REPORT

Tyrone Stockpile Stability Analysis for 2013 Closure Close-Out Plan Update

Tyrone, New Mexico

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1.0 INTRODUCTION

New Mexico Environment Department (NMED) issued a Supplemental Discharge Permit for closure (DP-1341) to Freeport-McMoRan Tyrone Inc. (Tyrone) on April 8, 2003. Per DP-1341 Condition 78, Tyrone submitted a Work Plan for Supplemental Slope Stability Analyses dated December 12, 2003. Tyrone submitted a series of stability assessment memorandums during 2006 and 2007 that addressed the stability of the Tyrone stockpiles.

The purpose of this report is to update the previous stockpile stability assessments to specifically address the Copper Rule criteria. The Copper Rule states that:

> *At closure, tailing impoundment(s) not regulated by the office of the state engineer, leach stockpile(s) or waste rock stockpile(s) shall be constructed to promote the long-term stability of the structure. Closure of all critical structures at a copper mine facility shall be designed for a long-term static factor of safety of 1.5 or greater and non-critical structures shall be designed for a long-term static factor of safety of 1.3 or greater. The units being closed shall also be designed for a factor of safety of 1.1 or greater under pseudo-static analysis. A stability analysis shall be conducted for the unit and shall include evaluation for static and seismic induced liquefaction.*
>
> *"Critical Structure" means earthen or rock structures or embankments (such as the outslope of a rock stockpile), that are likely to cause an exceedance of applicable groundwater standards or undue risk to property in the event of a significant unexpected slope movement*

This report provides a comprehensive report of the stability of the reclaimed configurations of the Tyrone leach and waste rock stockpiles, including stockpiles not addressed by the previous memorandums. The stability assessment applies consistent criteria for all stockpiles and updates data applied during the 2006-2007 stability assessments where new information is available.

2.0 SUMMARY OF PREVIOUS WORK COMPLETED

New Mexico Environmental Department (NMED) issued a Supplemental Discharge Permit for Closure (DP-1341) dated April 8, 2003 to Phelps Dodge Tyrone Inc. (now Freeport-McMoRan Tyrone Inc. [Tyrone]) for the Tyrone Mine. To comply with the New Mexico Water Quality Act (WCA) and the New Mexico Water Quality Control Commission (WQCC) regulations, Tyrone was required to conduct scientific studies that address a number of conditions specified under Section III of DP-1341. A slope stability study commenced, and the results were submitted in the memorandums issued during 2006-2007. These memorandums addressed Condition 78. Condition 78 states:

> *Tyrone shall perform a supplemental stability study on the Waste Rock Piles and Leach Ore Stockpiles at the Tyrone Mine Facility. In accordance with the schedule approved under Condition 74, Tyrone shall submit to NMED for approval a work plan including an implementation schedule for the supplemental stability study to evaluate the long-term physical stability of Waste Rock Piles and Leach Ore Stockpiles after closure. The study shall evaluate and quantify changes in the engineering parameters resulting from the natural weathering process of the Waste Rock Pile and Leach Ore Stockpile materials that may ultimately affect long-term stability. At a minimum, the work plan shall propose methods and analyses to account for changes in chemical and physical properties of the stockpile materials from the time of deposition to present day and to a specified time during post-closure. The study shall include an evaluation of the recently reported data for materials interior to the stockpiles and whether additional data collection is warranted to evaluate long-term stability.*

A Work Plan for Supplemental Slope Stability Analyses dated December 12, 2003 was submitted which was intended to address the supplemental stability requirements of Condition 78. The Work Plan had four primary objectives.

- Further characterize the internal composition, structure, chemical and physical state and engineering parameters of the leach ore stockpiles and waste stockpiles.
- Further characterize the geological and engineering parameters of the foundation materials of the leach stockpiles and waste stockpiles.
- Quantify the effects of chemical weathering/cementation on the engineering parameters of the stockpile materials with respect to long-term slope stability.
- Re-evaluate the stability of the stockpiles based on the more detailed geologic/geotechnical model and engineering parameters.

The following sections summarize the various investigations and studies that have been completed to address Condition 78. These included a number of memorandums that addressed the stability of individual stockpile facilities that were included as appendices to the construction design quality assurance plans (CDQAP) for the reclamation designs of those facilities as discussed in Section 2.6.

Several stockpile characterization programs and slope stability assessments of the waste rock piles and leach stockpiles at the Tyrone mine have been completed per Condition 78. Much of the information collected from those studies was summarized in the Interim Report for DP-1341, Condition 78 (Golder, 2005) which is included in Appendix I of this report. The drill hole and test pit locations are provided on the Figures 2 through 5. The previous stockpile assessment activities are summarized in the following sections. In 2019, Tyrone performed an additional test pit investigation at the 9A Waste and 9AX Waste stockpiles. This investigation is summarized in Section 2.7.

2.1 Closure/Closeout Plan Addendum

Golder completed a slope stability analysis of stockpiles at the Tyrone Mine and reported the results of those analyses in a report titled; Closure/Closeout Plan Addendum, Slope Stability Analysis, Phelps Dodge Tyrone Inc. dated February 24, 2000. The Closure/Closeout Plan Addendum study provided a description of the existing site conditions, stockpile descriptions, characterization of stockpile materials, determination of mechanical properties of the stockpile materials, and assessment of the stability of the stockpile slopes in terms of a factor of safety.

The stockpile materials that were characterized during this study were obtained from 14 surface excavations that were typically 15 feet deep. The test pit locations are shown on Figures 2 through 5 (GTP series). The percentage of oversized (>3 inch) rock fragments in each test pit was estimated visually. The stockpile soils (minus 3-inch fraction) at each site were logged according to ASTM (D2488) standards. Point load tests were performed on oversize rock fragments to quantify the strength of the cobbles. Approximately 10 point-load tests were performed for each test pit. Nuclear gauge moisture and density measurements were obtained from each test pit to develop stockpile density values. Bulk samples were collected from seven of the test pits and were subjected to grain size analyses and Atterberg limits testing. Two samples were also selected for triaxial shear testing. Staged triaxial shear testing was performed in a four-inch diameter triaxial cell, scalped of fragments larger than ¾ inch, under consolidated, undrained conditions with pore pressure measurements to allow the determination of both the drained and undrained shear strength parameters.

2.2 Characterization of Re-Mined Stockpiles

During closure hearings with the State of New Mexico, Tyrone received comments concerning the lack of geotechnical characterization of the interior portions of the stockpiles. The comments addressed the impact that leaching by low pH process solutions and long-term weathering may have on the long-term shear strength and, consequently, the long-term stability of the stockpiles and that the interior portions of the stockpiles may be more impacted by leaching and weathering than the surface. To address these comments, Golder conducted a field investigation during October 2001 to augment the previous stockpile characterization study.

Tyrone identified several stockpiles that had been partially re-mined, exposing the interiors. This work was reported previously in an Interim Report (Golder, 2005) which is included as Appendix I of this current report. Golder collected samples and classified the stockpile soils at 12 sites. Sample locations are shown on the figures (TYTP01 series). The percentage of oversize material (plus 3-inch fraction) was estimated visually and the visual estimates were verified or adjusted using scaled photographic images. The stockpile soils (minus 3-inch fraction) at each site were logged according to ASTM (D2488) standards.

Soil samples collected from each site were subjected to sieve analysis (ASTM C117/C136), and Atterberg Limits determination (ASTM D-4318). Extended grain size curves were prepared by combining the laboratory grain size curves with the visual estimates of the gradation of the oversize fraction. Four staged, consolidated, undrained triaxial shear tests were performed using a four-inch diameter triaxial cell with the soil scalped of fragments larger than ¾ inch.

During 2004, Tyrone re-mined a portion of the 1C Waste stockpile exposing the interior portions of this stockpile. Golder performed a site investigation to characterize the interior portions of the 1C Waste stockpile in September 2004. The characterization was completed in the same manner as the October 2001 program. Soil samples were collected from eight locations in the interior of the 1C Waste stockpile. The locations are shown on Figure 2 (GA04-TY series). The samples were subjected to sieve analysis (ASTM C117/C136), hydrometer analysis (ASTM D422) and Atterberg Limits determination (ASTM D-4318). Large-scale (6-inch shear box) direct shear tests were performed under saturated conditions. The direct shear test samples were scalped of fragments larger than one inch.

Observations of the stockpile interiors showed that the internal layering on dump faces varied in orientation on each successive, approximately 50-foot lift so that there is not continuous slope-parallel layering over the entire slope height.

2.3 2004 Rotosonic Stockpile Drilling Program

A rotosonic drilling program was completed during the fall of 2004. The locations of the drill holes are provided on Figures 2 through 5. Boreholes TSGT-1 through TSGT-3 were terminated within the stockpile. Borehole TSGT-4 extended approximately 15 feet into the foundation soils.

The drill holes were logged for geologic and geotechnical information and samples were collected for laboratory testing. Geotechnical and geological logs and laboratory testing results were provided in the 2005 Interim Report (Appendix I). Estimates of the moisture content were made but do not reflect in situ conditions because the samples were stored for seven months prior to geotechnical logging. The core recovery and percentage of fragments greater than 3-inches were also recorded. The estimates of the oversize fraction from the rotosonic core are considered less representative than from the test pits because of the relatively small diameter of the core.

After completion of each rotosonic core hole, a down-hole geophysical survey was performed. Geophysical logging included:

- Cased Density Log
- Natural Gamma Ray Spectrometry Tool
- Epithermal Neutron Log

The results of the geophysical logging were reported in Greystone, 2004.

2.4 2005 1A Leach Stockpile Rotosonic Drilling Program

During September 2005, Tyrone undertook a rotosonic drilling program of the 1A Leach stockpile to verify the condition prior to re-mining the slopes back to reclamation slope angles. Five rotosonic drill holes (S1A-1 through S1A-5 [referred to as T-1 through T-5 in the laboratory test results]) were completed to depths of 110 to 200 feet. Borehole locations are shown on the figures. A Golder engineer was present during drilling of rotosonic holes S1A-3 through S1A-5 to complete geotechnical logging and sampling of those holes. Hole S1A-3 penetrated through the base of the stockpile into the underlying Gila Conglomerate and encountered two feet of organic soil. The geotechnical logs are provided in Appendix B.3 of the Interim Report (Appendix I). Geologic logs prepared by Tyrone are provided in Appendix B.4. Nineteen samples were collected and subjected to sieve analysis (ASTM C117/C136), hydrometer analysis (ASTM D422) and Atterberg Limits determination (ASTM D-4318). The laboratory test results are provided in Appendix C.5 of the Interim Report (Appendix I) and are summarized in Table IV-1 of Appendix IV.

2.5 Materials Characterization Studies

EnviroGroup (2005) summarized materials characterization studies completed on the leached ore and waste rock stockpiles at the Tyrone mine to fulfil the requirements of the Condition 80 of DP-1341.

Golder reviewed stockpile cross sections prepared by EnviroGroup (formally Greystone) from historical mine maps to determine the year that various stockpiles were placed, and the mineral assemblages placed in the stockpiles. An abbreviated compilation of the compositional model cross sections is provided in Appendix II. Cross sections that have been included in Appendix II were selected to show the test pit and borehole locations which have been projected into the cross sections. The complete compositional model cross-sections were provided in EnviroGroup (2005). We have not use updated compositional models for this stability update as the drilling and sampling occurred on the older stockpile surfaces. The compositional models are based on a mineral assemblage (MA) classification system applied by Tyrone geologists that is summarized in Table 1.

Table 1: Tyrone Mineral Assemblage Classifications

Mineral Assemblage	Description
MA-0	Gila Conglomerate
MA-1	Leach Capping
MA-2	Oxide Copper
MA-3	Mixed Oxide and Chalcocite
MA-4	Chalcocite and Pyrite
MA-5	Mixed Chalcocite and Chalcopyrite
MA-6	Chalcopyrite and Pyrite
MA-7	Mixed Oxide and Chalcopyrite
MA-8	Native Copper and Cuprite

Table IV-1 in Appendix IV summarizes the sample locations, the age, and depth in the stockpiles. A characterization of mineral assemblage type in each stockpile was provided in Appendix E of the Preliminary Materials Characterization Report (DBS&A, 1997a) and the Supplemental Materials Characterization Report (DBS&A, 1997b). Those reports also include pit development maps, plan view stockpile distribution maps, and stockpile development cross sections. This information was use for determination of the placement history of each stockpile.

The materials near the base of the 1A Leach stockpile have been subjected to leaching for the longest duration of any of the stockpiles at Tyrone.

2.6 2006 Stability Memorandums

Golder prepared a number of stockpile stability reports in 2006 and 2007 for the stockpiles at Tyrone to provide an assessment of the stability of the stockpiles for the CDQAPs for stockpile reclamation and to address supplemental stability analyses requirements of Condition 78 of DP-1341. Stockpile names have been revised since the creation of these reports, and original names are used to reference these old reports for clarity.

Reports prepared included:

- Reclaimed 1 Stockpile (1 Leach)
- Reclaimed 1C Stockpile and 7A Waste Stability Analysis, dated May 4, 2006
- 1A Leach and 1B Leach Stockpiles Stability Analyses, dated July 14, 2006

- 2A Leach – 2B Waste Stockpile Stability Analysis, dated April 6, 2007
- 3A Leach Stockpile Stability Analysis, dated April 6, 2007
- 4C Leach Stockpile Stability Analysis, dated May 11, 2007
- 5A Waste Stockpile Stability Analyses, dated May 11, 2007
- Stability of Interior and In-Pit Stockpiles (1A Leach-1B Leach, 2B Waste, 2C Leach, 5A Waste, 3B Waste, 7B Leach, 8C Leach), dated May 11, 2007
- Addendum to the 1A and 1B Stockpile Stability Analysis, dated September 15, 2008

In addition to these reports, several State comment letters and response to comments letters were issued including:

- Response to NMED Comments Dated May 11, 2007, Conditional Approval, 3A Stability Analysis, dated June 18, 2007
- Response to NMED Comments Dated May 11, 2007 Conditional Approval No, 2A-2B Stockpile Stability Analysis, dated June 18, 2007

2.7 9A Waste and 9AX Waste Test Pit Investigation

Placement of waste rock at the 9A Waste and 9AX Waste stockpiles began after completion of the previous stockpile stability analyses. Two test pits were completed in December 2018 at the 9A Waste and 9AX Waste stockpiles to support this CCP update. Samples were analyzed for grain size, Atterberg limits, and a direct shear test was completed on a composite sample from the two test pits. The laboratory test results are provided in Appendix III. The sample locations are shown on Figure 5.

3.0 SITE CONDITIONS

3.1 Stockpile Descriptions

The current mode of open pit mining began in 1967 and waste rock stockpile placement began at that time. The Tyrone Stockpiles are generally situated near and within the Main, Gettysburg, Valencia, Little Rock, and other mine pits. The Reclaimed 1 Leach stockpile is located approximately one-mile east of the Main Pit. Reclamation of that stockpile is complete, and the stability is not addressed in this report. The stockpile crest elevations of the mine area stockpiles are generally between 6,200 and 6,700 feet and the stockpiles range in height between 350 to 600 feet from crest to toe. Stockpiles were placed at angle-of-repose with occasional setbacks resulting in overall slopes typically between 30° and 35°. The stockpiles were generally constructed by end dumping the materials in 30 to 50-foot lifts from the bottom up.

Limited leaching operations began in 1972, coincident with the opening of the precipitation plant. Mine-wide leaching operations began in 1984 after the commissioning of the solution extraction electrowinning (SX-EW) plant.

The following stockpiles which are designated on Figure 1, comprise the Tyrone Stockpile system addressed in this report. For naming consistency, only the current stockpile names are listed below.

- 1A Leach, 1B Leach, and Reclaimed 1C Waste

- 2A Leach and 2B Waste
- 3A Leach and 3B Waste
- 2 Leach (Areas 1 and 2), San Salvador Waste Backfill, and 7B Leach
- 7B Waste (South Rim Pit)
- 5A Waste
- 6B Leach and 6D Leach
- Reclaimed 7A Waste
- 9A Waste and 9AX Waste
- West In-Pit Waste Stockpile (at Little Rock)
- North In-Pit Waste Stockpile (at Little Rock)

Cross sections from the compositional model (Appendix II) located near drill hole and other sampling points are included in Appendix II.

Figures 1 through 6 illustrate the existing topography with the planned final reclamation grading of the stockpiles, overlain on the bedrock geology map. Cross sections on Figures 7 through 9 show the final reclaimed ground surfaces with the original ground surface and underlying geology.

3.2 Climate

The Tyrone Mine area is in a semi-arid region with elevations ranging from about 5,800 to 6,300 feet above mean sea level (amsl). The climate is warm and dry with mean annual precipitation of about 16 inches and a mean annual temperature near 50° F (Golder, 2007g). Precipitation falls mainly as rain, but snow may occur from November to March. Most precipitation falls during monsoon period from July through October in the form of short intense thunderstorms. About 60% of the precipitation falls during the monsoon. Annual evaporation greatly exceeds annual precipitation.

3.3 Geology

The geologic base map shown on Figures 1 through 6 was prepared by Golder (2007g) from a variety of sources that are listed on Figure 1. The mining district is in the northwest-striking Burro Mountain uplift. The mineralization is in and around the Quartz Monzonite of Tyrone (Tqm) stock, a 53 to 57 million-year-old Paleocene quartz monzonite porphyry (DuHamel et al., 1995) emplaced into the Precambrian Burro Mountain Granite (pCg). Paleozoic strata that are present north and east of Silver City and Cretaceous units present elsewhere in the Burro Mountains are not present in the Tyrone Mine area. Miocene-Pliocene-Pleistocene fan, sheet flood deposits, and older fan deposits (Qfo/Qtg), which includes the Gila Conglomerate (also referred to locally as the Mangas Conglomerate) are in direct contact with the crystalline basement rocks.

3.3.1 Lithology

The distribution of the lithologic units is shown on Figure 1. The bedrock units that are present below the Tyrone stockpiles include the Precambrian-age Burro Mountain Granite, containing dikes of quartz monzonite, rhyolite and diabase. The Burro Mountain Granite is described by Paige (1922) as a light-gray, medium grained, granular granite containing 20-40% perthitic microcline, 30-50% sodic oligoclase, 30-38% quartz and 2% biotite.

The Burro Mountain Granite is intruded by the Paleocene Quartz Monzonite of Tyrone. The quartz monzonite is a very light gray to pinkish-gray, medium-grained, granular rock containing 15% orthoclase, 60% oligoclase 20% quartz 4% biotite. The quartz monzonite is locally porphyritic.

The Pliocene-Pleistocene Gila Conglomerate (Qfo/QTg) is present around the margins of the crystalline basement exposed in the Burro Mountain uplift. The Gila Conglomerate is a well-consolidated basin fill and fan deposit ranging from sand to conglomerate. It is often cemented by caliche. Where exposed in the east wall of the main pit it forms steep bench slopes and maintains stable 50° slope angles.

The Mangas Conglomerate and Gila Conglomerate have been used interchangeably by various workers. Over most of the mine area where these units occur, Tyrone identifies the Upper and Lower Mangas units and assigns them a late Tertiary to Quaternary age. Hedlund identified Gila Conglomerate only in localized exposures northeast of the mine area, while he mapped the majority of the cemented alluvium and conglomerate in and adjacent to the mine area as older fanglomerate deposits (Qfo), Hedlund reports the Qfo as being derived from the underlying Gila Conglomerate. Where Hedlund mapped Qfo, others have mapped the Upper and Lower Mangas Conglomerate.

Griffin (2001) described the Lower Mangas as sediments eroded from the Big Burro Mountains and Silver City Range that were deposited in a graben system during the late Neogene. The Upper Mangas fan deposits were formed upon reactivation of basin and range faults which bisected the older graben forming the Mangas half-graben as described by Griffin.

Younger alluvium (Qa) is present along alluvial valleys in Brick Kiln Wash, Oak Grove Wash, Niagara Wash, and Mangas Wash and their tributaries. The alluvium is typically a relatively loose to compact sand to clayey sand. Local occurrences of Quaternary Fan (Qf) and Talus (Qt) are included in the Qa unit.

3.3.2 Structure

The main fault systems in the Tyrone Mine area trend northwest and northeast and are shown on Figure 1. The main northwest trending faults include the Mangas and Townsite Faults. Northeast trending faults include the West Main, Gettysburg Entry, Crusher, and San Salvador Faults. The northwest trending Mangas Fault is southwest dipping normal fault that has preserved a wedge of the Gila Conglomerate in the down-dropped block, being thickest at the fault and thinning to the southwest.

3.3.3 Alteration

Porphyry copper mineralization is related to the intrusion of the quartz monzonite with phyllic, propyllitic, and argillic primary alteration zoned around the intrusion. The primary alteration is overprinted by supergene alteration and secondary copper enrichment.

Sericite is the most abundant hydrothermal alteration product, Intensive kaolinization appears to have obliterated hypogene clay minerals in the higher levels of the ore body. Propyllitic alteration has been observed at the periphery of the deposit in the Gettysburg area. Argillization occurs in the southeast corner of the Racket area but appears localized. Silicification is prevalent in the granite -quartz monzonite contact zone. A zone of clay may be present at the base of the enrichment zone (Kolessar, 1982). The crystalline bedrock units are generally competent, brittle rock units

4.0 TEST DATA

4.1 Field Testing Data

Point load testing was performed on stockpile rock fragments during the test pit program carried out for the 2000 Closure/Closeout Addendum and the results were contained in Appendix B.2 of that report (Golder, 2000). Approximately 10 tests were performed at each of the 14 test pits. The point load index was multiplied by a typical conversion factor of 24 (ASTM, 2016) to estimate the uniaxial compressive strength (UCS). The averaged values from each test pit ranged from a UCS of 4,621 pounds per square inch (psi) corresponding to a medium strong rock according to the International Society for Rock Mechanics (ISRM, 1985) to 22,481 psi which corresponds to a very strong rock.

Field nuclear density testing was also performed during the 2000 program. Three tests were completed at each test pit and the density values for test pits completed on each stockpile were average. The average moist density ranged from 123.4 pounds per cubic foot (pcf) to 133.8 pcf and moisture contents ranged from 4.4% to 6.7%.

4.2 Laboratory Testing Data

The laboratory testing data collected from the previous stockpile stability assessments as well as the 2018 9AX Waste test pit program, are compiled on Table IV-1 in Appendix IV.

4.2.1 Grain Size

Grain size data is available from a total of 81 stockpile samples that have been collected during the various stockpile stability assessments described in Section 2.0. These include 18 waste rock samples and 63 leached ore samples. Hydrometer analyses were completed for 60 of the samples providing size gradation data for the fines fraction (<0.075 mm) to 1.4 microns.

Figures IV-1 and IV-2 in Appendix IV plot the grain size distribution for leach and waste stockpile material, respectively. The curves on the figures are for reference to compare the gradation of the leach and waste materials. The leach material has a larger percentage of test results above the reference line indicating the leach material is generally finer grained than the waste material. Although, the waste material generally falls within the size gradation range of the leach material.

Figures IV-3 and IV-4, in Appendix IV, plot the variations in the percent fines (<0.075 mm) and percent sand plus fines (<9.5 mm) respectively as a function of depth. Leach and waste materials are distinguished by different symbols. Linear trend lines are included. The results show no recognizable systematic trend in the grain size with the depth in the heap. Depth in the heap is also a relative measure of the time since placement.

4.2.1.1 Extended Grain Size Curves

The distribution of the various-sized particles plays a significant role in determining the physical properties of stockpiles. The strength of a soil with oversized particles may be characterized by the strength of the matrix material if the oversized particles are in a floating state. Conversely, the strength of the soil may be characterized by the properties of the oversized material if there is sufficient oversized particle to particle contact. The strength properties of a soil having less than 40% oversized material are controlled primarily by the soil matrix and that the strength properties of a soil with more than 65% oversized material is controlled primarily by the properties of the oversized material. The strength properties of soils having between 40% and 65% oversized material are influenced by both the soil matrix and the oversized material (Fragaszy, et al. 1992).

For the purposes of assessing the strength of a rockfill material and the influence of the oversize fraction, the oversize fraction is defined as the size larger than that included in laboratory testing apparatus. Triaxial testing was performed on materials finer than ¾ inch. The large-scale direct shear tests were performed on the minus 1-inch fraction. The percentages of the fragments larger than 3-inches (cobbles and boulders) were visually estimated from test pits completed in the re-mined leach stockpiles that were mapped in 2001 and the 1C Waste Stockpile in 2004. The logs from the mapping are included in Appendix A-2 and A-3 of the Interim Report included as Appendix I of the current report.

Extended grain size curves were prepared that shift the laboratory plots and include the greater than 3-inch fraction. The extended grain size curves for the leach ore and waste material are provided in Figures IV-5 and IV-6, respectively, in Appendix IV. Strength tests on leach ore samples were done entirely using the triaxial cell.

Four out of five of the strength tests performed on the waste material were done in the shear box. Therefore, oversize fraction for leach ore is >3/4 inch and for waste rock it is >1 inch. Estimates of the oversize fraction for the sonic boreholes are considered less reliable because of the relatively small diameter of the sonic core compared to the grain size of the stockpile and were not included in the extended grain size plots.

The oversize fraction was estimated to generally fall in the transitional range with 40% to 65% larger than the matrix size, i.e. <¾ inch or <1 inch for the leach ore and waste rock material. Therefore, the laboratory shear strength tests results from of the stockpile matrix is considered to underestimate the actual stockpile shear strength.

4.2.2 Atterberg Limits

Atterberg limits testing was performed on all 81 of the stockpile samples. Atterberg limits testing is performed on the <0.425 mm size fraction and is used to assess the plasticity of the soil. More plastic soils are composed of higher percentage of clay minerals and/or more active clay minerals. Clay minerals adsorb water into their mineral structure and more active clays (e.g. montmorillonite) can adsorb more water than less active clays (e.g. kaolinite). Soils with higher percentages of clay or active clays tend to have lower shear strengths.

The average plasticity index (PI) of the leach material is 13 with a standard deviation of 4, indicating fairly consistent PI values. Waste materials have a slightly higher average plasticity index value of 16 with a standard deviation of 2. These results suggest that leaching stockpiles has not caused the formation of clay or more active clay minerals which might cause an associated reduction in the shear strength.

Figure IV-7 in Appendix IV shows the variably of the PI as a function of depth (age). No recognizable systematic trend in the PI with depth in the stockpiles is evident.

The activity of a clay mineral is taken as the PI divided by the percentage of the clay size fraction (i.e. <2 micron). Activity has been used for engineering property correlations especially for inactive and active clays. Higher activities are indicative of more active clay minerals.

Figure IV-8 plots the clay activity with respect to depth with different symbols used for leach and waste samples. There is no tendency for higher activities for leach materials or with increase in depth (age) of the stockpile material, also suggesting that leaching or weathering in acid conditions does not lead to formation of more active clay minerals that might lead to a reduction in the shear strength of the stockpile materials.

4.2.3 Shear Strength

A total of 11 laboratory shear strength tests have been completed during the course of the various stockpile assessments. As discussed previously, seven tests were completed in a four-inch diameter triaxial cell and four were done in a 6-inch shear box. Six strength tests were completed on leach ore material and five strength tests were done on waste material. Each test method has advantages and disadvantages. The direct shear tests can accommodate larger size fragments and can be carried out to larger displacements. The triaxial tests better model higher confinement stresses. All six tests on leach ore material were triaxial tests. Four of the five tests on waste rock were direct shear tests. The shear strength test results are provided in Table 2 below. The Mohr-Coulomb (M-C) parameters friction angle (ϕ) and, cohesion (c) for the triaxial tests are reported at 5% strain. The direct shear test results reported in Table 2 are residual, large displacement, results. The laboratory reports from SGI (Appendix D-3 of the Interim Report included as Appendix I of this report) do not specify the amount of displacement that occurred at the reported residual strength, although the Golder direct shear test laboratory reports in Appendix III were run to a 20% strain and the SGI tests were likely run to that amount of displacement as well. The tested samples do not exhibit brittle behavior and the large-strain residual strengths are close to the peak strength.

Triaxial tests were performed in a 4-inch diameter cell on remolded samples that were scalped of material larger than ¾ inch. Samples were remolded to a dry density of generally between 120 and 125 pcf. Triaxial tests were performed under consolidated, undrained conditions with pore pressure measurements at confining loads of 25 to 100 psi simulating failure surface depths of 27 to 110 feet.

The direct shear tests were performed on remolded samples that were scalped of material larger than 1-inch. The material was nominally compacted and tested under inundated conditions and were allowed to consolidate at each normal load. Tests were done at normal loads of 40, 100, and 300 psi simulating failure surface depths of approximately 45 to 325 feet.

The direct shear test results from primarily waste rock samples shows considerable curvilinear strength envelop shape and were performed to a higher confining load compared to the triaxial tests. Therefore, the resulting linear M-C fit to the curvilinear envelopes for waste rock samples has lower ϕ angles and higher c values than the triaxial test results performed on leach ore samples.

Table 2: Laboratory Shear Strength Test Results

Sample Number	Stockpile[1]	Year Placed	Depth (ft)	Soil Classification	Method	Effective Friction Angle (ϕ°)	Effective Cohesion (c [psi])
GTP-03/02	5A Waste	1998	10	SC	Triaxial	34.6	5.8
GTP-06/03	2A Leach	1998	10	GP-GC	Triaxial	32.8	8.3
TYTP1-2	Copper Mtn. Leach	1978	400	GW-GC	Triaxial	36.2	0.6
TYTP1-4	Copper Mtn. Leach	1986	100	GC	Triaxial	35.5	0.4
TYTP1-7	6A Leach	1989	300	SC	Triaxial	36.9	0.6
TYTP1-9	Gettysburg Waste	1967	40	GC	Triaxial	34.1	2.2

Sample Number	Stockpile[1]	Year Placed	Depth (ft)	Soil Classification	Method	Effective Friction Angle (ϕ°)	Effective Cohesion (c [psi])
TSGT-4	2A Leach	1973	265	SM	Triaxial	38.4	0
GA04-TY-1	Reclaimed 1C Waste	1998	50	GC	DS	31.0	10.4
GA04-TY-5	Reclaimed 1C Waste	1978	250	GC	DS	32.0	11.8
GA04-TY-8	Reclaimed 1C Waste	1978	150	GC	DS	29.0	8.8
TY18-01/02	9A Waste, 9AX Waste	2017	10	GW-GC	DS	28.1	20.5
Average Leach Material						35.65	2.02
Average Waste Material						30.9	11.5

Notes:

1 - Stockpile names presented in this table are those used in the previous sampling efforts and associated reports and may not reflect the current stockpile names presented in the CCP Update.

4.3 Summary of the Impacts of Weathering

Condition 78 required an evaluation of the changes in the stockpile strength parameters and long-term stability resulting from the natural weathering processes. Key attributes that can affect the strength of stockpile materials include the gradation, durability (i.e. resistance to degradation over time), strength of rock fragments, fines content, clay content, and density (Hawley and Cunning, 2017). A well-graded soil gradation improves stockpile shear strength. The strength, angularity and durability of the rock fragments also tends to increase the shear strength. High fines and clay content tend to reduce rockfill strength. Potential causes of reductions in the shear strength over time due to weathering include weakening of inter-mineral bonds resulting in the physical breakdown of rock fragments and reduction of the oversize fraction, increase in the clay content or formation of more active clay minerals, and increase in the fines fraction. Potential causes of increases in the shear strength of stockpiles over time include settlement and increase in the density and cementation.

The assessment of the long-term impacts of chemical weathering were addressed by the Supplemental Materials Characterization study prepared by EnviroGroup (2005). The effects of stockpile weathering and leaching were investigated by examination of the material characteristic trends as a function of age, roughly translated as depth in the stockpiles. Trends in pH, acid-base potential, pyritic fraction, sulphate fraction, and meteoritic water mobility procedure extract parameters; acidity, Al, Cu, Fe, and SO4 were plotted as functions of stockpile age. The pyritic sulfur fraction diminished with age of the stockpile material indicating that pyrite is reacting in the stockpiles and is being depleted as they age. No other distinct trends in these parameters could be discerned as a function of age.

X-ray diffraction studies by Envirogroup showed there is a weak trend for muscovite and kaolinite to increase as feldspar decreases and the abundance of these minerals appears to be controlled by the degree of hydrothermal alteration that occurred during the time of mineralization rather due to changes after placement in the stockpile. Muscovite (illite) is formed under conditions of hydrothermal alteration and is not a product of stockpile weathering and leaching. Kaolinite can form under weathering conditions, but the downhole trends seen in the boreholes did not appear to be related to progressive weathering of the stockpile materials.

The depth trends with respect to amorphous clay, goethite, jarosite and pyrite were also evaluated by EnviroGroup. The amorphous clay in the stockpile samples was compared to the age (depth) and there was no evidence for a correlation of amorphous clay abundance with pyrite or jarosite content. Furthermore, the amorphous clay content in the waste rock stockpile samples range as high as those found in the leach ore stockpiles. This suggests that acidic conditions and leaching reactions are not resulting in the breakdown of the rock to amorphous clay components.

Golder evaluated the impacts of weathering on the physical parameters of the stockpile materials by evaluating the trends in the grain size, Atterberg limits, and shear strength as functions of depth in the stockpiles. The results presented in this section and the figures in Appendix IV indicate that there is no clear relationship between the fines content, PI, clay activity, or other factors potentially attributable to weathering that might negatively influence the stockpile shear strength with the age or leach history of the stockpiles. The results also do not indicate significant formation of clay minerals, formation of more plastic fines, or more active clay minerals with time or leach history.

The gradation curves in Figures IV-1 and IV-2 in Appendix IV show the leach stockpiles to be more fine-grained which may be the result of chemical weathering resulting in a breakdown in the rock fragment size. However, EnviroGroup have also noted that the finer grained nature of the leach ore compared to the waste rock may result from different blasting parameters that increase fragmentation to enhance ore recovery. Similar studies completed at the Chino mine stockpiles (Golder, 2008b) noted some tendency for the stockpiles to become finer grained with depth and this was attributed to particle crushing, downward migration of fines, and/or chemical weathering in the older (deeper) parts of the stockpiles. However, this tendency is not apparent from the Tyrone data. The Stockpiles at Tyrone are relatively young compared to the Chino stockpiles and the trends may not be as apparent.

Golder has concluded that the soil matrix fraction of leached material or material weathered for long periods of time remains similar in character to the matrix fraction of the less weathered material but may become higher in proportion due to the physical breakdown of the rock fragments. The fact that the PI and clay activity values are indistinguishable for leached and unleached material and for material that has been placed in the stockpiles for longer and shorter periods of time suggest that the process of weathering does not lead to the formation of additional clay fraction or more active clay minerals.

Both the waste rock and leach ore stockpiles have historically been stable and no significant stockpile failures have occurred to our knowledge. We are also not aware of the occurrence of instability developing in stockpiles at any of the porphyry copper mines in the southwest USA after long periods due to weathering and reduction in the shear strength over time.

5.0 DEVELOPMENT OF MODEL PARAMETERS

5.1 Summary of Material Parameters Applied in the Stability Analyses

Table 3 summarizes the material parameters applied in the stability analyses. The basis for the development of these parameters is described in the following sections.

Table 3: Summary of Material Parameters

Material	Strength Model	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	ϕ (°)	c (psi)
Leached Ore	M-C	125	138	35.5	2.0
Waste Rock	M-C	125	138	30.9	11.5
Alluvium	M-C	125	138	29.0	0
Liquified Alluvium	M-C	125	138	8.0	0
Gila Conglomerate	M-C	125	138	35	6.94
Quartz Monzonite	M-C	160	160	43	669
Precambrian Granite	M-C	160	160	35	340

5.2 Material Parameters for Leach Ore and Waste Rock Stockpiles

The results of the laboratory testing and geotechnical logging indicate that the leach ore and waste stockpile materials generally classify as clayey gravels (GC) or clayey sand (SC) with occasional poorly graded gravel with clay and sand. The soil has a low to moderate plasticity with PI values generally between 10 and 20. The oversize fraction varies considerably, comprising 10% to 50% of the material. There is no recognized differentiation in the soil classifications, PI, or oversize fraction between the leached materials and waste rock.

Leps (1970) published the results of large-diameter triaxial testing, capable of including particles up to 8-inch diameter, on 15 different rockfill materials that represent a range of grain size distributions, particle strength, and density.

Leps identified a range of rockfill material strength envelopes depending on the density, gradation, shape, and intact strength of the particles and provided curvilinear envelopes representing Strong Rockfill, Average Rockfill, and Weak Rockfill. These curves are often applied to assist in the selection of rockfill strengths for the design of rockfill structures and stockpiles. The laboratory strength test data from the Tyrone stockpiles are plotted on normal stress versus shear strength plots on Figures IV-10 and IV-11 in Appendix IV for leach ore and waste rock, respectively. These results are compared to curves for Weak, Average, and Strong rock fill provided by Leps (1970). The leach ore samples plot close to the average Lep’s strength and the waste rock generally falls between weak and average Lep’s strength.

The grain size distribution data and soil classifications for the stockpile samples show the material is generally well graded. The major components of the stockpiles are blasted, competent bedrock units that form strong angular fragments with limited fines content. The Gila Conglomerate, placed mainly on waste rock piles, has rounded fragments and higher fines content. The 5A Waste stockpile is primarily composed of Gila Conglomerate. Leaching and wetting of the leach ore stockpiles is expected to have induced settlement of the stockpiles and the leach ore stockpiles are likely in a more-dense state than the waste rock stockpiles. As discussed in Section 4.3, neither the waste rock or the leach ore stockpiles are predicted to develop higher clay contents or generate more active clay minerals that would cause a reduction in the shear strength over time due to long-term weathering. Therefore, it is reasonable that the waste rock stockpiles would have lower shear strengths compared to the leach ore stockpiles.

The laboratory-derived Mohr-Coulomb shear strengths of the stockpile samples range from $\phi = 29.0°$ and $c = 8.8$ psi to $\phi = 38.4°$ with $c = 0.0$ psi cohesion. The shear strength results were summarized in Table 2. The average Mohr-Coulomb strength parameters for leach ore are $\phi = 35.5°$ and $c = 2.0$ psi. The average strength parameters for the waste rock are $\phi = 30.9°$ and $c = 11.5$ psi.

Due to the limitation of particle size in the test apparatus (i.e., ¾-inch for triaxial cell and 1-inch for direct shear box) the impact of the larger size fragments is not included in the laboratory-derived shear strength estimates.

As discussed in Section 4.2.1.1, the boundaries provided on Figures IV-5 and IV-6 in Appendix IV between oversized controlled shear strength, matrix-controlled strength, and transitional behavior indicate the stockpiles are generally in the transitional region and the laboratory-derived shear strengths do not account for the influence the oversize fragments have on the shear strength of the stockpile materials.

Soil strengths assessed from the laboratory testing of remolded samples reflect the matrix strength without influence from the oversize fraction or from the in-situ cohesion resulting from cementation (e.g., gypsum precipitates). The shear strength values derived from the soil matrix are considered to reflect the fully weathered strength of the stockpile materials.

The use of effective stress (as opposed to total stress) strength parameters for stockpile materials is appropriate based on the unsaturated condition of the stockpiles and the granular nature of the stockpile materials. The average apparent cohesion, resulting from the linear best fit to the curvilinear strength envelope in the stress range under consideration has been applied. Cohesion due to cementation by sulphate and other minerals formed in the stockpile has been disregarded. The presence of sulphate minerals in the stockpiles derived from weathering after placement is documented in EnviroGroup (2005). The presence of cohesion from cementation is also evidenced by excavations into the re-mined 1C Waste stockpile material (Golder, 2005) that stood at near vertical slope angles and remained stable for years. The application of a stockpile shear strength represented by the average of the laboratory strength tests completed on remolded samples i.e. without the cementation from sulphate minerals or the influence of oversize fraction provides a reasonable estimate of the long-term, weathered stockpile strength. These strengths fall within the general range of average to weak Leps rockfill strengths showing the laboratory test results are in the expected range.

A M-C shear strength represented by an effective stress $\phi = 35.5°$ and $c = 2.0$ psi, corresponding to the average of all triaxial and direct shear test results completed on leach ore samples has been applied for the weathered strength of the leach ore stockpiles.

The waste rock stockpiles are assigned a strength represented by an effective stress ϕ = 30.9° and c = 11.5 psi corresponding to the average values from laboratory strength testing of waste stockpile samples.

Unit weight information collected and reported in the CCP Addendum (Golder, 2000) from nuclear density testing from stockpile surfaces was used as a basis for the selection of unit weight. The measured densities from the stockpile surfaces were likely affected by compaction by haul traffic but do not reflect compaction by burial in the stockpile. The range in variability of the test results from a stockpile are as variable as the results from all stockpiles and there is little basis to apply different values for different stockpiles. The design basis moist unit weight selected for the stockpiles is 125 pcf and the saturated unit weight is 138 pcf.

5.3 Material Parameters for Stockpile Foundations

Bedrock units underlying the Tyrone stockpiles are Precambrian Burro Mountain Granite and Paleocene Quartz Monzonite of Tyrone. Gila Conglomerate overlies the crystalline basement rocks along the east and north sides of the mine complex. There is no evidence that a weak interface is present at the base of the stockpiles. Alluvium is present in the Oak Grove, Brick Kiln, Niagara, Mangas, and Deadman Washes and their tributaries.

Two of the sonic boreholes (TSGT4, S1A Leach-3) were interpreted to have penetrated the base of the 2A Leach and 1A Leach stockpiles respectively. There was no evidence of a zone of clay soil or highly weathered weak interface at the base of the 2A Leach stockpile, underlain by Precambrian Granite. A thin 2-foot zone of organic soil layer was encountered at the base of the 1A Leach stockpile above the Gila Conglomerate. A triaxial test was take from the interface zone at the base of the 2A Leach stockpile that yielded a M-C strength of $\phi = 38.4°$ and c = 0 psi, higher than the average strength of the stockpile materials. Therefore, a weak basal zone has not been included in the cross-sectional models of the stockpiles.

The following sections describe the data available and applied to the development of engineering parameters for the foundation units.

5.3.1 Precambrian Granite

Precambrian Granite underlies the foundation of stockpiles in the northern portion of the mine area (Figure 1). CNI (1982) used uniaxial compression and Brazilian disk tests to estimate the intact strength of mine area granitic rocks for pit slope stability studies. Minimum reported estimates for intact bedrock cohesion and internal friction angle are c = 669 psi and ϕ = 43.4°, respectively. Strength testing along fractures resulted in ϕ = 26° to 28° and an apparent c = 13 psi to 16 psi. Applying the intact strength listed above, a fracture strength of ϕ = 26° and 16 psi cohesion, and assuming that failure surfaces involve 50% intact material with the remainder following pre-existing fractures, CNI estimated a M-C strength of $\phi = 35.6°$ and c = 340 psi for the Precambrian Granite. For the stockpile stability analyses, the strength of the Precambrian Granite bedrock has been assigned a M-C strength $\phi = 35.0°$ and c = 340 psi.

Soils developed on the surface of the Precambrian Granite are shallow and gravelly.

5.3.2 Monzonite

CNI (1982) reported strengths for the Quartz Monzonite unit. The minimum reported M-C strength parameters are $\phi = 43°$ and c = 669 psi and this value has been applied for the foundation strength.

Soils developed on the surface of the Quartz Monzonite are similarly shallow and gravelly.

5.3.3 Gila Conglomerate

CNI (1982) reported a peak shear strength of ϕ = 40.89° from large-scale, direct shear testing of disturbed samples of Gila Conglomerate. MWH applied a strength of ϕ = 35, c = 6.94 psi (1,000 pcf). We have applied the strength parameters applied by MWH and moist and saturated unit weights of 120 pcf and 133 pcf respectively to the QTg in the stability analyses.

5.3.4 Quaternary Alluvium

Golder tested two samples of alluvium recovered from the 3A Leach Stockpile seepage collection area from Boreholes 11-9 and 10-4 using staged consolidated, undrained (CU) triaxial tests (Golder, 2007b). Triaxial test specimens were remolded to field-measured in-situ density and moisture content. Effective ϕ = 38.8° and 37.5° were measured in staged CU triaxial tests. These were performed at confining pressures of 40 to 125 psi.

Several geotechnical drilling programs have been completed in the toe area of the stockpiles that yielded information on Quaternary alluvium including standard penetration testing (SPT) blow count data. These programs include:

- 1B Leach Collection System Relocation
- 1C Waste Toe Investigation, January 2005
- 3A Leach Soil Boring Investigation for PLS Catchments in Canyons 7 through 11, July 2006

The soils encountered in areas designated as Alluvium were typically classified silty to gravelly sand or poorly graded sand and are generally less than 30 feet thick.

A standard correlation between corrected blow count values to the relative density and friction angle of sands is provided in Table 4 (Das, 1985).

Table 4: Correlation of SPT Blow Counts to Compactness and Friction Angle

Corrected Standard Penetration Number	Compactness	ϕ (°)
0 - 5	Very Loose	26 – 30
5 - 10	Loose	28 – 35
10 - 30	Compact	35 – 42
30 – 50	Dense	38 - 46
>50	Very Dense	38 – 46

The boring logs with measured SPT blow counts and tables with the corrected blow counts are included in Appendix V. Based on the corrected blow count results, the alluvium encountered generally classifies as compact to dense. Lower blow count values reported in the 1B Leach stockpile toe area (Appendix V-1) were related to soft fill (i.e. sediment pond accumulations). As-built documentation shows that those soft fill deposits were removed and replaced with compacted fill. The corresponding ϕ angle for compact to dense cohesionless soils can be expected to range from 35° to 42° based on empirical values reported by Das (1985). However, these correlations are for clean sands and the presence of silts and fines will lower the shear strength.

For the analysis of the stability of stockpiles the alluvium has been assigned a Mohr-Coulomb strength of $\phi = 29°$ and c = 0 which is considered conservative based on the results of the SPT testing and laboratory testing information.

Moist and saturated unit weights of 125 pcf and 138 pcf, respectively, have been assumed for the alluvium.

Where saturated alluvium is present below the toe of the stockpiles and available standard penetration test (SPT) blow count data yields factors of safety against liquefaction of less than approximately 1.3 (see Section 6.3), the stability of the stockpiles is evaluated applying liquified strength parameters to the zone of saturated alluvium. Vaid and Thomas (1994) found that the residual strength of loose clean sand samples subjected to extension tests ranged from 0.1 to 0.18 times the effective overburden stress ($\sigma_{vo'}$). This is approximately equivalent to an internal friction angle of 5° to 11°. For the analysis of the stability with liquefied alluvium, the zones of alluvium below the modelled seasonal average groundwater table (discussed in Section 5.4.2) were assigned an internal friction angle of 8° representative of a residual, post-liquefaction shear strength. The liquefied stability analyses were performed applying pseudo-static loading conditions.

5.4 Hydrogeologic Conditions

5.4.1 Stockpile Moisture Conditions

Information regarding moisture conditions in the stockpiles at Tyrone is available from downhole geophysical logging in sonic drill holes completed in the 3A Leach, 6B Leach and the 5A Waste stockpiles, and gravimetric moisture content testing in the 1A Leach stockpile. Conditions within 3A Leach, 5A Waste, 6B Leach, and 1A Leach stockpiles are considered to be indicative of conditions in waste rock and leached ore stockpiles in general.

The 3A Leach stockpile was under active leaching at the time of geophysical logging. Logging results (EnviroGroup, 2005a) from sonic borehole TSGT-1 indicate a volumetric moisture content between 3 and 19 percent (ft^3/ft^3), averaging approximately 12%. Applying a dry unit weight of 114 pcf, this represents an average gravimetric moisture content of 1.6 to 10 percent (lbs/lb), averaging approximately 6.6 percent. Applying a specific gravity of soil solids of 2.765 (the average from available laboratory testing), saturated conditions would occur at a gravimetric moisture content of 19 percent. Geophysical logging in drill hole TBGC-6 in the 6B Leach stockpile indicated an average gravimetric moisture content of approximately 5 percent, applying the same criteria as described above, and ranged from 2 percent to 7.5 percent. The results from the 6B Leach stockpile also indicate drained conditions. Although the dry unit weight applied in these conversions are assumed values, consideration of a range reasonable dry unit weights indicates that the measured moisture contents from geophysical logs are generally below saturation levels and generally unsaturated conditions are indicated, even while under leach.

Geophysical logging conducted in drill hole TSGT-3 in the 5A Waste stockpile indicates a volumetric moisture content of 2 to 15 percent. These are approximately equivalent to gravimetric moisture contents of 1 to 7 percent and indicate that the waste stockpiles can be considered to be unsaturated.

Moisture content testing (ASTM D2216) of rotosonic borehole samples collected in October 2005 and reported in Appendix C-5 of the Interim Report (Appendix I) from the 1A Leach stockpile indicated gravimetric moisture contents ranging from 4.3 to 22.5 percent (a high clay content sample), averaging 10.1 percent. Stockpile material properties are expected to vary; however, unsaturated conditions are indicated within the leached ore stockpiles.

The potential for saturation to occur will be lower under post-closure conditions when leaching is terminated and following placement of a soil cover and surface water controls.

Elevated groundwater levels and local groundwater mounds in the stockpiles that would impact stability are not expected because of the drainage capacity of the stockpiles. In particular, the ore stockpiles have previously been leached at rates that exceed 100-year storm rainfall amounts on a daily basis. Saturation and instability did not occur under these conditions. The potential for elevated groundwater levels will be further reduced upon cessation of leaching operations, cover placement, and implementation of surface water management. In the waste rock piles, surface water management measures instituted at reclamation will reduce long term infiltration rates and further reduce the potential for the development of saturated conditions that could impact stability.

These data and conclusions are consistent with EnviroGroup (2005) findings, which indicate that the stockpiles are drained, that moisture content correlates with the grain size of the materials, with sands and gravels having low moisture content and zones with higher clay content having higher retained moisture. Overall, the stockpiles are indicated to be unsaturated.

5.4.2 Perched Alluvial and Regional Bedrock Groundwater Conditions

Groundwater levels applied in the stability models are based on the quarterly sitewide groundwater models provided by Daniel B. Stevens and Associates (DBS&A, 2018). Models are developed for the perched water table present in the alluvium within the East Side Area (Oak Grove Wash) and Deadman Canyon and included in bi-annual reports. Contoured perched water level data is not available for the alluvium in the Mangas and Niagara Wash areas and the perched groundwater levels were determined from individual well data. Site-wide groundwater models are also provided by DBS&A for the deeper regional water table in the mine and stockpile area.

Monitoring well data are available in the east side area, the 3A Leach area, and the Deadman Canyon Wash area from quarterly reporting for the period 2011 to 2018. These were used to define an “Average” (average over the period of record) and a “High” (the average positive deviation from the average water level for the wells in a given area) perched water table condition. The “High” water table condition applied in the liquefaction susceptibility analyses to identify zones where liquified strengths may be applied. The high perched water table levels are between 5.3 to 10.9 m above the average perched water table elevation.

Where water levels were measured in geotechnical boreholes and recorded on the drill logs (e.g. 1B Leach stockpile toe area), these levels were applied for the assessment of the liquefaction potential (Section 6.3). These measured water levels are significantly higher than the current water levels indicated in the quarterly monitoring.

There are a number of interceptor/barrier trenches in the alluvium that affect the perched groundwater levels. Perched models are not available in the 3A Leach stockpile area from the DBS&A quarterly monitoring reports.

The regional water table is in the basement below the stockpiles generally 200 to 500 feet below the stockpiles and is intercepted by the open pits.

5.5 Seismic Coefficient

Accepted geotechnical engineering practice indicates that certain types of embankments such as water retention dams and tailings dams must consider the potential impact of earthquakes on their stability. While there is less agreement among practitioners as to the impact of earthquakes on waste rock dumps and stockpiles, regulatory agencies in some jurisdictions require that earthquake ground motions be explicitly considered in the design of these facilities (Hawley and Cunning, 2017). For example, New Mexico Copper Rule specifies “a stability analysis be conducted for closure and the mine units being closed shall be designed for a factor of safety of 1.1 or greater under pseudo-static analysis and shall include evaluation for static and seismic induced liquefaction”.

A pseudo-static analysis requires selection of the seismic coefficient, which is estimated as a fraction of the horizontal peak ground acceleration (PGA) that the structure is expected to experience for a specified annual exceedance probability (AEP) or its inverse, return period. The PGA AEP value is developed through probabilistic seismic hazard analysis (PSHA). Based on the previous criteria applied for the stockpile stability assessments at Tyrone, an earthquake ground motion with a 2% probability of exceedance in 50 years (i.e., a 2,475-year return period) is applied for the stockpile stability assessment for closure conditions. The PGA at a site may be influenced by the type of soils overlying the bedrock. The stockpiles at Tyrone are predominantly underlain by competent crystalline bedrock (Burro Mountain Granite and Quartz Monzonite of Tyrone). However, the stockpiles located on the east and north sides of the mining complex (i.e., 1A Leach, 1B Leach, Reclaimed 1C Waste, 3A Leach, 3B Waste, 5A Waste, 9A Waste, and 9AX Waste) are in places underlain by Gila Conglomerate.

Previous stability assessments for Tyrone completed in 2006 and 2007 used the PGA with a 2,500- year return period based on a site-specific PSHA completed by URS Corporation (2005). Earthquake ground motion models and seismic hazard estimation methods, however, have been updated several times since the 2005 site-specific seismic hazard study was completed for Tyrone.

Golder has used the United States Geological Survey (USGS) Unified Hazard Tool to identify the site PGA for use in the development of the pseudo-static seismic coefficient (https://earthquake.usgs.gov/hazards/interactive/) and any liquefaction analysis. The USGS Unified Hazard Tool provides PGA and select spectral accelerations for sites from the 2014 US National Seismic Hazard Model (v4.0). For the Tyrone site, Golder used the USGS Unified Hazard Tool to obtain a PGA with a 2% probability of exceedance in 50 years (2,475-year return period) based on the Tyrone site location at 32.657591°North and 108.391275°West.

PGA was calculated, for Burro Mountain Granite and Quart Monzonite, assuming a ground condition equivalent to the ASCE 7-16 soil Site Class B/C boundary or time-averaged shear wave velocity ($V_{S,100}$) of 2,500 feet/second (760 m/s) for the upper 100 ft of the column under the stockpile. The 2,475-year return period PGA obtained from the USGS Unified Hazard Tool is 0.1088 g.

The other areas that are underlain by the Gila Conglomerate, Golder considers the ground conditions beneath these stockpiles are likely equivalent to a soil Site Class C, with 1,200 ft/s $\geq V_{S,100} \leq$ 2,500 ft/s. based on the physical descriptions of the Gila Conglomerate. The 0.1088 g PGA calculated for a soil site Class B/C site was converted to a soil Site Class C (i.e., $V_{S,100}$ of 1,760 ft/s) by applying a 1.3 amplification factor as indicated in ASCE-7 16 Table 11.4.1 for a short period site coefficient with S_S of < 0.5. The resulting site PGA is 0.141 g.

The deaggregation data from the 2014 USGS model is not yet available, so it is not possible at this stage to select directly the dominate earthquake magnitude and distance that contributes the greatest to the 2,475-year return period PGA hazard. For this study, Golder used the deaggregation of the 2008 USGS National model which indicates that a moment magnitude (**M**)6 earthquake at 14 miles (23 km) from the site is the mean magnitude distance earthquake for the 2,475-year return period PGA hazard. There is little difference between the 2008 (0.1079 g) and 2014 (0.1088 g) 2,475-year return period PGA values for the site, so an **M**6 at 23 km can be used to estimate any liquefaction hazard at the site.

The stability analyses of the stockpiles simulate the seismic loading using a pseudo-static coefficient that is applied as a constant horizontal force. Therefore, the pseudo-static coefficient applied in limit equilibrium stability analyses are taken as a fraction of the PGA. Hynes and Franklin (1984) discuss the selection of pseudo-static coefficients for use in dam design and recommend the use of one-half of the peak acceleration with a 20-percent reduction of the shear strength and a target factor of safety of 1.0. Bray et al. (1993) provides recommendations for seismic design of landfills and notes that "the normalized fundamental periods of many solid waste landfills are greater than two-seconds, and that for these cases, the maximum horizontal equivalent acceleration value used to represent the seismic loading will be less than one-half of the bedrock maximum horizontal acceleration." Jansen (1985) states an acceleration of 0.4 to 0.7 times peak ground acceleration is typically suitable for computing the sustained effect of an earthquake on embankment stability.

For stockpiles underlain by Gila Conglomerate, a seismic acceleration equal to two-thirds of the amplified peak ground acceleration (i.e., 0.094) for an event with a 2,500-year return period is appropriate for the pseudo-static analyses of these facilities. We have conservatively retained the same pseudo-static coefficient for stockpiles underlain by Burro Mountain Granite and Quart Monzonite Golder believes this approach to be conservative and consistent with standard industry practice.

6.0 STABILITY ANALYSIS METHOD

Golder used the two-dimensional, limit-equilibrium, method of slices analysis program, Slide version 2018 (RocScience, 2018) for the stability analyses. This program provides for various failure surface types, including circular and non-circular (block), and various failure surface search methods. Slide2018 allows the use of multiple methods of analyses. Golder applied Morgenstern-Price's Method of Slices which satisfies conditions of static horizontal and vertical equilibrium, as well as moment equilibrium.

Analyses considered both circular and block type failure surfaces. Circular failure surface searches were generally used to identify the most critical failure surface (i.e. lowest factor of safety) for failures through the stockpile materials. The circular surfaces also evaluate failures through the stockpile foundation. Block type failures are typically used to identify critical failure surfaces that develop along preferential zones of weakness, such as thin layers of weak alluvium or through liner systems. Where more complex failure modes may occur such as a combination of failure along a weak layer and circular failure through the upper slope, optimized path search methods (Cuckoo method) available in SLIDE2018 are used to identify the most critical failure surface.

The stability analyses cross section output for each analyzed failure mode is included in Appendix VI. The geotechnical units are indicated by colors with the color legend at the front of Appendix VI. The circular failure searches show the limits of the failure searches and the 10 lowest failure surfaces with the factor of safety for the lowest surface reported. Block failure surface search windows shown as red polygons. The perched and regional water table is shown on the stability output as blue lines.

Two-dimensional cross-sectional models were prepared based on pre-mining topography (digitized from early topographic maps), recent aerial surveys, and stockpile reclamation designs prepared by MWH Global (MWH). Stability analyses were performed for the reclaimed stockpile configuration. The geologic units present below the stockpiles is taken from the geological site map.

Stockpiles along the east and south sides of the mine area stockpile complex locally overlie alluvium present in the tributary channels to the Mangas, Brick Kiln, Niagara, and Oak Grove washes. Depths of the alluvium in the foundations shown in the model were based on the conditions encountered by previous geotechnical investigations where available and applying conservative estimates where site specific data is absent. Failure surface searches evaluated overall slope heights and included focused failure surface searches in the toe area where weak foundation materials are present.

The stockpiles were assumed to be fully drained for the closure conditions analyzed. In alluvium deposits, monitoring wells indicate perched water in the alluvium unit. The quarterly perched alluvial groundwater data from monitoring wells described in Section 5.4.2 were the basis for the perched water table levels used in the stability analyses.

In the sections that have alluvium below the perched water level, the potential for liquefaction was evaluated based on methods described in Section 6.3.

6.1 Selection of Critical Cross Sections

One to two sections were selected for the evaluation of the stability of each stockpile. Selection of the most-critical sections was based on the planned closure facility design slope gradient, slope height, subsurface geology, and hydrogeologic conditions. The critical cross section of each stockpile is described in more detail in Section 7.0. The closure stockpile surficial geology and planned closure geometry is shown in Figures 2 through 5 and sections are presented in Figures 6 through 8.

6.2 Loading Conditions

The stability of the reclaimed stockpile configurations was evaluated considering static conditions and pseudo-static loading cases. Based on the level of detail of the investigation and amount of available laboratory testing, use of average long-term shear strengths, targeting factors of safety as defined by Copper rule and DP-1341 have been applied. For the seismic case, Golder evaluated pseudo-static earthquake loading applying a pseudo-static coefficient of 0.094 as discussed in Section 5.5. A factor-of-safety of 1.5 for critical structures and 1.3 for non-critical structures is considered suitable under the Copper rule for static loading and minimum target factors of safety for pseudo-static loading are 1.1 or greater.

6.3 Evaluation of Liquefaction Potential

The potential for liquefaction of zones of saturated alluvium that locally underlie the toe of the stockpile was assessed using the Seed-Idriss Simplified Liquefaction Procedure (Seed and Idriss, 1971), and the various updates to the method (Boulanger and Idriss, 2014), a stress-based approach that compares the earthquake-induced cyclic stress ratios (CSR) with the cyclic resistance ratios (CRR) of the soil to determine a factor of safety against liquefaction. The Gila Conglomerate is considered to be non-liquefiable. The corrected SPT blow count results for all intervals of alluvium below the “High” perched groundwater level (discussed in Section 5.4.2) were used to develop the CRR. Where water levels were measured in geotechnical boreholes and recorded on the drill logs (e.g. 1B Leach stockpile toe area), these levels were applied for the assessment of the liquefaction potential. Otherwise, the water levels from the quarterly monitoring data was applied (Section 5.4.2).

A design earthquake of magnitude 6.7, imparting a peak amplified acceleration of 0.14 g was applied to determine CSR. Samples of alluvium subjected to grain size testing indicate they are granular soils with fines (<#200 sieve) fraction of 16% to 27%. Therefore, calculation of the $CRR_{7.5}$ applied the 10% fines content curve (Boulanger and Idriss, 2014).

Where liquefaction potential is indicated (factors of safety below approximately 1.3), additional stability analyses were performed to evaluate the potential impacts of seismic loading and liquified conditions during and after shaking. Liquefied material strengths as discussed in Section 5.2.4 were applied for the alluvium below the "average" perched water table level as described in Section 5.4.2 using static loading. Use of a "high" water table condition and pseudo-static loading is considered to be overly conservative.

The tabulated SPT data and the liquefaction potential calculations are contained in Appendix V.1 through V.3 with the associated boring logs. Where the SPT tests were above the modeled "high" water table condition the alluvium is considered non-liquefiable. The water levels that are currently being measured in wells near the leach stockpile toes are mainly leach solutions. Water table levels are expected to be further reduced at closure when leaching ceases and the stockpiles are capped and surface water controls are in place. Therefore, the perched water table conditions applied in the assessment of liquefaction are considered conservative.

7.0 STABILITY ANALYSIS RESULTS

The results of the stability analyses provided in this section were based on the parameters and methods described in the preceding sections. All the calculated factors of safety were found to be above the minimum required factor of safety criterion, and the stockpiles are predicted to maintain long-term stability for the planned closure geometries. Table 5 summarizes the minimum factors of safety obtained for each stockpile for static and pseudo-static loading conditions. Where alluvium is present underlying the toe area of the reclaimed stockpiles and SPT blow count data is lacking or indicates some potential for liquefaction exists, the factor of safety assuming liquefied strengths for alluvium below the water table is reported.

The following sections describe the individual stability models prepared for each stockpile, the analyses completed and resulting factors of safety. The factors of safety are provided for each of the failure surface search methods analyzed (e.g. block, circular, path). Output from all stability analysis models are provided in Appendix VI.

Unless otherwise noted the reclaimed slope geometry consists of overall 3.5H to 1V overall slopes consisting of 3H to 1V interbench slopes and benches spaced every 200 feet of slope length.

Table 5: Stability Analysis Results Summary

Stockpile	Minimum Static FOS	Minimum Pseudo-static FOS	Liquefied FOS
1A Leach	2.65	2.01	2.01
1B Leach	1.95	1.32	No liquefiable soils present
Reclaimed 1C Waste	3.52	2.40	1.56
2A Leach	2.78	2.02	No liquefiable soils present
2B Waste	3.45	2.54	No liquefiable soils present
3A Leach	1.85	1.63	1.51
3B Waste	5.80	2.15	No liquefiable soils present
2 Leach (Area 1)	2.56	1.92	No liquefiable soils present
2 Leach (Area 2)	2.28	1.70	No liquefiable soils present

Stockpile	Minimum Static FOS	Minimum Pseudo-static FOS	Liquefied FOS
(San Salvador Waste Backfill, 7B Leach)			
7B Waste	2.45	1.86	No liquefiable soils present
7B Waste and 7B Leach (South Rim Pit)	2.47	1.79	NA
5A Waste	2.33	1.71	1.71
6B Leach	2.98	2.20	No liquefiable soils present
6D Waste	3.00	2.24	No liquefiable soils present
Reclaimed 7A Waste (eastern)	3.16	2.33	No liquefiable soils present
Reclaimed 7A Waste (central)	3.13	2.44	No liquefiable soils present
Reclaimed 7A Waste (western)	3.22	2.37	No liquefiable soils present
9A Waste	3.31	2.43	No liquefiable soils present
9AX Waste	2.83	2.24	1.42
West In-Pit Waste (at Little Rock)	2.55	1.88	No liquefiable soils present
North In-Pit Waste (at Little Rock)	2.56	1.95	No liquefiable soils present

7.1 1A Leach, 1B Leach, and Reclaimed 1C Waste Stockpiles

Stockpiles 1A Leach, 1B Leach, and Reclaimed 1C Waste are located in the southeast area of the Tyrone mine. Highway 90 runs north-south along the east of the 1A Leach Stockpile, a minimum of 300 feet from the toe of the 1A Leach stockpile (Figure 2). The critical sections and descriptions of the analyses are described in the following sections. The minimum factors of safety results from the SLIDE2 models are summarized in Table 6.

7.1.1 1A Leach Stockpile

The 1A Leach stockpile is bounded by stockpiles 1B Leach and Reclaimed 1C Waste to the north and south, respectively and the Gettysburg Pit to the west (Figure 1). The 1A Leach stockpile has an overall slope height of approximately 340 feet. The reclamation slopes are being developed by holding the toe and mining the stockpile back to the reclamation configuration.

The critical stability section was selected to run through a finger of alluvium that extends up a tributary of Brick Kiln Wash under the stockpile. The location of the critical cross-section is shown on Figure 2 and the stability cross section model is shown on Figure 7. The alluvium is estimated to be approximately 10 to 40 feet deep under the stockpile and saturated below depths of approximately 25 feet based on the quarterly groundwater monitoring data. Stability analyses included overall circular failure, block failure along the alluvium, and local stability in the toe area overlying the alluvium.

The potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. A stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the perched (average) groundwater level. A liquefied strength was applied to these soils and the stability was computed applying pseudo-static loading conditions. The underlying native material below the alluvium is Gila conglomerate. The occurrence of liquefaction does not lower the factor of safety because of the distance from the stockpile toe to the zone of saturated alluvium.

Results of the stability analyses are summarized in Table 5. The most critical failure surface would be a global failure from crest to toe of the slope and has a minimum static factor of safety is 2.65 and the minimum pseudo-static factor of safety is 2.01.

7.1.2 1B Leach Stockpile

The 1B Leach stockpile is bounded by the 1A Leach stockpile on the south, 5A Waste stockpile to the north, and the Gettysburg Pit to the southwest (Figure 2). The 1B Leach stockpile has a maximum stockpile height of approximately 475 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability cross-section was selected to run through the relocated 1B Leach main seepage collection system. Previous stability analyses of the 1B Leach Stockpile (Golder, 2006b, Golder, 2008b) modeled the stockpile placed above low strength clay accumulations in a storm water sedimentation pond. As-built documentation Golder 2007h indicates the pond sediments were removed and replaced with common fill. A geomembrane-lined collection area is located below the final reclaimed toe of the 1B Leach stockpile. The collection system is underlain by native alluvium. The alluvium along this section is estimated to be approximately 25 feet, thickening to 50 feet thick toward the northeast and saturated below depths of approximately 25 feet.

Geotechnical drill data collected to support the relocation of the seepage collection pond was available to assess subsurface conditions. The location of the boreholes is shown on Figure 2. Table V.1-1 in Appendix V.1 provides the factors of safety against liquefaction for all SPT tests from these drill holes. Drill logs for these boreholes are included in Appendix V. A factor of safety of 1.5 against liquefaction was obtained from borehole GA-05-01 at a depth of 15 feet. The material was logged as fill (pond sediments) which as-built documentation shows was removed and replaced with compacted fill. Borehole GA-05-02 has a factor of safety of 1.0 at a depth of 10 feet. Borehole logs note the test encountered a void (PLS line). Borehole GA-05-05 has a factor of safety of 1.5 at a depth of 17.5 feet in material logged as PLS pond sediment which was also removed during relocation of the PLS Collection System. All other SPT intervals yielded factors of safety greater than 2.0 and there is a very low potential for liquefaction to occur. Therefore, no stability analyses that apply liquefied strength for alluvium below the perched water table are reported for this section.

The critical stability section evaluates potential sliding along the geomembrane interface applying a conservative interface friction angle $\phi = 10°$. This section also represents the greatest overall slope height.

The most critical failure modes are global failure from crest to toe of the slope and a small localized failure through the toe along the geomembrane. The minimum static factor of safety is 1.95 and the minimum pseudo-static factor of safety is 1.32.

7.1.3 Reclaimed 1C Waste Stockpile

The Reclaimed 1C waste stockpile is bounded by stockpiles 1A Leach and 7A East (Reclaimed 7A Waste) to the north and southwest, respectively, and the Gettysburg Pit to the northwest (Figure 1 and 2). The southeast slope has a crest elevation of 6260 feet and slopes at 3.9H to 3.5H:1V with a maximum stockpile height of 250 feet. The eastern and northern slopes have crest elevations of 6260 feet and overall slopes of 3.5H:1V and was reclaimed using “ridge-valley” reclamation grading. The Reclaimed 1C Stockpile was originally placed over Oak Grove Wash and the toe was mined-back to the northwest up to 1,200 feet prior to 2004 and prior to the reclamation “ridge-valley configuration” that was completed in approximately 2012.

The critical section was selected to run through a deposit of alluvium that extends up a drainage under the stockpile. The location of the critical section is shown on Figure 2 and the cross-section model is shown on Figure 7. The alluvium is estimated to be approximately 15 to 20 feet deep. Stability analyses included overall circular failure, block failure along the alluvium, and local stability in the toe area overlying the alluvium. The underlying native material is Quartz monzonite under the main heap with a local exposure of Precambrian granite.

The most critical failure surface is a small localized failure through the toe. The minimum static factor of safety is 3.52 and the minimum pseudo-static factor of safety is 2.40.

Due to the fact that the Reclaimed 1C waste stockpile was mined back to the current toe, the alluvium below the current toe was previously under much higher stockpile loads and it could be reasoned that the alluvium is non-liquefiable due to the high loads the alluvial soils have been subject to. However, the potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. A stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the perched (average) groundwater level. A liquefied strength was applied to these soils and the stability was computed using pseudo-static loading conditions. The underlying native material is Gila conglomerate. In the scenario in which the alluvium liquefies below the water table, the minimum pseudo-static factor of safety is 1.56.

Table 6: 1A Leach, 1B Leach and Reclaimed 1C Waste Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)	
			No liquefaction	Liquefaction below average perched water table
1A Leach	Block	2.70	2.04	2.04
	Circular	2.65	2.01	2.01
1B Leach	Block	2.82	2.08	No liquefiable soils present
	Circular	2.01	2.06	

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)	
			No liquefaction	Liquefaction below average perched water table
	Block Liner	1.95	1.32	
Reclaimed 1C Waste	Block	3.52	2.40	1.56
	Circular	3.73	2.59	2.01

7.2 2A Leach and 2B Waste Stockpiles

Stockpiles 2A Leach and 2B Waste are located in the northwest portion of the Tyrone mine area (Figure 5). Deadman Canyon runs north-south along the west of the stockpiles. The critical sections and descriptions of the analyses are described in the following sections. The factor of safety results from the SLIDE models are summarized in Table 7.

7.2.1 2A Leach Stockpile

The 2A Leach stockpile is bounded by stockpiles 9A Waste to the north, 2B Waste to the south, and the Valencia Pit to the east (Figures 1 and 5). The eastern slope has a crest elevation of 6300 feet. Two critical stability sections were selected to run through the west (2A-1) and east (2A-2) slopes of the stockpile perpendicular to the topography. The location of the critical cross-section is shown on Figure 5 and the stability cross section model is shown on Figure 7. The 2A Leach stockpile has an overall slope height of approximately 395 feet. The reclamation slopes are being developed primarily by holding the toe and mining the stockpile back to the reclamation configuration.

Stability analyses included overall circular failure and block type failure. The most critical failure surface is a global failure from crest to toe of the slope and has a minimum static factor of safety is 2.78 and the minimum pseudo-static factor of safety is 2.02.

7.2.2 2B Waste Stockpile

The 2B Waste stockpile is bounded by the 2A Leach stockpile on the north and the Copper Mountain Pit and 2B Leach to the south (Figure 1). The eastern and western slopes have a crest elevation of 6450 feet and a maximum stockpile height of 375 feet with a 200- foot wide bench at elevation 6350 feet breaking the slope into a 150-foot high upper slope and a 200-foot high lower slope.

The critical stability section was selected to run perpendicular to the topography at its greatest slope height. The location of the critical cross-section is shown on Figure 5 and the stability cross section model is shown on Figure 7. Stability analyses included overall circular failure and block type failure. The most critical failure surface is a global failure of the lower bench from bench crest to toe of the slope. The minimum static factor of safety is 3.45 and the minimum pseudo-static factor of safety is 2.54.

Table 7: 2A Leach and 2B Waste Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)
2A-1 Leach	Block	2.89	2.10
	Circular	2.87	2.09
2A-2 Leach	Block	2.80	2.05
	Circular	2.78	2.02
2B Waste	Block	3.63	2.64
	Circular	3.45	2.54

7.3 3A Leach and 3B Waste Stockpiles

Stockpiles 3A Leach and 3B Waste stockpiles are located in the northeast Tyrone mine Area (Figure 4). Brick Kiln Gulch runs north-south along the northeast side of the stockpiles. The critical sections and descriptions of the analyses are described in the following sections. The engineering FOS results from the SLIDE models are summarized in Table 8.

7.3.1 3A Leach Stockpile

The 3A Leach stockpile is bounded by the 3B Waste stockpile on the south and the Brick Kiln Gulch to the northwest (Figure 1). The northern slope has a crest elevation of 6300 feet with a maximum stockpile height of approximately 640 feet. The toe of the slope in the alluvium is locally steepened to accommodate the pond systems. The reclamation slope flattening will be accomplished by a combination of by holding the toe fixed and mining the crest back and placement of material at the toe in compacted lifts.

The critical stability section was selected to run through a finger of alluvium that extends up a tributary of Mangas Wash under the stockpile and through the existing process ponds at the toe. The location of the critical cross-section is shown on Figure 4 and the stability cross section model is shown on Figure 7. The alluvium is estimated to be approximately 20 to 70 feet deep under the stockpile and saturated below depths of 20 feet based on water levels in nearby wells. Stability analyses included overall circular failure, block failure along the alluvium, and local stability in the toe area overlying the alluvium. The most critical failure surface is a localized failure through the toe of the slope in the localized steepened section and has a minimum static factor of safety is 1.85 and the minimum pseudo-static factor of safety is 1.63.

The potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. However, geotechnical borehole data is available in the alluvium in several nearby tributary channels as shown on Figure 4. The results of liquefaction potential analyses are provided in Appendix V.3 and show the factors of safety against liquefaction are greater than 1.6 and the potential for liquefaction is low. Due to the lack of site-specific geotechnical borehole data, a stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the estimated perched groundwater level. A liquefied strength was applied to these soils and the stability was computed using pseudo-static loading conditions. The underlying native material below the alluvium is Gila Conglomerate. In the scenario in which the alluvium liquefies below the water table, the minimum pseudo-static factor of safety is 1.51.

7.3.2 3B Waste Stockpile

The 3B Waste stockpile is bounded by the 3A Leach stockpile on the north and the Main Pit to the southwest (Figure 1). The eastern slope has a crest elevation of 6320 feet and a maximum stockpile height of 485 feet with a 100- foot bench at elevation 6000 feet breaking the slope into a 350-foot high upper slope and a 100-foot high lower slope. Stockpile 5A Waste lies to the east of the critical section. The reclamation slope flattening will be accomplished by constructing at the final reclaimed slope angles.

The critical stability section was selected to run through a finger of alluvium that extends up a tributary of Mangas Wash under the stockpile. The location of the critical cross-section is shown on Figure 2 and the stability cross section model is shown on Figure 7. The alluvium is estimated to be approximately 10 to 40 feet deep under the stockpile and saturated below depths of 30 feet based on the quarterly monitoring data. As the alluvium is not under the toe of the slope and is under stockpile height of approximately 100 feet at confining loads that would preclude liquefaction. Therefore, the stability applying liquefied strengths for the saturated alluvium was not assessed. Stability analyses included overall circular and block type failure. The most critical failure surface is a shallow local failure through the lower bench and has a minimum static factor of safety is 5.80 and the minimum pseudo-static factor of safety is for a block failure in the upper slope with a factor of safety of 2.24.

Table 8: 3A Leach and 3B Waste Stability Analysis Results

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)	
			No liquefaction	Liquefaction below average perched water table
3A Leach	Block	2.26	1.96	1.97
	Circular	1.85	1.63	1.51
3B Waste	Block	7.65	2.15	No liquefiable soils present
	Circular	5.80	4.08	

7.4 2 Leach, Waste Backfill, 7B Leach, and 7B Waste Stockpiles

Stockpiles 2 Leach (Area 1 and 2), San Salvador Waste Backfill, and South Rim Pit (7B Waste and 7B Leach) are located in the south Tyrone mine area (Figure 3). The critical sections and descriptions of the analyses are described in the following sections. The engineering FOS results from the SLIDE models are summarized in Table 9.

7.4.1 2 Leach (Area 1) Stockpiles

The 2 Leach (Area 1) stockpile is bounded by the Copper Mountain Pit to the north and stockpile the San Salvador Waste Backfill to the east. (Figure 1). The western and southern slopes have a crest elevation of 6725 feet and overall slope height of approximately 200 to 250 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

Two critical stability sections were selected to run through the east and west slopes of the stockpile perpendicular to the topography. Section 2-1 evaluates the stability of the western slope, and Section SS evaluates the eastern slope through the backfilled San Salvador Pit. The location of the critical cross-section is shown on Figure 3 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface in 2-1 is a global failure of the lower bench from bench crest to toe of the slope and in SS is a failure of the upper bench from stockpile crest to the bench. The minimum static factor of safety is 2.56 and the minimum pseudo-static factor of safety is 1.92.

7.4.2 2 Leach (Area 2) Stockpile

The 2 Leach (Area 2) ore stockpile was placed over the backfilled San Salvador Pit and bounded by the 7B Leach stockpile on the east and the Valencia Pit to the north and the Copper Mountain Pit to the west (Figure 1). The southern slope has a crest elevation of 6700 feet and overall slope height of 325 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section was selected to run perpendicular to the topography at its greatest height and cuts through the backfilled San Salvador Pit and 7B Leach approximately 150 ft from the toe of the slope. The location of the critical cross-section 7B-2 is shown on Figure 3 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface is a global failure from crest to toe of the slope and has a minimum static factor of safety is 2.78 and the minimum pseudo-static factor of safety is 2.03.

7.4.3 7B Leach Stockpile

The 7B Leach stockpile was originally placed over the backfilled South Rim Pit and is bounded by the 2C Leach and Reclaimed 7A Waste stockpiles on the north and south and 6B Leach 6C Leach, and 6D Leach stockpiles to the east (Figure 1). The southern slope has a crest elevation of 6700 feet and has a maximum stockpile height of 325 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section 7B-1 was selected to run through the east and west slopes of the stockpile perpendicular to the topography and through the backfilled South Rim Pit. The location of the critical cross-section is shown on Figure 3 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure of the leached ore from crest to toe of the slope. The minimum static factor of safety is 2.45 and the minimum pseudo-static factor of safety is 1.86.

7.4.4 San Salvador Waste Backfill

One stockpile in the San Salvador Pit is located in the south Tyrone mine area. The engineering factor of safety results from the SLIDE models are summarized in Table 9.

The San Salvador Waste Backfill is bounded by the 2 Leach (Area 2), Reclaimed 7A Waste and 2 Leach (Area 1) stockpiles on the north, east, and west and the backfilled South Rim Pit to the northeast (Figure 3). The backfilled slopes have a crest elevation of 6700 in the upper leached ore slope and 6490 feet in the lower waste slopes. The waste stockpile has a maximum stockpile slope height of approximately 240 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section SS and 2-2 was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-sections are shown on Figure 3 and the stability cross section model is shown on Figure 9. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure of the upper leached ore bench from crest to toe or of the lower waste rock stockpile. The minimum static factor of safety is 2.28 and the minimum pseudo-static factor of safety is 1.70.

7.4.5 7B Waste Stockpile

One stockpile in the South Rim Pit is located in the south Tyrone mine area (Figure 3). The critical sections and descriptions of the analyses are described in the following sections. The engineering factor of safety results from the SLIDE models are summarized in Table 9.

The 7B Waste stockpile backfilled in the South Rim Pit and is bounded by the 2 Leach (Area 2) and Reclaimed 7A Waste stockpile on the north and east and the San Salvador Pit to the southwest (Figure 3). The backfilled slopes have a crest elevation of 6700 in the upper leached ore slope and 6550 feet in the lower waste slopes. Overall slopes are a maximum height of 230 feet and there is a 200-foot bench at elevation 6400, breaking the slope into an approximately 150-foot-high upper slope and a 100-foot lower slope. The reclamation slopes will be accomplished by constructing to the reclamation slope angles.

The critical stability section SR was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 3 and the stability cross section model is shown on Figure 9. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure of the upper waste rock bench from crest to bench. The minimum static factor of safety is 2.47 and the minimum pseudo-static factor of safety is 1.79

Table 9: 2 Leach, 7B Leach, and 7B Waste Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)
7B-1 Waste	Block	2.54	1.93
	Circular	2.45	1.86
7B-2 Leach	Block	2.82	2.06
	Circular	2.78	2.03
2 Leach, Area 1 (2-1)	Block	2.63	1.96
	Circular	2.56	1.92
2 Leach, Area 2 (2-2)	Block	2.55	1.87
	Circular	2.28	1.70
San Salvador Waste Backfill	Block	2.76	2.08
	Circular	2.71	2.04

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)
South Rim Pit (7B Waste, 7B Leach)	Block	2.47	1.79
	Circular	2.48	1.79

7.5 5A Waste Stockpile

Stockpile 5A Waste is located in the northeast Tyrone mine area (Figure 4). Mangas Wash runs northeast along the east side of the stockpiles. The south portion of the 5A Waste stockpile is designated here as the 5A-2 Waste. The critical sections and descriptions of the analyses are described in the following sections. The engineering FOS results from the SLIDE models are summarized in Table 10.

7.5.1 5A Waste Stockpile North

The 5A Waste stockpile is bounded by the 3B Waste stockpile on the north and the Main Pit to the southwest (Figure 4). Mangas Wash lies to the northeast. The northern portion of the 5A Waste stockpile has been designated with a representative cross section 5A-1 Waste in this report. The eastern and northern slope has a crest elevation of 6240 feet with a maximum stockpile height of 375 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section was selected to run through a finger of alluvium that extends up a tributary of Brick Kiln Gulch under the stockpile and several mine facilities lie at the toe. The location of the critical cross-section is shown on Figure 4 and the stability cross section model is shown on Figure 8. The alluvium is estimated to be approximately 40 to 70 feet deep under the stockpile and saturated below depths of 30 feet. Stability analyses included overall circular failure, block failure and a path search to evaluate the local stability in the toe area overlying the alluvium. The critical failure surface is a global failure from the crest to the toe of the slope through the underlying alluvium and has a minimum static factor of safety is 2.33 and the minimum pseudo-static factor of safety is 1.71.

The potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. A stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the perched (average) groundwater level. A liquefied strength was applied to these soils and the stability was computed using pseudo-static loading conditions. The underlying native material is Gila conglomerate. In the scenario in which the alluvium liquefies below the water table, the critical failure surface is a localized toe failure through the liquefied alluvium and has a minimum pseudo-static factor of safety is 1.71 Liquefaction does not result in a reduction in the pseudo-static factor of safety because of the distance of the liquefiable alluvium from the toe of the slope.

7.5.2 5A Waste Stockpile South

The southern portion of the 5A Waste stockpile has been designated with a representative cross section 5A-2 Waste in this report. It is bounded by the 5A Waste stockpile on the north and the Main Pit to the southwest (Figure 4). Mangas Wash lies to the northeast. The eastern and northern slope has a crest elevation of 6240 feet and a maximum stockpile height of 360 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section was selected to run through a finger of alluvium that extends up a tributary of Mangas Wash under the stockpile. The location of the critical cross-section is shown on Figure 4 and the stability cross section model is shown on Figure 8. The alluvium is estimated to be approximately 20 to 60 feet deep under the stockpile and saturated below depths of 35 feet. Stability analyses included overall circular failure, block failure along the alluvium, and local stability in the toe area overlying the alluvium. The most critical failure surface would be a global failure from crest to toe of the slope or a block type, shallow, localized failure through the underlying alluvium at the toe of the stockpile. The minimum static factor of safety is 2.65 and the minimum pseudo-static factor of safety is 1.94.

The potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. A stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the perched (high) groundwater level. A liquefied strength was applied to these soils and the stability was computed using static and pseudo-static loading conditions. The underlying native material is Gila conglomerate. In the scenario in which the alluvium liquefies below the water table, the minimum static factor of safety is 2.65 and the minimum pseudo static factor of safety is 1.94.

Table 10: 5A Waste Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)	
			No liquefaction	Liquefaction below average perched water table
5A-1 Waste	Cuckoo	2.33	1.71	1.71
	Circular	2.42	1.75	1.75
5A-2 Waste	Block	2.80	2.06	2.06
	Circular	2.65	1.94	1.94

7.6 6B Leach and 6D Leach Stockpiles

Stockpiles 6B Leach and 6D Leach stockpiles are located in the south Tyrone mine area (Figure 2). The critical sections and descriptions of the analyses are described in the following sections. The factor of safety results from the SLIDE models are summarized in Table 11.

7.6.1 6B Leach Stockpile

The 6B Leach stockpile is bounded by the Valencia Pit and Gettysburg Pit to the north and east and stockpiles 7B Leach and 6D Leach to the west and south. (Figure 1). The southern slope has a crest elevation of 6450 feet and overall maximum stockpile slope height of 100 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 2 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface is a global failure of the upper slope from crest to toe. The minimum static factor of safety is 2.98 and the minimum pseudo-static factor of safety is 2.20.

7.6.2 6D Leach Stockpile

The 6D Leach stockpile is bounded by the stockpile 6B Leach and Gettysburg Pit to the north and east and stockpiles 7B Leach and 7B Waste to the west and south. (Figure 2). The southern slope has a crest elevation of 6720 feet and with a maximum stockpile slope height of approximately 115 feet. The reclamation slope flattening will be accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 2 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface is a global failure of the upper slope from crest to toe. The minimum static factor of safety is 3.00 and the minimum pseudo-static factor of safety is 2.24.

Table 11: 6B Leach and 6D Leach Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)
6B Leach	Block	3.08	2.28
	Circular	2.98	2.20
6D Leach	Block	3.09	2.28
	Circular	3.00	2.24

7.7 Reclaimed 7A Waste Stockpiles

Three stockpiles consisting of 7A Waste are located in the south Tyrone mine area (Figures 2 and 3). The critical sections and descriptions of the analyses are described in the following sections. The engineering factor of safety results from the SLIDE models are summarized in Table 12.

7.7.1 Eastern Reclaimed 7A Waste Stockpile

The eastern Reclaimed 7A Waste closure stockpile is bounded by stockpiles Reclaimed 1C Waste and 7B Waste to the northeast and north, respectively (Figure 2). The south-eastern slope has a crest elevation of 6260 feet and with overall slopes of 3.9H to 3.5H:1V with a maximum stockpile height of 230 feet. The Oak Grove Wash has extending tributaries below the footprint of the stockpile. However, the alluvium is under stockpile thickness of 100 feet or more and is not considered to be susceptible to liquefaction under those confining loads. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section 7A-E was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 2 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure from crest to toe of the slope. The minimum static factor of safety is 3.16 and the minimum pseudo-static factor of safety is 2.33.

7.7.2 Central Reclaimed 7A Waste Stockpile

The central Reclaimed 7A Waste stockpile is bounded by the Reclaimed 7A Waste and 7B Waste stockpiles on the east and north, and the South Rim pit to the west (Figures 2 and 3). The southern slope has a crest elevation of 6410 feet and overall stockpile slope height of approximately 190 feet. The reclamation slope flattening is being accomplished by mining the upper slopes and placing material at the toe in compacted lifts.

The critical stability section 7A-W was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 3 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure from crest to toe of the slope. The minimum static factor of safety is 3.13 and the minimum pseudo-static factor of safety is 2.44.

7.7.3 Western Reclaimed 7A Waste Stockpile

The western Reclaimed 7A Waste western stockpile is bounded by the South Rim Pit to the north (Figure 3). The eastern and northern closure slopes have a crest elevation of 6450 feet and a maximum stockpile height of 210 feet. The eastern, southern, and northern slopes have crest elevations of 6440 feet and overall slopes of 3.5H:1V and were developed using “ridge-valley” reclamation grading. The stockpile was placed just north of the Oak Grove Wash.

The critical stability section 7A-FW was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 3 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure from crest to toe of the slope. The minimum static factor of safety is 3.22 and the minimum pseudo-static factor of safety is 2.37.

Table 12: Reclaimed 7A Waste Stability Analysis Summary

Stockpile Section	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)
Reclaimed 7A Waste (7A-E)	Block	3.30	2.43
	Circular	3.16	2.33
Reclaimed 7A Waste (7A-W)	Block	3.37	2.49
	Circular	3.13	2.44
Reclaimed 7A Waste (7A-FW)	Block	3.27	2.42
	Circular	3.22	2.37

7.8 9A Waste and 9AX Waste Stockpiles

Stockpiles 9A Waste and 9AX Waste stockpiles are located in the northwest of the Tyrone mine area (Figure 5). The critical sections and descriptions of the analyses are described in the following sections. The engineering factor of safety results from the SLIDE models are summarized in Table 13.

7.8.1 9A Waste Stockpile

The 9A waste stockpile is bounded by the 2A Leach stockpile on the south (Figure 5). The northern slope has a crest elevation of 6360 feet and a maximum stockpile height of 500 feet. The reclamation grading is being accomplished by constructing the stockpile at the reclamation slope angle.

The critical stability section was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 5 and the stability cross section model is shown on Figure 8. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a local, shallow failure from the middle of the slope to toe roughly parallel the contours of the native ground. The minimum static factor of safety is 3.31 and the minimum pseudo-static factor of safety is 2.40.

7.8.2 9AX Waste Stockpile

The 9AX waste stockpile is bounded by the 9A Waste stockpile on the south and the 3A Leach stockpile lies to the east (Figure 5). Tributaries of the Mangas Wash extend from the north under the toe of the stockpile. The western, eastern and northern slopes have a crest elevation of 6080 feet and a maximum stockpile height of 265 feet. The reclamation grading is being accomplished by constructing the stockpile at the reclamation slope angle.

Two critical stability sections were selected to run through the north and east slopes of the stockpile perpendicular to the topography. Section 9AX-1 was selected as the critical section for the northern slope and 9AX-2 was selected to run through a small section of potentially liquefiable alluvium in the eastern slope. The location of the critical cross-sections is shown on Figure 5 and the stability cross section models are shown on Figure 9. The alluvium is estimated to be approximately 10 to 25 feet deep in the tributaries and saturated below depths of 10 feet. Stability analyses included overall circular failure, block failure along the alluvium, and local stability in the toe area overlying the alluvium. The most critical failure surface for Section 9AX-1 is a global failure from crest to toe of the slope and for Section 9AX-2 is a global failure through native Gila conglomerate outcrop and terminating in the alluvium at the toe of the slope. The minimum static factor of safety is 2.83 and the minimum pseudo-static factor of safety is 2.24.

The potential for development of instability related to liquefaction was assessed. Site specific geotechnical borehole data and SPT blow count data are lacking in this zone of alluvium. A stability analysis was completed assuming loose sands (i.e. low blow count) are present in the alluvium below the perched groundwater level. A liquefied strength was applied to these soils and the stability was computed using static and pseudo-static loading conditions. The underlying native material is Gila conglomerate. In the scenario in which the alluvium liquefies below the water table, the most critical failure surface is a shallow, localized toe failure through the liquefied alluvium and has a minimum static factor of safety is 2.83 and the minimum pseudo-static factor of safety is 1.42.

Table 13: 9A Waste and 9AX Waste Stability Analysis Summary

Stockpile	Failure Type	Static Condition	Pseudo-static Condition (k = 0.094g)	
			No liquefaction	Liquefaction below average perched water table
9A Waste	Block	3.42	2.46	No liquefiable soils present
	Circular	3.31	2.40	
9AX Waste (1 of 2)	Block	3.10	2.28	No liquefiable soils present
	Circular	3.04	2.24	
9AX Waste (2 of 2)	Block	3.12	2.32	2.30
	Circular	2.83	2.26	1.42

7.9 Little Rock In-Pit Stockpiles

Two stockpiles in the Little Rock pit are located to the west of the Tyrone mine (Figure 6). Deadman Canyon runs north-south along the east of the pit. The critical sections and descriptions of the analyses are described in the following sections. The engineering factor of safety results from the SLIDE models are summarized in Table 14.

7.9.1 West In-pit Waste Stockpile

The West In-Pit Waste stockpile is contained to the north, south, and west by the pit walls (Figure 6). The eastern and northern slope has a crest elevation of 6200 feet and a maximum stockpile height of 560 feet. At closure, a pit lake may be allowed to form up to an estimated elevation of 5700 ft.

The critical stability section was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 6 and the stability cross section model is shown on Figure 9. The presence of a pit lake has the potential to affect the stability of the waste stockpile, so analyses included two conditions: one with a pit lake at 5700 ft and one with dry pit lake conditions. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure from crest to toe of the slope. The minimum static factor of safety is 2.55 and the minimum pseudo-static factor of safety is 1.88.

7.9.2 North In-pit Waste Stockpile

The North In-Pit Waste stockpile is contained to the north and east by the pit walls (Figure 1). The eastern and northern slope has a crest elevation of 6140 feet and overall slopes height of 310 feet. At closure, a pit lake may be allowed to form up to an estimated elevation of 5700 ft.

The critical stability section was selected to run perpendicular to the topography at its greatest height. The location of the critical cross-section is shown on Figure 6 and the stability cross section model is shown on Figure 9. The presence of a pit lake has the potential to affect the stability of the waste stockpile, so analyses included two conditions: one with a pit lake at 5700 ft and one with dry pit lake conditions. Stability analyses included overall circular failure and block type failure. The most critical failure surface would be a global failure from crest to toe of the slope above the southern containment outcrop of Burro Mountain granite. The minimum static factor of safety is 2.56 and the minimum pseudo-static factor of safety is 1.95.

Table 14: Little Rock In-Pit Stability Analysis Summary

Stockpile	Failure Type	Static Condition		Pseudo-static Condition (k = 0.094g)	
		No Pit Lake Condition	Pit Lake at elevation 5700 feet	No Pit Lake Condition	Pit Lake at elevation 5700 feet
West In-Pit Waste	Block	2.68	2.68	1.98	1.98
	Circular	2.55	2.55	1.88	1.88
North In-Pit Waste	Block	2.63	2.75	2.00	2.00
	Circular	2.57	2.56	1.95	1.95

8.0 CONCLUSIONS

Stability evaluations incorporating the design parameters outlined in this report indicate long-term factors of safety for the reclaimed stockpile configurations of at least 1.85 under static conditions and 1.48 under seismic loading. The stability analyses included an evaluation of the effects of liquefaction on the stockpile stability. These safety factors meet the minimum factor of safety criteria provided in the Copper Rule for all facilities (regardless of whether they would be categorized as non-critical or critical).

The stockpiles have been stable during operations. The reduction in the slope angles as part of reclamation will increase the degree of stability. The long-term effects of weathering on the shear strength of the stockpiles was assessed from the geochemical studies by EnviroGroup and evaluation of the engineering properties summarized in this report. These studies conclude the development of additional clays or more active clay minerals that might lead to a reduction in the stockpile shear strength is not predicted.

Reductions in the percentages of cobbles and boulders in the stockpile may occur as a result of long-term weathering, although we do not see evidence of it in the Tyrone stockpiles. It is recognized that the Tyrone stockpiles are relatively young compared to the Chino stockpiles. A correlation of reduced grain size of the stockpile material with the age of the material was recognized in a similar stockpile stability study completed at the Chino Mine (Golder, 2008) which are as much as 100 years old. The percentage of cobbles and boulders present in the Tyrone stockpiles is considered to contribute to the strength of the stockpile and potential long-term reductions in the percentage of these oversize particles can be expected to reduce the stockpile shear strength. The shear strengths assigned to the Tyrone stockpiles are based on laboratory testing of samples without oversize material that exists in the actual stockpile and reflect the stockpile matrix (or finer fraction) strength. Therefore, the laboratory derived shear strengths are lower than actual stockpile material strengths as they exist today but are considered to reasonably reflect the long-term strengths of the stockpile materials. Long term increases in the strength of the stockpiles can also be anticipated due to long term settlement and densification of the stockpiles and cementation, mainly by sulphate minerals.

The potential for earthquake induced instability was evaluated using pseudo-static analyses. The pseudo-static coefficient applied considered the peak ground acceleration associated with a design basis earthquake with a 2500- year return period and applied an amplification factor appropriate for the sites underlain by the Gila Formation. The factors of safety applying the pseudo-static loads met the minimum factor of safety. All were above 1.4.

The stability analyses also considered the potential for liquefaction. The potential for liquefaction of Quaternary alluvium deposits below the water table in the toe areas of stockpiles was assessed using available subsurface geotechnical information where available. Where site specific geotechnical information is not available, the alluvium below the perched water table was assumed to be susceptible to liquefaction. If liquefaction potential was indicated, an additional stability analysis was performed applying a liquefied strength to the saturated alluvium. The resulting factors of safety indicate that liquefaction is not predicted to lead to the instability of the reclaimed stockpiles.

The stockpiles are currently indicated to be generally unsaturated. We expect moisture contents in the stockpile and in the alluvium in the toe areas of the stockpiles will decrease further after closure as a result of the cessation of leaching, addition of cover placement, and implementation of surface water management measures. The development of elevated groundwater levels in the stockpiles that could impact the stockpile’s long-term stability is not expected. The potential for liquefaction of the alluvium will be further reduced as a result of cover placement and surface water management.

9.0 REFERENCES

American Society of Civil Engineers (ASCE) Standard 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures. American Society of Civil Engineers, 1st Printing, 2017.

ASTM, 2016. ASTM International Method D5731, Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications, 2016.

Boulanger, R.W. and Idriss, I.M., 2014. CPT and SPT Based Liquefaction Triggering Procedures, Report No. UCD/CGM-14/01, Center for Geochemical Modeling Department of Civil and Environmental Engineering, University of California at Davis, April 2014.

Bray, J.D., P.C. Repetto, A.J. Augello, and R.J. Byrne, 1993. *An Overview of Seismic Design Issues for Solid Waste Landfills*. Geosynthetics Research Institute Conference. December 1993.

Call and Nicholas Inc., 1982. Tyrone Pit Slope Design. Draft Report, prepared for Phelps Dodge Corp., Tyrone Branch.

Das, B., 1985. Principles of Geotechnical Engineering, PWS Publishing, Boston.

DBS&A, 2018. Discharge Permit 1341, Condition 60 Potentiometric Maps for Second Quarter 2018, letter from Anna McMullen to Keith Ehlert, dated August 27, 2018.

DuHamel, J.E., Cook, S.S., and Kolessar, J., 1995. Geology of the Tyrone Porphyry Copper Deposit, New Mexico, in Pierce, F.W., and Bolm, J.G., eds., Porphyry Copper Deposits of the American Cordillera: Tucson, Arizona Geological Society Digest 20, p. 464-472.

EnviroGroup Limited, 2005. Supplemental Materials Characterization of the Leached Ore Stockpiles and Waste Rock Stockpiles Final Report for DP-1341, Condition 80 Tyrone Mine, prepared for Phelps Dodge Tyrone, Inc., dated December 29, 2005, Project No. PD-0447.

Fragazy, R.J., Su, F.H., Siddiqi, and C.L. Ho, 1992, Modeling Strength of a Sandy Gravel, Jour. Geotechnical Engineering, Vol. 118, No. 6.

Golder, 2000. Closure/Closeout Plan Addendum, Slope Stability Analysis, Phelps Dodge Tyrone, Inc., submitted to Phelps Dodge Tyrone, Inc., Project No. 993-2546.001, dated February 24, 2000.

Golder, 2002. Results of Additional Stockpile Characterization Activities at the Tyrone Mine, prepared for Phelps Dodge Tyrone Inc., Project No. 013-1595, dated May 7, 2002.

Golder, 2005. Supplemental Stability Study of Waste Rock Piles and Leach Ore Stockpiles, Interim Report for DP-1341, Condition 78, Tyrone Mine, submitted to Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated January 13, 2005.

Golder, 2006a. Tyrone Reclamation No. 1C Stockpile and 7A Waste Stability Analysis, to Greg Schoen – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated May 4, 2006.

Golder, 2006b. Tyrone Reclamation No. 1A and 1B Stockpiles Stability Analysis, to Greg Schoen – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated July 14, 2006.

Golder, 2007a. Tyrone Reclamation No. 2A-2B Stockpile Stability Analysis, DP-1341, Condition 78, to Michael Jaworski – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated April 6, 2007.

Golder, 2007b. Tyrone Reclamation No. 3A Stockpile Stability Analysis, DP-1341, Condition 78, to Michael Jaworski – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated April 6, 2007.

Golder, 2007c. Tyrone Reclamation No. 3C and 5A Waste Stockpiles Stability Analysis, DP-1341, Condition 78, to Michael Jaworski – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated May 11, 2007.

Golder, 2007d. Tyrone Reclamation No. 4C Stockpile Stability Analysis, DP-1341, Condition 78, to Michael Jaworski – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated May 11, 2007.

Golder, 2007e. Tyrone Reclamation Stability of Interior and In-Pit Stockpiles, DP-1341, Condition 78, to Michael Jaworski – Phelps Dodge Tyrone, Inc., Project No. 053-2550, dated May 11, 2007.

Golder, 2007f. Response to NMED Comments Dated May 11, 2007, Conditional Approval, No. 3A Stockpile Stability Analysis, DP-1341, Condition 78, Project No. 053-2550, dated June 18, 2007.

Golder, 2007g. Tyrone Mine Closure/Closeout Plan Update, prepared for NMED and MMD, submitted by Phelps Dodge Tyrone Inc., Project No. 073-80012, dated October 11, 2007.

Golder, 2007h. No. 1B Stockpile PLS Collection System Relocation Design Project, Silver City New Mexico, May 2007, Rev. 1 As-Built Design.

Golder, 2008a. DP-1340 Condition 80 Supplemental Stability Analysis of Waste Rock Piles and Leach Ore Stockpiles Final Report, project 063-2575, dated March 11, 2008

Golder, 2008b. Tyrone Reclamation Addendum to the No. 1A and 1B Stockpile Stability Analysis, to Chuck Johnson – FMI Tyrone, Project No. 053-2550, dated September 15, 2008.

Griffin, J.D., 2001. *Alluvial Architecture and Tectonic Setting of the Mangas Conglomerate, Tyrone Mine Area, Grant County, New Mexico*, MS Thesis 2001-G875, University of Texas at Austin

Hawley, M. and Cunning, J., 2017. Guidelines for Mine Waste Dump and Stockpile Design, CRC Press/Balkema, The Netherlands.

Hoek, E., Carranza-Torres, C., and Corkum, B., 2002. Hoek-Brown Failure Criterion, 2002 Edition. Proceedings, 5th North American Rock Mechanics Symposium, Toronto, p. 267-273.

Hoek, 2012. Blast Damage Factor D, Technical note for RocNews – February 2, 2012, Winter 2012 issue.

Hynes, M.E. and A.G. Franklin, 1984. Rationalizing the Seismic Coefficient Method. Department of the Army, Waterways Experiment Station, Corps of Engineers. Final Report. July 1984.

International Society for Rock Mechanics (ISRM), 1985. Suggested Method for Determining Point Load Strength. International Journal of Rock Mechanics, 22(2), 53-60.

Jansen, R.B., 1985. *Evaluation of Seismic Effects on Embankment Dams.* Presented at Hawaii Dam Safety Conference, Honolulu, Hawaii. December 5, 1985.

Kolessar, J., 1982. The Tyrone Copper Deposit. In Titley, S.R., (ed) Advances in Geology of the Porphyry Copper Deposits Southwestern North America, University of Arizona Press, Tucson, Arizona. P. 327-333.

Marinos, P. and Hoek, E. (2000) GSI: A Geologically Friendly Tool for Rock Mass Strength Estimation. In Proceedings of GeoEng2000 Conference (ed. MC Erwin) Melbourne, vol 1pp. 1422-1440. Technomic, Lancaster, PA. Benissi, M. (1998). Applicability of the geological strength index (GSI) classification for the

Rocscience, 2013. DIPS, Graphical and Statistical Analysis of Orientation Data version 7.006. Rocscience Inc. Toronto.

Rocscience, 2018. SLIDE2, SLIDE-2D Limit Equilibrium Slope Stability Analysis version 2018, Rocscience Inc., Toronto.

Seed, H.B. and Idriss, I.M., 1971. Simplified Procedure for Evaluating Soil Liquefaction Potential, Jour. Soil Mech. and Foundations Div. ASCE 97 (SM0), 1249-1273.

URS Corporation, 2005. Seismic Hazard Evaluation, Tailing Impoundments, Prepared for Phelps Dodge Tyrone and M3 Engineering & Technology Corp. March 2, 2005.

USGS, 2019. USGS Unified Hazard Tool, https://earthquake.usgs.gov/hazards/interactive/.

Vaid, Y.P., J. Thomas, 1994. Post-liquefaction behavior of Sand, in Proceedings, 13th International Conference on Soil Mechanics and Foundation Engineering, New Delhi, India

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APPENDIX I

2005 Interim Report

FOR CLIENT REVIEW

SUPPLEMENTAL STABILITY STUDY OF WASTE ROCK PILES AND LEACH ORE STOCKPILES

INTERIM REPORT FOR DP-1341, CONDITION 78

TYRONE MINE

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December 19, 2005 053-2550

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1.0 INTRODUCTION

The New Mexico Environment Department (NMED) issued a Supplemental Discharge Permit for Closure (DP-1341) dated April 8, 2003 to Phelps Dodge Tyrone, Inc. (PDTI) for the Tyrone Mine. To comply with the New Mexico Water Quality Act and the New Mexico Water Quality Control Commission regulations, PDTI is required to conduct scientific studies that address a number of conditions specified under Section III of DP-1341. This Interim Report addresses Condition 78, which states:

> *Tyrone shall perform a supplemental stability study on the Waste Rock Piles and Leach Ore Stockpiles at the Tyrone Mine Facility. In accordance with the schedule approved under Condition 74, Tyrone shall submit to NMED for approval a work plan including an implementation schedule for the supplemental stability study to evaluate the long-term physical stability of Waste Rock Piles and Leach Ore Stockpiles after closure. The study shall evaluate and quantify changes in the engineering parameters resulting from the natural weathering process of the Waste Rock Pile and Leach Ore Stockpile materials that may ultimately affect long-term stability. At a minimum, the work plan shall propose methods and analyses to account for changes in chemical and physical properties of the stockpile materials from the time of deposition to present day and to a specified time during post-closure. The study shall include an evaluation of the recently reported data for materials interior to the stockpiles and whether additional data collection is warranted to evaluate long-term stability. (Golder Associates Inc. [Golder], 2003)*

A Work Plan for Supplemental Slope Stability Analyses dated December 12, 2003 was submitted that is intended to address the supplemental stability requirements of Condition 78. The work plan has four primary objectives. They are:

- further characterize the internal composition, structure, chemical and physical state, and engineering parameters of the leach ore stockpiles and waste stockpiles;
- further characterize the geological and engineering parameters of the foundation materials of the leach stockpiles and waste stockpiles;
- quantify the effects of chemical weathering/cementation on the engineering parameters of the stockpile materials with respect to long-term slope stability; and

- re-evaluate the stability of the stockpiles based on the more detailed geologic/geotechnical model and engineering parameters.

A similar work plan was issued for Condition 80 of DP-1340 for the Chino Mine. NMED issued a “Request for Additional Information” as a condition of acceptance of the Chino Mine Condition 78 work plan. A request for additional information was not issued in response to the Tyrone Mine Condition 78 work plan. However, we have assumed that the additional requirements for Chino will apply to the Tyrone Mine as well.

This Interim Report has been prepared to provide a summary of the stockpile characterization data that have been collected to date for use as reference for other ongoing studies related to other conditions.

The following stockpiles comprise the Tyrone Mine Stockpile system

- No. 1 Waste
- No. 1A Leach
- No. 1B Leach
- No. 1C Waste
- No. 2A Leach
- No. 2B Waste
- No. 3A Leach
- No. 3C Waste
- No. 4A Leach
- No. 5A Waste
- No. 6B Leach
- No. 7A Waste

The stockpiles at the Tyrone Mine were placed by end dumping in lifts generally 50 to 200 feet high. There is considerable primary slope-parallel layering and segregation in the stockpiles.

2.0 SUMMARY OF WORK COMPLETED

A number of stockpile characterization programs and slope stability assessments of the waste rock piles and leach stockpiles at the Tyrone Mine have been completed. Characterization activities have consisted of test pit excavations, rotosonic borehole drilling, and laboratory testing of samples collected from the test pits and boreholes. Test pit logs are provided in Appendix A. Borehole logs are provided in Appendix B. Golder logged the rotosonic borehole cores for geotechnical information and the geotechnical logs are provided in Appendix B-1. PDTI prepared geologic logs of the rotosonic boreholes and these are provided in Appendix B-2. Laboratory testing results are provided in Appendices C and D. This Interim Report has been prepared to summarize the information compiled to date.

2.1 Closure/Closeout Plan Addendum

Golder completed a slope stability analysis of stockpiles at the Tyrone Mine and reported the results of those analyses in Golder (2000). The Closure/Closeout Plan Addendum provided a description of the existing site conditions, stockpile descriptions, characterization of stockpile materials, determination of mechanical properties of the stockpile materials, and computation of the stability of the stockpile embankment slopes.

The stockpile materials characterized during this study were collected from 14 surface excavations that were typically 15-feet deep. Golder visually estimated the percentage of oversized (>3-inch) material in each test pit. Golder logged the stockpile soils (minus 3-inch fraction) at each site according to American Society for Testing and Materials (ASTM) (D2488) standards. The test pit locations are provided in Table 1. Golder performed point load tests on oversize rock fragments to quantify the strength of the cobbles. Approximately 10 point load tests were performed for each test pit and the results were averaged to provide the results listed in Table 2. Additionally, Golder obtained three nuclear gauge moisture and density measurements from each test pit, and the values were averaged to provide the dry densities listed in Table 2. The test pit logs are provided in Appendix A-1. Bulk samples were collected from seven of the test pits and were subjected to grain-size analyses and Atterberg limits testing. Grain-size test results are provided in Appendix C-1. Two samples were also selected for triaxial shear testing. Staged triaxial shear testing was performed under consolidated, undrained conditions with pore pressure measurements. The results are provided in Appendix D-1. A 4-inch diameter triaxial cell was used, and the soil was scalped of fragments larger than ¾ inch. The laboratory test results are summarized in Table 3.

2.2 Stockpile Characterization Activities at the Tyrone Mine

During closure hearings with the state of New Mexico, PDTI received comments concerning the lack of geotechnical characterization of the interior portions of the stockpiles. The comments addressed the impact that leaching by low pH process solutions and long-term weathering may have on the long-term shear strength and, consequently, the long-term stability of the stockpiles and that the interior portions of the stockpiles may be more impacted by leaching and weathering than the surface. To address these comments, Golder conducted a field investigation during October 11 and 12, 2001 to augment the previous stockpile characterization study. PDTI identified several stockpiles that had been partially re-mined, exposing the interiors. This work was reported previously in Golder (2002). We collected samples and classified the stockpile soils at 12 sites. The sampled sites are identified on Figure 1 and the locations are described in Table 1. One of the difficulties in characterizing coarse stockpile materials is collecting a sufficiently large sample to provide a valid representation of large (up to approximately 4-foot diameter) fragments. At each sample site Golder defined a cell approximately the width of the bench height (typically 50-feet high) and characterized the stockpile material within each cell. Golder visually estimated the percentage of oversize material (plus 3-inch fraction), and the visual estimates were verified using scaled photographic images. Golder took three photographs at each sample location: one across the entire cell width, one approximately 10-feet wide, and one approximately 18 inches across to allow resolution of particles from several feet to 3 inches in diameter. The stockpile soils (minus 3-inch fraction) at each site were logged according to ASTM (D2488) standards. Geotechnical logs with a photograph for each cell are provided in Appendix A-2. Golder reviewed stockpile cross-sections prepared by Greystone from historical mine maps to determine the year that various stockpiles were placed. Table 1 summarizes the sample locations and age and leaching history of the stockpiles

Approximately 60-pound soil samples were collected from each cell. The samples were sent to Golder's laboratory in Denver, Colorado and subjected to sieve analysis (ASTM C117/C136) and Atterberg limits determination (ASTM D4318). The grain-size and Atterberg limits test results are provided in Appendix C-2. Golder prepared extended grain-size curves by combining the laboratory grain-size curves with the visual estimates of the gradation of the oversize fraction. Figure 2 provides a plot of all of the extended grain-size curves that have been prepared from samples collected from the Tyrone Mine Stockpiles. Four staged, consolidated, undrained triaxial shear tests were performed, and the results are provided in Appendix D-2. A 4-inch diameter triaxial cell was used, and the soil was scalped of fragments larger than ¾ inch. Laboratory test results are summarized in Table 3.

2.3 2004 1C Stockpile Sampling Program

During 2004, PDTI re-mined a portion of the 1C Stockpile exposing the interior portions of the stockpile.

Golder performed a site investigation to characterize the interior portions of the 1C Stockpile on September 8 and 9, 2004. Golder's Senior Project Engineer, Thomas Wythes, performed the site investigation. Golder collected samples and classified the stockpile soils at eight sites. The sampled sites are identified on Figure 1, and approximate coordinates are provided in Table 1. The topography shown on Figure 1 does not reflect the topography at the time of sampling because the 1C Stockpile was being actively mined at that time and has since been reclaimed. At each sample site we defined a cell approximately the width of the bench height (typically 50-feet high) and characterized the stockpile material within each cell. The stockpile soils (i.e., the minus 3 inch fraction) at each site were logged according to ASTM (D2488) standards. Golder visually estimated the percentage of oversize material (plus 3-inch fraction), and the visual estimates were verified using scaled photographic images. Golder took three photographic images at each sample location: one across the entire the cell width, one approximately 10- to 20-feet wide, and one approximately 2- to 5-feet across to allow resolution of particles from several feet to 3 inches in diameter. Extended grain-size curves were prepared and are illustrated on Figure 2. Geotechnical logs for each cell are provided in Appendix A-3.

Approximately 60-pound soil samples were collected from each cell. The samples were sent to Golder's laboratory in Denver, Colorado and subjected to sieve analysis (ASTM C117/C136), hydrometer analysis (ASTM D422), and Atterberg limits determination (ASTM D4318). The grain-size and Atterberg limit test results are provided in Appendix C-3. Large scale (6-inch) direct shear tests were performed under saturated conditions. The direct shear test samples were scalped of fragments larger than 1 inch. The laboratory testing results are provided in Appendix D-3 and summarized in Table 3. An additional 30-pound sample was also collected from each cell for geochemical testing in support of studies related to Condition 80. Geochemical characterization is being performed by EnviroGroup Limited (formerly Greystone) under the direction of Dr. Drummond Early.

Golder reviewed stockpile cross-sections prepared by Greystone from historical mine maps to determine the year that various stockpiles were placed. Table 1 summarizes the sample locations, and the age and depth of the stockpiles. A characterization of mineral assemblage type in each stockpile was provided in Appendix E of the Preliminary Materials Characterization Report (Daniel B. Stephens & Associates, Inc. [DBS&A], 1997a) and the Supplemental Materials Characterization Report (DBS&A, 1997b). These reports also include pit development maps, plan view stockpile distribution maps, and stockpile development cross-sections. This information was useful in determining the history of each stockpile.

2.4 2004 Rotosonic Stockpile Drilling Program

PDTI completed a rotosonic drilling program between September 28 and October 13 2005. The locations of the drillholes are provided in Table 4 and illustrated on Figure 1. Boreholes TSGT-1 through TSGT-3 were terminated within the stockpile. Borehole TSGT-4 extended approximately 15 feet into the foundation soils.

The drill holes were logged for geologic and geotechnical information. Golder completed geotechnical logging after the drilling was completed and the rotosonic drill core was laid out in the core shed. Geotechnical logs are provided in Appendix B-1. PDTI performed geologic logging, and the geologic logs are provided in Appendix B-2. Information collected during geotechnical logging included a soil description and classification according to ASTM D2488. A color designation was also applied based on the Munsel color code. Estimates of the moisture content were made but are of little value because samples were stored for 7 months prior to geotechnical logging. The core recovery and percentage of fragments greater than 3 inches were also recorded. The estimates of the oversize fraction from the rotosonic core are considered less representative than those from the test pits because of the relatively small diameter of the core. The strength of the clasts was estimated based on the International Society of Rock Mechanics manual index test procedures as summarized on Table 5. Photographs of the rotosonic core are provided on the CD included in Appendix C.

Samples were collected from the rotosonic core during geotechnical logging at typical intervals of 25 to 50 feet. Samples were typically approximately 25 pounds, and fragments larger than 3 inches were generally excluded. The samples were sent to Golder's laboratory in Denver, Colorado and subjected to sieve analysis (ASTM C117/C136), hydrometer analysis (ASTM D422), and Atterberg limits determination (ASTM D4318). The grain-size and Atterberg limit test results are provided in Appendix C-4 and are summarized in Table 6.

After completion of each rotosonic corehole, a downhole geophysical survey was performed. Geophysical logging included:

- Cased Density Log,
- Natural Gamma Ray Spectrometry Tool, and
- Epithermal Neutron Log.

The results of the geophysical survey are reported in Greystone (2004).

2.5 2005 1A Stockpile Rotosonic Drilling Program

PDTI performed a rotosonic drilling program of the 1A Stockpile to verify their condition prior to re-mining from September 13 through 17, 2005. Five rotosonic drillholes (S1A-1 through S1A-5) were completed to depths of 110 to 200 feet. The locations of the 2005 rotosonic boreholes are shown on Figure 1 and the coordinates are provided on Table 4. Golder Engineer, Gene Muller, was present during drilling of rotosonic holes S1A-3 through S1A-5 and completed geotechnical logging and sampling of those holes. Hole S1A-3 penetrated through the base of the stockpile into the underlying Gila Conglomerate. The geotechnical logs are provided in Appendix B-3. Geologic logs prepared by PDTI are provided in Appendix B-4. Nineteen samples were collected and were sent to Golder's laboratory in Denver, Colorado and subjected to sieve analysis (ASTM C117/C136), hydrometer analysis (ASTM D422), and Atterberg Limits determination (ASTM D4318). The laboratory test results are provided in Appendix C-5 and are summarized in Table 6. The materials near the base of the 1A Stockpile have been subjected to leaching for the longest period of time of any stockpiles at the Tyrone Mine.

3.0 PRELIMINARY RESULTS

The results of the laboratory testing and geotechnical logging indicate that the stockpile materials typically classify as clayey gravels or clayey sand with occasional poorly graded gravel with clay and sand. The soil has a low to moderate plasticity generally between 10 and 20 percent. The oversize fraction varies considerably, comprising 10 to 50 percent of the material. The extended grain size curves provided on Figure 2 illustrate the range of grain sizes from the stockpile test pit samples. Localized clay zones 1- to 6-feet thick have been recognized in the rotosonic cores that are 1- to 4-feet thick.

The laboratory-derived Mohr-Coulomb shear strengths of the stockpile samples range from 29 degree friction with 8.8 pounds per square inch (psi) cohesion to 36.2 degrees friction with 0.6 psi cohesion. The shear strength results are summarized in Table 2. Due to the limitation of particle size in the test apparatus (i.e., ¾ inch for triaxial cell and 1 inch for direct shear box) the impact of the larger size fragments is not included in the laboratory-derived shear strength estimates. The distribution of the various sized particles plays a significant role in determining the physical properties of the stockpile materials. Research conducted by Fragaszy, et al. (1992) suggests that the strength of a soil with oversize particles (larger than the limitations of the testing apparatus) may be characterized by the strength of the matrix material if the oversized particles are in a floating state. Conversely, the strength of the soil may be characterized by the properties of the oversized material if there is sufficient oversized particle to particle contact. The research suggests that the strength properties of a soil having less than 40 percent oversized material are controlled primarily by the soil matrix and that the strength properties of a soil with more than 65 percent oversized material is controlled primarily by the properties of the oversized material. The strength properties of soils having between 40 and 65 percent oversized material are influenced by both the soil matrix and the oversized material. Boundaries have been provided on Figure 2 between oversized controlled shear strength, matrix controlled strength, and transitional behavior. The stockpiles are generally transitional. Laboratory-derived shear strengths can be considered to underestimate the shear strength of the stockpile materials.

The stockpiles are unsaturated, and moisture content variability is related to grain size of the soils. Coarse-grained materials are dry, and fine-grained zones have higher moisture retention.

4.0 REMAINING WORK

Additional work that will be completed to assess the stockpile stability is the characterization of the foundation conditions underlying the stockpiles. This work will be completed during early 2006 and will include identification of areas with potentially weak foundation materials based on available data and field reconnaissance. Where weak foundation materials are identified or suspected, the field characteristics will be recorded and samples will be collected and subjected to laboratory testing as determined to be appropriate.

The long-term impacts of weathering on the stability of the stockpiles will also be considered through weathering studies being performed by EnviroGroup Limited.

Two-dimensional, cross-sectional, slope stability models will be developed for critical cross-sections. Critical cross-sections will be selected based on consideration of slope height, slope angle, natural ground surface topography, groundwater conditions, the compositional model and assigned material parameters. Slope regrading is ongoing and the slope stability analyses will be performed for slope configurations that reflect the final conditions. Limit equilibrium slope stability analyses will be performed for the critical cross-sections, and the results will be reported in terms of a factor of safety.

The methodology and results will be described in a final report that will be prepared after the completion of the slope stability analyses and is scheduled for completion prior to September 2006.

5.0 USE OF THIS REPORT

This report has been prepared exclusively for the use of Phelps Dodge Tyrone, Inc. for specific application to the Tyrone Project. No third party engineer or consultant shall be entitled to rely on any of the information, conclusions, or opinions contained in this report without the prior written approval from PDTI and Golder.

The conclusions in this report have been prepared in a manner consistent with that level of care and skill ordinarily exercised by professionals currently practicing in this field. In preparing our conclusions and recommendations, Golder has relied upon information provided by the client and other parties involved in the study and Golder is not responsible for errors or omissions in the information provided by the client or the other parties.

Respectfully submitted,

GOLDER ASSOCIATES INC.

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Senior Geological Engineer

6.0 REFERENCES

Daniel B. Stephens & Associates, Inc. (DBS&A), 1997a. *Preliminary Materials Characterization Tyrone Mine Closure/Closeout*, prepared for Phelps Dodge Tyrone, Inc. April 30, 1997.

DBS&A, 1997b. *Supplemental Materials Characterization Tyrone Mine Closure/Closeout*, prepared for Phelps Dodge Tyrone, Inc. October 31, 1997.

Fragaszy, R.J., J. Su, F.H. Siddiqi, and C.L. Ho, 1992. *Modeling Strength of a Sandy Gravel. Journal of Geotechnical Engineering*. Vol. 118. No. 6.

Golder Associates Inc. (Golder), 2000. *Closure/Closeout Addendum, Slope Stability Analysis, Phelps Dodge Tyronne, Inc., Grant County, New Mexico*, prepared for Phelps Dodge Tyrone, Inc. February 24, 2000, project number 993-2546.001.

Golder, 2002. *Results of Additional Stockpile Characterization Activities at the Tyrone Mine*, prepared for Phelps Dodge Tyrone, Inc. May 7, 2002, project number 013-1595.

Golder, 2003. *Work Plan, Condition 78, Supplemental Slope Stability Analysis*, prepared for Phelps Dodge Tyrone, Inc. December 12, 2003, project number 013-1595-002.

Greystone, 2004. *Supplemental Materials Characterization Study of the Leached Ore Stockpiles and Waste Rock Stockpiles – Interim Report for DP-1341, Condition 80, Tyrone Mine,* prepared for Phelps Dodge Tyrone, Inc., prepared by Greystone Environmental Consultants, Inc.

TABLES

TABLE 1
SUMMARY OF STOCKPILE TEST PIT LOCATIONS

Sample #	Approximate Mine Coordinates			Stockpile Name	Year Stockpile Placed	Depth Below Stockpile Surface (feet)	% >3-inch
	Easting	Northing	Elev.				
2000 Closure/Closeout Plan Addendum[a]							
GTP-01	21349	11668	6123	No. 1		10	15
GTP-02	22620	11316	6150	No. 1		10	15
GTP-03	15937	14890	6250	No. 5A		10	20
GTP-04	15252	15617	6130	No. 5A		10	10
GTP-05	13426	16559	6180	No. 5A		10	20
GTP-06	4038	11230	6310	No. 2A		10	20
GTP-07	4694	13436	6380	No. 2A		10	20
GTP-08	4408	9437	6270	No. 2A		10	15
GTP-09	6075	6910	6400	No. 2A		10	45
GTP-10	11416	3546	6450	No. 7A		10	25
GTP-11	13141	4636	6400	No. 7A		10	20
GTP-12	16737	5541	6250	No. 1C		10	25
GTP-13	18450	6622	6250	No. 1C		10	20
GTP-14	10230	19063	6150	No. 3A		10	35
2001 Test Pit Program							
TYTP01-1	4757	10882	6270	No. 2B	1975	100	40
TYTP01-2	6335	8367	6100	No. 2C	1978	400	30
TYTP01-3	6643	8275	6200	No. 2C	1982	250	50
TYTP01-4	5945	9155	6350	No. 2C	1986	100	15
TYTP01-5	5766	6482	6400	No. 4C	1975	100	10
TYTP01-6	13643	9578	5925	No. 6B	1989	300	50
TYTP01-7	13282	9913	5975	No. 6B	1989	300	40
TYTP01-8	13523	9429	6025	No. 6B	1990	250	30
TYTP01-9	17378	8051	6150	No. 1A	1967	40	30
TYTP01-10	14429	12245	6200	No. 5A	1967	50	50
TYTP01-11	4473	10612	5850	No. 2B	1973	100	10
TYTP01-12	10770	15320	6275	No. 3B	1975	100	40
2004 1C Stockpile Sampling							
GA04-TY-1	17364	6537	6200	1C	1998	50.0	10
GA04-TY-2	18049	7149	6200	1C	1998	50.0	10
GA04-TY-3	17366	6367	6150	1C	1982	100.0	50
GA04-TY-4	18112	6939	6150	1C	1982	100.0	40
GA04-TY-5	18417	6253	6000	1C	1982	250.0	15
GA04-TY-6	18220	7116	6150	1C	1982	100.0	20
GA04-TY-7	18158	6690	6100	1C	1982	150.0	20
GA04-TY-8	18404	7044	6100	1C	1982	150.0	30

Note:
[a] Golder, 2000

TABLE 2
SUMMARY OF STOCKPILE SAMPLE FIELD TEST RESULTS

Sample #	Approximate Mine Coordinates			Stockpile Name	Average Clast UCS (psi)	Average Field Dry Density	Average Field Moisture
	Easting	Northing	Elev.				
GTP-01	21349	11668	6123	No. 1	9,436	121.3	5.0
GTP-02	22620	11316	6150	No. 1	14,187	118.7	6.8
GTP-03	15937	14890	6250	No. 5A	13,155	125.1	5.3
GTP-04	15252	15617	6130	No. 5A	8,006	121.1	3.3
GTP-05	13426	16559	6180	No. 5A	14,109	108.4	4.8
GTP-06	4038	11230	6310	No. 2A	9,268	127.5	6.8
GTP-07	4694	13436	6380	No. 2A	8,052	117.9	5.8
GTP-08	4408	9437	6270	No. 2A	5,119	121.7	9.8
GTP-09	6075	6910	6400	No. 2A	15,856	116.3	6.7
GTP-10	11416	3546	6450	No. 7A	4,621	127.1	6.0
GTP-11	13141	4636	6400	No. 7A	10,593	117.0	3.2
GTP-12	16737	5541	6250	No. 1C	7,906	128.3	5.0
GTP-13	18450	6622	6250	No. 1C	6,507	127.3	3.8
GTP-14	10230	19063	6150	No. 3A	22,481	119.6	5.3

Notes:
UCS = uniaxial compressive strength
psi = pounds per square inch

TABLE 3
SUMMARY OF STOCKPILE TEST PIT LABORATORY TEST RESULTS

Sample #	USCS Soil Classi-fication	Atterberg Limits			Grain-size Distribution			Effective Stress Parameters	
					% Finer	% Finer	% Finer	φ	C
		LL	PL	PI	3/4"	#4	#200	(degrees)	(psi)
GTP-01	GC	47	22	25	81	49	17		
GTP-03	SC	33	20	13	84	60	18	34.6[a]	5.8[a]
GTP-06	GP-GC	42	20	22	69	38	10	32.8[a]	8.3[a]
GTP-09	GP-GC	39	20	19	59	37	8		
GTP-10	GC	47	21	26	70	38	12		
GTP-13	GP-GC	38	19	19	74	49	11		
GTP-14	GP-GC	28	15	13	66	31	8		
TYTP01-1	GC	38	17	21	77	48	13		
TYTP01-2	GW-GC	30	14	16	78	48	10	36.2[a]	0.6[a]
TYTP01-3	GP-GC	36	18	18	75	38	9		
TYTP01-4	GC	40	17	23	76	53	15	35.5[a]	0.4[a]
TYTP01-5	GC	39	16	23	79	49	15		
TYTP01-6	GW-GC	29	16	13	70	42	8		
TYTP01-7	SC	28	15	13	81	63	15	36.9[a]	0.6[a]
TYTP01-8	SC	24	16	8	85	60	15		
TYTP01-9	GC	30	18	12	80	58	24	34.1[a]	2.2[a]
TYTP01-10	SC	30	18	12	96	80	17		
TYTP01-11	GC	37	17	20	85	50	13		
TYTP01-12	GC	30	16	14	77	46	14		
GA-04-TY-1	GC	34	20	14	70	41	18	31.0[b]	10.4[b]
GA-04-TY-2	GC	35	21	14	80	52	22		
GA-04-TY-3	GC	40	21	19	69	40	17		
GA-04-TY-4	GP-GC	50	17	33	46	15	6		
GA-04-TY-5	GC	33	19	14	59	33	14	32.0[b]	11.8[b]
GA-04-TY-6	GC	35	19	16	66	42	20		
GA-04-TY-7	GC	36	19	17	64	36	14		
GA-04-TY-8	GC	30	19	11	68	42	17	29.0[b]	8.8[b]
Average		*35.5*	*18.1*	*17.3*	*73.5*	*45.9*	*14.1*	*33.6*	*5.4*
Standard Deviation		*6.4*	*2.1*	*5.6*	*10.1*	*12.3*	*4.5*	*2.6*	*4.6*

Notes:

[a] consolidated-undrained triaxial shear with pore pressure measurements

[b] large-scale (6 in x 6 in) direct shear

USCS = Unified Soil Classification System

LL = liquid limit

PL = plastic limit

PI = plasticity index

psi = pounds per square inch

TABLE 4
ROTOSONIC BOREHOLE LOCATIONS

Drillhole	Easting	Northing	Elevation	Depth
TSGT-01	9537	19405	6208	410
TSGT-02	17009	11550	6378	281
TSGT-03	15999	14300	6298	250
TSGT-04	4156	10839	6311	2,730
S1A-1	18931	8274	6164	150
S1A-2	18744	9432	6159	110
S1A-3	18991	10092	6170	110
S1A-4	18606	8849	6304	115
S1A-5	18441	9895	6374	200

TABLE 5
INTERNATIONAL SOCIETY OF ROCK MECHANICS MANUAL INDEX TEST

Grade	Description	Field Identification	Approximate Range of Uniaxial Compressive Strength	
			(MPa)	(psi)
S1	Very Soft Clay	Easily penetrated several inches by fist	<0.025	<4
S2	Soft Clay	Easily penetrated several inched by thumb	0.025 – 0.05	4 – 7
S3	Firm Clay	Can be penetrated several inches by thumb with moderate effort	0.05 – 0.1	7 – 15
S4	Stiff Clay	Readily indented by thumb but penetrated only with great effort	0.1 – 0.25	15 – 35
S5	Very Stiff Clay	Readily indented by thumbnail	0.25 – 0.50	35 – 70
S6	Hard Clay	Indented with difficulty by thumbnail	>0.50	>70
R0	Extremely Weak Rock	Indented by thumbnail	0.25 – 1.0	35 – 150
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be pealed by a pocket knife	1.0 – 5.0	150 – 725
R2	Weak Rock	Can be pealed by a pocket knife with difficulty, shallow indentation made by firm blow with point of geological hammer	5.0 – 25	725 – 3,500
R3	Medium Strong Rock	Cannot be scraped or pealed with a pocket knife, specimen can be fractured with a single firm blow of geological hammer	25 – 50	3,500 – 7,500
R4	Strong Rock	Specimen requires more than one blow of geological hammer to fracture it	50 – 100	7,500 – 15,000
R5	Very Strong Rock	Specimen requires many blows of geological hammer to fracture it	100 – 250	15,000 – 35,000
R6	Extremely Strong Rock	Specimen can only be chipped with geological hammer	>250	>35,000

Notes:
MPa = megaPascals
psi = pounds per square inch

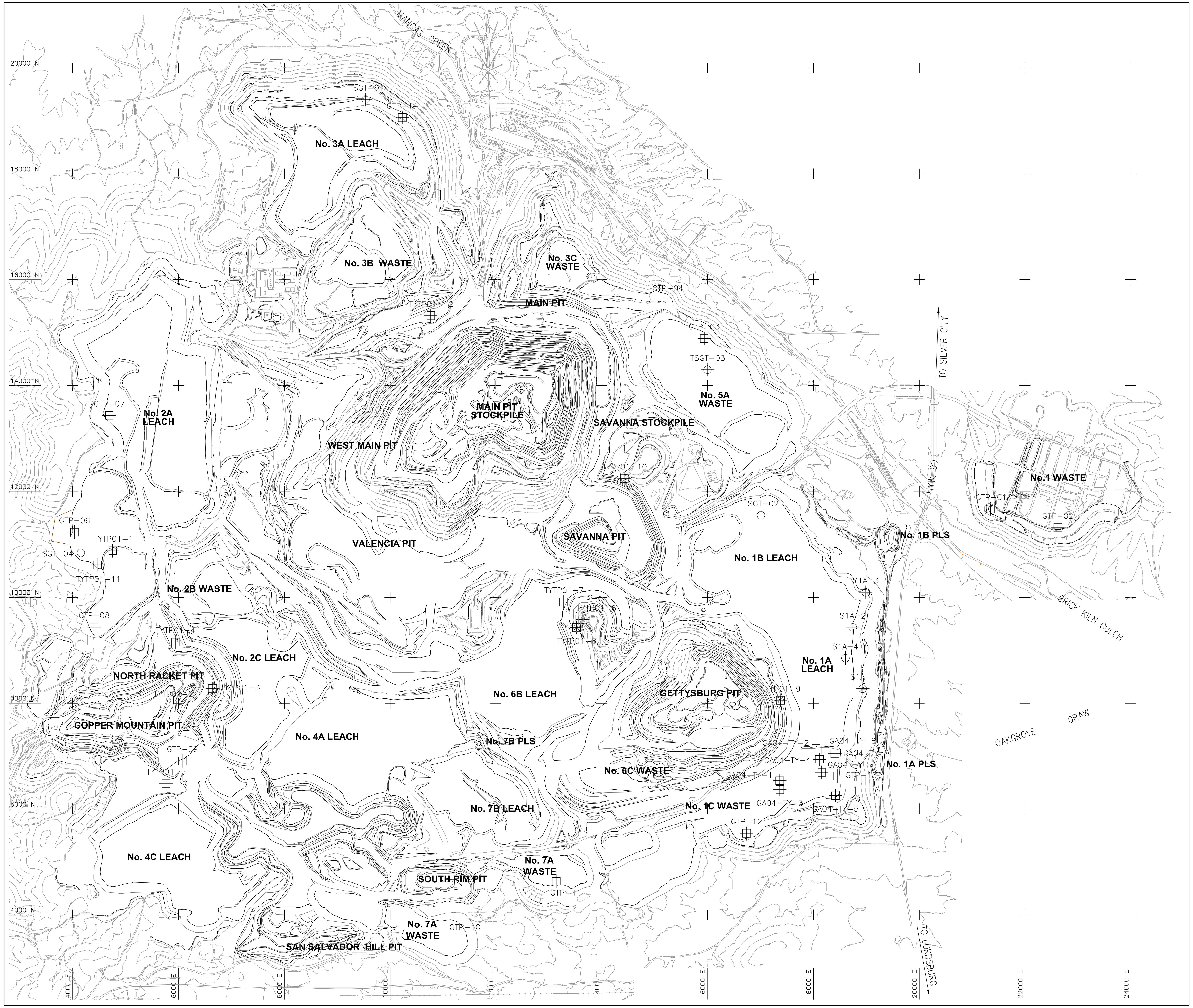
TABLE 6
SUMMARY OF LABORATORY TEST RESULTS FROM ROTOSONIC BOREHOLE SAMPLES

Drillhole	Depth (feet)	USCS Soil Classi-fication	Atterberg Limits			Grain-size Distribution		
						% Finer	% Finer	% Finer
			LL	PL	PI	3/4"	#4	#200
TSGT-1	19-21	SC	25	14	11	86	65	23
TSGT-1	47-48.5	GC	29	16	13	61	41	15
TSGT-1	75-77	SC-SM	26	19	7	81	60	17
TSGT-1	88-90	GC	28	18	10	84	58	23
TSGT-1	102-104	GC	33	20	13	80	55	21
TSGT-1	140-142	GC	29	18	11	66	46	21
TSGT-1	158.5-160	GC	34	19	15	64	41	18
TSGT-1	184-186	GC	30	20	10	72	50	17
TSGT-1	211-214	SC	27	16	11	93	76	32
TSGT-1	228-230	GC	23	15	8	72	52	21
TSGT-1	250.5-253	SC	27	16	11	89	69	30
TSGT-1	298-300	SC	28	14	14	95	82	38
TSGT-1	310-312	GC	29	16	13	78	55	21
TSGT-1	327-329	SC-SM	21	15	6	83	67	24
TSGT-1	356-358	SC	32	16	16	80	65	26
TSGT-1	388-390	SC	26	15	11	93	82	35
TSGT-2	18-20	GC	27	16	11	72	47	16
TSGT-2	42-44	GP-GC	22	14	8	64	37	12
TSGT-2	140-142	SC	34	20	14	86	63	18
TSGT-2	267-268.5	GC	29	19	10	66	46	12
TSGT-3	18-20	SC	28	17	11	94	66	16
TSGT-3	58-60	GC	29	17	12	85	56	15
TSGT-3	156-158	SC	29	15	14	94	75	28
TSGT-3	248-250	GC	28	17	11	74	56	22
TSGT-4	12-14	GC	34	18	16	78	55	21
TSGT-4	69-71	GC	36	20	16	64	34	12
TSGT-4	117-119	GC	35	20	15	68	38	14
TSGT-4	152-154	GC	31	18	13	88	55	18
TSGT-4	183-185	SC	31	19	12	94	78	24
TSGT-4	221-223	GC	29	17	12	78	47	16
TSGT-4	265-269	SM	NP	NP	NP	97	90	22
T3	11.0-12.5	GC	32	17	15	71	41	16
T3	31.0-32.5	GC	34	18	16	69	56	28
T3	51.0-52.5	GC	31	19	12	71	55	21
T3	71.0-72.5	SC	33	20	13	91	76	35
T3	76.5-77.5	SC-SM	23	16	7	88	67	28
T3	91.0-92.5	GC	31	18	13	79	62	26
T4	49.0-50.0	GC	31	17	14	77	55	22
T4	69.0-70.0	SC	31	16	15	86	63	25
T4	89-0-90.0	SC	36	20	16	86	66	30
T4	109.0-110.0	GC	35	20	15	74	55	24

Drillhole	**Depth (feet)**	**USCS Soil Classification**	**Atterberg Limits**			**Grain-size Distribution**		
						% Finer	**% Finer**	**% Finer**
			LL	**PL**	**PI**	**3/4"**	**#4**	**#200**
T4	113.0-114.0	SC	36	19	17	97	76	33
T4	129.0-130.0	GC	34	23	11	72	49	24
T5	16.5-17.5	GM	NP	NP	NP	69	49	15
T5	36.5-37.5	GC	30	16	14	56	37	13
T5	56.5-57.5	GC	34	18	16	58	38	13
T5	96.5-97.5	GC	37	21	16	71	55	20
T5	116.5-117.5	GC	33	19	14	84	62	27
T5	136.5-137.5	GC	33	18	15	67	47	19
T5	164.0-165.0	GC	35	17	18	75	53	20
Average			29.7	17.2	12.5	78.4	57.4	21.7
Standard Deviation			5.8	3.2	3.3	11.0	13.2	6.5

Notes:
USCS = Unified Soil Classification System
LL = liquid limit
PL = plastic limit
PI = plasticity index

FIGURES



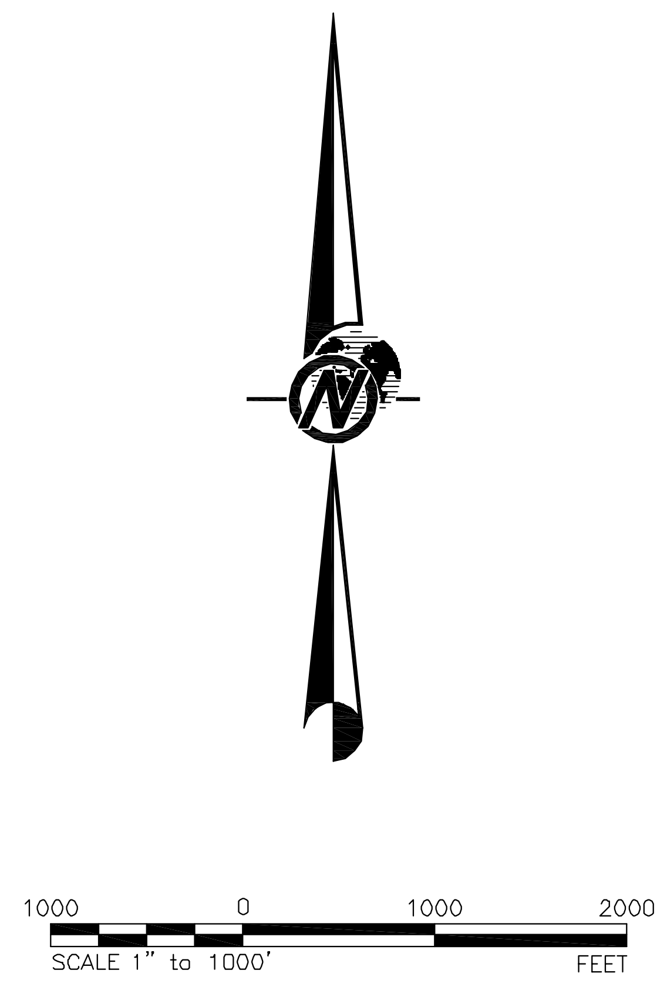
LEGEND

⊕ ROTOSONIC BOREHOLE LOCATION

⊞ STOCKPILE TEST PIT LOCATION

REFERENCES

1.) PRE-1999 TOPOGRAPHIC BASE MAP PROVIDED BY PHELPS DODGE TYRONE, INC.



PROJECT

phelps dodge TYRONE Inc.

INTERIM REPORT FOR
DP-1341 CONDITION 78
SUPPLEMENTAL STABILITY

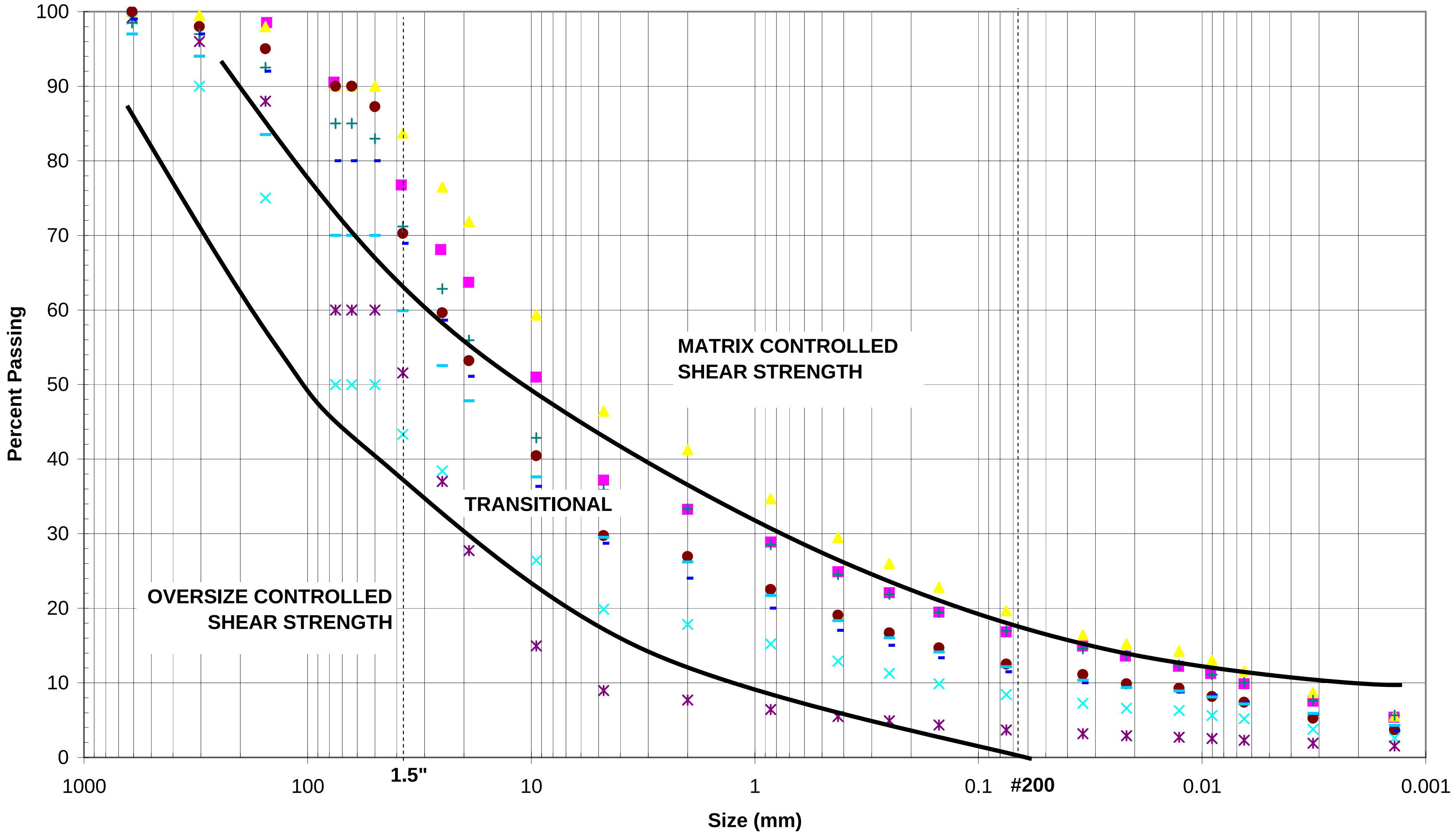
TITLE

GEOTECHNICAL EXPLORATION SITES

Golder Associates
Tucson, Arizona

PROJECT No.		053-2550	FILE No.	0532550A001
DESIGN	TJW	11/28/05	SCALE AS SHOWN	REV. A
CADD	NIL	11/28/05	FIGURE	
CHECK	TW	12/19/05	1	
REVIEW				

Drawing file: 0532550A001.dwg Jan 13, 2006 - 9:46am



CLIENT/PROJECT

Phelps Dodge Tyrone Inc.
DP-1341, Condition 78

Golder Associates

Tucson, Arizona

TITLE

Interim Report
1C Stockpile Extended Grain Size Curves

DRAWN	tjw	CHECKED	tjw	REVIEWED	dak	DATE	11-27-05	SCALE	N.T.S.	FILE NO.	gures.xls	JOB NO.	053-2550	REV. NO.	A	FIGURE	**2**

APPENDIX A

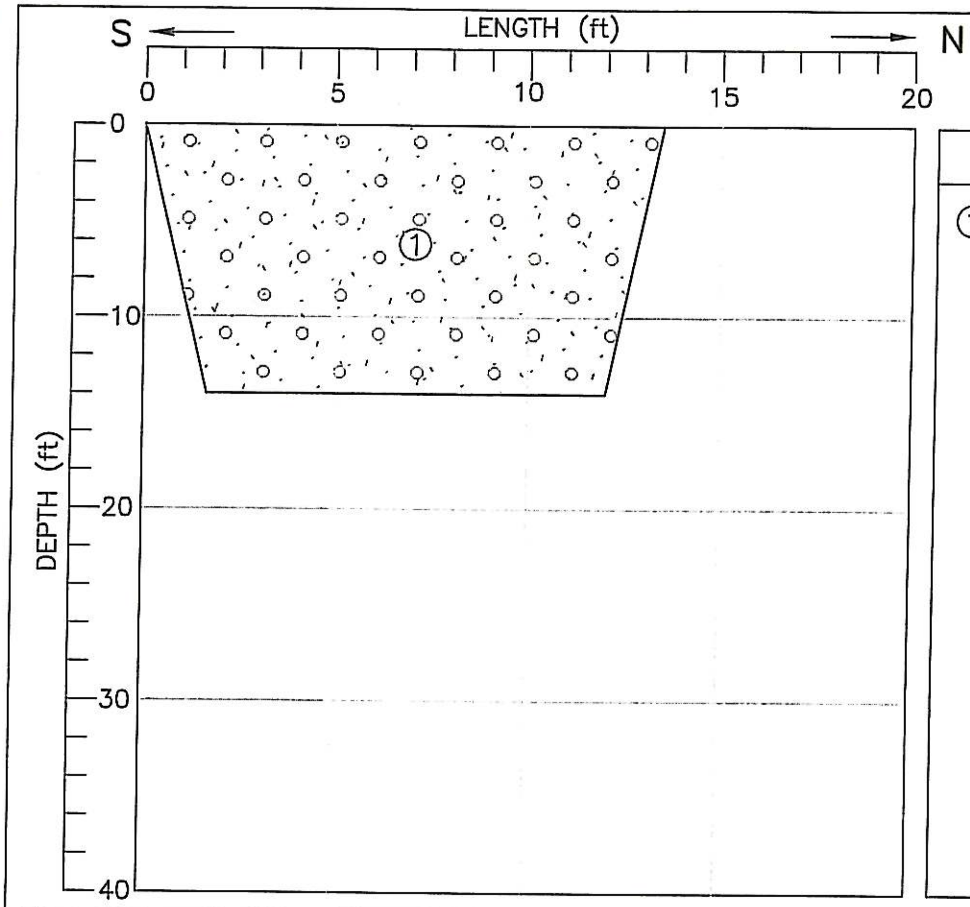
TEST PIT LOGS

APPENDIX A-1

2000 TEST PIT LOGS

FIELD TEST PIT LOG

TEST PIT GTP-01
TEMP 30 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 7, 2000
ELEVATION 6123.5 FT.
DATUM MSL
JOB 993-2546
LOCATION 11668.64 N, 21349.19 E
NO. 1 STOCKPILE



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Few boulders to 12 inches. Fine to coarse, angular gravel. Some fine to coarse sand. Little medium plasticity fines. Slightly moist–moist. Medium dense.

SAMPLES

NO.	DESCRIPTION
S-01	Bulk
–	Point Load Clasts

NOTES:

85% Soil Matrix
15% Oversize Clast

Excavation terminated at 14 foot depth.

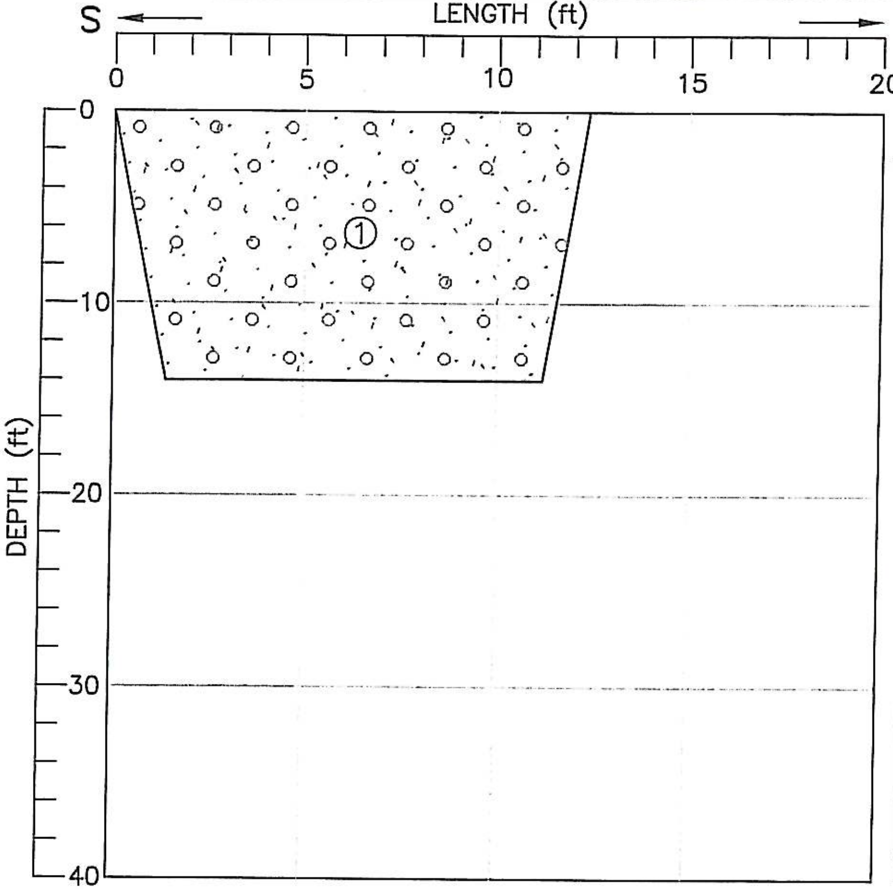
No groundwater encountered during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

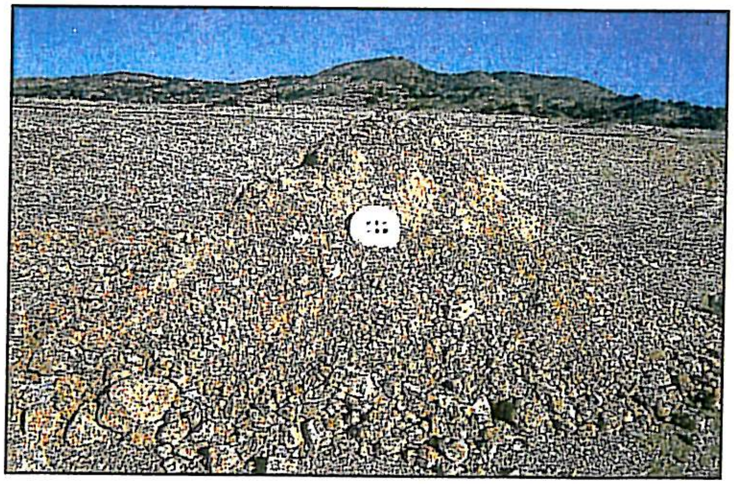
FIELD TEST PIT LOG

TEST PIT GTP-02
TEMP 30 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 7, 2000
ELEVATION 6150 FT.
DATUM MSL
JOB 993-2546
LOCATION 11315.70 N, 22620.44 E
NO. 1 STOCKPILE



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Few boulders to 36 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Medium dense.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

85% Soil Matrix
15% Oversized Clasts

Excavation terminated at 13.5 foot depth.

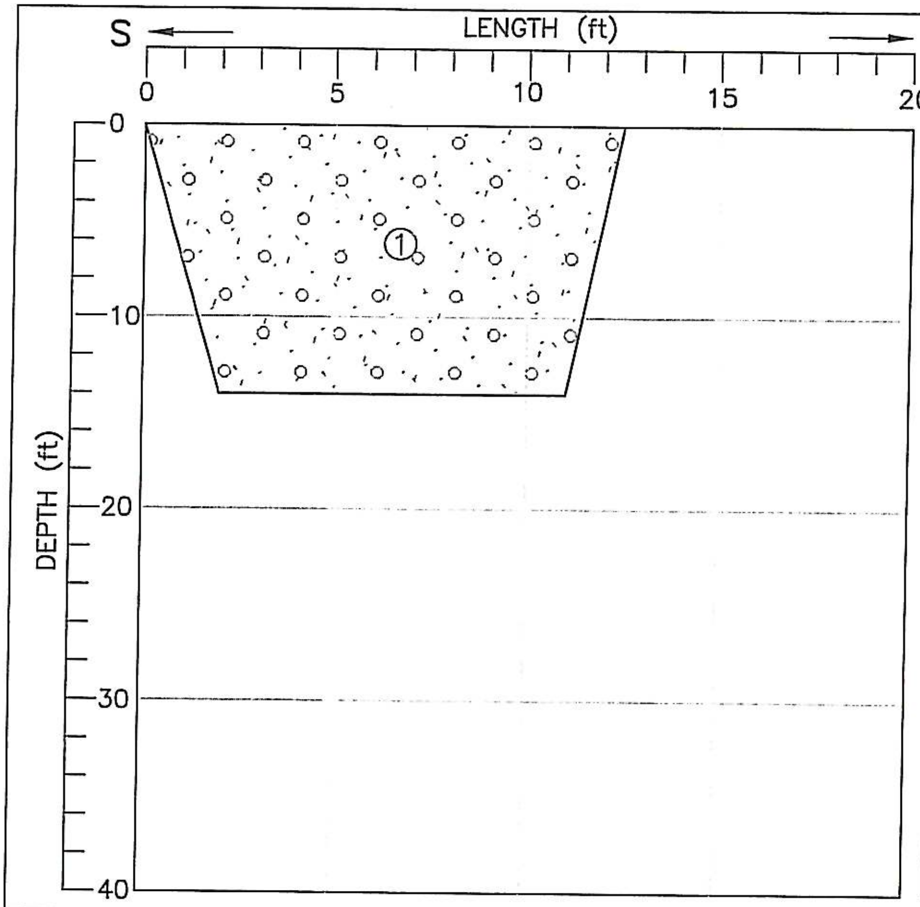
No groundwater encountered during excavations.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

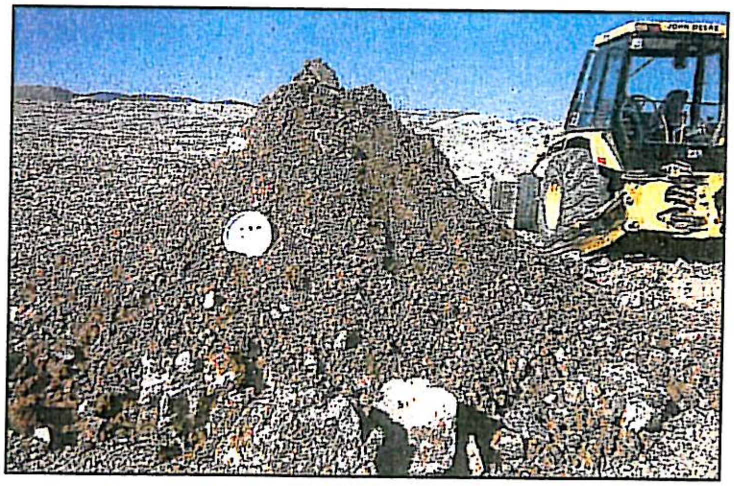
FIELD TEST PIT LOG

TEST PIT GTP-03
TEMP 32 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 7, 2000
ELEVATION 6250 FT.
DATUM MSL
JOB 993-2546
LOCATION 14889.58 N, 15936.84 E
1D Stockpile



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Little cobbles and boulders to 36 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Medium Dense.



SAMPLES

NO.	DESCRIPTION
S-02	Bulk
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavation terminated at 15 foot depth.

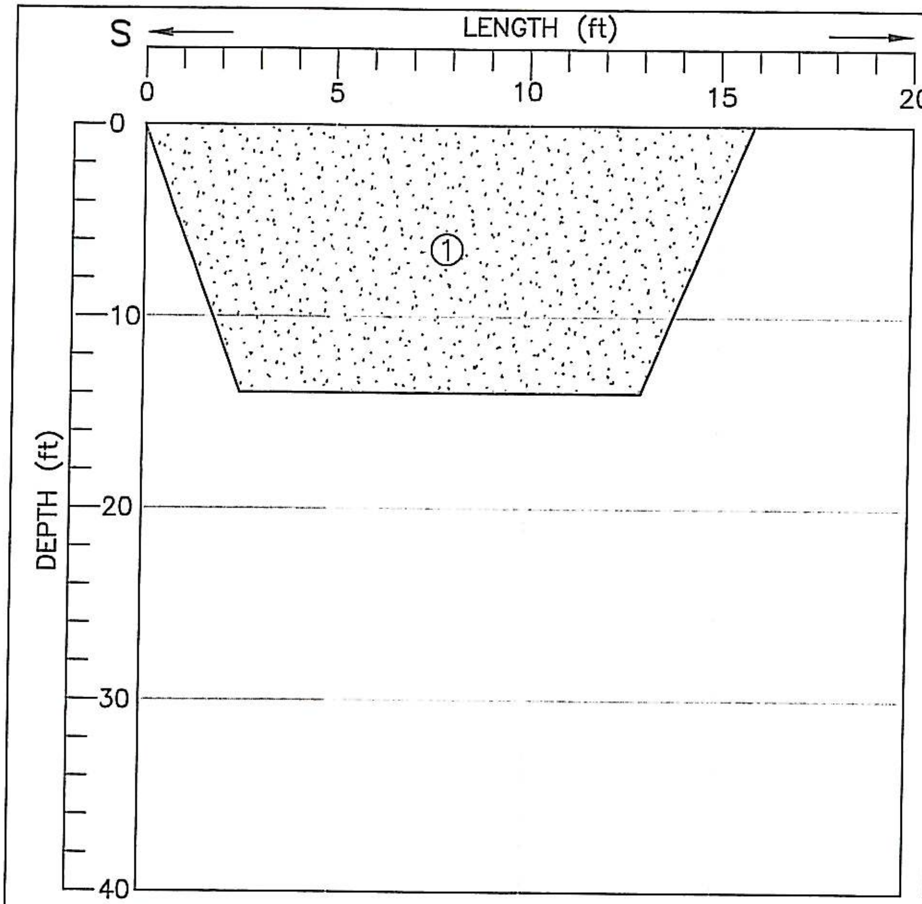
No groundwater encountered during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

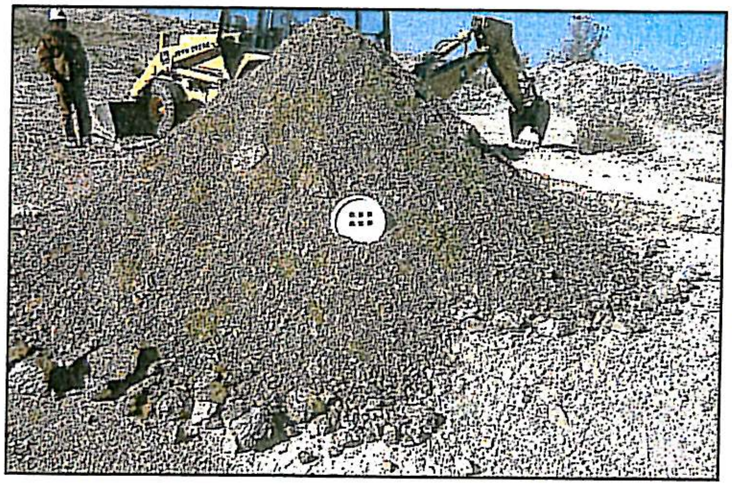
TEST PIT GTP-04
TEMP 35 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510 C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 7, 2000
ELEVATION 6130 FT.
DATUM MSL
JOB 993-2546
LOCATION 15616.96 N, 15252.46 E 1D STOCKPILE (MID BENCH)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Sand with Gravel. Fine to coarse sand. Some Fine to coarse angular gravel. Few cobbles and boulders to 24 inches. Few low plasticity fines. Moist. Medium dense.

Mostly moderately to severely weathered granitic rock material.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

90% Soil Matrix
10% Oversized Clasts

Excavation terminated at 15 foot depth.

No groundwater encountered during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

TEST PIT GTP-05

TEMP 40 °F WEATHER CLEAR

ENGINEER G. TORTELLI

OPERATOR SAL

EQUIPMENT DEERE 510C BACKHOE

CONTRACTOR HAMILTON

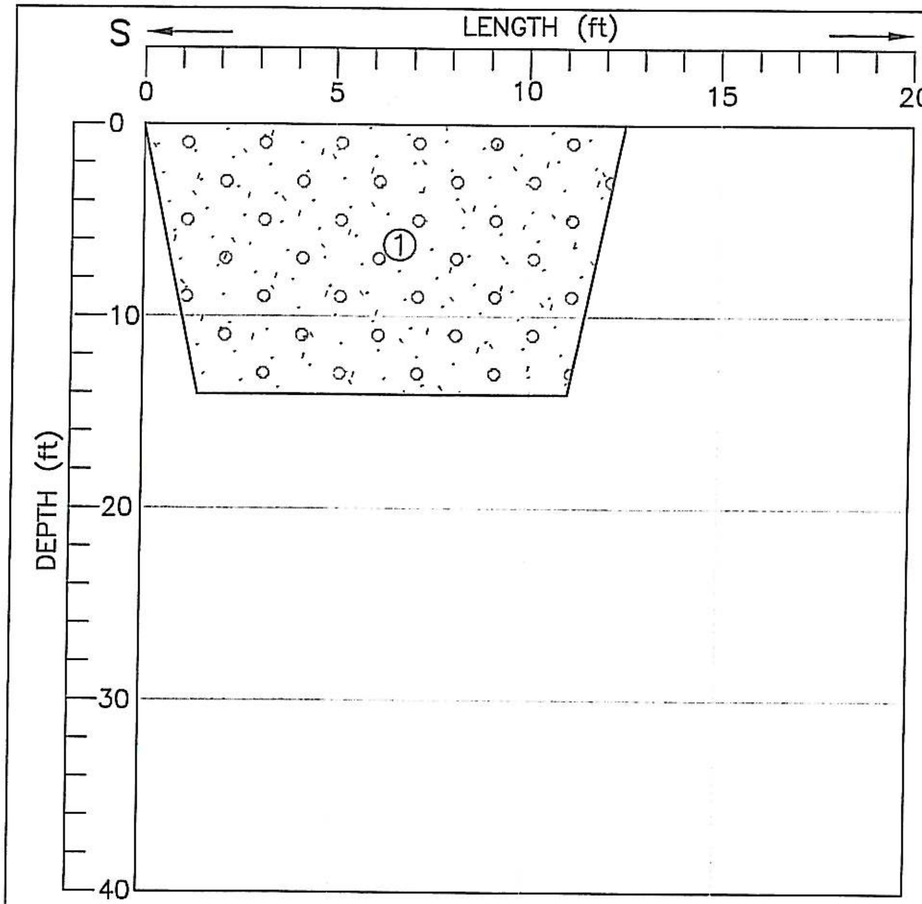
DATE JANUARY 7, 2000

ELEVATION 6180 FT.

DATUM MSL

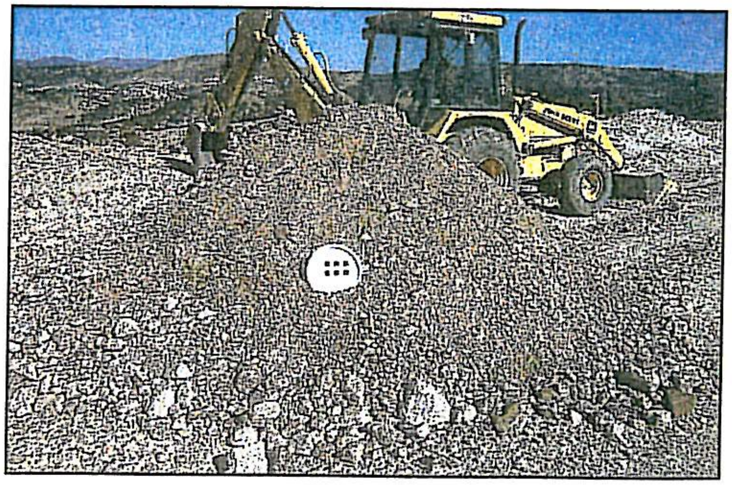
JOB 993-2546

LOCATION 16559.15 N, 13426.10 E 1D STOCKPILE (NORTH SIDE)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Little cobbles and boulders to 24 inches. Fine to coarse angular gravel. Some fine to coarse sand. Few low plasticity fines. Slightly moist–moist. Medium dense.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavaton terminated at 14 foot depth.

No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

TEST PIT GTP-06

TEMP 45 °F WEATHER CLEAR

ENGINEER G. TORTELLI

OPERATOR SAL

EQUIPMENT DEERE 510C BACKHOE

CONTRACTOR HAMILTON

DATE JANUARY 7, 2000

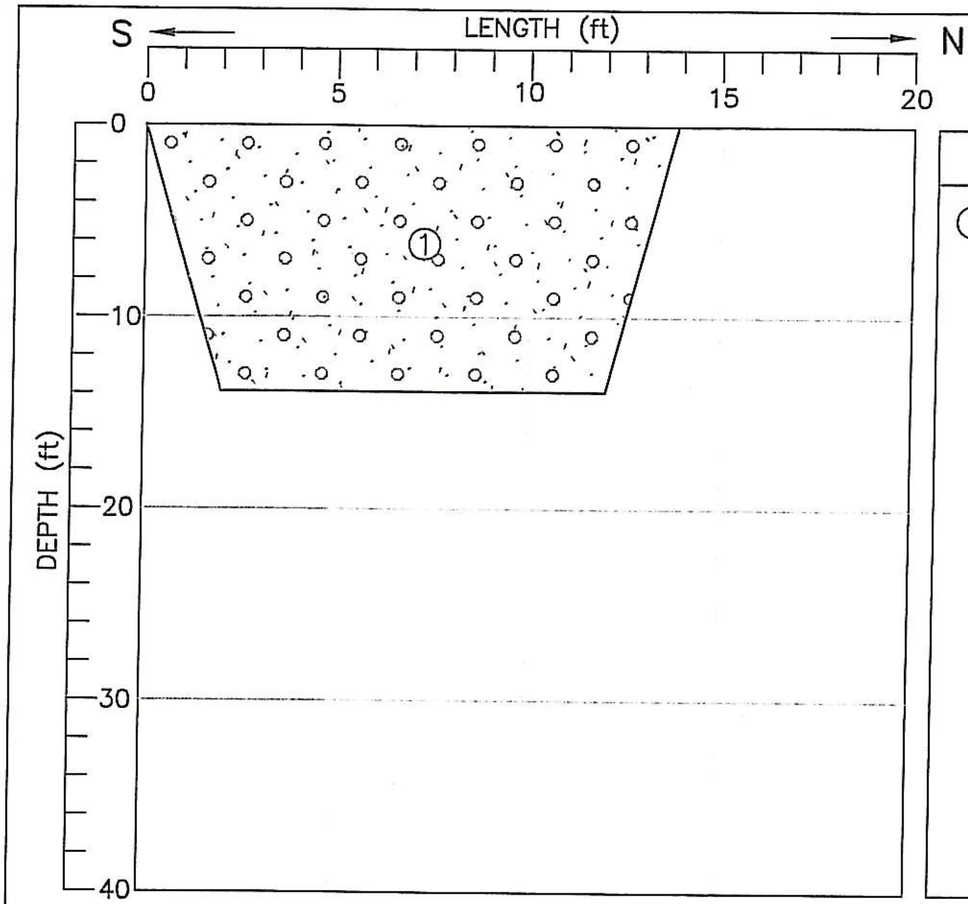
ELEVATION 6310 FT.

DATUM MSL

JOB 993-2546

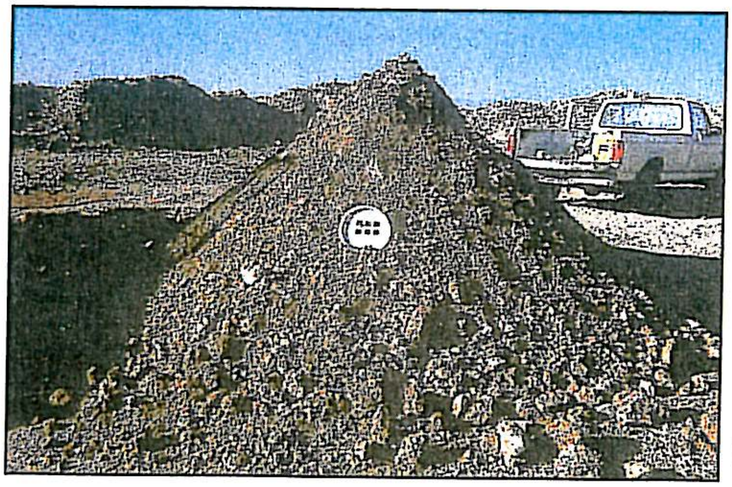
LOCATION 11230.62 N, 4038.42 E

2, 2A STOCKPILE GROUP (NORTH)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Few cobbles and boulders to 12 inches. Angular fine to coarse gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Medium dense.



SAMPLES

NO.	DESCRIPTION
S-03	Bulk
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavation terminated at 14.5 foot depth.

No groundwater encountered during excavation.

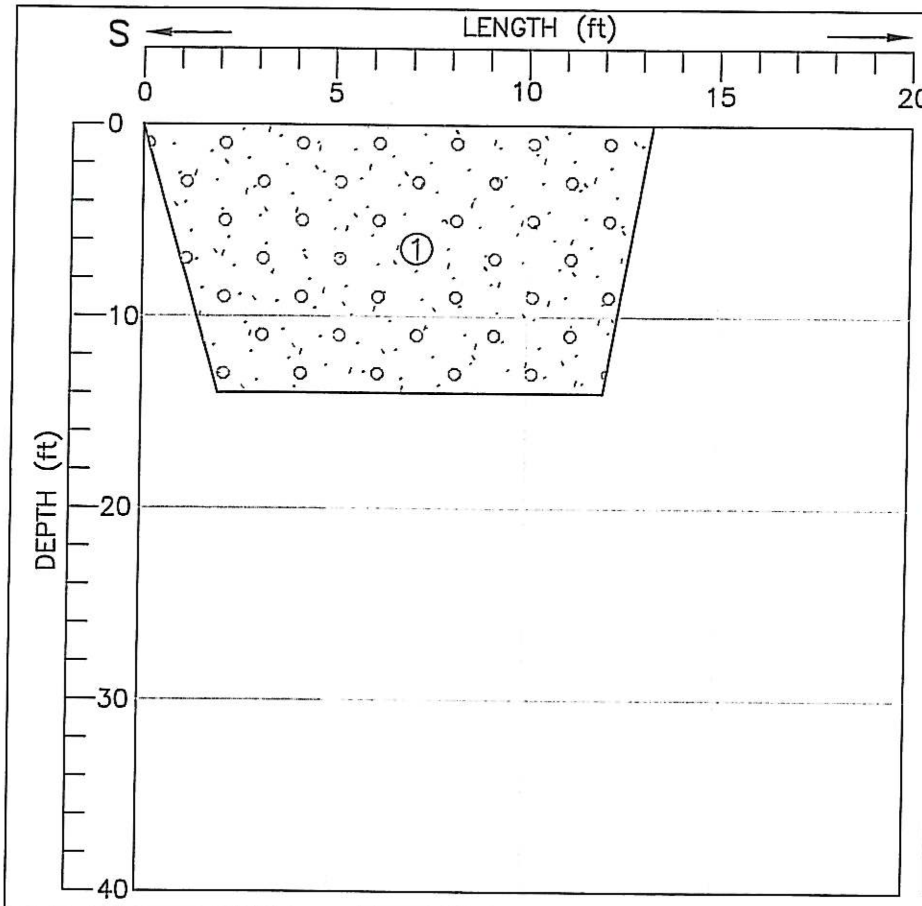
Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

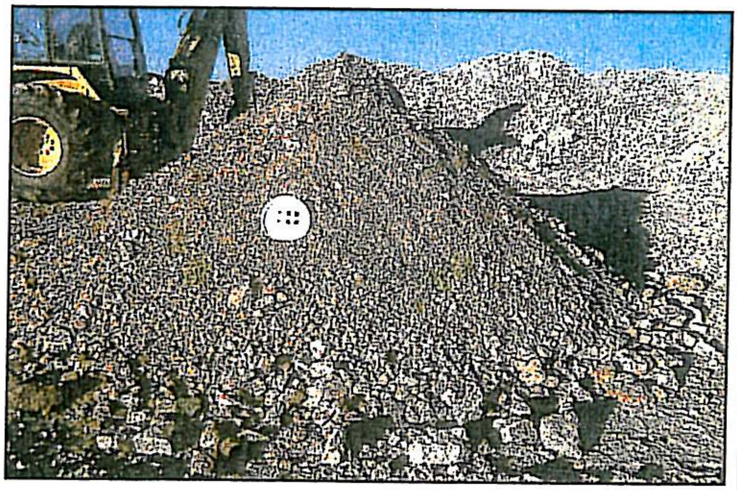
TEST PIT GTP-07

TEMP 30 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6380 FT.
DATUM MSL
JOB 993-2546
LOCATION 13435.50 N, 4693.92 E
2, 2A STOCKPILE GROUP (NORTH)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Occasional cobbles and boulders to 24 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Medium dense.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavation terminated at 14.5 foot depth.

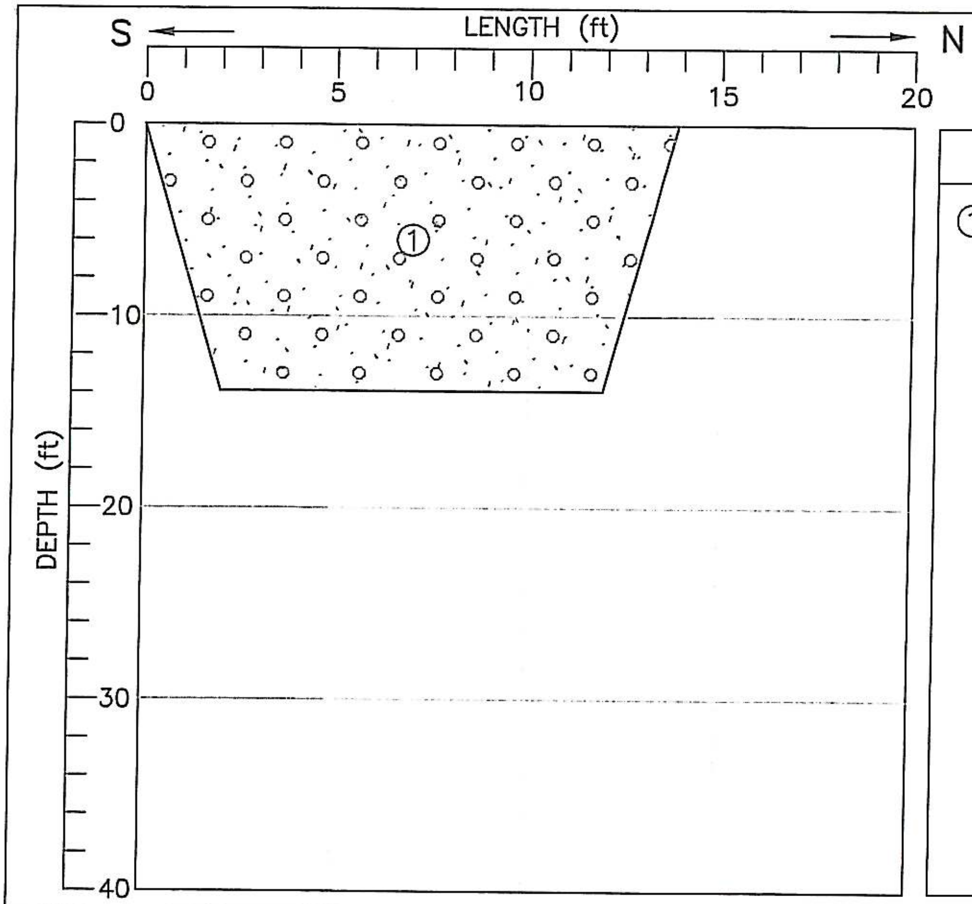
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

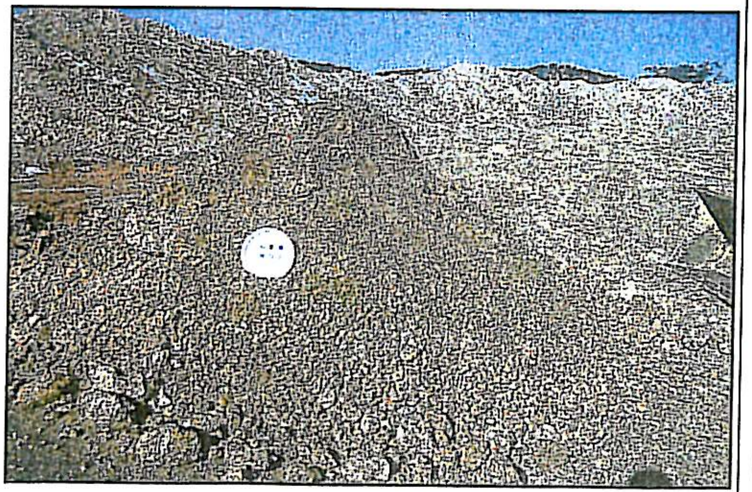
FIELD TEST PIT LOG

TEST PIT GTP-08
TEMP 30 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6270 FT.
DATUM MSL
JOB 993-2546
LOCATION 9437.31 N, 4407.96 E
2, 2A STOCKPILE GROUP (NORTH)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Occasional Cobbles and boulders to 24 inches. Fine to coarse angular gravel . Some fine to coarse sand. Little medium plasticity fines. Moist. Medium dense.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

85% Soil matrix.
15% Oversized Clasts.

Excavation terminated at 14 foot depth.

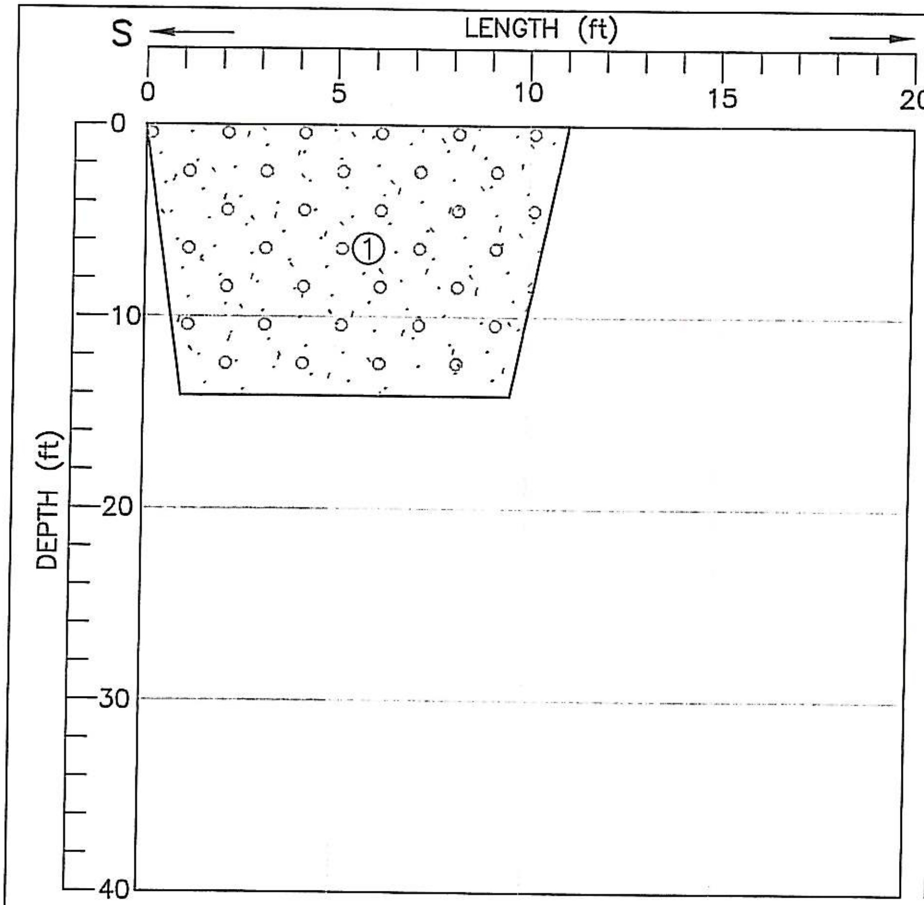
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

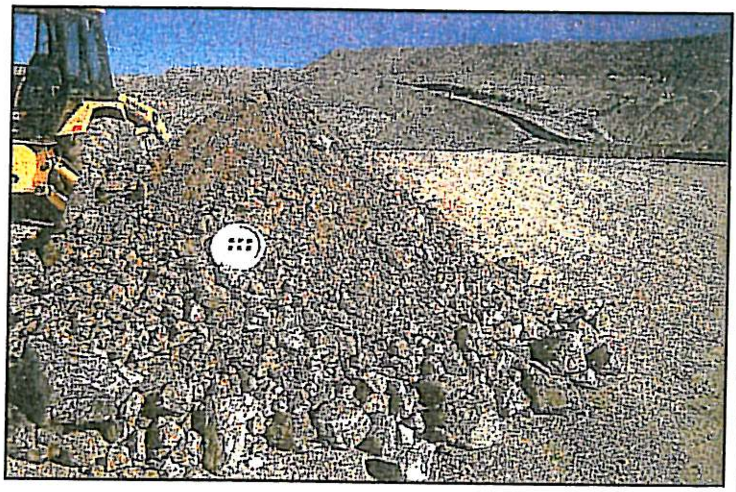
TEST PIT GTP-09
TEMP 40 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6400 FT.
DATUM MSL
JOB 993-2546
LOCATION 6909.68 N, 6075.43 E
2, 2A STOCKPILE GROUP (SOUTH)



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Frequent cobbles and boulders to 24". Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Medium Dense.

Cracking and vertical displacement of 12 to 18 inches observed near the crest of slope. Displacement is located at contact beweeen stockpile and pit wall. Displacement most likely due to settlement.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts
S-05	Bulk

NOTES:

55% Soil Matrix
45% Oversized Clasts

Excavation terminated at 14 foot depth.

No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

TEST PIT GTP-10

TEMP 40 °F WEATHER CLEAR

ENGINEER G. TORTELLI

OPERATOR SAL

EQUIPMENT DEERE

CONTRACTOR HAMILTON

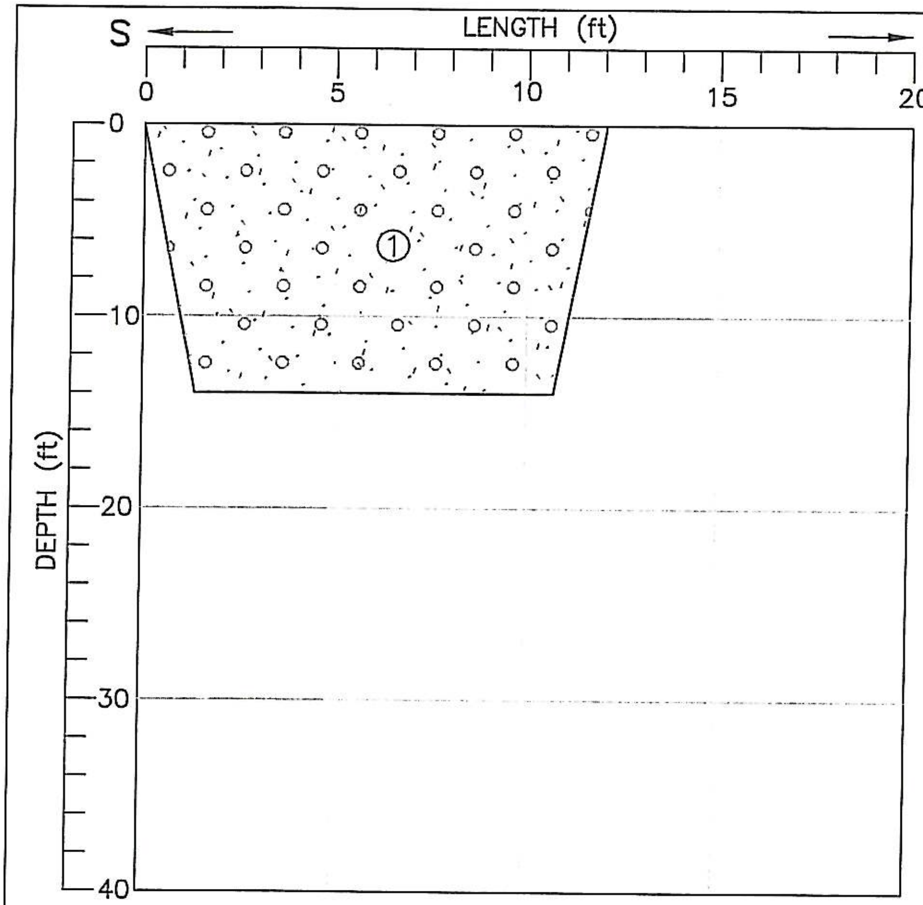
DATE JANUARY 8, 2000

ELEVATION 6450 FT.

DATUM MSL

JOB 993-2546

LOCATION 3545.95 N, 11415.52 E SOUTH RIM GROUP



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand and Clay. Occasional cobbles and boulders to 24 inches. Fine to coarse angular gravel. Some fine to coarse sand. Some medium plasticity fines.

SAMPLES

NO.	DESCRIPTION
S-04	Bulk
-	Point Load Clasts

NOTES:

75% Soil Matrix
25% Oversized Clasts

Excavation terminated at 14.5 foot depth.

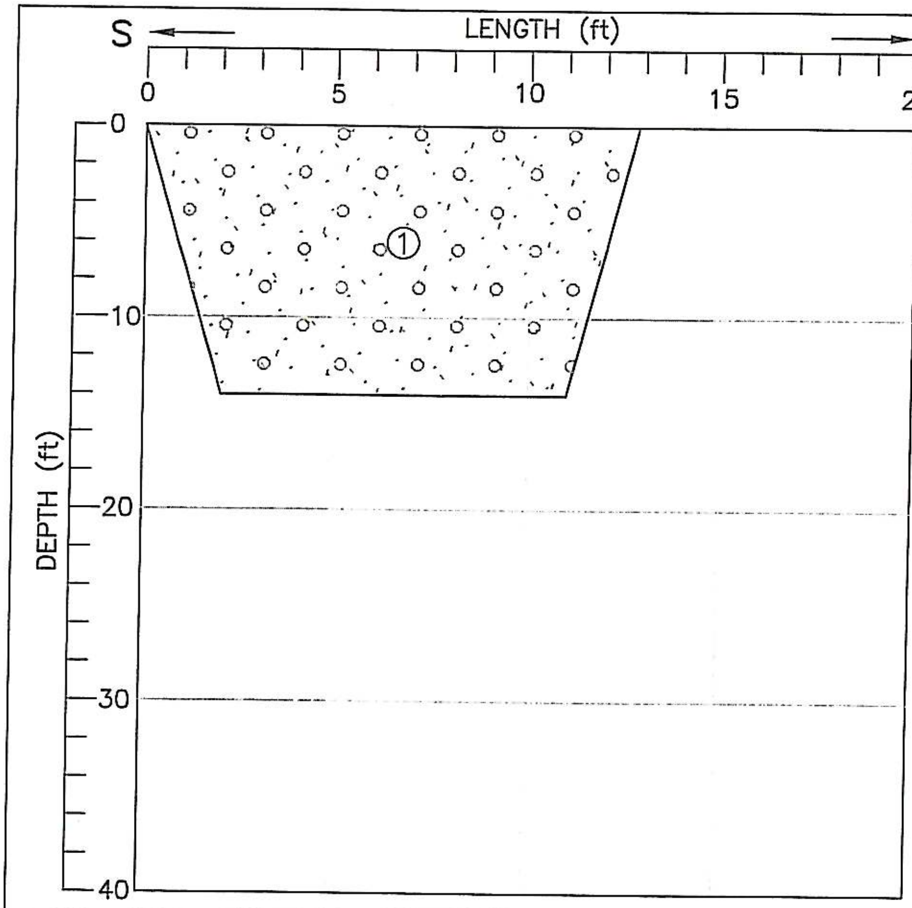
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

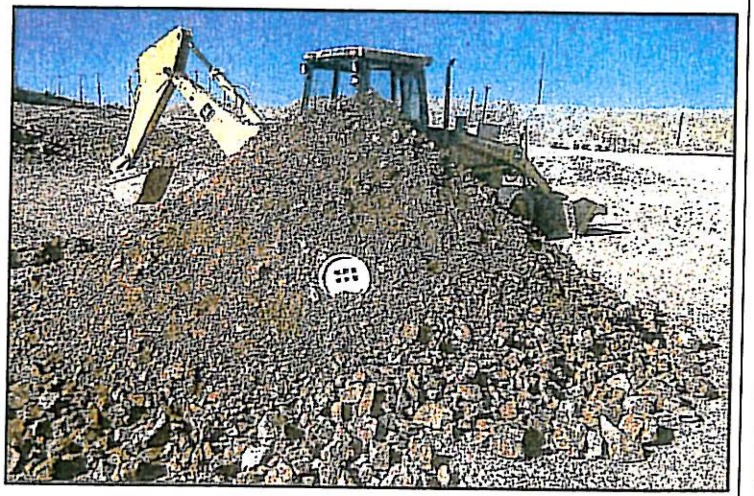
TEST PIT GTP-11
TEMP 40 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6400 FT.
DATUM MSL
JOB 993-2546
LOCATION 4636.20 N, 13141.36 E
SOUTH RIM GROUP



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Frequent cobbles and boulders to 24 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Slightly moist. Dense.

Occasional boulder/cobble clast supported pockets. Slight sloughing due to disturbance of clast pockets.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavation terminated at 14.5 foot depth.

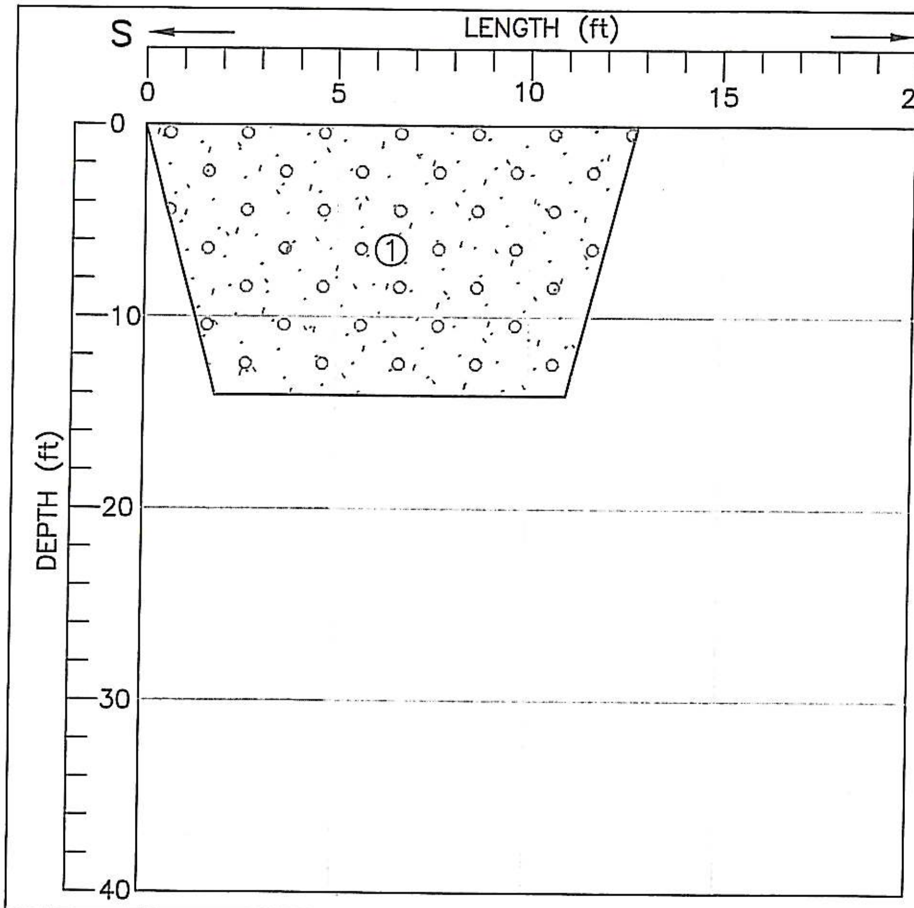
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

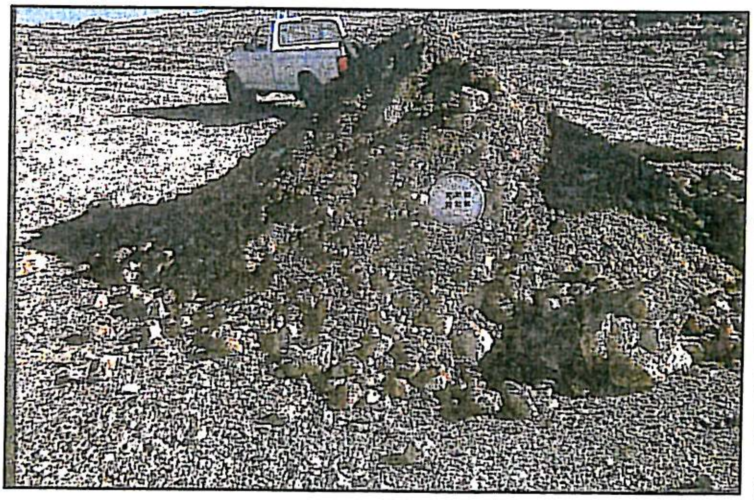
TEST PIT GTP-12
TEMP 45 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6250 FT.
DATUM MSL
JOB 993-2546
LOCATION 5541.28 N, 16737.02 E
1 A,B,C STOCKPILE GROUP



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Occasional cobbles and boulders to 36 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist. Dense.

Hard digging due to several large boulders.



SAMPLES

NO.	DESCRIPTION
–	Point Load Clasts

NOTES:

75% Soil Matrix
25% Oversized Clasts

Excavation terminated at 14.5 foot depth.

