adhesion: 5 lb/ft2
Pullout Strength Friction Angle: 40 degrees

Global Minimums

Method: bishop simplified
FS: 11.956800
Center: -516.970, 6468.046
Radius: 6107.435
Left Slip Surface Endpoint: -867.917, 370.702
Right Slip Surface Endpoint: 596.668, 463.000
Resisting Moment=2.0544e+010 lb-ft
Driving Moment=1.71819e+009 lb-ft

Method: janbu simplified
FS: 11.903600
Center: -516.970, 6468.046
Radius: 6107.435
Left Slip Surface Endpoint: -867.917, 370.702
Right Slip Surface Endpoint: 596.668, 463.000
Resisting Horizontal Force=3.35325e+006 lb
Driving Horizontal Force=281702 lb

Method: spencer
FS: 11.955500
Center: -516.970, 6468.046
Radius: 6107.435
Left Slip Surface Endpoint: -867.917, 370.702
Right Slip Surface Endpoint: 596.668, 463.000
Resisting Moment=2.05419e+010 lb-ft
Driving Moment=1.71819e+009 lb-ft
Resisting Horizontal Force=3.35407e+006 lb
Driving Horizontal Force=280545 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1229
Number of Invalid Surfaces: 3578
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -1000 reported for 3069 surfaces

Method: janbu simplified
Number of Valid Surfaces: 1229
Number of Invalid Surfaces: 3578
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -1000 reported for 3069 surfaces

Method: spencer
Number of Valid Surfaces: 1229
Number of Invalid Surfaces: 3578
Error Codes:
Error Code -101 reported for 46 surfaces
Error Code -110 reported for 463 surfaces
Error Code -1000 reported for 3069 surfaces