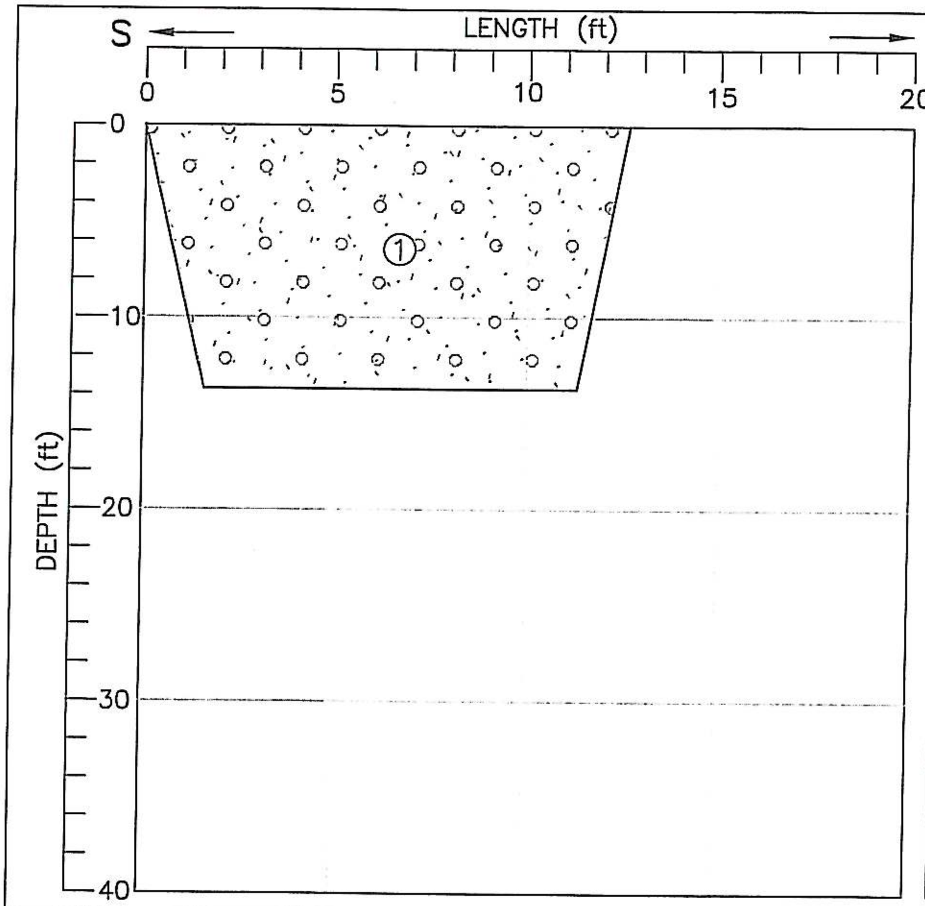
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

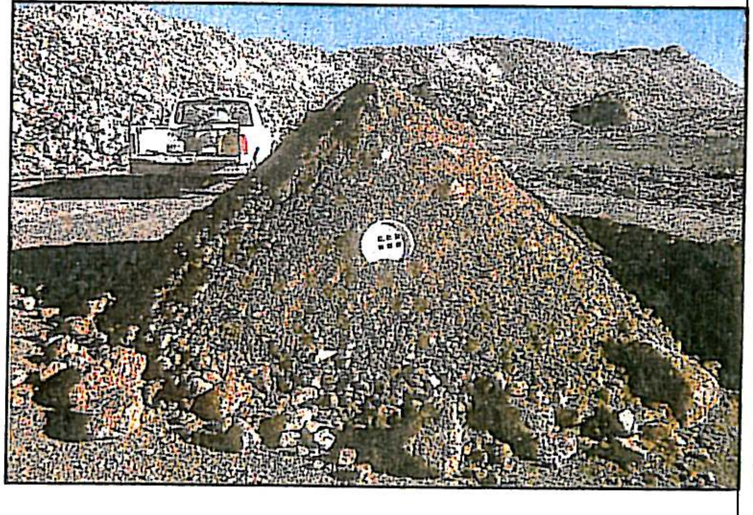
FIELD TEST PIT LOG

TEST PIT GTP-13
TEMP 45 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6250 FT.
DATUM MSL
JOB 993-2546
LOCATION 6622.14 N, 18449.57 E
1 A,B,C STOCKPILE GROUP



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Occasional cobbles and boulders to 24 inches. Fine ot coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines.



SAMPLES

NO.	DESCRIPTION
S-06	Bulk
–	Point Load Clasts

NOTES:

80% Soil Matrix
20% Oversized Clasts

Excavation terminated at 14.5 foot depth.

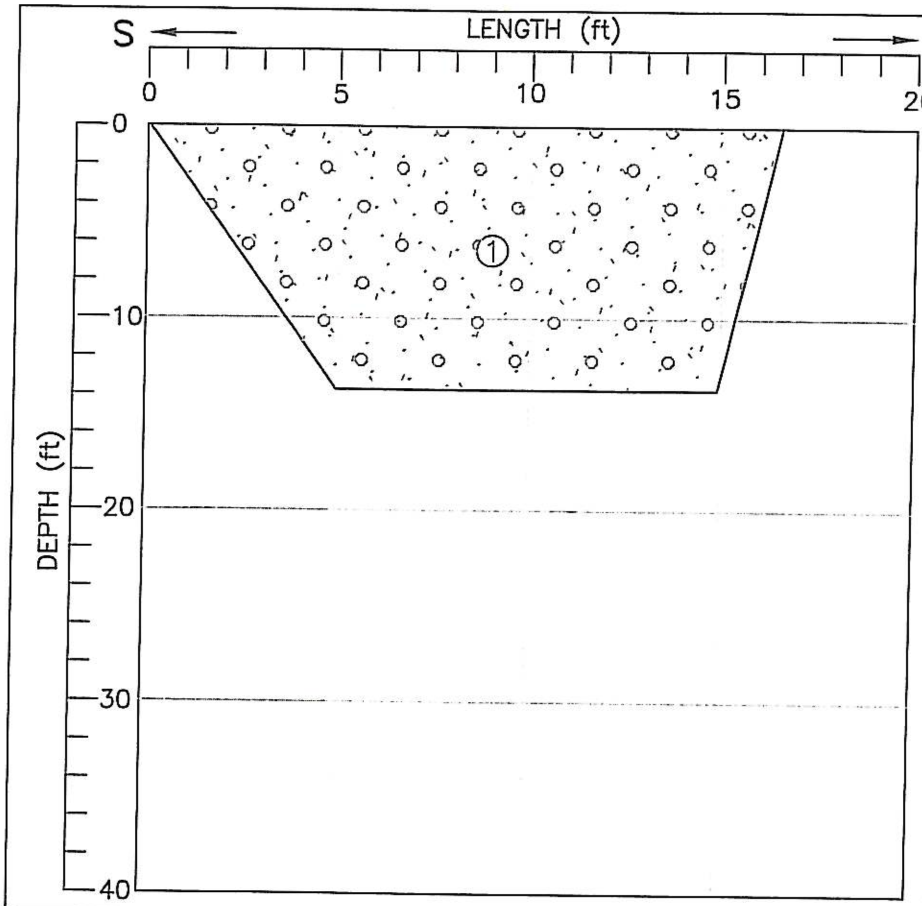
No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

FIELD TEST PIT LOG

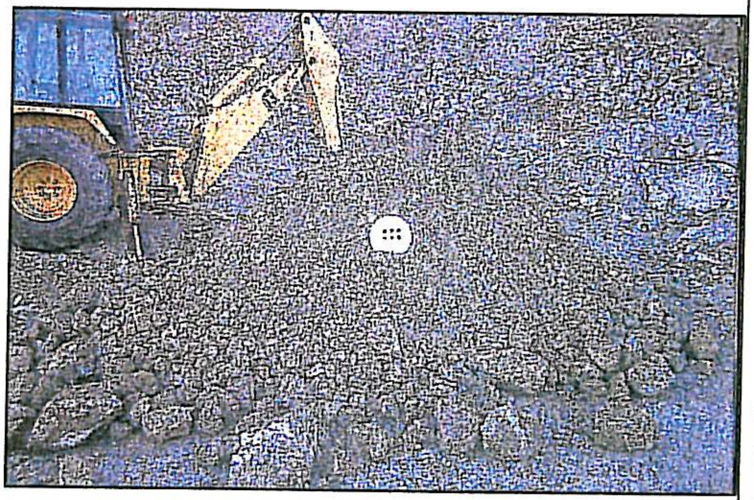
TEST PIT GTP-14
TEMP 40 °F WEATHER CLEAR
ENGINEER G. TORTELLI
OPERATOR SAL
EQUIPMENT DEERE 510C BACKHOE
CONTRACTOR HAMILTON
DATE JANUARY 8, 2000
ELEVATION 6150 FT.
DATUM MSL
JOB 993-2546
LOCATION 19063.47 N, 10230.42 E 3A STOCKPILE



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well Graded Gravel with Sand. Frequent cobbles and boulders at 36 inches. Fine to coarse angular gravel. Some fine to coarse sand. Little medium plasticity fines. Moist to very moist. Dense.

Currently under leach.



SAMPLES

NO.	DESCRIPTION
S-07	Bulk
–	Point Load Clasts

NOTES:

65% Soil Matrix
35% Oversized Clasts

Excavation terminated at 14.5 foot depth.

No graoundwater encounterd during excavation.

Test pit backfilled with excavated material.

Field density tests performed in vicinity of test pit.

APPENDIX A-2

2001 TEST PIT LOGS

FIELD TEST PIT LOG

TEST PIT TYTP01-1
TEMP 75 °F WEATHER SUNNY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/11/01
ELEVATION ± 6270
DATUM MSL
JOB 013-1595
LOCATION SOUTH END OF 2, 2A STOCKPILE GROUP

PHOTOGRAPH

SAMPLES	
NO.	DEPTH
TYTP01-1	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), and little fines, angular to subangular gravel, c-f sand, and medium plasticity fines, light brown, moist, no HCl reaction, strong sulfate(?) cementation. 40 percent cobbles and boulders up to 30", porphyry, medium strong rock (R3), jarositic oxidation, brown, yellow to buff in color, minor copper oxides.

TIME	DEPTH OF HOLE	DEPTH TO W/L
13:10	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0744617
3614571
MINE COORDINATE CONVERSION
10882N, 4748E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-10

TEMP 72 °F WEATHER SUNNY, WINDY

ENGINEER M. GRASS

OPERATOR NONE

EQUIPMENT NONE

CONTRACTOR NONE

DATE 10/12/01

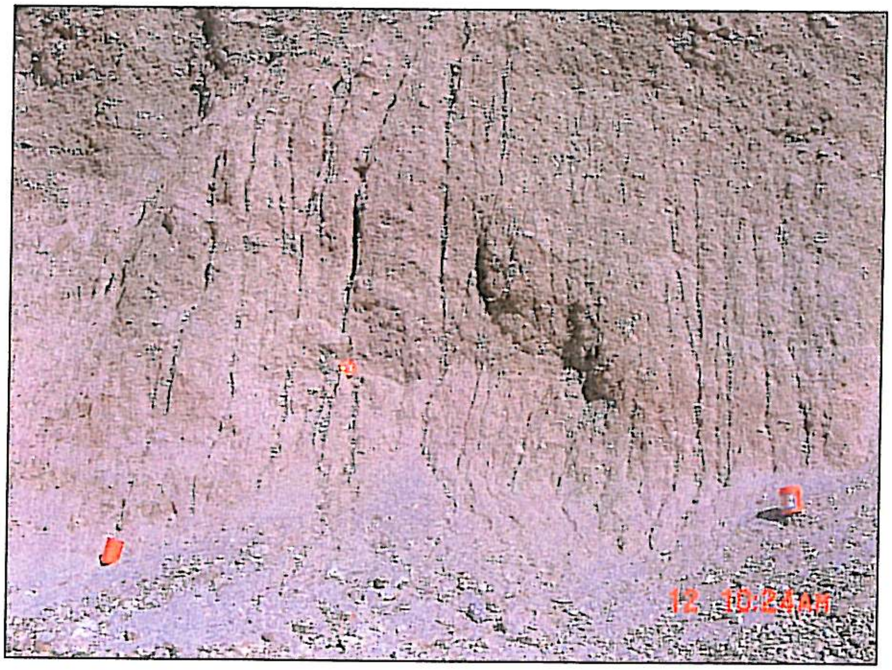
ELEVATION ± 6200

DATUM MSL

JOB 013-1595

LOCATION TOP OF NORTH EAST WALL OF SAVANNA PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-10	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey SAND with gravel (SW), angular to subrounded gravel, c-f sand, and little low plasticity fines, light brown, moist, no HCl reaction, not cemented. 50 percent cobbles and boulders up to 24", granite and porphyry, weak to medium strong rock (R2-R3), leach cap.

TIME	DEPTH OF HOLE	DEPTH TO W/L
11:05	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0747561
3615014
MINE COORDINATE CONVERSION
12245N, 14429E

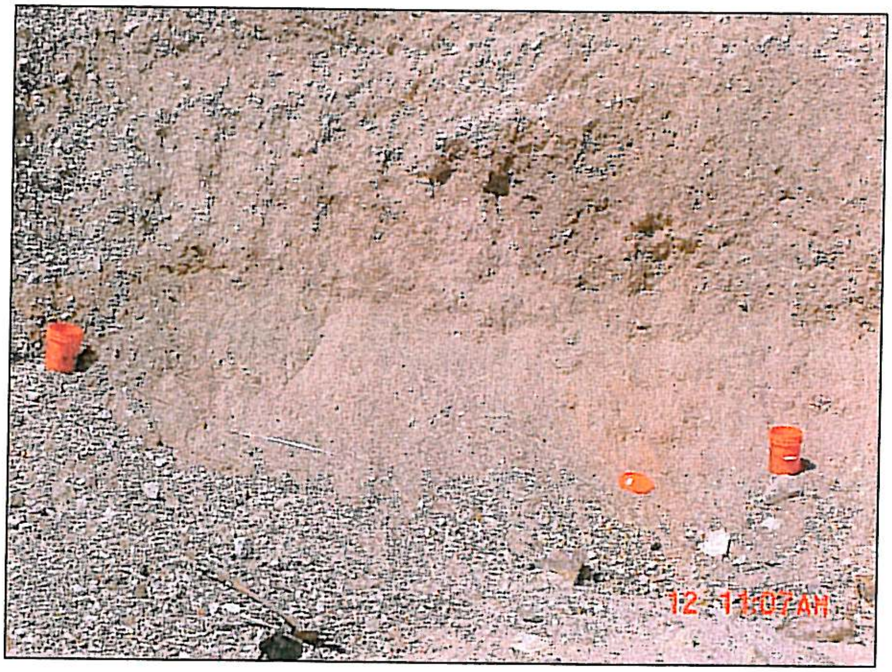
LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-11
TEMP 75 °F WEATHER SUNNY, WINDY ENGINEER M. GRASS OPERATOR NONE
EQUIPMENT NONE CONTRACTOR NONE DATE 10/12/01
ELEVATION ± 5850 DATUM MSL JOB 013-1595
LOCATION SOUTH END OF 2, 2A STOCKPILE GROUP

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-11	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), angular to subrounded gravel, c-f sand, and little medium plasticity fines, light brown, moist, no HCl reaction, not cemented. 10 percent cobbles and boulders up to 24", porphyry, medium strong rock (R3), leach cap.

TIME	DEPTH OF HOLE	DEPTH TO W/L
11:50	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0744531
3614488
MINE COORDINATE CONVERSION
10612N, 4473E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-12
TEMP 75 °F WEATHER SUNNY, WINDY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/12/01
ELEVATION ± 6275
DATUM MSL
JOB 013-1595
LOCATION NORTH WEST WALL OF MAIN PIT, NO. 3 LEACH STOCKPILE

PHOTOGRAPH

SAMPLES	
NO.	DEPTH
TYTP01-12	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), angular to subangular gravel, c-f sand, little low plasticity fines, light brown, moist, no HCl reaction, strong sulfate(?) cementation. 40 percent cobbles and boulders up to 30", porphyry and granite, medium strong rock (R3), leach cap, copper percipitate on rock surfaces.

TIME	DEPTH OF HOLE	DEPTH TO W/L
12:30	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0746437
3615941
MINE COORDINATE CONVERSION
15321N, 10770E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-2
TEMP 75 °F WEATHER SUNNY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/11/01
ELEVATION 6100
DATUM MSL
JOB 013-1595
LOCATION EAST END, BOTTOM OF COPPER MOUNTAIN PIT

PHOTOGRAPH

SAMPLES	
NO.	DEPTH
TYTP01-2	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well graded GRAVEL with clay and sand (GW-GC), angular to subrounded gravel, c-f sand, and low to medium plasticity fines, light yellowish brown, moist, no HCl reaction, minor sulfate(?) cementation. 30 percent cobbles and boulders up to 24", porphyry, medium strong to strong rock (R3-R4), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
14:15	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0745105
3613809
MINE COORDINATE CONVERSION
8367N, 6335E

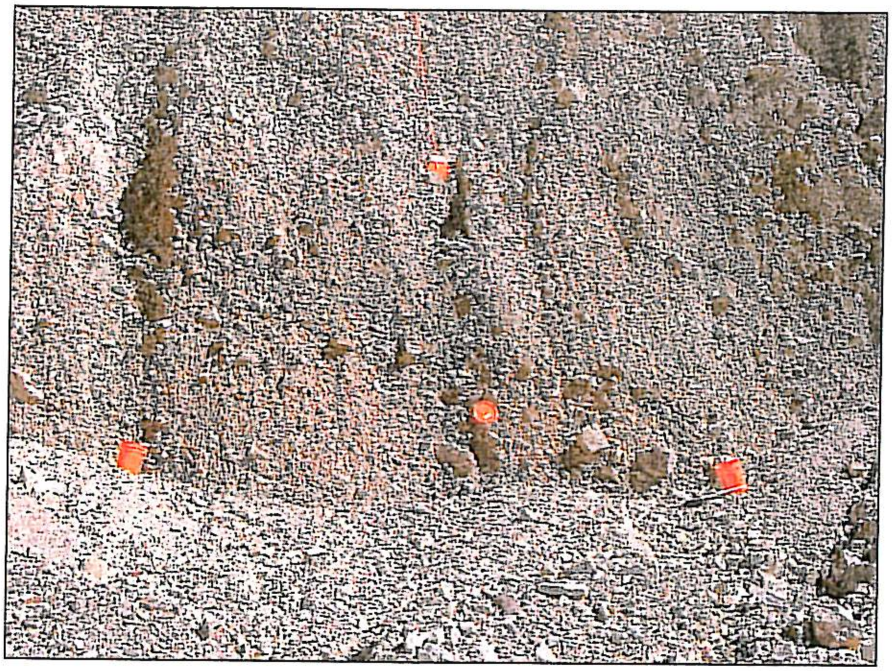
LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-3
TEMP 75 °F WEATHER SUNNY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/11/01
ELEVATION ± 6200
DATUM MSL
JOB 013-1595
LOCATION EAST END, MID-HEIGHT OF COPPER MOUNTAIN PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-3	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Poorly Graded GRAVEL with clay and sand (GP-GC), angular to subangular gravel, c-f sand, and low to medium plasticity fines, light brown, moist, no HCl reaction, minor sulfate(?) cementation. 50 percent cobbles and boulders up to 36", porphyry and granite, medium strong to strong rock (R3-R4), leach cap, waste rock.

TIME	DEPTH OF HOLE	DEPTH TO W/L
15:00	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0745199
3613782
MINE COORDINATE CONVERSION
8276N, 6643E

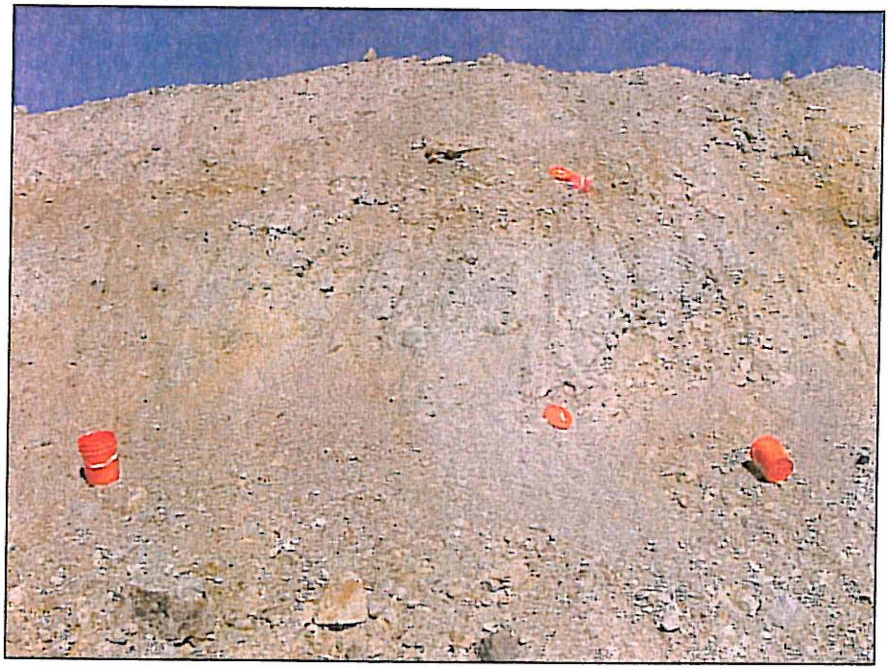
LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-4
TEMP 75 °F WEATHER SUNNY, WINDY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/11/01
ELEVATION ± 6350
DATUM MSL
JOB 013-1595
LOCATION EAST END, TOP OF COPPER MOUNTAIN PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-4	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), angular to subangular gravel, c-f sand, and medium plasticity fines, light yellowish brown, moist, no HCl reaction, strong sulfate(?) cementation. 15 percent cobbles and boulders up to 30", porphyry, medium strong to strong rock (R3-R4), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
15:35	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0744984
3614048
MINE COORDINATE CONVERSION
9155N, 5946E

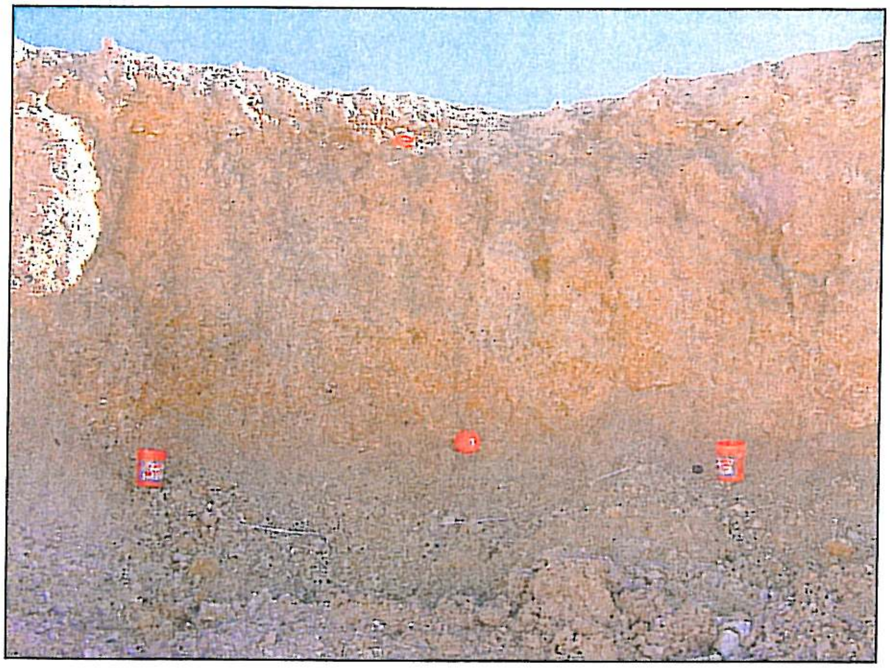
LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-5
TEMP 75 °F WEATHER SUNNY, WINDY
ENGINEER M. GRASS
OPERATOR NONE
EQUIPMENT NONE
CONTRACTOR NONE
DATE 10/11/01
ELEVATION 6400
DATUM MSL
JOB 013-1595
LOCATION NORTH END OF 4C STOCKPILE

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-5	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), angular to subangular well graded gravel, c-f sand, and low to medium plasticity fines, light yellowish brown, moist, no HCl reaction, strong sulfate(?) cementation. 10 percent cobbles and boulders up to 24", porphyry, weak rock (R2), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
16:15	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0744937
3613233
MINE COORDINATE CONVERSION
6483N, 5767E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

APPENDIX A-3

2004 1C STOCKPILE TEST PIT LOGS

FIELD TEST PIT LOG

TEST PIT TYTP01-6

TEMP 55 °F WEATHER SUNNY, WINDY ENGINEER M. GRASS OPERATOR NONE

EQUIPMENT NONE CONTRACTOR NONE DATE 10/12/01

ELEVATION ± 5925 DATUM MSL JOB 013-1595

LOCATION WEST END, BOTTOM OF SAVANNA PIT

PHOTOGRAPH

SAMPLES	
NO.	DEPTH
TYTP01-6	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Well graded GRAVEL with clay and sand (GW-GC), angular to subrounded gravel, c-f sand, and low plasticity fines, yellowish brown, moist, no HCl reaction, strong sulfate(?) cementation. 50 percent cobbles and boulders up to 30", granite, medium strong to strong rock (R3-R4), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
8:50	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0747329
3614199
MINE COORDINATECONVERSION
9579N, 13643E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-7

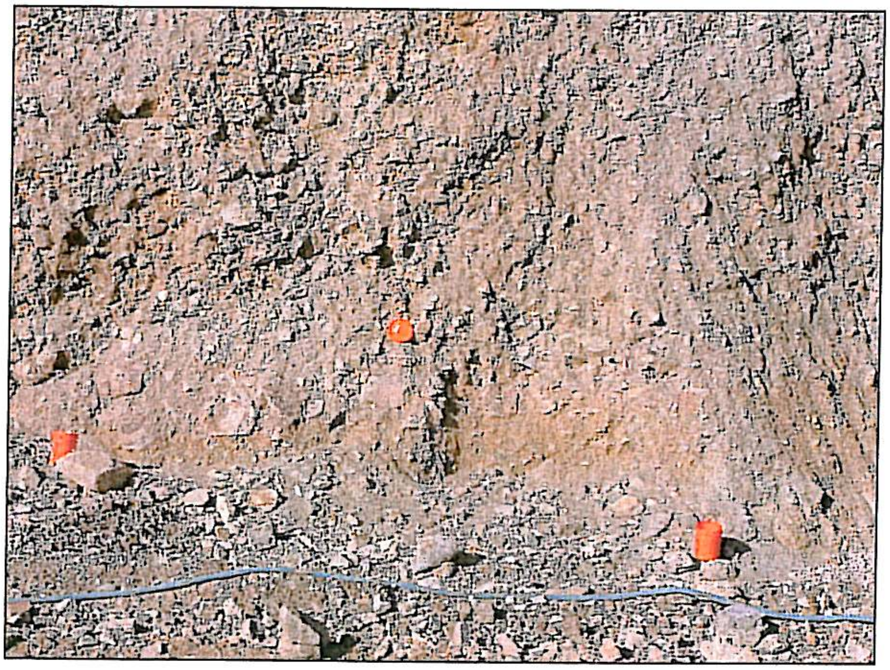
TEMP 65 °F WEATHER SUNNY, WINDY ENGINEER M. GRASS OPERATOR NONE

EQUIPMENT NONE CONTRACTOR NONE DATE 10/12/01

ELEVATION ± 5975 DATUM MSL JOB 013-1595

LOCATION WEST END, 2 BENCHES FROM BOTTOM OF SAVANNA PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-7	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey SAND with gravel (SC), subangular to subrounded well graded gravel, c-f sand, and low to medium plasticity fines, light brown, moist, no HCl reaction, strong sulfate(?) cementation. 40 percent cobbles and boulders up to 30", porphyry and granite, medium strong to strong rock (R3-R4) with minor weak rock (R2), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
9:25	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0747218
3614300
MINE COORDINATE CONVERSION
9914N, 13282E

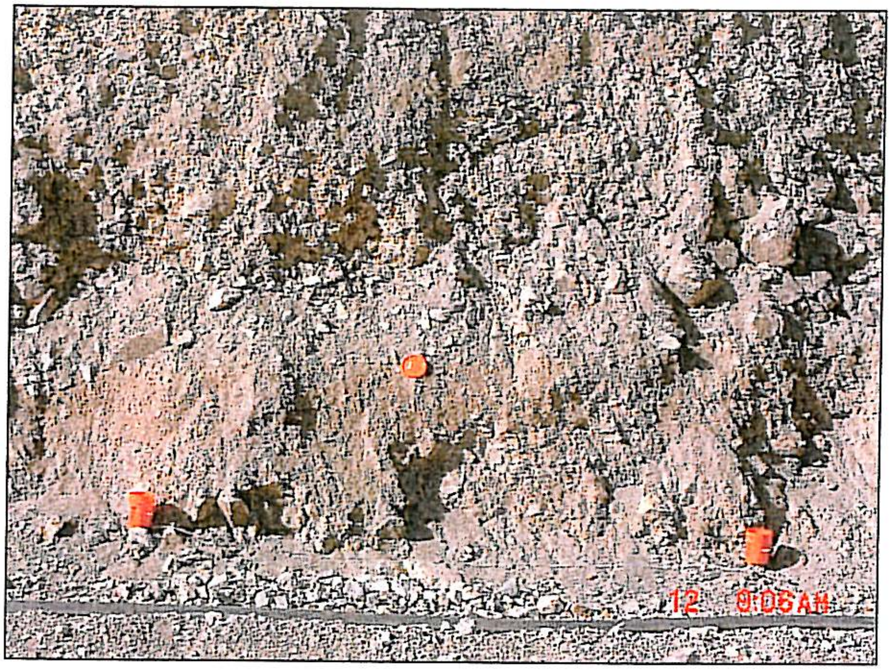
LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-8
TEMP 70 °F WEATHER SUNNY, WINDY ENGINEER M. GRASS OPERATOR NONE
EQUIPMENT NONE CONTRACTOR NONE DATE 10/12/01
ELEVATION ± 6025 DATUM MSL JOB 013-1595
LOCATION WEST END, 4 BENCHES FROM BOTTOM OF SAVANNA PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-8	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey SAND with gravel (SC), subangular to subrounded gravel, c-f well graded sand, and low to medium plasticity fines, light brown, moist, no HCl reaction, strong sulfate(?) cementation. 30 percent cobbles and boulders up to 30", porphyry and granite, medium strong to strong rock (R3-R4), leached.

TIME	DEPTH OF HOLE	DEPTH TO W/L
9:50	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0747295
3614153
MINE COORDINATE CONVERSION
9429N, 13524E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

FIELD TEST PIT LOG

TEST PIT TYTP01-9

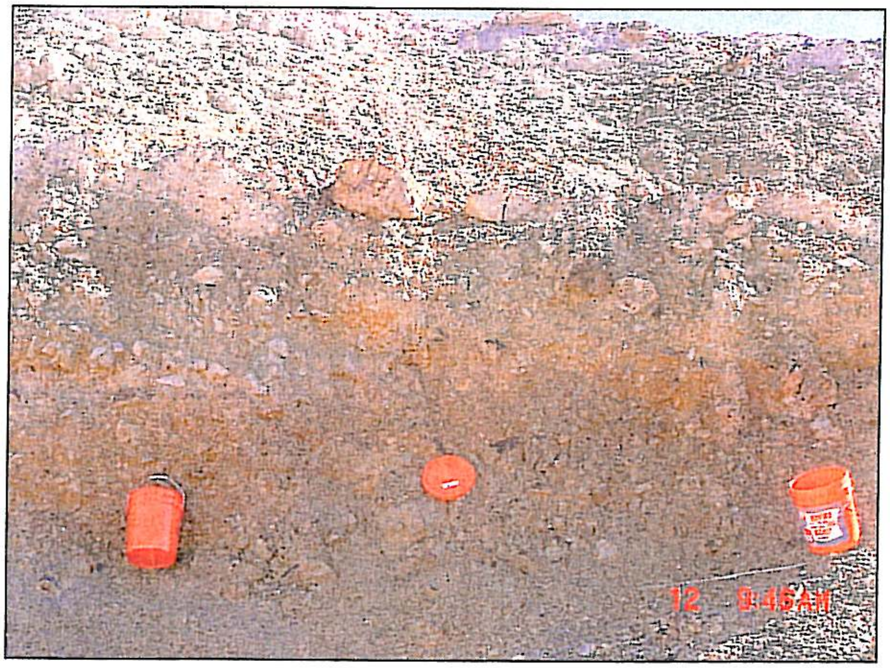
TEMP 70 °F WEATHER SUNNY, WINDY ENGINEER M. GRASS OPERATOR NONE

EQUIPMENT NONE CONTRACTOR NONE DATE 10/12/01

ELEVATION ± 6150 DATUM MSL JOB 013-1595

LOCATION TOP OF NORTH EAST WALL OF GETTYSBURG PIT

PHOTOGRAPH



SAMPLES	
NO.	DEPTH
TYTP01-9	BULK

LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

① Clayey GRAVEL with sand (GC), angular to subrounded gravel, c-f sand, and low to medium plasticity fines, light yellowish brown, moist, no HCl reaction, strong sulfate(?) cementation. 30 percent cobbles and boulders up to 30", porphyry and granite, medium strong rock (R3), leach cap.

TIME	DEPTH OF HOLE	DEPTH TO W/L
10:30	---	---

SPECIAL NOTES:

GPS COORDINATES (NAD83, UTM):
12 S 0748472
3613744
MINE COORDINATE CONVERSION
8051N, 17379E

LOG OF EXISTING BENCH CUT

SAMPLES:
2 5-GALLON BUCKETS TAKEN FROM SLOUGH AT TOE OF SLOPE OF -3" MATERIAL.

STOCKPILE BENCH FACE LOG

053-2550

Project: Tyrone Stockpile Characterization
Project No.:
Location: Tyrone Mine 1 C Stockpile
Cell No. GA04-TY-1

Date
Coordinates: 3613259 N 748460 E
Elevation:

Soil Fraction
60% fine to coarse gravel
25% fine to coarse sand
15% low to medium plastic fines
Clayey Gravel with Sand (GC). Reddish brown (10R4/6), dry becoming moist 6" below surface. Sloughn at toe of the cut has cemented surface crust (sulfate?). Noncalcareous.

Oversize
10%>3"
80% 3" to 6"
15% 6" to 12"
5% >12"
Leach Cap. Bleached porphyry. 80%. R3, 2-10 mm feldspar in fine grained tan to greenish groundmass w/ Tan to black fracture coating. 10% is R4 w/ qtz selvages, py casts and partial silicification. 10% R2, pervasive argillic

Maximum vertical slopes in cut approx. 18 feet.

STOCKPILE BENCH FACE LOG

Project: Tyrone Stockpile Characterization
Project No.:
Location: Tyrone Mine 1 C Stockpile
Cell No. GA04-TY-2

Date
Coordinates: 3613446 N 748669 E
Elevation:

Soil Fraction
50% fine to coarse gravel
30% fine to coarse sand
20% low to medium plastic fines
Clayey Gravel with Sand (GC). Reddish brown (10R4/6), dry becoming moist 6" below surface. Noncalcareous.

Oversize
10% >3"
3" to 6" 80%
6" to 12" 15%
>12" 5%
Leach Cap. Bleached porphyry. Typ 1-5 mm feldspar phenos in lt. gray matrix w/ tan to black fracture oxides, variably bleached and slicified, R2 to R4. Trace gossan (R0). Trace holocrystalline granite w. K-spar, qtz, hb, and fg plag. (R5). Typically R3.

STOCKPILE BENCH FACE LOG

Project: Tyrone Stockpile Characterization
Project No. 043-2572
Location: Tyrone Mine 1 C Stockpile
Cell No. GA04-TY-3

Date Sept. 8, 2004
Coordinates: 3613207 N 748461 E
Elevation:

Soil Fraction
60% fine to coarse gravel
25% fine to coarse sand
15% low to medium plastic fines
Clayey Gravel with Sand (GC). Yellowish orange (10YR 8/6). dry becoming moist 6" below surface. Noncalcareous, nonmagnetic.

Oversize
50% >3"
3" to 6" 50%
6" to 12" 30%
>12" 20%
Max 72"

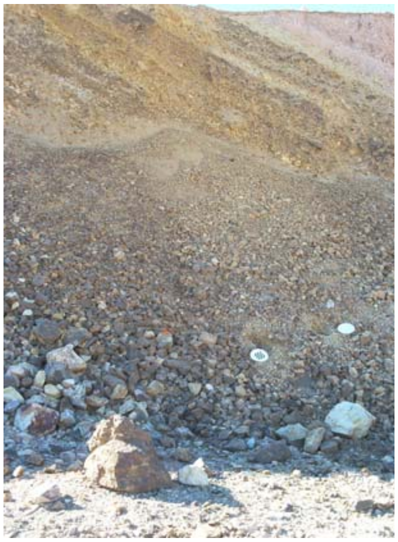
Pervasively silicified groundmass, clay altered feldspar phenos, tan to black fract oxide, black to brassy cubic py < 1 mm, other finer grained black specks disseminated near py. Typ. R3.

Samples GA04-TY-3-GC 1, 5 gal bucket
GA04-TY-3-GT 2, 5 gal buckets + 1, 1 gal ziplock

Notes:
Max. vertical cut slope 32'

STOCKPILE BENCH FACE LOG

Project:	Tyrone Stockpile Characterization	Date	Sept. 8, 2004	
Project No.	043-2572	Coordinates:	3613382 N	748688 E
Location:	Tyrone Mine 1 C Stockpile	Elevation:		
Cell No.	GA04-TY-4			



Soil Fraction
85% fine to coarse gravel
10% fine to coarse sand
5% low to medium plastic fines
Poorly graded Gravel with Clay and Sand. Reddish (10YR 6/6). dry becoming moist 6" below surface. Noncalcareous, nonmagnetic.

Oversize
40% >3"
3" to 6" 70%
6" to 12" 20%
12" to 24" 8%
>24 2%
max 36"

Porphyry w/ lt. gray siliceous matrix, dism. oxidized sulfides, milky euhedral feldspar, some black tabular sulfides(?). Fracture surfaces have lt. reddish brown to tan and dk. brown. Consistent R4.

Samples GA04-TY-4-GC 1, 5 gal bucket
GA04-TY-4-GT 2, 5 gal buckets

Notes:
Max. vertical cut slope 25'

STOCKPILE BENCH FACE LOG

Project: Tyrone Stockpile Characterization
Project No. 043-2572
Location: Tyrone Mine 1 C Stockpile
Cell No. GA05-TY-5

Date Sept. 8, 2004
Coordinates: 3613172 N 748781 E
Elevation:

Soil Fraction
55% fine to coarse gravel
25% fine to coarse sand
20% low to medium plastic fines
Clayey Gravel with Sand. Pale reddish brown (10YR 6/6). Dry. Mod. calcareous, nonmagnetic.

Oversize
15% >3"
3" to 6" 50%
6" to 12" 30%
12" to 24" 10%
>24" 8%
max 72"

Typically bleached granite w/ 50% pink feldspar 40% greenish gray feldspar intergrown, andhedral to subhedral, 10% euhedral to subhedral biotite, R3). Unbleached is R4.

Samples GA04-TY-5-GC 1, 5 gal bucket
GA04-TY-5-GT 2, 5 gal buckets + 1, 1 gal ziplock

Notes:

STOCKPILE BENCH FACE LOG

Project:	Tyrone Stockpile Characterization	Date	Sept. 8, 2004		
Project No.	043-2572	Coordinates:		3613436 N	748721 E
Location:	Tyrone Mine 1 C Stockpile	Elevation:			
Cell No.	GA04-TY-6				

Soil Fraction
50% fine to coarse gravel
30% fine to coarse sand
20% low to medium plastic fines
Clayey Gravel with Sand. Reddish orange (10YR 6/6). Dry to moist. Noncalcareous, nonmagnetic.

Oversize
20% >3"
3" to 6" 85%
6" to 12" 10%
12" to 24" 3%
>24" 2%
max. 36"

Porphyry. White feldspathic matrix. Locally 50% euhedral qtz eyes. 3% to 5% fine grained dism. black spherical oxidized sulfides, anhedral biotite and biotite books up to 2 mm. Tan to black fracture oxides, R3.

Samples GA04-TY-6-GC 1, 5 gal bucket
GA04-TY-6-GT 2, 5 gal buckets + 1, 1 gal ziplock

Notes:

STOCKPILE BENCH FACE LOG

Project:	Tyrone Stockpile Characterization	Date	Sept. 8, 2004	
Project No.	043-2572	Coordinates:	3613306 N	748702 E
Location:	Tyrone Mine 1 C Stockpile	Elevation:		
Cell No.	GA04-TY-7			

Soil Fraction
50% fine to coarse gravel
30% fine to coarse sand
20% low to medium plastic fines
Clayey Gravel with Sand. Reddish orange (10YR 6/6). Dry to moist. Noncalcareous, nonmagnetic.

Oversize
20% >3"
3" to 6" 60%
6" to 12" 35%
12" to 24" 10%
>24" 5
max. 36"

Granite. 2 feldspar w/ qtz eyes and dism. py and biotite approx. 1 mm. Also prophyry with a silicic greenish matrix w/ remnant feldspar phenos and abun. sulfides disseminatied and along fracts. Tan and black fract. oxides.

Samples GA04-TY-7-GC 1, 5 gal bucket
GA04-TY-7-GT 2, 5 gal buckets + 1, 1 gal ziplock

Notes:

STOCKPILE BENCH FACE LOG

Project: Tyrone Stockpile Characterization
Project No. 043-2572
Location: Tyrone Mine 1 C Stockpile
Cell No. GA04-TY-8

Date Sept. 8, 2004
Coordinates: 3613414 N 748777 E
Elevation:

Soil Fraction
55% fine to coarse gravel
25% fine to coarse sand
20% low to medium plastic fines
Clayey Gravel with Sand. Reddish brown (10YR 6/6). Dry to moist. Noncalcareous, nonmagnetic.

Oversize
30% >3"
3" to 6" 45%
6" to 12" 35%
12" to 24" 10%
>24" 10%
max. 60"

Predominantly greenish silicic matrix w/ remnant cloudy feldspar phenos. 3-5% dism. and fract. coating sulfides (py, cpy).

Samples GA04-TY-8-GC 1, 5 gal bucket
GA04-TY-8-GT 2, 5 gal buckets + 1, 1 gal ziplock

Notes:

APPENDIX B

BOREHOLE LOGS

APPENDIX B-1

2004 ROTOSONIC DRILLING LOGS

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	1 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing	Notes Test Results
0 5	**0'-8': Clayey GRAVEL with sand,** GC, 40% gravel, 30% sand, 30% clay, yellowish gray (5Y 7/2), slightly moist and loose. Coarse: subangular. Fines: medium plasticity.	GC	5Y 7/2	SM	▨	▨	▨	▨	▨						▨	▨	▨											
10	**8'-13': Clayey GRAVEL with sand,** GC, 60% gravel, 25% sand, 15% clay, pale olive (10Y 6/2), slightly moist and loose. Coarse: subangular. Fines: low plasticity.	GC	10Y 6/2	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨		▨	▨	▨	▨	▨				
15	**13'-17': Clayey GRAVEL**, GC, 50% gravel, 10% sand, 40% clay, grayish orange colored (10 YR 7/4), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	GC	10 YR 7/4	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
20	**17'-21': Clayey GRAVEL with sand**, GC, 45% gravel, 35% sand, 20% clay, pale yellowish brown colored (10 YR 6/2), dry and medium dense. Coarse: subangular. Fines: medium plasticity.	GC	10YR 6/2	D	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 19'-21'	
25	**21'-29': GRAVEL with sand**, GW, 75% gravel, 15% sand, 10% clay, pale yellowish brown colored (10 YR 6/2), dry and dense. Coarse: subangular. Fines: low plasticity.	GW	10YR 6/2	D	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
30 35	**29'-48': Clayey GRAVEL with sand,** GC, 60% gravel, 25% sand, 15% clay, dark reddish brown to grayish orange (10R 3/4 to 10YR 7/4), slightly moist and loose to medium dense. Coarse: subangular. Fines: low to medium plasticity.	GC	10R 3/4	SM	▨	▨	▨	▨	▨						▨	▨	▨											
40			10YR 7/4		▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project: G&K/Stockpile Characterization
Datum:
Collar Elev: 6207.6
Project No.: 043-2572
Drill date: 10/13/2004
Coordinates N: 19405.4 E: 9536.6
Sheet 2 of 11
Location: Tyrone Mine
Drill rig:
Azimuth: N/A
Inclination: 90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing	Notes Test Results
40 45	**Continued**	GC	10R 6/4	SM	▨	▨	▨	▨	▨						▨	▨	▨											
			10YR 7/4		▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨							Sample Bucket: 47' 48.5'	
50 55	**58'-61': Clayey GRAVEL with sand,** GC, 40% gravel, 20% sand, 40% clay, light olive gray (5Y 5/2), dry and loose. Coarse: subangular. Fines: low plasticity.	GC	5Y 5/2	D	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
60	**58'-61': Clayey GRAVEL with sand**, GC, 50% gravel, 20% sand, 30% clay, grayish yellow (5Y 8/4), slightly moist and dense. Coarse: Subrounded to subangular. Fines: Medium plasticity.	GC	5Y 8/4	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
65 70	**61'-73': Clayey GRAVEL with sand**, GC, 45% gravel, 15% sand, 40% clay, light brown to pale orange (5YR 5/6 to 10YR 8/2), slightly moist and dense. Coarse: subangular. Fines: Medium to High plasticity.	GC	5YR 5/6 10YR 8/2	D	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
					▨	▨	▨	▨	▨						▨	▨	▨											
75	**73'-84': Gravely CLAY with sand**, CH, 25% gravel, 20% sand, 55% clay, light brown (5YR 5/6), slightly moist and dense. Coarse: subangular. Fines: High plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 75' 77'	
80					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				

Scale:
Drilling Contractor:
Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

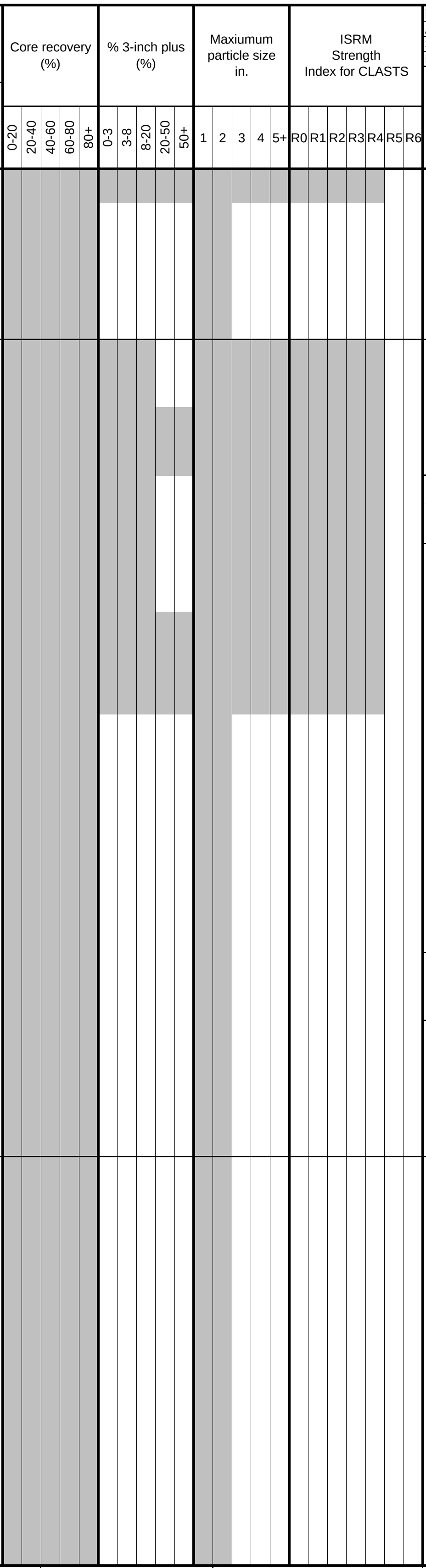
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization		Datum:	Collar Elev:	6207.6
Project No.:	043-2572	Drill date: 10/13/2004	Coordinates N: 19405.4 E: 9536.6	Sheet	3 of 11
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Core recovery (%): 0-20, 20-40, 40-60, 60-80, 80+ — % 3-inch plus (%): 0-3, 3-8, 8-20, 20-50, 50+ — Maxiumum particle size in.: 1, 2, 3, 4, 5+ — ISRM Strength Index for CLASTS: R0, R1, R2, R3, R4, R5, R6



Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture	Physical Testing	Notes Test Results
80	**Continued**	CH	5YR 5/6 5YR 6/4	SM		
85 90 95 100 105	**84'-108': Clayey GRAVEL with sand**, GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 5/6), slightly moist, dense and low HCL reaction. Coarse: angular. Fines: Medium to high plasticity.	GC	5YR 5/6 5Y 7/2 5YR 5/6 5Y 7/2 5YR 5/6	SM	Sample Bucket: 80' 90' Sample Bucket: 102'-104'	Cobbles and boulders from 86' to 88'. Cobbles and boulders from 92'-95'
110 115 120	**108'-126': Clayey GRAVEL with sand,** GC, 40% gravel, 25% sand, 35% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular to angular. Fines: High plasticity.	GC	5YR 5/6	SM		

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	4 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture (D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated)	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing (D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index)	Notes Test Results
120	**Continued**	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨				
125					▨	▨	▨	▨	▨						▨	▨												
	126'-129': Clayey GRAVEL with sand, GC, 40% gravel, 30% sand, 30% clay, light brown (5YR 5/6), slightly moist, dense. Coarse: subangular to angular. Fines: Medium plasticity.		5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
130	**129'-133': Clayey SAND with gravel**, SC, 30% gravel, 35% sand, 35% clay, light brown (5YR 5/6), slightly moist and dense. Coarse: angular. Fines: Medium to high plasticity.	SC	5YR 5/6	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨														
135	**133'-148': Clayey GRAVEL with sand**, GC, 60% gravel, 15% sand, 25% clay, yellowish gray (5Y 7/2), dry and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5Y 7/2	D	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
140 145					▨	▨	▨	▨	▨						▨	▨	▨										Sample Bucket: 140'-142'	
150 155 160	**148'-164': Gravelly CLAY,** CH, 30% gravel, 10% sand, 60% clay, yellowish gray (5Y 7/2), slightly moist and medium dense. Coarse: angular. Fines: high plasticity.	CH	5Y 7/2	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		Sample Bucket: 158.5'-160.5'	

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	5 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing	Notes Test Results
160	**Continued**	CH	5Y 7/2	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
165	**164'-178': Clayey GRAVEL,** GC, 60% gravel, 10% sand, 30% clay, yellowish gray to light brown (5Y 7/2 to 5YR 5/6), slightly moist and medium dense. Coarse: angular. Fines: high plasticity.	GC	5Y 7/2 - 5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨											
170 175					▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
	178'-190': Gravelly CLAY, CH, 40% gravel, 10% sand, 50% clay, yellowish gray to light brown (5Y 7/2 to 5YR 5/6), slightly moist and loose to medium dense. Coarse: subangular. Fines: high plasticity.	CH	5Y 7/2 - 5YR 5/6	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			
180					▨	▨	▨	▨	▨						▨	▨	▨											
185					▨	▨	▨	▨	▨						▨	▨	▨										Sample Bucket: 184'-186'	
190					▨	▨	▨	▨	▨						▨	▨	▨											
	190'-194': Clayey GRAVEL with sand, GC, 70% gravel, 15% sand, 15% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨												
195	**194'-201': Gravelly CLAY,** CH, 40% gravel, 10% sand, 50% clay, light brown to yellowish gray (5YR 5/6 to 5Y 7/2), slightly moist and loose to medium dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨											
200			5Y 7/2		▨	▨	▨	▨	▨						▨	▨	▨											

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization		Datum:	Collar Elev:	6207.6
Project No.:	043-2572	Drill date: 10/13/2004	Coordinates N: 19405.4 E: 9536.6	Sheet	6 of 11
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A	Inclination:	90°

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
200	**Continued**	CH	5Y 7/2	SM	▨	▨	▨	▨	▨						▨	▨	▨											
205	**201'-205': Gravelly CLAY with sand,** CH, 25% gravel, 15% sand, 60% clay, moderate yellowish brown (10YR 5/4), dry and loose. Coarse: subangular. Fines: low to medium plasticity.	CH	10YR 5/4	D	▨	▨	▨	▨	▨						▨	▨												
210	**205'-211': Clayey GRAVEL with sand,** GC, 60% gravel, 15% sand, 25% clay, yellowish gray (5Y 7/2), dry and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5Y 7/2	D	▨	▨	▨	▨	▨						▨	▨	▨											
	211'-214': Clayey GRAVEL with sand, GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 5/6), slightly moist, dense and low HCL reaction. Coarse: angular. Fines: Medium to high plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 211'-214'	
215	**214'-217': Gravelly CLAY with sand,** CH, 25% gravel, 25% sand, 50% clay, light brown (5YR 5/6), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
220	**217'-222': Clayey GRAVEL with sand,** GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 5/6), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
225 230	**222'-232': Clayey GRAVEL with sand,** GC, 40% gravel, 15% sand, 45% clay, light brown to pale yellowish brown (5YR 5/6 to 10YR 6/2), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6 - 10YR 6/2	SM	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 228'-230'	
235 240	**232'-240': Clayey GRAVEL,** GC, 50% gravel, 10% sand, 40% clay, yellowish gray (5Y 7/2), slightly moist and loose to medium dense. Coarse: subangular. Fines: medium plasticity.	GC	5Y 7/2	SM	▨	▨	▨	▨	▨						▨	▨												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	7 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results
240	**240'-245': Clayey GRAVEL with sand,** GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 5/6), slightly moist, dense and low HCL reaction. Coarse: angular. Fines: Medium to high plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
245	**245'-248': Clayey GRAVEL with sand,** GC, 60% gravel, 20% sand, 20% clay, pale orange to light brown (10YR 8/2 to 5YR 5/6), dry and loose and low HCL reaction. Coarse: subangular. Fines: medium plasticity.	GC	10YR 8/2-5YR 5/	D	▨	▨	▨	▨	▨						▨	▨												
250	**248'-252': Gravelly CLAY,** CH, 40% gravel, 10% sand, 50% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 250.5'-253'	
255	**252'-268': Clayey GRAVEL with sand**, GC, 45% gravel, 20% sand, 35% clay, Pale yellowish brown to Dark yellowish orange (10YR 6/2 to 10YR 6/6), slightly moist and loose to medium dense. Coarse:subangular. Fines: high plasticity.	GC	10YR 6/2 - 10YR 6/6	SM	▨	▨	▨	▨		▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨	▨			
260 265					▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨	▨			
270	**268'-275': Clayey GRAVEL with sand**, GC, 40% gravel, 30% sand, 30% clay, Pale olive (10Y 6/2), dry and medium dense. Coarse:subround to subangular. Fines: medium plasticity.	GC	10Y 6/2	D	▨	▨	▨	▨	▨						▨	▨												
275 280	**275'-283': Clayey GRAVEL with sand**, GC, 60% gravel, 15% sand, 25% clay, Pale to Moderate yellowish brown (10YR 6/2 to 10YR 5/4), slightly moist and medium dense. Coarse:subangular. Fines: medium plasticity.	GC	10YR 6/2 - 10YR 5/4	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization		Datum:	Collar Elev:	6207.6
Project No.:	043-2572	Drill date: 10/13/2004	Coordinates N: 19405.4 E: 9536.6	Sheet	8 of 11
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							Physical Testing	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
280	**Continued**	GC	10YR 6/2 - 10YR 5/4	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								
285	**283'-288': Clayey GRAVEL with sand**, GC, 30% gravel, 25% sand, 45% clay, Moderate brown (5YR 4/4), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 4/4	SM	▨	▨	▨	▨	▨						▨	▨	▨											
290	**288'-293': Clayey GRAVEL with sand**, GC, 35% gravel, 30% sand, 35% clay, Pale yellowish brown (10YR 6/2), slightly moist and medium dense. Coarse: subangular to angular. Fines: medium plasticity.	GC	10YR 6/2	SM	▨	▨	▨	▨	▨						▨	▨	▨											
295 300	**293'-301': Clayey GRAVEL with sand**, GC, 50% gravel, 25% sand, 25% clay, Dusky yellow to moderate yellowish brown (5Y 6/4 - 10YR 5/4), dry and loose to medium dense. Coarse: subangular to angular. Fines: medium plasticity.	GC	5Y 6/4 - 10YR 5/4	D	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 298'-300'	
305 310 315 320	**301'-323': Clayey GRAVEL with sand**, GC, 40% gravel, 15% sand, 45% clay, Pale olive to light brown (10Y 6/2 to 5YR 5/6), slightly moist and dense. Coarse: subround. Fines: low to medium plasticity.	GC	10Y 6/2 - 5YR 5/6 5Y 7/6	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨							Sample Bucket: 310'-312'	

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	9 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing	Notes Test Results
320 - - -	**Continued**				▨	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨								
- 325 - - - - 330 - - - - 335 -	**323'-336': Clayey GRAVEL with sand**, GC, 40% gravel, 20% sand, 40% clay, Moderate yellowish brown to light olive gray (10YR 5/4 to 5Y 6/1), slightly moist and medium dense to dense. Coarse: subangular. Fines: high plasticity.	GC	10YR 5/4 - 5Y 6/1	SM	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			Sample Bucket: 327'-329'	
- -	**336'-338': Clayey GRAVEL with sand** GC, 60% gravel, 15% sand, 25% clay, Moderate yellowish brown (10YR 5/4), slightly moist and medium dense. Coarse: subangular. Fines: medium plasticity.	GC	10YR 5/4	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								
- 340 - - - -	**338'-344': Clayey GRAVEL with sand**, GC, 50% gravel, 25% sand, 25% clay, Dusky yellow to moderate yellowish brown (5Y 6/4 - 10YR 5/4), dry and loose to medium dense. Coarse: subangular to angular. Fines: medium plasticity.	GC	5Y 6/4 - 10YR 5/4	D	▨	▨	▨	▨	▨						▨	▨												
345 - - - - 350	**344'-350': Gravely CLAY**, 40% gravel, 10% sand, 50% clay, Moderate yellowish brown (10Y 6/2), slightly moist and medium dense. Coarse: subangular. Fines: High plasticity.	CH	10YR 5/4	SM	▨	▨	▨	▨	▨						▨													
- - - - 355 -	**350'-356': Clayey GRAVEL with sand**, 40% gravel, 25% sand, 35% clay, Pale olive (10Y 6/2), Slightly moist and dense. Coarse: subangular. Fines: High plasticity.	GC	10Y 6/2	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								
- - - 360	**356'-364': Clayey GRAVEL with sand**, 40% gravel, 35% sand, 25% clay, Moderate yellowish brown (10YR 5/4), slightly moist and dense. Coarse: subrounded to subangular. Fines: High plasticity.	GC	10YR 5/4	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨							Sample Bucket: 356'-358'	

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6207.6
Project No.:	043-2572	Drill date:	10/13/2004	Coordinates	N: 19405.4 E: 9536.6	Sheet	10 of 11
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (m)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maxiumum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R0	R1	R2	R3	R4	R5	R6	Physical Testing	Notes Test Results
360	**Continued**	GC	10YR 5/4	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨								
365 370	**364'-373': Clayey GRAVEL with sand**, GC, 35% gravel, 25% sand, 40% clay, moderate yellowish brown (10YR 5/4), dry and medium dense. Coarse: subangular. Fines: High plasticity.	GC	10YR 5/4	D	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								
375	**373'-378': Clayey GRAVEL with sand**, GC, 35% gravel, 25% sand, 40% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular to angular. Fines: medium plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨	▨											
380 385	**378'-388': Clayey GRAVEL with sand**, GC, 40% gravel, 25% sand, 35% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular to angular. Fines: High plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
390	**388'-391': Clayey GRAVEL with sand**, GC, 35% gravel, 25% sand, 40% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular to angular. Fines: medium plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨	▨										Sample Bucket: 388'-390'	
395 400	**391'-400': Clayey GRAVEL with sand**, GC, 50% gravel, 30% sand, 20% clay, light brown (5YR 5/6), slightly moist and medium dense. Coarse: subangular. Fines: medium plasticity.		5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 01

Project: G&K/Stockpile Characterization
Datum:
Collar Elev: 6207.6
Project No.: 043-2572
Drill date: 10/13/2004
Coordinates N: 19405.4 E: 9536.6
Sheet 11 of 11
Location: Tyrone Mine
Drill rig:
Azimuth: N/A
Inclination: 90°

Depth (m)	Soil / Rock Type **Description** (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results	Depth
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6			
400	**400'-402': Clayey GRAVEL with sand**, GC, 35% gravel, 25% sand, 40% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular to angular. Fines: medium plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨	▨												400
405	**402'-406': Clayey GRAVEL with sand**, GC, 45% gravel, 25% sand, 30% clay, grayish orange (10YR 7/4), dry and loose. Coarse: subangular to angular. Fines: medium plasticity.	GC	10YR 7/4	D	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨					405
410	**406'-410': Clayey GRAVEL with sand**, GC, 30% gravel, 25% sand, 45% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨					410
415 420 425 430 435 440																													415 420 425 430 435 440

Scale:

Drilling Contractor:

Driller:

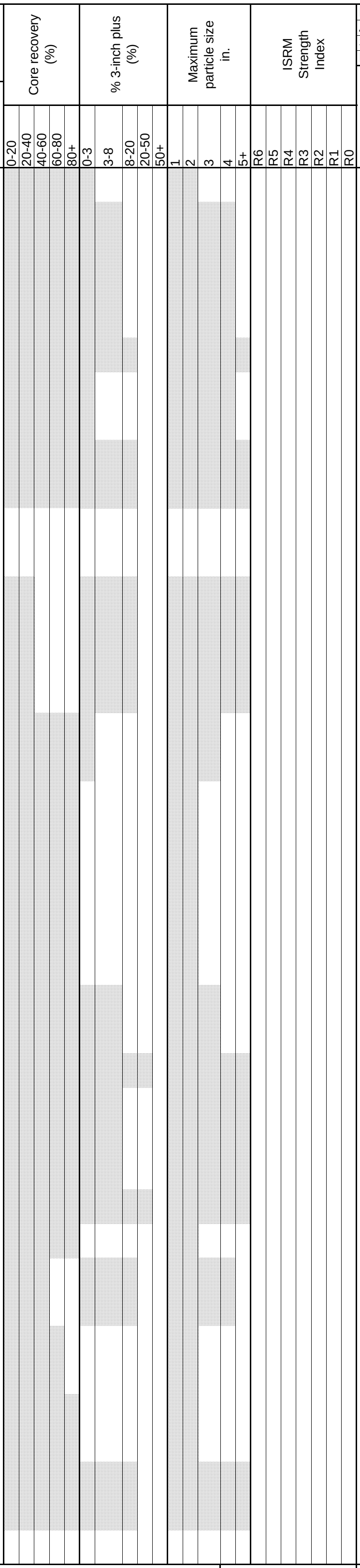
USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project:	G&K/Stockpile Characterization		Datum:		Collar Elev:
Project No.:	043-2572	Drill date:	Coordinates N:	E:	Sheet 1 of 7
Location:	Tyrone Mine	Drill rig:	Azimuth		Inclination: vertical

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture (D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated)	Physical Testing (D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index)	Notes Test Results
0	**SANDY GRAVEL**, small amount to some silt and clay, well graded angular gravel, predominantly fine- to medium-grained sand, non-plastic to low plasticity, brown (7.5YR 7/2)	GW		SM		
-				M		pyrite throughout (<1mm)
-						
-				M		
-						
5				SM		
-	**GRAVEL**, some sand and cobbles, small amount of silt and clay, predominantly coarse, angular, low plasticity, brown (10 Y 8/)	GP				
-				M		
-						
-				D		
10						sample missing
-						
-						trace mal, FeOx
-				M		
-						
15						
-				D		
-						
-	**SILTY GRAVEL**, considerable sand, some clay, well graded, sub-angular to angular, low plasticity, light brown to yellow-brown (10 Y 8/)	GP		D		
-						
20				SM		
-						
-				SM		
-						trending to light gray
-				D		
25						
-	gravel from 26 to 28'			D		
-						
-				D		
-						
30				D		
-	gravelly silt from 31 to 32'	ML				
-	**SANDY GRAVEL**, considerable clay and cobble, well graded angular sand and gravel, low to medium plasticity, brown (2.5Y 7/3)	GW		D		FeOx
-						
-				M		
35						Cu sulfates
-				M		
-						
-						
-	low plasticity below 38'			SM		
40						



Scale

Drilling Contractor

Driller

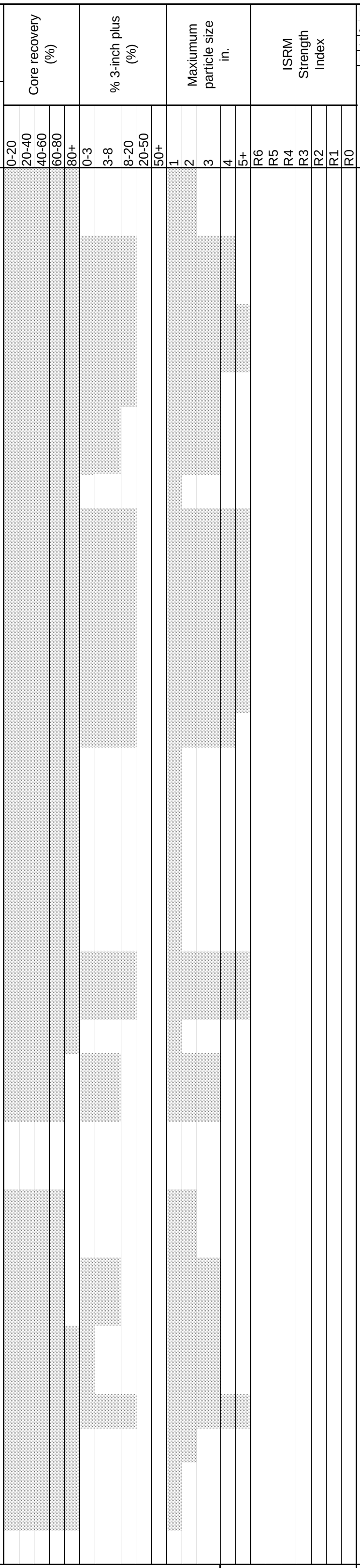
USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project:	G&K/Stockpile Characterization		Datum:		Collar Elev:
Project No.:	043-2572	Drill date:	Coordinates N:	E:	Sheet 2 of 7
Location:	Tyrone Mine	Drill rig:	Azimuth		Inclination: vertical

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture D-dry SM-slightly moist M-moist VM-very moist S-saturated	Physical Testing D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index	Notes Test Results
40	**SILTY GRAVEL**, some sand and clay, predominantly coarse, angular, non-plastic, light brown	GM		D		
	GRAVEL, considerable sand, some cobbles, silt and clay, low plasticity, gray (2.5Y 7/2)	GW		SM		
45	sandy gravel from 44' to 49'			D		
				D		
	silty gravel from 49 to 50'	GM		SM		
50				D		greenish-gray to yellow-brown (2.5Y 8/4) from 50 to 56'
						smectitie coatings at 52'
				D		
55				D		
	silty gravel from 55 to 58'	ML				
				D		
	CLAYEY SAND, considerable gravel, small amount of silt, angular, medium plasticity, reddish-brown (10R 6/4)	SC		M		
60				M		
				M		
65	sandy gravel from 64' to 66'	GP		SM-M		
				D		
						sample missing
70				M		
				M		
	SANDY GRAVEL, small amount of silt, clay and cobbles, well graded angular gravel, well graded sand, low plasticity, brown to light brown	GW				
75				D		
				D		
				SM		
	CLAYEY to GRAVELLY SAND, fine gravel, fine- to medium-grained sand, low to medium plasticity, red- to yellow-brown	SP		M		
80						



Scale

Drilling Contractor

Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

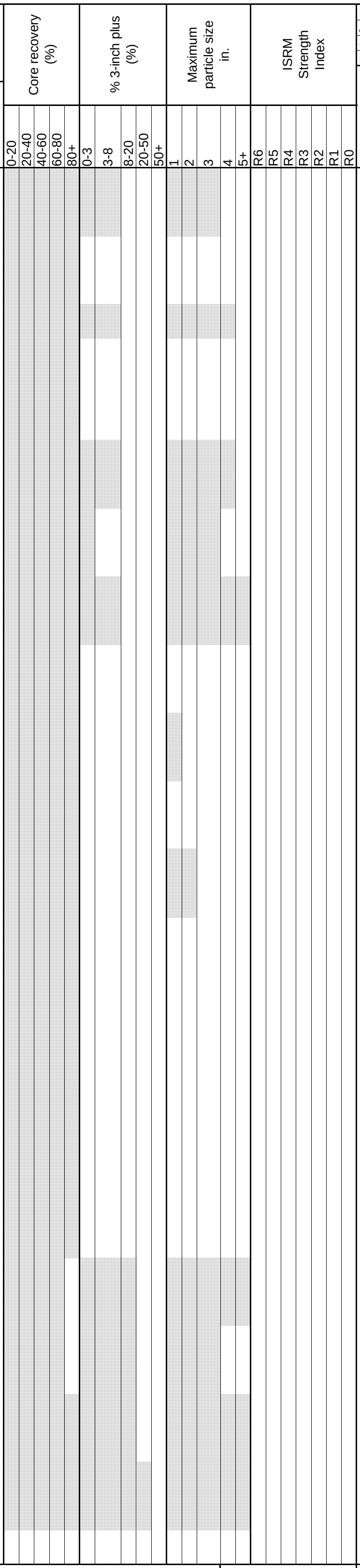
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 3 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

D-dry
SM-slightly moist
M-moist
VM-very moist
S-saturated

D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
80	**CLAYEY to GRAVELLY SAND** (cont.)	SP		M		
	clayey sand	SC		M		
	gravel from 83 to 84' **GRAVELLY SAND**, considerable clay, some silt, predominantly fine- to medium-grained sand, non-plastic to low plasticity, bluish-gray (10B 6/)	SP		M SM M SM D		
	sandy gravel from 92 to 94'	GP		D		
	CLAYEY SAND, some gravel, well graded angular sand, medium plasticity, reddish-brown (7.5YR 6/4) to yellow-brown (2.5Y 8/4)	SC		M M M		
100	clayey gravel 100 to 101'	GC		SM		
				M		
105	**CLAYEY SAND**, some gravel, predominantly fine- to medium-grained angular sand, medium plasticity, bluish-gray (10B 7/)	SC		M M M M		
	GRAVELLY SAND, considerable clay and silt, well graded sand, low plasticity, yellow-brown (2.5Y 7/6)	SW				
120						120



Scale

Drilling Contractor

Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 4 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated
Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture	Core recovery (%) 0-20 20-40 40-60 60-80 80+	% 3-inch plus (%) 0-3 3-8 8-20 20-50 50+	Maxiumum particle size in. 1 2 3 4 5+	ISRM Strength Index R6 R5 R4 R3 R2 R1 R0	Physical Testing	Notes Test Results
120	**GRAVELLY SAND** (cont.), considerable clay and silt, well graded sand, low plasticity, yellow-brown (2.5Y 7/6)	SW		M						
				M						
				M						solid plug of core from 122 to 123', 126 to 1
125	increase in clay from 122-123', 126' to 127'									
				M						
	reddish-brown (10R 5/6) from 127 to 130'			M						
130	greenish-brown (5GY 7/) from 130 to 133'			M						
				M						
	very mottled colors (reddish-brown, blue-gray) from 133 to 148'									
				M						
135										solid core from 136 to 144'
				M						
				M						
140				M						
				M						
				M						
145										
				M						
				M						
	SANDY GRAVEL, considerable clay and silt, small amount cobbles, predominantly fine angular gravel, well graded angular sand, low plasticity, blue-gray (149 to 153'; N 6/) to reddish-brown (153 to 157')	GP								
150				M						
				M						
				M						
155				SM						
										lge cobble (boulder?) from 156 to 157'
	GRAVELLY SAND, considerable clay and silt, well graded sand, low plasticity, yellow-brown (10R 5/4)	SW		VM						solid plug of core from 157 to 159'
				M						
160										

Scale
Drilling Contractor
Driller

USC (MPa)	
R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

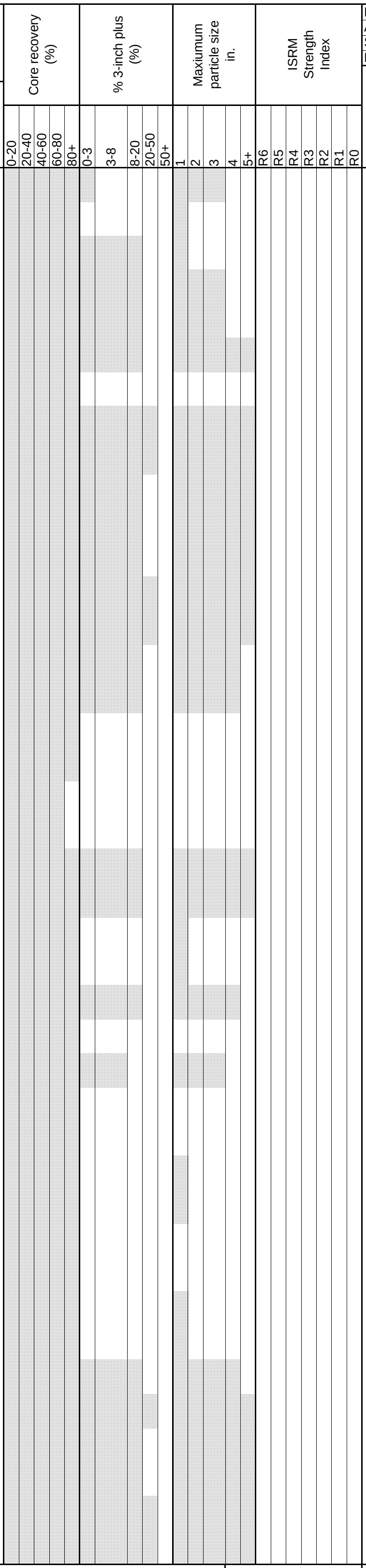
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 5 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
160	**GRAVELLY SAND** (cont.)					
-						
-		SW		M		
-						
-				M		
165						
-				M		
-	**SANDY GRAVEL**, some silt and clay, predominantly coarse angular gravel, predominantly fine- to medium-grained sand, low plasticity, light reddish-brown (5YR 7/4)					brown (10R 5/3) from 166 to 167'
-				M		
-		GP				
170				M		
-	**GRAVEL**, considerable sand, small amount of clay and silt, predominantly coarse-grained, angular, non-plastic, gray (N 8/)					
-				SM		
-		GP				
-				D		
175						
-	**GRAVELLY SAND**, considerable silt and clay, small amount cobbles, well graded angular sand, low plasticity, yellow-brown (2.5Y 8/2)			SM		
-						
-		SW		M		
-	reddish-brown (10R 5/3) below 179'					
180				M		
-						
-				M		
-						
-				M		
185						
-				M		
-				SM		
-						
-				M		
190						
-				SM		
-						
-	sandy gravel from 193 to 196'			SM		
-				M		
195						
-	**GRAVEL**, considerable sand, some silt and clay, predominantly coarse-grained, angular, non-plastic, yellow-brown (2.5Y 7/3)			SM		
-						
-		GP		SM		
-						
200				SM		



Scale
Drilling Contractor
Driller

USC (MPa)	
R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

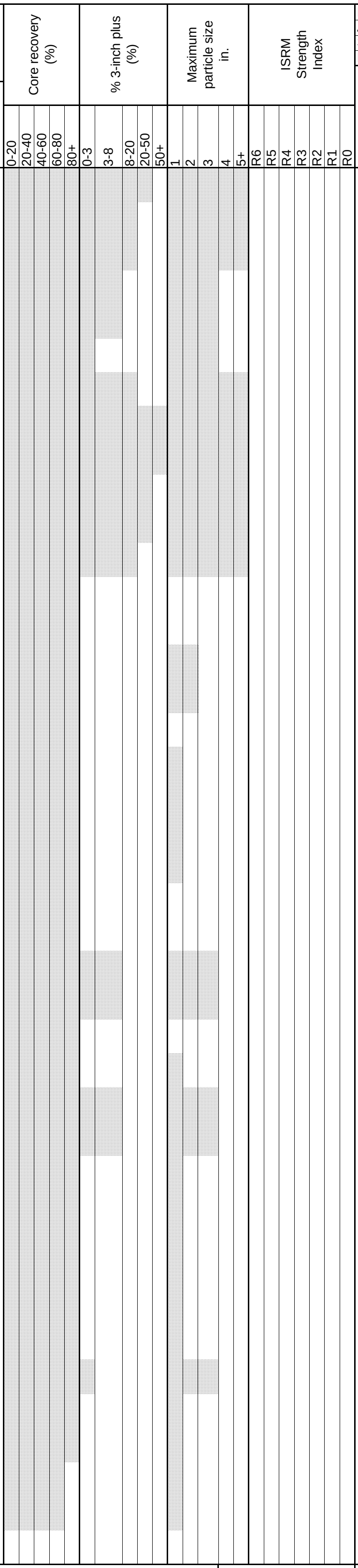
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project: G&K/Stockpile Characterization
Project No.: 043-2572
Location: Tyrone Mine
Drill date:
Drill rig:
Datum:
Coordinates N: E:
Azimuth
Collar Elev:
Sheet 6 of 7
Inclination: vertical

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type – Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
200–206	**GRAVEL** (cont.), considerable sand, some silt and clay, predominantly coarse-grained, angular, non-plastic, yellow-brown (2.5Y 7/3)	GP		M SM D		
206–212	gray gravelly silt from 206 to 207' (N 6/) **GRAVEL**, small amount to considerable gray silt, some cobbles, predominantly coarse-grained, angular, non-plastic, brown (10YR 7/3) to reddish-brown (10R 7/4)	GP		D D D		
212–233	**GRAVELLY SAND**, considerable clay, some silt, predominantly fine- to medium-grained angular sand, low plasticity, yellow-brown (10YR 6/6)	SP		SM M M M M M M SM S S M M		
233–237	**CLAYEY SAND**, considerable fine angular gravel and silt, predominantly fine- to medium-grained angular sand, medium plasticity, yellow-brown (10YR 6/8)	SC		M M		
237–240	**GRAVELLY SAND**, considerable clay, some silt, predominantly fine- to medium-grained angular sand, low plasticity, yellow-brown (10YR 7/4)	SP		M		



Scale
Drilling Contractor
Driller

USC (MPa)

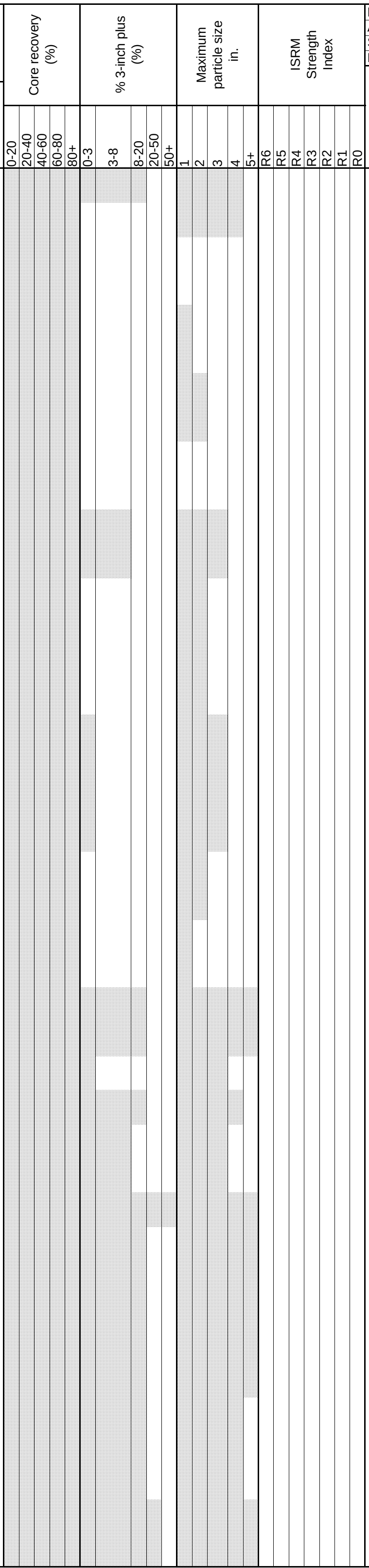
R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-2

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 7 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated



Depth (m)	Soil / Rock Type: Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
240 245	**GRAVELLY SAND** (cont.), considerable clay, some silt, predominantly fine- to medium-grained angular sand, low plasticity, yellow-brown (10YR 7/4) reddish-brown at 249' (5YR 7/6)	**SP**		M M M M SM		
250 255	**CLAYEY to GRAVELLY SAND**, some silt, low plasticity, yellow-brown (2.5YR 8/4)	**SP** **SC**		M M M		
260 265	**SANDY GRAVEL**, considerable silt and clay, predominantly fine angular gravel, low plasticity, yellow-brown (2.5Y 6/6) reddish-brown below 264' (10YR 6/6)	**GP**		M M M M M M M		
270 275 280	**GRAVEL**, considerable cobbles and sand, small amount of silt and clay, predominantly coarse-grained, angular, non-plastic, yellow-brown (10YR 6/4)	**GP**		D SM D D M SM		*END OF RECORD (281')*

Scale
Drilling Contractor
Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

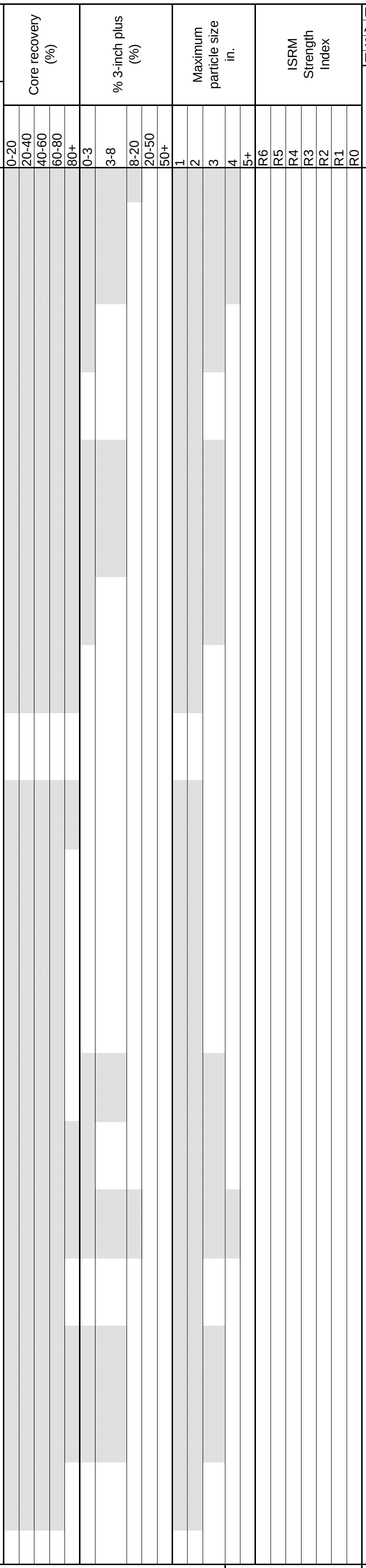
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 1 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
0	**SANDY GRAVEL**, small amount to some silt and clay, well graded angular gravel, predominantly fine- to medium-grained sand, non-plastic to low plasticity, brown (7.5YR 7/2) loose throughout	GW		SM M		
				M		
5						trace FeOx at 5.5'
				M		
				M		
10				M		
				M		
				M		
15						sample missing
				M		
20				M		
				SM		
25	**SANDY GRAVEL**, small amount to some silt and clay, predominantly coarse angular gravel, predominantly fine- to medium-grained sand, non-plastic to low plasticity, brown (7.5YR 7/3) loose throughout	GP		VM		
				SM		
30				M		
				M		
	well graded gravel from 34-36'	GW				
35				M		
		GP		M		
40				VM		40



Scale
Drilling Contractor
Driller

USC (MPa)	
R0-0.25-1.0 R1-1.0-5.0 R2-5.0-25 R3-25-50	R4-50-100 R5-100-250 R6->250

Golder Associates

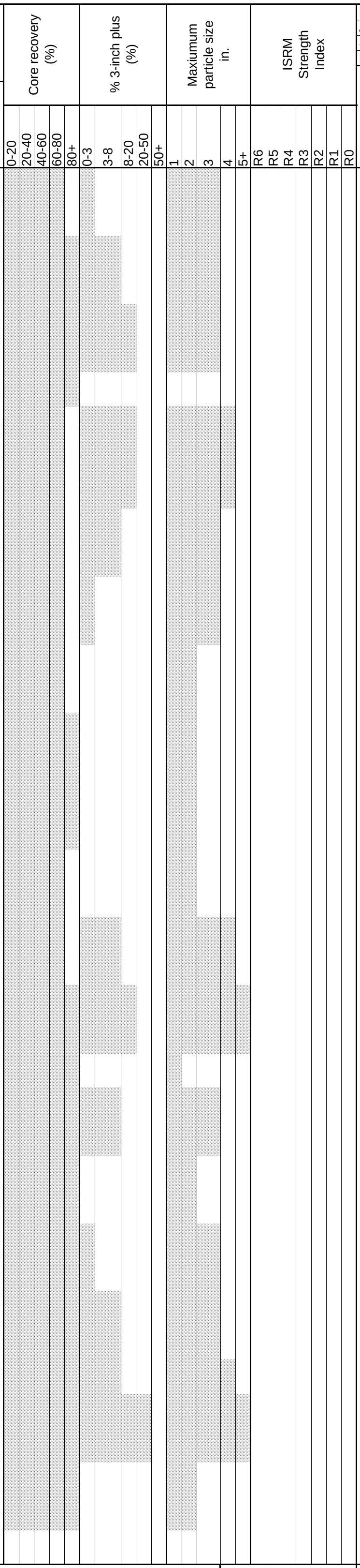
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 2 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
40	**SANDY GRAVEL** (cont.)	GP		M		
				M		trace FeOx at 43'
45				M		
				M		
				M		plug of solid core 49 to 50'
50				M		
				SM		
55				M		
	SANDY GRAVEL, small amount to some silt and clay, predominantly coarse angular gravel, predominantly fine- to medium-grained sand, non-plastic to low plasticity, brown (7.5YR 7/3)	GP		M		solid core 56 to 62'
60				M		
	GRAVELLY SAND, considerable silt and clay, some cobbles, predominantly fine-grained angular sand, predominantly coarse angular gravel, low to medium plasticity, reddish-brown (10R 7/3)	SP		M		
65				M		
				M		
				M		
70				VM		solid core 66 to 75', 77 to 83'
				M		
75				M		
				M		
80	predominantly fine gravel from 78 to 80'			M		



USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

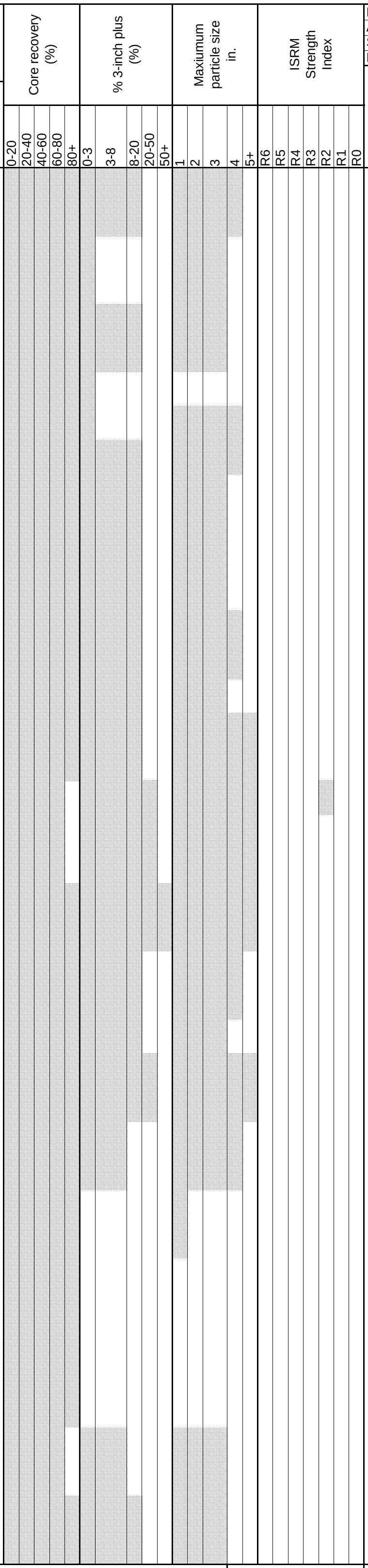
Scale
Drilling Contractor
Driller

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 3 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Depth (m)	Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
80	**GRAVELLY SAND** (cont.)	SP		M		
81	**SANDY GRAVEL**, some silt and clay, small amount cobbles, well graded angular gravel, non-plastic to low plasticity, reddish-brown (10 R 5/4) to gray (10 BG 5/)			M M		thin (2") layers of open gravel at 83, 90'
86	clayey sand from 86-87'	SC		M		
87		SP		M M M M M M		solid core from 87 to 92' solid core from 98 to 99'
100	**GRAVEL,** some silt and fine sand, angular, predominantly coarse-grained, non-plastic, gray (5PB 7/)	GP		D		
103	**SANDY GRAVEL**, considerable silt and clay, some cobbles, predominantly coarse angular gravel, well graded sand, low plasticity, reddish- to purplish-brown (10 R 7/3)	GP		M M M M M M		color change to orange-brown (2.5 YR 6/6) from 107 to 108' orange-brown (2.5 YR 6/6) from 110 to 111', 114 to 115' solid core from 112 to 115'
116	**GRAVEL to SANDY GRAVEL,** small amount of silt and clay, predominantly coarse angular to sub-angular gravel, non-plastic, orange-brown (2.5 YR 5/6)	GP		M SM SM		



USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

Scale

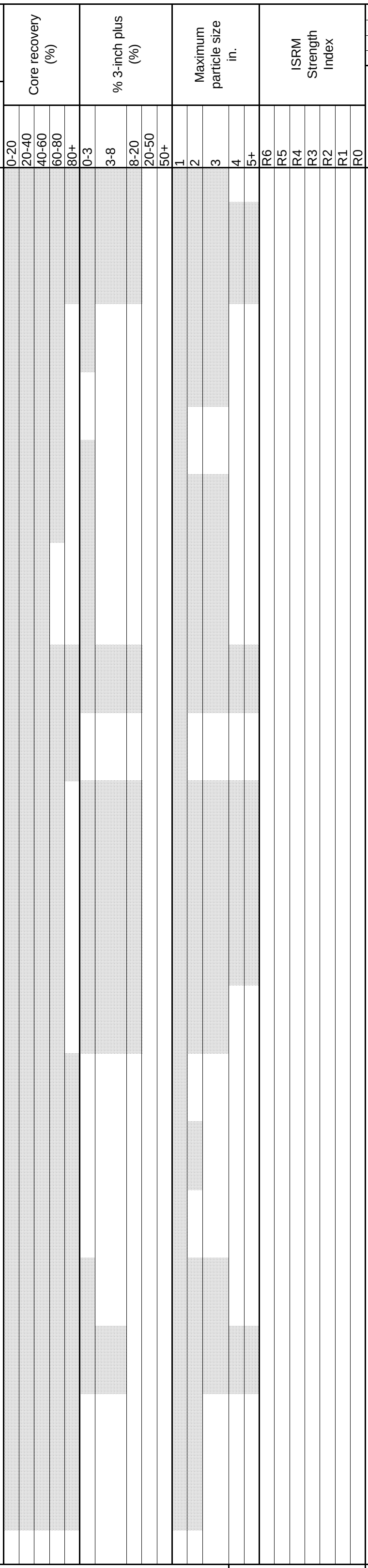
Drilling Contractor

Driller

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization		Datum:		Collar Elev:	
Project No.: 043-2572	Drill date:	Coordinates N:	E:	Sheet	4 of 7
Location: Tyrone Mine	Drill rig:	Azimuth		Inclination:	vertical

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture D-dry SM-slightly moist M-moist VM-very moist S-saturated	Physical Testing D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index	Notes Test Results
120	**GRAVEL to SANDY GRAVEL** (cont.)	GP		M		
123	**GRAVELLY SAND**, some silt and clay, predominantly fine- to medium-grained sand, low plasticity, dark reddish-brown (5YR 6/6)	SW		M M M M M		
130	**SANDY GRAVE**L, some to considerable clay, some silt and cobbles, well graded angular gravel, low plasticity, reddish-brown to orange-brown	GW		M M M M M SM M		dark reddish-brown (2.5 YR 4/6) at 134' - small piece of solid core 2" seam of orange-brown sand at 147'
147	**SAND and GRAVEL**, small amount of silt and clay, well graded sand, predominantly fine gravel, low plasticity, brown (7.5 TR 7/3)	SW-GP		M M SM SM M M		sand, reddish-brown (10 R 5/6) from 156 to 157' some solid core from 158 to 163'
160						



Scale

Drilling Contractor

Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

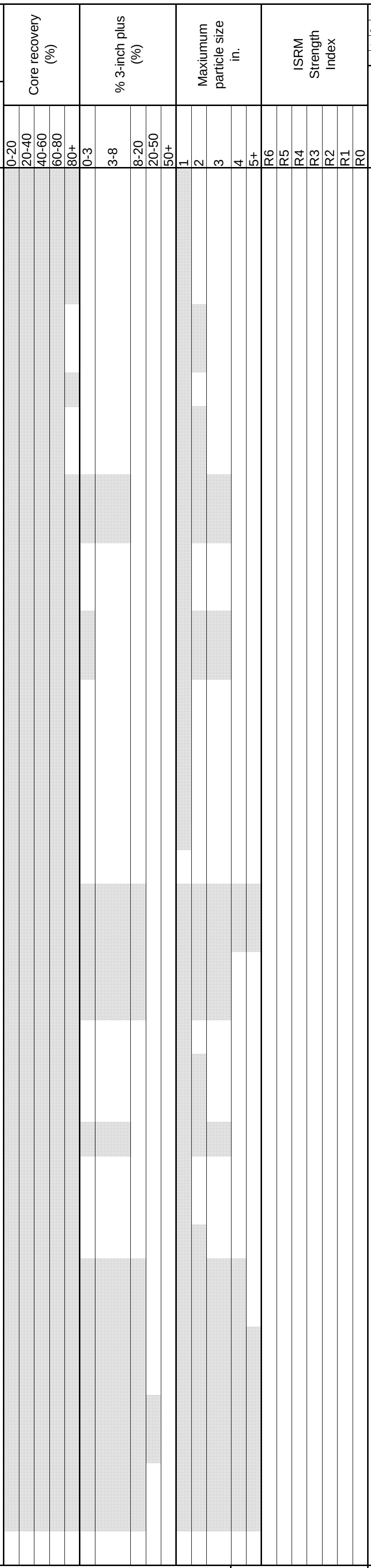
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization
Datum:
Collar Elev:
Project No.: 043-2572
Drill date:
Coordinates N:
E:
Sheet 5 of 7
Location: Tyrone Mine
Drill rig:
Azimuth
Inclination: vertical

D-dry
SM-slightly moist
M-moist
VM-very moist
S-saturated

D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Depth (m)	Soil / Rock Type Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
160	**SAND and GRAVEL** (cont.)	SW-GP		M M		
165	**SANDY GRAVEL**, some to considerable silt and clay, some cobbles, well graded angular gravel, well graded sand, low plasticity, yellow-brown (5 YR 6/3) considerable silt at 168' very few fines from 186 to 187.5'	GW		SM to M M M M SM SM M M M M M M M		solid core at 177, 180' reddish-brown (10 R 6/3) below 180' solid core at 183, 186'
190	**GRAVEL**, considerable sand, considerable silt (195'), small amount of clay, predominantly coarse-grained, angular, non-plastic, gray (5 PB 7/)	GP				solid core at 198'
200						



Scale
Drilling Contractor
Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

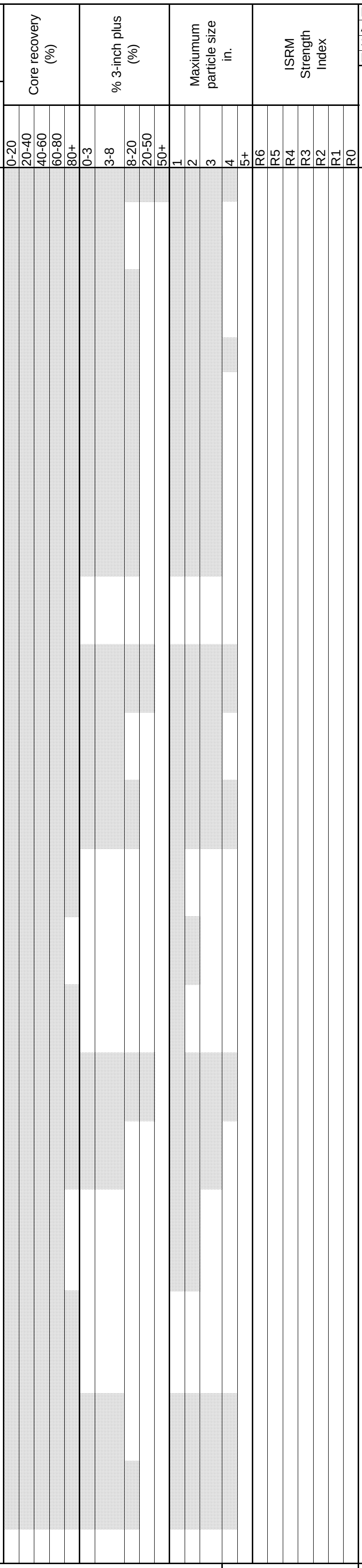
ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project: G&K/Stockpile Characterization
Project No.: 043-2572
Location: Tyrone Mine
Drill date:
Drill rig:
Datum:
Coordinates N:
E:
Azimuth
Collar Elev:
Sheet 6 of 7
Inclination: vertical

D-dry
SM-slightly moist
M-moist
VM-very moist
S-saturated

D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description	USCS	Run No.	Moisture	Physical Testing	Notes Test Results
200	**SANDY GRAVEL**, considerable silt and clay, some cobbles, predominantly coarse angular gravel, non-plastic, gray (2.5 Y 6/1)	GP		M		Cu sulfates at 200.5' much solid core below 200'
-						
-				M		
-						
-				M		
205						
-				M		
-						
-				M		
-						
210				M		
-						
-				M		
-						
-				SM		
215						
-				SM		
-						
-				SM		reddish-brown 2.5 YR 7/4), less fines from 218 to 219'
-						
220				M		
-	predominantly fine gravel below 221'					
-				M		
-						
-				M		
225						
-				SM		
-						
-	**GRAVELLY SAND**, considerable clay, some silt, predominantly fine gravel, predominantly fine- to medium-grained sand, low plasticity, reddish-brown (2.5 YR 6/3)	SP		M		
-						
230				M		
-						
-				M		
-						
-				M		
235						
-				M		
-						
-				M		
-						
240						



Scale

Drilling Contractor

Driller

USC (MPa)	
R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT-3

Project:	G&K/Stockpile Characterization		Datum:		Collar Elev:
Project No.:	043-2572	Drill date:	Coordinates N:	E:	Sheet 7 of 7
Location:	Tyrone Mine	Drill rig:	Azimuth		Inclination: vertical

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description	USCS	Run No.	Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maximum particle size in. 1	2	3	4	5+	ISRM Strength Index R6	R5	R4	R3	R2	R1	R0	Physical Testing	Notes Test Results
240	**GRAVELLY SAND** (cont.)	SP		M	▨	▨	▨	▨		▨	▨				▨	▨	▨											
-					▨	▨	▨	▨		▨	▨				▨	▨	▨											
-	**GRAVEL**, small amount of sand, trace silt and clay, predominantly coarse-grained, angular, non-plastic, brown (5YR 7/3)			M	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨									
-		GP		SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨									
-				M	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨									
245					▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨									
-				M	▨	▨	▨	▨	▨						▨													
-	**GRAVELLY SAND**, considerable silt and clay, predominantly fine- to medium-grained angular sand, predominantly fine angular gravel, low plasticity, dark reddish-brown (10R 6/6)				▨	▨	▨	▨	▨						▨													
-		SP		M	▨	▨	▨	▨	▨						▨													
-					▨	▨	▨	▨	▨						▨													
250	*END OF RECORD*																											

Scale

Drilling Contractor

Driller

USC (MPa)

R0-0.25-1.0	R4-50-100
R1-1.0-5.0	R5-100-250
R2-5.0-25	R6->250
R3-25-50	

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:			Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6	E: 4155.5	Sheet	1 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth			Inclination:	90°

Depth (m)	Soil / Rock Type **Description** (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Soil / Rock Type Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
0	**0'-2': Gravely to sandy CLAY**, CH, 20% gravel, 20% sand, 60% clay, light brown (5YR 5/6), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨												
5 10 15	**2'-18': Clayey GRAVEL with sand**, GC, 40% gravel, 15% sand, 45% clay, dusky yellow (5Y 6/4), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5Y 6/4	SM	▨	▨	▨	▨	▨						▨	▨	▨										Sample Bucket: 12'-14'	
20	**18'-24': Gravely CLAY**, CH, 40% gravel, 10% sand, 50% clay, light brown (5YR 5/6), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨											
25 30	**24'-32': Clayey GRAVEL with sand**, GC, 40% gravel, 15% sand, 45% clay, dark yellowish orange (10YR 5/6), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	GC	10YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨											
35	**32'-36': Gravely CLAY**, CH, 40% gravel, 10% sand, 50% clay, light brown (5YR 5/6), slightly moist and dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨											
40	**36'-42': Clayey GRAVEL with sand**, GC, 35% gravel, 25% sand, 40% clay, light brown (5YR 6/4), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 6/4	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨								

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6 E: 4155.5	Sheet	2 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth		Inclination:	90°

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture: D-dry SM-slightly moist M-moist VM-very moist S-saturated	Core recovery (%)					% 3-inch plus (%)					Maximum particle size in.					ISRM Strength Index for CLASTS							Physical Testing: D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
40 - 42	**Continued**	GC	5YR 6/4	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨								
42 - 50	**42'-80': Clayey GRAVEL with sand**, GC, 45% gravel, 25% sand, 30% clay, light brown (5YR 6/4 to 5YR 5/6), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 6/4	SM	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨								
50 - 62			5YR 5/6		▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨								
62 - 69			5YR 6/4		▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨								
69 - 71					▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨							Sample Bucket: 69'-71'	
71 - 80					▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨	▨	▨								

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:			Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6	E: 4155.5	Sheet	3 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth			Inclination:	90°

Depth (m)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6			
80 85 90	**80'-92': Clayey GRAVEL with sand**, 60% gravel, 15% sand, 25% clay, light brown (5YR 6/4), slightly moist and dense. Coarse: subangular. Fines: high plasticity. From 89' to 92', color changes to moderate reddish brown (10R 4/6)	GC	5YR 6/4 10R 4/6	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨									80 85 90
95	**92'-96': Clayey GRAVEL with sand**, GC, 45% gravel, 20% sand, 35% clay, Pale reddish brown to light brown (10 R 5/4 to 5YR 5/6), dry and dense. Coarse: subangular. Fines: high plasticity.	GC	10 R 5/4-5YR 5/6	D	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨									95
100	**97'-102': Clayey GRAVEL with sand**, GC, 55% gravel, 25% sand, 20% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨									100
105 110 115	**102'-116': Clayey GRAVEL with sand**, GC, 40% gravel, 15% sand, 45% clay, light brown (5YR 5/6) slightly moist and medium dense to dense. Coarse: subangular. Fines: high plasticity. From 115' to 116', color changes to moderate reddish brown (10R 4/6)	GC	5YR 5/6 10 R 4/6	SM	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨	▨	▨	▨									105 110 115
120	**116'-122': Clayey GRAVEL with sand**, GC, 45% gravel, 25% sand, 30% clay, dark yellowish orange to light brown (10YR 6/6 to 5YR 5/6), slightly moist and medium dense to dense. Coarse: subangular. Fines: high plasticity.	GC	10 YR 6/6-5YR 5/6	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨							Sample Bucket: 117'-119'		120

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:		Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6 E: 4155.5	Sheet	4 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth		Inclination:	90°

Depth (m)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6			
120	**Continued**	GC	10 YR 6/6-5YR 5/6	SM	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨									120
125	**122'-129': Gravelly CLAY**, CH, 30% gravel, 20% sand, 50% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨													125
130 135	**129'-136': Clayey GRAVEL with sand**, GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨													130 135
140 145	**136'-146': Clayey SAND with gravel**, SC, 25% gravel, 35% sand, 40% clay, light brown (5YR 5/6), slightly moist, well graded and medium dense. Coarse: subangular. Fines: high plasticity.	SC	5YR 5/6	SM	▨	▨	▨	▨	▨						▨	▨	▨												140 145
150 155	**146'-156': Clayey SAND with gravel**, SC, 30% gravel, 35% sand, 35% clay, pale reddish brown (10R 5/4), dry, well graded and loose to medium dense. Coarse: subangular. Fines: medium plasticity.	SC	10R 5/4	D	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 152'-154'		150 155
160	**156'-162': Gravelly to Sandy CLAY**, CH, 25% gravel, 25% sand, 50% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	D	▨	▨	▨	▨	▨						▨														160

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:				Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N:	10838.6	E: 4155.5	Sheet	5 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth				Inclination:	90°

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
160	**Continued**	CH	5YR 5/6	D	▨	▨	▨	▨	▨						▨													
165 170 175 180 185	**162'-188': Clayey SAND with gravel**, SC, 30% gravel, 35% sand, 45% clay, dark yellowish orange to light brown (10YR 6/6 to 5YR 5/6), dry, well graded and loose. Coarse: subangular. Fines: high plasticity.	SC	10YR 6/6-5YR 5/6	D	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨			Sample Bucket: 183'-185'	
190	**188'-191': Clayey GRAVEL with sand**, GC, 50% gravel, 25% sand, 25% clay, dark yellowish orange to light brown (10YR 6/6 to 5YR 5/6), slightly moist and loose. Coarse: subangular. Fines: high plasticity.	GC	10YR 6/6-5YR 5/	SM	▨	▨	▨	▨	▨						▨	▨	▨											
195	**191'-198': Clayey GRAVEL with sand**, GC, 45% gravel, 15% sand, 40% clay, light brown (5YR 6/4), slightly moist and medium dense. Coarse: subangular. Fines: high plasticity.	GC	5YR 6/4	SM	▨	▨	▨	▨	▨						▨	▨	▨											
200	**198'-204': Clayey SAND with gravel**, SC, 30% gravel, 35% sand, 35% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: medium plasticity.	SC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:			Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6	E: 4155.5	Sheet	6 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth			Inclination:	90°

Depth (m)	Soil / Rock Type		Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated	Core recovery (%)					% 3-inch plus (%)					Maximum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index	Notes Test Results
	Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol		Moisture	0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6	Physical Testing	
200	**Continued**	SC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨												
205	**204'-208': Clayey GRAVEL with sand**, GC, 50% gravel, 20% sand, 30% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular to angular. Fines: medium plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨												
210	**208'-213': Clayey GRAVEL with sand**, GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 6/4), dry and loose. Coarse: subangular. Fines: high plasticity.	GC	5YR 6/4	D	▨	▨	▨	▨	▨						▨	▨	▨											
215	**213'-217': Gravelly to Sandy CLAY**, CH, 25% gravel, 25% sand, 50% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	CH	5YR 5/6	D	▨	▨	▨	▨	▨						▨													
	From 215' to 216', Clayey Gravel with sand.	GC			▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨				
		CH			▨	▨	▨	▨	▨						▨													
220	**217'-220': Clayey GRAVEL with sand**, GC, 40% gravel, 20% sand, 40% clay, light brown (5YR 6/4), dry and loose. Coarse: subangular. Fines: high plasticity.	GC	5YR 6/4	D	▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨				
225 230 235	**220'-236': Clayey GRAVEL with sand**, GC, 40% gravel, 25% sand, 35% clay, light brown (5YR 5/6), dry and loose. Coarse: subangular. Fines: high plasticity.	GC	5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨											Sample Bucket: 221'-223'	
240	**236'-240': Clayey GRAVEL with sand**, GC, 45% gravel, 15% sand, 40% clay, light brown to grayish orange (5YR 5/6 to 10YR 7/4), slightly moist and medium dense. Coarse: subangular to angular. Fines: high plasticity.	GC	5YR 5/6-10YR 7/4	SM	▨	▨	▨	▨	▨						▨	▨												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - BOREHOLE TSGT- 04

Project:	G&K/Stockpile Characterization			Datum:			Collar Elev:	6310.7
Project No.:	043-2572	Drill date:	9/28/2004	Coordinates	N: 10838.6	E: 4155.5	Sheet	7 of 7
Location:	Tyrone Mine	Drill rig:		Azimuth			Inclination:	90°

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (m)	Soil / Rock Type: Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture	Core recovery (%)					% 3-inch plus (%)					Maximum particle size in.					ISRM Strength Index for CLASTS							Physical Testing	Notes Test Results
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R0	R1	R2	R3	R4	R5	R6		
240 245	**240'-251': Clayey SAND with gravel**, SC, 30% gravel, 35% sand, 45% clay, dark yellowish orange to light brown (10YR 6/6 to 5YR 5/6), dry, well graded and loose. Coarse: subangular. Fines: high plasticity	SC	10YR 6/6-5YR 5/6	D	▨	▨	▨	▨	▨						▨	▨												
250					▨	▨	▨	▨	▨	▨	▨				▨	▨	▨	▨		▨	▨	▨	▨	▨				
255	**251'-255': Clayey GRAVEL with sand**, GC, 40% gravel, 30% sand, 30% clay, pale reddish brown (10R 5/4), slightly moist, well graded and medium dense. Coarse: subrounded to subangular. Fines: high plasticity	GC	10R 5/4	SM	▨	▨	▨	▨	▨						▨	▨												
	255'-259': Clayey GRAVEL, GC, 60% gravel, 10% sand, 30% clay, pale reddish brown to dark yellowish orange (10R 5/4 to 10YR 5/6), dry and loose. Coarse: subrounded to subangular. Fines: medium plasticity	GC	10R 5/4-10YR 5/6	D	▨	▨	▨	▨	▨	▨	▨	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
260 265 270	**251'-255': Clayey SAND with gravel**, SC, 20% gravel, 50% sand, 30% clay, moderate brown (5YR 4/4 to 5YR 3/4), slightly moist and loose. Coarse: subrounded to subangular. Fines: low plasticity	SC	5YR 4/4-5YR 3/4	SM	▨	▨	▨	▨	▨						▨												Sample Bucket: 265'-269'	
275 280																												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

APPENDIX B-2

2004 PHELPS DODGE TYRONE, INC.
GEOLOGIC LOGS

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-1 Northing: 19405.4 Easting: 9536.6 C.E.: 6207.6

Date Drilled: 10-13-04 Type: SONIC Hole Depth: 410 Orientation: -90° Logged by: RJW

05-03-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
				0' 3'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							7.2% GT	3			2%	1	–	–	–	–					MP - MEDIUM GRAY W/ LIGHT BROWN TINT NO NOTICEABLE ENRICH - NO VISIBLE Cu OX
				3' 8'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR	3	GREEN CuOX		2.5%	3	.25%		.1%	1	CHAL				MP MEDIUM GRAY - HIGH PY W/ ENRICH GREEN CU OX & CHALCANTHITE PRESENT
Composite:																														
				13'				12'-16'-2.5' MISSING	PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR	3	GREEN CuOX		2.5%	3	.2%		.1%	1	CHAL				MP MEDIUM GRAY HIGH PY W/ VERY LITTLE ENRICH. TRACES OF GREEN CU OX & CHALCANTHITE,
				18'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.1% HM	2			1.0%	3	–	–	–	–					MP MEDIUM TO LIGHT GRAY - IN PART SILICIFIED NO VISIBLE ENRICHMENT NO VISIBLE GREEN CU OX OR CHALCAN.
				23'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							NONE				2.0%	3	–	–	–	–					MP MEDIUM GRAY - NO VISIBLE ENRICH NO VISIBLE GREEN CU OX OR CHALCAN.
				28'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							NONE				2.0%	3	TR	3	–	–					MP MEDIUM GRAY TRACES OF ENRICH NO VISIBLE GREEN CU OX OR CHALCAN.
				33'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% HM > GT				1.0% FIRST FOOT THEN 0%	3	TR FIRST FOOT	3	–	–					FROM 28' TO 29' - MEDIUM GRAY MP W/ 1.0% PY - TC ENRICH FROM 29 TO 33' - ALTERED MP W/ NO VISIBLE SULFIDES - LIGHT TO MEDIUM REDDISH BROWN NO VISIBLE CU OX
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

Page: 2 of 9

Project:
Hole Number: TSGT-1
Date Drilled:
Type:
Northing: 19405.4
Hole Depth: 410
Easting: 95366
Orientation: -90
CE: 6207.6
Logged by: RJW

05-03-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				38'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% HM	3	BLACK CUOX		–	–	–	–	–	–					ALTERED MP CLAYS DARK RED TO 36' THEN MEDIUM BROWN TO 38' NO VISIBLE SULFIDES TR BLACK CU OX IN FRACTURES TR. GYPSUM ON FRACTURES
				43'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.0% HM>GT	3	BLACK CUOX		–	–	–	–	–	–					ALTERED MP MEDIUM REDDISH BROWN NO VISIBLE SULFIDES - BLACK CU OX ON FRACTURE SURFACES
				48'					PALT: 3 SALT: 5 CLAY: 35 LCAP:							1.0% HM>GT	3			–	–	–	–	–	–					ALTERED MP MEDIUM TO LIGHT REDDISH BROWN NO VISIBLE SULFIDES - NO VISIBLE CU OX.
				53'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR	3			1.5%	3	TR	1	TR	1	TR CHALC				MP MEDIUM GRAY VERY WEAK ENRICH TRACES OF CHALCANTHITE ALONG FRACTURES
				58'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.2% GT>HM	3			1.5%	3	TR CV	1	TR	1					MP FROM 53 TO 56' MEDIUM GRAY FROM 56' TO 58' LIGHT BROWN. TR COVELLITE ENRICH NO VISIBLE CU OX
150 Composite:																														
				63'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.0% HM	3 IN CLAY			1.0%	3	TR CV CC	1	TR	1					FROM 58' TO 60' MEDIUM GRAY FROM 61' (MP) TO 63' CLAY DARK RED. VERY WEAK CC & CU ENRICH. NO VISIBLE CU OX.
				68'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1% HM	3 IN CLAY			1.0%	3	TR CV CC	1	–	–					FROM 63' TO 65' DARK RED CLAY FROM 65' TO 68' MEDIUM RED CLAY W/ MP ROCKS W/ VERY WEAK ENRICH. NO VISIBLE CU OX
				73'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.5% HM	3 IN CLAY			1.0%	3	TR CV CC	1	–	–					ALTERED MP HM IN CLAY VERY WEAKLY ENRICHED PY - CC & CV NO VISIBLE CU OX
				78'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM	3 IN CLAY			.5%	3	.15% CV	1	–	–					HIGHLY ALTERED MP W/ STRONG HM IN CLAY SOME MP ROCKS COMPLETELY OXIDIZED; SOME W/ WEAK (.5%) DISS PY W/ WEAK COVELLITE ENRICH. NO VISIBLE CU OX
				83'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% HM	3 IN CLAY			.5%	3	.10% CV	1							ALTERED MP - HM IN CLAY W/ MP ROCKS WEAK PY W/ VERY WEAK ENRICH OF CV NO VISIBLE CU OX.
25 Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 3 of 9

Project:

Hole Number: TSGT-1

Date Drilled:

Type:

Northing: 19405.4

Hole Depth: 410

Easting: 9536.6

Orientation: -90

C.E.: 6207.6

Logged by:

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				88'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.0% HM>GT	FeSt 3'			.5%	1	CU .1%	1	—	—					FROM 83 TO 86' - HM IN CLAY W/ MINOR GT FROM 86' TO 88' - LARGE FRAGMENTS OF MP MEDIUM GRAY WEAK PY W/ VERY WEAK CU ENRICHMENT
				93'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.5% HM	IN CLAY	TR BLACK OX B		.25%	1	TR CU	1	—	—					ALTERED MP STRONG HM IN CLAY - LARGE FRAGMENTS OF MP VERY WEAK PY W/ TR OF CU ENRICH. VERY MINOR TR OF BLACK OX.
				98'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2.0% HM	3	BLACK OX		.5%	1	TR CU	1	-	—					FROM 93' to 95' MEDIUM GRAY LARGE FRAG OF MP W/ WEAK PY W/ TRACE CU ENRICHMENT. FROM 95 TO 98' SOFT ALTERED MP W/ STRONG HM & SOME BLACK OX TRACES OF GYPSUM IN FRACTURES
				103'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							20% HM>GT	3			—	—	—	—	—	—					SOFT HIGHLY ALTERED MP W/ FeOX COLORS. SMALL FRAGMENTS & CLAY NO VISIBLE SULFIDES - NO VISIBLE CuOX
				108'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.5% HM>GT	3	BLACK OX		—	—	—	—	—	—					ALTERED MP REDDISH BROWN CLAY W/ FRAGMENTS TRACES OF BLACK OX IN CLAY. NO VISIBLE SULFIDES.
Composite:																														
				113'					PALT: 3 SALT: 5 CLAY: LCAP: 50%							2.5% HM	3			—	—	—	—	—	—					ALTERED MP CLAYS COLORED DARK RED, NO VISIBLE SULFIDES OR CU OX
				118'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							15% HM>GT	3			—	—	—	—	—	—					ALTERED MP CRUMBLY REDDISH BROWN NO VISIBLE SULFIDES OR CU OX
				123'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.5% HM>GT	3			—	—	—	—	—	—					ALTERED MP MOSTLY CRUMBLY CLAY REDDISH BROWN NO VISIBLE SULFIDES NO VISIBLE CuOX
				128'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							20% HM>GT	3			—	—	—	—	—	—					ALTERED MP REDDISH BROWN MOSTLY CLAY W/ FEW FRAGMENTS NO VISIBLE SULFIDES NO VISIBLE CU OX.
				133'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.5%	1 GT>HM IN CLAY			.5%	1	CU TR	1	—	—					LIGHT GRAY MP - LARGE FRAGMENTS DISS. VERY SMALL GRAINS OF PY W/ VERY SMALL TRACE OF ENRICH. NO VISIBLE CU OX
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project:
Hole Number: TSGT-1
Date Drilled:
Type: SONIC
Northing: 19405.4
Hole Depth: 410
Easting: 9536.6
Orientation: -90
C.E.: 6207.6
Logged by: RJW

CORE SIZE CHANGE @ 186' FROM 5¼" TO 3⅝" DIA.
05-04-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				133' 138'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							TR	3			1.0%	1	TR	1	-	-					MP- MEDIUM GRAY W/ SLIGHTLY YELLOWISH CLAY. VERY SMALL DISSEMINATED GRAINS OF PY W/ VERY WEAK ENRICH. NO VISIBLE CU OX FINE SPRAYS OF GYPSUM IN FRACTURES.
				143'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							.5% JAR				1.0%	1	-	-	-	-					MP FRAGMENTS IN YELLOWISH CLAY SMALL DISSEM GRAINS OF PY NO VISIBLE CU OX FINE SPRAYS OF GYPSUM IN FRACTURES
				148'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							.5% JAR				.5%	1	TR CC CV	1	-	-					MP FRAGMENTS IN YELLOWISH CLAY SMALL DISSEM GRAINS OF PY W/ VERY WEAK ENRICH. NO VISIBLE CUOX. FINE SPRAYS OF GYPSUM IN FRACTURES.
				153'					PALT: 3 SALT: 5 CLAY: 55% LCAP:							.5% JAR				1.5%	1	TR CC	1	TR	1					MP FRAGMENTS (LARGE) IN YELLOWISH CLAY. DISS. PY GRAINS W/ VERY WEAK ENRICH. NO VISIBLE CU OX
				158'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							[illegible]				1.5%	1	TR CC		TR	1					LARGE FRAGMENTS OF MP W/NO FEOX NO VISIBLE CU OX
Composite:																														
				163'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TRACE [illegible]				.5%	1	TR CC								LARGE FRAGMENTS OF MP IN HEAVY GRAY CLAY. ROCK FRAGMENTS W/.5% PY W/ NO VISIBLE ENRICHMENT. TR CC IN CLAY NO VISIBLE CU OX
				168'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR JAR				.5%	3	.25 CC				CHAL				LARGE FRAGMENTS OF MP IN HEAVY GRAY CLAY ROCK FRAGMENTS CONTAIN MOSTLY DISS. SMALL GRAINS OF PY W/ NO VISIBLE ENRICHMENT CC IN HEAVY CLAY W/ MINOR CHALCANTHITE
				173'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.1% GT>JAR				.5%	1	.15 CC								FRAGMENTS OF MP IN MEDIUM GRAY CLAY. ROCK HAS SMALL MOSTLY DISS GRAINS OF PY W/ NO VISIBLE ENRICH CLAY HAS SOME DISS. CC MINOR FEOX IN CLAY FROM 172 TO 173'
				178'					PALT: 3 SALT: 5 CLAY: 50 LCAP:							.1% GT>HM				.5%	1	.15% CC	1							FROM 173' TO 174' MINOR FEOX IN CLAY FROM 174 TO 178- MP FRAGMENTS W/ SMALL DISSEM GRAINS OF PY W/MINOR ENRICH. GRAINS OF PY IN CLAY W/ MINOR CC ENRICH NO VISIBLE CUOX.
				183'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.1% [illegible]				1%	3	.2% CC		TR	1					ALTERED MP IN MIXED GRAY & FEOX COLORED CLAY. SMALL DISS GRAINS OF PY W/ MINOR ENRICH NO VISIBLE CU OX
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

CORE SIZE CHANGE FROM 5 1/4" TO 3 5/8" DIA. @ 186'

Project:
Hole Number: TSGT-1
Date Drilled:
Type: SONIC
Northing: 19405.4
Hole Depth: 410
Easting: 9536.6
Orientation: -90
C.E.: 6207.6
Logged by: RJW
05-04-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				183' 186'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							.5% HM/GT	3			–	–	–	–	–	–					FRAGMENTS OF 110 IN HM COLORED CLAY NO VISIBLE PY OR ENRICH. NO VISIBLE CU OX
				193'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							TR GT	3			1.0%	1	.1% CC	1	–	–					ALTERED MP FRAGMENTS W/ SOME CLAY VERY SMALL DISSEM. GRAINS OF PY W/ WEAK ENRICH. NO VISIBLE CU OX
				198'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.5% HM	3			.5%	3	.15% CC	3	–	–					FROM 193 TO 194' - GRAY CLAY W/ SMALL MP FRAGMENTS; FROM 194 TO 198' MOSTLY DARK REDDISH CLAY W/ SMALL PEBBLES OF MP
				203'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM	3			.75%	3	.10% CC	3	–	–					FROM 198' TO 201' - HEAVY DARK GRAY CLAY W/ FRAGMENTS OF 110 W/ TR PY; FROM 201' TO 203 FRAGMENTS OF MP W/ 1.0% PY & WEAK ENRICH IN RED CLAY NO VISIBLE CU OX
				208'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							1.0% FIRST 2' HM THEN NONE	3			1.0%	3	.10% CC	3	–	–					FROM 203 TO 205' REDDISH CLAY W/ MP FRAG. AS ABOVE; FROM 205' TO 208' HEAVY DARK GRAY CLAY W/ FRAGMENTS OF 110 W/ 1.0% PY & WEAK ENRICH NO VISIBLE CU OX.
Composite:																														
				213'					PALT: 5 SALT: 6 CLAY: 60% LCAP:							NONE TO 211 THEN 2.0%				1.0%	3	.05% CC	3	–	–					FROM 208' TO 211 HEAVY CLAY W/ 110 FRAGMENTS W/ 1.0% PY W/ VERY WEAK ENRICH. NO VISIBLE CU OX
				218'					PALT: SALT: CLAY: LCAP:							1.0% GT>HM	3			.5	1	.1% CC CV	1	–	–					MIXED ALTERED MP & 110 - SOME FRAG. OXIDIZED & SOME NOT, WEAK ENRICH OF PY W/ CC & CV. NO VISIBLE CU OX MINOR SPRAYS OF GYPSUM
				223'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							5% HM>GT	3			1.0%	1	.1% CC	1	–	–					ALTERED MP - ROCK FRAGMENTS IN CLAY VERY SMALL DISS GRAINS OF PY W/ WEAK ENRICH. NO VISIBLE CU OX
				228'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2.5% HM>GT	3			1.0%	3	.2% CC	3	–	–					MIXED MP & 110 FRAGMENTS IN RED COLORED CLAY WEAK ENRICH OF PY; ALSO PY GRAINS W/ ENRICH IN CLAY
				233'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							5% GT>HM	3			1.0%	3	.2% CC	3	TR	1					FRAGMENTS OF 110 W/ ~15% [illegible] IN CLAY CONTAINING MINOR AMOUNT OF FE OX NO VISIBLE CU OX WEAK ENRICH
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-1 Northing: 19405.4 Easting: 9536.6 CE: 6207.6

Date Drilled: Type: SONIC Hole Depth: 410 Orientation: -90° Logged by:

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				233' 238'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR JAR	3			1.0%	1	TR CUTR	1	–	–					ALTERED MP W/ LIGHT GRAY CLAY - SOME WITH YELLOWISH TINGE. VERY SMALL DISSEM GRAINS OF PY W/ WEAK CC & CU ENRICH NO VISIBLE CU OX
				243'					PALT: 5 SALT: 6 CLAY: 60% LCAP:							240'-242' 5% HM	3			1.5%	3	TR CC	3	–	–					MOSTLY ALTERED 110 - RED W/ HM FROM 240' TO 242'; THEN GT COLORING FROM 242' TO 243' LIGHT GRAY FROM 238' TO 240' 1.5% PY W/ VERY WEAK CC ENRICH. NO VISIBLE CU OX.
				248'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							.1% 244' GT TO THEN TR	3			1.5%	3	TR CC	3	TR	1					ALTERED 110 W/ ~10% K-SPAR VERY WEAKLY ENRICHED PY NO VISIBLE CU OX.
				253'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							1.5% 248.5-252'	3			1.0%	3	VERY MINOR TR	3	TR	1					ALTERED 110; REDDISH BROWN FROM 248.5 TO 252'; REMAINDER LIGHT GRAY BROWN (GT) VERY SPARSE- SCATTERED CC ENRICH. NO VISIBLE CU OX
				258'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							.25% FROM 257-258 .25 HM	3			1.0	1	TR CC	1	–	–					ALTERED 110 TO 256 (MEDIUM GRAY) THEN ALTERED MP - SMALL DISSEM. GRAINS OF PY W/ VERY WEAK ENRICH. NO VISIBLE CU OX.
Composite:																														
				263'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							.5% HM>GT	3			1.5%	3	TR CC	1	–	–					MIXED ALTERED 110 & MP; 110 ~10% K SPAR. HM & GT IN CLAY FROM 258' TO 261'. VERY WEAK ENRICH OF PY. NO VISIBLE CU OX
				268'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							FROM 264' 10%	3			1.0%	3	TR CC	1	–	–					FROM 263 TO 264' NO OX. ALTERED 110 THEN HM > GT COLORED CLAY W/ FRAGMENTS NO VISIBLE CU OX
				273'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							.75% GT	3			1.0%	3	TR CC	1	–	–					ALTERED 110; MINOR GT > HM COLORED CLAY FROM 268 TO 270.5; THEN MEDIUM GRAY. VERY WEAK ENRICH OF PY. NO VISIBLE CU OX
				278'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR GT	3			1.5%	3	TR CC CU	3	TR TR BN	3					ALTERED MP W/ MEDIUM TO DARK GRAY CLAY. PY, CPY, BN WITH WEAK ENRICH NO VISIBLE CU OX.
				283'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							TR HM	3			1.0%	3	2%, SUBCC	3	–	–					ALTERED MP FRAGMENTS IN MEDIUM GRAY TO DARK CLAY. 1.0% PY W/ COVELLITE & CC ENRICH (WEAK) NO VISIBLE CU OX
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

Project:
Hole Number: TSGT-1
Date Drilled: 10-13-04 Type: SONIC
Northing: 19405.4
Hole Depth: 410'
Easting: 9536.6
Orientation: -90°
C.E.: 6207.6
Logged by: RJW
05-04-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)														Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				283' 288'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.25% HM	3			.2%	1	TR CC	1	–	–					ALTERED MP W/ CLAY COLORED W/ VARYING AMOUNTS OF HM. VERY SPARSE DISSEM OF PY W/ TR. OF CC ENRICH NO VISIBLE CU OX
				293'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.25% HM=GT	3			.25	3	TR CC	3	–	–					ALTERED MP W/ HIGH CLAY CONTENT VERY SPARSE PY W/ VERY WEAK ENRICH MINOR YELLOWISH CLAY FROM 288 TO 289 NO VISIBLE CU OX
				298'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.25% HM>GT	3			1.0	3	.1 CC	3	–	–					FROM 293' TO 294' ALTERED & OXIDIZED MP NO PY 1.5% HM. FROM 294 TO 298' GRAY CLAY & FRAGMENTS OF MP W/ 1.0% PY WEAK ENRICH. NO VISIBLE CU OX
				303'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							TR GT	3			.5%	3	TR CC	3	–	–					ALTERED MP - MOSTLY SMALL FRAGMENTS & DUST. VERY WEAK & SPARSE ENRICH VERY SMALL SPRAYS OF GYPSUM IN FRACTURES. NO VISIBLE CU OX
				308'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							5% GT>JAR	3			1.0%	3	TR CV	3	–	–					ALTERED MP - GRAY FROM 303 TO 304'; LIGHT BROWN FROM 304 TO 306; YELLOWISH GRAY FROM 306 TO 308' TRACE CV ENRICH TRACE GYPSUM ALONG FRACTURES NO VISIBLE CU OX
Composite:																														
				313'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							.5% GT≥JAR	3			1.0%	3	TR CC	3	–	–					ALTERED MP FROM 308 TO 310' COLORED BY HM>GT; FROM 310' TO 313' GRAY W/ YELLOW (JAR) SMALL GRAINS OF PY W/ VERY WEAK ENRICH. NO VISIBLE CU OX
				318'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							3% GT>HM	3			1.0%	1	.1% CC	1	–	–					MOSTLY MEDIUM BROWN CLAY GT>HM W/ SMALL DISSEM GRAINS OF PY W/ WEAK ENRICH. NO VISIBLE CU OX
				323'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% JAR	3			1.0%	1	TR CV	1	–	–					ALTERED MP W/ YELLOWISH CLAY 1.0% PY W/ WEAK CV ENRICH. NO VISIBLE CU OX
				328'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							.5% JAR	3			1.0%	3	TR CV	1	–	–					ALTERED MP W/ MEDIUM GRAY CLAY W/ YELLOWISH 1/2" "SPOTS" PY MOSTLY SMALL DISSEM GRAINS W/ CV ENRICH NO VISIBLE CU OX.
				333'					PALT: 5 SALT: 4 CLAY: 40% LCAP:							TR JAR	3			.75%	1	TR CC	1	–	–					ALTERED /10, 10% K-SPAR LARGE HARD FRAGMENTS W/ YELLOWISH CLAY VERY SMALL DISSEM GRAINS OF PY W/ WEAK ENRICH NO VISIBLE CU OX
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:
Hole Number: TSGT-1
Date Drilled:
Type:
Northing: 19405.4'
Hole Depth: 410'
Easting: 9536.6
Orientation: -90°
CE: 6207.6
Logged by: RJW

05-05-05
05-04-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				333' 338'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							333' 336' TR JAR	3			5%	1	TR CC CV	1	–	–					ALTERED 110 FROM 333' TO 336' LIGHT MED. GRAY; FROM 336' TO 338' - LIGHT REDDISH BROWN VERY WEAK ENRICH W/CV & CC. NO VISIBLE CU OX.
				343'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							TR JAR & GT	3			5%	3	TR CV	1	–	–					ALTERED 110' MEDIUM GRAY W/TRACES OF JAR & GT. VERY SPARSE ENRICH W/CV NO VISIBLE CU OX. 10% K-SPAR.
				348'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							TR JAR HM>GT	3			1.0%	3	.1 CV	1	–	–					ALTERED 110 MEDIUM TO DARK BROWN CLAY: 344 TO 346! FROM 343' TO 344' LIGHT GRAY W/ YELLOWISH CORES, WEAK CV ENRICHMENT NO VISIBLE CU OX
				353'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							TR GT>JAR	3			1.0%	3	.1% CC	1	TR	1					ALTERED 110 CRUMBLY CLAY LIGHT REDDISH BROWN WEAK ENRICH W/ CC NO VISIBLE CU OX 10% K-SPAR
Composite:				358'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							353' to 356' TR JAR	3			1.5%	3	.25% CC	3	–	–					ALTERED 110; FROM 356' TO 353 HEAVY REDDISH-BROWN CLAY (MOSTLY) WEAK TO MODERATE ENRICH. NO VISIBLE CU OX
				363'					PALT: 5 SALT: 5 CLAY: 50% LCAP:							1% GT	3			1.5%	3	.15% CV CC	3	TR	1					ALTERED 110 LIGHT TO MED GRAY TO 360' THEN LIGHT BROWN CLAY. WEAK ENRICH OF PY W/ CV & CC NO VISIBLE CU OX
				368'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							5% GT>MN>JAR	3			1.0%	1	TR CC & CV	1	–	–					ALTERED MP; TO 366' MEDIUM GRAY FROM 366' TO 368' LIGHT BROWN CLAY. VERY WEAK ENRICHMENT OF CC & CV. NO VISIBLE CU OX.
				373'					PALT: 5 SALT: 4 CLAY: 40% LCAP:							.25% GT	3			.5%	3	.1% CC	1	–	–					ALTERED 110 ~15% K-SPAR. LIGHT BROWN COLOR IN CLAY. WEAK ENRICH OF PY W/CC. NO VISIBLE CU OX.
				378'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							5% GT>JAR	3			5%	1	–	–	–	–					ALTERED MP: CLAYS LIGHT BROWN W/ SOME YELLOWISH, SPARSE DISSEM PY W/ NO VISIBLE ENRICH. NO VISIBLE CU OX.
Composite:				383'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM>GT	3			–	–	–	–	–	–					ALTERED MP CLAY COLORED MEDIUM REDDISH BROWN. NO VISIBLE SULFIDES NO VISIBLE CU OX.

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

Page: 9 of 9

Project:
Hole Number: TSGT-1
Date Drilled:
Type: SONIC
Northing: 194054'
Hole Depth: 410'
Easting: 9536.6
Orientation: -90°
C.E.: 6207.6
Logged by: RJW
05-05-05

Analysis			Interval		Drill Log		Graphic Log		Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock				Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				385 388'						PALT: 5 SALT: 6 CLAY 60% LCAP:							1.5% HM>GT	3			–	–	–	–	–	–					HIGHLY ALTERED 110; CLAY COLORED REDDISH BROWN W/ HM & GT. PY COMPLETELY OXIDIZED - NO VISIBLE SULFIDES - NO VISIBLE CU OX
				393						PALT: 5 SALT: 6 CLAY 60% LCAP:							1.0% GT>JAR	3	5% CHYR	2	TR	1	–	–	–	–	TR BLACK OX				HIGHLY ALTERED 110; LIGHT BROWN TO YELLOWISH COLORED CLAY. PY NEARLY COMPLETELY OXIDIZED. SOME CHRYSOCOLLA ON FRACTURE SURFACES. TR BLACK OX
				398'						PALT: 5 SALT: 6 CLAY 60% LCAP:							1.0% JAR=GT>HM	3			1.0%	3	2% CC&CV	3	–	–	TR GREEN CUOX				ALTERED 110; CLAY LIGHT YELLOW TO LIGHT BROWN ~~IN~~ COLOR. PY W/ MODERATE CC & CV ENRICHMENT. TRACES OF GREEN CU OXIDE ON FRACTURE SURFACES.
				403'						PALT: 5 SALT: 5 CLAY 55% LCAP:							1.0% GT	3			1.5%	3	2% CC&CV	3	TR	1					ALTERED 110; LIGHT BROWN TO MEDIUM BROWN COLORED CLAY. PY W/ MODERATE ENRICH OF CC & CV. NO VISIBLE CU OX
				408'						PALT: 5 SALT: 4 CLAY 40% LCAP:							.5% GT&JAR	3			1.5%	3	3% CC&CV	3	–	–					ALTERED 110 ~ 15% K-SPAR; CLAY VERY LIGHT BROWN - YELLOWISH COLOR PY W/ MODERATE ENRICHMENT OF CC & CV. NO VISIBLE CU OX
Composite:																															
				410'						PALT: 5 SALT: 4 CLAY: 40% LCAP:							1% GT	3			1.0%	3	MINR TR	1	–	–					ALTERED 110 ~ 15% K-SPAR; CLAY W/ LIGHT BROWN GT COLOR. EXTREMELY MINOR TRACE OF ENRICH. NO VISIBLE CU OX.
										PALT: SALT: CLAY: LCAP:																					E.O.H.
										PALT: SALT: CLAY: LCAP:																					
										PALT: SALT: CLAY: LCAP:																					
										PALT: SALT: CLAY: LCAP:																					
Composite:																															

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project:
Hole Number: TSGT-2
Date Drilled: 10-02-04 Type: SONIC
Northing: 11549.9
Hole Depth: 281'
Easting: 170089
Orientation: - 90°
C.E.: 6378.0
Logged by: RJW
CORE DIAMETER : 5 1/4"
Page: 1 of 6
04-20-05
04-19-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					↓ FILL DUMP MATERIAL ↓
				0' 3'	DRY ↓				PALT: 3 SALT: 1 CLAY: 40% LCAP:							Hm 5%	2			2%	3	.25%	3	TR	1					ROCK FRAGMENTS FROM 5" TO DUST IN SIZE. MONZONITE PORPHYRY ~2% PY MINOR FeOX OF PY - MOSTLY BARREN PY MINOR CC ENRICH NO VISIBLE SEC. CU OXIDES
15' Composite:																														
				8'					PALT: 3 SALT: 1 CLAY: 40% LCAP:											1%	3	.1%	3	TR	1					MONZONITE PORPHYRY ~1% PY WEAK ENRICH TR. GREEN CUOX TR. CU ENRICH SPHALERITE VERY LITTLE FeOX SIZE DISTRIBUTION 5" TO DUST
				13'				10' to 12' MISSING	PALT: 3 SALT: 1 CLAY: 40% LCAP:							TR GT		>1%	2	1.5%	3	>.1%	3							5" TO DUST SIZE DIST. MONZONITE POR. MOSTLY DISSEM. PY W/ VERY WEAK ENRICH MINOR GT OX OF PY ON FRACTURES TR. BLACK OX. BRECCIA FRAGMENTS (BOU)
				18'				13' to 18' - 4' MISSING	PALT: 3 SALT: 1 CLAY: 20% LCAP:							TR GT		.5%	2	1.0%	3	>.1%	3							MOSTLY 5" to 2" CHUNKS - MONZONITE PORPHYRY BRECCIA FRAGMENTS 1% PY WEAK ENRICH GREEN CU OXIDES ON FRACTURES.
				23'				NOTE: 18'-20' SENT TO GOLDER FOR SAMPLING	PALT: 3 SALT: 1 CLAY 30% LCAP:											.5%	1	TR	1							MONZONITE PORPHYRY - BRECCIA FRAGS IN PART VERY WEAK ENRICH MINOR OX OF PY (GT)
				28'					PALT: 3 SALT: 5 CLAY: 40% LCAP:									.1%	2	1%	3	TR	1			TR GR.OX				MONZONITE PORPHYRY HIGH CLAY VERY MINOR OX (GT) OF PY TR GREEN CU OX
50' Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project:
Hole Number: TSGT-2
Date Drilled: 10-02-04 Type: SONIC
Northing: 11549.9
Hole Depth: 281'
Easting: 17008.9
Orientation: -90°
C.E.: 6378.0
Logged by: RJW

04-19-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				33'	DRY ↓				PALT: 3 SALT: 5 CLAY: 50% LCAP:							5%GT	1			2%	3	TR	1							MONZONITE PORPHYRY ALMOST NO CU ENRICH. HIGH CLAY W/GT COLORS MOST PY AS DISSEM.
				38'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1% HM>GT	2			3%	3	.2%	1			CHAL <1%				MONZONITE PORPHYRY 3% PY - STRONG VEINS BUT ENRICH RESTRICTED TO DISSEMINATIONS FEOX ON FRACTURES HM>GT HIGH CLAY W/FEW LARGE CHUNKS DISS. OF CHALCANITE & IN FRACTURES.
				43'				NOTE: 42' TO 44' SENT TO GOLDER(SAMPLING)	PALT: 3 SALT: 1 CLAY: 40% LCAP:							2%	2			1%	1	MINOR TR	1	TR	1	CHAL .1%				MONZONITE PORPHYRY - SILICIFIED EXTREMELY MINOR ENRICH. VEINS & COATINGS OF JAR SIZE DIST. 4" TO DUST CHALCANITE IN FINES.
				48'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							5%	2			.5%	1	TR	1	TR	1	TR CHAL .2%				MONZON PORPHYRY VERY WEAK MINER. LOW PY TRACES CHAL. ON MINOR FRACTURES HIGH CLAY ESPECIALLY 49' TO 50' (ALL DUST) TR. COVELLITE
				53'					PALT: 3 SALT: 2 CLAY: 50% LCAP:							TR	2			1%	3	TR	1	TR	1	CHAL .1%	GREEN CU OX			MOSTLY MONZ PORPHYRY W/MINOR 110 MINOR CHALCANTHITE & GREEN CUOX ON FRACTURES
325' Composite:																														
				58'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							7.1%	1% CLAY			.1%	3	VERY MINOR TR	2			CHAL 7.1%				MONZONITE PORPHYRY HIGH CLAY ALTER TR. CHALCANITE & CC ON FRACTURES NO FEOX TO 58' THEN 2% FEOX JAR & GT, HM
				63'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							HM 2%	3			–		–								MONZONITE PORPHYRY - CRUMBLY - HIGH CLAY NO VISIBLE PY OR SECONDARY CU MIN. GT & JAR FEOX
				68'				INTERVAL 68'-70'	PALT: 3 SALT: 5 CLAY: LCAP:							2%	3			–		–				TR CHAL				MONZONITE PORPHYRY VERY LITTLE PY IF ANY JAR & GT FEOX TR. BLACK CUOX MINOR GYPSUM TR. CHAL.
				73'				NOTE: 70'-72' SENT TO GOLDER FOR SAMPLING INTERVAL 72'-73'	PALT: 3 SALT: 6 CLAY: 40% LCAP:							1%	3			.5%	2	TR	2							MONZONITE PORPHYRY RADIATING SPRAYS OF GYPSUM ALONG FRACTURES. LESS FEOX BELOW 76'
				78'					PALT: 3 SALT: 5 CLAY: 40% LCAP:							1%	3			.3%	1	TR	1							MOSTLY MONZONITE PORPHYRY - MINOR 110 W/ALTERED BIOTITE & K-SPAR. MINOR SPRAYS OF GYPSUM ALONG FRACTURES- JAR & GT FEOX
50' Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 5 of 6

Project:

Hole Number: TSGT-2

Date Drilled: 10-02-04 Type: SONIC

Northing: 11549.9

Hole Depth: 281'

Easting: 17008.9

Orientation: -90°

C.E.: 6378.0

Logged by: RTW

CORE DIAMETER: 5 1/4"

04-20-05

Analysis			Interval		Drill Log		Graphic Log		Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock				Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				83'	DRY ↓					PALT: 2 SALT: 4 CLAY: 40% LCAP:							1% [illegible]	3			.5%	1	TR	1	TR	1					QUARTZ MONZONITE PORPHYRY MINOR DISS. PY W/TRACE ENRICH SIZE DIST. 4" TO DUST HIGH CLAY NO VISIBLE OXIDE CU MINERALS
				88'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							>5%	2			.75%	1	TR	1							MONZONITE PORPHYRY HIGH CLAY DISS. PY W/ WEAK ENRICH. NO VISIBLE OX. CU MINERALS.
				93'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							1%	2			.5%	1	TR	1	TR	1					MONZONITE PORPHYRY MINOR JAR IN FRACTURES; GYPSUM [illegible] IN FRACTURES. STRONG HM 90' to 91' PY IN VERY SMALL GRAINS & CRYSTALS.
				98'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							>1.0%	2			1%	1	WEAK	1							MONZONITE PORPHYRY 1% PY W/ WEAK ENRICH. MINOR GT FeOX HIGH CLAY NO VISIBLE CU OXIDES
				103'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							1% HM or JAR	2			1%	1	WEAK	1	TR	1					MONZONITE PORPHYRY SMALL SCATTERED PYRITE GRAINS W/ WEAK ENRICH. JAR, HM & GT ON SOME FRACTURES W/ TRACE OF GYPSUM. NO FeOX FROM 104 to 108' NO VISIBLE CU OXIDES.
Composite:																															
				108'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							>5%	2			1%	1	WEAK TR	1							MONZONITE PORPHYRY WEAK DISS PY W/ WEAK ENRICH HIGH CLAY. NO VISIBLE CU OX MINERALS.
				113'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							>1% FeOX	GT 2			.5%	1	TR	1							MONZONITE PORPHYRY ALTERED EUHEDRAL BOOKS OF BIOTITE. LOW FeOX WEAK ENRICH TR. COVELLITE. NO VISIBLE CU OXIDE MINERALS.
				118'						PALT: 3 SALT: 5 CLAY: 50 LCAP:							>1% FeOX	JAR 2			1%	1		CV MOD							MONZONITE PORPHYRY MINOR JAR ON FRACTURES WEAK TO MOD COVELLITE ENRICH OF PYRITE. NO VISIBLE CU OX MINERALS. HIGH CLAY
				123'						PALT: 3 SALT: 5 CLAY: 50% LCAP:							>1% FeOX	2			.1%	1	TR	1							MONZONITE PORPHYRY MINOR JAR FeOX HIGH CLAY ALTER. NO VISIBLE CuOX MINERALS. FROM 119' TO 127' LT JAR STAINING OF CLAY.
				128'						PALT: 3 SALT: 6 CLAY: 50% LCAP:							2% HU	2			.5%	1	WEAK	1			BLA OX				MONZONITE PORPHYRY HIGHLY ALTERED WEAK PY W/ WEAK ENRICH, TRACE BLACK CU OX NO VISIBLE [illegible] OF BLK CU OX MINERALS. [illegible] WITH [illegible]
Composite:																															

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 4 of 6

Project:
Hole Number: TSGT-2
Date Drilled: 10-02-04
Type: SONIC
Northing: 11549.9
Hole Depth: 281'
Easting: 17008.9
Orientation: -90°
C.E.: 6378.0
Logged by: RCW

04-20-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				133'	DRY ↓				PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% JAR	2			.75%	3	CC CV	3			TR CHAL				MONZONITE PORPHYRY HIGH CLAY CONTENT WEAK PY W/ WEAK TO MOD ENRICH W/ CC & CV. JAR & GT COATINGS OF SOME FRACTURES. MINOR TR OF CHALCANTHITE ON SOME FRACTURES
				138'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM/GT	2			.5%	1	CC CV	1			TR CHAL				HIGHLY ALTERED MONZONITE PORPHYRY WEAK PY W/ BOTH CC & CV ENRICH (VERY SPARSE) TRACE CHALCANTHITE HIGH CLAY JAR & GT FEOX
				143'				NOTE: 140'-142' SENT TO GOLDER FOR SAMPLE	PALT: 3 SALT: 6 CLAY: 60% LCAP:							5% GT/JAR	2			7.1%	1	TR CC CV	1							HIGHLY ALTERED MONZONITE PORPHYRY HIGH CLAY VERY SPARSE PY W/ CC & CV ENRICH. NO VISIBLE CU OX MINERALS.
				148'					PALT: 3 SALT: 6 CLAY: 65% LCAP:							3% GT-JAR	2			.5%	3	TR CC CV	3							HIGHLY ALTERED MONZONITE PORPHYRY HIGH CLAY VERY SPARSE PY W/ BOTH CC & CV ENRICH. JAR & HM OXID. OF PY TR. GYPSUM.
				153'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							3% GT JAR	2			.1%	1	TR CC	1							HIGHLY ALTERED MONZONITE PORPHYRY HIGH CLAY EXTREMELY SPARSE ENRICHED PY
Composite:																														
				158'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							10%	3			7.1%	2	–	–							HIGHLY ALTERED MONZONITE PORPHYRY ALMOST ALL PY OXIDIZED TO HM, JAR, GT BOTH DISS & VEINLETS. NO VISIBLE CU OX MINERALS.
				163'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							5%	3			TR	3	–	–							HIGHLY ALTERED MONZONITE PORPHYRY HIGH CLAY TR PY REMAINING MOSTLY OXIDIZED TO HM, JAR, GT. NO VISIBLE CU OX MINERALS.
				168'					PALT: 3 SALT: 5 CLAY: 50% LCAP:							5%	3													HIGHLY ALTERED MONZONITE PORPHYRY MOSTLY COMPLETELY OXIDIZED SULFIDES @ 170' 2% PY NO ENRICH OR OXIDIZATION FEOX HM, GT, JAR BOTH DISS & VEINLETS NO VISIBLE CU OX MINERALS
				173'					PALT: 3 SALT: 5 CLAY: 55% LCAP:							2% FeOx	3			1%	3	–	–							HIGHLY ALTERED MONZONITE PORPHYRY PARTLY OXIDIZED PY W/ NO ENRICH NO VISIBLE CU OXIDE MINERALS. HM, GT ON FRACTURES
				178'					PALT: 3 SALT: 5 CLAY: 55% LCAP:							4% FeOx														ALTERED MONZONITE PORPHYRY MOSTLY OXIDIZED PY WITH HM, GT, JAR IN DISS. & FRACTURES HIGH CLAY NO VISIBLE CU OX MINERALS
Composite:																														

25

30

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 5 of 6

Project:
Hole Number: TSST-2
Date Drilled: 10-02-04 Type: SONIC
Northing: 11549.9
Hole Depth: 281'
Easting: 17009.7
Orientation: - 90°
C.E.: 6378.0
Logged by: RJW

04-20-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				183'	CR ↓				PALT: 3 SALT: 5 CLAY: 50% LCAP:							4%	3			—	—	—	—							HIGHLY ALTERED MONZONITE PORPHYRY PY ALMOST COMPLETELY OXIDIZED TO HM, GT, JAR NO VISIBLE CU SULFIDES OR CU OX MINERALS. HIGH CLAY CRUMBLY
				188					PALT: 3 SALT: 5 CLAY: 60% LCAP:							3% [illegible]	3			—	—	—	—							HIGHLY ALTERED MONZONITE PORPHYRY PY OXIDIZED TO HM, GT, JAR NO VISIBLE CU SULFIDES OR CU OX MINERALS CRUMBLY - HIGH CLAY.
				193					PALT: 3 SALT: 5 CLAY: 50% LCAP:							4% [illegible]	3			—	—	—	—			TR CHAL				HIGHLY ALTERED PORPHYRY "CROWDED" PY OXIDIZED TO HM, GT & JAR CRUMBLY - HIGH CLAY CONTENT TR. CHALCANITE ON FRACTURES.
				198					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1% FEOX	3			.75%	1	2%	1							QUARTZ MONZONITE PORPHYRY ALTERED BOOKS OF BIOTITE MOSTLY UNOXIDIZED PY W/WEAK ENRICH (CC) MINOR OXIDIZATION OF PY NO VISIBLE CU OX MINERALS.
				203'					PALT: 3 SALT: 4 CLAY: 40% LCAP:							.5% FEOX	2			1.0%	3	.25%	CC 3							MONZONITE PORPHYRY WEAKED ENRICHED PY W/CC & CV. ONLY MINOR FEOX IN CLAYS. NO VISIBLE CU OX MINERALS TRACE GYPSUM IN FRACTURES
Composite:																														
				208					PALT: 3 SALT: 4 CLAY: 40% LCAP:							3% FEOX	3			.75%	3	VERY TR	1							MONZONITE PORPHYRY PART(1/2) W/PY W/VERY WEAK TR OF ENRICH. OTHER PART 209 TO 210, 212 TO 213 PY OXIDIZED TO HM, GT, JAR.
				213					PALT: 3 SALT: 5 CLAY: 50% LCAP:							3% FEOX	3			—	—	—	—			BLACK OX (2)				MONZONITE PORPHYRY HIGHLY ALTERED NO SULFIDES PRESENT. BLACK CU OXIDES IN FRACTURE SURFACES. GYPSUM PRESENT ON FRACTUR SURFACES
				218				NOTE: 216 TO 217 SENT TO GOLDER FOR SAMPLE	PALT: 3 SALT: 4 CLAY: 40% LCAP:							3% FEOX	3			TR	1	VERY TR				BLACK OX (2)				MONZONITE PORPHYRY ALTERED VERY MINOR TR PY W/ENRICH BLACK CU OX ON FRACTURE SURFACES NO VISIBLE GREEN CU OX MINERALS
				223					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% FEOX	2			—	—	—	—			—				MONZONITE PORPHYRY ALTERED CHALKY WHITE. JAROSITE - GT ON FRACTURE SURFACES. NO VISIBLE CU OX MINERALS
				228					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% FEOX	1			—	—	—	—							ALTERED MONZONITE PORPHYRY - STAINED YELLOWISH LIGHT BROWN. HIGH CLAY NO VISIBLE SULFIDES NO VISIBLE CU OX MINERALS
Composite:																														

75

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Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 6 of 6

Project:

Hole Number: TSGT-2

Date Drilled: 10-02-04 Type: SONIC

Northing: 11549.9

Hole Depth: 281'

Easting: 17008.9

Orientation: -90

C.E.: 6378.0

Logged by: RJW

04-21-05
04-20-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				233	DRY ↓				PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% FeOx	3			—	—	VERY TR	2	—	—	BLACK OX (2)				ALTERED MONZONITE PORPHYRY HIGH CLAY ALMOST NO SULFIDE REMAINING TR BLACK CU OXIDE ON FRACTURE SURFACES CLAY YELLOWISH LIGHT BROWN NO VISIBLE GREEN CU OX.
				238					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% FeOx	3			—	—	—	—	—	—					ALTERED MONZONITE PORPHYRY HIGH CLAY NO REMAINING SULFIDES. FEOX AS DISSM & FRACTURE COATINGS GT & JAR. NO VISIBLE CU OX MINERALS.
				243					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% FeOx	3			TR	1	TR	1	—	—					ALTERED MONZONITE PORPHYRY VERY LIGHT YELLOWISH BROWN TR SULFIDE- ALMOST COMPLETELY OXIDIZED TO HM JAR GT NO VISIBLE CU OX MINERALS.
				248					PALT: 3 SALT: 6 CLAY: 60% LCAP:							3% FeOx	3			TR	1	TR	—	—	—					ALTERED MONZONITE PORPHYRY LIGHT YELLOW BROWN COLOR TO 248; HM COLORED 248 TO 250' TRACE OF PY NO VISIBLE CU OX MINERALS.
				253					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% FeOx	3			TR	1	TR CC	1	—	—					ALTERED PORPHYRY HIGH CLAY - LIGHT YELLOWISH BROWN TRACE PY W/ENRICH VERY SPARSE - VERY SMALL GRAINS NO VISIBLE GREEN CU OX MINERALS.
25 Composite:																														
				258					PALT: 3 SALT: 7 CLAY: 70% LCAP:							2% FeOx	3			VERY TR	1	VERY TR	1	—	—					ALTERED MONZONITE PORPHYRY - MOSTLY LIGHT YELLOWISH BROWN CLAY. VERY SLIGHT TRACE OF VERY SMALL GRAINS OF PY W/ENRICH. NO VISIBLE CU OX MINERALS. PRESENT
				263					PALT: 3 SALT: 7 CLAY: 70% LCAP:							2% FeOx	3			VERY TRACE	1	VERY TR	1	—	—	TR CHAL				ALTERED MONZONITE PORPHYRY FELDSPARS TO CHALKY WHITE CLAYS ALMOST NO VISIBLE PY - FEW TINY GRAINS MINUTE TRACES OF CHALCANTHITE ALONG FRACTURES. JAR & GT ALONG FRACTURES & DISS.
				268				NOTE: 267' to 268.5' SENT TO GOLDER	PALT: 3 SALT: 7 CLAY: 70% LCAP:							2% FeOx	3			—	—	—	—	—	—	—				ALTERED MONZONITE POR. FELDSPARS ALTERED TO CHALKY WHITE CLAY NO VISIBLE PY JAR, GT, HM DISS & IN FRACTURES NO VISIBLE CU OX MINERALS
				273					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% FeOx	3			—	—	—	—	—	—	TR CHAL	TR BLACK OX			ALTERED MONZONITE PORPHYRY FELDSPARS ALTERED TO CHALKY WHITE CLAY NO VISIBLE PY OR CC TRACES OF BLACK CU OXIDE & CHALCANTHITE ABSORBED IN CLAY FEOX DISS. & ON FRACTURES JAR, GT, HM
				278 281'					PALT: 3 SALT: 5 CLAY: LCAP:							7% FeOx	3			5%	1	TR	1	—	—	TR BLACK OX				ALTERED M.P. FELDSPARS ALTERED TO WHITE CLAY 1% PY W/ EXTREMELY WEAK ENRICH IN PART PY FRESH, OXIDIZED IN PART MOSTLY OXIDIZED W/ DISS & FRACTURES W/ JAR, GT HM TRACES BLACK CU OX LARGE (5") PIECES
00 Composite:																														

E.O.H. 281'

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 1 of 5

Project:

Hole Number: TSGT-3
Date Drilled: 10-05-04 Type: SONIC
Northing: 14300.3
Hole Depth: 250'
Easting: 15998.5
Orientation: -90°
C.E.: 6297.6
Logged by: RJW

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				0' 26'	DRY ↓				PALT: 3 SALT: 5 CLAY: 50% LCAP:							2%	3	-	-	.5%	1	.1%	1	-	-					MYXED FINE-GRAINED GRANODIOR & PORPHYRY PY ENRICHED & PARTIALLY OXIDIZED JAR&GT ON FRACTURES ALSO NO VISIBLE CU OXIDE MINERALS HIGH CLAY LT BROWN.
				7.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2%	3	-	-	.5%	1	.1%	1	-	-					MIXED PORPHYRY & GRANODIORITE ENRICHED & PARTIALLY OXIDIZED JAR & GT ON FRACTURES NO VISIBLE CU OX MINERALS
				12.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1%	3	TR	2	-	-	-								GRANODIORITE W/ 5% FRESH BIOTITE NO VISIBLE PY. TRACES BLACK CU OX. SOME ALTERED GRANODIORITE LIGHT BROWN CLAYS GILA CONGLOM
				17.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1%	3	-	-	-	-	-								FRESH GRANODIORITE W/ 5% BIOTITE SOME ALTERED GRANODIORITE (FELDSPARS) LIGHT BROWN CLAYS GILA CONGLOM.
				22.6				2.5' MISSING 17.6 TO 22.6'	PALT: 3 SALT: 4 CLAY: 40% LCAP:							1%	3	-	-	TR >.1%	1	TR >.1%	1	-						PARTLY ALTERED, GRANODIORITE W/ TR ENRICHED PY (SCATTERED GRAINS) SOME ALTERATION OF BIOTITE NO VISIBLE CU OX MINERALS. ROUNDED COBBLE GILA CONGLOM.
275 Composite:																														
				27.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							1%	3	-	-	TR >.1%	1	TR >.1%	1	-						PARTLY ALTERED GRANODIORITE TRACES OF PY W/ GOOD ENRICH. NO VISIBLE CU OX / MINERALS LIGHT BROWN CLAY. NO VISIBLE CU OX MINERALS GILA CONGLOM.
				32.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							1.5%	3	TR	2	TR >.1%	1	TR >.1%	1	-						PARTIALLY ALTERED GRANODIORITE BIOTITE PARTIALLY ALTERED TR ENRICHED PY - SCATTERED GRAINS. BLACK CU OX ALONG FRACTURES & GRAIN BOUNDARIES GILA CONGLOM
				37.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							1.5%	3	TR	2	TR >.1%	1	TR >.1%	1	-						PARTIALLY ALTERED GRANODIORITE BIOTITE PARTIALLY ALTERED LIGHT BROWN CLAY VERY SPARSELY SCATTERED ENRICHED PY GRAINS TR OF BLACK CU OX NO GREEN CU OX VISIBLE
				42.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							1.5%	3			.1%	1	.1%	1	-						TO 39' SLIGHTLY ALTERED GRANODIORITE FROM 39' TO 42.6 "CROWDED" MONZ PORPHYRY W/ VERY SMALL SCATTERED GRAINS OF ENRICHED PY NO VISIBLE CU OX GILA CONGLOM.
				47.6					PALT: SALT: CLAY: LCAP:							1.5%	3			>.1%	1	>.1%	1	-						VERY SLIGHTLY ALTERED GRANODIORITE W FAIRLY FRESH BIOTITE VERY SPARSELY SCATTERED GRAINS OF ENRICHED PY LIGHT BROWN CLAY NO VISIBLE CU OX
250 Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-3

Date Drilled: 10-05-04 Type: SONIC

Northing: 14300.3

Hole Depth: 250'

Easting: 15998.5

Orientation: -90°

CE: 6297.6

Logged by: RJW

04-22-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)														Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				47.6 52.6					PALT: SALT: CLAY: LCAP:									–	–	–	–	–	–	–						MOSTLY SLIGHTLY ALTER GRANODIORITE COBBLE: W/SLIGHTLY ALTERED BIOTITES. SOME SAND & CLAY MEDIUM BROWN IN COLOR SOME WEATHERED CRUMBLY PINK GRANITE GILA CONGLOMER:
				57.6					PALT: SALT: CLAY: LCAP:									–	–	–	–	–	–	–						FAIRLY FRESH GRANODIORITE COBBLES W/ SLIGHTLY ALTER BIOTITES. SAND & GRV MEDIUM BROWN IN COLOR. GILA CONGLOM.
				62.6					PALT: SALT: CLAY: LCAP:									–	–	–	–	–	–	–						ROUNDED COBBLES, PEBBLES, SAND, GRAVEL SOME CLAY MEDIUM BROWN IN COLOR POORLY SORTED GILA CONGLOM
				67.6					PALT: SALT: CLAY: LCAP:									–	–	–	–	–	–	–						POORLY SORTED, ROUNDED COBBLES, GRAVEL, SAND & SOME CLAY. @66 LARGE ROUNDED (5") COBBLE OF 110 W/ SS ALTERATION & .5% PY @ 66' CHANGES FROM GILA TO DUMP ☒
				72.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% HM	3	–	–	–	–	–	–	–						MOSTLY MP ANGULAR FRAGMENTS WHITE SOLUBLE SALTS ON SIM CORE FROM 71' TO 75' ALL ROCKS BLEACHED & ALTERED NO VISIBLE PY OR CU MINERALS.
225 Composite:																														
				77.6					PALT: 5 SALT: 4 CLAY: 4% LCAP:							1% GT>HM	3			1%	3	TR CC&CV	3	TR	3					110 FRAGMENTS PY IN VEINLETS & DISSEM. MINUTE TR OF ENRICH CU MINERALS CC & CV NO VISIBLE CU OX MINERALS 15% K-SPAR
				82.6					PALT: 5 SALT: 4 CLAY: 4% LCAP:							1% GT>HM	3			1%	3	TR CC	3	TR	1					ANGULAR FRAGMENTS OF 110 W 5% K-SPAR. VEINLETS & DISS OF PY W/ VERY WEAK ENRICH OF CC. LIGHT BROWN IN COLOR
				87.6					PALT: 3 SALT: 4 CLAY: 4% LCAP:							1% GT>HM	3			1%	3	VERY TR	3	TR	1					ANGULAR FRAGMENTS OF 110 & MP VEINLETS & DISS OF PY W/ EXTREMELY SPARSE CC ENRICHMENT. NO VISIBLE SECONDARY CU MINERALS.
				92.6					PALT: 3 SALT: 5 CLAY: 5% LCAP:							>1% HM>GT				1%	3	TR	3	TR	1					ANGULAR FRAGMENTS OF MP MINOR HM & GT ON FRACTURE SURFACES. TRACES OF CC ENRICHMENT TINY GYPSUM XTALS ON SOME FRACTURE SURFACES. NO VISIBLE CU OXIDE MINERALS.
				97.6					PALT: 3 SALT: 4 CLAY: 10% LCAP:							>1% GT>HM				5%	1	–	–	TR	1					MOSTLY ANGULAR FRAGMENTS OF 110 W/ DISSEM GRAINS OF SLIGHTLY OXIDIZED PYRITE NO ENRICH NO CU OXIDE MINERALS
20 Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

Page: 3 of 5

Project:
Hole Number: TSGT-3
Date Drilled: 10-05-04 Type: SONIC
Northing: 14300.3
Hole Depth: 250'
Easting: 15998.5
Orientation: -90°
C.E.: 6297.6
Logged by:

04-25-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				97.6 102.6					PALT: 5 SALT: 3 CLAY: 30% LCAP:							>5% HM	1			2%	1	TR	1	TR	1					[illegible] CORED FRAGMENTS OF 110 - FRESH ALMOST ALL DISSEM. MM. NO OXIDATION VERY LITTLE ENRICH NO CU OX MINERALS LITTLE CLAY.
				107.6					PALT: 3 SALT: 5 CLAY: 50% LCAP:							2% HM	1			–	–	–	–	–	–					FROM 102.6 TO 103 SAME AS ABOVE. FROM 103 TO 107.6 - HIGHLY ALTERED 500 & 110 FRAGMENTS - PY COMPLETELY OXIDIZED TO HM. HIGH CLAY. NO VISIBLE CU OXIDE
				112.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM	1			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY CONTENT PY COMPLETELY OX TO HM NO ENRICH OR CU OX MINERALS.
				117.6					PALT: 3 SALT: 6 CLAY: 65% LCAP:							2% HM	1			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY ALL SULFIDES COMPLETELY OXIDIZED TO HM NO ENRICH NO VISIBLE CU OX MINERALS
				122.6					PALT: 5 SALT: 6 CLAY: 65% LCAP:							2% HM>GT	1			–	–	–	–	–	–					HIGHLY ALTERED 110 HIGH CLAY NO REMAINING SULFIDES - COMPLETELY OX TO MOSTLY HM W/MINOR JAR. NO VISIBLE CU OX.
75 Composite:																														
				127.6					PALT: 5 SALT: 6 CLAY: 60% LCAP:							2% HM	1			–	–	–	–	–	–					HIGHLY ALTERED 110 HIGH CLAY CONTENT NO REMAINING SULFIDES PY COMPLETELY OXIDIZED TO HM. NO VISIBLE CU OX
				132.6					PALT: 5 SALT: 6 CLAY: 60% LCAP:							2% HM	1			–	–	–	–	–	–					HIGHLY ALTERED 110 HIGH CLAY CONTENT NO REMAINING SULFIDES PY COMPLETELY OX TO HM. SOME FRAGMENTS OF MP NO VISIBLE CU OX.
				137.6					PALT: 3 SALT: 6 CLAY: 65% LCAP:							2.5% HM	1			MIN TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY CONTENT MINUTE TR OF REMAINING SULF STRONG HM IN CLAY NO VISIBLE CU OX
				142.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% HM	1			–	–	–	–	–	–					HIGHLY ALTERED MP W/ FRAG OF FRESH GRANODIORITE NO REMAINING SULFIDES NO VISIBLE CU OX MINERALS
				147.6					PALT: 5 SALT: 6 CLAY: 60% LCAP:							3% GT>HM	3			–	–	–	–	–	–					HIGHLY ALTERED 110 W/ GT>HM NO REMAINING SULFIDES NO VISIBLE CU OX.
50 Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGF3 Northing: 14300.3 Easting: 15998.5 C.E.: 6297.6

Date Drilled: 10-05-04 Type: SONIC Hole Depth: 250 Orientation: -90° Logged by:

04-25-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				152.6	DRY ↓				PALT: 5 SALT: 7 CLAY: 70% LCAP:							1% HM&GT	1			–	–	–	–	–	–					FROM 147 DOWN - FRAGMENTS OF CRUMBLY 110 W/ ORGANIC DIRT NO SULFIDES - NO CU OXIDE MINERALS GILA CONGLOM?
				157.6					PALT: 5 SALT: 7 CLAY: 70% LCAP:							1% GT>HM	1			–	–	–	–	–	–					HIGHLY ALTERED 110 - CRUMBLY - HIGH CLAY NO SULFIDES - NO SECONDARY CU OXIDES. GILA CONGLOM. ?
				162.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GT>HM	1			TR	1	–	–	–	–					MOSTLY GRANULAR COARSE SAND FRAGMENTS & PEBBLES OF MP - NO LARGE FRAGMENTS EXCEPT FOR MINOR PY IN SOME MP PEBBLES - NO SULFIDES NO CU OX MINERALS.
				167.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							7.5% GT>HM	1			TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY, NO LARGE ROCKS - JUST PEBBLES W/ VERY SMALL DISS GRAINS OF PY NO ENRICH NO CU OX MINERALS
				172.6					PALT: 3 SALT: 60 CLAY: 60% LCAP:							7.5% GT>HM	1			TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY W/ PEBBLES CONTAINING VERY SMALL DISS GRAINS OF PY NO ENRICH NO CU OX MINERALS
Composite:																														
				177.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							7.5% GT>HM	1			–	–	TR CV	2	–	–	BLACK OX-TR				HIGHLY ALTERED MP HIGH CLAY OCCASSIONAL SMALL FRAGMENTS - TR CV W/ MINOR GYPSUM IN FRACTURES MOSTY ANGULAR GRANULAR LARGE SAND
				182.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							7.5% GT>HM				–	–	–	–	–	–					ALTERED MP HIGH CLAY GRANULAR @180.5' LARGE COBBLE OF GRANODIORITE NO VISIBLE PY NO ENRICH. NO CU OXIDE.
				187.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							7.5% GT>HM				–	–	–	–	–	–	TR BLACK OX 2				HIGHLY ALTERED MP HIGH CLAY GRANULAR W/ PEBBLES NO VISIBLE SULFIDES OR CU OX.
				192.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM				–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LOOSE CRUMBLY GRANULAR - PEBBLES OF MP NO VISIBLE PY NO ENRICH NO CU OX. TO 192'
				197.6					PALT: 3 SALT: 4 CLAY: 30% LCAP:							7.25% GT				2%	3	–	–	–	–					@192' CONTACT W/ LARGE FRAGMENTS OF MP CONTAINING PY - MINOR OXIDATION - GT NO VISIBLE ENRICHMENT OR CU OX HARD ROCK
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-3
Northing: 14300.3,
Easting: 15998.5
C.E.: 6297.6

Date Drilled: 10-05-04 Type: SONIC
Hole Depth: 250'
Orientation: -90°
Logged by: RJW

04-25-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				197.6' 202.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							NONE				2%	1	TR	1	–	–					LARGE HARD FRAGMENTS OF MP CONTAINING SMALL DISS GRAINS OF PY NO VISIBLE ENRICH NO VISIBLE Cu OX TR CC ENRICH IN CLAY.
				207.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							NONE				2%	1	TR	1	–	–					FRAGMENTS OF HARD MP w/ SMALL DISS GRAINS OF PY. MINOR CC ENRICH IN CLAY AREAS.
				212.6					PALT: 3 SALT: 4 CLAY: 40% LCAP:							.1% HM	1			1.5%	3	–	–	–	–					LARGE HARD FRAGMENTS OF MP CONTAIN SMALL DISS. GRAINS OF PY NO ENRICH NO Cu OX
				217.6					PALT: 3 SALT: 3 CLAY: 50% LCAP:							TR JAR	1			1.5%	3	TR	1	–	–					ANGULAR FRAGMENTS OF ALTERED MP CONTAIN SMALL DISS GRAINS OF PY VERY MINOR TR OF CC ENRICH NO Cu OX
				222.6					PALT: 3 SALT: 5 CLAY: 5% LCAP:							TR JAR	1			1.5%	1	–	–	–	–					HARD FRAGMENTS OF MP CONTAINING SMALL DISS GRAINS PY NO VISIBLE ENRICH NO Cu OX
Composite:																														
				227.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							.1% HM>JT	1			.5%	1	TR	1	–	–					ANGULAR FRAGMENTS OF MP CONTAINING SMALL DISS. GRAINS OF PY VERY MINOR TR OF CC ENRICH OF PY NO VISIBLE Cu OX
				232.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							.5% HM	1			1%	1	.15%	1	–	–					FRAGMENTS OF ALTERED MP CONTAINING ENRICHED SMALL DISS. GRAINS OF PY NO VISIBLE Cu OX
				237.6					PALT: 3 SALT: 7 CLAY: 70% LCAP:							2% HM	3			–	–	–	–	–	–					HIGHLY ALTERED MP - MOSTLY CLAY, NO VISIBLE SULFIDES HM AS DISS & ON FRACTURES NO VISIBLE Cu OX
				242.6					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% HM	3			.1%	1	–	–	–	–					ALTERED MP MINOR PY AS DISS.- MOSTLY OXIDIZED NO VISIBLE ENRICH OR Cu OX MINERALS.
				247.6 250					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.5% HM				1% PY	1	TR	1	–	–					ATERED MP MINOR DISS. PY w/ MINUTE TR OF CC - MOSTLY OXIDIZED-HM. VERY REDDISH CORE FROM 247.6 TO 250' NO VISIBLE CuOX MINERALS
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 1 of 6

Project:

Hole Number: TSGT-4 | Northing: 10838.6 | Easting: 4155.5 | CE: 6310.7

Date Drilled: 09-28-04 Type: [illegible] | Hole Depth: [illegible] | Orientation: -90 | Logged by: RJW

05-02-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
									PALT: SALT: CLAY: LCAP:																					
				0' 6.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GTS JAR	3			1.5%	3	.1%	3	TR	1					HIGHLY ALTERED (TO CLAY) MP LIGHT BROWN 0' TO 2' - LIGHT YELLOWISH FROM 2' TO 6' TRACE CV ALSO VERY MINOR HM FROM 5.5 TO 6.0' ALL SOFT W/ HIGH CLAY. WEAK ENRICHMENT, NO VISIBLE Cu OX
				6.0' 11.0'					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GTS JAR	3			1.5%	3	.1%	3	TR	1					HIGHLY ALTERED MP (HIGH CLAY) LIGHT YELLOWISH FROM 6 TO 8'; LIGHT BROWN FROM 8 TO 11' WEAK ENRICHMENT LIGHT GT ON FRACTURES NO VISIBLE Cu OX.
Composite:																														
				16.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GTS JAR	3			1.25%	3	.25%	3	TR	1					HIGHLY ALTERED MP HIGH CLAY LIGHT YELLOWISH WEAK ENRICH TR CV. GT ON SOME FRACTURES NO VISIBLE Cu OX
				21.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5 JAR>GT HM	3			1.0%	3	.25%	3	TR	1					HIGHLY ALTERED MP HIGH CLAY LIGHT YELLOWISH FROM 16' TO 18' THEN BROWN-REDDISH (GT & HM) WEAK ENRICH NO VISIBLE Cu OX.
				26.0					PALT: 3 SALT: 7 CLAY: 70% LCAP:							1.0% GT-JAR	3			1.0%	3	.25%	3	-	-					MOSTLY ALTERED TO CLAY / MP SOFT-CRUMBLY WEAK ENRICHMENT REDDISH BROWN FROM 21 TO 25; THEN LIGHT YELLOWISH BROWN NO VISIBLE Cu OX
				31.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% GT>HM	3			.5%	3	-	-	-	-					HIGHLY ALTERED MP FeOX AS DISS & FRACTURE COATINGS HM & GT EXTREMELY WEAK ENRICH NO VISIBLE Cu OX.
				36.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM-GT	3	BLACK CuOX	1											HIGHLY ALTERED MP HIGH CLAY. NO VISIBLE PY OR ENRICH. FeOX (GT & HM) AS DISS. & ON FRACTURES BLACK Cu OX ON FRACTURES
Composite:																														

300

75

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project:
Hole Number: TSGT-4 Northing: 10838.6 Easting: 4155.5 C.E.: 6310.7
Date Drilled: 07-28-04 Type: SONIC Hole Depth: 273 Orientation: - 90° Logged by:

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				41.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM	3	CHRC	3	-	-	-	-	-	-					HIGHLY ALTERED MP NO VISIBLE SULFIDES REMAINING FROM 40' TO 41' SOLUBLE CU IN CLAY. LIGHT GREENISH-BLUE
				46.0					PALT: 3 SALT: 6 CLAY: 60% LCAP: 10%							2% HM>GT	3	CHRC	3	-	-	-	-	-	-					HIGHLY ALTERED MP MOSTLY CLAYS NO VISIBLE SULFIDES. TRACE SOLUBLE CU IN CLAYS - TRACE GYPSUM
				51.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% HM>GT	3			TR	1	-	-	-	-					HIGHLY ALTERED MP HIGH CLAY TR. DISS PY NO VISIBLE ENRICH NO VISIBLE CU OX
				56.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.% HM	3			-	-	-	-	-	-					HIGHLY ALTERED MP HIGH CLAY STRONG HM FROM 51' TO 55' NO VISIBLE PY OR OTHER SULFIDES NO VISIBLE CU OX
				61.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM>GT	3													HIGHLY ALTERED MP HIGH CLAY STRONG HM FROM 57' TO 61' NO VISIBLE NO VISIBLE PY OR ENRICHMENT -
Composite:																														
				66.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2% HM	3			.25%	3	10%	3	-	-					HIGHLY ALTERED, MP HIGH CLAY FROM 63' TO 64' DISS. PY W/ WEAK ENRICHMENT. FROM 64 TO 66' GT > HM NO VISIBLE CU OX
				71.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% JAR>GT	3			-	-	-	-	-	-					HIGHLY ALTERED MP JAR > GT LIGHT YELLOW-BROWNISH GT ON FRACTURES NO VISIBLE PY OR ENRICH. NO VISIBLE CU OX.
				76.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% JAR>GT	3			-	-	-	-	-	-					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE PY OR ENRICH. NO VISIBLE CU OX LIGHT BROWN-SLIGHTLY YELLOWISH
				81.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% GT>HM	3			TR	1	-	-	-	-					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE CU OX SOFT CRUMBLY
				86.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% GT>HM	3			-	-	-	-	-	-					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES NO VISIBLE CU OX. LIGHT BROWN W/ SOME REDDISH
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 3 of 5

Project:

Hole Number: TSGT-4 Northing: 10838.6 Easting: 4155.5 C.E.: 6310.7

Date Drilled: 09-23-04 Type: SONIC Hole Depth: 273 Orientation: -90° Logged by: RJW

05-02-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				86.0 91.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% GT>HM	3	BLACK CuOX	2	–	–	–	–	–	–					HIGHLY ALTERED MP - HIGH CLAY MEDIUM BROWN COLOR TR BLACK Cu OX ON FRACTURES
				96.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM>GT	3	BLACK CuOX	2	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY STRONG HM FROM 92 TO 95' NO VISIBLE SULFIDES OR ENRICHMENT TR BLACK Cu OXIDES ON FRACTURES
				101.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% HM>GT	3	BLACK CuOX	2	–	–	–	–	–	–	TR SOLUBLE Cu IN CLAY				HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES OR ENRICHMENT TR OF BLACK OX ON FRACTURES TR GREEN SOLUBLE Cu IN CLAY
				106.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM	3	Cu OX	2	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY MEDIUM RED COLOR NO VISIBLE TRACES OF GREEN Cu OXIDES
				111.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM>GT	3	Cu OX	2	–	–	–	–	–	–	TR BLACK CuOX				HIGHLY ALTERED MP HIGH CLAY MEDIUM BROWN COLOR NO VISIBLE SULFIDES OR ENRICH
Composite:																														
				116.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM	3	Cu OX	2	–	–	–	–	–	–	TR BLACK OX Cu				HIGHLY ALTERED MP HIGH CLAY STRONG HM FROM 112' TO 115'. NO VISIBLE SULFIDES. FROM 115' TO 116 GT>HM
				121.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% GT>HM	3	Cu OX	2	–	–	–	–	–	–	TR BLACK CuOX				HIGHLY ALTERED MP HIGH CLAY MEDIUM TO LIGHT BROWN COLOR NO VISIBLE SULFIDES
				126.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% HM>GT	3			–	–	–	–	–	–	TR BLACK CuOX				HIGHLY ALTERED MP HIGH CLAY MEDIUM REDDISH BROWN COLOR NO VISIBLE SULFIDES
				131.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0 HM>GT	3			–	–	–	–	–	–	–				HIGHLY ALTERED MP HIGH CLAY MEDIUM REDDISH BROWN NO VISIBLE SULFIDES NO VISIBLE Cu OX
				136.1					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0 HM>GT	3			–	–	–	–	–	–	–				HIGHLY ALTERED MP HIGH CLAY FROM 134 TO 136' LIGHT YELLOWISH BROWN NO VISIBLE SULFIDES NO VISIBLE Cu OX.
Composite:																														

200

175

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 4 of 6

Project:
Hole Number: TSGT-4
Date Drilled: 04-28-05 Type: SONIC
Northing: 10833.6
Hole Depth: 273
Easting: 4155.5
Orientation: – 90°
CE: 6310.7
Logged by: RJW

05-02-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				141.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							3% HM	3	BLACK OX	2	—	—	—	—	—	—					HIGHLY ALTERED PORPHYRY HIGH CLAY FROM 139' TO 140' STRONG RED HM COLOR. TR BLACK OX COATINGS NO VISIBLE SULFIDES OR ENRICHMENT
				146.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.5 HM>GT	3	—	—	—	—	—	—	—	—					HIGHLY ALTERED MP HIGH CLAY FROM 142' TO 144' DARK RED; OTHERWISE MEDIUM BROWN NO VISIBLE SULFIDES NO VISIBLE CU OX
				151.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							2.0% GT>HM	3	–	–	TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY FINE GRAINED TR PY NO VISIBLE ENRICH MEDIUM BROWN COLOR
				156.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% GT>HM	3	BLACK OX	2	TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES OR ENRICH. TR BLACK OX MEDIUM BROWN COLOR
				161.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% HM>GT	3			–	–	–	–	–	—					HIGHLY ALTERED MP HIGH CLAY LIGHT BROWN EXCEPT 156 TO 158- THEN MEDIUM TO DARK RED. NO VISIBLE SULFIDES
Composite:																														
				166.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% GT>HM		BLACK CuOX	2	–	–	–	–	–	—					HIGHLY ALTERED MP HIGH CLAY LIGHT BROWN COLOR NO VISIBLE SULFIDES TR BLACK OX ON SURFACES
				171.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.5% GT>HM		BLACK CuOX	2	TR	1	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT BROWN COLOR (DRY) TR PY NO VISIBLE ENRICH. TR BLACK CU OX
				176.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% JR>GT		—	–	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT YELLOWISH BROWN COLOR NO VISIBLE SULFIDES OR ENRICHMENT NO VISIBLE CU OX.
				181.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% GT>JAR		—	—	TR	1	–	–	—	—					HIGHLY ALTERED MP HIGH CLAY LIGHT BROWN W/YELLOWISH TINGE TR PY. NO ENRICH. NO VISIBLE CU OX
				186.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1.0% GT		—	—	2%	1	–	–	—	–					HIGHLY ALTERED MP HIGH CLAY FROM 181 TO 186 LIGHT BROWN COLOR NO VISIBLE CU OX NO ENRICH
Composite:																														

50

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-4 Northing: 10838.6 Easting: 4155.5 C.E.: 6310.7'

Date Drilled: 03-29-04 Type: SONIC Hole Depth: 275 Orientation: - 90° Logged by: RJW

05-03-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				191.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							15% GT>HM	3	TR BLACK OX	2	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES OR ENRICH TR BLACK OX ON SURFACES
				196.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							20% HM>GT	3	TR BLACK OX	2	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES MEDIUM, BROWN COLOR - REDDISH FROM 195'-196' TR BLACK OX ON SURFACES
				201.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GT>HM	3	TR BLACK OX	2	–	–	–	–	–	–	CHALC IN CLAY				HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES LIGHT TO MEDIUM BROWN TR VERY SPARSE SOLUBLE CU ABSORBED IN GRAINS OF CLAY TR BLACK OX ON SURFACES.
				206.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GT>HM	3	TR BLACK OX	2	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES LIGHT TO MEDIUM BROWN. GT MUCH GREATER THAN HM
				211.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							1% GT>HM	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY NO VISIBLE SULFIDES OR CU OX LIGHT TO MEDIUM BROWN GT GREATER THAN HM
Composite:																														
				216.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							15% GT>HM	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT TO MEDIUM BROWN EXCEPT 213 TO 214' - REDDISH NO VISIBLE SULFIDES OR CU OX
				221.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							10% GT>HM	3	TR BLACK OX		–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT TO MEDIUM BROWN TR BLACK OX ON SURFACES NO VISIBLE SULFIDES. FROM 220 TO 221 - PIECES OF 110.
				226.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							10% GT>HM	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT TO MEDIUM BROWN NO VISIBLE SULFIDES - NO VISIBLE CU OX
				231.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							10% GT>HM	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY LIGHT TO MEDIUM BROWN NO VISIBLE SULFIDES - NO VISIBLE CU OX HM INCREASING
				236.0					PALT: 3 SALT: 6 CLAY: 60% LCAP:							15% HM=GT	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY CONTENT LIGHT REDDISH-BROWN COLOR NO VISIBLE SULFIDES OR CU OX.
Composite:																														

100

75

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project:

Hole Number: TSGT-4
Date Drilled: 07-28-04 Type: SONIC
Northing: 10838.6
Hole Depth: 275
Easting: 4155.5
Orientation: -90°
C.E.: 6510.7'
Logged by: RJW

05-03-05

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
									PALT: 3							1.0% GT>HM	3		–	–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY CONTENT NO VISIBLE SULFIDES - NO VISIBLE CUOX MEDIUM BROWN COLOR EXCEPT 240 TO 241' - REDDISH BROWN.
									SALT: 6																					
									CLAY: 60%																					
				241.0					LCAP:																					
									PALT: 3							1.0% HM>GT	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLA CONTEN LIGHT REDDISH-BROWN COLOR NO VISIBLE SULFIDES OR CU OX.
									SALT: 36																					
									CLAY: 60%																					
				246.0					LCAP:																					
									PALT: 3							1.0% GT>HM	3	TR BLACK OX		–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY CONTENT MEDIUM TO LIGHT REDDISH BROWN TR BLACK OX ON SURFACES NO VISIBLE SULFIDES
									SALT: 6																					
									CLAY: 60%																					
				251.0					LCAP:																					
									PALT: 3							2.0% HM>GT	3			–	–	–	–	–	–					HIGHLY ALTERED MP HIGH CLAY MEDIUM TO DARKER REDDISH BROWN NO VISIBLE SULFIDES - NO VISIBLE CU OX
									SALT: 6																					
									CLAY: 60%																					
				256.0					LCAP:																					
									PALT: 3							1.0 GT>HM>JAR	3			–	–	–	–	–	–					TO 259' - HIGHLY ALTERED MP NO VISIBLE SULFIDES - NO VISIBLE CUOX MEDIUM BROWN TO SLIGHTLY YELLOWISH FROM 259' DOWN - GILA CONGLOM.
									SALT: 6																					
									CLAY: 60%																					
				259.0					LCAP:																					
Composite:																														
				259.0					PALT:																					FROM 259' DOWN - GILA CONGLOM DARK REDDISH BROWN NO SULFIDES - NO CU OX. SANDY W/ GRAVEL
									SALT:																					
									CLAY:																					
				266.0					LCAP:																					
									PALT:																					E.O.H.@ 271'
									SALT:																					
									CLAY:																					
				271					LCAP:																					
									PALT:																					
									SALT:																					
									CLAY:																					
				[illegible]					LCAP:																					
									PALT:																					
									SALT:																					
									CLAY:																					
									LCAP:																					
									PALT:																					
									SALT:																					
									CLAY:																					
									LCAP:																					
Composite:																														

50

APPENDIX B-3

2005 ROTOSONIC BOREHOLE LOGS

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-3

Project:	Tyrone 1A Stockpile			Datum:		Collar Elev:	
Project No.:	013-1595-002	Drill date:	9/15/2005	Coordinates	N: E:	Sheet	1 of 3
Location:	Tyrone Mine	Drill rig:	Sonic	Azimuth:	N/A	Inclination:	

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index	Notes Test Results	
				Moisture	0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0	Physical Testing		
0	**Red brn Clayey gravel (GC), cohesive, fine low to med plasticity**	GC	10YR 5/4	M							▨						▨					▨							0
-											▨						▨					▨							-
-	**rock**	Rock	5YR 5/2	SM										▨					▨			▨							-
-														▨					▨			▨							-
-	**Clayey gravel, mostly yellow gray, gravel with non plastic to plastic fines, few durable cobbles**	GC	10YR 6/6	M								▨						▨					▨						-
5												▨						▨					▨						5
-												▨						▨					▨						-
-												▨						▨					▨						-
-												▨						▨					▨						-
-												▨						▨					▨						-
10												▨						▨					▨						10
-												▨						▨					▨				S, PI	T3-11-12.5 (9.35 lb)	-
-												▨						▨					▨						-
-												▨						▨					▨						-
-												▨						▨					▨						-
15												▨						▨					▨						15
-												▨						▨					▨						-
-	**17.0' Lower zone, typically red brn, sandy clay (SC), locally high plasticity, few rocky zones, cohesive zones stiff to very stiff (S4 to S5)**	SC	10R 4/6									▨						▨			▨	▨							-
-												▨						▨			▨	▨							-
-												▨						▨			▨	▨							-
20												▨					▨	▨			▨	▨							20
-												▨					▨	▨			▨	▨							-
-													▨				▨	▨			▨	▨							-
-													▨				▨	▨			▨	▨							-
-													▨				▨	▨			▨	▨							-
25													▨				▨	▨			▨	▨							25
-													▨				▨	▨			▨	▨							-
-													▨				▨	▨			▨	▨							-
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
30												▨					▨				▨	▨							30
-												▨					▨				▨	▨					S, PI	T-3 31-32.5 (6.5 lb)	-
-												▨					▨				▨	▨							-
-													▨					▨			▨	▨							-
-													▨					▨			▨	▨							-
35											▨							▨			▨	▨							35
-											▨							▨			▨	▨							-
-											▨							▨			▨	▨							-
-											▨							▨			▨	▨							-
-											▨							▨			▨	▨							-
40											▨							▨			▨	▨							40

Scale:

Drilling Contractor:

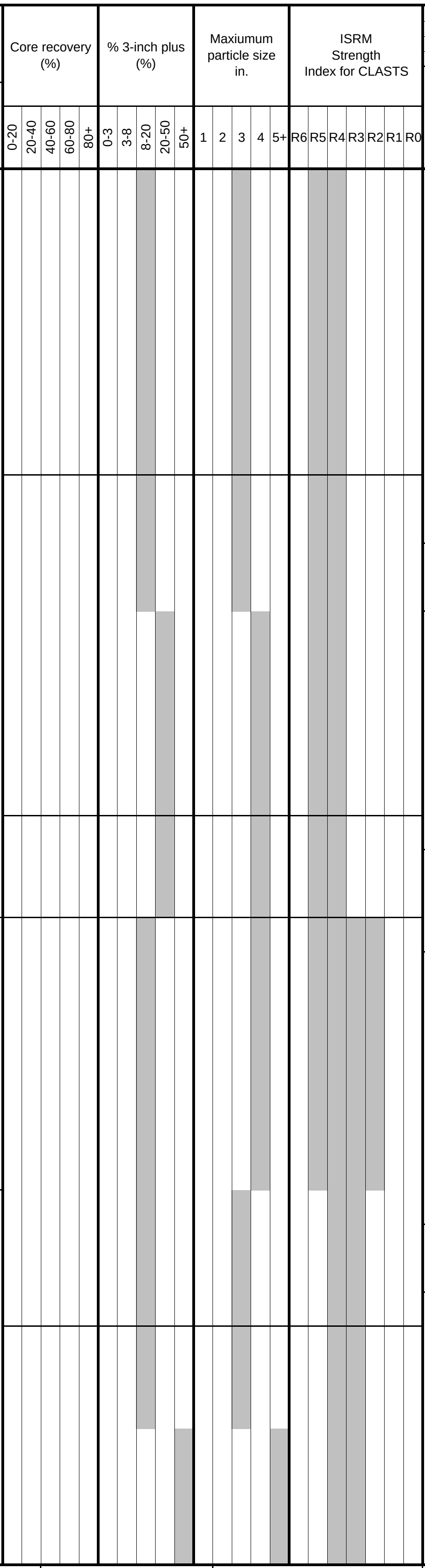
Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-3

Project:	Tyrone 1A Stockpile		Datum:	Collar Elev:	
Project No.:	013-1595-002	Drill date:	Coordinates N: E:	Sheet	2 of 3
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A	Inclination:	

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture D-dry SM-slightly moist M-moist VM-very moist S-saturated
40 45	**clayey sans to clayey gravel (SC to GC), rd brn, variable plasticity (low to med), clay/cohesive zones S4 to S%**	SC to GC	10R 4/6	M
50 55 60	**mostly clayey gravel**	GC		
65	**Rocky zone**	**Rocky**	N8 to 10R 6/6	SM
70 75	**Clayey zone/cohesive zone, clayey sand to clayey gravel, 40% clay, very stiff (S4 to S5)**	SC/GC	10R 4/6	M
80	**Rocky zone, locally clayey (SC), low to high plasticity**	Rocky	10R 6/6	



D-Point Load-diametral
A-Point Load-axial
S-Sieve
PI-Plasticity Index

Physical Testing	Notes Test Results
S, PI	T3-51-52.5 (9.15lb)
	T3-60-62.5 Bucket
S, PI	T3- 71-72.5 (8.4lb)

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

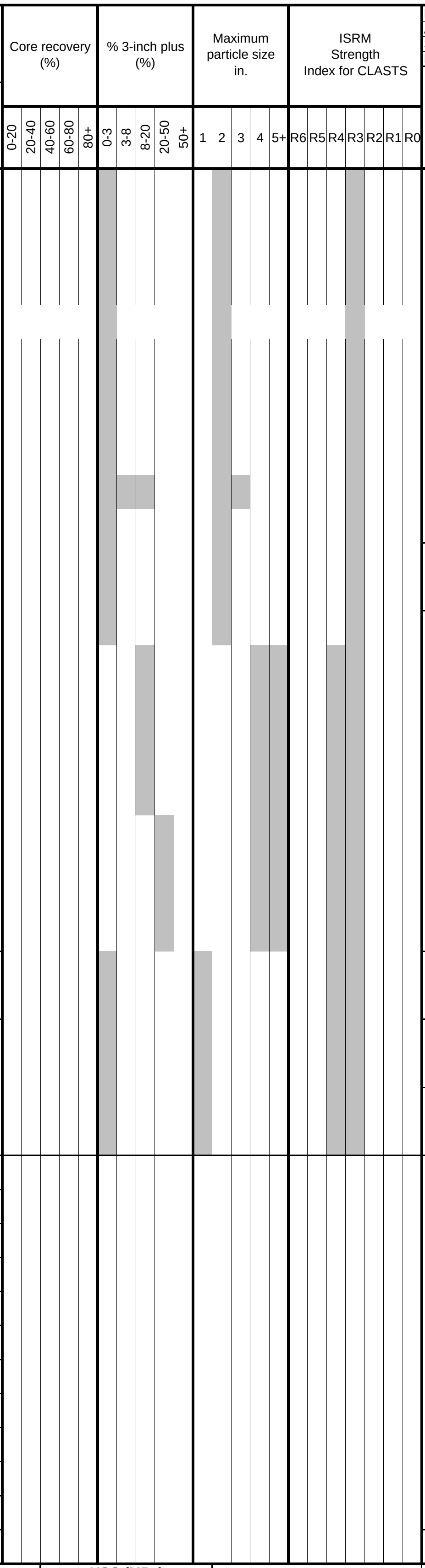
Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-3

Project:	Tyrone 1A Stockpile		Datum:		Collar Elev:
Project No.:	013-1595-002	Drill date:	Coordinates N:	E:	Sheet 3 of 3
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A		Inclination:

Depth (ft): 80 - - - - 85 - - - - 90 - - - - 95 - - - - 100 - - - - 105 - - - - 110 - - - - 115 - - - - 120

Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results
Weathered zone, clayey sand, cohesive, variable plasticity, stiff to very stiff (S4 to S5), weathered rocky zone at 88'	SC	10R 4/6	M to SM	S, PI	T3-91-92.5 (9.9 lb)
gravelly zone, clayey gravel (GC), variable plasticity, stiff to very stiff groundmass	GC				
103' Basal contact, organic silt and clay, stiff (S4), dk brn with red mottles, organic debris	OL to OH	5R 2/2	M		T3-103-105 (Bucket)
105' Gila conglomerate, yellow brn, mostly sand with 10% clay, mod plasticity, slightly cohesive, locally gravelly. The Gila shows evidence of leaching from 105 to 106.5 and is locally cemented. Appears unaffected below 106.5.	SC	10YR 5/4	SM		T3-105-106.5 (Bucket) T3-106.5-110 (Bucket)
End at 110.					



Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-4

Project: Tyrone 1A Stockpile
Datum:
Collar Elev:
Project No.: 013-1595-002
Drill date: 9/16/2005
Coordinates N: E:
Sheet 1 of 4
Location: Tyrone Mine
Drill rig: Sonic
Azimuth: N/A
Inclination: 90

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0			
0	**Rocky zone, clayey gravel, gray to olive gray, locally mottled**	GC	5Y 6/1	M										▨					▨		▨	▨							0
-														▨					▨		▨	▨							-
-			5Y 5/2 to 10YR 7/4											▨					▨		▨	▨							-
-														▨					▨		▨	▨							-
-														▨					▨		▨	▨							-
5														▨					▨		▨	▨							5
-			5Y 5/2											▨					▨		▨	▨							-
-	**7.5' lt brn clayey gravel, fines high plasticity, angular rock frags composed of silica**	GC								▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨					S, PI	T-4-9 to 10 (10.0 lb)	-
10	**10' gray to olive gray, locally reddish, clayey gravel, non plastic to plastic fines, angular fragments**	GC								▨							▨				▨	▨							10
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
15			5YR 7/2							▨							▨				▨	▨							15
-										▨							▨				▨	▨							-
-			5Y 7/2 to 5Y 5/2							▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨						locally 5Y 7/6	-
20	**clayey/cohesive zone, clayey gravel, matrix soft to firm (S2 to S3),**	GC								▨							▨				▨	▨							20
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
-										▨							▨				▨	▨							-
25												▨					▨				▨	▨							25
-												▨						▨			▨	▨							-
-	**Clayey/cohesive zone, greenish gray clayey gravel to clayey sand, (GC to SC), matrix stiff to very stiff (S4 to S5)**	GC to SC										▨						▨			▨	▨							-
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨					S, PI	T4 29-30 (9.7 lb)	-
30												▨					▨				▨	▨							30
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
35	**clayey gravel, fewer fines, mostly -1" gravel (+/- 50%),**	GC											▨						▨		▨	▨							35
-													▨						▨		▨	▨							-
-													▨						▨		▨	▨							-
-													▨				▨				▨	▨							-
-													▨				▨				▨	▨						T4-37.5-40 (Bucket)	-
40													▨				▨				▨	▨							40

Scale:
Drilling Contractor:
Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-4

Project:	Tyrone 1A Stockpile			Datum:		Collar Elev:
Project No.:	013-1595-002	Drill date:	9/16/2005	Coordinates N:	E:	Sheet 2 of 4
Location:	Tyrone Mine	Drill rig:		Azimuth: N/A		Inclination:

Depth (ft)	Soil / Rock Type **Description** (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0			
40	**Clayey zone, clayey gravel to clayey sand (GC to SC), yellowish gray, matrix \stiff to very stiff (S4 to S5), rocky at 45-47**	GC to SC	5GY 6/1										▨				▨				▨	▨							40
-													▨				▨				▨	▨							-
-													▨				▨				▨	▨							-
-													▨				▨				▨	▨							-
-													▨				▨				▨	▨							-
45													▨						▨		▨	▨	▨						45
-													▨						▨		▨	▨	▨						-
-	**Silty to clayey gravel (GC to GM), non plastic fines, stiff to very stiff,**	GC to GM											▨				▨				▨	▨	▨						-
-													▨				▨				▨	▨	▨						-
-			5Y 6/1 to 5Y 5/2										▨				▨				▨	▨	▨						-
50													▨				▨				▨	▨	▨						50
-													▨				▨				▨	▨	▨						-
-													▨				▨				▨	▨	▨						-
-													▨				▨				▨	▨	▨						-
-													▨				▨				▨	▨	▨						-
55	**rock/boulder**		N7				▨							▨			▨				▨	▨							55
-							▨							▨			▨				▨	▨							-
-	**Clayey gravel red brn, matrix stiff to very stiff, mod plasticity**	GC	5YR 5/6											▨			▨				▨	▨							-
-														▨			▨				▨	▨							-
-														▨			▨				▨	▨							-
60	**cleyey gravel to sand (GC to SC), stiff to very stiff matrix, low plasticity**	GC to SC												▨			▨				▨	▨							60
-														▨			▨				▨	▨							-
-														▨			▨				▨	▨							-
-														▨			▨				▨	▨							-
-														▨			▨				▨	▨							-
65	**Clayey gravel, lt gray to mottled red, low to mod plasticity fines, cohesive**	GC	N7 locally 5YR 4/4											▨				▨			▨	▨							65
-														▨				▨			▨	▨							-
-														▨				▨			▨	▨							-
-														▨				▨			▨	▨							-
-													▨					▨			▨	▨							-
70	**Clayey Gravel (GC), gray, mottled, locally plastic, groundmass S4 to S5**	GC										▨						▨			▨	▨							70
-												▨						▨			▨	▨							-
-												▨						▨			▨	▨							-
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
75	**rock/boulder**											▨					▨				▨	▨							75
-												▨					▨				▨	▨							-
-												▨					▨				▨	▨							-
-	**clayey gravel, brown**	GC	5YR 4/4									▨						▨			▨	▨							-
-												▨						▨			▨	▨							-
80												▨						▨			▨	▨							80

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-4

Project:	Tyrone 1A Stockpile		Datum:		Collar Elev:
Project No.:	013-1595-002	Drill date: 9/16/2005	Coordinates N:	E:	Sheet 3 of 4
Location:	Tyrone Mine	Drill rig:	Azimuth: N/A		Inclination:

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (ft)	Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	Moisture	Core recovery (%) 0-20 / 20-40 / 40-60 / 60-80 / 80+	% 3-inch plus (%) 0-3 / 3-8 / 8-20 / 20-50 / 50+	Maxiumum particle size in. 1 / 2 / 3 / 4 / 5+	ISRM Strength Index for CLASTS R6 / R5 / R4 / R3 / R2 / R1 / R0	Physical Testing	Notes Test Results
80 - 89	**Clayey gravel, brn, mottled, low to mod plasticity fines**	GC	5YR 4/4	M		20-50	3	R5, R4		
89 - 90	**clayey sand, gray, stiff,**	SC	N6			20-50	3	R5, R4	S, PI	T4-89-90 (9.5 lb)
90 - 91	**Clayey gravel, (GC), red brn, low to mod plasticity, 20% clay**	GC	5YR 4/6			20-50	5+	R5, R4		
91 - 95						20-50	4	R5, R4		
95 - 97	**rocky zone @ 95', sandy groundmass with 50% cobbles, locally cohesive with non-plastic fines**					50+	4	R5, R4		
97 - 100						20-50	4	R5, R4		
100 - 102	**mostly rock, rock is fresh**	Rock	N7			50+	5+	R5, R4		
102 - 108	**Clayey gravel, with 10 to 30% clay, non-plastic to plastic, clayey zones very stiff (S4 to S5)**	GC	10YR 7/4	M		50+	3	R5, R4		
108 - 109	**Rocky zone, >50% cobbles**					50+	3	R5, R4		
109 - 112	**clayey gravel (GC)**					50+	3	R5, R4	S, PI	T4-109-110 (10.2 lb)
112 - 116	**112.5', mostly clay (CL to SC), plastic, soft (S2), with +/- 20% -1/2" rock fragments**	CL to SC	5YR 6/4	S		50+	1	R5, R4	S, PI	T4-113-114
116 - 120	**116' Clayey gravel (GC), yellow brn, up tp 30% 3" gravel, locally cohesive and stiff to very stiff (S4 to S5), 10 to 30% fines**	GC	10YR 7/4	M		50+	3	R5, R4		

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S-4

Project:	Tyrone 1A Stockpile			Datum:		Collar Elev:	
Project No.:	013-1595-002	Drill date:	9/16/2005	Coordinates	N: E:	Sheet	4 of 4
Location:	Tyrone Mine	Drill rig:		Azimuth:	N/A	Inclination:	

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%) 0-20	20-40	40-60	60-80	80+	% 3-inch plus (%) 0-3	3-8	8-20	20-50	50+	Maximum particle size in. 1	2	3	4	5+	ISRM Strength Index for CLASTS R6	R5	R4	R3	R2	R1	R0	D-Point Load-diametral A-Point Load-axial S-Sieve PI-Plasticity Index Physical Testing	Notes Test Results
120	**Clayey gravel (GC), yellow brn, cohesive, with -3" gravel, locally up to 50% fines,**	GC	5Y 7/2	M									▨				▨				▨	▨						
129													▨				▨				▨	▨					S, PI	T4-129-130 (10.4lb)
130	**locally moderate to high plasticity fines**												▨				▨				▨	▨						
135	**Clay 20 to 40%, 20% sand, 10-40% -3" gravel**												▨				▨				▨	▨						
140			10YR 7/4										▨				▨				▨	▨						
147	**Rock/ boulder at 147'**		N7	M to SM										▨					▨		▨	▨						
150	**EOH @ 150'**																											
160																												

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5

Project:	Tyrone 1A Stockpile			Datum:		Collar Elev:	
Project No.:	013-1595-002	Drill date:	9/17/2005	Coordinates	N: E:	Sheet	1 of 5
Location:	Tyrone	Drill rig:	Sonic	Azimuth:	N/A	Inclination:	90

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	D-dry SM-slightly moist M-moist VM-very moist S-saturated	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index	Notes Test Results	
				Moisture	0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0	Physical Testing		
0	**Clayey gravel (GC), pale orange to lt brn, 20-30% clay, fines plastic, 50% rock, S5**	GC	10YR 8/2	M									▨				▨					▨	▨						0
-													▨				▨					▨	▨						-
-													▨				▨					▨	▨						-
-			10YR 5/2										▨				▨					▨	▨						-
-													▨				▨					▨	▨						-
5													▨				▨					▨	▨						5
-			5YR 6/4										▨					▨				▨	▨						-
-													▨					▨				▨	▨						-
-													▨					▨				▨	▨						-
-													▨					▨				▨	▨						-
10	**Rocky zone/boulder, gray porphyry, slightly weathered**	Rock	N7	SM				▨						▨					▨		▨	▨						Poor recovery	10
-								▨						▨					▨		▨	▨							-
-								▨						▨					▨		▨	▨							-
-								▨						▨					▨		▨	▨							-
-								▨						▨					▨		▨	▨							-
15								▨						▨					▨		▨	▨							15
-	**Clayey gravel red brn, cobbles in sandy groundmass, 10% clay, NP**	GC	10R 4/6	M									▨				▨					▨	▨				Grad, PI	T5-16.5-17.5 (12.5 lb)	-
-													▨					▨				▨	▨						-
-													▨					▨				▨	▨						-
-													▨					▨				▨	▨						-
20	**Rock zone/boulder**	Rock	N7	M										▨					▨		▨	▨	▨						20
-														▨					▨		▨	▨	▨						-
-														▨					▨		▨	▨	▨						-
-														▨					▨		▨	▨	▨						-
-														▨					▨		▨	▨	▨						-
25	**Clayey to sandy gravel, red brn, minor clay, slightly cohesive to cohesive**	GW to GC	10R 4/6	M								▨					▨					▨	▨						25
-												▨					▨					▨	▨						-
-			5YR 5/6									▨					▨					▨	▨						-
-												▨					▨					▨	▨						-
-			10R 4/6									▨					▨					▨	▨						-
30												▨					▨					▨	▨						30
-												▨					▨					▨	▨						-
-	**Cohesive/clayey zone, red brn, very stiff (S5), moderate plasticity,**	GC	10R 4/6	M									▨						▨			▨	▨						-
-													▨						▨			▨	▨						-
-													▨						▨			▨	▨						-
35													▨						▨			▨	▨						35
-													▨						▨			▨	▨				Grad, PI	T36.5-37.5 (10.65 lb), 50% Oversized	-
-			5YR 5/6										▨						▨			▨	▨						-
-													▨	▨					▨			▨	▨						-
-													▨	▨					▨			▨	▨						-
40													▨				▨					▨	▨						40

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5

Project: Tyrone 1A Stockpile
Project No.: 013-1595-002
Location: Tyrone
Drill date: 9/17/2005
Drill rig:
Datum:
Coordinates N: E:
Azimuth: N/A
Collar Elev:
Sheet 2 of 5
Inclination:

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Seive, PI-Plasticity Index

Depth (ft)	Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Core recovery (%)	% 3-inch plus (%)	Maxiumum particle size in.	ISRM Strength Index for CLASTS	Physical Testing	Notes Test Results
40-42	**Clayey gravel, GC, lt brn, locally cohesive, 10% clay, NP to moderate plasticity**	GC	5YR 5/6	M		20-50	3, 4	R4, R3		Bucket sample 40-42.5
42-45		GC	5YR 5/6	M		20-50	3, 4	R4, R3		
45-46	**Increasing clay, +/- 20%**	GC	5YR 4/4	M		20-50	3, 4	R4, R3		
46-50		GC	5YR 4/4	M		20-50	3, 4	R4, R3		
50-51	**Lt brn**	GC	5YR 6/4	M		20-50	3, 4	R4, R3		
51-54		GC	5YR 6/4	M		20-50	3, 4	R4, R3		
54-56		GC	5YR 6/4	M		20-50	4	R4, R3		
56-58		GC	5YR 6/4	M		20-50	3	R4, R3	S. PI	T5-56.5-57.5 (10.9 lb)
58-60.8	**Cohesive zone, S5, 25% clay, plastic fines**	GC	5YR 4/4	M		20-50	4	R4, R3		
60.8-62	**Rocky/boulder**	Rock	N7	M		20-50	4	R4, R3		
62-63	**Clayey gravel, locally cohesive, lt brn, mottled, very stiff (S3), mod plasticity, increasing clay (20%) at 70'**	GC	5YR 5/6	M		20-50	5+	R4, R3		
63-65		GC	5YR 5/6	M		50+	5+	R4, R3		
65-68		GC	5YR 5/6	M		50+	3	R4, R3		
68-75		GC	5YR 5/4	M		50+	3	R4, R3		
75-80	**Rock zone/boulder, mostly rock frags in sandy groundmass**	GP	N7/N6	SM		20-50	5+	R4, R3		

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Scale:
Drilling Contractor:
Driller:

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5

Project: Tyrone 1A Stockpile
Datum:
Collar Elev:
Project No.: 013-1595-002
Drill date: 9/17/2005
Coordinates N: E:
Sheet 3 of 5
Location: Tyrone
Drill rig:
Azimuth: N/A
Inclination:

Depth (ft)	Soil / Rock Type **Description** (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0			
80	**Clayey gravel, pale lt. brn, cohesive zone, few large cobles. Mostly -3" gravel, 20=30% clay, very stiff (S5), sandy fines**	GC	10R 5/4	M								▨							▨		▨	▨							80
-												▨							▨		▨	▨							-
-													▨						▨		▨	▨							-
-													▨						▨			▨	▨						-
-													▨						▨			▨	▨						-
85													▨						▨			▨	▨						85
-													▨						▨			▨	▨						-
-													▨				▨							▨	▨				-
-													▨				▨							▨	▨				-
-	**Lt Brn** **Decrepit rock zone, 87.5-111.5, rock structure altered**		5yr 6/1										▨				▨							▨	▨				-
90													▨				▨							▨	▨				90
-													▨				▨							▨	▨				-
-													▨				▨							▨	▨				-
-	**Cohesive zone, clayey gravel, very stiff (S5), lt brn, 30% clay, mod to high plastuicity, 50 percent gravel**		10YR 4/6										▨				▨							▨	▨				-
-													▨				▨							▨	▨				-
95													▨				▨							▨	▨				95
-													▨				▨					▨	▨				S, PI	T-5 96.5-97.5 (10.35lb)	-
-													▨				▨					▨	▨						-
-	**Sandy zone, GW, grayish red, fines non plastic, +/- 50% gravel, clasts deeply weathered, fines plastic at 102'**	GW	5R 4/2										▨		▨	▨	▨					▨	▨						-
-													▨		▨							▨	▨						-
100													▨		▨							▨	▨						100
-													▨		▨							▨	▨						-
-													▨		▨							▨	▨						-
-													▨		▨							▨	▨						-
-													▨		▨							▨	▨						-
105	**Clayey gravel to clayey sand, red, with weathered decrepit clasts, cohesive zone**	GC to SC	5R 4/6									▨						▨				▨	▨						105
-												▨						▨				▨	▨						-
-	**Clayey gravel to clayey sand, +/- 10% -2" cobbles in sandy, clayey groundmass,**		5Y 8/1									▨				▨						▨	▨						-
-			N6									▨				▨						▨	▨						-
-												▨				▨						▨	▨						-
110												▨				▨						▨	▨						110
-												▨				▨						▨	▨						-
-												▨				▨						▨	▨						-
-	**Clayey gravel to clayey sand, yellow gray, mottled, +/-50% oversize**											▨							▨			▨	▨						-
-												▨							▨			▨	▨						-
115												▨	▨						▨			▨	▨				S, PI	T-5 166.5-117.5 (12.3lb) (20% oversize)	115
-												▨	▨						▨					▨	▨				-
-												▨							▨					▨	▨				-
-	**Clayey gravel, brn, 30% gravel, 15% clay, low plasticity**	GC	5yr 4/4									▨				▨								▨	▨				-
-												▨				▨								▨	▨				-
120												▨				▨								▨	▨				120

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5

Project: Tyrone 1A Stockpile | Datum: | Collar Elev:

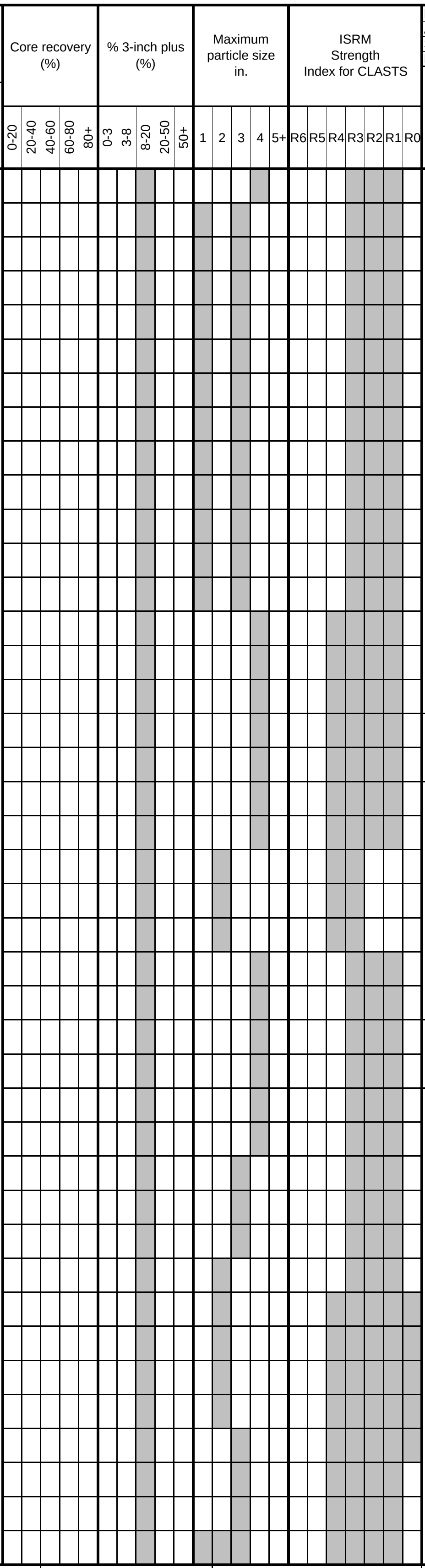
Project No.: 013-1595-002 | Drill date: 9/17/2005 | Coordinates N: E: | Sheet 4 of 5

Location: Tyrone | Drill rig: | Azimuth: N/A | Inclination:

Moisture: D-dry, SM-slightly moist, M-moist, VM-very moist, S-saturated

Physical Testing: D-Point Load-diametral, A-Point Load-axial, S-Sieve, PI-Plasticity Index

Depth (ft)	Soil / Rock Type Description (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsell)	Moisture	Physical Testing	Notes Test Results
120-133	**Yellowish gray sandy clay (SC) groundmass 30% residual (decrepit) cobbles, 20% clay**	SC	5YR 7/2	moist		
133-140	**Lt brn, clayey gravel, (GC), +/- 50% -3" cobbles, low plasticity, 15-20% clay, cobles decrepit (lower horizon)**	GC	5YR 5/6	moist	S, PI (136-138)	T5-136.5 -137.5, 20% oversized not bagged,
140-143	**Lt brn, clayey gravel (GC), 30-40% clay, high plasticity**	GC	5YR 6/4	moist		
143-153	**Red brn, clayey sand and gravel, (SC, GC), with few decrepit cobbles/gravel, 30% clay, 50% sand, mottled with gray, less clay @ 150**	SC	10R 4/6	moist		T5-145-147.5 bucket (145-147)
153-158	**Red brn clayey gravel (GC), 40% -2" gravel, 20-30% clay, med plasticity**	GC	10r 5/4	moist		
158-160	**yellowish gray, 50% gravel, 20% clay, med plasticity**	GC	5Y 7/2	moist		



Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5

Project: Tyrone 1A Stockpile
Datum:
Collar Elev:

Project No.: 013-1595-002
Drill date: 9/17/2005
Coordinates N: E:
Sheet 5 of 5

Location: Tyrone
Drill rig:
Azimuth: N/A
Inclination:

ROTOSONIC COREHOLE LOG - Tyrone Borehole S5	Soil / Rock Type **Description** (i.e. Group Name, % fines/sand/gravel, plasticity, color, HCL reaction, cementation, angularity, odor, structure)	Group Symbol	Color code (Munsel)	D-dry SM-slightly moist M-moist VM-very moist S-saturated Moisture	Core recovery (%)					% 3-inch plus (%)					Maxiumum particle size in.					ISRM Strength Index for CLASTS							D-Point Load-diametral A-Point Load-axial S-Seive PI-Plasticity Index Physical Testing	Notes Test Results	
					0-20	20-40	40-60	60-80	80+	0-3	3-8	8-20	20-50	50+	1	2	3	4	5+	R6	R5	R4	R3	R2	R1	R0			
160	**GC, continued**	GC	5Y 7/2	M								▨										▨	▨	▨	▨				160
-												▨										▨	▨	▨	▨				-
-	**lt brn clayey gravel (GC), high clay content, soft, 40% clay, 50% gravel, high plasticity**		5YR 6/4	VM						▨						▨	▨						▨	▨	▨				-
-										▨						▨	▨						▨	▨	▨				-
-										▨						▨	▨						▨	▨	▨		S, PI	T5- 164-165 (10 lb)	-
165										▨						▨	▨						▨	▨	▨				165
-										▨						▨	▨						▨	▨	▨				-
-	**Red brn clayey gravel, (GC), 10-15% clay fines, non plastic, cobbles weak and friable, weekly cohesive, decrepit**		10R 4/6	SM								▨							▨				▨	▨	▨				-
-												▨				▨							▨	▨	▨				-
-												▨				▨							▨	▨	▨				-
170												▨				▨							▨	▨	▨				170
-												▨				▨							▨	▨	▨				-
-												▨				▨							▨	▨	▨				-
-												▨				▨							▨	▨	▨				-
-			5Y 7/2									▨				▨							▨	▨	▨				-
175	**End of logging at 174' in lower horizon**																												175
-																													-
-																													-
-																													-
-																													-
180																													180
-																													-
-																													-
-																													-
-																													-
185																													185
-																													-
-																													-
-																													-
-																													-
190																													190
-																													-
-																													-
-																													-
-																													-
195																													195
-																													-
-																													-
-																													-
-																													-
200																													200

Scale:

Drilling Contractor:

Driller:

USC (MPa)	
R0	0.25-1.0
R1	1.0-5.0
R2	5.0-25
R3	25-50
R4	50-100
R5	100-250
R6	>250

Golder Associates

APPENDIX B-4

2005 PHELPS DODGE TYRONE, INC.
GEOLOGIC LOGS

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: [illegible]

Hole Number: [illegible]

Date Drilled: [illegible] Type:

Northing: 8274.425

Hole Depth:

Easting: 16931.064

Orientation: [illegible]

C.E.: 6164.116

Logged by: R.J. WAIDLER

09-13-05

10:45 BROWN HYDRAULIC LINE

Page: 1 of 6

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)														Enrch	Notes
Tcu	OxCu	CLT	Elev.	FL	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				0 [illegible]					PALT: SALT: CLAY: LCAP:																					MOIST- TO ALMOST DRY CRUMBLY CLAY GRANULAR W/ GRAVEL .5 TO 1/4" DIAMETER. LIGHT TO MEDIUM BROWN
				2.5 5.0					PALT: SALT: CLAY: LCAP:																					SMALL PEBBLES- COARSE SAND W/ CLAY MATRIX LIGHTLY MOIST 50% COARSE ANGULAR SAND 30% PEBBLES REMAINDER CLAY.
				5.0 7.5					PALT: SALT: CLAY: LCAP:																					COARSE SAND IN CLAY MATRIX W/ ANGULAR PEBBLES BARELY MOIST
				7.5 10.0					PALT: SALT: CLAY: LCAP:																					HEAVY STICKY CLAY YELLOWISH BROWN LESS COARSE SAND PEBBLES & ROCK CLASTS UP TO 3" BARELY MOIST
				10.0 12.0					PALT: SALT: CLAY: LCAP:																					LIGHT BROWN CLAY W/COARSE SAND W/ PEBBLES & ANGULAR ROCK CLASTS UP TO 2½" TRACES OF GYPSUM. BARELY MOIST
Composite:																														
				12.0 15.0					PALT: SALT: CLAY: LCAP:																					LIGHT BROWN STICKY CLAY-MOIST W/ COARSE ANGULAR SAND & PEBBLES PYRITE PRESENT AS DISSEMINATIONS IN ROCK CLASTS
				15.0 17.5					PALT: SALT: CLAY: LCAP:																					LIGHT YELLOWISH BROWN HEAVY STICKY CLAY-MOIST- W/COARSE SAND & ANGULAR PEBBLES. CAN FORM BALLS.
				17.5 20.0					PALT: SALT: CLAY: LCAP:																					MOSTLY LIGHT YELLOWISH BROWN WET STICKY CLAY W/ COARSE SAND & PEBBLES- SEVERAL SMALL INTERVALS OF DRY DARK REDDISH BROWN CLAY W/ PEBBLES.
				20.0 22.5					PALT: SALT: CLAY: LCAP:																					LIGHT YELLOWISH BROWN CLAY MOIST TO WET- W/ COARSE SAND & PEBBLES 60% CLAY CAN FORM BALLS-PLASTIC
				22.5 25.0					PALT: SALT: CLAY: LCAP:																					LIGHT YELLOWISH CLAY- WET STICKY PLASTIC FORMS BALLS- COARSE SAND PEBBLES. CLASTS UP TO 3" DIA. 40-45% CLAY- REMAINDER COARSE SAND PEBBLES, ROCK CLASTS
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services EMPHASIS ON PHYSICAL CHARACTERISTICS Page 2 of 6

Drill Hole Logging Form
Project: IA-1B DUMP
Hole Number: SONIC #1 S1-1A Northing: Easting: C.E.
Date Drilled: 09-13-05 Type: Hole Depth: Orientation: Logged by: RJW

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	OS	Ctz	Ksa	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSl	Cpy	CpySl	Orr #1	Orr #2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				25.0 27.5					PALT: SALT: CLAY: LCAP:																					VERY LIGHT YELLOWISH BROWN COLORED CLAY - LESS THAN ABOVE - BLOCKY - NUMEROUS ANGULAR COARSE SAND FRAGMENTS - MOIST LESS THAN THAN ABOVE. 30-35% CLAY SOME PEBBLES
				27.5 30.0					PALT: SALT: CLAY: LCAP:																					LIGHT GRAY MOIST CLAY W/ NUMEROUS ANGULAR COARSE SAND & PEBBLES ~30% CLAY DOES NOT FORM BALLS.
				30.0 32.5					PALT: SALT: CLAY: LCAP:																					FROM 30' TO 51 MOIST STICKY BALL-FORMING LIGHT BROWN COLORED CLAY ~40% to 45% CLAY W ANGULAR COARSE SAND & PEBBLES FROM 31' to 32.5 LARGE 4" DIA
				32.5 35.0					PALT: SALT: CLAY: LCAP:																				–	ANGULAR ROCKS - NO CLAY - DRY. COARSE ANGULAR SAND, PEBBLES ROCK FRAGMENTS W/~20-25% LIGHT BROWN COLORED STICKY WET CLAY.
				35.0 37.5					PALT: SALT: CLAY: LCAP:																					LIGHT GRAY TO LIGHT BROWN COLORED CLAY - MOIST TO WET - W/COARSE ANGULAR SAND TO 2" DIA. PEBBLES 35% CLAY - FORMS BALLS.
Composite:																														
				37.5 40.0					PALT: SALT: CLAY: LCAP:																					LIGHT BROWN TO LIGHT GRAYISH COLORED CLAY W/ COARSE SAND & ANGULAR PEBBLE/GRAVEL OF PORPHYRY CLAY FORMS BALLS MOIST ~25% CLAY.
				40.0 42.5					PALT: SALT: CLAY: LCAP:																					MOIST COARSE ANGULAR SAND & GRAVEL W/ SOME CLAY - DOES NOT FORM BALLS 15-20% CLAY LIGHT GRAY COLOR.
				42.5 45.0					PALT: SALT: CLAY: LCAP:																					LIGHT YELLOWISH BROWN CLAY W/ COARSE ANGULAR SAND & GRAVEL CLAY 15%-20% DOES NOT FORM BALLS.
				45.0 47.5					PALT: SALT: CLAY: LCAP:																					DAMP LIGHT BROWN TO LIGHT ORANGE CLAY 15% to 20% COARSE ANGULAR SAND & GRAVEL - DOES NOT FORM BALLS, COARSE ANGULAR CRUMBLY
				47.5 50.0					PALT: SALT: CLAY: LCAP:																					SAME AS ABOVE TO 49 · THEN GRAY COARSE ANGULAR GRAVEL & SAND W/ MINOR CLAY - DOES NOT FORM BALLS · CRUMBLY - ALMOST DRY.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

9:45' - DOWN TO 135 09-14-05

Page: 3 of 6

Drill Hole Logging Form
Project: 1A & 1B DUMP CHARACTERISTICS
Hole Number: SIA-1 #1
Date Drilled: 09-13-05
Type:
Northing:
Hole Depth:
Easting:
Orientation:
G.E.:
Logged by:

Analysis			Interval		Drill Log		Graphic Log		Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	FL	H2O	Rock				Code	WC	YC	CS	Qz	Ksp	Chl	FeOx	FeSt	CuOx	CuSl	Py	PySt	Cc	CcSl	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				50.0						PALT.																					MEDIUM GRAY TO LIGHT BROWN COARSE SAND GRAVEL & ROCK CLASS UP TO 2" IN DIA. W/CLAY ~ 15% DOES NOT FORM BALLS. GRANULAR DAMP
										SALT.																					
				52.5						CLAY.																					
										LCAP.																					
				52.5						PALT.																					LIGHT TO MEDIUM BROWN CLAY W/ COARSE ANGULAR SAND & GRAVEL AND ROCK CLASTS TO 2.5" ACROSS CLAY ~ 15% DOES NOT FORM BALLS
										SALT.																					
				55.0						CLAY.																					
										LCAP.																					
				55.0						PALT.																					LIGHT GRAY TO LIGHT BROWN CLAY W/ COARSE ANGULAR SAND, GRAVEL & LARGE (UP TO 4" DIA) ROCK FRAGMENTS - 15% CLAY DOES NOT FORM BALLS - DAMP
										SALT.																					
				57.5						CLAY.																					
										LCAP.																					
				57.5						PALT.																					COARSE SAND, GRAVEL & LARGE (UP TO 5" ACROSS) ROCK CLASTS W/~15% MEDIUM BROWN CLAY DOES NOT FORM BALLS - DAMP
										SALT.																					
				60.0						CLAY.																					
										LCAP.																					
				60.0						PALT.																					LIGHT BROWN TO GRAYISH ANGULAR COARSE SAND, GRAVEL, & LARGE ROCK FRAGMENTS UP TO 2" DIAMETER CLAY DOES NOT FORM BALLS - DAMP
										SALT.																					
				62.5						CLAY.																					
										LCAP.																					
Composite:																															
				62.5						PALT.																					LIGHT TO MEDIUM GRAY COARSE SAND GRAVEL & LARGE ROCK FRAGMENTS DAMP TO ALMOST DRY. ~15% CLAY DOES NOT FORM BALLS.
										SALT.																					
				65.0						CLAY.																					
										LCAP.																					
				65.0			65.0 to 66.5			PALT.																					LIGHT TO MEDIUM BROWN CLAY MATRIX (~15%) W/ COARSE ANGULAR SAND, GRAVEL, AND ROCK CLASTS TO 2" ACROSS CLAY DOES NOT FORM BALLS DAMP TO ALMOST DRY.
										SALT.																					
				67.0						CLAY.																					
										LCAP.																					
				67.0						PALT.																					LIGHT BROWN GRAYISH CLAY MATRIX W/ COARSE ANGULAR SAND GRAVEL & ROCK FRAGMENTS TO 3" ACROSS CLAY ~15% - MOIST TO DAMP
										SALT.																					
				71.5						CLAY.																					
										LCAP.																					
				71.5						PALT.																					MEDIUM GRAY TO LIGHT BROWN CLAY MATRIX (~15% CLAY) W/ COARSE ANGULAR SAND GRAVEL & LARGE ROCK FRAGMENTS UP TO 3" ACROSS DAMP TO DRY CLAY DOES NOT FORM BALLS
										SALT.																					
				74.0						CLAY.																					
										LCAP.																					
				74.0			74.0 to 75.0			PALT.																					LIGHT TO MEDIUM GRAY COLORED CLAY MATRIX W/ COARSE ANGULAR SAND GRAVEL & LARGE UP TO 4" ACROSS ROCK FRAGMENTS ~15% CLAY - DOES NOT FORM CLAY BALLS DAMP
										SALT.																					
				75.0						CLAY.																					
										LCAP.																					
Composite:																															

Page: 4 of 6

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project: 1A & 1B Dump Characteristics
Hole Number: S1A-1
Date Drilled: 9-17-04 Type: Sonic
Northing:
Hole Depth:
Easting:
Orientation:
C.E.:
Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuCx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				77.5 80					FALT: SALT: CLAY: LCAP:																					Orange, md. grey/ sandy to cobbly material up to 4" cobbles minor clay <10%. Damp does not form clay balls support a shovel
				80 82.5					FALT: SALT: CLAY: LCAP:																					Tan, red minor grey 35% clay in ore zone that forms clay balls. damp remainder is sandy to cobbly (up to 4" clasts, will support shovel some completely dry zones
				82.5 85					FALT: SALT: CLAY: LCAP:																					Tans, red silty to sandy with minor pebbles and cobbles (up to 3") mostly dry some damp areas No clay balls will support shovel <5% clay
				85 87.5					FALT: SALT: CLAY: LCAP:																					Red orange 33% clay damp some cobbles and gravel (up to 3") not saturated can form clay balls 1.5 feet of clayey zone
				87.5 90					FALT: SALT: CLAY: LCAP:																					Red, tan sandy gravel, up to 1" <8% clay, damp to dry, no clay balls will support shovel
Composite:																														
				90 92.5					FALT: SALT: CLAY: LCAP:																					Tan, brown, grey, mainly sand gravel and cobbles (up to 4.5") ~10% clay that is damp and forms balls, no saturation. will support shovel.
				92.5 95					FALT: SALT: CLAY: LCAP:																					Grey, tan, yellow bouldery gravel (up to 5") damp <5% clay, no clay balls, will support shovel
				95 97.5					FALT: SALT: CLAY: LCAP:																					Grey orange, white, mostly boulders & gravel, damp, minor clay <10% no clay balls will support shovel
				97.5 100					FALT: SALT: CLAY: LCAP:																				*	Brown to grey clay to clayey gravel, 55% clay that is wet to damp, forms clay balls, up to 4" gravel, clay is 1.5' zone
				100 102.5					FALT: SALT: CLAY: LCAP:																				*	Grey tan clay, damp, will form clay balls sand and gravel is not saturated may not support shovel
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 5 of 6

Project: 1A & 1B DUMP CHARACTERISTICS

Hole Number: S1A-1 Northing: Easting: C.E.:

Date Drilled: 09-14-04 Type: Hole Depth: Orientation: Logged by: R.J. WAIDLER

Analysis			Interval		Drill Log		Graphic Log		Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich.	Notes
Tcu	OxCu	Q.T	Elev.	Ft.	H₂O	Rock				Code	WC	VC	OS	Qtz	Kso	Chl	FeOx	FeSi	CuOx	CuSi	Py	PySi	Cc	CcSi	Cov	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				102.5 106.0			102.5 to 103.5			FALT. SALT. CLAY: LCAP:																					LIGHT GRAY TO LIGHT BROWN CLAY (10 TO 15% CLAY) W/ COARSE SAND GRAVEL, AND LARGE ANGULAR ROCK FRAGMENTS (UP TO 4" ACROSS) FES. CLAY DOES NOT FORM BALLS - DAMP
				106. 108.5						FALT. SALT. CLAY: LCAP:																					LIGHT GRAY TO LIGHT BROWN CLAY (10-15%) W/ COARSE ANGULAR SAND GRAVEL AND LARGE ROCK FRAGMENTS UP TO 4" ACROSS CLAY DOES NOT FORM BALLS DAMP
				108.5 110						FALT. SALT. CLAY: LCAP:																					LIGHT BROWN TO GRAY CLAY MATRIX 10-15% CLAY W/COARSE SAND GRAVEL & LARGE ROCK FRAGMENTS UP TO 3" ACROSS CLAY DOES NOT FORM BALLS DAMP
				110 112.5						FALT. SALT. CLAY: LCAP:																					TO 111' SAME AS ABOVE; FROM 111 TO 112.5 ALMOST DRY GOLDEN YELLOW CLAY MATRIX - CRUMBLY W/COARSE SAND, GRAVEL, ROCK FRAGMENTS
				112.5 115'						FALT. SALT. CLAY: LCAP:																					GOLDEN YELLOW CLAY MATRIX TO 114'; THEN MIXED GRAY & YELLOW CLAY ~10 TO 15% W/ COARSE ANGULAR SAND, GRAVEL, & ROCK FRAGMENTS DAMP CLAY DOES NOT BALL
Composite:																															
				115 117.5						FALT. SALT. CLAY: LCAP:																					LIGHT BROWN CRUMBLY CLAY MATRIX (10% TO 15%) W/ COARSE SAND, GRAVEL & ROCK FRAGMENTS DAMP TO ALMOST DRY CLAY DOES NOT FORM BALLS.
				117.5 120						FALT. SALT. CLAY: LCAP:																					DAMP TO AMOST DRY CLAY DOES NOT BALL MEDIUM BROWN CRUMBLY CLAY MATRIX (10 TO 15%) W/ COARSE ANGULAR SAND, GRAVEL ROCK
				120 122.5						FALT. SALT CLAY: LCAP:																					FRAGMENTS UP TO 3" ACROSS MEDIUM GRAY ALMOST COMPLETELY DRY MINOR CRUMBLY CLAY < 10% W/COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 6" ACROSS CLAY DOES NOT BALL
				122.5 125						FALT. SALT. CLAY: LCAP:																					LIGHT GRAY TO MEDIUM BROWN CLAY MATRIX (15% CLAY) W/ COARSE ANGULAR SAND, GRAVEL & ROCK FRAGMENTS CLAY DOES NOT BALL DAMP.
				125 127.5						FALT. SALT. CLAY: LCAP:																					LIGHT YELLOWISH BROWN CRUMBLY CLAY MATRIX ~15% CLAY W/ COARSE ANGULAR SAND, GRAVEL & ROCK FRAGMENTS TO 2" ACROSS CLAY DOES NOT BALL DAMP TO ALMOST DRY
Composite:																															

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 6 of 6

Project: 1A & 1B Dump Characteristics

Hole Number: S1A-1 Northing: Easting: C.E.:

Date Drilled: 9-14-05 Type: Sonic Hole Depth: Orientation: Logged by: A. Londe

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	OLT	Elev.	Ft	H₂O	Rock			Code	WC	YC	QS	Ctz	Ksp	Ch	FeOx	FeSi	CuOx	CuSi	Py	PySi	Cc	CcSi	Cpy	CpySi	Cmin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				127.5 130					PALT: SALT: CLAY: LCAP:																					Orange, red, white mainly gravel and cobbles, damp to dry, up to 3" cobbles, <15% clay that is damp and forms crumbly clay balls, will support shovel)
				130 132.5					PALT: SALT: CLAY: LCAP:																					Brown, grey, red boulders & gravel (up to 5" dia.) minor clay <10%, no clay balls, dry to damp, will support shovel.
				132.5 135					PALT: SALT: CLAY: LCAP:																					Orange, tan, grey, boulders, gravel (up to 4" dia.), minor clay (<10%), damp to dry will support shovel
				135 137.5					PALT: SALT: CLAY: LCAP:																					Tan, grey gravel with minor cobbles (up to 2"), damp to dry minor clay <10%, no clays, will support shovel
Composite:				137.5 140					PALT: SALT: CLAY: LCAP:																					White, red, grey mixed sand & clay, ~35% clay, damp, some local clay balls, majority is consistency of cement, should support shovel, minor cobbles up to 5"
				140 142.5					PALT: SALT: CLAY: LCAP:																					Grey cobbles & gravel mainly boulders (up to 5") dry to damp will support shovel, trace fines
				142.5 145					PALT: SALT: CLAY: LCAP:																					Red, grey gravel with minor cobbles (1.5 to 2") dry to damp will support shovel
				145 147.5					PALT: SALT: CLAY: LCAP:																					Grey gravel and cobbles (up to 5") dry to damp, <5% clay, no clay balls will support shovel.
				147.5 150					PALT: SALT: CLAY: LCAP:																					Orange to grey gravel with some cobbles (up to 4") minor fines, dry to damp, will support shovel.
Composite:			EOH						PALT: SALT: CLAY: LCAP:																					

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 1 of 5

Project: IAS IB DUMP CHARACTERISTICS

Hole Number: SIA-2

Northing: 9431.726

Easting: 18943.572

CE: 6158.877

Date Drilled: 09-14-05 Type:

Hole Depth:

Orientation:

Logged by: R.J. WAIDLER

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	QLT	Elev	Ft.	H_2O	Rock			Code	WC	YC	OS	Ctz	Ksp	Chl	FeOx	FeSl	CuOx	CuSl	Py	PySt	Cc	CcSt	Cpy	CpySt	Omnt1	Cmn2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				0 2.5					PALT: SALT CLAY: LCAP:																					MAROON RED CLAY MATRIX ~25% CLAY W/ COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS DAMP CLAY STICKY BUT DOESNT QUITE FORM BALLS
				2.5 5.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX CRUMBLY & GRANULAR ~15% CLAY W/ COARSE ANGULAR SAND GRAVEL & ROCK FRAGMENTS UP TO 6" ACROSS. DAMP CLAY DOES NOT BALL
				5.0 7.5					PALT: SALT: CLAY: LCAP:																					MEDIUM TO DARK RED CLAY MATRIX CRUMBLY GRANULAR W/ ANGULAR -15% CLAY COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 2" ACROSS DAMP TO MOIST
				7.5 10.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY & SAND MATRIX ~10% CLAY W/ ANGULAR COARSE SAND GRAVEL & ROCK FRAGMENTS UP TO 4" ACROSS DAMP
				10.0 12.5					PALT: SALT: CLAY: LCAP:																					MEDIUM TO DARK RED CLAY MATRIX ~20% CLAY W/ ANGULAR COARSE SAND GRAVEL & ROCK FRAGMENTS CLAY FORMS BALLS. MOIST
Composite:																														
				12.5 15.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX STICKY BUT DOES NOT FORM BALLS; ~15% W/ ANGULAR COARSE SAND GRAVEL & ROCK FRAGMENTS UP TO 2" ACROSS, MOIST
				15.0 17.5					PALT: SALT: CLAY: LCAP:																					DARK RED CLAY MATRIX ~15% STICKY BUT DOESNT FORM BALLS W/ ANGULAR COARSE SAND GRAVEL & ROCK FRAGMENTS UP TO 6" ACROSS MOIST- ROCKY
				17.5 20.0					PALT: SALT: CLAY: LCAP:																					REDDISH BROWN CLAY MATRIX ~15% TO 20% CLAY W/ ANGULAR COARSE SAND, GRAVEL, & ROCK FRAGMENTS UP TO 3" ACROSS MOIST CLAY STICKY BUT DOES NOT FORM BALLS
				20.0 22.5					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~20% CLAY BARELY FORMS BALLS W/ COARSE ANGULAR SAND GRAVEL & ROCK FRAGMENTS UP TO 2" ACROSS CRUMBLY- DAMP
				22.5 25.0					PALT: SALT: CLAY LCAP:																					MEDIUM RED CLAY MATRIX ~20% W/ LIGHT GRAY CLASTS OF ALTERED MP, COARSE ANGULAR SAND, GRAVEL & ROCK FRAGMENTS CLAY BARELY FORMS BALLS MOIST FEWER ROCKS
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

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Drill Hole Logging Form

Project: LAS1B DUMP CHARACTERISTICS

Hole Number: S1A-2

Date Drilled: 09-14-05

Type:

Northing:

Hole Depth:

Easting:

Orientation:

C.E.:

Logged by: RJW

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich.	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeCx	FeSt	CuOx	CuSi	Py	PySi	Cc	CcSi	Cpy	Cp/St	Orn.1	Orn.2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				25.0 27.5					PALT: SALT: CLAY: LCAP:																					MEDIUM TO DARK RED CLAY MATRIX ~20-25% CLAY - STICKY - FORMS BALLS w/ ANGULAR COARSE SAND, GRAVEL NO LARGE ROCK FRAGMENTS MOIST CLAY STICKY
				27.5 30.0					PALT: SALT: CLAY: LCAP:																					FROM 27.5 TO 29' - DRY MOSTLY ROCK FRAGMENTS UP TO 3" ACROSS FROM 29' TO 30' - WET - MEDIUM RED CLAY ~25% HEAVY STICKY FORMS BALLS; W/ ANGULAR COASE SAND GRAVEL
				30.0 32.5					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~15% CLAY W/ NUMEROUS ROCK FRAGMENTS & COARSE ANGULAR SAND MOIST ROCK FRAGMENTS UP TO 3" ACROSS. CLAY DOES NOT FORM BALLS
				32.5 35.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~15% CLAY W/ NUMEROUS ROCK FRAGMENTS UP TO 3" ACROSS. ANGULAR COARSE SAND & GRAVEL CLAY STICKY BUT MOIST DOES NOT FORM BALLS TOO MUCH SAND
				35.0 37.5					PALT: SALT: CLAY: LCAP:																					DARK RED HEAVY STICKY CLAY ~25% - FORMS BALLS - WITH ANGULAR COARSE SAND GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS MOIST
Composite:																														
				37.5 40.0					PALT: SALT: CLAY: LCAP:																					FROM 37.5 TO 38.5 SAME AS ABOVE HEAVY STICKY BALLING CLAY MOIST FROM 38.5 TO 40' - DRY LARGE 6" ACROSS TO GRAVEL SIZED ROCK FRAGMENTS - NO CLAY
				40.0 42.5					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~15% TO 20% CLAY - DOES NOT BALL W/ ANGULAR COARSE SAND & GRAVEL NO LARGE ROCK FRAGMENTS MOIST.
				42.5 45.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED STICKY CLAY ~20% TO 15% BARELY FORMS BALLS - W/ INCLUDED ANGULAR COARSE SAND GRAVEL NO LARGE ROCK FRAGMENTS MOIST
				45.0 47.5					PALT: SALT: CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~15% CLAY - DOES NOT BALL - BLOCKY ANGULAR DAMP W/ ANGULAR COARSE SAND, GRAVEL & SOME ROCK FRAGMENTS UP TO 3" ACROSS
				47.5 50.0					PALT: SALT: CLAY: LCAP:																					LIGHT BROWN SANDY CLAY ~30% CLAY - WET FORMS BALLS - W/ ANGULAR COARSE SAND, GRAVEL NO LARGE ROCK FRAGMENTS
Composite:																														

BAD MATERIAL SECTION

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: 1A&1B DUMP CHARACTERISTICS

Hole Number: SIA-2 Northing: Easting: C.E.:

Date Drilled: 09-1405 Type: Hole Depth: Orientation: Logged by: RJW

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSl	CuOx	CuSl	Py	PySl	Cc	CcSl	Cpy	CpySl	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				50.0 52.5					FALT. SALT. CLAY: LCAP:																					LIGHT BROWN TO RED CLAY MATRIX ~15-20% CLAY W/ ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS CLAY DOES NOT BALL-TOO MUCH SAND MOIST
				52.5 55.0					FALT. SALT. CLAY: LCAP:																					FROM 52.5 TO 54'- DAMP GRANULAR CRUMBLY SAND(ANGULAR) & CLAY GRAYISH RED FROM 54' TO 55' HEAVY STICKY CLAY W/ ANGULAR COARSE SAND & GRAVEL-MOIST
				55.0 57.5					FALT. SALT. CLAY: LCAP:																					MEDIUM RED HEAVY STICKY CLAY MATRIX W/ ANGULAR COARSE SAND & MINOR GRAVEL MOIST TO WET CLAY FORMS BALLS.
				57.5 60.0					FALT. SALT. CLAY: LCAP:																					MEDIUM RED CLAY MATRIX ~20% CLAY W/ ANGULAR COARSE SAND, GRAVEL AND ROCK FRAGMENTS - SOME CLASTS OF ALTERED MP DAMP TO DRY @ 60.0 CLAY FORMS BALLS
				60.0 62.5					FALT. SALT. CLAY: LCAP:																					REDDISH TO LIGHT BROWN SANDY CLAY W/ NUMEROUS LARGE ANGULAR ROCK FRAGMENTS DAMP TO ALMOST DRY. DOES NOT BALL
Composite:																														
				62.5 65.0					FALT. SALT. CLAY: LCAP:																					LIGHT BROWNISH RED CRUMBLY SANDY TO GRANULAR CLAY DAMP TO ALMOST DRY W/ ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 5" ACROSS
				65.0 67.5					FALT. SALT. CLAY: LCAP:																					GRAY SANDY CLAY POWDERY & MOSTLY DRY W/ ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS.
				67.5 70.0					FALT. SALT. CLAY: LCAP:																					MEDIUM RED SANDY CLAY MATRIX W/ ~15% CLAY W/ ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS. DAMP CLAY DOES NOT BALL
				70.0 72.5					FALT. SALT. CLAY: LCAP:																					REDDISH TO LIGHT BROWN SANDY CLAY- GRANULAR BLOCKY DOES NOT BALL ~15% CLAY W/ ANGULAR COARSE SAND, GRAVEL, ROCK FRAGMENTS UP TO 4" ACROSS DAMP TO ALMOST DRY
				72.5 75.0					FALT. SALT. CLAY: LCAP:																					MEDIUM TO DARK RED BLOCKY GRANULAR CLAY W/ COARSE SAND GRAVEL & ROCK FRAGMENTS CLAY BALLS DAMP
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form
Project:
Hole Number: SIA-2 Northing: Easting: C.E.:
Date Drilled: 09-15-04 Type: Hole Depth: Orientation: Logged by: RSW

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Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich.	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	OS	Qtz	Ksp	Chl	FeOx	FeSl	CuOx	CuSl	Py	PySt	Cc	CcSl	Cpy	CpySt	Omn1	Omn2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structural)
				75.0 78.5					PALT: SALT: CLAY: LCAP:																					FROM 75 TO 78' TOTALLY SATURATED RED SANDY CLAY - STICKY WET LIKE TOOTHPASTE 78.0 TO 78.5 DRY POWDERY MEDIUM GRAY SANDY CLAY
				78.5 80.0					PALT: SALT: CLAY: LCAP:																					FIRST 1/3 - LARGE ANGULAR ROCK FRAGMENTS MIDDLE 1/3: MEDIUM RED HARD CLAY W/ COARSE SAND & GRAVEL MOIST; LAST 1/3 ALMOST DRY-DAMP SANDY GRAY CLAY W/ GRAVEL
				80.0 82.5					PALT: SALT: CLAY: LCAP:																					GRAY-RED HARD CRUMBLY CLAY W/ ANGULAR COARSE SAND; CLAY DOES NOT BALL - DAMP, ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS
				82.5 85.0					PALT: SALT: CLAY: LCAP:																					MEDIUM RED TO GRAYISH CRUMBLY BLOCKY CLAY W/ ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS TO 3" ACROSS - DAMP
				85.0 87.5					PALT: SALT: CLAY: LCAP:																					SAME AS ABOVE W/ WELL DEFINED CORE - HARD CLAY - DAMP
Composite:																														
				87.5 90.0					PALT: SALT: CLAY: LCAP:																					SAME AS ABOVE W/ CRUMBLY ANGULAR BLOCKY CLAY DOES NOT BALL DAMP
				90.0 92.5					PALT: SALT: CLAY: LCAP:																					SATURATED - WET - MINOR RED CLAY - MOSTLY ANGULAR COARSE SAND, GRAVEL & ROCK FRAGMENTS UP TO 3" ACROSS.
				92.5 95.0					PALT: SALT: CLAY: LCAP:																					RED TO LIGHT GRAY CLAY MATRIX W/ ALTERED LIGHT GRAY MP CLASTS BLOCKY ANGULAR MOIST TO DAMP CLAY DOES NOT BALL MOIST TO DAMA
				95.0 97.5					PALT: SALT: CLAY: LCAP:																					COMPLETELY SATURATED SANDY RED CLAY W/ ANGULAR COARSE SAND, GRAVEL SOFT STICKY - LIKE TOOTHPASTE.
				97.5 100.0					PALT: SALT: CLAY: LCAP:																					LARGE [illegible] FRAGMENTS UP TO 6" ACROSS W/ REDDISH SAND GRAVEL & MINOR CLAY DAMP TO ALMOST DRY.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

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Project:

Hole Number: SIA-2 Northing: Easting: C.E.:

Date Drilled: 09-15-05 Type: Hole Depth: Orientation: Logged by: RJW

Analysis			Interval		Drill Log		Graphic Log		Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev.	Ft	H2O	Rock				Code	WC	YC	CS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Orm1	Orm2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				100.0						FALT:																					DRY CRUMBLY ALTERED MP FRAGMENTS, GRAVEL, CLAY & SAND SIZE UP TO 4" ACROSS DAMP TO ALMOST DRY. CLAY < 10% LIGHT BROWN COLOR.
										SALT:																					
				102.5						CLAY:																					
										LCAP:																					
				102.5						FALT:																					NUMEROUS FRAGMENTS OF ALTERED MP UP TO 3" ACROSS. GRAY TO LIGHT BROWN CLAY SAND & GRAVEL. DAMP TO ALMOST DRY.
										SALT:																					
				105.0						CLAY:																					
										LCAP:																					
				105.0						FALT:																					LAST THREE INTERVALS ALL VERY SIMILIAR - DAMP TO ALMOST DRY NUMEROUS FRAGMENTS OF ALTERED MP, CLAY, SAND GRAVEL LIGHT GRAYISH BROWN FRAGMENTS UP
										SALT:																					
				107.5						CLAY:																					
										LCAP:																					
				107.5						FALT:																					TO 3" ACROSS. ~15% CLAY NON-BALLING. E.O.H. @ 110'
										SALT:																					
				110			EOH 110'			CLAY:																					
										LCAP:																					
										FALT:																					
										SALT:																					
										CLAY:																					
										LCAP:																					
Composite:																															
										FALT:																					
										SALT:																					
										CLAY:																					
										LCAP:																					
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										FALT:																					
										SALT																					
										CLAY:																					
										LCAP:																					
Composite:																															

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: 1A & 1B Stockpile Characterization

Hole Number: SA1-3 Northing: 10092.41 Easting: 18990.928 C.E.: 6169.825

Date Drilled: 9-15-05 Type: Sonic Hole Depth: 110' Orientation: -90° Logged by: A. Lande

* Golder removed some material listed below.

Page: 1 of 5

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				0 2.5					FALT: SALT: CLAY: LCAP:																					Light brown, gravel to clay damp, w/ clay, forms clay balls, gravels (up to 1.5") will compact under shovel
				2.5 5.0					FALT: SALT: CLAY: LCAP:																					Gray to minor red boulders, cobbles & gravel (up to 6") dry to locally damp, minor sandy fines ~5%, will support shovel.
				5.0 7.5					FALT: SALT: CLAY: LCAP:																					Orange to white sand gravel, with minor clay, barely forms gritty clay balls, up to 5.5" cobbles ~5% clay damp, wettest in clay will support shovel.
				7.5 10.0					FALT: SALT: CLAY: LCAP:																					Orange, tan, brown, gravel, cobbles, sand, & clay ~15% clay will form clay balls damp, clay is wettest, will compact under shovel.
				10.0 2.5			Golder 9.35 lbs. removed		FALT: SALT: CLAY: LCAP:																					tan, brown, orange gravel, clay, & minor cobbles (up to 2.5") clay forms gritty balls, damp will compact under shovel 15% clay
Composite:																														
				12.5 15.0					FALT: SALT: CLAY: LCAP:																					Brown, tan, yellow clay, cobbles (up to 4") and gravel, clay will form gritty balls, damp 15% clay will compact under shovel.
				15.0 17.5					FALT: SALT: CLAY: LCAP:																					Red, light brown, grey gravel, clay & cobbles (up to 4.5") 10% clay mildly wet to damp forms gritty clay balls will support shovel.
				17.5 20.0					FALT: SALT: CLAY: LCAP:																					Red & white gravel, clay & cobbles (up to 2.5") clay forms gritty balls is mildly wet to damp, will compact under shovel 20% clay
				20.0 22.5					FALT: SALT: CLAY: LCAP:																					Red light brown, white, yellow gravel, cobbles (up to 2.5") minor sand 10% clay, will form gritty clay balls, damp, will support shovel
				22.5 2.5'					FALT: SALT: CLAY: LCAP:																					Red, white, orange gravel, clay & sand, & cobbles (up to 2.5") damp to mildly wet 15% clay will form gritty clay balls, will compact under shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder removed some material listed below.

Page: 2 of 5

Project: 1F & 1B Stockpile Characterization

Hole Number: SIA-3
Northing:
Easting:
C.E.:

Date Drilled: 9-15-05
Type: Sonic
Hole Depth: 110'
Orientation: -90°
Logged by: A. Lande

Analysis			Interval		Drill Loc		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				25					PALT:																					brown orange, white gravel clay & cobbles (up to 2.5"), 10% clay, that forms gritty friable balls, damp, will compact under shovel.
									SALT:																					
									CLAY:																					
				27.5					LCAP:																					
				27.5					PALT:																					Red, white orange cobbles clay & gravel (up to 3.5") mildly wet to damp clay 15% forms gritty friable balls, will compact under shovel.
									SALT:																					
									CLAY:																					
				30					LCAP:																					
				30					PALT:																					Grey red white boulders, cobbles, clay & gravel (up to 5") 15% clay will form gritty clay balls, damp will compact under shovel.
									SALT:																					
									CLAY:																					
				32.5					LCAP:																					
				32.5					PALT:																					light brown, red, white gravel, clay & cobbles (up to 2.5") 15% damp clay that forms gritty clay balls, will compact under shovel
									SALT:																					
									CLAY:																					
				35					LCAP:																					
				35			Golder 6.5 lbs. Removed.		PALT:																					Red grey gravel & clay (up to 1.5") damp clay 20% will form gritty clay balls, will compact under shovel.
									SALT:																					
									CLAY:																					
				37.5					LCAP:																					
Composite:																														
				37.5					PALT:																					Red grey white clay, cobbles and gravel (up to 4") damp to mildly wet clay will form gritty balls, will compact under shovel.
									SALT:																					
									CLAY:																					
				40					LCAP:																					
				40					PALT:																					Grey Red black orange boulders, cobbles, gravel & mixing fines, damp will support shovel. boulders are locally friable due to feldspars altering to white clay.
									SALT:																					
									CLAY:																					
				42.5					LCAP:																					
				42.5					PALT:																					Red white sand, gravel & clay (up to 1.5") damp clay mix with sand does not form balls (wet) will compact under shovel.
									SALT:																					
									CLAY:																					
				45					LCAP:																					
				45					PALT:																					Orange white light brown, gravel, clay, cobbles (up to 4") damp clay 15% forms gritty balls, will compact under shovel
									SALT:																					
									CLAY:																					
				47.5					LCAP:																					
				47.5					PALT:																					Red brown, white clay & gravel damp clay 25% forms gritty clay balls (up to 1.5" dia gravel) will compact under shovel
									SALT:																					
									CLAY:																					
				50					LCAP:																					
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project 1A & 1B Dump Characterization

Hole Number: S1A-3

Date Drilled: 9-15-05 Type: Sonic

Northing:

Hole Depth: 110'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

* Golder took 60-62.5' for analysis and removed some material listed below.

Page: 3 of 5

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev	Ft	H_2O	Rock			Code	WC	YC	QS	Qtz	Kss	Chl	FeOx	FeSl	CuOx	CuSl	Py	PySl	Cc	CcSl	Cpy	CpySl	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				50 52.5			Golder 9.15 lbs removed		PALT: SALT: CLAY: LCAP:																					Red grey, white gravel, clay, & cobbles (up To 4"), 10% damp clay will from gritty balls, will compact under shovel
				52.5 55					PALT: SALT: CLAY: LCAP:																					Red, white, orange boulders, cobbles, clay, & gravel (up to 5") damp clay 20% will form gritty clay balls, will compact under shovel.
				55 57.5					PALT: SALT: CLAY: LCAP:																				*	Red white clay & cobbles (up to 4.5") 30% mildly wet to damp clay will form balls, shovel will sink
				57.5 60					PALT: SALT: CLAY: LCAP:																				*	Red white, orange clay gravel, & cobbles (up to 2.5"), 35% damp to mildly wet clay, will form gritty clay balls, Shovel will compact to sink (borderline)
				60 62.5			Interval taken by Golder for analysis		PALT: SALT: CLAY: LCAP:																					Red, grey, white orange, gravel sand, clay cobbles. (up to 2.5") damp clay will from gritty balls (15% clay) will compact under shovel, Damp
Composite:																														
				62.5 65					PALT: SALT: CLAY: LCAP:																					Red white light brown gravel, cobbles (up To 5"), sand & minor white clay (5%) will form gritty balls, damp, will support shovel.
				65 67.5					PALT: SALT: CLAY: LCAP:																					White, Red Cobbles (up to 4"), gravel & <5% white clay, no clay balls damp to dry; will support shovel
				67.5 70					PALT: SALT: CLAY: LCAP:																					White, red, cobbles (up To 4"), gravel and minor 5% white clay, damp to dry, will form gritty balls, will support shovel
				70 72.5			Golder 8.40 lbs, Removed		PALT: SALT: CLAY: LCAP:																					Red, white gravel, sand, clay (up to 1" dia.) damp red clay forms gritty friable balls, will compact under shovel. ~11% clay
				72.5 75					PALT: SALT: CLAY: LCAP:																					Red, orange, grey cobbles (up to 2") gravel & minor red clay (5%), damp no clay balls; will support shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder removed some material listed below.

Page: 4 of 5

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-3　Northing:　Easting:　C.E.:

Date Drilled: 9-15-05　Type: Sonic　Hole Depth: 100'　Orientation: -90°　Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev	Ft	H₂O	Rock			Code	WD	YC	DS	Qtz	Kso	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Ormin1	Ormin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				75 77.5					PALT: SALT: CLAY: LCAP:																					Red, white grey cobbles (up to 2.5") gravel & sand, silt (<50%) damp, no clay balls, will support shovel.
				77.5 80					PALT: SALT: CLAY: LCAP:																					Red grey boulder and gravel, mix [illegible] damp [illegible] clay balls, will support shovel.
				80 82.5					PALT: SALT: CLAY: LCAP:																					Red, orange, grey cobbles (up to 2.5") gravel, minor clay (<5%) damp, forms gritty friable clay balls, will support shovel.
				82.5 85					PALT: SALT: CLAY: LCAP:																					Red, white boulders, gravel (up to 3.5") & clay, damp to dry, no clay balls, will support shovel. ~5% clay
Composite:				85 87.5					PALT: SALT: CLAY: LCAP:																					Red white boulders cobbles gravel (up to 5") and sand/clay (5%) damp, will form gritty friable clay balls, will support shovel
				87.5 90					PALT: SALT: CLAY: LCAP:																					Red, white gravel cobbles (up to 3.5") & clay (10%) damp mixed clay/sand [illegible] will support some under shovel.
				90 92.5					PALT: SALT: CLAY: LCAP:																					Red white orange boulders & cobble (up to 5"), minor clay (<5%) no clay balls, will support shovel, damp
				92.5 95			Golder 9.90 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Red, white, boulders, cobble sandy minor fines damp to dry (up to 6") will support some white gravel dia. to 4" fines no clay balls
				95 97.5					PALT: SALT: CLAY: LCAP:																					Orange, red, white boulders, cobble/gravel (up to 4.5") minor fines/damp, no clay balls, will support shovel
Composite:				97.5 100					PALT: SALT: CLAY: LCAP:																					Red, white, cobbles & gravel (up to 2.5") minor fines, damp, no clay balls, will support shovel

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 5 of 5

Project: 1A & 1B Stockpile Characterization
Hole Number: S 1A-3
Date Drilled: 9-15-05 Type: Sonic
Northing:
Hole Depth: 110'
Easting:
Orientation: -90°
C.E.:
Logged by: A. Lando

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	OS	Qtz	Ksc	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CoSt	Cov	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				100 102.5					FALT: SALT: CLAY: LCAP:																					Red, white cobbles (up to 4.5"), gravel, sand & minor clay, damp, no clay balls, will compact a little under shovel due to 30% fines
				102.5 105			Golder 32.35 lbs. Removed		FALT: SALT: CLAY: LCAP:																					Black, dark brown soil, clay, gravel, top foot of interval is black soil with charcoal, wood, plant matter. Sand at base, 20% clay, damp, gritty, clay balls, will compact
				105 107.5					FALT: SALT: CLAY: LCAP:																					brown, pinky, tan, black, minor soil and remainder Gila, mainly sandy partially consolidated, damp, minor clay balls will support shovel
				107.5 110			Golder 9.30 lbs. Removed		FALT: SALT: CLAY: LCAP:																					Light brown Gila, mildly wet to damp sandy material with minor fines, will compact some under shovel, no clay balls
			E.O.H.						FALT: SALT: CLAY: LCAP:																					

Composite:

Composite:

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 1 of 6

* Golder remove material from intervals listed below,

Project: IAS 1B DUMP CHARACTERISTICS
Hole Number: SIA-4
Date Drilled 07-15-05
Type:
Northing: 8849.394
Hole Depth:
Easting: 18605.652
Orientation:
C.E.: 6302.127
Logged by: RJ WAIDLER & A. LANDE

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	OS	Clz	Ksz	Chl	FeOx	FeSi	CuOx	CuSi	Py	PySi	Cc	CcSl	Cpy	CpySi	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				5 7.5					PALT: SALT: CLAY: LCAP:																					MOSTLY LARGE ROCKS UP TO 6" ACROSS SOME GRAVEL & COARSE SAND ≤5% CLAY DAMP TO ALMOST DRY MEDIUM GRAY COLOR DAMP TO ALMOST DRY
				7.5 10.0			Golder 10.50 lbs. Removed		PALT: SALT: CLAY: LCAP:																					FROM 5' TO 7' LARGE ROCK FRAGMENTS ANGULAR DAMP; FROM 7 TO 7.5' HEAVY STICKY BALL-FORMING MEDIUM GRAY CLAY W/ ANGULAR COARSE SAND MOIST.
				10.0 12.5					PALT: SALT: CLAY: LCAP:																					FROM 7.5 TO 8.5 - LIGHT BROWN CLAY MATRIX W/ CONSIDERABLE GRAVEL FROM 8.5 TO 10' GRAVEL & COARSE SAND ANGULAR - W/ SOME CLAY - NON-BALLING MOIST.
				12.5 15.0					PALT: SALT: CLAY: LCAP:																					MOSTLY GRAVEL & ROCK FRAGMENTS W/ COARSE ANGULAR SAND ~ 10% MEDIUM GRAY CLAY MOIST (GRANITE ROCK FRAGMENTS UP TO 3" ACROSS MOIST
				15.0 17.5					PALT: SALT: CLAY: LCAP:																					ANGULAR COARSE GRAVEL & SAND W/ SECONDARY CLAY ~10% OCCASSIONAL MP ROCK FRAGMENTS MOIST. NON-BALLING SLIGHTLY REDDISH TO LIGHT GRAY TRI COLOR
Composite:																														
				17.5 20.					PALT: SALT: CLAY: LCAP:																					SAME AS ABOVE - MEDIUM GRAY GRAVEL - COARSE ANGULAR SAND MOIST
				20.0 22.5					PALT: SALT: CLAY: LCAP:																					SAME AS ABOVE - ANGULAR COARSE SAND, GRAVEL W/ MINOR CLAY. MOIST MEDIUM GRAY COLOR. MOIST
				22.5 25.0					PALT: SALT: CLAY: LCAP:																					COARSE ANGULAR GRAVEL, COARSE SAND, ~10% CLAY NON-BALLING W/ LARGE ROCK FRAGMENTS @ BOTTOM OF INTERVAL (UP TO 4" ACROSS) MOIST
				25.0 27.5					PALT: SALT: CLAY: LCAP:																					ANGULAR COARSE GRAVEL, SAND & MINOR CLAY - NON-BALLING - CLAY < 10% OCCASSIONAL LARGE (TO 3") ROCK FRAGMENTS MOIST.
				27.5 30.5			Golder 9.70 lbs. Removed		PALT: SALT: CLAY: LCAP:																					LIGHT YELLOWISH GRAY CLAY MATRIX 15-20% CLAY - NON-BALLING, SOLID CORE W/ INCLUDED COARSE SAND & GRAVEL MOIST
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

*Golder removed interval 37.5-40'. and material from locations listed below.

Page: 2 of 6

Project: 1A S 1B Dump Characteristics

Hole Number: SLA-4

Date Drilled: 9/15/05 Type: Sonic

Northing:

Hole Depth: 150'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSi	CuOx	CuSi	Py	PySi	Cc	CcSi	Cpy	CpySi	Cmt1	Cmt2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				30.0 32.5					PALT: SALT: CLAY: LCAP:																					White-grey gravel & clay (up to 1.5") mildly wet clay (25%) forms gritty clay balls will compact with weight of shovel.
				32.5 35					PALT: SALT: CLAY: LCAP:																					White-grey cobbles gravel & clay (up to 4" dia.) mildly wet clay. forms balls (mostly gritty) will compact under shovel weight.
				35 37.5					PALT: SALT: CLAY: LCAP:																					Grey-brown cobbles and gravel, ~10% mildly wet clay. forms gritty clay balls (up to 3.5" cobbles). will support shovel
				37.5 40	Golder took this interval				PALT: SALT: CLAY: LCAP:																					Grey gravel with minor cobbles (up to 2") and ~10% clay no clay balls too much sand will support a shovel.
				40 42.5					PALT: SALT: CLAY: LCAP:																				*	Grey-white gravel & clay (up to 1" dia.) clay 35% mildly wet forms gritty clay balls, shovel will compact.
Composite:																														
				42.5 45					PALT: SALT: CLAY: LCAP:																					Grey-white boulders (up to 5") cobbles gravel & clay mildly wet (15% clay) forms gritty clay balls will compact ~ sand under shovel
				45 47.5					PALT: SALT: CLAY: LCAP:																					Grey, red, tan boulders, cobbles (up to 5"), gravel, some clay (5%) no clay balls, damp will support shovel.
				47.5 50			Golder 10.55 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Grey gravel, cobbles (up to 2.5") and clay (15-20%) damp to mildly wet will form gritty clay balls, will compact under shovel.
				50 52.5					PALT: SALT: CLAY LCAP:																					Grey gravel (up to 1") and ~10% clay damp forms gritty clay balls, will compact under shovel
				52.5 55					PALT: SALT: CLAY: LCAP:																					Grey-white boulders (up to 5") cobbles, gravel & clay ~15% damp to dry will form gritty clay balls will support shovel
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

*Golder removed material listed below Page: 3 of 5

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-4 Northing: Easting: C.E.:

Date Drilled: 9-16-05 Type: Sonic Hole Depth: 150' Orientation: -90° Logged by: A. Londo

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)														Enrich	Notes
Tcu	CxCu	QLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSl	Py	PySl	Cc	CcSl	Cpy	CpySl	Omn1	Omn2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				55 58.5					PALT: SALT: CLAY: LCAP:																					Grey-red boulders (up to 5"), cobbles & minor red clay (5%) / gritty clay balls, will support shovel, damp [illegible], boulders
				58.5 61					PALT: SALT: CLAY: LCAP:																					Red-grey cobbles, gravel & clay (.5" to 2.5") / red clay [illegible] 15% damp, forms gritty clay balls / will compact sand under shovel
				61 63.5					PALT: SALT: CLAY: LCAP:																					Red-grey gravel & clay (up to 1" dia.) red clay 15%, damp, will form gritty clay balls will compact under shovel
				63.5 66					PALT: SALT: CLAY: LCAP:																					Grey-red Boulders gravel and minor (<5%) clay dry, forms gritty friable balls (up to 5" size) will support shovel
				66 68.5					PALT: SALT: CLAY: LCAP:																					Grey-light brown cobbles (up to 2.5") gravel, minor clay (<5%) damp forms poor gritty friable clay balls will compact a little under shovel
Composite:																														
				68.5 70			Golder 11.20 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Grey, red boulder (up to 4.5") gravel (majority) dry to damp, no clay balls, will support shovel
				70 72.5					PALT: SALT: CLAY: LCAP:																					Light brown, grey, yellow cobbles (up to 4.5"), gravel & 10% clay damp to dry, will form gritty clay balls, will support shovel.
				72.5 75					PALT: SALT: CLAY: LCAP:																					Grey-red boulders (up to 5"), feldspars / [illegible] boulder altered to white clay & yellow clay (10-15%). damp will support shovel. forms gritty clay balls
				75 77.9					PALT: SALT: CLAY: LCAP:																					Grey-orange boulders (up to 5"), cobbles, & sand, no clay balls, damp, will support shovel.
				77.9 80					PALT: SALT: CLAY: LCAP:																					Grey, orange gravel, sand and minor clay (~15%). damp, no clay balls, up to 1.5" gravel, will support shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: 1A & 1B stockpile Characterization

Hole Number: S1A-4

Date Drilled: 9-6-05 Type: Sonic

Northing:

Hole Depth: 150'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

* Golder removed material from interval listed below.

Page: 4 of 5

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	QS	Clz	Ksc	Chl	FeOx	FeSl	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Other1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structural)
				80 82.5					PALT: SALT: CLAY: LCAP:																					Light brown boulder gravel (up to 5") and clay (~10%) damp forms gritty clay balls. will compact some under shovel
				82.5 85					PALT: SALT: CLAY: LCAP:																					Brown-gray boulders, cobbles (up to 5") and minor clay (2%) and clay balls, will support shovel
				85 87.5					PALT: SALT: CLAY: LCAP:																					Light brown-grey cobbles gravel (up to 2"), minor fines damp no clay balls will support shovel.
				87.5 90			Golder 9.50 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Red, grey, yellow cobbles gravel (up to 2") and minor clay (5%) will form gritty clay balls; will support shovel
				90 92.5					PALT: SALT: CLAY: LCAP:																					Red to grey cobbles, gravel (up to 2") minor clay ~2% damp, forms gritty friable balls, will support shovel
Composite:																														
				95					PALT: SALT: CLAY: LCAP:																					Red, Tan, yellow boulders (up to 5"), cobble, gravel, minor clay (2.5%) no clay balls, damp will support shovel
				97.5					PALT: SALT: CLAY: LCAP:																					Red, yellow, gray boulders (up to 5") cobble gravel, minor clay (3.0%) mildly wet. clay balls will support shovel
				100					PALT: SALT: CLAY: LCAP:																					Red, orange, gray boulders (up to 4"), cobbles, gravel, trace clay, damp (almost dry), no clay balls will support shovel
				102.5					PALT: SALT: CLAY: LCAP:																					gray, yellow, boulders (up to [illegible]) gravel, clay (10%) 1/2 wet to 1/2 dry clay balls, will compact some under shovel
				105					PALT: SALT: CLAY: LCAP:																					yellow, gray, black cobbles (up to 3") gravel, minor clay (4.0%) mildly wet, clay balls. will support shovel
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder removed material from intervals listed below,

Page: 5 of 6

Project: 1A-1B Stockpile Characterization

Hole Number: STA-4

Northing:

Easting:

C.E.:

Date Drilled: 9/16/05 Type: Sonic

Hole Depth: 150'

Orientation: -90°

Logged by:

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Clz	Xsai	CH	FeOx	FeSt	CuCx	CuSt	Py	PySl	Cc	CcSl	Cpy	CpySl	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				105 107.5					PALT: SALT: CLAY: LCAP:																				*	light brown, b[illegible] clay & gravel (up to 1") [illegible] wet clay (25%) clay balls form, shovel will sink
				107.5 110			Golder 10.20 lbs. Removed		PALT: SALT: CLAY: LCAP:																					White grey cobbles (up to 2.5"). gravel and very minor clay [illegible] no clay balls, will support the shovel, (~1.5% clay)
				110 112.5					PALT: SALT: CLAY: LCAP:																					Tan white grey gravel, minor cobbles (up to 3"). damp, minor clay (~1.5%), no clay balls will compact some under shovel.
				112.5 115			Golder 9.35 lbs. Removed		PALT: SALT: CLAY: LCAP:																				*	Light Brown. Saturate clay w/gravel, 50% clay forms clay balls & intermixed gravel shovel will sink in this zone "Tooth paste"
				115 117.5					PALT: SALT: CLAY: LCAP:																				*	Tan grey wet to mildly wet clay (40%) forms clay balls, cobbles (up to 3") and gravel, will not support shovel
Composite:																														
				117.5 120					PALT: SALT: CLAY: LCAP:																					Tan grey Boulders (up to 5" dia) cobbles, gravel, & clay (15%) will form gritty clay balls, mildly wet to damp, will compact under shovel
				120 122.5					PALT: SALT: CLAY: LCAP:																					Tan grey cobbles (up to 2.5") gravel & clay (15%) mildly wet forms gritty clay balls, will compact under shovel.
				122.5 125					PALT: SALT: CLAY: LCAP:																					Tan grey boulders (up to 5") cobbles gravel & clay (10%) mildly wet, forms clay balls will compact [illegible] under shovel
				125 127.5					PALT: SALT: CLAY: LCAP:																					Tan gravel (up to 1.5") and some clay (~5%) mildly wet forms gritty friable balls, will compact some under shovel
				127.5 130			Golder 10.40 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Tan-grey Boulders (up to 5") cobbles, gravel & [illegible] no clay balls, will support shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page: 6 of 6

Project: 1A-1B Stockpile Characterization

Hole Number: S1A-4

Date Drilled: 9/15/05 Type: Sonic

Northing:

Hole Depth: 150'

Easting:

Orientation: -40°

C.E.:

Logged by: A. Landa

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	OS	Ctz	Ksp	Ch	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				130 132.5					PALT: SALT: CLAY: LCAP:																					Tan white cobbles (up to 3") gravel & clay mildly wet (will form clay balls (5%) will compact a little by shovel
				132.5 135					PALT: SALT: CLAY: LCAP:																					Tan grey Boulder (up to 5") cobbles, minor gravel, clay (15%) mildly wet, will form clay balls, will compact some under shovel
				135 137.5					PALT: SALT: CLAY: LCAP:																					Tan grey cobbles (up to 4") gravel to clay [illegible] [illegible] clay balls, mildly wet, will compact some under shovel
				137.5 140					PALT: SALT: CLAY: LCAP:																					Tan gravel with minor clay (<5%), no clay balls (up to 1.5"), will compact some under shovel
				140 142.5					PALT: SALT: CLAY: LCAP:																					Tan grey minor cobbles (up to 2"), gravel and clay (15%) mildly wet, will form clay balls, will compact under shovel
Composite:																														
				142.5 145					PALT: SALT: CLAY: LCAP:																					Tan grey boulder (up to 5") gravel, minor clay, damp, no clay balls, minor compaction under shovel,
				145 147.5					PALT: SALT: CLAY: LCAP:																					Grey yellow tan cobbles (up to 4") gravel & clay (5%) mildly wet to damp, will form clay balls, will compact some under shovel
				147.5 150					PALT: SALT: CLAY: LCAP:																					Grey tan boulders (up to 5") gravel and minor clay (2%) no clay balls, damp to dry, will support shovel.
			E.O.H.						PALT: SALT: CLAY: LCAP:																					E.O.H.
									PALT: SALT: CLAY: LCAP:																					
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

*Golder removed some sample listed below.

Page: 1 of 9

Project: 1A & 1B Stockpile Characterization
Hole Number: S1A-5
Date Drilled: 9/16/05 Type: Sonic
Northing: 9894.598
Hole Depth: 200.5
Easting: 18440.855
Orientation: -90°
C.E.: 6373.529
Logged by: A. Lunde

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft	H₂O	Rock			Code	WC	YC	CS	Clz	Ksp	Chl	FeOx	FeSt	CuOx	CuSl	Py	PySl	Cc	CcSl	Cpy	CpySl	Orc n1	Orc n2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				0 2.5					PALT: SALT: CLAY: LCAP:																					Tan-grey Cobbles (up to 3.5") gravel and clay, mildly wet to wet, Forms gritty clay balls, will support under shovel ~5% clay
				2.5 5					PALT: SALT: CLAY: LCAP:																					tan, red, grey cobbles (up to 2.5") gravel and clay (5%) damp to mildly wet, forms clay balls, will compact under shovel,
				5 7.5					PALT: SALT: CLAY: LCAP:																					Grey, red Boulders (up to 5") cobbles gravel & minor fines, No clay balls, will support shovel.
				7.5 10					PALT: SALT: CLAY: LCAP:																					Tan red grey Boulders (up to 5") cobbles, gravel and clay (3%) forms gritty clay balls, damp will support some under shovel.
				10 12.5					PALT: SALT: CLAY: LCAP:																					Grey light brown, red, boulders (up to 5") cobbles gravel & minor clay (2%) forms gritty clay balls damp to dry will support shovel.
Composite:																														
				12.5 15					PALT: SALT: CLAY: LCAP:																					Grey, red, boulders cobbles, gravel & minor red clay, mildly wet to dry, forms gritty clay balls, will support shovel.
				15 17.5			Golder 12.5 lbs Removed		PALT: SALT: CLAY: LCAP:																					Red, orange, grey cobbles (up to 3") gravel, and minor clay (2.5%) mildly wet to damp forms gritty clay balls
				17.5 20					PALT: SALT: CLAY: LCAP:																					Grey, red Boulders (up to 5"), gravel and some clay (4%) mildly wet to damp forms gritty clay balls will compact minor under shovel
				20 22.5					PALT: SALT: CLAY: LCAP:																					Grey, red Boulders (up to 5") cobbles, gravel trace clay No clay balls, will support shovel, Damp
				25					PALT: SALT: CLAY: LCAP:																					Grey, light brown, red boulders (up to 5") cobbles, gravel and minor clay (1%) no clay balls will support shovel, damp.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder took 40-42.5 for analysis, and removed sample from interval listed below.

Page 2 of 9

Project: 1A & 1B Stockpile Characterization
Hole Number: S1A-5
Date Drilled: 9-16-05 Type: Sonic
Northing:
Hole Depth: 205.5'
Easting:
Orientation: -90°
C.E.:
Logged by: A. Londe

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Error	Notes
Tcu	OxCu	OLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSl	CuOx	CuSl	Py	PySl	Cc	CcSl	Cpy	CpySl	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				25 27.5					FALT: SALT: CLAY: LCAP:																					tan light brown Cobbles (up to 2") gravel and minor clay damp to mildly wet forms gritty clay balls (2%), will compact under shovel.
				27.5 30					FALT: SALT: CLAY: LCAP:																					Orange, grey Cobbles (up to 3.5") gravel and clay (4%) mildly wet to damp, forms gritty clay balls, will compact under shovel.
				30 32.5					FALT: SALT: CLAY: LCAP:																					Red grey, cobbles (up to 2"), gravel and clay (10%) forms gritty clay balls, will compact under shovel, mildly wet to damp.
				32.5 35					FALT: SALT: CLAY: LCAP:																					Red, orange, grey cobbles (up to 4") gravel, and clay (5%) mildly wet forms gritty clay balls. will compact under shovel
				35 37.5			Golder 10.65 lbs. Recovered		FALT: SALT: CLAY: LCAP:																					Orange, grey Boulders (up to 5") cobbles, gravel, and clay (2%) damp to mildly wet, minor gritty clay balls, will support shovel.
Composite:																														
				37.5 40					FALT: SALT: CLAY: LCAP:																					Grey light brown, Boulders cobbles / gravel and minor clay (3%) damp to mildly wet, forms gritty clay balls, will support shovel.
				40 42.5			taken by Golder for Analysis		FALT: SALT: CLAY: LCAP:																					Brown, black, tan Boulders (up to 5"), cobbles, gravel, and clay (3%) forms gritty clay balls, will support shovel damp
				42.5 45					FALT: SALT: CLAY: LCAP:																					light brown, grey ~~[illegible]~~ cobbles & clay (50%) mildly wet, forms clay balls, damp locally, will compact under shovel
				45 47.5					FALT: SALT: CLAY: LCAP:																				*	Red brown, gravel and clay (25%) wet, forms clay balls. ([illegible] gravel), shovel will sink
				47.5 50					FALT: SALT: CLAY: LCAP:																					Light brown, red, black Boulders (up to 5"), cobbles, gravel, clay (10%) mildly wet, forms gritty clay balls, will compact under shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-5

Date Drilled: 9-17-05 Type: Sonic

Northing:

Hole Depth: 200,5'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Londe

*Golder removed sample from interval listed below,

Page: 3 of 9

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcr	OxCu	OLT	Elev.	Ft	H_2O	Rock			Code	WC	YC	QS	Qtz	Ksc	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Ornm1	Ornm2	Other	Ox Code	(Rock Description Alteration, Mineralization Structure)
				50 52.5					PALT SALT: CLAY: LCAP:																				*	Light brown, dark grey Boulders (up to 5"), gravel, and clay (15%) clay balls, shovel may sink
				52.5 55					PALT: SALT: CLAY: LCAP:																				*	Light brown grey cobbles (up to 4") gravel and clay (10%) wet to mildly wet (not saturated), forms gritty clay balls, may sink shovel.
				55 57.5				Golder 10.92 lbs. Removed	PALT: SALT: CLAY: LCAP:																					Light Brown grey cobbles (up to 2.5") gravel and clay (15%) clay balls, mild wet, will compact under shovel.
				57.5 60					PALT: SALT: CLAY: LCAP:																					Light brown, yellow, Boulders (up to 5") cobbles, gravel & clay (25%) mildly wet will compact under shovel.
				60 62.5					PALT: SALT: CLAY: LCAP:																					Light Brown to grey Boulders (up to 5"), cobbles & clay 3%) no clay balls, damp. will support shovel.
Composite:																														
				62.5 65					PALT: SALT: CLAY: LCAP:																					Tan grey Boulders, Cobbles (up to 5") gravel & clay (5%) mildly wet to damp gritty clay balls, will compact some under shovel.
				65 67.5					PALT: SALT: CLAY: LCAP:																					Grey orange, light brown cobbles (up to 2.5") gravel & minor clay (<1%) no clay balls, will support shovel.
				67.5 70					PALT: SALT: CLAY: LCAP:																					Brown cobbles (up to 4") gravel & clay (25%) forms clay balls, mildly wet, will compact under shovel
				70 72.5					PALF SALT. CLAY LCAP																					Brown cobbles (up to 2.5") gravel clay (25%) mildly wet, forms clay balls. will compact under shovel.
				72.5 75					PALT: SALT: CLAY: LCAP																					Brown, grey boulders (up to 5") gravel & clay (5%) mildly wet will form clay balls. will compact under shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

*Solder removed sample from intervals listed below,

Page: 4 of 9

Project: 1A & 1B stockpile characterization

Hole Number: S1A-5 Northing: Easting: C.E.:

Date Drilled: 9-17-05 Type: Sonic Hole Depth: 200.5' Orientation: -90° Logged by: A. Lando

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization [vol%]													Enrich	Notes
Tau	OxCu	QLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				75 77.5			Solder 13.25 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Grey orange, Boulders (up to 6"), cobbles, gravel, v. minor clay (<1%). Dry, no clay balls, will support shovel.
				77.5 80					PALT: SALT: CLAY: LCAP:																					Grey orange Boulder (up to 5"), cobble gravel, trace fines, dry to damp, will support shovel. No clay balls
				80 82.5					PALT: SALT: CLAY: LCAP:																					Light brown, yellow, grey Boulder (up to 5"), cobbled, gravel and clay (10%) mild wet, clay balls, will compact under shovel.
				82.5 85					PALT: SALT: CLAY: LCAP:																					Light Brown, grey Boulders (up to 5"), Cobbles, gravel, clay (7%) mildly wet to damp, clay balls, will compact under shovel.
				85 87.5					PALT: SALT: CLAY: LCAP:																					Orange, tan Boulders (up to 5"), cobbles, gravel & minor fines, No clay balls, damp, will support shovel.
Composite:																														
				87.5 90					PALT: SALT: CLAY: LCAP:																					Tan grey Boulders (up to 5"), cobbles, gravel & clay (5%), damp, forms clay balls, will compact under shovel
				96 92.5					PALT: SALT: CLAY: LCAP:																					Light brown red cobble gravel, minor fines (<1%) v clay, (up to 2.5") will compact under shovel.
				92.5 95					PALT: SALT: CLAY: LCAP:																					Red, grey cobbles (up to 2") gravel, clay (10%) forms clay balls, mildly wet will compact under shovel.
				95 97.5			Solder 11.35 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Red, tan cobble (up to 3.5") gravel and clay (15%) mildly wet, forms clay balls will compact under shovel.
				97.5 100					PALT: SALT: CLAY: LCAP:																					Brown, red, Boulder (up to 5") gravel, minor fines, damp will support shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder removed sample from interval listed below.

Page 5 of 9

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-5

Date Drilled: 9-17-05 Type: Sonic

Northing:

Hole Depth: 200.5

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	GS	Ctz	Ksc	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Omin1	Omin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				100 102.5					PALT: SALT: CLAY: LCAP:																					Brown Cobbles (up to 2.5") gravel, and clay (10%) mildly wet to damp, forms clay balls, will compact under shovel.
				102.5 105					PALT: SALT: CLAY: LCAP:																					Red grey boulder (up to 5") gravel / v. minor fines (<1%) clay damp to dry, will support shovel
				105 107.5					PALT: SALT: CLAY: LCAP:																					Grey, red Boulders (up to 5") cobbles, v. minor fines, dry to damp, will support shovel.
				107.5 110					PALT: SALT: CLAY: LCAP:																					Grey Boulders (up to 5") cobbles, gravel, clay (10%) mildly/wet, forms clay balls, will support shovel. No clay balls
Composite:				110 112.5					PALT: SALT: CLAY: LCAP:																					Grey yellow Boulders (up to 5") gravel & minor clay (<1%). damp, No clay balls, will support shovel.
				112.5 115					PALT: SALT: CLAY: LCAP:																					Grey Boulders (up to 5"), gravel v. minor fines (<1% clay) No clay balls. damp, will support shovel.
				115 117.5			Golder 12.30 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Grey yellow Boulders (up to 5") cobbles, and clay (~1%) will form clay balls (britty). damp, will support shovel.
				117.5 120					PALT: SALT: CLAY: LCAP:																					Brown Gravel with minor fines (<1%) clay, no clay balls, damp, will support a shovel.
				120 122.5					PALT: SALT: CLAY: LCAP:																					Grey, yellow Boulders (up to 5") cobbles, gravel, (<1% clay) damp no clay balls, will support a shovel.
Composite				122.5 125					PALT: SALT: CLAY: LCAP:																					Grey yellow cobbles (up to 8.5") gravel & clay (3%) no clay balls, will support a shovel damp

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-5

Date Drilled: 9-17-05 Type: Sonic

Northing:

Hole Depth: 220.5'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

* Golder took 145-147.5 for testing and sample from interval listed below.

Page: 6 of 9

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Ernest	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	W/C	YC	OS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSl	Py	PySt	Cc	CcSt	Ccy	CpySt	Omin1	Omin2	Other	Code	(Rock Description, Alteration, Mineralization, Structure)
				125 127.5					PALT: SALT: CLAY: LCAP:																					Grey, brown Cobbles (up to 2.5") gravel & minor clay (2%) no clay balls, damp, will support a shovel.
				127.5 130					PALT: SALT: CLAY: LCAP:																					Grey, yellow gravel with minor clay (2%) no clay balls, damp, will compact with a shovel. (up to 3/4")
				130 132.5					PALT: SALT: CLAY: LCAP:																					Grey, yellow, red cobbles gravel & clay (<1%) damp no clay balls, will support a shovel.
				132.5 135					PALT: SALT: CLAY: LCAP:																					Grey, red Cobbles, gravel (up to 2.0") very little clay (1%) no clay balls, damp will support a shovel.
				135 137.5			Golder 7.70 lbs. Removed		PALT: SALT: CLAY: LCAP:																					Light brown, red cobbles, gravel, & clay (15%) mildly wet, clay balls form, shovel will compact.
Composite:																														
				137.5 140					PALT: SALT: CLAY: LCAP:																				*	Tan, grey cobbles (up to 3.5") gravel, clay (15%) wet to mildly wet, clay balls form, shovel will sink
				140 142.5					PALT: SALT: CLAY: LCAP:																					Tan Boulders (up to 5") cobbles gravel, clay (10%) mildly wet clay balls form, shovel will compact.
				142.5 145					PALT: SALT: CLAY: LCAP:																					Red, yellow Boulders (up to 5") cobbles, gravel, with minor fines (<1% clay) no clay balls, damp
				145 147.5			Golder Took for testing		PALT: SALT: CLAY: LCAP:																					Red, white, boulders, gravel and (up to 5") minor clay (2%) mildly wet to dry, will for clay balls, will support a shovel.
				147.5 150					PALT: SALT: CLAY: LCAP:																					Red, grey Boulders, cobbles (up to 5") gravel & minor clay (<1%) damp few balls of clay, will support a shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

* Golder removed sample from interval listed below.

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-5

Date Drilled: 9-17-05 Type: Sonic

Northing:

Hole Depth: 200.5'

Easting:

Orientation: -90°

C.E.:

Logged by: A. Lande

Analysis			Interval		Drill Loc		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	CLT	Elev.	Ft.	H2O	Rock			Code	WC	YC	OS	Ctz	Ksp	Chl	FeOx	FeSt	CuOx	CuSi	Py	PySi	Cc	CcSi	Cpy	Cpy/Si	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				150 52.5					PALT: SALT: CLAY: LCAP:																					Red grey Boulders (up to 5") cobbles, gravel & minor clay (<10%) damp, will support a shovel)
				52.5 155					PALT: SALT: CLAY: LCAP:																					Red brown, Cobbles (up to 3.5") gravel, some clay (40%) forms clay balls, will support a shovel, damp
				155 157.5					PALT: SALT: CLAY: LCAP:																					Red grey, light brown, cobbles (up to 2.5") gravel & clay (15%) mildly wet to damp Forms clay balls, will support under shovel
				57.5 160					PALT: SALT: CLAY: LCAP:																					Grey, yellow Boulders, gravel (up to 5") and clay (15%) forms clay balls damp to mildly wet, will support shovel
				160 162.5					PALT: SALT: CLAY: LCAP:																					Yellow grey cobbles (up to 2") gravel and clay (10%) damp, forms clay balls, will support under shovel
Composite:																														
				162.5 165			Golder 10.00 lbs. Removed		PALT: SALT: CLAY: LCAP:																				*	Red brown gravel (up to 1") and clay (15%), wet / saturated will form ~~fit~~ clay balls shovel will sink
				165 167.5					PALT: SALT: CLAY: LCAP:																				*	Brown cobbles (up to 2.5") gravel and clay (12%) wet to damp partially / saturated, shovel will sink, forms clay balls
				167.5 170					PALT: SALT: CLAY: LCAP:																					Red grey cobbles (up to 4.5"), gravel and minor fines. dry to damp, no clay balls will support a shovel
				170 172.5					PALT: SALT: CLAY: LCAP:																					Red, grey cobbles (up to 3.5") gravel and minor clay (1%) dry to damp. No clay balls will support a shovel
				172.5 174					PALT: SALT: CLAY: LCAP:																					Tan, light brown cobbles gravel (up to 2.5") and clay (15%) damp, forms clay balls, will support under shovel.
Composite:																														

Phelps Dodge Tyrone Mine - Geological Services
Drill Hole Logging Form

Page: 8 of 9

Project: 1A&1B Stockpile Characterization
Hole Number: S1A-5
Date Drilled: 9-17-05 Type: Sonic
Northing:
Hole Depth: 200.5'
Easting:
Orientation: -90°
C.E.:
Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	CxCu	CLT	Elev.	Ft.	H₂O	Rock			Code	WC	YC	QS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	FySt	Cc	CcSt	Cpy	CpySt	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				174 175.5					PALT: SALT: CLAY: LCAP:																				*	Brown, gray cobble (up to 3") gravel, clay (15%) saturated forms gritty clay balls, shovel will sink
				175.5 178					PALT: SALT: CLAY: LCAP:																					Grey-brown cobbles (up to 2.5") gravel and clay (10%) will form clay balls, damp to mildly wet, will compact under shovel
				178 180.5					PALT: SALT: CLAY: LCAP:																				*	Tan-grey gravel and clay (up to 1" dia.) and (35%) clay wet form and clay balls, shovel will sink.
				180.5 183					PALT: SALT: CLAY: LCAP:																					Tan-grey cobbles (up to 2.5") gravel and tan clay (10%) form gritty clay balls (friable), will compact under shovel, mildly wet
Composite:				183 185.5					PALT: SALT: CLAY: LCAP:																					Orange grey cobbles (up to 2") gravel and clay (15%) forms clay balls, mildly wet, will compact under shovel
				185.5 188					PALT: SALT: CLAY: LCAP:																					Grey tan orange (up to 5") cobble, gravel and clay (5%) mildly wet to damp forms clay balls, will support a shovel
				188 191.5					PALT: SALT: CLAY: LCAP:																					Tan grey gravel (up to 1.5") and clay (10%) forms clay balls will compact under clay
				191.5 194					PALT: SALT: CLAY: LCAP:																					Tan grey boulders (up to 5") cobbles, gravel, and clay (7%) mildly wet, forms clay balls, will compact under shovel
				194 196.5					PALT: SALT: CLAY: LCAP:																					Grey orange, yellow cobbles (up to 2.5") gravel and clay (5%) forms gritty clay balls, mildly wet.
Composite:				196.5 199					PALT: SALT: CLAY: LCAP:																					Brown, tan, gray, cobbles (up to 3"), gravel and clay (5%) mildly wet, forms gritty clay balls, shovel will compact

Phelps Dodge Tyrone Mine - Geological Services

Drill Hole Logging Form

Page 9 of 9

Project: 1A & 1B Stockpile Characterization

Hole Number: S1A-5 Northing: Easting: C.E.:

Date Drilled: 9-17-05 Type: Sonic Hole Depth: 200.5 Orientation: -90° Logged by: A. Lande

Analysis			Interval		Drill Log		Graphic Log	Graphic Log Notes	Alteration	Alteration						Mineralization (vol%)													Enrich	Notes
Tcu	OxCu	QLT	Elev.	Ft.	H_2O	Rock			Code	WC	YC	OS	Qtz	Ksp	Chl	FeOx	FeSt	CuOx	CuSt	Py	PySt	Cc	CcSt	Cpy	CpySt	Cmin1	Cmin2	Other	Oxide	(Rock Description, Alteration, Mineralization, Structure)
				198					PALT:																					orange, grey gravel with
									SALT:																					some clay (v<5%) mildly wet
									CLAY:																					no clay balls, will compact
				200.5					LCAP:																					under shovel
									PALT:																					
				EOH					SALT:																					
									CLAY:																					
									LCAP:																					
									PALT:																					
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									LCAP:																					
Composite:																														

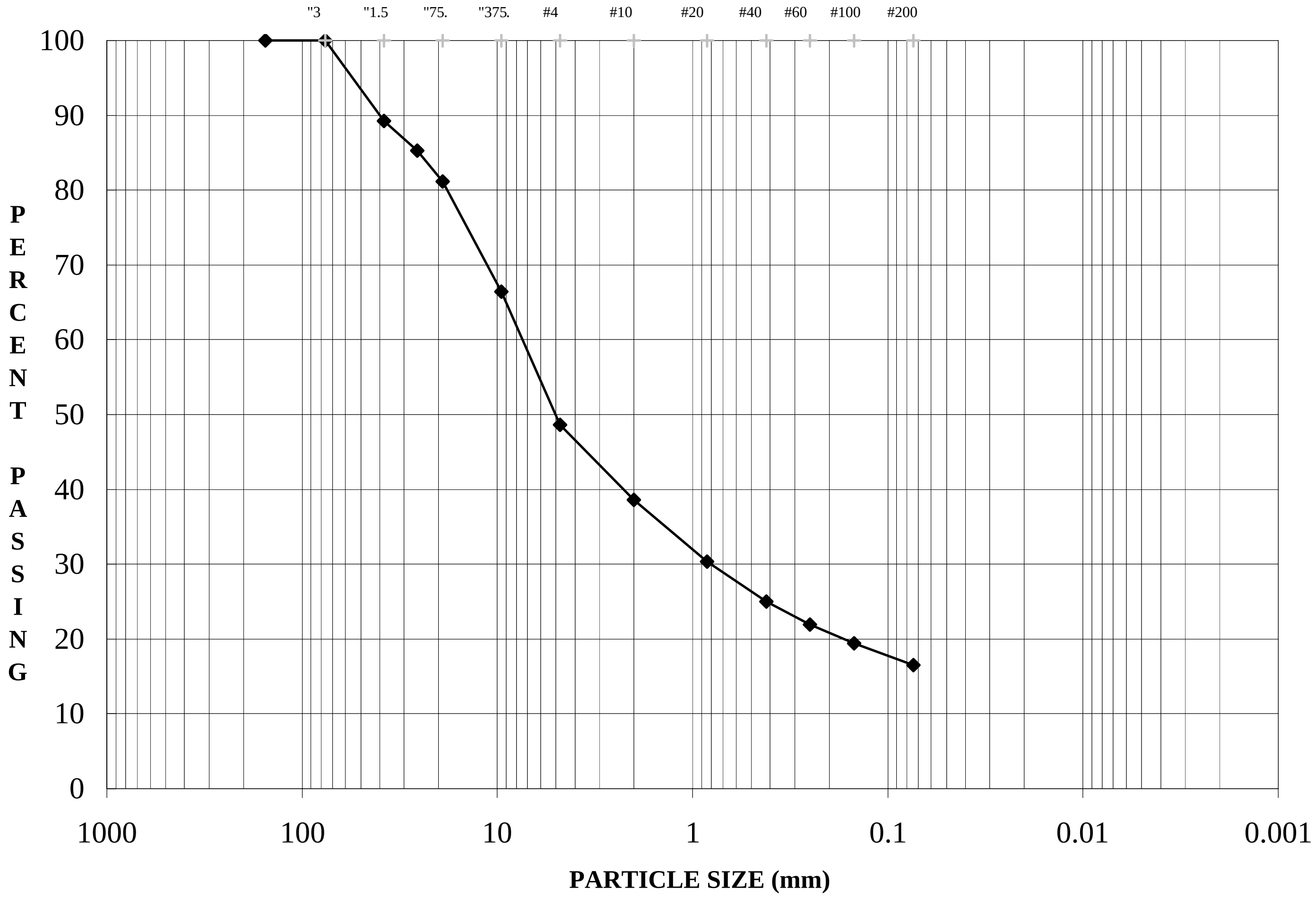
APPENDIX C

LABORATORY INDEX TESTING

APPENDIX C-1

2000 GRAIN-SIZE ANALYSIS

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: **GTP-01/01**

DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, and fine to coarse sand, some clay (GC)**

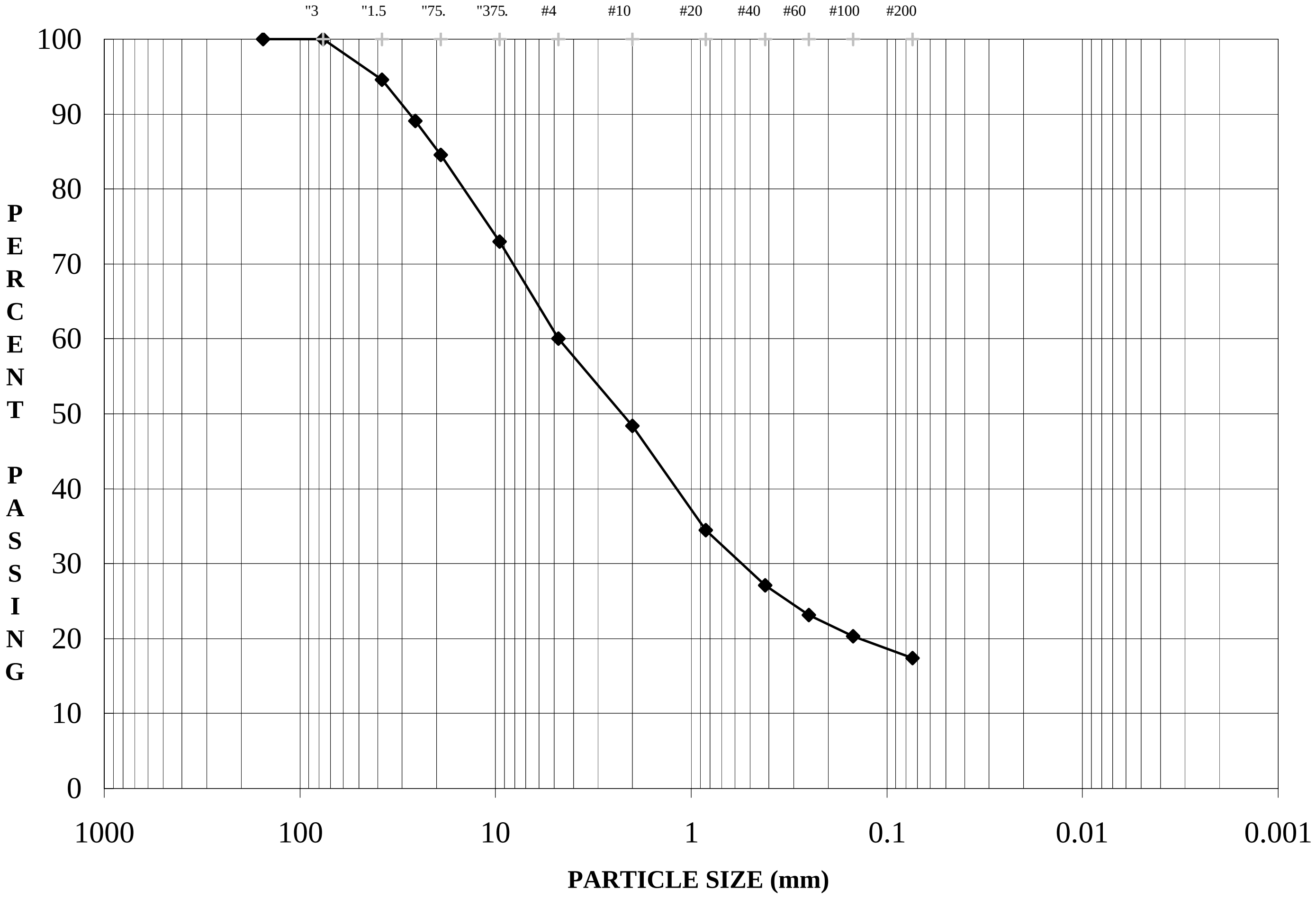
MC (As tested): 2.2%
LL: 47
PL: 22
PI: 25
Gs: -

TYRONE/STABILITY/
993-2546.001

20-Jan-00
MJK
DMD

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #: **GTP-03/02**

DEPTH (ft):

DESCRIPTION: **Fine to coarse SAND,**
and fine to coarse gravel,
some clay (SC)

MC (As tested):	**1.0%**
LL:	**33**
PL:	**20**
PI:	**13**
Gs:	**-**

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993-2546.001

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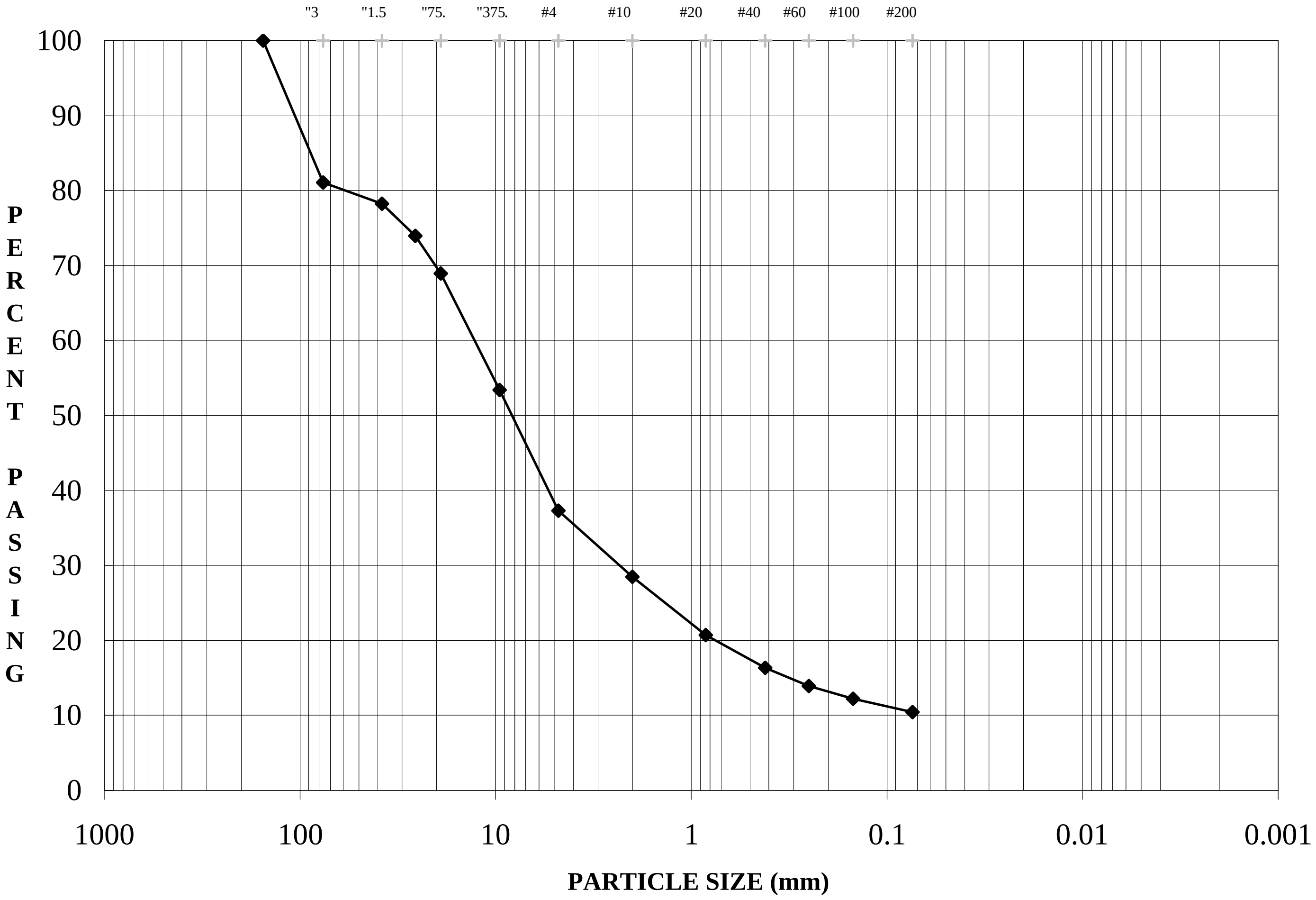
PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #: **GTP-06/03**
DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, some fine to coarse sand, little clay (GP-GC)**

MC (As tested):	3.7%
LL:	42
PL:	20
PI:	22
Gs:	-

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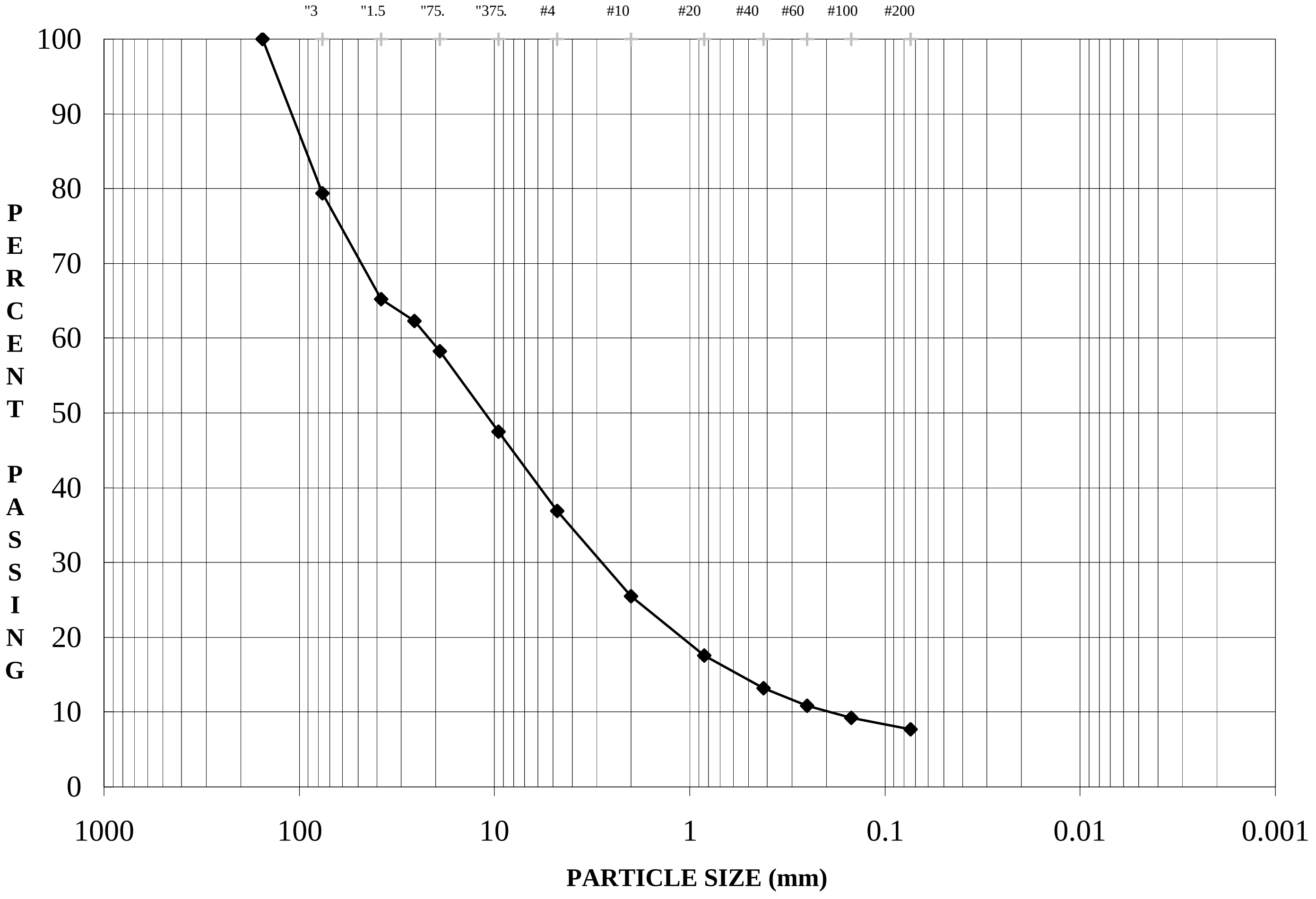
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: **GTP-09/05**
DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, some fine to coarse sand, little clay (GP-GC)**

MC (As tested):	**3.3%**
LL:	**39**
PL:	**20**
PI:	**19**
Gs:	**-**

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22-Jan-00
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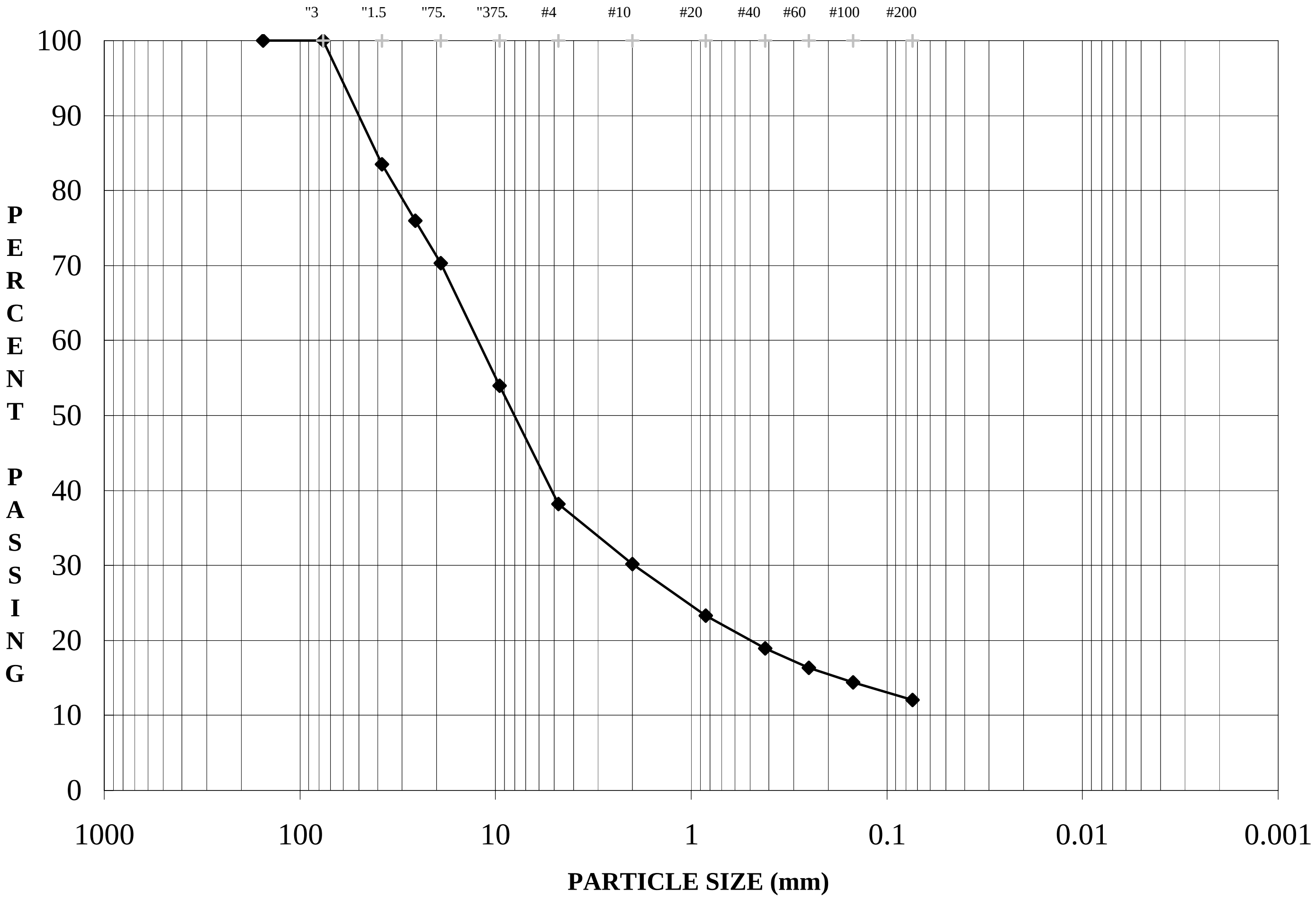
PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #: **GTP-10/04**
DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, some fine to coarse sand, some clay (GC)**

MC (As tested):	**3.4%**
LL:	**47**
PL:	**21**
PI:	**26**
Gs:	**-**

TYRONE/STABILITY/
993-2546.001

22-Jan-00
MJK
DMD

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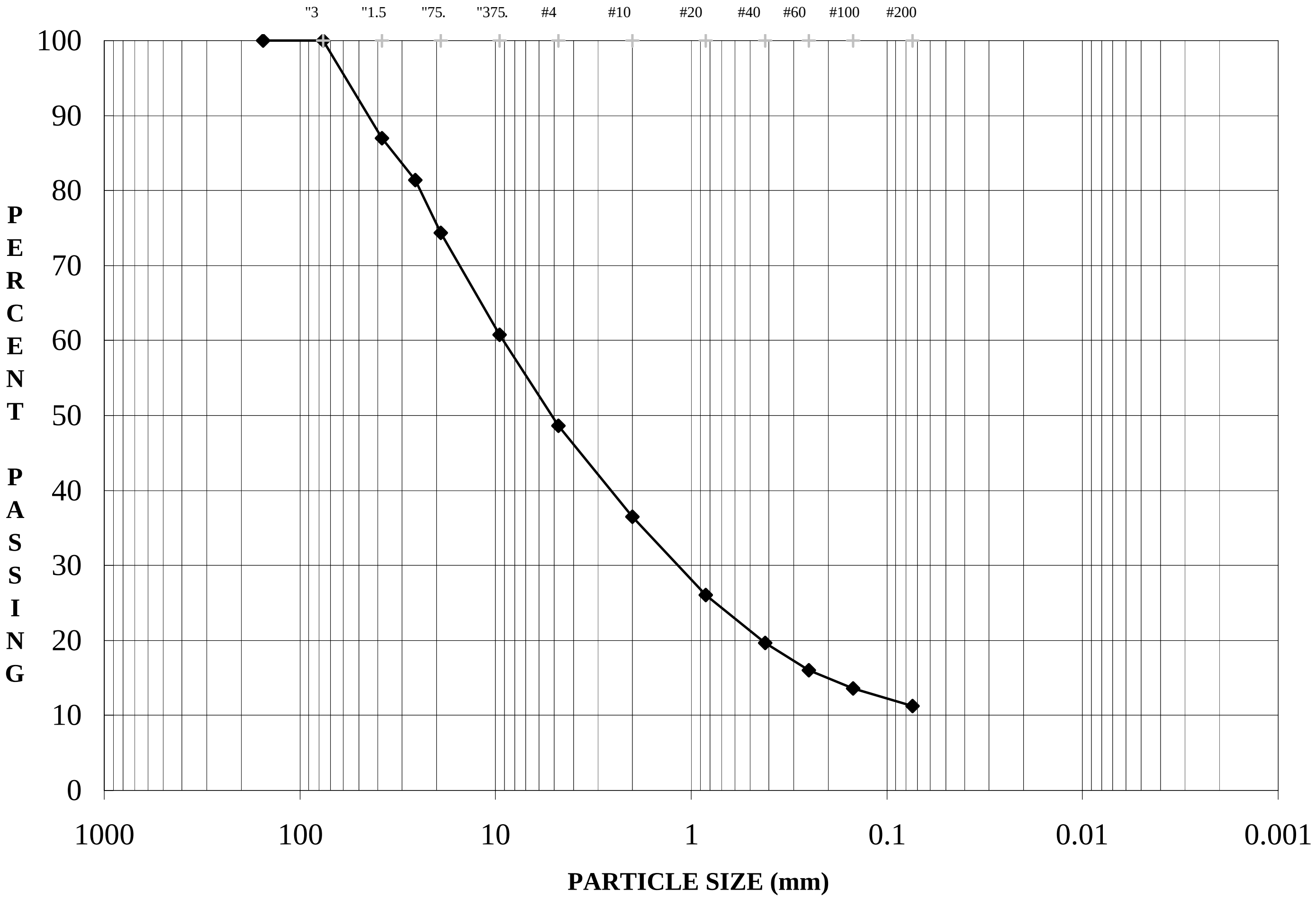
PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: **GTP-13/06**
DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, and fine to coarse sand, little clay (GP-GC)**

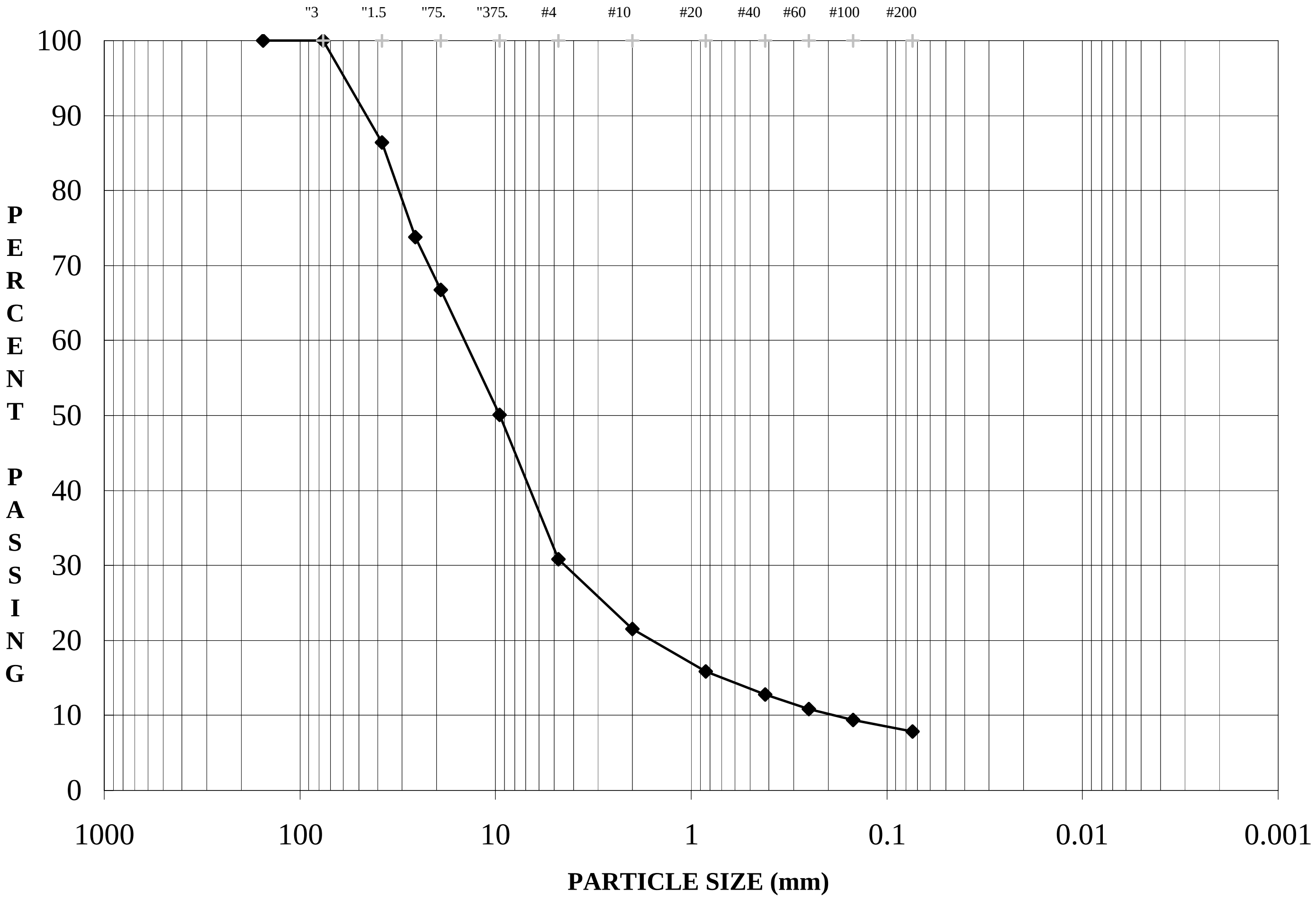
MC (As tested): **2.3%**
LL: **38**
PL: **19**
PI: **19**
Gs: **-**

TYRONE/STABILITY/
993-2546.001

22-Jan-00
MJK
DMD

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #: **GTP-14/07**

DEPTH (ft):

DESCRIPTION: **Fine to coarse GRAVEL, some fine to coarse sand, little clay (GP-GC)**

MC (As tested):	**4.5%**
LL:	**28**
PL:	**15**
PI:	**13**
Gs:	**-**

TYRONE/STABILITY/
993-2546.001

22-Jan-00
MJK
DMD

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

APPENDIX C-2

2001 SOIL SUMMARY AND GRAIN-SIZE ANALYSIS

TABLE C-2.1
SUMMARY OF SOIL DATA

Sample Type	Sample Number	USCS Soil Classification	Atterberg Limits			Grain-size Distribution		
			LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200
bucket	TYTP01-1	GC	38	17	21	77	48	13
	TYTP01-2	GW-GC	30	14	16	78	48	10
	TYTP01-3	GP-GC	36	18	18	75	38	9
	TYTP01-4	GC	40	17	23	76	53	15
	TYTP01-5	GC	39	16	23	79	49	15
	TYTP01-6	GW-GC	29	16	13	70	42	8
	TYTP01-7	SC	28	15	13	81	63	15
	TYTP01-8	SC	24	16	8	85	60	15
	TYTP01-9	GC	30	18	12	80	58	24
	TYTP01-10	SC	30	18	12	96	80	17
	TYTP01-11	GC	37	17	20	85	50	13
	TYTP01-12	GC	30	16	14	77	46	14

Notes:

LL = Liquid Limit

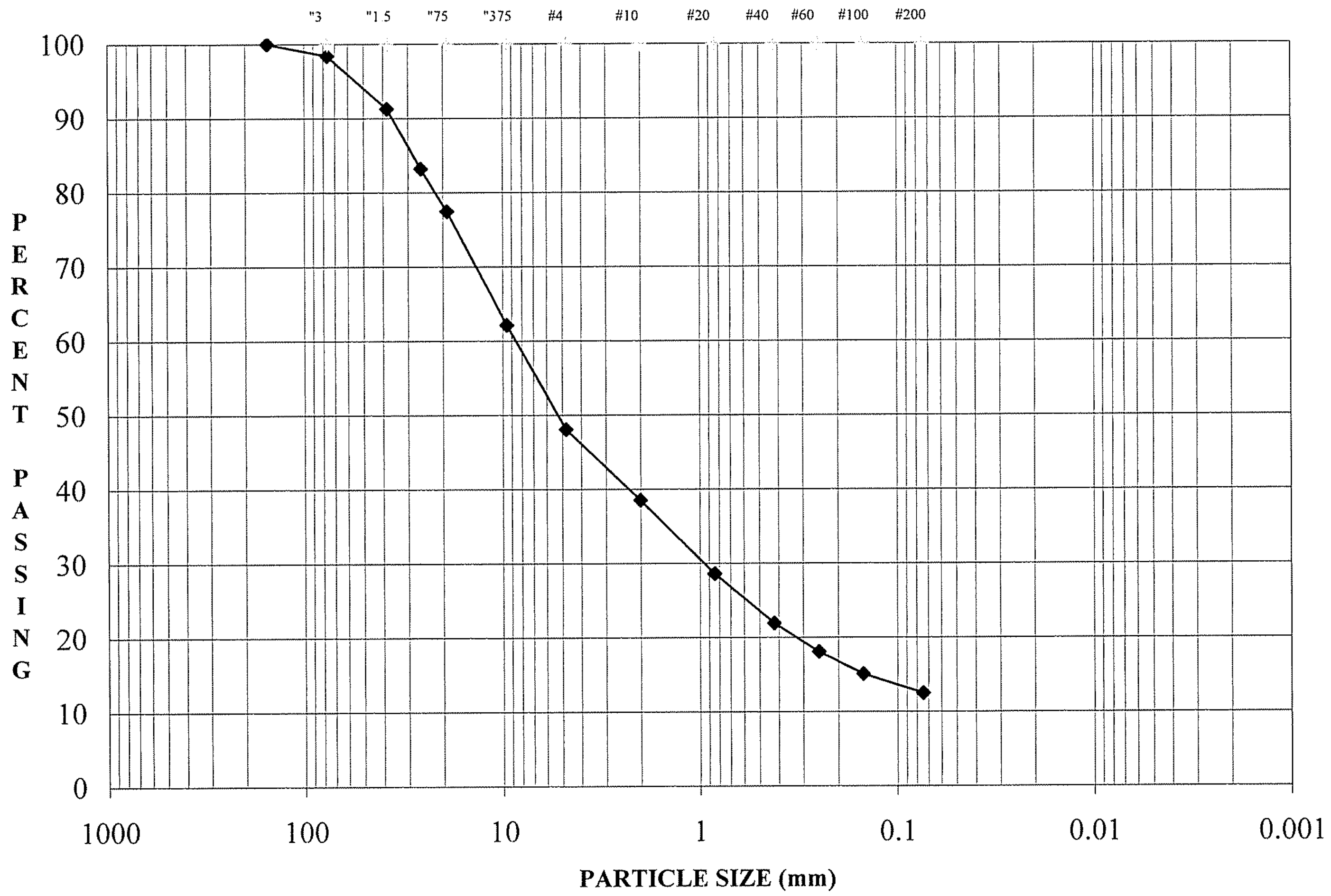
PL = Plastic Limit

PI = Plastic Index

USCS = Unified Soil Classification System

PCF = pounds per cubic foot

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-1

DEPTH (ft):

DESCRIPTION: Clayey gravel with sand (GC)

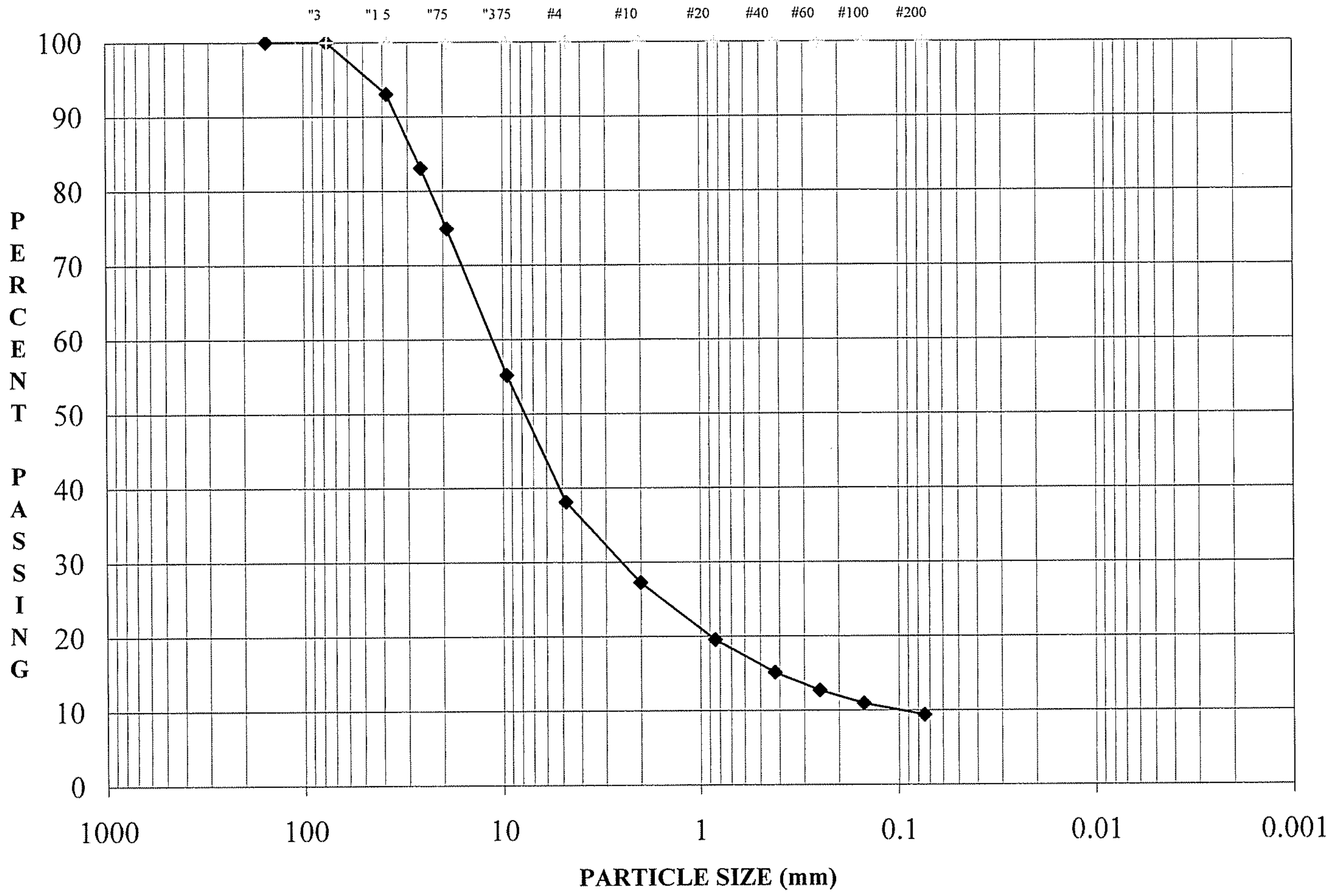
MC (As tested):	5.7%
LL:	38
PL:	17
PI:	21
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

23-Oct-01
TM
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #:	TYTP01-3
DEPTH (ft):	
DESCRIPTION:	Poorly graded gravel with clay and sand (GP-GC)

MC (As tested):	7.1%
LL:	36
PL:	18
PI:	18
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

22-Oct-01
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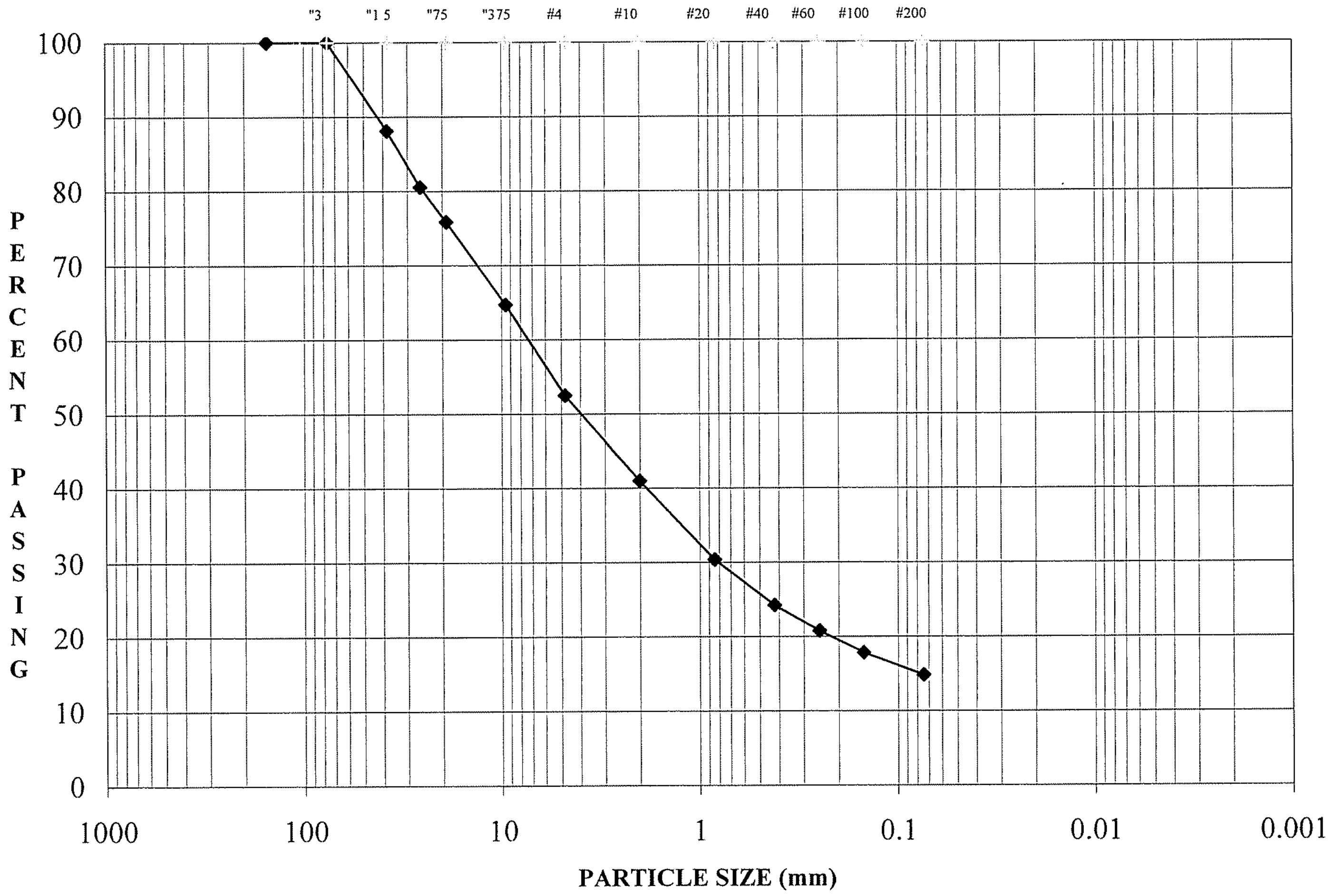
PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-4
DEPTH (ft):

DESCRIPTION: Clayey gravel with sand (GC)

MC (As tested):	3.3%
LL:	40
PL:	17
PI:	23
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

18-Oct-01
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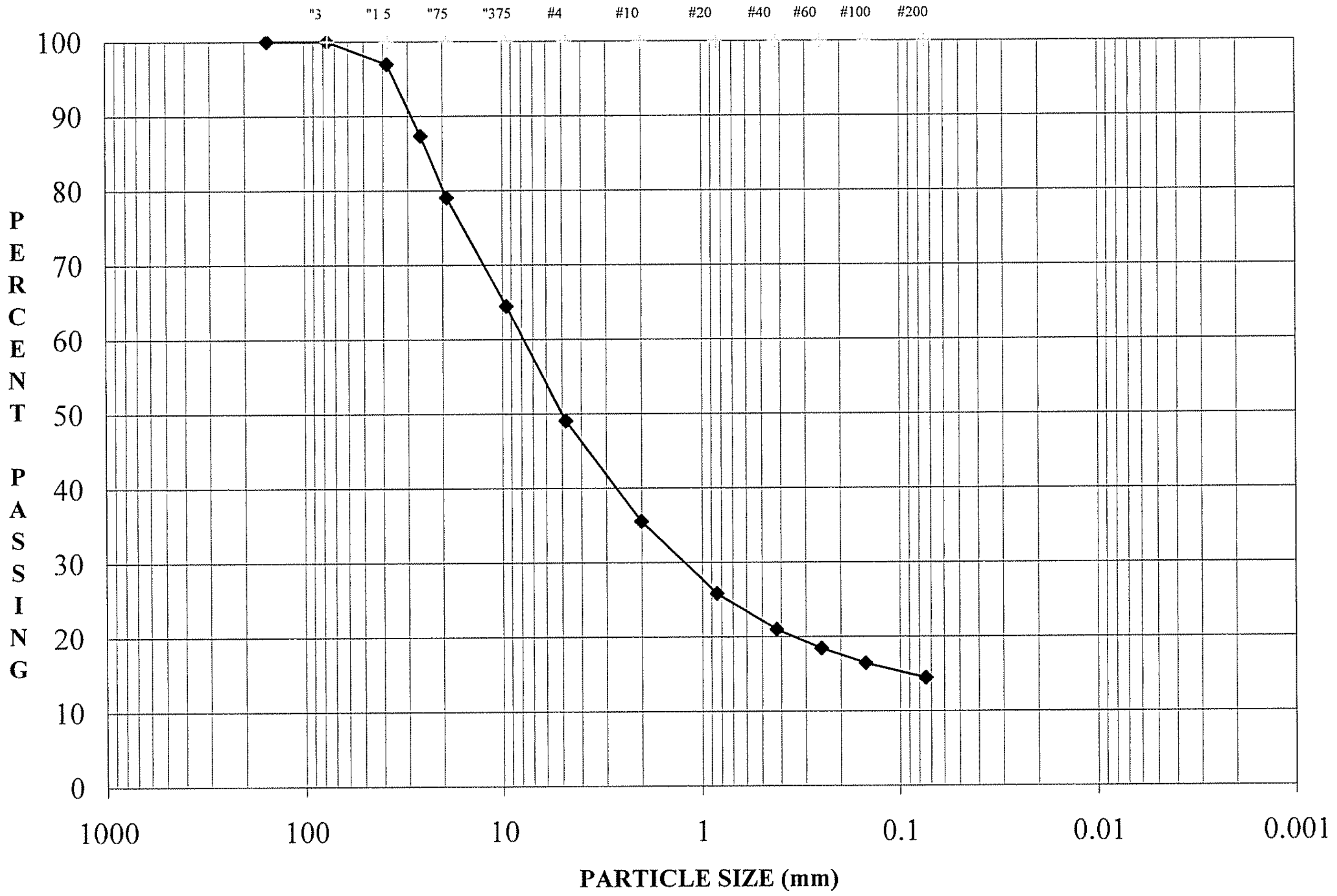
PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-5
DEPTH (ft):

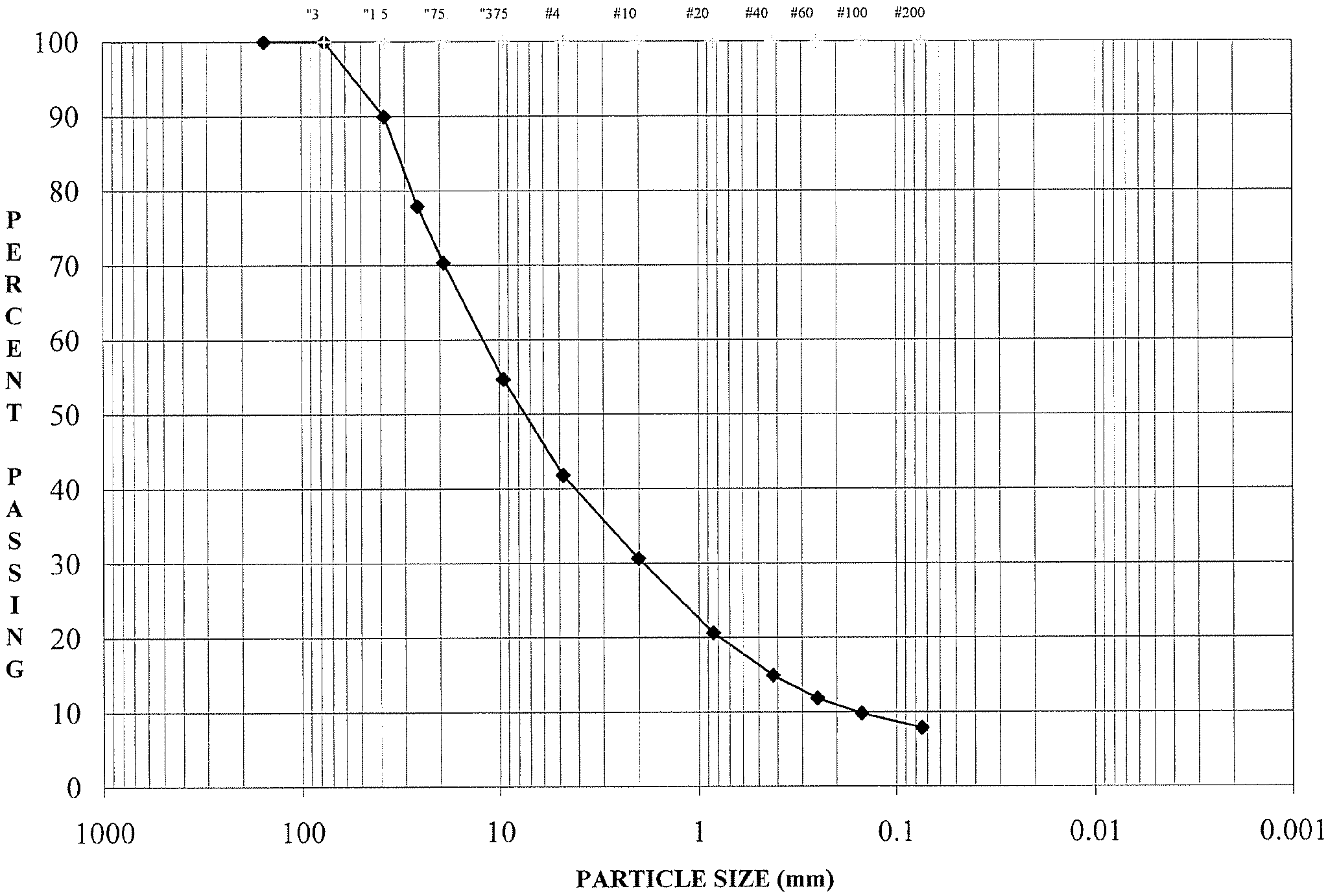
DESCRIPTION: Clayey gravel with sand (GC)

MC (As tested):	10.1%
LL:	39
PL:	16
PI:	23
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

19-Oct-01
MC
NG

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-6

DEPTH (ft):

DESCRIPTION: Well-graded gravel with clay and sand (GW-GC)

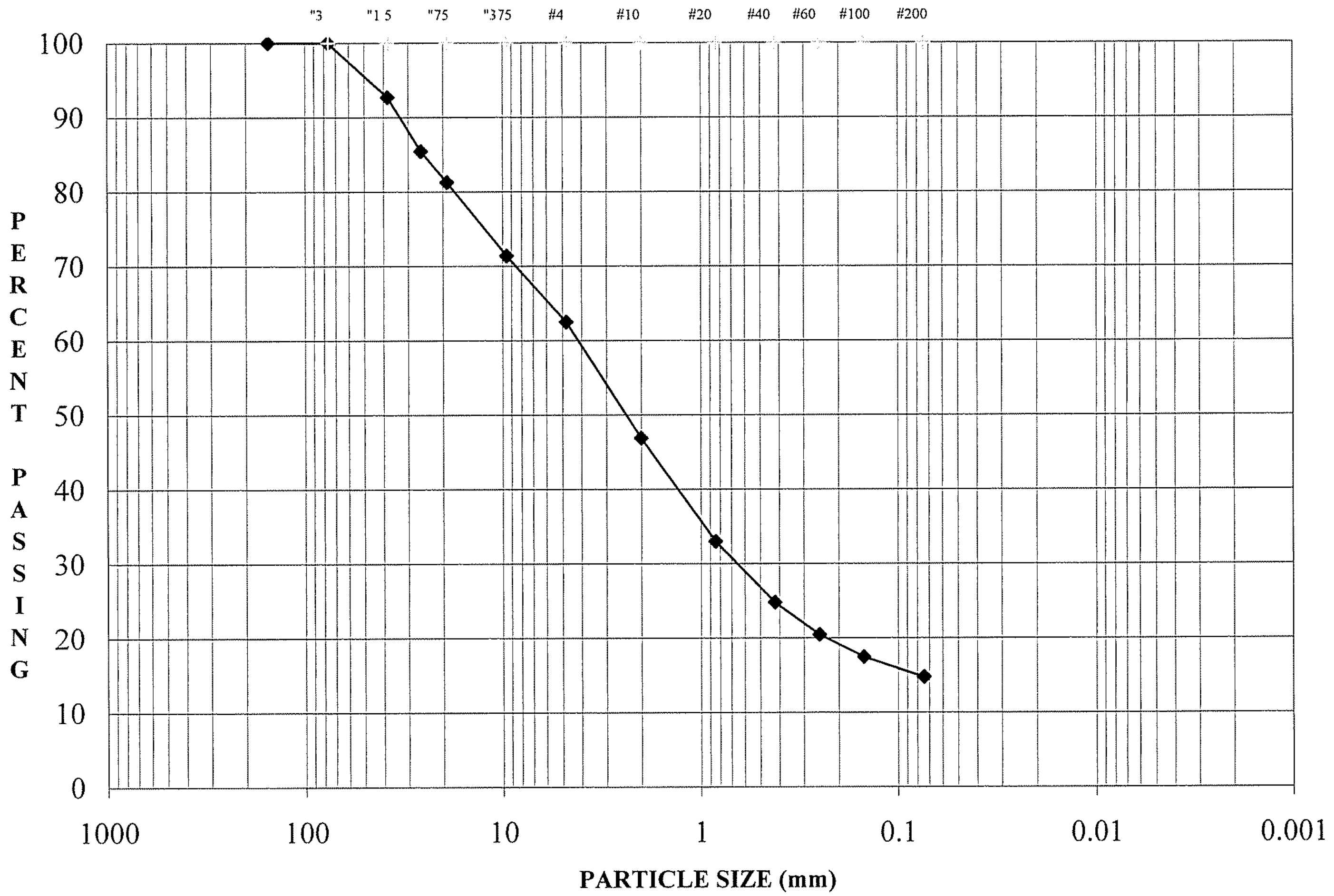
MC (As tested):	6.3%
LL:	29
PL:	16
PI:	13
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

19-Oct-01
MP
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-7
DEPTH (ft):

DESCRIPTION: Clayey sand with gravel (SC)

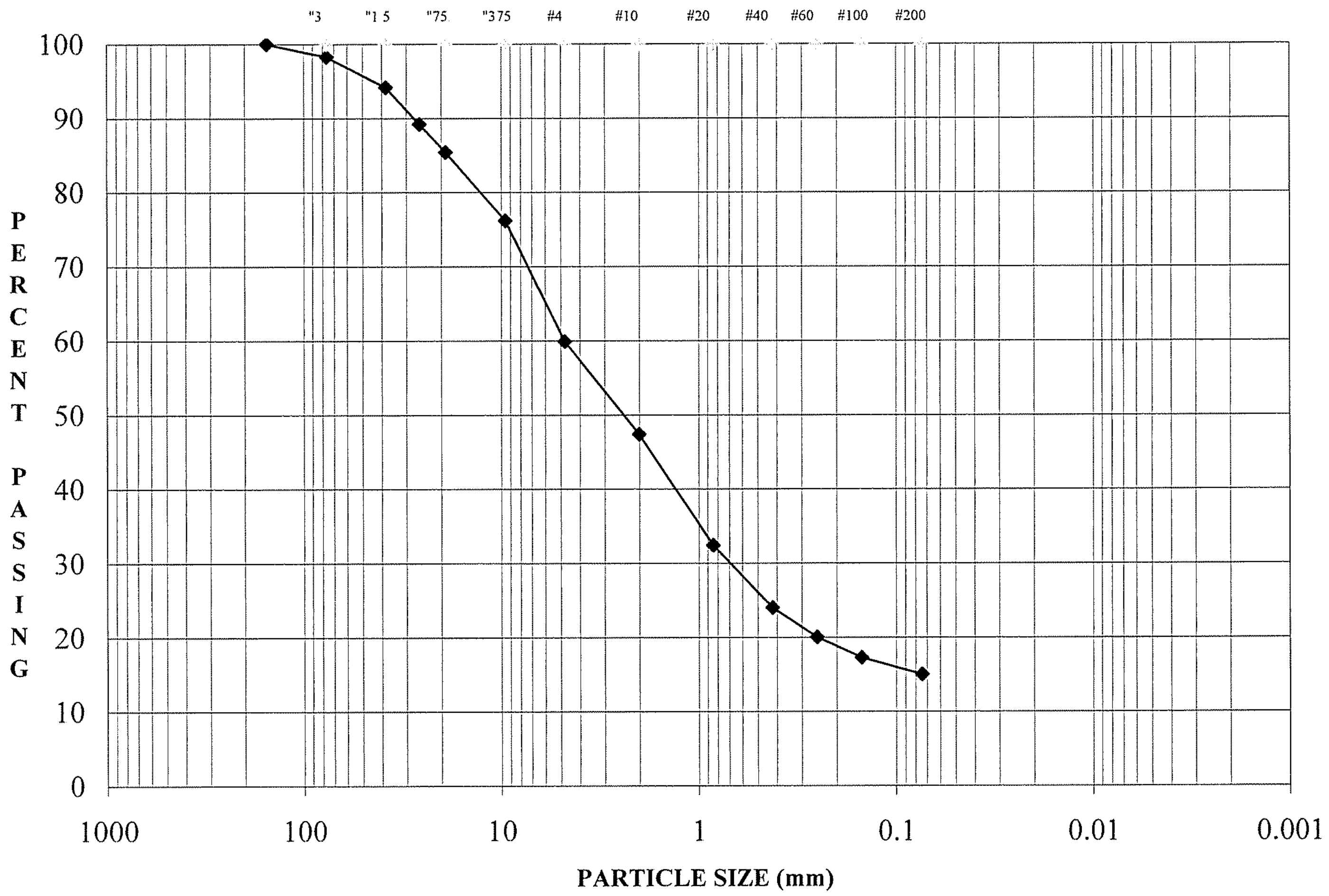
MC (As tested):	7.5%
LL:	28
PL:	15
PI:	13
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

19-Oct-01
MP
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-8
DEPTH (ft):

DESCRIPTION: Clayey sand with gravel (SC)

MC (As tested):	**5.4%**
LL:	**24**
PL:	**16**
PI:	**8**
Gs:	**Gs**

G & K / Tyrone Closure hearing / AZ
013-1595

24-Oct-01
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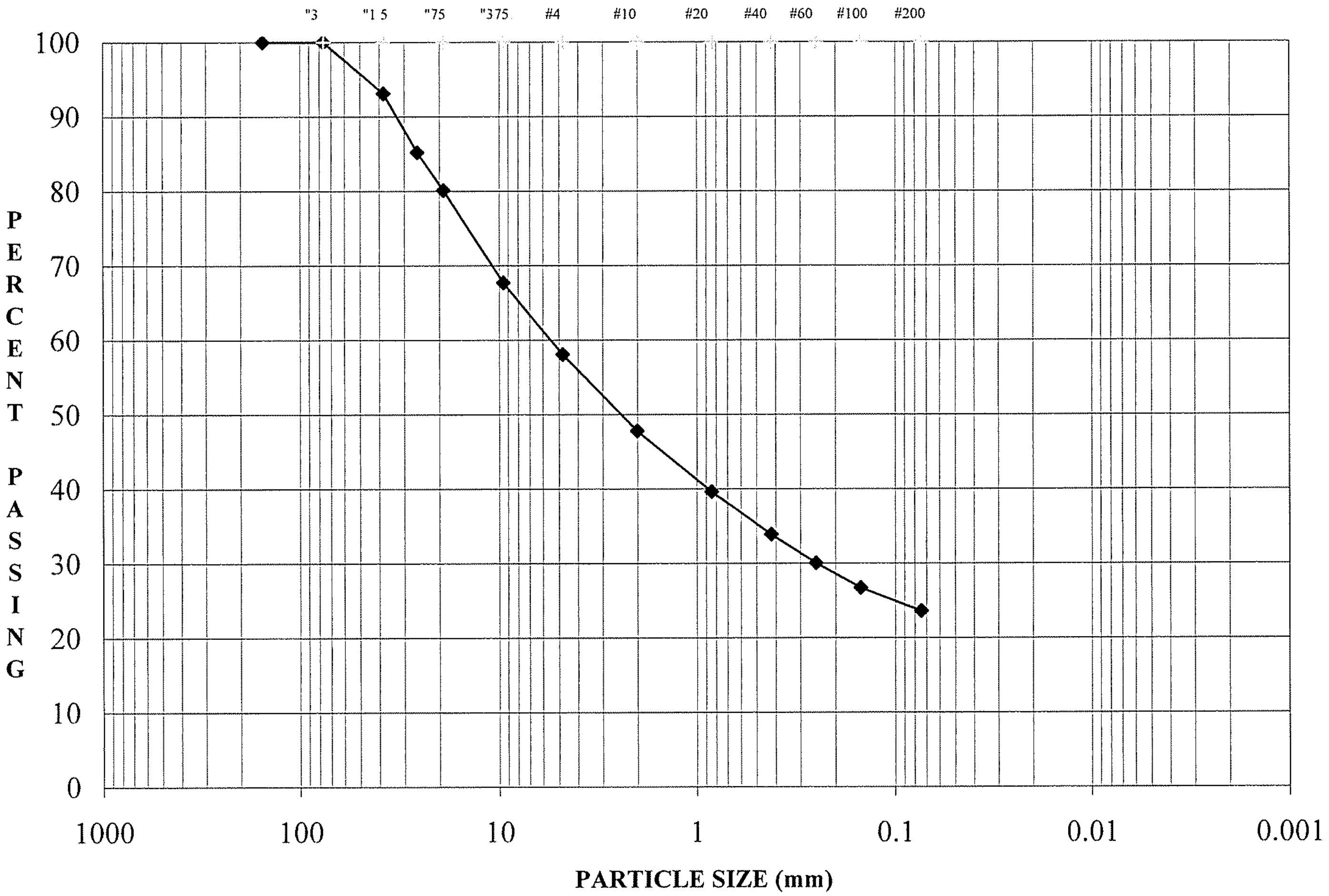
GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-9
DEPTH (ft):

DESCRIPTION: Clayey gravel with sand (GC)

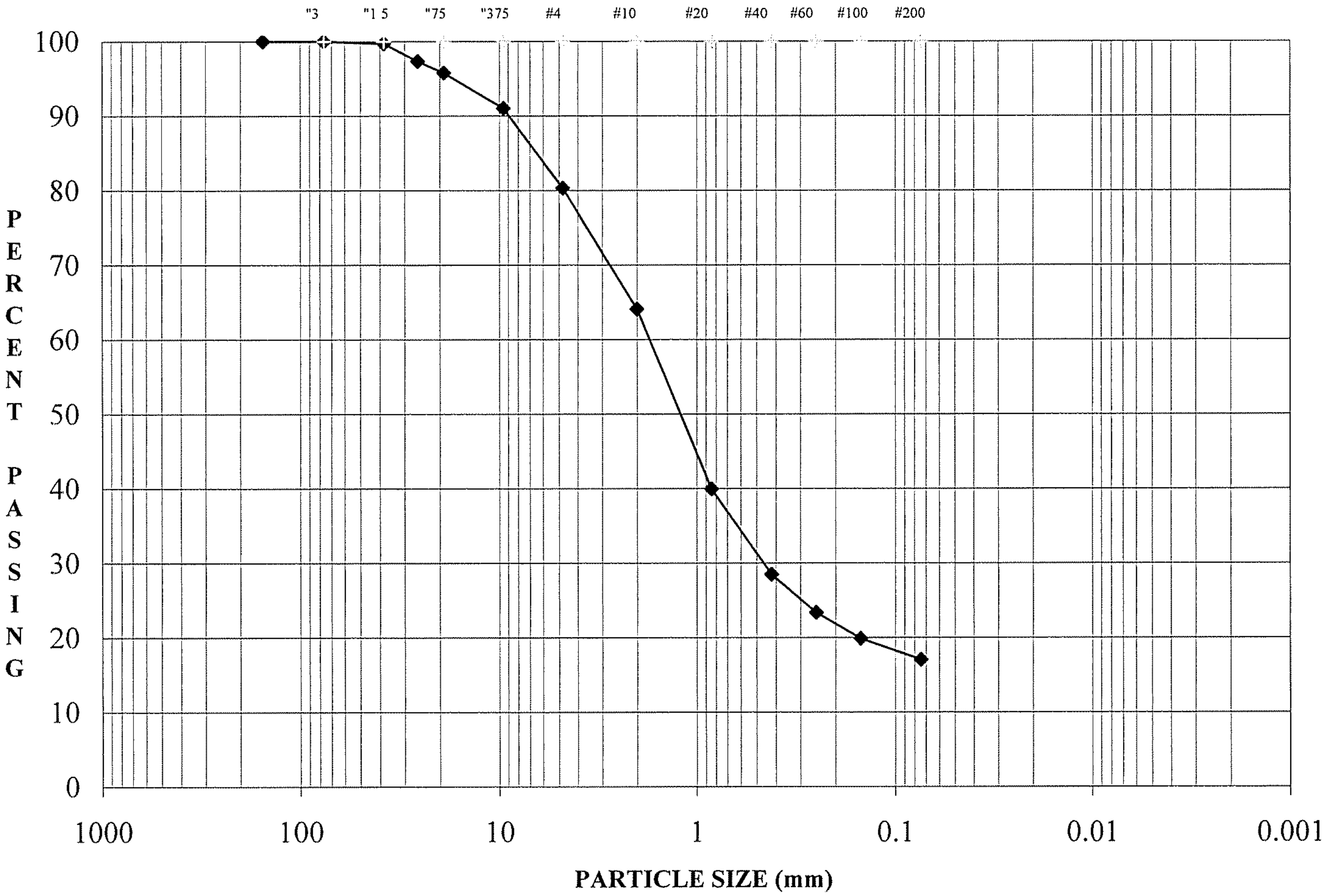
MC (As tested): 9.4%
LL: 30
PL: 18
PI: 12
Gs: Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

23-Oct-01
MC
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #: **TYTP01-10**
DEPTH (ft):
DESCRIPTION: **Clayey sand with gravel (SC)**

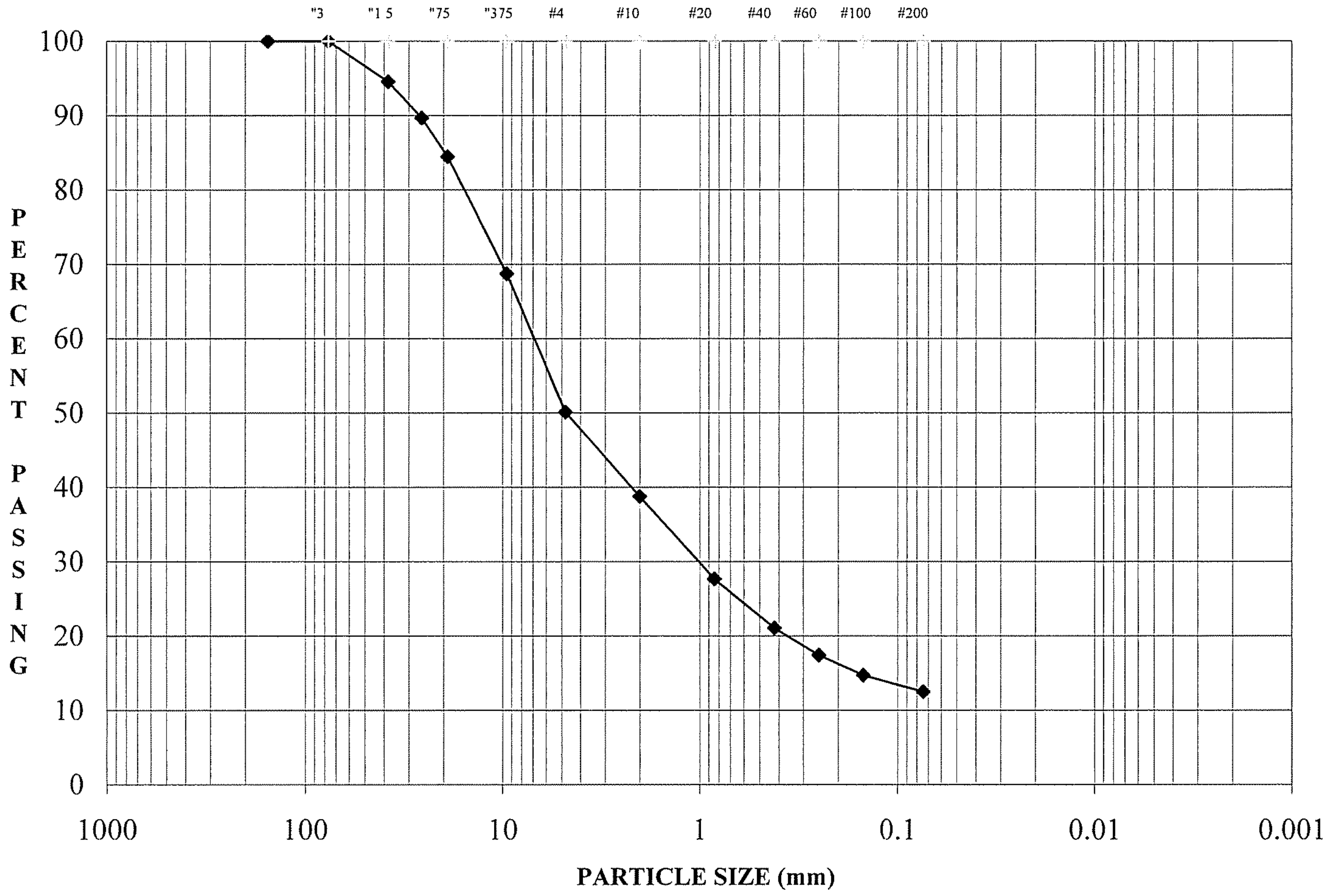
MC (As tested):	**3.7%**
LL:	**30**
PL:	**18**
PI:	**12**
Gs:	**Gs**

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

22-Oct-01
MP
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	**GRAVEL**		**SAND**			**FINES**

SAMPLE #:	**TYTP01-11**
DEPTH (ft):	
DESCRIPTION:	**Clayey gravel with sand (GC)**

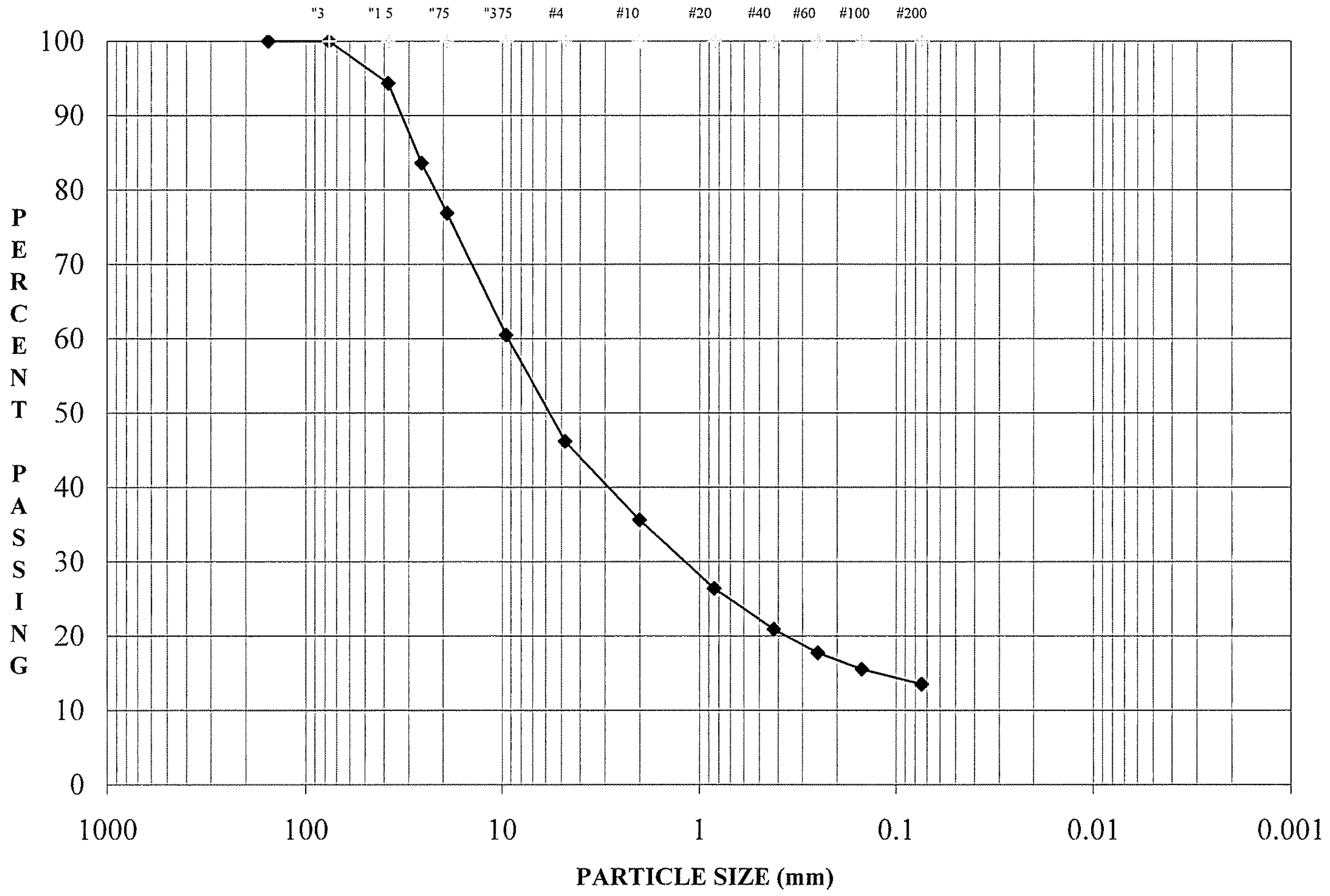
MC (As tested):	7.8%
LL:	37
PL:	17
PI:	20
Gs:	Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

22-Oct-01
MP
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
COBBLES	GRAVEL		SAND			FINES

SAMPLE #: TYTP01-12
DEPTH (ft):
DESCRIPTION: Clayey gravel with sand (GC)

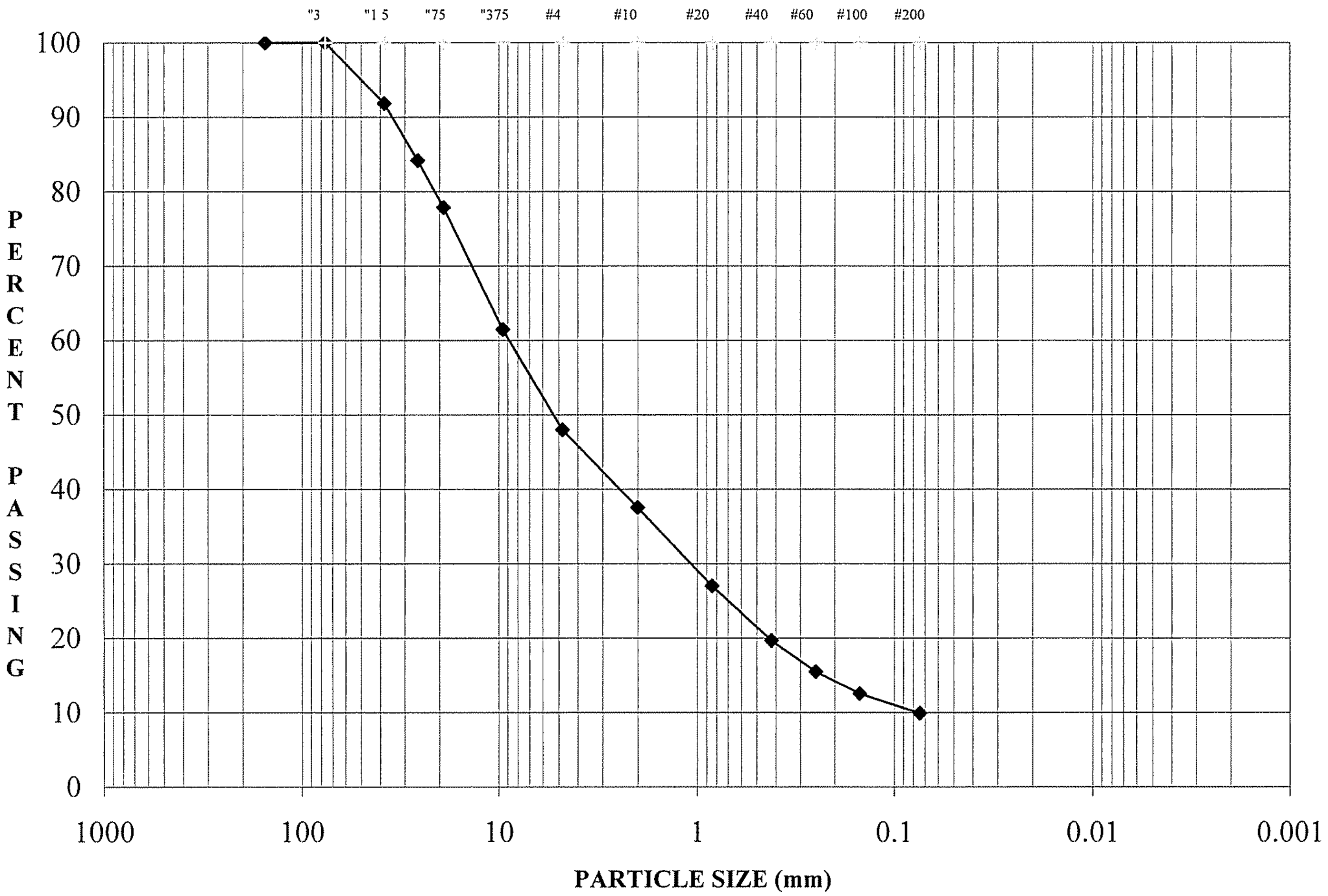
MC (As tested): 5.8%
LL: 30
PL: 16
PI: 14
Gs: Gs

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

22-Oct-01
MP
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

PARTICLE-SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



COBBLES	Coarse	Fine	Cor	Med	Fine	Silt or Clay Size
	GRAVEL		SAND			FINES

SAMPLE #:	**TYTP01-2**		**MC (As tested):**	**7.2%**
DEPTH (ft):			**LL:**	**30**
			PL:	**14**
DESCRIPTION:	**Well-graded gravel with clay and sand (GW-GC)**		**PI:**	**16**
			Gs:	**Gs**

G&K/TYRONE CLOSURE HEARING/AZ
013-1595.002

19-Oct-01
MC
NG

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

APPENDIX C-3

2004 1C STOCKPILE SOIL SUMMARY AND GRAIN-SIZE ANALYSIS

TABLE C-3.1
SUMMARY OF SOIL DATA

Sample Type	Sample Number	Sample Depth (feet)	USCS Soil Classification	Delivered Moisture (%)	Atterberg Limits			Grain-size Distribution			Specific Gravity	Moisture/Density Relationship	
					LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200		PCF (Dry)	Moist (%)
Bulk	GA04-TY-1-GT	--	GC	8.8	34	20	14	70	41	18	--	--	--
Bulk	GA04-TY-2-GT	--	GC	7.6	35	21	14	80	52	22	--	--	--
Bulk	GA04-TY-3-GT	--	GC	10.5	40	21	19	69	40	17	--	--	--
Bulk	GA04-TY-4-GT	--	GP-GC	1.9*	50	17	33	46	15	6	--	--	--
Bulk	GA04-TY-5-GT	--	GC	5.4	33	19	14	59	33	14	--	--	--
Bulk	GA04-TY-6-GT	--	GC	8.4	35	19	16	66	42	20	--	--	--
Bulk	GA04-TY-7-GT	--	GC	5.9	36	19	17	64	36	14	--	--	--
Bulk	GA04-TY-8-GT	--	GC	8.0	30	19	11	68	42	17	--	--	--

Notes:

* Delivered moisture content taken from Bulk sample due to no bag sample present

LL = Liquid Limit

PL = Plastic Limit

PI = Plastic Index

USCS = Unified Soil Classification System

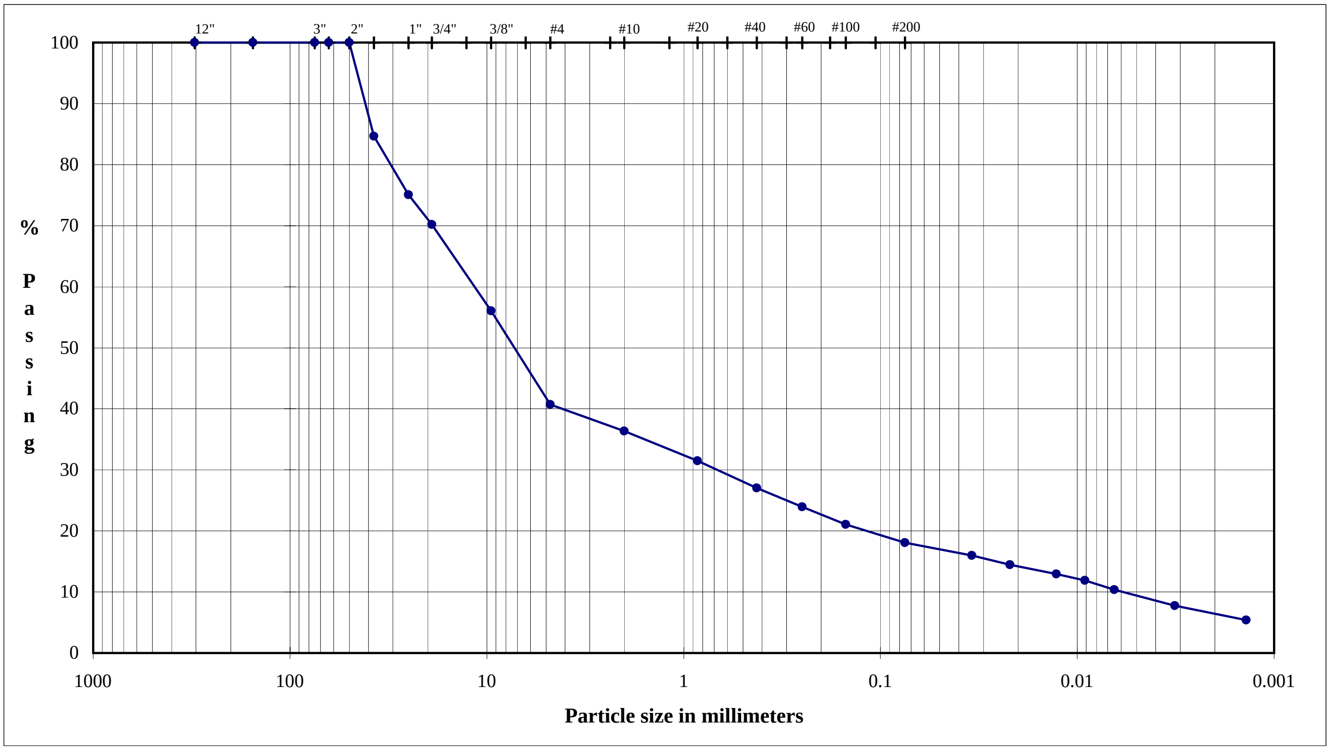
PCF = pounds per cubic foot

October-04 **043-2576-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**GA04-TY-1-GT**	Depth:	--
TYPE:	**BULK**		



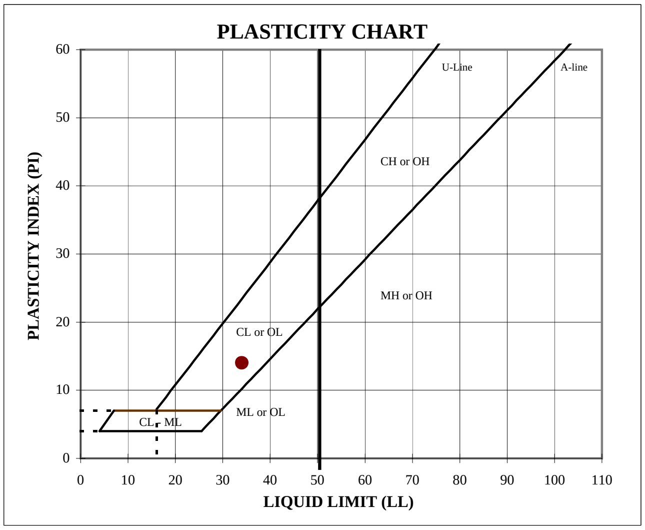
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**29.82**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**84.7**		
1.0"	25.0	**75.0**		
0.75"	19.0	**70.2**	Fine Gravel	**29.48**
0.375"	9.5	**56.0**		
#4	4.8	**40.7**		
#10	2.00	**36.3**	Coarse Sand	**4.36**
#20	0.85	**31.5**	Medium Sand	**9.30**
#40	0.43	**27.1**		
#60	0.25	**23.9**	Fine Sand	**8.96**
#100	0.15	**21.0**		
#200	0.075	**18.1**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**16.0**	Fines Silt or Clay	**18.09**
0.022	**14.5**		
0.013	**13.0**		
0.0091	**11.9**		
0.0065	**10.4**		
0.0032	**7.8**		
0.0014	**5.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
8.8	**34**	**20**	**14**	**2.70**

DESCRIPTION: Pale reddish brown clayey gravel with sand

USCS: GC

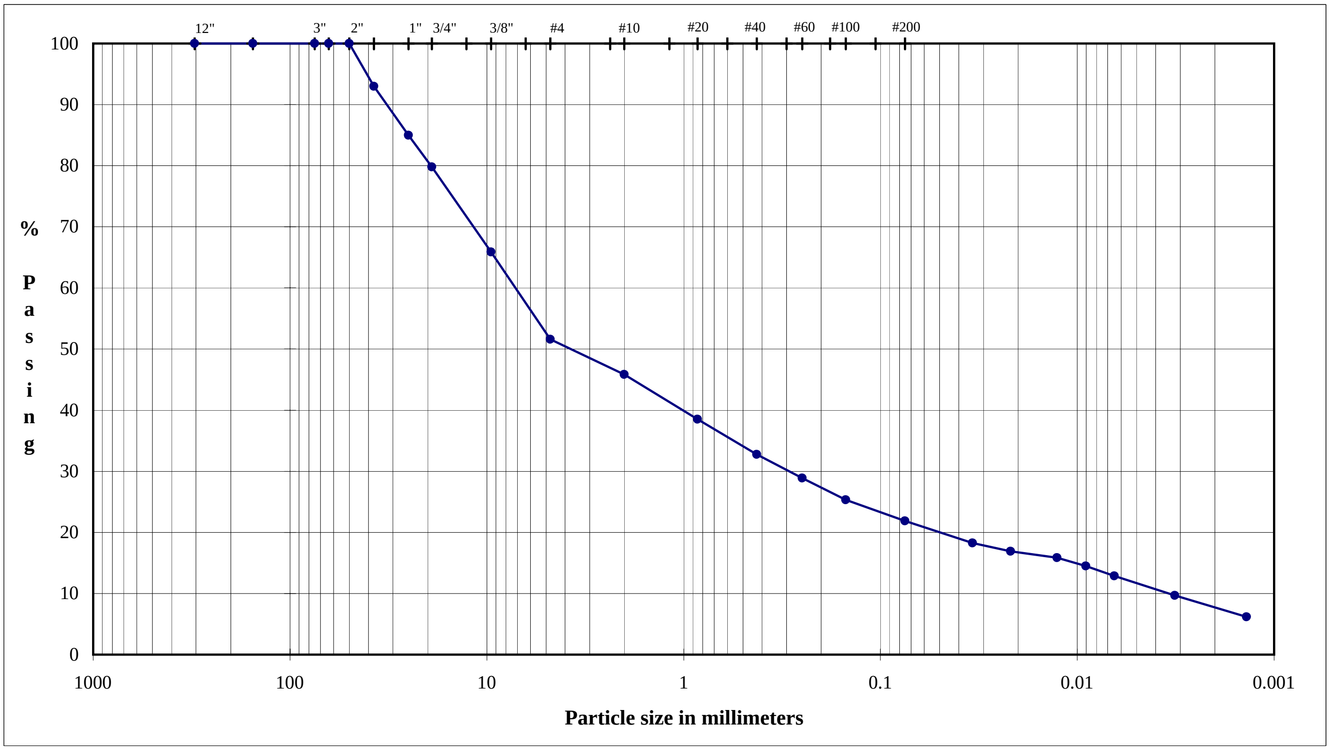
TECH	JR
DATE	10/4/2004
REVIEW	MB

October-04 **043-2576-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **GA04-TY-2-GT** Depth: --
TYPE: **BULK**



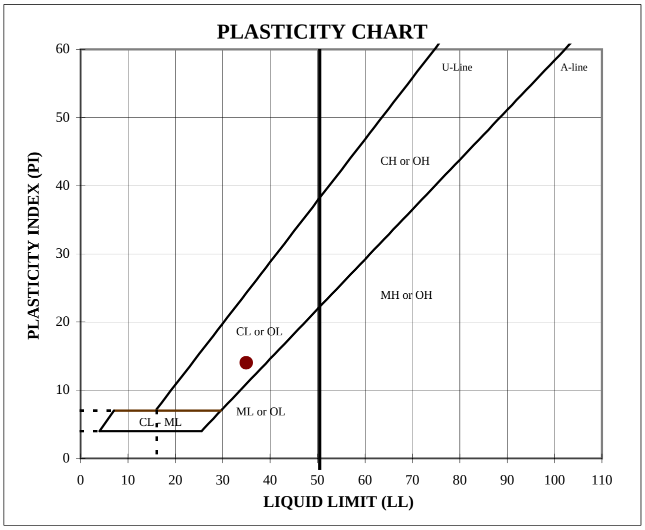
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**20.18**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**93.0**		
1.0"	25.0	**85.0**		
0.75"	19.0	**79.8**	Fine Gravel	**28.23**
0.375"	9.5	**65.9**		
#4	4.8	**51.6**		
#10	2.00	**45.8**	Coarse Sand	**5.77**
#20	0.85	**38.5**	Medium Sand	**13.05**
#40	0.43	**32.8**		
#60	0.25	**28.9**	Fine Sand	**10.91**
#100	0.15	**25.3**		
#200	0.075	**21.9**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**18.2**	Fines Silt or Clay	**21.86**
0.022	**16.9**		
0.013	**15.8**		
0.0090	**14.5**		
0.0065	**12.9**		
0.0032	**9.7**		
0.0014	**6.2**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
7.6	**35**	**21**	**14**	**2.70**

DESCRIPTION: Pale reddish brown clayey gravel with sand

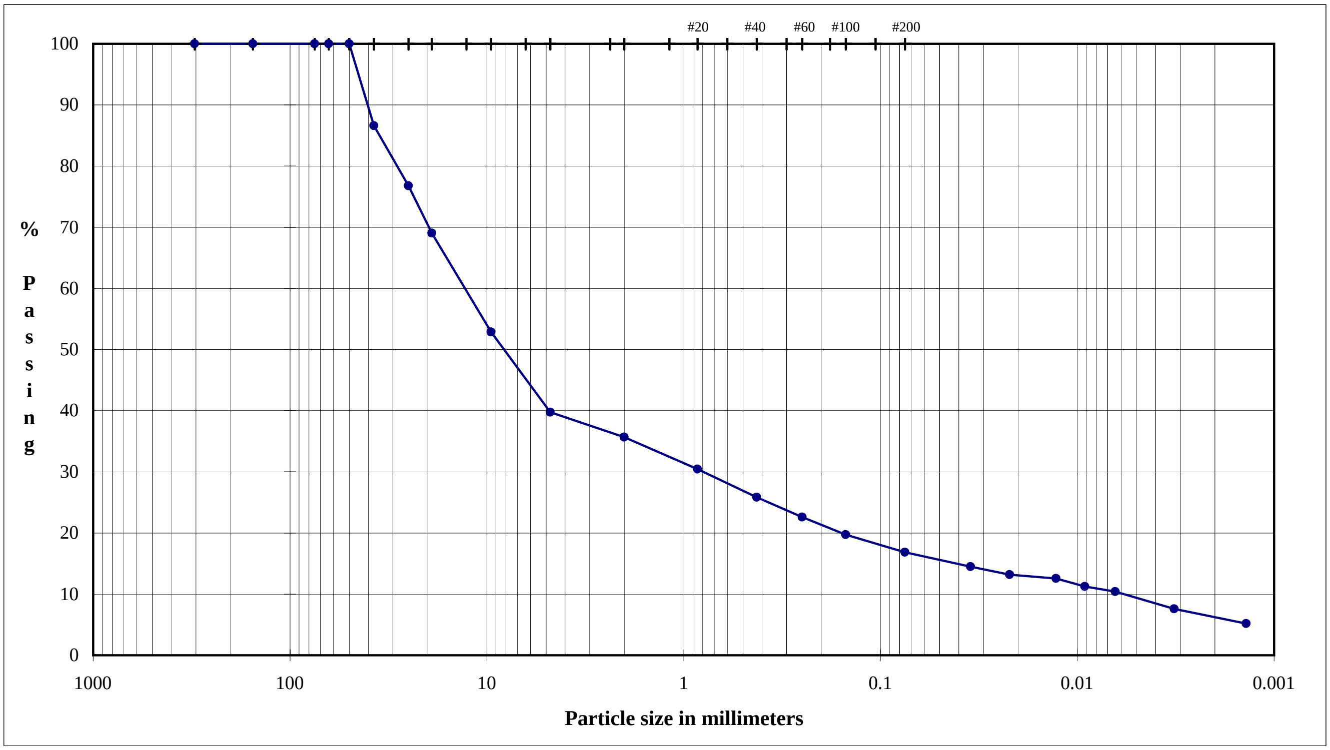
USCS: GC

TECH JR
DATE 10/4/2004
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **GA04-TY-3-GT** Depth: --
TYPE: **BULK**

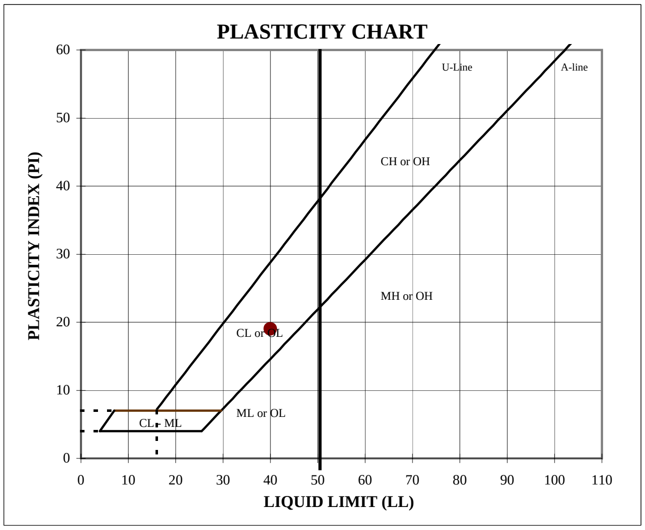


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**30.96**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**86.6**		
1.0"	25.0	**76.8**		
0.75"	19.0	**69.0**	Fine Gravel	**29.30**
0.375"	9.5	**52.9**		
#4	4.8	**39.7**		
#10	2.00	**35.7**	Coarse Sand	**4.08**
#20	0.85	**30.4**	Medium Sand	**9.81**
#40	0.43	**25.8**		
#60	0.25	**22.6**	Fine Sand	**9.02**
#100	0.15	**19.7**		
#200	0.075	**16.8**		

Hydrometer Analysis (mm)	%Finer		
0.035	**14.5**	Fines Silt or Clay	**16.83**
0.022	**13.2**		
0.013	**12.6**		
0.0091	**11.3**		
0.0064	**10.4**		
0.0032	**7.6**		
0.0014	**5.2**		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
10.5	**40**	**21**	**19**	**2.70**

DESCRIPTION: Grayish orange clayey gravel with sand

USCS: GC

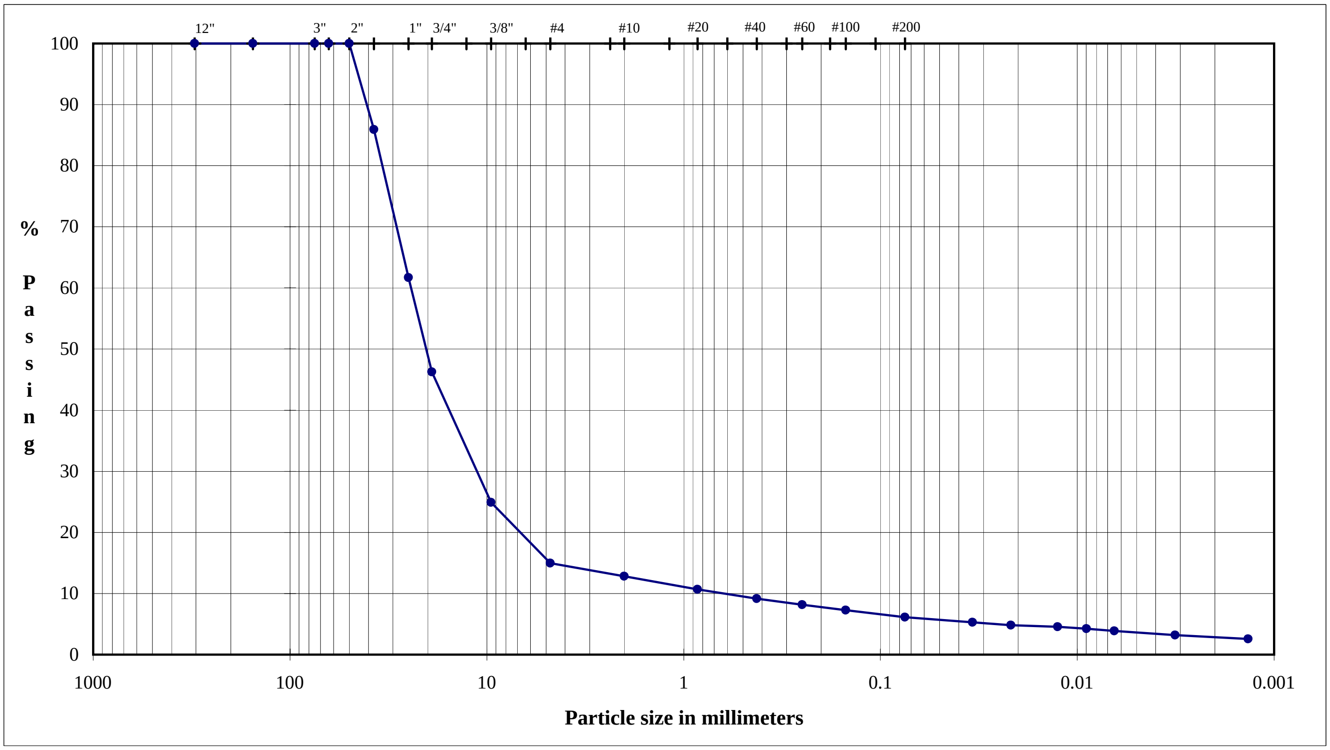
TECH JR
DATE 10/4/2004
REVIEW MB

October-04 **043-2576-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **GA04-TY-4-GT** Depth: --
TYPE: **BULK**



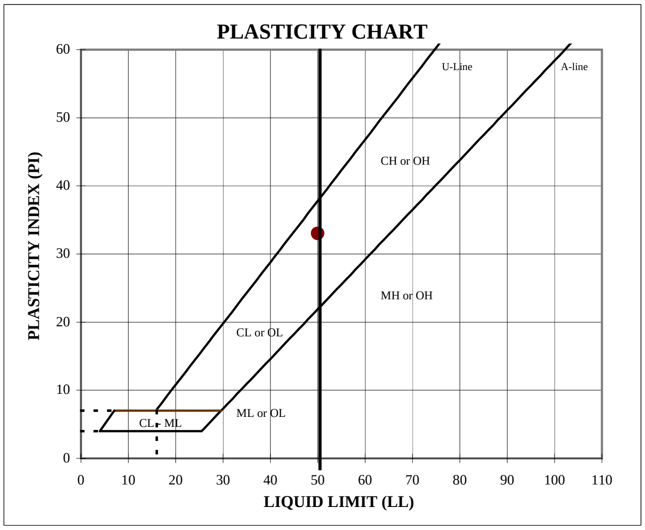
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**53.75**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**85.9**		
1.0"	25.0	**61.7**		
0.75"	19.0	**46.2**	Fine Gravel	**31.30**
0.375"	9.5	**24.9**		
#4	4.8	**14.9**		
#10	2.00	**12.8**	Coarse Sand	**2.13**
#20	0.85	**10.7**	Medium Sand	**3.65**
#40	0.43	**9.2**		
#60	0.25	**8.2**	Fine Sand	**3.03**
#100	0.15	**7.3**		
#200	0.075	**6.1**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**5.3**	Fines Silt or Clay	**6.14**
0.022	**4.8**		
0.013	**4.5**		
0.0090	**4.2**		
0.0065	**3.9**		
0.0032	**3.2**		
0.0014	**2.6**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
1.9	**50**	**17**	**33**	**2.70**

DESCRIPTION: Grayish orange poorly graded gravel with clay and sand

USCS: GP-GC

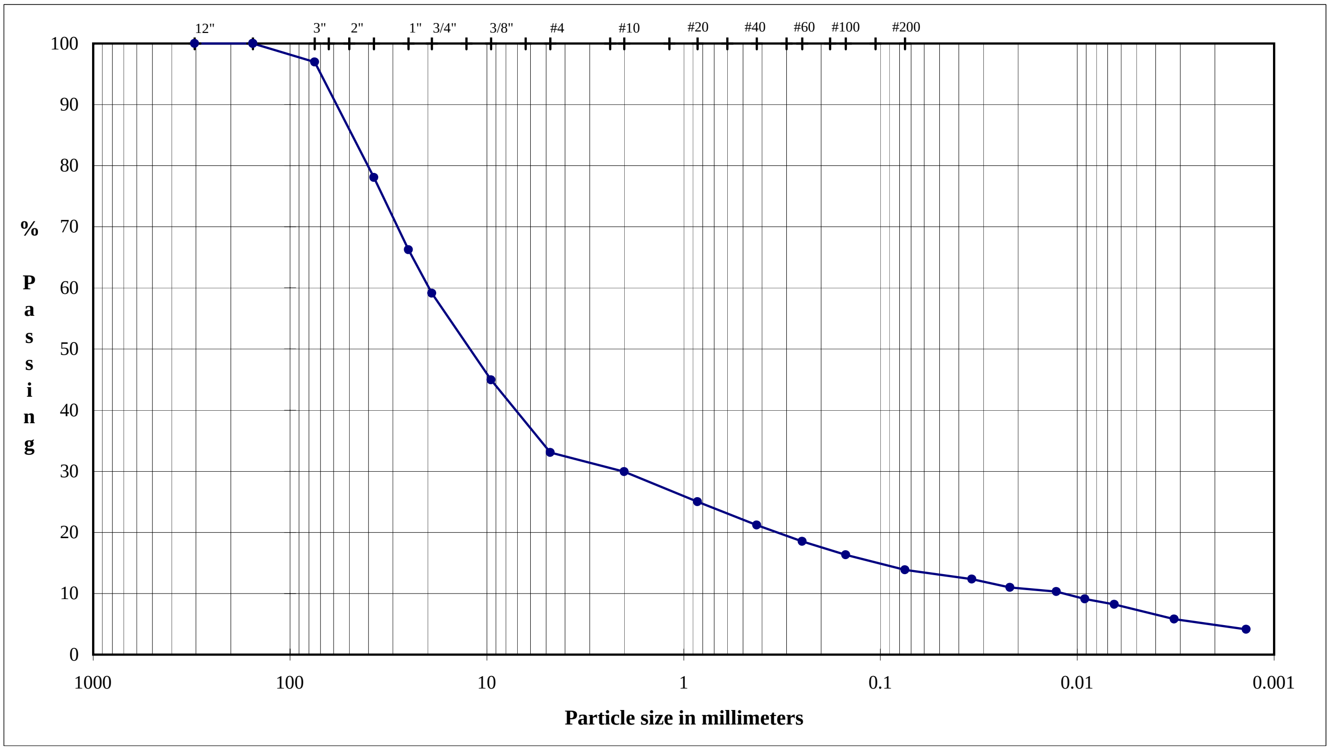
TECH	JR
DATE	10/4/2004
REVIEW	MB

October-04 **043-2576-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID:	**GA04-TY-5-GT** Depth: --
TYPE:	**BULK**



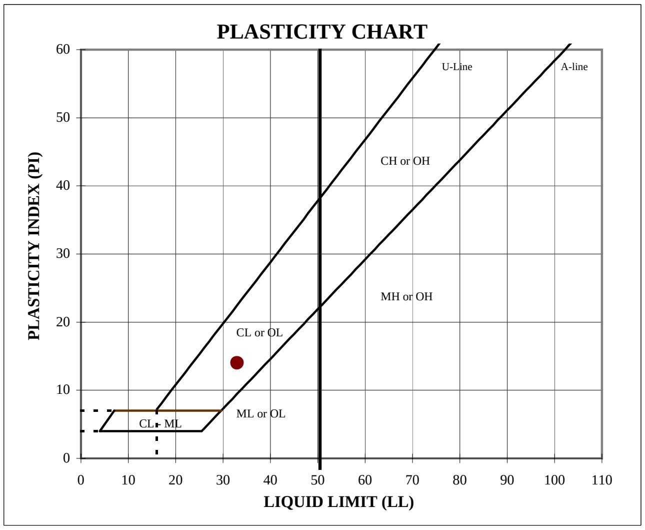
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**3.05**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**37.83**
6.0"	154.2	**100.0**		
3.0"	75.0	**97.0**		
1.5"	37.5	**78.1**		
1.0"	25.0	**66.3**		
0.75"	19.0	**59.1**	Fine Gravel	**26.07**
0.375"	9.5	**44.9**		
#4	4.8	**33.1**		
#10	2.00	**29.9**	Coarse Sand	**3.14**
#20	0.85	**25.0**	Medium Sand	**8.74**
#40	0.43	**21.2**		
#60	0.25	**18.5**	Fine Sand	**7.29**
#100	0.15	**16.3**		
#200	0.075	**13.9**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**12.3**	Fines Silt or Clay	**13.89**
0.022	**11.0**		
0.013	**10.3**		
0.0091	**9.1**		
0.0065	**8.2**		
0.0032	**5.8**		
0.0014	**4.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
5.4	**33**	**19**	**14**	**2.70**

DESCRIPTION: Light brown clayey gravel with sand

USCS: GC

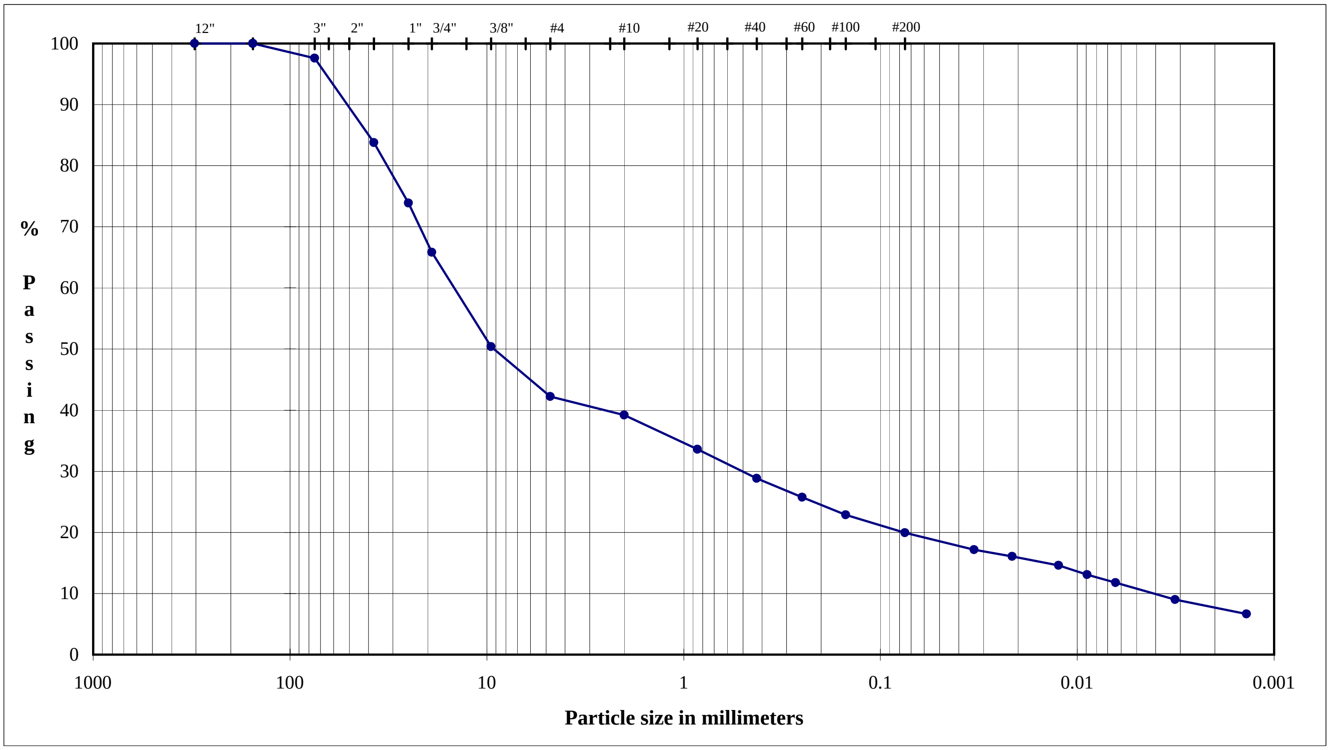
TECH	JR
DATE	10/4/2004
REVIEW	MB

October-04 **043-2576-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **GA04-TY-6-GT** Depth: --
TYPE: **BULK**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

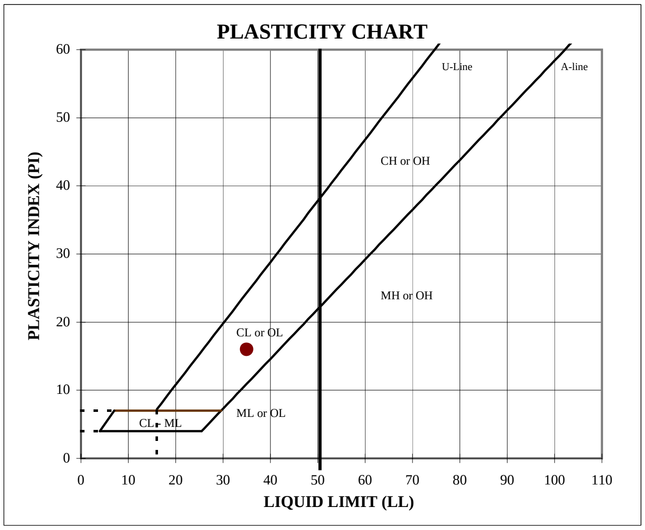
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**2.40**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**31.80**
6.0"	154.2	**100.0**		
3.0"	75.0	**97.6**		
1.5"	37.5	**83.8**		
1.0"	25.0	**73.9**		
0.75"	19.0	**65.8**	Fine Gravel	**23.60**
0.375"	9.5	**50.4**		
#4	4.8	**42.2**		
#10	2.00	**39.2**	Coarse Sand	**3.00**
#20	0.85	**33.6**	Medium Sand	**10.36**
#40	0.43	**28.8**		
#60	0.25	**25.8**	Fine Sand	**8.91**
#100	0.15	**22.9**		
#200	0.075	**19.9**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**17.2**	Fines Silt or Clay	**19.94**
0.021	**16.1**		
0.012	**14.6**		
0.0089	**13.1**		
0.0064	**11.8**		
0.0032	**9.0**		
0.0014	**6.6**		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
8.4	**35**	**19**	**16**	**2.70**

DESCRIPTION: Moderate yellowish brown clayey gravel with sand

USCS: GC

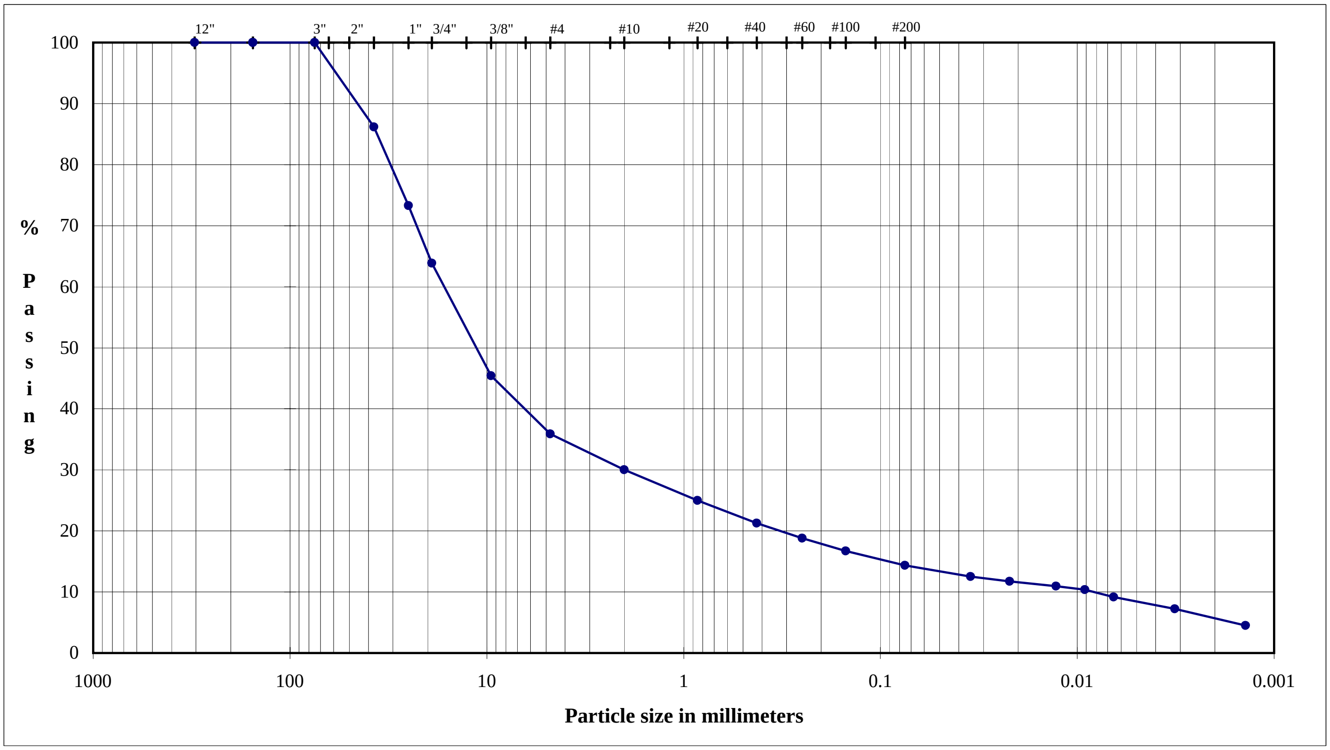
TECH	JR
DATE	10/4/2004
REVIEW	MB

Golder Associates Inc.

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**GA04-TY-7-GT**	Depth:	--
TYPE:	**BULK**		



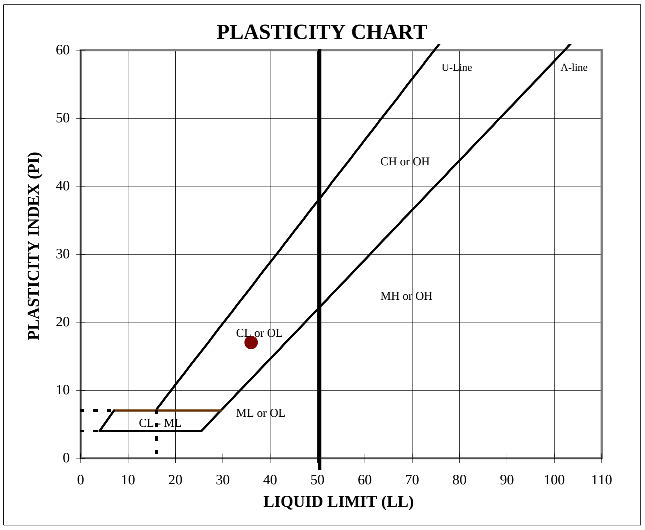
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**36.16**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**86.2**		
1.0"	25.0	**73.3**		
0.75"	19.0	**63.8**	Fine Gravel	**27.96**
0.375"	9.5	**45.4**		
#4	4.8	**35.9**		
#10	2.00	**30.0**	Coarse Sand	**5.86**
#20	0.85	**25.0**	Medium Sand	**8.73**
#40	0.43	**21.3**		
#60	0.25	**18.8**	Fine Sand	**6.95**
#100	0.15	**16.7**		
#200	0.075	**14.3**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**12.5**	Fines Silt or Clay	**14.33**
0.022	**11.7**		
0.013	**10.9**		
0.0091	**10.4**		
0.0065	**9.2**		
0.0032	**7.2**		
0.0014	**4.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
5.9	**36**	**19**	**17**	**2.70**

DESCRIPTION: Dark yellowish orange clayey gravel with sand

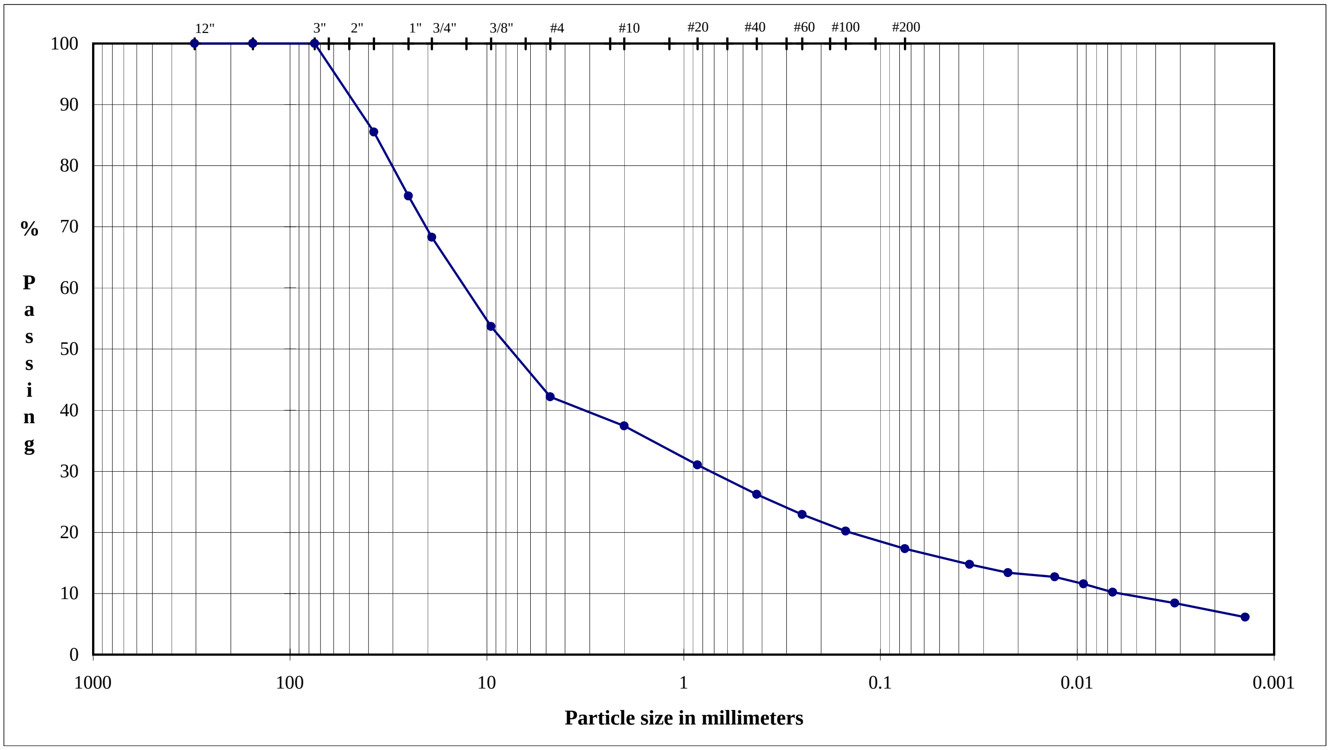
USCS: GC

TECH	JR
DATE	10/4/2004
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **GA04-TY-8-GT** Depth: --
TYPE: **BULK**



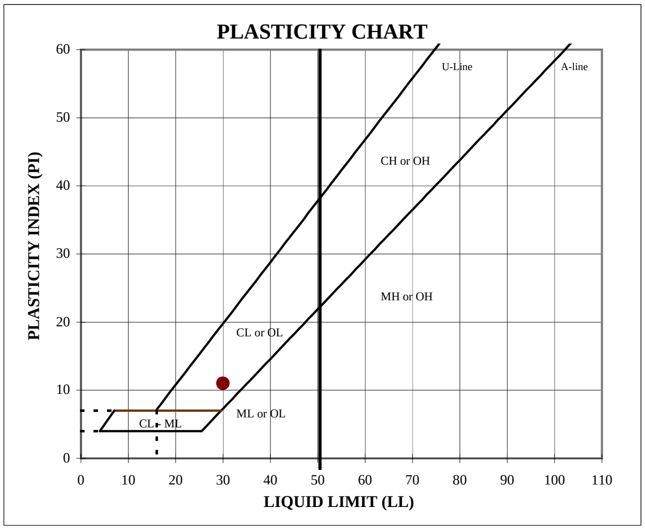
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size		Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**31.70**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**85.5**		
1.0"	25.0	**75.0**		
0.75"	19.0	**68.3**	Fine Gravel	**26.15**
0.375"	9.5	**53.7**		
#4	4.8	**42.2**		
#10	2.00	**37.4**	Coarse Sand	**4.74**
#20	0.85	**31.0**	Medium Sand	**11.22**
#40	0.43	**26.2**		
#60	0.25	**22.9**	Fine Sand	**8.85**
#100	0.15	**20.2**		
#200	0.075	**17.3**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**14.8**	Fines Silt or Clay	**17.34**
0.022	**13.4**		
0.013	**12.7**		
0.0093	**11.6**		
0.0066	**10.2**		
0.0032	**8.4**		
0.0014	**6.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
8.0	**30**	**19**	**11**	**2.70**

DESCRIPTION: Moderate yellowish brown clayey gravel with sand

USCS: GC

TECH	MKS
DATE	10/4/2004
REVIEW	MB

APPENDIX C-4

2004 SONIC DRILLING SOIL SUMMARY AND GRAIN-SIZE ANALYSIS

TABLE C-4.1
SUMMARY OF SOIL DATA

Sample Type	Sample Number	Sample Depth (feet)	USCS Soil Classification	Delivered Moisture (%)	Atterberg Limits			Grain-size Distribution			Specific Gravity	Moisture/Density Relationship Standard Proctor	
					LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200		PCF (Dry)	Moist (%)
Bulk	GA04-TY-1-GT	--	GC	8.8	34	20	14	70	41	18	--	--	--
Bulk	GA04-TY-2-GT	--	GC	7.6	35	21	14	80	52	22	--	--	--
Bulk	GA04-TY-3-GT	--	GC	10.5	40	21	19	69	40	17	--	--	--
Bulk	GA04-TY-4-GT	--	GP-GC	1.9*	50	17	33	46	15	6	--	--	--
Bulk	GA04-TY-5-GT	--	GC	5.4	33	19	14	59	33	14	--	--	--
Bulk	GA04-TY-6-GT	--	GC	8.4	35	19	16	66	42	20	--	--	--
Bulk	GA04-TY-7-GT	--	GC	5.9	36	19	17	64	36	14	--	--	--
Bulk	GA04-TY-8-GT	--	GC	8.0	30	19	11	68	42	17	--	--	--
Pail	TSGT-1	19-21	SC	--	25	14	11	86	65	23	2.91	--	--
Pail	TSGT-1	47-48.5	GC	--	29	16	13	61	41	15	--	--	--
Pail	TSGT-1	75-77	SC-SM	--	26	19	7	81	60	17	--	--	--
Pail	TSGT-1	88-90	GC	--	28	18	10	84	58	23	--	--	--
Pail	TSGT-1	102-104	GC	--	33	20	13	80	55	21	--	--	--
Pail	TSGT-1	140-142	GC	--	29	18	11	66	46	21	--	--	--
Pail	TSGT-1	158.5-160	GC	--	34	19	15	64	41	18	--	--	--
Pail	TSGT-1	184-186	GC	--	30	20	10	72	50	17	2.75	--	--
Pail	TSGT-1	211-214	SC	--	27	16	11	93	76	32	--	--	--
Pail	TSGT-1	228-230	GC	--	23	15	8	72	52	21	--	--	--
Pail	TSGT-1	250.5-253	SC	--	27	16	11	89	69	30	--	--	--
Pail	TSGT-1	298-300	SC	--	28	14	14	95	82	38	--	--	--
Pail	TSGT-1	310-312	GC	--	29	16	13	78	55	21	--	--	--
Pail	TSGT-1	327-329	SC-SM	--	21	15	6	83	67	24	--	--	--
Pail	TSGT-1	356-358	SC	--	32	16	16	80	65	26	--	--	--
Pail	TSGT-1	388-390	SC	--	26	15	11	93	82	35	2.70	--	--
Pail	TSGT-2	18-20	GC	--	27	16	11	72	47	16	2.89	--	--
Pail	TSGT-2	42-44	GP-GC	--	22	14	8	64	37	12	--	--	--
Pail	TSGT-2	140-142	SC	--	34	20	14	86	63	18	--	--	--
Pail	TSGT-2	267-268.5	GC	--	29	19	10	66	46	12	--	--	--
Pail	TSGT-3	18-20	SC	--	28	17	11	94	66	16	2.69	--	--
Pail	TSGT-3	58-60	GC	--	29	17	12	85	56	15	--	--	--
Pail	TSGT-3	156-158	SC	--	29	15	14	94	75	28	--	--	--
Pail	TSGT-3	248-250	GC	--	28	17	11	74	56	22	2.78	--	--
Pail	TSGT-4	12-14	GC	--	34	18	16	78	55	21	2.83	--	--
Pail	TSGT-4	69-71	GC	--	36	20	16	64	34	12	--	--	--
Pail	TSGT-4	117-119	GC	--	35	20	15	68	38	14	2.73	--	--
Pail	TSGT-4	152-154	GC	--	31	18	13	88	55	18	2.66	--	--
Pail	TSGT-4	183-185	SC	--	31	19	12	94	78	24	2.71	--	--
Pail	TSGT-4	221-223	GC	--	29	17	12	78	47	16	--	--	--
Pail	TSGT-4	265-269	SM	--	NP	NP	NP	97	90	22	--	--	--

Notes:

* Delivered moisture content taken from Bulk sample due to no bag sample present

LL = Liquid Limit

PL = Plastic Limit

PI = Plastic Index

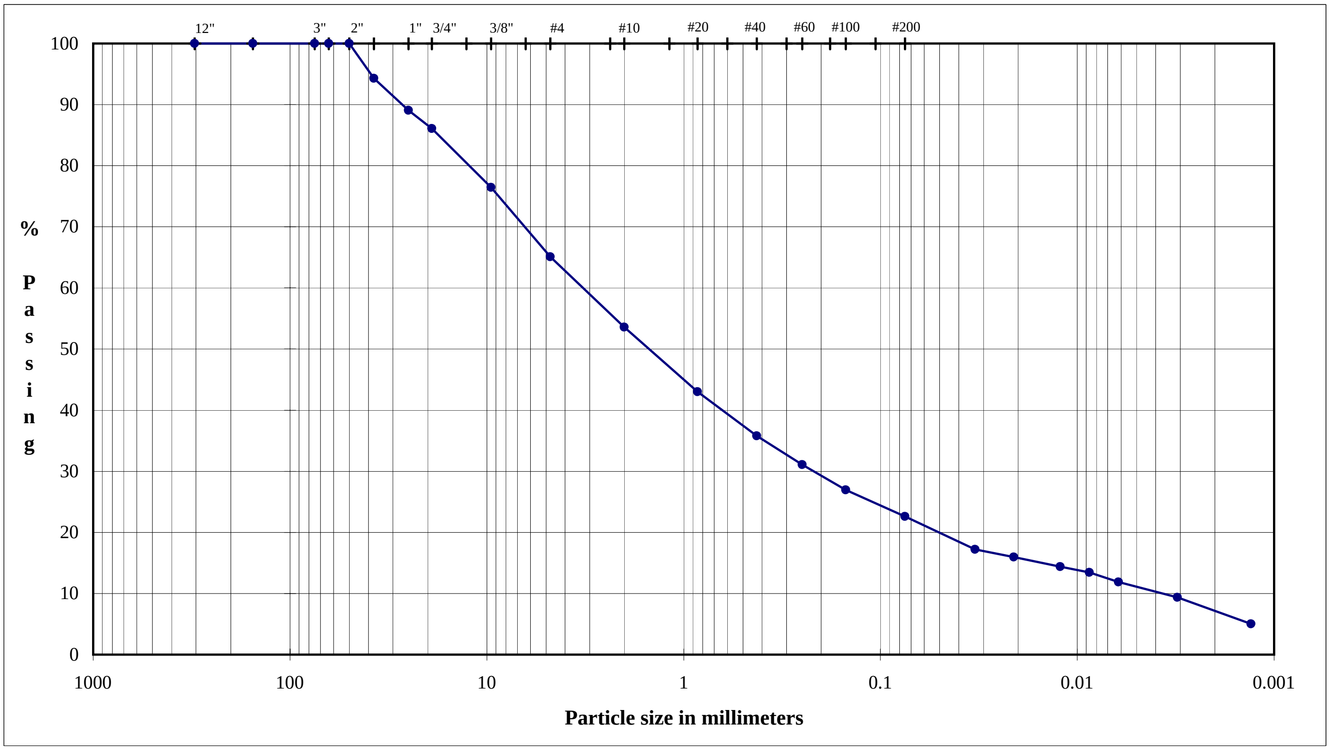
USCS = Unified Soil Classification System

PCF = pounds per cubic foot

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **19-21**
TYPE: **Pail**



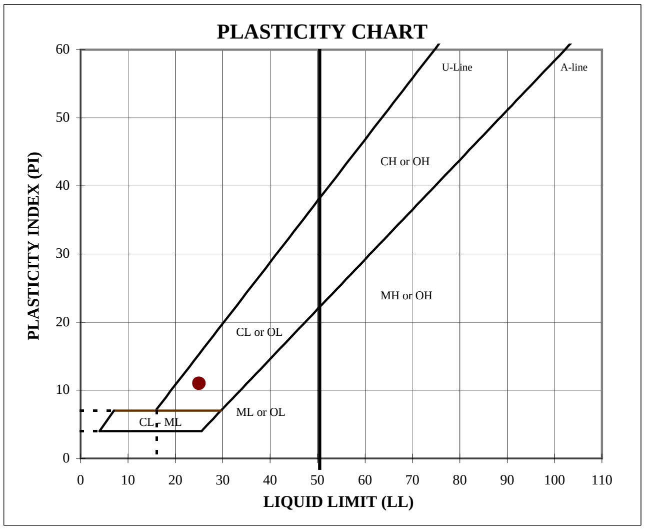
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**13.90**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**94.3**		
1.0"	25.0	**89.1**		
0.75"	19.0	**86.1**	Fine Gravel	**21.03**
0.375"	9.5	**76.5**		
#4	4.8	**65.1**		
#10	2.00	**53.6**	Coarse Sand	**11.49**
#20	0.85	**43.0**	Medium Sand	**17.79**
#40	0.43	**35.8**		
#60	0.25	**31.1**	Fine Sand	**13.19**
#100	0.15	**26.9**		
#200	0.075	**22.6**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**17.2**	Fines Silt or Clay	**22.59**
0.021	**16.0**		
0.012	**14.4**		
0.0087	**13.5**		
0.0062	**11.9**		
0.0031	**9.4**		
0.0013	**5.0**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	25	14	11	2.91

DESCRIPTION: Pale yellow clayey sand with gravel

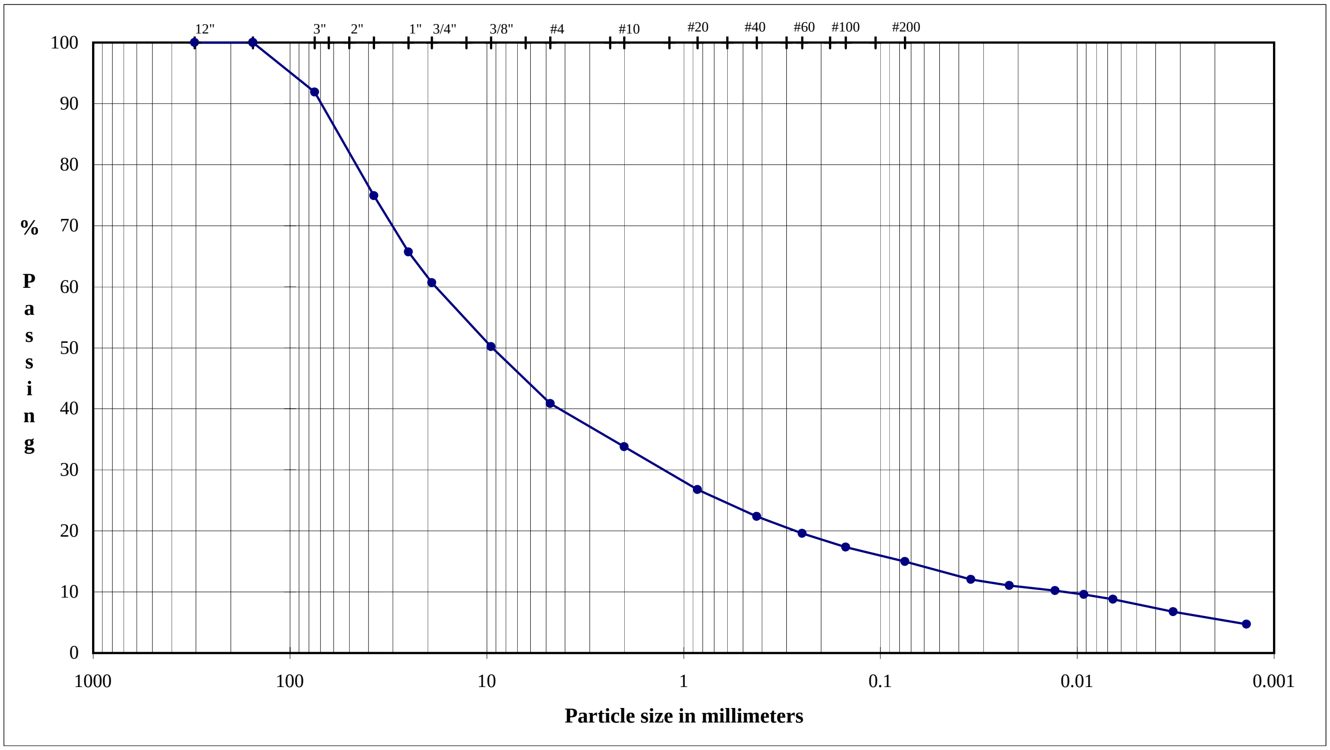
USCS: SC

TECH	MKS
DATE	6/15/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **47-48.5**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

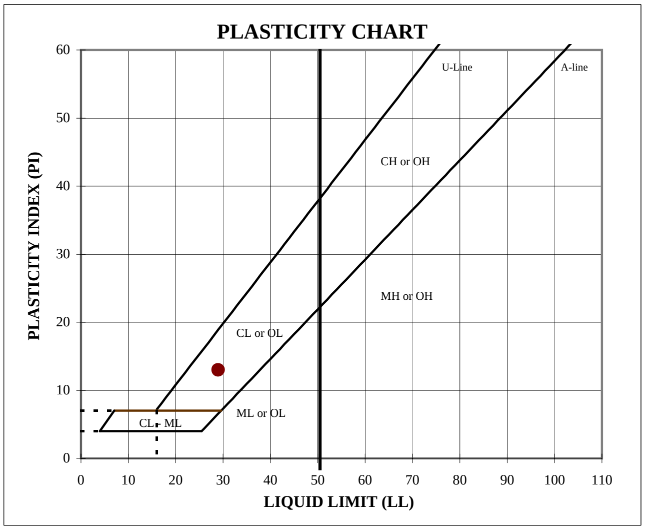
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**8.09**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**31.23**
6.0"	154.2	**100.0**		
3.0"	75.0	**91.9**		
1.5"	37.5	**74.9**		
1.0"	25.0	**65.7**		
0.75"	19.0	**60.7**	Fine Gravel	**19.83**
0.375"	9.5	**50.2**		
#4	4.8	**40.8**		
#10	2.00	**33.8**	Coarse Sand	**7.06**
#20	0.85	**26.8**	Medium Sand	**11.40**
#40	0.43	**22.4**		
#60	0.25	**19.6**	Fine Sand	**7.39**
#100	0.15	**17.4**		
#200	0.075	**15.0**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**12.1**	Fines Silt or Clay	**14.99**
0.022	**11.0**		
0.013	**10.2**		
0.0092	**9.6**		
0.0066	**8.8**		
0.0033	**6.7**		
0.0014	**4.7**		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	29	16	13	2.70

DESCRIPTION: Reddish yellow clayey gravel with sand

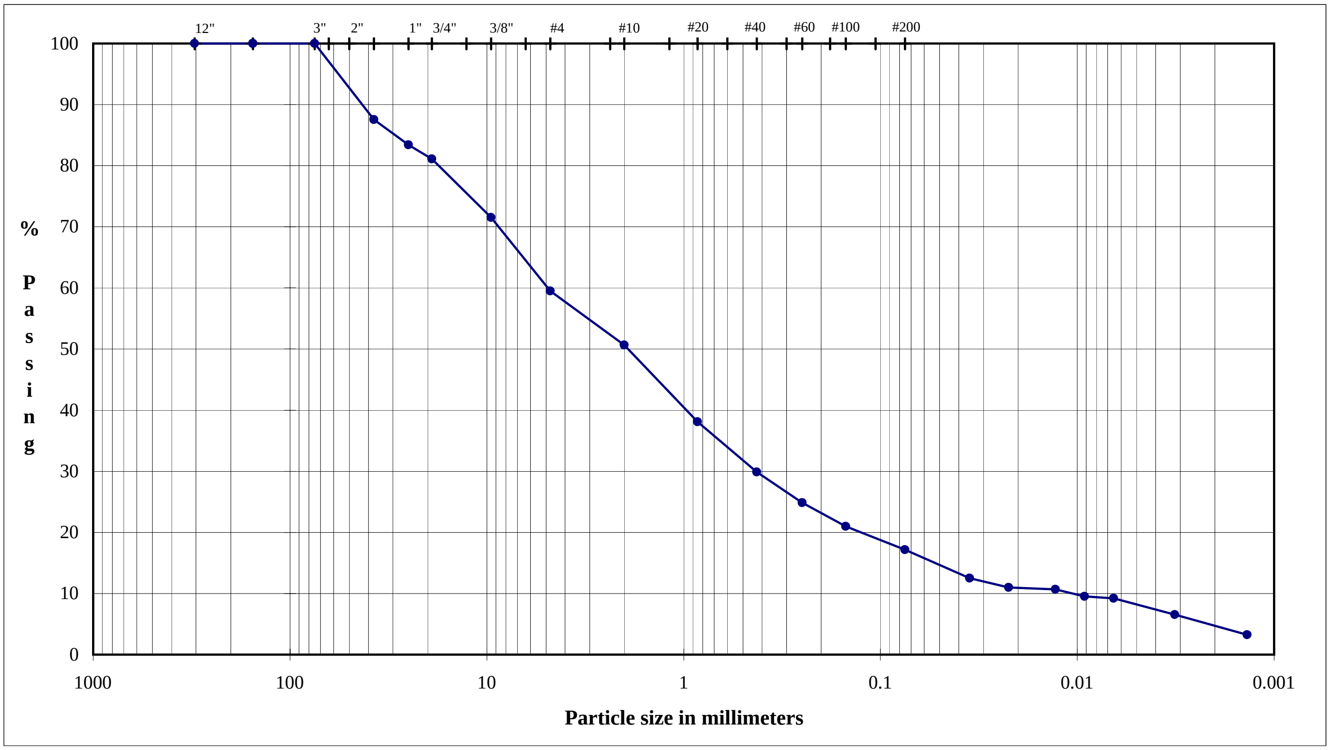
USCS: GC

TECH	MKS
DATE	6/15/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **75-77**
TYPE: **Pail**



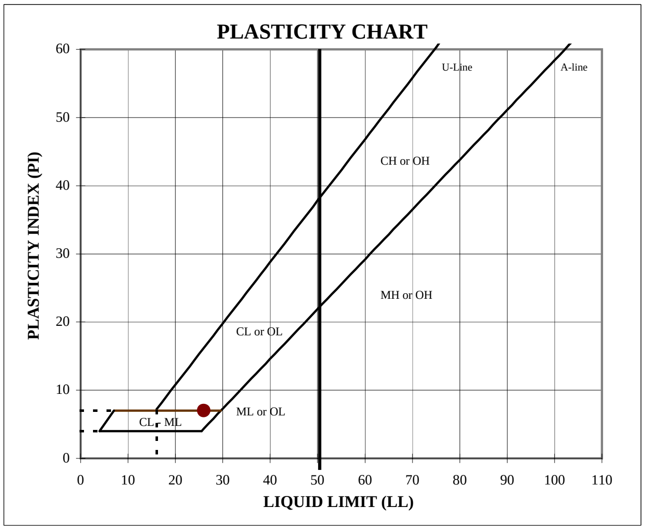
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**18.91**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**87.6**		
1.0"	25.0	**83.4**		
0.75"	19.0	**81.1**	Fine Gravel	**21.57**
0.375"	9.5	**71.5**		
#4	4.8	**59.5**		
#10	2.00	**50.7**	Coarse Sand	**8.86**
#20	0.85	**38.1**	Medium Sand	**20.78**
#40	0.43	**29.9**		
#60	0.25	**24.8**	Fine Sand	**12.68**
#100	0.15	**21.0**		
#200	0.075	**17.2**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**12.5**	Fines Silt or Clay	**17.19**
0.022	**11.0**		
0.013	**10.7**		
0.0092	**9.5**		
0.0065	**9.2**		
0.0032	**6.5**		
0.0014	**3.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**26**	**19**	**7**	**2.70**

DESCRIPTION: Pale red silty, clayey sand with gravel

USCS: SC-SM

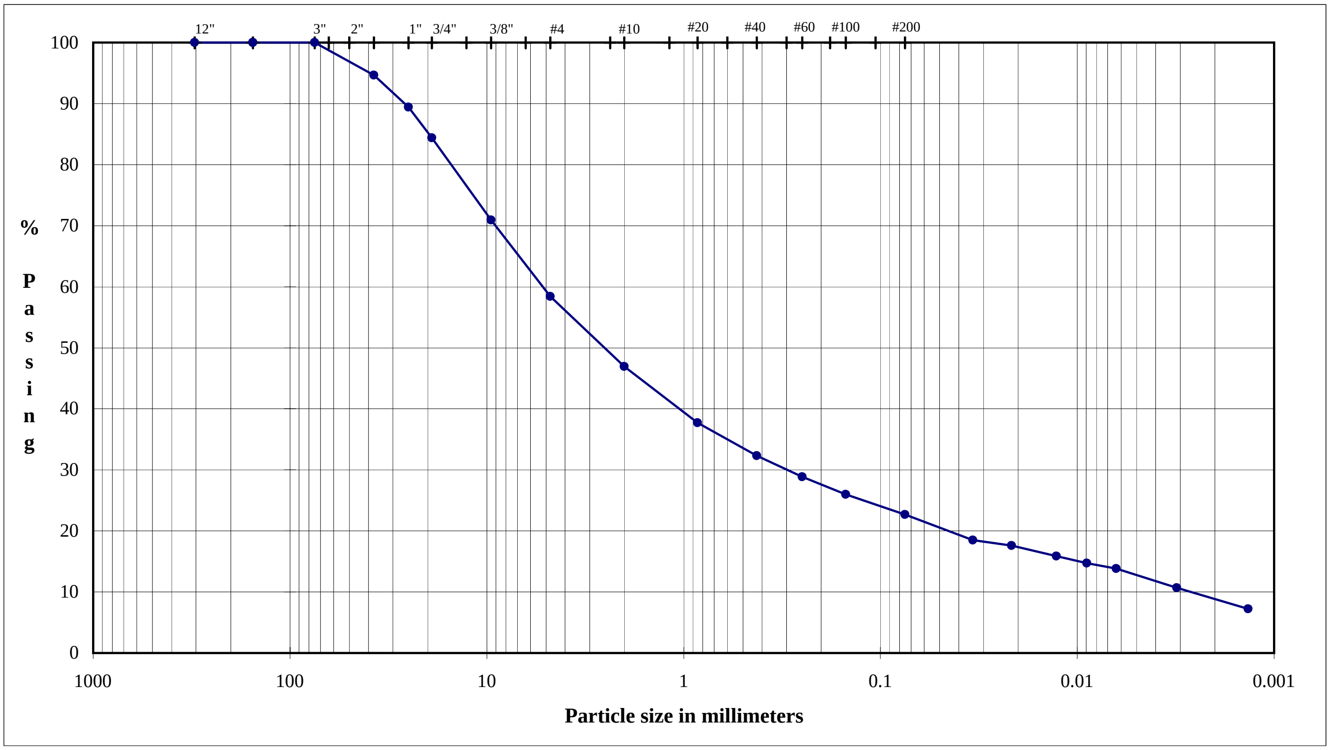
TECH DS
DATE 6/17/2005
REVIEW MB

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **88-90**
TYPE: **Pail**



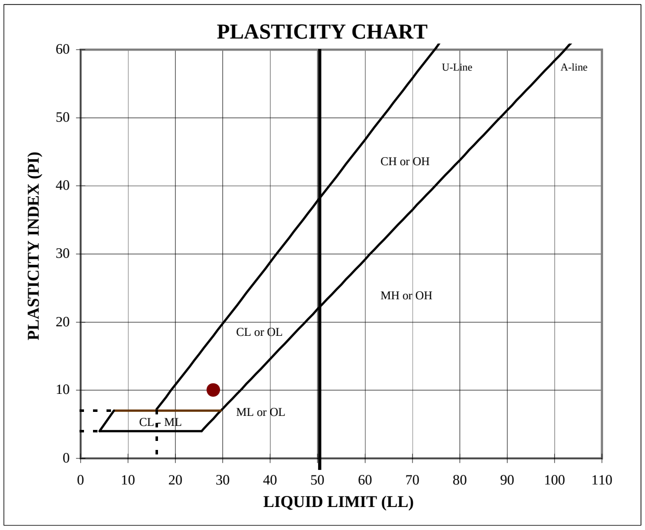
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**15.63**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**94.6**		
1.0"	25.0	**89.4**		
0.75"	19.0	**84.4**	Fine Gravel	**25.95**
0.375"	9.5	**71.0**		
#4	4.8	**58.4**		
#10	2.00	**46.9**	Coarse Sand	**11.49**
#20	0.85	**37.7**	Medium Sand	**14.60**
#40	0.43	**32.3**		
#60	0.25	**28.9**	Fine Sand	**9.63**
#100	0.15	**26.0**		
#200	0.075	**22.7**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**18.5**	Fines Silt or Clay	**22.70**
0.022	**17.6**		
0.013	**15.9**		
0.0090	**14.7**		
0.0063	**13.8**		
0.0031	**10.7**		
0.0014	**7.2**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**28**	**18**	**10**	**2.70**

DESCRIPTION: Light brown clayey gravel with sand

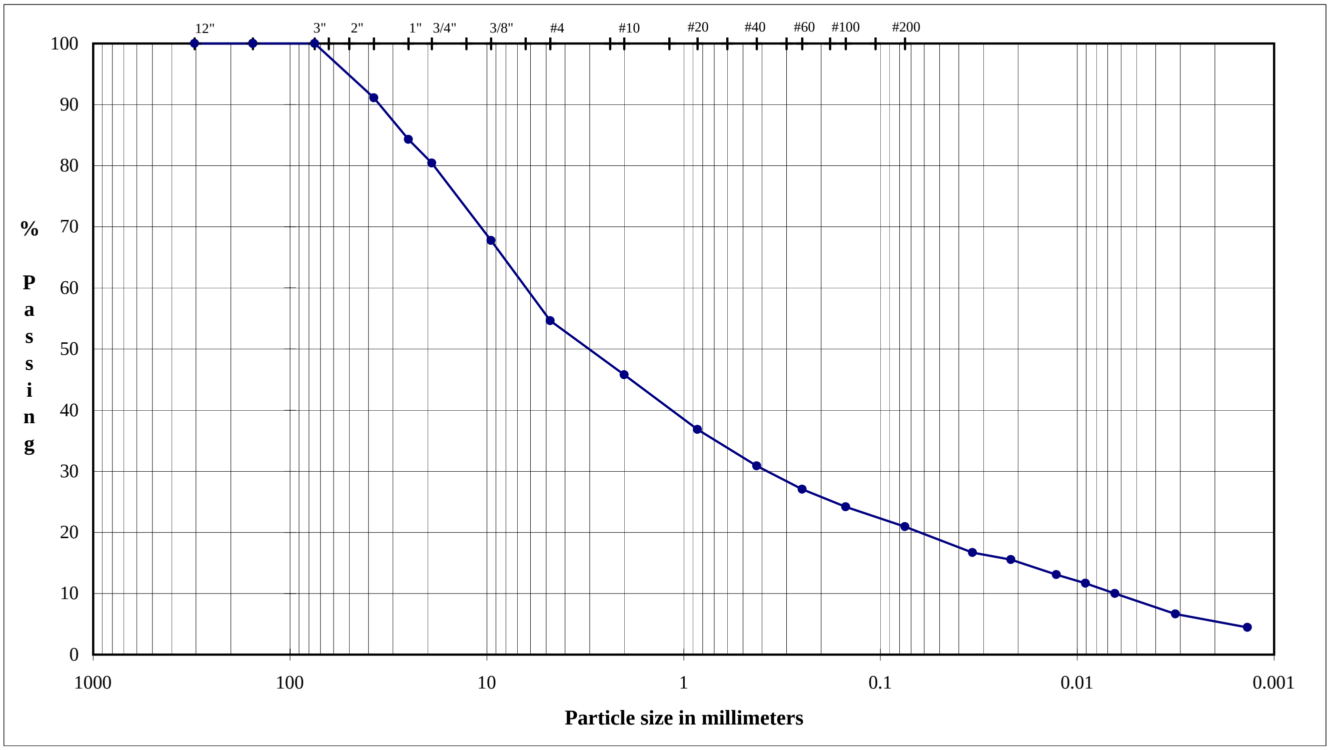
USCS: GC

TECH DS
DATE 6/15/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **102-104**
TYPE: **Pail**



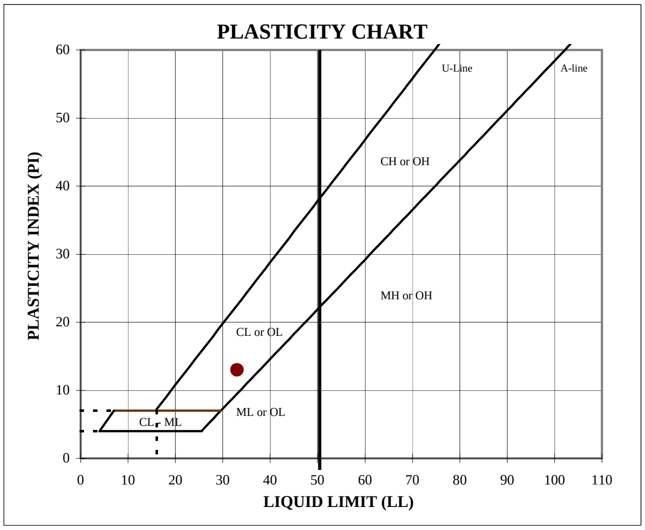
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**19.55**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**91.1**		
1.0"	25.0	**84.3**		
0.75"	19.0	**80.4**	Fine Gravel	**25.81**
0.375"	9.5	**67.8**		
#4	4.8	**54.6**		
#10	2.00	**45.8**	Coarse Sand	**8.84**
#20	0.85	**36.8**	Medium Sand	**14.94**
#40	0.43	**30.9**		
#60	0.25	**27.1**	Fine Sand	**9.90**
#100	0.15	**24.2**		
#200	0.075	**21.0**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**16.7**	Fines Silt or Clay	**20.95**
0.022	**15.6**		
0.013	**13.1**		
0.0091	**11.7**		
0.0064	**10.0**		
0.0032	**6.7**		
0.0014	**4.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**33**	**20**	**13**	**2.70**

DESCRIPTION: Weak red clayey gravel with sand

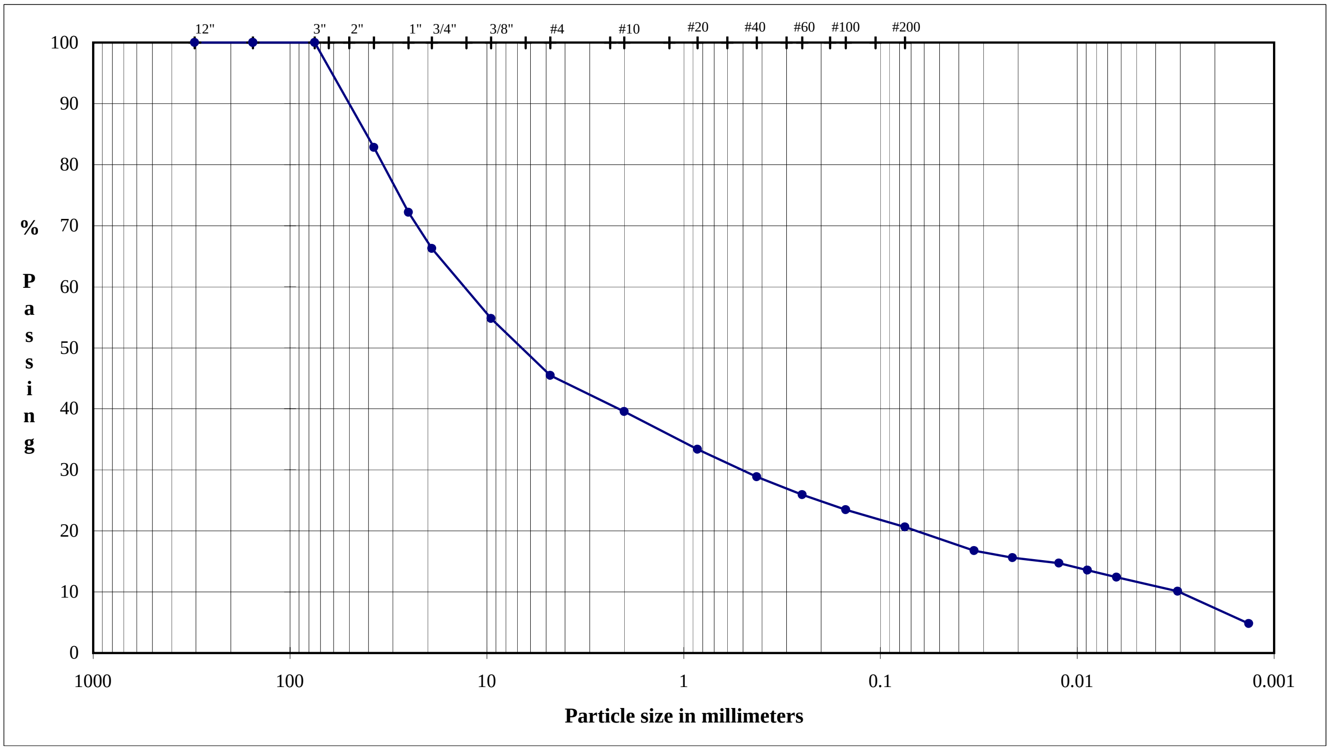
USCS: GC

TECH	MKS/DS
DATE	6/17/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **140-142**
TYPE: **Pail**



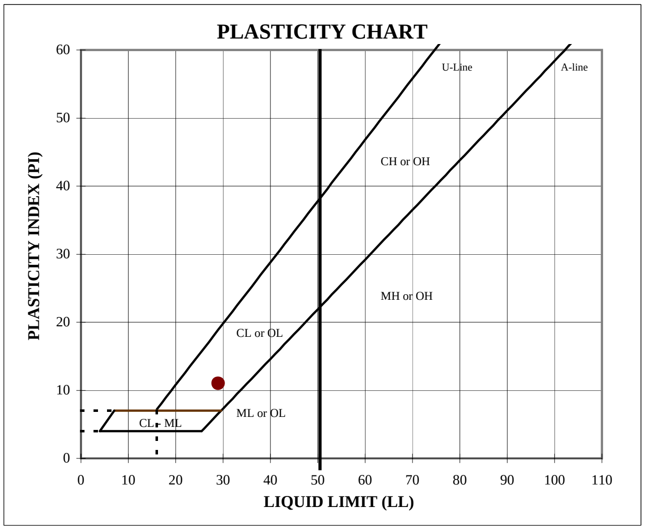
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**33.72**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**82.8**		
1.0"	25.0	**72.2**		
0.75"	19.0	**66.3**	Fine Gravel	**20.80**
0.375"	9.5	**54.8**		
#4	4.8	**45.5**		
#10	2.00	**39.6**	Coarse Sand	**5.92**
#20	0.85	**33.3**	Medium Sand	**10.67**
#40	0.43	**28.9**		
#60	0.25	**25.9**	Fine Sand	**8.24**
#100	0.15	**23.5**		
#200	0.075	**20.6**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**16.8**	Fines Silt or Clay	**20.64**
0.021	**15.6**		
0.012	**14.7**		
0.0089	**13.6**		
0.0063	**12.4**		
0.0031	**10.1**		
0.0013	**4.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**29**	**18**	**11**	**2.70**

DESCRIPTION: Pale yellow clayey gravel with sand

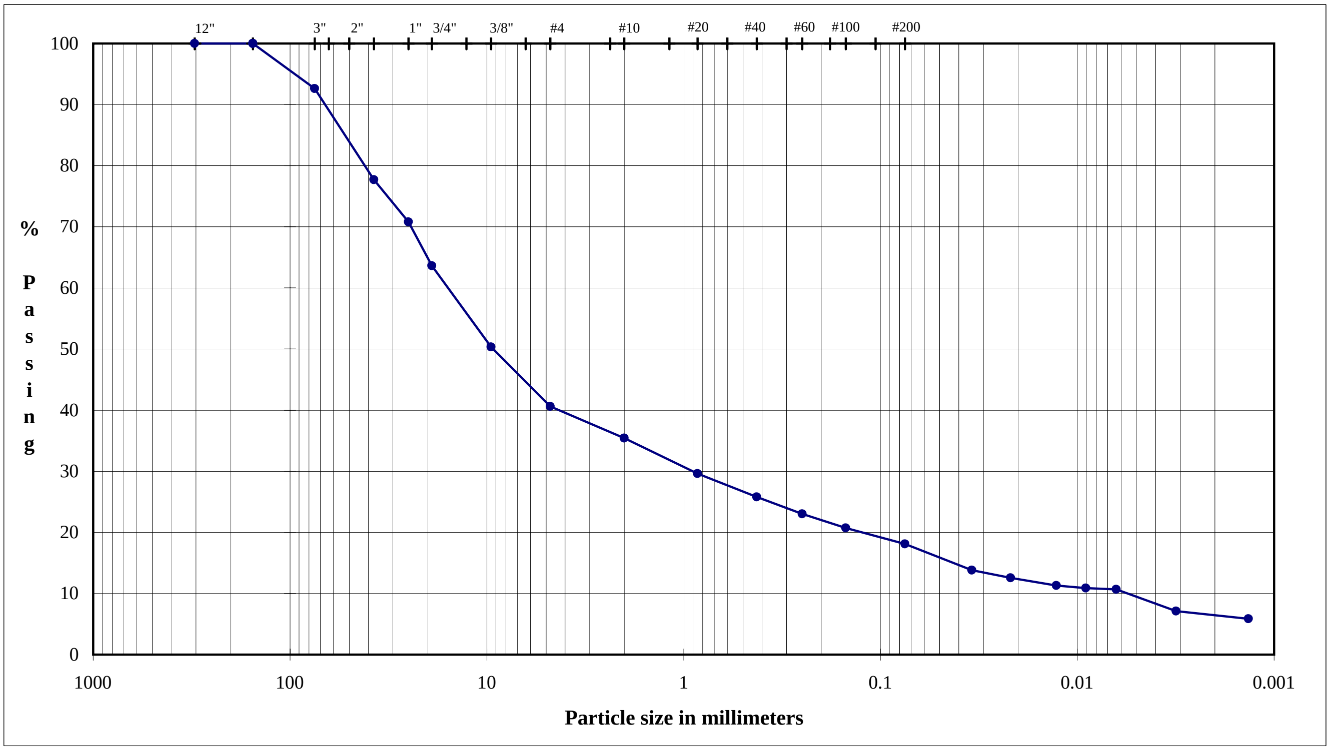
USCS: GC

TECH	DS
DATE	6/17/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **158.5-160**
TYPE: **Pail**



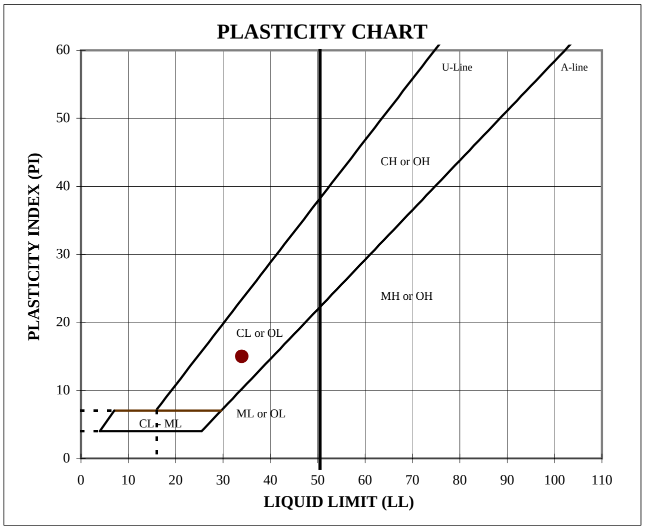
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**7.39**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**28.99**
6.0"	154.2	**100.0**		
3.0"	75.0	**92.6**		
1.5"	37.5	**77.7**		
1.0"	25.0	**70.8**		
0.75"	19.0	**63.6**	Fine Gravel	**23.01**
0.375"	9.5	**50.3**		
#4	4.8	**40.6**		
#10	2.00	**35.4**	Coarse Sand	**5.19**
#20	0.85	**29.6**	Medium Sand	**9.63**
#40	0.43	**25.8**		
#60	0.25	**23.0**	Fine Sand	**7.69**
#100	0.15	**20.7**		
#200	0.075	**18.1**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**13.8**	Fines Silt or Clay	**18.10**
0.022	**12.5**		
0.013	**11.3**		
0.0090	**10.9**		
0.0063	**10.7**		
0.0031	**7.1**		
0.0013	**5.9**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**34**	**19**	**15**	**2.70**

DESCRIPTION: Pale olive clayey gravel with sand

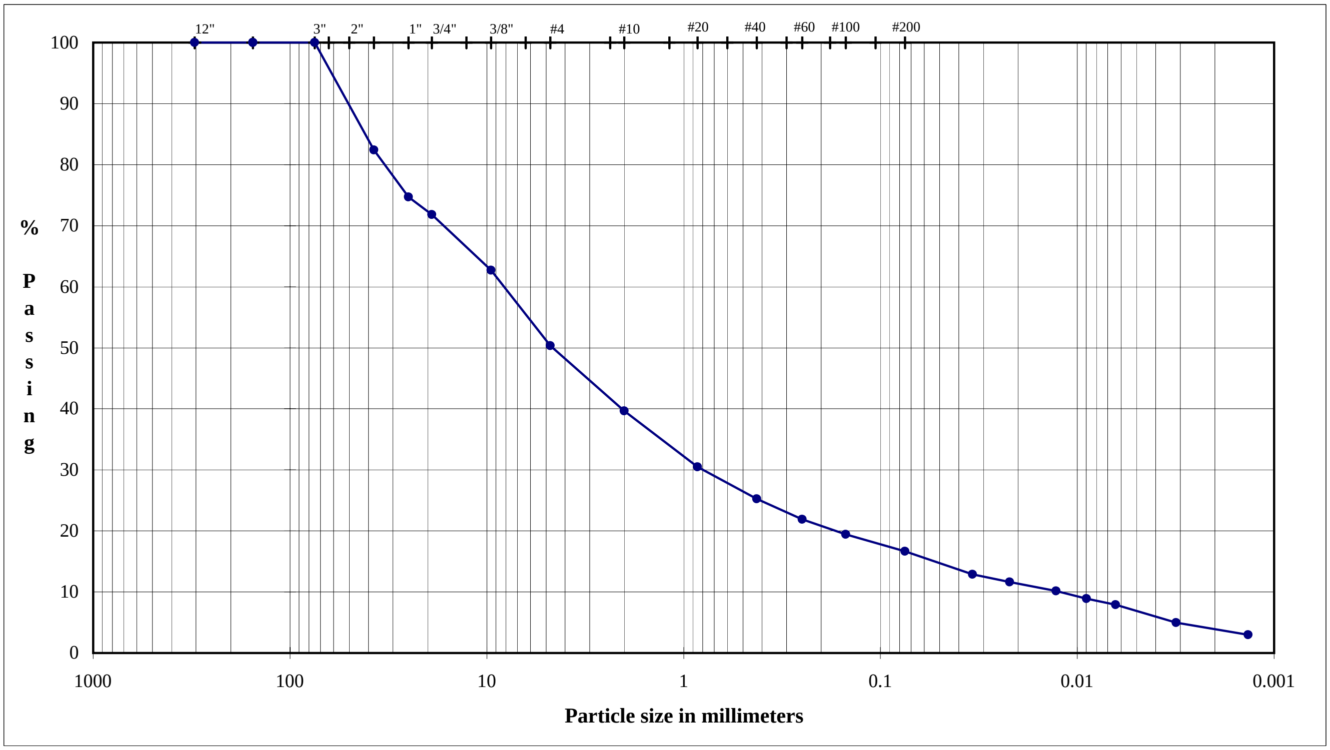
USCS: GC

TECH	MKS
DATE	6/17/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **184-186**
TYPE: **Pail**



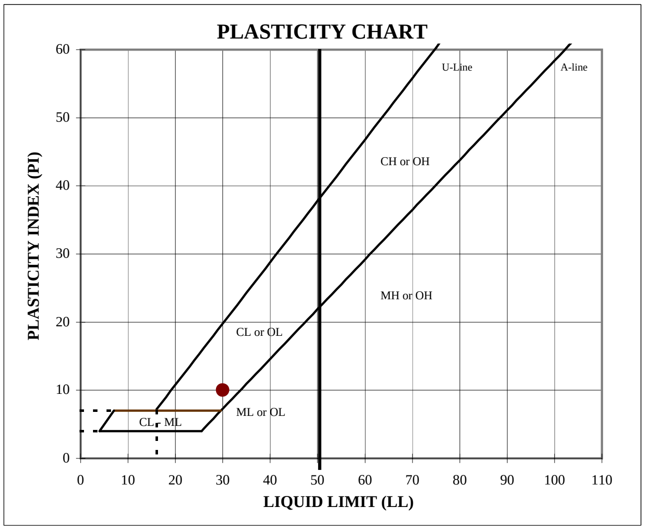
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**28.18**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**82.4**		
1.0"	25.0	**74.7**		
0.75"	19.0	**71.8**	Fine Gravel	**21.50**
0.375"	9.5	**62.7**		
#4	4.8	**50.3**		
#10	2.00	**39.6**	Coarse Sand	**10.67**
#20	0.85	**30.5**	Medium Sand	**14.39**
#40	0.43	**25.3**		
#60	0.25	**21.9**	Fine Sand	**8.57**
#100	0.15	**19.5**		
#200	0.075	**16.7**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**12.9**	Fines Silt or Clay	**16.68**
0.022	**11.6**		
0.013	**10.2**		
0.0090	**8.9**		
0.0064	**7.9**		
0.0031	**5.0**		
0.0014	**3.0**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	**30**	**20**	**10**	**2.75**

DESCRIPTION: Pale red clayey gravel with sand

USCS: GC

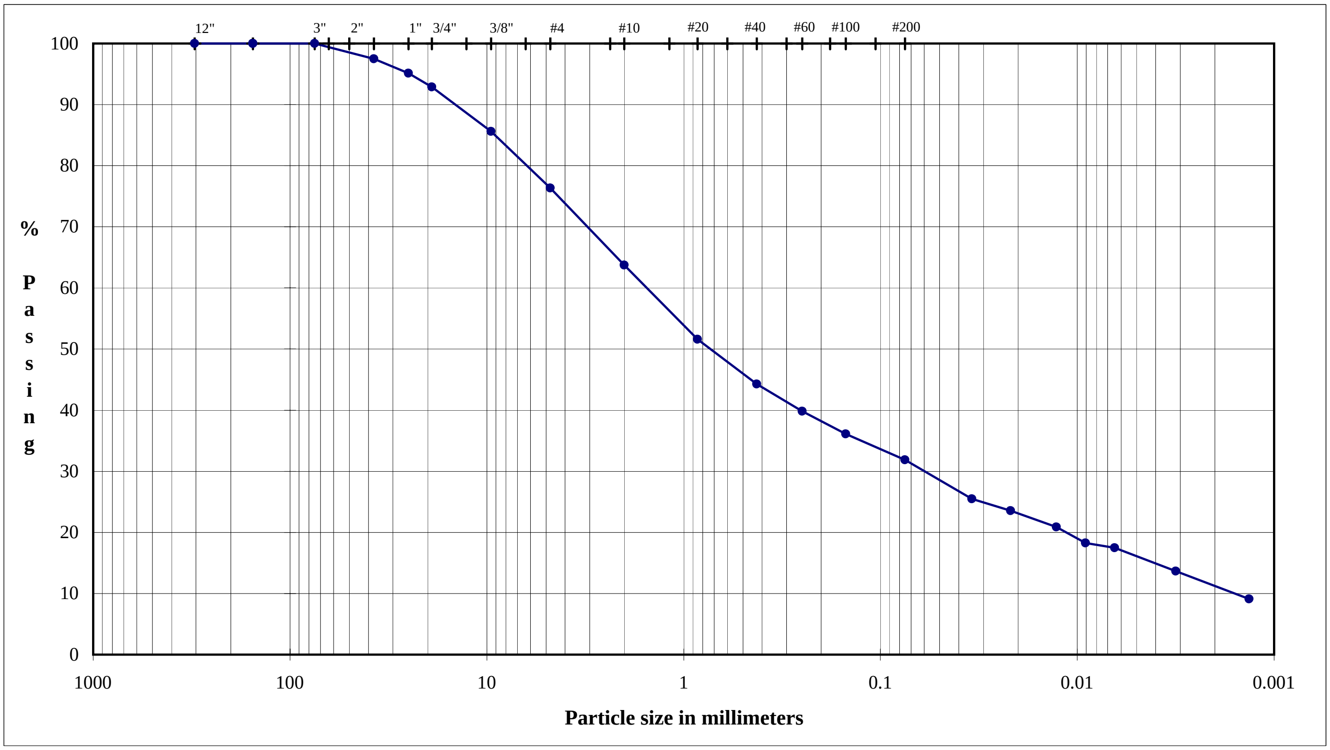
TECH	MKS
DATE	6/17/2005
REVIEW	MB

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **211-214**
TYPE: **Pail**



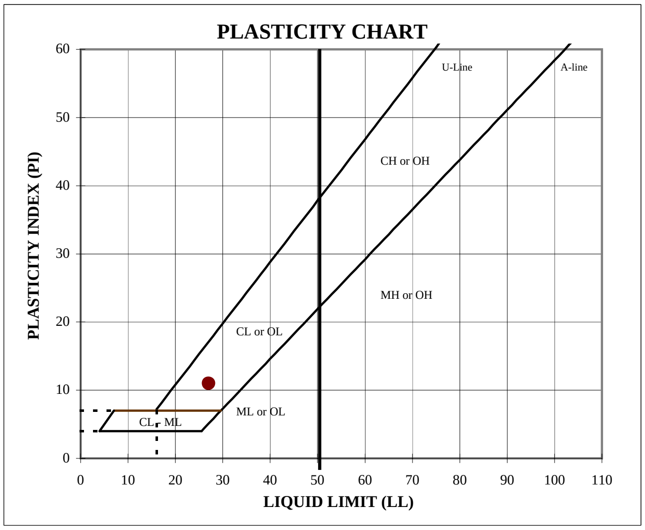
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	7.12
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	97.5		
1.0"	25.0	95.1		
0.75"	19.0	92.9	Fine Gravel	16.51
0.375"	9.5	85.6		
#4	4.8	76.4		
#10	2.00	63.7	Coarse Sand	12.64
#20	0.85	51.6	Medium Sand	19.45
#40	0.43	44.3		
#60	0.25	39.8	Fine Sand	12.42
#100	0.15	36.1		
#200	0.075	31.9		

Hydrometer Analysis

(mm)	%Finer		
0.034	25.5	Fines Silt or Clay	31.86
0.022	23.6		
0.013	20.9		
0.0091	18.2		
0.0065	17.5		
0.0032	13.7		
0.0013	9.1		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	27	16	11	2.70

DESCRIPTION: Light brown clayey sand with gravel

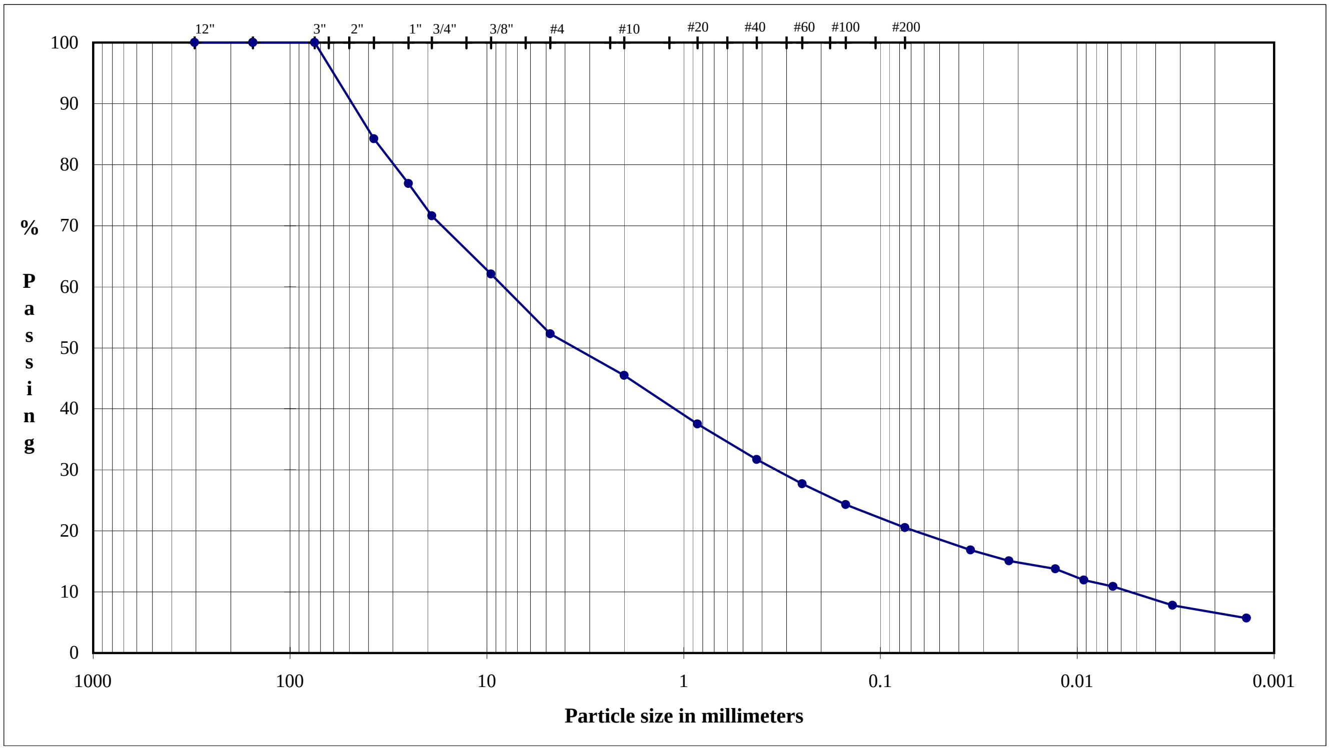
USCS: SC

TECH	DS
DATE	6/20/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

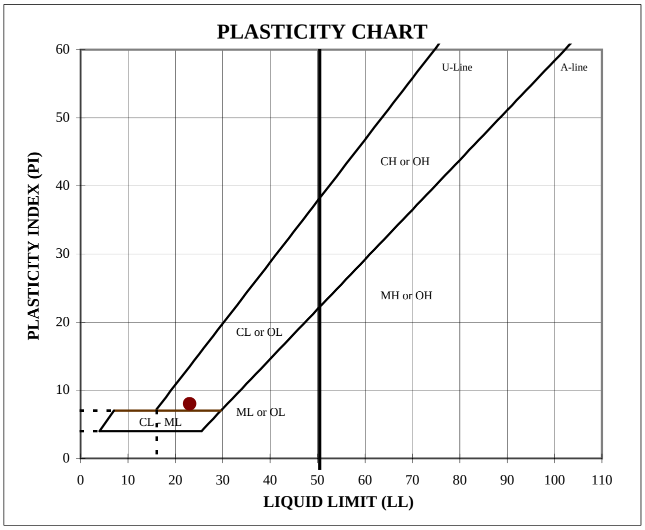
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **228-230**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**28.41**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**84.2**		
1.0"	25.0	**76.9**		
0.75"	19.0	**71.6**	Fine Gravel	**19.32**
0.375"	9.5	**62.1**		
#4	4.8	**52.3**		
#10	2.00	**45.5**	Coarse Sand	**6.78**
#20	0.85	**37.5**	Medium Sand	**13.78**
#40	0.43	**31.7**		
#60	0.25	**27.7**	Fine Sand	**11.19**
#100	0.15	**24.3**		
#200	0.075	**20.5**		

Hydrometer Analysis	(mm)	%Finer		
	0.035	**16.9**	Fines Silt or Clay	**20.52**
	0.022	**15.1**		
	0.013	**13.8**		
	0.0092	**11.9**		
	0.0066	**10.9**		
	0.0033	**7.8**		
	0.0014	**5.7**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**23**	**15**	**8**	**2.70**

DESCRIPTION: Pinkisk grey clayey gravel with sand

USCS: GC

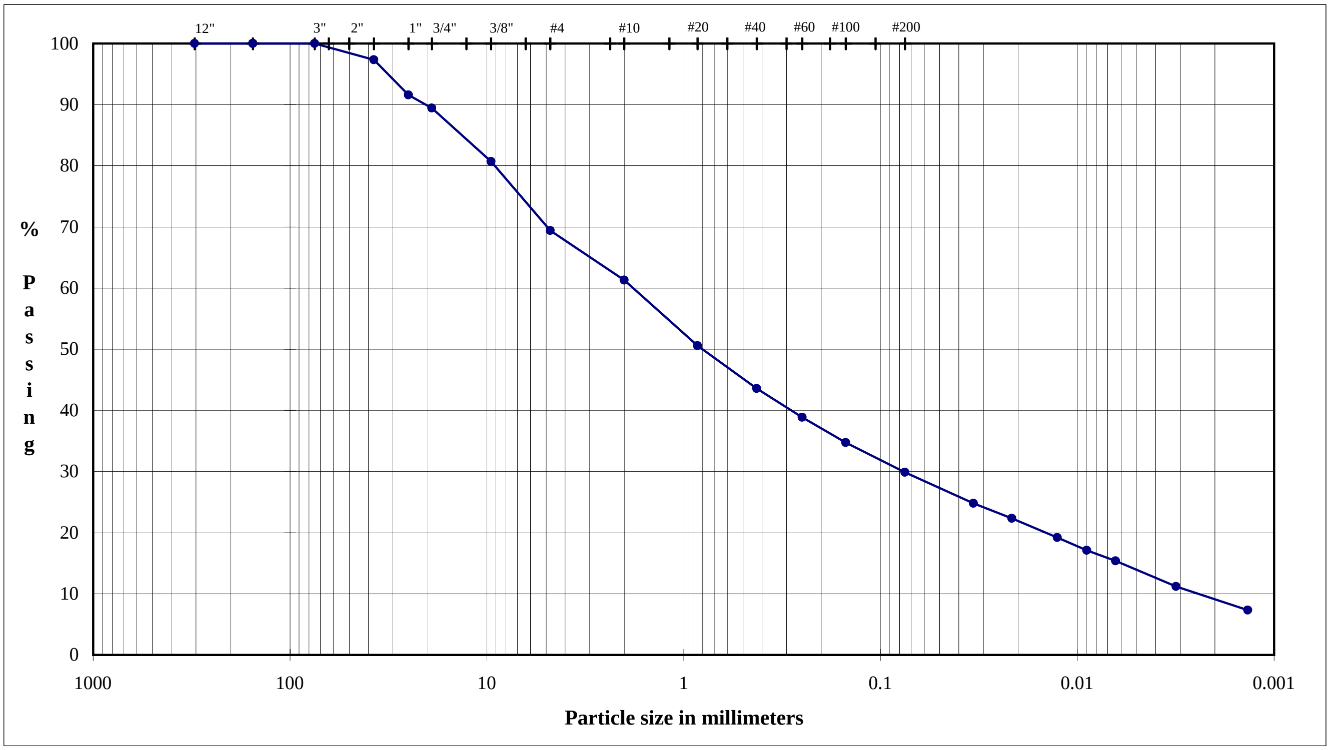
TECH MKS
DATE 6/15/2005
REVIEW MB

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

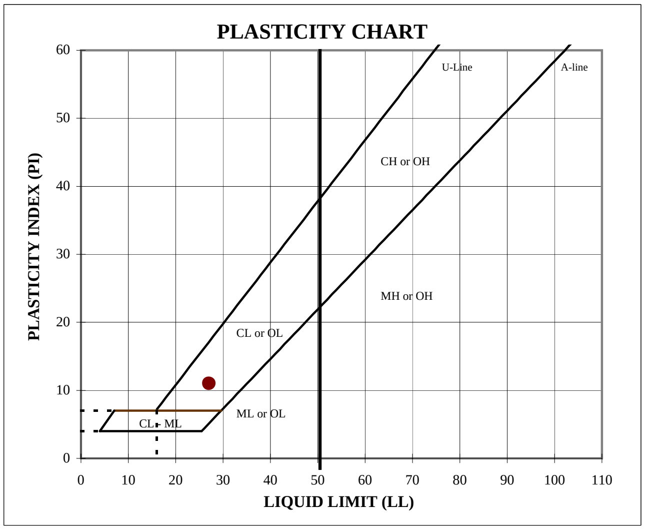
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **250.5-253**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**10.59**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**97.3**		
1.0"	25.0	**91.6**		
0.75"	19.0	**89.4**	Fine Gravel	**20.02**
0.375"	9.5	**80.7**		
#4	4.8	**69.4**		
#10	2.00	**61.3**	Coarse Sand	**8.08**
#20	0.85	**50.6**	Medium Sand	**17.75**
#40	0.43	**43.6**		
#60	0.25	**38.9**	Fine Sand	**13.68**
#100	0.15	**34.7**		
#200	0.075	**29.9**		

Hydrometer Analysis (mm)	%Finer		
0.034	**24.8**	Fines Silt or Clay	**29.89**
0.021	**22.3**		
0.013	**19.2**		
0.0090	**17.1**		
0.0064	**15.4**		
0.0031	**11.2**		
0.0014	**7.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	27	16	11	2.70

DESCRIPTION: Weak red clayey sand with gravel

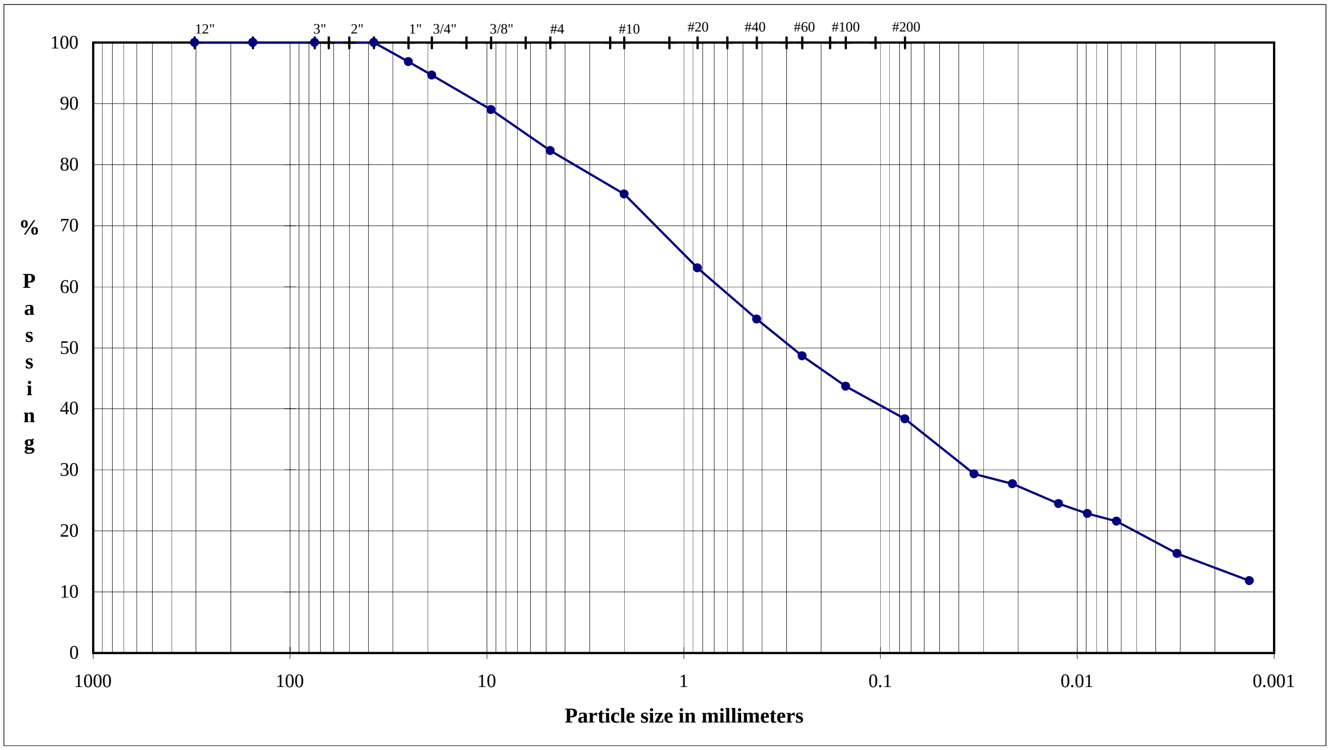
USCS: SC

TECH DS
DATE 6/17/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **298-300**
TYPE: **Pail**



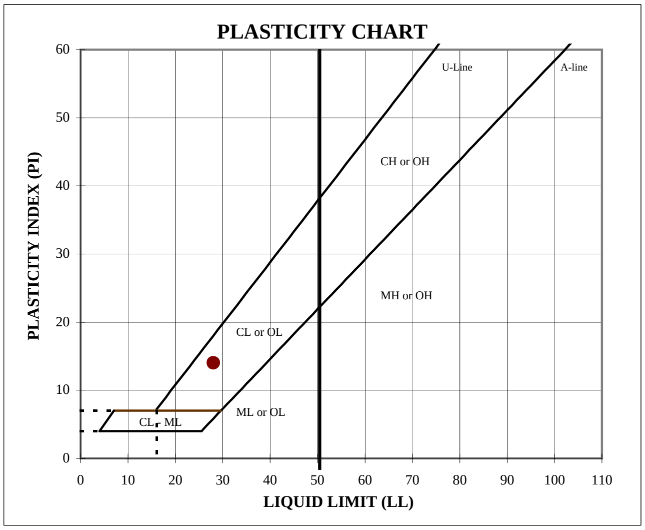
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**5.35**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**96.9**		
0.75"	19.0	**94.6**	Fine Gravel	**12.34**
0.375"	9.5	**89.0**		
#4	4.8	**82.3**		
#10	2.00	**75.2**	Coarse Sand	**7.13**
#20	0.85	**63.1**	Medium Sand	**20.50**
#40	0.43	**54.7**		
#60	0.25	**48.7**	Fine Sand	**16.35**
#100	0.15	**43.7**		
#200	0.075	**38.3**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**29.3**	Fines Silt or Clay	**38.33**
0.021	**27.7**		
0.012	**24.4**		
0.0089	**22.8**		
0.0063	**21.6**		
0.0031	**16.3**		
0.0013	**11.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	28	14	14	2.70

DESCRIPTION: Light brown clayey sand with gravel

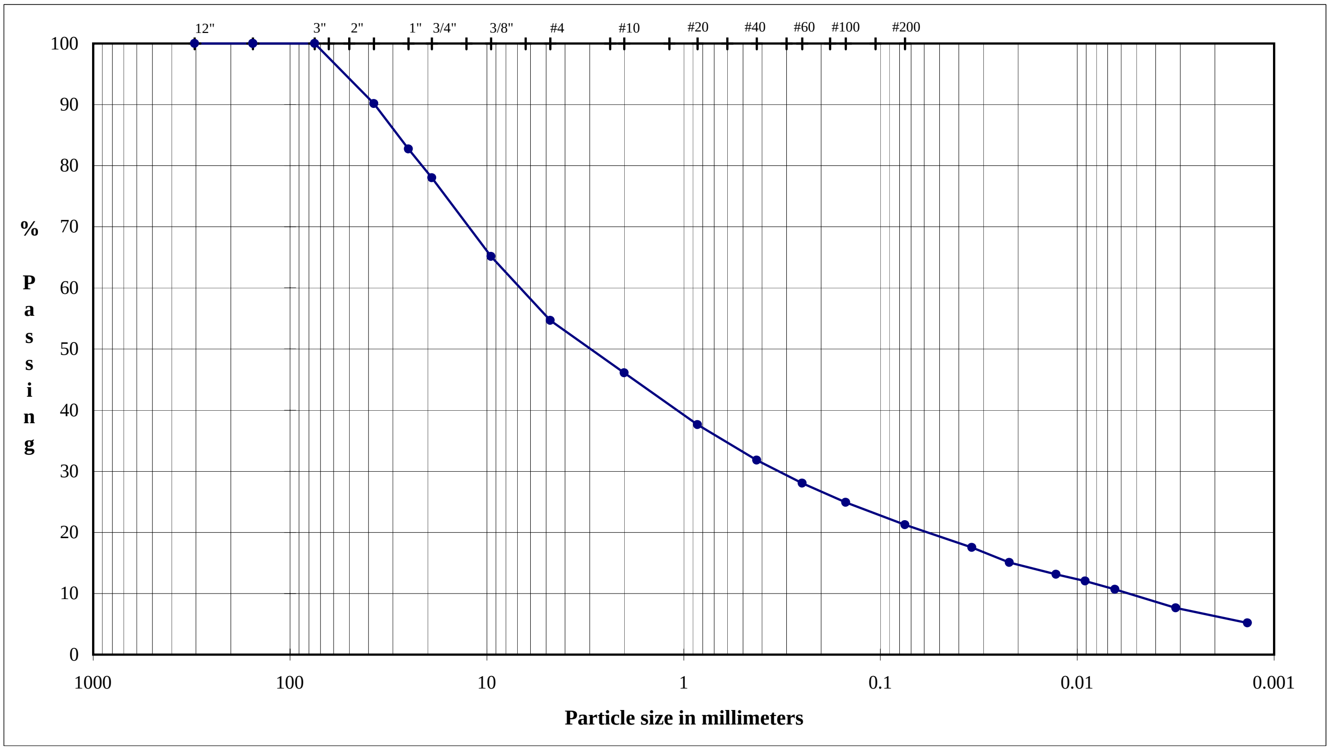
USCS: SC

TECH	DS
DATE	6/17/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **310-312**
TYPE: **Pail**



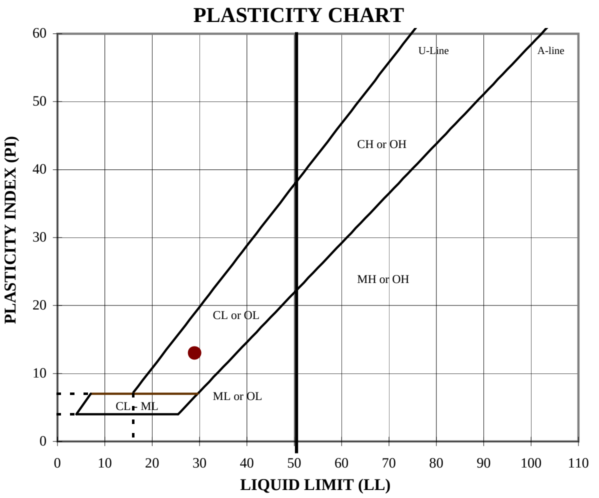
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**21.96**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**90.1**		
1.0"	25.0	**82.7**		
0.75"	19.0	**78.0**	Fine Gravel	**23.35**
0.375"	9.5	**65.1**		
#4	4.8	**54.7**		
#10	2.00	**46.1**	Coarse Sand	**8.57**
#20	0.85	**37.6**	Medium Sand	**14.30**
#40	0.43	**31.8**		
#60	0.25	**28.0**	Fine Sand	**10.55**
#100	0.15	**24.9**		
#200	0.075	**21.3**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**17.5**	Fines Silt or Clay	**21.26**
0.022	**15.1**		
0.013	**13.1**		
0.0091	**12.0**		
0.0064	**10.7**		
0.0032	**7.7**		
0.0014	**5.2**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**29**	**16**	**13**	**2.70**

DESCRIPTION: Pale yellow gravely clay with sand

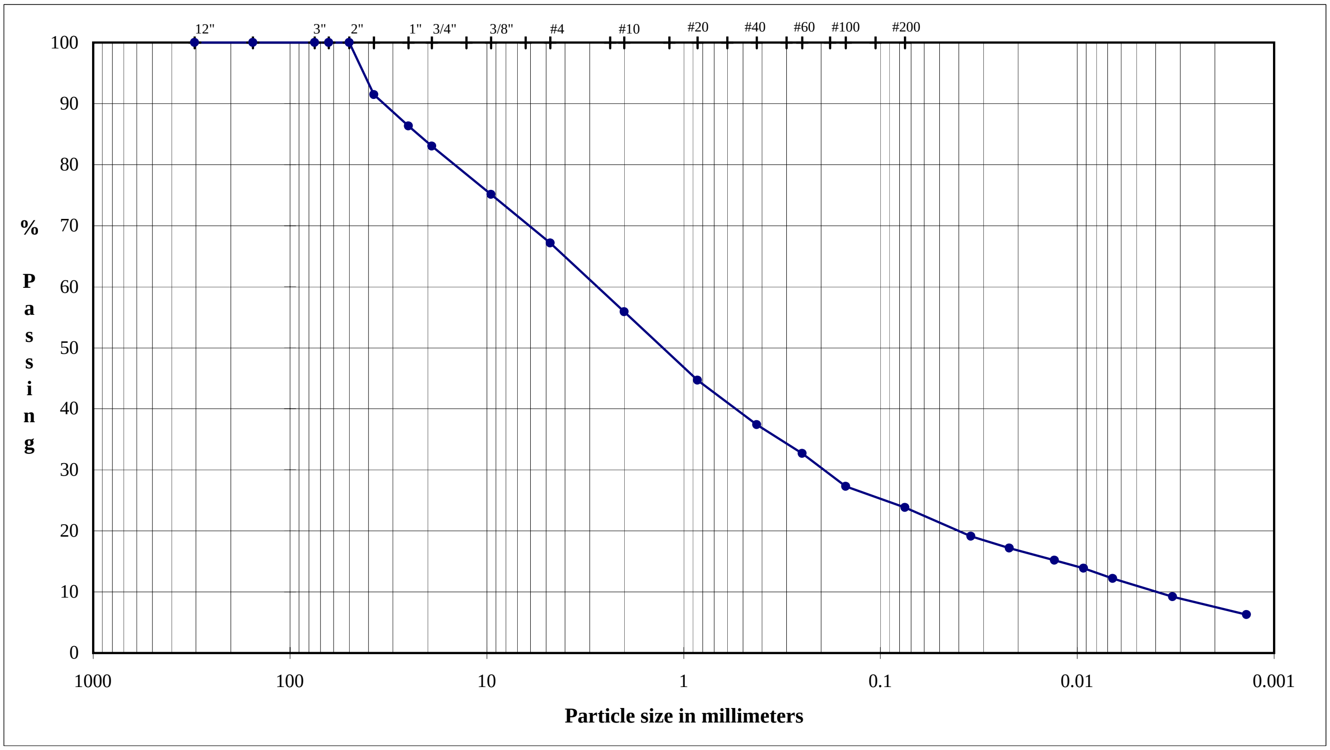
USCS: GC

TECH MKS
DATE 6/17/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **327-329**
TYPE: **Pail**



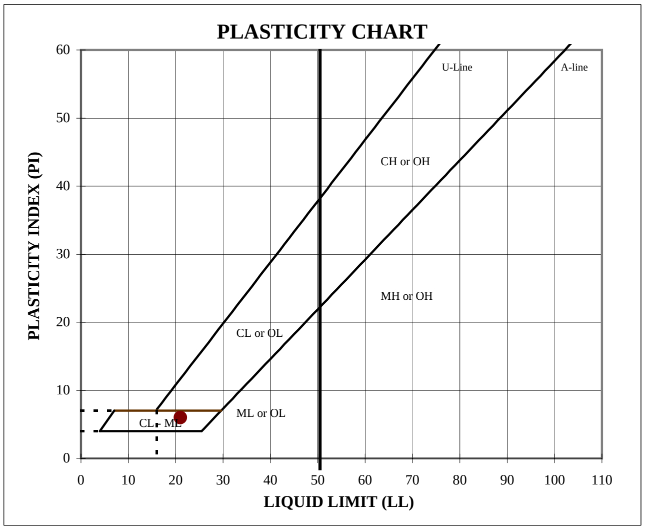
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Coarse Gravel	**16.97**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**91.4**		
1.0"	25.0	**86.3**		
0.75"	19.0	**83.0**	Fine Gravel	**15.88**
0.375"	9.5	**75.1**		
#4	4.8	**67.1**		
#10	2.00	**55.9**	Coarse Sand	**11.28**
#20	0.85	**44.7**	Medium Sand	**18.47**
#40	0.43	**37.4**		
#60	0.25	**32.7**	Fine Sand	**13.57**
#100	0.15	**27.3**		
#200	0.075	**23.8**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**19.1**	Fines Silt or Clay	**23.82**
0.022	**17.2**		
0.013	**15.2**		
0.0093	**13.9**		
0.0066	**12.2**		
0.0033	**9.2**		
0.0014	**6.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	21	15	6	2.70

DESCRIPTION: Light greenish grey silty, clayey sand with gravel

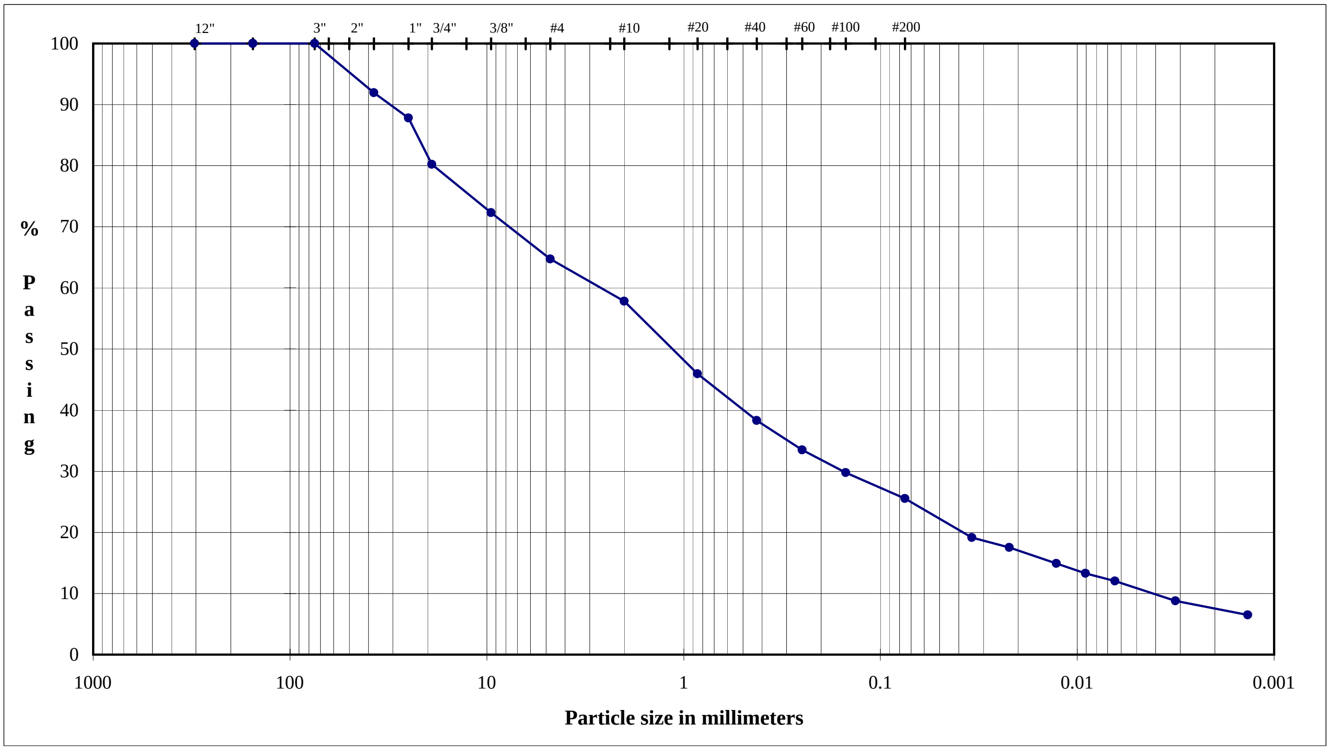
USCS: SC-SM

TECH MKS
DATE 6/15/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **356-358**
TYPE: **Pail**



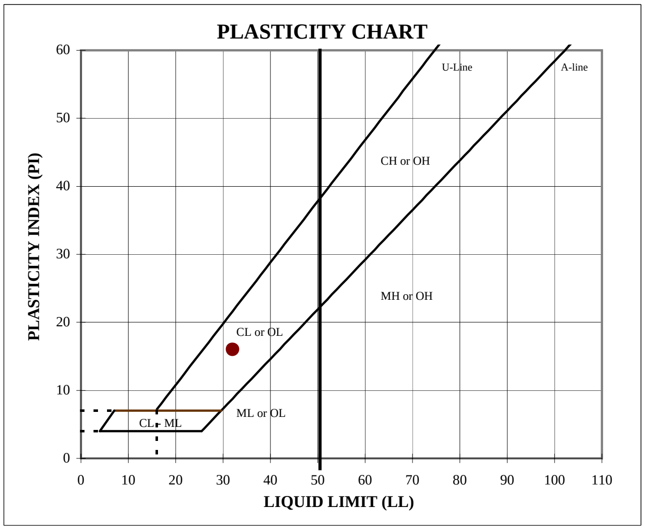
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**19.76**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**91.9**		
1.0"	25.0	**87.8**		
0.75"	19.0	**80.2**	Fine Gravel	**15.50**
0.375"	9.5	**72.3**		
#4	4.8	**64.7**		
#10	2.00	**57.8**	Coarse Sand	**6.93**
#20	0.85	**45.9**	Medium Sand	**19.48**
#40	0.43	**38.3**		
#60	0.25	**33.5**	Fine Sand	**12.82**
#100	0.15	**29.7**		
#200	0.075	**25.5**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**19.2**	Fines Silt or Clay	**25.51**
0.022	**17.5**		
0.013	**14.9**		
0.0091	**13.3**		
0.0064	**12.0**		
0.0032	**8.8**		
0.0014	**6.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	32	16	16	2.70

DESCRIPTION: Pinkish white clayey sand with gravel

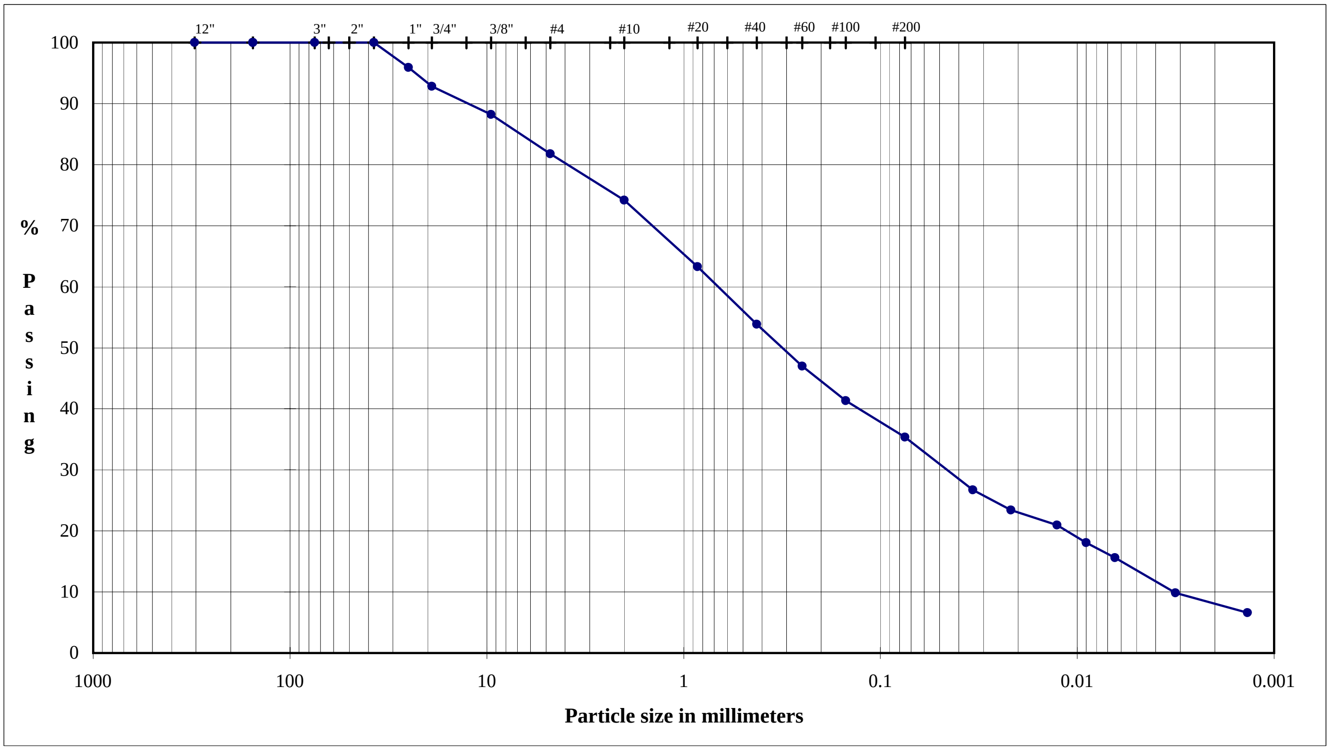
USCS: SC

TECH	MKS
DATE	6/17/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-01** Depth (ft): **388-390**
TYPE: **Pail**



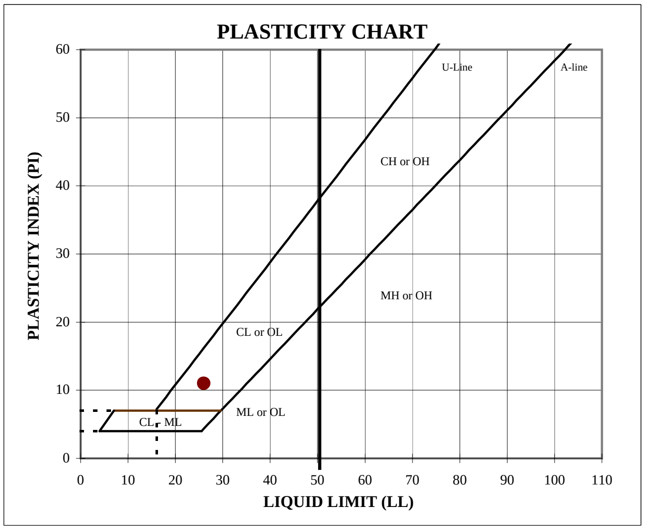
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**7.16**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**95.9**		
0.75"	19.0	**92.8**	Fine Gravel	**11.06**
0.375"	9.5	**88.2**		
#4	4.8	**81.8**		
#10	2.00	**74.2**	Coarse Sand	**7.59**
#20	0.85	**63.3**	Medium Sand	**20.33**
#40	0.43	**53.9**		
#60	0.25	**47.0**	Fine Sand	**18.52**
#100	0.15	**41.3**		
#200	0.075	**35.3**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**26.7**	Fines Silt or Clay	**35.34**
0.022	**23.4**		
0.013	**21.0**		
0.0090	**18.1**		
0.0064	**15.6**		
0.0032	**9.9**		
0.0014	**6.6**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	26	15	11	2.70

DESCRIPTION: Pale red clayey sand with gravel

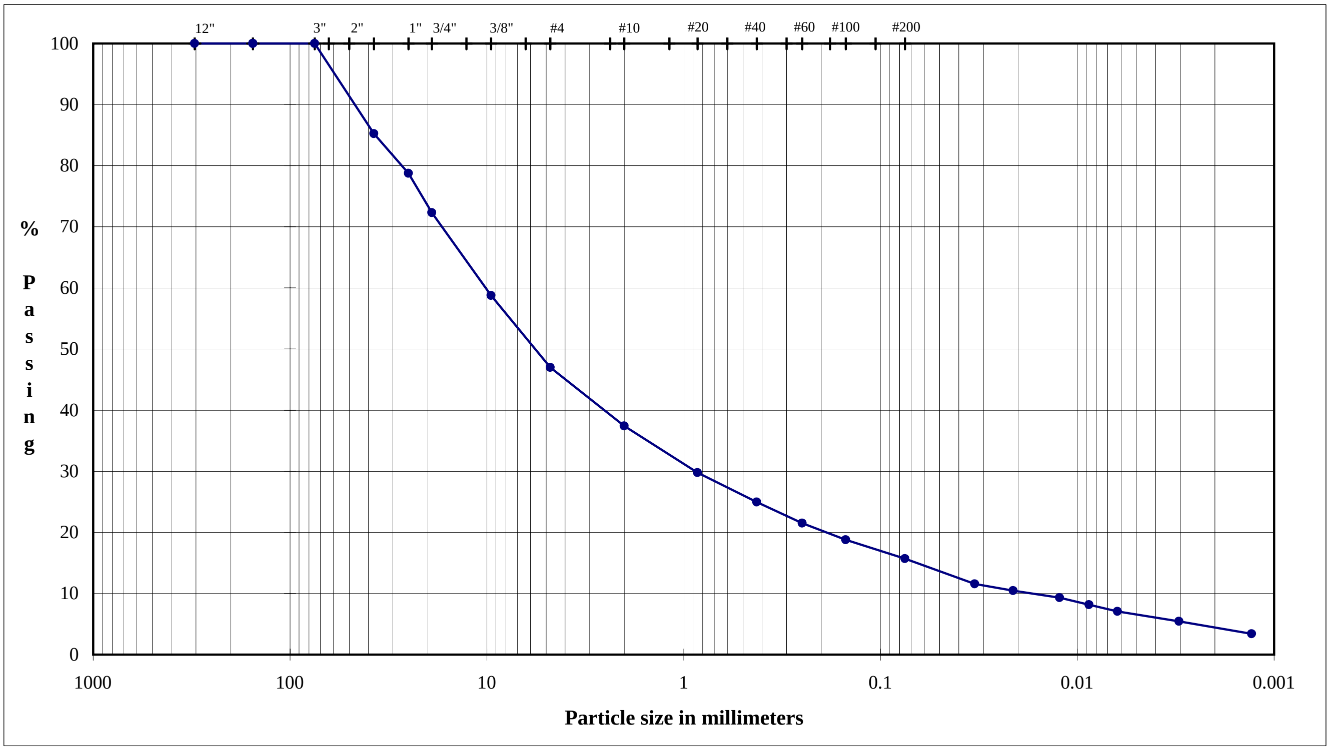
USCS: SC

TECH	MKS
DATE	6/15/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-02** Depth (ft): **18-20**
TYPE: **Pail**



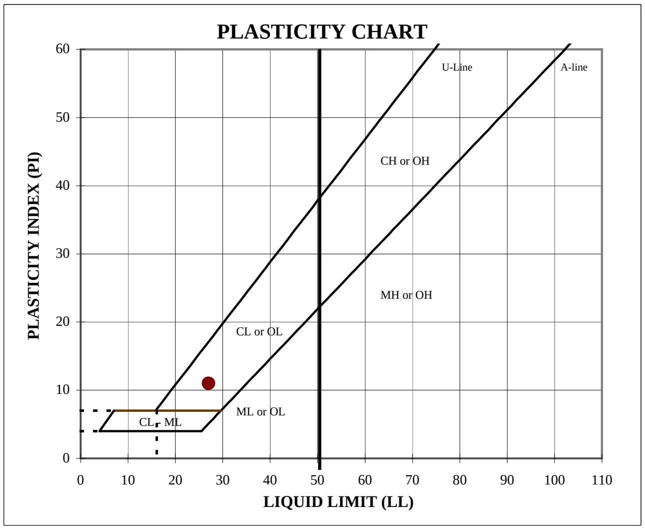
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**27.70**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**85.2**		
1.0"	25.0	**78.7**		
0.75"	19.0	**72.3**	Fine Gravel	**25.29**
0.375"	9.5	**58.7**		
#4	4.8	**47.0**		
#10	2.00	**37.4**	Coarse Sand	**9.58**
#20	0.85	**29.8**	Medium Sand	**12.47**
#40	0.43	**25.0**		
#60	0.25	**21.5**	Fine Sand	**9.27**
#100	0.15	**18.8**		
#200	0.075	**15.7**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**11.6**	Fines Silt or Clay	**15.69**
0.021	**10.5**		
0.012	**9.3**		
0.0087	**8.2**		
0.0062	**7.0**		
0.0030	**5.5**		
0.0013	**3.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	27	16	11	2.89

DESCRIPTION: Pale yellow clayey gravel with sand

USCS: GC

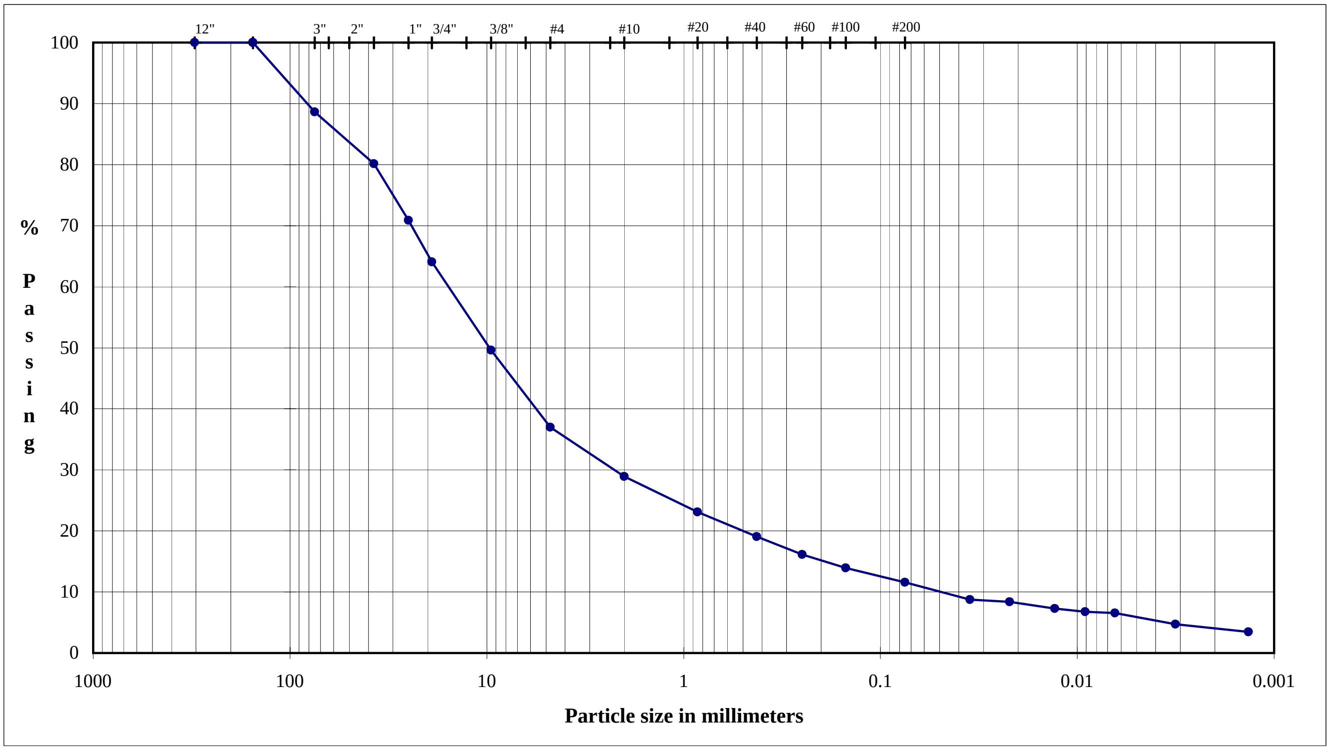
TECH	DS
DATE	6/21/2005
REVIEW	MB

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-02** Depth (ft): **40-42**
TYPE: **Pail**



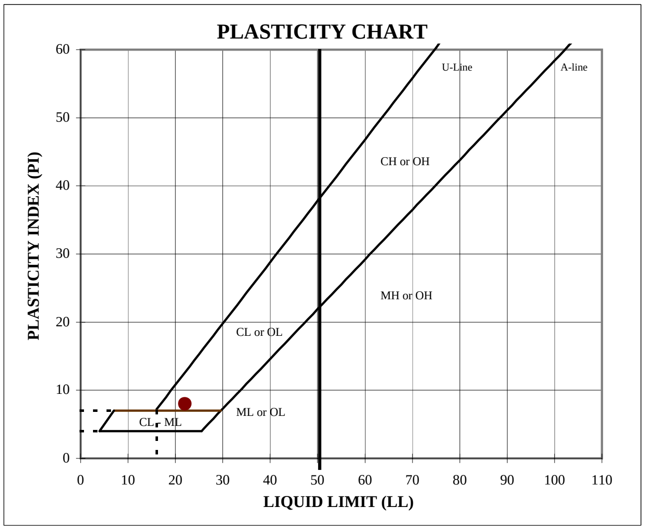
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**11.39**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**24.55**
6.0"	154.2	**100.0**		
3.0"	75.0	**88.6**		
1.5"	37.5	**80.1**		
1.0"	25.0	**70.9**		
0.75"	19.0	**64.1**	Fine Gravel	**27.07**
0.375"	9.5	**49.6**		
#4	4.8	**37.0**		
#10	2.00	**28.9**	Coarse Sand	**8.05**
#20	0.85	**23.1**	Medium Sand	**9.88**
#40	0.43	**19.1**		
#60	0.25	**16.1**	Fine Sand	**7.49**
#100	0.15	**13.9**		
#200	0.075	**11.6**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**8.7**	Fines Silt or Clay	**11.57**
0.022	**8.4**		
0.013	**7.3**		
0.0091	**6.7**		
0.0064	**6.6**		
0.0032	**4.7**		
0.0014	**3.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**22**	**14**	**8**	**2.70**

DESCRIPTION: Light gray poorly graded gravel with clay and sand

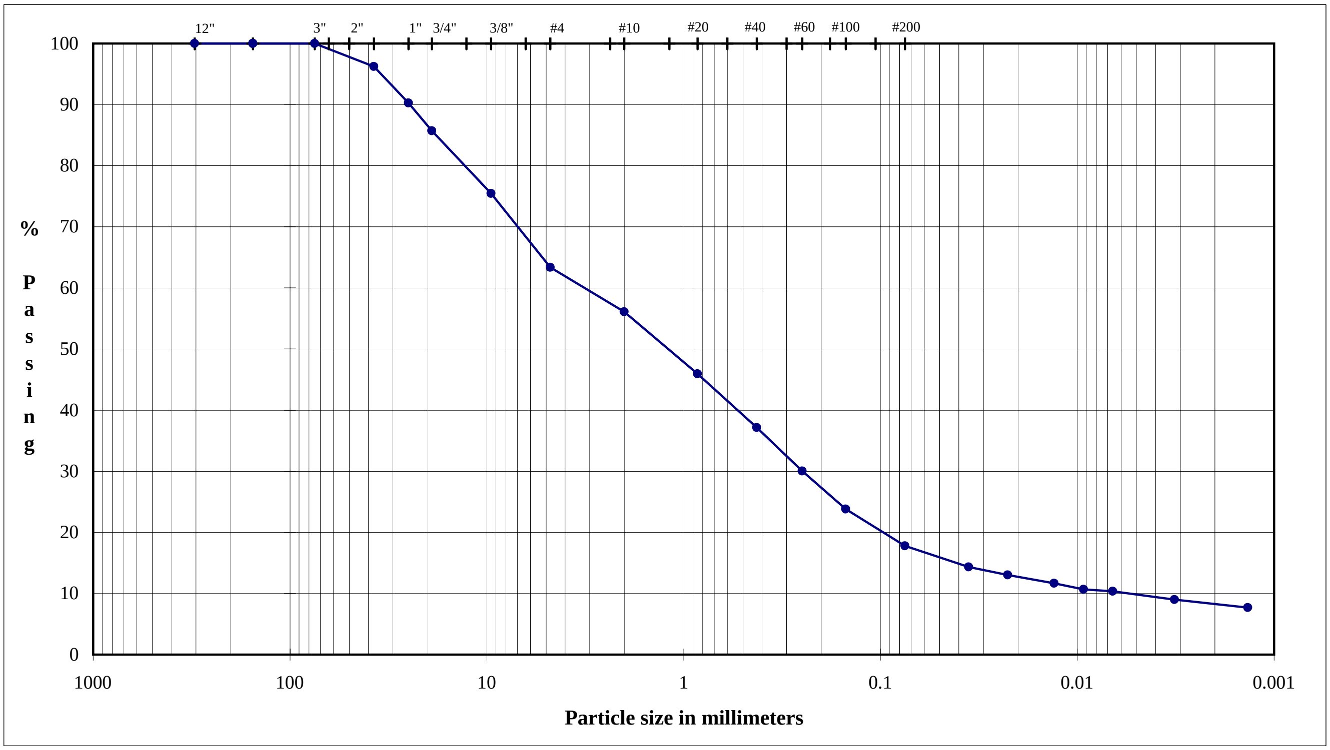
USCS: GP-GC

TECH DS
DATE 6/20/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-02** Depth (ft): **140-142**
TYPE: **Pail**



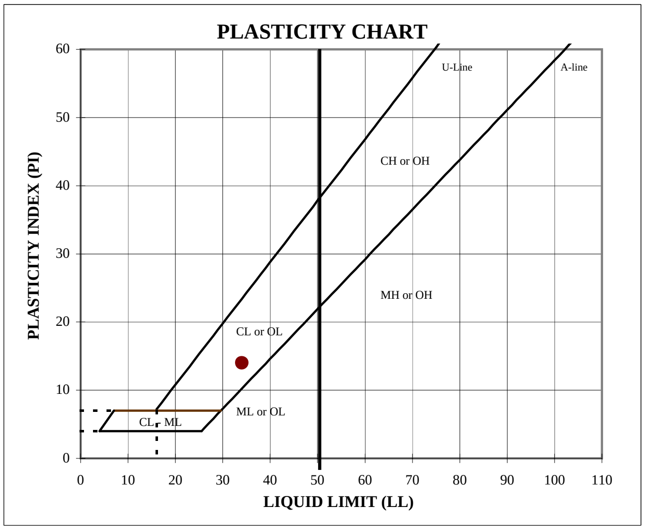
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**14.27**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**96.2**		
1.0"	25.0	**90.3**		
0.75"	19.0	**85.7**	Fine Gravel	**22.34**
0.375"	9.5	**75.5**		
#4	4.8	**63.4**		
#10	2.00	**56.1**	Coarse Sand	**7.28**
#20	0.85	**46.0**	Medium Sand	**18.94**
#40	0.43	**37.2**		
#60	0.25	**30.0**	Fine Sand	**19.39**
#100	0.15	**23.8**		
#200	0.075	**17.8**		

Hydrometer Analysis

(mm)	%Finer		
0.036	**14.4**	Fines Silt or Clay	**17.77**
0.023	**13.0**		
0.013	**11.7**		
0.0093	**10.7**		
0.0066	**10.3**		
0.0032	**9.0**		
0.0014	**7.7**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**34**	**20**	**14**	**2.70**

DESCRIPTION: Ligth brown clayey sand with gravel

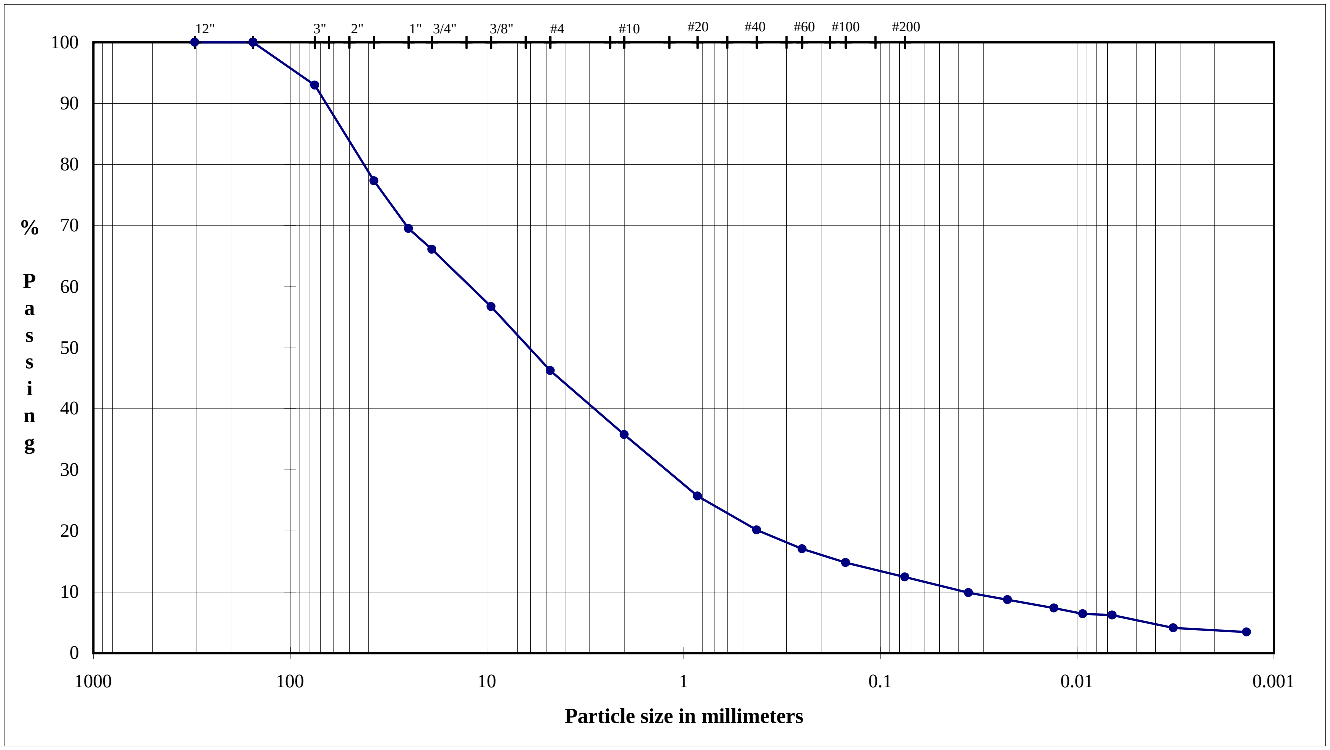
USCS: SC

TECH	DS
DATE	6/24/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-02** Depth (ft): **267-268.5**
TYPE: **Pail**



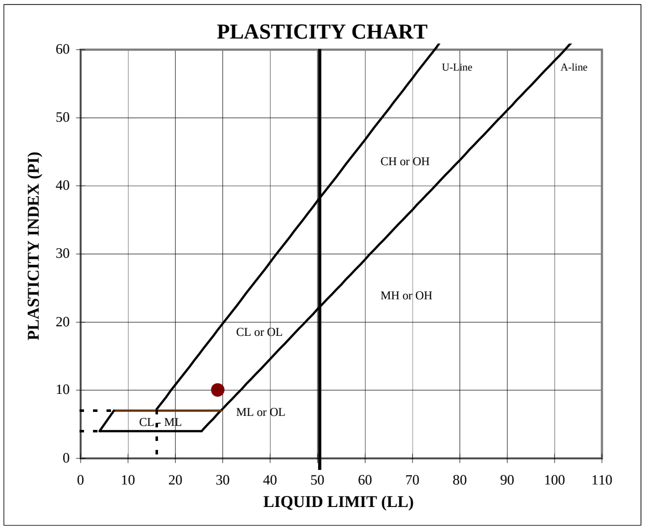
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**7.03**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**26.84**
6.0"	154.2	**100.0**		
3.0"	75.0	**93.0**		
1.5"	37.5	**77.3**		
1.0"	25.0	**69.5**		
0.75"	19.0	**66.1**		
0.375"	9.5	**56.7**	Fine Gravel	**19.85**
#4	4.8	**46.3**		
#10	2.00	**35.8**	Coarse Sand	**10.51**
#20	0.85	**25.7**	Medium Sand	**15.62**
#40	0.43	**20.1**		
#60	0.25	**17.1**	Fine Sand	**7.70**
#100	0.15	**14.8**		
#200	0.075	**12.4**		

Hydrometer Analysis

(mm)	%Finer		
0.036	**9.9**	Fines Silt or Clay	**12.45**
0.023	**8.8**		
0.013	**7.4**		
0.0093	**6.5**		
0.0066	**6.2**		
0.0032	**4.2**		
0.0014	**3.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**29**	**19**	**10**	**2.70**

DESCRIPTION: Pink clayey gravel with sand

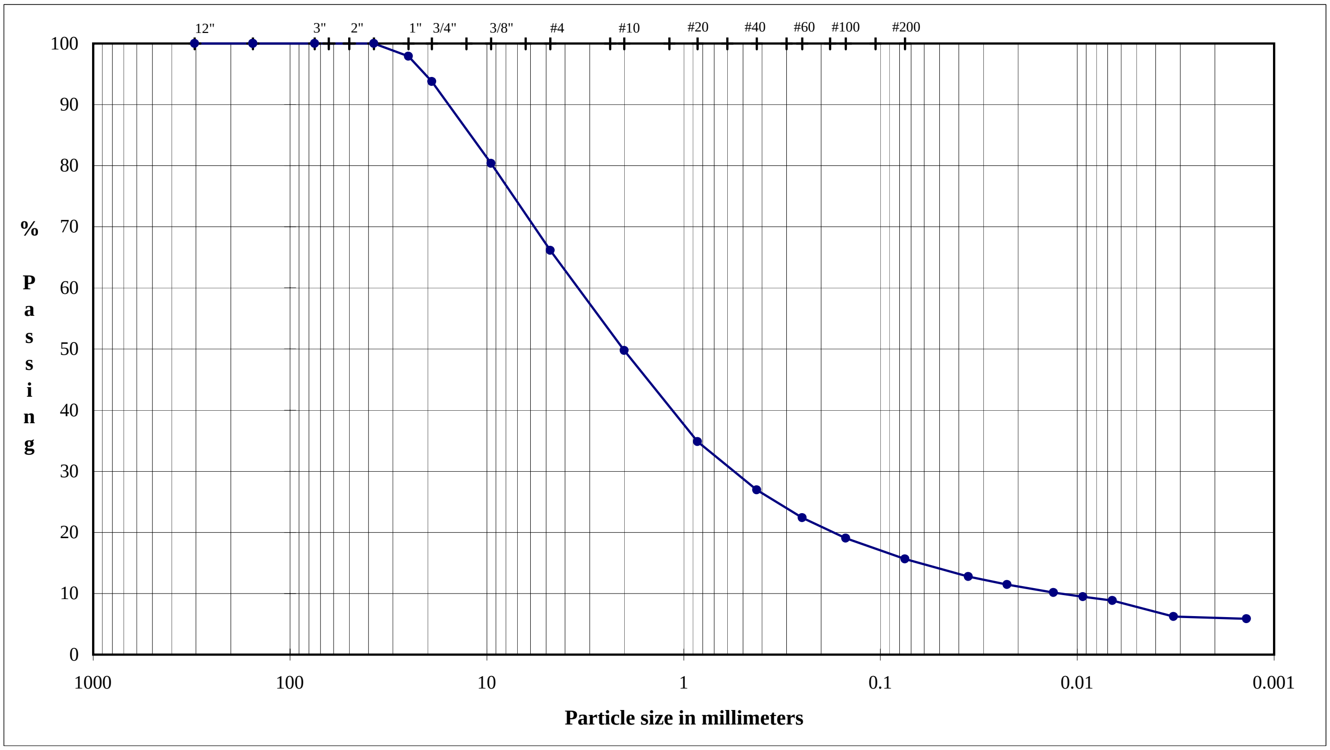
USCS: GC

TECH	DS
DATE	6/20/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-03** Depth (ft): **18-20**
TYPE: **Pail**



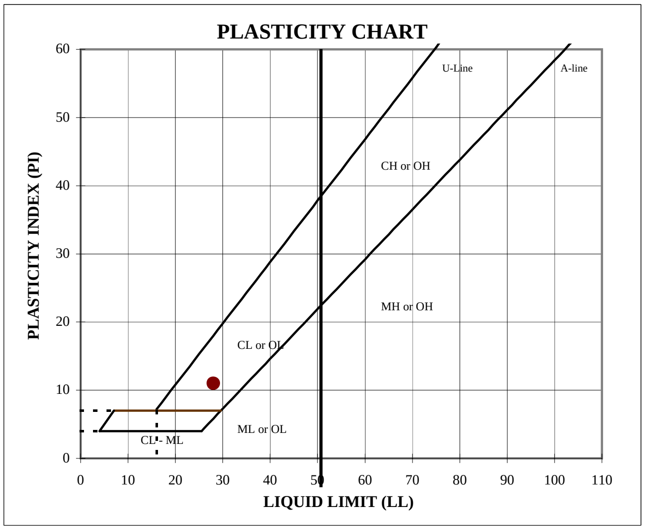
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**6.20**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**97.9**		
0.75"	19.0	**93.8**	Fine Gravel	**27.66**
0.375"	9.5	**80.4**		
#4	4.8	**66.1**		
#10	2.00	**49.8**	Coarse Sand	**16.38**
#20	0.85	**34.9**	Medium Sand	**22.81**
#40	0.43	**26.9**		
#60	0.25	**22.4**	Fine Sand	**11.30**
#100	0.15	**19.1**		
#200	0.075	**15.7**		

Hydrometer Analysis

(mm)	%Finer		
0.036	**12.7**	Fines Silt or Clay	**15.65**
0.023	**11.4**		
0.013	**10.1**		
0.0093	**9.5**		
0.0066	**8.8**		
0.0032	**6.2**		
0.0014	**5.9**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	28	17	11	2.69

DESCRIPTION: Light brown clay sand with gravel

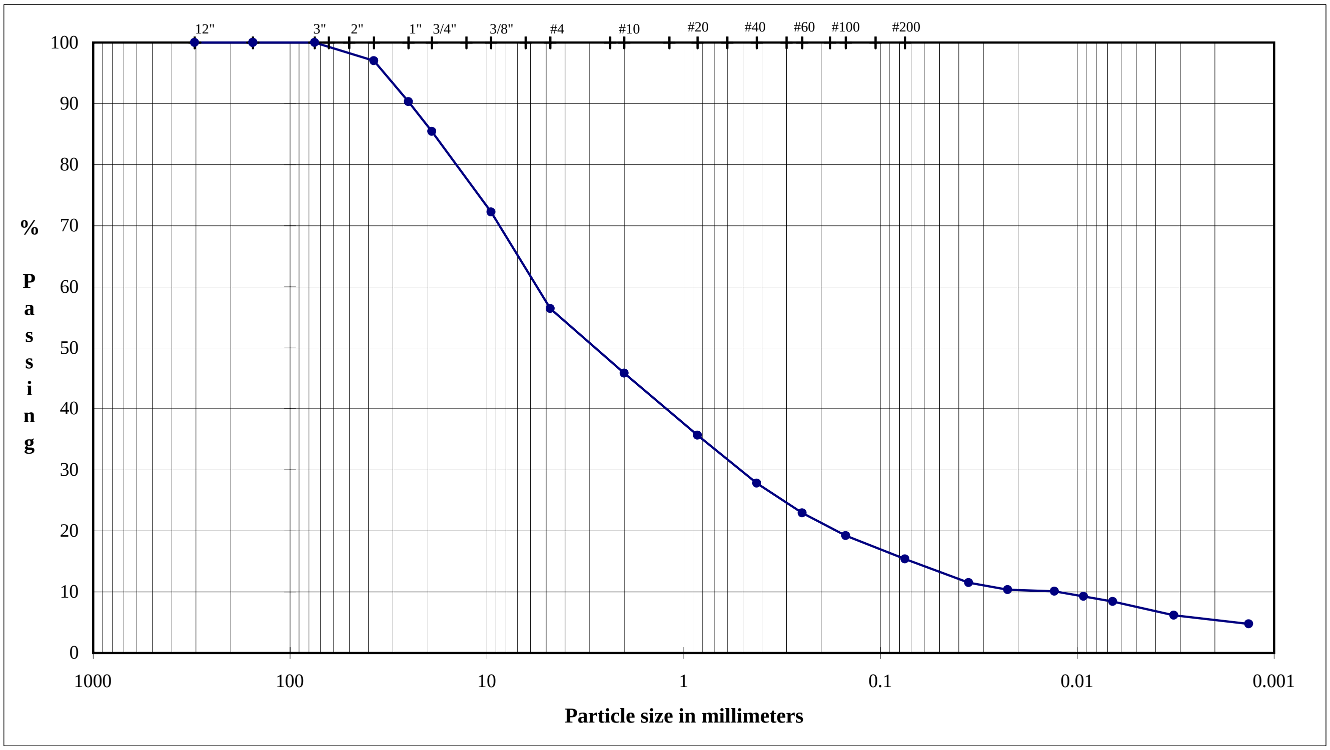
USCS: SC

TECH	MGC
DATE	6/27/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-03** Depth (ft): **58-60**
TYPE: **Pail**



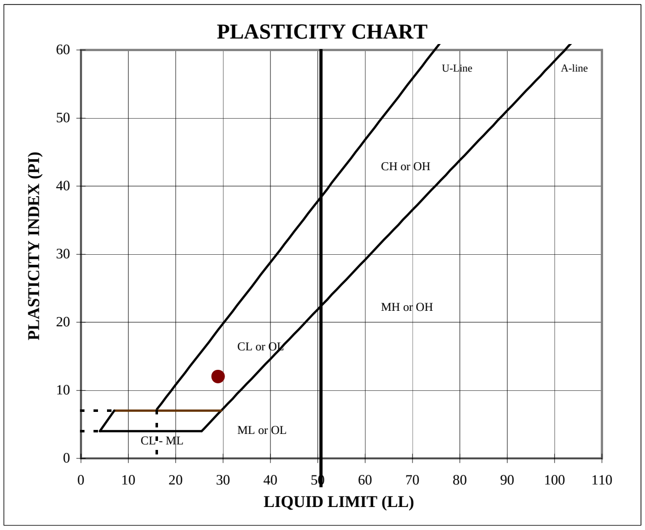
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**14.55**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**97.0**		
1.0"	25.0	**90.3**		
0.75"	19.0	**85.4**	Fine Gravel	**29.04**
0.375"	9.5	**72.3**		
#4	4.8	**56.4**		
#10	2.00	**45.8**	Coarse Sand	**10.57**
#20	0.85	**35.6**	Medium Sand	**18.01**
#40	0.43	**27.8**		
#60	0.25	**22.9**	Fine Sand	**12.41**
#100	0.15	**19.2**		
#200	0.075	**15.4**		

Hydrometer Analysis

(mm)	%Finer		
0.036	**11.5**	Fines Silt or Clay	**15.41**
0.023	**10.4**		
0.013	**10.1**		
0.0093	**9.3**		
0.0066	**8.4**		
0.0032	**6.2**		
0.0013	**4.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**29**	**17**	**12**	**2.70**

DESCRIPTION: Light yellowish brown clayey gravel with sand

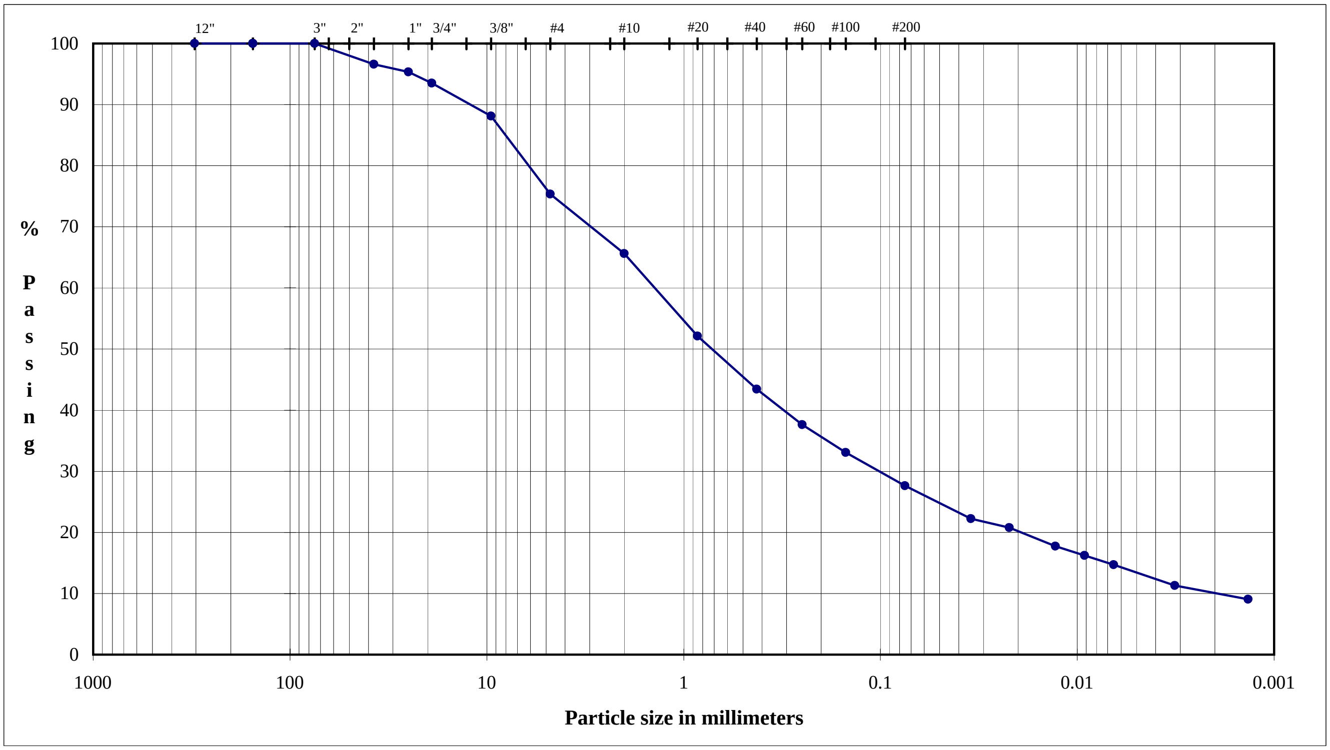
USCS: GC

TECH	MGC
DATE	6/27/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-03** Depth (ft): **156-158**
TYPE: **Pail**



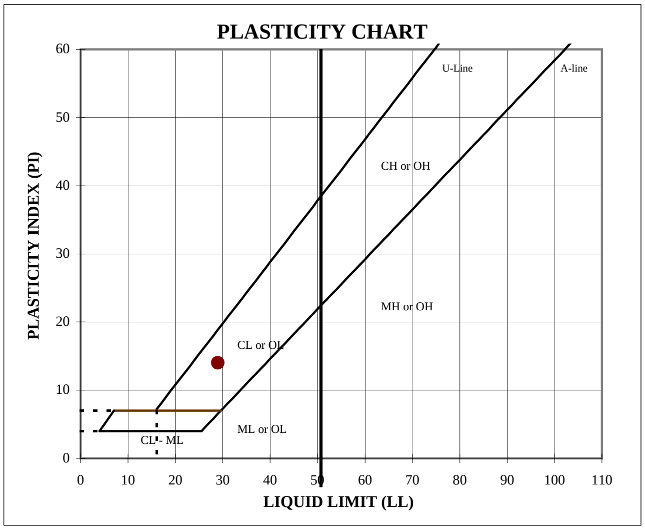
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**6.47**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**96.6**		
1.0"	25.0	**95.3**		
0.75"	19.0	**93.5**	Fine Gravel	**18.18**
0.375"	9.5	**88.1**		
#4	4.8	**75.3**		
#10	2.00	**65.6**	Coarse Sand	**9.71**
#20	0.85	**52.1**	Medium Sand	**22.18**
#40	0.43	**43.5**		
#60	0.25	**37.6**	Fine Sand	**15.84**
#100	0.15	**33.1**		
#200	0.075	**27.6**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**22.3**	Fines Silt or Clay	**27.62**
0.022	**20.8**		
0.013	**17.7**		
0.0092	**16.2**		
0.0065	**14.7**		
0.0032	**11.3**		
0.0014	**9.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**29**	**15**	**14**	**2.70**

DESCRIPTION: Light brown clayey sand with gravel

USCS: SC

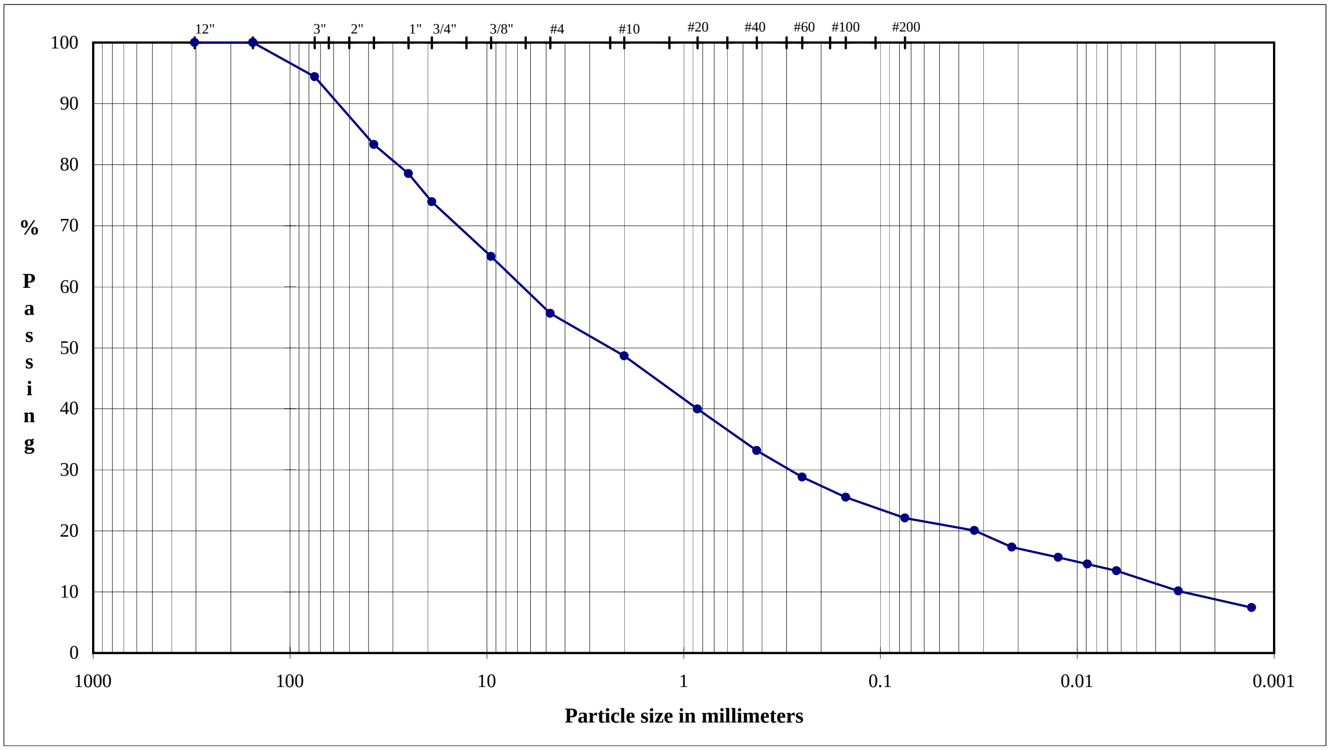
TECH DS
DATE 6/24/2005
REVIEW MB

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**TSGT-03**	Depth (ft):	**248-250**
TYPE:	**Pail**		



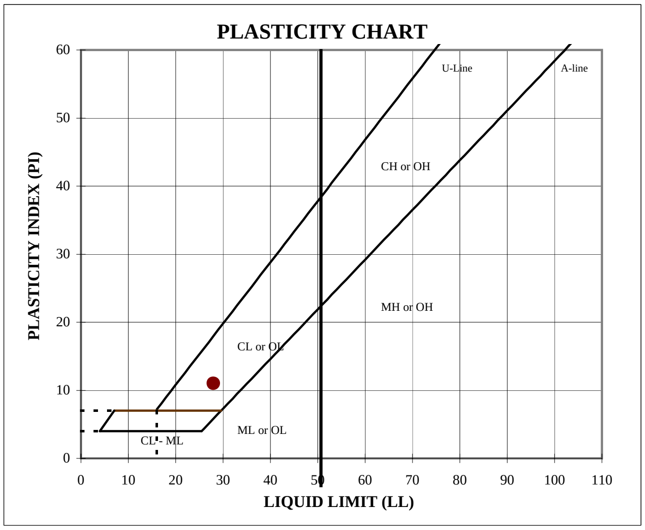
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**5.58**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**20.50**
6.0"	154.2	**100.0**		
3.0"	75.0	**94.4**		
1.5"	37.5	**83.3**		
1.0"	25.0	**78.5**		
0.75"	19.0	**73.9**	Fine Gravel	**18.28**
0.375"	9.5	**64.9**		
#4	4.8	**55.6**		
#10	2.00	**48.7**	Coarse Sand	**6.98**
#20	0.85	**40.0**	Medium Sand	**15.51**
#40	0.43	**33.1**		
#60	0.25	**28.8**	Fine Sand	**11.05**
#100	0.15	**25.5**		
#200	0.075	**22.1**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**20.1**	Fines Silt or Clay	**22.10**
0.021	**17.3**		
0.012	**15.7**		
0.0089	**14.6**		
0.0063	**13.5**		
0.0031	**10.2**		
0.0013	**7.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	28	17	11	2.78

DESCRIPTION: Pale pink clayey gravel with sand

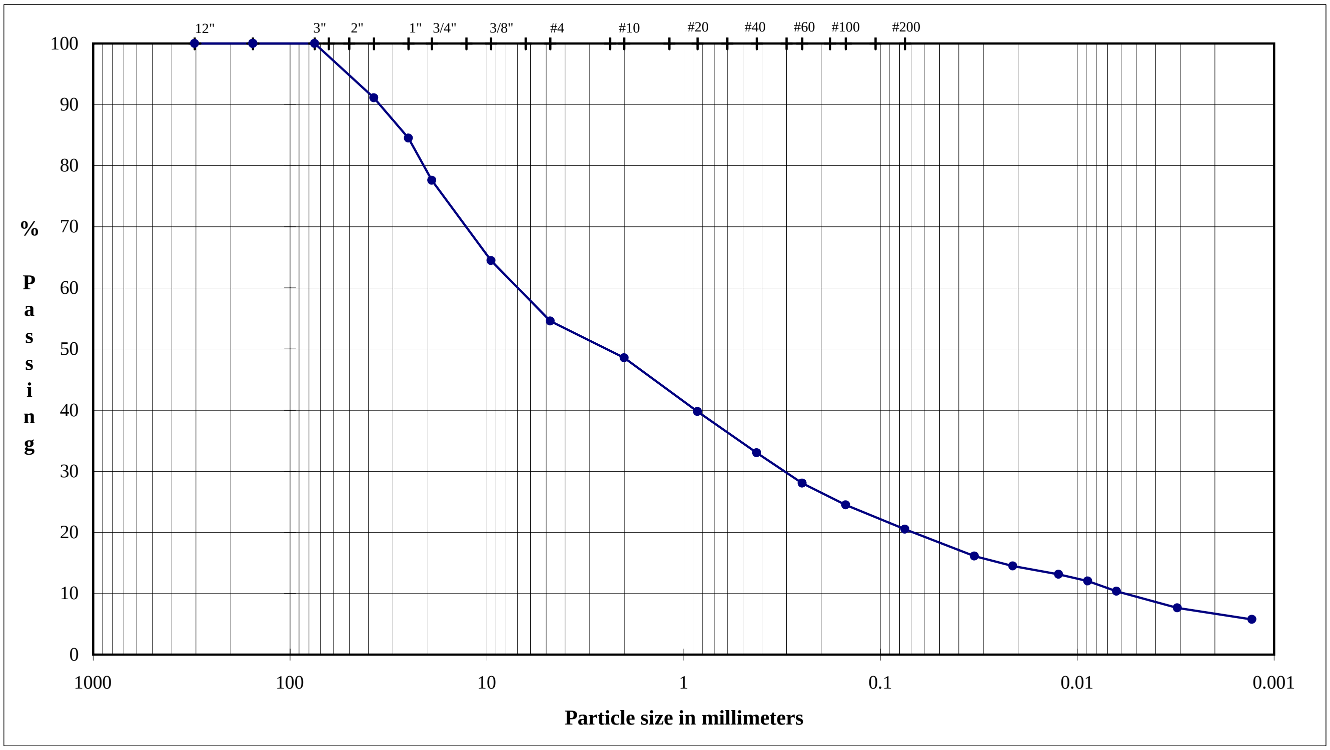
USCS: GC

TECH	MGC
DATE	6/27/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

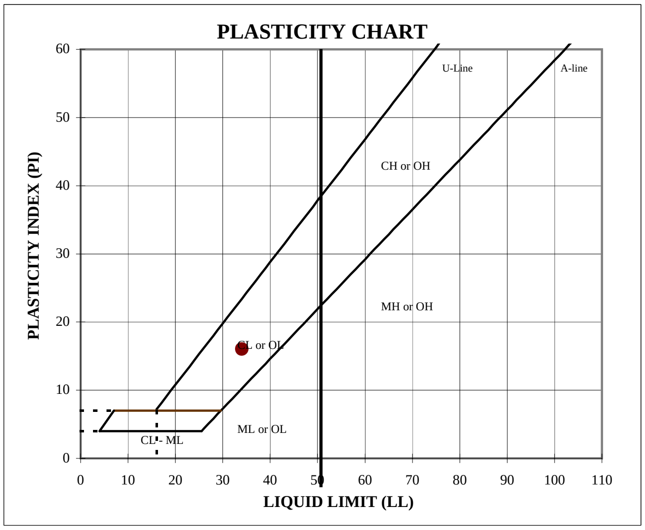
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **12-14**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**22.39**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**91.1**		
1.0"	25.0	**84.5**		
0.75"	19.0	**77.6**	Fine Gravel	**23.04**
0.375"	9.5	**64.5**		
#4	4.8	**54.6**		
#10	2.00	**48.6**	Coarse Sand	**6.00**
#20	0.85	**39.8**	Medium Sand	**15.55**
#40	0.43	**33.0**		
#60	0.25	**28.1**	Fine Sand	**12.49**
#100	0.15	**24.5**		
#200	0.075	**20.5**		

Hydrometer Analysis (mm)	%Finer		
0.033	**16.1**	Fines Silt or Clay	**20.53**
0.021	**14.5**		
0.012	**13.1**		
0.0089	**12.0**		
0.0063	**10.4**		
0.0031	**7.7**		
0.0013	**5.7**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	**34**	**18**	**16**	**2.83**

DESCRIPTION: Pale yellow clayey gravel with sand

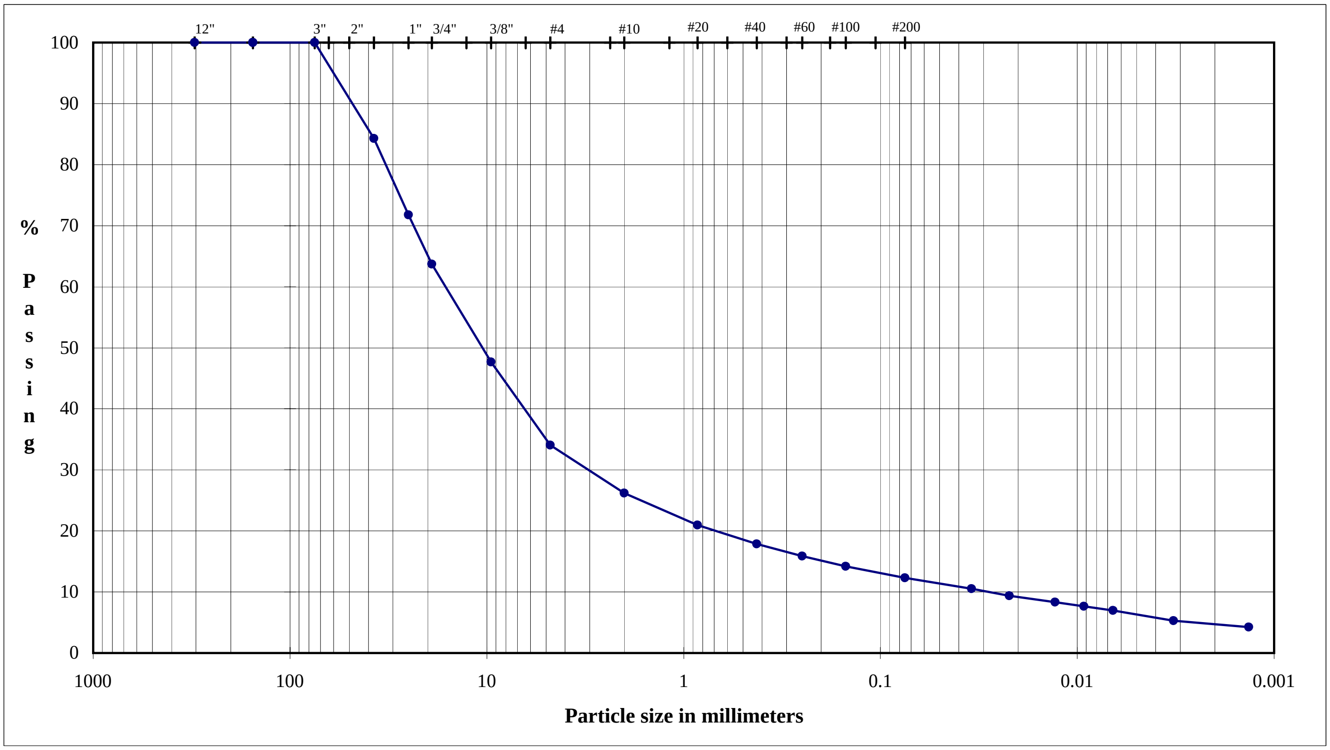
USCS: GC

TECH	MGC
DATE	6/29/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **69-71**
TYPE: **Pail**



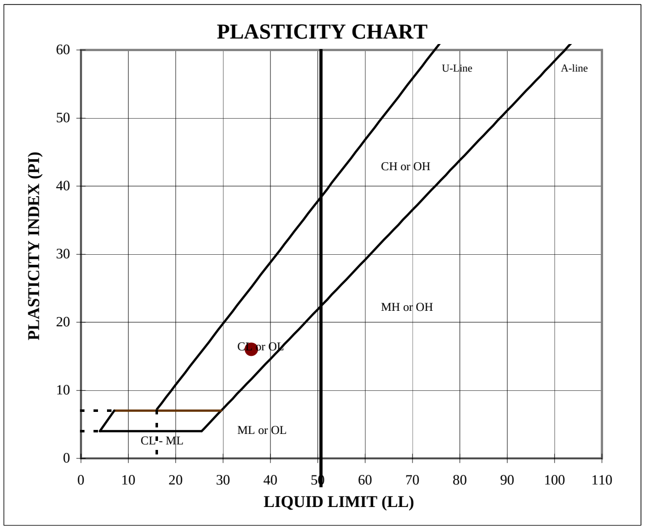
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**36.30**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**84.3**		
1.0"	25.0	**71.8**		
0.75"	19.0	**63.7**	Fine Gravel	**29.63**
0.375"	9.5	**47.7**		
#4	4.8	**34.1**		
#10	2.00	**26.2**	Coarse Sand	**7.91**
#20	0.85	**21.0**	Medium Sand	**8.31**
#40	0.43	**17.9**		
#60	0.25	**15.9**	Fine Sand	**5.56**
#100	0.15	**14.2**		
#200	0.075	**12.3**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**10.5**	Fines Silt or Clay	**12.29**
0.022	**9.4**		
0.013	**8.3**		
0.0092	**7.7**		
0.0066	**7.0**		
0.0032	**5.3**		
0.0013	**4.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	36	20	16	2.70

DESCRIPTION: Pink clayey gravel with sand

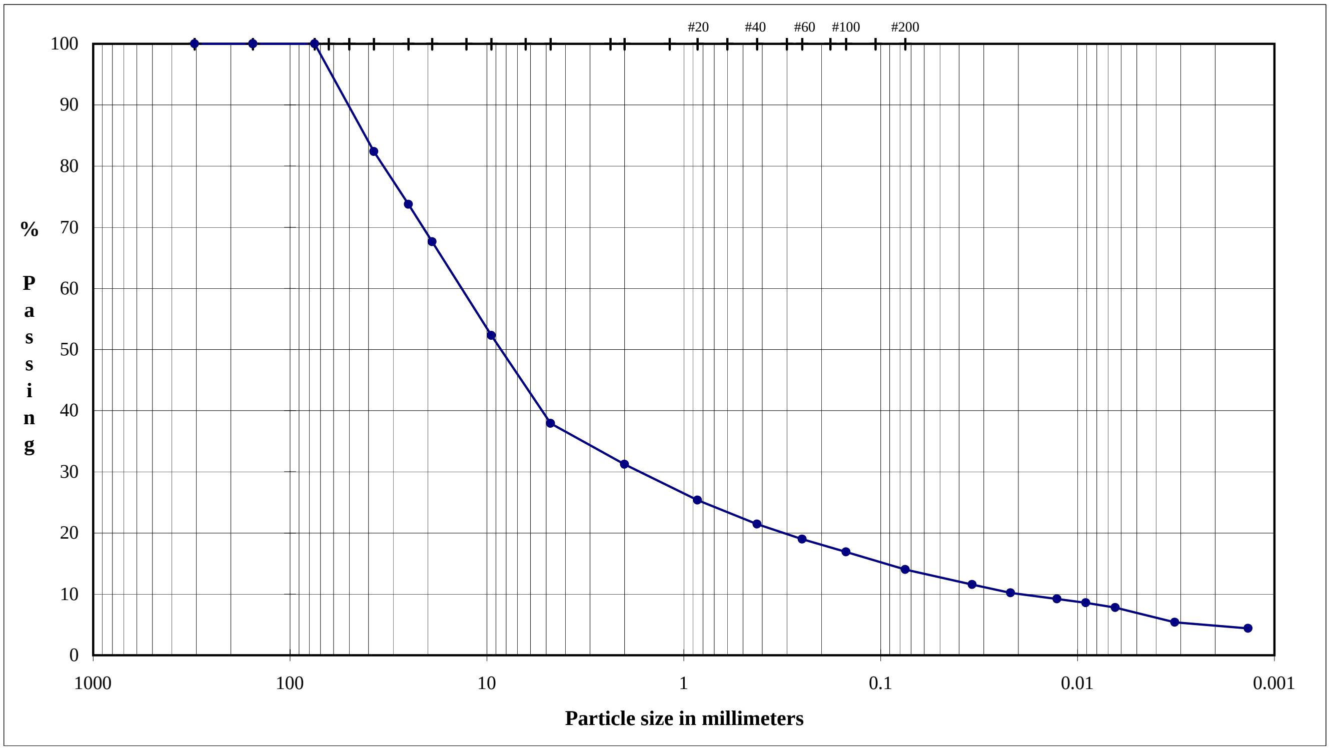
USCS: GC

TECH	DS
DATE	6/28/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **117-119**
TYPE: **Pail**



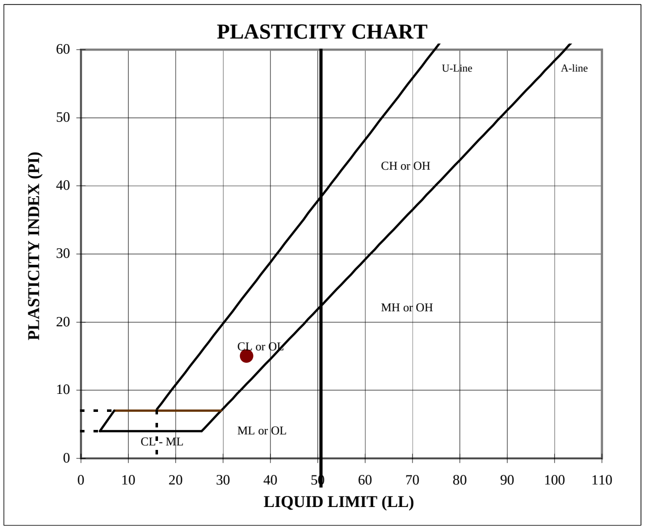
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**32.35**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**82.4**		
1.0"	25.0	**73.8**		
0.75"	19.0	**67.6**	Fine Gravel	**29.70**
0.375"	9.5	**52.3**		
#4	4.8	**37.9**		
#10	2.00	**31.2**	Coarse Sand	**6.72**
#20	0.85	**25.3**	Medium Sand	**9.75**
#40	0.43	**21.5**		
#60	0.25	**19.0**	Fine Sand	**7.45**
#100	0.15	**16.9**		
#200	0.075	**14.0**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**11.6**	Fines Silt or Clay	**14.02**
0.022	**10.2**		
0.013	**9.2**		
0.0091	**8.6**		
0.0064	**7.8**		
0.0032	**5.4**		
0.0014	**4.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	35	20	15	2.73

DESCRIPTION: Yellow clayey gravel with sand

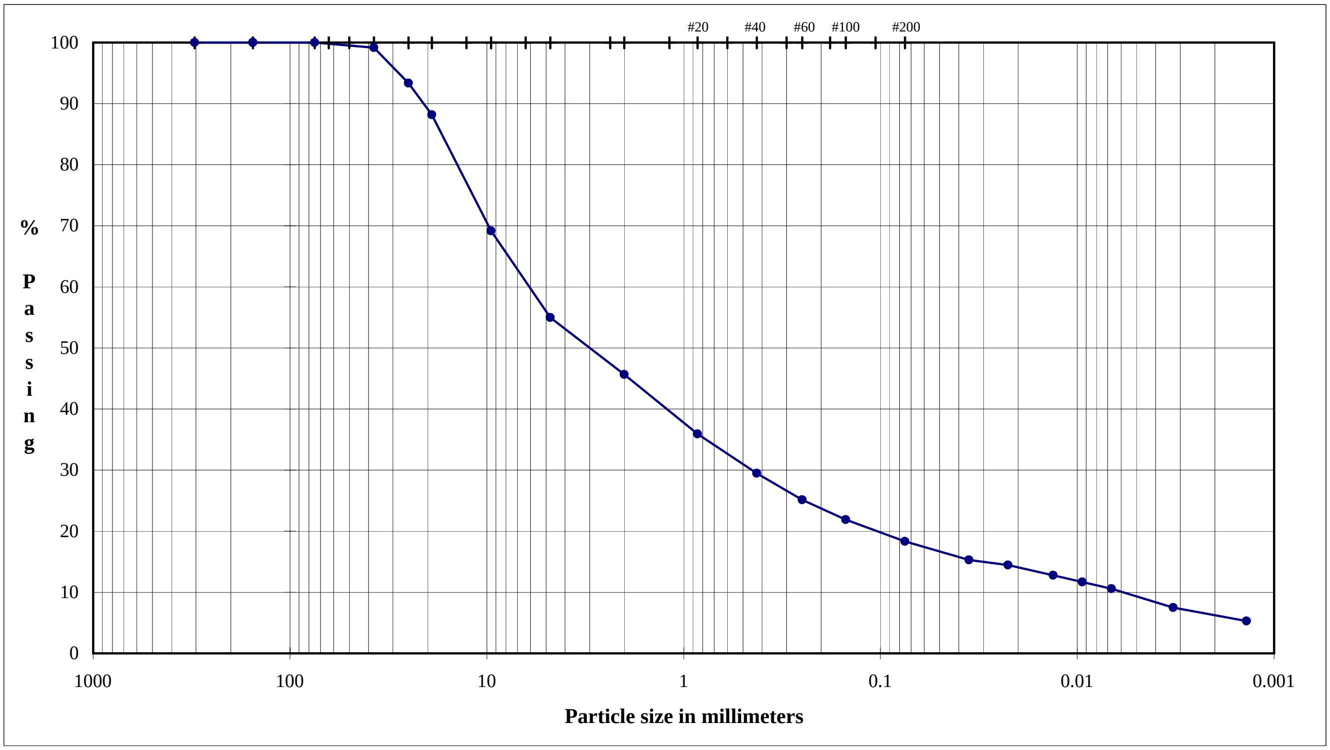
USCS: GC

TECH	MGC
DATE	6/27/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **152-154**
TYPE: **Pail**



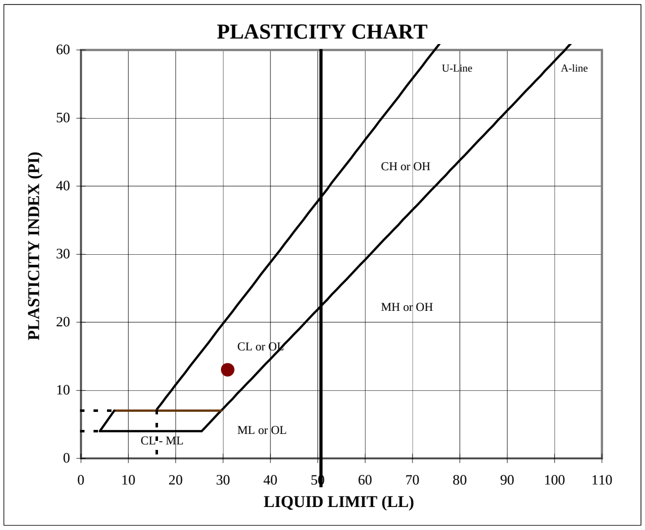
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**11.82**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**99.1**		
1.0"	25.0	**93.4**		
0.75"	19.0	**88.2**	Fine Gravel	**33.22**
0.375"	9.5	**69.1**		
#4	4.8	**55.0**		
#10	2.00	**45.6**	Coarse Sand	**9.33**
#20	0.85	**35.9**	Medium Sand	**16.15**
#40	0.43	**29.5**		
#60	0.25	**25.1**	Fine Sand	**11.16**
#100	0.15	**21.9**		
#200	0.075	**18.3**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**15.3**	Fines Silt or Clay	**18.32**
0.022	**14.5**		
0.013	**12.8**		
0.0094	**11.7**		
0.0067	**10.6**		
0.0033	**7.5**		
0.0014	**5.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	31	18	13	2.66

DESCRIPTION: Pink clayey gravel with sand

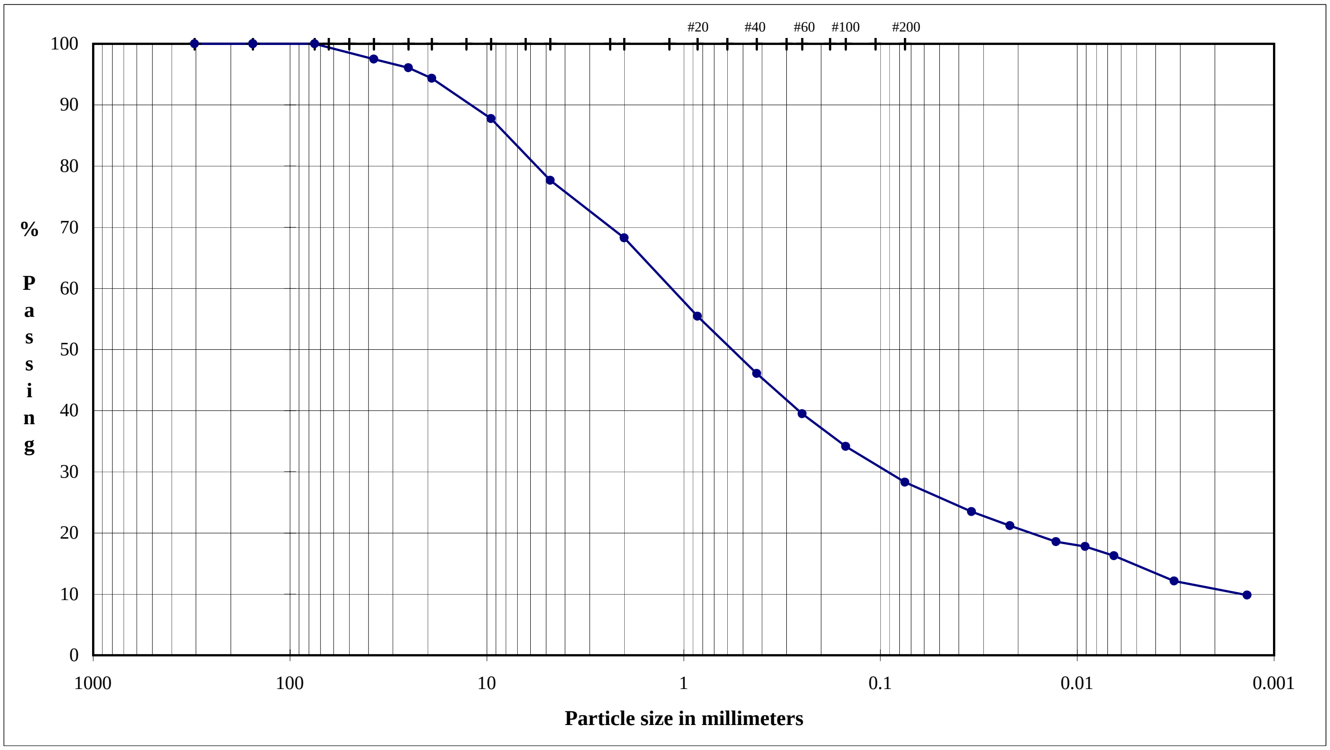
USCS: GC

TECH MGC
DATE 6/27/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

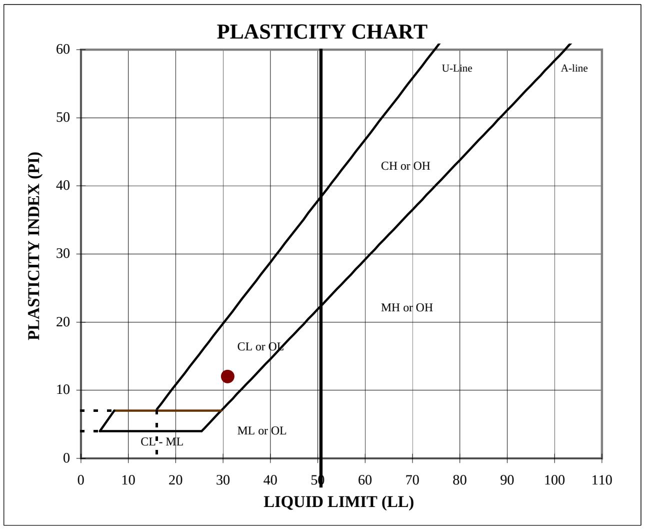
ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **183-185**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

		Particle Size (mm)	% Passing	Particle Size Classification	Percentage
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	**100.0**	Cobbles	**0.00**
	6.0"	154.2	**100.0**		
	6.0"	154.2	**100.0**	Coarse Gravel	**5.66**
	6.0"	154.2	**100.0**		
	3.0"	75.0	**100.0**		
	1.5"	37.5	**97.5**		
	1.0"	25.0	**96.1**		
	0.75"	19.0	**94.3**	Fine Gravel	**16.69**
	0.375"	9.5	**87.8**		
	#4	4.8	**77.7**		
	#10	2.00	**68.2**	Coarse Sand	**9.42**
	#20	0.85	**55.5**	Medium Sand	**22.17**
	#40	0.43	**46.1**		
	#60	0.25	**39.5**	Fine Sand	**17.74**
	#100	0.15	**34.2**		
	#200	0.075	**28.3**		
		(mm)	%Finer		
Hydrometer Analysis		0.034	**23.5**	Fines Silt or Clay	**28.32**
		0.022	**21.2**		
		0.013	**18.6**		
		0.0091	**17.8**		
		0.0065	**16.3**		
		0.0032	**12.1**		
		0.0014	**9.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	31	19	12	2.71

DESCRIPTION: Pink clayey sand with gravel

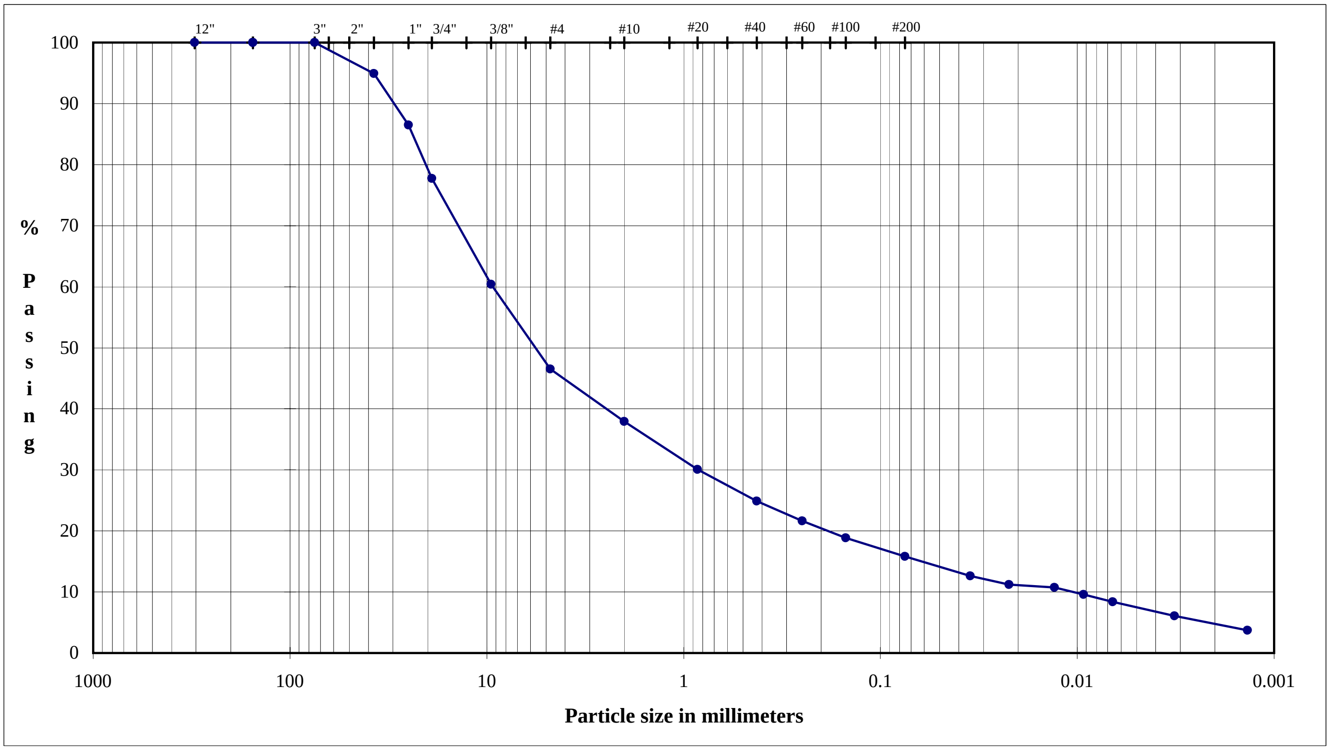
USCS: SC

TECH MGC
DATE 6/27/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **221-223**
TYPE: **Pail**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

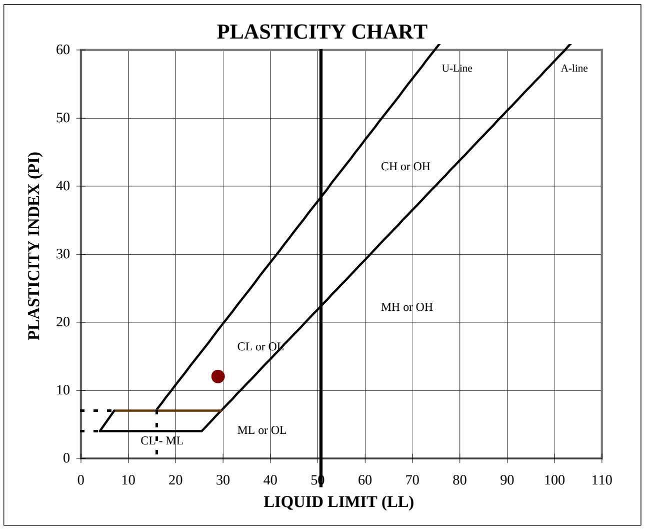
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**22.29**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**94.9**		
1.0"	25.0	**86.5**		
0.75"	19.0	**77.7**	Fine Gravel	**31.17**
0.375"	9.5	**60.4**		
#4	4.8	**46.5**		
#10	2.00	**37.9**	Coarse Sand	**8.61**
#20	0.85	**30.1**	Medium Sand	**13.03**
#40	0.43	**24.9**		
#60	0.25	**21.6**	Fine Sand	**9.08**
#100	0.15	**18.8**		
#200	0.075	**15.8**		

Hydrometer Analysis

(mm)	%Finer		
0.035	**12.6**	Fines Silt or Clay	**15.83**
0.022	**11.2**		
0.013	**10.7**		
0.0093	**9.6**		
0.0066	**8.4**		
0.0032	**6.1**		
0.0014	**3.7**		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	29	17	12	2.70

DESCRIPTION: Very pale brown clayey gravel with sand

USCS: GC

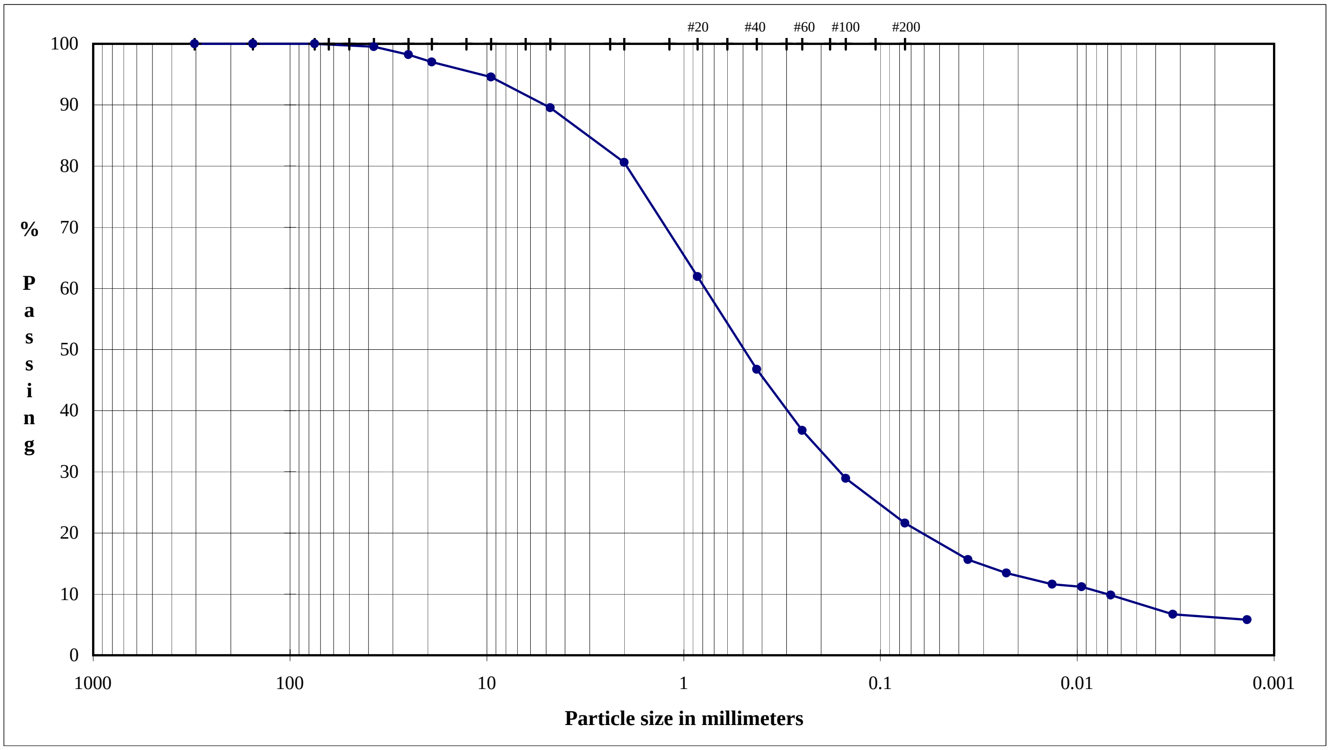
TECH	MGC
DATE	6/29/2005
REVIEW	MB

Jun-05 043-2572-001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **265-269**
TYPE: **Pail**



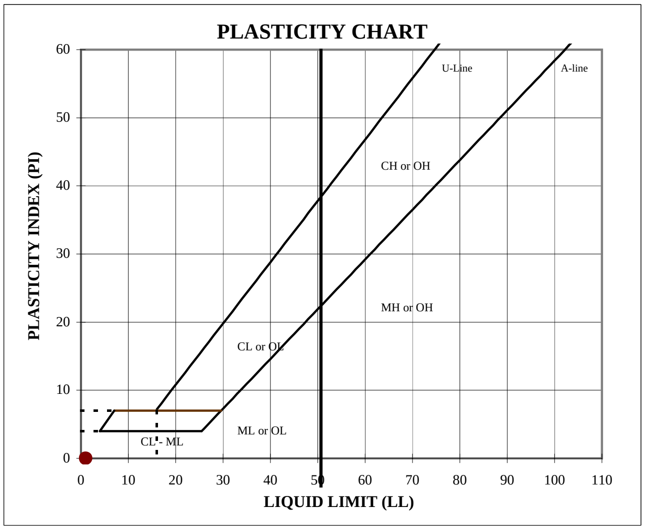
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**2.97**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**99.5**		
1.0"	25.0	**98.2**		
0.75"	19.0	**97.0**	Fine Gravel	**7.48**
0.375"	9.5	**94.6**		
#4	4.8	**89.6**		
#10	2.00	**80.6**	Coarse Sand	**8.97**
#20	0.85	**61.9**	Medium Sand	**33.83**
#40	0.43	**46.8**		
#60	0.25	**36.8**	Fine Sand	**25.15**
#100	0.15	**28.9**		
#200	0.075	**21.6**		

Hydrometer Analysis

(mm)	%Finer		
0.036	**15.7**	Fines Silt or Clay	**21.60**
0.023	**13.4**		
0.013	**11.6**		
0.0095	**11.2**		
0.0068	**9.8**		
0.0033	**6.7**		
0.0014	**5.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**NP**	**NP**	**NP**	**2.70**

DESCRIPTION: Light brown silty sand

USCS: SM

TECH	DS
DATE	6/28/2005
REVIEW	MB

APPENDIX C-5

2005 SOIL SUMMARY AND GRAIN-SIZE ANALYSIS

TABLE C-5.1
SUMMARY OF SOIL DATA

Sample Type	Sample Number	Sample Depth (feet)	USCS Soil Classification	Delivered Moisture (%)	Atterberg Limits			Grain-size Distribution			Specific Gravity	Moisture/Density Relationship Standard Proctor		Additional Tests Comments (see Notes)
					LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200		PCF (Dry)	Moist (%)	
Bag	T3	11.0-12.5	GC	10.6	32	17	15	71	41	16	2.66	--	--	
Bag	T3	31.0-32.5	GC	22.5	34	18	16	69	56	28	2.76	--	--	
Bag	T3	51.0-52.5	GC	11.8	31	19	12	71	55	21	2.84	--	--	
Bag	T3	71.0-72.5	SC	12.8	33	20	13	91	76	35	2.87	--	--	
Bag	T3	76.5-77.5	SC-SM	4.3	23	16	7	88	67	28	2.85	--	--	Bag labeled T5@76.5-77.5
Bag	T3	91.0-92.5	GC	8.6	31	18	13	79	62	26	2.74	--	--	
Bag	T4	49.0-50.0	GC	6.8	31	17	14	77	55	22	2.80	--	--	
Bag	T4	69.0-70.0	SC	6.9	31	16	15	86	63	25	2.81	--	--	
Bag	T4	89-0-90.0	SC	9.5	36	20	16	86	66	30	2.93	--	--	
Bag	T4	109.0-110.0	GC	12.0	35	20	15	74	55	24	2.79	--	--	
Bag	T4	113.0-114.0	SC	17.7	36	19	17	97	76	33	2.86	--	--	
Bag	T4	129.0-130.0	GC	9.3	34	23	11	72	49	24	2.91	--	--	
Bag	T5	16.5-17.5	GM	5.9	NP	NP	NP	69	49	15	2.78	--	--	
Bag	T5	36.5-37.5	GC	10.2	30	16	14	56	37	13	2.81	--	--	
Bag	T5	56.5-57.5	GC	8.7	34	18	16	58	38	13	2.71	--	--	
Bag	T5	96.5-97.5	GC	12.6	37	21	16	71	55	20	2.75	--	--	
Bag	T5	116.5-117.5	GC	8.2	33	19	14	84	62	27	2.81	--	--	
Bag	T5	136.5-137.5	GC	9.6	33	18	15	67	47	19	2.80	--	--	
Bag	T5	164.0-165.0	GC	14.0	35	17	18	75	53	20	2.85	--	--	

Notes:

LL = Liquid Limit

PL = Plastic Limit

PI = Plastic Index

USCS = Unified Soil Classification System

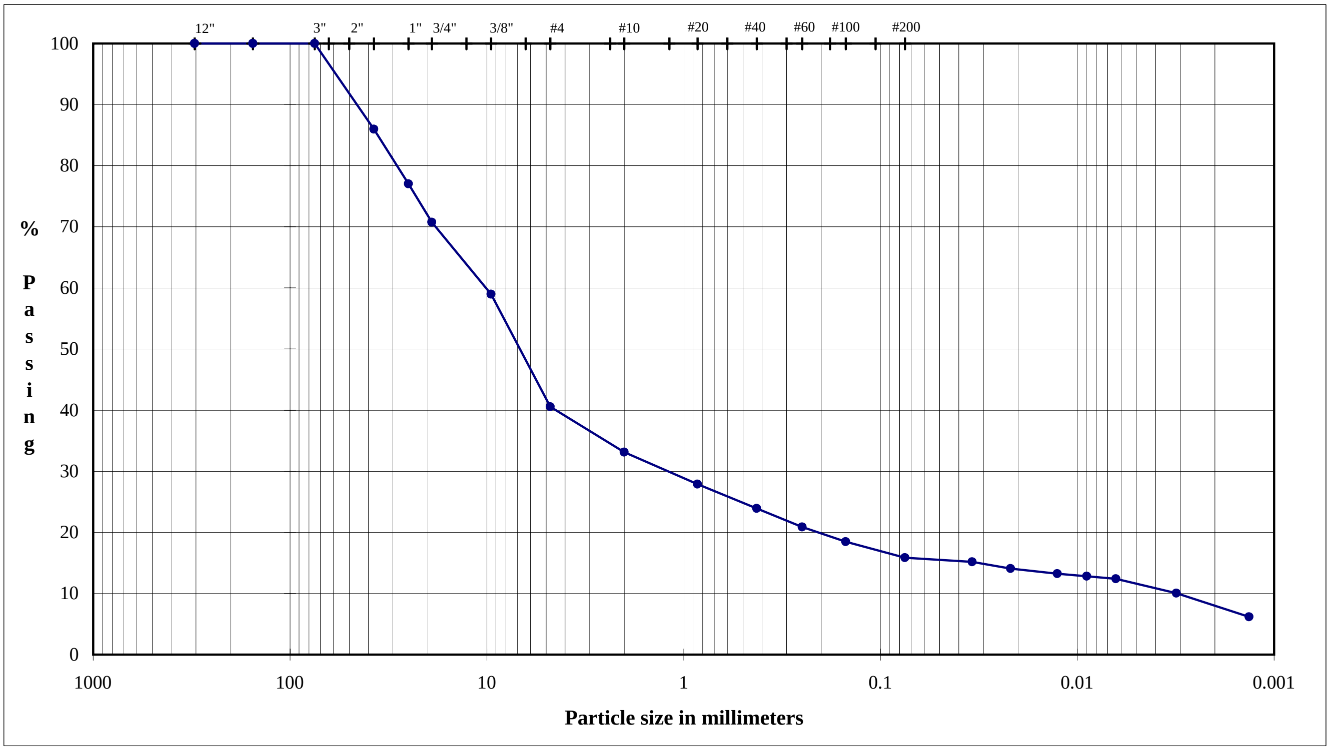
PCF = pounds per cubic foot

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-3** Depth: **11.0-12.5**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

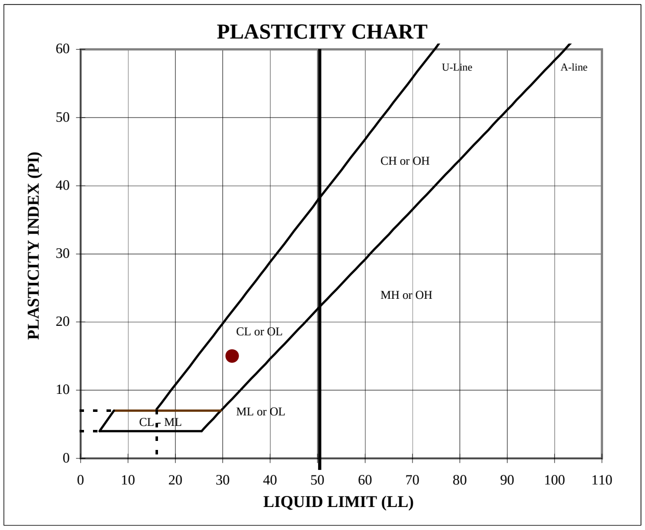
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**29.23**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**86.0**		
1.0"	25.0	**77.0**		
0.75"	19.0	**70.8**	Fine Gravel	**30.22**
0.375"	9.5	**59.0**		
#4	4.8	**40.5**		
#10	2.00	**33.1**	Coarse Sand	**7.44**
#20	0.85	**27.9**	Medium Sand	**9.19**
#40	0.43	**23.9**		
#60	0.25	**20.9**	Fine Sand	**8.07**
#100	0.15	**18.5**		
#200	0.075	**15.8**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**15.2**	Fines Silt or Clay	**15.85**
0.022	**14.1**		
0.013	**13.2**		
0.0089	**12.8**		
0.0064	**12.4**		
0.0031	**10.0**		
0.0013	**6.2**		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
10.6	**32**	**17**	**15**	**2.66**

DESCRIPTION: Weak red clayey gravel with sand

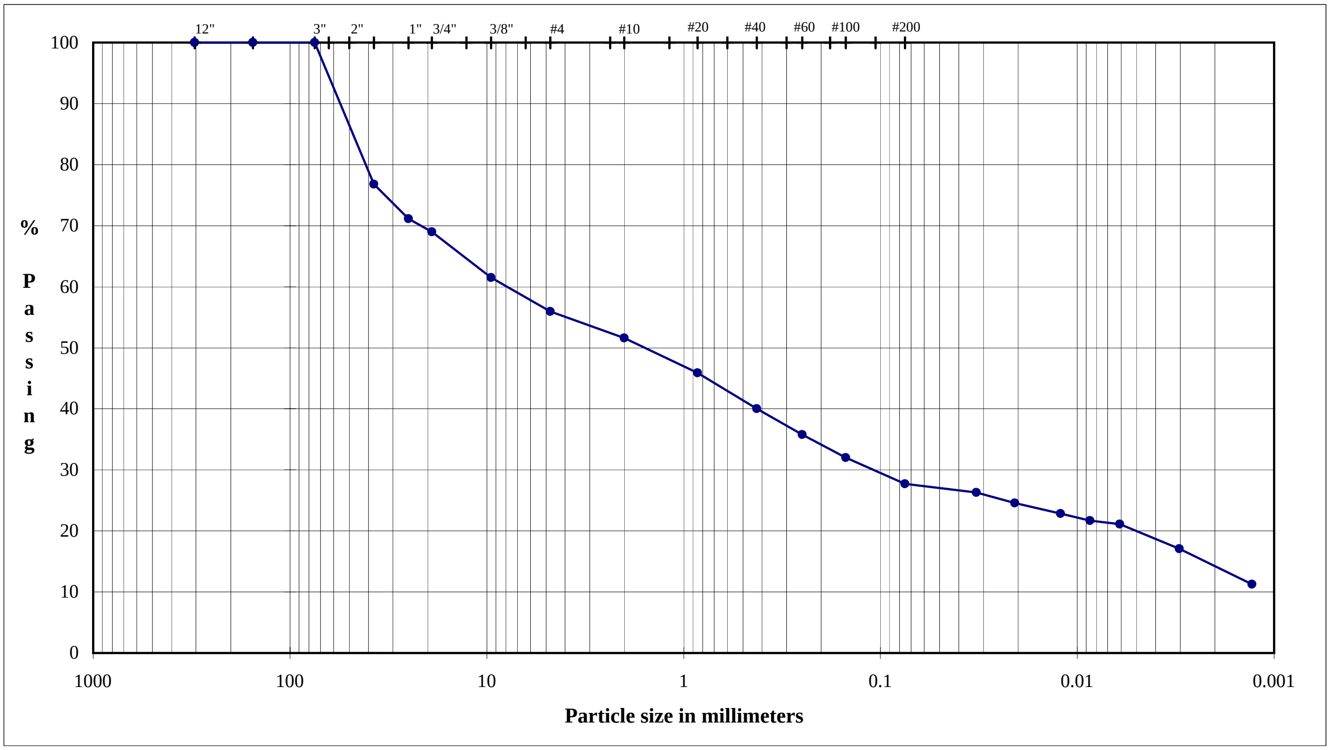
USCS: GC

TECH	SW
DATE	9/29/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-3** Depth: **31.0-32.5**
TYPE: **Bag**

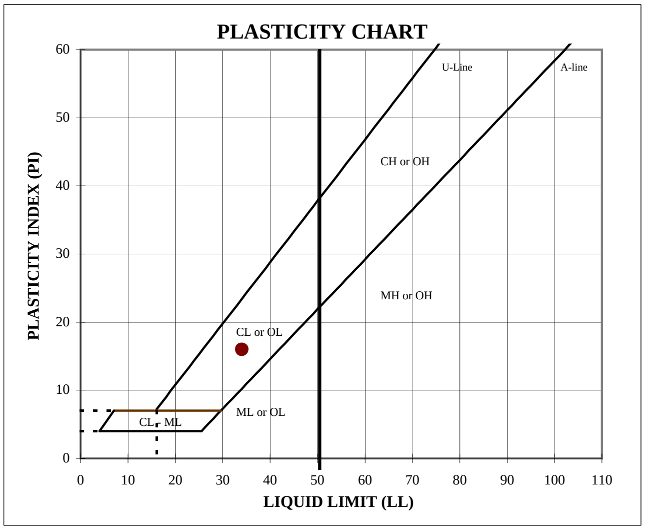


COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**31.01**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**76.8**		
1.0"	25.0	**71.1**		
0.75"	19.0	**69.0**	Fine Gravel	**13.04**
0.375"	9.5	**61.5**		
#4	4.8	**55.9**		
#10	2.00	**51.6**	Coarse Sand	**4.34**
#20	0.85	**45.9**	Medium Sand	**11.57**
#40	0.43	**40.0**		
#60	0.25	**35.8**	Fine Sand	**12.32**
#100	0.15	**32.0**		
#200	0.075	**27.7**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**26.3**	Fines Silt or Clay	**27.72**
0.021	**24.6**		
0.012	**22.8**		
0.0086	**21.7**		
0.0061	**21.1**		
0.0030	**17.1**		
0.0013	**11.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
22.5	34	18	16	2.76

DESCRIPTION: Weak red clayey gravel with sand

USCS: GC

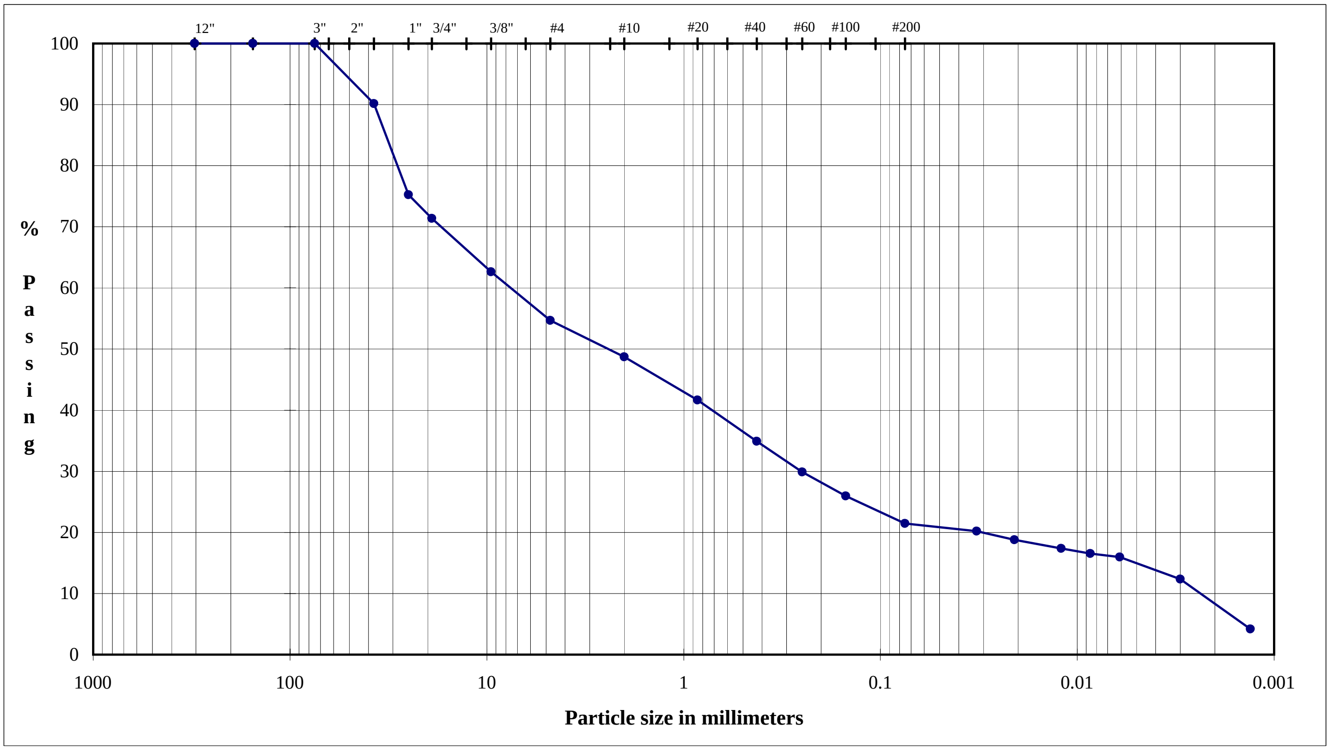
TECH	MKS
DATE	10/11/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-3** Depth: **51.0-52.5**
TYPE: **Bag**



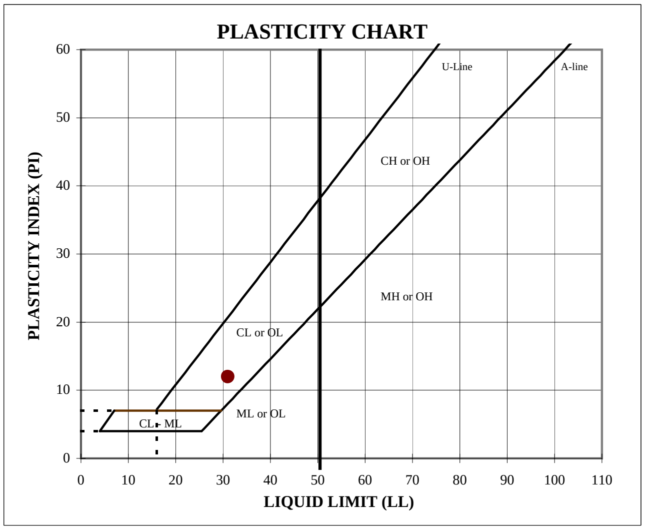
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**28.64**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**90.2**		
1.0"	25.0	**75.2**		
0.75"	19.0	**71.4**	Fine Gravel	**16.68**
0.375"	9.5	**62.6**		
#4	4.8	**54.7**		
#10	2.00	**48.7**	Coarse Sand	**5.94**
#20	0.85	**41.6**	Medium Sand	**13.84**
#40	0.43	**34.9**		
#60	0.25	**29.9**	Fine Sand	**13.45**
#100	0.15	**25.9**		
#200	0.075	**21.4**		

Hydrometer Analysis

(mm)	%Finer		
0.032	**20.2**	Fines Silt or Clay	**21.44**
0.021	**18.8**		
0.012	**17.4**		
0.0086	**16.5**		
0.0061	**16.0**		
0.0030	**12.3**		
0.0013	**4.2**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
11.8	**31**	**19**	**12**	**2.84**

DESCRIPTION: Light reddish brown clayey gravel with sand

USCS: GC

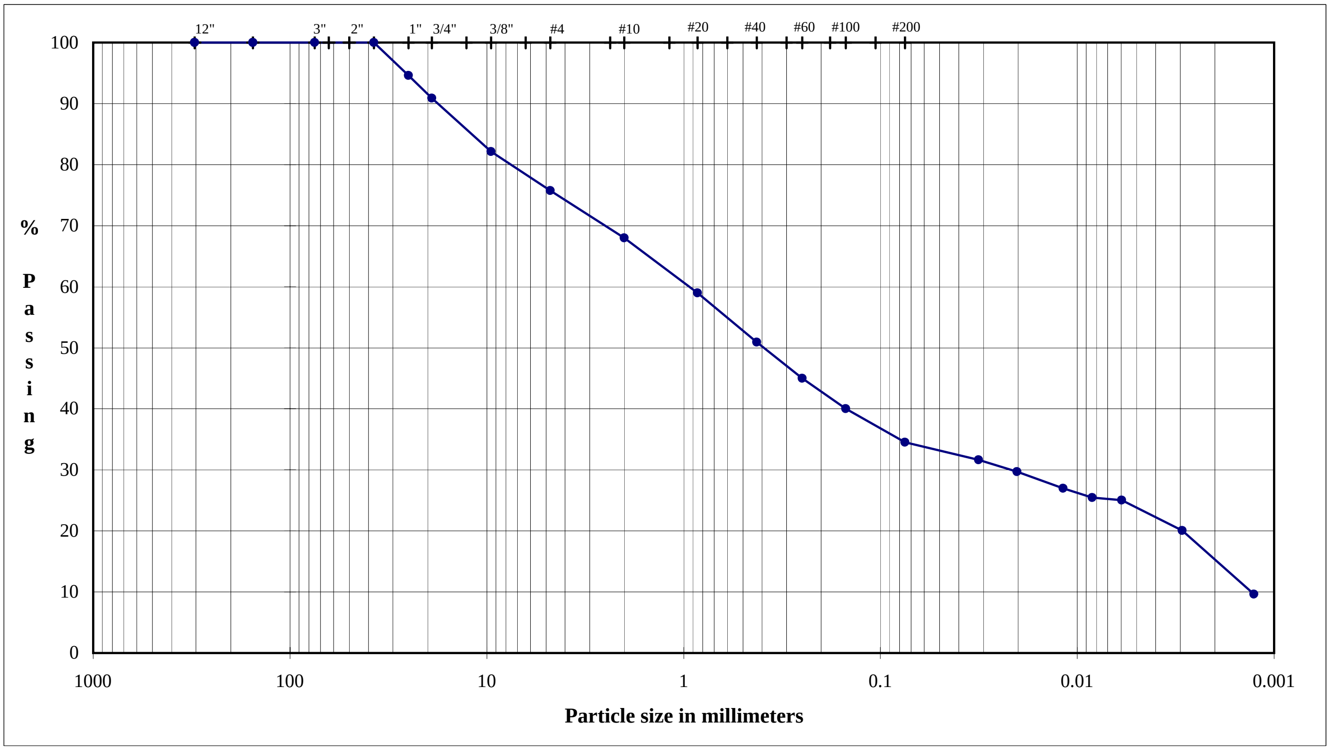
TECH MKS
DATE 10/11/2005
REVIEW MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-3**	Depth:	**71.0-72.5**
TYPE:	**Bag**		



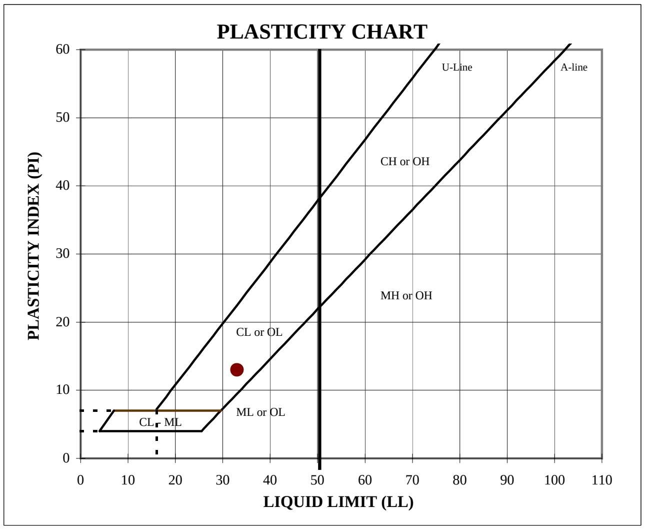
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**9.09**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**94.6**		
0.75"	19.0	**90.9**	Fine Gravel	**15.16**
0.375"	9.5	**82.1**		
#4	4.8	**75.7**		
#10	2.00	**68.0**	Coarse Sand	**7.73**
#20	0.85	**59.0**	Medium Sand	**17.09**
#40	0.43	**50.9**		
#60	0.25	**45.0**	Fine Sand	**16.40**
#100	0.15	**40.0**		
#200	0.075	**34.5**		

Hydrometer Analysis

(mm)	%Finer		
0.032	**31.6**	Fines Silt or Clay	**34.52**
0.020	**29.7**		
0.012	**27.0**		
0.0084	**25.4**		
0.0059	**25.1**		
0.0029	**20.0**		
0.0013	**9.6**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
12.8	**33**	**20**	**13**	**2.87**

DESCRIPTION: Red clayey sand with gravel

USCS: SC

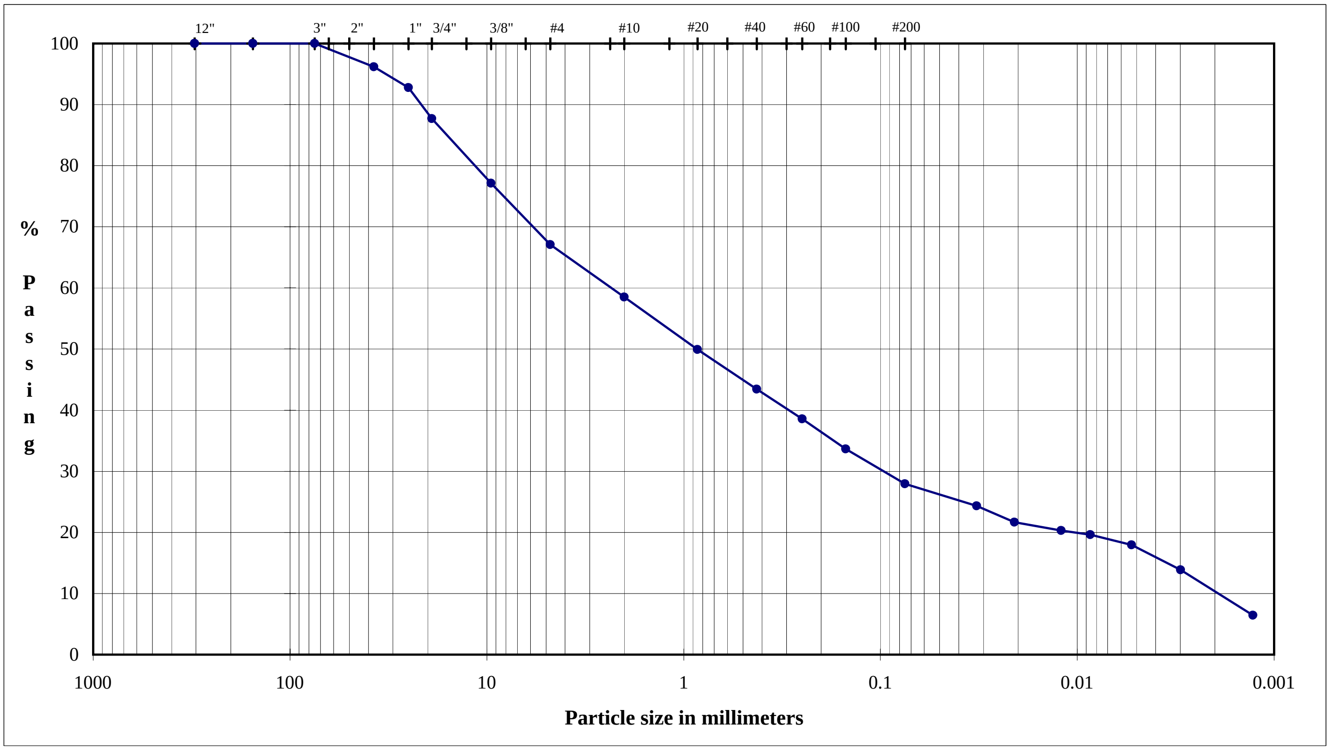
TECH	SW
DATE	9/29/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

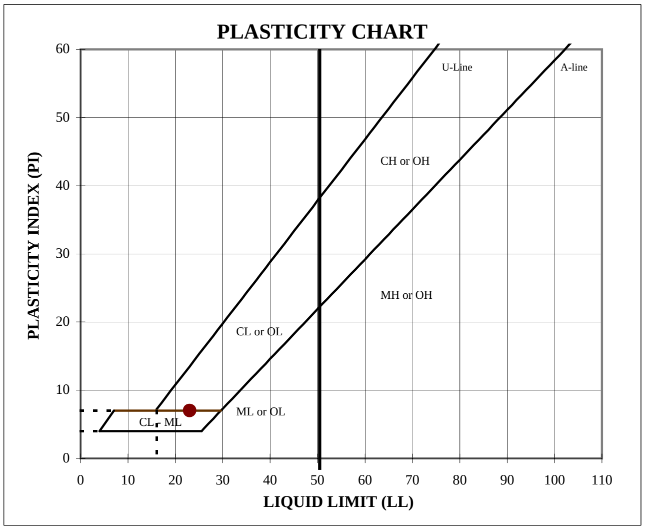
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-3** Depth: **76.5-77.5**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**12.28**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**96.2**		
1.0"	25.0	**92.8**		
0.75"	19.0	**87.7**	Fine Gravel	**20.61**
0.375"	9.5	**77.1**		
#4	4.8	**67.1**		
#10	2.00	**58.5**	Coarse Sand	**8.62**
#20	0.85	**49.9**	Medium Sand	**15.05**
#40	0.43	**43.4**		
#60	0.25	**38.6**	Fine Sand	**15.52**
#100	0.15	**33.6**		
#200	0.075	**27.9**		

Hydrometer Analysis	(mm)	%Finer		
	0.032	**24.4**	Fines Silt or Clay	**27.92**
	0.021	**21.6**		
	0.012	**20.3**		
	0.0086	**19.6**		
	0.0053	**17.9**		
	0.0030	**13.9**		
	0.0013	**6.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
4.3	23	16	7	2.85

DESCRIPTION: Light gray silty, clayey sand with gravel

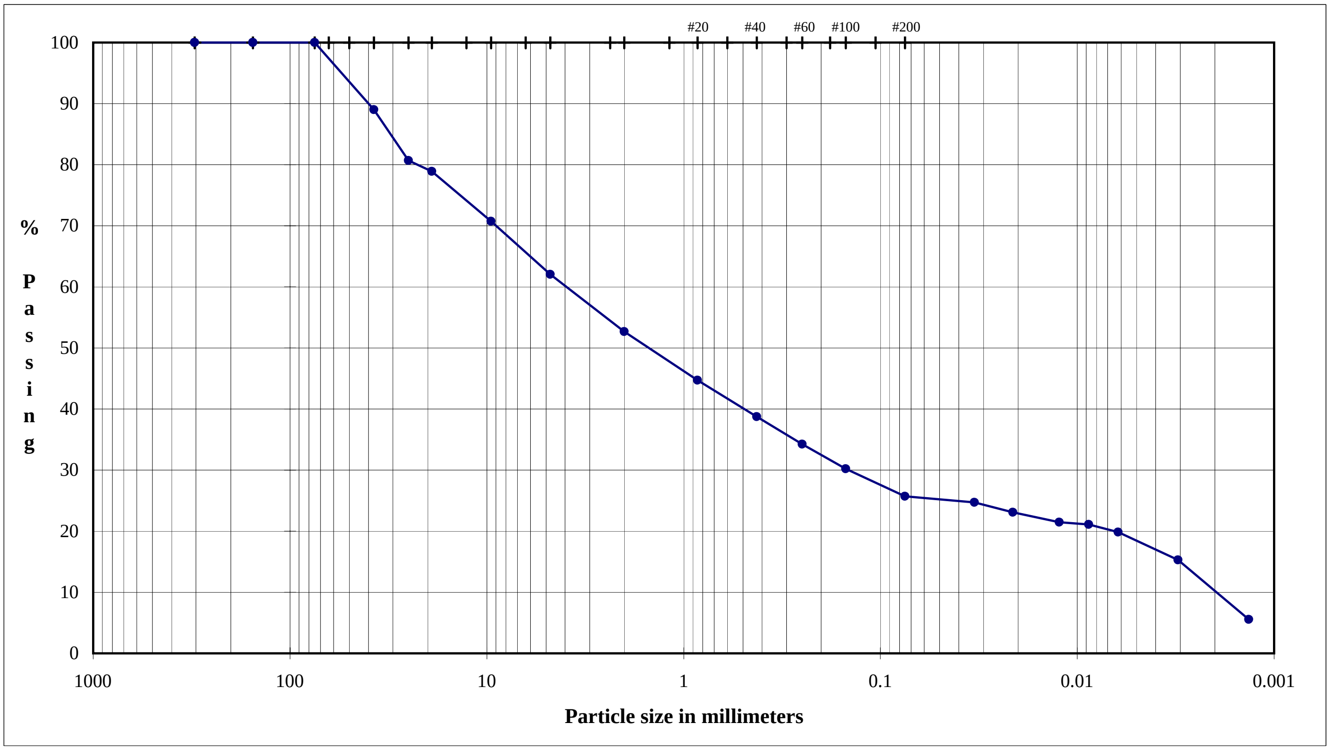
USCS: SC-SM

TECH MKS
DATE 10/11/2005
REVIEW 0

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-3**	Depth:	**91.0-92.5**
TYPE:	**Bag**		



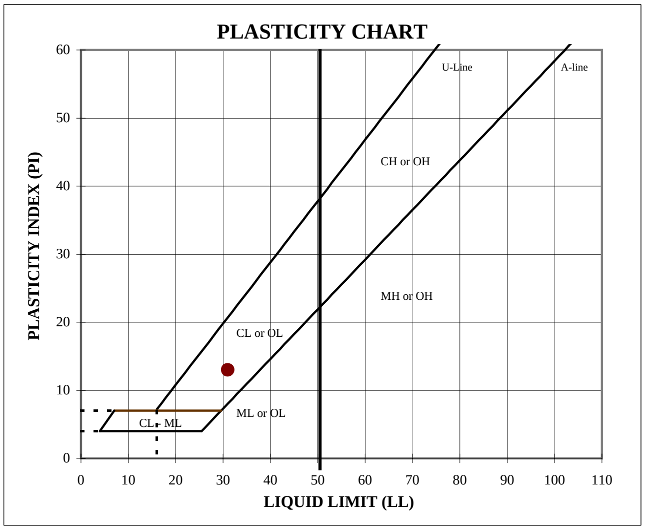
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**21.09**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**89.0**		
1.0"	25.0	**80.7**		
0.75"	19.0	**78.9**	Fine Gravel	**16.85**
0.375"	9.5	**70.7**		
#4	4.8	**62.1**		
#10	2.00	**52.7**	Coarse Sand	**9.40**
#20	0.85	**44.7**	Medium Sand	**13.93**
#40	0.43	**38.7**		
#60	0.25	**34.2**	Fine Sand	**13.04**
#100	0.15	**30.2**		
#200	0.075	**25.7**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**24.7**	Fines Silt or Clay	**25.69**
0.021	**23.1**		
0.012	**21.5**		
0.0087	**21.1**		
0.0062	**19.8**		
0.0031	**15.3**		
0.0013	**5.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
8.6	**31**	**18**	**13**	**2.74**

DESCRIPTION: Weak red clayey gravel with sand

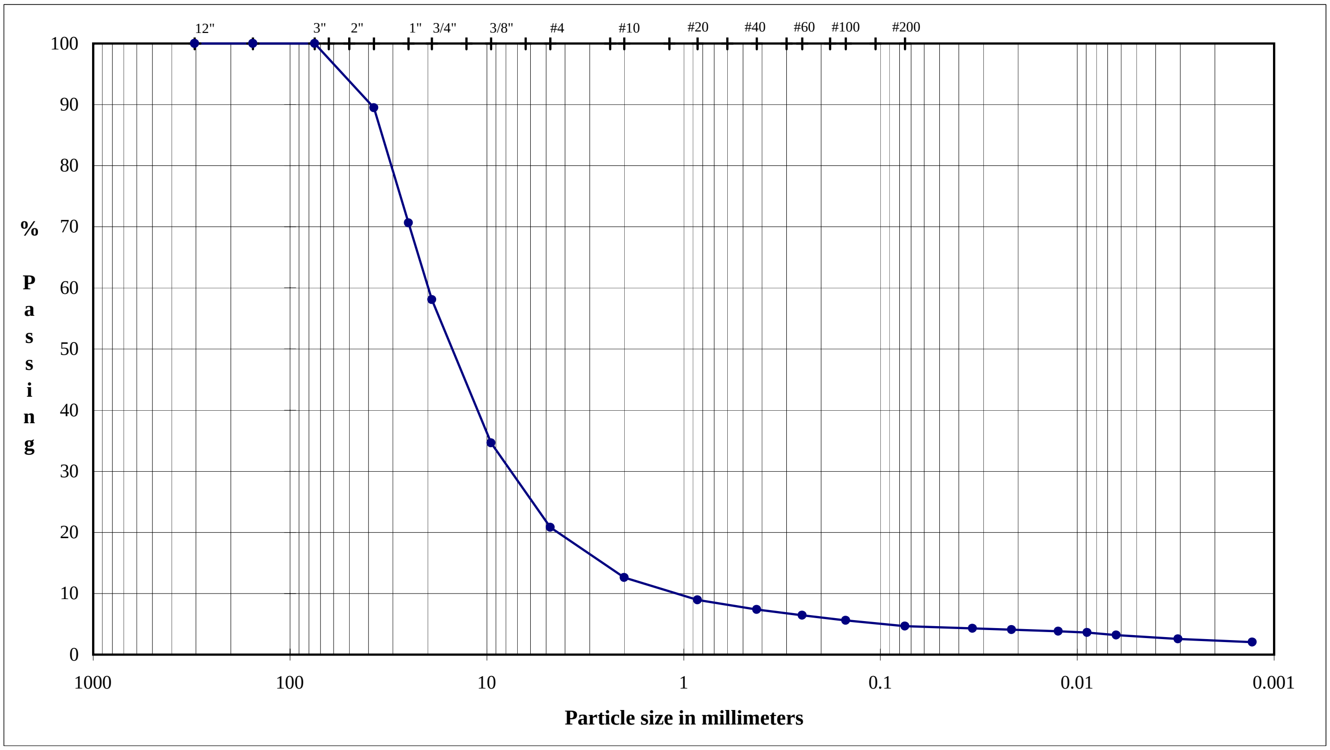
USCS: GC

TECH	MKS
DATE	10/12/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

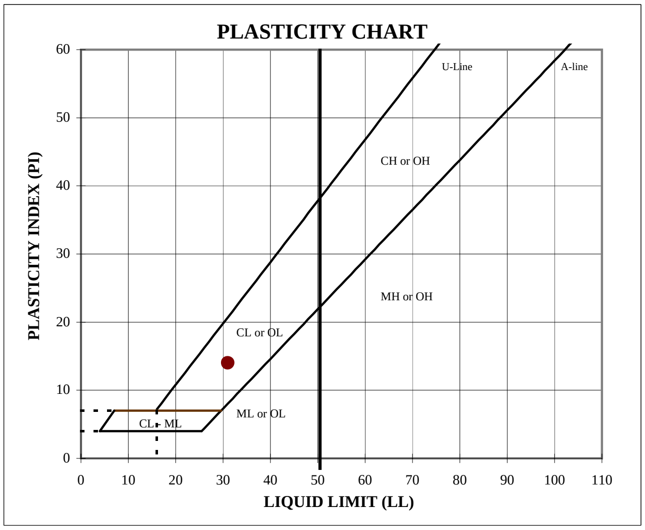
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-4** Depth: **9.0-10.0**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**41.92**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**89.5**		
1.0"	25.0	**70.6**		
0.75"	19.0	**58.1**	Fine Gravel	**37.27**
0.375"	9.5	**34.6**		
#4	4.8	**20.8**		
#10	2.00	**12.6**	Coarse Sand	**8.23**
#20	0.85	**8.9**	Medium Sand	**5.22**
#40	0.43	**7.4**		
#60	0.25	**6.4**	Fine Sand	**2.69**
#100	0.15	**5.6**		
#200	0.075	**4.7**		

Hydrometer Analysis (mm)	%Finer		
0.034	**4.3**	Fines Silt or Clay	**4.68**
0.022	**4.1**		
0.012	**3.8**		
0.0089	**3.6**		
0.0063	**3.2**		
0.0031	**2.6**		
0.0013	**2.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
4.9	**31**	**17**	**14**	**2.83**

DESCRIPTION: Pale yellow well-graded gravel with sand

USCS: GW

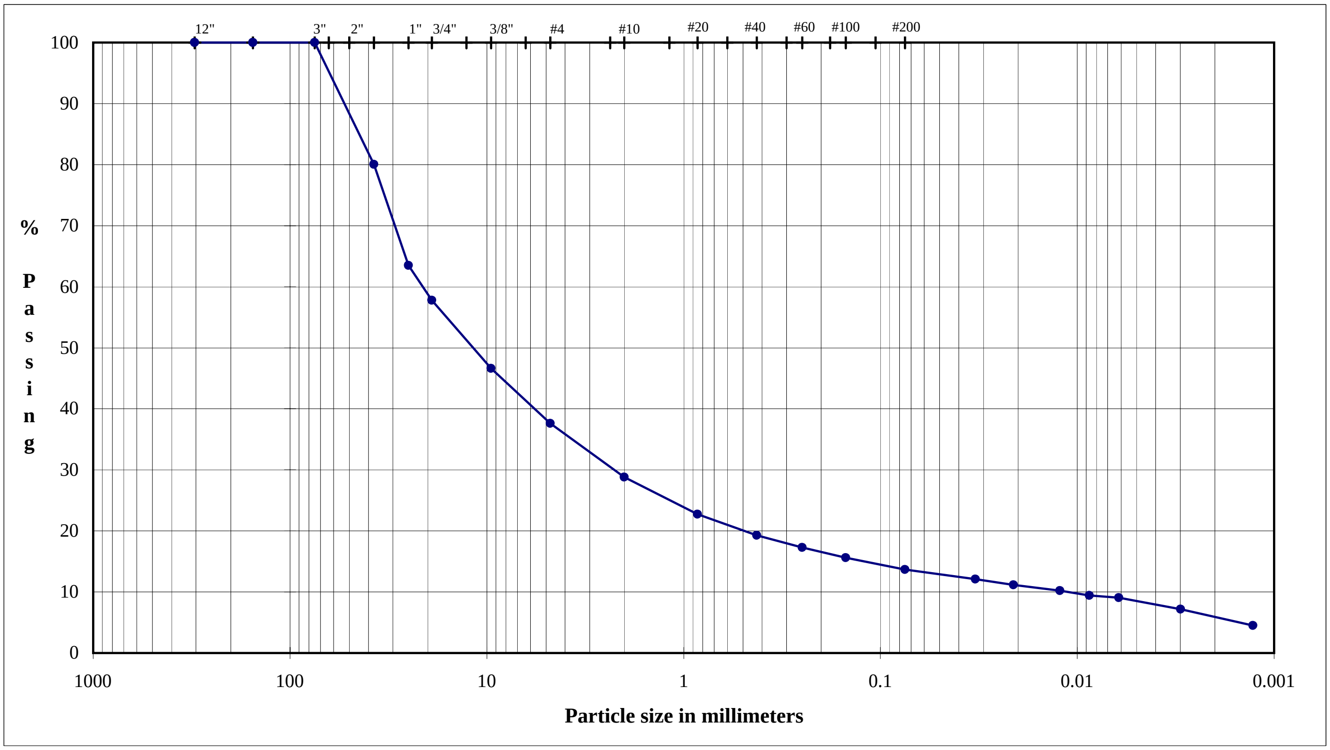
TECH	MKS
DATE	10/12/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-4** Depth: **29.0-30.0**
TYPE: **Bag**



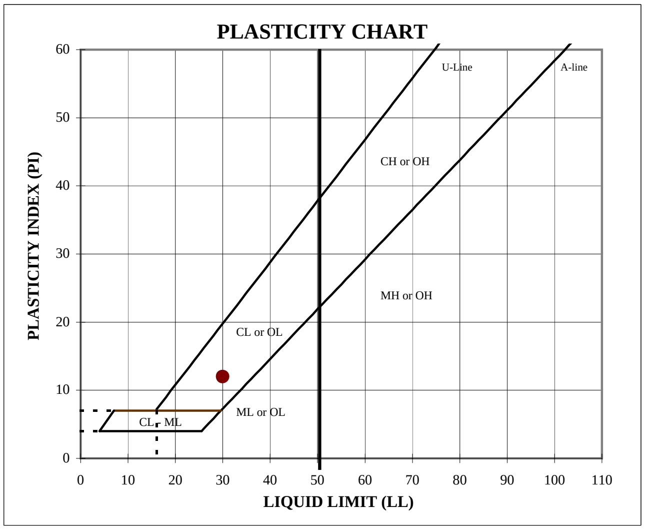
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**42.23**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**80.0**		
1.0"	25.0	**63.5**		
0.75"	19.0	**57.8**	Fine Gravel	**20.17**
0.375"	9.5	**46.6**		
#4	4.8	**37.6**		
#10	2.00	**28.8**	Coarse Sand	**8.78**
#20	0.85	**22.7**	Medium Sand	**9.52**
#40	0.43	**19.3**		
#60	0.25	**17.3**	Fine Sand	**5.60**
#100	0.15	**15.6**		
#200	0.075	**13.7**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**12.1**	Fines Silt or Clay	**13.70**
0.021	**11.1**		
0.012	**10.2**		
0.0087	**9.4**		
0.0061	**9.1**		
0.0030	**7.2**		
0.0013	**4.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
6.9	30	18	12	2.84

DESCRIPTION: Light gray clayey gravel with sand

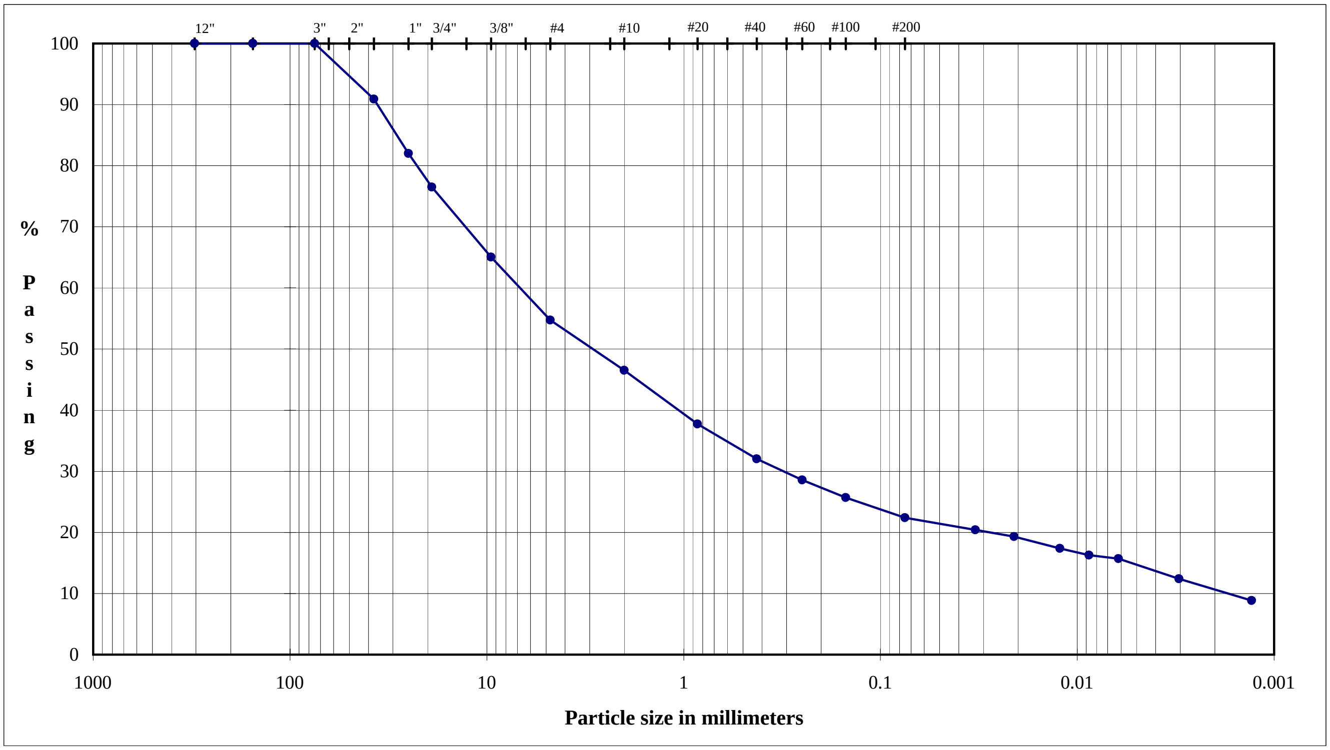
USCS: GC

TECH	SW
DATE	9/29/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-4**	Depth:	**49.0 - 50.0**
TYPE:	**Bag**		



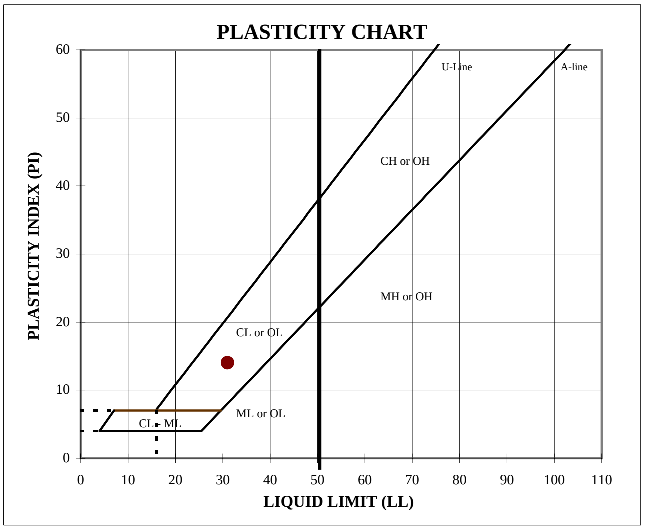
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

Particle Size	(mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**23.50**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**90.9**		
1.0"	25.0	**82.0**		
0.75"	19.0	**76.5**	Fine Gravel	**21.75**
0.375"	9.5	**65.1**		
#4	4.8	**54.7**		
#10	2.00	**46.5**	Coarse Sand	**8.21**
#20	0.85	**37.7**	Medium Sand	**14.49**
#40	0.43	**32.0**		
#60	0.25	**28.6**	Fine Sand	**9.65**
#100	0.15	**25.7**		
#200	0.075	**22.4**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**20.4**	Fines Silt or Clay	**22.40**
0.021	**19.3**		
0.012	**17.4**		
0.0087	**16.3**		
0.0062	**15.7**		
0.0030	**12.4**		
0.0013	**8.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
6.8	**31**	**17**	**14**	**2.80**

DESCRIPTION: Light gray clayey gravel with sand

USCS: GC

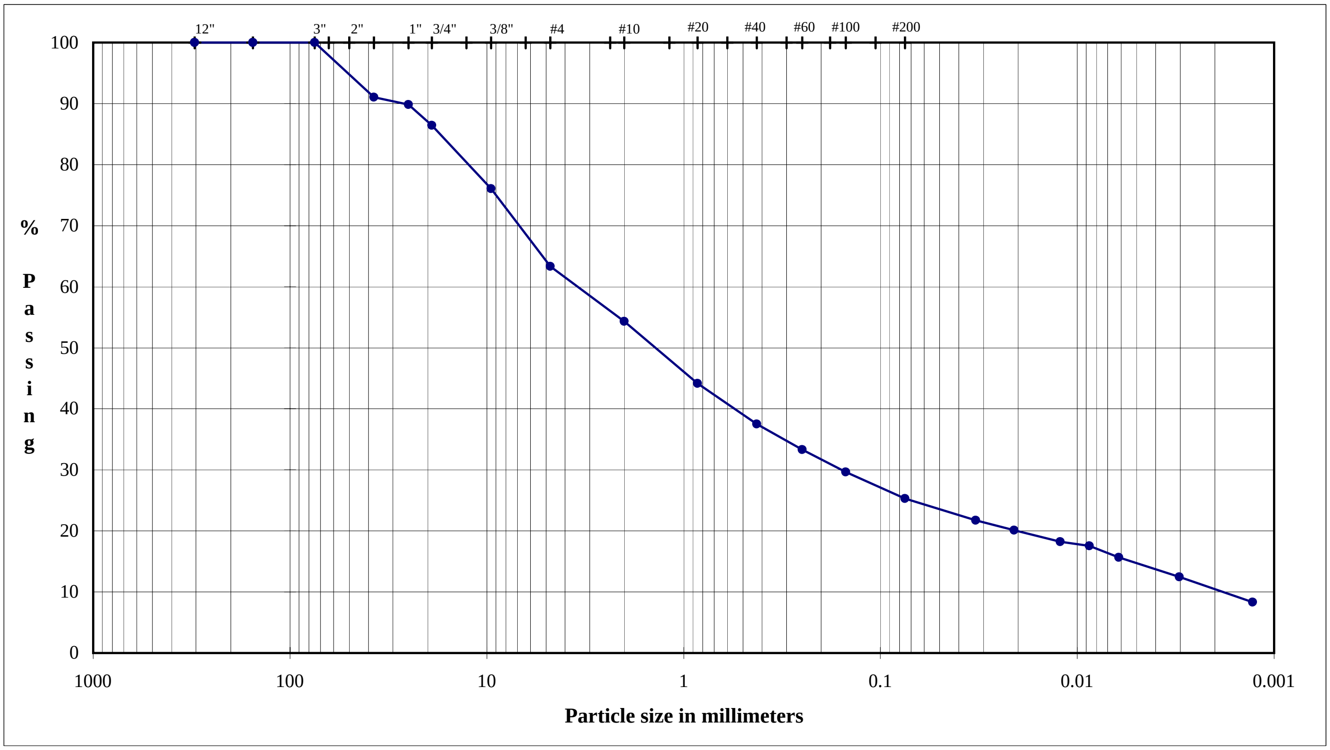
TECH	MKS
DATE	10/12/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-4** Depth: **69.0-70.0**
TYPE: **Bag**



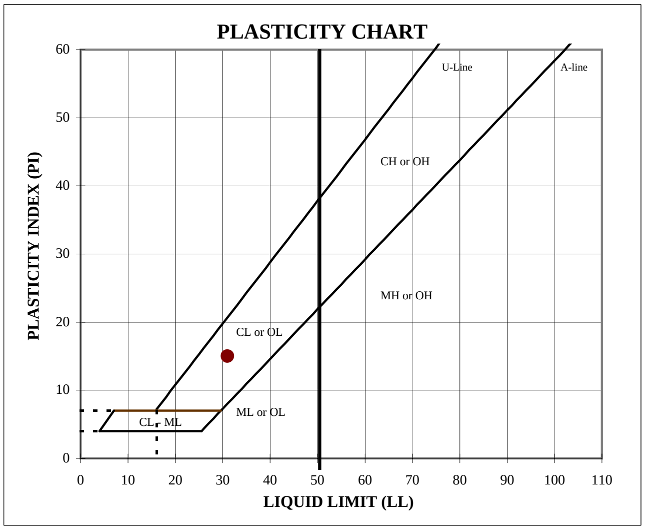
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**13.55**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**91.1**		
1.0"	25.0	**89.8**		
0.75"	19.0	**86.4**	Fine Gravel	**23.13**
0.375"	9.5	**76.0**		
#4	4.8	**63.3**		
#10	2.00	**54.3**	Coarse Sand	**9.00**
#20	0.85	**44.2**	Medium Sand	**16.83**
#40	0.43	**37.5**		
#60	0.25	**33.3**	Fine Sand	**12.17**
#100	0.15	**29.6**		
#200	0.075	**25.3**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**21.7**	Fines Silt or Clay	**25.32**
0.021	**20.1**		
0.012	**18.2**		
0.0087	**17.6**		
0.0062	**15.7**		
0.0030	**12.5**		
0.0013	**8.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
6.9	**31**	**16**	**15**	**2.81**

DESCRIPTION: Weak red clayey sand with gravel

USCS: SC

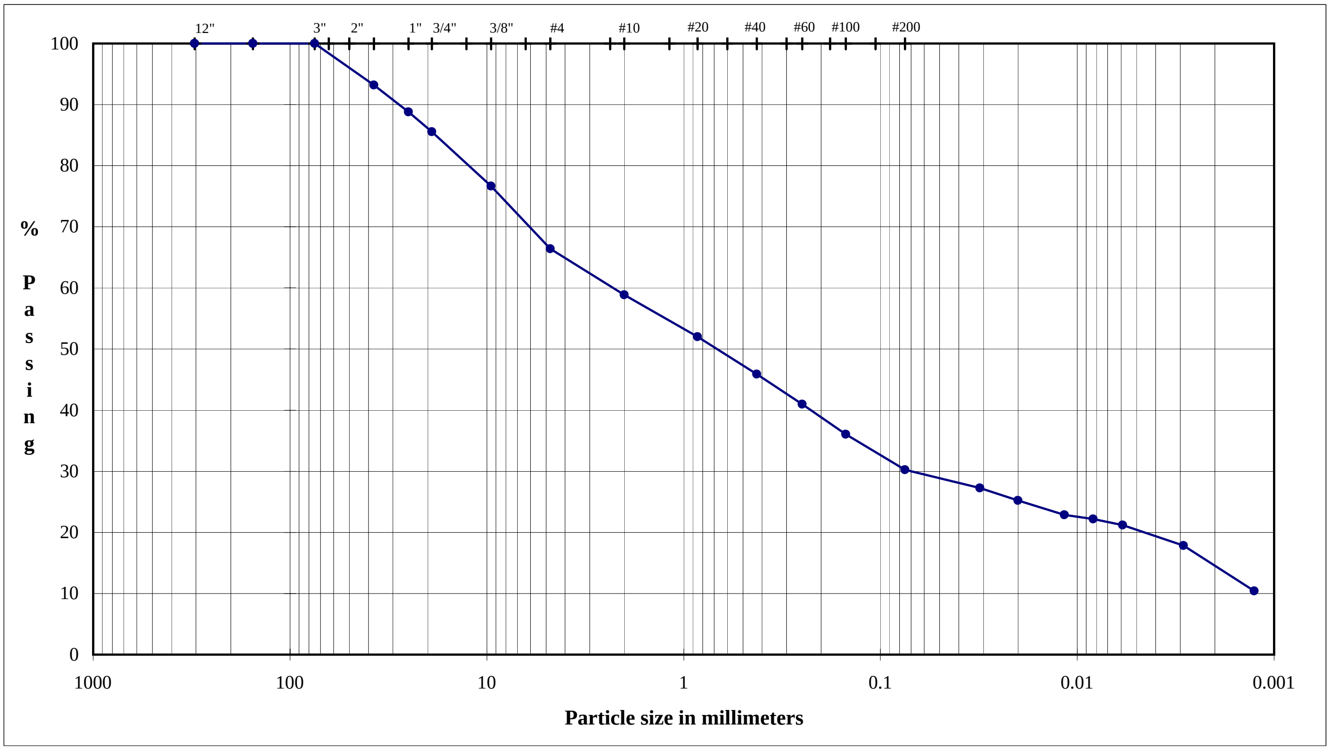
TECH SW
DATE 9/29/2005
REVIEW MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-4** Depth: **89.0-90.0**
TYPE: **Bag**



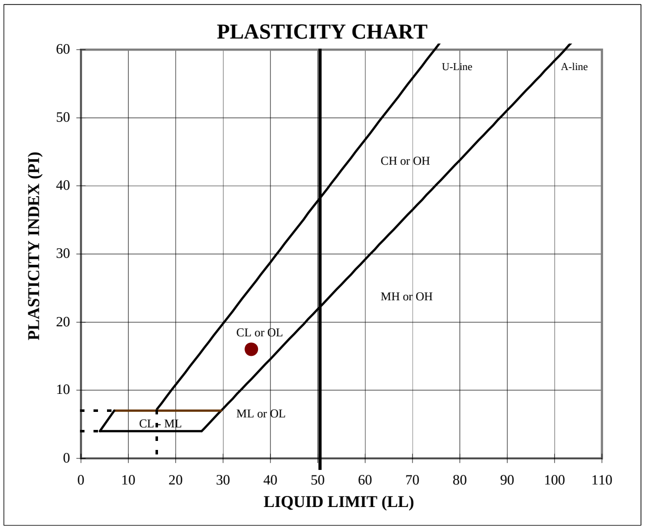
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**14.46**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**93.2**		
1.0"	25.0	**88.8**		
0.75"	19.0	**85.5**	Fine Gravel	**19.13**
0.375"	9.5	**76.7**		
#4	4.8	**66.4**		
#10	2.00	**58.9**	Coarse Sand	**7.52**
#20	0.85	**52.0**	Medium Sand	**12.97**
#40	0.43	**45.9**		
#60	0.25	**41.0**	Fine Sand	**15.66**
#100	0.15	**36.1**		
#200	0.075	**30.3**		

Hydrometer Analysis

(mm)	%Finer		
0.031	**27.2**	Fines Silt or Clay	**30.25**
0.020	**25.2**		
0.012	**22.9**		
0.0083	**22.2**		
0.0059	**21.2**		
0.0029	**17.8**		
0.0013	**10.4**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
9.5	**36**	**20**	**16**	**2.93**

DESCRIPTION: Light gray clayey sand with gravel

USCS: SC

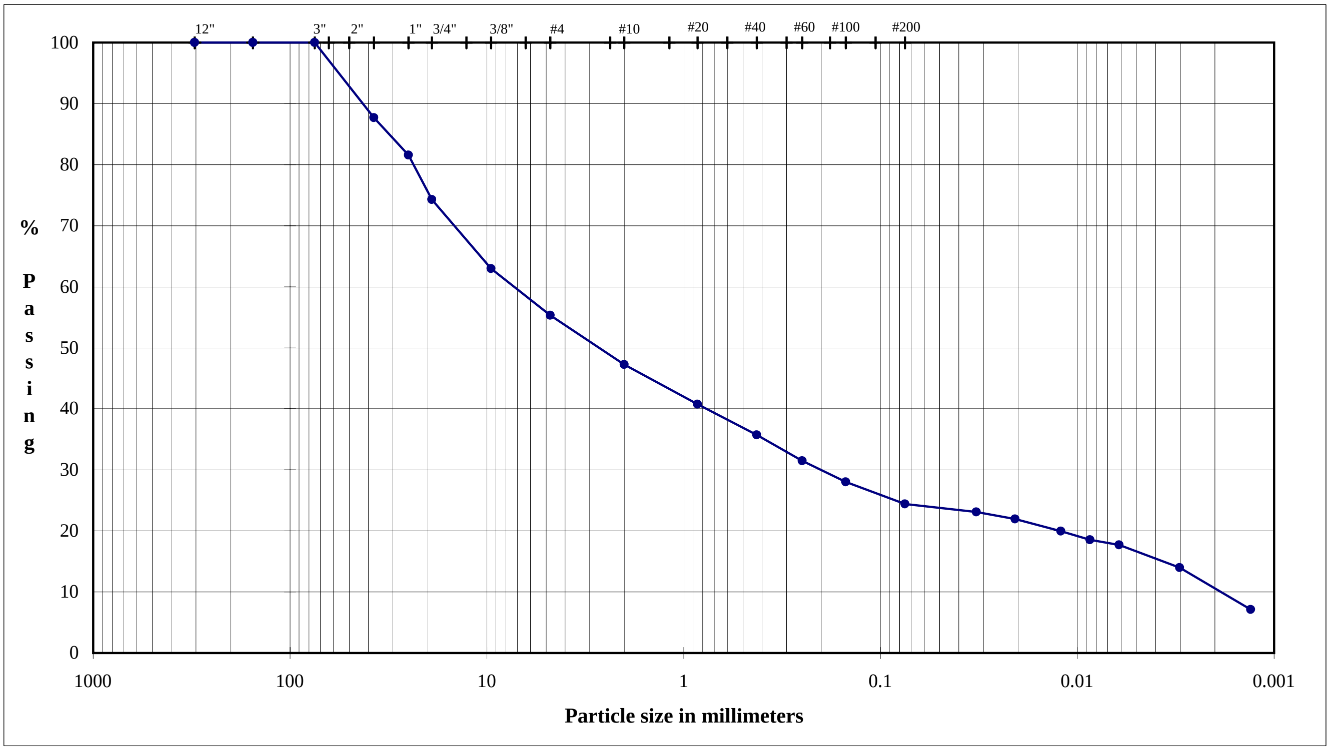
TECH	MKS
DATE	10/11/2005
REVIEW	0

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-4**	Depth:	**109-110**
TYPE:	**Bag**		



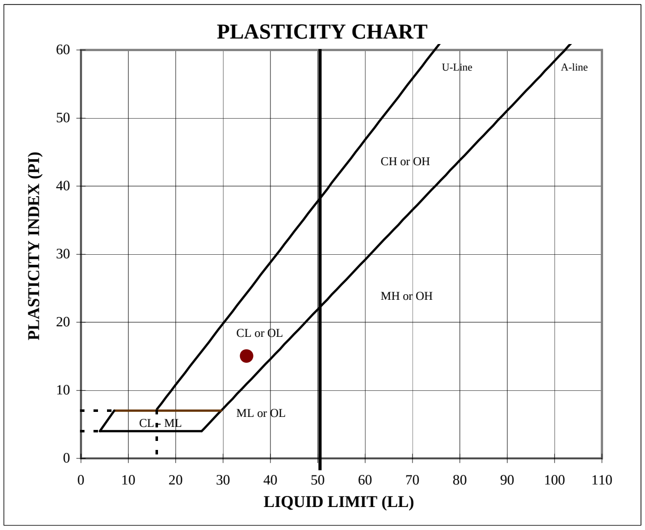
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size	(mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**25.72**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**87.7**		
1.0"	25.0	**81.5**		
0.75"	19.0	**74.3**	Fine Gravel	**18.96**
0.375"	9.5	**63.0**		
#4	4.8	**55.3**		
#10	2.00	**47.3**	Coarse Sand	**8.06**
#20	0.85	**40.8**	Medium Sand	**11.55**
#40	0.43	**35.7**		
#60	0.25	**31.5**	Fine Sand	**11.31**
#100	0.15	**28.0**		
#200	0.075	**24.4**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**23.1**	Fines Silt or Clay	**24.40**
0.021	**22.0**		
0.012	**20.0**		
0.0086	**18.5**		
0.0061	**17.7**		
0.0030	**14.0**		
0.0013	**7.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
12.0	**35**	**20**	**15**	**2.79**

DESCRIPTION: Pale yellow clayey gravel with sand

USCS: GC

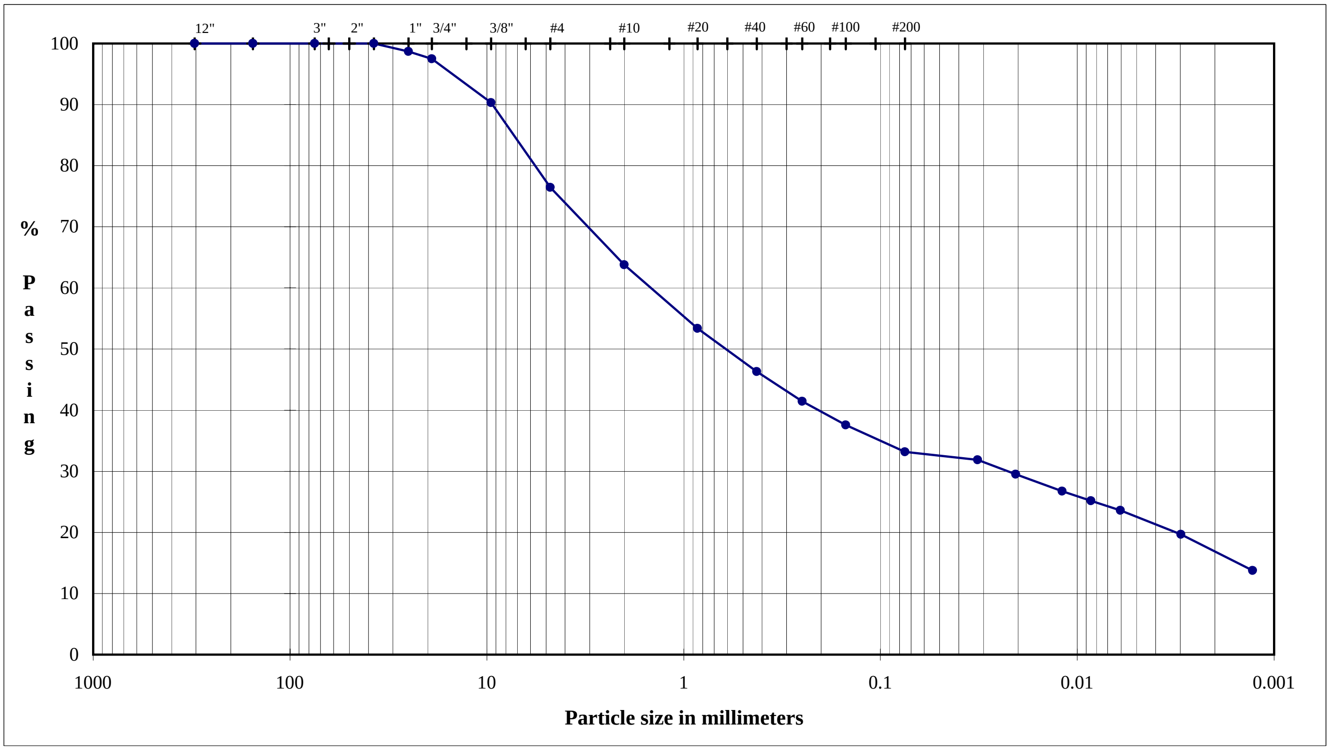
TECH	MKS
DATE	10/12/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

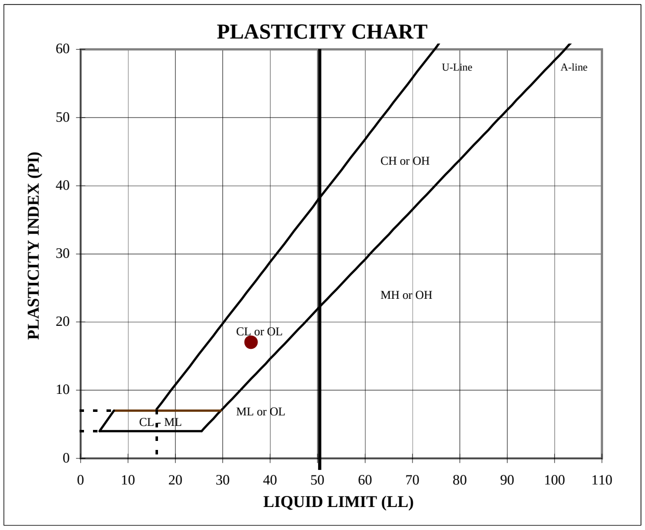
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-4** Depth: **113-114**
TYPE: **Bag**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**2.52**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**98.7**		
0.75"	19.0	**97.5**	Fine Gravel	**21.04**
0.375"	9.5	**90.3**		
#4	4.8	**76.4**		
#10	2.00	**63.8**	Coarse Sand	**12.67**
#20	0.85	**53.4**	Medium Sand	**17.48**
#40	0.43	**46.3**		
#60	0.25	**41.4**	Fine Sand	**13.11**
#100	0.15	**37.6**		
#200	0.075	**33.2**		

Hydrometer Analysis (mm)	%Finer		
0.032	**31.9**	Fines Silt or Clay	**33.18**
0.021	**29.5**		
0.012	**26.7**		
0.0085	**25.2**		
0.0060	**23.6**		
0.0030	**19.7**		
0.0013	**13.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
17.7	**36**	**19**	**17**	**2.86**

DESCRIPTION: Light yellowish brown clayey sand with gravel

USCS: SC

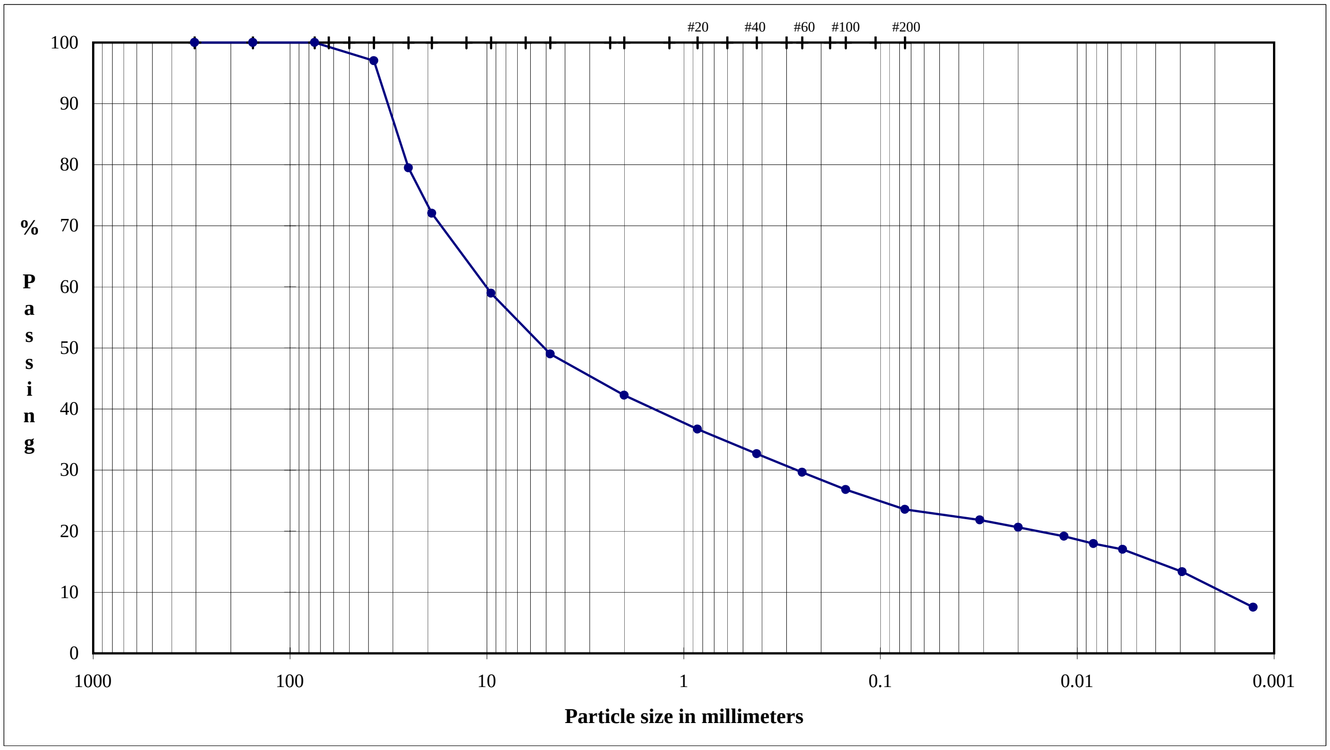
TECH MKS
DATE 10/14/2005
REVIEW MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-4**	Depth:	**129-130**
TYPE:	**Bag**		



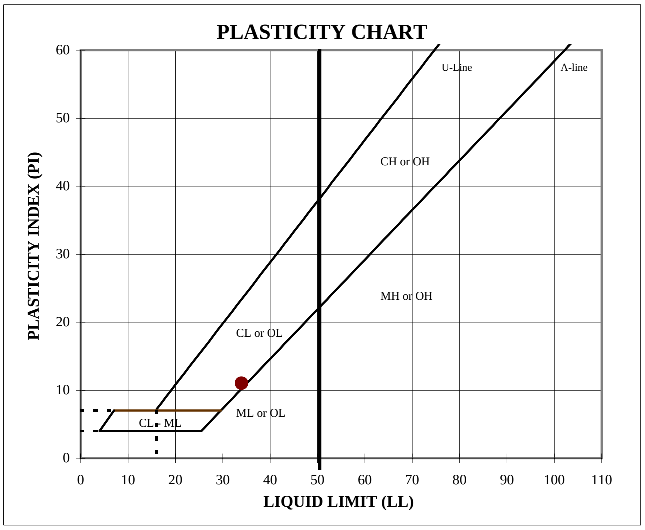
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**27.96**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**97.0**		
1.0"	25.0	**79.5**		
0.75"	19.0	**72.0**	Fine Gravel	**23.06**
0.375"	9.5	**58.9**		
#4	4.8	**49.0**		
#10	2.00	**42.3**	Coarse Sand	**6.73**
#20	0.85	**36.7**	Medium Sand	**9.60**
#40	0.43	**32.7**		
#60	0.25	**29.7**	Fine Sand	**9.09**
#100	0.15	**26.8**		
#200	0.075	**23.6**		

Hydrometer Analysis

(mm)	%Finer		
0.031	**21.8**	Fines Silt or Clay	**23.57**
0.020	**20.6**		
0.012	**19.2**		
0.0083	**18.0**		
0.0059	**17.0**		
0.0029	**13.4**		
0.0013	**7.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
9.3	**34**	**23**	**11**	**2.91**

DESCRIPTION: Pale yellow clayey gravel with sand

USCS: GC

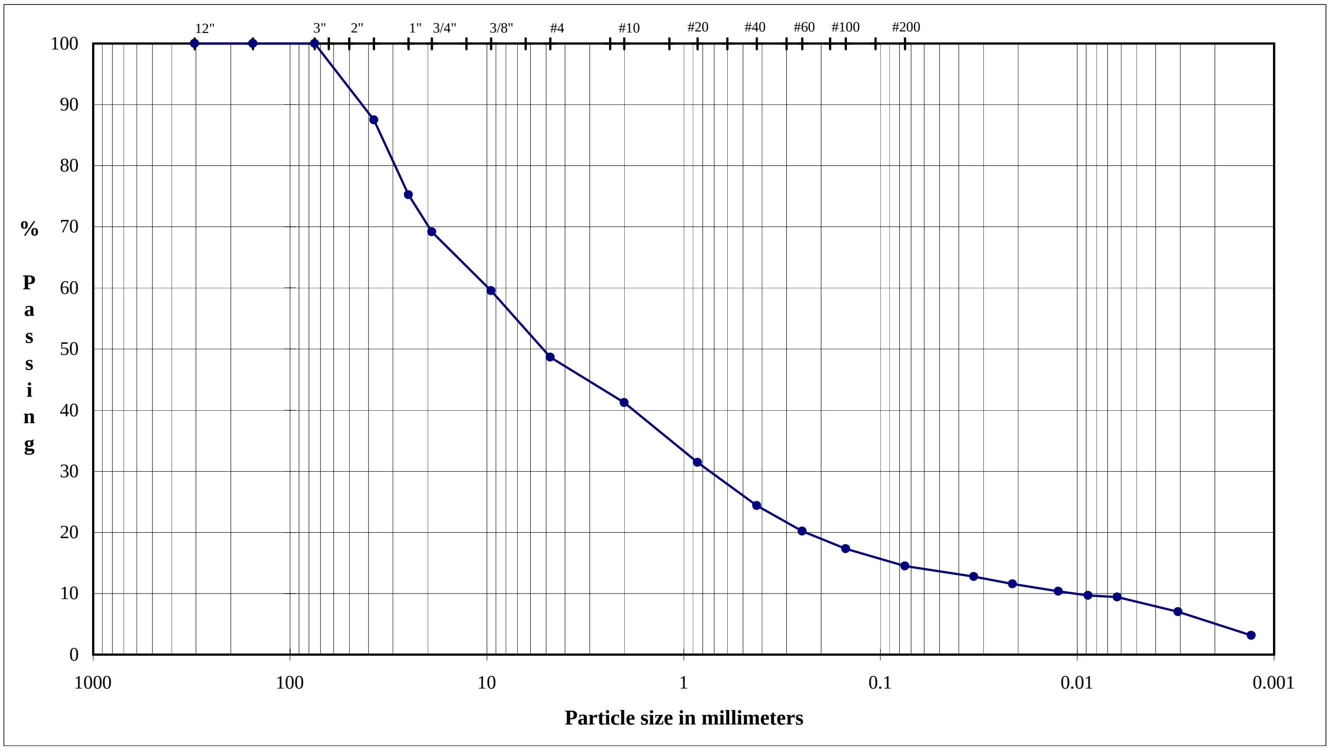
TECH	MKS
DATE	10/14/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **16.5-17.5**
TYPE: **Bag**



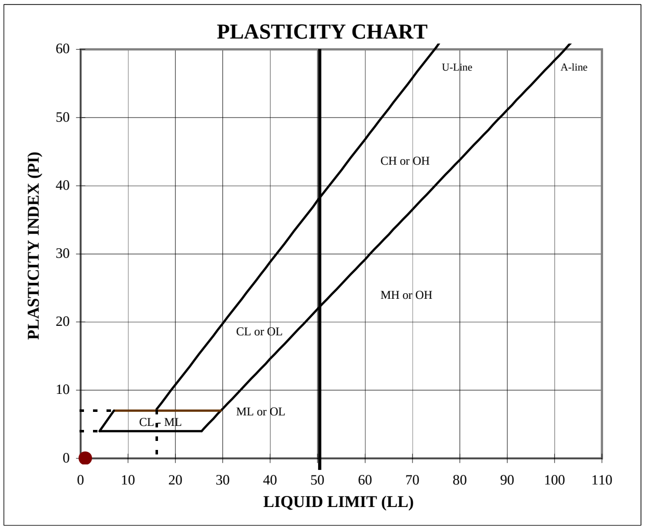
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**30.84**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**87.5**		
1.0"	25.0	**75.2**		
0.75"	19.0	**69.2**	Fine Gravel	**20.49**
0.375"	9.5	**59.6**		
#4	4.8	**48.7**		
#10	2.00	**41.2**	Coarse Sand	**7.42**
#20	0.85	**31.4**	Medium Sand	**16.88**
#40	0.43	**24.4**		
#60	0.25	**20.2**	Fine Sand	**9.87**
#100	0.15	**17.3**		
#200	0.075	**14.5**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**12.8**	Fines Silt or Clay	**14.50**
0.021	**11.6**		
0.012	**10.4**		
0.0088	**9.7**		
0.0063	**9.4**		
0.0031	**7.0**		
0.0013	**3.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
5.9	**NP**	**NP**	**NP**	**2.78**

DESCRIPTION: Red silty gravel with sand

USCS: GM

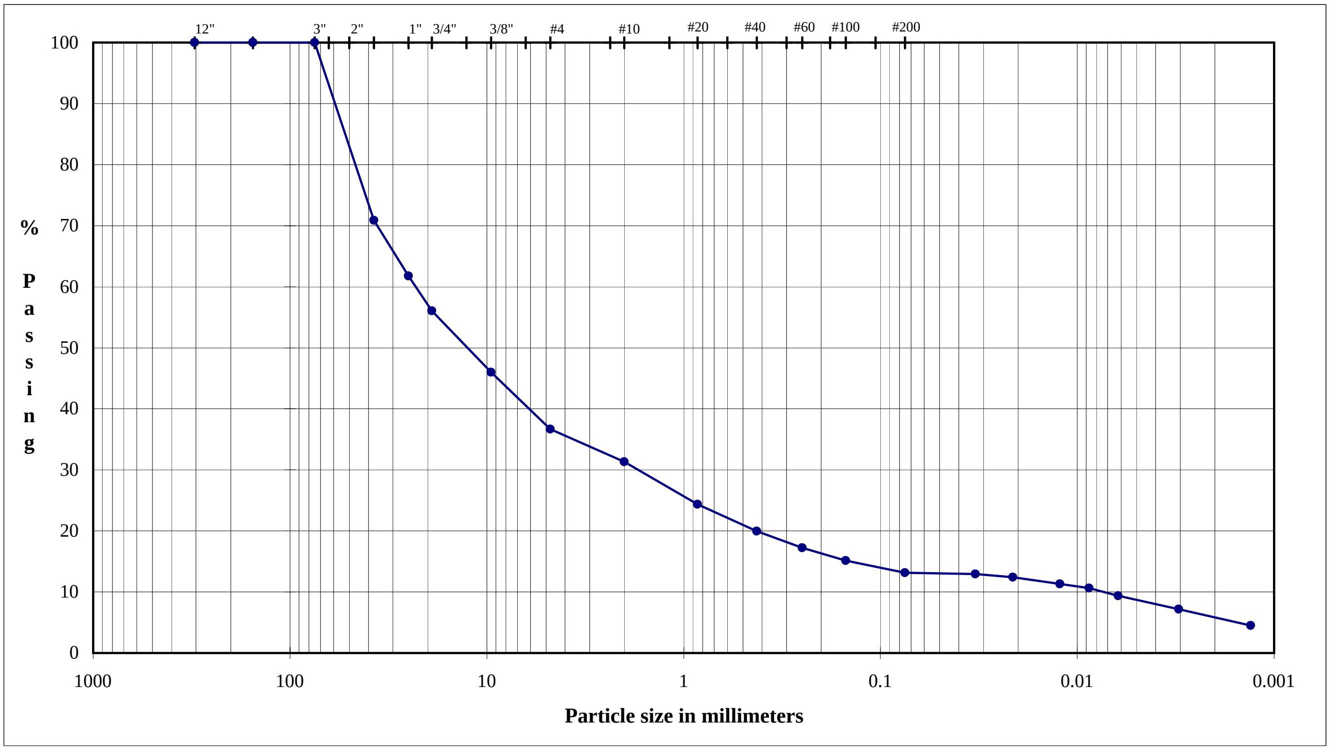
TECH	SW
DATE	9/29/2005
REVIEW	MB

Oct-05 043-2572.003

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **36.5-37.5**
TYPE: **Bag**



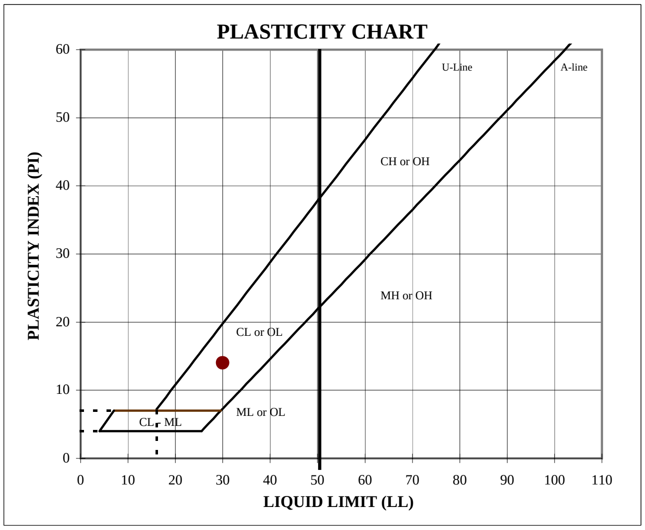
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**43.94**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**70.9**		
1.0"	25.0	**61.8**		
0.75"	19.0	**56.1**	Fine Gravel	**19.40**
0.375"	9.5	**46.0**		
#4	4.8	**36.7**		
#10	2.00	**31.3**	Coarse Sand	**5.34**
#20	0.85	**24.4**	Medium Sand	**11.36**
#40	0.43	**20.0**		
#60	0.25	**17.2**	Fine Sand	**6.81**
#100	0.15	**15.1**		
#200	0.075	**13.1**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**12.9**	Fines Silt or Clay	**13.15**
0.021	**12.4**		
0.012	**11.3**		
0.0087	**10.6**		
0.0062	**9.4**		
0.0031	**7.2**		
0.0013	**4.5**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
10.2	**30**	**16**	**14**	**2.81**

DESCRIPTION: Very pale brown clayey gravel with sand

USCS: GC

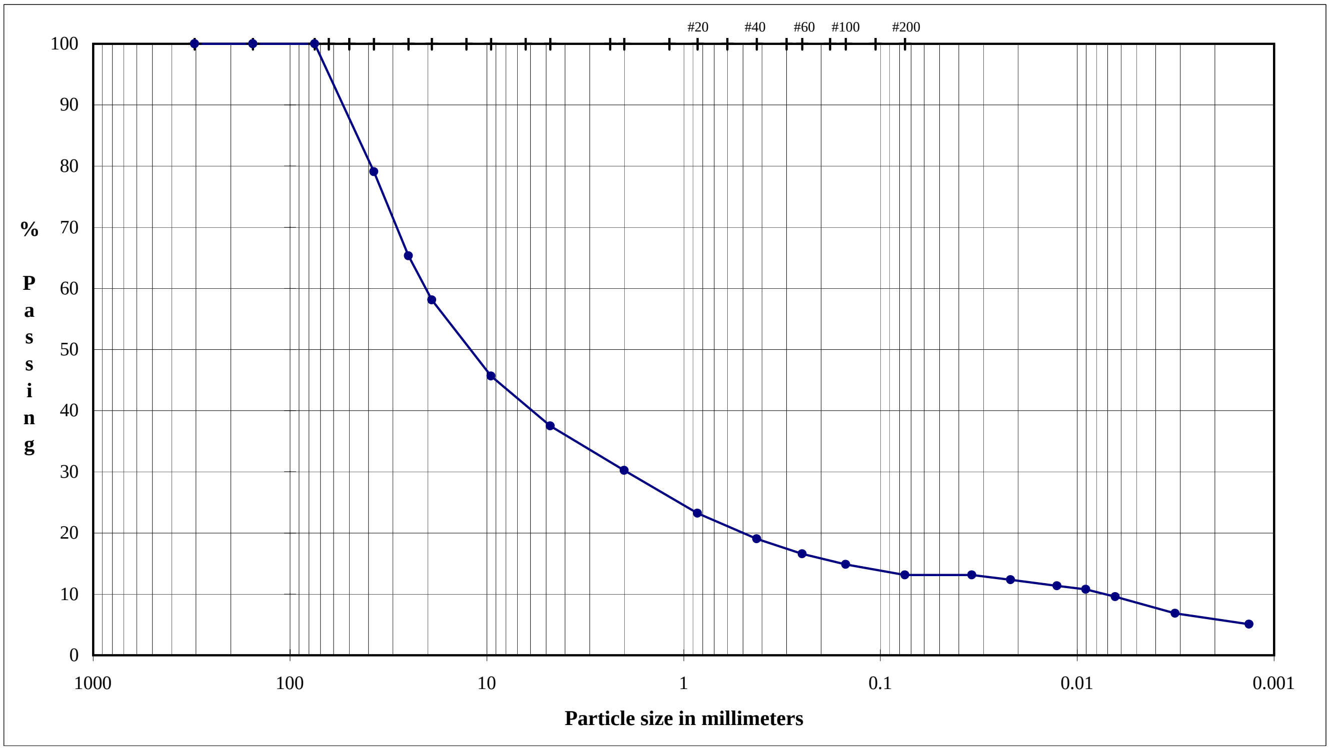
TECH MKS
DATE 10/14/2005
REVIEW MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **56.5-57.5**
TYPE: **Bag**



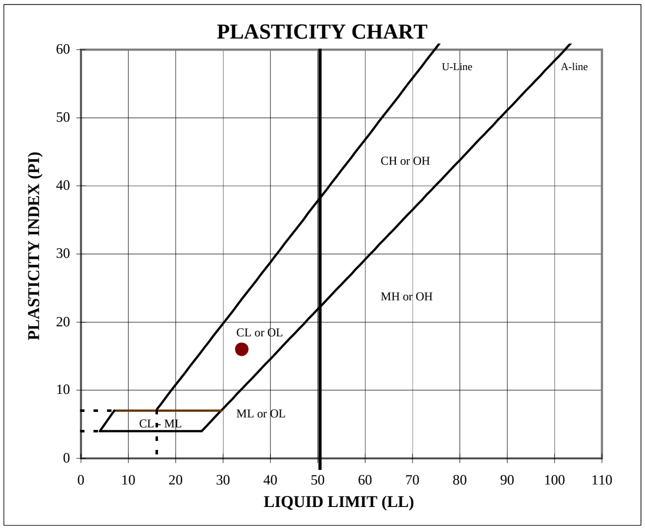
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**41.87**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**79.1**		
1.0"	25.0	**65.3**		
0.75"	19.0	**58.1**	Fine Gravel	**20.62**
0.375"	9.5	**45.7**		
#4	4.8	**37.5**		
#10	2.00	**30.2**	Coarse Sand	**7.30**
#20	0.85	**23.2**	Medium Sand	**11.15**
#40	0.43	**19.1**		
#60	0.25	**16.6**	Fine Sand	**5.91**
#100	0.15	**14.9**		
#200	0.075	**13.2**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**13.1**	Fines Silt or Clay	**13.15**
0.022	**12.3**		
0.013	**11.4**		
0.0090	**10.8**		
0.0064	**9.6**		
0.0032	**6.9**		
0.0013	**5.1**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
8.7	**34**	**18**	**16**	**2.71**

DESCRIPTION: Light brown clayey gravel with sand

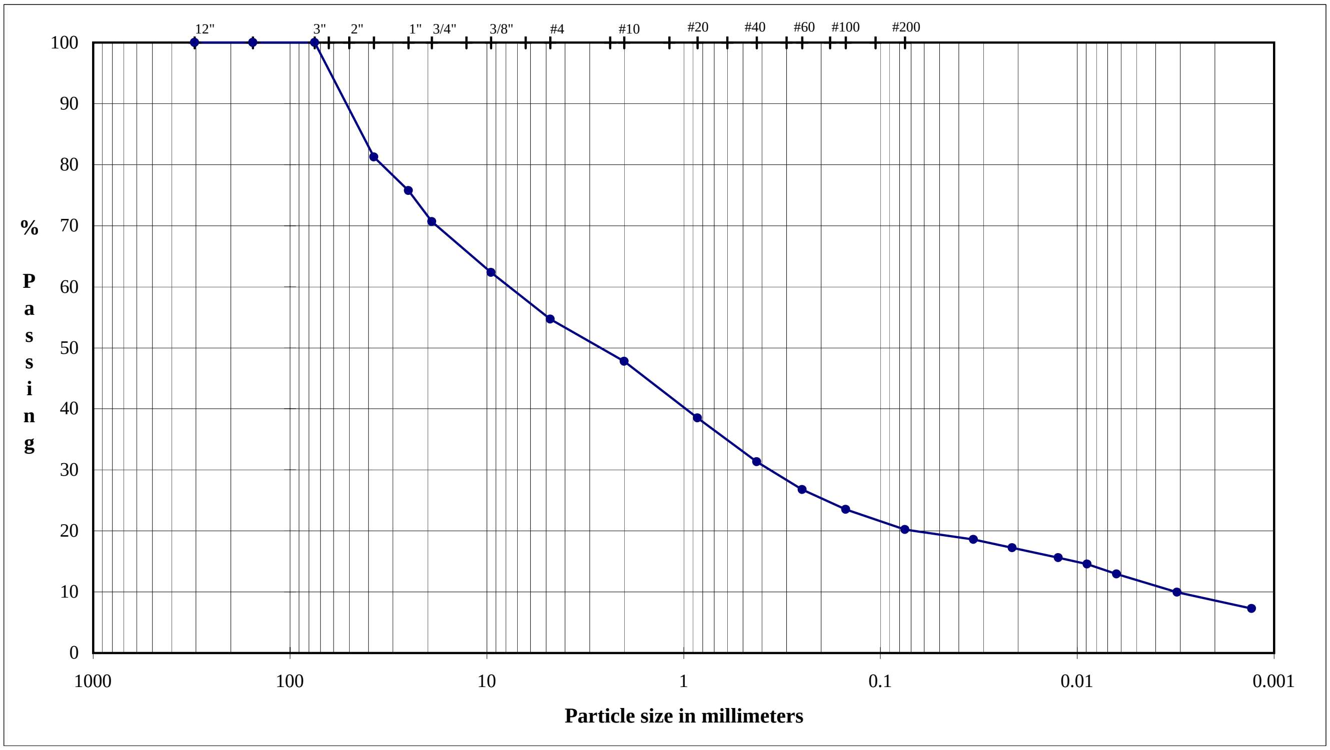
USCS: GC

TECH MKS
DATE 10/11/2005
REVIEW MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **96.5-97.5**
TYPE: **Bag**



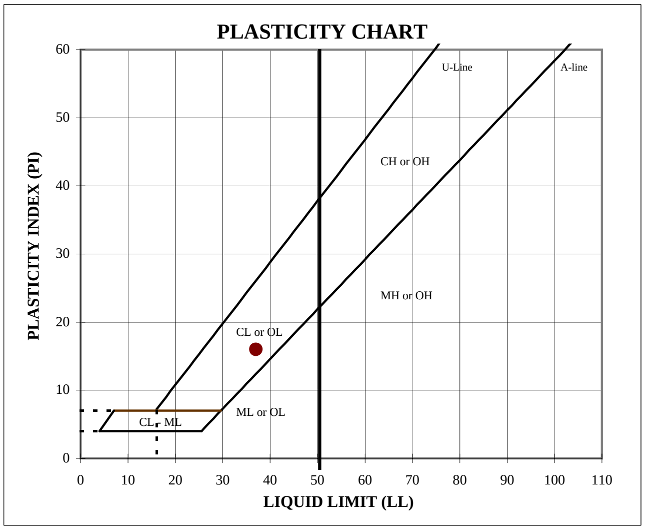
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**29.33**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**81.3**		
1.0"	25.0	**75.8**		
0.75"	19.0	**70.7**	Fine Gravel	**16.00**
0.375"	9.5	**62.3**		
#4	4.8	**54.7**		
#10	2.00	**47.8**	Coarse Sand	**6.89**
#20	0.85	**38.5**	Medium Sand	**16.44**
#40	0.43	**31.3**		
#60	0.25	**26.8**	Fine Sand	**11.11**
#100	0.15	**23.5**		
#200	0.075	**20.2**		

Hydrometer Analysis

(mm)	%Finer		
0.034	**18.6**	Fines Silt or Clay	**20.23**
0.021	**17.3**		
0.012	**15.6**		
0.0089	**14.6**		
0.0063	**12.9**		
0.0031	**10.0**		
0.0013	**7.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
12.6	37	21	16	2.75

DESCRIPTION: Pinkish gray clayey gravel with sand

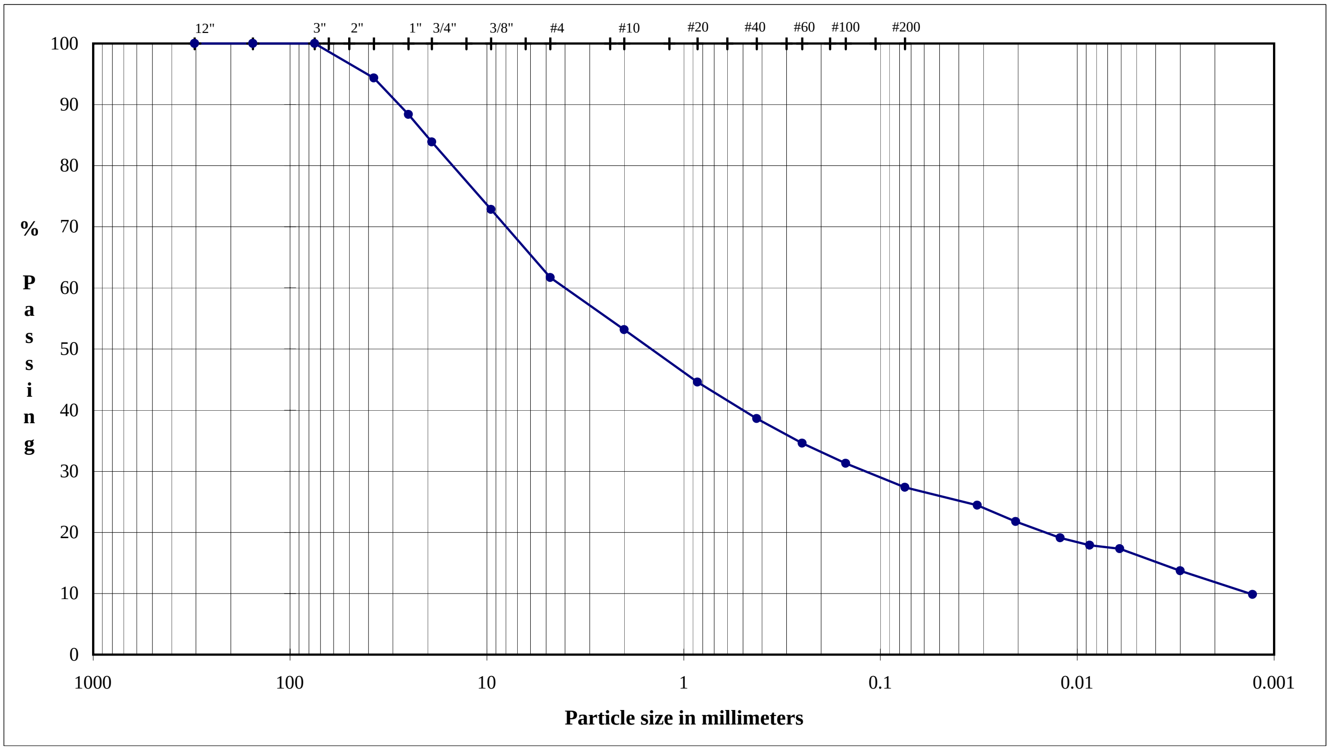
USCS: GC

TECH	MKS
DATE	10/5/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

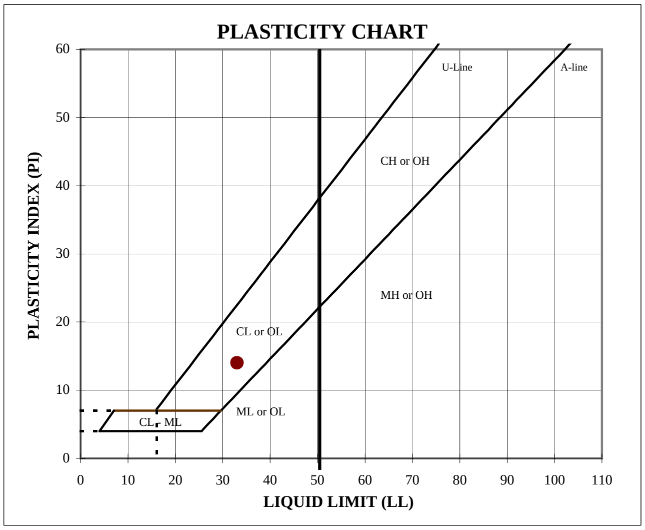
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **116.5-117.5**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**16.13**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**94.4**		
1.0"	25.0	**88.4**		
0.75"	19.0	**83.9**	Fine Gravel	**22.15**
0.375"	9.5	**72.9**		
#4	4.8	**61.7**		
#10	2.00	**53.2**	Coarse Sand	**8.54**
#20	0.85	**44.6**	Medium Sand	**14.56**
#40	0.43	**38.6**		
#60	0.25	**34.6**	Fine Sand	**11.23**
#100	0.15	**31.3**		
#200	0.075	**27.4**		

Hydrometer Analysis (mm)	%Finer		
0.032	**24.5**	Fines Silt or Clay	**27.39**
0.021	**21.8**		
0.012	**19.1**		
0.0087	**17.9**		
0.0061	**17.3**		
0.0030	**13.7**		
0.0013	**9.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
8.2	33	19	14	2.81

DESCRIPTION: Light bluish gray clayey gravel with sand

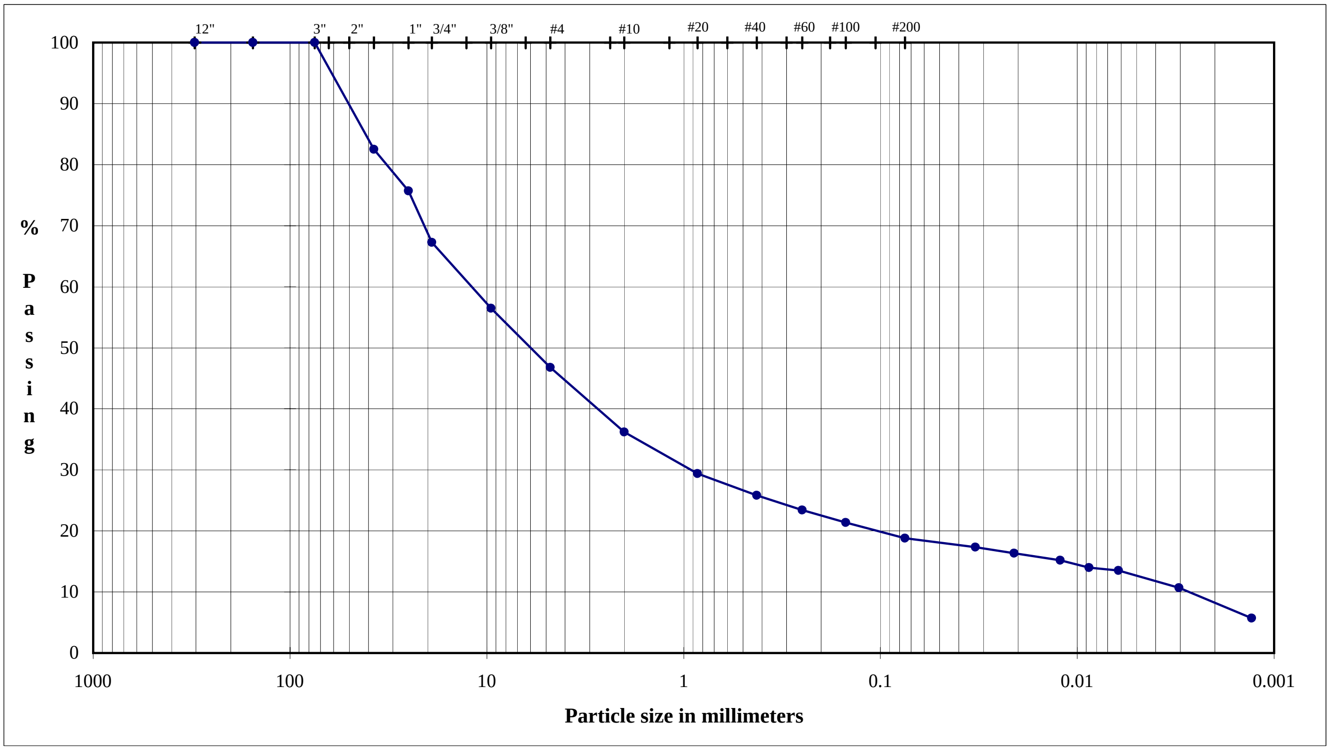
USCS: GC

TECH	MKS
DATE	10/4/2005
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	**G&K/Tyrone Stockpile Geotech/AZ**		
SAMPLE ID:	**T-5**	Depth:	**136.5-137.5**
TYPE:	**Bag**		



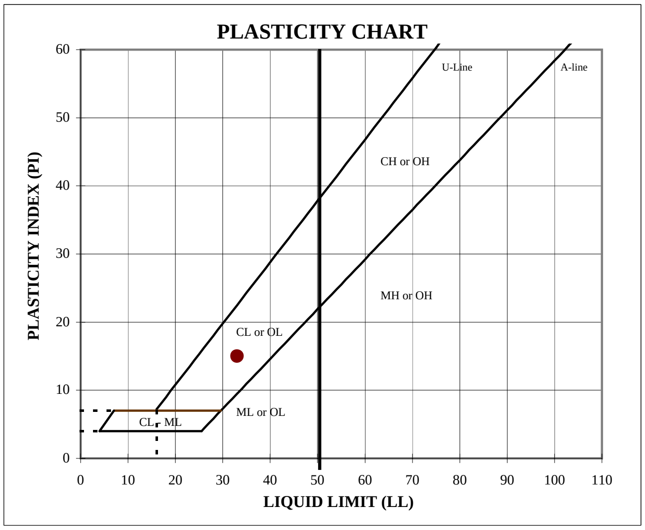
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**32.77**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**82.5**		
1.0"	25.0	**75.7**		
0.75"	19.0	**67.2**	Fine Gravel	**20.48**
0.375"	9.5	**56.5**		
#4	4.8	**46.8**		
#10	2.00	**36.2**	Coarse Sand	**10.54**
#20	0.85	**29.4**	Medium Sand	**10.39**
#40	0.43	**25.8**		
#60	0.25	**23.4**	Fine Sand	**7.04**
#100	0.15	**21.4**		
#200	0.075	**18.8**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**17.3**	Fines Silt or Clay	**18.79**
0.021	**16.4**		
0.012	**15.2**		
0.0087	**14.0**		
0.0062	**13.5**		
0.0030	**10.7**		
0.0013	**5.7**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
9.6	**33**	**18**	**15**	**2.80**

DESCRIPTION: Very pale brown clayey gravel with sand

USCS: GC

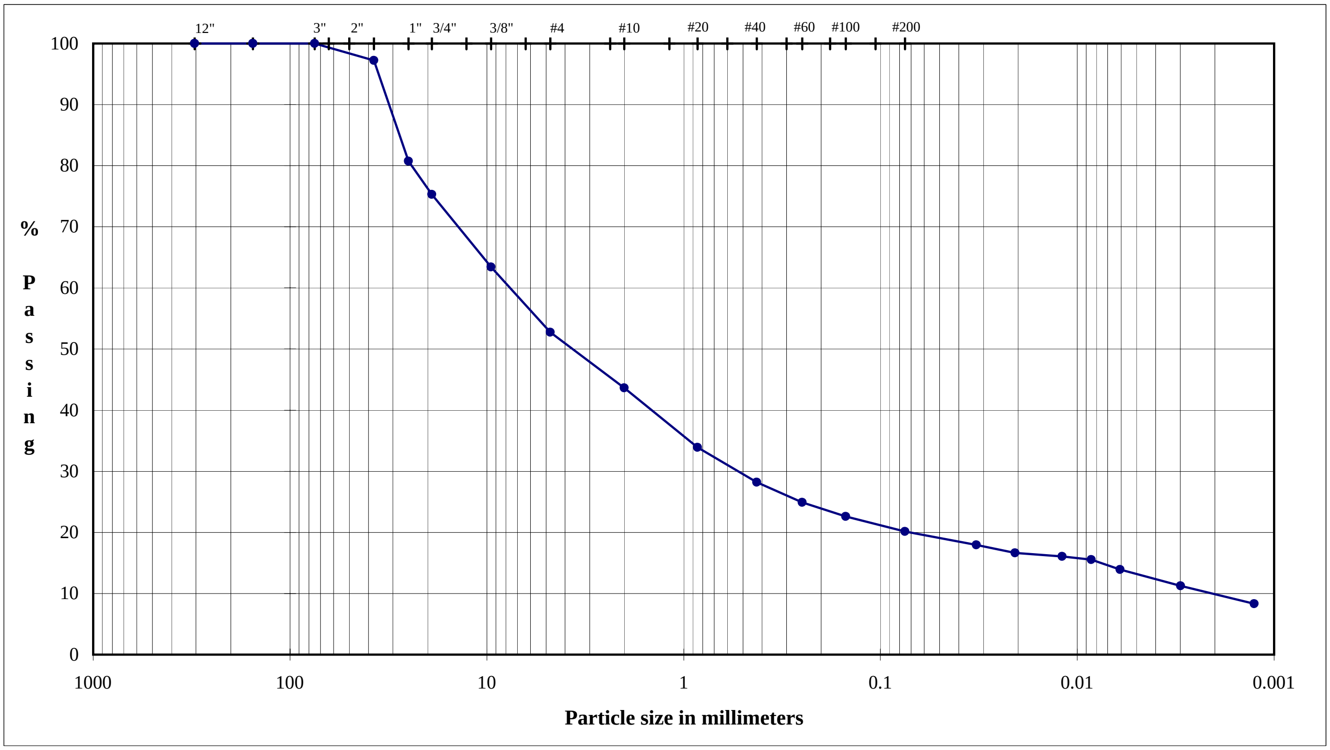
TECH	MKS
DATE	10/12/2005
REVIEW	MB

October-05 **043-2572.003**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **T-5** Depth: **164.0-165.0**
TYPE: **Bag**



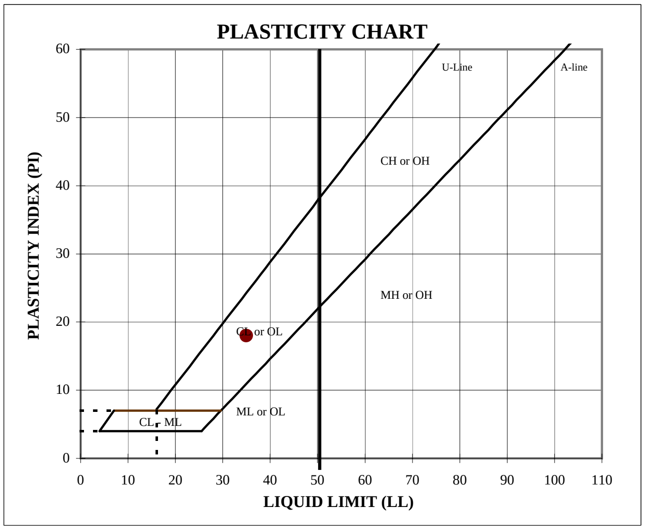
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**24.72**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**97.2**		
1.0"	25.0	**80.7**		
0.75"	19.0	**75.3**	Fine Gravel	**22.53**
0.375"	9.5	**63.4**		
#4	4.8	**52.8**		
#10	2.00	**43.7**	Coarse Sand	**9.10**
#20	0.85	**33.9**	Medium Sand	**15.46**
#40	0.43	**28.2**		
#60	0.25	**24.9**	Fine Sand	**8.04**
#100	0.15	**22.6**		
#200	0.075	**20.2**		

Hydrometer Analysis

(mm)	%Finer		
0.033	**18.0**	Fines Silt or Clay	**20.15**
0.021	**16.6**		
0.012	**16.1**		
0.0085	**15.5**		
0.0061	**13.9**		
0.0030	**11.3**		
0.0013	**8.3**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
14.0	**35**	**17**	**18**	**2.85**

DESCRIPTION: Weak red clayey gravel with sand

USCS: GC

TECH	SW
DATE	9/29/2005
REVIEW	MB

APPENDIX D

LABORATORY SHEAR STRENGTH TESTS

APPENDIX D-1

2000 TRIAXIAL SHEAR TESTS

Sample # =	Bag BD		Sample # =	Bag BD		Sample # =	Bag BD	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	20.35	cm	Length =	20.35	cm	Length =	20.30	cm
Diameter =	10.10	cm	Diameter =	10.10	cm	Diameter =	10.10	cm
Wet Weight =	3407.40	g	Wet Weight =	3407.40	g	Wet Weight =	3402.70	g
Area =	80.1	sq.cm	Area =	80.1	sq.cm	Area =	80.1	sq.cm
Sample Area =	12.42	sq. in.	Sample Area =	12.42	sq. in.	Sample Area =	12.42	sq. in.
Volume =	1630.4	cc	Volume =	1630.4	cc	Volume =	1626.4	cc
Moisture Content =	5.3%		Moisture Content =	5.3%		Moisture Content =	5.2%	
Specific Gravity =	2.7		Specific Gravity =	2.7		Specific Gravity =	2.7	
Dry Weight of Solids =	3235.90	g	Dry Weight of Solids =	3235.90	g	Dry Weight of Solids =	3234.51	g
Wet Density =	2.09	g/cc	Wet Density =	2.09	g/cc	Wet Density =	2.09	g/cc
Dry Density =	1.98	g/cc	Dry Density =	1.98	g/cc	Dry Density =	1.99	g/cc
Wet Density =	130.4	pcf	Wet Density =	130.4	pcf	Wet Density =	130.6	pcf
Dry Density =	123.8	pcf	Dry Density =	123.8	pcf	Dry Density =	124.1	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	110	psi
Back Pressure =	75	psi	Back Pressure =	50	psi	Back Pressure =	10	psi
Confining Pressure =	25	psi	Confining Pressure =	50	psi	Confining Pressure =	100	psi

Notes:

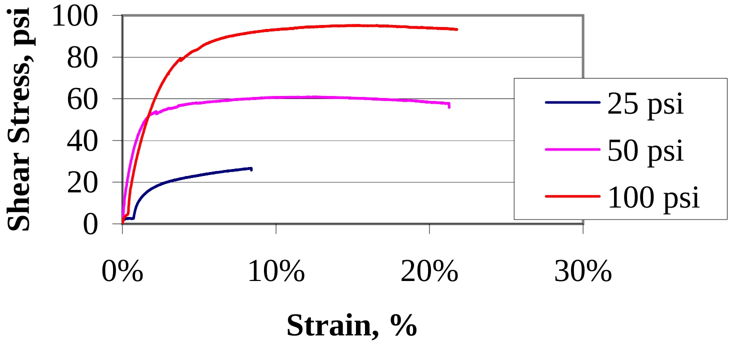
Golder Associates, Inc.
Denver, Colorado

Job Short Title:
PD/TYRONE/NM

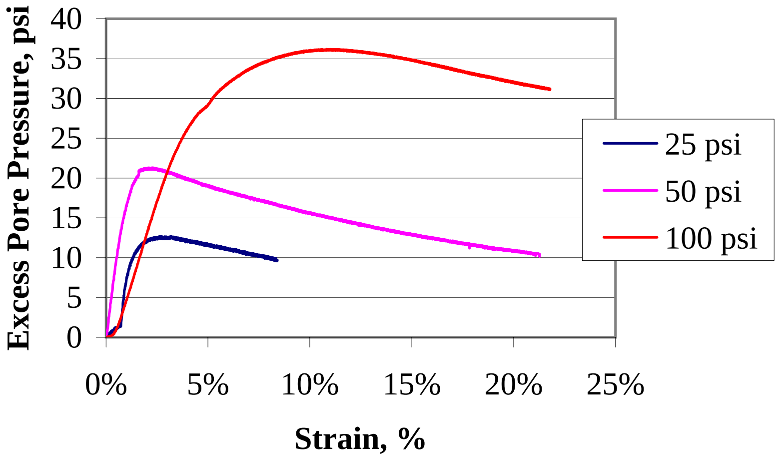
Title:
TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

Sample No. **GTP3-2**
Depth **n/a**
Reviewed:
Date: Feb., 2000
Job Number: 993-2546
Figure: 1

Shear Stress vs. Strain



Excess Pore Pressure vs. Strain



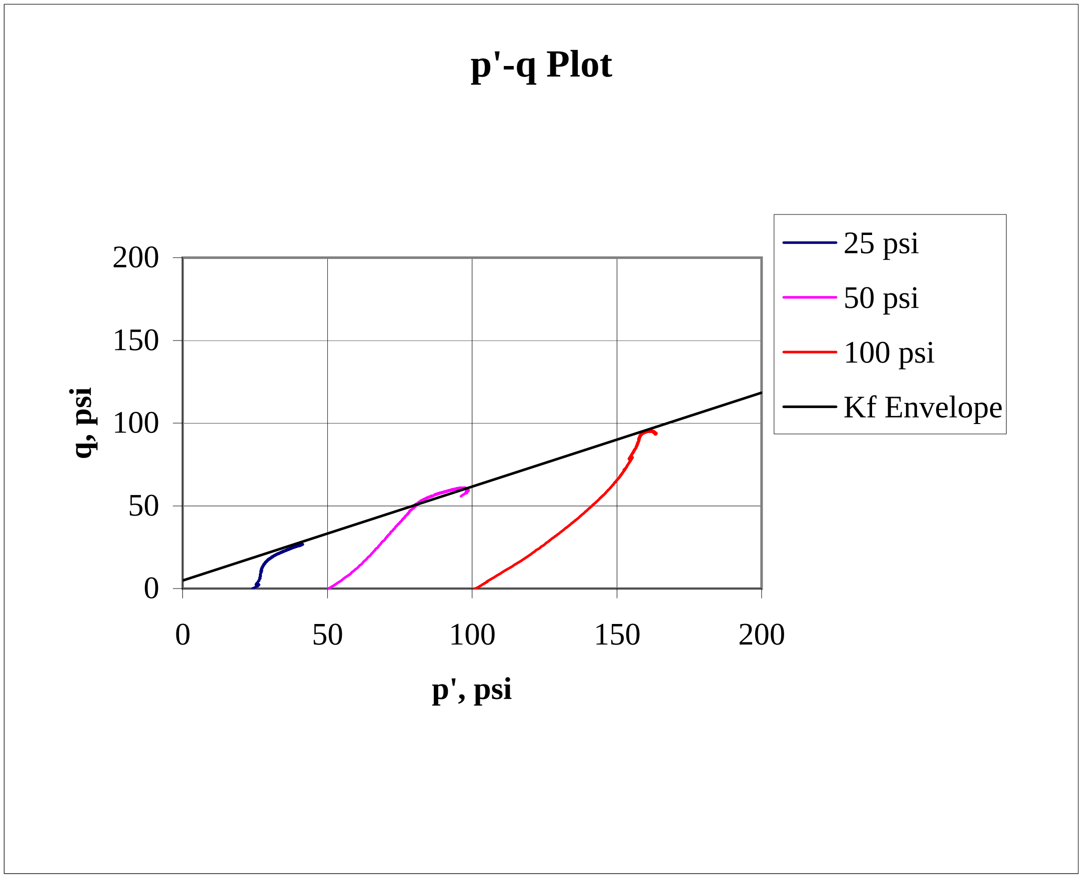
Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
STRESS AND Δ PORE PRESSURE PLOTS

Job Short Title:
PD/TYRONE/NM

Sample No.	Depth	Reviewed:	**Date:**	**Job Number:**	**Figure:**
GTP3-2	n/a		Feb., 2000	993-2546	2

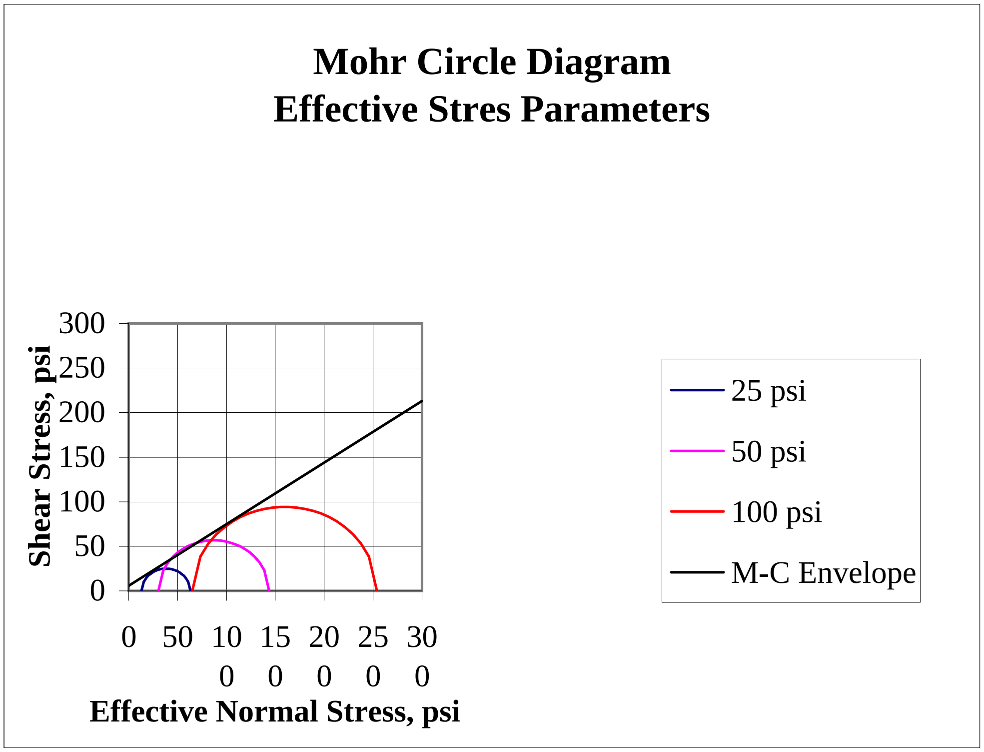


Stress Path Parameters

ψ' = 29.6 degrees
a' = 4.7 psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**
Job Short Title: **PD/TYRONE/NM**	

Sample No. GTP3-2	Depth n/a	Reviewed:	**Date:** Feb., 2000	**Job Number:** 993-2546	**Figure:** **3**


Mohr Circle Diagram
Effective Stres Parameters

Mohr-Coulomb Parameters

ϕ ' =	34.6	degrees
c' =	5.8	psi

Golder Associates, Inc.
Denver, Colorado

Job Short Title:
PD/TYRONE/NM

Title:
CU TRIAXIAL SHEAR DATA
MOHR CIRCLE DIAGRAM

Sample No.	Depth	Reviewed:	**Date:**	**Job Number:**	**Figure:**
GTP3-2	n/a		Feb., 2000	993-2546	4

Sample # =	GTP06/03		Sample # =	GTP06/03		Sample # =	GTP06/03	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	20.40	cm	Length =	20.40	cm	Length =	20.40	cm
Diameter =	10.10	cm	Diameter =	10.10	cm	Diameter =	10.10	cm
Wet Weight =	3510.40	g	Wet Weight =	3510.40	g	Wet Weight =	3510.00	g
Area =	80.1	sq.cm	Area =	80.1	sq.cm	Area =	80.1	sq.cm
Sample Area =	12.42	sq. in.	Sample Area =	12.42	sq. in.	Sample Area =	12.42	sq. in.
Volume =	1634.4	cc	Volume =	1634.4	cc	Volume =	1634.4	cc
Moisture Content =	7.0%		Moisture Content =	7.0%		Moisture Content =	7.0%	
Specific Gravity =	2.65		Specific Gravity =	2.65		Specific Gravity =	2.65	
Dry Weight of Solids =	3281.67	g	Dry Weight of Solids =	3281.67	g	Dry Weight of Solids =	3281.29	g
Wet Density =	2.15	g/cc	Wet Density =	2.15	g/cc	Wet Density =	2.15	g/cc
Dry Density =	2.01	g/cc	Dry Density =	2.01	g/cc	Dry Density =	2.01	g/cc
Wet Density =	134.0	pcf	Wet Density =	134.0	pcf	Wet Density =	134.0	pcf
Dry Density =	125.3	pcf	Dry Density =	125.3	pcf	Dry Density =	125.3	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	110	psi
Back Pressure =	75	psi	Back Pressure =	50	psi	Back Pressure =	10	psi
Confining Pressure =	25	psi	Confining Pressure =	50	psi	Confining Pressure =	100	psi

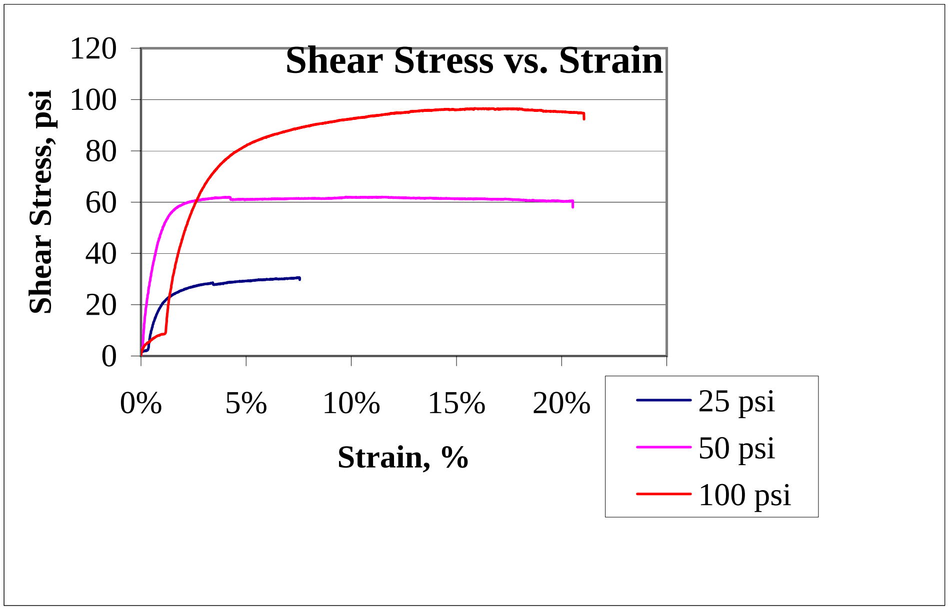
Notes:

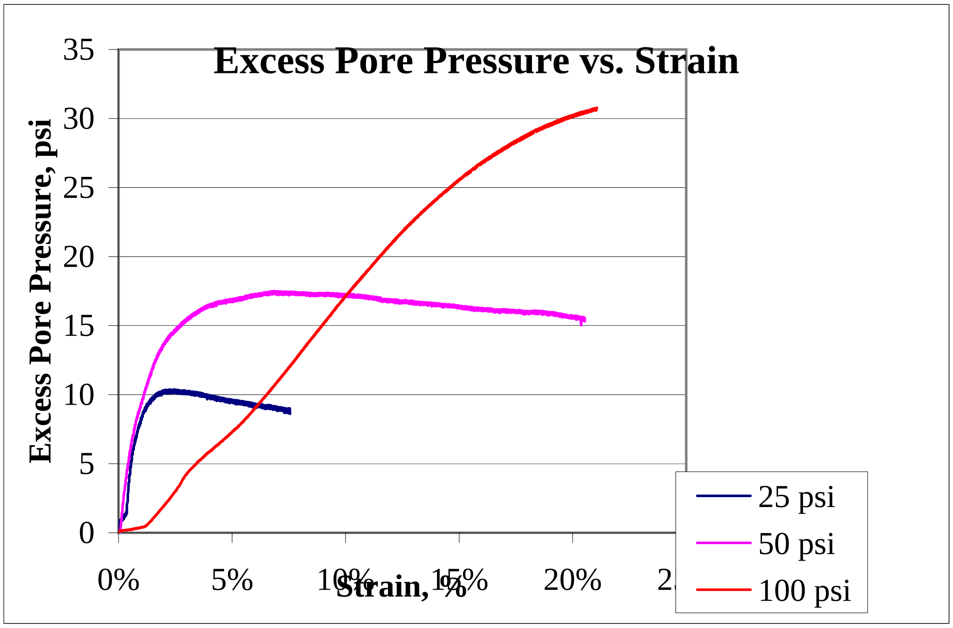
Golder Associates, Inc.
Denver, Colorado

Job Short Title:
Phelps Dodge/Tyrone

Title:
TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

Sample No.	**Depth**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
GTP06/03	**-**		Feb. 2000	993-2546	1





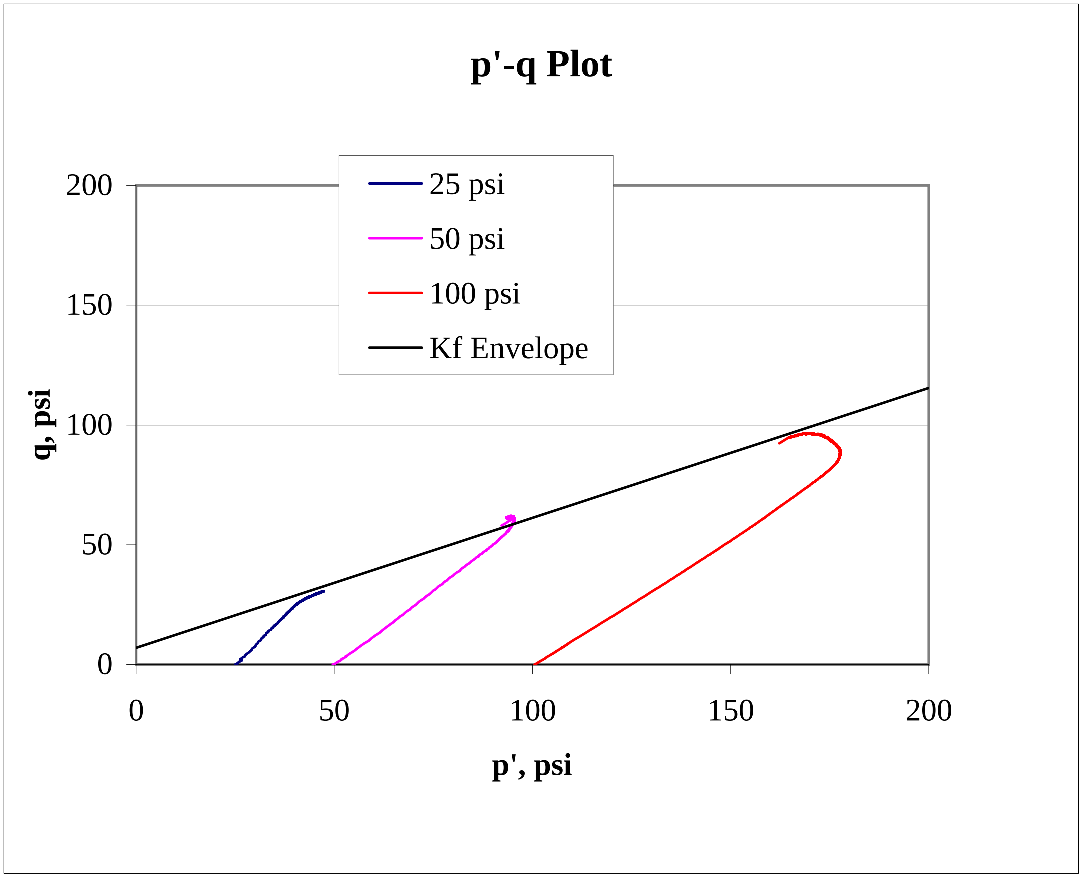
Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
STRESS AND Δ PORE PRESSURE PLOTS

Job Short Title:
Phelps Dodge/Tyrone

Sample No.	Depth	Reviewed:	**Date:**	**Job Number:**	**Figure:**
GTP06/03	-		Feb. 2000	993-2546	2



Stress Path Parameters

ψ' = 28.5 degrees
a' = 7.0 psi

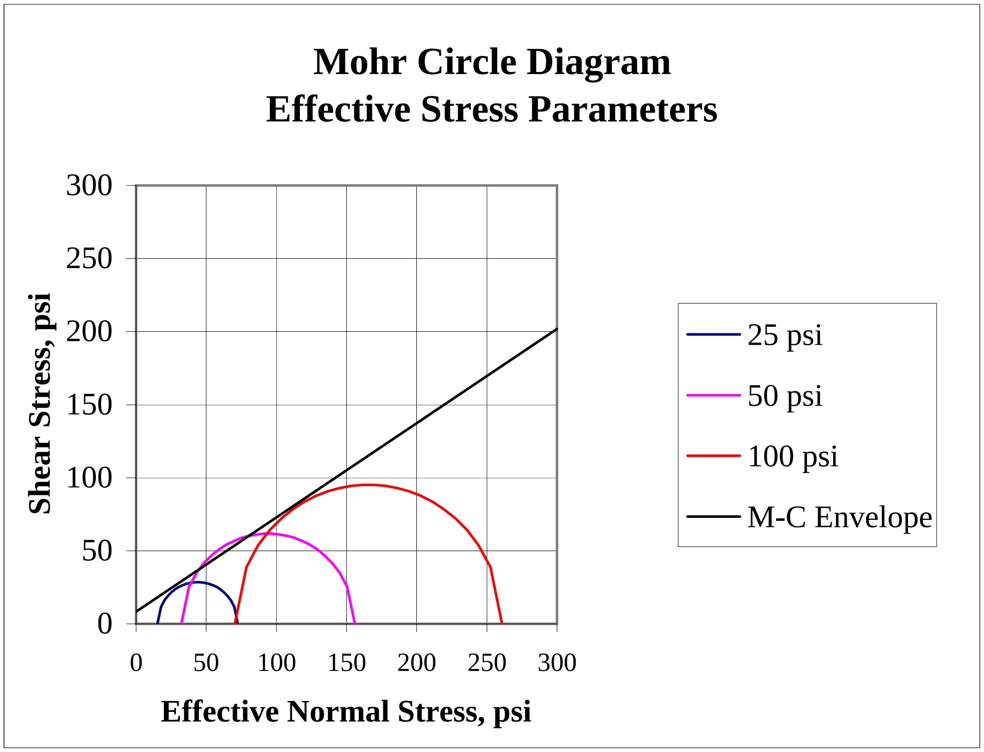
Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
STRESS PATH PLOT

Job Short Title:
Phelps Dodge/Tyrone

Sample No.	Depth	Reviewed:	**Date:**	**Job Number:**	**Figure:**
GTP06/03	-		Feb. 2000	993-2546	3



Mohr-Coulomb Parameters

ϕ ' =	32.8	degrees
c' =	8.3	psi

Golder Associates, Inc. **Denver, Colorado**			**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**		
Job Short Title: **Phelps Dodge/Tyrone**					
Sample No. GTP06/03	Depth -	Reviewed:	**Date:** Feb. 2000	**Job Number:** 993-2546	**Figure:** 4

APPENDIX D-2

2001 TRIAXIAL SHEAR TESTS

Sample # =	TYTP 01-2		Sample # =	TYTP 01-2		Sample # =	TYTP 01-2	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	20.35	cm	Length =	20.35	cm	Length =	20.35	cm
Diameter =	10.14	cm	Diameter =	10.14	cm	Diameter =	10.14	cm
Wet Weight =	3386.30	g	Wet Weight =	3386.30	g	Wet Weight =	3386.30	g
Area =	80.8	sq.cm	Area =	80.8	sq.cm	Area =	80.8	sq.cm
Sample Area =	12.52	sq. in.	Sample Area =	12.52	sq. in.	Sample Area =	12.52	sq. in.
Volume =	1643.3	cc	Volume =	1643.3	cc	Volume =	1643.3	cc
Moisture Content =	5.8%		Moisture Content =	5.8%		Moisture Content =	5.8%	
Specific Gravity =	NA		Specific Gravity =	NA		Specific Gravity =	NA	
Dry Weight of Solids =	3200.66	g	Dry Weight of Solids =	3200.66	g	Dry Weight of Solids =	3200.66	g
Wet Density =	2.06	g/cc	Wet Density =	2.06	g/cc	Wet Density =	2.06	g/cc
Dry Density =	1.95	g/cc	Dry Density =	1.95	g/cc	Dry Density =	1.95	g/cc
Wet Density =	128.6	pcf	Wet Density =	128.6	pcf	Wet Density =	128.6	pcf
Dry Density =	121.5	pcf	Dry Density =	121.5	pcf	Dry Density =	121.5	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	120	psi
Back Pressure =	75	psi	Back Pressure =	50	psi	Back Pressure =	20	psi
Confining Pressure =	25	psi	Confining Pressure =	50	psi	Confining Pressure =	100	psi

Notes:

1. Staged test at 25, 50 and 100 psi confining pressure
2. Sample remolded to 122.6 lb/ft^3 and 6% moisture content

Golder Associates, Inc.
Denver, Colorado

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Title:

TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

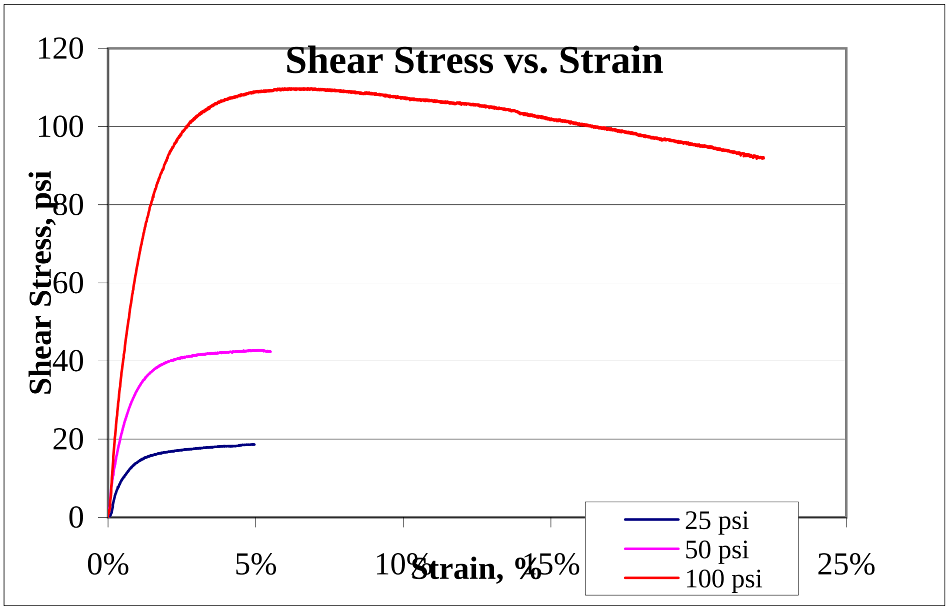
Sample No.
TYTP 01-2

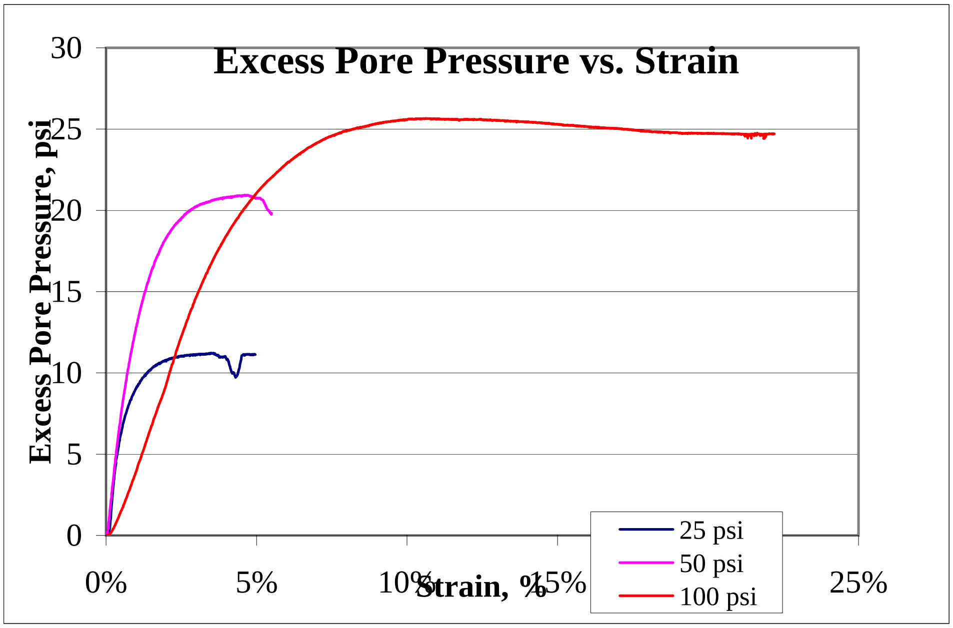
Reviewed: GE

Date: 11/16/2001

Job Number: 013-1595

Figure: 1





Golder Associates, Inc.
Denver, Colorado

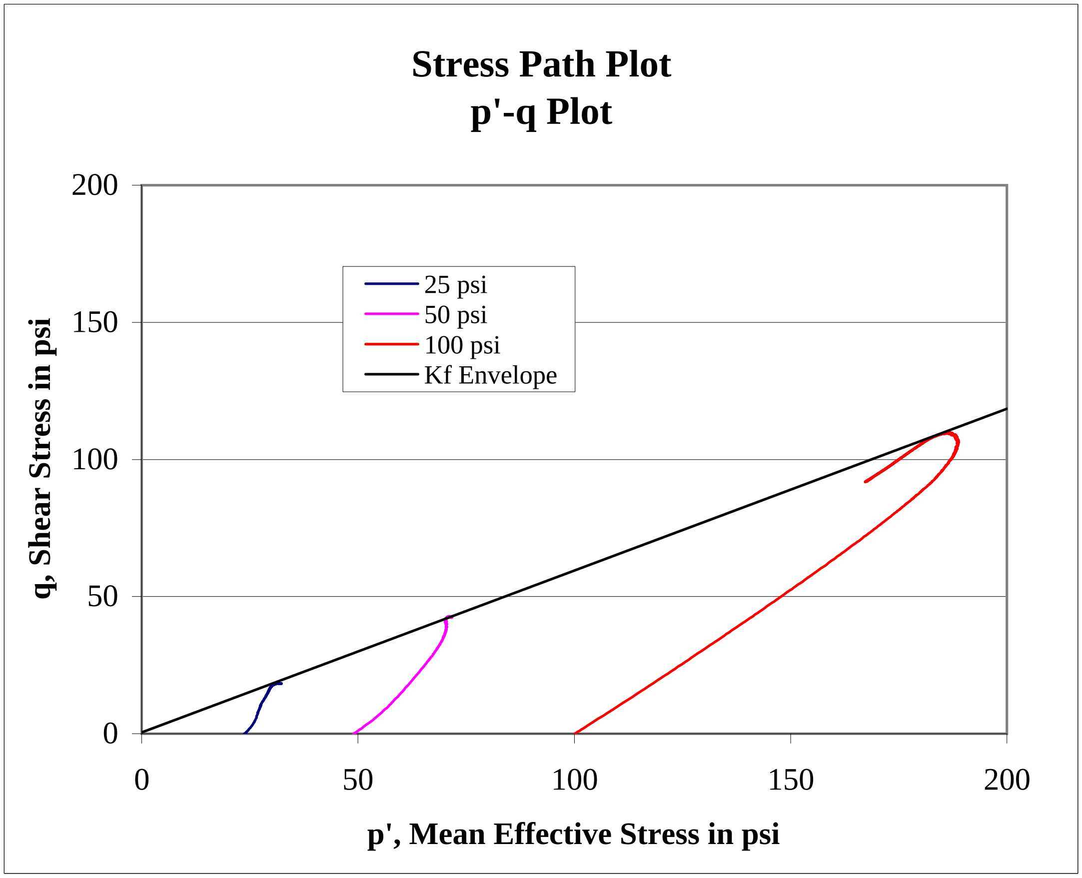
Job Short Title:

G&K/TYRONE CLOSURE HEARING/AZ

Title:

CU TRIAXIAL SHEAR DATA
STRESS AND Δ PORE PRESSURE PLOTS

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:** 2
TYTP 01-2	**GE**	11/16/01	013-1595	



Stress Path Parameters

ψ' = 30.5 degrees
a' = 0.5 psi

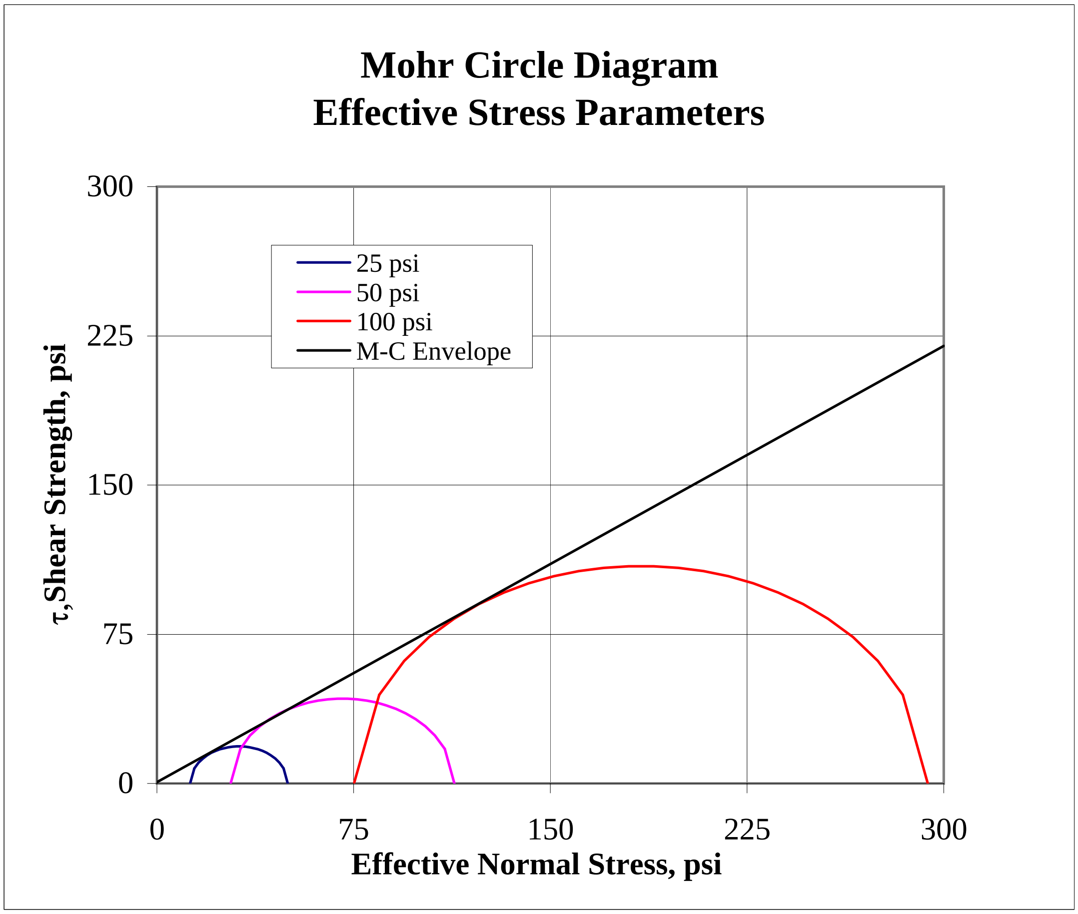
Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
STRESS PATH PLOT

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Sample No. TYTP 01-2	Reviewed: **GE**	**Date:** 11/16/01	**Job Number:** 013-1595	**Figure:** **3**



Mohr-Coulomb Parameters

ϕ ' =	36.2	degrees
c' =	0.6	psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**	

Sample No. TYTP 01-2	Reviewed: **GE**	**Date:** 11/16/01	**Job Number:** 013-1595	**Figure:** 4

Sample # =	TYTP 01-04		Sample # =	TYTP 01-04		Sample # =	TYTP 01-04	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	20.55	cm	Length =	20.55	cm	Length =	20.55	cm
Diameter =	10.11	cm	Diameter =	10.11	cm	Diameter =	10.11	cm
Wet Weight =	3362.40	g	Wet Weight =	3362.40	g	Wet Weight =	3362.40	g
Area =	80.3	sq.cm	Area =	80.3	sq.cm	Area =	80.3	sq.cm
Sample Area =	12.44	sq. in.	Sample Area =	12.44	sq. in.	Sample Area =	12.44	sq. in.
Volume =	1649.6	cc	Volume =	1649.6	cc	Volume =	1649.6	cc
Moisture Content =	5.8%		Moisture Content =	5.8%		Moisture Content =	5.8%	
Specific Gravity =	NA		Specific Gravity =	NA		Specific Gravity =	NA	
Dry Weight of Solids =	3178.07	g	Dry Weight of Solids =	3178.07	g	Dry Weight of Solids =	3178.07	g
Wet Density =	2.04	g/cc	Wet Density =	2.04	g/cc	Wet Density =	2.04	g/cc
Dry Density =	1.93	g/cc	Dry Density =	1.93	g/cc	Dry Density =	1.93	g/cc
Wet Density =	127.2	pcf	Wet Density =	127.2	pcf	Wet Density =	127.2	pcf
Dry Density =	120.2	pcf	Dry Density =	120.2	pcf	Dry Density =	120.2	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	120	psi
Back Pressure =	75	psi	Back Pressure =	50	psi	Back Pressure =	20	psi
Confining Pressure =	25	psi	Confining Pressure =	50	psi	Confining Pressure =	100	psi

Notes: 1. Sample remolded to 122 lb/ft^3 and 6% mc

Golder Associates, Inc.
Denver, Colorado

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Title:
TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

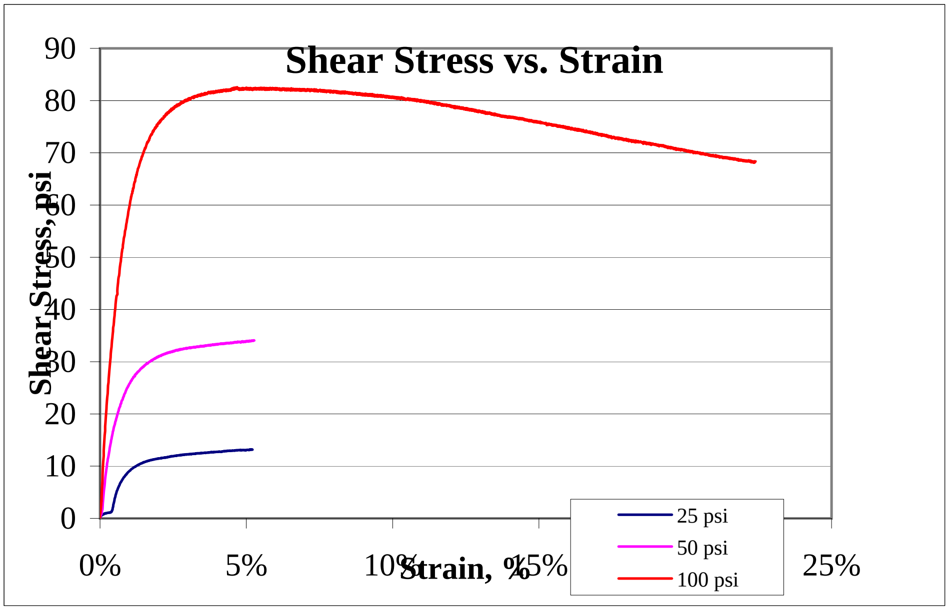
Sample No.
TYTP 01-04

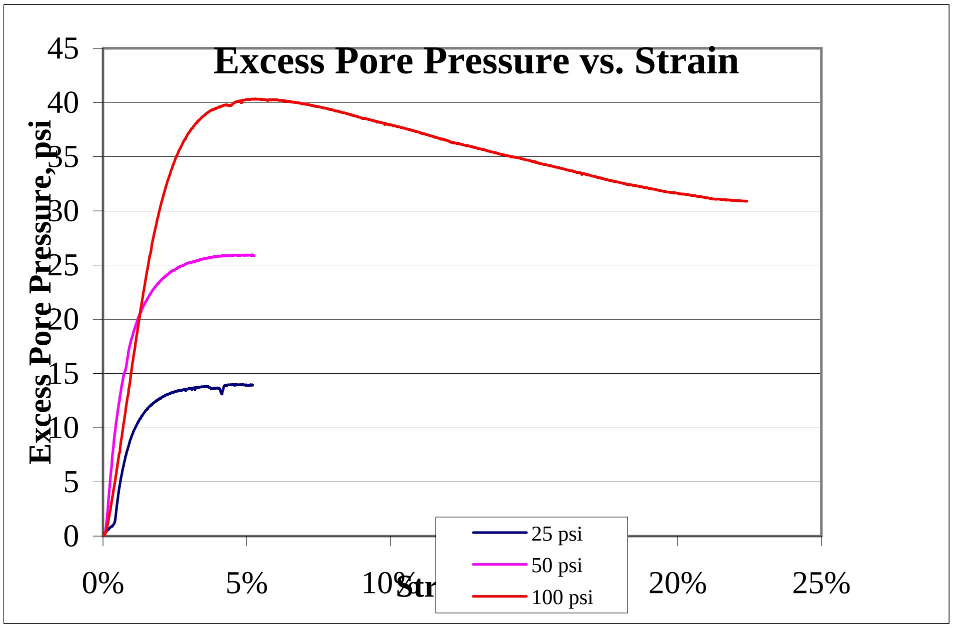
Reviewed: GE

Date: 11/30/2001

Job Number: 013-1595

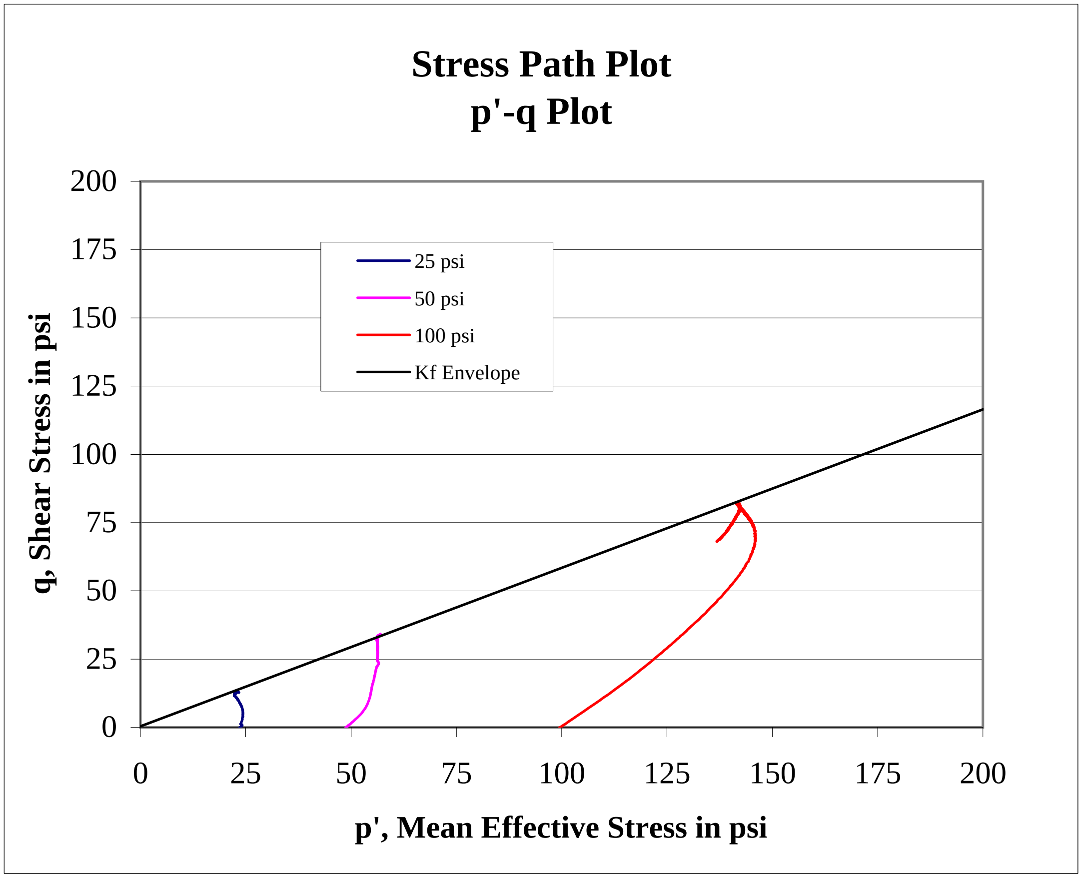
Figure: 1





Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **STRESS AND Δ PORE PRESSURE PLOTS**
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**	

Sample No. TYTP 01-04	Reviewed: **GE**	**Date:** 11/30/01	**Job Number:** 013-1595	**Figure:** 2

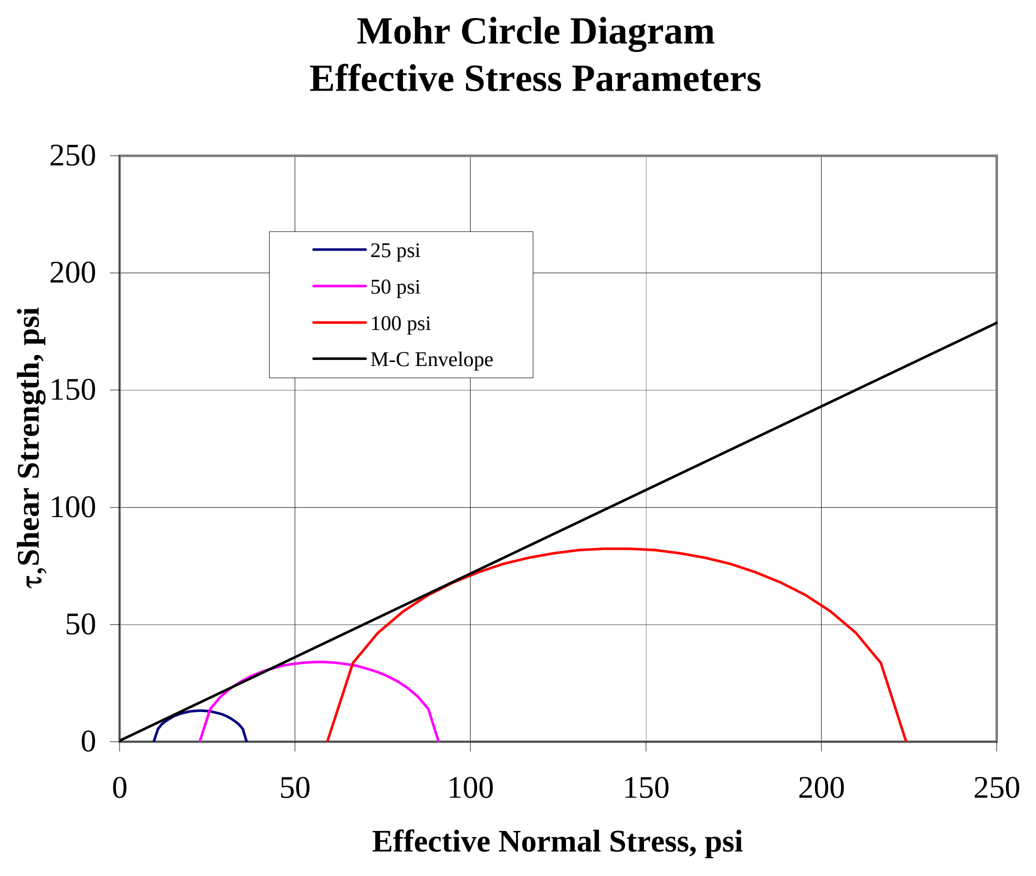


Stress Path Parameters

ψ' = 30.1 degrees
a' = 0.3 psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**	

Sample No. TYTP 01-04	Reviewed: **GE**	**Date:** 11/30/01	**Job Number:** 013-1595	**Figure:** 3



Mohr-Coulomb Parameters

ϕ ' =	35.5	degrees
c' =	0.4	psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**	

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:** 4
TYTP 01-04	**GE**	11/30/01	013-1595	

Sample # =	TYTP 01-7		Sample # =	TYTP 01-7		Sample # =	TYTP 01-7	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	20.30	cm	Length =	20.30	cm	Length =	20.30	cm
Diameter =	10.13	cm	Diameter =	10.13	cm	Diameter =	10.13	cm
Wet Weight =	3387.40	g	Wet Weight =	3387.40	g	Wet Weight =	3387.40	g
Area =	80.6	sq.cm	Area =	80.6	sq.cm	Area =	80.6	sq.cm
Sample Area =	12.49	sq. in.	Sample Area =	12.49	sq. in.	Sample Area =	12.49	sq. in.
Volume =	1636.0	cc	Volume =	1636.0	cc	Volume =	1636.0	cc
Moisture Content =	6.3%		Moisture Content =	6.3%		Moisture Content =	6.3%	
Specific Gravity =	NA		Specific Gravity =	NA		Specific Gravity =	NA	
Dry Weight of Solids =	3186.64	g	Dry Weight of Solids =	3186.64	g	Dry Weight of Solids =	3186.64	g
Wet Density =	2.07	g/cc	Wet Density =	2.07	g/cc	Wet Density =	2.07	g/cc
Dry Density =	1.95	g/cc	Dry Density =	1.95	g/cc	Dry Density =	1.95	g/cc
Wet Density =	129.2	pcf	Wet Density =	129.2	pcf	Wet Density =	129.2	pcf
Dry Density =	121.5	pcf	Dry Density =	121.5	pcf	Dry Density =	121.5	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	120	psi
Back Pressure =	75	psi	Back Pressure =	50	psi	Back Pressure =	20	psi
Confining Pressure =	25	psi	Confining Pressure =	50	psi	Confining Pressure =	100	psi

Notes:

1. Staged test at 25, 50 and 100 psi confining pressure
2. Sample remolded to 122.6 lb/ft^3 and 6% moisture content

Golder Associates, Inc.
Denver, Colorado

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Title:
TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

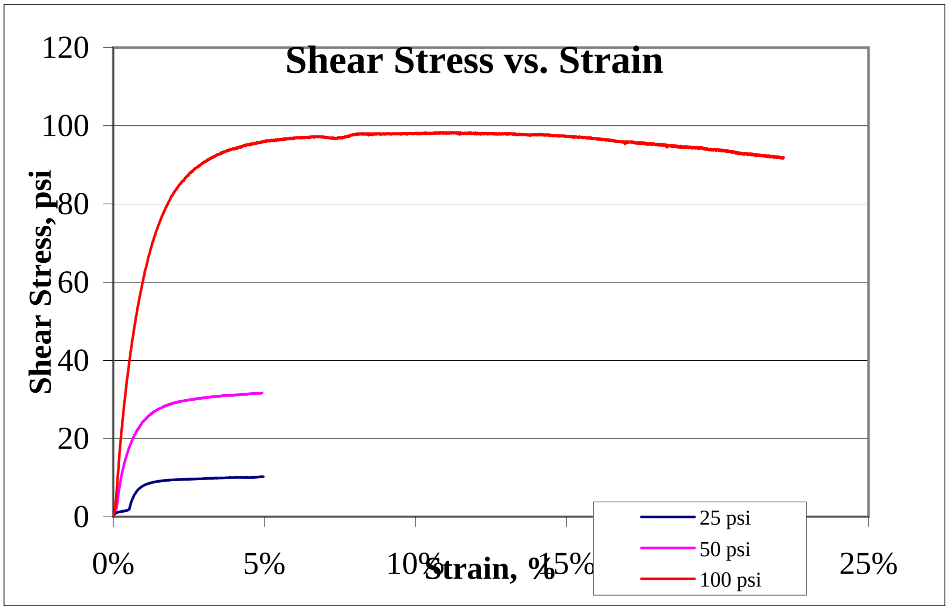
Sample No.
TYTP 01-7

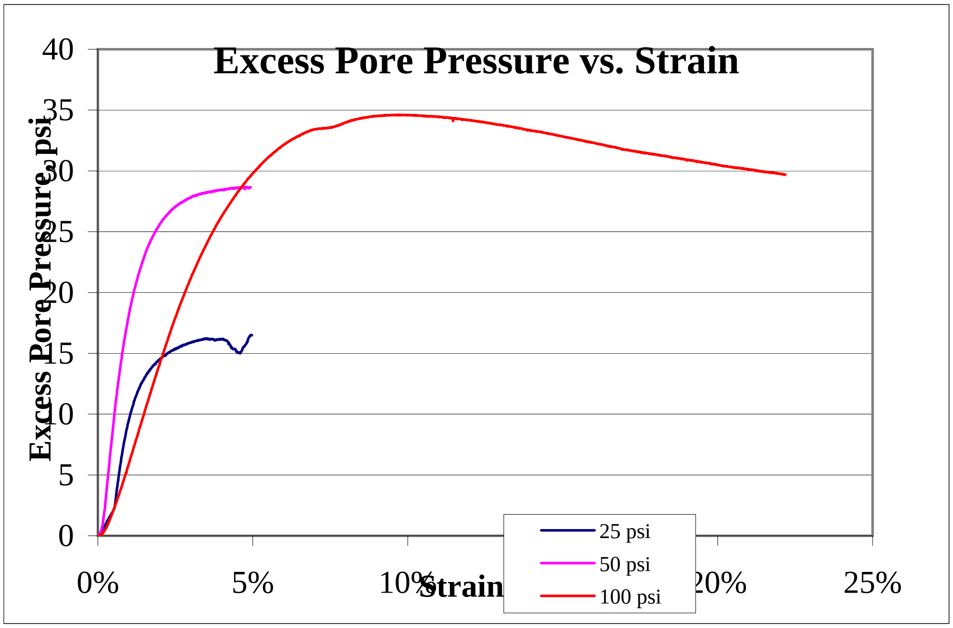
Reviewed: GE

Date: 11/25/2001

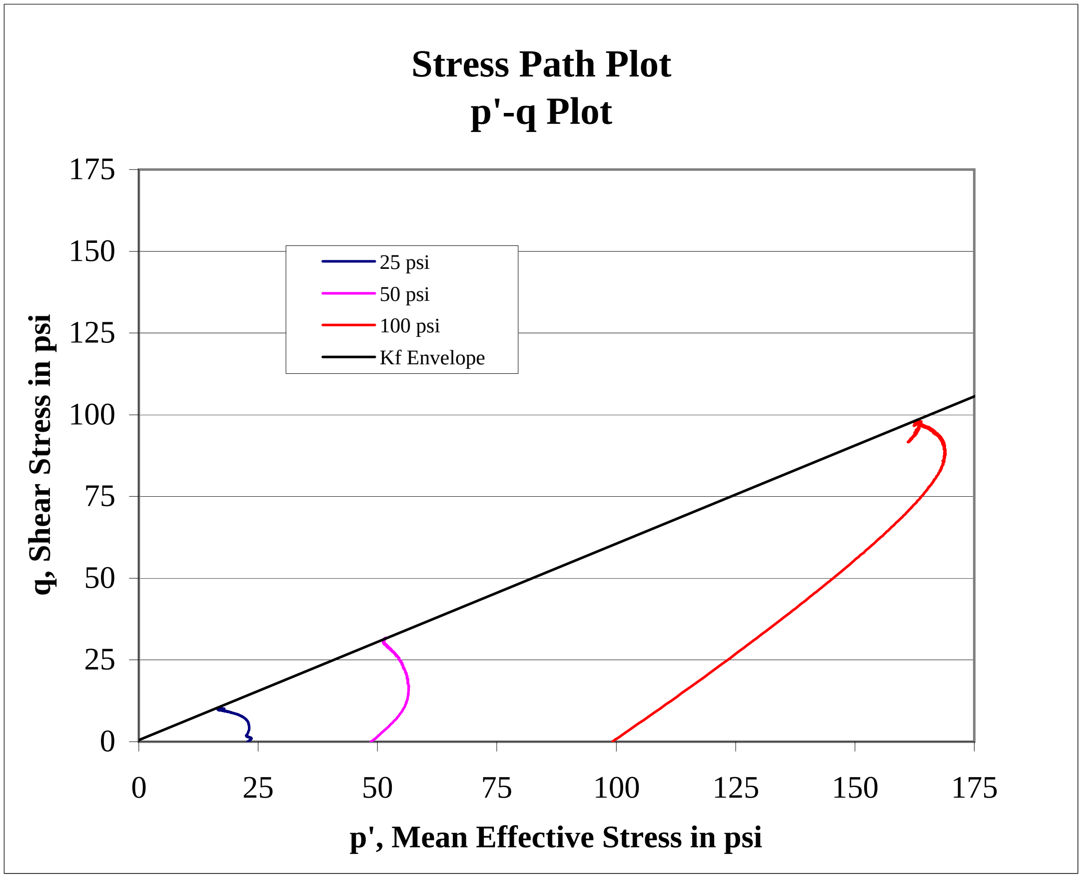
Job Number: 013-1595

Figure: 1





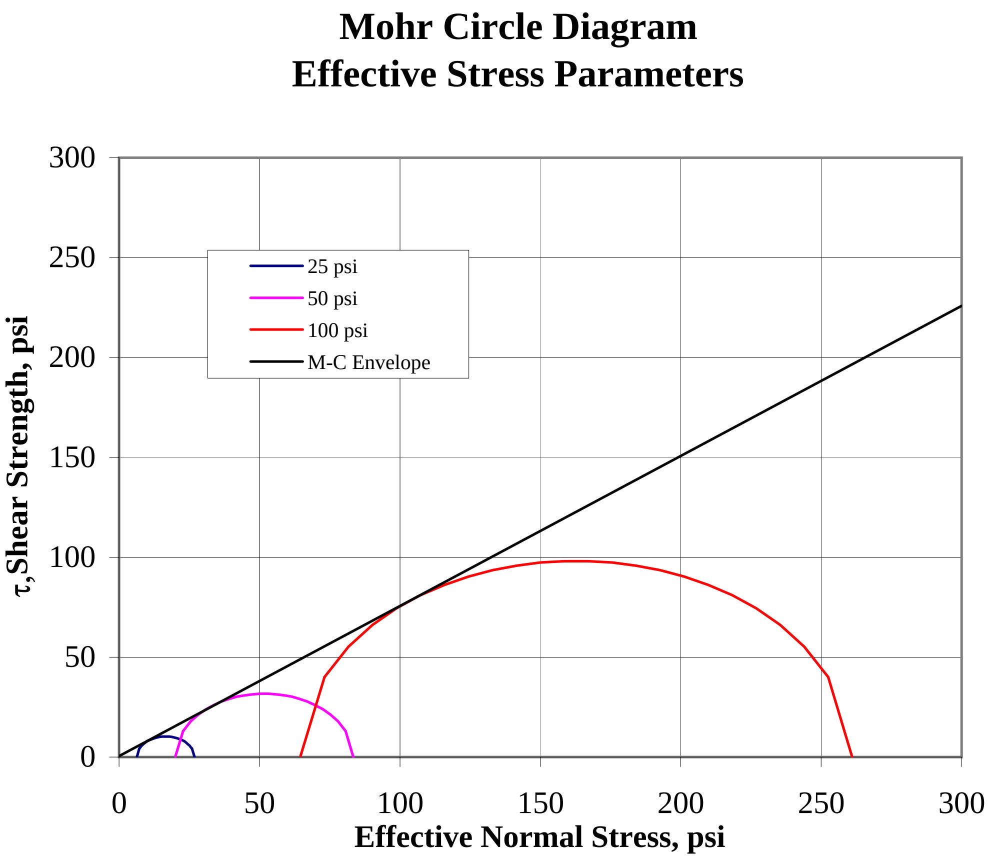
Golder Associates, Inc. **Denver, Colorado**		**Title:** **CU TRIAXIAL SHEAR DATA** **STRESS AND Δ PORE PRESSURE PLOTS**		
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**				
Sample No. TYTP 01-7	Reviewed: **GE**	**Date:** 11/25/01	**Job Number:** 013-1595	**Figure:** **2**



Stress Path Parameters

ψ' =	31.0	degrees
a' =	0.4	psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **CU TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**		
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**				
Sample No. TYTP 01-7	Reviewed: **GE**	**Date:** 11/25/01	**Job Number:** 013-1595	**Figure:** 3



Mohr-Coulomb Parameters

$\phi' =$ 36.9 degrees
c' = 0.6 psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**
Job Short Title: **G&K/TYRONE CLOSURE HEARING/AZ**	

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:** 4
TYTP 01-7	**GE**	11/25/01	013-1595	

Sample # =	TYTP 01-9		TYTP 01-9		TYTP 01-9	
Point # =	1		2		3	
	Initial		**Initial**		**Initial**	
Length =	20.35	cm	20.35	cm	20.35	cm
Diameter =	10.12	cm	10.12	cm	10.12	cm
Wet Weight =	3386.20	g	3386.20	g	3386.20	g
Area =	80.4	sq.cm	80.4	sq.cm	80.4	sq.cm
Sample Area =	12.47	sq. in.	12.47	sq. in.	12.47	sq. in.
Volume =	1636.8	cc	1636.8	cc	1636.8	cc
Moisture Content =	6.1%		6.1%		6.1%	
Specific Gravity =	NA		NA		NA	
Dry Weight of Solids =	3191.52	g	3191.52	g	3191.52	g
Wet Density =	2.07	g/cc	2.07	g/cc	2.07	g/cc
Dry Density =	1.95	g/cc	1.95	g/cc	1.95	g/cc
Wet Density =	129.1	pcf	129.1	pcf	129.1	pcf
Dry Density =	121.7	pcf	121.7	pcf	121.7	pcf
Cell Pressure =	100	psi	100	psi	120	psi
Back Pressure =	75	psi	50	psi	20	psi
Confining Pressure =	25	psi	50	psi	100	psi

Notes:
1. Sample remolded to 122.6 lb/ft^3 and 6% mc
2. Soil is gravelly clay material

Golder Associates, Inc.
Denver, Colorado

Job Short Title: G&K/TYRONE CLOSURE HEARING/AZ

Title:

TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

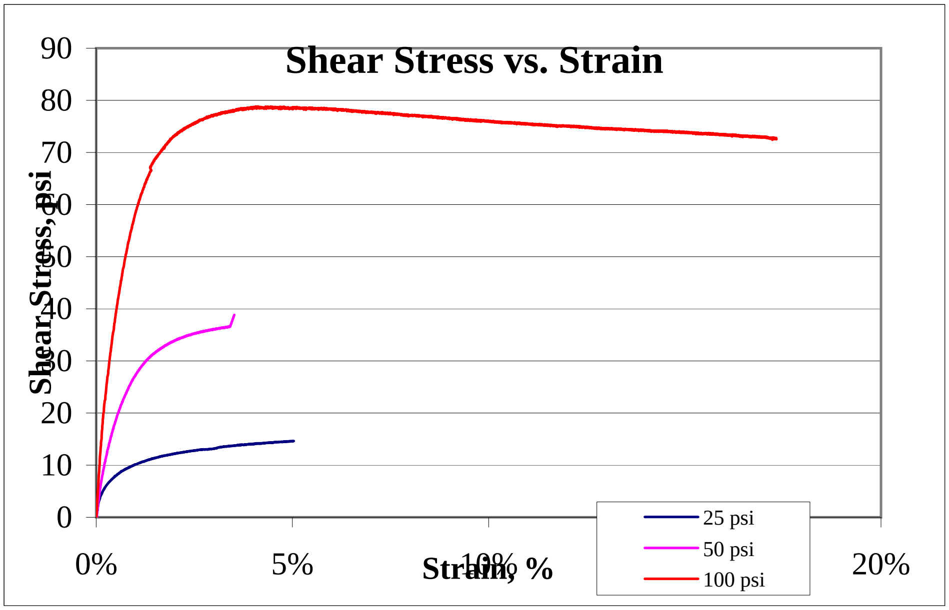
Sample No. **TYTP 01-9**

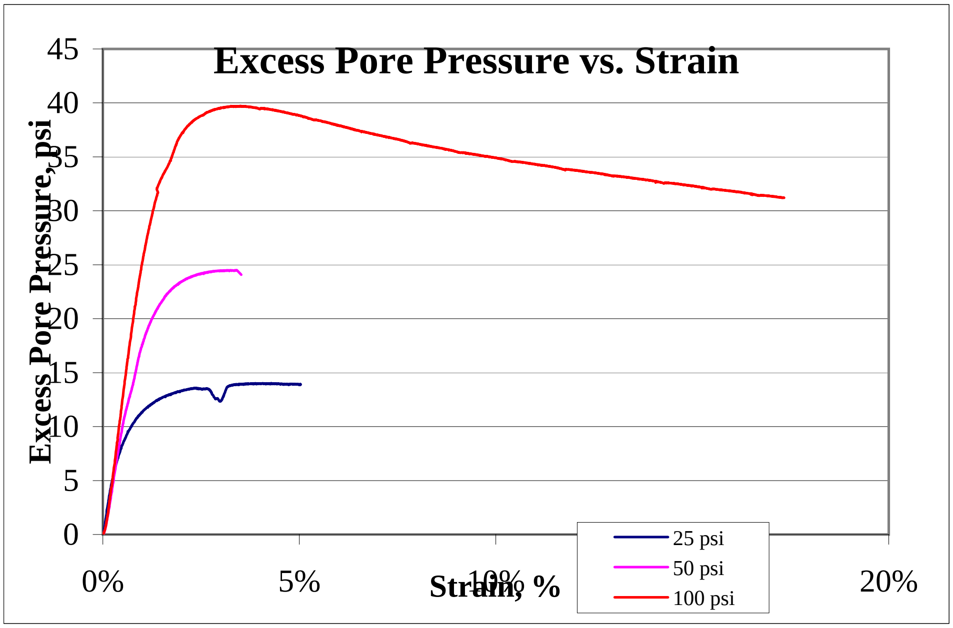
Reviewed: GE

Date: 12/5/2001

Job Number: 013-1595

Figure: 1





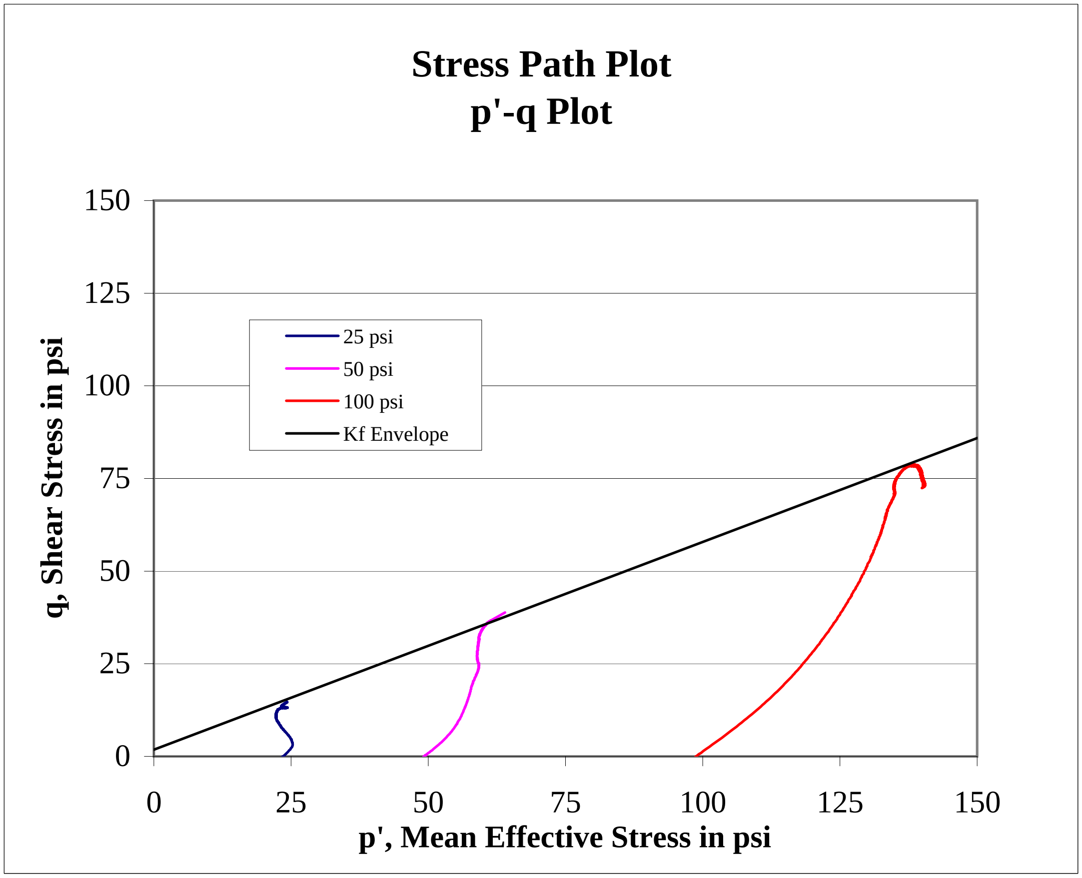
Golder Associates, Inc.
Denver, Colorado

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Title:

CU TRIAXIAL SHEAR DATA
STRESS AND Δ PORE PRESSURE PLOTS

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:** 2
TYTP 01-9	**GE**	12/05/01	013-1595	



Stress Path Parameters

ψ' = 29.3 degrees
a' = 1.8 psi

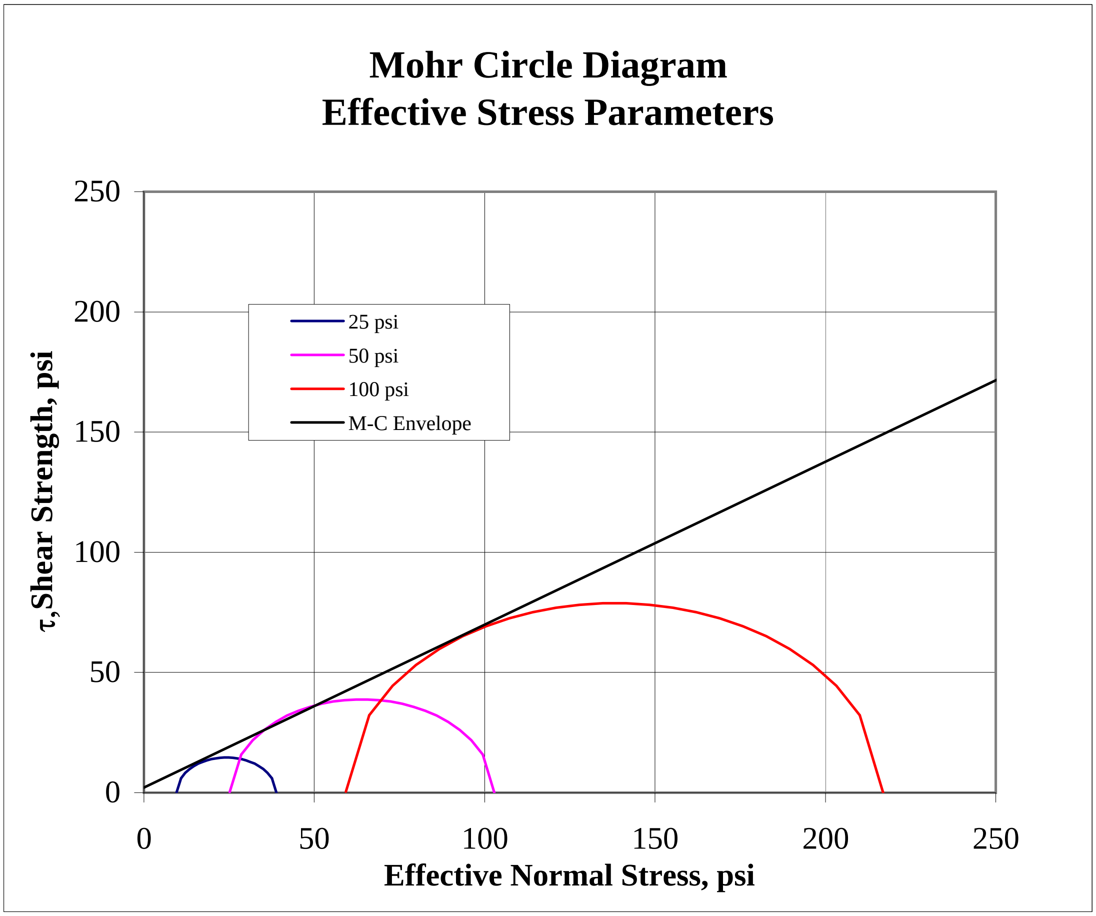
Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
STRESS PATH PLOT

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:**
TYTP 01-9	**GE**	12/05/01	013-1595	**3**



Mohr-Coulomb Parameters

$\phi' =$ 34.1 degrees
c' = 2.2 psi

Golder Associates, Inc.
Denver, Colorado

Title:

CU TRIAXIAL SHEAR DATA
MOHR CIRCLE DIAGRAM

Job Short Title:
G&K/TYRONE CLOSURE HEARING/AZ

Sample No.	Reviewed:	**Date:**	**Job Number:**	**Figure:**
TYTP 01-9	**GE**	12/05/01	013-1595	**4**

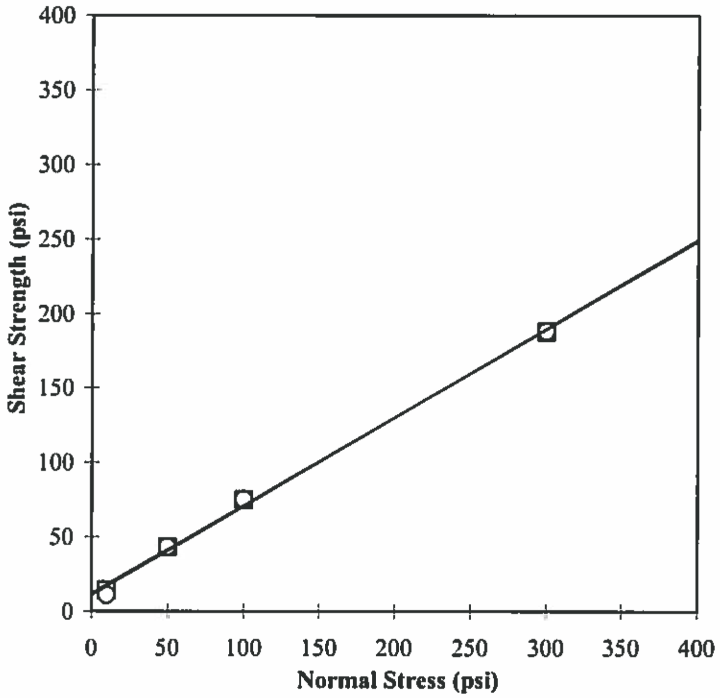
APPENDIX D-3

1C STOCKPILE DIRECT SHEAR TESTS

SGI TESTING SERVICES, LLC

INTERNAL DIRECT SHEAR TESTING (ASTM D 3080)
GOLDER ASSOCIATES, INC.
GOLDER PROJECT NO. 053-2503-001

Test Series No. 1:
internal strength of sample GA04-TY-1-GT material under soaked and consolidation conditions



Test Conditions:

Shear Box Size (in x in): 6 x 6
Shear Area (sq. in.): 36

Upper Box: Tamped In-Place at as-received moisture

Lower Box: Tamped In-place at as-received moisture

Soaking Stress (psi): N/A
Soaking Time (hour) N/A
Consolidation Stress (psi): 10
Consolidation Time (hour) 1

Shear Rate (in/min): 0.04

Normal Stress (psi)	Peak Load (lb)	Large Displ Load (lb)	Peak Strength (psi)	Large Displ Strength (psi)	Shear Strength Parameters			
					Peak		Large Displacement	
					Friction Angle (degree)	Adhesion (psf)	Friction Angle (degree)	Adhesion (psf)
10	499	385	13.86	10.69	31	1720	31	1495
50	1555	1555	43.19	43.19				
100	2689	2689	74.69	74.69				
300	6764	6764	187.89	187.89				

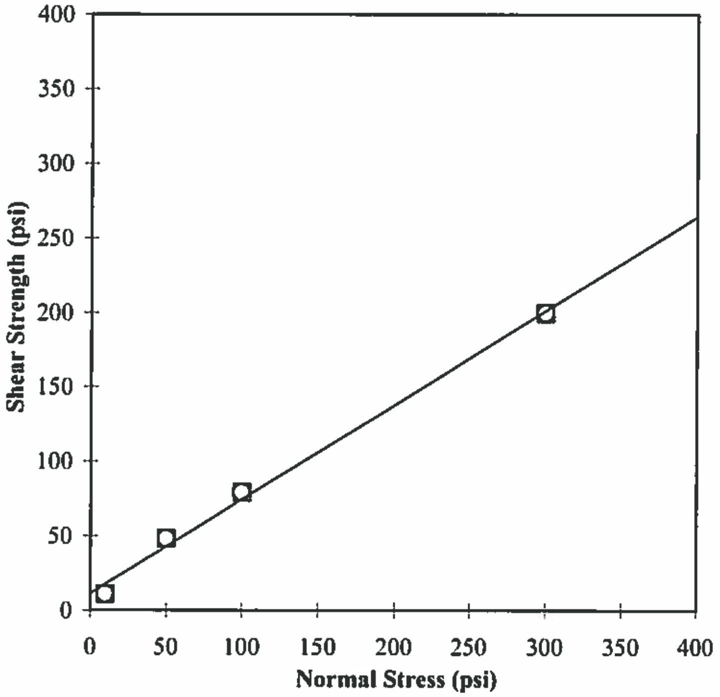
Note: Shear failure occurred within the soil at the mid-plane of the shear box after each test..

Project No.: SGI5021
S5021-1

SGI TESTING SERVICES, LLC

INTERNAL DIRECT SHEAR TESTING (ASTM D 3080)
GOLDER ASSOCIATES, INC.
GOLDER PROJECT NO. 053-2503-001

Test Series No. 2:
internal strength of sample GA04-TY-5-GT material under soaked and consolidation conditions



Test Conditions:

Shear Box Size (in x in):	6 x 6
Shear Area (sq. in.):	36
Upper Box:	Tamped In-Place at as-received moisture
Lower Box:	Tamped In-place at as-received moisture
Soaking Stress (psi):	N/A
Soaking Time (hour)	N/A
Consolidation Stress (psi):	10
Consolidation Time (hour)	1
Shear Rate (in/min):	0.04

Normal Stress (psi)	Peak Load (lb)	Large Displ Load (lb)	Peak Strength (psi)	Large Displ Strength (psi)	Shear Strength Parameters			
					Peak		Large Displacement	
					Friction Angle (degree)	Adhesion (psf)	Friction Angle (degree)	Adhesion (psf)
10	381	381	10.58	10.58	32	1630	32	1630
50	1721	1721	47.81	47.81				
100	2839	2839	78.86	78.86				
300	7172	7172	199.22	199.22				

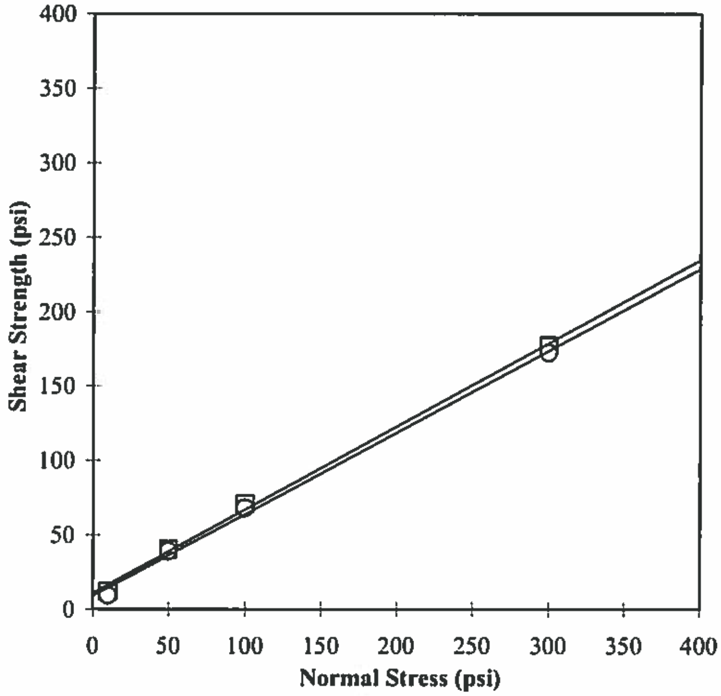
Note: Shear failure occurred within the soil at the mid-plane of the shear box after each test..

Project No.: SGI5021
S5021-2

SGI TESTING SERVICES, LLC

INTERNAL DIRECT SHEAR TESTING (ASTM D 3080)
GOLDER ASSOCIATES, INC.
GOLDER PROJECT NO. 053-2503-001

Test Series No. 3:
internal strength of sample GA04-TY-8-GT material under soaked and consolidation conditions



Test Conditions:

Shear Box Size (in x in):	6 x 6
Shear Area (sq. in.):	36
Upper Box:	Tamped In-Place at as-received moisture
Lower Box:	Tamped In-place at as-received moisture
Soaking Stress (psi):	N/A
Soaking Time (hour)	N/A
Consolidation Stress (psi):	10
Consolidation Time (hour)	1
Shear Rate (in/min):	0.04

Normal Stress (psi)	Peak Load (lb)	Large Displ Load (lb)	Peak Strength (psi)	Large Displ Strength (psi)	Shear Strength Parameters: Peak Friction Angle (degree)	Peak Adhesion (psf)	Large Displacement Friction Angle (degree)	Large Displacement Adhesion (psf)
10	436	329	12.11	9.14	29	1540	29	1260
50	1443	1399	40.08	38.86				
100	2551	2439	70.86	67.75				
300	6369	6190	176.92	171.94				

Note: Shear failure occurred within the soil at the mid-plane of the shear box after each test..

Project No.: SGI5021
S5021-3

APPENDIX II

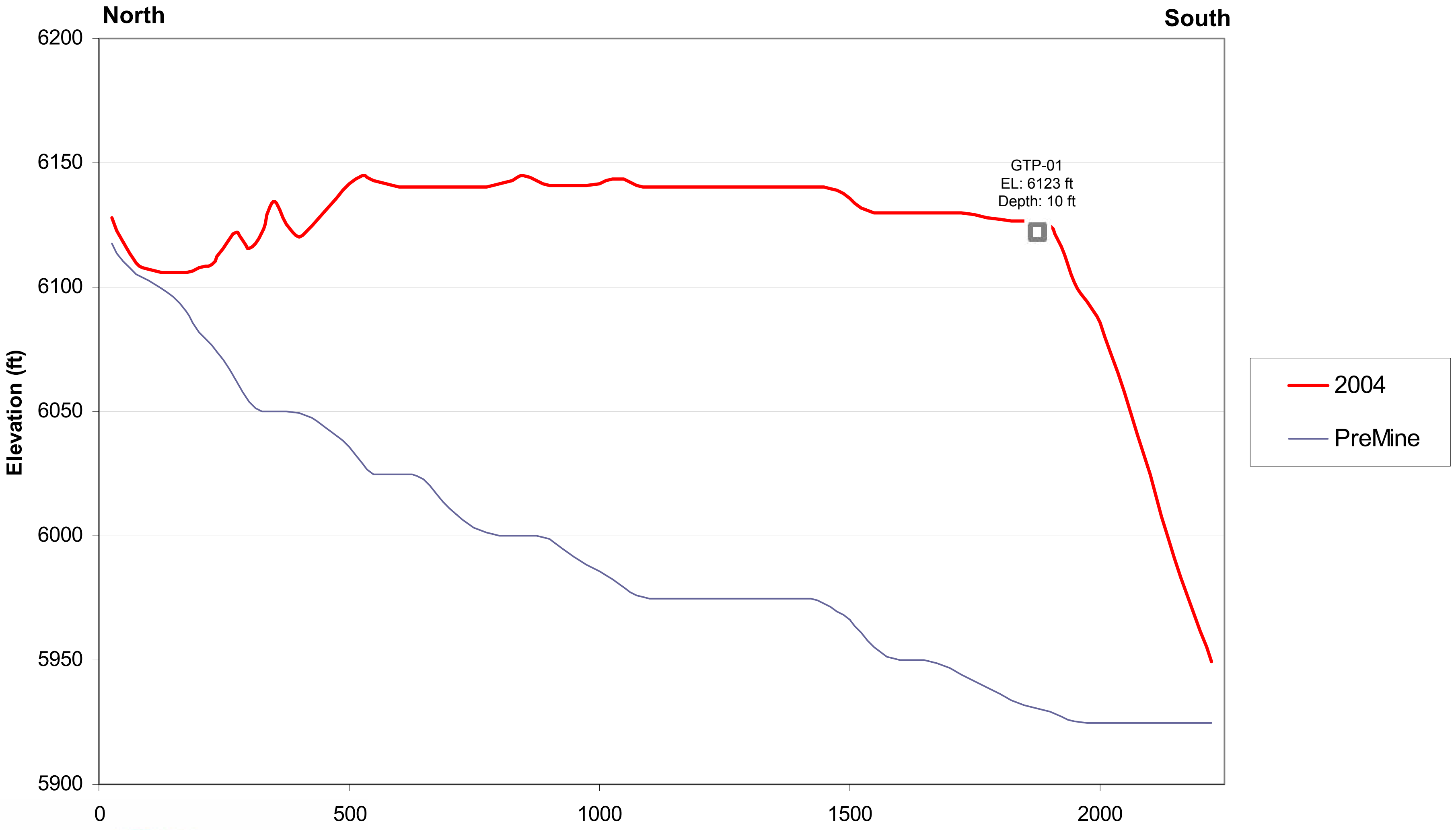
2005positional Model

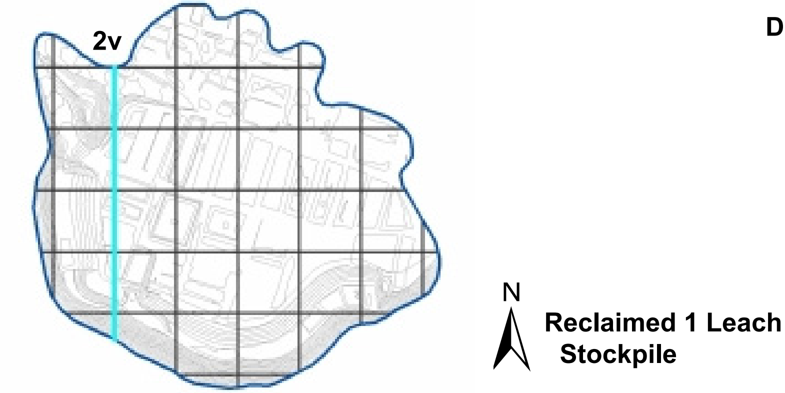
APPENDIX II

COMPOSITIONAL MODELS

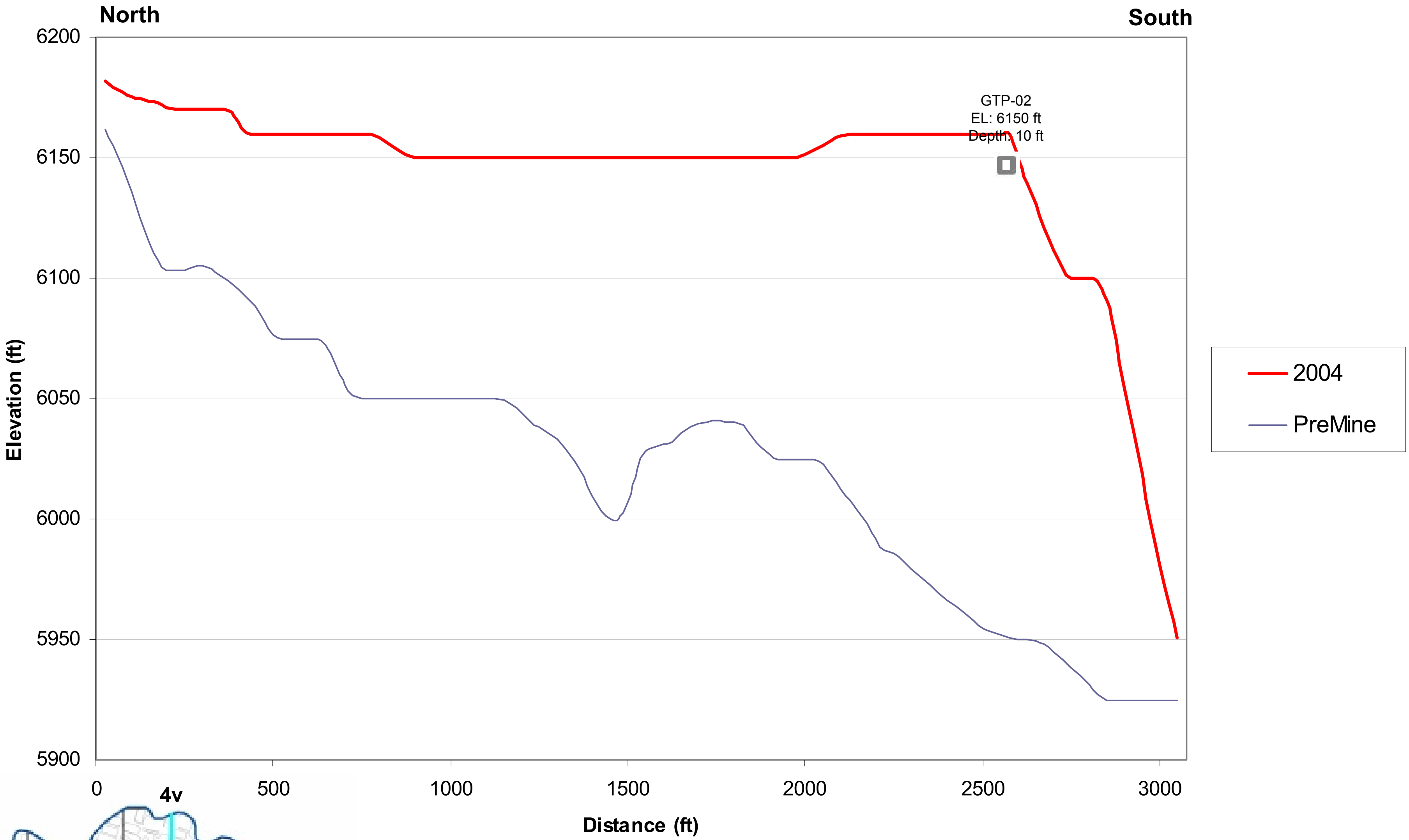
COMPOSITIONAL MODELS – Reclaimed 1 Leach Stockpile

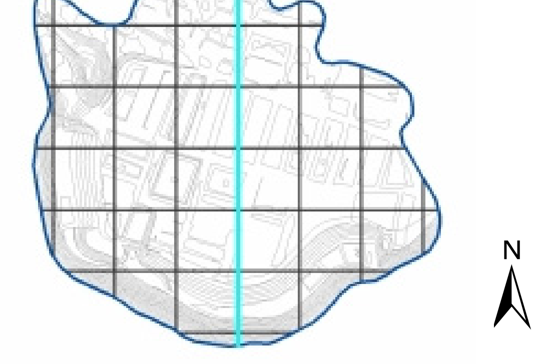
Tyrone Mine - Reclaimed 1 Leach Stockpile - Cross Section 2v





Tyrone Mine - Reclaimed 1 Leach Stockpile - Cross Section 4v

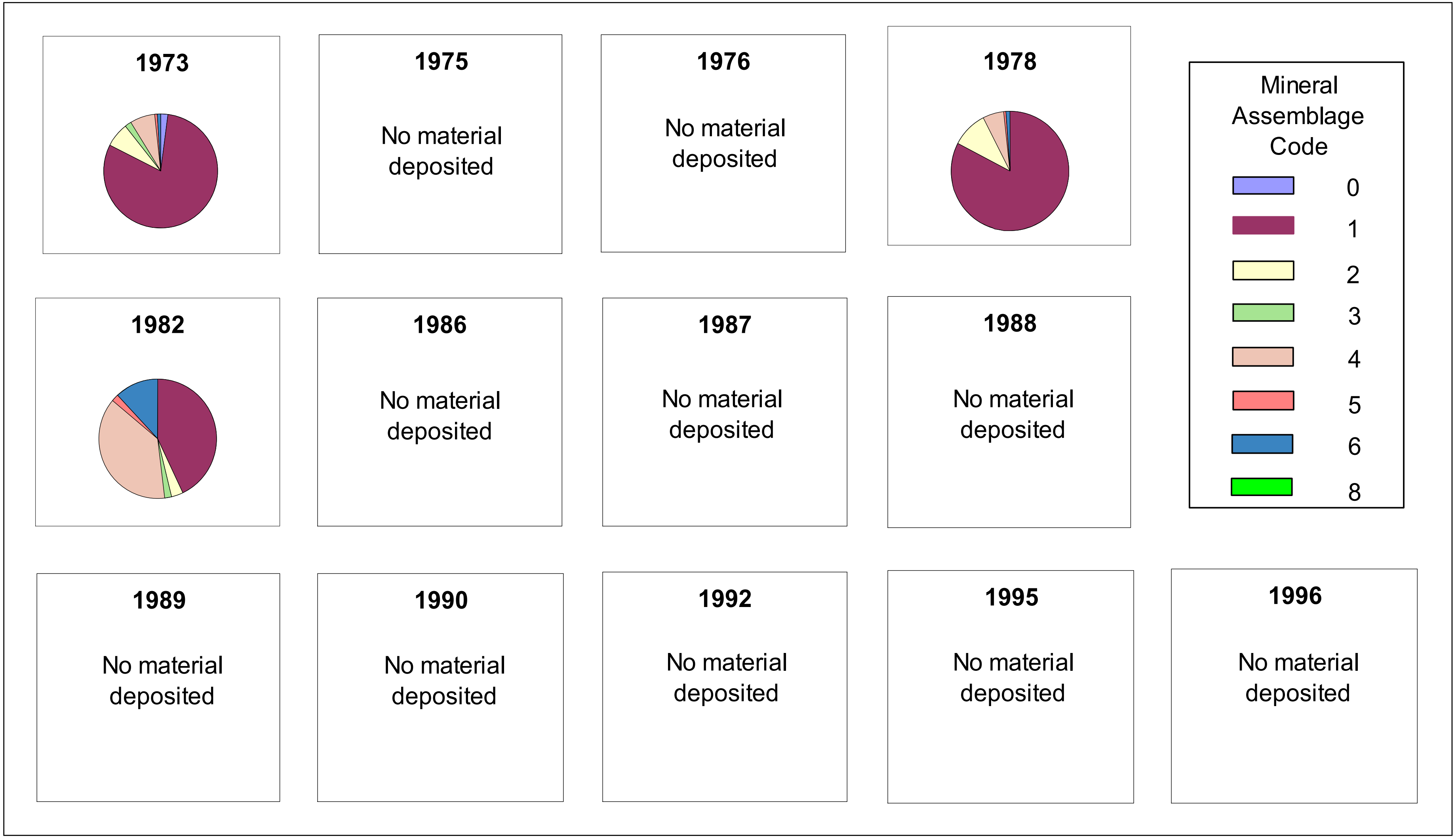




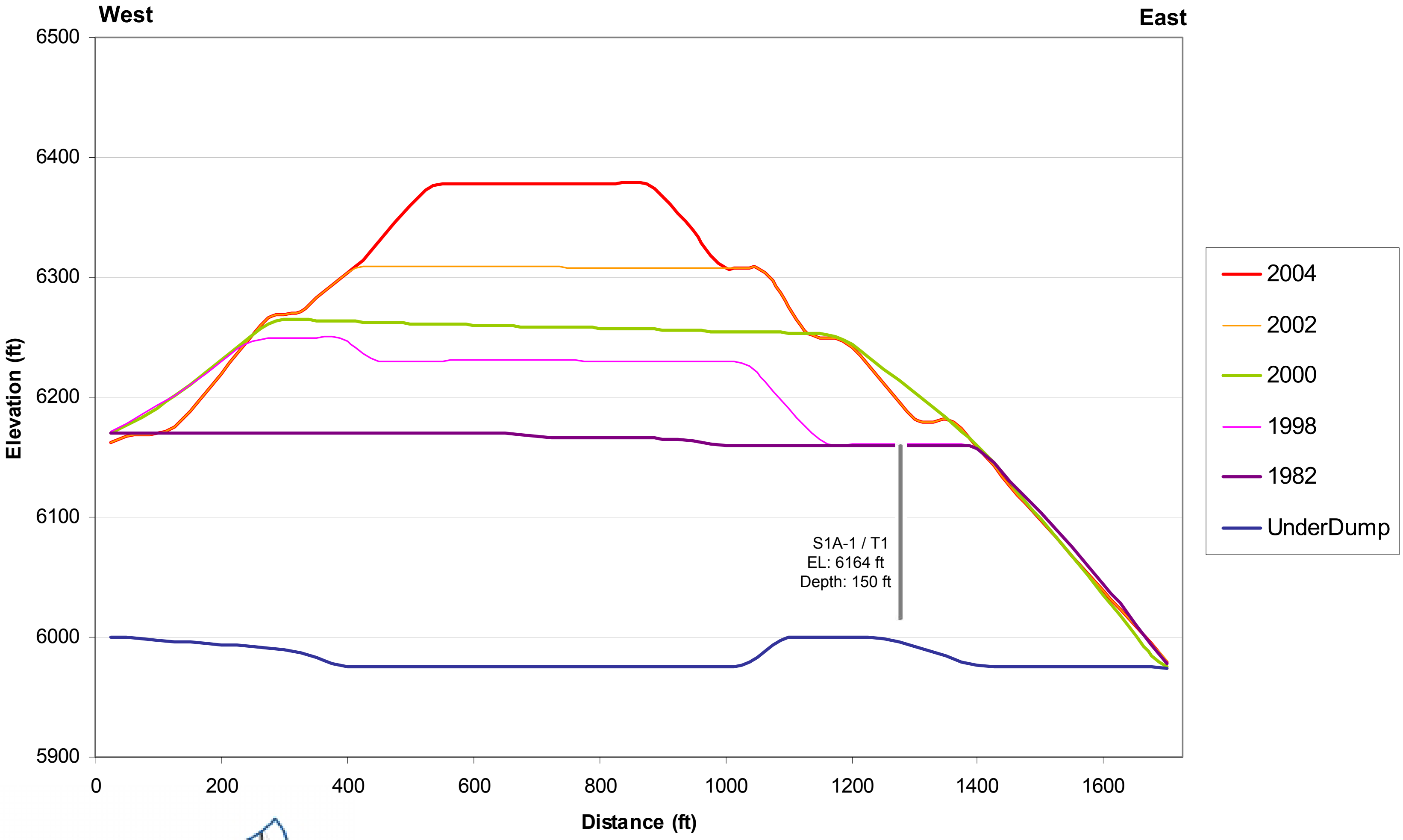
Reclaimed 1 Leach Stockpile

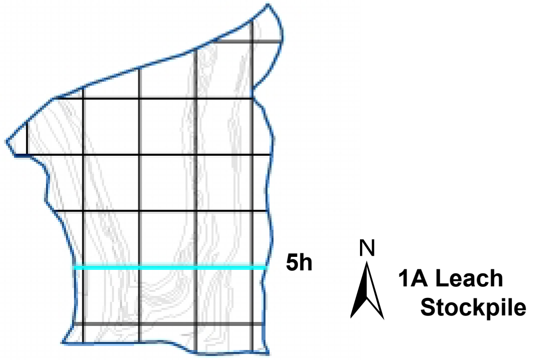
COMPOSITIONAL MODELS – 1A Leach Stockpile

1A Leach Stockpile

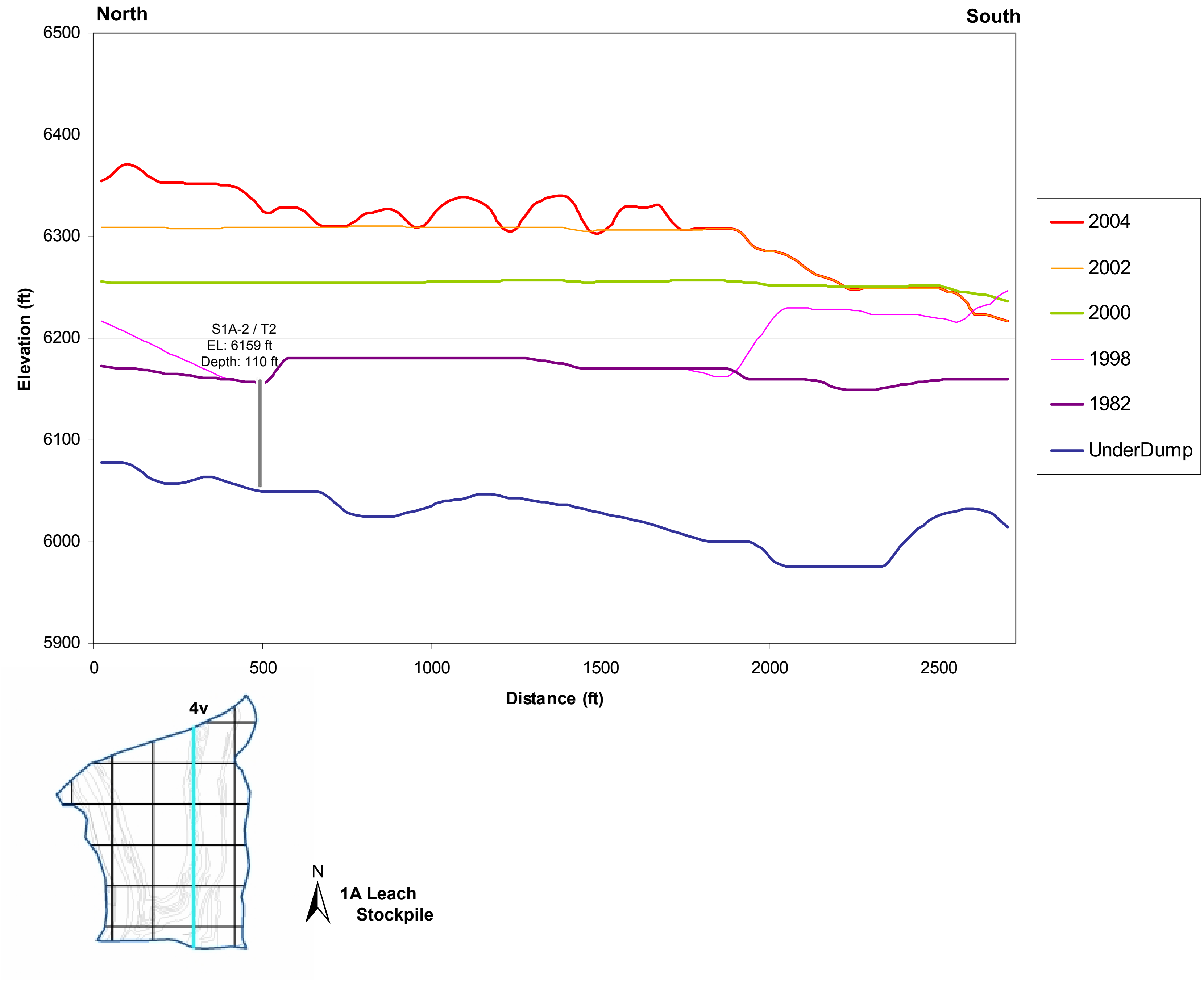


Tyrone Mine - 1A Leach Stockpile - Cross Section 5h

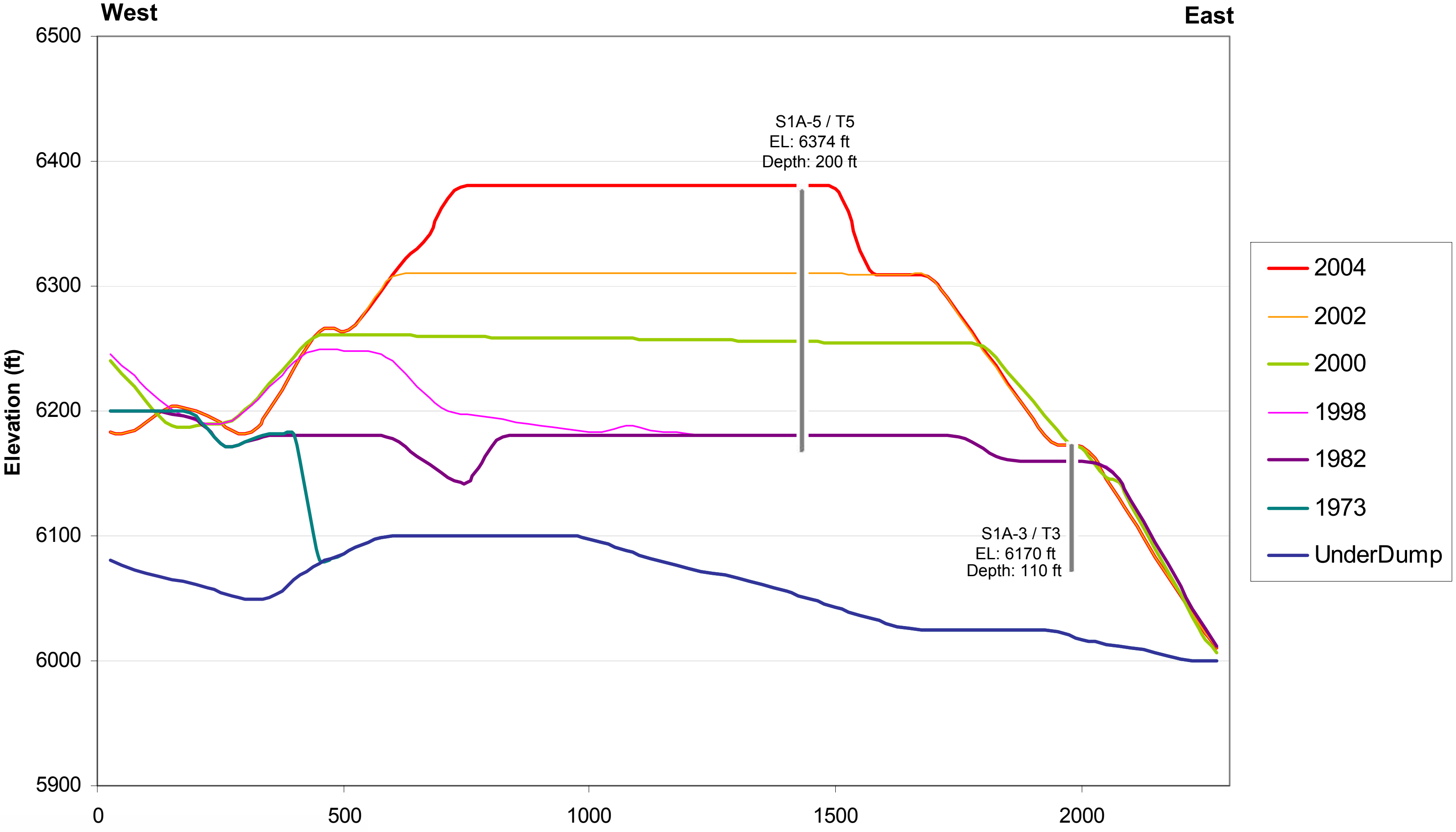


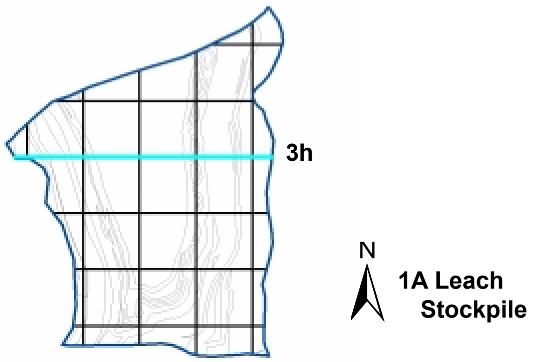


Tyrone Mine - 1A Leach Stockpile - Cross Section 4v

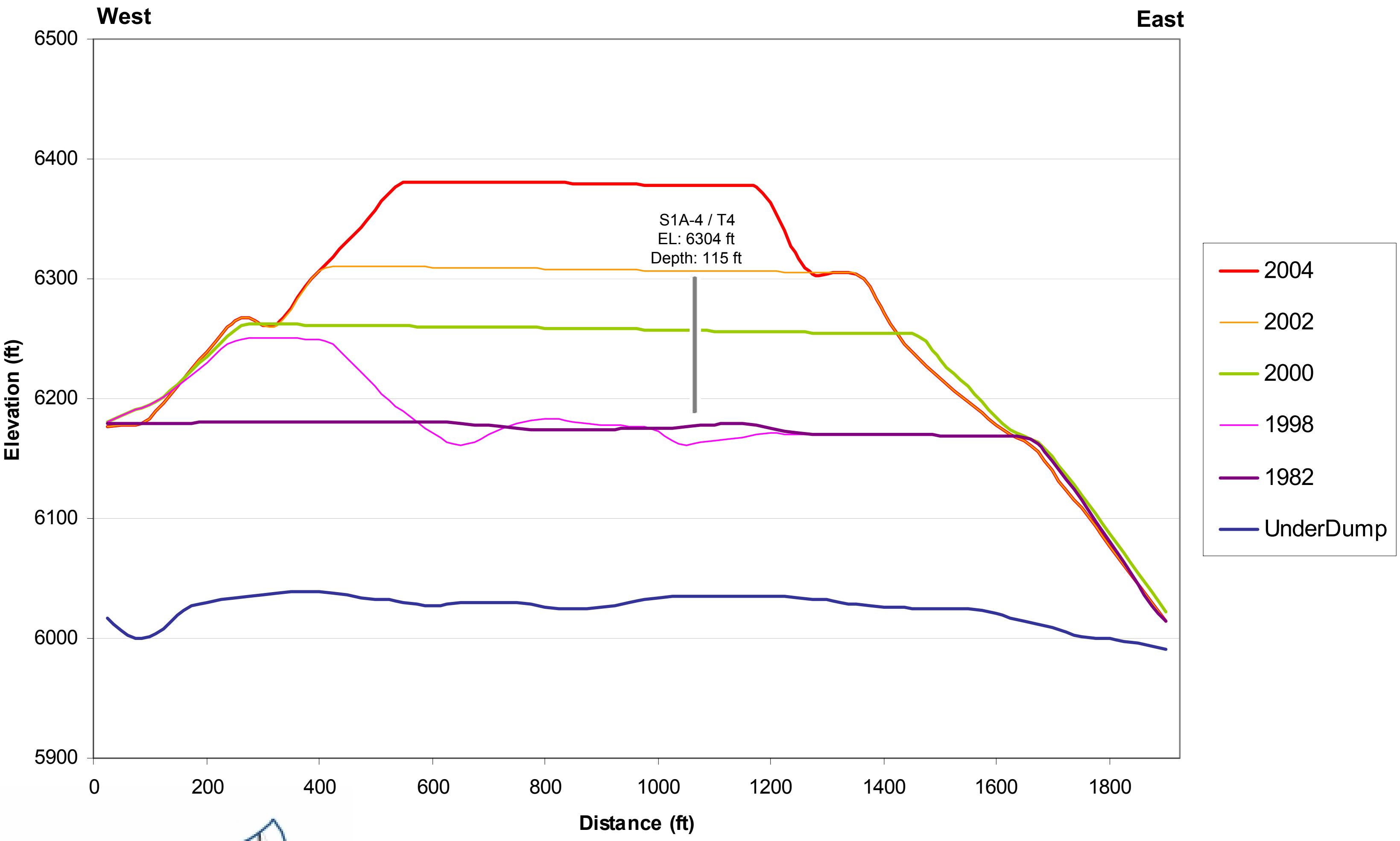


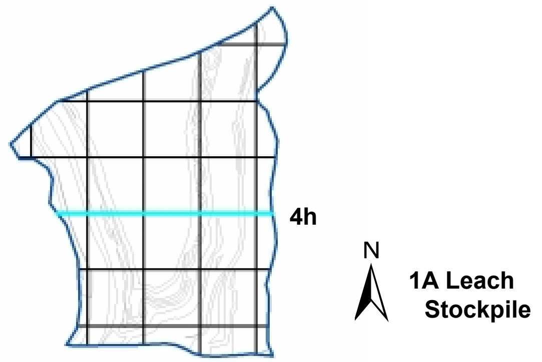
Tyrone Mine - 1A Leach Stockpile - Cross Section 3h





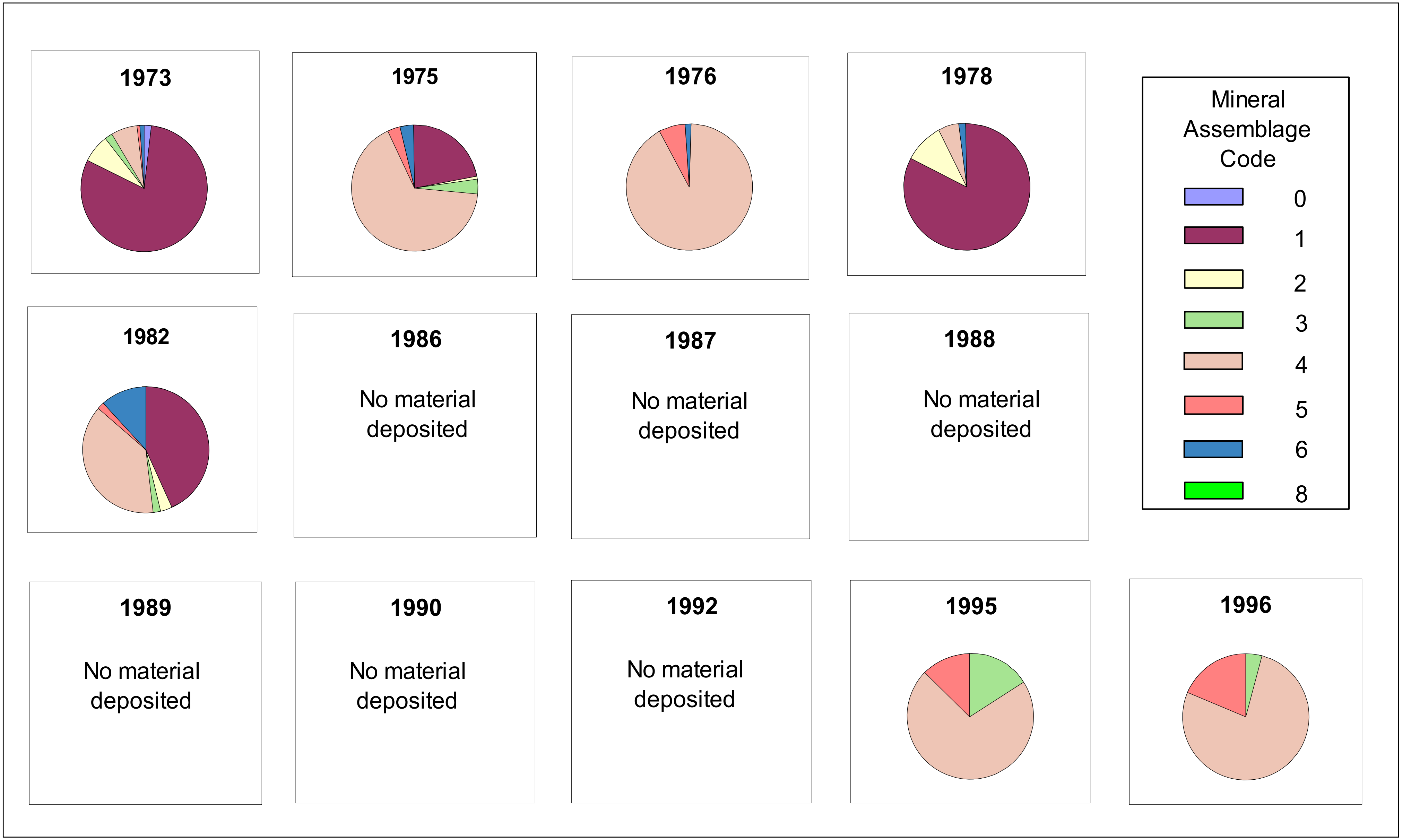
Tyrone Mine - 1A Leach Stockpile - Cross Section 4h



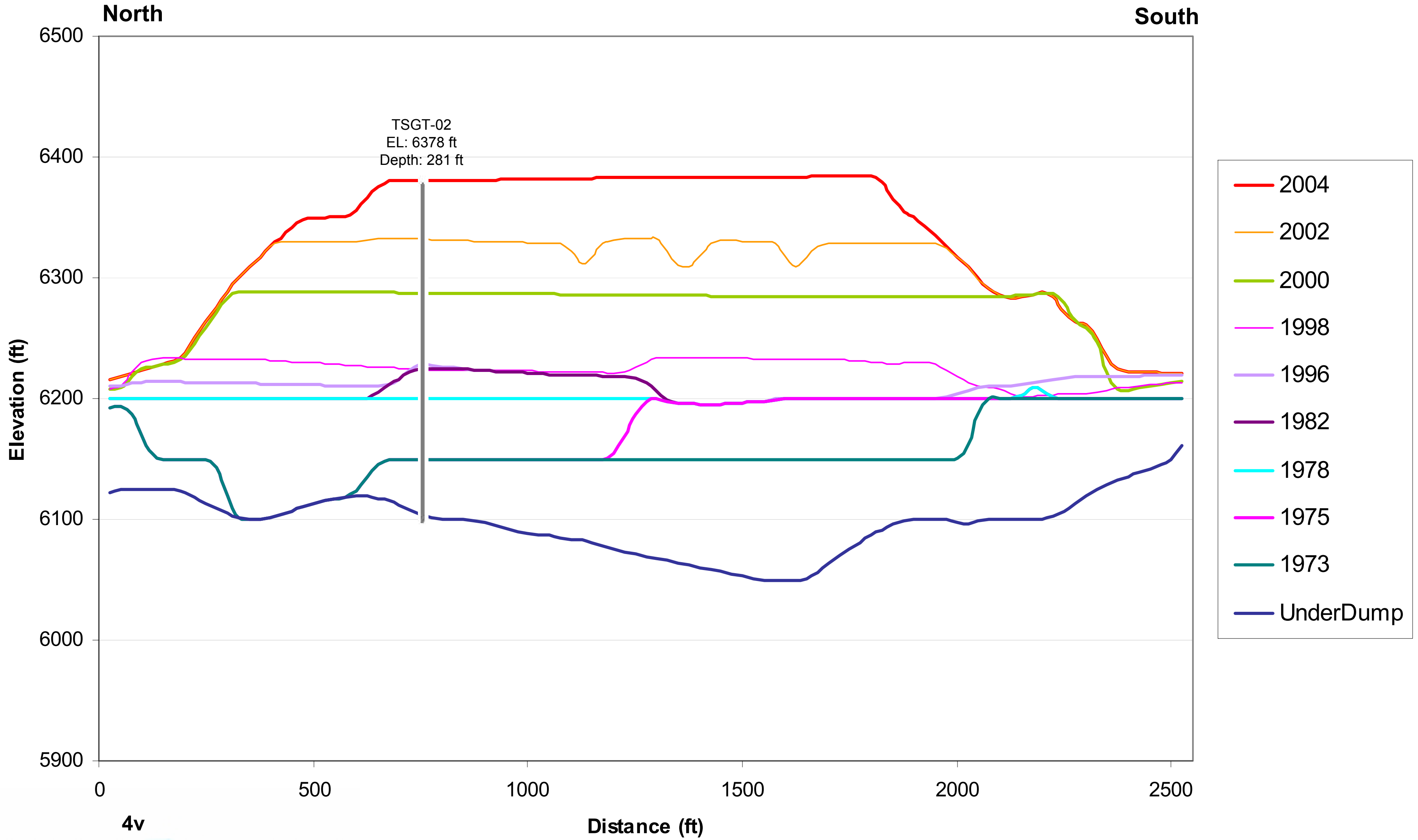


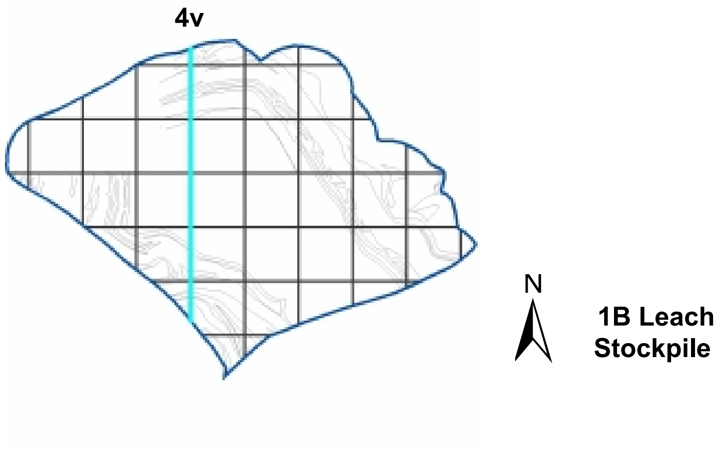
COMPOSITIONAL MODELS – 1B Leach Stockpile

1B Leach Stockpile



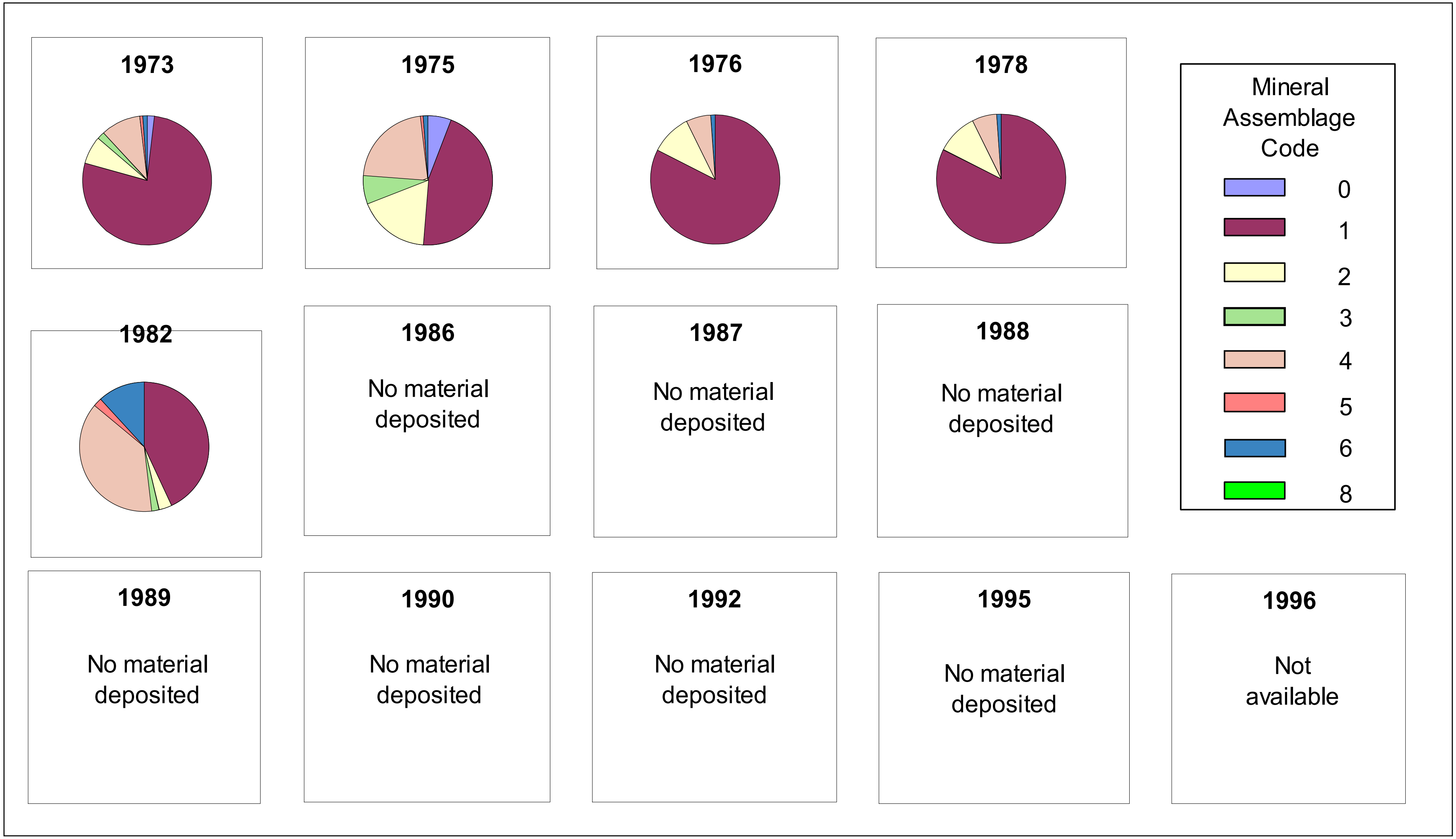
Tyrone Mine - 1B Leach Stockpile - Cross Section 4v



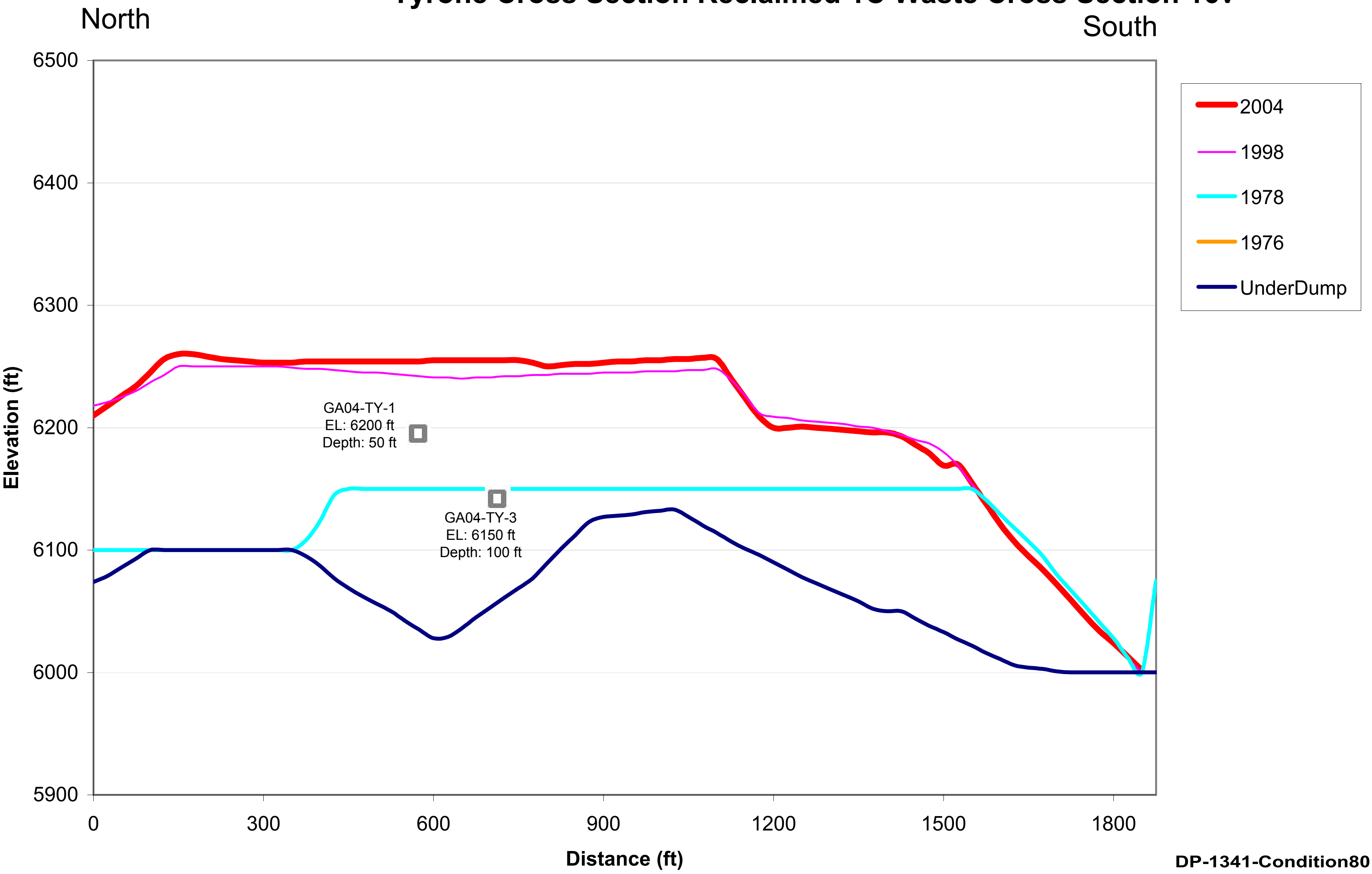


COMPOSITIONAL MODELS – Reclaimed 1C Waste Stockpile

Reclaimed 1C Waste Stockpile

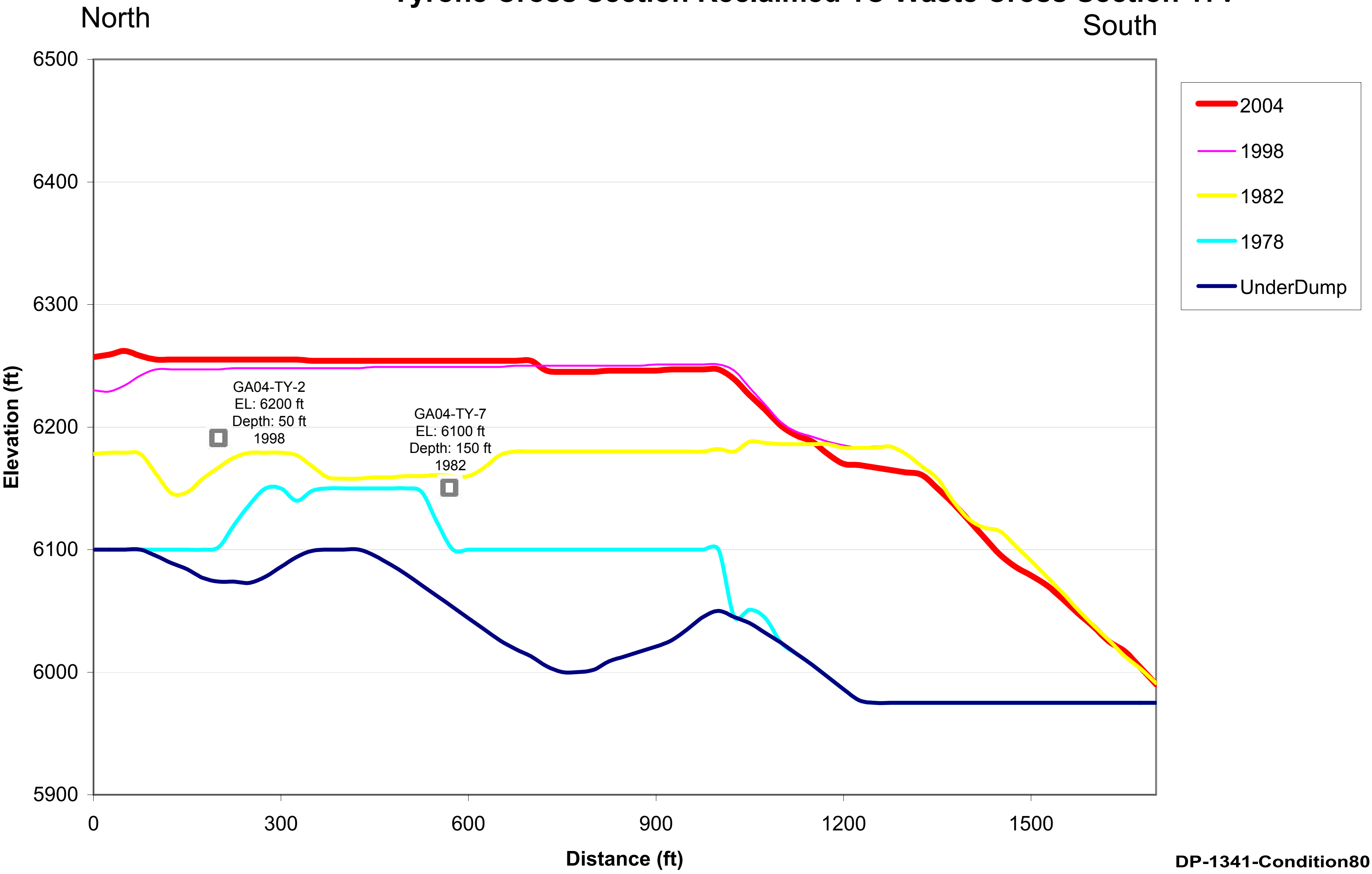


Tyrone Cross Section Reclaimed 1C Waste Cross Section 16v

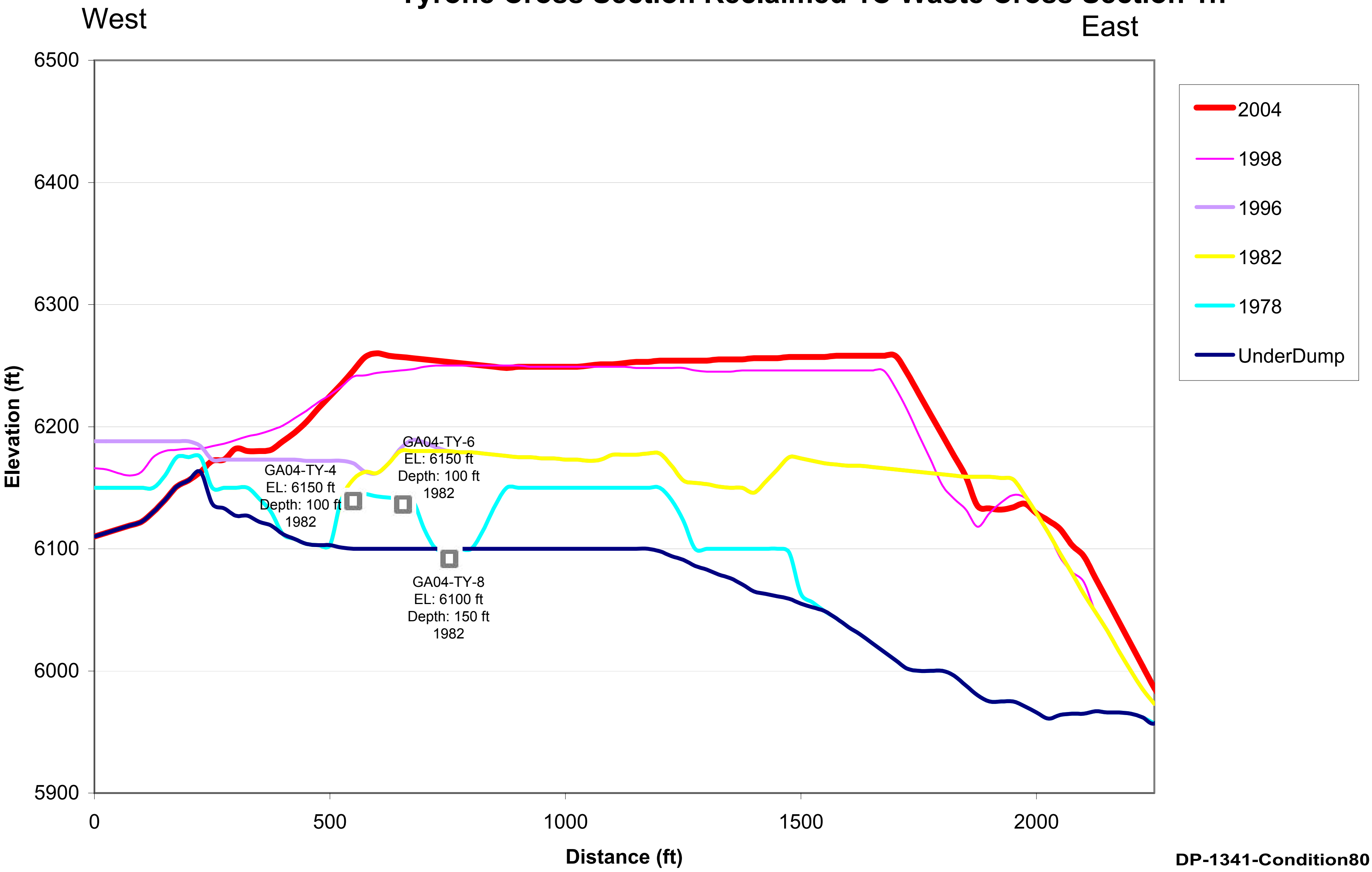


DP-1341-Condition80

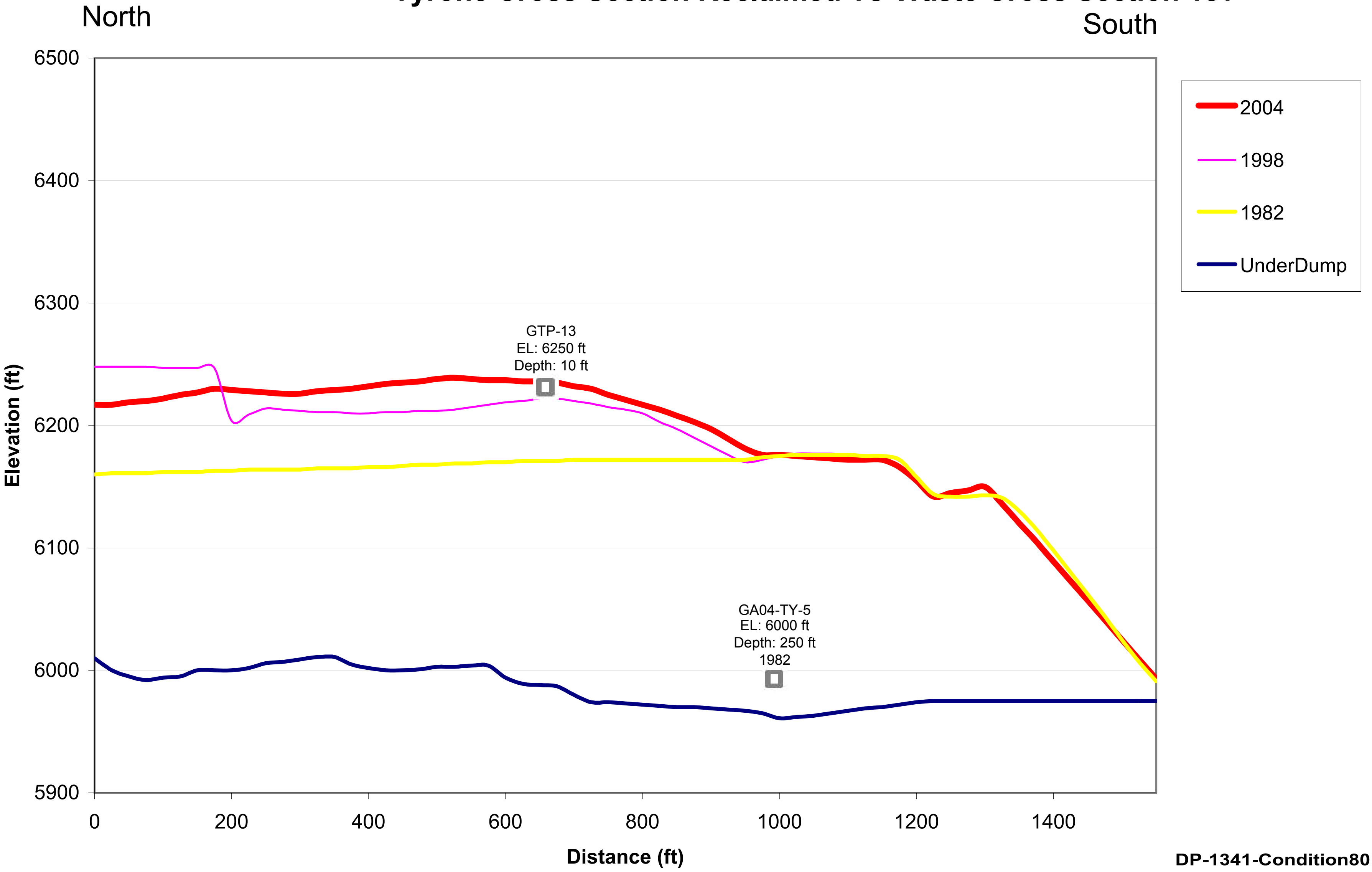
Tyrone Cross Section Reclaimed 1C Waste Cross Section 17v



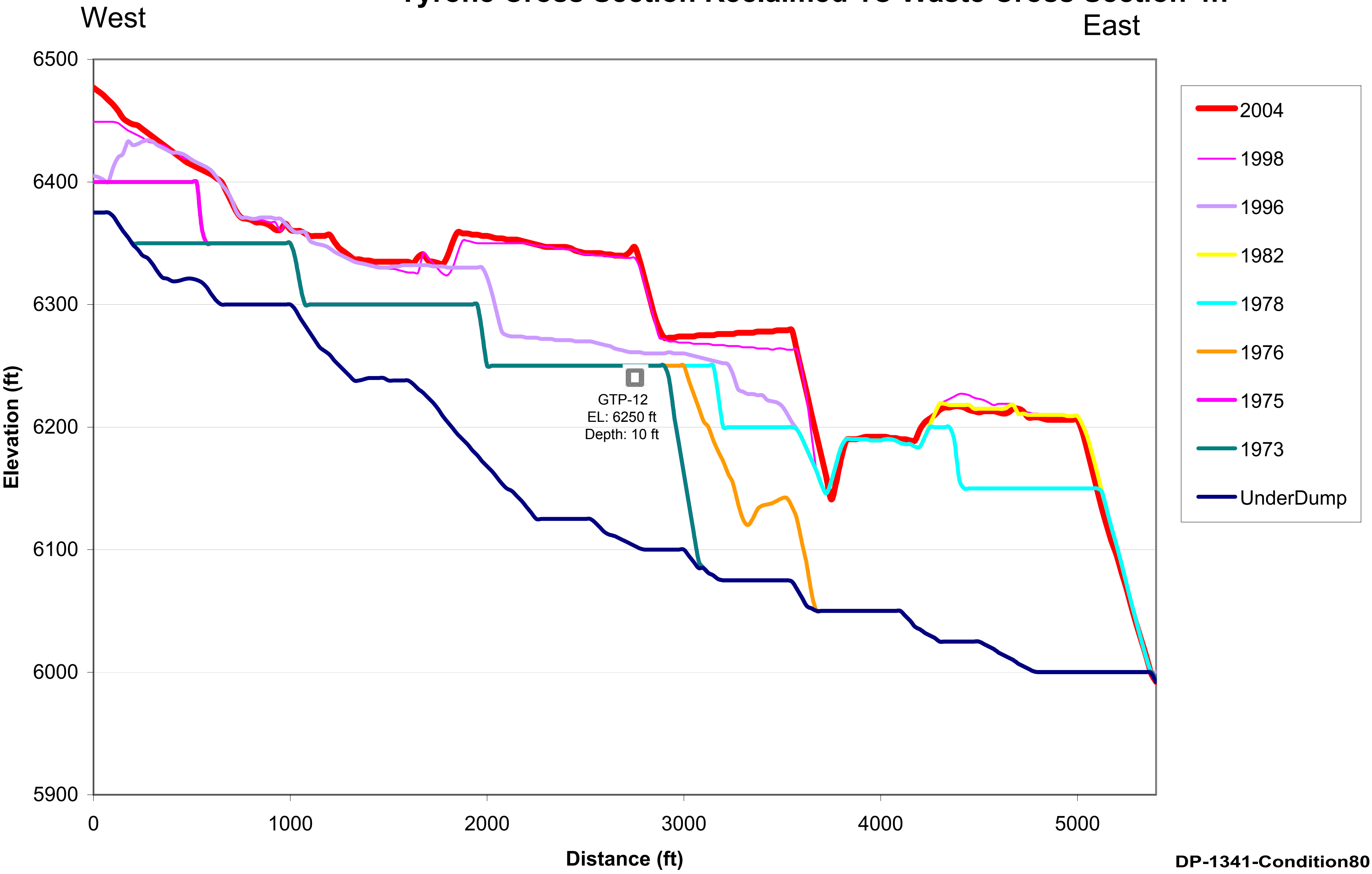
Tyrone Cross Section Reclaimed 1C Waste Cross Section 1h



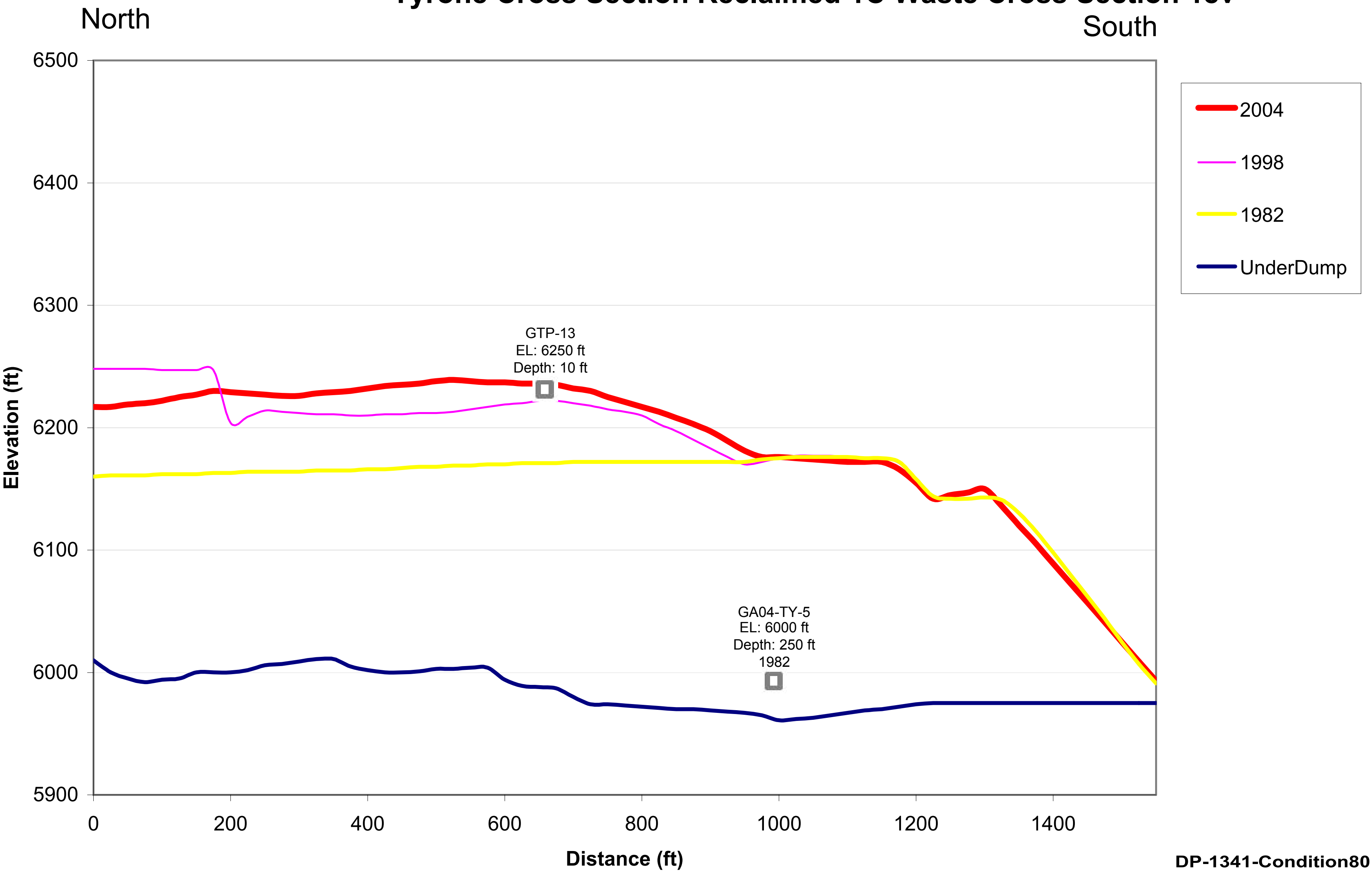
Tyrone Cross Section Reclaimed 1C Waste Cross Section 18v



Tyrone Cross Section Reclaimed 1C Waste Cross Section 4h



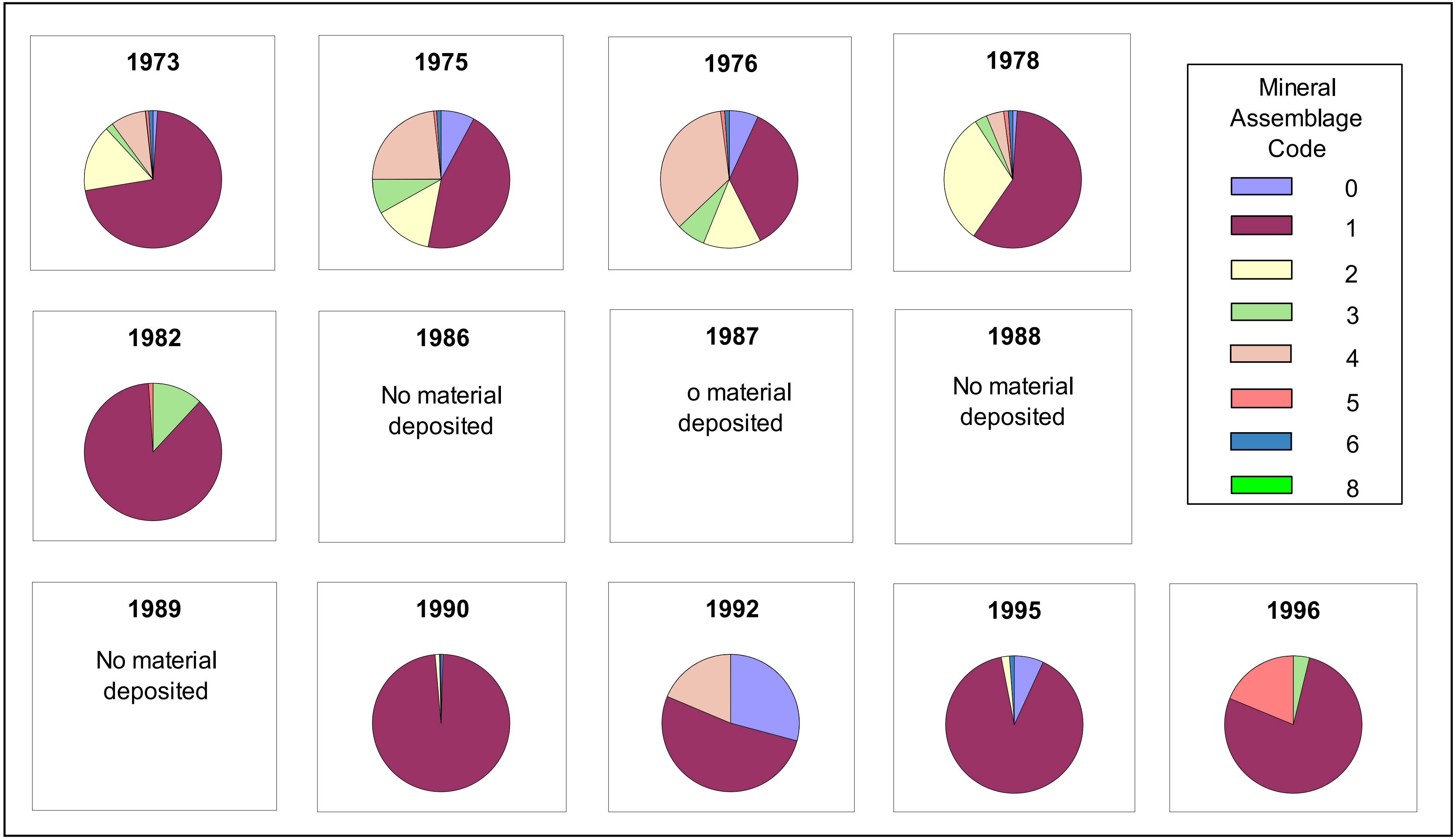
Tyrone Cross Section Reclaimed 1C Waste Cross Section 18v



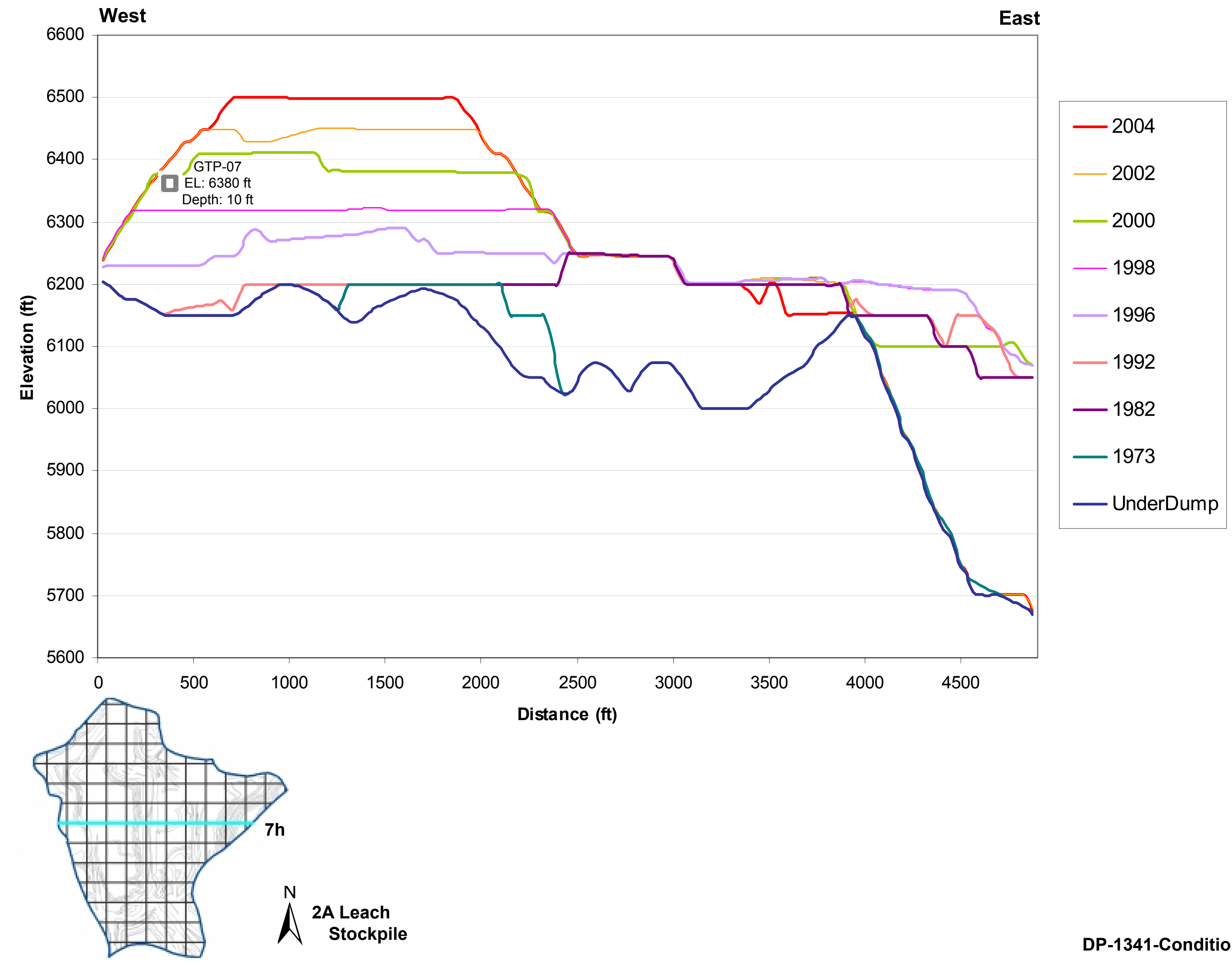
DP-1341-Condition80

COMPOSITIONAL MODELS – 2A and 2B Leach Stockpiles

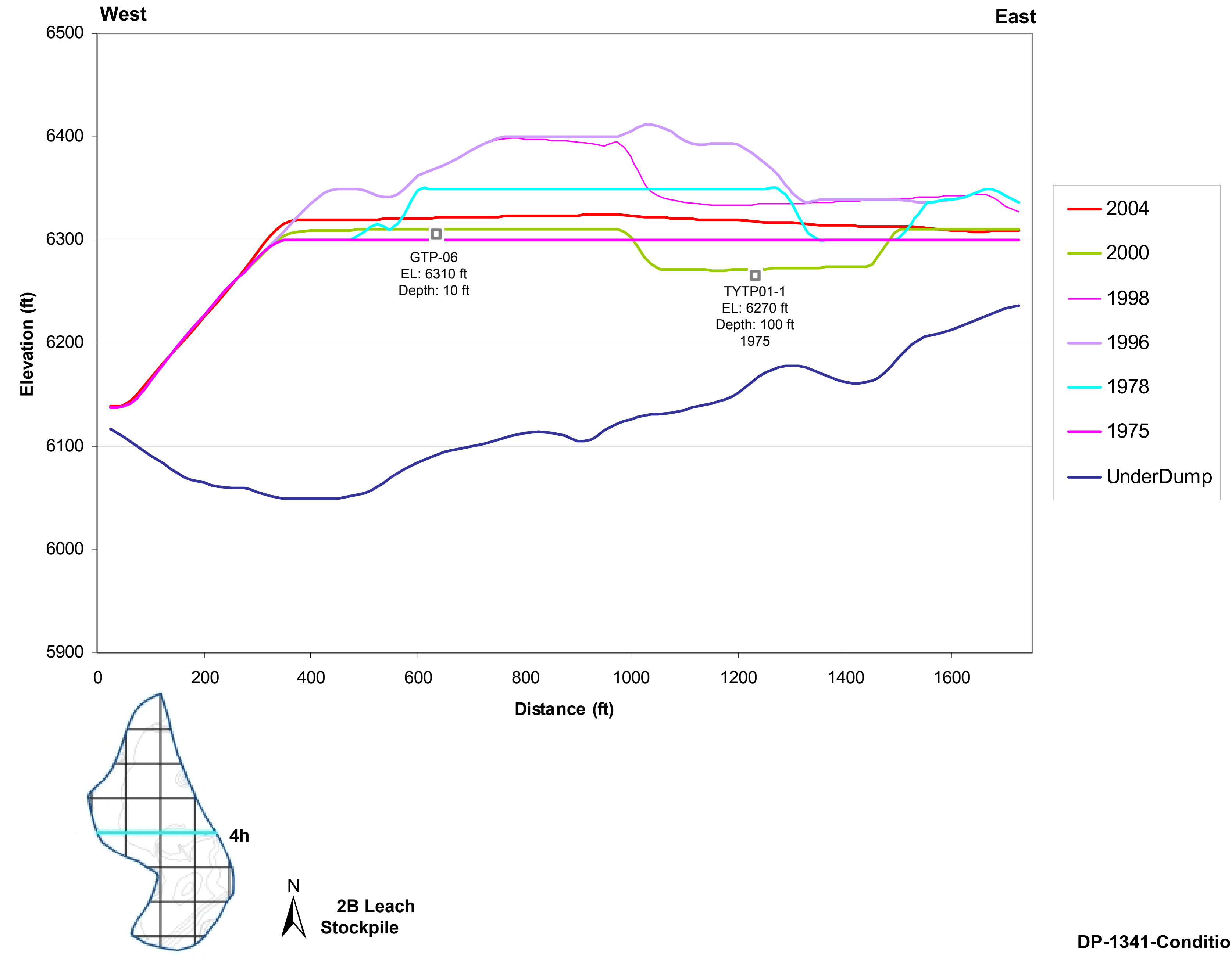
2A and 2B Leach Stockpiles



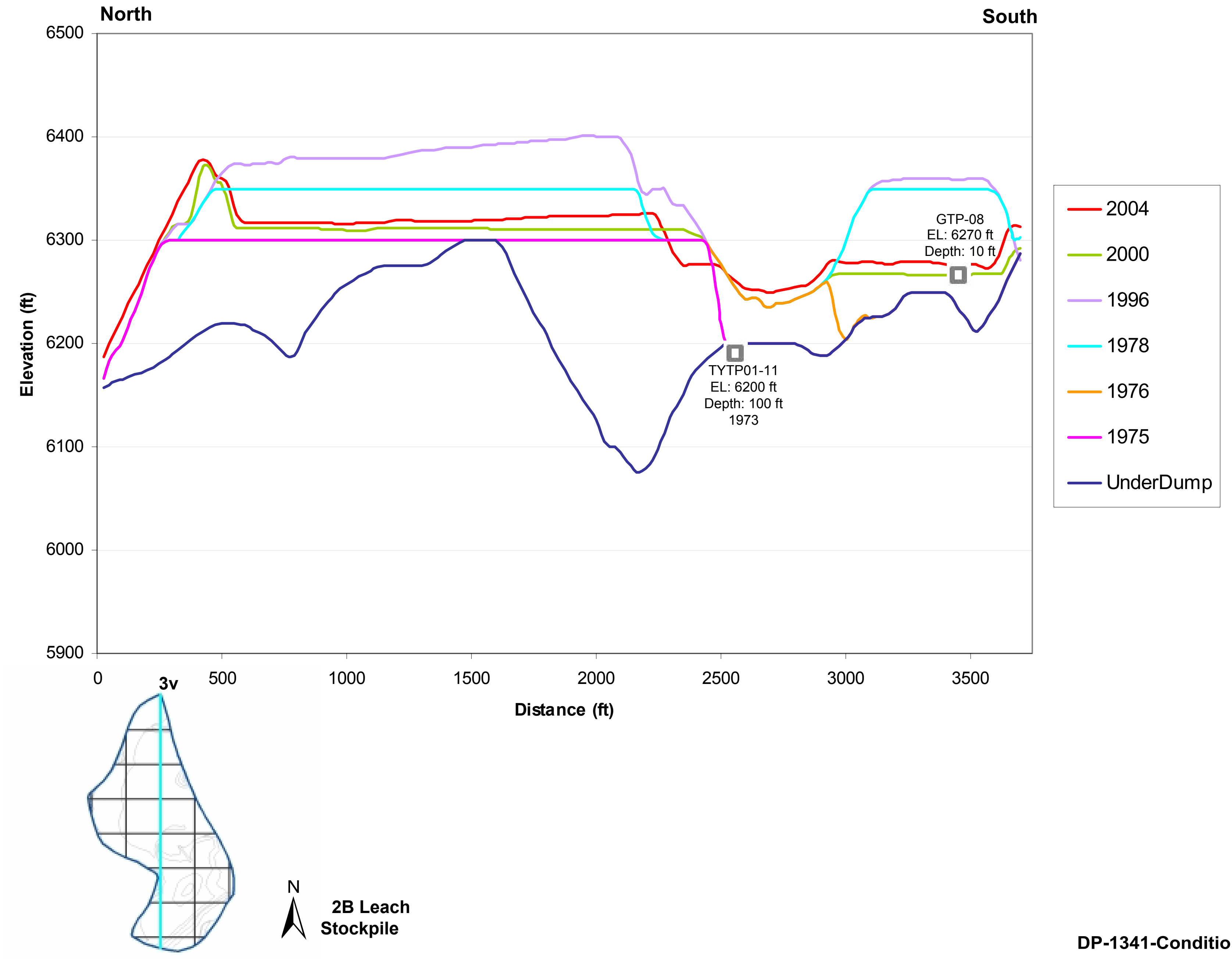
Tyrone Mine - 2A Leach Stockpile - Cross Section 7h

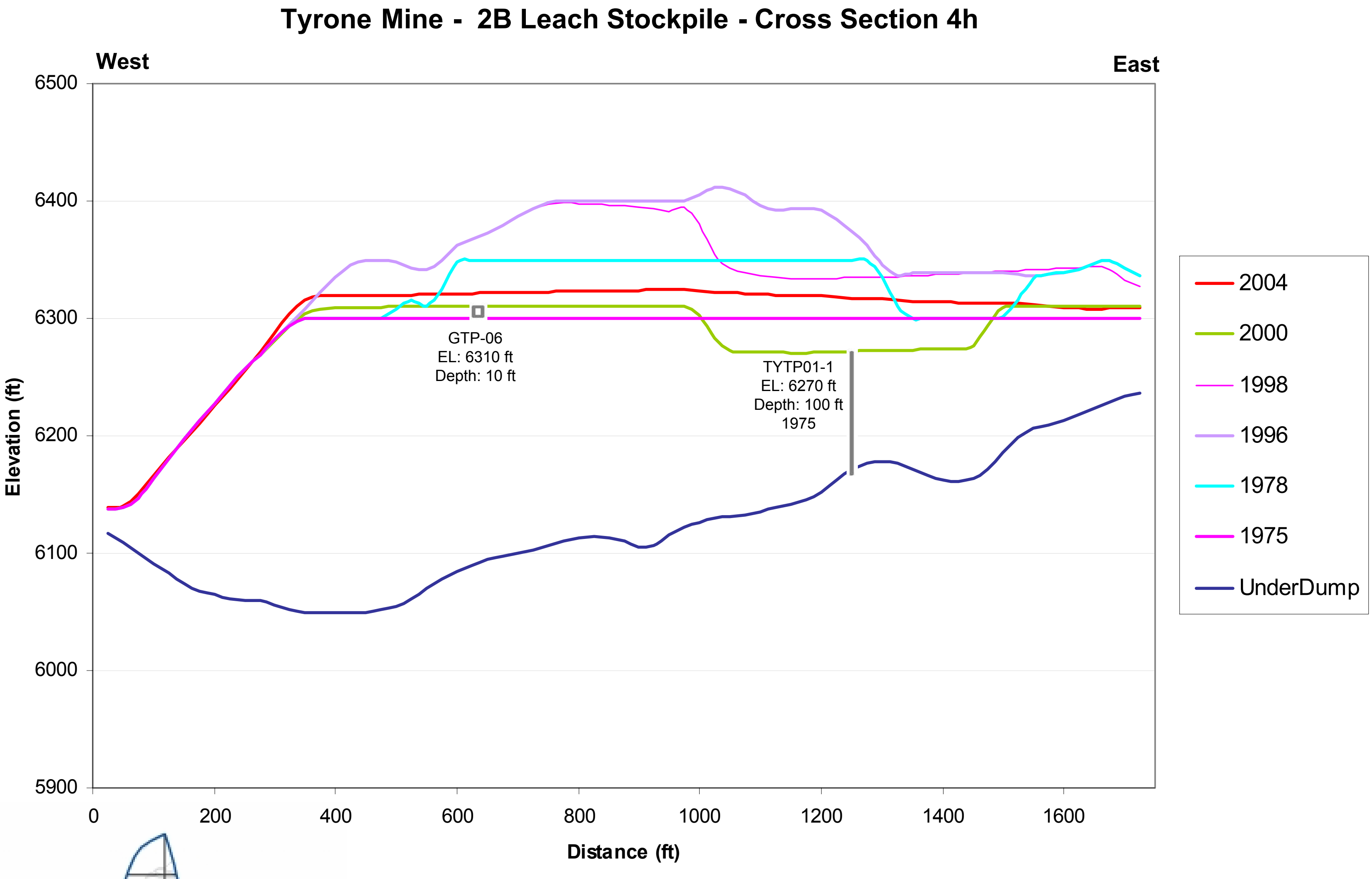


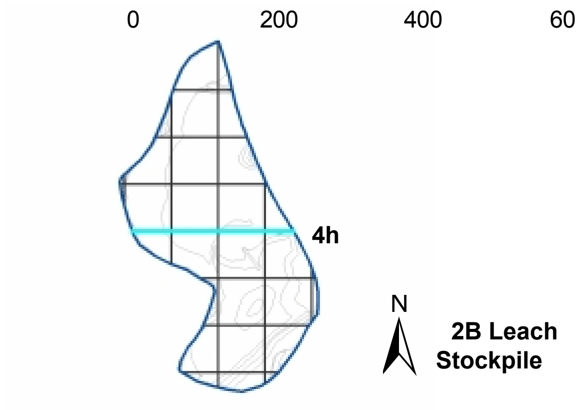
Tyrone Mine - 2B Leach Stockpile - Cross Section 4h



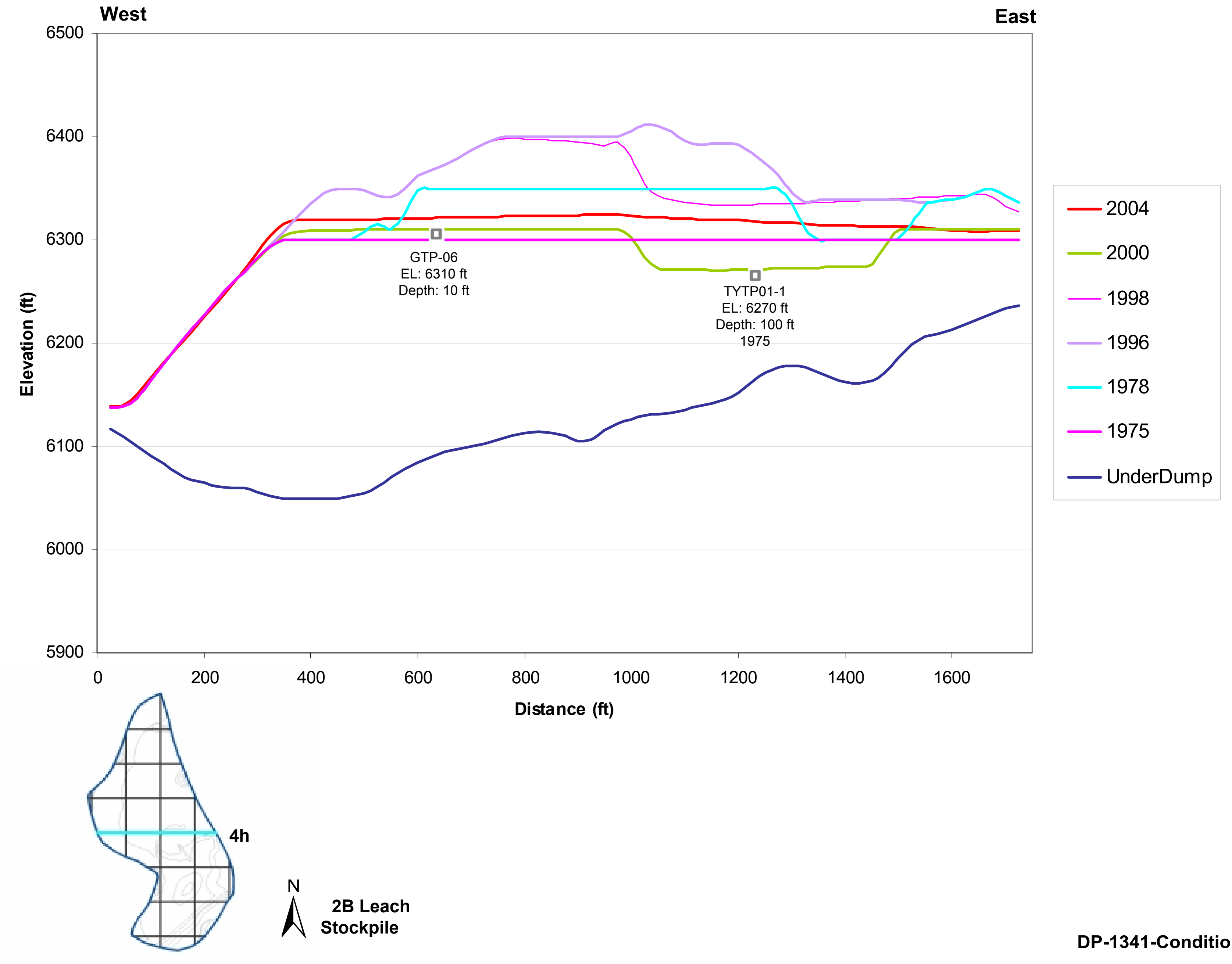
Tyrone Mine - 2B Leach Stockpile - Cross Section 3v



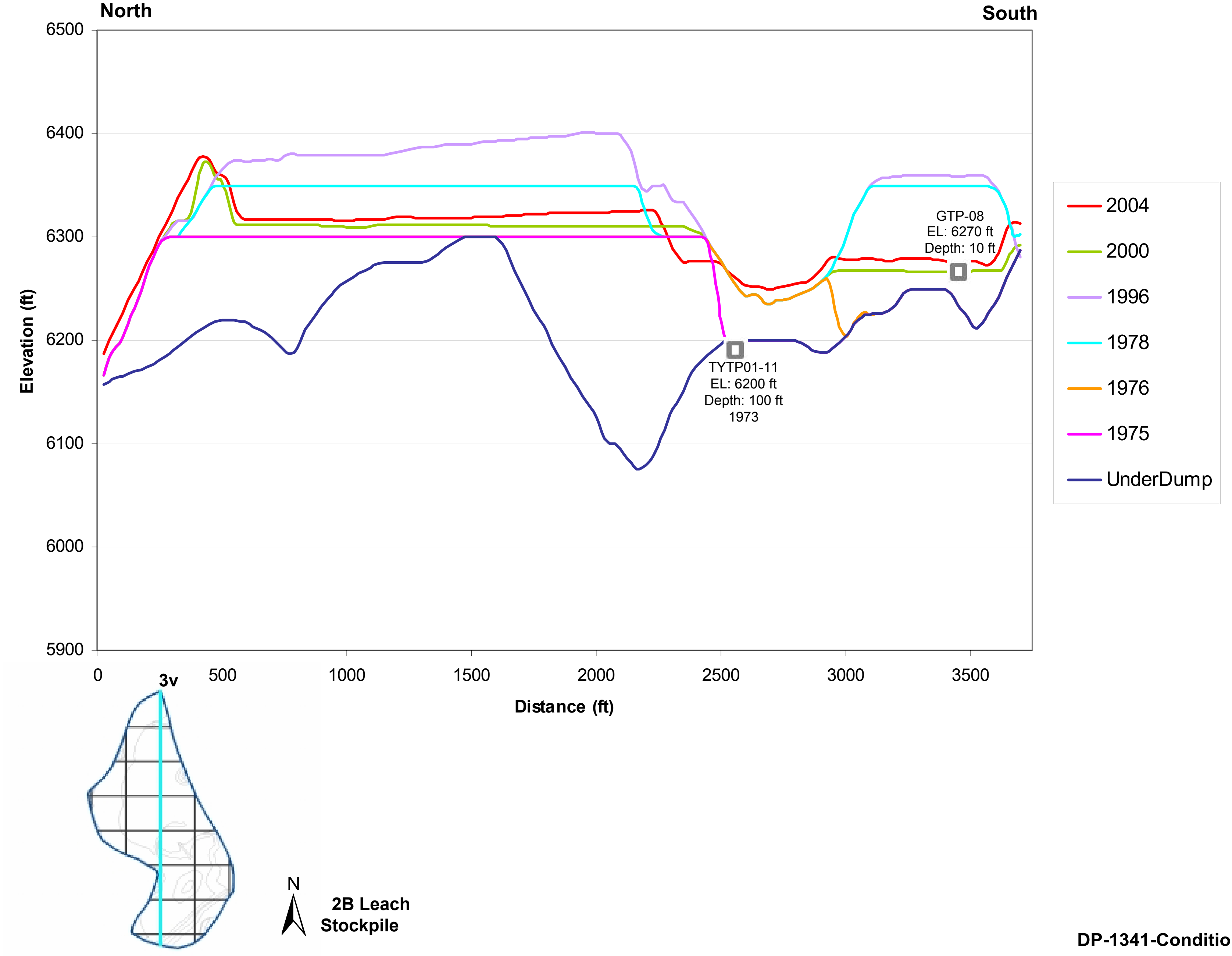

Tyrone Mine - 2B Leach Stockpile - Cross Section 4h
West
East
6500
6400
6300
6200
6100
6000
5900
Elevation (ft)
0
200
400
600
800
1000
1200
1400
1600
Distance (ft)
GTP-06
EL: 6310 ft
Depth: 10 ft
TYTP01-1
EL: 6270 ft
Depth: 100 ft
1975
2004
2000
1998
1996
1978
1975
UnderDump


4h
N
2B Leach
Stockpile

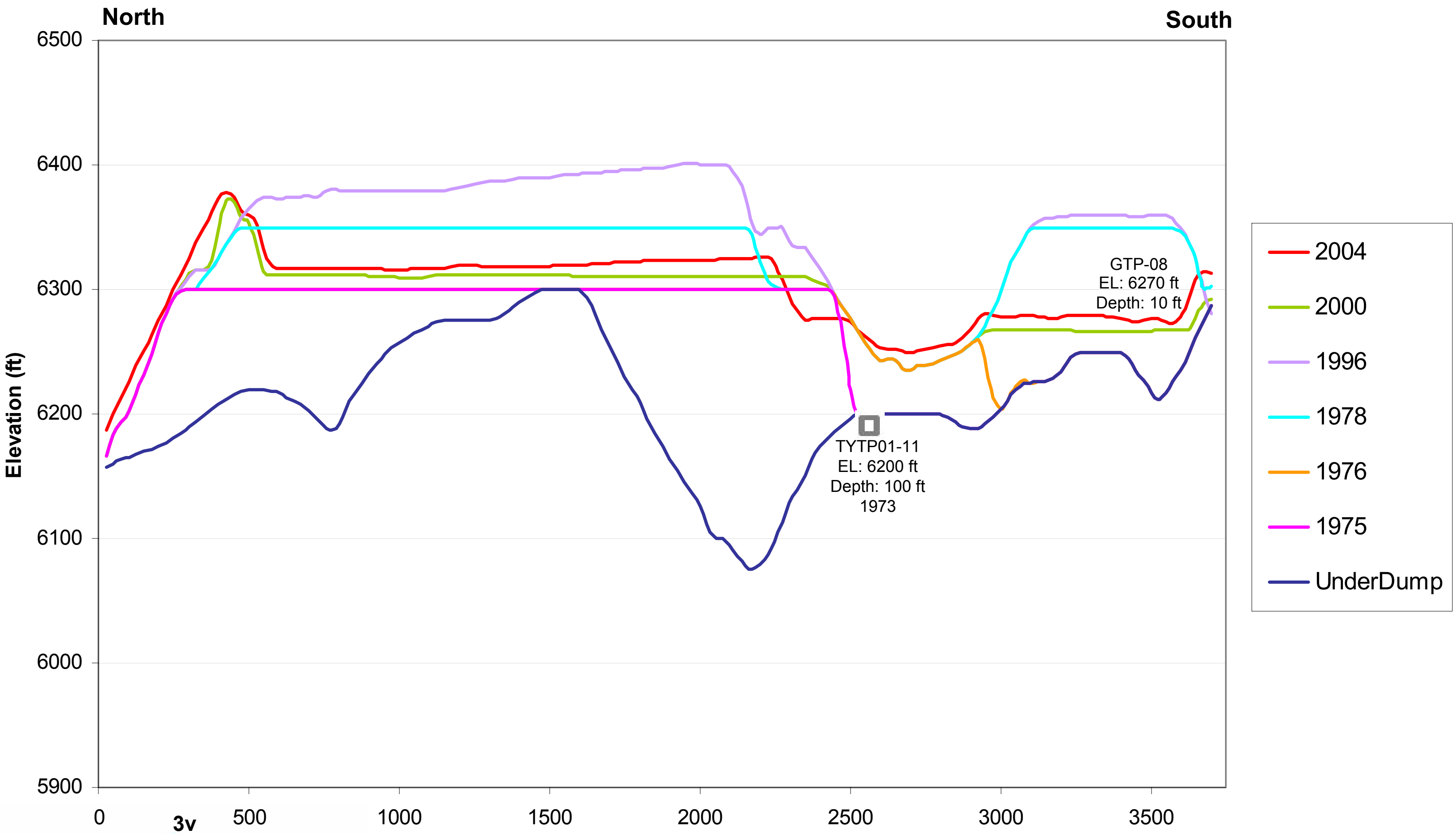
Tyrone Mine - 2B Leach Stockpile - Cross Section 4h

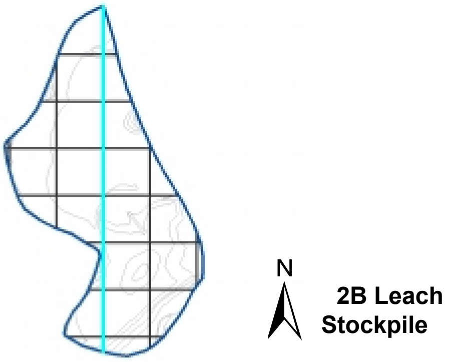


Tyrone Mine - 2B Leach Stockpile - Cross Section 3v

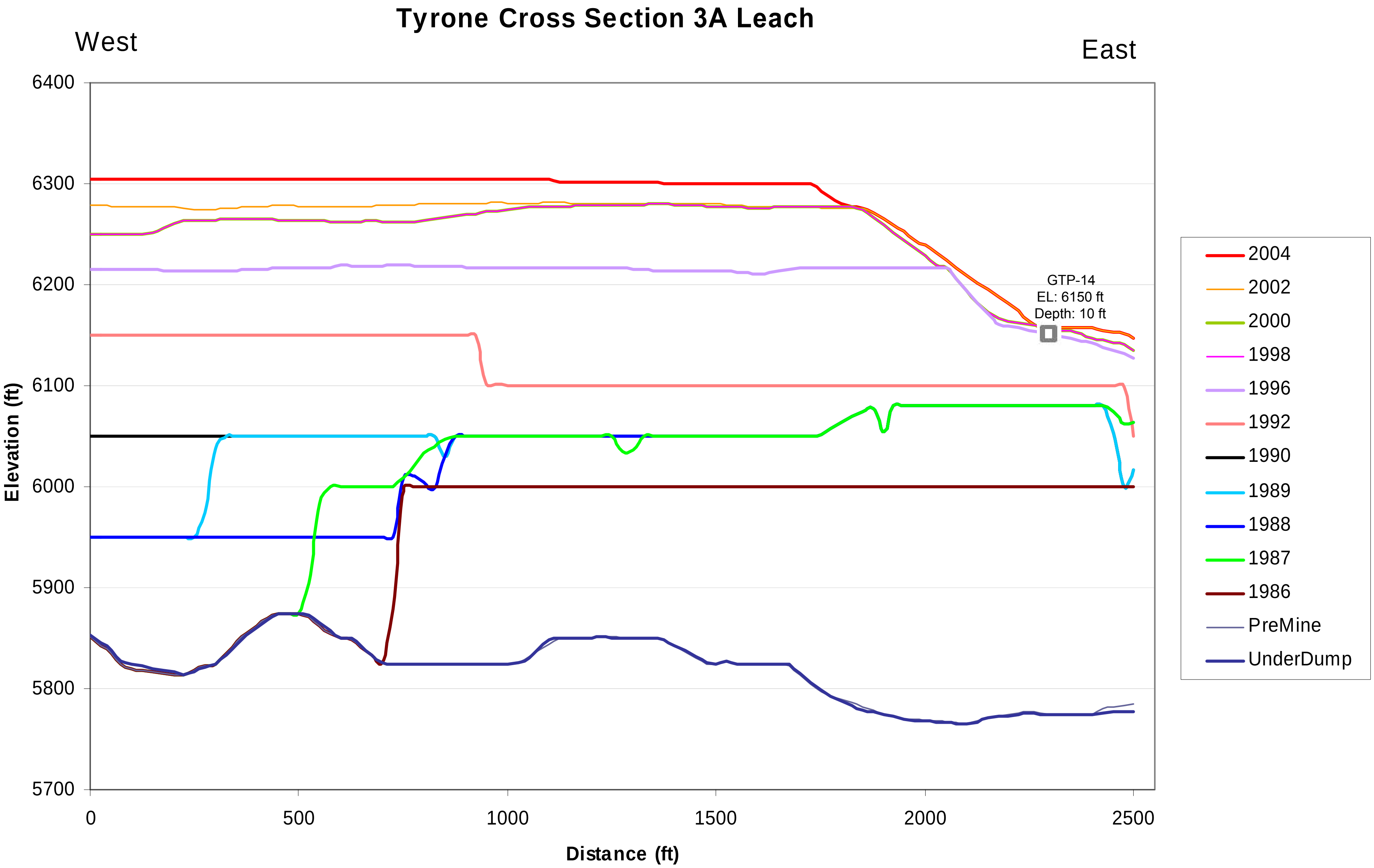


Tyrone Mine - 2B Leach Stockpile - Cross Section 3v

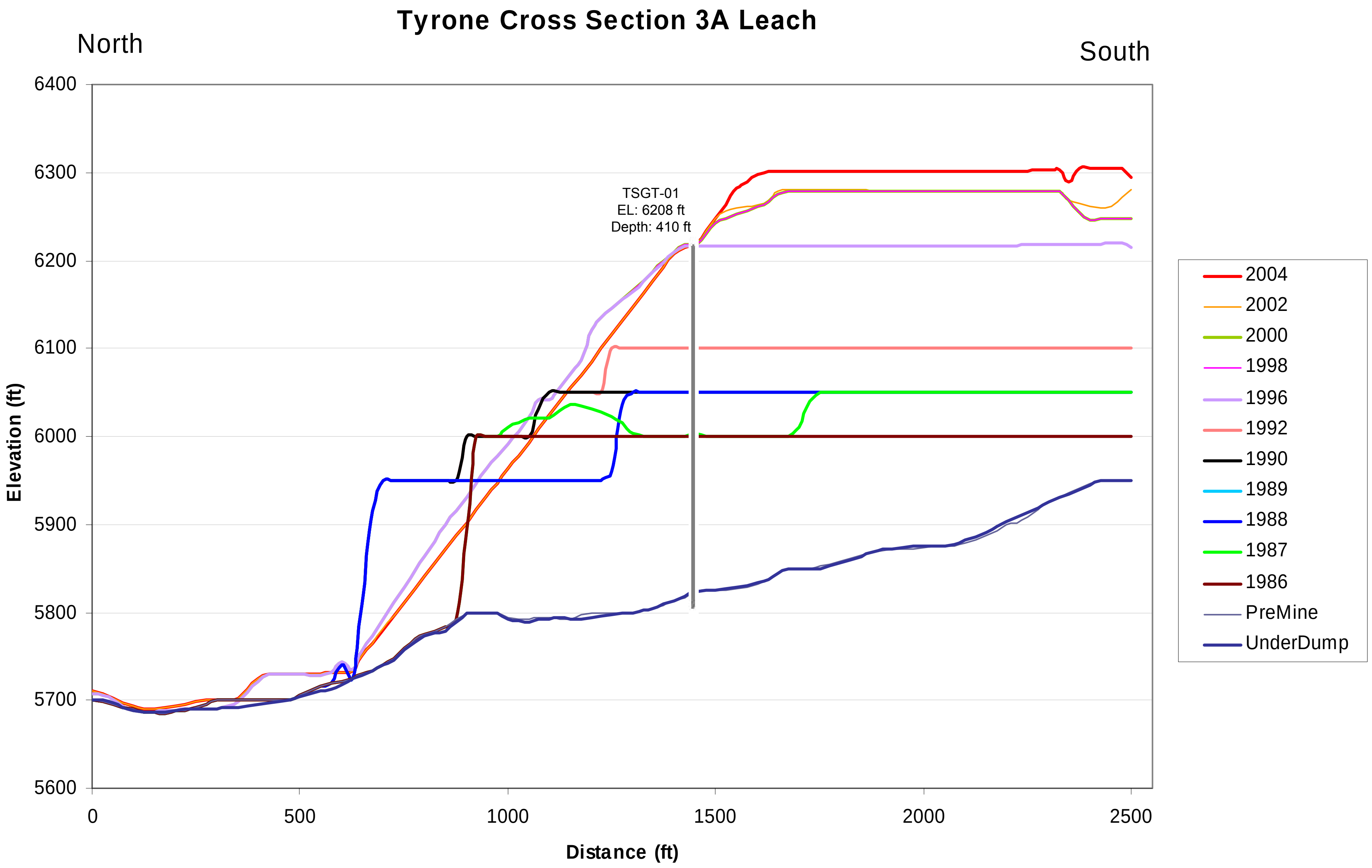




COMPOSITIONAL MODELS – 3A Leach Stockpile

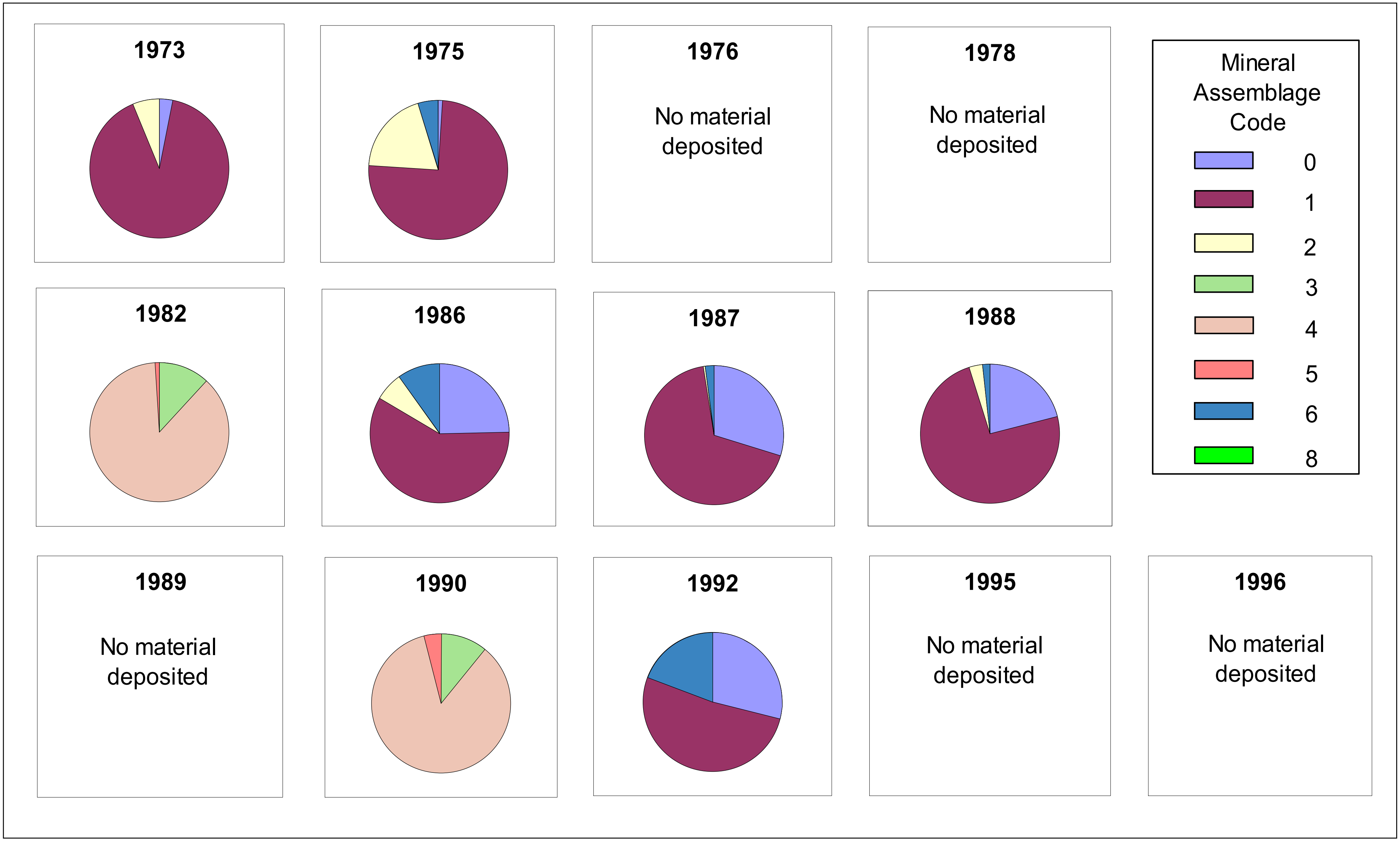


Tyrone Cross Section 3A Leach
West
East
6400
6300
6200
6100
6000
5900
5800
5700
Elevation (ft)
0
500
1000
1500
2000
2500
Distance (ft)
GTP-14
EL: 6150 ft
Depth: 10 ft
2004
2002
2000
1998
1996
1992
1990
1989
1988
1987
1986
PreMine
UnderDump

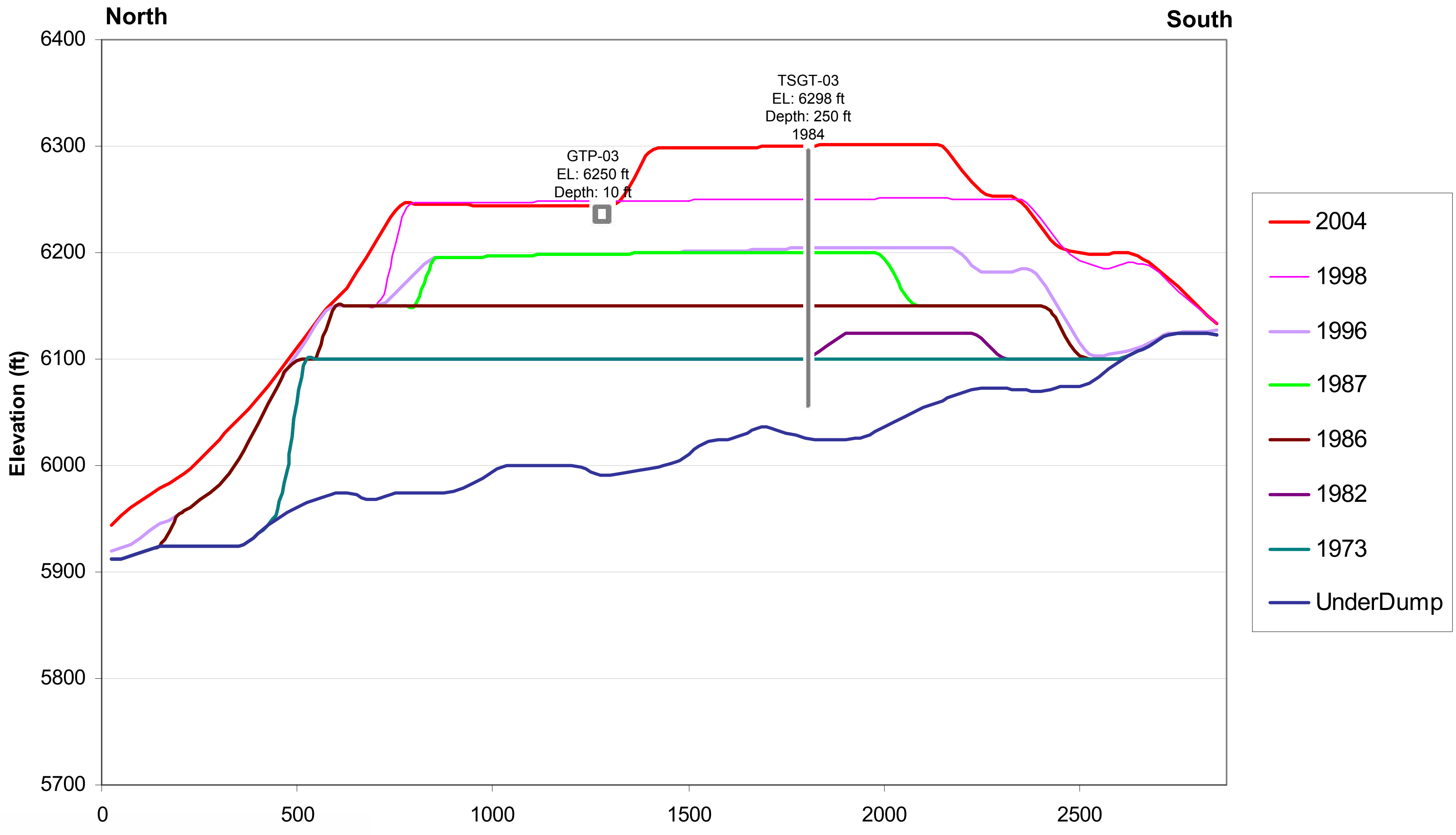

Tyrone Cross Section 3A Leach
North
South
TSGT-01
EL: 6208 ft
Depth: 410 ft
Elevation (ft)
6400
6300
6200
6100
6000
5900
5800
5700
5600
0
500
1000
1500
2000
2500
Distance (ft)
2004
2002
2000
1998
1996
1992
1990
1989
1988
1987
1986
PreMine
UnderDump

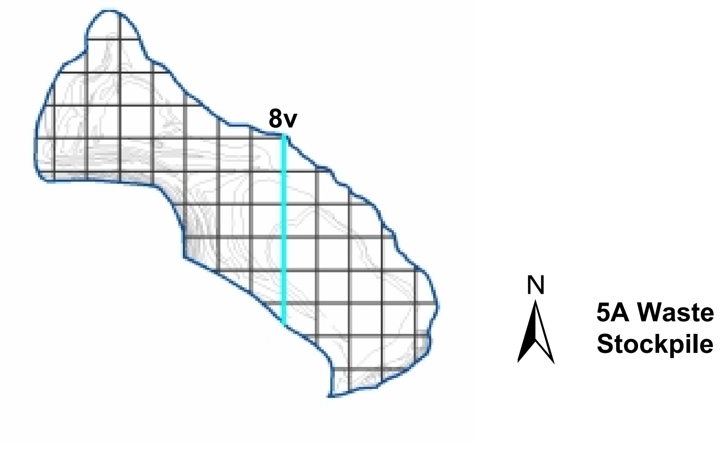
COMPOSITIONAL MODELS – 5A Waste Stockpile

5A Waste Stockpile

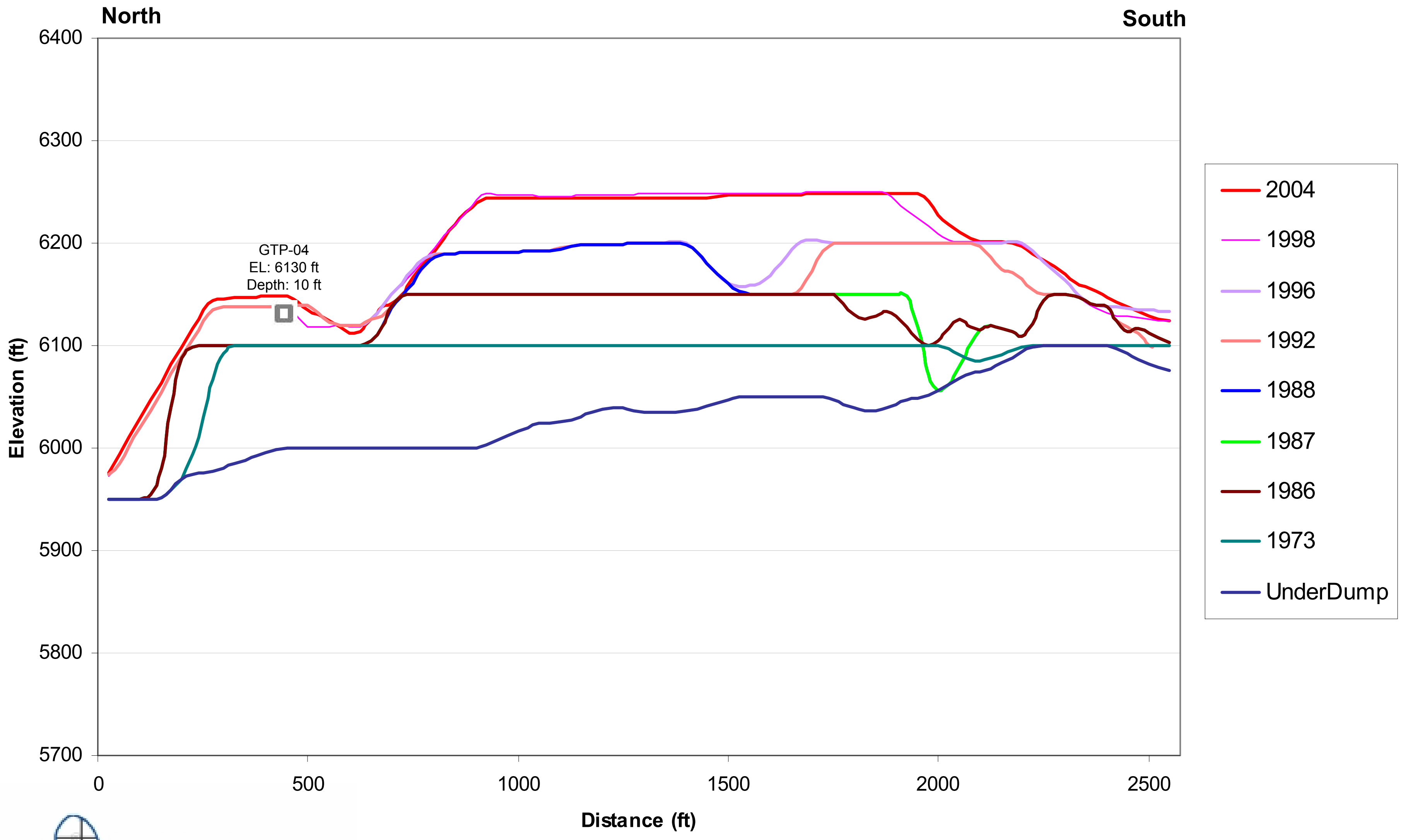


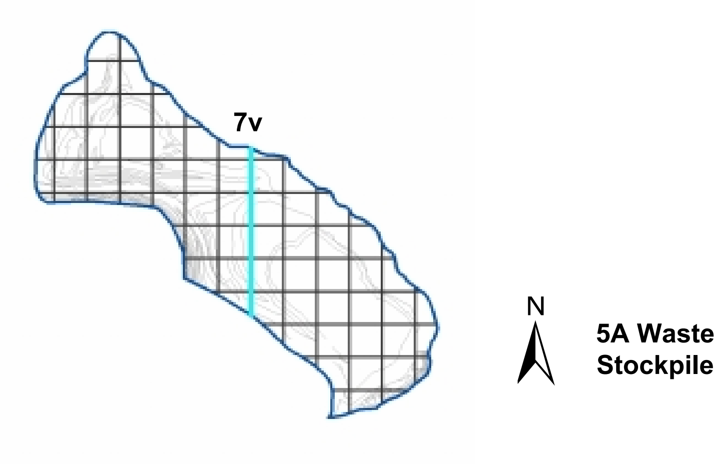
Tyrone Mine - 5A Waste Stockpile - Cross Section 8v



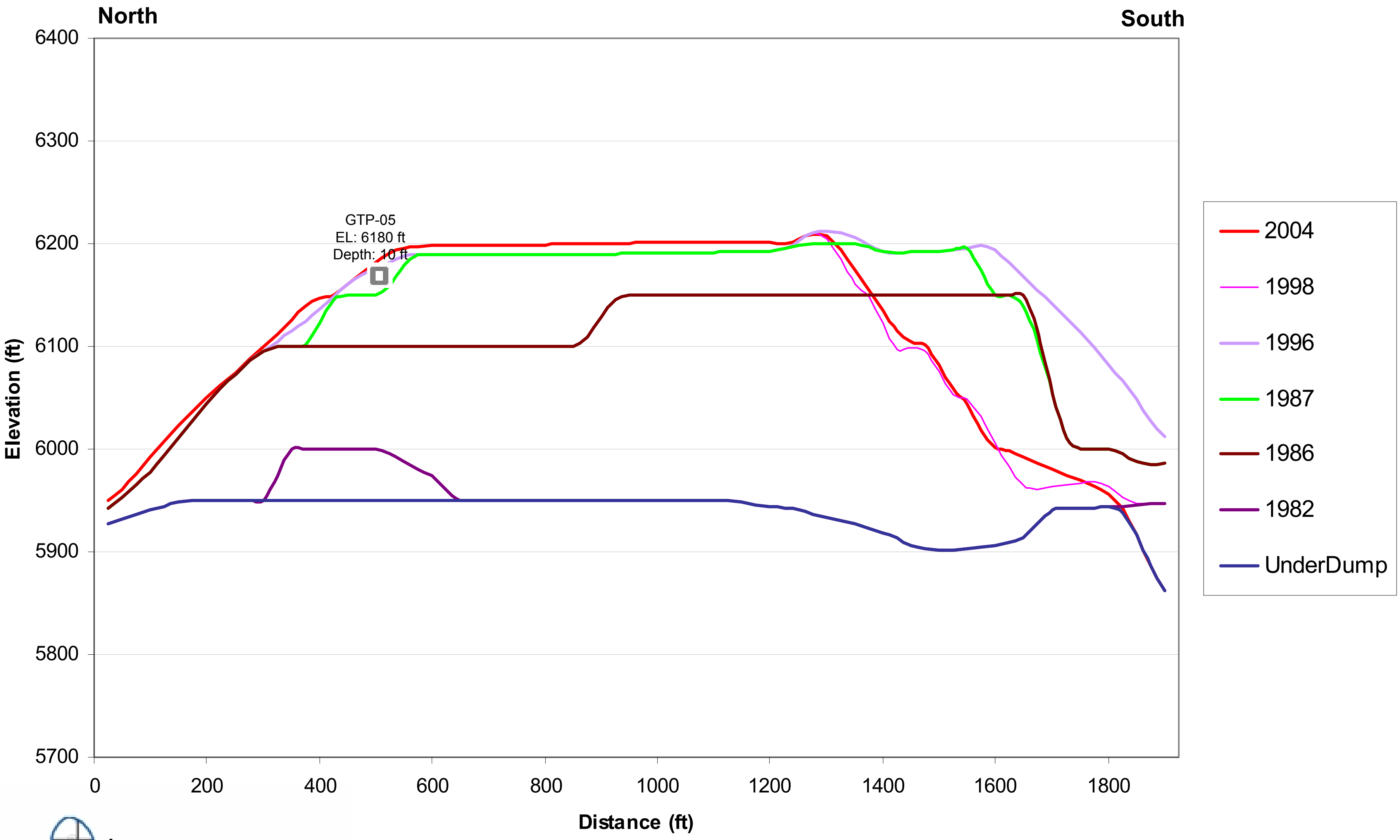


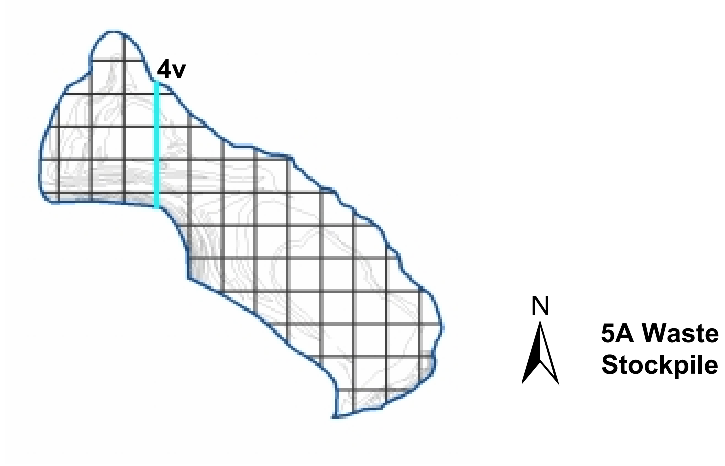
Tyrone Mine - 5A Waste Stockpile - Cross Section 7v



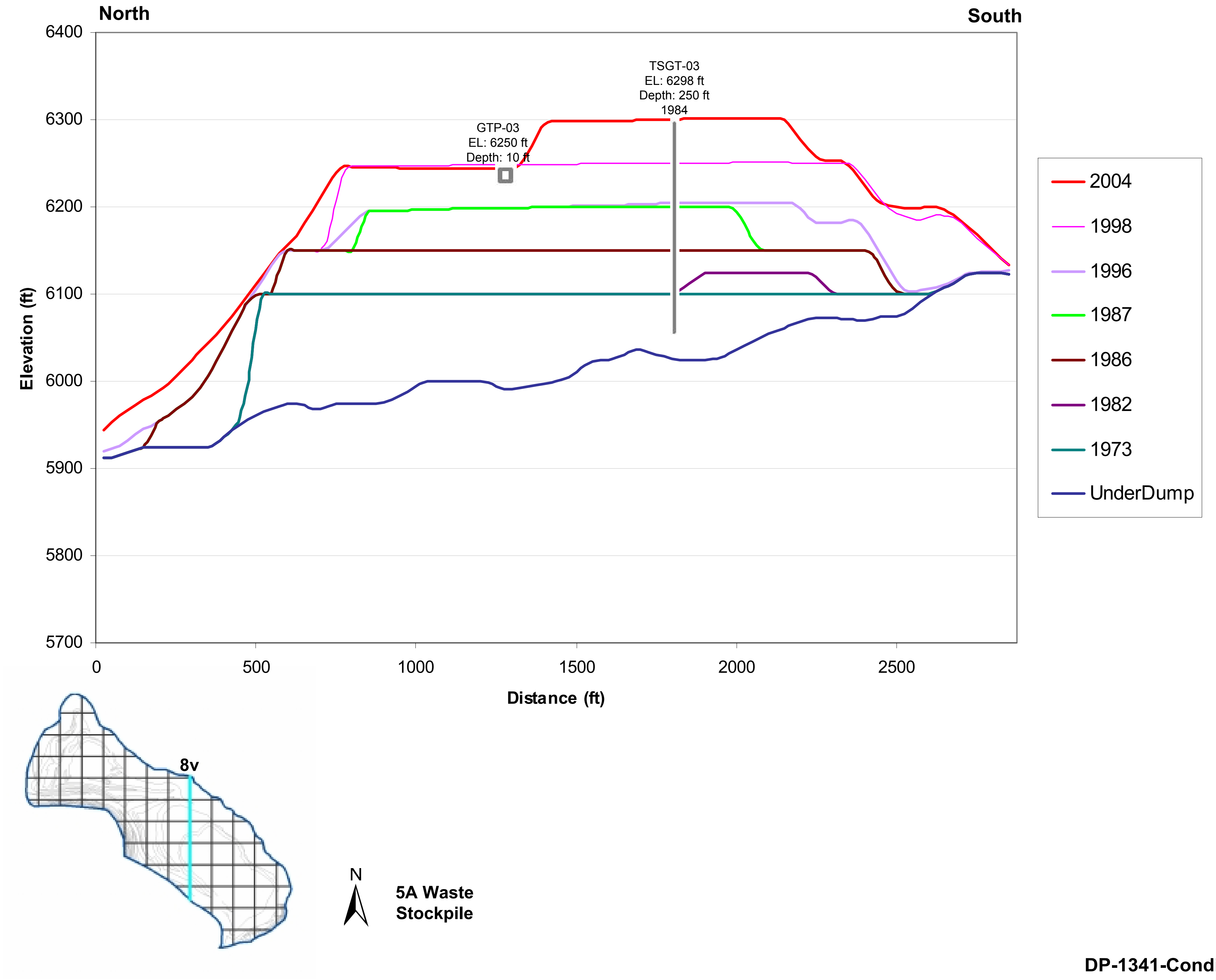


Tyrone Mine - 5A Waste Stockpile - Cross Section 4v



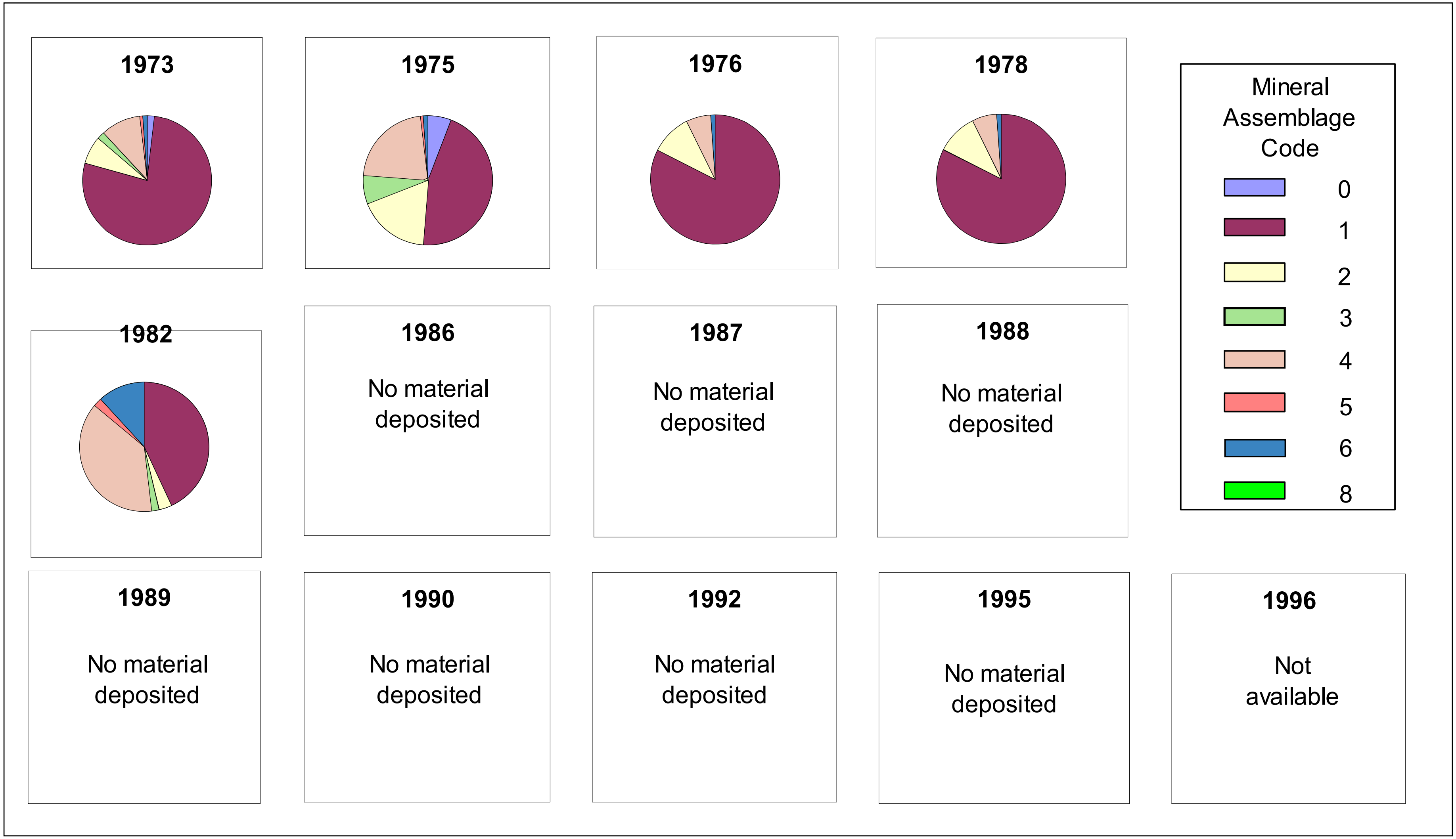


Tyrone Mine - 5A Waste Stockpile - Cross Section 8v

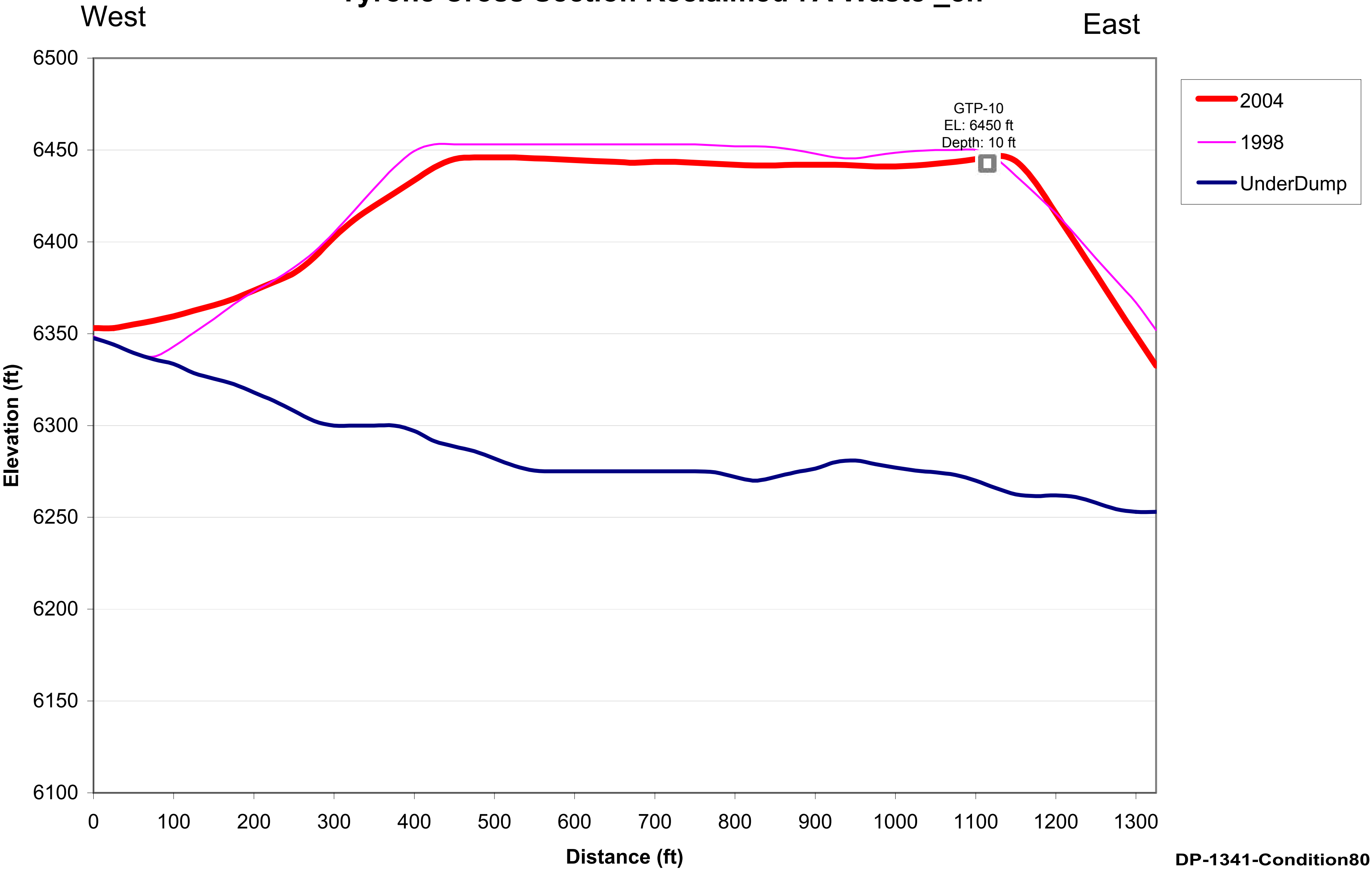


COMPOSITIONAL MODELS – Reclaimed 7A Waste Stockpiles

Reclaimed 7A Waste Stockpile

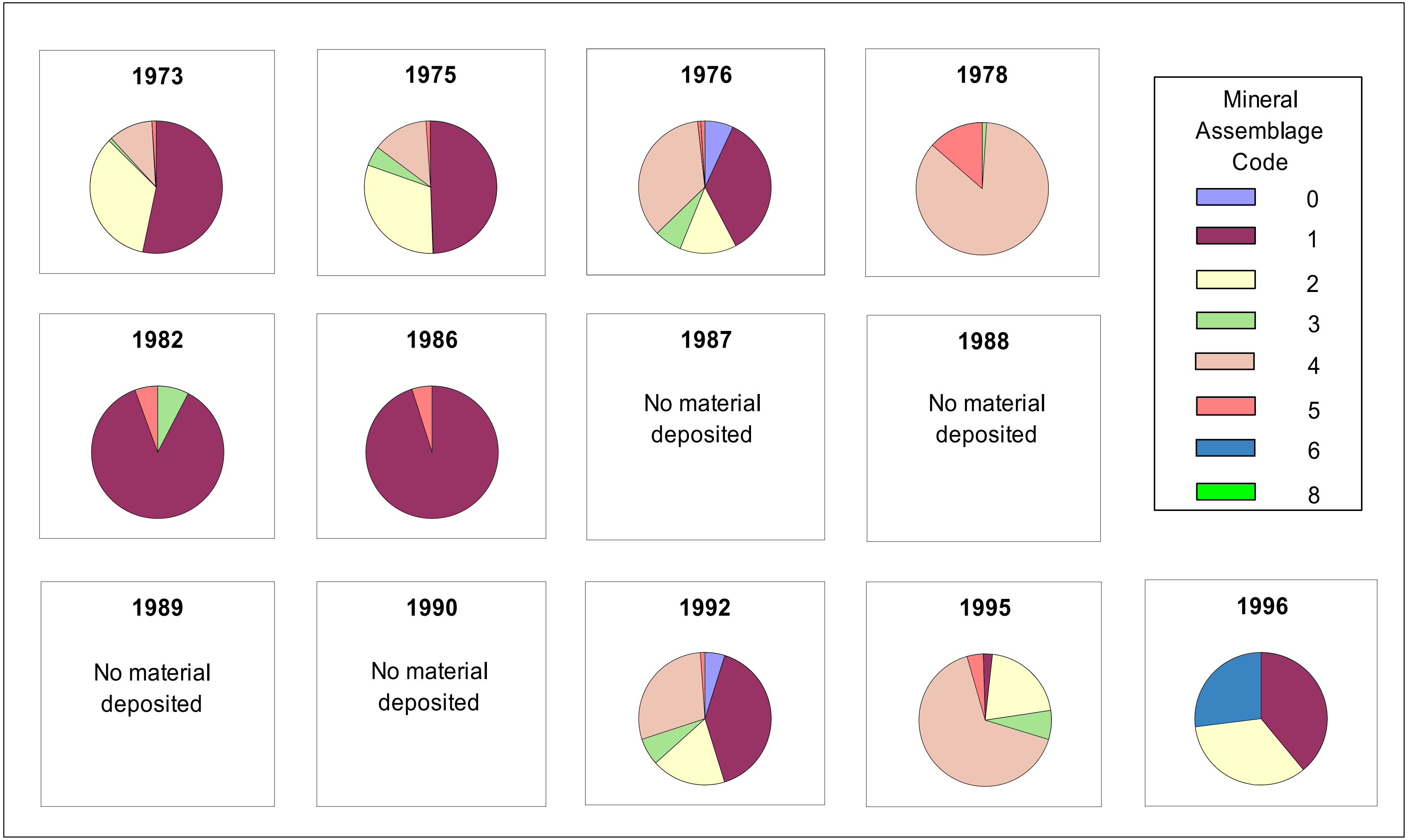


Tyrone Cross Section Reclaimed 7A Waste _8h

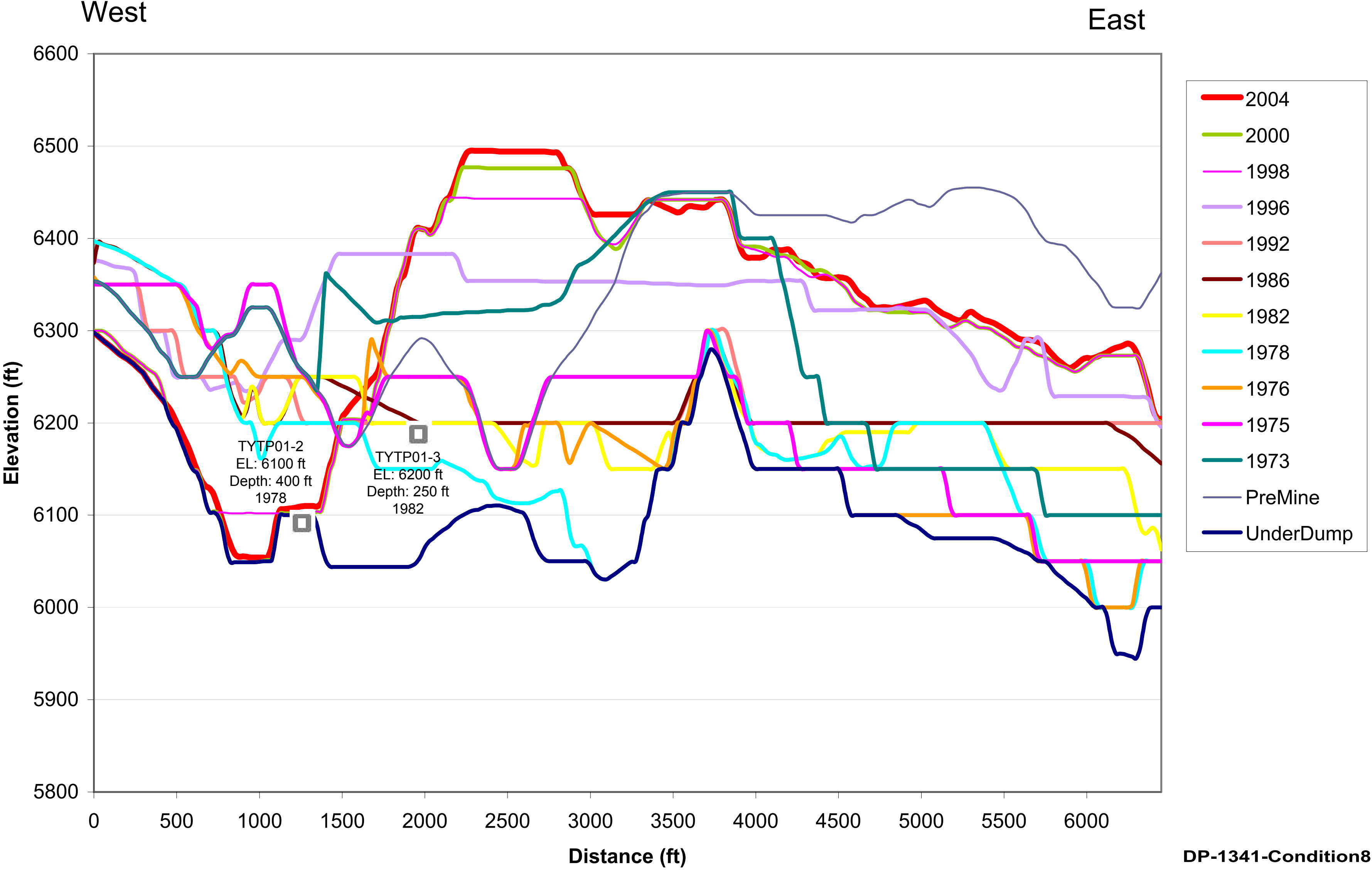


COMPOSITIONAL MODELS –Pit Leach Stockpiles

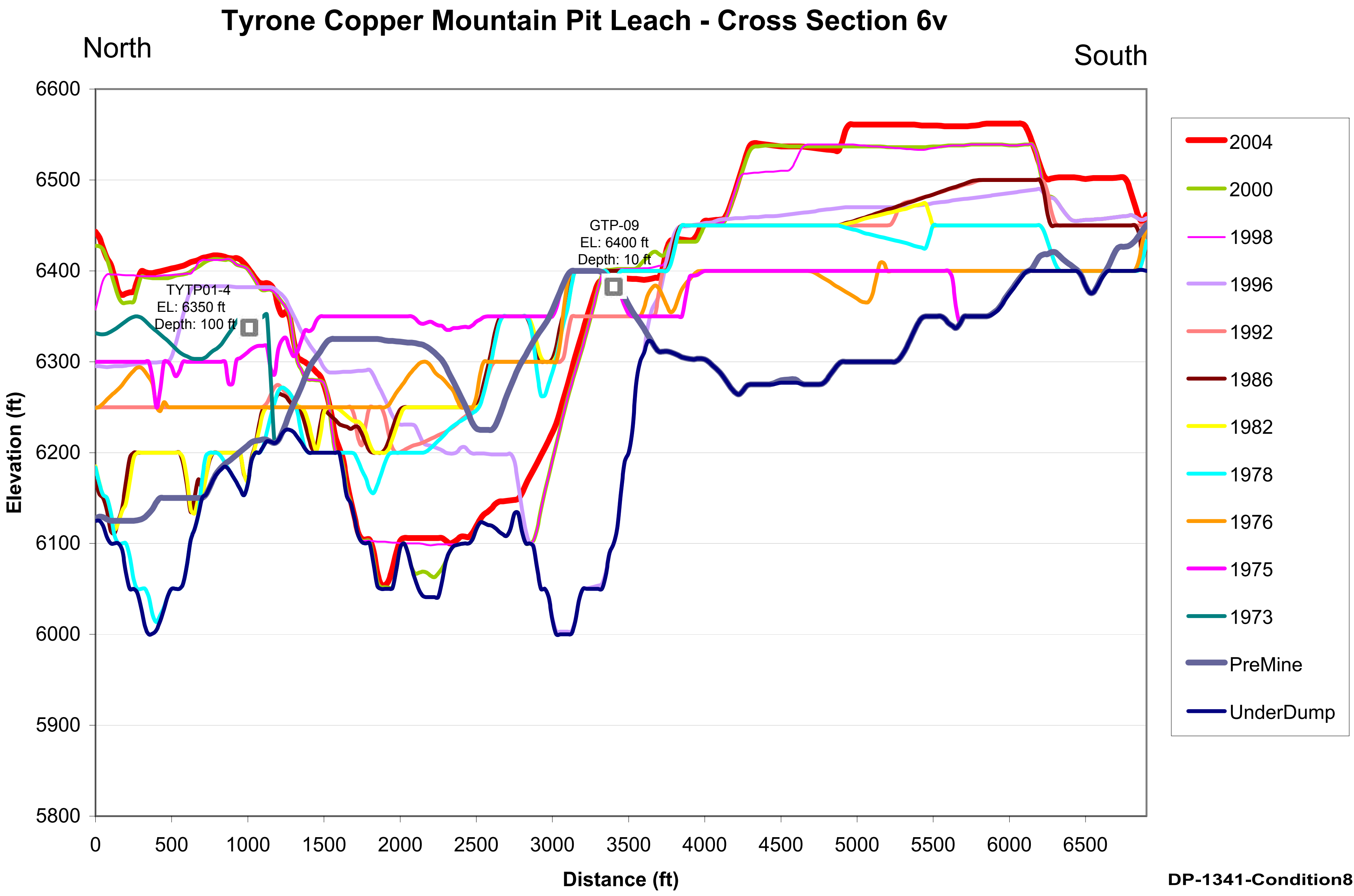
Copper Mountain Pit Leach Stockpile



Tyrone Copper Mountain Pit - Cross Section 4v



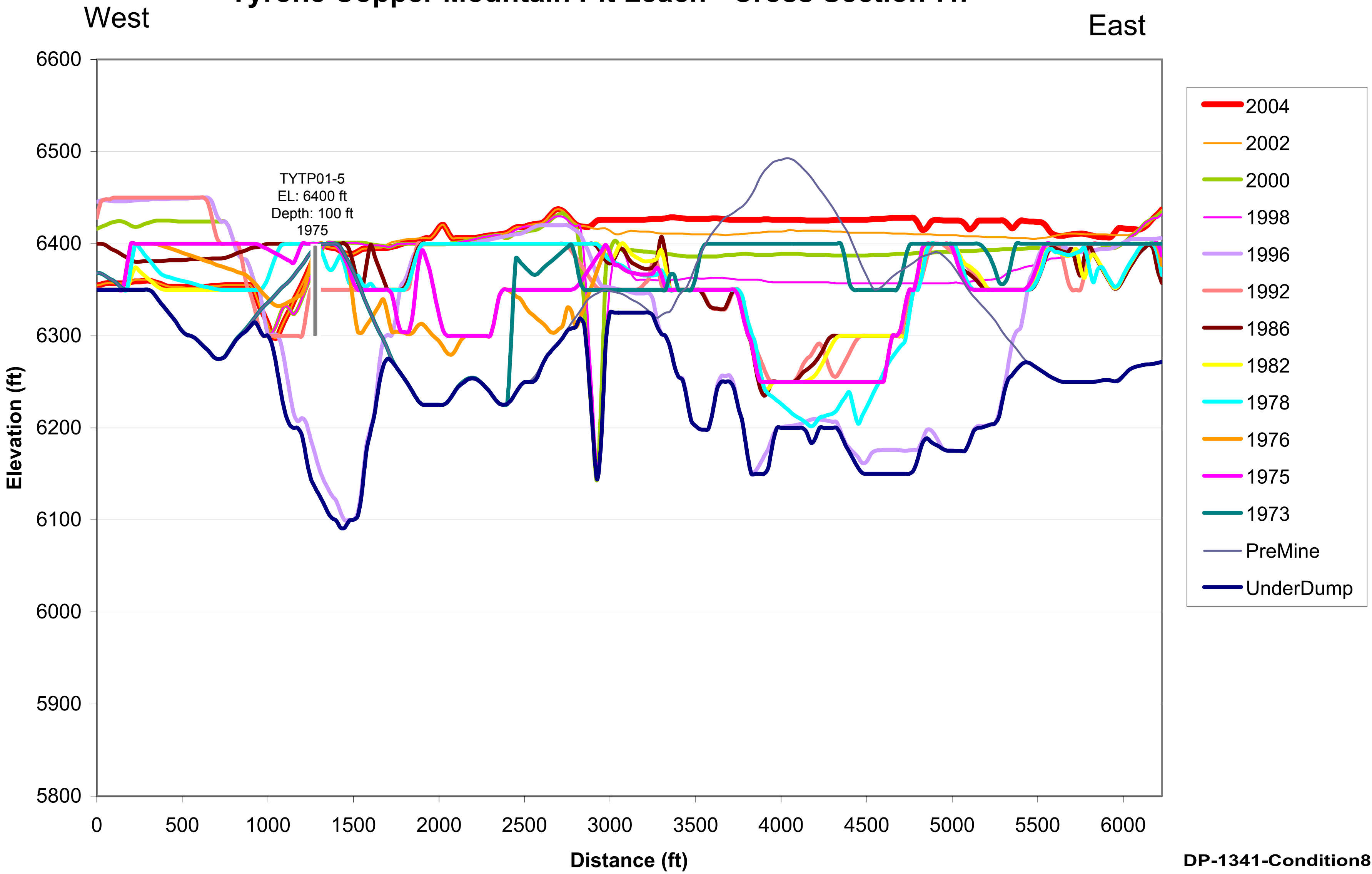
DP-1341-Condition80



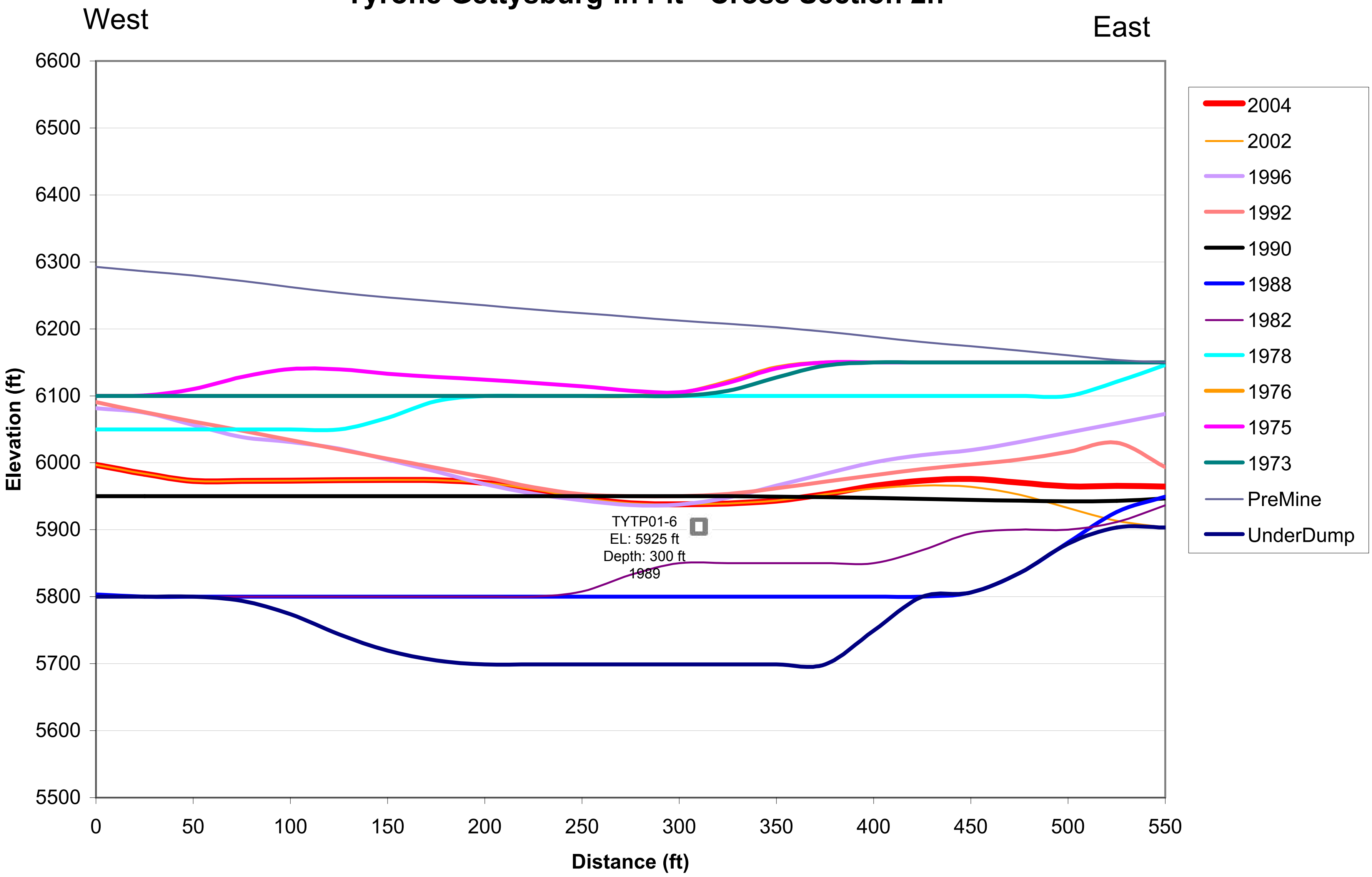
Tyrone Copper Mountain Pit Leach - Cross Section 6v

DP-1341-Condition80

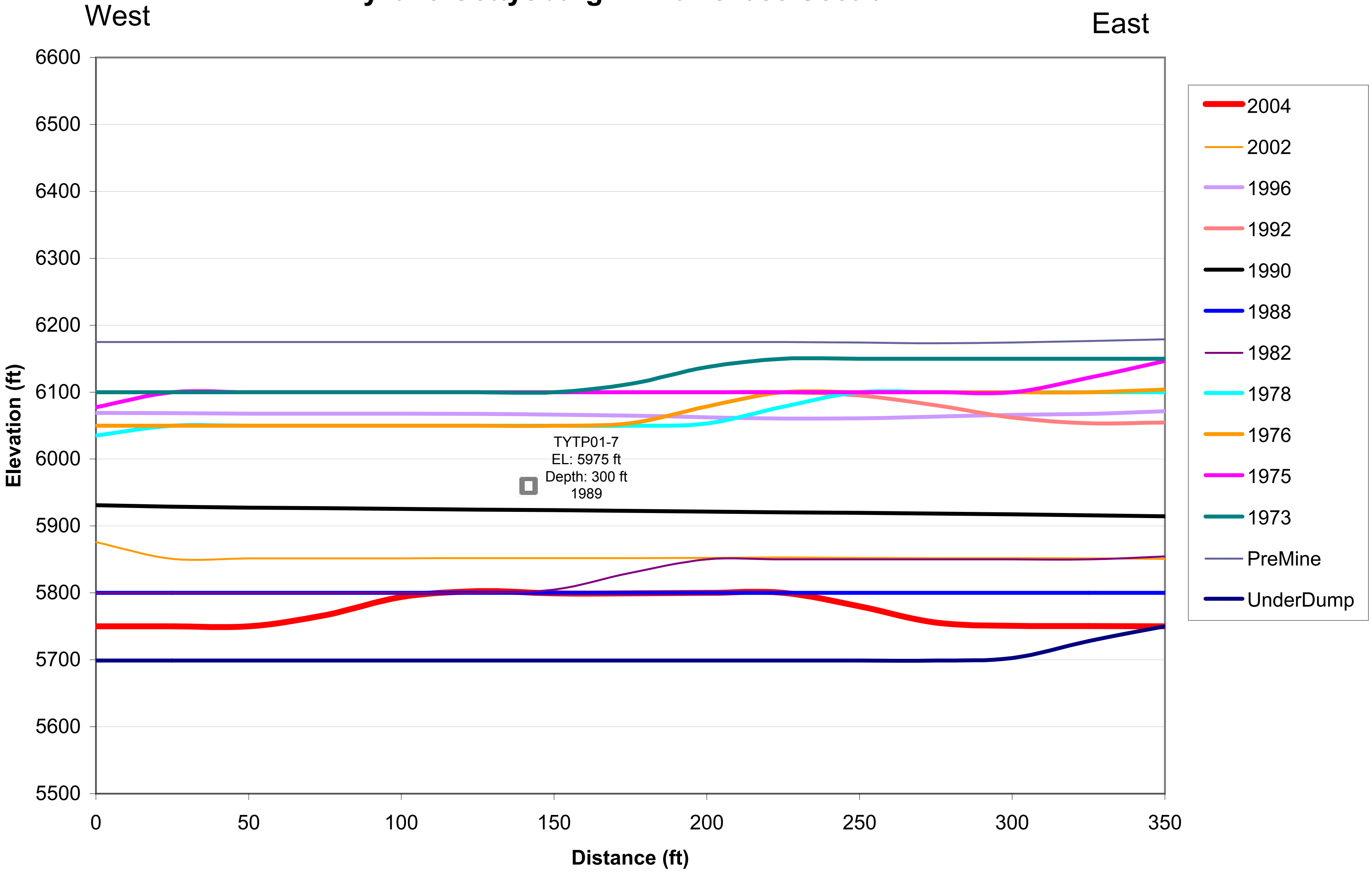
Tyrone Copper Mountain Pit Leach - Cross Section 7h

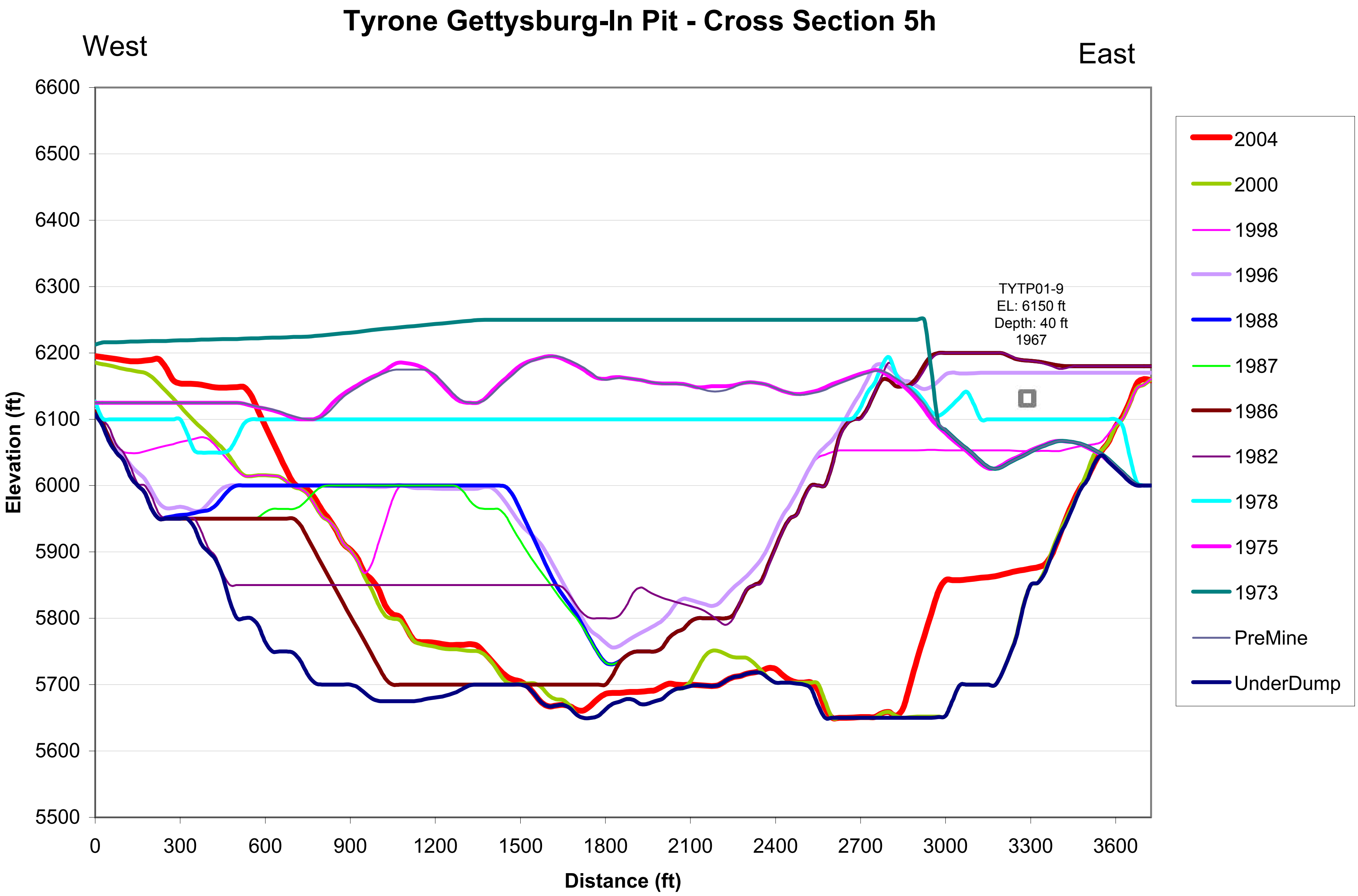


Tyrone Gettysburg-In Pit - Cross Section 2h

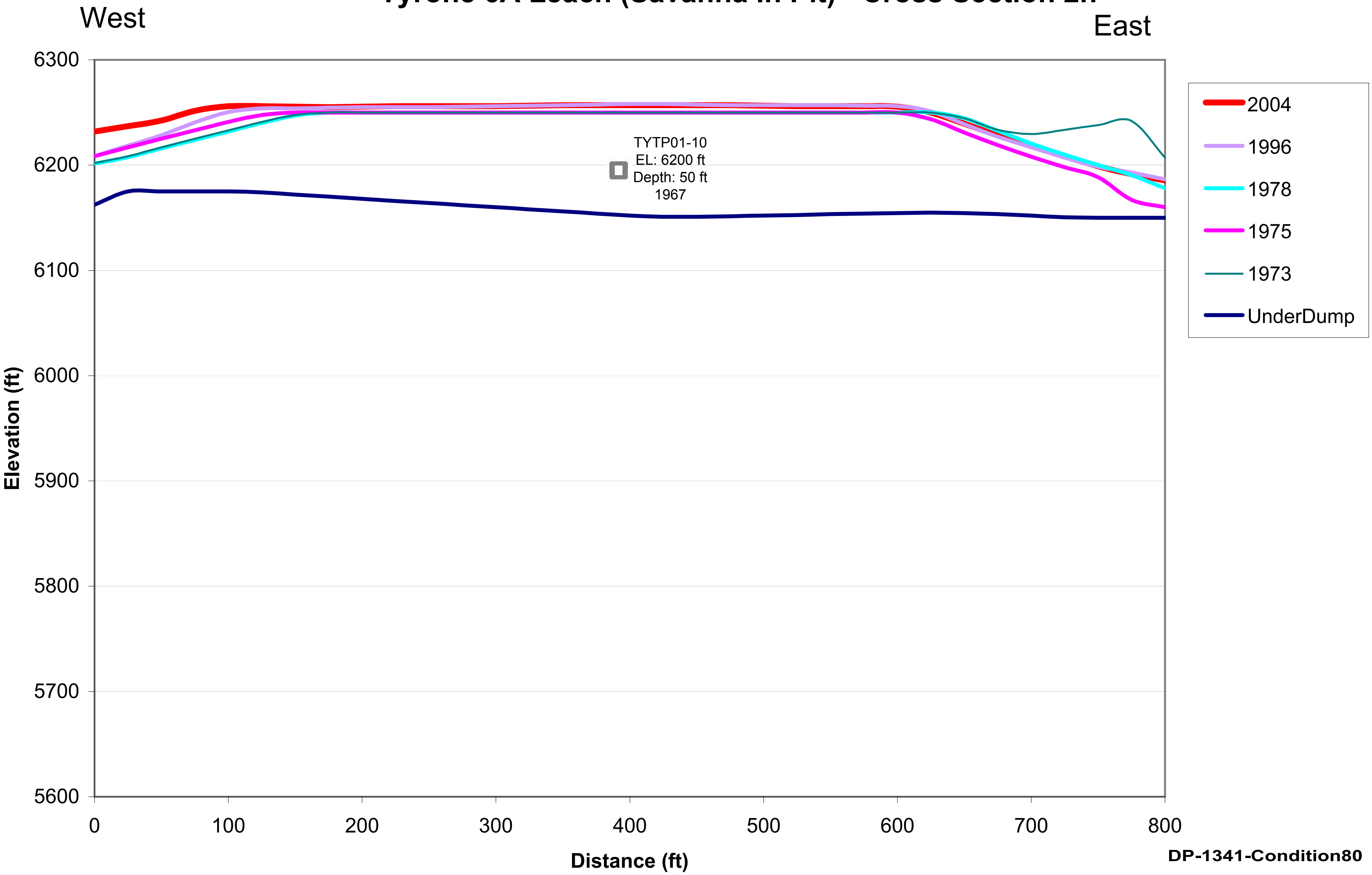


Tyrone Gettysburg-In Pit - Cross Section 1h




Tyrone Gettysburg-In Pit - Cross Section 5h
West
East
6600
6500
6400
6300
6200
6100
6000
5900
5800
5700
5600
5500
Elevation (ft)
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
3300
3600
Distance (ft)
TYTP01-9
EL: 6150 ft
Depth: 40 ft
1967
2004
2000
1998
1996
1988
1987
1986
1982
1978
1975
1973
PreMine
UnderDump

Tyrone 6A Leach (Savanna In Pit) - Cross Section 2h



DP-1341-Condition80

APPENDIX III

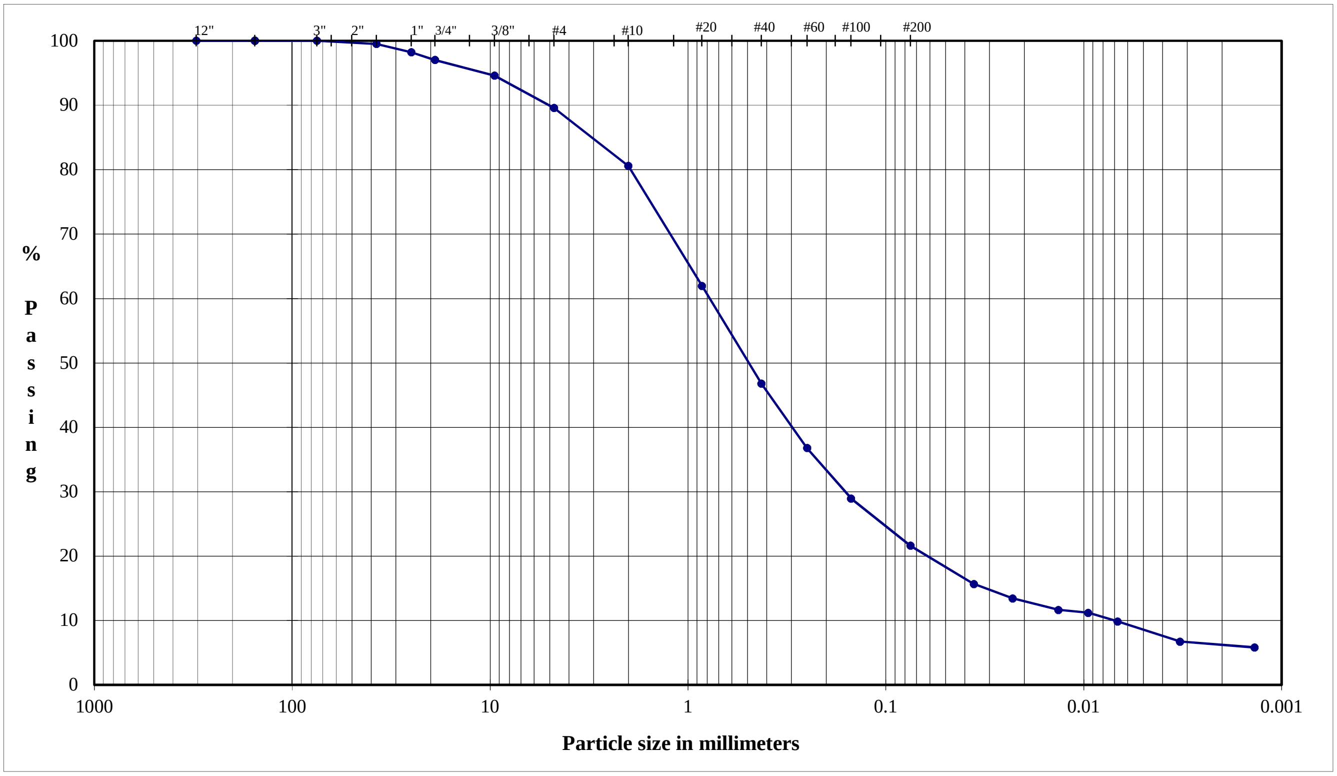
Previously Unreported Testing

Jun-05 **043-2572-001**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

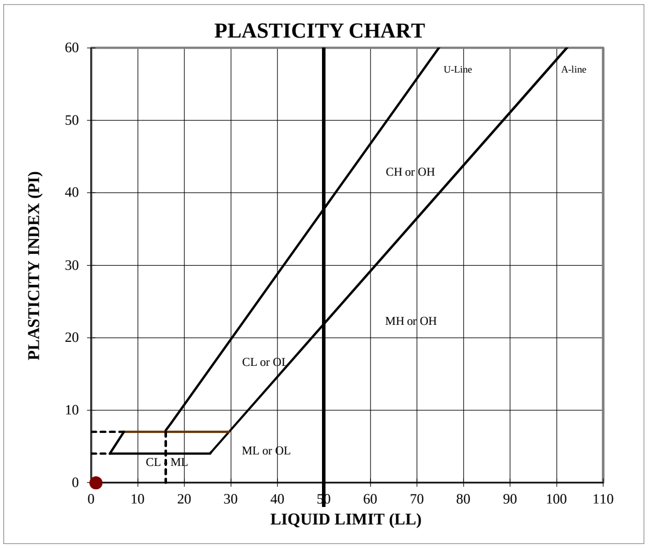
PROJECT NAME: **G&K/Tyrone Stockpile Geotech/AZ**
SAMPLE ID: **TSGT-04** Depth (ft): **265-269**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
6.0"	154.2	**100.0**		
6.0"	154.2	**100.0**	Coarse Gravel	**2.97**
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**99.5**		
1.0"	25.0	**98.2**		
0.75"	19.0	**97.0**	Fine Gravel	**7.48**
0.375"	9.5	**94.6**		
#4	4.8	**89.6**		
#10	2.00	**80.6**	Coarse Sand	**8.97**
#20	0.85	**61.9**	Medium Sand	**33.83**
#40	0.43	**46.8**		
#60	0.25	**36.8**	Fine Sand	**25.15**
#100	0.15	**28.9**		
#200	0.075	**21.6**		

Hydrometer Analysis	(mm)	%Finer		
	0.036	**15.7**	Fines Silt or Clay	**21.60**
	0.023	**13.4**		
	0.013	**11.6**		
	0.0095	**11.2**		
	0.0068	**9.8**		
	0.0033	**6.7**		
	0.0014	**5.8**		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
--	**NP**	**NP**	**NP**	**2.70**

DESCRIPTION: Light brown silty sand

USCS: SM

TECH	DS
DATE	6/28/2005
REVIEW	MB

Sample # =	TSTG-04		Sample # =	TSTG-04		Sample # =	TSTG-04	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	14.67	cm	Length =	14.67	cm	Length =	14.67	cm
Diameter =	7.27	cm	Diameter =	7.27	cm	Diameter =	7.27	cm
Wet Weight =	1235.20	g	Wet Weight =	1235.20	g	Wet Weight =	1235.20	g
Area =	41.5	cm^2	Area =	41.5	cm^2	Area =	41.5	cm^2
Sample Area =	6.43	in^2	Sample Area =	6.43	in^2	Sample Area =	6.43	in^2
Volume =	608.9	cm^3	Volume =	608.9	cm^3	Volume =	608.9	cm^3
Moisture Content =	11.0%		Moisture Content =	11.0%		Moisture Content =	11.0%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g
Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3
Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3
Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf
Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf
Cell Pressure =	80	psi	Cell Pressure =	150	psi	Cell Pressure =	250	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	30	psi	Confining Pressure =	100	psi	Confining Pressure =	200	psi

Notes: Material visually described as sand, reddish-brown, with clay and fine gravel.
Specimen remolded with a light to moderate tamp at visually estimated optimum moisture content.
Failure defined as maximum principal stress ratio.
The strain rate was 0.1mm/min, and t_{50} was 0.1 minutes.
Test was a staged trixial test.

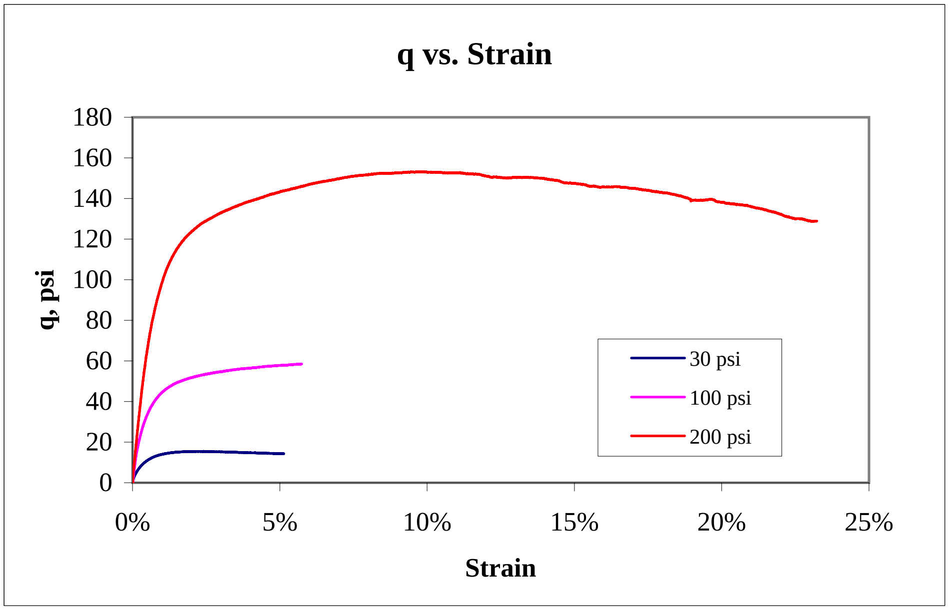
Golder Associates, Inc.
Denver, Colorado

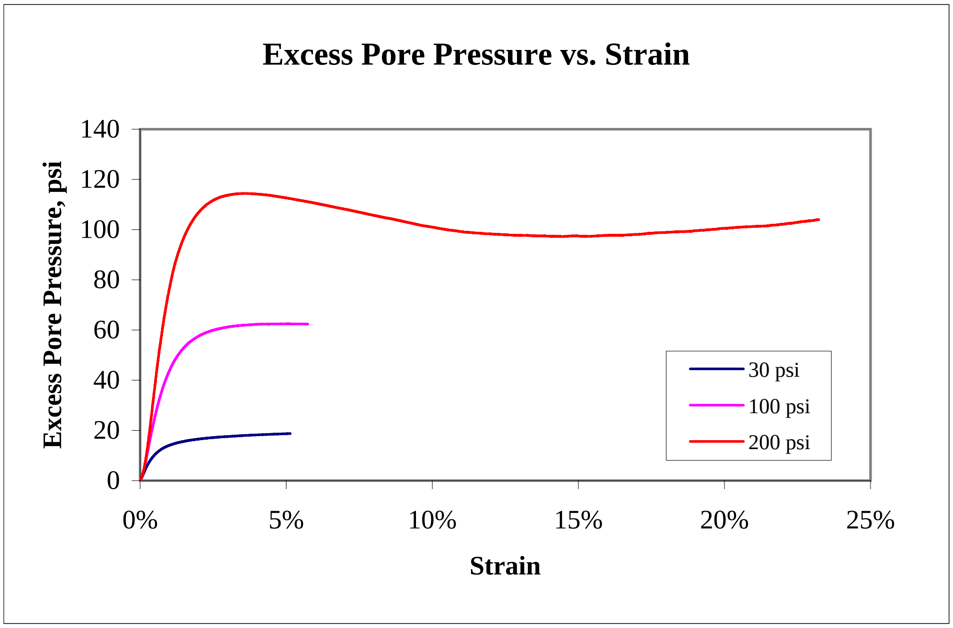
Job Short Title:
PD Tyrone/Stockpile Geotech

Title:

TRIAXIAL SHEAR TEST REPORT
SAMPLE DATA AND CALCULATIONS

Sample Number:	Reviewed:	Date:	Job Number:	Figure:
TSTG-04 @ 265-268	**JEO**	**6/7/2006**	**053-2550**	**1**





Golder Associates, Inc.
Denver, Colorado

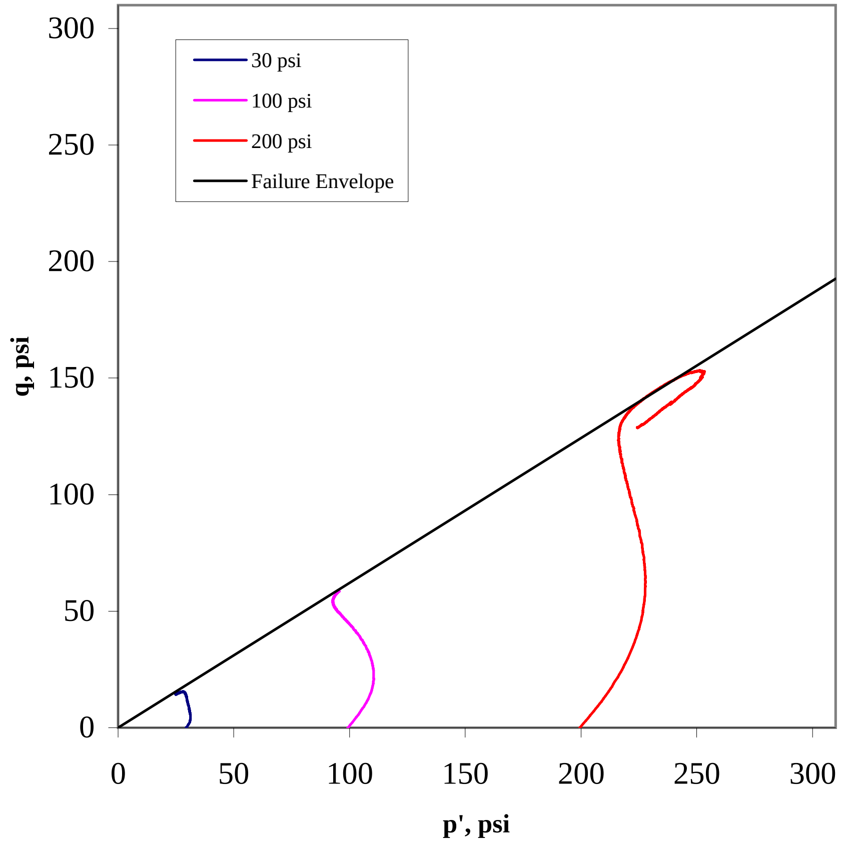
Job Short Title:
PD Tyrone/Stockpile Geotech

Title:

C-U TRIAXIAL SHEAR DATA
q AND EXCESS PORE PRESSURE PLOTS

Sample Number:	Reviewed:	Date:	Job Number:	Figure:
TSTG-04 @ 265-268	**JEO**	**06/07/06**	**053-2550**	**2**

Stress Path (p'-q) Plot



Stress Path Parameters

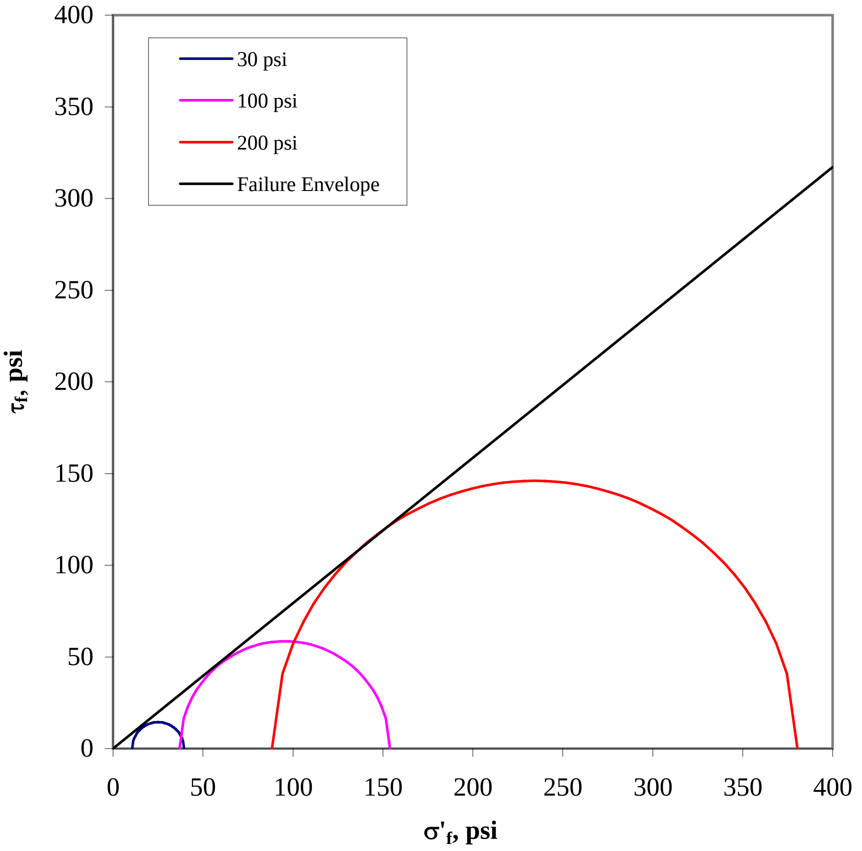
ψ' = 31.8 degrees

a' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **C-U TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**
Job Short Title: **PD Tyrone/Stockpile Geotech**	

Sample Number:	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
TSTG-04 @ 265-268	**JEO**	**6/7/2006**	**053-2550**	**3**

Mohr's Circle Diagram
Effective Stress Parameters



Effective Stress Shear Strength Parameters

ϕ' = 38.4 degrees
c' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **C-U TRIAXIAL SHEAR DATA** **MOHR'S CIRCLE DIAGRAM**
Job Short Title: **PD Tyrone/Stockpile Geotech**	

Sample Number:	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
TSTG-04 @ 265-268	**JEO**	**6/7/2006**	**053-2550**	**4**

Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

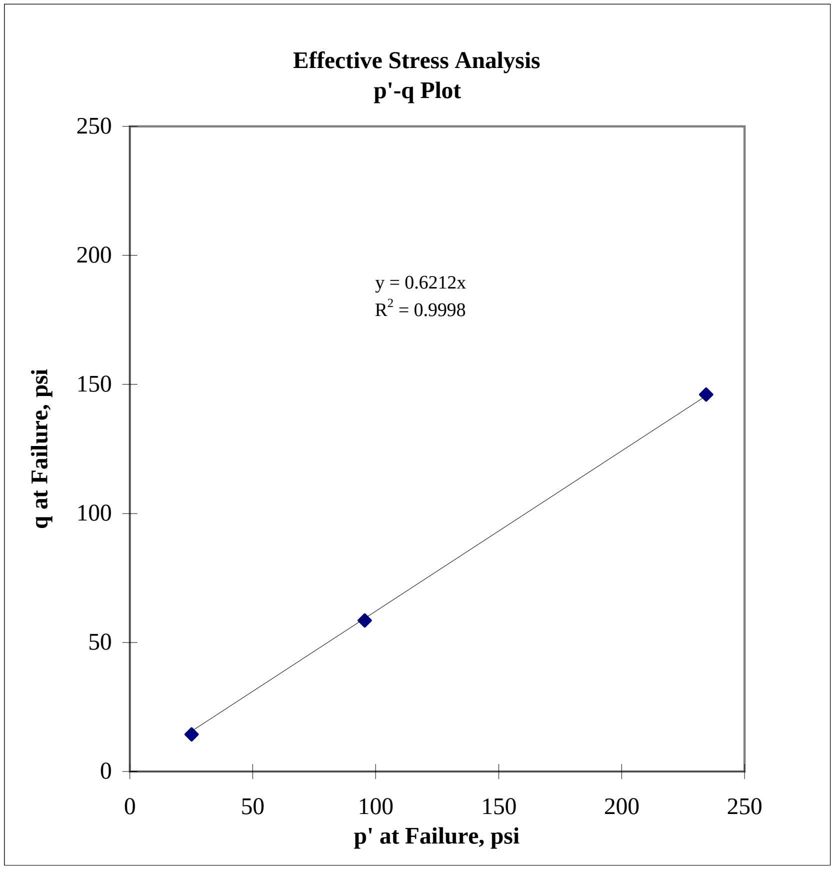
Sample Number TSTG-04 @ 265-268

Effective Stress Analysis

Point Number	p' (psi)	q (psi)
1	25.1	14.4
2	95.5	58.5
3	234.4	146.0

tan(ψ') = **0.6212**
a' = **0.0** **psi**

ϕ' = **38.4** **degrees**
c' = **0.0** **psi**



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

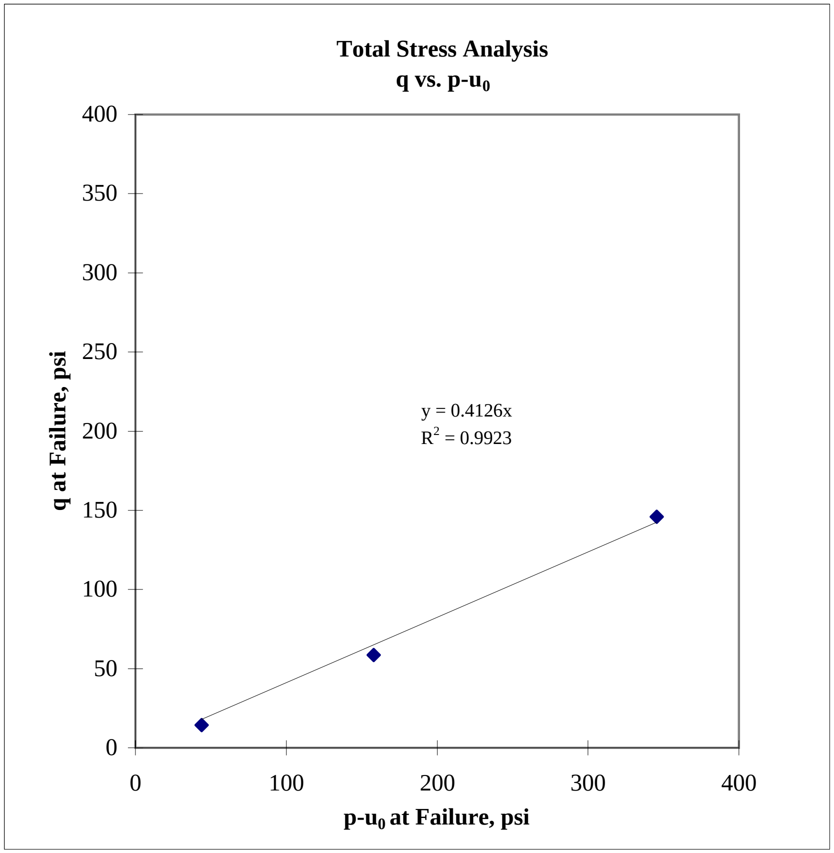
Sample Number TSTG-04 @ 265-268

Total Stress Analysis

Point Number	$p-u_o$ (psi)	q (psi)
1	43.8	14.4
2	157.8	58.5
3	345.5	146.0

tan(ψ) = 0.4126
a = 0.0 psi

ϕ = 24.4 degrees
c = 0.0 psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: PD Tyrone/Stockpile Geotech
Project Number: 053-2550

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c’, c = effective and total stress cohesion intercepts
ϕ’, ϕ = effective and total stress friction angles
τ_{ff} = shear strength on the failure surface at failure
σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress
p’, p = mean effective and total stresses
σ'_1, σ_1 = effective and total axial stresses
σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a’, a = intercepts of the q-axis in effective stress and total stress spaces
ψ’, ψ = angles of the failure envelopes in effective stress and total stress spaces
q = maximum shear stress at failure
p’ = mean effective stress at failure
$p-u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

The relationships between ψ’ and ϕ’ and a’ and c’ are as follows:

$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$

PD TYRONE/STOCKPILE GEOTEC
053-2550
TSTG=4 @265-268
STAGED TRIAXIAL SHEAR TEST

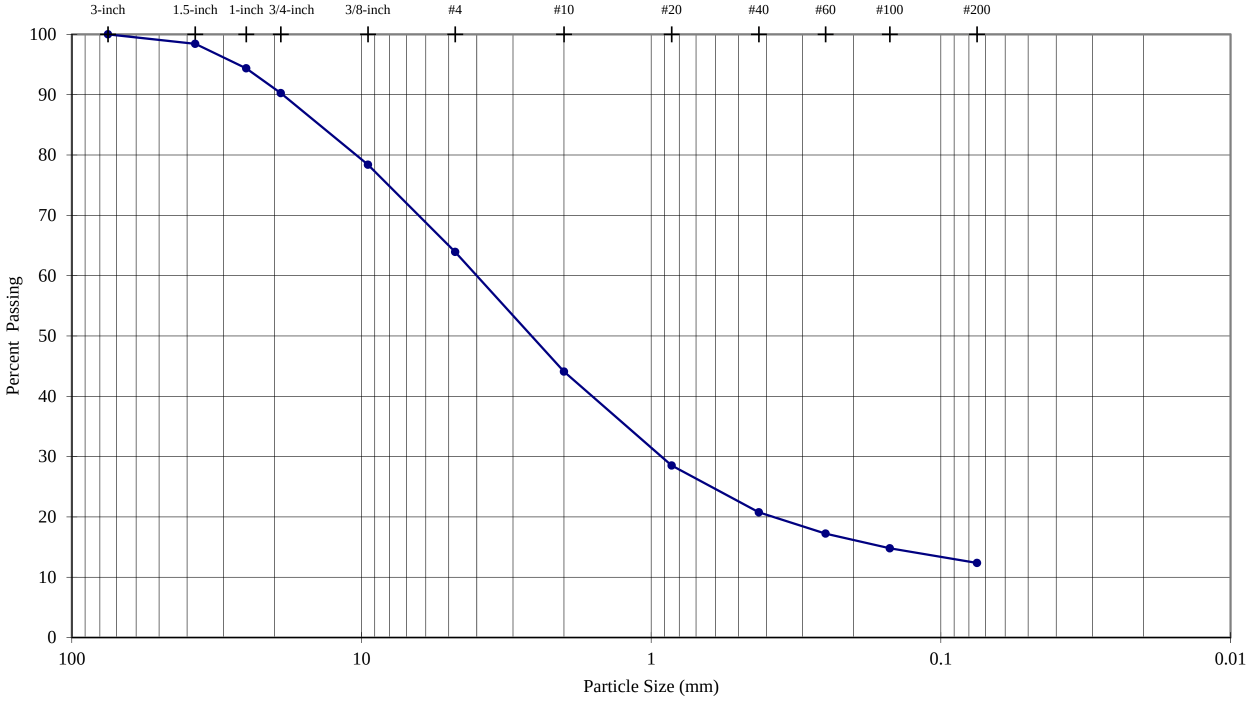
Golder Associates, Inc.
Denver, Colorado

January-19 **18106417.3B**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

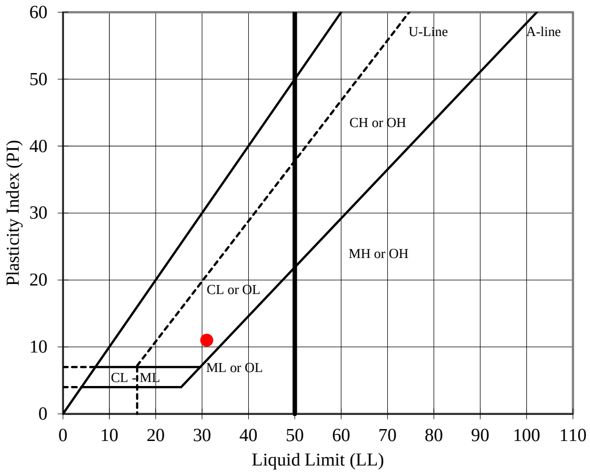
PROJECT NAME: **FMI/TyroneCCP Support 2018-2019**
SAMPLE ID: **TY18-01** DEPTH (ft): --
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**98.4**
1-inch	25.0	**94.4**
3/4-inch	19.0	**90.3**
3/8-inch	9.5	**78.4**
#4	4.75	**63.9**
#10	2.0	**44.1**
#20	0.850	**28.5**
#40	0.425	**20.8**
#60	0.250	**17.2**
#100	0.150	**14.8**
#200	0.075	**12.4**

Description	Percentage
Coarse Gravel	**9.74**
Fine Gravel	**26.33**
Coarse Sand	**19.84**
Medium Sand	**23.33**
Fine Sand	**8.40**
Silt or Clay Fines	**12.36**



USCS Description (ASTM D 2487):

Clayey sand with gravel, reddish brown, moist

LL	PL	PI
31	**20**	**11**

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0 g of particles up to 75.0 mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

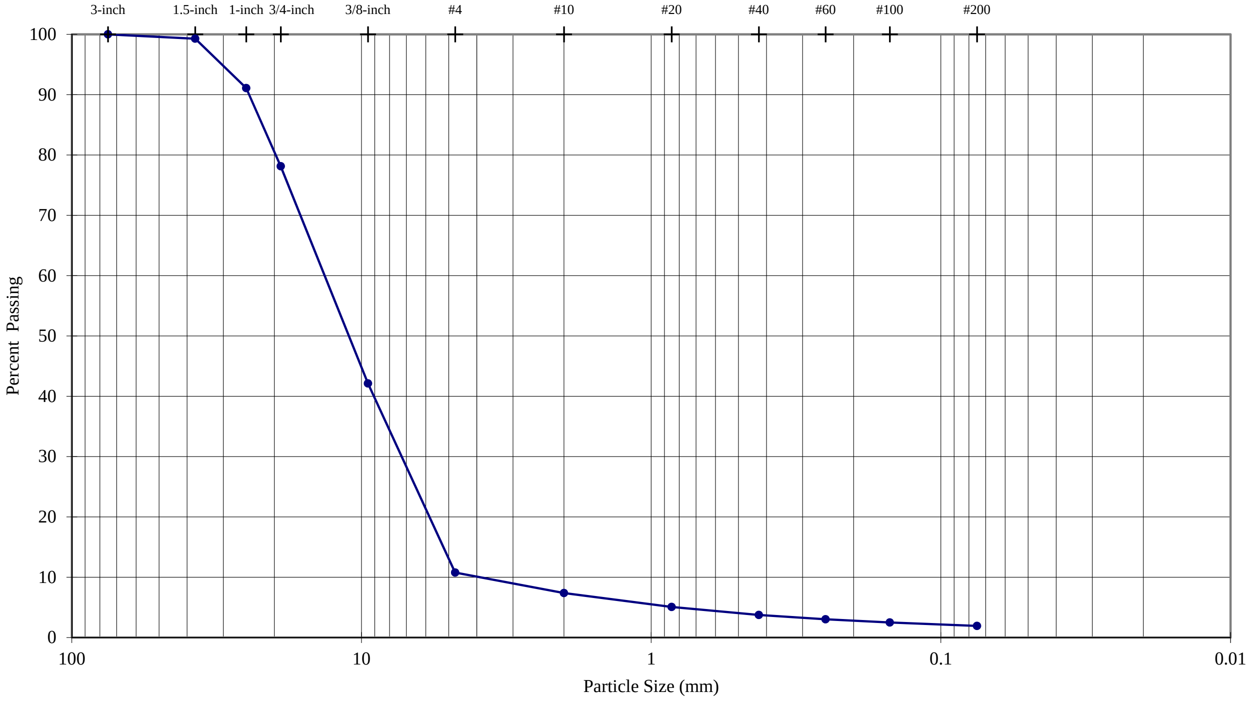
TECH	JP
DATE	4-Jan-2019
REVIEW	MB

January-19 **18106417.3B**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

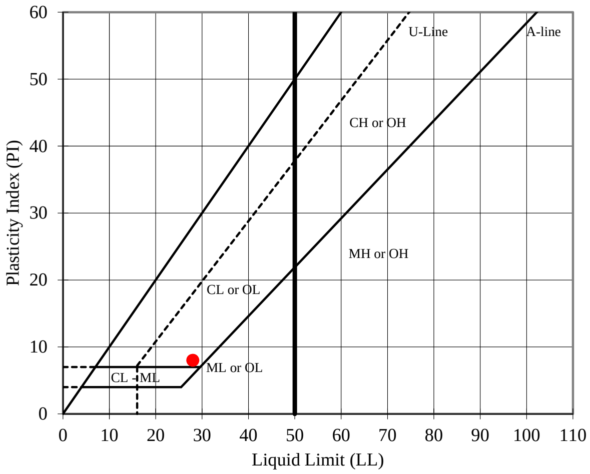
PROJECT NAME: **FMI/TyroneCCP Support 2018-2019**
SAMPLE ID: **TY18-02** DEPTH (ft): --
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**99.3**
1-inch	25.0	**91.1**
3/4-inch	19.0	**78.1**
3/8-inch	9.5	**42.1**
#4	4.75	**10.8**
#10	2.0	**7.4**
#20	0.850	**5.1**
#40	0.425	**3.8**
#60	0.250	**3.0**
#100	0.150	**2.5**
#200	0.075	**1.9**

Description	Percentage
Coarse Gravel	**21.87**
Fine Gravel	**67.35**
Coarse Sand	**3.39**
Medium Sand	**3.63**
Fine Sand	**1.82**
Silt or Clay Fines	**1.93**



USCS Description (ASTM D 2487):

Poorly graded gravel, dark yellowish brown, moist

LL	PL	PI
28	**20**	**8**

As-Received Moisture Content (%): --

USCS Group Symbol: GP

Notes: 0 g of particles up to 75.0 mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	EH
DATE	7-Jan-2019
REVIEW	MB

Boring or Test Pit:	Comp		Boring or Test Pit:	Comp		Boring or Test Pit:	Comp	
Sample:	TY18-01/02		Sample:	TY18-01/02		Sample:	TY18-01/02	
Depth:	0-8	ft	Depth:	0-8	ft	Depth:	0-8	ft
Point No.:	1		Point No.:	2		Point No.:	3	
	Initial			**Initial**			**Initial**	
Bottom Thickness =	3.00	in	Bottom Thickness =	2.00	in	Bottom Thickness =	2.00	in
Top Thickness =	3.00	in	Top Thickness =	3.00	in	Top Thickness =	2.00	in
Bottom Length =	12.00	in	Bottom Length =	9.00	in	Bottom Length =	6.00	in
Top Length =	12.00	in	Top Length =	9.00	in	Top Length =	6.00	in
Width =	12.00	in	Width =	9.00	in	Width =	6.00	in
Wet Mass =	65.21	lb	Wet Mass =	30.72	lb	Wet Mass =	10.89	lb
Volume =	864	in^3	Volume =	405	in^3	Volume =	144	in^3
Specific Gravity =	2.70	(Assumed)	Specific Gravity =	2.70	(Assumed)	Specific Gravity =	2.70	(Assumed)
Dry Mass of Solids =	62.47	lb	Dry Mass of Solids =	29.31	lb	Dry Mass of Solids =	10.40	lb
Moisture Content =	4.4%		Moisture Content =	4.8%		Moisture Content =	4.7%	
Wet Unit Weight =	130.4	pcf	Wet Unit Weight =	131.1	pcf	Wet Unit Weight =	130.7	pcf
Dry Unit Weight =	124.9	pcf	Dry Unit Weight =	125.1	pcf	Dry Unit Weight =	124.8	pcf
Void Ratio =	0.35		Void Ratio =	0.35		Void Ratio =	0.35	
Percent Saturation =	34%		Percent Saturation =	38%		Percent Saturation =	36%	
	Pre-Shear			**Pre-Shear**			**Pre-Shear**	
Top Thickness =	2.96	in	Top Thickness =	2.96	in	Top Thickness =	1.88	in
Volume =	858	in^3	Volume =	402	in^3	Volume =	140	in^3
Moisture Content =	9.3%		Moisture Content =	8.5%		Moisture Content =	7.8%	
Wet Unit Weight =	137.5	pcf	Wet Unit Weight =	136.7	pcf	Wet Unit Weight =	138.9	pcf
Dry Unit Weight =	125.8	pcf	Dry Unit Weight =	126.0	pcf	Dry Unit Weight =	128.8	pcf
Void Ratio =	0.34		Void Ratio =	0.34		Void Ratio =	0.31	
Percent Saturation =	75%		Percent Saturation =	68%		Percent Saturation =	69%	
Shear Rate =	0.0195	in/min	Shear Rate =	0.0192	in/min	Shear Rate =	0.0192	in/min
Normal Stress =	5,760	psf	Normal Stress =	14,400	psf	Normal Stress =	43,200	psf

Notes:

Visual description: Sandy gravel, brown, moist

Atterberg limits: LL = -- PL = -- PI = -- (-- indicates test was not performed)

Percent finer: 3/4 in. = -- No. 4 = -- No. 200 = -- (-- indicates test was not performed)

Specimen type: ☐ Intact ☒ Reconstituted Remold targets: 125.0 pcf (dry) at Delivered moisture

Inundation: Specimens were inundated after normal load was applied

Apparatus: DGSI large scale shear device

In accordance with ASTM D3080, no area correction is made; nominal shear stresses and normal stresses are reported.

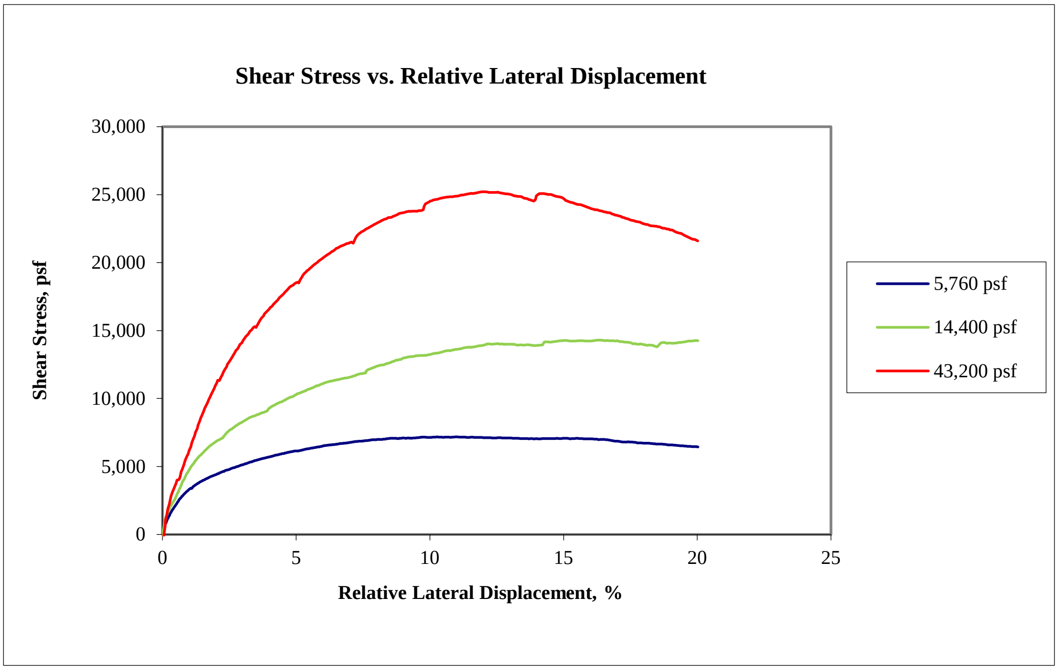
Gap between top and bottom shear boxes was approximately 0.25 inches during shear.

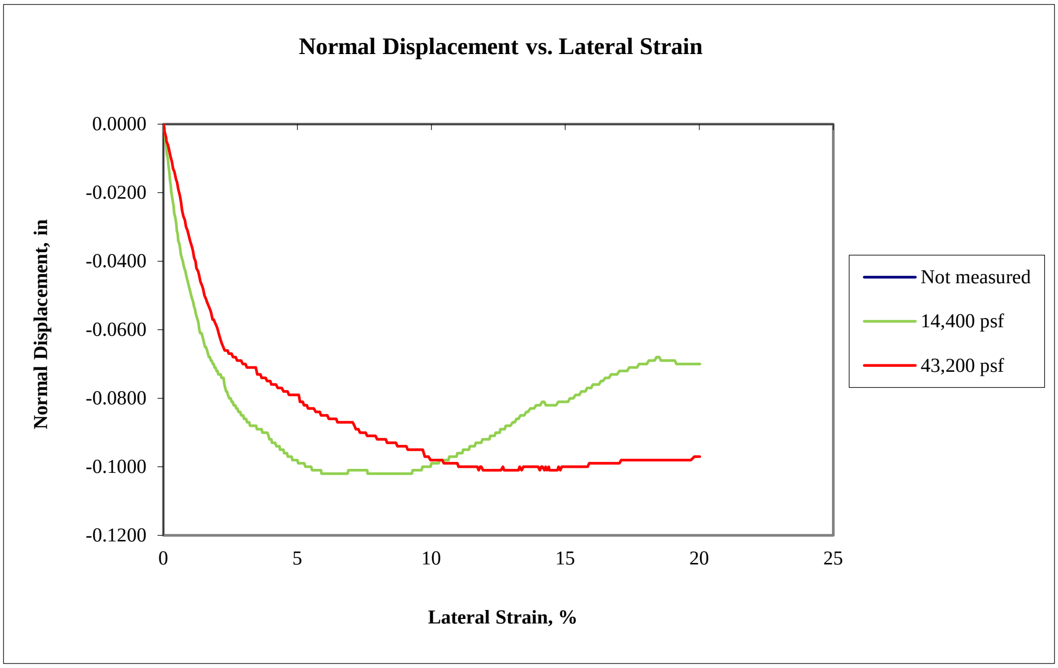
Project Name:
FMI/Tyrone CCP Support 2018-2019

Project Number:
18106417.3B

ASTM D3080 - MODIFIED
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT
SAMPLE AND TEST DATA

Sample ID:	**Technician:**	**Checked:**	**Reviewed:**	**Date:**	**Figure:**
Composite TY18-01 / TY18-02	**EH**	**PRH**	**MK**	**30-Jan-2018**	**1**

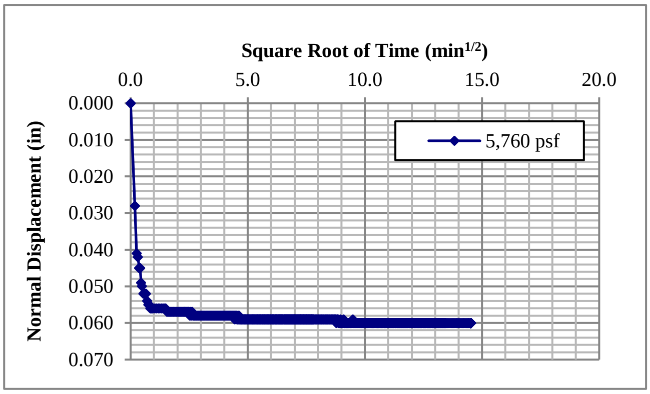


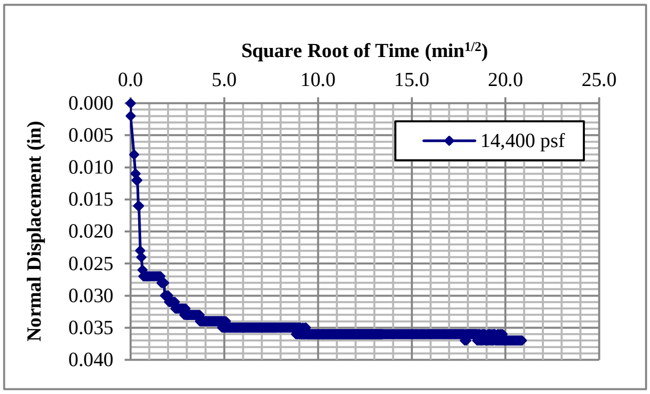


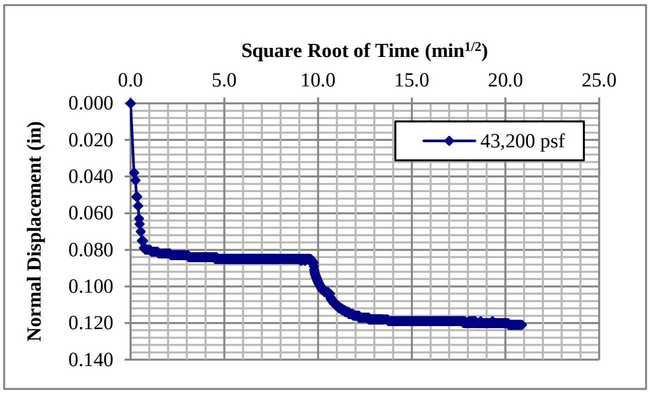
Project Name: FMI/Tyrone CCP Support 2018-2019	**ASTM D3080 - MODIFIED** **CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT** **SHEAR STRESS AND NORMAL DISPLACEMENT PLOTS**
Project Number: 18106417.3B	

Sample ID: Composite TY18-01 / TY18-02	**Technician:** EH	**Checked:** PRH	**Reviewed:** MK	**Date:** 30-Jan-2018	**Figure:** 2

Consolidation Data Used to Determine Shear Rate







Normal Stress, psf	Normal Displacement, in	Load Duration, min
Point No. 1		
5,760	0.0435	1,084
Point No. 2		
14,400	0.0370	1,036
Point No. 3		
43,200	0.1240	1,218

Note: Change in normal displacement for 43,200 psf specimen at approximately 95 minutes occurred at time of inundation.

Project Name:
FMI/Tyrone CCP Support 2018-2019

Project Number:
18106417.3B

Sample ID:
Composite TY18-01 / TY18-02

ASTM D3080 - MODIFIED

CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT
CONSOLIDATION DATA

Technician:	**Checked:**	**Reviewed:**	**Date:**	**Figure:**
EH	**PRH**	**MK**	**30-Jan-2018**	**3**

Point No.:	1		Point No.:	2		Point No.:	3	
Normal Stress =	5,760	psf	Normal Stress =	14,400	psf	Normal Stress =	43,200	psf
Shear Rate =	0.0195	in/min	Shear Rate =	0.0192	in/min	Shear Rate =	0.0192	in/min

Shear Stress psf	Relative Lateral Displacement %	Normal Displacement in	Shear Stress psf	Relative Lateral Displacement %	Normal Displacement in	Shear Stress psf	Relative Lateral Displacement %	Normal Displacement in
2,155	0.5	-	2,780	0.5	-0.031	3,569	0.5	-0.016
3,293	1.0	-	4,688	1.0	-0.048	6,193	1.0	-0.034
3,946	1.5	-	5,973	1.5	-0.063	8,793	1.5	-0.048
4,411	2.0	-	6,821	2.0	-0.072	10,961	2.0	-0.059
4,793	2.5	-	7,619	2.5	-0.080	12,705	2.5	-0.067
5,134	3.0	-	8,277	3.0	-0.085	14,109	3.0	-0.070
5,447	3.5	-	8,766	3.5	-0.089	15,233	3.5	-0.073
5,705	4.0	-	9,283	4.0	-0.092	16,569	4.0	-0.075
5,945	4.5	-	9,779	4.5	-0.095	17,613	4.5	-0.078
6,146	5.0	-	10,293	5.0	-0.098	18,517	5.0	-0.079
6,323	5.5	-	10,691	5.5	-0.100	19,485	5.5	-0.083
6,510	6.0	-	11,088	6.0	-0.102	20,341	6.0	-0.085
6,632	6.5	-	11,367	6.5	-0.102	21,045	6.5	-0.087
6,764	7.0	-	11,564	7.0	-0.101	21,481	7.0	-0.087
6,881	7.5	-	11,838	7.5	-0.101	22,317	7.5	-0.090
6,983	8.0	-	12,357	8.0	-0.102	22,865	8.0	-0.092
7,091	9.0	-	12,951	9.0	-0.102	23,657	9.0	-0.094
7,142	10.0	-	13,242	10.0	-0.099	24,465	10.0	-0.098
7,175	11.0	-	13,626	11.0	-0.096	24,893	11.0	-0.099
7,134	11.9	-	13,921	12.0	-0.092	25,213	12.0	-0.101
7,099	13.0	-	13,994	13.0	-0.088	25,033	13.0	-0.101
7,052	14.0	-	13,921	14.0	-0.082	24,905	14.0	-0.100
7,070	15.0	-	14,263	14.9	-0.081	24,745	15.0	-0.100
7,043	16.0	-	14,243	16.0	-0.077	24,001	16.0	-0.099
6,863	17.0	-	14,232	16.9	-0.073	23,497	17.0	-0.099
6,729	18.0	-	13,984	18.0	-0.070	22,881	18.0	-0.098
6,587	19.0	-	14,090	19.0	-0.069	22,409	19.0	-0.098
6,458	20.0	-	14,268	20.0	-0.070	21,701	19.9	-0.097

Project Name:
FMI/Tyrone CCP Support 2018-2019

Project Number:
18106417.3B

ASTM D3080 - MODIFIED
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT
SHEAR DATA

Sample ID:
Composite TY18-01 / TY18-02

Technician:	Checked:	Reviewed:	Date:	Figure:
EH	PRH	MK	30-Jan-2018	4

Project Name: FMI/Tyrone CCP Support 2018-2019	**ASTM D3080 - MODIFIED** **CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT** **SPECIMEN PHOTOGRAPH - 5,760 psf**
Project Number: 18106417.3B	

Sample ID: Composite TY18-01 / TY18-02	**Technician:** EH	**Checked:** PRH	**Reviewed:** MK	**Date:** 30-Jan-2018	**Figure:** 5

Project Name: FMI/Tyrone CCP Support 2018-2019	**ASTM D3080 - MODIFIED** **CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT** **SPECIMEN PHOTOGRAPH - 14,400 psf**
Project Number: 18106417.3B	

Sample ID:	**Technician:**	**Checked:**	**Reviewed:**	**Date:**	**Figure:**
Composite TY18-01 / TY18-02	EH	PRH	MK	30-Jan-2018	6

Project Name: FMI/Tyrone CCP Support 2018-2019	**ASTM D3080 - MODIFIED** **CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT** **SPECIMEN PHOTOGRAPH - 43,200 psf**				
Project Number: 18106417.3B					
Sample ID: Composite TY18-01 / TY18-02	**Technician:** EH	**Checked:** PRH	**Reviewed:** MK	**Date:** 30-Jan-2018	**Figure:** 7

APPENDIX IV

Laboratory Testing Summary

TABLE IV-1

Laboratory Testing Summary

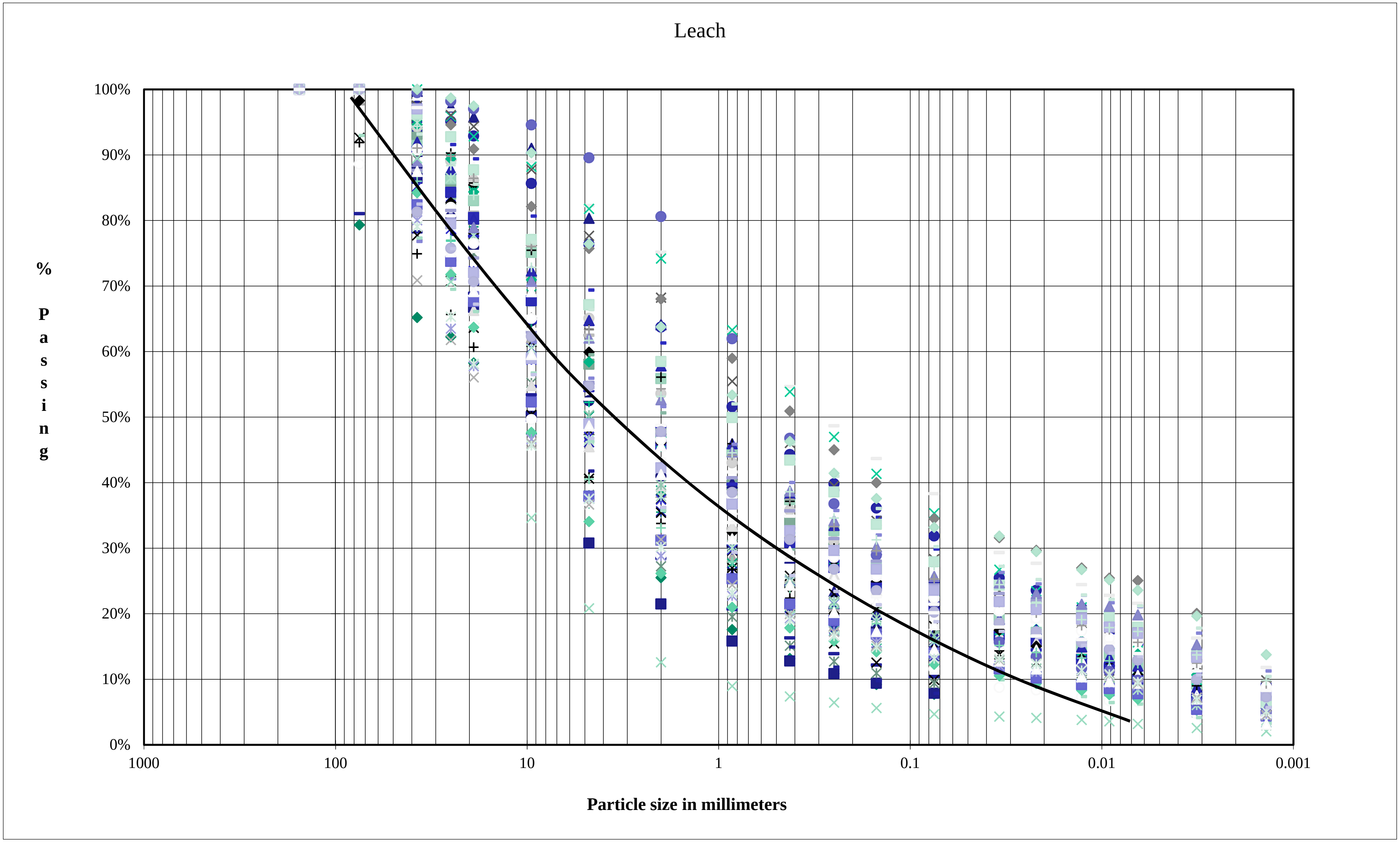
									Coarse Gravel	Coarse Gravel		Fine Gravel		Coarse S	Medium Sand		Fine Sand			Fines													Triaxial		Direct Shear	
			Mine Coords.					6.000"	3.000"	1.500"	1.000"	0.750"	0.375"	#4	#10	#20	#40	#60	#100	#200													ϕ'	c'	ϕ'	c'
Date Sampled	Number	Depth	Easting	Northing	Stockpile	Year Placed	%>3 inch	154.2	75	37.5	25	19	9.5	4.75	2	0.85	0.425	0.25	0.15	0.075	0.034	0.022	0.013	0.009	0.006	0.003	0.001	Activity	LL	PL	PI	USCS	(°)	psi	(°)	psi
1/22/2000	GTP-01/01	10	21349	11668	No. 1		15	100.0%	100.0%	89.2%	85.3%	81.2%	66.4%	48.6%	38.6%	30.3%	25.0%	21.9%	19.4%	16.5%									47	22	25	GC				
1/22/2000	GTP-03/02	10	15937	14890	1D		20	100.0%	100.0%	94.6%	89.1%	84.5%	73.0%	60.0%	48.4%	34.5%	27.1%	23.2%	20.3%	17.4%									33	20	13	SC	34.6	5.8		
1/22/2000	GTP-06/03	10	4038	11230	2, 2A North		20	100.0%	81.1%	78.3%	73.9%	68.9%	53.4%	37.3%	28.5%	20.8%	16.3%	13.9%	12.2%	10.4%									42	20	22	GP-GC	32.8	8.3		
1/22/2000	GTP-09/05	10	6075	6910	2, 2A South		45	100.0%	79.3%	65.2%	62.3%	58.3%	47.5%	36.9%	25.5%	17.6%	13.2%	10.9%	9.2%	7.7%									39	20	19	GP-GC				
1/22/2000	GTP-10/04	10	11416	3546	S. Rim		25	100.0%	100.0%	83.5%	76.0%	70.3%	54.0%	38.2%	30.2%	23.3%	18.9%	16.4%	14.4%	12.1%									47	20	26	GC				
1/22/2000	GTP-13/06	10	18450	6622	1 C	2000	20	100.0%	100.0%	87.0%	81.4%	74.4%	60.8%	48.6%	36.5%	26.0%	19.6%	16.0%	13.6%	11.2%									38	19	19	GP-GC				
1/22/2000	GTP-14/07	10	10230	19063	3A		35	100.0%	100.0%	86.4%	73.8%	66.8%	50.1%	30.8%	21.5%	15.8%	12.8%	10.9%	9.4%	7.9%									28	15	13	GP-GC				
10/19/2001	TYTP1-1	100	4757	10882	2, 2A South	1975	40	100.0%	98.4%	91.3%	83.2%	77.4%	62.1%	48.1%	38.5%	28.6%	21.9%	18.1%	15.1%	12.5%									38	17	21	GC				
10/19/2001	TYTP1-2	400	6335	8367	Copper Mtn.	1978	30	100.0%	100.0%	91.8%	84.2%	77.9%	61.5%	48.0%	37.5%	27.0%	19.7%	15.5%	12.5%	9.9%									30	14	16	GW-GC	36.2	0.6		
10/19/2001	TYTP1-3	250	6643	8275	Copper Mtn	1982	50	100.0%	100.0%	93.0%	83.1%	74.9%	55.2%	38.1%	27.2%	19.5%	15.1%	12.7%	10.9%	9.4%									36	18	18	GP-GC				
10/19/2001	TYTP1-4	100	5945	9155	Copper Mtn	1986	15	100.0%	100.0%	88.1%	80.5%	75.9%	64.7%	52.5%	41.0%	30.4%	24.2%	20.8%	17.8%	14.8%									40	17	23	GC	35.5	0.4		
10/19/2001	TYTP1-5	100	5766	6482	4C North	1975	10	100.0%	100.0%	97.0%	87.3%	79.0%	64.5%	49.1%	35.5%	25.8%	21.0%	18.4%	16.5%	14.5%									39	16	23	GC				
10/19/2001	TYTP1-6	300	13643	9578	Savanna	1989	50	100.0%	100.0%	90.0%	77.9%	70.3%	54.7%	41.8%	30.6%	20.6%	14.9%	11.9%	9.8%	7.9%									29	16	13	GW-GC				
10/19/2001	TYTP1-7	300	13282	9913	Savanna	1989	40	100.0%	100.0%	92.7%	85.4%	81.3%	71.4%	62.5%	46.9%	33.0%	24.8%	20.5%	17.4%	14.7%									28	15	13	SC	36.9	0.6		
10/19/2001	TYTP1-8	250	13523	9429	Savanna	1990	30	100.0%	98.3%	94.2%	89.2%	85.4%	76.2%	59.9%	47.4%	32.4%	24.0%	20.0%	17.3%	15.0%									24	16	8	SC				
10/19/2001	TYTP1-9	40	17378	8051	Gettysberg	1967	30	100.0%	100.0%	93.1%	85.2%	80.1%	67.7%	58.1%	47.8%	39.6%	33.9%	30.0%	26.7%	23.6%									30	18	12	GC	34.1	2.2		
10/19/2001	TYTP1-10	50	14429	12245	Savanna	1967	5	100.0%	100.0%	99.7%	97.3%	95.8%	91.0%	80.3%	64.1%	40.0%	28.5%	23.4%	19.9%	17.0%									30	18	12	SC				
10/19/2001	TYTP1-11	100	4473	10612	2, 2A	1973	10	100.0%	100.0%	94.6%	89.7%	84.5%	68.7%	50.1%	38.8%	27.7%	21.1%	17.4%	14.7%	12.5%									37	17	20	GC				
10/19/2001	TYTP1-12	100	10770	15320	No 3 Leach	1975	40	100.0%	100.0%	94.3%	83.6%	76.9%	60.5%	46.2%	35.6%	26.4%	20.9%	17.7%	15.5%	13.5%									30	16	14	GC				
9/8/2004	GA04-TY-1	50	17363.7	6537.2302	1C Waste	1998	10	100.0%	100.0%	84.7%	75.0%	70.2%	56.0%	40.7%	36.3%	31.5%	27.1%	23.9%	21.0%	18.1%	16.0%	14.5%	13.0%	11.9%	10.4%	7.8%	5.4%	2.1	34	20	14	GC			31.0	10.4
9/8/2004	GA04-TY-2	50	18049.785	7148.82	1C Waste	1998	10	100.0%	100.0%	93.0%	85.0%	78.8%	65.9%	51.6%	54.8%	38.5%	32.8%	28.9%	25.4%	21.9%	18.2%	16.9%	15.8%	14.5%	12.9%	9.7%	6.2%	1.8	35	21	14	GC				
9/8/2004	GA04-TY-3	100	17366.983	6367.1624	1C Waste	1982	50	100.0%	100.0%	86.6%	76.8%	69.0%	52.9%	39.7%	35.7%	30.5%	25.9%	22.6%	17.7%	16.8%	14.5%	13.2%	12.6%	11.3%	10.4%	7.6%	5.2%	3.0	40	21	19	GC				
9/8/2004	GA04-TY-4	100	18112.156	6939.5058	1C Waste	1982	40	100.0%	100.0%	85.9%	61.7%	46.2%	24.9%	14.9%	12.8%	10.7%	9.2%	8.2%	7.3%	6.1%	5.3%	4.8%	4.5%	4.2%	3.9%	3.2%	2.6%		50	17	33	GP-GC				
9/8/2004	GA04-TY-5	250	18417.447	6252.6937	1C Waste	1982	15	100.0%	97.0%	78.1%	66.3%	59.1%	44.9%	33.1%	29.9%	25.0%	21.2%	18.5%	16.3%	13.9%	12.3%	11.0%	10.3%	9.1%	8.2%	5.8%	4.1%	2.8	33	19	14	GC			32.0	11.8
9/8/2004	GA04-TY-6	100	18220.485	7116.1147	1C Waste	1982	20	100.0%	97.6%	83.8%	73.9%	65.8%	50.4%	42.2%	39.2%	33.6%	28.8%	25.8%	22.9%	19.9%	17.2%	16.1%	14.6%	13.1%	11.8%	9.0%	6.6%	2.0	35	19	16	GC				
9/8/2004	GA04-TY-7	150	18158.114	6690.9453	1C Waste	1982	20	100.0%	100.0%	86.2%	73.3%	63.8%	45.4%	35.9%	30.0%	25.0%	21.3%	18.8%	16.7%	14.3%	12.5%	11.7%	10.9%	10.4%	9.2%	7.2%	4.5%	2.9	36	19	17	GC				
9/8/2004	GA04-TY-8	150	18404.316	7044.1629	1C Waste	1982	30	100.0%	100.0%	85.5%	75.0%	68.3%	53.7%	42.2%	37.4%	31.0%	26.2%	22.9%	20.2%	17.3%	14.8%	13.4%	12.7%	11.6%	10.2%	8.4%	6.1%	1.5	30	19	11	GC			29.0	8.8
10/13/2004	TSGT-1	19	9537	19405	3A Leach			100.0%	100.0%	94.3%	89.1%	86.1%	76.5%	65.1%	53.6%	43.0%	35.8%	31.1%	26.9%	22.6%	17.2%	16.0%	14.4%	13.5%	11.9%	9.4%	5.0%	1.5	25	14	11	SC				
10/13/2004	TSGT-1	47	9537	19405	3A Leach			100.0%	91.9%	74.9%	65.7%	60.7%	50.2%	40.8%	33.8%	26.8%	22.4%	19.6%	17.4%	15.0%	12.1%	11.0%	10.2%	9.6%	8.8%	6.7%	4.7%	2.3	29	16	13	GC				
10/13/2004	TSGT-1	75	9537	19405	3A Leach			100.0%	100.0%	87.6%	83.4%	81.1%	71.5%	59.5%	50.7%	38.1%	29.9%	24.8%	21.0%	17.2%	12.5%	11.0%	10.7%	9.5%	9.2%	6.5%	3.3%	1.4	26	19	7	SC-SM				
10/13/2004	TSGT-1	88	9537	19405	3A Leach			100.0%	100.0%	94.6%	89.4%	84.4%	71.0%	58.4%	46.9%	37.7%	32.3%	28.9%	26.0%	22.7%	18.5%	17.6%	15.9%	14.7%	13.8%	10.7%	7.2%	1.1	28	18	10	GC				
10/13/2004	TSGT-1	102	9537	19405	3A Leach			100.0%	100.0%	91.1%	84.3%	80.4%	67.8%	54.6%	45.8%	36.8%	30.9%	27.1%	24.2%	21.0%	16.7%	15.6%	13.1%	11.7%	10.0%	6.7%	4.4%	2.3	33	20	13	GC				
10/13/2004	TSGT-1	140	9537	19405	3A Leach			100.0%	100.0%	82.8%	72.2%	66.3%	54.8%	45.5%	39.6%	33.3%	28.9%	25.9%	23.5%	20.6%	16.8%	15.6%	14.7%	13.6%	12.4%	10.1%	4.8%	1.5	29	18	11	GC				
10/13/2004	TSGT-1	158.5	9537	19405	3A Leach			100.0%	92.6%	77.7%	70.8%	63.6%	50.3%	40.6%	35.4%	29.6%	25.8%	23.0%	20.7%	18.1%	13.8%	12.5%	11.3%	10.9%	10.7%	7.1%	5.9%	2.3	34	19	15	GC				
10/13/2004	TSGT-1	184	9537	19405	3A Leach			100.0%	100.0%	82.4%	74.7%	71.8%	62.7%	50.3%	39.6%	30.5%	25.3%	21.9%	19.5%	16.7%	12.9%	11.6%	10.2%	8.9%	7.9%	5.0%	3.0%	2.5	30	20	10	GC				
10/13/2004	TSGT-1	211	9537	19405	3A Leach			100.0%	100.0%	97.5%	95.1%	92.9%	85.6%	76.4%	63.7%	51.6%	44.3%	39.8%	36.1%	31.9%	25.5%	23.6%	20.9%	18.2%	17.5%	13.7%	9.1%	1.0	27	16	11	SC				
10/13/2004	TSGT-1	228	9537	19405	3A Leach			100.0%	100.0%	84.2%	76.9%	71.6%	62.1%	52.3%	45.5%	37.5%	31.7%	27.7%	24.3%	20.5%	16.9%	15.1%	13.8%	11.9%	10.9%	7.8%	5.7%	1.2	23	15	8	GC				
10/13/2004	TSGT-1	250.5	9537	19405	3A Leach			100.0%	100.0%	97.3%	91.6%	89.4%	80.7%	69.4%	61.3%	50.6%	43.6%	38.9%	34.7%	29.9%	24.8%	22.3%	19.2%	17.1%	15.4%	11.2%	7.3%	1.2	27	16	11	SC				
10/13/2004	TSGT-1	298	9537	19405	3A Leach			100.0%	100.0%	100.0%	96.9%	94.6%	89.0%	82.3%	75.2%	63.1%	54.7%	48.7%	43.7%	38.3%	29.3%	27.7%	24.4%	22.8%	21.6%	16.3%	11.8%	1.0	28	14	14	SC				
10/13/2004	TSGT-1	310	9537	19405	3A Leach			100.0%	100.0%	90.1%	82.7%	78.0%	65.1%	54.7%	46.1%	37.6%	31.8%	28.0%	24.9%	21.3%	17.5%	15.1%	13.1%	12.0%	10.7%	7.7%	5.2%	2.0	29	16	13	GC				
10/13/2004	TSGT-1	327	9537	19405	3A Leach			100.0%	100.0%	91.4%	86.3%	83.0%	75.1%	67.1%	55.9%	44.7%	37.4%	32.7%	27.3%	23.8%	19.1%	17.2%	15.2%	13.9%	12.2%	9.2%	6.3%	0.8	21	15	6	SC-SM				
10/13/2004	TSGT-1	356	9537	19405	3A Leach			100.0%	100.0%	91.9%	87.8%	80.2%	72.3%	64.7%	57.8%	45.9%	38.3%	33.5%	29.7%	25.5%	19.2%	17.5%	14.9%	13.3%	12.0%	8.8%	6.5%	2.1	32	16	16	SC				
10/13/2004	TSGT-1	388	9537	19405	3A Leach			100.0%	100.0%	100.0%	95.9%	92.8%	88.2%	81.8%	74.2%	63.3%	53.9%	47.0%	41.3%	35.3%	26.7%	23.4%	21.0%	18.1%	15.6%	9.9%	6.6%	1.3	26	15	11	SC				
10/13/2004	TSGT-2	18	17009	11550	1B Leach	2004		100.0%	100.0%	85.2%	78.7%	72.3%	58.7%	47.0%	37.4%	29.8%	25.0%	21.5%	18.8%	15.7%	11.6%	10.5%	9.3%	8.2%	7.0%	5.5%	3.4%	2.5	27	16	11	GC				
10/13/2004	TSGT-2	42	17009	11550	1B Leach	2004		100.0%	88.6%	80.1%	70.9%	64.1%	49.6%	37.0%	28.9%	23.1%	19.1%	16.1%	13.9%	11.6%	8.7%	8.4%	7.3%	6.7%	6.6%	4.7%	3.5%	2.0	22	14	8	GP-GC				
10/13/2004	TSGT-2	140	17009	11550	1B Leach	2000		100.0%	100.0%	96.2%	90.3%	85.7%	75.5%	63.4%	56.1%	46.0%	37.2%	30.0%	23.8%	17.8%	14.4%	13.0%	11.7%	10.7%	10.3%	9.0%	7.7%	1.7	34	20	14	SC				
10/13/2004	TSGT-2	267	17009	11550	1B Leach	1973		100.0%	93.0%	77.3%	69.5%	66.1%	56.7%	46.3%	35.8%	25.7%	20.1%	17.1%	14.8%	12.4%	9.9%	8.8%	7.4%	6.5%	6.2%	4.2%	3.5%	2.6	29	19	10	GC				
10/13/2004	TSGT-3	18	15999	14300	5A Waste	1996		100.0%	100.0%	100.0%	97.9%	93.8%	80.4%	66.1%	49.8%	34.9%	26.9%	22.4%	19.1%	15.7%	12.7%	11.4%	10.1%	9.5%	8.8%	6.2%	5.9%	1.8	28	17	11	SC				
10/13/2004	TSGT-3	58	15999	14300	5A Waste	1986		100.0%	100.0%	97.0%	90.3%	85.4%	72.3%	56.4%	45.8%	35.6%	27.8%	22.9%	19.2%	15.4%	11.5%	10.4%	10.1%	9.3%	8.4%	6.2%	4.8%	2.2	29	17	12	GC				
10/13/2004	TSGT-3	156	15999	14300	5A Waste	1984		100.0%	100.0%	96.6%	95.3%	93.5%	88.1%	75.3%	65.6%	52.1%	43.5%	37.6%	33.1%	27.6%	22.3%	20.8%	17.7%	16.2%	14.7%	11.3%	9.1%	1.4	29	15	14	SC				
10/13/2004	TSGT-3	248	15999	14300	5A Waste	1982		100.0%	94.4%	83.3%	78.5%	73.9%	64.9%	55.6%	48.7%	40.0%	33.1%	28.8%	25.5%	22.1%	20.1%	17.3%	15.7%	14.6%	13.5%	10.2%	7.4%	1.2	28	17	11	GC				
10/13/2004	TSGT-4	12	4156	10839	2A Leach	2004		100.0%	100.0%	91.1%	84.5%	77.6%	64.5%	54.6%	48.6%	39.8%	33.0%	28.1%	24.5%	20.5%	16.1%	14.5%	13.1%	12.0%	10.4%	7.7%	5.7%	2.4	34	18	16	GC				
10/13/2004	TSGT-4	69	4156	10839	2A Leach	2000		100.0%	100.0%	84.3%	71.8%	63.7%	47.7%	34.1%	26.2%	21.0%	17.9%	15.9%	14.2%	12.3%	10.5%	9.4%	8.3%	7.7%	7.0%	5.3%	4.3%	3.4	36	20	16	GC				
10/13/2004	TSGT-4	117	4156	10839	2A Leach	1978		100.0%	100.0%	82.4%	73.8%	67.6%	52.3%	37.9%	31.2%	25.3%	21.5%	19.0%	16.9%	14.0%	11.6%	10.2%	9.2%	8.6%	7.8%	5.4%	4.4%	3.1	35	20	15	GC				
10/13/2004	TSGT-4	152	4156	10839	2A Leach	1975		100.0%	100.0%	99.1%	93.4%	88.2%	69.1%	55.0%	45.6%	35.9%	29.5%	25.1%	21.9%	18.3%	15.3%	14.5%	12.8%	11.7%	10.6%	7.5%	5.3%	2.0	31	18	13	GC				
10/13/2004	TSGT-4	183	4156	10839	2A Leach	1974		100.0%	100.0%	97.5%	96.1%	94.3%	87.8%	77.7%	68.2%	55.5%	46.1%	39.5%	34.2%	28.3%	23.5%	21.2%	18.6%	17.8%	16.3%	12.1%	9.8%	1.1	31	19	12	SC				
10/13/2004	TSGT-4	221	4156	10839	2A Leach	1973		100.0%	100.0%	94.9%	86.5%	77.7%	60.4%	46.5%	37.9%	30.1%	24.9%	21.6%	18.8%	15.8%	12.6%	11.2%	10.7%	9.6%	8.4%	6.1%	3.7%	2.4	29	17	12	GC				
10/13/2004	TSGT-4	265	4156	10839	2A Leach	1973		100.0%	100.0%	99.5%	98.2%	97.0%	94.6%	89.6%	80.6%	61.9%	46.8%	36.8%	28.9%	21.6%	15.7%	13.4%	11.6%	11.2%	9.8%	6.7%	5.8%	0.6	24	20	4	SM	38.4	0		
9/13/2005	S1A-3	11	18991	10092	1A Leach	1982		100.0%	100.0%	86.0%	77.0%	70.8%	59.0%	40.5%	33.1%	27.9%	23.9%	20.9%	18.5%	15.8%	15.2%	14.1%	13.2%	12.8%	12.4%	10.0%	6.2%	1.8	32	17	15	GC				

TABLE IV-1

Laboratory Testing Summary

									Coarse Gravel	Coarse Gravel		Fine Gravel		Coarse S	Medium Sand		Fine Sand			Fines													Triaxial		Direct Shear	
			Mine Coords.					6.000"	3.000"	1.500"	1.000"	0.750"	0.375"	#4	#10	#20	#40	#60	#100	#200													ϕ'	c'	ϕ'	c'
Date Sampled	Number	Depth	Easting	Northing	Stockpile	Year Placed	%>3 inch	154.2	75	37.5	25	19	9.5	4.75	2	0.85	0.425	0.25	0.15	0.075	0.034	0.022	0.013	0.009	0.006	0.003	0.001	Activity	LL	PL	PI	USCS	(°)	psi	(°)	psi
9/13/2005	S1A-3	31	18991	10092	1A Leach	1982		100.0%	100.0%	76.8%	71.1%	69.0%	61.5%	55.9%	51.6%	45.9%	40.0%	35.8%	32.0%	27.7%	26.3%	24.6%	22.8%	21.7%	21.1%	17.1%	11.3%	1.1	34	18	16	GC				
9/13/2005	S1A-3	51	18991	10092	1A Leach	1982		100.0%	100.0%	90.2%	75.2%	71.4%	62.6%	54.7%	48.7%	41.6%	34.9%	29.9%	25.9%	21.4%	20.2%	18.8%	17.4%	16.5%	16.0%	12.3%	4.2%	1.5	31	19	12	GC				
9/13/2005	S1A-3	71	18991	10092	1A Leach	1982		100.0%	100.0%	100.0%	94.6%	90.9%	82.1%	75.7%	68.0%	59.0%	50.9%	45.0%	40.0%	34.5%	31.6%	29.7%	27.0%	25.4%	25.1%	20.0%	9.6%	0.9	33	20	13	SC				
9/13/2005	S1A-3	76.5	18991	10092	1A Leach	1982		100.0%	100.0%	96.2%	92.8%	87.7%	77.1%	67.1%	58.5%	49.9%	43.4%	38.6%	33.6%	27.9%	24.4%	21.6%	20.3%	19.6%	17.9%	13.9%	6.4%	0.7	23	16	7	SC-SM				
9/13/2005	S1A-3	91	18991	10092	1A Leach	1982		100.0%	100.0%	89.0%	80.7%	78.9%	70.7%	62.1%	52.7%	44.7%	38.7%	34.2%	30.2%	25.7%	24.7%	23.1%	21.5%	21.1%	19.8%	15.3%	5.5%	1.2	31	18	13	GC				
9/13/2005	S1A-4	9	18606	8849	1A Leach	2004		100.0%	100.0%	89.5%	70.6%	58.1%	34.6%	20.8%	12.6%	8.9%	7.4%	6.4%	5.6%	4.7%	4.3%	4.1%	3.8%	3.6%	3.2%	2.6%	2.1%	6.1	31	17	14	GW				
9/13/2005	S1A-4	29	18606	8849	1A LEach	2004		100.0%	100.0%	80.0%	63.5%	57.8%	46.6%	37.6%	28.8%	22.7%	19.3%	17.3%	15.6%	13.7%	12.1%	11.1%	10.2%	9.4%	9.1%	7.2%	4.5%	2.1	31	18	12	GC				
9/14/2005	S1A-4	49	18606	8849	1A Leach	2004		100.0%	100.0%	90.9%	82.0%	76.5%	65.1%	54.7%	46.5%	37.7%	32.0%	28.6%	25.7%	22.4%	20.4%	19.3%	17.4%	16.3%	15.7%	12.4%	8.8%	1.3	31	17	14	GC				
9/14/2005	S1A-4	69	18606	8849	1A Leach	2003		100.0%	100.0%	91.1%	89.8%	86.4%	76.0%	63.3%	54.3%	44.2%	37.5%	33.3%	29.6%	25.3%	21.7%	20.1%	18.2%	17.6%	15.7%	12.5%	8.3%	1.4	31	16	15	SC				
9/14/2005	S1A-4	89	18606	8849	1A Leach	2002		100.0%	100.0%	93.2%	88.8%	85.5%	76.7%	66.4%	58.9%	52.0%	45.9%	41.0%	36.1%	30.3%	27.2%	25.2%	22.9%	22.2%	21.2%	17.8%	10.4%	1.1	36	20	16	SC				
9/14/2005	S1A-4	109	18606	8849	1A Leach	2001		100.0%	100.0%	87.7%	81.5%	74.3%	63.0%	55.3%	47.3%	40.8%	35.7%	31.5%	28.0%	24.4%	23.1%	22.0%	20.0%	18.5%	17.7%	14.0%	7.1%	1.4	35	20	15	GC				
9/15/2005	S1A-4	113	18606	8849	1A Leach	2000		100.0%	100.0%	100.0%	98.7%	97.5%	90.3%	76.4%	63.8%	53.4%	46.3%	41.4%	37.6%	33.2%	31.9%	29.5%	26.7%	25.2%	23.6%	19.7%	13.8%	1.0	36	19	17	SC				
9/15/2005	S1A-4	129	18606	8849	1A Leach	1999		100.0%	100.0%	97.0%	79.5%	72.0%	58.9%	49.0%	42.3%	36.7%	32.7%	29.7%	26.8%	23.6%	21.8%	20.6%	19.2%	18.0%	17.0%	13.4%	7.5%	1.1	34	23	11	GC				
9/15/2005	S1A-5	16.5	18441	9895	1A Leach	2004		100.0%	100.0%	87.5%	75.2%	69.2%	59.6%	48.7%	41.2%	31.4%	24.4%	20.2%	17.3%	14.5%	12.8%	11.6%	10.4%	9.7%	9.4%	7.0%	3.1%	0.8	24	20	4	GM				
9/17/2005	S1A-5	36.5	18441	9895	1A Leach	2003		100.0%	100.0%	70.9%	61.8%	56.1%	46.0%	36.7%	31.3%	24.4%	20.0%	17.2%	15.1%	13.1%	12.9%	12.4%	11.3%	10.6%	9.4%	7.2%	4.5%	2.4	30	16	14	GC				
9/17/2005	S1A-5	56.5	18441	9895	1A Leach	2003		100.0%	100.0%	79.1%	65.3%	58.1%	45.7%	37.5%	30.2%	23.2%	19.1%	16.6%	14.9%	13.2%	13.1%	12.3%	11.4%	10.8%	9.6%	6.9%	5.1%	2.7	34	18	16	GC				
9/17/2005	S1A-5	96.5	18441	9895	1A Leach	2002		100.0%	100.0%	81.3%	75.8%	70.7%	62.3%	54.7%	47.8%	38.5%	31.3%	26.8%	23.5%	20.2%	18.6%	17.3%	15.6%	14.6%	12.9%	10.0%	7.3%	1.9	37	21	16	GC				
9/17/2005	S1A-5	116.5	18441	9895	1A Leach	2000		100.0%	100.0%	94.4%	88.4%	83.9%	72.9%	61.7%	53.2%	44.6%	38.6%	34.6%	31.3%	27.4%	24.5%	21.8%	19.1%	17.9%	17.3%	13.7%	9.8%	1.2	33	19	14	GC				
9/17/2005	S1A-5	136.5	18441	9895	1A Leach	1999		100.0%	100.0%	82.5%	75.7%	67.2%	56.5%	46.8%	36.2%	29.4%	25.8%	23.4%	21.4%	18.8%	17.3%	16.4%	15.2%	14.0%	13.5%	10.7%	5.7%	1.8	33	18	15	GC				
9/17/2005	S1A-5	164	18441	9895	1A Leach	1998		100.0%	100.0%	97.2%	80.7%	75.3%	63.4%	52.8%	43.7%	33.9%	28.2%	24.9%	22.6%	20.2%	18.0%	16.6%	16.1%	15.5%	13.9%	11.3%	8.3%	1.8	35	17	18	GC				
12/27/2018	TY18-01	5	5491	16395	9AX	2015	50	100%	100%	98.4%	94.4%	90.3%	78.4%	63.9%	44.1%	28.5%	20.8%	17.2%	14.8%	12.4%									31.0	20.0	11.0	SC			28.1	20.5
12/28/2018	TY18-02	5	5275	16818	9AX	2015	40	100%	100%	99.3%	91.1%	78.1%	42.1%	10.8%	7.4%	5.1%	3.8%	3.0%	2.5%	1.9%									28.0	20.0	8.0	GP				

□	Leach Stockpile
▨	Waste Stockpile



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Grain Size Distribution Leach Material

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

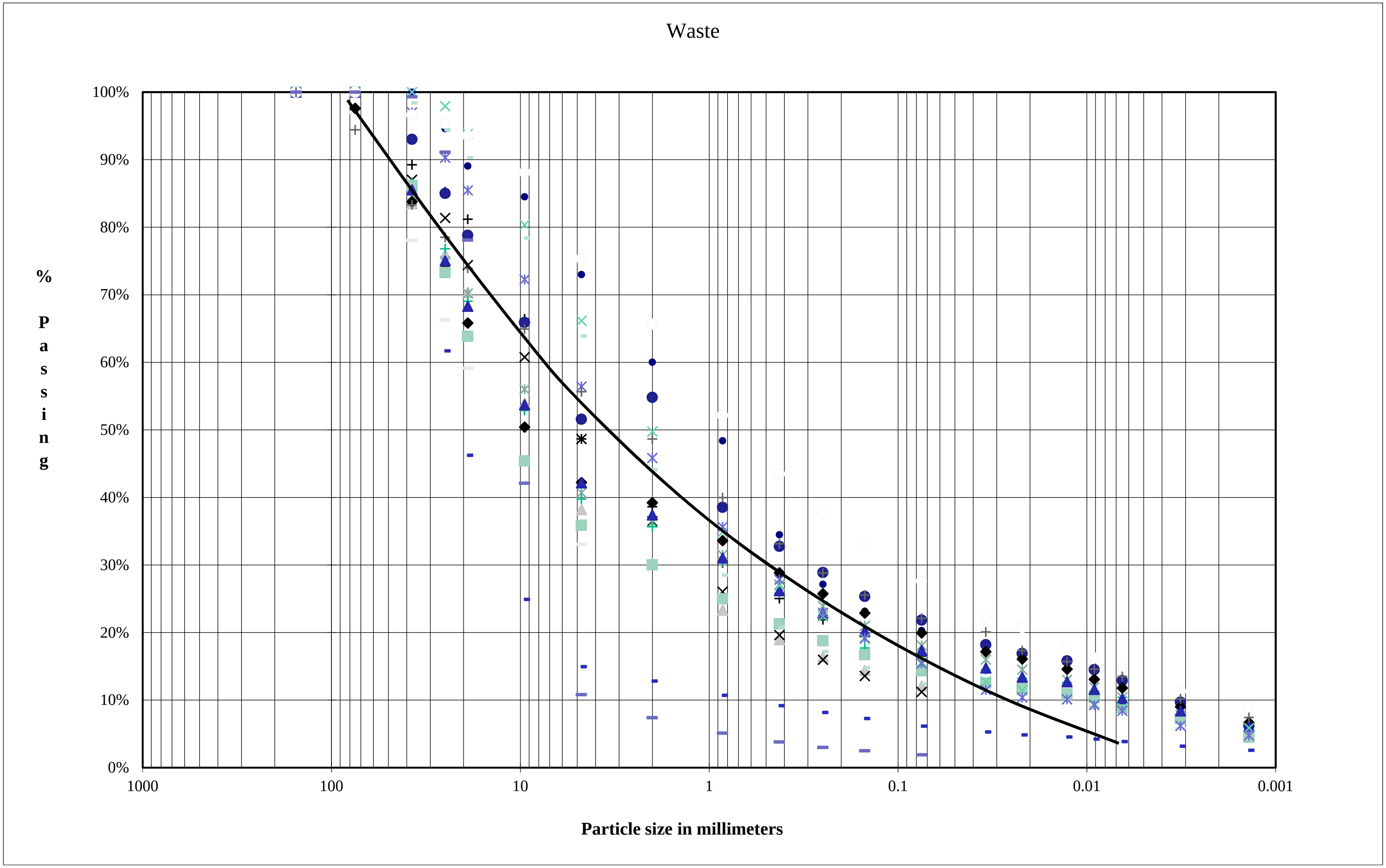
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-1



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Grain Size Distribution Waste Material

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-2

GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Percent Fines versus Depth

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

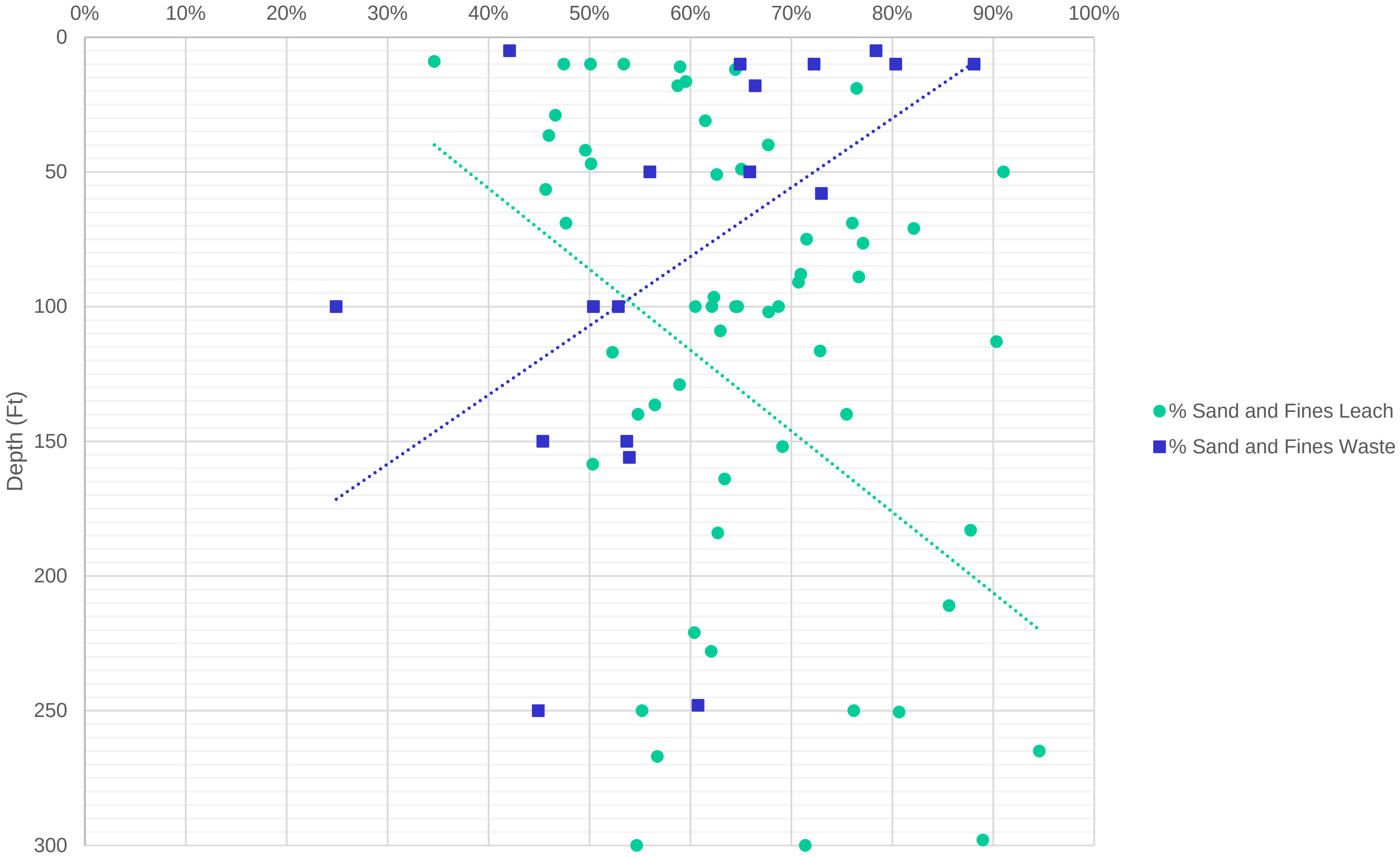
TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS:	Stockpile Stability		
PROJECT NO.:	18106417	PHASE:	REV:

PREPARED BY:	TJW
REVIEWED BY:	TJW
APPROVED BY:	DAK

DATE: 04/05/2019

FIGURE- IV-3



9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Percent Sand and Fines versus Depth

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

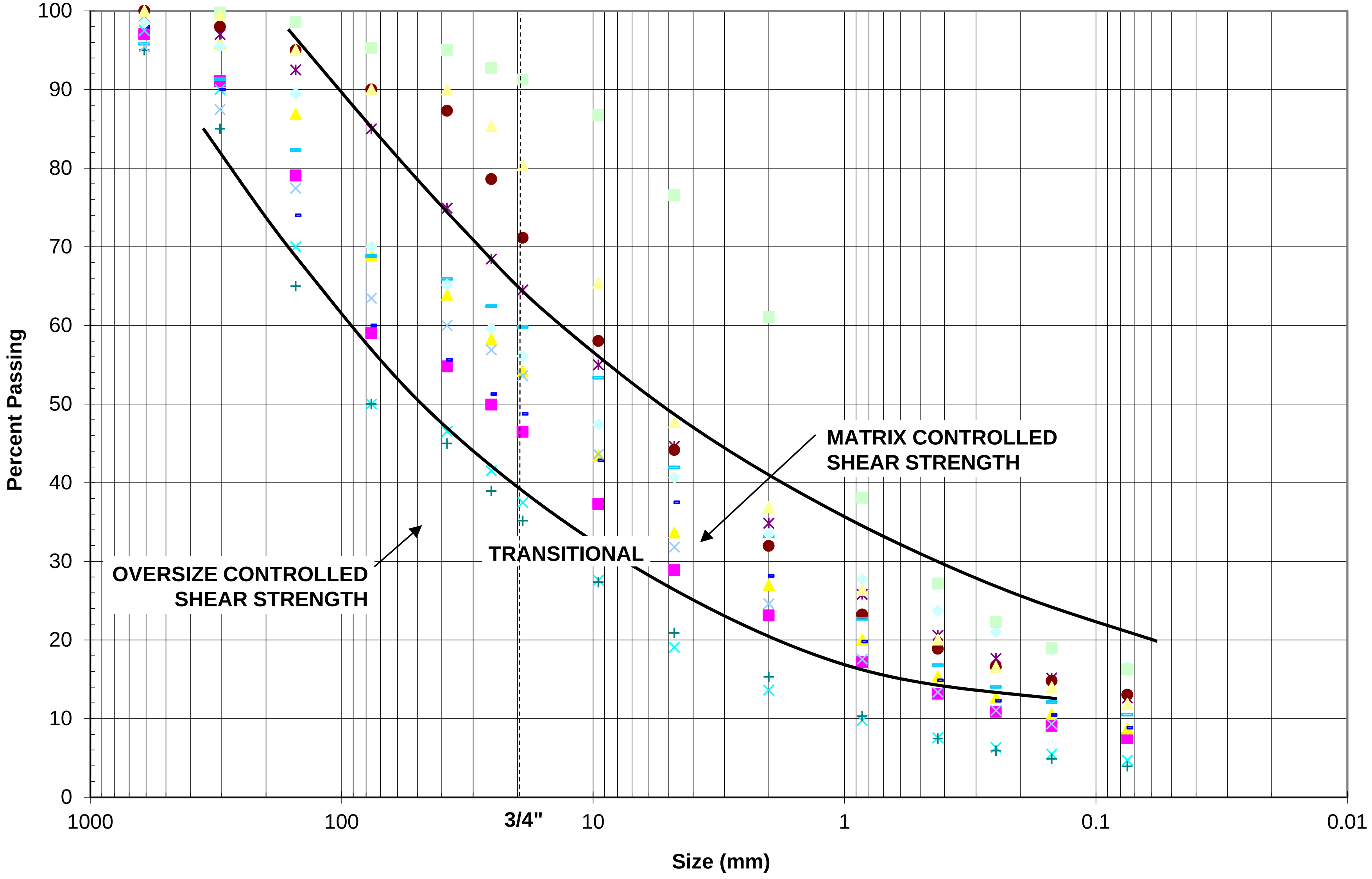
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-4



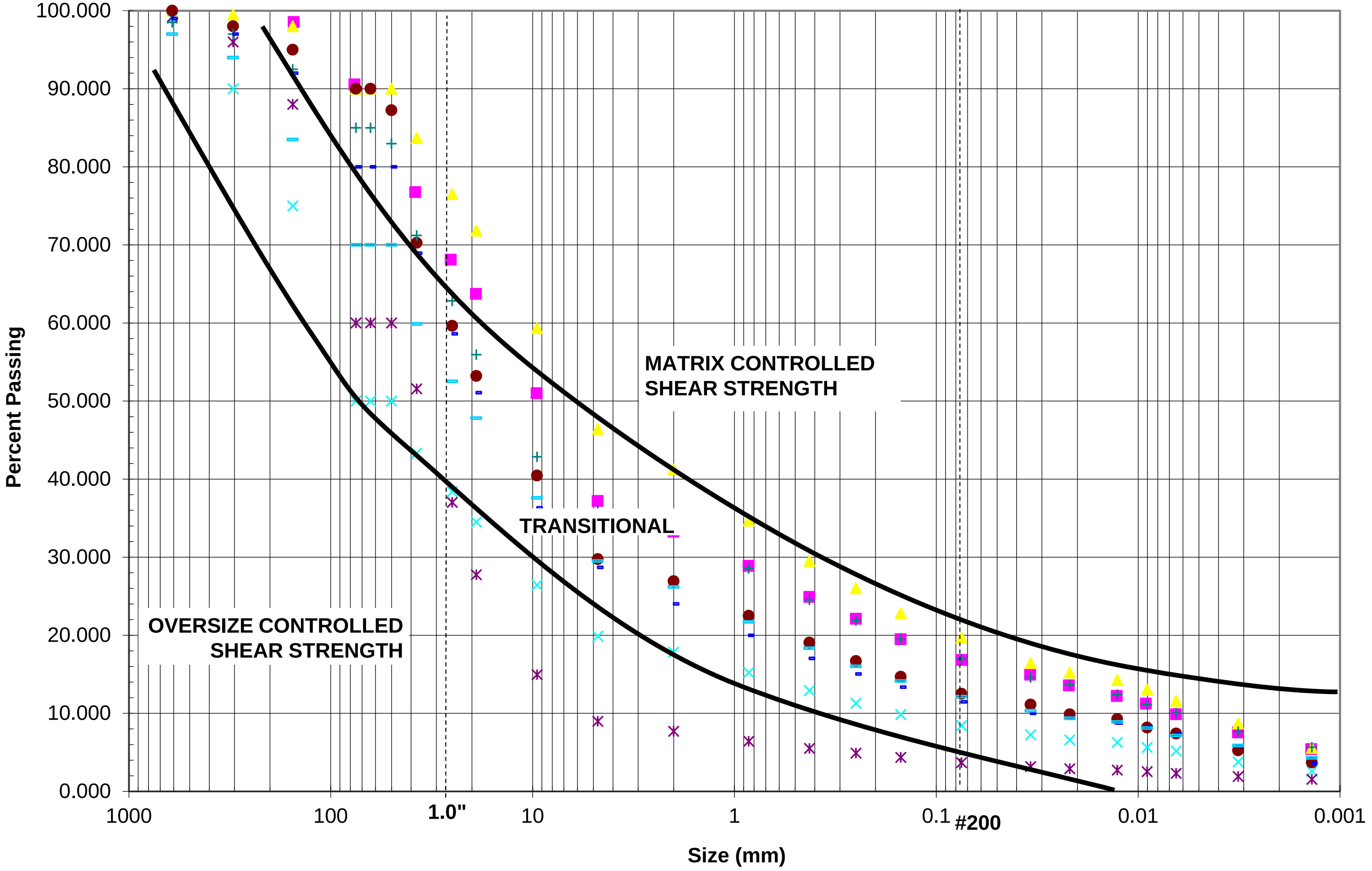
GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Extended Grain Size Distribution Leach Material

CLIENT AND PROJECT:			
FREEPORT MCMORAN TYRONE INC.	**TYRONE STOCKPILE STABILITY 2019 CCP UPDATE**		
ANALYSIS:	Stockpile Stability		
PROJECT NO.:	18106417	PHASE:	REV:
PREPARED BY:	TJW	DATE:	04/05/2019
REVIEWED BY:	TJW		
APPROVED BY:	DAK	**FIGURE- IV-5**	



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Extended Grain Size Distribution Waste Material

CLIENT AND PROJECT:

**FREEPORT MCMORAN
TYRONE INC.**

**TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE**

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

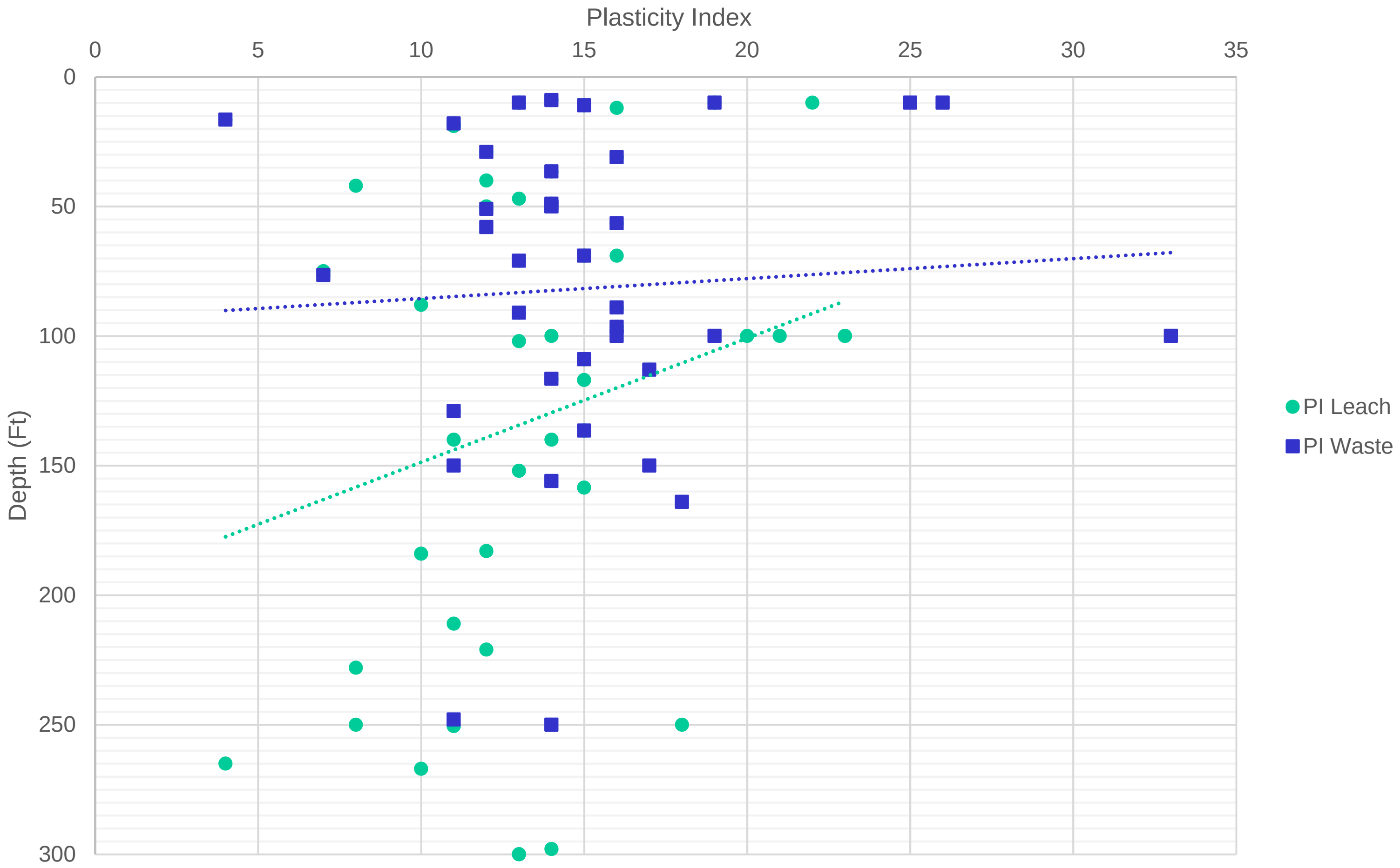
PHASE:

REV:

PREPARED BY:	TJW
REVIEWED BY:	TJW
APPROVED BY:	DAK

DATE: 04/05/2019

FIGURE- IV-6



9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Plasticity Index versus Depth

CLIENT AND PROJECT:

FREEPORT MCMORAN TYRONE INC.

TYRONE STOCKPILE STABILITY 2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

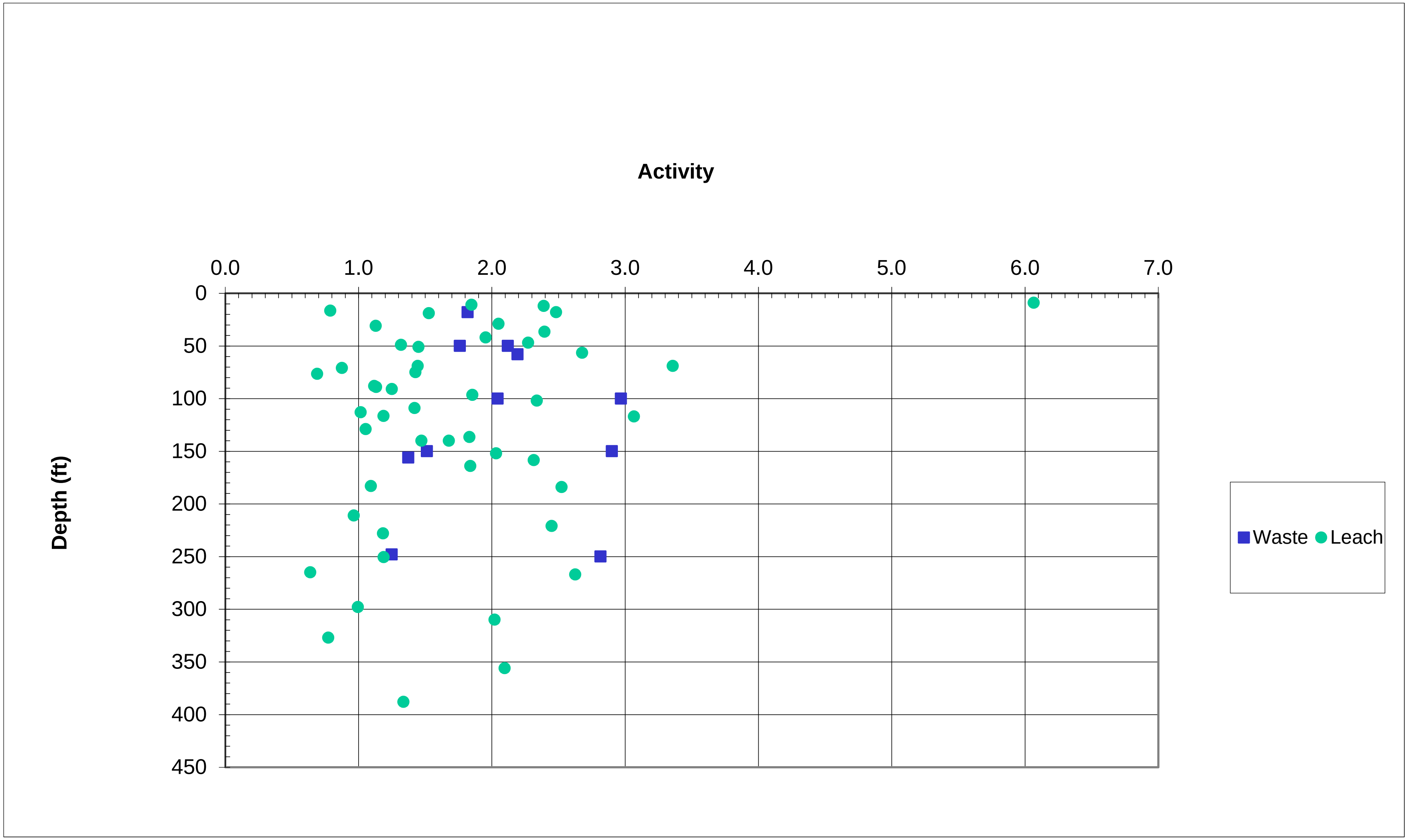
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-7



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Clay Activity versus Depth

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

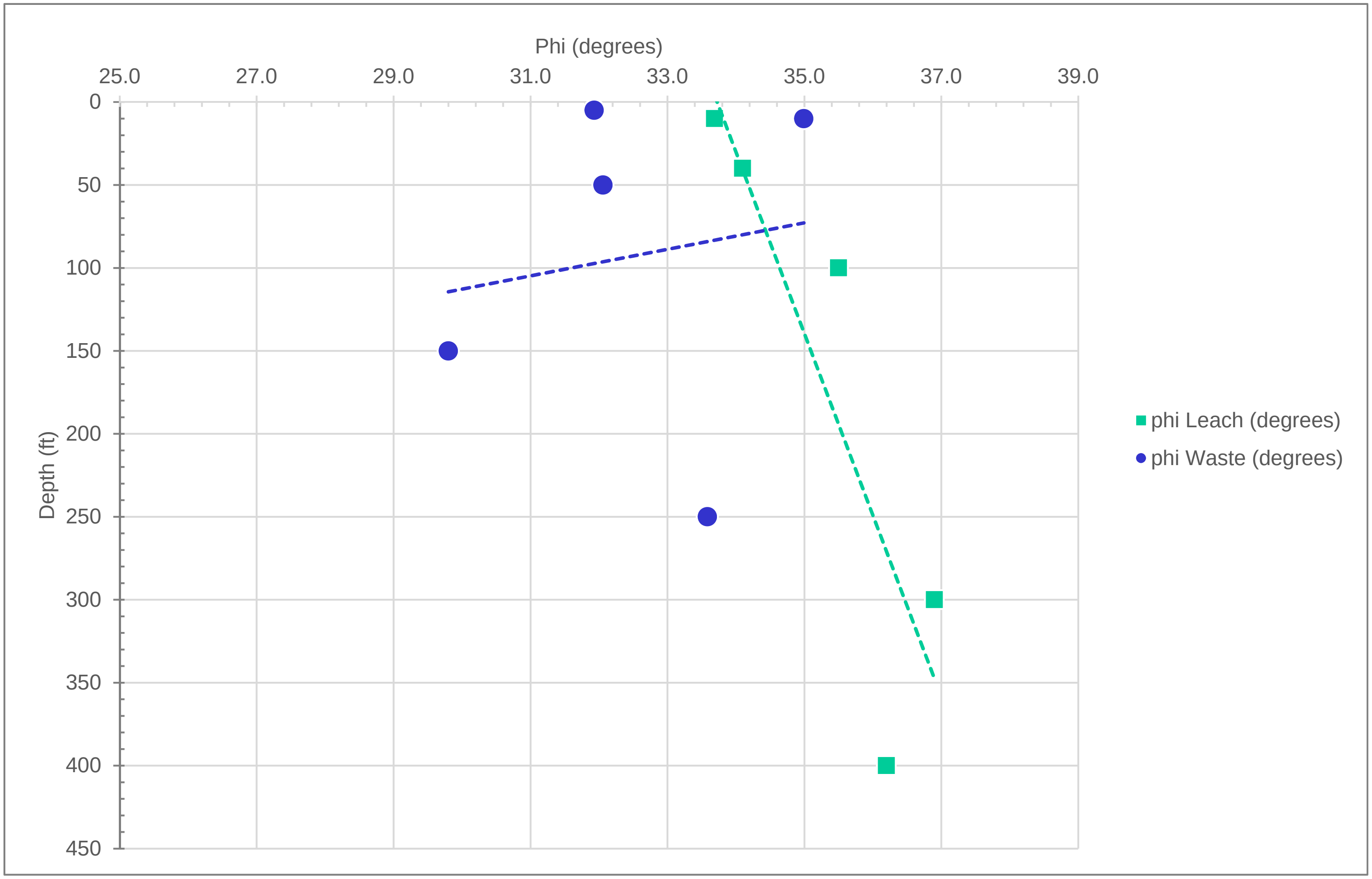
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-8



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Laboratory Measured Friction Angle versus Depth

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

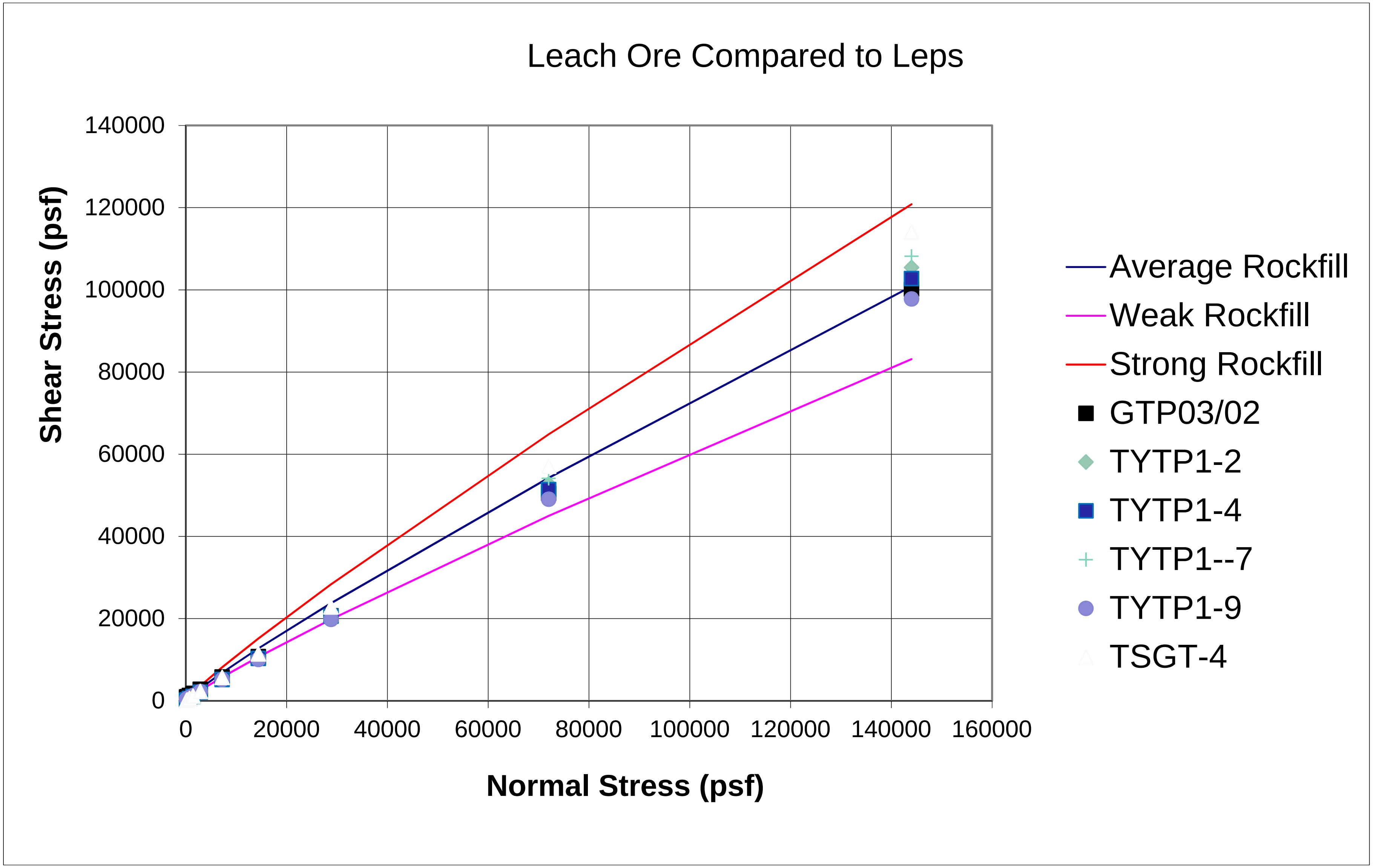
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-9



9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Leached Ore Compared to Leps (1970)

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

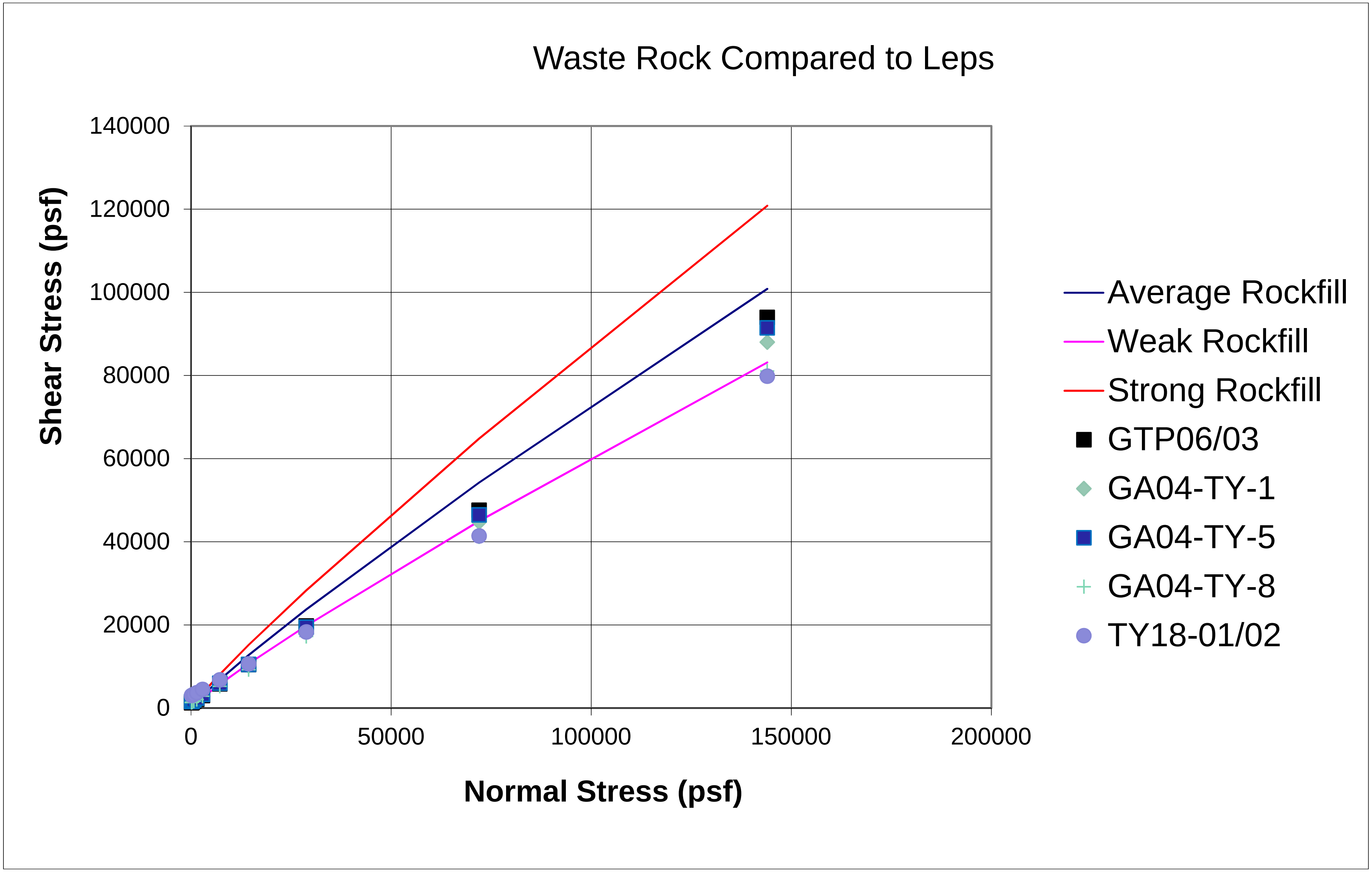
PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-10



GOLDER

9 Monroe Parkway Suite 270
Portland, Oregon 97035
Ph: +1 (503) 607 1820

TITLE:

Waste Rock Compared to Leps (1970)

CLIENT AND PROJECT:

FREEPORT MCMORAN
TYRONE INC.

TYRONE STOCKPILE
STABILITY
2019 CCP UPDATE

ANALYSIS: Stockpile Stability

PROJECT NO.: 18106417

PHASE:

REV:

PREPARED BY: TJW

REVIEWED BY: TJW

APPROVED BY: DAK

DATE: 04/05/2019

FIGURE- IV-11

APPENDIX V

Liquefaction and Foundation Investigation Borehole Logs

TABLE V-1
1A-1B Liquefaction Assessment

All Qal SPT Data, 1A and 1B Leach Stockpile
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF
Qal sat unit weight	130	PCF

Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	No. 1A-1B			30% Amplification
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)	
GA-05-01	11	5	Fill	12	0	0	600	600	1.70	17.14	0.99	0.090	0.2975	NL	
GA-05-01	11	10	Fill	26	0	0	1200	1200	1.29	28.20	0.98	0.089	2.4689	NL	
GA-05-01	11	15	Fill	6	4	249.6	1840	1590.4	1.12	5.65	0.97	0.102	0.1234	1.5	
GA-05-01	11	20	Fill	13	9	561.6	2490	1928.4	1.02	11.12	0.95	0.112	0.2061	2.3	
GA-05-01	11	25	Qal	29	14	873.6	3140	2266.4	0.94	22.88	0.94	0.119	0.4209	4.4	
GA-05-02	7	5	Fill	20	0	0	600	600	1.70	28.56	0.99	0.090	2.4689	NL	
GA-05-02	7	10	Fill	2	3	187.2	1230	1042.8	1.38	2.33	0.98	0.105	0.0864	1.0	Void (PLS Line?)
GA-05-03	0	20	Qal	20	20	1248	2600	1352	1.22	20.43	0.95	0.167	0.3605	2.7	
GA-05-03	0	25	Qal	23	25	1560	3250	1690	1.09	21.02	0.94	0.165	0.3901	2.9	
GA-05-03	0	23	Qal	87	23	1435.2	2990	1554.8	1.13	82.89	0.95	0.166	2.4689	NL	
GA-05-04	16	5	Fill	28	0	0	600	600	1.70	39.98	0.99	0.090	2.4689	NL	
GA-05-04	16	10	Fill	14	0	0	1200	1200	1.29	15.18	0.98	0.089	0.2679	NL	
GA-05-04	16	15	Fill	9	0	0	1800	1800	1.05	7.97	0.97	0.088	0.1506	NL	
GA-05-04	16	20	Fill	18	4	249.6	2440	2190.4	0.96	14.45	0.95	0.097	0.2494	3.2	
GA-05-04	16	25	Fill	29	9	561.6	3090	2528.4	0.89	21.67	0.94	0.105	0.3901	4.6	
GA-05-04	16	30	Qtg	50	14	873.6	3740	2866.4	0.84	35.08	0.93	0.110	2.4689	NL	
GA-05-05	14	17.5	Qal	6	3.5	218.4	2135	1916.6	1.02	5.15	0.96	0.097	0.1234	1.6	PLS Pond Sedime
GA-05-05	14	22.5	Qtg	52	8.5	530.4	2785	2254.6	0.94	41.14	0.95	0.107	2.4689	NL	
GA-05-06	20	5	Qal	32	0	0	600	600	1.70	45.70	0.99	0.090	2.4689	NL	
GA-05-06	20	10	Qal	43	0	0	1200	1200	1.29	46.63	0.98	0.089	2.4689	NL	
GA-05-06	20	15	Qtg	50	0	0	1800	1800	1.05	44.27	0.97	0.088	2.4689	NL	
GA-05-07	21	5	Fill	31	0	0	600	600	1.70	44.27	0.99	0.090	2.4689	NL	
GA-05-07	21	10	Qal	6	0	0	1200	1200	1.29	6.51	0.98	0.089	0.1383	NL	
GA-05-07	21	15	Qal	7	0	0	1800	1800	1.05	6.20	0.97	0.088	0.1383	NL	
GA-05-07	21	20	Qtg	50	0	0	2400	2400	0.91	38.34	0.95	0.087	2.4689	NL	
GA-05-08	29	5	Fill	16	0	0	600	600	1.70	22.85	0.99	0.090	0.4209	NL	
GA-05-08	29	10	Fill	12	0	0	1200	1200	1.29	13.01	0.98	0.089	0.2358	NL	
GA-05-08	29	15	Fill	18	0	0	1800	1800	1.05	15.94	0.97	0.088	0.2679	NL	
GA-05-08	29	20	FIll	28	0	0	2400	2400	0.91	21.47	0.95	0.087	0.3901	NL	
GA-05-08	29	25	Fill	25	0	0	3000	3000	0.82	17.15	0.94	0.086	0.2975	NL	
GA-05-08	29	30	Fill	46	1	62.4	3610	3547.6	0.75	29.01	0.93	0.086	2.4689	35.4	
GA-05-08	29	35	Qtg	50	6	374.4	4260	3885.6	0.72	30.13	0.92	0.092	2.4689	NL	
GA-05-09	31	20	FIll	50	0	0	2400	2400	0.91	38.34	0.95	0.087	2.4689	NL	
GA-05-09	31	25	Fill	40	0	0	3000	3000	0.82	27.43	0.94	0.086	1.2344	NL	
GA-05-09	31	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	0.085	2.4689	NL	

TABLE V-2
1C Liquefaction Analysis

All Qal SPT Data, Reclaimed 1C Waste Transects 1-3
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF		
Qal sat unit weight	130	PCF		
Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	No. 1C			30% Amplificatior
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)		CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
B1C-1	25	5	Qtg	16	0	0	600	600	1.70	22.85	0.99	2	0.090	0.4209	NL
B1C-1	25	10	Qtg	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-1	25	15	Qtg	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-1	25	20	Qtg	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-1	25	25	Qtg	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-2	20.5	5	Qal	20	0	0	600	600	1.70	28.56	0.99	2	0.090	2.4689	NL
B1C-2	20.5	10	Qal	2	0	0	1200	1200	1.29	2.17	0.98	2	0.089	0.0864	NL
B1C-2	20.5	15	Qtg	20	0	0	1800	1800	1.05	17.71	0.97	2	0.088	0.2975	NL
B1C-2	20.5	20	Qtg	23	0	0	2400	2400	0.91	17.64	0.95	2	0.087	0.2975	NL
B1C-3	15.5	5	Qal	87	0	0	600	600	1.70	124.24	0.99	2	0.090	2.4689	NL
B1C-3	15.5	10	Qtg	28	0	0	1200	1200	1.29	30.36	0.98	2	0.089	2.4689	NL
B1C-3	15.5	15	Qtg	14	0	0	1800	1800	1.05	12.40	0.97	2	0.088	0.2222	NL
B1C-4	32	5	Qal	16	0	0	600	600	1.70	22.85	0.99	2	0.090	0.4209	NL
B1C-4	32	10	Qal	38	0	0	1200	1200	1.29	41.21	0.98	2	0.089	2.4689	NL
B1C-4	32	15	Qal	55	0	0	1800	1800	1.05	48.70	0.97	2	0.088	2.4689	NL
B1C-4	32	20	Qtg	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-4	32	25	Qtg	53	0	0	3000	3000	0.82	36.35	0.94	2	0.086	2.4689	NL
B1C-4	32	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	2	0.085	2.4689	NL
B1C-4	32	35	Qtg	50	3	187.2	4230	4042.8	0.70	29.54	0.92	2	0.087	2.4689	34.9
B1C-5	22.5	5	Qal	75	0	0	600	600	1.70	107.10	0.99	2	0.090	2.4689	NL
B1C-5	22.5	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-5	22.5	12	Qal	50	0	0	1440	1440	1.18	49.50	0.97	2	0.088	2.4689	NL
B1C-5	22.5	15	Qal	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-5	22.5	20	Qtg	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-6	35	5	Qal	20	0	0	600	600	1.70	28.56	0.99	2	0.090	2.4689	NL
B1C-6	35	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-6	35	15	Qal	48	0	0	1800	1800	1.05	42.50	0.97	2	0.088	2.4689	NL
B1C-6	35	20	Qal	55	0	0	2400	2400	0.91	42.17	0.95	2	0.087	2.4689	NL
B1C-6	35	26	Qtg	50	0	0	3120	3120	0.80	33.63	0.94	2	0.085	2.4689	NL
B1C-6	35	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	2	0.085	2.4689	NL
B1C-6	35	35	Qtg	46	0	0	4200	4200	0.69	26.66	0.92	2	0.084	0.9875	14.6
B1C-7	10.5	5	Qtg	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-7	10.5	10	Qtg	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-8	10	5	Qtg	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-8	10	10	Qtg	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-9	20.5	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-9	20.5	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-9	20.5	15	Qal	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-9	20.5	20	Qtg	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-10	28.5	5	Qal	20	0	0	600	600	1.70	28.56	0.99	2	0.090	2.4689	NL
B1C-10	28.5	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-10	28.5	15	Qal	33	0	0	1800	1800	1.05	29.22	0.97	2	0.088	2.4689	NL
B1C-10	28.5	20	Qal	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-10	28.5	25	Qtg	45	0	0	3000	3000	0.82	30.86	0.94	2	0.086	2.4689	NL
B1C-10	28.5	27	Qtg	50	0	0	3240	3240	0.79	33.00	0.94	2	0.085	2.4689	NL
B1C-11	15.5	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-11	15.5	10	Qtg	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-11	15.5	15	Qtg	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-12	10.3	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-12	10.3	10	Qtg	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL

TABLE V-2
1C Liquefaction Analysis

All Qal SPT Data, Reclaimed 1C Waste Transects 1-3
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF		
Qal sat unit weight	130	PCF		
Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
No. 1C				30% Amplificatior
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)		CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
B1C-13	30.5	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-13	30.5	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-13	30.5	15	Qal	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-13	30.5	20	Qal	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-13	30.5	25	Qtg	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-13	30.5	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	2	0.085	2.4689	NL
B1C-14	25.2	5	Qal	41	0	0	600	600	1.70	58.55	0.99	2	0.090	2.4689	NL
B1C-14	25.2	10	Qal	40	0	0	1200	1200	1.29	43.38	0.98	2	0.089	2.4689	NL
B1C-14	25.2	15	Qal	40	0	0	1800	1800	1.05	35.42	0.97	2	0.088	2.4689	NL
B1C-14	25.2	20	Qal	40	0	0	2400	2400	0.91	30.67	0.95	2	0.087	2.4689	NL
B1C-14	25.2	25	Qal	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-15	5.5	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-15	5.5	10	W. BR	50	4.5	280.8	1245	964.2	1.44	60.49	0.98	2	0.115	2.4689	NL
B1C-15	5.5	15	W. BR	50	9.5	592.8	1895	1302.2	1.24	52.05	0.97	2	0.128	2.4689	NL
B1C-16	12	5	Qal	28	0	0	600	600	1.70	39.98	0.99	2	0.090	2.4689	NL
B1C-16	12	10	W. BR	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-17	35	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-17	35	10	Qal	46	0	0	1200	1200	1.29	49.88	0.98	2	0.089	2.4689	NL
B1C-17	35	15	Qal	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-17	35	20	W. BR	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-17	35	25	W. BR	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-17	35	30	W. BR	50	0	0	3600	3600	0.75	31.30	0.93	2	0.085	2.4689	NL
B1C-17	35	35	W. BR	50	0	0	4200	4200	0.69	28.98	0.92	2	0.084	2.4689	36.5
B1C-18	37.5	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-18	37.5	10	Qal	33	0	0	1200	1200	1.29	35.79	0.98	2	0.089	2.4689	NL
B1C-18	37.5	15	Qal	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-18	37.5	20	Qtg	46	0	0	2400	2400	0.91	35.27	0.95	2	0.087	2.4689	NL
B1C-18	37.5	25	Qtg	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-18	37.5	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	2	0.085	2.4689	NL
B1C-18	37.5	35	W. BR	50	0	0	4200	4200	0.69	28.98	0.92	2	0.084	2.4689	NL
B1C-18	37.5	37	W. BR	50	0	0	4440	4440	0.67	28.19	0.91	2	0.083	2.4689	NL
B1C-19	27.3	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-19	27.3	10	Qal	33	0	0	1200	1200	1.29	35.79	0.98	2	0.089	2.4689	NL
B1C-19	27.3	15	W. BR	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-19	27.3	20	W. BR	46	0	0	2400	2400	0.91	35.27	0.95	2	0.087	2.4689	NL
B1C-19	27.3	25	W. BR	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-19	27.3	27	W. BR	50	0	0	3240	3240	0.79	33.00	0.94	2	0.085	2.4689	NL
B1C-24	20	5	Qal	34	0	0	600	600	1.70	48.55	0.99	2	0.090	2.4689	NL
B1C-24	20	10	W. BR	35	0	0	1200	1200	1.29	37.96	0.98	2	0.089	2.4689	NL
B1C-24	20	15	W. BR	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-24	20	20	W. BR	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-25	10	5	W. BR	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-25	10	10	W. BR	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-26	5	5	Qal	30	0	0	600	600	1.70	42.84	0.99	2	0.090	2.4689	NL
B1C-26	5	10	Qal	50	5	312	1250	938	1.46	61.33	0.98	2	0.118	2.4689	NL
B1C-26	5	15	Qal	50	10	624	1900	1276	1.25	52.58	0.97	2	0.131	2.4689	NL
B1C-26	5	20	W. BR	30	15	936	2550	1614	1.11	28.05	0.95	2	0.137	2.4689	22.2
B1C-26	5	25	W. BR	30	20	1248	3200	1952	1.01	25.51	0.94	2	0.140	0.7777	6.8
B1C-26	5	30	W. BR	50	25	1560	3850	2290	0.93	39.25	0.93	2	0.142	2.4689	NL
B1C-26	5	35	W. BR	50	30	1872	4500	2628	0.87	36.64	0.92	2	0.143	2.4689	NL

TABLE V-2
1C Liquefaction Analysis

All Qal SPT Data, Reclaimed 1C Waste Transects 1-3
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF		
Qal sat unit weight	130	PCF		
Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	No. 1C			30% Amplificatior
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)		CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
B1C-27	15	5	Qal	30	0	0	600	600	1.70	42.84	0.99	2	0.090	2.4689	NL
B1C-27	15	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-27	15	15	Qal	43	0	0	1800	1800	1.05	38.07	0.97	2	0.088	2.4689	NL
B1C-27	15	20	Qal	40	5	312	2450	2138	0.97	32.50	0.95	2	0.099	2.4689	NL
B1C-27	15	25	Qal	30	10	624	3100	2476	0.90	22.65	0.94	2	0.107	0.4209	4.8
B1C-27	15	30	W. BR	50	15	936	3750	2814	0.84	35.41	0.93	2	0.113	2.4689	NL
B1C-28	5	10	Qal	49	5	312	1250	938	1.46	60.10	0.98	2	0.118	2.4689	NL
B1C-28	5	15	Qal	28	10	624	1900	1276	1.25	29.45	0.97	2	0.131	2.4689	23.3
B1C-28	5	20	Qal	50	15	936	2550	1614	1.11	46.75	0.95	2	0.137	2.4689	NL
B1C-28	5	25	Qal	43	20	1248	3200	1952	1.01	36.56	0.94	2	0.140	2.4689	NL
B1C-28	5	30	W. BR	50	25	1560	3850	2290	0.93	39.25	0.93	2	0.142	2.4689	NL
B1C-28	5	35	W. BR	50	30	1872	4500	2628	0.87	36.64	0.92	2	0.143	2.4689	NL
B1C-29	12	15	Qal	50	3	187.2	1830	1642.8	1.10	46.34	0.97	2	0.098	2.4689	NL
B1C-29	12	20	Qal	35	8	499.2	2480	1980.8	1.00	29.54	0.95	2	0.109	2.4689	28.1
B1C-29	12	25	Qal	50	13	811.2	3130	2318.8	0.93	39.01	0.94	2	0.116	2.4689	NL
B1C-29	12	30	W. BR	50	18	1123.2	3780	2656.8	0.87	36.44	0.93	2	0.120	2.4689	NL
B1C-30	25	5	Qal	45	0	0	600	600	1.70	64.26	0.99	2	0.090	2.4689	NL
B1C-30	25	10	Qal	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-30	25	15	W. BR	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL
B1C-30	25	20	W.BR	50	0	0	2400	2400	0.91	38.34	0.95	2	0.087	2.4689	NL
B1C-30	25	25	W. BR	50	0	0	3000	3000	0.82	34.29	0.94	2	0.086	2.4689	NL
B1C-31	15	5	Qal	50	0	0	600	600	1.70	71.40	0.99	2	0.090	2.4689	NL
B1C-31	15	10	W. BR	50	0	0	1200	1200	1.29	54.22	0.98	2	0.089	2.4689	NL
B1C-31	15	15	W. BR	50	0	0	1800	1800	1.05	44.27	0.97	2	0.088	2.4689	NL

Golder Associates

BOREHOLE LOG BIC-1

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine

Transect 1

NORTHING 3613191

EASTING: 0749026

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. BIC-1 (29)

SHEET PAGE 1 OF 1

WATER LEVEL	>25					
TIME						
DATE						
CASING DEPTH						

DRILLING START	FINISH
2:00	3:30
DATE 1/25/05	DATE

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR (moist)	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
1''					SL (18%) 2.5Y 5/3, NE 40% grl, subrounded, (50% of grl is fine), dry		40	35	25	2.5Y 5/3	soft	SS, SP	
5	16	100	(5-5.5') QTg		SL(18%), NE, dry, grl are subrounded, one 1" grl of granite.	0	40	35	25	2.5Y 5/3	FR	SS SP	
10	50	100	(10-10.5')		upper 3" SL (15% clay) 10YR 5/4, dry, grl subrounded	0	40	35	25	10YR 5/4	FR	SS SP	
~~15~~					lower 3" CoLS (5% clay) 10YR4/4(m), dry; NE grl subrounded,	0	40	50	10	10YR 4/4	H	SO PO	
~~20~~ 15'	50	0		15'	on rock.								
~~25~~ 20'	50	100	QTg		most blows Hit rock on top, SL(15%) 10YR5/4(m) dry, NE grl are subrounded, 1" broken rock of qtz. diorite	?	45	33	22	10YR 5/4	FR	SS SP	
~~30~~ 25'	50	100	QTg		SL (18% clay), NE grl subrounded dry	0	45	33	22	10YR 5/3	FR	SS SP	
35			?		~~*Photo of Alluv/ Gila contact in split spoon, largest grl in spoon 1/2"~~								
40				—	driller said harder drilling at 13'. photo 38 of sample 10-10.5'								

15'

20'

25'

Harder drilling at 13' but hard at 10'

All Gila, upper 13' softer

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil; soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil; weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

— drill pad cut into original surface about 1' + is constructed of Gila. no samples

TD 25.5'

Start drilling 2:15

photo 39 ? of sample

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

Summary over

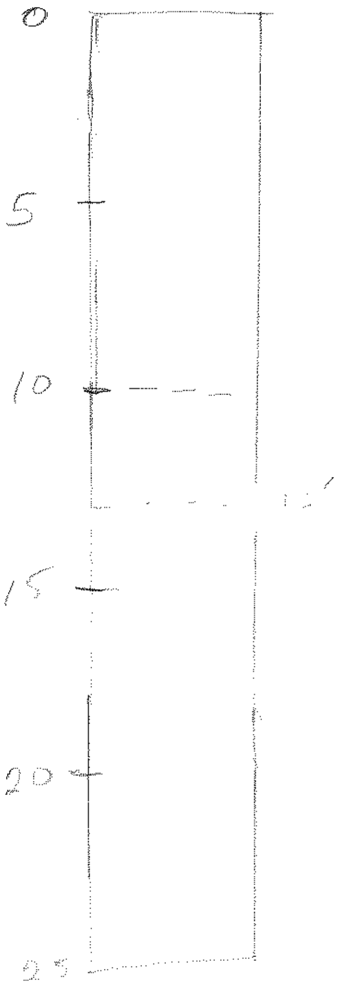
LOGGED BY: Dave Buscher

DATE: 1/25/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

BC1-1



0 - 10' relatively
soft Gila

10'-25' hard
Gila

Golder Associates

BOREHOLE LOG BIC 2

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine

Transect 1

NORTHING 3613183

EASTING: 0749020

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. ~~BIC-2~~ 28

SHEET PAGE 1 OF 1

								DRILLING START	DRILLING FINISH
WATER LEVEL								4:00	6:00
TIME								DATE	DATE
DATE									
CASING DEPTH									

SURFACE CONDITIONS:

DRILL RIG:

ANGLE: 90 BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5 5'	18	100	Qal		(5-6.5') CoLS (5% clay), 50% grl- subrounded, 1/2" largest gravel. moist	0	50	40	10	10YR 4/3	FR	50 po	
10 10'	14		Qal		10-11' 10YR3/4 CL (25% clay) 5% subrounded- subangular fine + med gravel moist	0	5	30	65		FR	SP	
15					11-11.5' 10YR 4/3 CoLS (7% clay) 50% grl. subangular- angular. 3/4" largest grl. moist	0	50	40	10		FR	50 po	
20					— 15' — Gila ———								
25 15'	50 hit rock	100			15-15.5 10YR3/4 SCL (28% clay) NE (one 2" grl)	0 →	20	40	40		VH	SP	
30					15.5-15.7 10YR CoLS, NE (7% clay), grl subangular- angular. 1/2" largest grl		50	40	10		FR	50 po	
35					—17' Gila Hard Dry								
~~4~~0 20'	50	100			20-20.5' 10YR 3/4 SCL (25% clay), 20% fine + med. grl - Subrounded, Dry, NE	0	20	50	30		VH	SP	

later, probably all hard, pounding on spoon breaks up cementation

↓

Gila 15-17 Stratified w/ very hard + Firm layers.

> 17' all v. hard.

Summary over

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

Completed drilling 5:45

completed tripping 6:00

Samples: BCI-2 20-20.5'

TD 20.5'

pad is ≈ 2' above original ground level

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

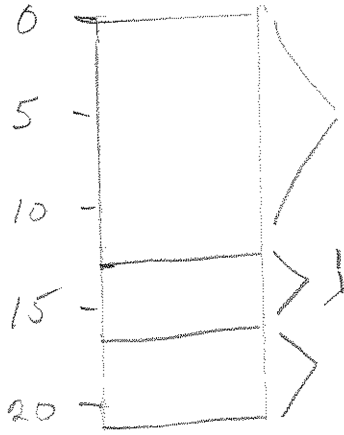
LOGGED BY: Dave Buscher

DATE: 1/25/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

BC1 - 2



0-13' Qal

~~13~~ 15-17' stratified Gila, either very hard or firm

17-20.5' very hard Gila

later: probably all hard, cement breaks down during pounding on spoon

Golder Associates

BOREHOLE LOG B1C-3

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 1,
BC1-3 is in between BC1-1
+ BC1-2

NORTHING

EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.

SHEET
PAGE OF

WATER LEVEL							
TIME							
DATE							
CASING DEPTH							

DRILLING	
START	FINISH
7:30	9:??
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

slightly harder drilling

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
	hit rock												
5	50	80	Qal		5 – 5.5' 10YR3/2 CoLS (7% clay), NE, moist grl are subrounded to angular.	5	25	60	10		FR	SnPo	
10													
7'					Gila 7'								
15	50	100	QTg		10' – 10.5' 10YR5/3 CoSL (10% clay), NE, dry grl are rounded to subrounded. largest grl [illegible]	0	50	35	15		FR	SnPo	
20													
25	50	100	QTg		15 – 15.5' 10YR5/3 CoLS (5% clay) NE, dry grl are subrounded to subangular	0	45	45	10		FR	SnPo	
30													
35													
40					Samples B1C-3 5-5.5' 10-10.5' 15-15.5'								

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

drillers on site 7:30

drilling at 7:45

TD 15.5'

raining

drill pad ≃ 1' below original ground surface + constructed of Gila material

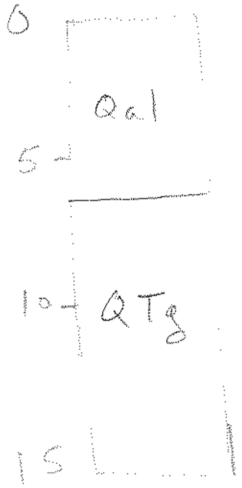
DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/26/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs



Gila 7-15'

Golder Associates

BOREHOLE LOG B1C - 4

raining

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 1 center of drainage	DRILLING METHOD: Hollow Stem Auger	BORING NO. B1C-4
	SAMPLING METHOD: Split Spoon	SHEET PAGE 1 OF 2
NORTHING	EASTING:	

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
9:00	12:00
DATE	DATE

drillers took lunch, went to town at ~12:00

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	5 10 6	80	Qal		10YR 2/2 CoSL (13% clay), moist, original surface, grl are subrounded to angular, NE 5-6.5'	0	40	40	20	10YR 2/2	FR	55 sp	
10	20 20 18	80	Qal		10-11.5 10YR5/4 CoLS, (5% clay), moist, grl are subrounded to angular, some granodiorite 2.5", some red altered grl. NE	5	50	35	10		FR	50 po	
15													
20	20 30 25	100	Qal		15-16.5' 10YR 3/4 CoLS, (6% clay), NE, moist, grl is subrounded to angular, some diorite + altered grl.	0	50	40	10		FR	50 po	
25	50	0	rock		20' on cobble								
30	40 50	10	rock		21' piece of diorite								
35	24 28 25	100			25-26.5 10YR 4/4 CoLS, grl subrounded to subangular, NE, moist, 3/4" largest grl.	0	60	35	5		FR	50 po	
40	50	100	QTg	?	30-30.5 10YR 5/4 SL, 14% clay, moist	0	50	30	20		FR	55 sp	
					Water at 32'								
	50	0			35' - rock								

drilling slightly harder at 30'

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

drill pad is about 4' above original ground surface.

Samples: BC1-4 5-6.5'
10-11.5'
15-16.5'
25-26.5'
30-30.5'
40-40.4'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 11/24/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC-5

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 1

DRILLING METHOD: Hollow Stem Auger

BORING NO. BIC-5

SHEET PAGE OF

SAMPLING METHOD: Split Spoon

DRILLING START 2:30 FINISH 4:00

DATE DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

NORTHING

EASTING:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	45 30	20	Qal		5-6' hit rock CoLS Gila material but still in road base.	← road fill							
			Qal		6-9' 10YR 2/2 SCL (original surface between 6-9')						FR	SP	
10	50	0	rock		10'								
	50	0	rock		12'								
15	50	80	rock Qal		15-15.3' 10YR 3/2 SCL, 22% clay, moist. grl are subrounded to subangular + fine to medium. NE. Much of the blows due to rock.	10	15	40	35		FR	SP	
					17— Gila								
25	50	1.0	QTg		20-20.5 rock. granodiorite + small amt. of 10YR 5/3 CoSL (12%), moist	0	30	40	30		?	ss sp	
35	50	100	QTg		22-22.5', 10YR 5/3 CoLS, grl are subrounded to subangular. Some 1" granodiorite. NE slightly moist	0	50	40	10		10 ↑ pulverized?	so po	
40													

← according to driller, harder drilling + change in material.

17—

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Samples: BCI-5 15-15.3'
22-22.5'

drill pad is elevated ~ 5' above original surface — pad constructed of Gila material

TD = 22'

raining

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/26/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG B1C4 cont.

raining

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 1
center of drainage

NORTHING

EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. B1C-4

SHEET PAGE 2 OF 2

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5					32' mud, 10YR 5/2 CoSL, 30% grl. NE pH of mud = 4.5 pH of water = 4.0								
10													
15					according to driller pearched water ends at about 38' ± a couple feet								
20	50	0			35' - rock								
	50	0			37' - rock								
25													
	50	100	QTg		40-40.4' 10YR 5/4 CoSL (14% clay) NE, moist, grl subrounded	0	60	25	15		FR	ss sp	
30													
35													
40													

TD = 40'

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/26/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Over

X-Section on back

Golder Associates

BOREHOLE LOG B1C-6

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 1

DRILLING METHOD: Hollow Stem Auger

BORING NO.

SAMPLING METHOD: Split Spoon

SHEET
PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
9:30	12:00
DATE	DATE

NORTHING

EASTING:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

Drillers on site at 9:10 due to rain

Drilling at 9:30

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Hit original surface @ 4'.								
5	8 10 10	70	Qal		5-6.5' 10YR2/2 SL (15% clay), moist NE, grl subrounded	0	40	55			FR	SS sp	
10	50	0			rock								
15	24 24	100	Qal		15-16 10YR4/2 SL, NE, grl subrounded to subangular.	5	35	55			FD	SS sp	
											FR	Sn po	
20	25 30	80	Qal		20-21' 10YR5/4 CoLS (7% clay) NE, moist. grl generally subrounded minor amt of [illegible] red stained grl	-	60	30					
~~25~~					25'- rock								
~~30~~		0	rock										
	50 50	90	QTg		26-26.5 10YR5/3 CoSL 13% clay, grl subrounded to angular; moist	0	60	60			FR	SS sp	
35											MH	SP	
			OTg		26.5-27 10YR5/3 SCL 22% clay, grl subrounded to subangular, moist	0	40	40					
~~40~~													
	50	80	QTg		30-30.5 10YR5/4 CoSL dry, NE, grl are subrounded	0	50	60			10	SS sp	
	50	100	QTg		35-35.5 10YR5/3 SCL, slightly moist (22% clay), NE grl are subrounded	0	70	60			H	SP	

Gila at 26'

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

- Drill pad is elevated about 4' above original surface.

Drilled an additional 5' to check for water

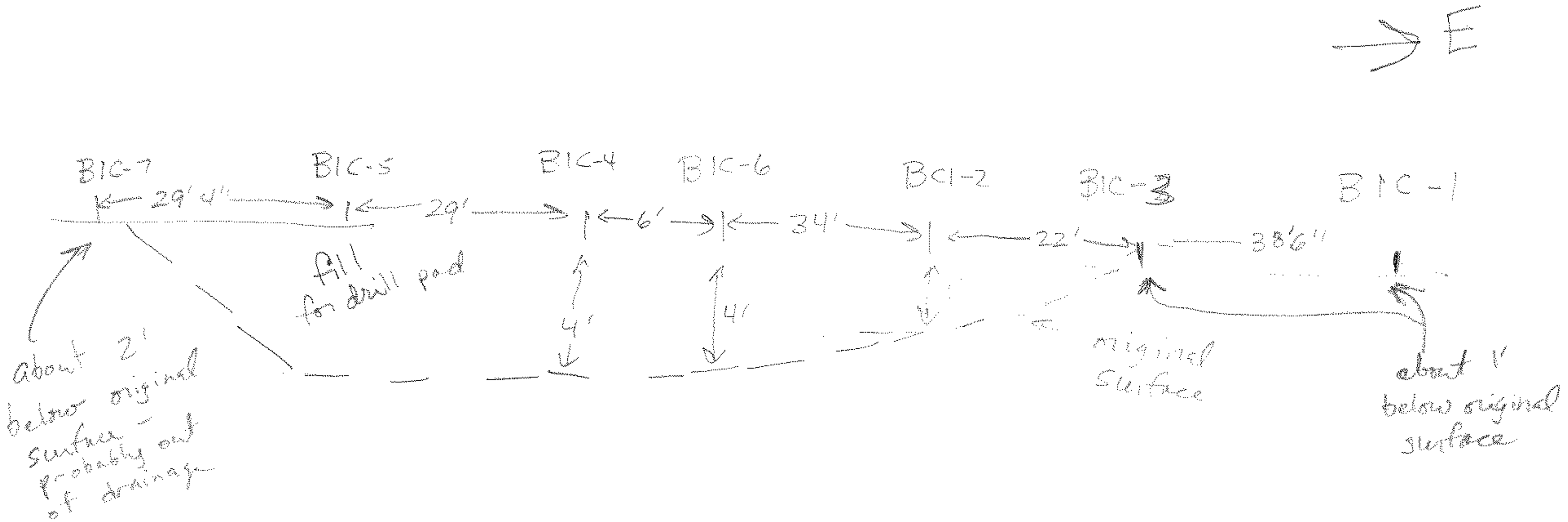
DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

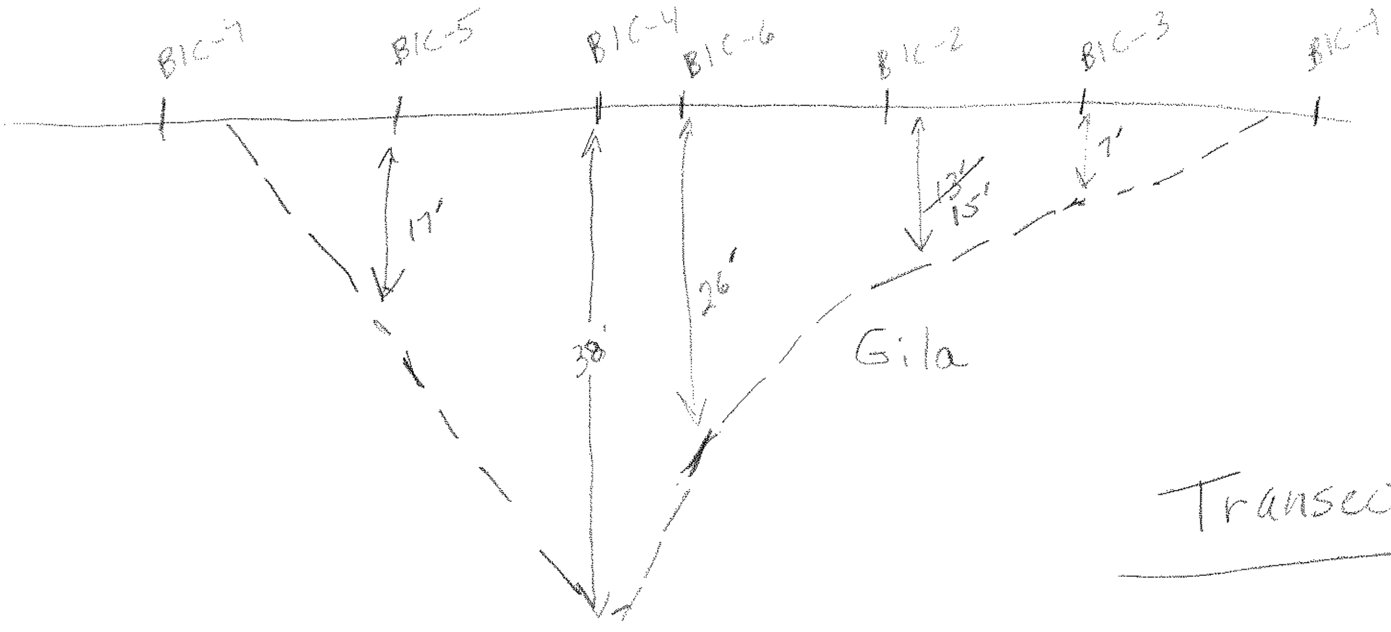
LOGGED BY: Dave Buscher

DATE: 11/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs


→ E
BIC-7
29' 4"
BIC-5
29'
BIC-4
6'
BIC-6
34'
BCI-2
22'
BIC-3
38'6"
BIC-1
fill for drill pad
4'
4'
about 2' below original surface - probably out of drainage
original surface
about 1' below original surface


BIC-7
BIC-5
BIC-4
BIC-6
BIC-2
BIC-3
BIC-1
17'
38'
26'
~~13'~~ 15'
7'
Gila

Transect 1

Golder Associates

BOREHOLE LOG B1C-7

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 1	DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: Split Spoon	BORING NO. B1C-7 SHEET PAGE OF	
		DRILLING	
		START	FINISH
NORTHING EASTING:	WATER LEVEL TIME DATE CASING DEPTH	12:00	12:30
		DATE	DATE
DRILL RIG: ANGLE: 90 BEARING: - SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	SURFACE CONDITIONS:		

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	50	100	QTg		5-5.4" 10YR5/4 CoLS grl + subrounded to subangular, NE, one broken 2" rock in spoon.	5	45	40	10				
~~10~~													
~~15~~	50	100	QTg		10-10.5 10YR 5/4 CoLS grl, subrounded to subangular, NE	0	45	40	10				
20													
25					TD 10.5								
30													
35													
40													

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

pad is about 2' below original surface.

samples: BC1-7 5-5.4'
10-10.5'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher / Mike Gabora

DATE: 01/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

all material is NFF + S/ [illegible]

Golder Associates

BOREHOLE LOG BLC-8

(stake marked #14, western ~~most~~ BH on transect #2 - rig pulled to location)

drill rig stuck at 1:00

Unstuck at 2:45pm (still waiting on equip. truck road being fixed) 3:05 - fully operational

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2	DRILLING METHOD: Hollow Stem Auger		BORING NO. BLC-8
	SAMPLING METHOD: Split Spoon		SHEET PAGE 1 OF 1
NORTHING	EASTING:		DRILLING

							START	FINISH
WATER LEVEL							1500	1530
TIME								
DATE							DATE 1/27/05	DATE 1/27/05
CASING DEPTH								

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	50/4"		QTg	①	5-5.5' 10YR 5/6 LS, gr is subangular, fine to medium, dry		30	60	10		soft- [illegible] varied	SO po [illegible]	NE
10	50/3"		QTg	②	10-10.5 10YR 5/4, CoLS 10% clay gr is subrounded to subangular, fine to med. dry		45	40	15		FR-HARD	SO po	NE
15													
20													
25					TD. 10.0' t = 1540								
30													
35													
40													

Driller indicated that drilling was hard.

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher / M. Gabora

DATE: 01/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Drill pad is ~~[illegible]~~ 2-3' below original grade

Samples: BCI-8 5-5.4'
10-10.5'

Golder Associates

BOREHOLE LOG

(2nd from W. end of transect) BIC - 9

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. BIC-9

SHEET PAGE 1 OF 1

	DRILLING START	DRILLING FINISH
		5457
DATE	1/27/05	1/27

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

NORTHING

EASTING:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					0-1 10YR 2/2 SCL								
5	10 49 50			①	5-6.5 9" recovery								
					3" SCL 10YR3/2, sl.moist		30	40	30		soft ~~sf~~	sp	NE
10	25 25 25				6" CoSL 10YR4/4 grl is subangular to subrounded, fine to medium dry		50	30	20		soft	so po	NE
15													
20	25 25 25			②	10-11.5 14" rec, 9" 7.5YR 5/4 ~~[illegible]~~ SL, grl. subang to sub rounded dry		35	55	10		soft-firm	so, sp ~~to pl~~	NE
					3" SCL 10YR 3/2, grl. fine to med, s.angl to s. round.		25	45	30		firm	so, sp. to pl	NE
25													
	10 45/4"			③	15-16.5 10" recovery Gila 16'								
30					6" 10 YR 5/3 SCL dry		25	45	30		hard	ss. sp.	
35					* likely contact at 15.5' to 16' 4" CoSL, grl are subrounded, fine to med, 10YR 5/4, dry-sl.moist		55	35	10		[illegible] (soft)	so, po	NE
40	50/6"			④	20-20.5 10YR 6/4 6" recovery, Co SL grl is fine, subrounded, sl. moist		45	45	10		firm-hard	so, po	NE
					TD 20.5'								

Driller noted tougher drilling from ~16' down

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

Borehole surface at original grade.

sp= slightly plastic

Samples:
5-6.5'
10-11.5'
15-16.5'
20-20.5'

LOGGED BY: Dave Buscher / Mike Gabora

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

DATE: 1/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG B1C-10

drillers on site at 7:20

completed drilling at 9:25

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2
DRILLING METHOD: Hollow Stem Auger
BORING NO. B1C10
SAMPLING METHOD: Split Spoon
SHEET PAGE OF

NORTHING
EASTING:

							DRILLING	
WATER LEVEL							START	FINISH
TIME							7:50	9:15
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	8 8 12	100	Qal		5-6.5' 10YR4/4 CoSL, NE most grl are fine & subrounded dry. hit original surface 10YR2/2 SCl at about 2'		65	20	15		FR	SO,PO	
10 15	8 50	60	Qal		10-11' hit rock at 10.5' 7.5YR4/4 CoSL 15% clay, moist, grl are subround to subangular. NE	5	60	20	15		FR	S,P	
20 25	17 17 16	100	Qal		15-16.5' SCL(35% clay) 7.5YR4/3, NE, grl are fine. moist	0	15	50	35		HA	SP	
30	50	100			20-20.5 one broken rock in sample, may caused the 50 blow counts. 7.5YR4/4 SLL, 26% clay, NE, moist	5	10	45	40		HA	SP	
35 23' Gila													
40	45	100	QTg		25-25.5 5YR 4/4 CoSL 13% clay, NE, moist most grl are fine	0	60	25	15		MH		
	40 50 50	100	QTg		27-28.5 27-28. 5YR4/4 SCL 28% clay, NE, grl 10%	0	10	—	—		FR-MH	SP	

23' - driller indicated hard drilling at 23'

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

28-28.5 5YR4/4 CoLS
20% subrounded grl,
slightly moist. NE
FR, SO,PO

Water running across the drill pad coming from bottom of stockpile, pH= 3

boring hole 2' above original surface

boring is across from stake 15

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG

B1C-11

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 2

DRILLING METHOD: Hollow Stem Auger

BORING NO. B1C-11

SHEET

PAGE OF

SAMPLING METHOD: Split Spoon

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
9:30	10:30
DATE	DATE

NORTHING

EASTING:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 46 50	100	Qal QTg		5-5.5 10YR4/4 CoSL 15% clay, wet, grl are subrounded to subangular		40	40	20		FR	SSP	
					5.5-6.5 7.5YR4/4 SCL 34% clay, dry NE		15	50	35		HR-VH	SP	
10													
15	50	100			10-10.5 7.5YR 3/3 SCL 34% clay, dry, NE grl is fine		15	50	35				
20	50	100			15-15.6 (7" - 50 blows) 7.5YR 3/3 SCL (30% clay) NE, dry, 15% fine grl subround to subangular		15	50	35		HR-MD	SP	
25													
30					Gila at 5.5'								
35													
40													

relatively easy drilling to 10'
high blow count possibly from
tight clay, going 5' min.

drilling a bit
harder below 10'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

- boring hole about 1' above original surface

- across from stake 20.

- photo 41 of Qal / QTg contact
note wet 5-5.5' + dry 5.5-6.5'
← not saturated

Samples: B1C-11 5-6.5'
10-10.5'
15-15.6'

photo 40 drilling T2

Golder Associates

BOREHOLE LOG BIC-12

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2	DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: Split Spoon	BORING NO.	
		SHEET PAGE OF	
		DRILLING	
		START	FINISH
NORTHING EASTING:	WATER LEVEL TIME DATE CASING DEPTH	11:00	11:30
		DATE	DATE
DRILL RIG: ANGLE: 90 BEARING: - SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	SURFACE CONDITIONS:		

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
	25 25 50	100	Qal		5-6.5 7.5YR 4/4 CoLS 3% clay, 30% grl most is fine subrounded to subangular, NE. bottom 1" may be Gila	0	30	65	5		FR	50 PO	
	50	100	QTg		10-10.3 (50 blows 4") 7.5YR 4/4 CoSL. 10% clay, NE	0	50	35	15		HA VH	50 PO	

5
10
15
20
25
30
35
40

Gila at 6.5'

TD 10'

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

boring is in between BIC-8 + 9.

boring hole is about 1' below original surface

* did not drill next to stake 16, one to the North

11:30 ready to move on standby dozer fixing road.

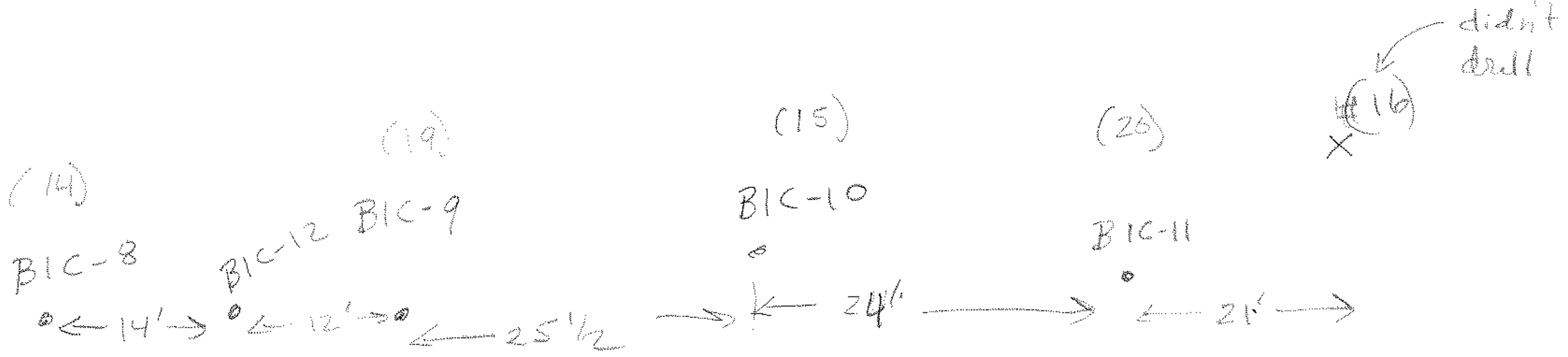
DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/03

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs



stake BIC-11 fell down
in water. Surveyor had
22' from 10 but should
be 24'

Golder Associates

BOREHOLE LOG BC1 - 8

(stake marked #14, westernmost BH on transect #2 - rig pulled to location)

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2	DRILLING METHOD: Hollow Stem Auger		BORING NO. BC1-8
	SAMPLING METHOD: Split Spoon		SHEET PAGE 1 OF 1
			DRILLING
		START	FINISH
NORTHING	EASTING:		

WATER LEVEL							1500	1530
TIME								
DATE							DATE 1/27/05	DATE 1/27/05
CASING DEPTH								

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE¹	% GRAVEL²	% SAND²	% FINES²	COLOR	CONSISTENCY³/ CEMENTATION⁴	PLASTICITY (np, l, m, h)	OTHER TESTS⁵
5	50/4"		QTg	①	5-5.5' 10YR 5/6 LS, gr is subangular, fine to medium, dry		30	60	10		soft-PULVERIZED	SO PO (SM)	NE
10	50/3"		QTg	②	10-10.5 10YR 5/4, CoLS 10% clay gr is subrounded to subangular, fine to med. dry		45	40	15		FR-HARD	SOPO	NE
15													
20													
25					TD. 10.0' t = 1540								
30													
35													
40													

riller indicated hat drilling as hard.

drill rig Stuck at 1:00

Unstuck at 2:45pm (still waiting on equip. truck, road being fixed)

3:05 - fully operational

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher / M. Gabora

DATE: 01/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
¹ Percent > 3inch.
² Sum of gravel, sand, and fines = 100%
³ For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
⁴ For noncohesive soil: weak, moderate, strong.
⁵ Pocket penetrometer, torevane, in situ density, etc.

Drill pad is ~~[illegible]~~ 2-3' below original grade

Samples: BC1-8 5-5.4'
10-10.5'

Golder Associates

BOREHOLE LOG

(2nd from W. end of transect) BC1 - 9

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 2

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. BC1-9

SHEET PAGE 1 OF 1

WATER LEVEL						**DRILLING START**	**DRILLING FINISH**
TIME							5:45 ?
DATE						DATE 1/27/05	DATE 1/27
CASING DEPTH							

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					0-1 10YR 2/2 SCL								
5	10 49 50			①	5-6.5 9" recovery								
					3" SCL 10YR3/2, sl.moist		30	40	30		soft ~~sf~~	sp	NE
10					~~[illegible]~~								
	25 25 25				6" CoSL 10YR4/4 grl is subangular to subrounded, fine to medium dry		50	30	20		soft	so po	NE
15													
20	25 25 25			②	10-11.5 14" rec, 9" 7.5YR 5/4 SL, grl. subang to sub rounded, dry		35	55	10		soft-firm	so, sp. ~~to pl.~~	NE
					3" SCL 10YR3/2, grl. fine to med, s.angl to s. rond.		25	45	30		firm	so, sp. to pl	NE
25	10 45/4"		—	③	15-16.5 ——— Gila 16' 10" recovery								
30					6" 10 YR 5/3 SCL dry		25	45	30		hard	ss. sp.	
35					* likely contact at 15.5' to 16' 4" CoSL, grl are subrounded, fine to med, 10YR 5/4, dry-sl.moist		55	35	10		pulv. (soft)	so, po	NE
40	59/6"			④	20 - 20.5 10YR 6/4 6" recovery, CoSL grl is fine, subrounded, sl. moist		45	45	10		firm-hard	so, po	NE
					TD 20.5'								

riller
ited tougher
rilling from
16' down

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Borehole surface at original grade.

sp = slightly plastic

Samples:
5-6.5'
10-11.5'
15-16.5'
20-20.5'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher/Mike Gabora

DATE: 1/27/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BC1-10

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2	DRILLING METHOD: Hollow Stem Auger
	SAMPLING METHOD: Split Spoon
NORTHING	EASTING:
DRILL RIG:	SURFACE CONDITIONS:
ANGLE: 90	BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	

WATER LEVEL						BORING NO. BC1-10	
TIME						SHEET PAGE OF	
DATE						DRILLING	
CASING DEPTH						START	FINISH
						7:50	9:45
						DATE	DATE

drillers on site at 7:20

Complete trip at 9:25

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5 10	8 8 12	100	Qal		5-6.5' 10YR4/4 CoSL, NE most grl are fine & subrounded, dry. hit original surface 10YR2/2 SCl at about 2'		65				FR	SoPo	
15 20	8 50	60	Qal		10-11' hit rock at 10.5' 7.5YR4/4 CoSL 15% clay, moist, grl are subround to subangular, NE	5	60	20	15		FR	SoSP	
25	17 17 16	100	Qal		15-16.5' SCL (35% clay) 7.5YR4/3, NE, grl are fine, moist	0	15				HA	SP	
30 35	50	100			20-20.5 one broken rock in sample, may caused the 50 blow counts. 7.5YR4/4 SCL, 28% clay, NE, moist	0	10				HA	SP	
40	45	100	QTg		25-25.5 5YR 4/4 CoSL 13% clay, NE, moist most grl are fine	0	60				MH		
	40 50 50	100	QTg		27-28.5 27-28 - 5YR4/4 SCL 28% clay, NE, grl 10%	0	10				FR-MH	SP	

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

28-28.5 5YR4/4 CoLS
20% subrounded grl,
slightly moist. NE
FR, SO, PO

* water running across the drill pad coming from bottom of stockpile, pH = 3

boring hole 1-2' above original surface

boring is across from stake 15

23' - driller indicated hard drilling at 23'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG B1C-11

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 2

NORTHING

EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. B1C-11

SHEET PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
9:30	10:30
DATE	DATE

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 46 50	100	Qal QTg		5-5.5 10YR4/4 CoSL 15% clay, wet, grl are subrounded to subangular		40				FR	sssp	
10					5.5-6.5 7.5YR4/4 SCL 34% clay, dry NE		15				HR-VH	SP	
15	50	100			10'-10.5 7.5YR 3/3 SCL 34% clay, dry, NE grl is fine		15						
20	50	100			15-15.6 (7"-50 blows) 7.5YR 3/3 SCL (30% clay) NE, dry, 15% fine grl subround to subangular		15				HR-MD	SP	
25													
30													
35													
40													

Gila at 5.5'

relatively easy drilling to 10'
high blow count possibly from
tight clay, going 5' more

drilling a bit
harder below 10'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

- boring hole about 1' above original surface.
- across from stake 20.
- photo of Qal / QTg contact note wet 5-5.5' + dry 5.5-6.5'

Samples: B1C-11
5-6.5'
10-10.5'
15-15.6'

Golder Associates

BOREHOLE LOG BIC-12

* did not drill next to stake 16, one to the North

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 2

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: Split Spoon

BORING NO.
SHEET
PAGE OF

							DRILLING START	DRILLING FINISH
WATER LEVEL								
TIME							11:00	11:30
DATE							DATE	DATE
CASING DEPTH								

11:30 ready to move - on standby dozer fixing road,

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	25 25 50	100	Qal		5-6.5 7.5YR 4/4 CoLS 3% clay, 30% grl most is fine subrounded to subangular, NE. bottom 1" may be Gila	0	30	65	5		FR	50 PO	
10													
	50	100	QTg		10-10.3 (50 blows 4") 7.5YR 4/4 CoSL, 10% clay, NE	0	50				HA VH	50 PO	
15													
20					Gila at 6.5'								
25					TD 10'								
30													
35													
40													

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher
DATE: 1/28/05

JOB NO.043-2319-0002
FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

boring is inbetween BIC-8 + 9.

boring hole is about 1' below original surface

at stake 9

Golder Associates

BOREHOLE LOG BIC-13

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 3 at NE end.	DRILLING METHOD: Hollow Stem Auger	BORING NO.	
	SAMPLING METHOD: Split Spoon	SHEET PAGE OF	
		DRILLING	
		START	FINISH
NORTHING	EASTING:	12:30	2:00
	WATER LEVEL / TIME / DATE / CASING DEPTH	DATE	DATE
DRILL RIG: ANGLE: 90 BEARING: - SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	SURFACE CONDITIONS:		

Standby over at 12:15

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					upper 2' road fill – but close to original surface level								
			no sample		2-5' 10YR4/4 SCL, NE 24% clay, 30% subrounded grl								
5	50	100			5-5.4 10YR5/3 CoSL (16% clay), 50% grl that breaks apart – highly weathered. Either a weathered diorite or close to bedrock. – No		50	30	20		H	SS SP	
10 15	20 50	100	rock		10-11' 10-10.5' 7.5YR 5/6 SCL (27% clay), NE 10.5-11' pulverized granodiorite. dry	5	15	50	30		FR	SP	
20 25	40 40	100			15-16' 10R4/6 SCL, 28% clay, grl are red + angular. NE, dry		60	25	15		MH	SP	
30	20 50	70	rock		20-21' 10R 4/6 SCL, 32% clay, NE, dry grl are red subrounded to subangular, most are fine. Rock at 20.7-21'	5	35	40	20		MH	SP	
35 25'													
40	50	100			25-25.5 10R 4/6 SCL 28% clay, grl are red subangular to subround, hit several larger rocks. dry	10	40	30	20		H	SP	
	50	100			30-30.5 – hard weathered diorite. 7.5YR6/2 rock dry						VH	—	

5' - 25' soft weathered bedrock

25 - 30' harder bedrock

easy drilling

easy drilling

harder drilling

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

TD 30"
– close to original ground level, but not absolutely sure.

Samples: BK-13
10-10.5'
15-16'
20-21'
25-25.5
30-30.5

photo 43 of 10-11' spoon sample

Weathered diorite bedrock is 33' to the NE along drill pad.

Photo 42 – drilling

at stake 8

Golder Associates

BOREHOLE LOG BIC-14

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.

SHEET PAGE OF

DRILLING	
START	FINISH
2:20	3:45
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

NORTHING

EASTING:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	14 16 25	40			5-6.5' 7.5YR 4/3 SCL 28% clay, grl are angular-subangular diorite, moist	5	30	35	25		FR	SP	
10	30 20 20	40			10-11.5 5YR 4/4 SCL 32% clay, grl are red & subrounded to angular moist	5	40	33	22		H		
15 20	20 20 20	100			15-16.5 5YR 4/4 SC 38% clay moist grl are fine, NE	0	5	50	45		H- VH	SP	
25	20 20 20	100			20-21.5 5YR 4/4 SC 50% clay, slightly moist, gravels are fine NE	0	5	45	50		H VH	VSVP	
30 35 40	50	20			25' 5YR 4/6 SCL 34% clay, saturated (only got 2", either on large rock or hard bed rock) refusal at 25.2', thin layer of water on top. > pH of mud = 6.5	0	5	50	45		—	SP	

0-25' red clay-rich soil
25' refusal - diorite

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/28/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

- bore hole at about original surface level.
- photo 44 15-16.5' sample

Samples: BIC14 5-6.5'
10-11.5
15-16.5
20-21.5
25'

— Spoon had about 0.5 ft mud on the outside
— saturated zone 0.5-1' thick.
← close to original ground level

Golder Associates

BOREHOLE LOG BIC-15

on site 7:00, [illegible] work on rig drilling 8:00

10:00 discontinued hole, unable to sample due to mud in hole,

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 3	DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: Split Spoon	BORING NO.	
		SHEET PAGE OF	
		DRILLING	
		START	FINISH
NORTHING	EASTING:	WATER LEVEL TIME	8:00	10:00
		DATE	DATE
		CASING DEPTH	8:30	10:30
DRILL RIG: ANGLE: 90 BEARING: - SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	SURFACE CONDITIONS:		

1/29/05

2/2/05

2/2/05
8:00 filled water tank
8:30 drilling

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	30 30	100			5-6' 10YR5/4 CoSL, 15% clay, grl are fine NE 5-5.5' moist 5.5-6' saturated. pH of mud 4.5		30	40	30		Fr	ssp	
10 15	25 35 50	100			10-11.6' 10YR4/4 SCL 28% clay, NE, grl are fine, 10-11' saturated pH of water = 4.0, moist → 11-11.6' weathered diorite		15	50	35		HR	sp	
20 25 30	?				15 - no sample, problem with water in the hole 20' unable to sample mud in hole.		2/2/05						
35 40					15' tried collecting sample twice, last one 60 blows 4" of sample spoon was bouncing, but mud sucked into spoon. Sample consisted of mud + diorite chips.								
		100			20-21' 7.5YR5/4 SCL, moist NE, with broken diorite fragments.	5	30	0	0				
3"	50	100			25-25.3 hard diorite dry, dumped								

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/29/05 - 2/2/05

JOB NO. 043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

photo 45 of 5-6'

photo 46 showing diorite/alluvium contact across from BIC-15

Samples: BIC-15 5-6'
10-11.6'
20-21'
25-25.3

TD = 25'

— boring hole 4-5' below original surface

Golder Associates

BOREHOLE LOG BIC-16

at stake 1

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3
SW end

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: Split Spoon

BORING NO. BIC-16
SHEET
PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING START	DRILLING FINISH
11:00	12:00
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 12 16	100	soil		upper foot 7.5YR 2.5/2 SC (38% clay) - probably on original surface 5-6.5 5YR 4/3 SC (36% clay), ES, 15% fine gravel, moist	0	10	45	45		H	SP	
~~10~~	30 50	100	soil bedrock		10-11': 10-10.5' 5YR 3/2 SCL (34% clay), ES, moist. 10% fine gravel	0	10	50	40		H	SP	
~~15~~					10.5-11' 7.5YR 4/3 CoLS (3% clay); NE weathered qtz. diorite (or qtz. monzonite), dry	-	80 ← weathered bedrock						
20													
25					photo 47 of 10-11'								
30					refusal at 12'								
35													
40													

Soil derived from diorite

10.5' ——
weathered diorite

12' ——
hard bedrock

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Samples: BIC-16 5-6.5' — close to original ground level
10-10.5'
10.5-11'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/29/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC - 17

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3
2nd from SW end.

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.
SHEET PAGE 1 OF 1

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING START	DRILLING FINISH
12:30	2:30
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					about 1', 10YR 2/1. SCL, maybe original surface.								
5	20 20 30	100			5-6.5' 10YR 3/3 SC 37% clay, NE, moist		10	45	45		H	S P	
10 15	20 22 24	100	Qal	?	10-11.5 10-11' 7.5YR3/3 SC, NE, slightly moist. (37% clay) grl are fine		15	45	40		H	S-P	
20					11-11.5' 10YR 4/4 CoLS, dry, most grl are fine subangular		35	60	5		FR	SO PO	
25 30	10 30 30	100	Qal Soil	?	15-16.5' stratified 10YR4/4 SCL (34% clay)		10	45	45		MH FR H	S.P SO PO	
					1" 10YR4/4 CoLS and at →		20	75	5				
35					bottom 5YR4/4 SC → 38% clay, all NE slightly moist		10	45	45				
40	20 20 30	100	Soil		20-21.5' 5YR4/6 SCL 32% clay, NE, dry, grl are subangular		10	60	30		H	S P	
	25 35 40	100	Soil		25-26.5' 5YR4/6 SCL 34% clay, NE, dry		10	55	35				
	40 50	100	R		30-31' weathered diorite		—	—	—		H	—	

the red SCL contains stacked plates of muscovite, so is probably derived from qtz. diorite

Qal

16'

Soil derived from diorite

30'

weathered diorite

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/29/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

- photo 48 of 10-11.5' sample

Samples: BIC-17 5-6.5'
10-11'
11-11.5'
15-16.5'
20-21.5'
25-26.5'

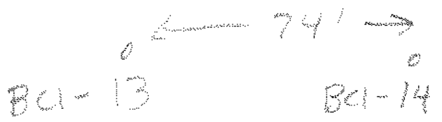
BIC-17 30-31'
35-35.4'

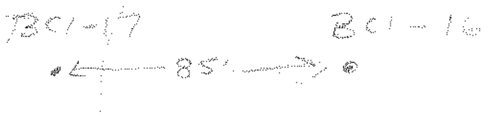
drilled additional 5' to make sure 30' wasn't just a rock

50 blows 4" 35-35.4 - hard diorite (VH)

- close to original ground level

TD = 35'


74'
Bcl-13
Bcl-14


Bcl-17
Bcl-16
85'

Golder Associates

BOREHOLE LOG BIC-18

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 3	DRILLING METHOD: Hollow Stem Auger		BORING NO.
	SAMPLING METHOD: Split Spoon		SHEET PAGE OF
			DRILLING
			START 3:00 / FINISH 5:30
NORTHING	EASTING:	WATER LEVEL / TIME / DATE / CASING DEPTH	DATE / DATE
DRILL RIG: ANGLE: 90 BEARING: - SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	SURFACE CONDITIONS:		

5:30 –
trip 6:00
decon. 6:00 –
left site 6:15

Next to stake 3

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	12 15 15	100			5-6.5' 10YR3/3 SCL (26% clay), moist, NE grl are subangular, contains some mica	0	30	40	30		MH	S P	
10	20 36 50	100	Qal		10-11.5' 10YR 4/4 CoSL 12% clay, moist, NE grl are subangular + most are fine. Rock at bottom	0	35	40	25		FR	ss/p	
15 20	20 30 28	80	Qal		15-16.5 10YR4/4 CoSL 10% clay, NE grl are subrounded subangular, 1" layer of SCL	0	35	40	25		FR	So Po	
25	20 30 50	100			20-21.5' 7.5YR 4/3, SC 45% clay, NE, moist	0	20	40	40		HA	ss/p	
30	20 35 40	100			25-26.5' 7.5YR 4/4 SCL, 27% clay, NE moist grl are fine	0	10	55	35		MH	S P	
35 40	20 [illegible] 50	100			30-31.5' 5YR 4/4 SCL 35% clay, NE, moist, grl are fine (weathered from diorite,	0	5	60	35		MH	S P	
	60	100			dry — 35-35.5' weathered diorite, with 2" of mud on top, 5YR 4/4 SCL						H	—	
	70	100			37-37.5' - 7" red v. hard weathered diorite						VH	—	

Qal

20'
18'

older Qal or Soil from diorite

30'

red soil

35'
weathered diorite

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Weathered diorite is dry
– about 3' below original ground level

→ mud in spoon from hydraulic head
pH of mud = 5.0, water filled
the hole,

Samples: BIC-18
5-6.5'
10-11.5
15-16.5
20-21.5
25-26.5
30-31.5
35-35.5
37-37.5

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/29/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

see back

cold - ground is frozen

7:50 moved rig to site

10:30 moving to transect 4.

10:00-10:30 tripping ~~in~~. Clean some augers

Golder Associates

BOREHOLE LOG BIC-19

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine

Transect 3

NORTHING

EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.

SHEET PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING START	DRILLING FINISH
8:00	10:00
DATE	DATE

DRILL RIG:

ANGLE: 90 BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					about 2' 10YR 2/1 SCL								
5			Qal	?	Saturated soil ≃ 3' ← from recent rains PH of mud = 6.0								
	27 30 27	80	↓		5-6.5' 7.5YR 3/3 SCL 22% clay, mica flakes, sl moist, NE, 5% fine grl	0	5	55	40		MH	S P	
10													
	14 14 19	100			10-11.5' 7.5YR 3/3 SC 45% clay, moist, NE 5% fine grl,	0	5	50	45		MH	VSVP	
15			15' ↑										
20	25 30 35	60	soil derived from diorite		15-16.5 5YR 4/4 SCL 32% clay, NE, moist 5% fine grl	5	5	55	40		MH	S P	
25	16 23 23	100	↓		20-21.5 5YR 4/6 SCL 34% clay, NE, sl moist, 5 grl	0	5	55	40		MH	S P	
30			25'										
	50	100	↑		25-25.3 red weathered diorite (fines are 2.5R 4/4 SCL 22% clay) dry	—	—	—			VH	S P	
35													
40	50	100	weathered diorite		27-27.3 - red weathered diorite, dry NE	—	—	—			VH		
					TD 27'								

weathered diorite drills fairly easy

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 1/30/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

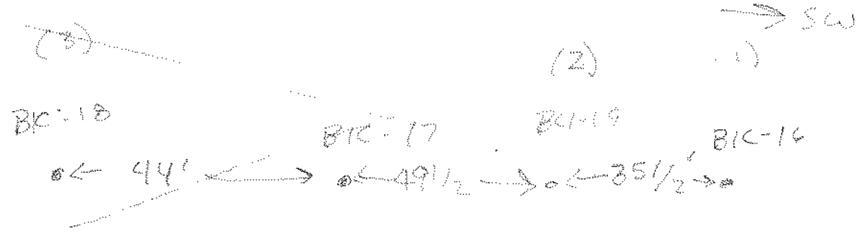
[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

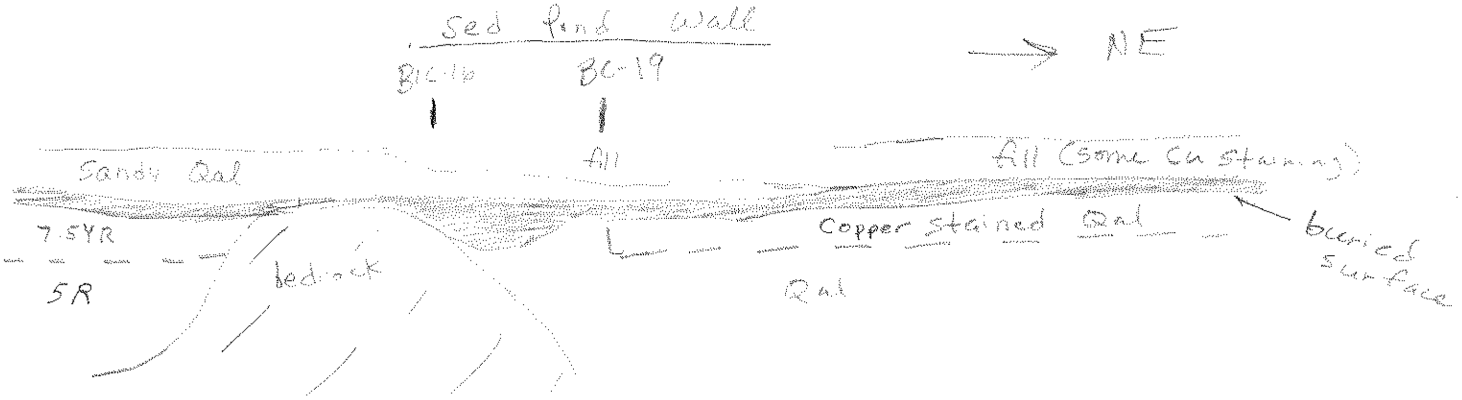
Samples: BIC-19
5-6.5'
10-11.5'
15-16.5'
20-21.5'
25-25.3'
27-27.3'

- close to original ground level

* large sed pond wall, ≃ 20' to west, has alluvium about 20' S of BIC-19. Thought was this boring would be in alluvium.



→ SW
(3)
(2)
(1)
BIC-18
BIC-17
BC-19
BIC-16
44'
49 1/2
35 1/2'



Sed Pond Wall
→ NE
BIC-16
BC-19
Sandy Qal
fill
fill (Some Cu staining)
7.5YR
5R
bedrock
Copper Stained Qal
Qal
buried surface

at stake 5

Golder Associates

BOREHOLE LOG BIC-24

8:00 filled water tank, moved rig.

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 3

NORTHING

EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO. BIC-24

SHEET

PAGE OF

DRILLING START 8:30 FINISH 9:30

DATE DATE

WATER LEVEL

TIME

DATE

CASING DEPTH

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

driller indicated upper 6" slurf

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 13 21	60	Qal 10'		5-6.5 10YR4/4 CoLS, 5% clay, NE, Sl. moist grl are subround/subangular	0	25	70	5		soft	so po	
10	5 15 20	80	soil ~~from~~ diorite 15		10-11' 5YR4/4 SCL, NE moist (34% clay) contains much qtz. + mica.	0	5	60	35		MH	s p	
15	50	100	weathered diorite		15-15.4' 5YR4/4 CoSL, NE dry, 14% clay, - either rock or weathered diorite.						H	ss sp	
20	20 50	100			20-20.4' same as 15-15.4' - weathered diorite, dry						H		
25													
30					about 6" of slurf of 7.5YR4/4 CL, MH moist, 35% clay, 40% sand, NE - probably somewhere between 16-20'								
35													
40					TD 20'								

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 2/11/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

- about 3' below original surface

photo 52 water seeping at bottom of waste pile.

photo 53 small diorite outcrop across from BIC-24

Samples: BIC-24 5-6.5'
10-11'
15-15.4'
20-20.4'

Golder Associates

BOREHOLE LOG BIC-25

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine

NORTHING

EASTING:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

BORING NO.

SHEET

PAGE OF

DRILLING	
START	FINISH
10:00	10:30
DATE	DATE

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

DEPTH IN METERS (ELEVATION)	BLOW 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	50	100			5-5.5' 5YR4/4 COSL 10% clay, dry, broken granodiorite, NE	—					H	SO PO	
10			upper		↗ above 5' 10YR3/3 SCL (34% clay) moist, MH, S P, NE								
15	50	100	1-2'		10-10.3' same as 5-5.5' weathered, dry granodiorite much K-spar, which gives the 5YR color.	—					VH		
20													
25													
30													
35													
40													

hand drilling > 5'

LOGGED BY: Dave Buscher

DATE: 2/11/05

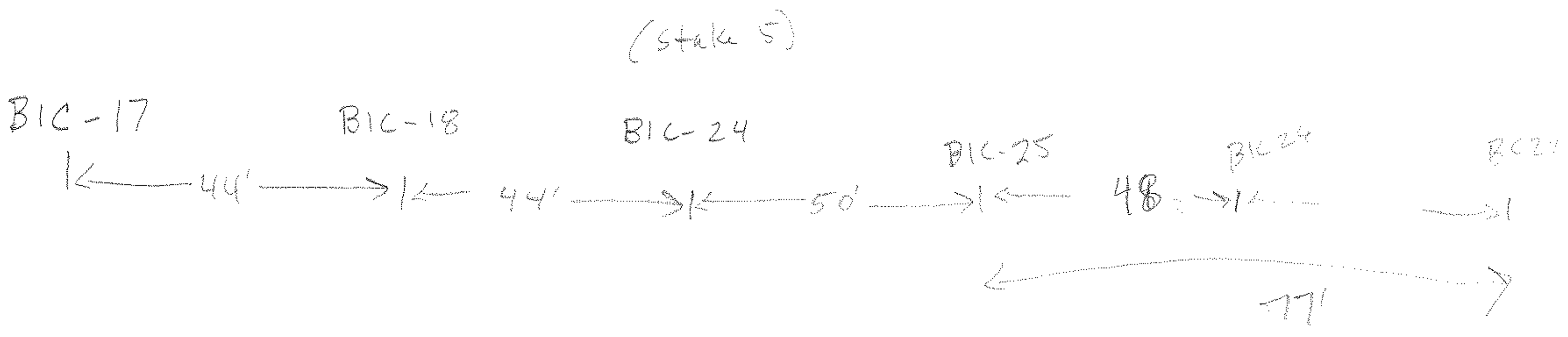
JOB NO. 043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

bore hole about 3-4' below original ground level

TD 10'


(stake 5)
BIC-17
44'
BIC-18
44'
BIC-24
50'
BIC-25
48
BIC 24
BC24
77'

at stake 6

Golder Associates

BOREHOLE LOG BIC-26

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3

NORTHING

EASTING:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

BORING NO.

SHEET PAGE OF

DRILLING START	DRILLING FINISH
10:30	1:00
DATE	DATE

completed cleaning augers 1:20

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 2/1/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

DEPTH IN METERS (ELEVATION)	BLOW 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 30 30	100	Qal		on top of drill pad cut - alluvium - 10YR4/3 CoSL (15% clay) 1' thick over a few feet of 10YR2/2 SCL (22% clay) 5-6.5' 10YR4/4 CoLS/sand Wet, NE, grl subrounded to subangular, some red grl (Saturated)	0	20				FR	SO PO	
10 15	25 25 26		Qal		10-11' 10YR4/4 CoLS Wet, NE (Saturated)	0	30					SO PO	
20 25	30 30	100	Qal	20'	15-16' 10YR4/4 CoSL (13% clay) wet, NE, 1/2" largest grl, grl subrounded/subangular. pH of water = 4.0	0	40					SS SP	
30	≃ 30	100	soil derived from diorite		20-20.5 (upper 1' all sluf). 5YR4/3 SC, (clay?). NE, sli moist	0	5				VH	S P	
35	≃ 30	100		30'	25-25.5' 2.5YR4/6 SCL (34% clay), NE slightly moist.	0	15				H	S P	
40	50	100	weathered diorite		30-30.4' 7.5YR5/4 CoSL, weathered diorite. dry mainly broken rock	—	—				VH	SS SP	
	50	100			35-35.4' weathered diorite - like 30-30.4'						VH		

about 1' of sluf

sluf

outside of mud sample is slightly moist from auger

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

boring hole about 5' below original ground level

pH of mud between 5-10' = 4 or less, (scale only goes to 4)

water 5≃20'

Samples BIC-26 5-6.5'
10-11
15-16
20-20.5
30-30.4
35-35.4

TD 35'

-Sample spoon is platting copper

4:00-5:00 tripped, washed augers, moved rig to next site.

Golder Associates

BOREHOLE LOG B16-27

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine Transect 3	DRILLING METHOD: Hollow Stem Auger
	SAMPLING METHOD: Split Spoon
NORTHING	EASTING:
DRILL RIG:	SURFACE CONDITIONS:
ANGLE: 90	BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	

BORING NO.

SHEET PAGE OF

DRILLING	START	FINISH
	1:30	4:00
	DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DEPTH IN METERS (ELEVATION)	BLOW 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 10 20	100			5-6.5 10YR3/4 CL (35% clay) moist, NE	0	5				FR	S P	
					bottom 2" 7.5YR4/3 SL(18% clay) moist	0	10						
10	10 20 30	100			10-11.5' 10YR 4/4 SCL, 30% clay, moist, NE	0	10	60			FR	SO P	
15					bottom 1" 7.5YR5/4 CoSL 12% clay.								
20	21 23 20	100	Qal		15-16.5' 10YR5/4 CoSand Wet, NE, grl are subrounded/subangular pH of mud = 4.5 pH of water = 4.0	0	40				soft	SO PO	
25	— 40	100			20-20.5' (upper 1' sluf) 7.5YR4/4 CoSl &	5	30				MH	SO PO	
30					7.5YR 4/4 SCL (30% clay) moist, NE		5				MH	S P	
35	30	100			7.5YR5/4 CoSL (15% clay) moist, NE 25-25.5'	0	10				MH	SS SP	
40	30 50	100			30-31 2.5YR 4/6 CL (35% clay) Sl. moist, NE	0	5				MH	S P	
					over weathered diorite at 30.5'	—	—				H	—	
					35-35.5 2.5YR weathered diorite dry	—	—				VH		

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

bore hole about 5' below original ground level

in drill pad cut
- 0-1.5' 10YR 4/3 CoSL (12% clay) 30% grl
- 1.5-2.5' 10YR 2/1 SCL (28% clay) 5% grl
- 2.5-5' 10YR 2/2 CL (35% clay) 10% grl

water 15-20'

Sample spoon is plating copper

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 2/1/05

JOB NO. 043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC-28

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: Split Spoon

BORING NO.
SHEET
PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING START	DRILLING FINISH
1/1/00	1/1/00
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5					0-6.5' - no sample Qal. water @ 5'								
10	10 15 34	100			10-11.5 10-11 7.5YR4/4 CoSL, 13% clay, wet NE;	0	15				FR	SS PO	
15					11-11.5' 10YR4/4 SCL, 25% clay, NE moist. water pH = 4	0	5				FR	S P	
20	13 13 15	100			15-16.5' lenses of 10YR 4/4 CoLS, wet NE	0	20				Soft	SO PO	
					+ 7.5YR 4/4 clay (40% clay) NE slightly moist	0	0				H	VS VP	
25	35 35	100			20-21' 7.5YR 4/6 SCL, 25% clay, NE moist.	0	5				MH	S P	
30	21 20 23				25-26.5 7.5YR 5/4 CoSL, wet with	0	40				soft	SO PO	
35					layers of 7.5YR 3/3 SCL, 32% clay, NE moist	0	5				MH	S P	
40	50	80			30-30.4' rock at bottom (diorite) + some 7.5YR 4/4 SCL 35% clay, moist	50	5				MH	S P	
	60	100			35-35.4 deep red weathered diorite, dry- very hard						VH	—	

Qal

slue

30' weathered diorite moist

35' weathered diorite dry

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

- Boring is about 5' below original surface

Samples: BIC-28 10-11.5'
15-16.5'
20-21'
25-26.5'
30-30.4', 35-35.4'

TD = 35'

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher
DATE: 2/2/05

JOB NO.043-2319-0002
FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC-29

≃ 10' N of BIC-18

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3

NORTHING
EASTING:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

WATER LEVEL
TIME
DATE
CASING DEPTH
SURFACE CONDITIONS:

BORING NO. BIC-29
SHEET
PAGE OF

DRILLING	
START	FINISH
1:30	3:30
DATE	DATE

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5					at 10' pulled augers up + was slightly moist at bottom of auger – Qal								
10		13 45 45	60	Qal	15-16.5 upper 6" 7.5YR 5/4 SCL Saturated 25% clay, bottom 6" 10YR3/3 Clay, 45% clay, sl. moist	0 0	5 0				--- H	S P VS VP	
15		10 15 20	100	?	20-21.5 7.5YR 4/4 + 5YR4/4 SC, 40% clay, moist	0	5				MH	S P	
20 25		10 20 43	100		25-26.5 5YR 4/4 SCL 38% clay, moist, bottom 2" pulverized diorite	0	10				MH	S P	
30 35		25 25 30	100		30-31.5' 2.5YR 4/6 SCL 28% clay, moist, with diorite fragments within the soil.	0	15				FR	S P	
40		50 50	6" 5"		35-36' 2.5YR 4/6 Clay (40% clay) moist 35-35.5' 35.6-36' hard, weathered diorite, dry	0 —	5				H VH	VS VP —	

small amt. of water did not bring any mud to surface

hit water at ≃ 12'

pushing rock

between 31.5 + 35' thin layer of water, saturated mud – 2.5YR4/6 SCL

brought up some red mud to surface

Notes:
1 Percent > 3inch.
2 Sum of gravel, sand, and fines = 100%
3 For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
4 For noncohesive soil: weak, moderate, strong.
5 Pocket penetrometer, torevane, in situ density, etc.

boring hole is ≃ 2 below original surface

Samples: BIC-29
15-16.5'
20-21.5'
25-26.5'
30-31.5
35-36'

– tripping out of hole, last auger wet + caked in red mud.

– pH of red mud = 6.0

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)
LOGGED BY: Dave Buscher
DATE: 2/2/05
JOB NO. 043-2319-0002
FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC-30

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect 3
~35' N of BIC-15

NORTHING
EASTING:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.

SHEET PAGE OF

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
4:00	5:30
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	10 15 30	100			5-6.5' 10YR3/3 SCL 35% clay, NE moist grl subrounded/Subangular	0	10				FR	S P	
10	10 30 40	100	Qal 15		10-11.5' 10YR4/4 CoSL, moist, NE, grl are subrounded.	0	50				FR	So Po	
15 sluf	10 27 36	60	red soil		15-16.5' 25YR 4/6 SC (38% clay) moist, NE, few diorite frags.	0	5						
20 possibly sluf?	15 45 50	100	20 diorite		20-21. deep red weathered diorite 2,5YR 4/8 SCL, 22% clay, sl. moist/dry	—					VH	—	
25 30	60				25-25.5' grayish-white weathered diorite, dry	—					VH		
35 40					TD 25'								

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

top of boring ≈ 1½' below original surface

Total 120' for day

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

LOGGED BY: Dave Buscher

DATE: 2/2/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Golder Associates

BOREHOLE LOG BIC-31

SITE NAME AND LOCATION: 1C Stockpile Reclaim Area, Tyrone Mine
Transect

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: Split Spoon

BORING NO.

SHEET
PAGE OF

DRILLING START	DRILLING FINISH
8:00	9:00
DATE	DATE

NORTHING

EASTING:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
5	15 25 30				5-6,5' 10YR 4/3 CoSL, NE, slightly moist. grl are subrounded/ subangular	0	40				H	so po	
10	50	100			10-10.4' 10YR 4/4 CoLS— weathered diorite. mainly broken rock. dry, NE	—					VH	so po	
15													
20	50	100			15-15.5' broken diorite (like 10-10.4'), dry	—					VH	so po	
25													
30					TD 15'								
35													
40													

DRILLING CONTRACTOR: Layne-Western (Chandler, AZ)

7:30 drillers moved rig + filled water tank

10: drillers deconing truck, augers I left at 10:00

LOGGED BY: Dave Buscher

DATE: 2/3/05

JOB NO.043-2319-0002

FILE NAME: 043-2319-0002-BH Logs

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

boring close to original surface level

samples: BIC-31 5-6.5'
10-10.4'
15-15.5'

photo 54
photo 55 → of cut showing possible North drainage.

TABLE V-1
1A-1B Liquefaction Assessment

All Qal SPT Data, 1A and 1B Leach Stockpile
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF		
Qal sat unit weight	130	PCF		
Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	No. 1A-1B			30% Amplification
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
GA-05-10	12	5	Fill	22	0	0	600	600	1.70	31.42	0.99	0.090	2.4689	NL
GA-05-10	12	10	Fill	7	0	0	1200	1200	1.29	7.59	0.98	0.089	0.1506	NL
GA-05-10	12	15	Qal	54	3	187.2	1830	1642.8	1.10	50.05	0.97	0.098	2.4689	NL
GA-05-10	12	20	Qal	61	8	499.2	2480	1980.8	1.00	51.49	0.95	0.109	2.4689	NL
GA-05-10	12	25	Qtg	50	13	811.2	3130	2318.8	0.93	39.01	0.94	0.116	2.4689	NL
GA-05-11	27.5	5	Fill	13	0	0	600	600	1.70	18.56	0.99	0.090	0.3172	NL
GA-05-11	27.5	10	Fill	9	0	0	1200	1200	1.29	9.76	0.98	0.089	0.1790	NL
GA-05-11	27.5	15	Fill	13	0	0	1800	1800	1.05	11.51	0.97	0.088	0.2061	NL
GA-05-11	27.5	20	Fill	17	0	0	2400	2400	0.91	13.04	0.95	0.087	0.2358	NL
GA-05-11	27.5	25	FIll	24	0	0	3000	3000	0.82	16.46	0.94	0.086	0.2777	NL
GA-05-11	27.5	30	Qtg	50	2.5	156	3625	3469	0.76	31.89	0.93	0.088	2.4689	NL
GA-05-11	27.5	35	Qtg	50	7.5	468	4275	3807	0.72	30.44	0.92	0.094	2.4689	NL
GA-05-12	36	5	Fill	13	0	0	600	600	1.70	18.56	0.99	0.090	0.3172	NL
GA-05-12	36	10	Fill	15	0	0	1200	1200	1.29	16.27	0.98	0.089	0.2777	NL
GA-05-12	36	15	Fill	7	0	0	1800	1800	1.05	6.20	0.97	0.088	0.1383	NL
GA-05-12	36	20	Fill	21	0	0	2400	2400	0.91	16.10	0.95	0.087	0.2777	NL
GA-05-12	36	25	Qal	57	0	0	3000	3000	0.82	39.09	0.94	0.086	2.4689	NL
GA-05-12	36	30	Qtg	50	0	0	3600	3600	0.75	31.30	0.93	0.085	2.4689	NL
GA-05-12	36	35	Qtg	50	0	0	4200	4200	0.69	28.98	0.92	0.084	2.4689	NL
1B-1	32.7	24		27	0	0	2880	2880	0.83	18.90	0.94	0.086	0.3172	NL
1B-1	32.7	29		50	0	0	3480	3480	0.76	31.84	0.93	0.085	2.4689	NL
1B-1	32.7	34		50	1.3	81.12	4093	4011.88	0.71	29.65	0.92	0.085	2.4689	35.7
1B-1	32.7	39		50	6.3	393.12	4743	4349.88	0.68	28.48	0.91	0.090	2.4689	33.8
1B-5	24.4	9	Qal	13	0	0	1080	1080	1.36	14.86	0.98	0.089	0.2494	NL
1B-5	24.4	14	Qal	28	0	0	1680	1680	1.09	25.66	0.97	0.088	0.7777	NL
1B-5	24.4	19	Qal	50	0	0	2280	2280	0.94	39.34	0.96	0.087	2.4689	NL
1B-5	24.4	24	Qal	50	0	0	2880	2880	0.83	35.00	0.94	0.086	2.4689	NL
1B-5	24.4	29	Qtg	50	4.6	287.04	3526	3238.96	0.79	33.00	0.93	0.092	2.4689	NL
1B-6	23.5	9		23	0	0	1080	1080	1.36	26.29	0.98	0.089	0.9875	NL
1B-6	23.5	14		22	0	0	1680	1680	1.09	20.16	0.97	0.088	0.3605	NL
1B-6	23.5	19		22	0	0	2280	2280	0.94	17.31	0.96	0.087	0.2975	NL
1B-6	23.5	24		50	0.5	31.2	2885	2853.8	0.84	35.16	0.94	0.087	2.4689	NL
1B-6	23.5	29	Qtg	50	5.5	343.2	3535	3191.8	0.79	33.25	0.93	0.094	2.4689	NL
1B-6	23.5	34	Qtg	50	10.5	655.2	4185	3529.8	0.75	31.61	0.92	0.099	2.4689	NL
1B-7	23.5	19		56	0	0	2280	2280	0.94	44.06	0.96	0.087	2.4689	NL
1B-7	23.5	24		50	0.5	31.2	2885	2853.8	0.84	35.16	0.94	0.087	2.4689	NL

TABLE V-1
1A-1B Liquefaction Assessment

All Qal SPT Data, 1A and 1B Leach Stockpile
Corrected N Value (As per Youd et al, 1996 and 1998 NCEER Workshops)

Qal moist unit weight	120	PCF
Qal sat unit weight	130	PCF

Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	No. 1A-1B			30% Amplification
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study (2017)	
Mag Scale Factor	1.234426		Idriss and Boulanger (2008)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	0	PSF at surface		

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) BPF (Youd eqn 8)	rd (Youd eqn 2a)	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
1B-7	23.5	29		50	5.5	343.2	3535	3191.8	0.79	33.25	0.93	0.094	2.4689	NL

Golder Associates

DRAFT

BOREHOLE LOG GA-05-01

SITE NAME AND LOCATION: name and location

NORTHING:
EASTING:
DATUM: amsl
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

SURFACE CONDITIONS:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			fill		Waste Rock, gravel, sand cobbles, light reddish brown							NP	pH 4.5
					sand, silty, fine to med, reddish brown, sl moist					2.5yr 4/4	Soft	M	pH 7.0
5	9 4 4	0 0 0		NO Blows tube Shelby tube Failed (Rock)									
10	2 9 17	0 100 100		11.0-11.5	Geo fabric Quartzite gravel, silty, dark reddish gray					5yr 4/2	firm		pH 4.5
			fill		Waste rock, gravel, sand, silty								
15	3 3 3										Soft		pH 4.0
20	3 5 8										Soft		pH 4.0
			QAL ?		Flowing sand, coarse, sub Angular, brown					7.5yr 4/3			
25													

PL 5 ∇

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-01

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE 9-20-05	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	14		QAL		Sand, A.A.								
	17									10yr 7/3	hard		pH 8.0
	15		Qtg		Drilling much harder, Sand, gravelly, silty yellowish brown								
													pH 8.0
30	30									10yr 6/4	v. hard		
	504				TD: 30 ft								

DRILLING CONTRACTOR QSI

LOGGED BY: Clay Stuve

DATE: 9-20-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG GA-05-02

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.
SHEET 1 of 1

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Waste Rock, sand, silty, pink					5YR 7/4	Firm	NP	PH:6.5
			fill										
5	9 11 9	0 0 No Sample 0											pH:6.5
					Gravel (Quartzite)								
∇ PLS Saturated			fill		Sandy Gravel								
10	5 1 1	0 0 No sample 20			Void 11ft to 12ft (PLS Line?)								
				Shelby									
			Qal		Sand, silty, Angular, dark brown, Saturated					7.5YR 4/3	soft	M	pH: 4.0
15	24 50+		Qtg		Gravel, sandy, silty very pale brown					10YR 7/4	hard	NP	PH: 8.0
20	50+				TD: 20								
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 5-22-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-04

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		Fill								
5	10 9 19	0 100 100			Sand, silt, gravelly, sl. moist					5yr 4/6	soft	L	pH 5.5
10	5 8 6	0 25 100			Gravel, silt, sand, sl. moist					5yr 4/6	firm	N	pH 5.5
Saturated → stringer 15	7 3 6	0 50 100		Shelby tube 16-17	Gravel, sandy, silty, dark red, v. moist					2.5 YR 3/6			pH 4.0
20	12 10 6	0 0 80			Gravel, sandy, silty dark red, moist					2.5 YR 3/6			pH 4.5
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 9-21-05

JOB NO.

FILE NAME:

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-04

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger	BORING NO.
		SHEET 2 of 2
	SAMPLING METHOD: SPT, Shelby	DRILLING
		START / FINISH
NORTHING / EASTING:	WATER LEVEL	
DATUM: amsl / ELEVATION:	TIME	
	DATE	DATE / DATE
	CASING DEPTH	
DRILL RIG:	SURFACE CONDITIONS:	
ANGLE: 90 / BEARING: -		
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.		

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	12 18 11	0 0 100	Fill		Sand, gravelly, medium, Sl. moist, reddish yellow					7.5 YR 6/6			pH: 4.0
			Qtg		Drilling much slower								
30	42 50	0 100 100			gravel, sandy, yellow Sl. moist					10YR 7/6			pH 4.0
					TD: 30 ft								
35													

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 9-21-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DENNISON Sampski PO 870 Scranton PA Bulletin 11
717-586-2061

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BOREHOLE LOG GA-05-05

Golder Associates

SITE NAME AND LOCATION: name and location	DRILLING METHOD: ~~Hollow Stem Auger~~ Tubex	BORING NO.
	SAMPLING METHOD: SPT, Shelby	SHEET 1 of 1
NORTHING DATUM: amsl	EASTING: ELEVATION:	DRILLING START: DATE 9-22-05 FINISH: DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

▽ PLS Saturated (at 14)

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		No Sampling, previous observations at Test Pit 8 8-19-05								
					5-14: Boulders (waste Rock)								
5													
10			Waste Rock										
15			PLS Pond Sediment	Shelby 15-17	Sand, silty, plastic Dark Brown, Saturated					7.5 YR 4/4	soft	h	PH: 4.0
	4 4 3	0 80 100											
20				Shelby fail									
			Qtg		Gila								
	21 23 29	100 100 100			Sand, coarse, gravelly, silty, reddish yellow					7.5 YR 6/6	hard	NP	PH: 4.0
25					TD Drilled · 22								

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 9-22-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

992-3068 - Annalie home
538-7181 - Jawaski

DRAFT

Golder Associates

BOREHOLE LOG GA-05-06

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS: Road bed in fill

BORING NO.

SHEET 1 of 1

DRILLING	
START	FINISH
DATE	DATE

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			fill		Fill sand, gravelly silty, Reddish brown sl. moist					5YR 5/3	firm	L	PH: 7.0
5	8 13 19	0 75 100	Qal		Sand, silty, gravelly, yellowish red, sl moist					5YR 5/6	firm	L	pH: 7.0
				Shelby 8-10									
10	13 23 20	0 20 100			Sand, gravelly, coarse silty, dark yellowish brown, sl. moist					10YR 4/6	V. hard	L	pH: 7.0
			Qtg		Drilling v. hard					2.5 YR 8/4	V. hard	L	PH: 7.0
15	25 50+	50 100			Sand, coarse, gravelly, pale yellow, dry								
					TD: 15 ft								
20													
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Clay/Gilmer

DATE: 9-21-05

JOB NO.

FILE NAME:

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG GA-05-07

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 1

DRILLING	
START	FINISH
DATE 9-21-05	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			fill		Fill, gravel, sandy, silty cultural debris (trash)						firm	NP	
					Fill sand, gravelly, silty, reddish brown						firm	L	
5	15 15 16	0 30 100								5yr 4/6	hard	NP	PH: 7.0
10	3 2 4	0 30 100	Qal		Sand, silty, gravelly dark reddish brown, sl. moist					5yr 4/3	soft	L	PH: 7.0
				Shelby 12-14									
15	4 4 3	0 20 100			Sand, silty, gravelly reddish brown, sl. moist					5yr 4/4	Soft	L	PH: 7.0
			Qtg		Gila, sand, gravelly, pink, Hard, dry					7.5 yr 7/3	v. hard	ND	
20	17 50 50+	5 80 100											PH: 7.0
					TD: 20ft								
25													

DRILLING CONTRACTOR

LOGGED BY: Clay Filmer

DATE: 9-21-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA05-08

SITE NAME AND LOCATION: name and location

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

							DRILLING START	DRILLING FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

SURFACE CONDITIONS: Road Bed in natural material / waste rock fill

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN METERS (ELEVATION)	BLOW/6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		Fill, [illegible]					[illegible]			
5	9 9 7	0 20 100			Fill, Sand, silty, gravelly, dark reddish brown Sl. Moist					5YR 3/4	Soft	L	pH: 7.0
10	7 5 7	100 100 100			Fill, sand, silty, gravelly, dark brown, Sl moist					7.5YR 3/3	Soft	L	pH: 6.0
15	6 7 11	0 5 55			Fill, sand, gravelly, silty, light brown, Sl. Moist					7.5YR 6/4	Firm	N	pH 5.0
20	6 9 19	0 60 100			Fill, Sand, gravelly, Silty, reddish yellow Sl. Moist					5YR 6/6	hard	N	PH: 4.5
25													

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

992-3010

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

BORING NO.

SHEET 2 of 2

DRILLING	
START	FINISH
DATE 9-20	DATE

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	9 14 11	0 80 100	fill		Gravel, sandy, silty, pink Sl. moist					7.5 yr 8/4	Firm	NP	pH: 4.0
29 ▽ PLS			fill										
30	10 18 28				Gravel, sandy, silty, reddish brown, saturated					5yr 5/4	hard	LP	pH: 4.0
			Qtg										
35	50+				Gravel, sandy, silty, moist, reddish yellow					7.5 yr 6/6	hard	NP	pH: 4.0
					TD:35								

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 9-20-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-09

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: ~~Hollow Stem Auger~~
TubEx

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Fill, waste rock, gravel, sand, silt								
5													
10													
15													
20	19 21 50+	100 100 100			gravel, sandy, silty pale brown, sl. moist					10YR 6/3	Frm	L	PH 4.0

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Kilmer

DATE: 9-21-05

JOB NO.

FILE NAME:

DRAFT

Golder Associates

BOREHOLE LOG GA-05-09

SITE NAME AND LOCATION: name and location

DRILLING METHOD: ~~Hollow Stem Auger~~ Tubex

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

DRILLING	
START	FINISH
DATE	DATE

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	14 22 18	0 80 100	fill		Waste Rock Gravel, sandy, silty, reddish brown, sl. moist					5yr 4/4	hard	N	pH: 8.0
30	20 50+	0 50 100	Qtg		Gravel, sandy, silty, yellowish brown, sl moist					10yr 5/4	hard	N	pH: 8.0
35													

DRILLING CONTRACTOR GSI

LOGGED BY: Clay/Tina

DATE: 9-21-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-10

SITE NAME AND LOCATION: name and location

GA-05-10

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE 9-20-05	DATE

SURFACE CONDITIONS:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		Fill, silty, clayey sandy loam stormwater basin, strong brown, sl moist					10yr 4/6		L	pH 5.5
					Fill sand, silty, med, angular dark brown								
5	6 11 11	100 100 100		6.0-6.5						10yr 3/4		M	pH 5.0
			350 PSI 100% Recovery	Shelby Tube 6.5-8.5									
10	3 4 3	0 100 100		11.0-11.5	Fill, roots rock, sand, gravelly, coarse, angular PLS saturation --- tools plating out in copper					10yr 7/6		N	pH 4.0
			1000+ PSI 50%	Shelby Tube 11.5-13.5									
15	4 12 42	75 100 100		16.0-16.5								N	pH <4.0
			QAL ?		Drilling harder sand, gravelly, coarse, sub rounded					7.5yr 6/3			
20	16 29 32	5 100 100		21.0-21.5						7.5yr 6/3		N	
			Qtg		Gravel, sandy, coarse pink					7.5yr 7/4			
25													

▽
WL
12'

DRILLING CONTRACTOR Geotechnics SW

LOGGED BY: Clay Gilmore

DATE: 9-20-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG GA-05-10

SITE NAME AND LOCATION: name and location

GA-05-10

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	50+	0 0 100		25.0- 25.5									
					TD: 25 ft								
30													

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-11

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING START	DRILLING FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS: Road Bed

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		Fill, sand, gravelly, sl. moist yellowish red					5yr 4/6	Soft	L	PH 6.8
5	10 8 5	20 70 100		6.0 6.5	Fill, sand, gravelly, silty angular, dark olive brown sl. moist					2.5y 3/3	Firm	L	PH 5.5
				Shelby failure (rock)									
10	7 5 4	0 30 100		11.0 -11.5	Fill sandy silt, varve-like layers (PLS pond deposit?) -sticky -moist granular -drier					10yr 3/3	Soft	M	PH 4.0
15	8 5 4	0 0 0	No sample recovery										
20	16 5 8				Waste rock, gravel, sand silt, brown, sl. moist					7.5yr 5/3	firm	L	
25													

DRILLING CONTRACTOR: GSI

LOGGED BY: Clay Tilmer

DATE: 7-20-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

6
10
14

DRAFT

Golder Associates

BOREHOLE LOG GA-05-11

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

WATER LEVEL							
TIME							
DATE							
CASING DEPTH							

DRILLING
START DATE
FINISH DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	6 10 14	9 50 100			waste rock, gravel, sand, silt, brown, sl. moist					7.5yr 6/3	firm	L	pH 4.5
275 ▽ PLS Saturation			fill										
30	33 504	0 20 100	q+g		waste rock, gravel, sand, silt, brown, saturated					7.5yr 6/3	firm	N	pH 4.0
35	17 504	0 25 100			Sand, silty, minor fine gravel, light grey moist					10yr 7/2	hard	N	pH 4.0
40					Sand, gravelly, light grey TD: 40					10yr 7/2	hard	N	pH 5.5-6.0

DRILLING CONTRACTOR GSI

LOGGED BY Clay Fillmore

DATE: 9-20-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-12

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET 1 of 2

DRILLING	
START	FINISH
DATE	DATE

SURFACE CONDITIONS: Road bed in fill

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Fill		Sand, gravelly, silty Reddish brown					5yr 7/3	firm	L	PH: 7.0
5	10 8 5	0 70 100			Sand, gravelly, silty dark reddish brown sl. moist					5yr 3/3	firm	N	PH: 6.5
10	8 8 7	0 50 100			Sand, gravelly, silty brown, sl. moist					7.5 yr 5/4	hard	N	PH: 5.0
15	3 2 5	0 0 80			Sand, silty, gravelly Reddish brown, sl. moist					5yr 5/3	soft	1	PH: 4.5
20	11 10 11	0 80 100			waste rock, gravel, sandy,					2.5 yr 5/6	firm	NP	PH: 5.0
25													

DRILLING CONTRACTOR: GSI

LOGGED BY: Clay Silmer

DATE: 9-23-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG GA-05-12

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN METERS (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	22 23 34	6 40 100	fill		waste rock, gravel, sand, silt, red					2.5 YR 5/6	hard	NP	pH: 5.6
			Qal		gravel, rounded								
			Qtg		27 out of gravel - drilling much harder								
30	35 50/4	6 50 100			Sand, gravelly, silty brownish yellow, moist					10yr 6/6	hard	NP	pH: 4.0
35	50+	0 0 100			Sand, silty, gravelly, brownish yellow, moist					10yr 6/6	hard	NP	pH: 4.0
					TD: 35 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: Clay Tilluse

DATE: 5-23-05

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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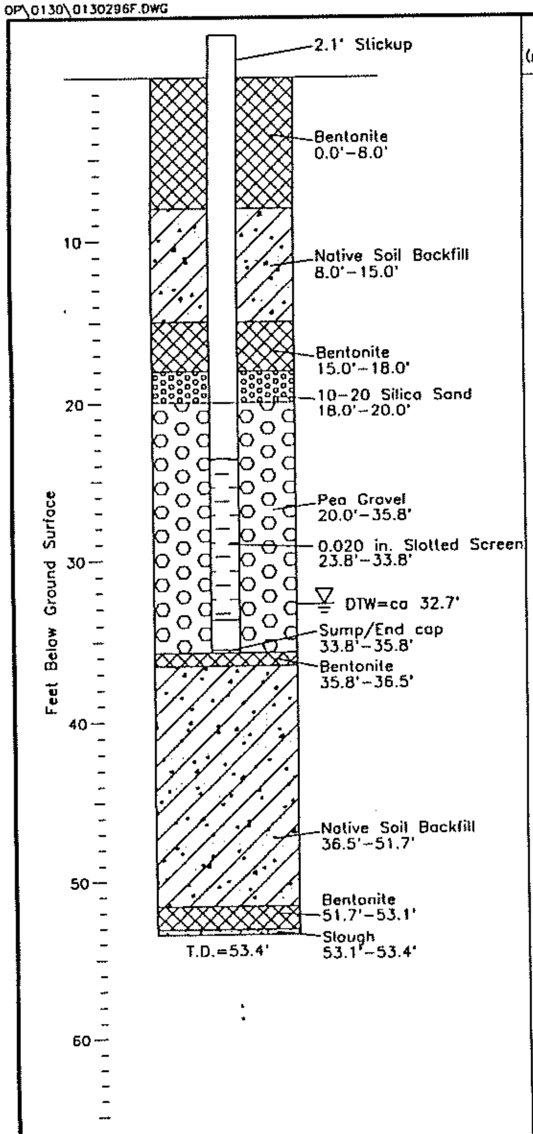

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SC	5	Brown (7.5 YR 5/4); clayey fine to medium sand; moist. Road fill
		SP–SM	10	Brown (7.5 YR 3/4); fine to medium sand with silt
		SC	15	Brown (7.5 YR 3/4); clayey fine to medium sand; dry
		SW	20	Brown (7.5 YR 4/4); fine to medium sand with gravel; dry
15, 13, 14	1.3/1.5	SC, SW	23.9–25.2	Brown (7.5 YR 4/4); clayey fine to medium sand and interlayered fine to medium sand; slightly moist
23, 40, 50 @ 6"	1.2/1.5	SW	28.9–30.1	Brown (7.5 YR 5/4); gravelly fine to medium sand; slightly moist
50 @ 4"	0.2/0.3	SC	33.4–33.6	Brown (7.5 YR 5/4) to yellowish brown (10 YR 5/4) clayey fine to medium sand with gravel; free water
40, 50 @ 6"	0.5/0.5	SW	38.4–38.9	Brown (7.5 YR 5/4); gravelly fine to medium sand; moist to wet
50 @ 6"	0.5/0.5	SC	43.4–43.9	Light brown (7.5 YR 6/4); clayey fine to medium sand with gravel; moist
50 @ 3"	0/0.3		48.4–48.4	No recovery
50 @ 3"	0.3/0.3	GW/SW	53.4–53.7	Light brown (7.5 YR 6/4); sandy gravel; moist

Gila Conglomerate contact at 30'
Monitor well 1B–1 completed in borehole 1B–B11

Explanation

▨ Native backfill
▩ Bentonite seal
○ Gravel pack
▦ Silica sand
⁘ Slough
▯ Screen
ca= Approximately

Geologist: AP
Driller: Layne Environmental Drilling, Inc.
Date Completed: 12–8–96
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow–stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 8.0 in.
Total Drill Depth: 53.4 ft.
Screen Interval: 23.8 ft to 33.8 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	No. 1B Stockpile	Transect No. 1	WELL LOG: 1B–1

DANIEL B. STEPHENS & ASSOCIATES, INC.

IN 0130

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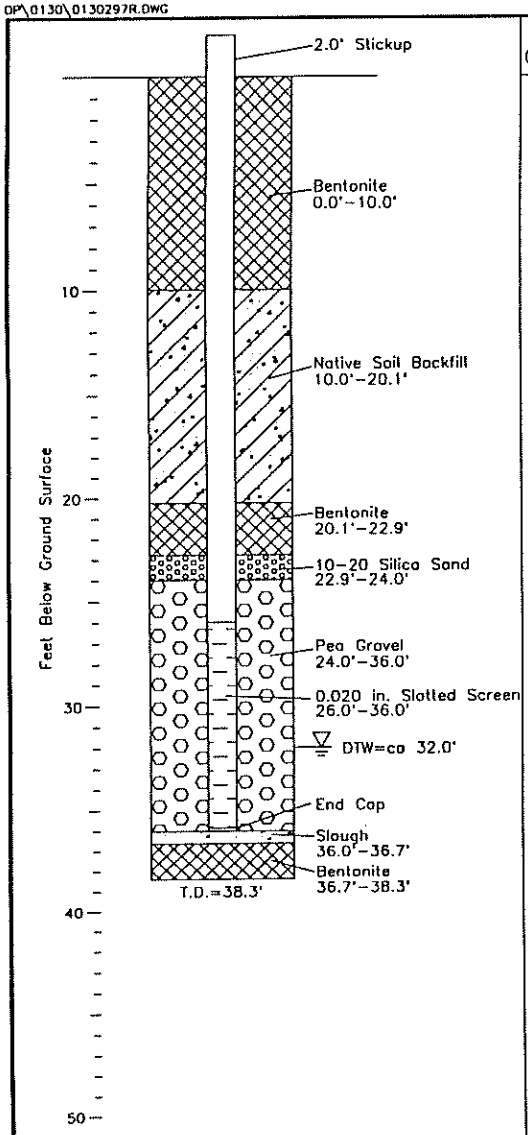

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SC	5	Brown (7.5YR 4/4); clayey fine to medium sand; moist
10, 8, 11	1.1/1.5	CH	8–9.1	Gray (7.5YR 3/1); sandy clay; dry
23, 50 @ 3"	0.35/0.8	SC, CH	13–13.35	Grayish brown (10YR 3/2); clayey sand and sandy clay; dry
12, 12, 14	1.4/1.5	SW	18–19.4	Brown (10YR 4/3); fine to coarse sand; dry
15, 25, 16	0.9/1.5	SW	23–23.9	Yellowish brown (10YR 4/4); fine to medium sand with gravel; dry
19, 25, 24	1.1/1.5	SW	28–29.1	Brown (10YR 4/3); fine to medium sand with gravel; dry
		GW	31	Gravel
25, 50 @ 5"	0.8/0.9	SC	33–33.8	Yellowish brown (10YR 4/4); clayey fine to medium sand with gravel; moist
50 @ 6"	0.5/0.5	SC	38–38.5	Yellowish brown (10YR 5/4); clayey fine to medium sand with gravel; moist

Gila Conglomerate contact at 33'

Monitor well 1B–2 completed in borehole 1B–B1

Explanation

- ▨ Native backfill
- ▩ Bentonite seal
- ○ Gravel pack
- ▦ Silica sand
- ⁘ Slough
- ☐ Screen
- ca= Approximately

Geologist: AP
Driller: Layne Environmental Drilling, Inc.
Date Completed: 12–8–96
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow–stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 10.5 in.
Total Drill Depth: 38.3 ft.
Screen Interval: 26.0 ft to 36.0 ft
Screen Type: 0.020 in. Slotted

DANIEL B. STEPHENS & ASSOCIATES, INC.
1–3–97
JN 0130

PHELPS DODGE TYRONE, INC.
Tyrone, New Mexico

No. 1B Stockpile

Transect No. 1

WELL LOG: 1B–2

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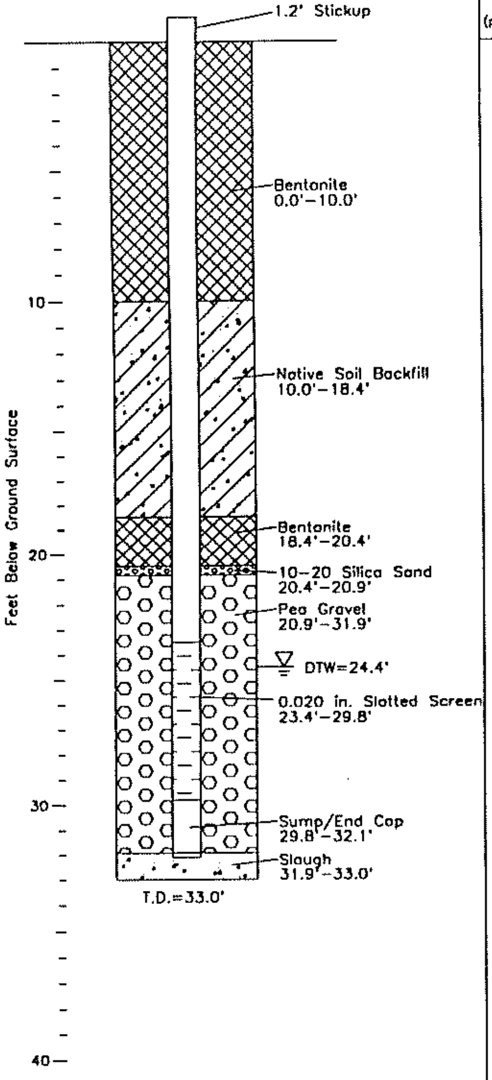

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (in/in)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SW		0-9 – Strong brown (7.5YR 4/6); very fine to coarse sand with minor silt and gravel; damp to dry
8, 6, 7	15/18	SW, GW		9 – Brown (10YR 4/3); very fine to coarse gravelly sand and sandy gravel with trace silt; damp
9, 8, 20	16/18	SW, GW		14 – Strong brown (7.5YR 5/6); very fine to coarse sand and sandy gravel; damp
20, 12, 50 @ 6"	17/18	GW		19 – Brownish yellow (10YR 6/6); very fine to coarse sandy gravel; damp to dry
20, 31, 50 @ 6"	18/18	GW, SW		24 – Light yellowish brown (10YR 6/4); very fine to coarse sandy gravel and gravelly sand; saturated
50 @ 3"	3/3	SW		29 – Strong brown (7.5YR 4/6); very fine to coarse gravelly sand; damp
				Gila Conglomerate contact at 27.0' Monitor well 1B-5 completed in borehole 1B-B15

Explanation

▨ Native Backfill
▩ Bentonite Seal
○ Gravel Pack
▦ Silica Sand
⁖ Slough
☰ Screen

Hydrologist: BC
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-22-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 10.5 in.
Total Drill Depth: 33.0 ft
Screened Interval: 23.4 ft – 29.8 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	No. 1B Stockpile	Transect No. 2	Well Log: 1B-5

DANIEL B. STEPHENS & ASSOCIATES, INC.
4-15-97
JN 0130

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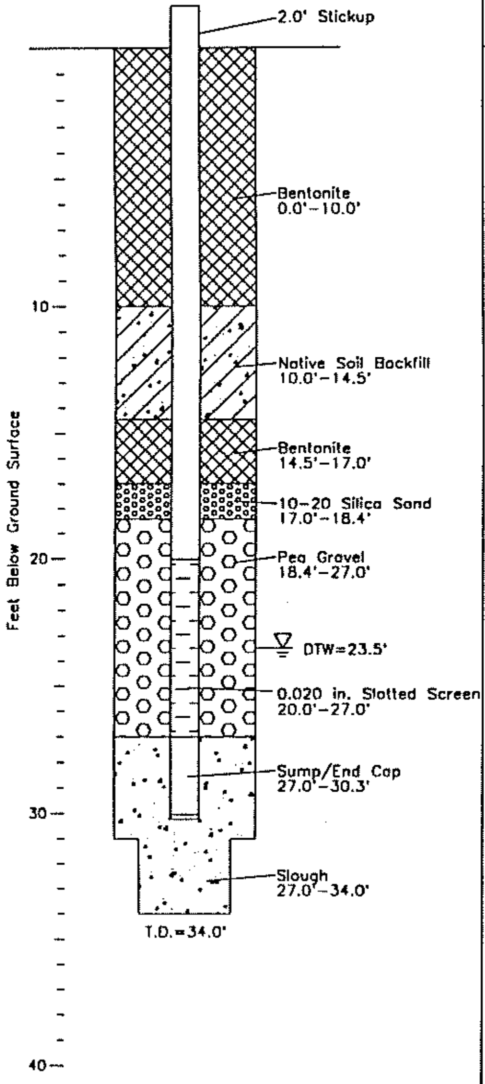

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (in/in)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SW, GW	0-8	Dark brown (10YR 3/3); gravelly very fine to coarse sand with minor silt to silty sandy gravel; damp
8, 10, 13	16/18	SW	9	Brown (10YR 5/4); very fine to coarse sand; some brick red FeOx stain; damp
13, 11, 11	18/18	GW	14	Brown (10YR 5/4); very fine to coarse sandy gravel; gravel to 3/4"; damp
12, 12, 10	16/18	GW	19	Yellowish brown (10YR 5/4); very fine to coarse sandy gravel; moist to wet
20, 50 @ 3"	7/9	GC	24	Mottled brownish yellow (10YR 6/8) to light reddish brown (5YR 6/3); very fine to coarse sandy clayey gravel; damp to moist
50 @ 5.5"	5/5.5	GW	29	Pink (7.5YR 7/3); silty, very fine to coarse sandy gravel
50 @ 3.5"	1/3.5	GM	34	Pink; silty sandy gravel, as above

Gila Conglomerate contact at 24.5'
Monitor well 1B-6 completed in borehole 1B-B16

Explanation

- ▨ Native Backfill
- ▩ Bentonite Seal
- ○ Gravel Pack
- ▦ Silica Sand
- ⁘ Slough
- ☰ Screen

Hydrologist: BC
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-22-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 10.5 in. at 0.0 ft - 31.0 ft
8.5 in. at 31.0 ft - 34.0 ft
Total Drill Depth: 34.0 ft
Screened Interval: 20.0 ft - 27.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	No. 1B Stockpile	Transect No. 2	Well Log: 1B-6

DANIEL B. STEPHENS & ASSOCIATES, INC.
4-2-97
JN 0130

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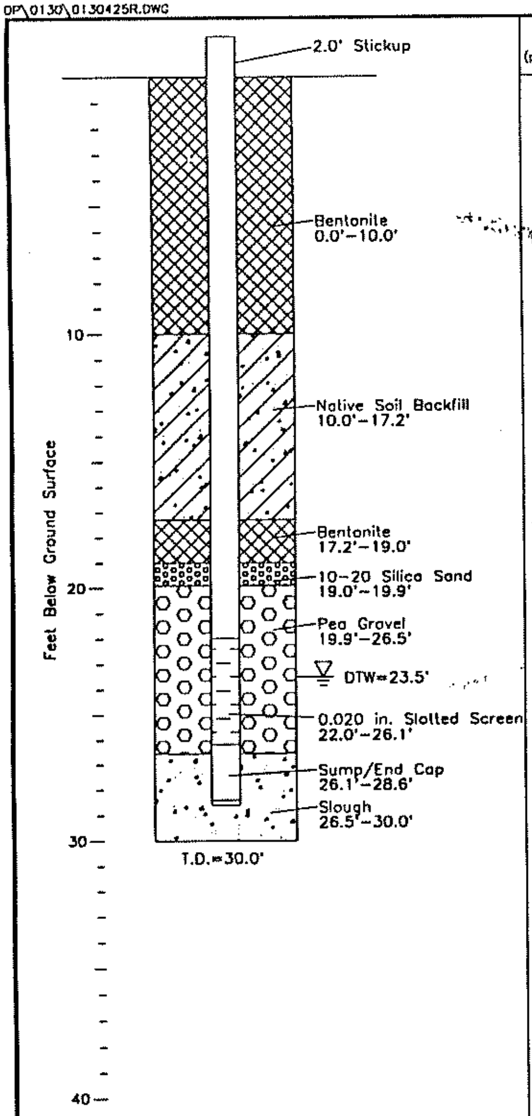

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (in/in)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SM	0–7	Dark brown (7.5YR 3/3); silty, very fine to coarse sand with gravel layers; damp
		CH	7–9	Yellowish red (5YR 4/6); very fine to fine sandy clay; medium to high plasticity; damp to moist
		SM	9–13	Brown (7.5YR 4/3); silty, very fine to medium coarse sand with minor clay and layers of gravel; damp
		SW	13–19	Brown (7.5YR 4/3); gravelly, very fine to coarse sand with trace silt to well graded sand; damp
22, 28, 28	13/18	GW	19	Strong brown (7.5YR 4/6); very fine to medium sandy gravel; damp
12, 50 @ 5"	8/11	GW GM to SW	24 24.5	Strong brown (7.5YR 4/4); very fine to coarse sandy gravel; saturated Reddish yellow (7.5YR 6/6); silty, very fine to coarse sandy gravel to gravelly sand; damp
50 @ 6"	6/6	GM	29	Reddish yellow (7.5YR 6/6); silty, very fine to coarse sandy gravel; damp

Gila Conglomerate contact at 24.5'

Monitor well 1B–7 completed in borehole 1B–B20

Explanation

▨	Native Backfill
▩	Bentonite Seal
○	Gravel Pack
▦	Silica Sand
⁘	Slough
☐	Screen

Hydrologist: BC
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2–24–97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow–stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 10.5 in.
Total Drill Depth: 30.0 ft
Screened Interval: 22.0 ft – 26.1 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	No. 1B Stockpile	Transect No. 2	Well Log: 1B–7

DANIEL B. STEPHENS & ASSOCIATES, INC.
4–2–97
JN 0130

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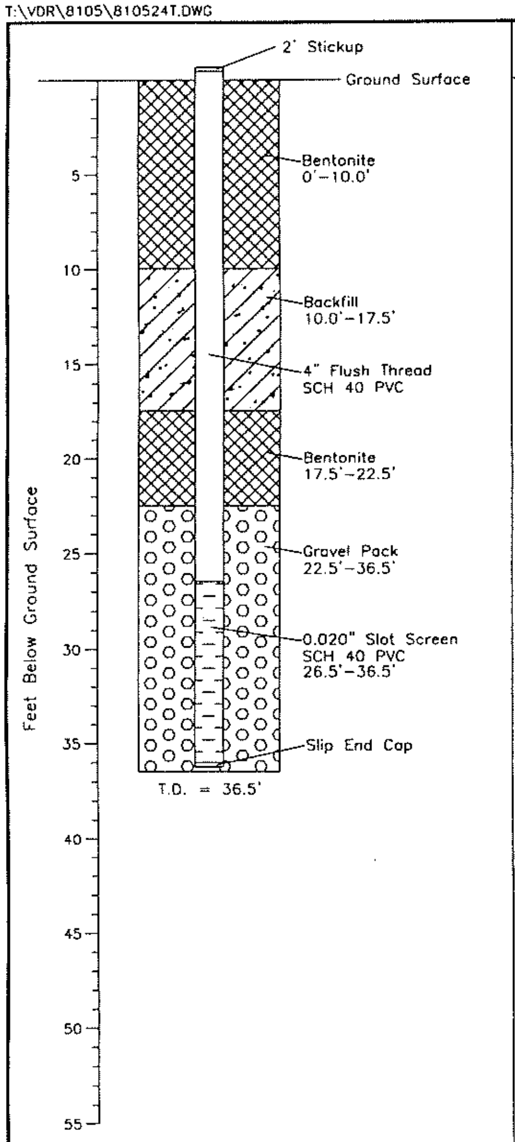

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	PID Reading (ppm)	Sampling Device	USCS Symbol	Sample Interval/Depth (feet bgs) Lithologic Description and Comments
				SM	0 – Reddish brown (5YR 4/4); silty sand with gravels (fill); slightly moist
					10 – As above
					15 – As above
					20 – As above, with more gravel
				GW	25 – As above, with gravel, some large cobbles; slightly moist; as above
50, 5	.5/2.0		Split Spoon	SC	35 – Gila Conglomerate; light brown (7 1/2YR 5/6); clayey sand–50% with some cobbles
					37 – Total depth; Gila confirmed
					Gila conglomerate contact at 35.0 ft.

Explanation

▩ Bentonite Seal

○ Gravel Pack

▨ Native Backfill

☰ Screen

Geologists: M. Koffler
Driller: Alliance Environmental Inc.
Date Completed: 12–21–98
Drilling Method: Hollow–stem auger

Bit Diameter: 11.5 in.
Total Drill Depth: 36.5 ft

PHELPS DODGE TYRONE, INC.
Tyrone, New Mexico

NO. 1B STOCKPILE

Monitor Well: IB–9

Daniel B. Stephens & Associates, Inc.
5–24–99
JN 8105

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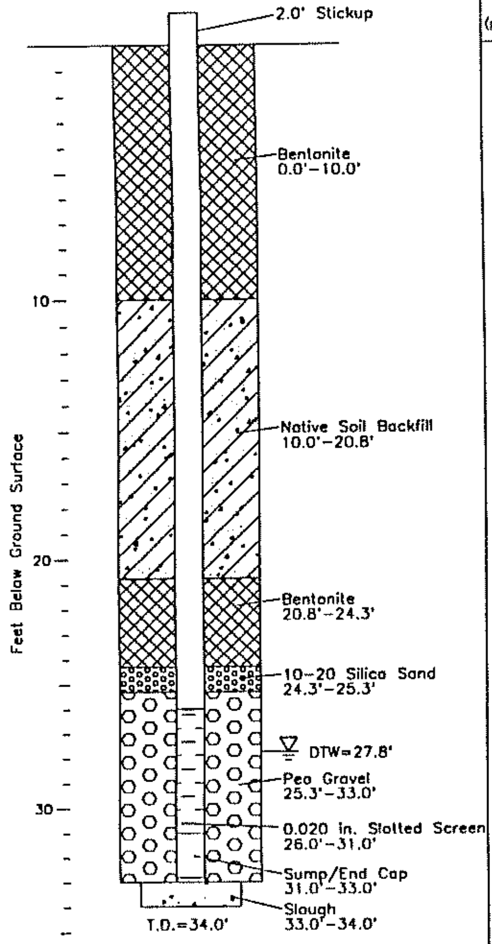

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs) Lithologic Description and Comments
10, 25, 40	1.1/1.5	SW, GW	19 – Reddish brown (5YR 4/4); sands and gravel; slightly moist
20, 20, 24	1.3/1.5	SW, GW	24 – Same as above; wet, not saturated
20, 40, 28	1.5/1.5	SW, GW SC	29 – Same as above; saturated 29.5 – Light reddish brown (5YR 6/4); clayey sand with gravel; wet, not saturated
30, 50	0.9/1.0	SC	34 – Gila Conglomerate; slightly moist

Gila Conglomerate contact at 34.0'
Monitor well BK-2 completed in borehole BK-B5

Explanation

▨	Native Backfill	⁚	Slough
▩	Bentonite Seal	☐	Screen
○	Gravel Pack		
░	Silica Sand		

Hydrologist: DB
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-10-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon
Bit Diameter: 10.5 in. at 0.0 ft – 33.0 ft
8.5 in. at 33.0 ft – 34.0 ft
Total Drill Depth: 34.0 ft
Screened Interval: 26.0 ft – 31.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	Brick Kiln Gulch	Transect 1	Well Log: BK-2

DANIEL B. STEPHENS & ASSOCIATES, INC.
4-16-97
JN 0130

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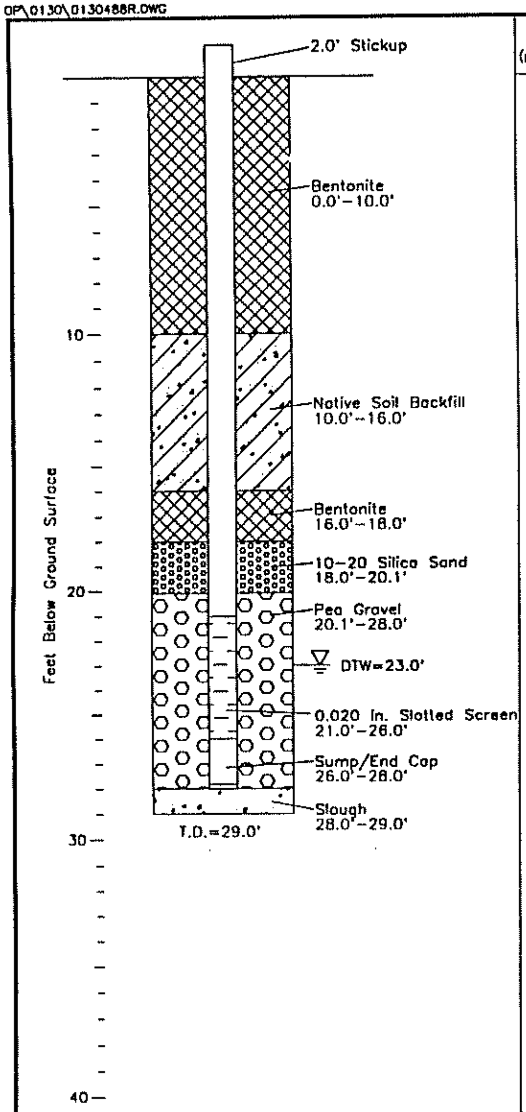

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
7, 6, 15	1.0/1.5	SP, SW	14	Reddish brown (5YR 4/4); fine-grained sand; interbedded with coarse sand
11, 30, 50	1.5/1.5	SW, GW	19	Yellowish red (5YR 5/6); medium to coarse sand; some gravels
16, 25, 50	1.0/1.5	SW, GW	24	Reddish brown (5YR 4/4); medium to coarse sands and gravels; wet
		SW, GW	25	Semiconsolidated sands and gravels; moist
50 @ 6"	0.3/0.5	SW, GW	29	Reddish brown (5YR 4/4); semiconsolidated sands and gravel; slightly moist

Gila Conglomerate contact at 24.5'
Monitor well BK-4 completed in borehole BK-B13

Explanation

▨ Native Backfill
▩ Bentonite Seal
○ Gravel Pack
▦ Silica Sand
⁖ Slough
☰ Screen

Hydrologist: DB, MR
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-17-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon
Bit Diameter: 8.5 in.
Total Drill Depth: 29.0 ft
Screened Interval: 21.0 ft – 26.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	Brick Kiln Gulch	Transect 2	Well Log: BK-4

DANIEL B. STEPHENS & ASSOCIATES, INC.
4-17-97
JN 0130

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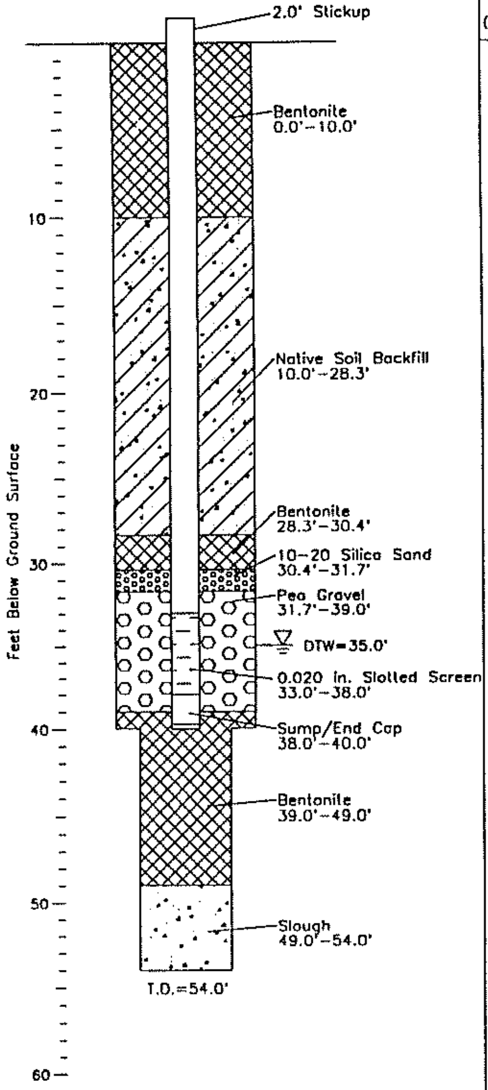

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SW, GW		
4, 6, 9	1.5/1.5	SW, SC	24	– Reddish brown (5YR 4/4); sands and clayey sands with gravel; moist
18, 20, 31	1.4/1.5	SW, GW	29	– Yellowish red (5YR 6/8); medium to coarse sands and gravel; unconsolidated; slightly moist
9, 9, 18	1.5/1.5	SW, SC	34	– Yellowish red and reddish brown; sands and clayey sands; moist to 35 feet, wet (not saturated) at 35 feet
30, 50 @ 4"	0.8/0.8	SC	39	– Light reddish brown (5YR 6/4); clayey sands with gravel; moist to slightly moist
50 @ 5"	0.4/0.4	SC	44	– Same material; moist
50 @ 2"	0.1/0.1	SC	49	– Same as above
50 @ 5"	0.4/0.4	SC	54	– Same as above

Gila conglomerate contact at 36.0'
Monitor well BK-6 completed in borehole BK-B21

Explanation

▨	Native Backfill
▩	Bentonite Seal
○	Gravel Pack
▦	Silica Sand
⁘	Slough
☐	Screen

Hydrologist: DB
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-19-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon
Bit Diameter: 10.5 in. at 0.0 ft – 40.0 ft
8.5 in. at 40.0 ft – 54.0 ft
Total Drill Depth: 54.0 ft
Screened Interval: 33.0 ft – 38.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC.
Tyrone, New Mexico

Brick Kiln Gulch

Transect No. 3

Well Log: BK-6

DANIEL B. STEPHENS & ASSOCIATES, INC.
4-21-97
JN 0130

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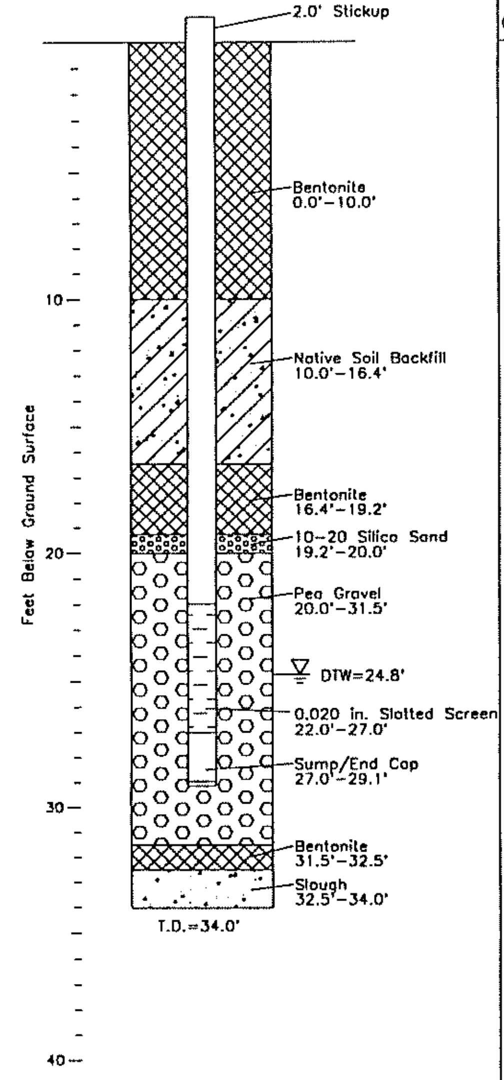

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (in/in)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SM		0-2 – Dark brown (7.5YR 3/3); silty, very fine to medium sand with minor gravel to 1"; damp
7, 6, 9	18/18	SW CL		4-4.8 – Strong brown (7.5YR 5/6); gravelly; very fine to coarse sand; dry 4.8 – Dark brown (7.5YR 3/3); very fine to coarse sandy clay; damp to moist
5, 5, 5	18/18	GW to SW		8.0-9 – Strong brown (7.5YR 4/6); very fine to coarse, sandy gravel to gravelly sand; damp
		CL		10.3 – Strong brown (7.5YR 4/6); very fine to fine sandy clay; damp
5, 4, 13	18/18	SW to CL		14-15.1 – Strong brown (7.5YR 4/6); thin layers of very fine to coarse gravelly sand and very fine to fine sandy clay, as above; damp to moist
7, 22, 25	18/18	SW to CL GW		19 – Strong brown (7.5YR 4/6); alternating gravelly sand and clay with very fine to fine sand and very fine to coarse sand 20 – Strong brown (7.5YR 5/8); very fine to very coarse, sandy gravel with minor silt and clay; damp
17, 18 50 @ 4"	18/18	SC, SW GC		24 – Strong brown (7.5YR 4/6); clayey, very fine to fine sand, with layers of coarser sand; moist 24.5 – Reddish brown (5YR 5/4); clayey, very fine to fine sandy gravel; saturated
50 @ 6"	5/6	SW		29 – Reddish brown (5YR 5/4); gravelly, very fine to medium sand; damp

Gila Conglomerate contact at 25.0'
Monitor well BK-7 completed in borehole BK-B25

Explanation

▨ Native Backfill
▩ Bentonite Seal
○ Gravel Pack
▦ Silica Sand
⁘ Slough
☐ Screen

Hydrologist: BC
Driller: Layne Environmental Drilling, Inc.
Date Completed: 2-26-97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow-stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 8.5 in.
Total Drill Depth: 34.0 ft
Screened Interval: 22.0 ft – 27.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	Brick Kiln Gulch	Transect No. 4	Well Log: BK-7

DANIEL B. STEPHENS & ASSOCIATES, INC.
1-21-97 JN 0130

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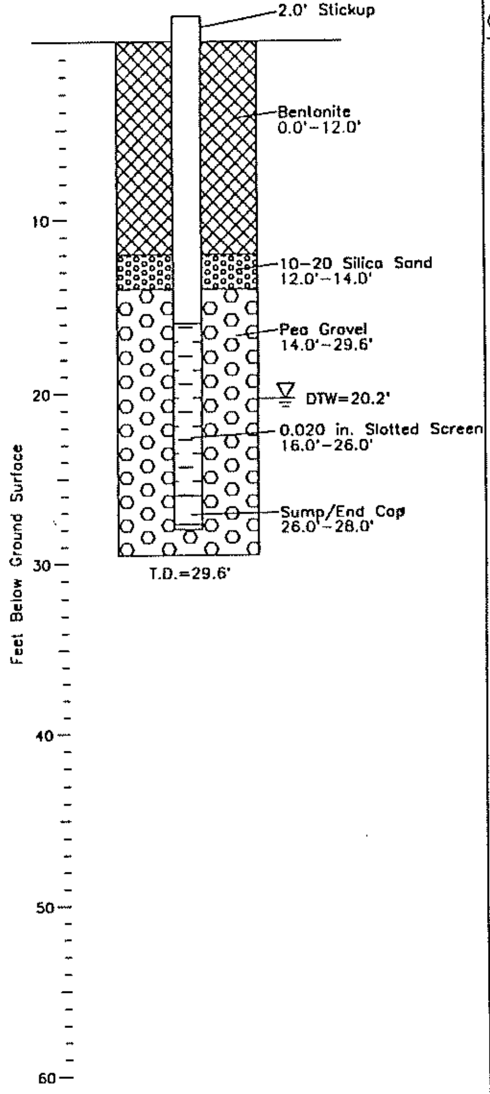

Blow Counts (per 0.5 ft unless indicated)	Sample Recovery (ft/ft)	USCS Symbol	Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
		SC	5	Dark brown (7.5YR 3/3); clayey fine to medium sand; moist
		SC	10	Strong brown (7.5YR 4/6); fine sandy clay; moist
9, 14, 19	1.2/1.5	SC	14.5–15.7	Strong brown (7.5YR 4/6); clayey fine to medium sand; slightly moist
7, 25, 25	1.1/1.5	SW	19.5–20.6	Yellowish brown (10YR 5/8); fine to medium sand; wet at 20.2–20.6
50 @ 6"	0.4/0.5	SW	24.6–25	Brown (7.5Yr 5/4); fine to medium sand; moist; 1' of muddy water and slurry in top of barrel
50 @ 6"	0.5/0.5	SW	29.6–30.1	Brown (7.5YR 5/4); fine to medium sand; moist

Gila Conglomerate contact at 24.6'
Monitor well BK-10 completed in borehole BK-B33

Explanation

▨	Native Backfill
▩	Bentonite Seal
○	Gravel Pack
▦	Silica Sand
⁘	Slough
☰	Screen

Hydrologist: AP
Driller: Layne Environmental Drilling, Inc.
Date Completed: 3–10–97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Hollow–stem auger

Sampler Type: Split spoon and cuttings
Bit Diameter: 8.5 in.
Total Drill Depth: 29.6 ft
Screened Interval: 16.0 ft – 26.0 ft
Screen Type: 0.020 in. Slotted

PHELPS DODGE TYRONE, INC.
Tyrone, New Mexico

Brick Kiln Gulch

Transect No. 5

Well Log: BK–10

DANIEL B. STEPHENS & ASSOCIATES, INC.
4–15–97
JN 0130

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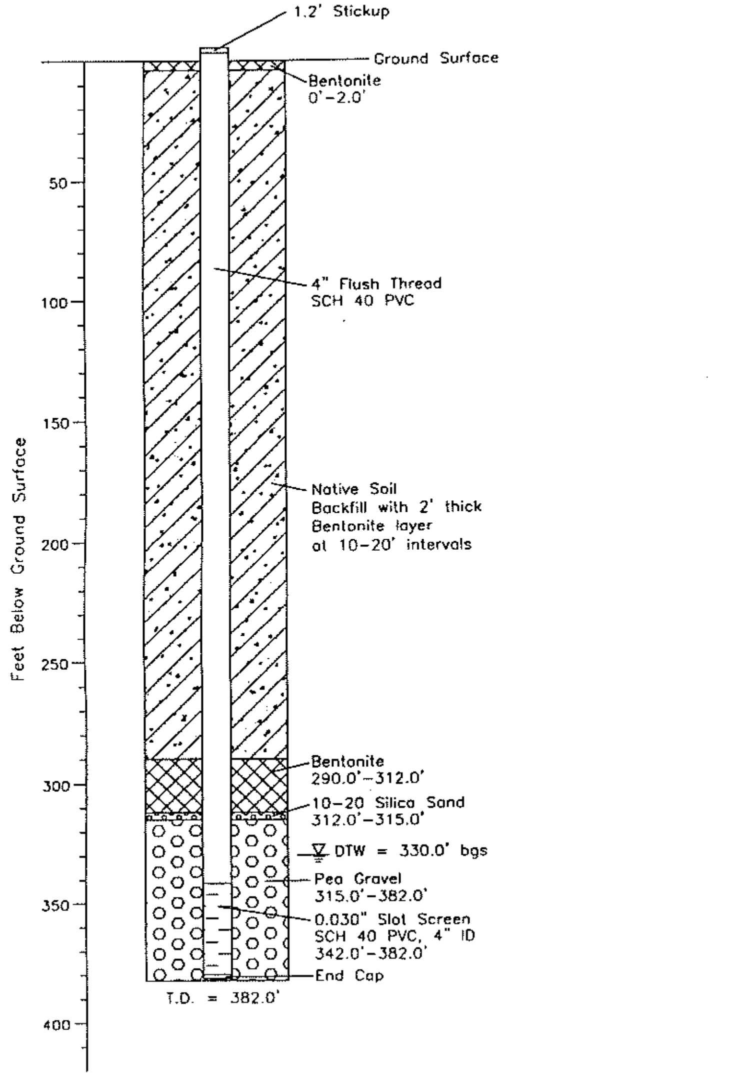

Sample Interval/Depth (feet bgs)	Lithologic Description and Comments
0.0-255	QTg - Gila Conglomerate
255-333	Dark brown; fractured / "weathered" rock
333-382	Light red; "weathered" rock

Note: Lithologic description based on driller's notes.

Explanation

▩ Bentonite Seal

○ Gravel Pack

▨ Native Backfill

☷ Screen

▦ Silica Sand

Hydrologist: Rick Lawrence
Driller: Aaron Roberts
Date Completed: 5-18-99
Drilling Method: Cable Tool

Bit Diameter: 8.0 in. O.D.
Total Drill Depth: 382.0'
Sampler Type: Cuttings

Daniel B. Stephens & Associates, Inc.
11-29-99
JN 9096

PHELPS DODGE TYRONE, INC.
Tyrone, New Mexico

TYRONE EAST SIDE No. 1 STOCKPILE AREA

Well Schematic: MB-40

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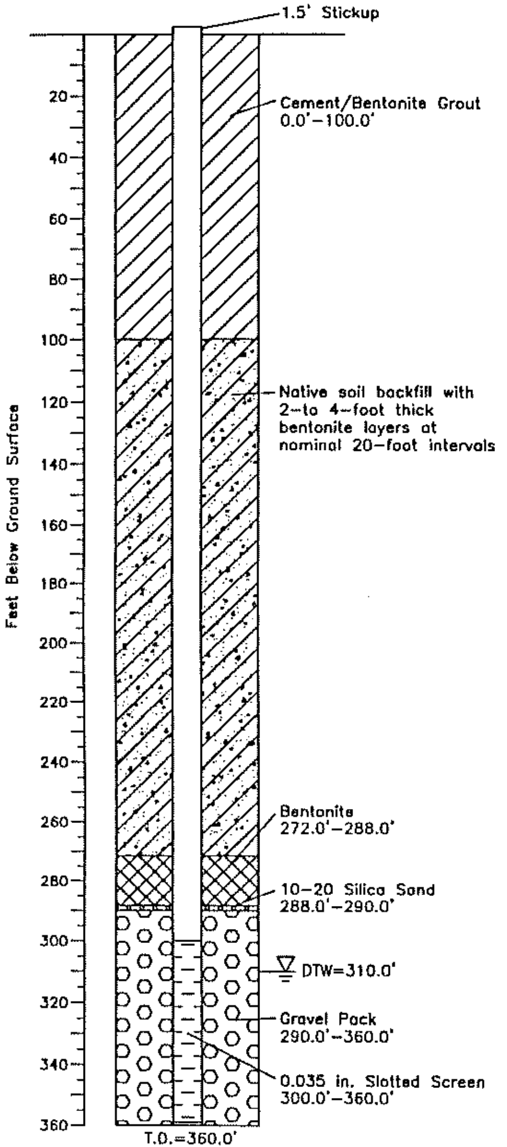

Soil Chemical Parameters

Depth	pH	Electrical Conductivity at 25°C (μmhos/cm)
0–10	7.72	325
10–20	7.76	201
20–30	7.79	155
30–40	7.82	182
40–50	7.93	140
50–60	8.22	132
60–70	8.1	112
70–80	8.25	84
80–90	8.17	106
90–100	8.19	124
100–110	8.34	106
110–120	8.18	104
120–130	8.09	108
130–140	8.12	116
140–150	8.4	89
150–160	8.13	122
160–170	8.22	122
170–180	8.11	133
180–190	8.11	150
190–200	8.18	118
200–210	8.18	130
210–220	8.06	140
220–230	8.31	114
230–240	8.22	101
240–250	8.11	120
250–260	8.11	129
260–270	8.1	130
270–280	8.04	123
280–290	8.23	176
290–300	8.17	212
300–310	7.99	270
310–320	7.62	231
320–330	8.19	393
330–340	7.67	1086
340–350	7.55	1119
350–360	7.35	1626

Comments and Lithology

Lithologic description based on driller's log

Gila conglomerate – 0 – 298
- 0–230 – Reddish brown conglomerate abundant cobbles
- 230–298 – Light brown conglomerate with boulders

Bedrock – 298–360 – (no lithologic data available at this time)
- 298–330 – Light brown hard rock
- 330–360 – Dark brown soft rock

Note: Paste pH and electrical conductivity were measured on drill cuttings collected at 10–ft intervals

Explanation

▨ Native backfill
▨ Cement/Bentonite Grout
▦ Bentonite seal
☷ Screen
○ Gravel pack
▒ Silica sand

Hydrologists: RSP
Driller: Aaron Roberts
Date Completed: 8–15–97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Cable Tool

Bit Diameter: 8.0 in.
Total Drill Depth: 360.0 ft
Screened Interval: 300.0 ft to 360.0 ft
Screen Type: 0.035" Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	East Side Area	No. 1 Stockpile	WELL LOG: MB–34

DANIEL B. STEPHENS & ASSOCIATES, INC.
11–7–97
JN 0130

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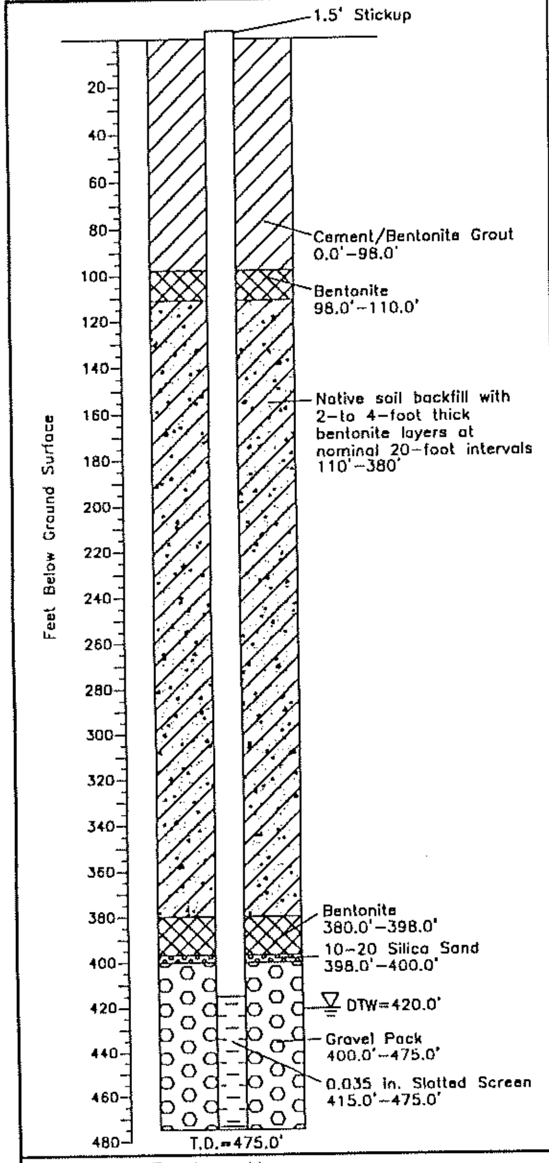

Soil Chemical Parameters

Depth	pH	Electrical Conductivity at 25°C (μmhos/cm)
0–10	7.29	292
10–20	7.26	327
20–30	7.73	129
30–40	7.84	133
40–50	7.87	162
50–60	7.95	83
60–70	7.82	95
70–80	6.31	128
80–90	7.00	207
90–100	7.52	214
100–110	7.63	211
110–120	7.80	199
120–130	7.86	224
130–140	7.84	214
140–150	7.88	212
150–160	7.81	201
160–170	7.93	197
170–180	7.90	184
180–190	8.09	133
190–200	8.11	170
200–210	8.07	173
210–220	6.85	200
220–230	7.04	205
230–240	7.21	221
240–250	7.33	203
250–260	7.36	216
260–270	7.56	210
270–280	7.57	187
280–290	7.54	175
290–300	7.53	214
300–310	7.49	228
310–320	7.64	188
320–330	7.73	218
330–340	7.34	252
340–350	7.48	218
350–360	7.60	152
360–370	7.64	180
370–380	7.68	218
380–390	7.82	102
390–400	7.79	160
400–410	7.84	197
410–420	7.88	212
420–430	7.81	196
430–440	7.93	190
440–450	7.96	170
450–460	7.95	186
460–475	7.98	206

Comments and Lithology

Lithologic description based on driller's log

Gila conglomerate – 0–475'

- 0–120 brown conglomerate, loose
- 120–240 brown conglomerate, tight
- 240–275 conglomerate with boulders
- 275–385 brown conglomerate
- 385–410 conglomerate with course gravel, some boulders
- 410–475 brown conglomerate

Note: Paste pH and electrical conductivity were measured on drill cuttings collected at 10–ft intervals

Explanation

▨	Native backfill
▨	Cement/ Bentonite Grout
▩	Bentonite seal
▤	Screen
○	Gravel pack
▦	Silica sand

Hydrologists: RSP
Driller: Aaron Roberts
Date Completed: 12–17–97
Well Diameter: 4.0 in.
Casing Material: SCH 40 PVC
Drilling Method: Cable Tool

Bit Diameter: 8.0 in.
Total Drill Depth: 475.0 ft
Screened Interval: 415.0 ft to 475.0 ft
Screen Type: 0.035" Slotted

PHELPS DODGE TYRONE, INC. Tyrone, New Mexico	East Side Area	No. 1B Stockpile	WELL LOG: MB–36

DANIEL B. STEPHENS & ASSOCIATES, INC.
2-27-98
JN 0130

3A Leach Stockpile Liquefaction Evaluation
Qal SPT Data, All Sampled Intervals
Corrected N Value (As per Youd et al., 1996 and 1998 NCEER Workshops)
Saturation Assumed below 20 ft

Qal moist unit weight	120	PCF		
Qal sat unit weight	133	PCF		
Borehole dia correction	1.05	(Cb)	Youd et al	
Rod length corr	0.8	(Cr)	Youd et al	
Energy Ratio	1	(Ce)	Youd et al	
Sampling Method Corr	1	(Cs)	Youd et al	
Correction Product	0.84	(Less Ovb corr, Column J)		
Max surface Accel	0.14	g	USGS Unified Hazard Tool	Site Class (760 m/sec)
	3A Leach			30% Amplification
Percent Fines	10	%		
Max Quake Magnitude	6.7		URS Seismicity Study	
Mag Scale Factor	1.31		Table 3, Idriss, Column 3 (after Youd and Noble 1997)	
Regrade Burial Depth	0	Feet		
Surcharge Pressure	**0**	**PSF at surface**		

Hole	**Depth to Water (bgs)**	**Sample Depth**	**Material**	**Blows/ft (uncorr)**	**Depth below gws**	**u (pcf)**	**Total Stress**	**Effective Stress**	**CSR (Youd eqn 1)**	**CRR (LIQFAC Lookup)**	**FS (Youd eqn 23)**
7-2	20	5	Qal	17	0	0	600	600	0.090	0.5699	NL
7-2	20	10	Qal	9	0	0	1200	1200	0.089	0.1900	NL
7-3	20	5	Qal	18	0	0	600	600	0.090	0.8253	NL
7-3	20	10	Qal	13	0	0	1200	1200	0.089	0.2646	NL
7-3	20	15	Qal	11	0	0	1800	1800	0.088	0.1900	NL
7-3	20	20	Qal	5	0	0	2400	2400	0.087	0.1048	1.6
7-3	20	25	Qal	18	5	312	3065	2753	0.095	0.2358	3.2
7-3	20	30	Qal	25	10	624	3730	3106	0.102	0.2948	3.8
7-4	20	5	Qal	17	0	0	600	600	0.090	0.5699	NL
7-4	20	10	Qal	28	0	0	1200	1200	0.089	2.6200	NL
7-4	20	15	Qal	13	0	0	1800	1800	0.088	0.2188	NL
7-4	20	20	Qal	14	0	0	2400	2400	0.087	0.2031	3.1
7-4	20	25	Qal	18	5	312	3065	2753	0.095	0.2358	3.2
7-5	20	5	Qal	25	0	0	600	600	0.090	2.6200	NL
7-5	20	10	Qal	26	0	0	1200	1200	0.089	2.6200	NL
7-5	20	15	Qal	14	0	0	1800	1800	0.088	0.2358	NL
7-5	20	20	Qal	18	0	0	2400	2400	0.087	0.2502	3.8
7-5	20	25	Qal	32	5	312	3065	2753	0.095	0.4467	6.1
7-6	20	5	Qal	20	0	0	600	600	0.090	2.6200	NL
7-6	20	10	Qal	57	0	0	1200	1200	0.089	2.6200	NL
7-8	20	5	Qal	29	0	0	600	600	0.090	2.6200	NL
7-8	20	10	Qal	38	0	0	1200	1200	0.089	2.6200	NL
7-8	20	15	Qal	63	0	0	1800	1800	0.088	2.6200	NL
7-8	20	20	Qal	14	0	0	2400	2400	0.087	0.2031	3.1
7-8	20	25	Qal	25	5	312	3065	2753	0.095	0.3157	4.3
8-2	20	5	Qal	10	0	0	600	600	0.090	0.2646	NL
8-2	20	10	Qal	46	0	0	1200	1200	0.089	2.6200	NL
8-3	20	10	Qal	7	0	0	1200	1200	0.089	0.1598	NL
8-3	20	15	Qal	13	0	0	1800	1800	0.088	0.2188	NL

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
8-3	20	20	Qal	16	0	0	2400	2400	0.087	0.2358	3.6
8-4	20	5	Qal	8	0	0	600	600	0.090	0.2188	NL
8-4	20	10	Qal	9	0	0	1200	1200	0.089	0.1900	NL
8-4	20	15	Qal	27	0	0	1800	1800	0.088	0.4913	NL
8-4	20	20	Qal	40	0	0	2400	2400	0.087	2.6200	NL
8-5	20	5	Qal	11	0	0	600	600	0.090	0.2843	NL
8-5	20	10	Qal	33	0	0	1200	1200	0.089	2.6200	NL
8-8	20	5	Qal	4	0	0	600	600	0.090	0.1310	NL
8-8	20	10	Qal	50	0	0	1200	1200	0.089	2.6200	NL
8-8	20	15	Qal	26	0	0	1800	1800	0.088	0.4913	NL
8-8	20	20	Qal	47	0	0	2400	2400	0.087	2.6200	NL
8-9	20	5	Qal	28	0	0	600	600	0.090	2.6200	NL
8-9	20	10	Qal	38	0	0	1200	1200	0.089	2.6200	NL
8-9	20	15	Qal	31	0	0	1800	1800	0.088	1.3100	NL
8-9	20	20	Qal	37	0	0	2400	2400	0.087	2.6200	39.6
8-10	20	5	Qal	23	0	0	600	600	0.090	2.6200	NL
8-10	20	10	Qal	70	0	0	1200	1200	0.089	2.6200	NL
8-10	20	15	Qal	21	0	0	1800	1800	0.088	0.3367	NL
8-10	20	20	Qal	50	0	0	2400	2400	0.087	2.6200	NL
9-1	20	5	Qal	21	0	0	600	600	0.090	2.6200	NL
9-1	20	10	Qal	27	0	0	1200	1200	0.089	2.6200	NL
9-1	20	15	Qal	49	0	0	1800	1800	0.088	2.6200	NL
9-1	20	20	Qal	15	0	0	2400	2400	0.087	0.2188	3.3
9-1	20	25	Qal	69	5	312	3065	2753	0.095	2.6200	NL
10-2	20	5	Qal	32	0	0	600	600	0.090	2.6200	NL
10-3	20	5	Qal	29	0	0	600	600	0.090	2.6200	NL
10-3	20	10	Qal	23	0	0	1200	1200	0.089	0.5699	NL
10-4	20	5	Qal	17	0	0	600	600	0.090	0.5699	NL
10-4	20	10	Qal	21	0	0	1200	1200	0.089	0.4467	NL
10-4	20	15	Qal	22	0	0	1800	1800	0.088	0.3563	NL
10-4	20	20	Qal	24	0	0	2400	2400	0.087	0.3367	5.1
10-4	20	25	Qal	37	5	312	3065	2753	0.095	1.0480	14.4
10-4	20	30	Qal	41	10	624	3730	3106	0.102	1.3100	16.9
10-5	20	5	Qal	20	0	0	600	600	0.090	2.6200	NL
10-5	20	10	Qal	28	0	0	1200	1200	0.089	2.6200	NL
10-5	20	15	Qal	14	0	0	1800	1800	0.088	0.2358	NL
10-5	20	20	Qal	26	0	0	2400	2400	0.087	0.3563	5.4
10-5	20	25	Qal	46	5	312	3065	2753	0.095	2.6200	NL
10-5	20	30	Qal	75	10	624	3730	3106	0.102	2.6200	NL
10-6	20	5	Qal	19	0	0	600	600	0.090	1.3100	NL
10-6	20	10	Qal	17	0	0	1200	1200	0.089	0.3367	NL
10-6	20	15	Qal	23	0	0	1800	1800	0.088	0.3825	NL
10-6	20	20	Qal	25	0	0	2400	2400	0.087	0.3563	5.4
10-6	20	25	Qal	55	5	312	3065	2753	0.095	2.6200	NL
10-6	20	30	Qal	51	10	624	3730	3106	0.102	2.6200	NL
10-7	20	5	Qal	55	0	0	600	600	0.090	2.6200	NL
10-8	20	5	Qal	19	0	0	600	600	0.090	1.3100	NL
10-11	20	5	Qal	25	0	0	600	600	0.090	2.6200	NL
10-11	20	10	Qal	18	0	0	1200	1200	0.089	0.3563	NL

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
10-11	20	15	Qal	20	0	0	1800	1800	0.088	0.3157	NL
11-14	20	5	Qal	14	0	0	600	600	0.090	0.3563	NL
11-14	20	10	Qal	46	0	0	1200	1200	0.089	2.6200	NL
11-14	20	15	Qal	11	0	0	1800	1800	0.088	0.1900	NL

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BOREHOLE LOG 7-1

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

BORING NO.
SHEET

DRILLING	
START	FINISH
DATE	DATE

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
	24 37 50	100			Fill in 7 Canyon Reworked Gila/Qal								
	20 30 47	100	Qtg		Sand, silty, gravelly reddish yellow, dry		15	60	25	7.5 YR 7/6	hard	np	pH: 8.0
10	22 19 39		SP		Sand, gravelly, cobbly, silty, reddish yellow, dry		25	60	15	7.5 YR 7/6	hard	NP	pH 8.0
	30 35 39												pH: 7.0
20	21 44 48		SP		Sand, silty, gravelly, pink, dry		15	55	30	7.5 YR 7/3	hard	NP	pH: 7.0
	50+				Sand As Above								
30	40 41 36		SP		Sand, gravelly, silty strong brown, moist		40	40	20	7.5 YR 5/6	hard	l	pH: 7.0
	36 43 50+		SP		Sand, gravelly, silty strong brown moist		25	60	15	7.5 YR 5/6	hard	NP	pH: 7.0
40					TD:35 ft								

DRILLING CONTRACTOR: GSI

LOGGED BY: K Gilmer

DATE: 7-11-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 7-2

SITE NAME AND LOCATION: name and location

grade surveyed -2 ft

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			SP		Sand, gravelly, silty, brown, sl moist		15	60	25	7.5 YR 4/4	Soft	1	PH: 8.0
5	5 5 12	100											
10	3 4 5		SP		sand, silty, gravelly brown, sl. moist		15	60	25	7.5 YR 4/4	Soft	1	PH: 7.0
15	14 21 13		Qal Plg		Sand, silty, gravelly Reddish yellow, sl. moist		15	60	25	7.5 YR 6/6	firm	NP	PH: 7.5
20	20 32 39		SP		Sand, gravelly, reddish yellow, sl moist		25	70	5	7.5 YR 6/8	hard	NP	PH: 7.0
					TD: 20 ft								
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 7-3

Sheet 1

SITE NAME AND LOCATION: name and location

hole spudded @ surveyed L.S. -0.5 ft

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 2

DRILLING

START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Fill, reworked Qal, Qtg								
5	11 11 9	60%	SP		Sand, gravelly, silty reddish yellow, dry		35	50	15	7.5 YR 7/8	firm	NP	pH: 7.0
10	6 5 7	70%	SP		Sand, silty, gravelly, strong brown, sl moist		10	65	25	7.5 YR 5/6	firm	1	pH: 7.0
15	4 5 6	50%	SP		Sand, As Above		10	65	25	7.5 YR 5/6	firm	1	pH: 7.0
20	3 2 3	90%	SP		Sand, silty, gravelly dark brown		10	60	30	7.5 YR 3/2	firm	NP	pH 7.0
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

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BOREHOLE LOG 7-3 Sheet 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

							DRILLING START	DRILLING FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
25	5 7 11	80%	SP		Sand, As Above								
			SP		Sand, gravelly, silty, reddish yellow. v.sl. moist		20	65	15	7.5 YR 7/6	firm	np	PH: 7.0
30	17 18 17	90%	Qal Qtg		Sand, gravelly, silty, reddish yellow, moist drilling hard		25	65	10	7.5 YR 6/8	hard	l	PH: 4.0
35	24 50+	70	SP		Sand, gravelly, silty reddish yellow, moist v. hard drilling		25	65	10	7.5 YR 6/6	hard	l	PH: 5.0
40					TD: 35 ft hole moist @ bottom -36.5 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 7-4 Sheet 1

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger	BORING NO.	
	SAMPLING METHOD: SPT, Shelby	SHEET 1 of 2	
		DRILLING	
		START	FINISH
NORTHING / DATUM: amsl	EASTING: / ELEVATION:		

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					fill, reworked Qal, Qtg								
5	7 7 10	100%	SP		Sand, silty, gravelly, brown dry waste rock		20	60	20	7.5 YR 3/2	Soft	NP	pH: 7.5
			GP		large rock 7 ft - refusal / skidded rig 3' west -								
10	20 19 9	0			waste rock fragments in cuttings								
15	8 7 6	30	SP		sand, gravelly, silty brown, dry (waste rock fragments)		25	60	15	7.5 YR 5/4	firm	NP	pH: 7.0
20	13 12 12	20	GP		Sand, gravelly, cobbly, silty, sl. moist (waste rock fragments)		30	50	20	7.5 YR 5/4	firm	l	pH: 7.0
25													

DRILLING CONTRACTOR GST

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 7-4

Sheet 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Sand, As Above								
25	4 6 8	40%	SP		Sand, silty, gravelly dark brown, Sl. moist		25	55	20	7.5 YR 4/4	firm	np	pH: 6.5
30	5 7 11	70%	SP Qal Qtg		sand, gravelly, silty, light yellowish brown, moist, Drilling hard		25	65	10	10 YR 6/4	firm	l	pH: 8.5
35	19 50+	90%											pH: 4.0
40	37 50	95%	SP		Gravelly sandy silt light yellow brown, slightly moist.		40	50	10	10yr 5/6	Firm	NP	pH : 4.0

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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Golder Associates

BOREHOLE LOG 7-5 Sheet 1

SITE NAME AND LOCATION: name and location

Spudded @ ~0.7ft below surveyed point

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			SP		fill, mixed Qal, Qtg waste rock								
5	7 11 14	0											
10	14 12 14	60%	SP		fill, mixed Qal, Qtg waste rock, wood								pH: 5.0
			fill										
15	8 7 7	50%	SP		fill, mixed Qal, Qtg waste rock								pH: 7.0
			GP		cobbly, gravelly								
20	18 8 8	30%	(rock)										pH: 8.0
			Qal										
25	16 16 16												

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR GSI
LOGGED BY: Kilmer/Schindler
DATE: 7-12-06
JOB NO.
FILE NAME: Tyrone 3A

Golder Associates

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BOREHOLE LOG 7-5

Sheet 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
25	16 16 16	90%	SP Qal Qtg		Sand, gravelly, silty pink, dry -Drilling hard-		30	50	20	7.5 YR 7/4	hard	NP	pH: 7.5
30	16 23 50+		SP		Sand, gravelly, silty brown, very sl. moist TD: 30 ft		30	60	10	7.5 YR 7/4	V hard	NP	pH: 6.5

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer/Schindele

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3R

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 7-6

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.
SHEET

WATER LEVEL							
TIME							
DATE							
CASING DEPTH							

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					fill mixed Qal, Qtg, waste rock								
5	8 9 11	100%	SP		Sand, gravelly, silty pink, dry		25	65	10	7.5 YR 7/3	soft	NP	pH: 8.0
			fill										
10	14 28 29	80%	SP		sand, gravelly, silty pinkish grey, v. sl. moist (waste rock fragments)		25	65	10	7.5 YR 6/2	hard	NP	pH: 8.0
			Qal		Drilling hard								
15	34 50+	50%	Qtg SP		Sand, gravelly, silty reddish yellow. sl. moist		25	60	15	7.5 YR 6/6	v. hard	NP	pH: 7.0
20	33 50+		SP		Sand, As Above		25	60	15	7.5 YR 6/6	V. hard	np.	pH: 7.0
					TD: 20 ft								
25													

GSI

DRILLING CONTRACTOR

LOGGED BY: Kilmer

DATE: 7-12-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 7-8

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

						DRILLING START	DRILLING FINISH
WATER LEVEL	dry	@ 15 ft					
TIME		7:15					
DATE		8-12-06				DATE	DATE
CASING DEPTH							

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
	13 9 20	100	SP *No Recovery Brass Tube 5-6.5 in SPT	5 gallon grab sample	Sand, silty, gravelly strong brown, sl moist		25	50	25	7.5 YR 5/6	firm	l	pH: 8.0
5	5 14 24	100	SP Brass Tube 10-11.5	5 gallon grab sample	sand, silty, gravelly Dark brown, moist plastic		15	50	30	7.5 YR 5/4	firm	M	pH: 8.0
10	22 25 38	100	SP		Sand, gravelly, silty v. moist to saturated (soil) very dark grey to brown, organic		20	60	20	7.5 YR 3/2	firm	l	pH: 4.0
15	6 6 8	100	SP		Sand, coarse, gravelly sl. silty, brown, saturated, friable					7.5 YR 5/4	Soft	NP	pH: 4.0
20	8 9 16		SP		Sand, As above					7.5 YR 5/4	Soft	NP	pH: 4.0
					TD: 20 feet								

DRILLING CONTRACTOR GSI

LOGGED BY: KGilmer

DATE: 7-11-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-1

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

BORING NO.

SHEET 1 of 1

SAMPLING METHOD: SPT, Shelby

DRILLING START FINISH

DATE DATE

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Weathered Qtg @ Surface, Sandy silty loam,								
5	13 32 39		Qtg SP		Sand, gravelly, silty, reddish yellow, dry		25	60	15	7.5 6/6	hard	Np	pH: 6.5
10	27 34 37		SP		Sand, gravelly								pH: 8.0
					TD = 10 ft								
15													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-13-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

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Golder Associates

BOREHOLE LOG 8-2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Soil, sandy silty loam								pH: 7.0
5	21 25 21		SP		Sand, silty, gravelly, brown, dry (organic)		15	60	25	7.5 YR 5/2	firm	NP	pH: 8.0
10	4 5 5		SP Qal		Sand, gravelly, silty Strong brown, sl. Moist		20	60	20	7.5 YR 5/6	soft	NP	pH: 5.0
			Qtg										
15	37 50/		SP		Sand, gravelly, silty, brown, v. sl. moist		30	60	10	7.5 YR 5/4	hard	NP	pH: 7.0
					TD: 15 ft								

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-13-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-3

Sheet 1 of 2

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

BORING NO.

SHEET 1 of 2

SAMPLING METHOD: SPT, Shelby

						DRILLING	
						START	FINISH
WATER LEVEL							
TIME							
DATE						DATE	DATE
CASING DEPTH							

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			ML	Shelby sample	Tailing, sand, white saturated		0	100	0	10 YR 8/2	weak	M	5.0
5	0-	20% split spoon sank with weight of hammer		Shelby tube	Tailing Qal								pH: 4.0
10	3 4 3	60%	SP	Brass tube 10.5-11.5	Sand gravelly, silty, light brown, sl moist		25	60	15	7.5 YR 6/3	firm	NP	pH 5.0
15	8 7 6	30%	SP	15.5-16.5	Sand, silty, gravelly light brown, sl. moist		20	60	20	7.5 YR 4/3	hard	NP	pH 4.5
20	5 7 9	60%	SP	Brass Tube samples 20.5-21.5	sand, silty, gravelly brown, sl. moist		15	65	20	7.5 YR 5/4	hard	l	pH: 5.5
				25.5-26.5	Drilling hard								pH: 4.0
25	23 34 50+	80%											

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-13-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG 8-3

Sheet
2 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 2 of 2

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL					
TIME					
DATE					
CASING DEPTH					

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			Qal		— Drilling Hard								
25	23 38 50/4	80%	Qtg SP	Tube Sample 25.5-26.5 ☐	Sand, gravelly, silty strong brown, sl. moist		20	55	15	7.5 YR 5/8	hard	NP	PH: 4.0
					[illegible]								
30	25 25 46	100	SP	Brass Tube Sample 30.5-31.5 ☐	Sand, gravelly, silty strong brown, sl. moist		25	60	15	7.5 YR 5/6	v. hard	1	PH 7.0
					TD: 30 ft								

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-4

Sheet 1 of 2

SITE NAME AND LOCATION: name and location

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			ML		Tailing, sand, silty, saturated		0	80	20	7.5 YR 8/6	soft	h	pH: 4.0
			fill tailings										
5	5 4 4	100%	Qal SW		Soil, sandy, gravelly loam, dark brown, sl. moist, friable		25	65	10	7.5 YR 4/3	soft	NP	pH 8.0
10	3 4 5	100%	SP		Sand, silty, gravelly dark brown, sl. moist		15	60	25	7.5 YR 4/3	firm	l	pH: 8.0
15	9 13 14	100%	SW		sand, coarse, gravelly, silty, brown, friable, moist		15	70	15	7.5 YR 5/4	firm	NP	pH: 7.0
20	16 19 21		GP Qal		Gravel, sandy, silty, strong brown, moist		50	30	20	7.5 YR 4/6	hard	NP	pH: 4.0
			Qtg		Drilling very hard								
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-13-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

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Golder Associates

BOREHOLE LOG 8-4 Sheet 2 of 2

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

BORING NO.

SAMPLING METHOD: SPT, Shelby

SHEET

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

							DRILLING	
							START	FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	9 17 25		SP		Sand, gravelly, silty strong brown, sl. moist		20	65	15	7.5 YR 5/6	v. hard	NP	PH: 8.0
					TD: 25ft								

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-13-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

Golder Associates

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BOREHOLE LOG 8-5

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	START	FINISH
	DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			ML		Tailings, sand, moist, pink			80	20	7.5 YR 8/4	V. Soft	M	PH: 4.0
5	4 4 7		Qal SP	▯	Soil on Qtg, gravelly sandy loam, dark brown, dry		35	40	25	7.5 YR 4/3	soft		PH: 4.0 PH: 8.0
10	22 18 25		GP Qal Qtg	▯	gravel, sandy, silty reddish yellow, dry		45	35	20	7.5 YR 7/8	hard	NP	PH: 7.0
15	30 50+		GP	▯	gravel, as above, dry TD: 15 ft		45	35	20	7.5 YR 7/8	hard	NP	PH: 7.0

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-6

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE^1	% GRAVEL^2	% SAND^2	% FINES^2	COLOR	CONSISTENCY^3/ CEMENTATION^4	PLASTICITY (np, l, m, h)	OTHER TESTS^4
			Qal Qtg		Soil, sandy, gravelly loam, dark brown (soil developed on Qtg)					7.5YR 4/4			PH: 7.0
5	12 17 19	100%	GP		gravel, sandy, silty brown, organic, dry		40	40	20	7.5 YR 5/3	firm	np	PH: 7.0
10	38 50+		GP		gravel, sandy, silty, reddish yellow, sl. moist		40	35	25	7.5 YR 6/6	hard	NP	
					TD: 10 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: K [illegible]

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-7

SITE NAME AND LOCATION: name and location
Spudded 12' east of staked location
(Surveyed elev.- 4.5 ft)

NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			Qtg		Soil, sandy gravelly loam, dark brown (soil developed on Qtg)					7.5YR 4/4			PH: 8.0
5	22 50+	40%	GP		Gravel, sandy, silty, pink, dry		40	35	25	7.5 YR 7/3	hard	np	PH: 8.0
					TD: 5ft								
10													
15													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-14-05

JOB NO.

FILE NAME: Tybors 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-8

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 1

							DRILLING	
							START	FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
	10 8 8	70%	SP		fill, cultural debris Cement								PH 8.0
5	4 2 2	60%	SP	Shelby Tube (failed)	Sand, coarse, silty, gravelly, strong brown Sl moist		20	60	20	7.5 YR 5/6	firm	L	pH: 8.0
10	46 50+	65%	SP		Sand, silty, gravelly, dark grey, v.sl. moist		15	65	20	7.5 YR N4/	hard	NP	PH: 8.0
					sand, gravelly, silty, strong brown, sl. moist		15	60	25	7.5 YR 5/6	firm	NP	PH: 8.0
15	9 13 13	100%	SP										
20	16 22 25		SP		Sand, gravelly, silty Sl. moist dark brown. TD: 20 ft					7.5 YR 3/2			pH: 7.0

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-11-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 8-9

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger	BORING NO.
		SHEET
	SAMPLING METHOD: SPT, Shelby	DRILLING START / FINISH
NORTHING DATUM: amsl	EASTING: ELEVATION:	
	WATER LEVEL	
	TIME	
	DATE	DATE / DATE
	CASING DEPTH	
DRILL RIG: ANGLE: 90 SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.	BEARING: -	SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Road Grade								
	25 15 13	10 (Rock)	SP Brass Tube 5-6.5	5-gal grab	Sand, gravelly, silty brown, sl. moist		30	50	20	7.5 YR 5/4	hard	1	pH: 8.0
5	28 25 29	100	SP										pH: 8.0
			Brass Tube 10-11.5	5-gal grab									
10	18 17 19	100%	SP		Sand, AA, 1-inch layer of darker organic		30	50	20	7.5 YR 5/4	firm	1	pH: 7.0
15	11 17 14		SP		Sand, silty, minor gravel strong brown, sl. moist		10	70	30	7.5 YR 5/6	firm	1	pH: 7.0
					Sand, gravelly, silty friable brown, sl. moist		20	65	15	7.5 YR 5/4	firm	NP	pH: 7.0
20	7 20 17		SP		Sand, silty, gravelly dark brown, moist Buried soil, roots TD: 20 ft		15	60	25	7.5 YR 3/2	firm	1	pH: 7.0

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-11-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Golder Associates

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BOREHOLE LOG 8-10

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Road way fill								
				5-gallon grab sample	Sand, gravelly, silty, reddish yellow, sl. moist		20	50	30	7.5 YR 6/6	firm	1	pH: 8.0
	9 26 17	100	SP										
5	10 10 13	100	SP	5-gallon grab sample									
10	17 39 31	100	SP		Sand, gravelly, silty very dark grey, sl moist		20	60	20	7.5 YR N3/	firm	1	pH: 7.0
					sand, gravelly, silty, light brown, friable sl. moist		25	65	10	7.5 YR 4/4	firm	NP	pH: 8.0
15	5 10 11		SP		sand, gravelly, silty very dark grey, sl. moist		25	65	10	7.5 YR N3/	firm	NP	pH: 7.0
20	30 50+		SP		Sand, gravelly, silty, Strong brown		20	60	20	7.5 YR 5/6	firm	1	pH: 7.0
					TD: 20 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: KC/MSA

DATE: 7-11-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 9-1

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger	BORING NO.
	SAMPLING METHOD: SPT, Shelby	SHEET 1 of 1
NORTHING	EASTING:	DRILLING START / FINISH
DATUM: amsl	ELEVATION:	DATE / DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
	20 12 9	100	SP	0-5 Soil grab sample	Soil, gravelly loam, silty sandy, pink		60	20	20	7.5 YR 8/4	firm	NP	pH:7.0
			5-6.5 Brass tube		Sand, silty, gravelly sl. moist yellowish red		15	50	35	7.5 YR 6/6	firm	l	PH7.0
5	12 13 14	100	SP	5-10 Soil grab sample	sand, gravelly, silty, light brown, sl. moist		25	50	25	7.5 YR 6/4	firm	l	pH7.0
10	8 33 26	100	SP 10-11.5 Brass tube		sand gravelly, sandy, very dark greyish brown, v. moist (soil)		15	65	20	10 YR 3/2	firm-hard	M	pH: 4.0
15	9 7 8	80	SP		sand, gravelly, as above, significant wood - tree roots saturated in lowest portion		15	65	20	10 YR 3/2	hard	M	pH: 4.0
20	17 25 44		SP		sand, gravelly, silty, pink, sl moist TD: 20 ft		15	70	15	5YR 7/3	hard	NP	pH: 7.0

DRILLING CONTRACTOR GSI
LOGGED BY: Kilmer
DATE: 7-10-06
JOB NO.
FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 10-2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Soil, sandy silty loam, dark brown		5	70	25	7.5 YR 4/4	Soft	1	
5	12 15 17		SP		Sand, silty, gravelly brown		10	65	25	75 YR 5/4	Firm	NP	PH: 7.0
				Qal Qtg	Drilling hard								
10	24 37 33		SP		Sand, gravelly, silty, reddish yellow, 5/1 moist		20	70	10	7.5 YR 6/6	V. hard	NP	pH: 7.0
15					TD: 10 ft								
20													

DRILLING CONTRACTOR GSI

LOGGED BY: Kiman

DATE: 7-17-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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Golder Associates

BOREHOLE LOG 10-3

SITE NAME AND LOCATION: name and location
NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

BORING NO.
SHEET
DRILLING START FINISH
DATE DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.
SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Soil, sandy gravelly silty loam, dk brown organic					7.5 YR 4/4			
5	13 18 17	50%	SP		Sand, silty gravelly, Lt brown, dry		15	60	25	7.5 YR 6/4	firm	np	pH: 6.5
10	11 11 12	60%	SP		Sand, gravelly, silty Strong brown, dry		25	60	15	7.5 YR 5/6	hard	np	pH: 7.0
15	17 23 28	85%	GP	Qal QTg	gravelly, cobbly, sand, pink v. sl. moist Drilling hard	10	60	20	10	7.5 YR 7/4	hard	np	pH: 7.0
20	38 50/4		SP		sand, silty, strong brown, sl. moist		5	75	20	7.5 YR 5/6	hard	np	PH: 7.0
25					TD: 20 ft								

DRILLING CONTRACTOR GSI
LOGGED BY: Kinner
DATE: 7-17-06
JOB NO.
FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Golder Associates

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BOREHOLE LOG 10-4 Sheet 1 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			SP		Soil sandy, gravelly loam								
5	6 8 8	30%	GP		Gravel, sandy, silty, brown, dry		50	30	20	7.5 YR 5/4	firm	NP	pH: 7.0
10	9 9 12	60%	SP		Sand, silty, gravelly light brown, dry		15	55	20	7.5 YR 6/4	firm	NP	pH: 7.0
15	7 11 4	30%	SP		Sand, silty, gravelly, light brown, dry		15	65	20	7.5 YR 6/3	firm	NP	pH: 7.0
20	13 11 13	60%	SP		sand, gravelly, silty pink, dry		20	70	10	7.5 YR 7/3	firm	NP	pH: 7.5
25													

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR GSI

LOGGED BY: Gilmer

DATE: 7-17-06

JOB NO.

FILE NAME: Tyrone 3A

DRAFT

Golder Associates

BOREHOLE LOG 10-4 Sheet 2 of 2

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger	BORING NO.	
	SAMPLING METHOD: SPT, Shelby	SHEET	
NORTHING	EASTING:	DRILLING START	DRILLING FINISH
DATUM: amsl	ELEVATION:	DATE	DATE

WATER LEVEL					
TIME					
DATE					
CASING DEPTH					

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	9 17 20	30	SP		Sand, silty, gravelly, yellowish red, dry		20	60	20	5yr 5/6	hard	np	pH: 7.0
30	12 21 20	60%	GP		Gravel, sandy, silty, yellowish red, sl. moist		65	25	10	5yr 4/6	hard	Np	pH: 5.0
				Qal Ptg	Drilling Hard								
35	50+		GP		Gravel, As Above		65	25	10	5yr 4/6	hard	NP	5.5
40					TD: 35 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: E. Wise

DATE: 7-17-06

JOB NO.

FILE NAME: Tuppers 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 10-5

Sheet 1 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 In. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
			Qal		Soil, sandy gravelly loam,					7.5 yr 5/4			6.5 pH.
5	7 11 9	70%	SP		sand, gravelly, silty brown, dry		25	60	15	7.5 yr 5/4	soft	NP	pH: 6.5
10	13 14 14	30%	SP		sand, gravelly, silty light brown, dry		20	65	15	7.5 yr 6/4	firm	NP	pH: 6.5
15	8 8 8	75%	SP		Sand, silty, gravelly brown, friable, sl. moist		15	65	25	7.5 yr 5/4	firm	NP	8.0
20	11 11 15	0%	Rock in sampler end										
25													

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:

[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 10-5

Sheet 2 of 2

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE¹	% GRAVEL²	% SAND²	% FINES²	COLOR	CONSISTENCY³/ CEMENTATION⁴	PLASTICITY (np, l, m, h)	OTHER TESTS⁵
25	11 19 27	75%	SP		Sand, gravelly, reddish yellow, dry		30	55	15	7.5 YR 6/6	firm	NP	PH: 7.0
30	39 43 32	40%	SP		Sand, silty, gravelly, strong brown, sl. moist		15	60	25	7.5 YR 5/6	hard	NP	pH: 4.5
35	23 36 40	100%	Qal SP Otg		Sand, silty, gravelly, strong brown, moist		15	55	30	7.5 YR 5/8	firm	l	pH: 4.0
					-Drilling hard-								
40	15 46 50+		SP		Sand, gravelly, silty, yellowish red, sl. moist		25	50	25	5YR YR 5/8	hard	NP	PH: 6.0
					TD: 40 ft								

Notes:

¹ Percent > 3inch.

² Sum of gravel, sand, and fines = 100%

³ For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

⁴ For noncohesive soil: weak, moderate, strong.

⁵ Pocket penetrometer, torevane, in situ density, etc.

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

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BOREHOLE LOG 10-6

Sheet 1 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Soil, gravelly sandy Loam								
5	8 8 11	30%	SP		Sand, gravelly, silty Reddish yellow, dry		25	60	15	7.5 YR 6/6	soft	NP	pH: 7.0
10	8 13 14	30%	SP		Sand, gravelly, silty Reddish yellow, dry		25	60	15	7.5 YR 6/8	firm	NP	pH: 7.0
15	9 9 14	60%	SP		Sand, silty, gravelly Reddish yellow, dry		15	65	20	7.5 YR 6/8	firm	NP	pH: 7.0
20	8 11 14	60%	SP		sand, silty, gravelly Reddish yellow, dry		15	65	20	7.5 YR 6/8	firm	NP	pH: 7.0
25	18 28 21												

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG

10-6 Sheet 2 of 2

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
25	18 28 27	60	SP		Sand, gravelly, silty, Reddish yellow, dry		25	55	20	7.5 YR 6/8	hard	NP	7.0
30	22 25 28	60%	SP Qal		Sand, gravelly, silty, Strong brown, sl. moist		30	50	20	7.5 YR 5/8	hard	NP	pH: 4.0
			Qtg		Drilling hard -								
35	50+	30%	GP		Gravel, sandy, strong brown		50	30	20	7.5 YR 5/6	v. hard	NP	pH: 4.0
					TD: 35 ft								

DRILLING CONTRACTOR

LOGGED BY:

DATE:

JOB NO.

FILE NAME:

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 10-7

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Soil, sandy gravelly loam								6.5
			Qal SP		Sand, gravelly, silty, organic, dark brown, dry								
5	15 30 25	60%					30	50	20	7.5 YR 4/3	v. hard	np	6.5
			Qtg										
10	39 50+		SP		sand, gravelly, reddish yellow, sl. moist, friable					7.5 YR 6/8	V. hard	np	7.5
					TD: 10 ft								
15													
20													
25													

DRILLING CONTRACTOR GST

LOGGED BY: Kimsek

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 10-8

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Soil, sandy gravelly loam								
5	8 8 11	50%	SP		Sand, silty, gravelly brown, dry, friable,		15	65	20	75 YR 5/2	soft	np	pH: 75
10	19 23 50+	70%	GP Qal Qtg		gravel, sandy, silty, strong brown, dry		45	30	25	75 YR 5/6	hard	np	pH: 8.0
15	50+	20%	SP		Sand, gravelly, silty reddish yellow, sl. moist, friable		25	45	30	7.5 YR 6/8	hard	np	pH: 7.0
					TD: 15 ft								
20													

DRILLING CONTRACTOR GSI

LOGGED BY: Filmer

DATE: 7-14-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 10-11

SITE NAME AND LOCATION: name and location

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 1

DRILLING START / FINISH

DATE / DATE

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN ~~METERS~~ feet (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
	10 10 15	100	SP	5gal Grab Sample 0-5 ft	Roadgrade, sandy gravel, silty, reddish yellow		40	35	25	5YR 7/6	soft	NP	pH 7.0
5	8 9 9	5% Rock	SP	Brass Tube 5-6.5	Sand, gravelly, silty reddish yellow		20	50	30	5YR 6/6	soft	|	pH 7.0
											firm		pH 7.0
10	7 9 11	100	SP	5gal Grab Sample 5-10 ft Brass Tube 10-11.5	Sand, gravelly, silty sl moist, dark brown		15	50	35	7.5 YR 3/2		M	
					— Drilling hard — Gila?'								
15	18 22 50+	100	SP		Sand, as above		15	55	30	7.5 YR 3/2	hard	L	pH 7.0
20	9 10 13	2% rock	GP		Gravel, sandy reddish yellow dry TD: 20 ft		40	35	25	7.5 YR 6/6	firm	NP	pH 7.0

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-10-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 11-1

3A Soil boring

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO. 11-1

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE 7/18	DATE 7/18

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 In. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			Qtg										
Qtg													
5	35 48	50%	SP/gm		silty sandy gravel dry (7.5YR 7/6) soft, reddish brn, pH=7.5		15	50	35	7.5 YR 7/6	NC	NP	pH=7.5
6.5					Drilled 6.5' into Gila, From Gila								
					Gila from surface								
15													

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

JOB NO. 013-1595-002
FILE NAME:

LOGGED BY: Steven Schindler
DATE: 7/18/2006

DRILLING CONTRACTOR Geomechanics Southwest Inc.

DRAFT

Golder Associates

BOREHOLE LOG 11-2

3A Boring

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
7/18	7/18
DATE	DATE
7/18	7/10

SURFACE CONDITIONS:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
	Qal		Qty										
5	50	30%	SP		sandy silty gravel, slightly moist, (7.5YR 5/6) pH=7.5-8.0 slightly Firm, slightly cemented		15	50	35	7.5YR 5/6	low	NP	
6.5													
10					Drilled 5' into Gila from surface								
15													

DRILLING CONTRACTOR GST

LOGGED BY: Steven Schindler

DATE: 7/18/2000

JOB NO. 013-1595-002

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG 11-3

Golder Associates

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
~~DATE~~ 7/12	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
			SP		Reworked Fill, soil, Gila								
5 Qal	—	no recor.	/										
6													
Qtg					Gila ≈ 6'								
7													
8													
9													
10	50.												
11 11.5		30%	SP		11.5' Sandy silty Gravel V slightly moist, pH 7.5+ (7.5YR(6/8) slightly Firm, moderately cemented)	-	10%	50	40	7.5YR 6/8	poor	np	pH 7.5
12													
13													
14													
15													

DRILLING CONTRACTOR GSI

LOGGED BY: Steven Schindler

DATE: 7/12/2006

JOB NO. 013-1595-008

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

BOREHOLE LOG 11-4

3A soil borings

Golder Associates

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

WATER LEVEL					
TIME					
DATE					
CASING DEPTH					

DRILLING	
START	FINISH
DATE 7/18	DATE 7/18

DRILL RIG:
ANGLE: 90 BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Gila ≥ 6'								
5 Qal 6 Qty 7	25 40 50	70%	SP		sandy silty gravel soft poorly cemented, subang to sub rd gravel, dry, 7.5 YR 6/6 pH 5.5		10	45	45	(7.5YR 6/6)	poor	np	pH 5.5
8 9													
10 Qty	34 37 40	80%	SP		sandy silty gravel, slight to moderate cemented, slightly moist, firm, (7.5YR 6/6) pH 7.5+		10	45	45	7.5YR 6/6	slight	L	pH 7.5+
15													
16.5 Qty	29 50+	80%	SP		sandy silty gravel slightly moist, soft to friable, 7.5 YR 6/8 pH 7.5+		5	50	45	7.5YR 6/8	moder.	L	pH 7.5
20													
21.5	47	30%	SP		21.5' same as above pH: 7.0								pH 7.0

DRILLING CONTRACTOR GSI

LOGGED BY: Steven Schindler

DATE: 7/18/2005

JOB NO. 013-1595-002

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-5

3A soil Boring

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

SURFACE CONDITIONS:

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE 7/18	DATE 7/18

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
Qal 3' 4	20 36 50	80%	sp		sand, silt, gravel, dry, Firm 7.5YR 6/6 pH=7.0, Gila ≥ 5'	+0	10	40	50	7.5YR 6/6	slight	n/p	pH 7.0
5 Qtg 6 7													
8'	48 50+	80%	Sp		as above, Firm, sandy silty gravel, dry, (7.5YR 5/6) pH7.0		10	40	50	,	np		pH 7.0
Qtg 13' 14.5	48 50+	40%			As above, 14.5' TD Hard		10	40	50	—	—	np	pH 7.0
18'													
23'													

DRILLING CONTRACTOR GSI

LOGGED BY: Steven Schindler

DATE: 7/18/2006

JOB NO. 013-1595-002

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

Golder Associates

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BOREHOLE LOG 11-6

3A Soil Boring

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby
Brass samples

BORING NO.

SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE 7/13	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
Qal					soil, brown								
5'	10 14 14	80%	SP		sandy silty gravel soft, 7.5YR (7/6) pH 7.0, dry		10	50	40	7.5YR 7/6	soft	np	pH 7.0
6.5					Gila ≥ 11'								
Qal 10' Qtg	29 36 50+	60%	SP		Gravelly sandy silt (10YR 6/6) dry, Firm, pH=6.0 more gravels, & cementation		20	40	40	10YR 6/6	Firm	np	pH 6.0
Qty													
15'	50+	20%	SP/GM										
20'					TD 16.5' Gravelly silty sand, (10 YR (6/6) Hard, dry, pH 6.0		25	35	40	10YR 6/6	Hard	np	pH 6.0

DRILLING CONTRACTOR 6SI

LOGGED BY: Steven Schindler

DATE: 7/18/2006

JOB NO. 013-1595.002

FILE NAME:

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 11-7

SITE NAME AND LOCATION: name and location
Spotted on fill (+2.5 ft) above surveyed point

NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

WATER LEVEL
TIME
DATE
CASING DEPTH

SURFACE CONDITIONS:

BORING NO.
SHEET
DRILLING
START
FINISH
DATE
DATE

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Soil sandy gravelly, silty loam								
5	9 10 13	70%	SP		Sand, gravelly, silty Reddish yellow, dry		25	60	15	7.5 YR 6/6	firm	NP	PH: 6.5
10	14 15 20	50%	SP		Sand, silty, gravelly Reddish yellow, dry		15	50	25	7.5 YR 6/6	firm	NP	PH: 7.0
15	6 17 35	80%	GP		Gravel, sandy, silty yellowish red, dry		55	25	20	5YR 5/6	hard	NP	PH: 6.5
20	19 32 32	70%	GP	Qal Qtg	Gravel, Sand, As Above — Drilling Hard		55	25	20	5YR 5/6	hard	NP	PH: 6.5 PH: 6.5
25	50+	60%	SP		Sand, silty, gravelly, pink v. sl. moist		10	65	25	7.5 YR 7/4	hard	NP	PH: 7.0

TD=25 ft

DRILLING CONTRACTOR GSI

LOGGED BY: K. Imer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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Golder Associates

BOREHOLE LOG

11-8 Sheet 1 of 2

SITE NAME AND LOCATION: name and location

NORTHING

DATUM: amsl

EASTING:

ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:

ANGLE: 90

BEARING: -

SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Soil, sand, silty loam dark brown								
5	7 11 15	100%	SP		Sand, silty, gravelly reddish yellow, dry		15	65	20	7.5 YR 6/8	firm	NP	PH: 6.5
10	9 11 11	75%	SP		Sand, gravelly, silty, strong brown, dry		25	60	15	7.5 YR 5/8	hard	np	PH: 6.5
15	10 12 14	95%	SP		Sand, silty, strong brown, dry		10	65	25	7.5 YR 5/8	hard	NP	PH: 7.0
20	14 32 24	80%	GP		Gravel, sandy, silty, pinkish grey, sl. moist		40	35	25	7.5 YR 7/2			PH: 7.0
25													

DRILLING CONTRACTOR GSI

LOGGED BY: K. Moore

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-8

Sheet 2 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

BORING NO.

SHEET

DRILLING

START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
25	23 22 18	100	SP		Sand, silty, gravelly, reddish yellow, friable, v. sl. moist		15	65	20	7.5 YR 6/8	hard	Np	pH: 7.0
30	20 28 35	90%	SP		sand, silty, gravelly reddish yellow, friable sl. moist		15	65	20	7.5 YR 7/8	hard	Np.	pH: 7.0
				Qal Qtg									
35	50+	5%	- rock		in sampler								
			GP		Gravel, sandy, silty Reddish yellow, dry		50	30	20	7.5 YR 6/6	hard	np.	pH: 7.0
40	50+	20%	SP		Sand, gravelly, silty Reddish yellow, dry		20	65	15	7.5 YR 6/6	hard	Np.	pH: 7.0
					TD: 40 ft								

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 11-9 Sheet 1 of 2

SITE NAME AND LOCATION: name and location
Spaldston fill 2' above survey point

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

BORING NO.
SHEET

WATER LEVEL							
TIME							
DATE							
CASING DEPTH							

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Soil, sandy loam, dark brown								
5	9 8 9	60%	SP		Sand, silty, gravelly Reddish yellow, dry		15	65	20	7.5 YR 6/6	firm	NP	PH: 7.0
10	11 22 27	60%	SP		Sand, silty, gravelly As above		15	65	20	7.5 YR 6/6	firm	NP	PH: 7.0
15	8 16 19	60%	SP		Sand, silty, gravelly Reddish yellow, dry		15	60	25	7.5 YR 7/6	firm	NP	PH: 7.0
20	18 24 25	50%	SP		Sand, silty, gravelly Reddish yellow		15	60	25	7.5 YR 5/6	hard	NP.	PH: 7.0
				Ref Rtg	~ Drilling hard								
25													

DRILLING CONTRACTOR QSI

LOGGED BY: Kilmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 11-9 Sheet 2 of 2

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl
EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: SPT, Shelby

BORING NO.
SHEET

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILLING	
START	FINISH
DATE	DATE

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
25	42 50+	60%	SP		Sand, silty, gravelly light brown, dry		10	65	25	7.5 YR 6/4	hard	NP.	pH: 7.0
					TD: 25 ft								
30													
35													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

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BOREHOLE LOG 11-10

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

							DRILLING	
							START	FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[5]
					Soil, sandy, silty loam dark brown								
5	12 18 19	80%	SP	Qal	sand, silty, gravelly, strong brown, dry		10	65	25	7.5 YR 5/6	firm	NP.	PH: 6.5
10	50+	30%	GP	Qtg	Gravel, sandy, silty, Reddish yellow, dry		55	25	20	7.5 YR 7/6	hard	NP.	PH: 7.0
15	50+	20%	SP		sand, silty, gravelly, strong brown, sl. moist friable TD: 15 ft		15	65	20	7.5 YR 5/6	v. hard	NP.	PH: 7.5
20													
25													

DRILLING CONTRACTOR GSI

LOGGED BY: Kimsek

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-11

SITE NAME AND LOCATION: name and location	DRILLING METHOD: Hollow Stem Auger			BORING NO.
				SHEET
	SAMPLING METHOD: SPT, Shelby			DRILLING
				START / FINISH
NORTHING	EASTING:	WATER LEVEL		
DATUM: amsl	ELEVATION:	TIME		
		DATE		DATE / DATE
		CASING DEPTH		
DRILL RIG:		SURFACE CONDITIONS:		
ANGLE: 90	BEARING: -			
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.				

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
					Spudded on weathered Gila, soil, sandy silty loam, dark brown								
5	17 27 22	70%	SP		Sand, silty, gravelly pink, dry		15	65	20	7.5 YR 8/4	firm	np	pH: 7.0
				Qal QTg									
10	50+	20%	SP		sand, silty, gravelly, strong brown, sl. moist		10	65	25	7.5 YR 5/6	hard	Np.	pH: 7.5
					TD: 10 ft								
15													
20													

DRILLING CONTRACTOR GST

LOGGED BY: Filmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:

[1] Percent > 3inch.

[2] Sum of gravel, sand, and fines = 100%

[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.

[4] For noncohesive soil: weak, moderate, strong.

[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-12

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

							DRILLING START	DRILLING FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
				Pal	Spudded on weathered Gila outcrop, Soil, Sandy, silty loam, dK Brown								
5	50+	20%	SP	Qtg	Sand, silty, gravelly Reddish yellow, friable. dry		15	75	10	7.5 YR 6/6	hard	NP.	PH: 7.0
					TD: 5 ft								
10													
5													

DRILLING CONTRACTOR GSI

LOGGED BY: Kilmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-13

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET

							DRILLING START	DRILLING FINISH
WATER LEVEL								
TIME								
DATE							DATE	DATE
CASING DEPTH								

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
				Qal	Spudded on weathered Gila, soil, sandy, silty loam dark brown								
5	50+	30%	SP	Qtg	Sand, gravelly, silty reddish yellow		25	60	15	7.5 yr 6/6	hard	NP	pH: 7.0
					TD: 5 ft								
10													

DRILLING CONTRACTOR GST

LOGGED BY: Kilmer

DATE: 7-19-06

JOB NO.

FILE NAME: Tyrone 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

DRAFT

Golder Associates

BOREHOLE LOG 11-14

SITE NAME AND LOCATION: name and location

NORTHING
DATUM: amsl

EASTING:
ELEVATION:

DRILLING METHOD: Hollow Stem Auger

SAMPLING METHOD: SPT, Shelby

BORING NO.

SHEET 1 of 1

DRILLING	
START	FINISH
DATE	DATE

WATER LEVEL						
TIME						
DATE						
CASING DEPTH						

DRILL RIG:
ANGLE: 90
BEARING: -
SAMPLER: 2.0 in. OD Split Spoon, 140 lb hammer.

SURFACE CONDITIONS:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN.	RECOVERY	SYMBOL	SAMPLE NO.	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, laminations)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	OTHER TESTS[4]
				Grab sample 0-5	Road grade, sandy gravelly loam, reddish brown		25	60	15	5yr 4/3	soft	L	pH 7.0
	11 11 11	100%	GP	Brass Tube	gravel, sandy, silty, reddish brown, sl moist		45	50	25	5yr 5/4	soft	M	pH 7.0
5	5 6 8	- moist near 60% satur.											
				Grab sample 5-10	Sand, silty gravelly, dark reddish brown v. sl. moist		20	60	20	5yr 3/2	firm	M	pH 7.0
10	8 32 14	100%	SP	Brass Tube 10.0-11.5			10	75	15	5YR 5/4	firm	l	pH 70
15	4 6 5	100%	SP		Firm Drilling Top of Gila?		10	75	15	5yr 5/4	firm	l	pH 7.0
20	38 50+		SP		Sand, gravelly, silty Reddish yellow, v. sl. moist TD = 20 ft		10	75	15	5yr 6/6	firm	N	pH 7.0

DRILLING CONTRACTOR QSI

LOGGED BY: Gilmore

DATE: 7-16-06

JOB NO.

FILE NAME: Tyrone SP 3A

Notes:
[1] Percent > 3inch.
[2] Sum of gravel, sand, and fines = 100%
[3] For cohesive soil: soil-v. soft, soft, firm, hard, v. hard.
[4] For noncohesive soil: weak, moderate, strong.
[5] Pocket penetrometer, torevane, in situ density, etc.

APPENDIX VI

Stability Output

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
QTg - Gila Congolomerate	🟧	125	138	Mohr-Coulomb	1000	35	Water Surface	Custom	1	
pCg - Burro Mountain Granite	🟩	160	160	Mohr-Coulomb	48960	35	Water Surface	Custom	1	
Tqm - Quartz Monzonite + Intrusive Rocks	🟥	160	160	Mohr-Coulomb	96336	43	Water Surface	Custom	1	
Qa - Alluvium	🟨	125	138	Mohr-Coulomb	0	29	Piezometric Line 1	Custom	1	
Qa - Alluvium (liquefied)	🟫	125	138	Mohr-Coulomb	0	8	Piezometric Line 1	Custom	1	
Waste Rock	🟦	125	138	Mohr-Coulomb	1656	30.9	Piezometric Line 1	Custom	1	
Leached Ore	⬛	125	138	Mohr-Coulomb	288	35.5	Piezometric Line 1	Custom	1	
Structural Fill	🟪	125		Mohr-Coulomb	0	35.5	Piezometric Line 1	Custom	1	
Liner	🟩	125	138	Mohr-Coulomb	0	10	None			0

GOLDER

Tyrone Mine Closure Stockpile Stability - Soil and Rock Mass Material Properties

Analysis Description Soil Legend

Figure

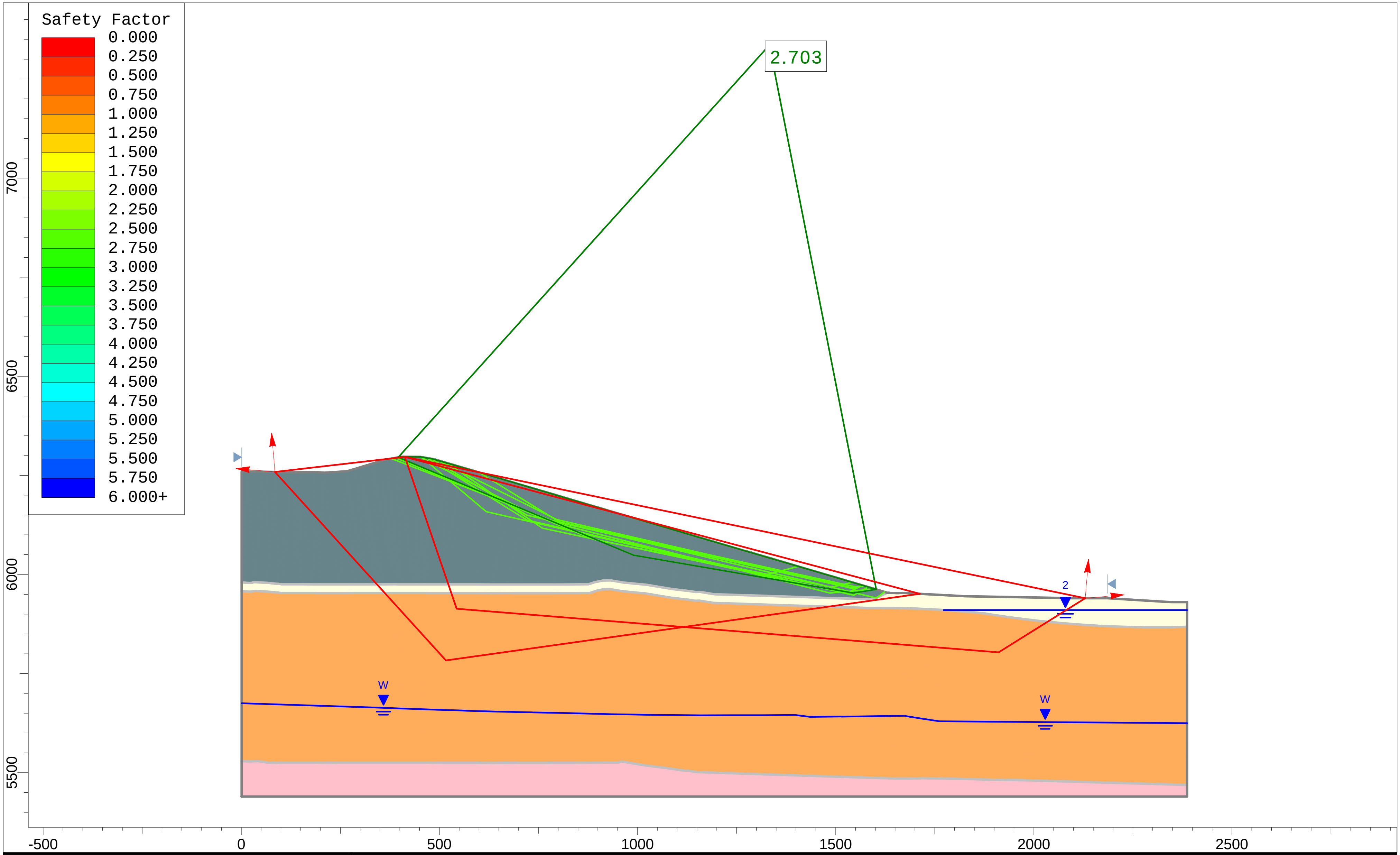
Scale

Company Golder Associates

Date

File Name

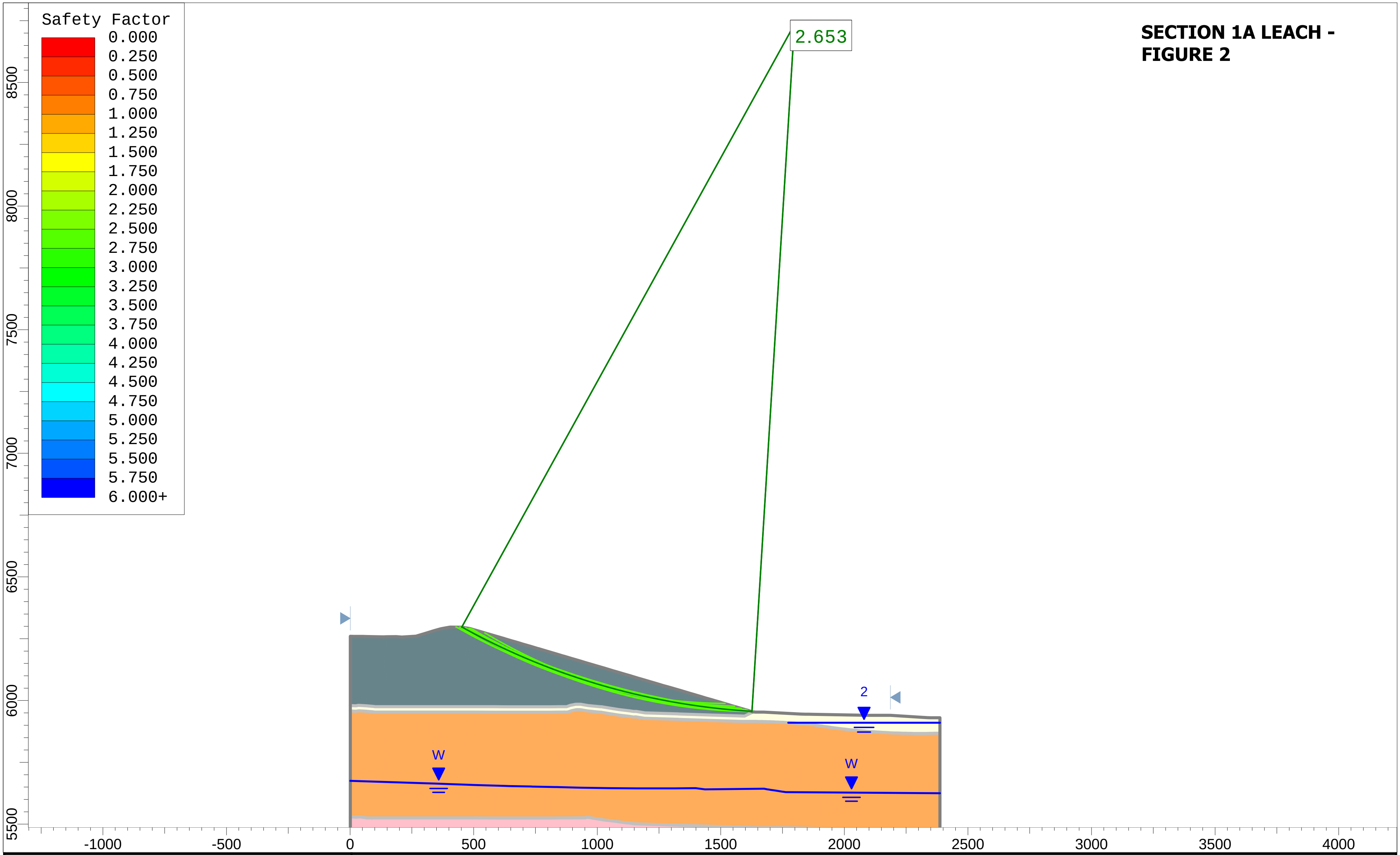
SLIDE 8.014



GOLDER

SLIDEINTERPRET 8.014

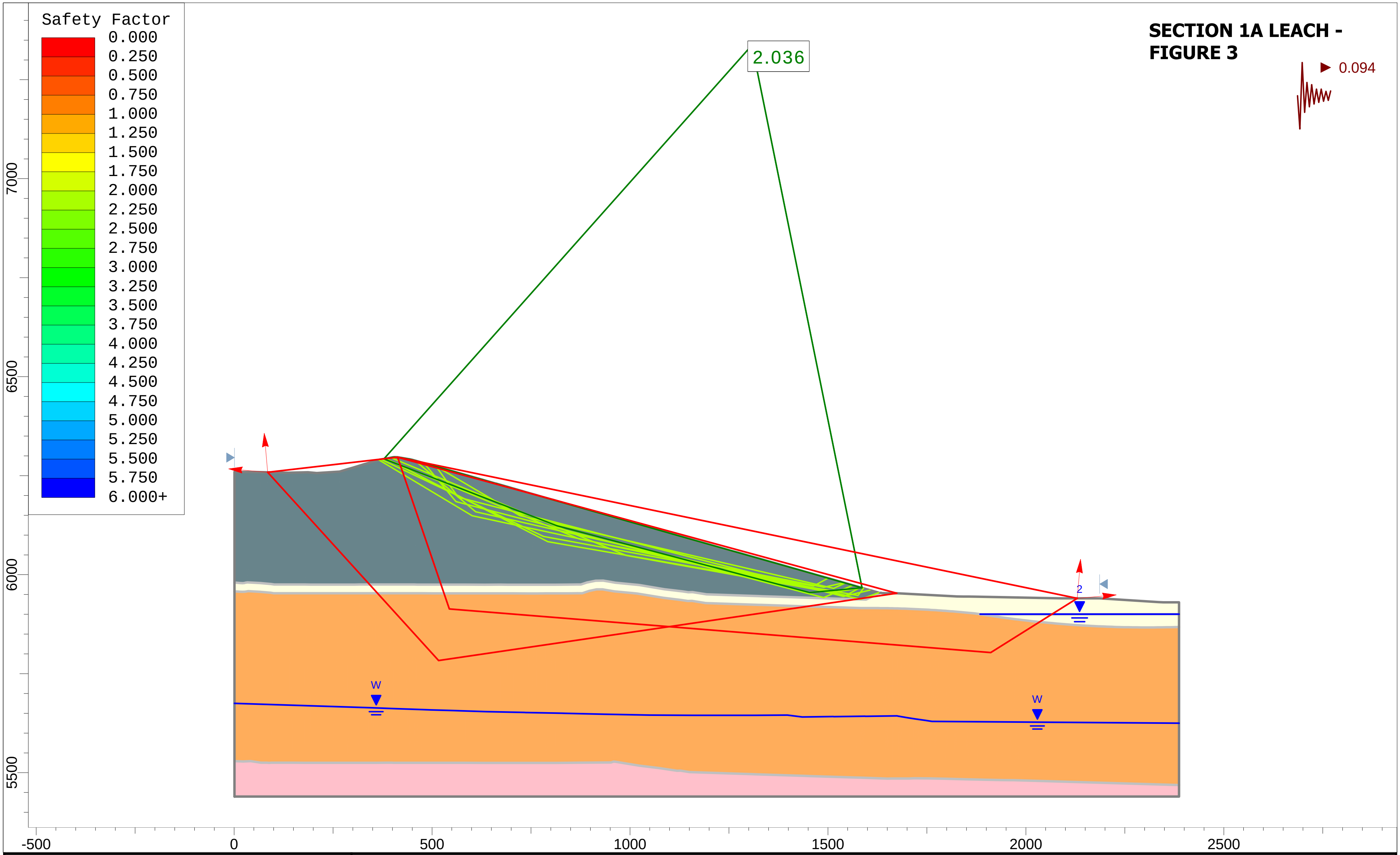
Project	Tyrone Mine Closure Stockpile Stability - Section 1A		
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4021	*Company*	Golder Associates
Date 1/2/2019		*File Name*	1A.slmd



SECTION 1A LEACH - FIGURE 2

Project	Tyrone Mine Closure Stockpile Stability - Section 1A LEACH		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:6447	*Company*	Golder Associates
Date		*File Name*	1A.slmd

SLIDEINTERPRET 8.014

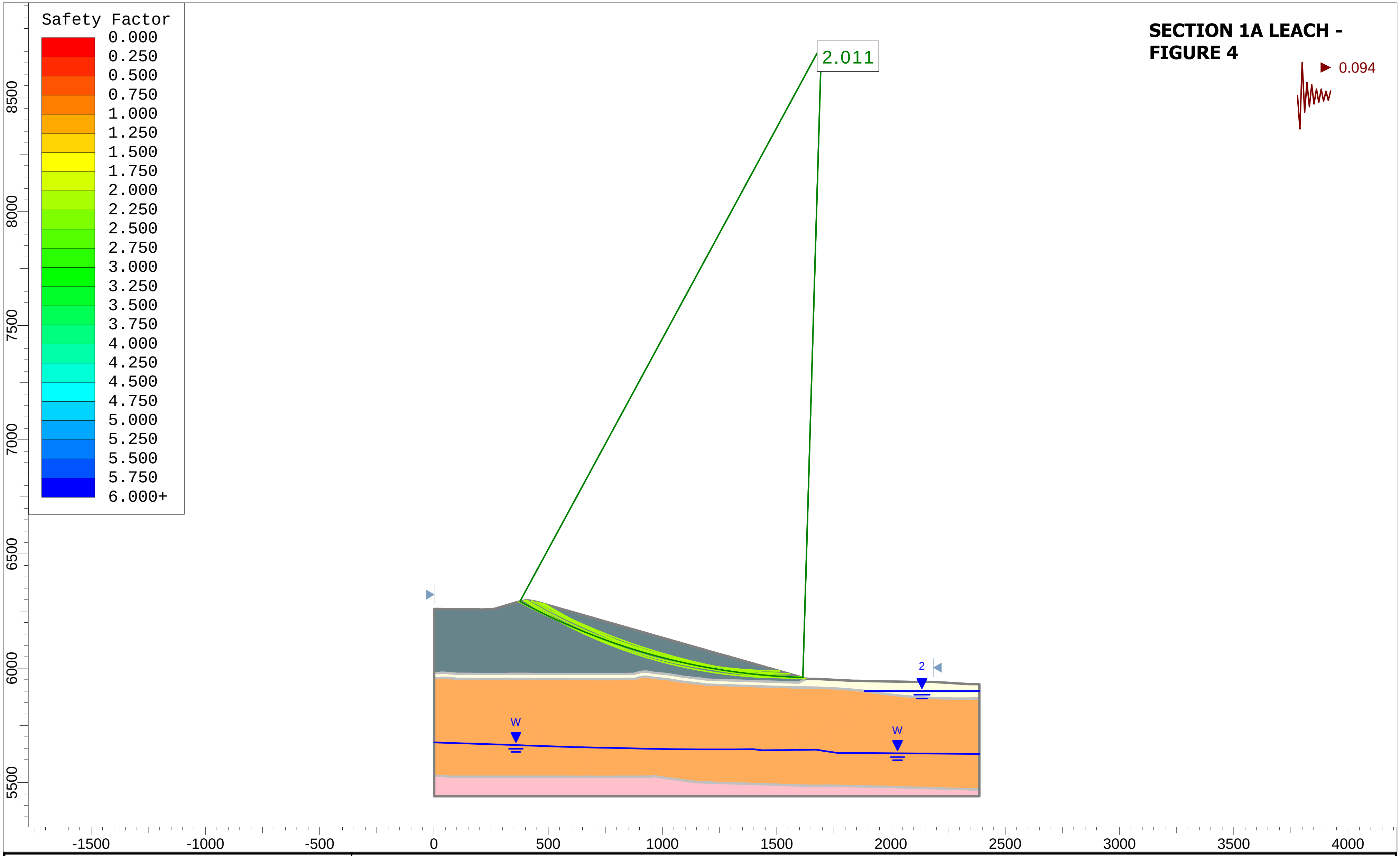


SECTION 1A LEACH - FIGURE 3

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 1A LEACH
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:4025
Company	Golder Associates
Date	1/2/2019
File Name	1A.slmd

SLIDEINTERPRET 8.014

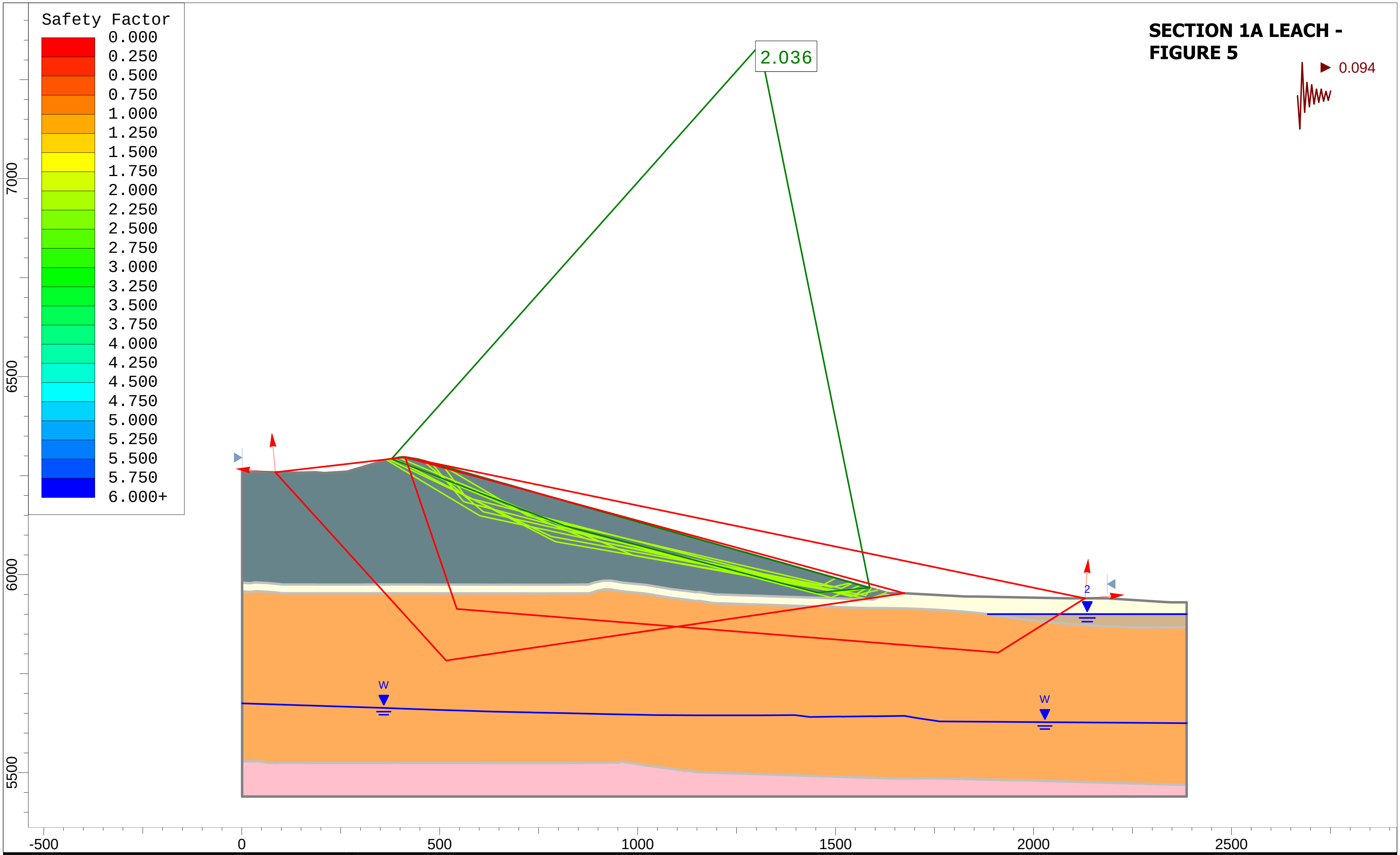


SECTION 1A LEACH - FIGURE 4

GOLDER

SLIDEINTERPRET 8.014

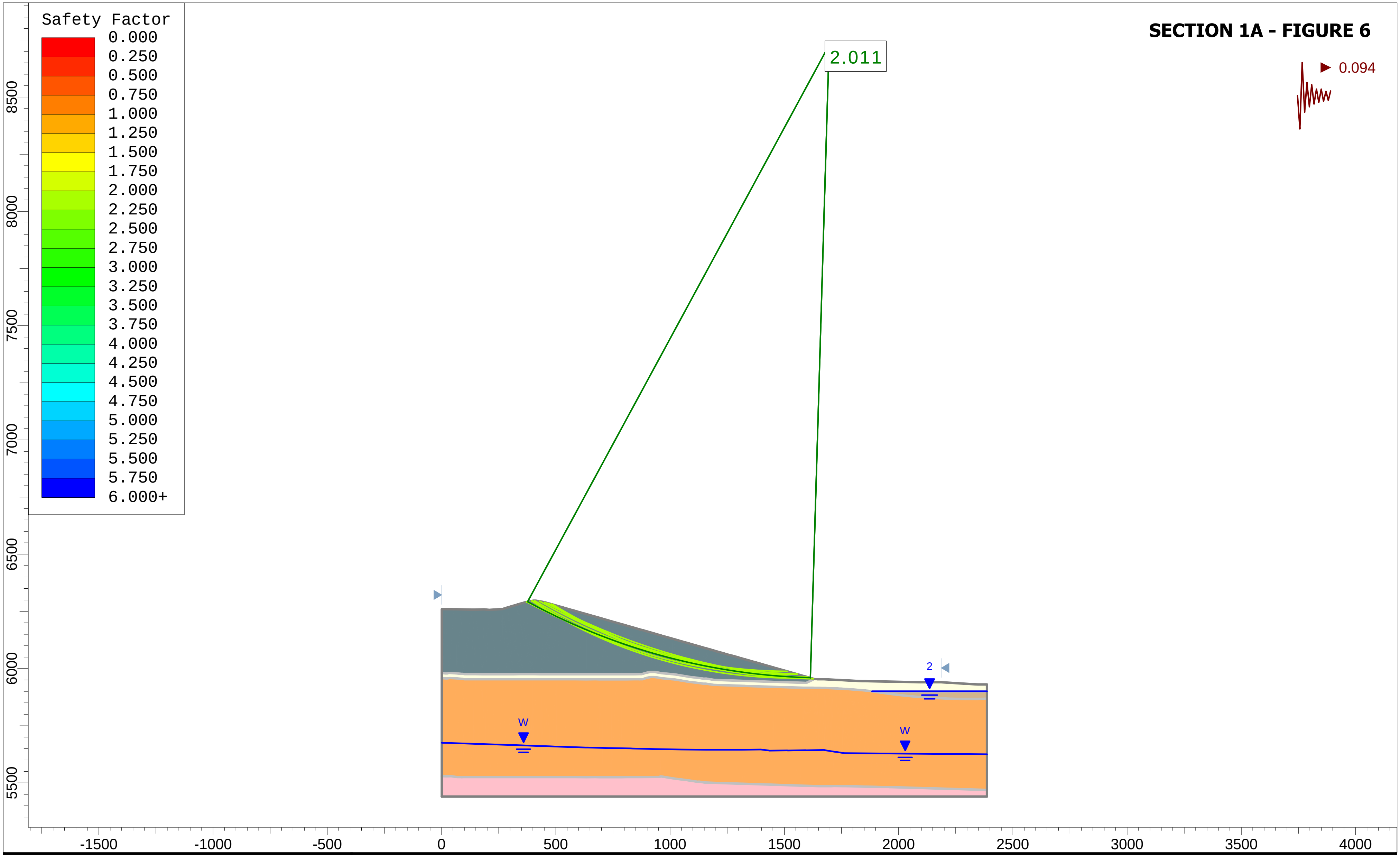
Project	Tyrone Mine Closure Stockpile Stability - Section 1A LEACH		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:6973	*Company*	Golder Associates
Date	1/2/2019	*File Name*	1A LEACH.slmd



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section 1A LEACH
Analysis Description	Seismic - Liquefied Qa - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:4025
Company	Golder Associates
Date	1/2/2019
File Name	1A.slmd

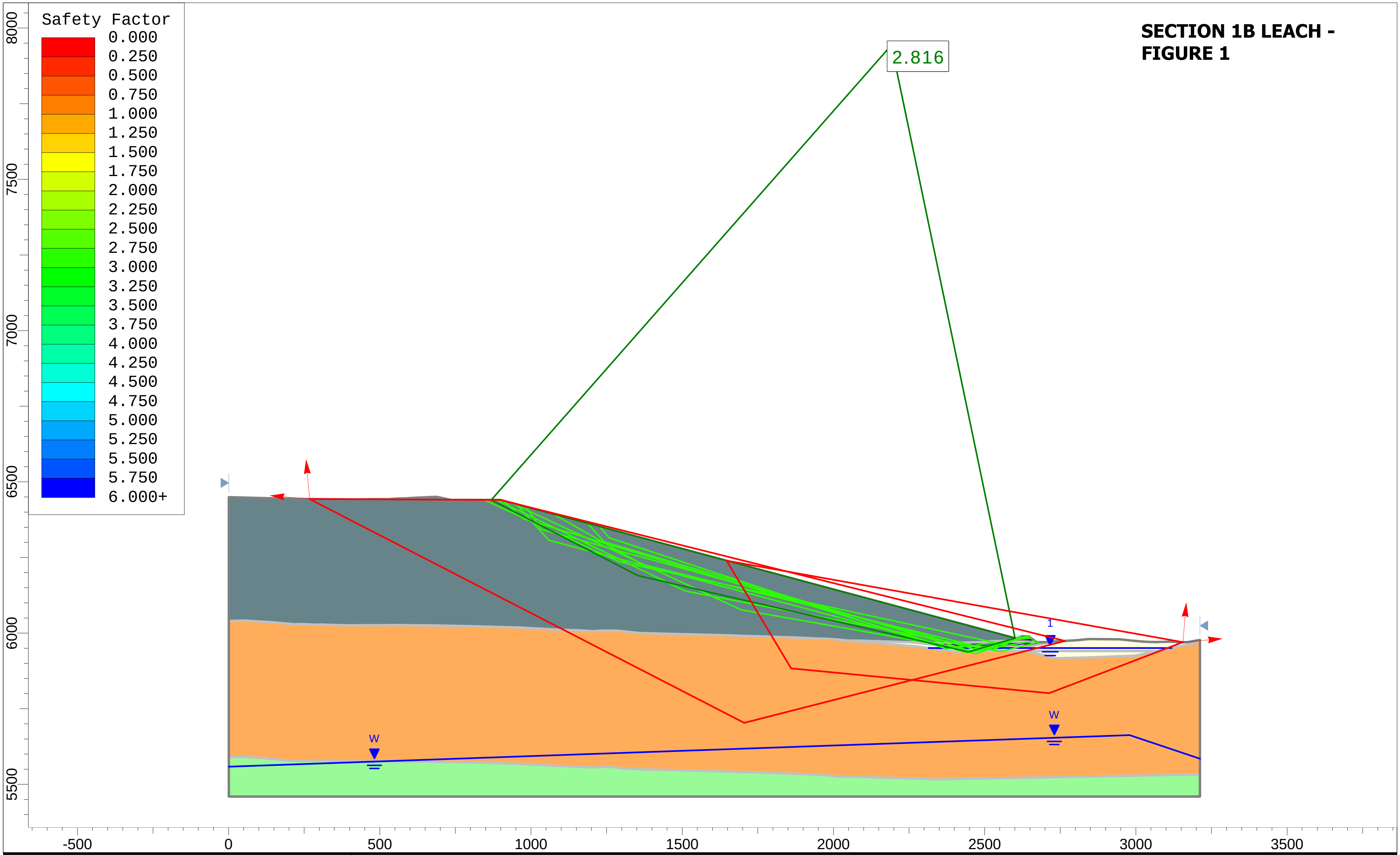


GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 1A LEACH		
Analysis Description	Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:6973	*Company*	Golder Associates
Date	1/2/2019	*File Name*	1A.slmd

SLIDEINTERPRET 8.014

SECTION 1B LEACH - FIGURE 1



GOLDER

Project
Tyrone Mine Closure Stockpile Stability - SECTION 1B LEACH

Analysis Description
Static - Block Failure (GLE / Morgenstern-Price)

Figure

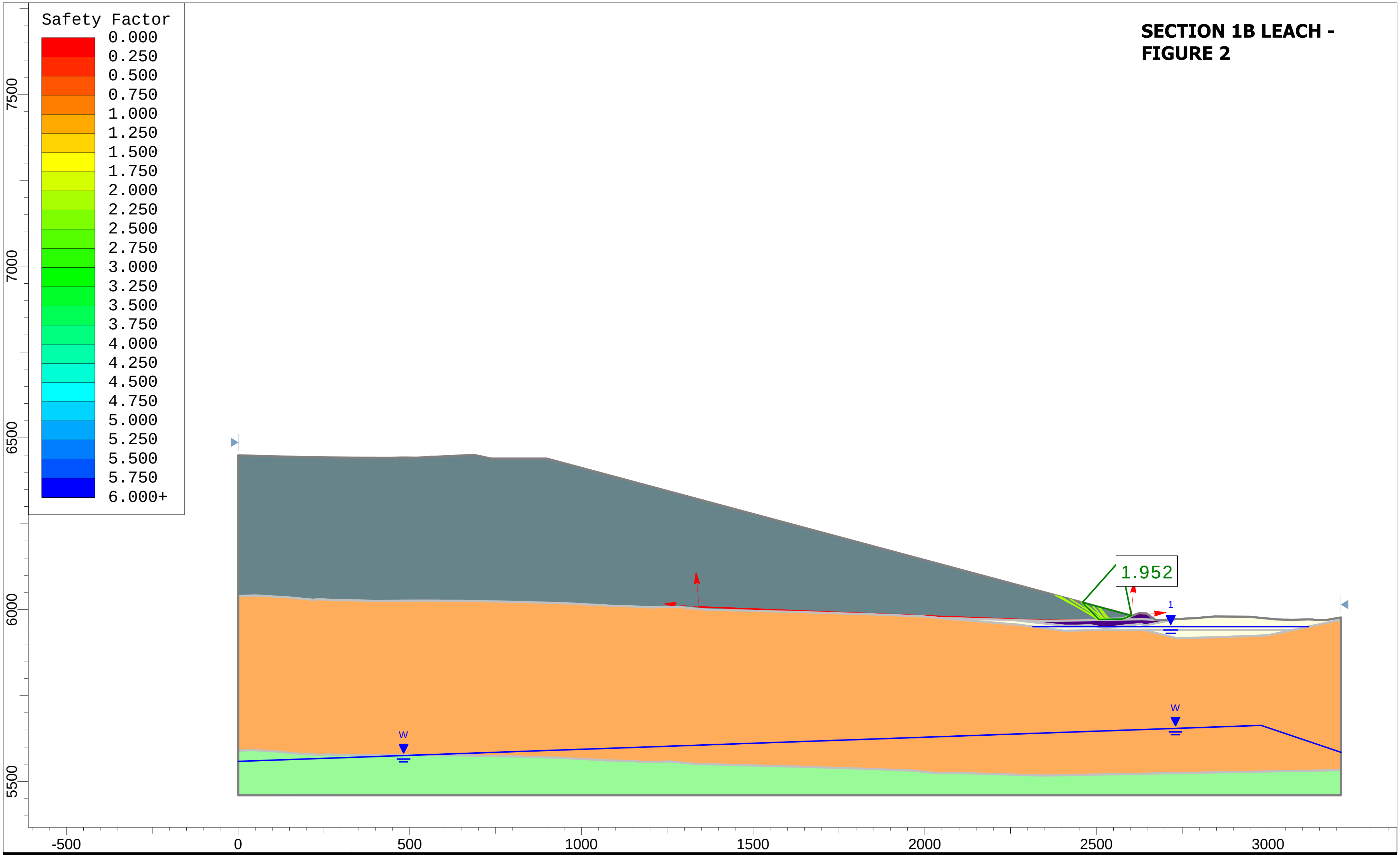
Scale
1:5268

Company
Golder Associates

Date
1/2/2019

File Name
1B - Modified.slmd

SLIDEINTERPRET 8.014



SECTION 1B LEACH - FIGURE 2

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 1B LEACH

Analysis Description Static - Block Liner Failure (GLE / Morgenstern-Price)

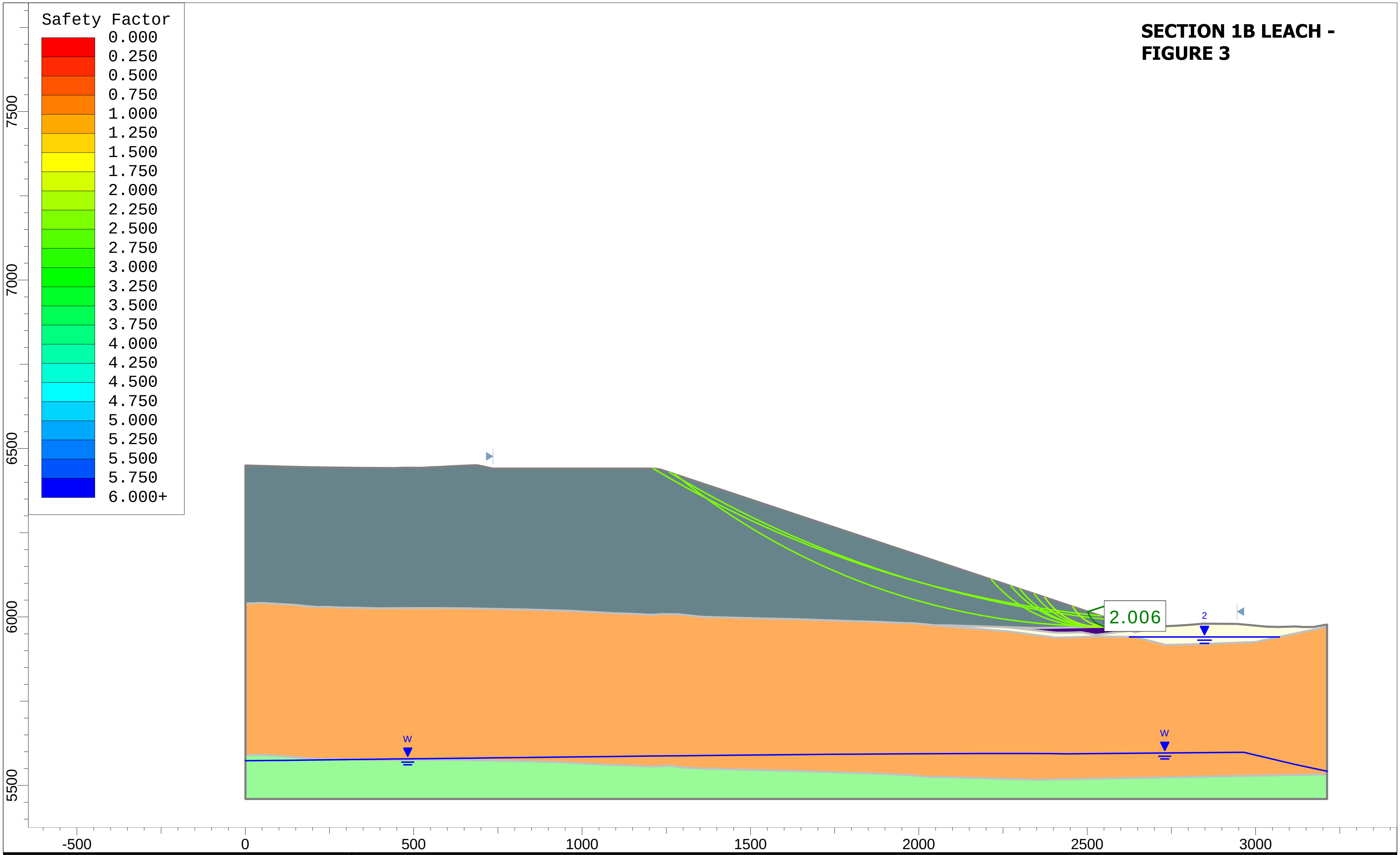
Figure

Scale 1:4641

Company Golder Associates

Date 1/2/2019

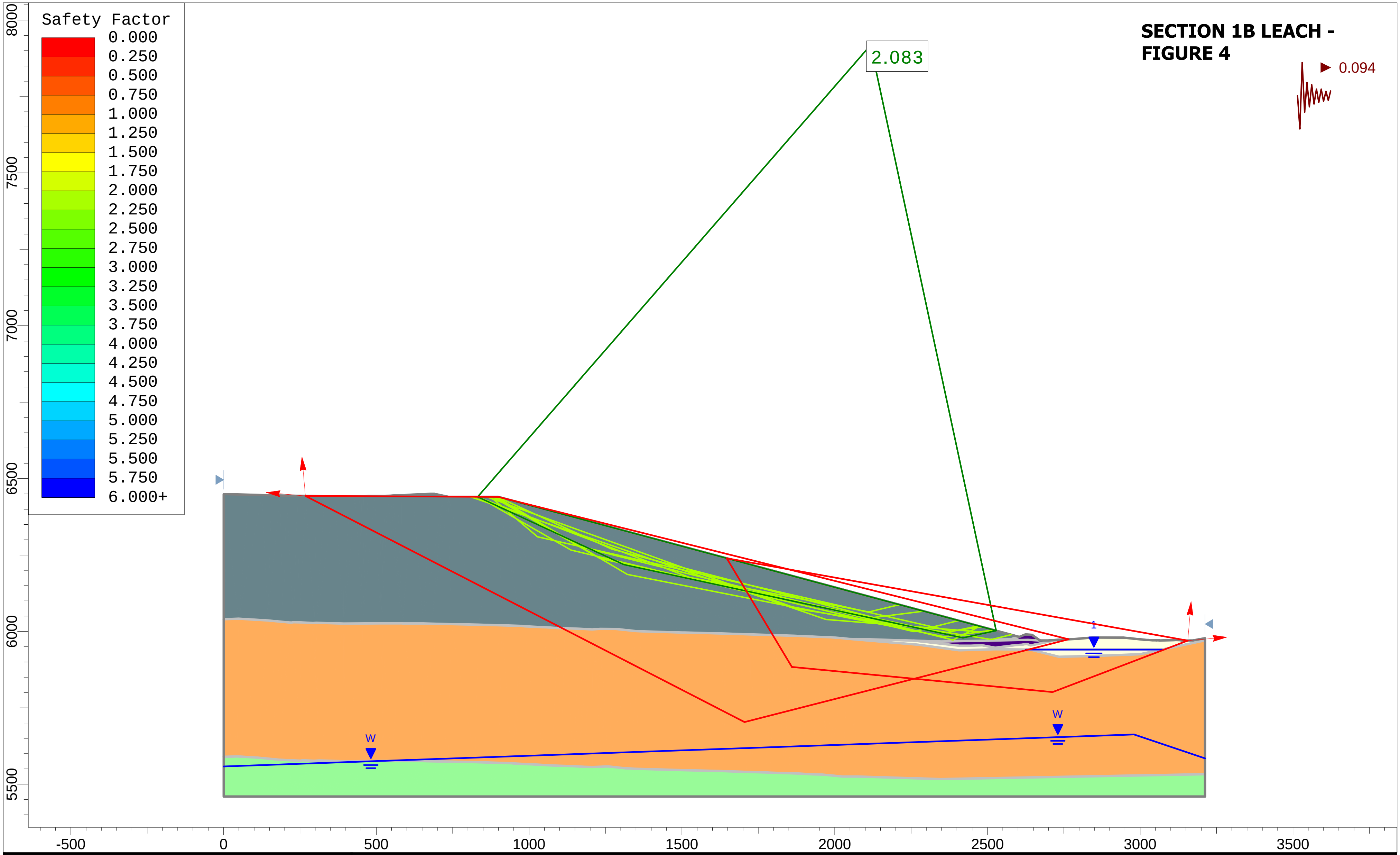
File Name 1B - Modified.slmd



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrnoe Mine Closure Stockpile Stability - SECTION 1B LEACH
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:15521
Company	Golder Associates
Date	
File Name	1B(2).slmd



SECTION 1B LEACH - FIGURE 4

GOLDER

Project: Tyrone Mine Closure Stockpile Stability - SECTION 1B LEACH

Analysis Description: Seismic - Block Failure (GLE / Morgenstern-Price)

Figure:

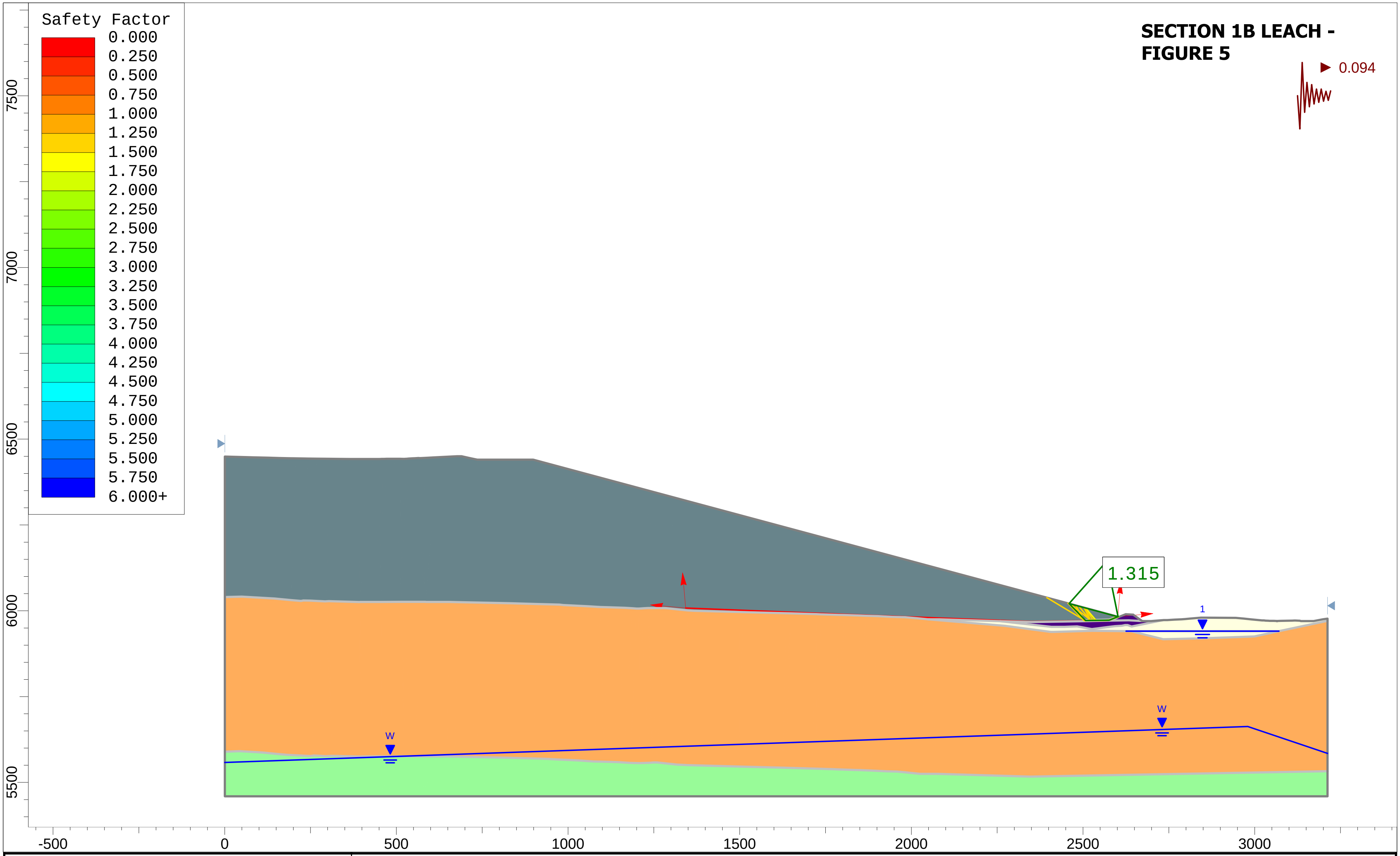
Scale: 1:5214

Company: Golder Associates

Date: 1/2/2019

File Name: 1B - Modified.slmd

SLIDEINTERPRET 8.014



SECTION 1B LEACH - FIGURE 5

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 1B LEACH

Analysis Description Seismic - Block Liner Failure (GLE / Morgenstern-Price)

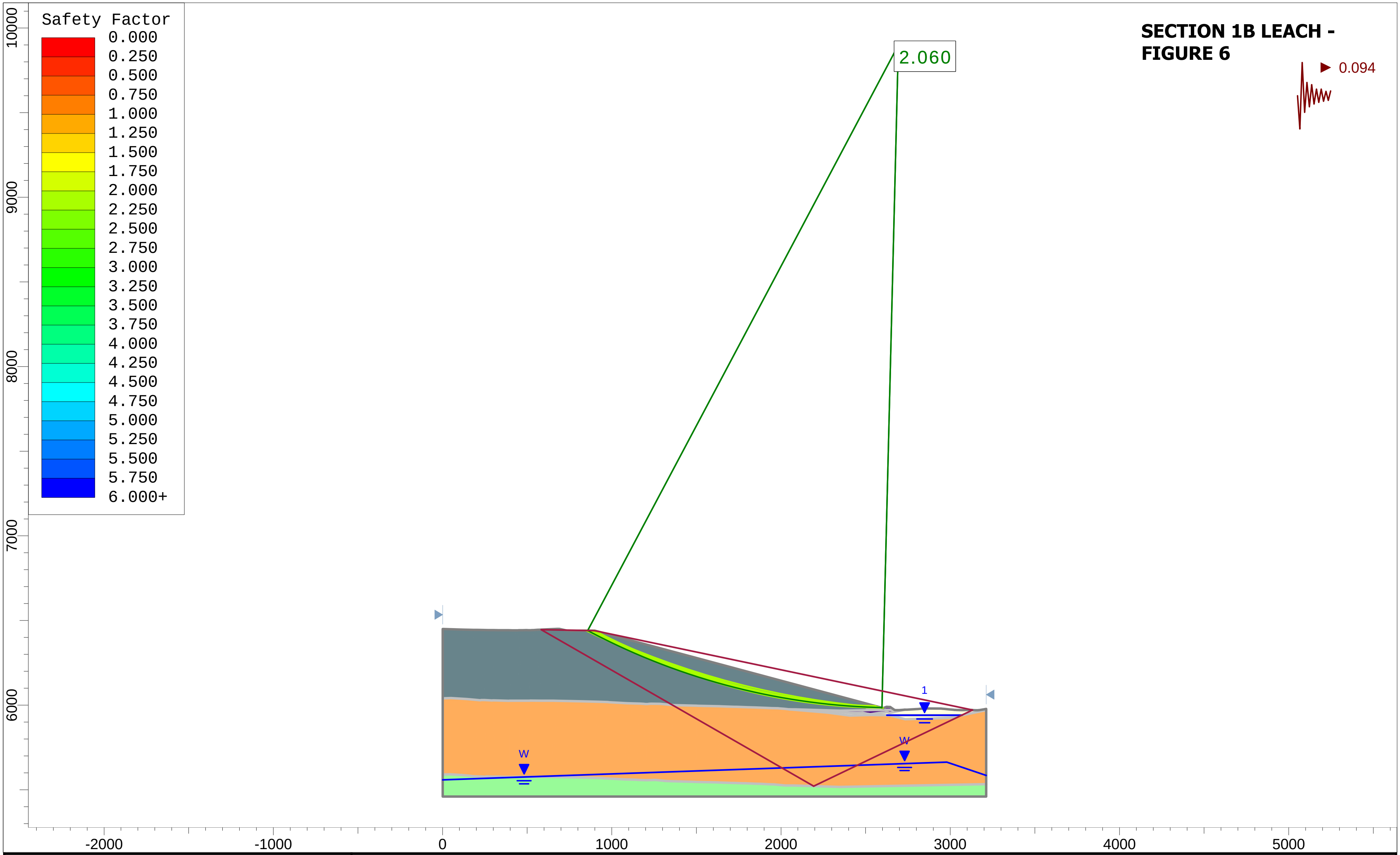
Figure

Scale 1:4641

Company Golder Associates

Date 1/2/2019

File Name 1B - Modified.slmd



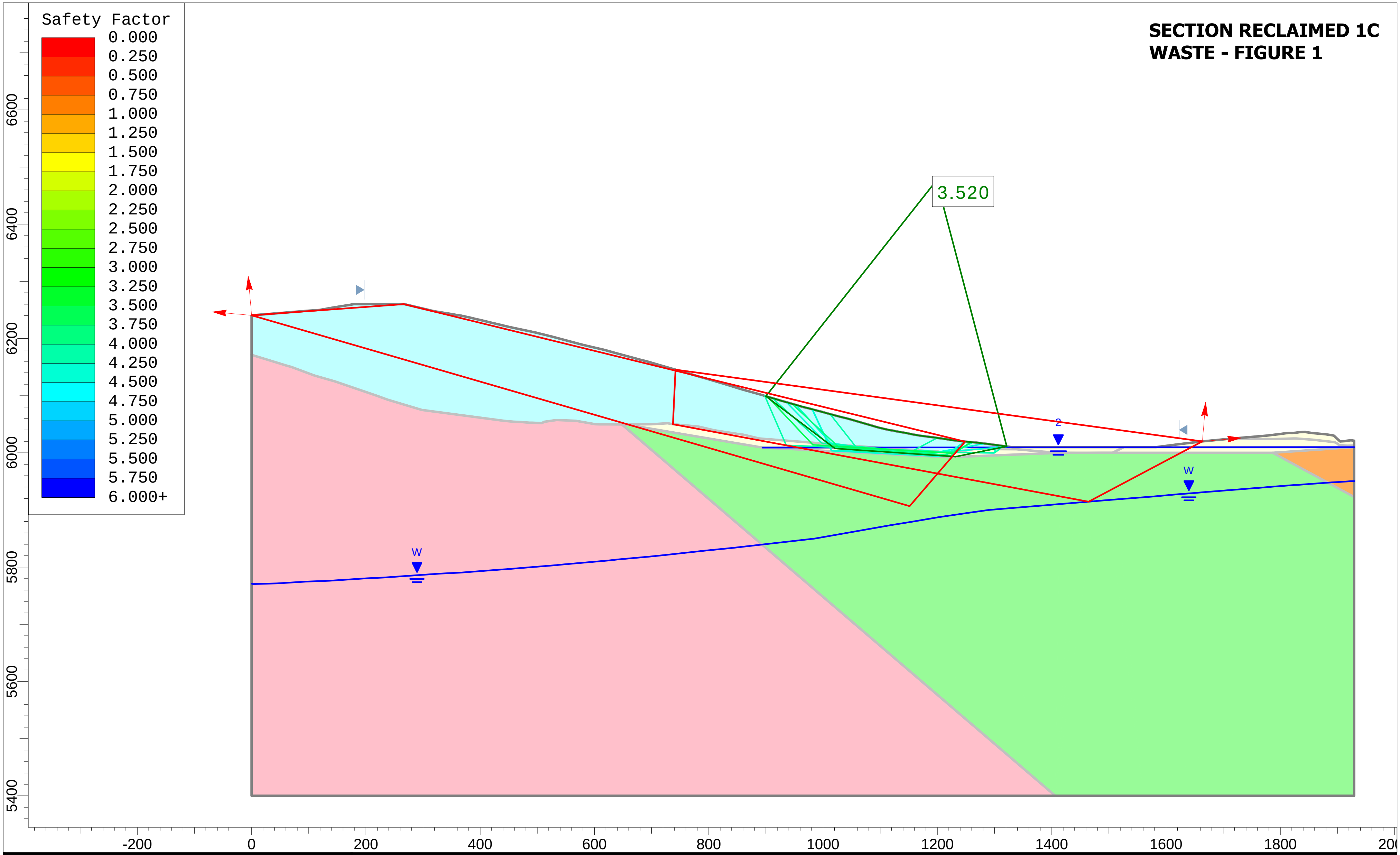
SECTION 1B LEACH - FIGURE 6

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 1B LEACH		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:9415	*Company*	Golder Associates
Date	1/2/2019	*File Name*	1B - Modified.slmd

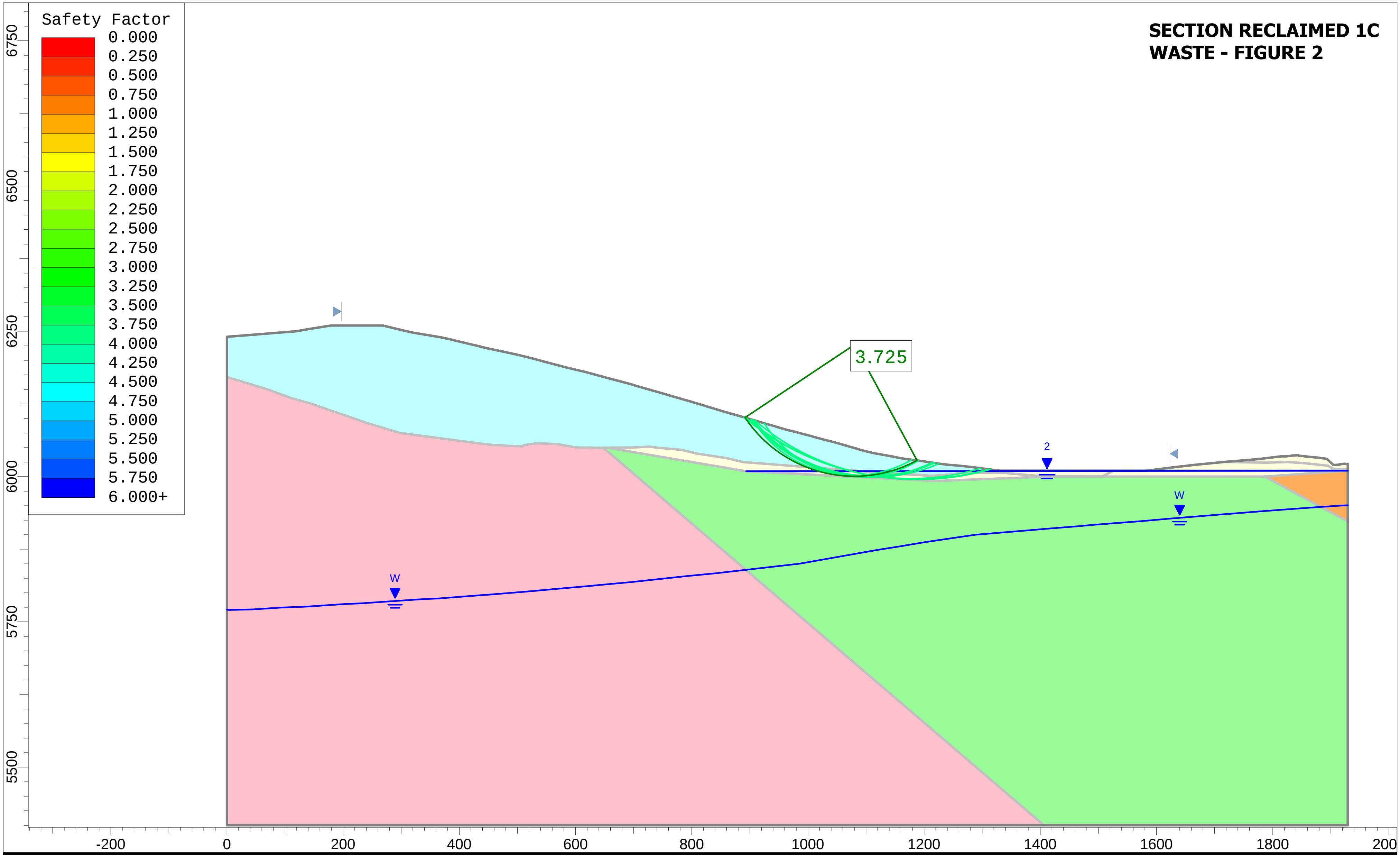
SLIDEINTERPRET 8.014

SECTION RECLAIMED 1C WASTE - FIGURE 1



Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 1C WASTE				
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)				
Figure		*Scale*	1:2788	*Company*	Golder Associates
Date	1/2/2019			*File Name*	1C.slmd

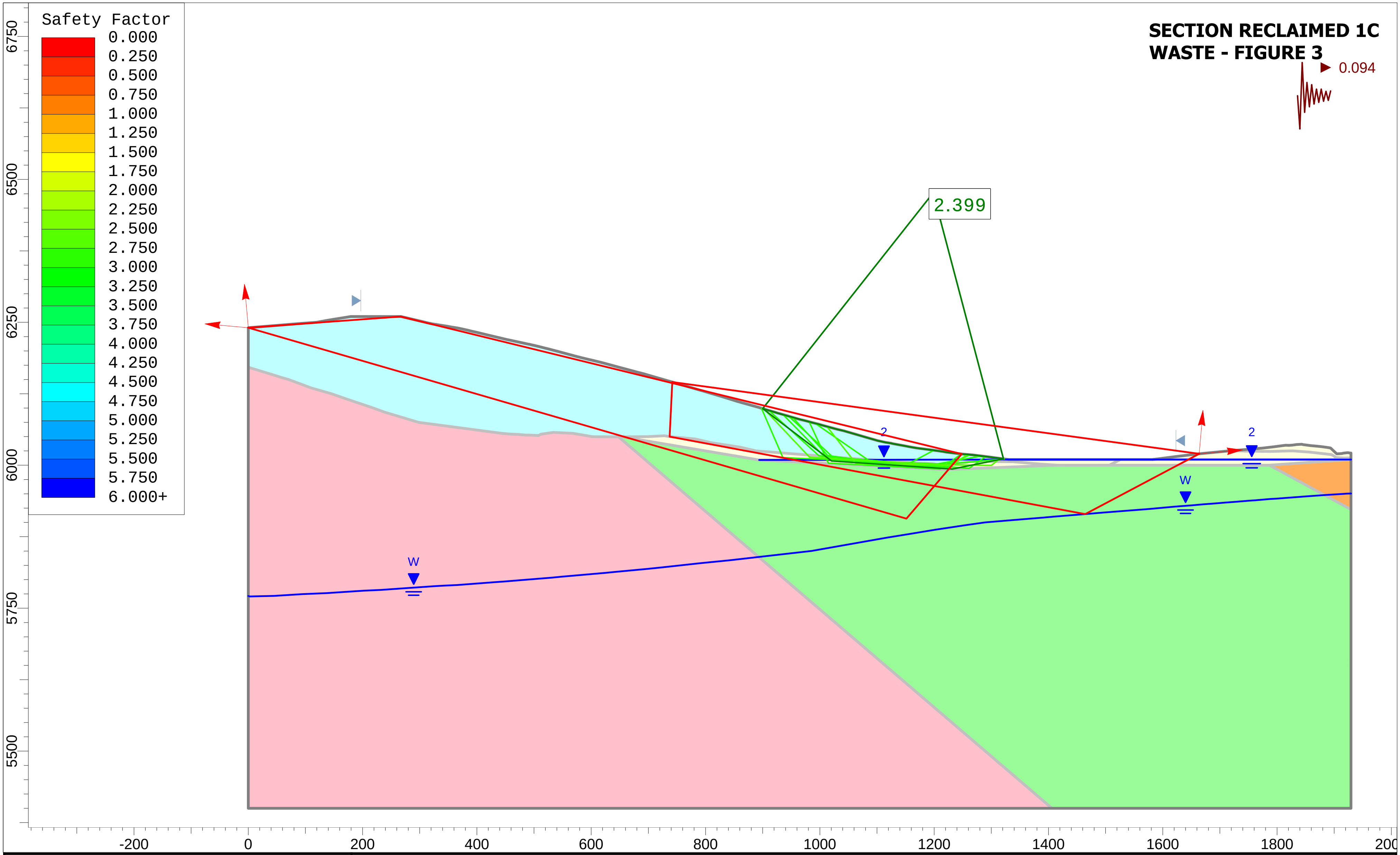
SLIDEINTERPRET 8.014


SECTION RECLAIMED 1C WASTE - FIGURE 2

GOLDER

Project	Tyrone Mine Closure Stockpile Stability		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2742	*Company*	Golder Associates
Date		*File Name*	1C.slmd

SLIDEINTERPRET 8.014

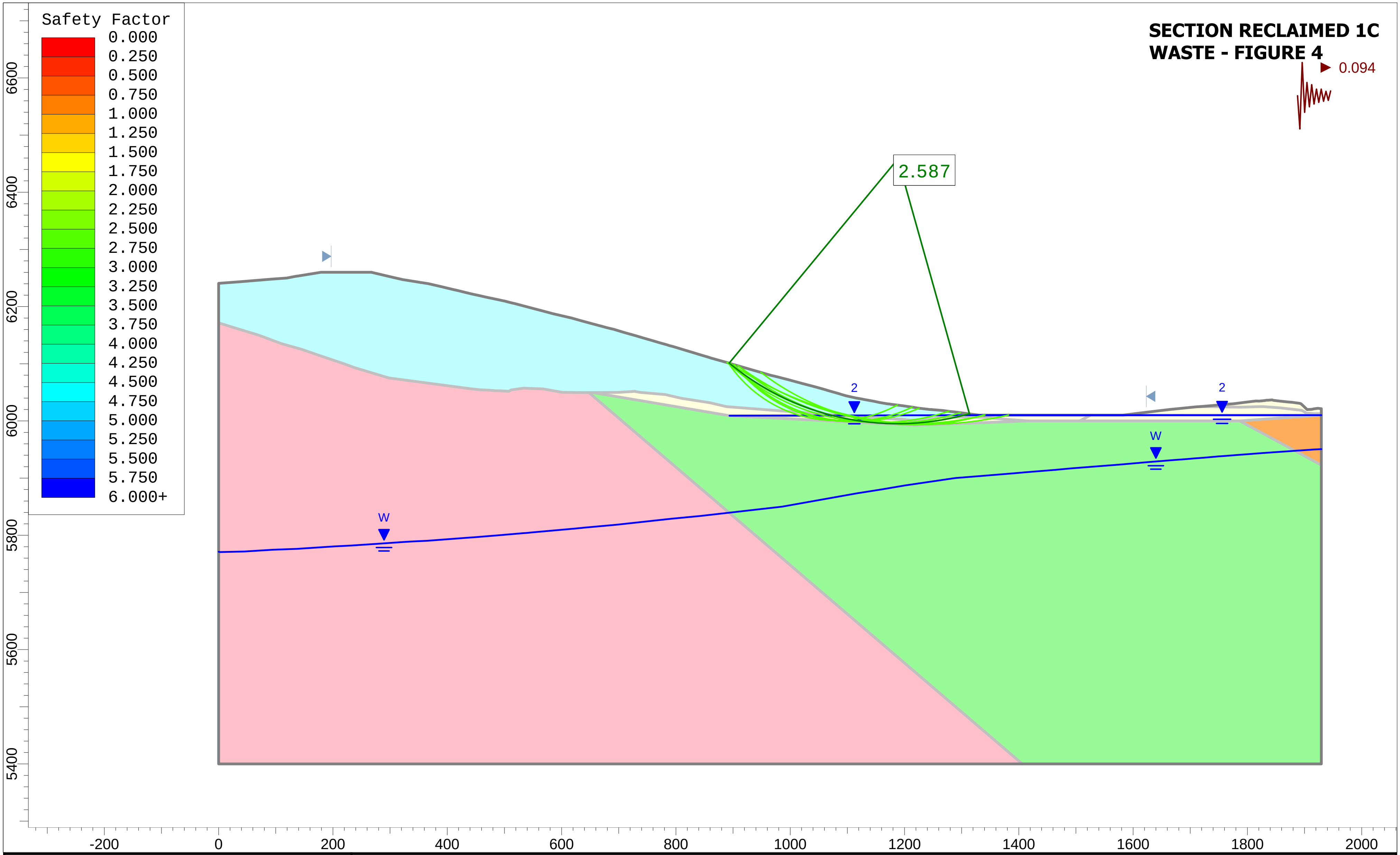


SECTION RECLAIMED 1C WASTE - FIGURE 3

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 1C WASTE
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:2788
Company	Golder Associates
Date	1/2/2019
File Name	1C.slmd

SLIDEINTERPRET 8.014



Project
Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 1C WASTE

Analysis Description
Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure

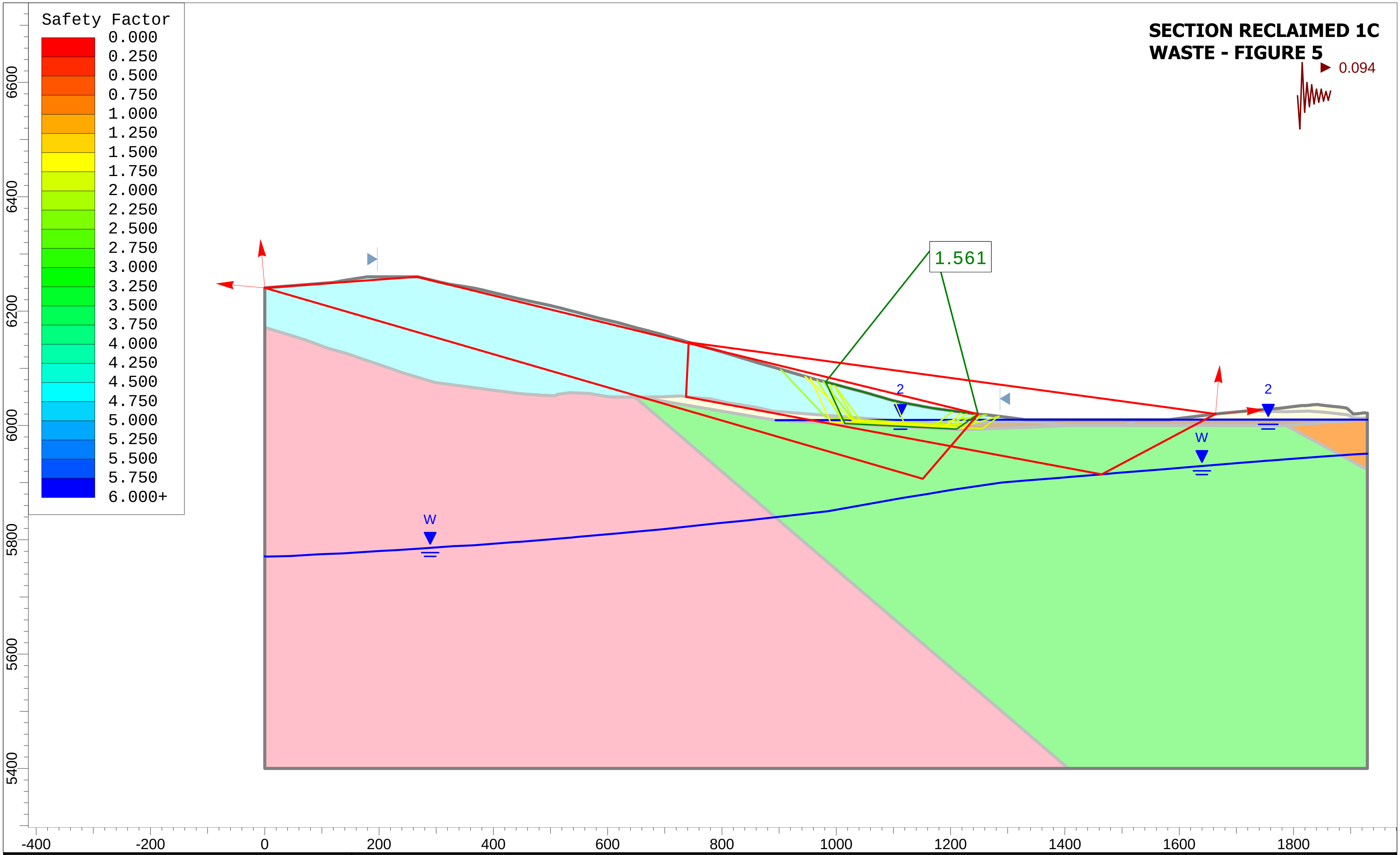
Scale 1:2788

Company Golder Associates

Date 1/2/2019

File Name 1C.slmd

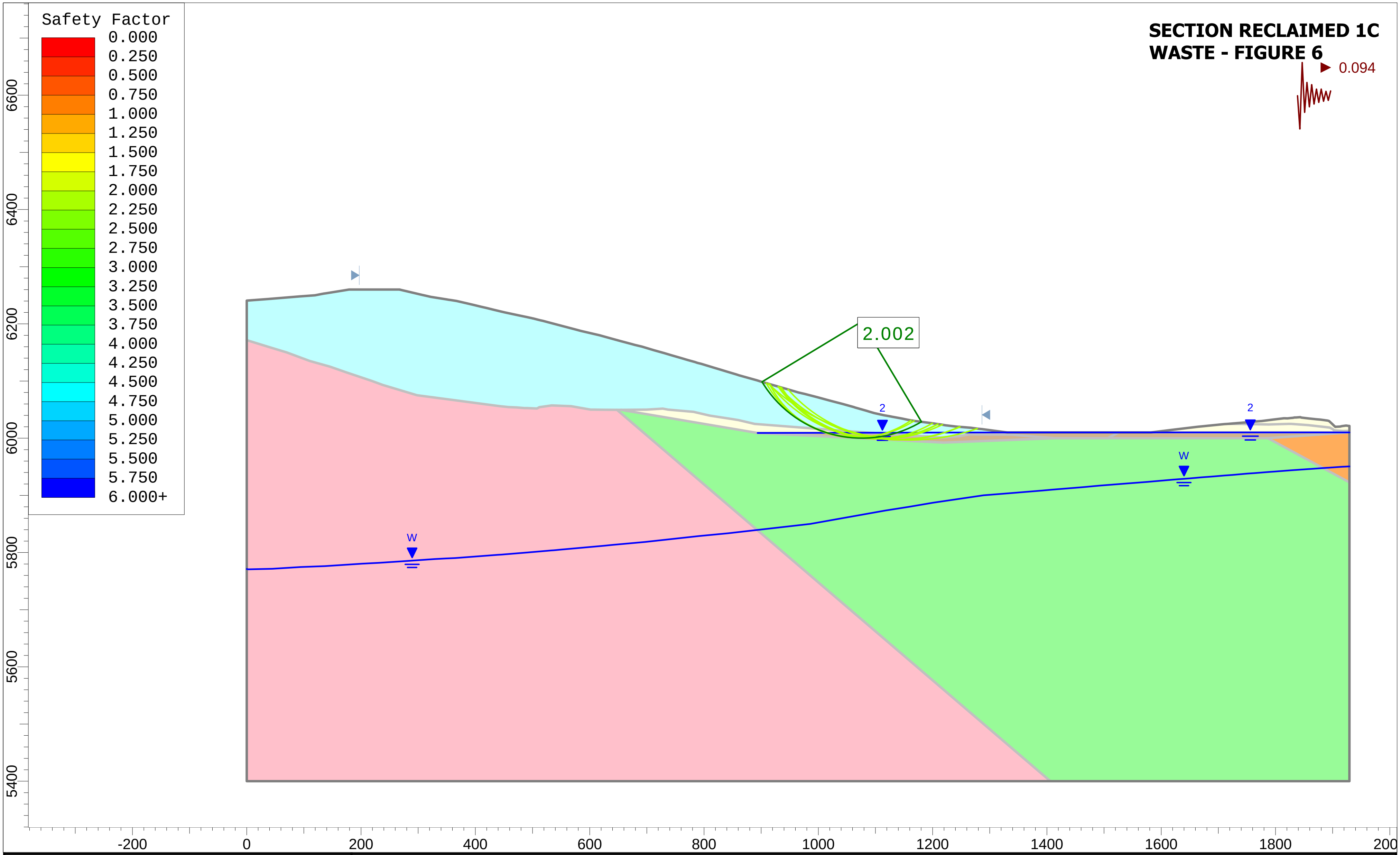
SLIDEINTERPRET 8.014



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 1C WASTE		
Analysis Description	Seismic - Liquefied Qa - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2788	*Company*	Golder Associates
Date 1/2/2019		*File Name*	1C.slmd

SLIDEINTERPRET 8.014



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 1C WASTE

Analysis Description Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)

Figure

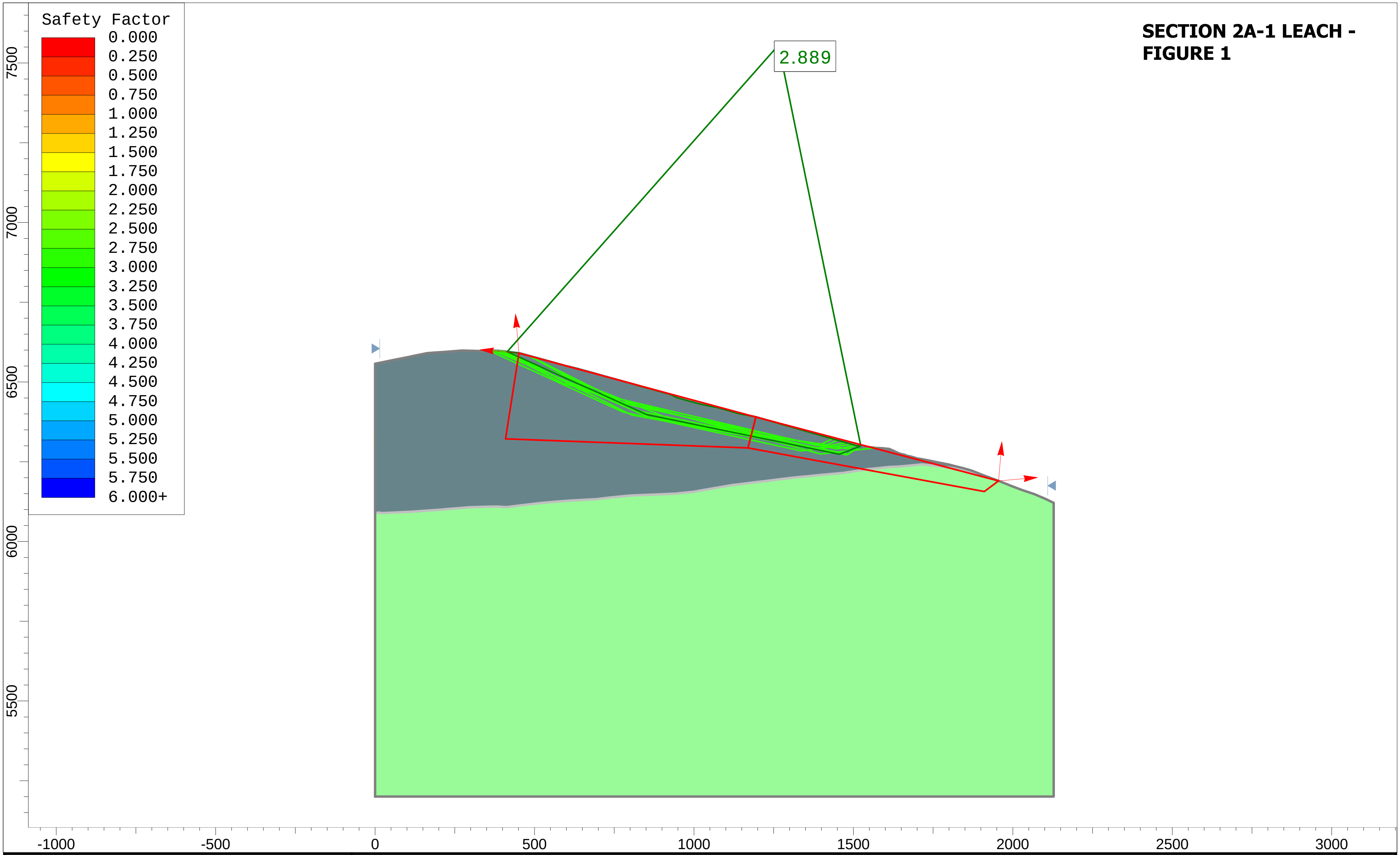
Scale 1:2788

Company Golder Associates

Date 1/2/2019

File Name 1C.slmd

SECTION 2A-1 LEACH - FIGURE 1



Project Tyrone Mine Closure Stockpile Stability - SECTION 2A-1 LEACH

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

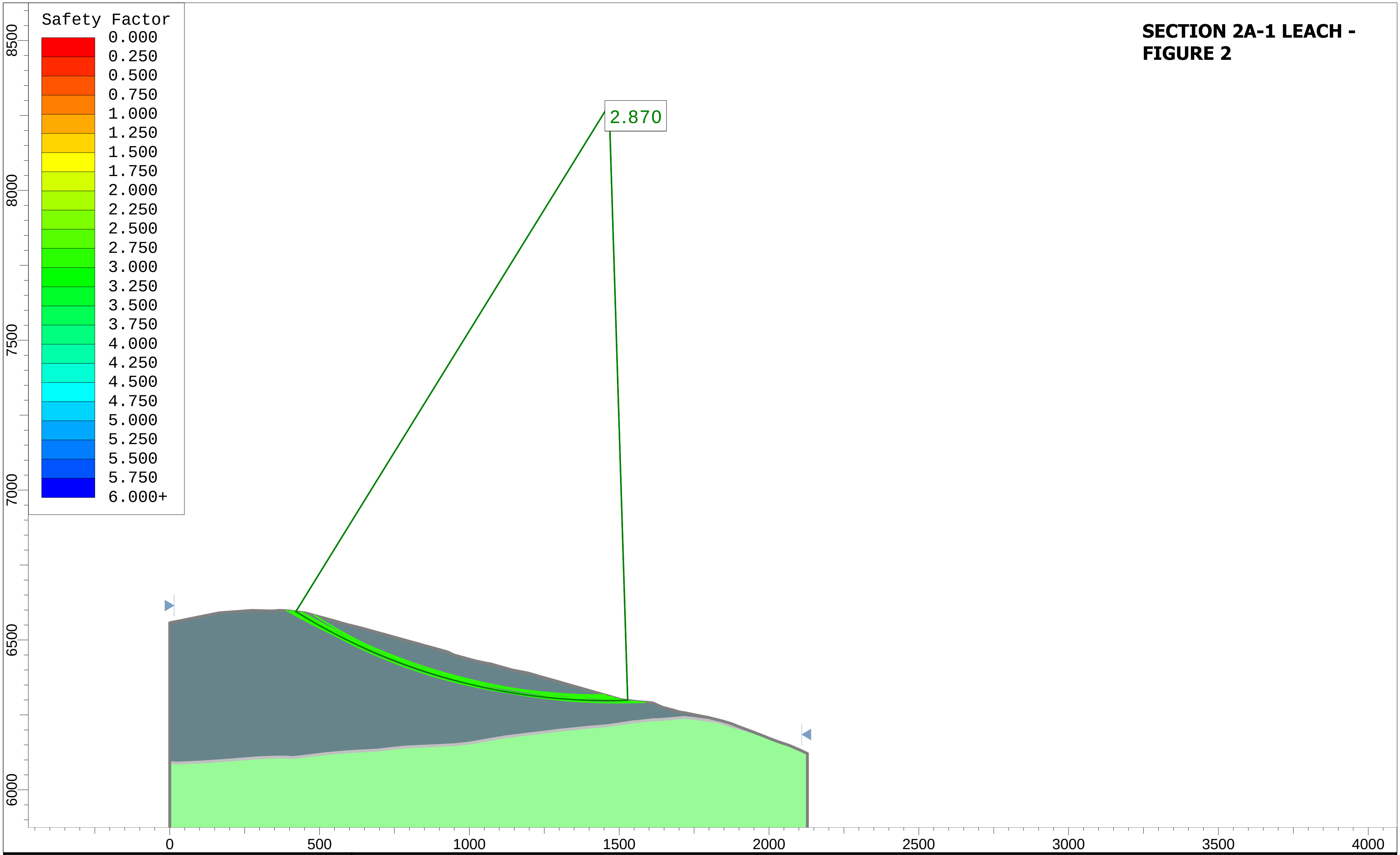
Scale 1:4997

Company Golder Associates

Date 1/2/2019

File Name 2A-1.slmd

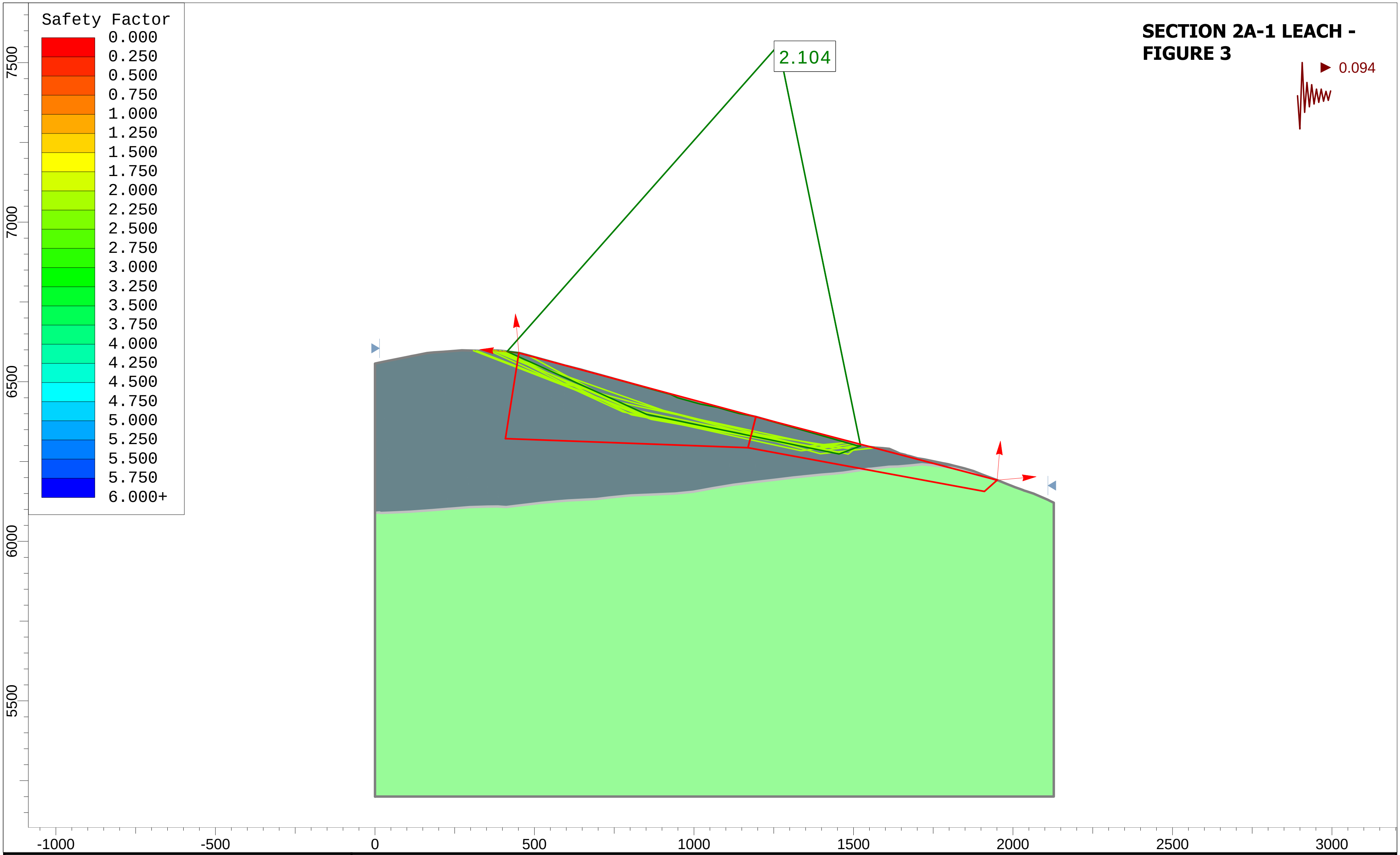
SLIDEINTERPRET 8.014



SECTION 2A-1 LEACH - FIGURE 2

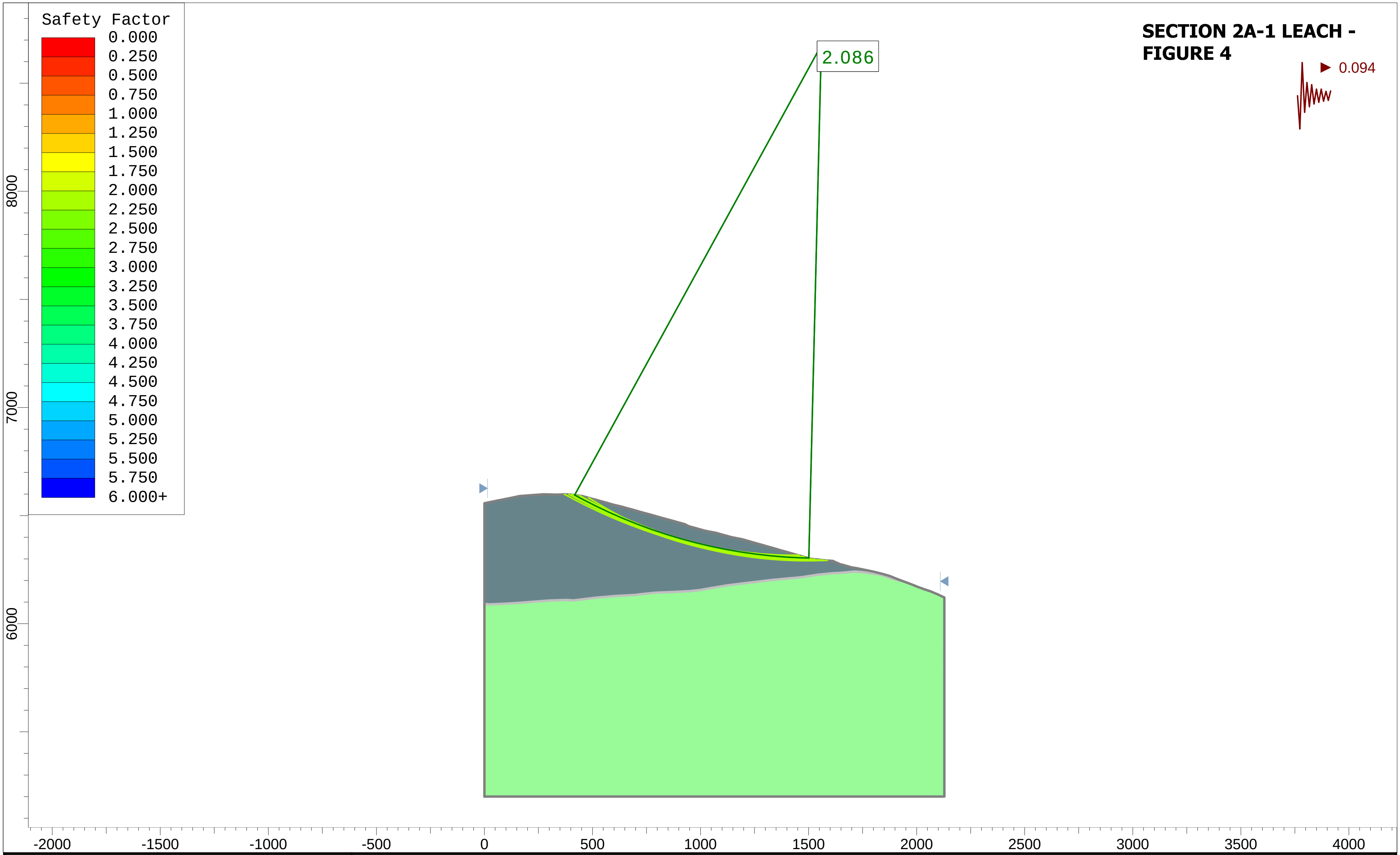
Project	Tyrone Mine Closure Stockpile Stability - SECTION 2A-1 LEACH
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:5318
Company	Golder Associates
Date	
File Name	2A-1.slmd

SLIDEINTERPRET 8.014



Project	Tyrone Mine Closure Stockpile Stability - SECTION 2A-1 LEACH		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4994	*Company*	Golder Associates
Date	1/2/2019	*File Name*	2A-1.slmd

SLIDEINTERPRET 8.014

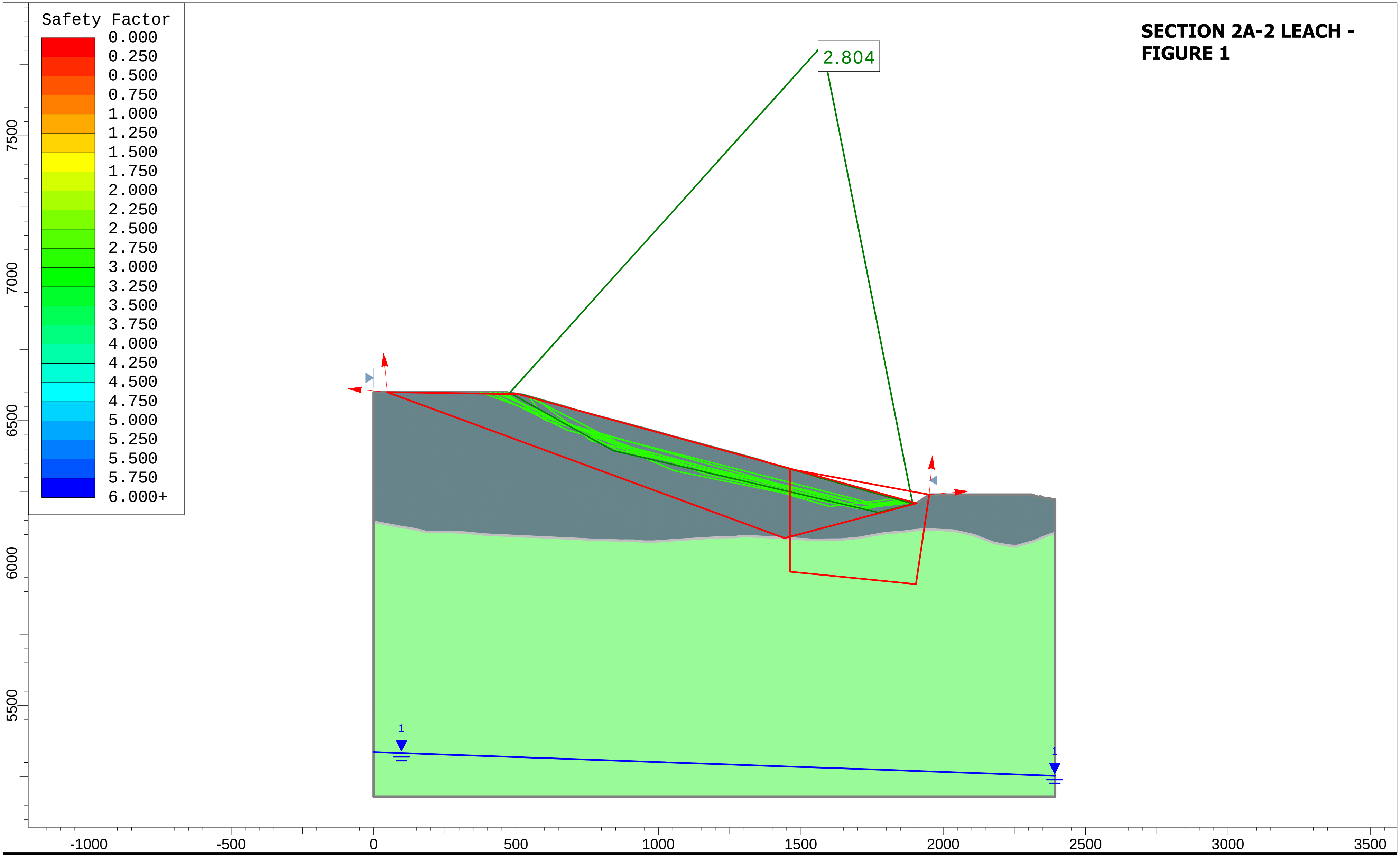


Project	Tyrone Mine Closure Stockpile Stability - SECTION 2A-1 LEACH		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:7372	*Company*	Golder Associates
Date 1/2/2019		*File Name*	2A-1.slmd

GOLDER

SLIDEINTERPRET 8.014

SECTION 2A-2 LEACH - FIGURE 1



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability		
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)		
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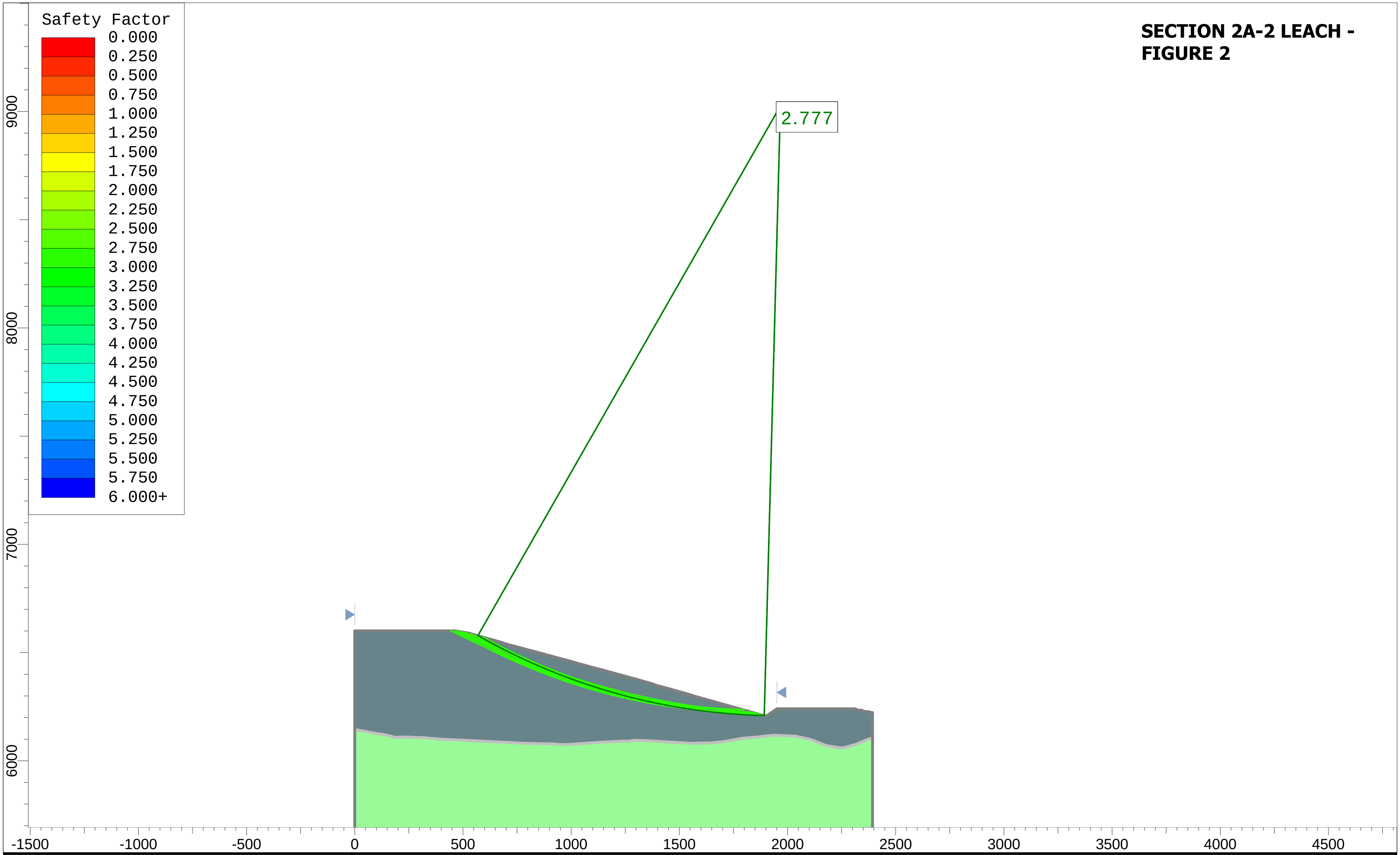
Date 1/2/2019		*File Name*	2A-2.slmd

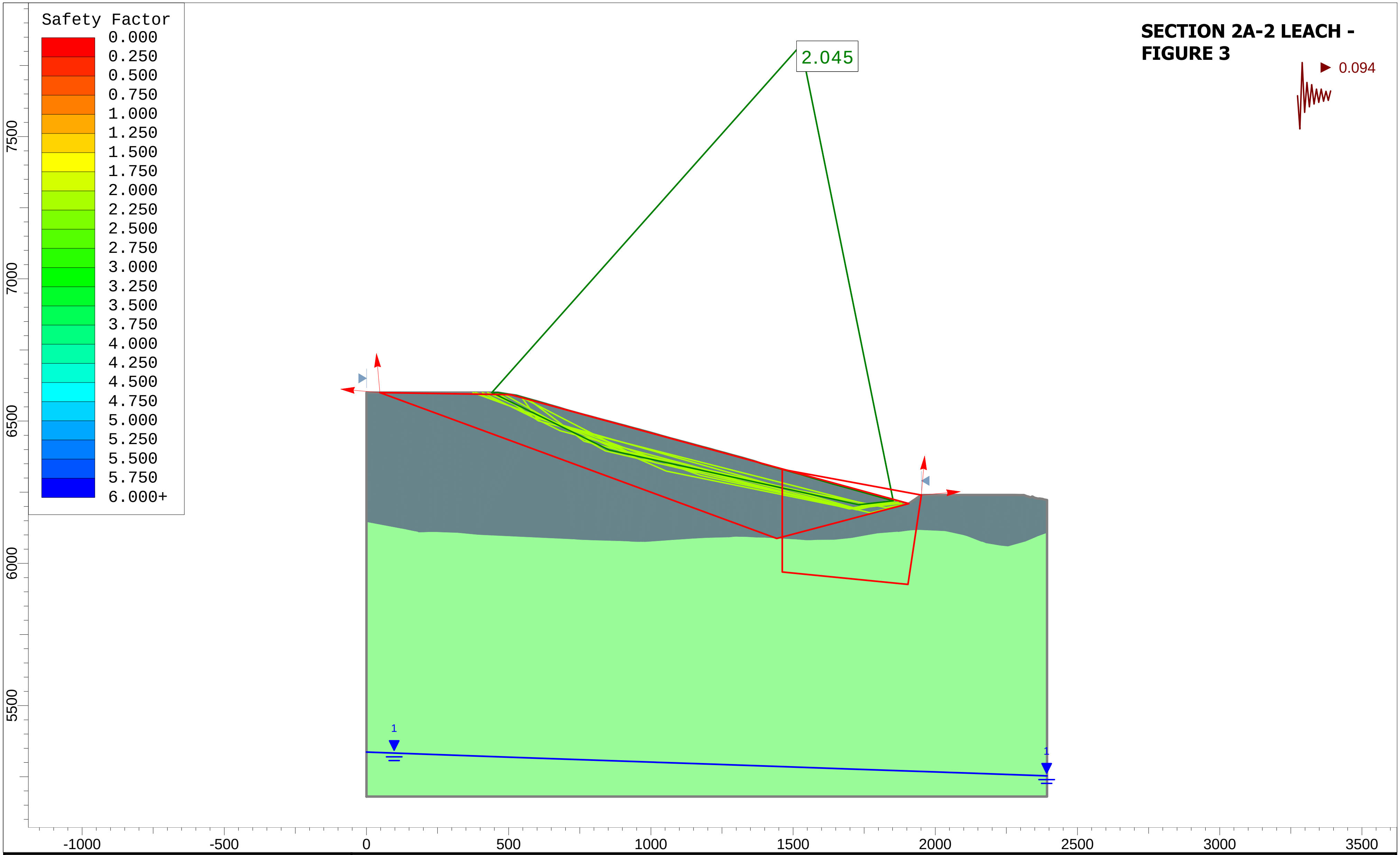
SECTION 2A-2 LEACH - FIGURE 2



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:7364
Company	Golder Associates
Date	
File Name	2A-2.slmd



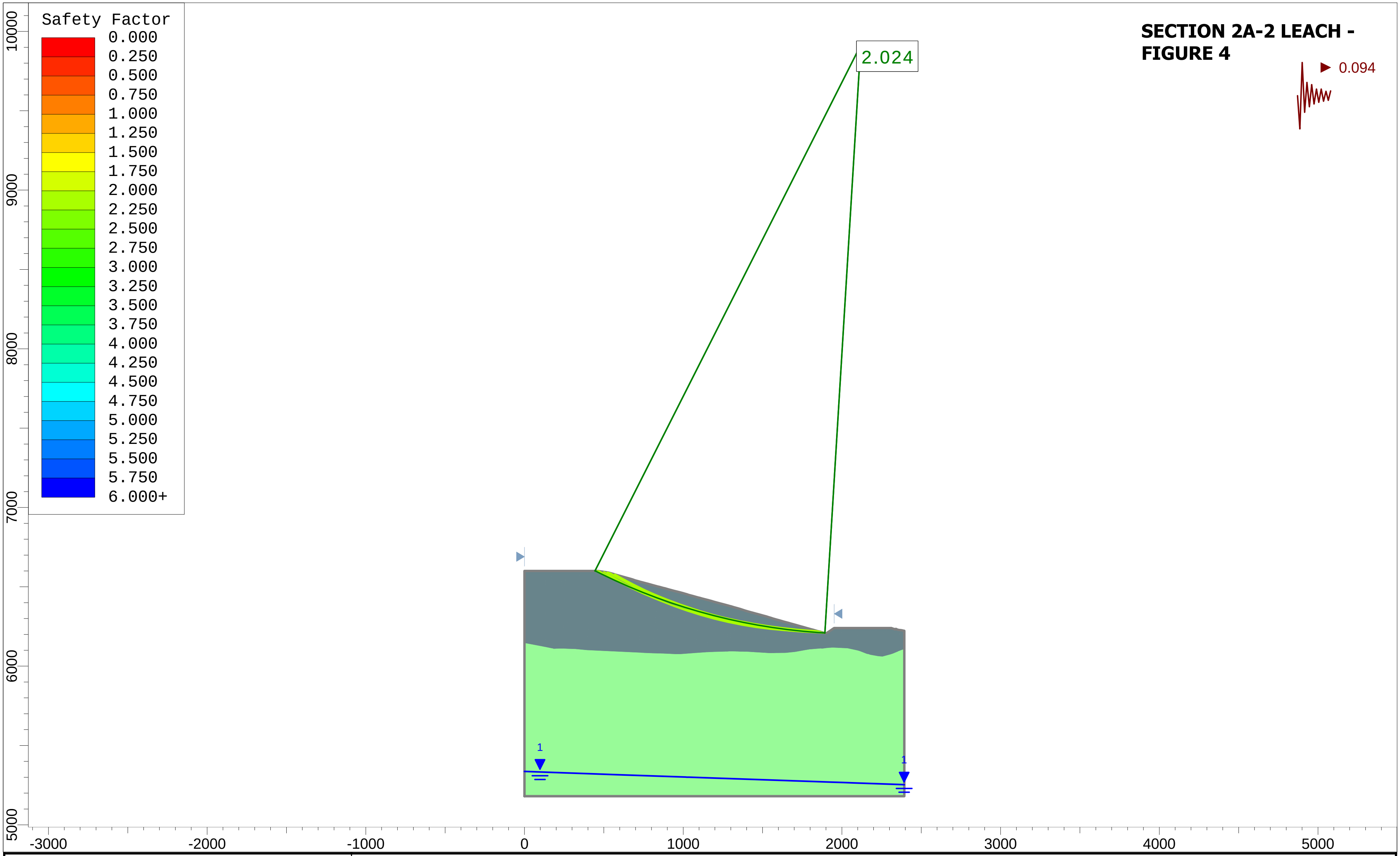
SECTION 2A-2 LEACH - FIGURE 3

GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:5602	*Company*	Golder Associates
Date	1/2/2019	*File Name*	2A-2.slmd

SECTION 2A-2 LEACH - FIGURE 4

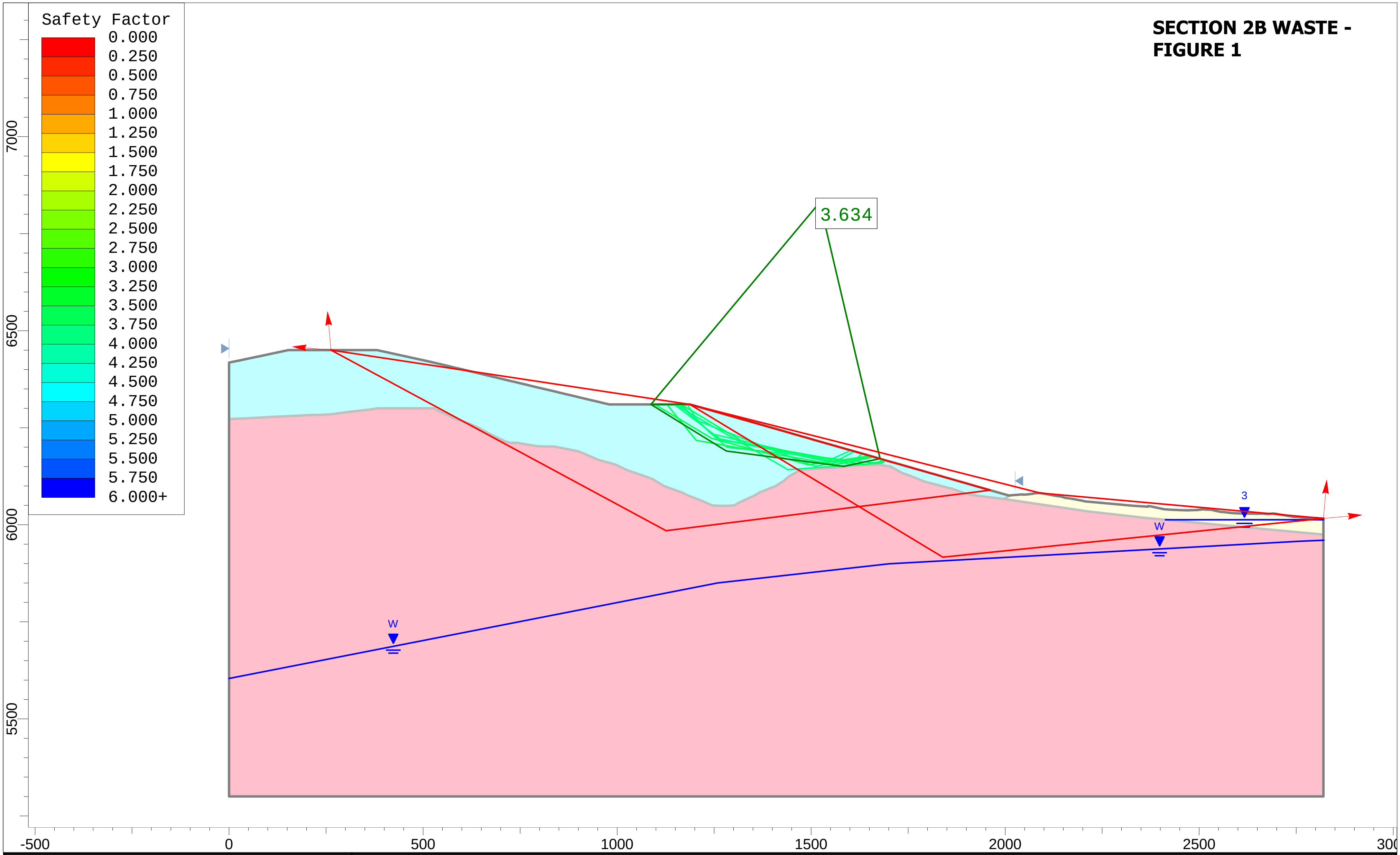


GOLDER

Project	Tyrone Mine Closure Stockpile Stability		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:10040	*Company*	Golder Associates
Date 1/2/2019		*File Name*	2A-2.slmd

SLIDEINTERPRET 8.014

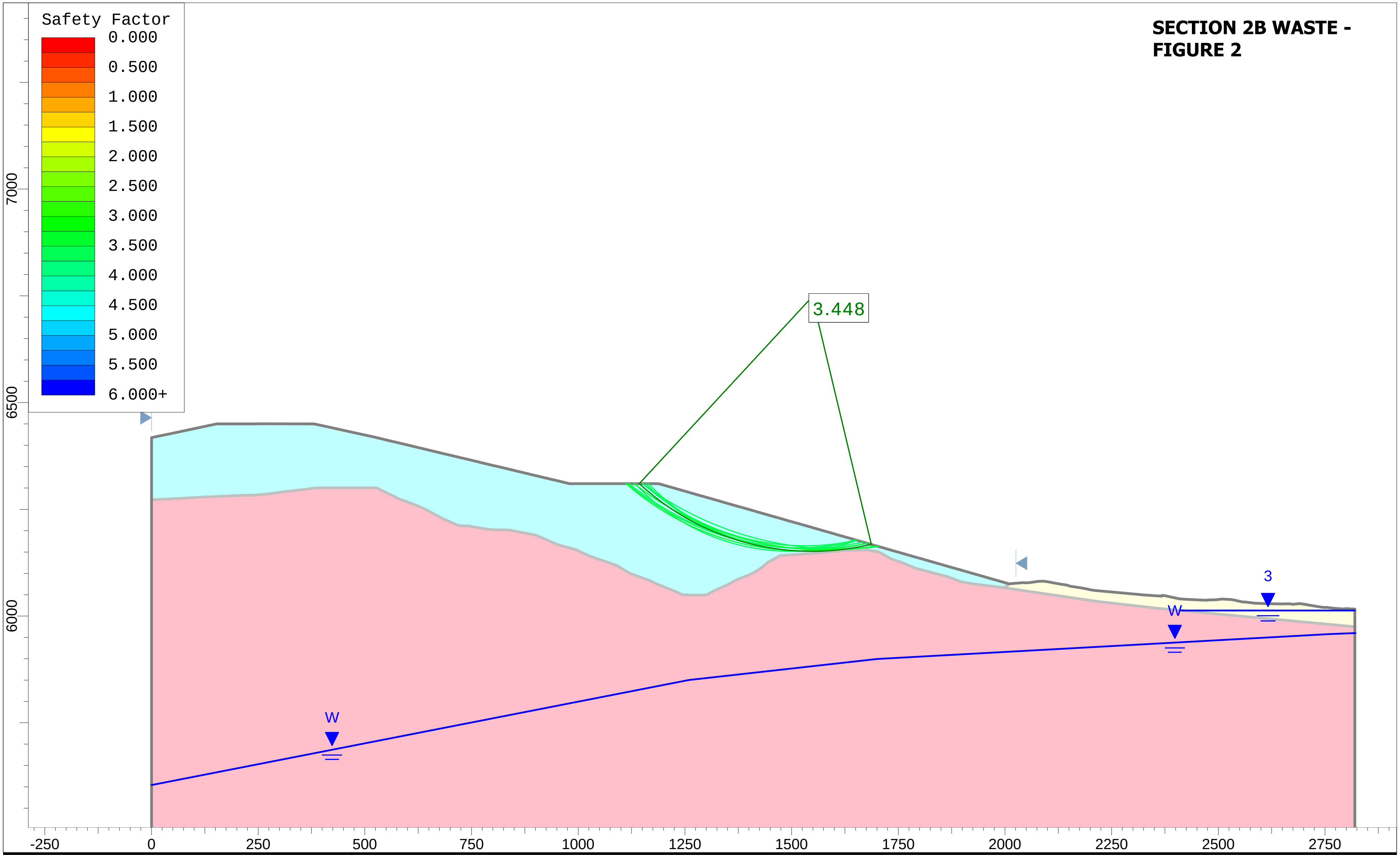
SECTION 2B WASTE - FIGURE 1



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 2B WASTE		
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4106	*Company*	Golder Associates
Date	1/2/2019	*File Name*	2B.slmd

SLIDEINTERPRET 8.014



SECTION 2B WASTE - FIGURE 2

GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - SECTION 2B WASTE

Analysis Description
Static - Circular Failure (GLE / Morgenstern-Price)

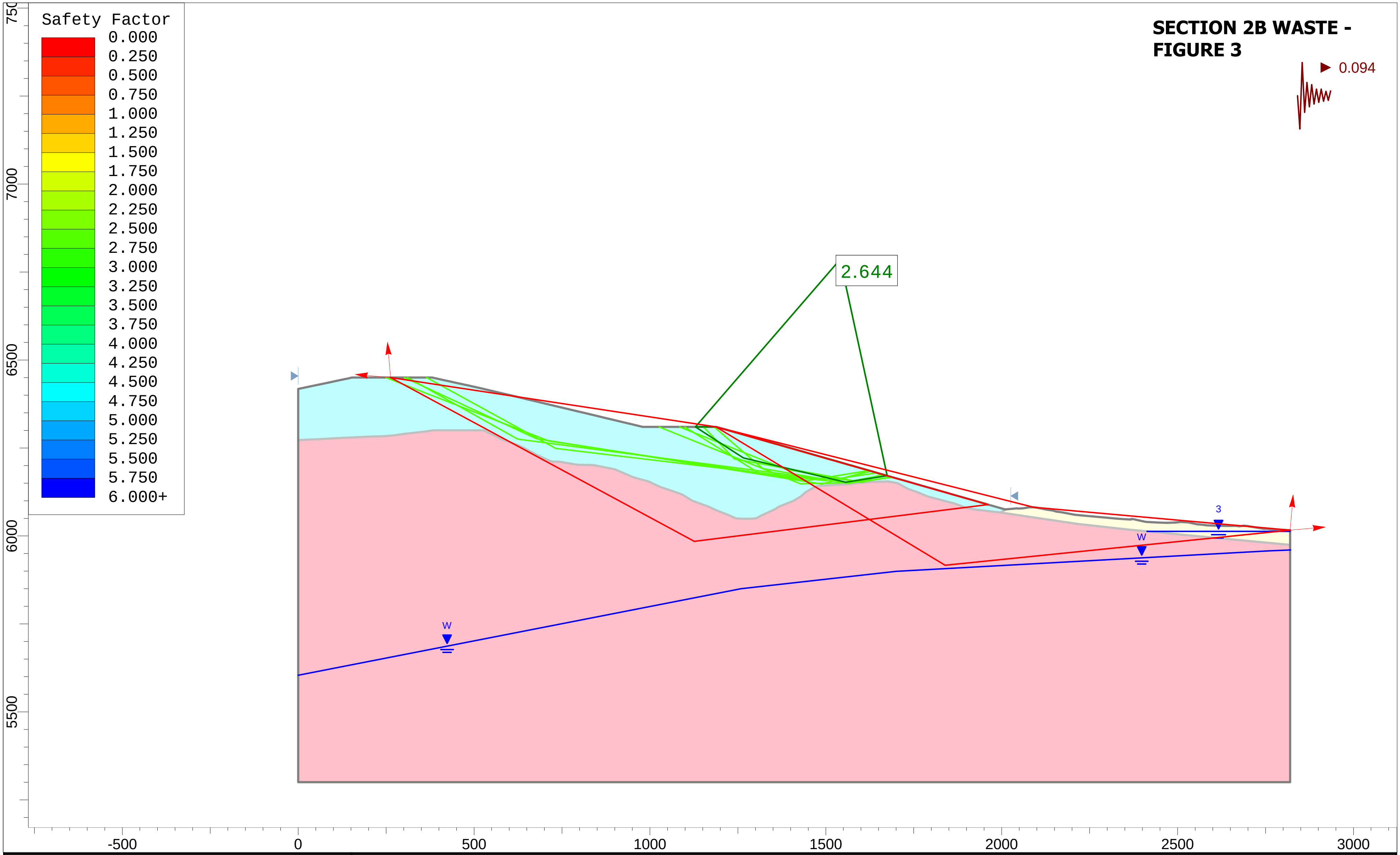
Figure

Scale 1:3733

Company Golder Associates

Date

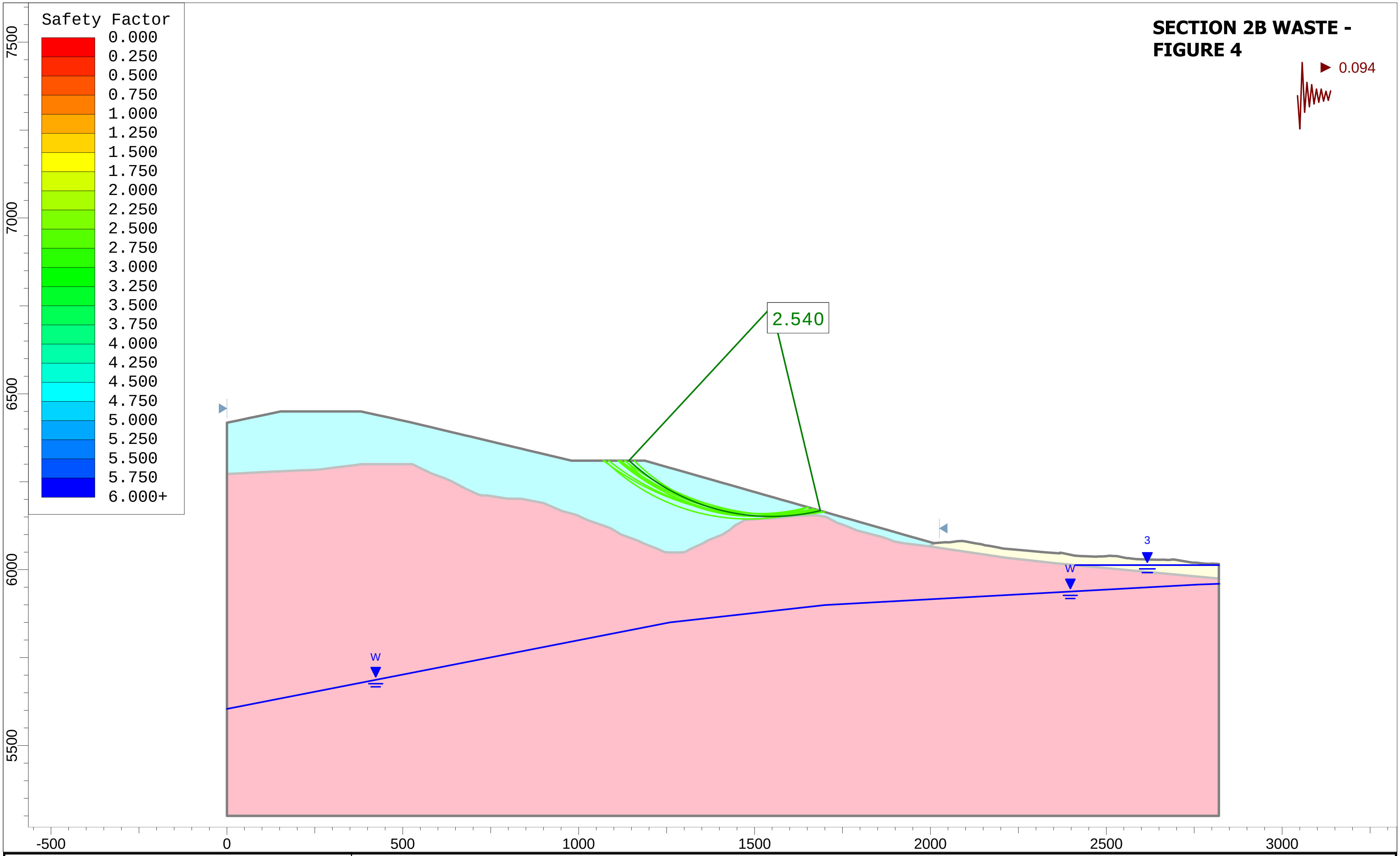
File Name 2B.slmd



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - SECTION 2B WASTE		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4530	*Company*	Golder Associates
Date	1/2/2019	*File Name*	2B.slmd



Project Tyrone Mine Closure Stockpile Stability - SECTION 2B WASTE

Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure

Scale 1:4530

Company Golder Associates

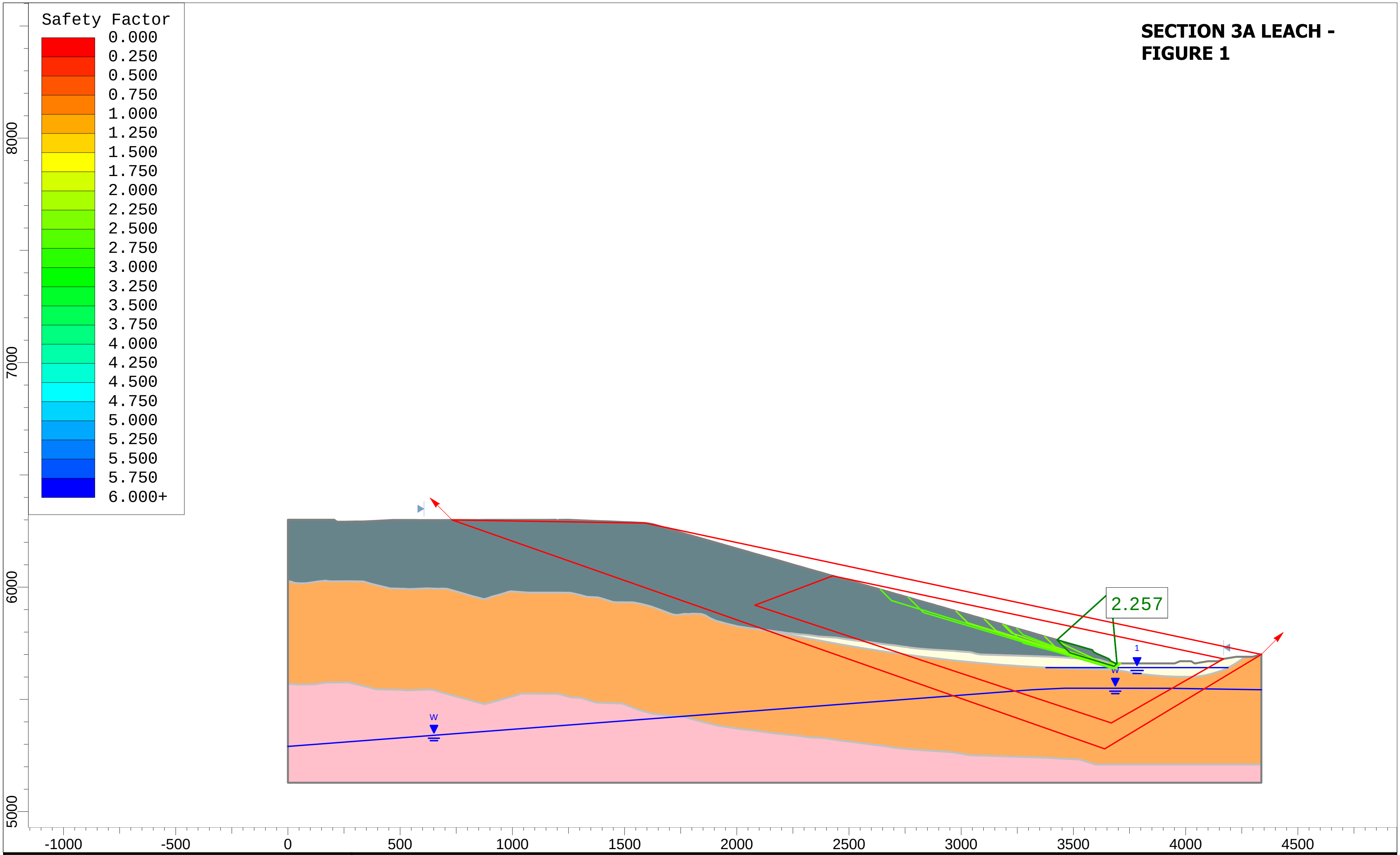
Date 1/2/2019

File Name 2B.slmd

GOLDER

SLIDEINTERPRET 8.014

SECTION 3A LEACH - FIGURE 1



GOLDER

Project Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

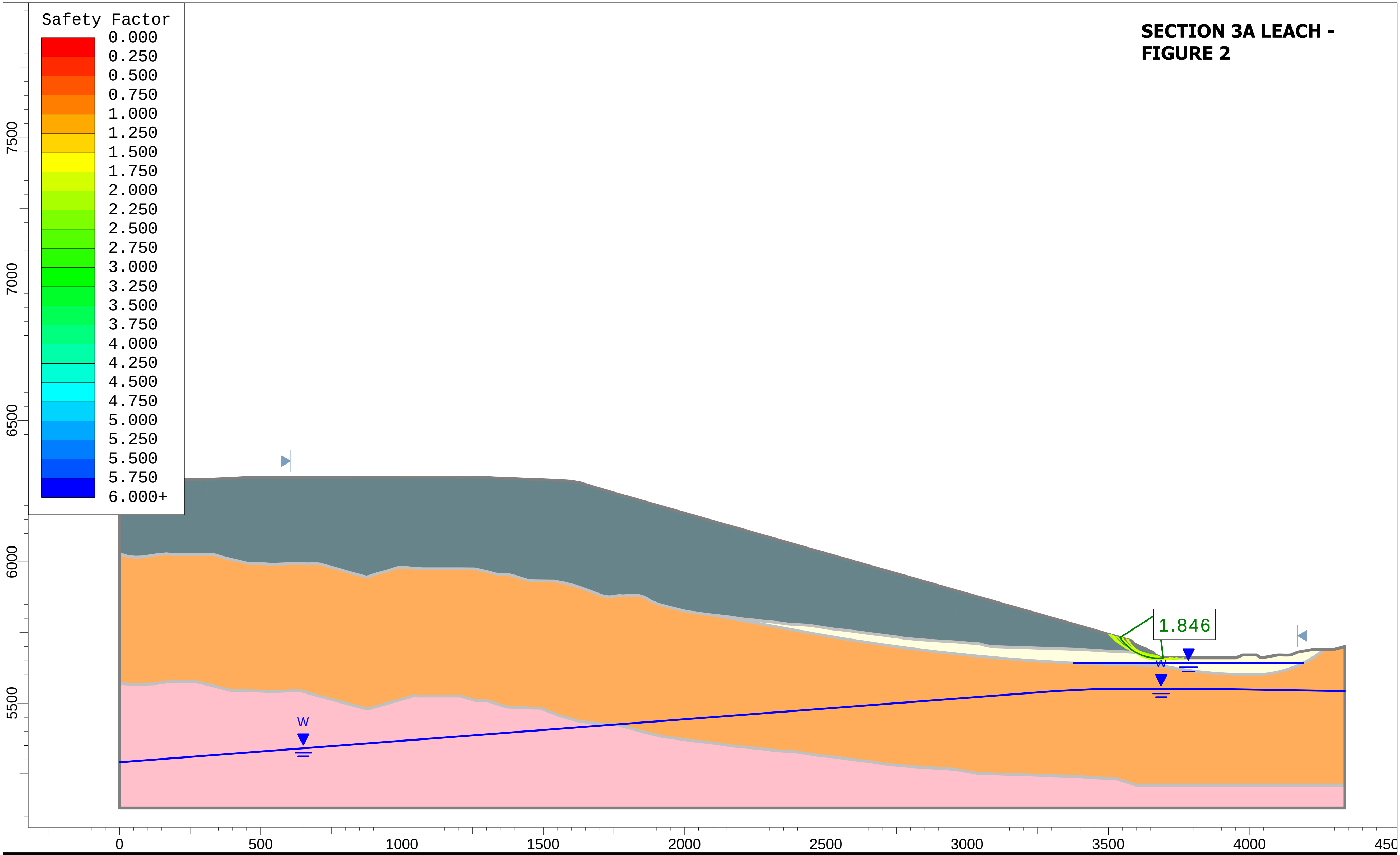
Scale 1:7099

Company Golder Associates

Date 1/2/2019

File Name 3A.slmd

SLIDEINTERPRET 8.014



SECTION 3A LEACH - FIGURE 2

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH

Analysis Description Static - Circular Failure (GLE / Morgenstern-Price)

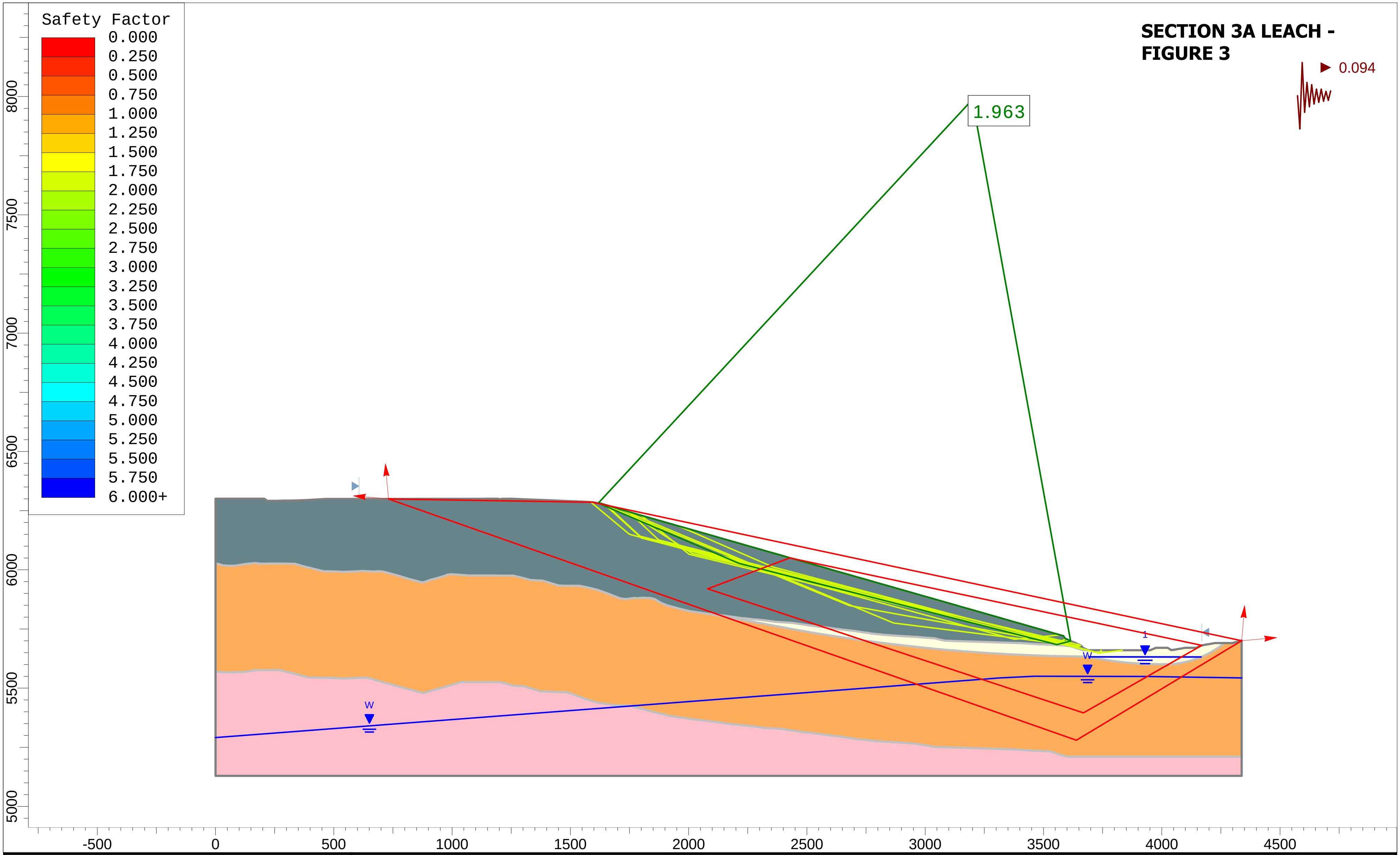
Figure

Scale 1:5639

Company Golder Associates

Date

File Name 3A.slmd



GOLDER

Project
Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH

Analysis Description
Sesimic - Block Failure (GLE / Morgenstern-Price)

Figure

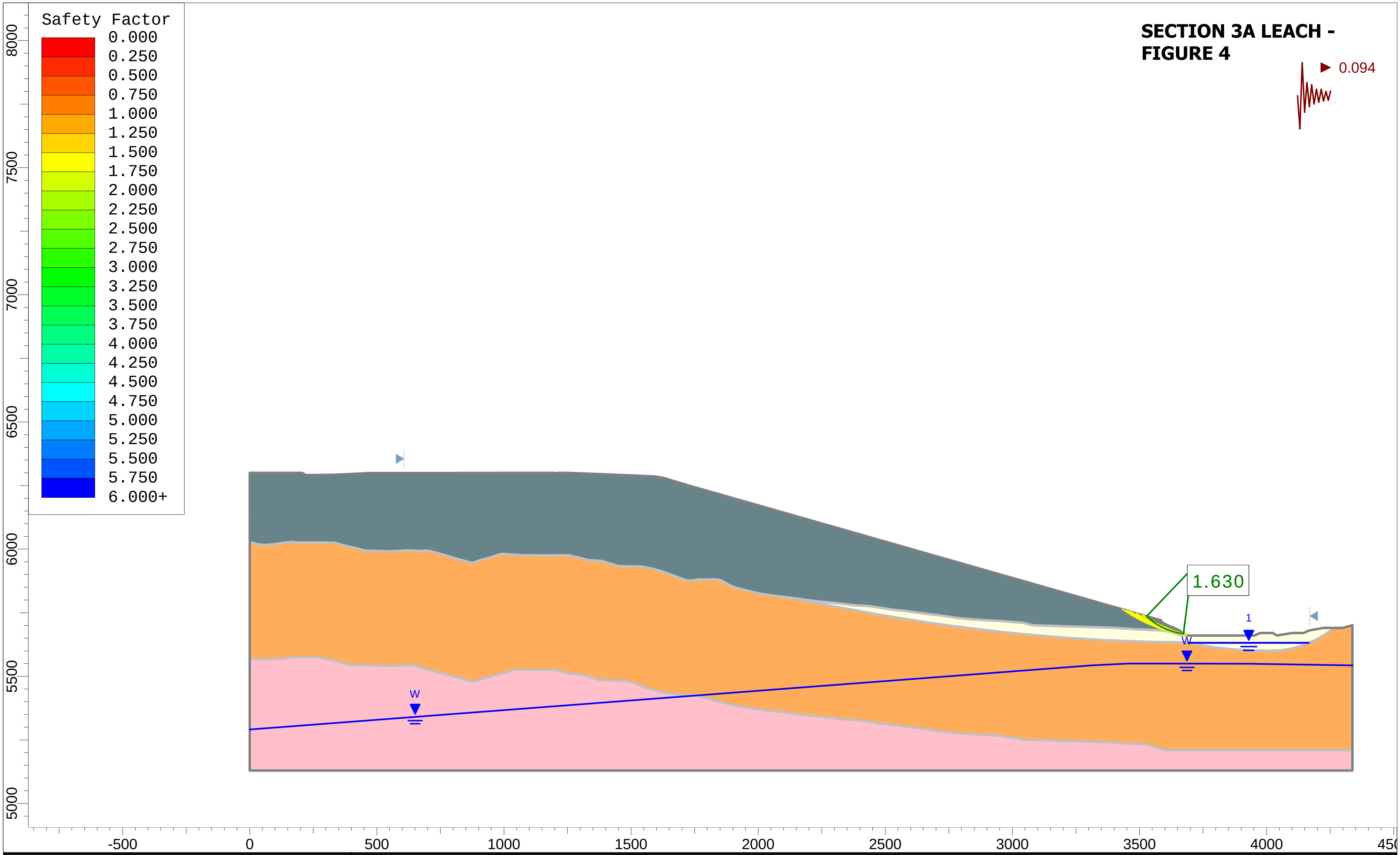
Scale 1:6735

Company Golder Associates

Date 1/2/2019

File Name 3A.slmd

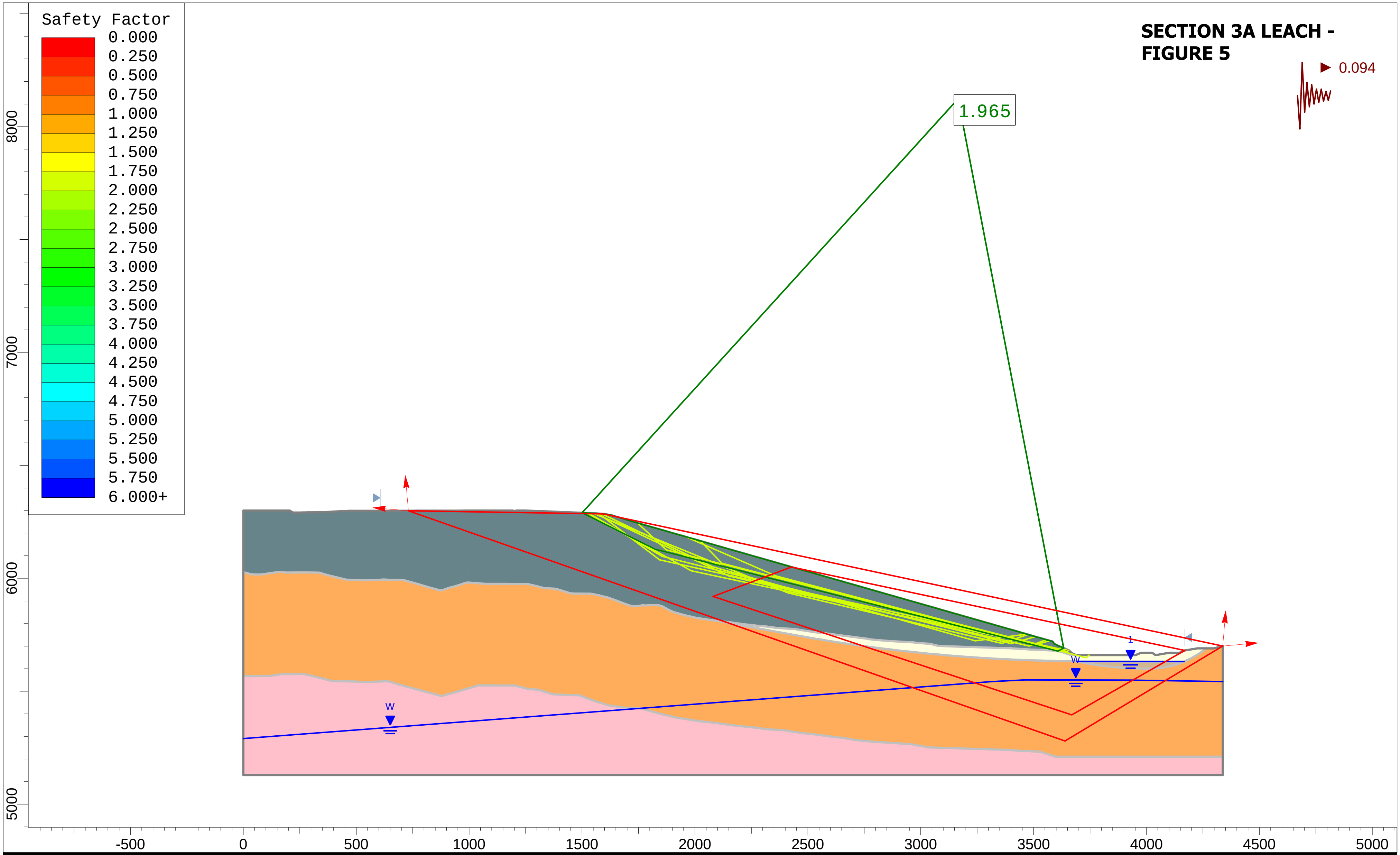
SLIDEINTERPRET 8.014



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH		
Analysis Description	Sesimic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:6268	*Company*	Golder Associates
Date 1/2/2019		*File Name*	3A.slmd

SLIDEINTERPRET 8.014

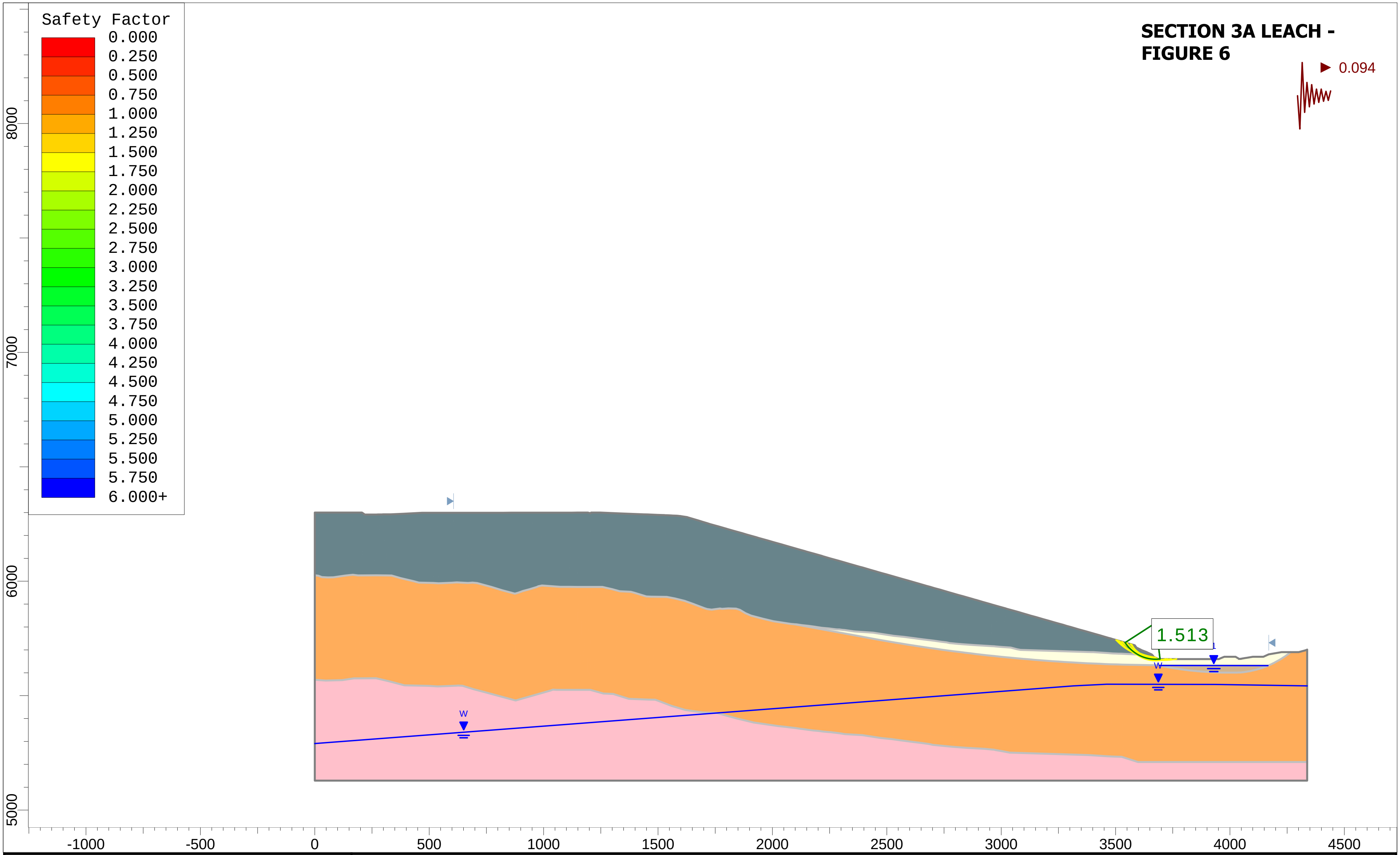


SECTION 3A LEACH -
FIGURE 5

GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH		
Analysis Description	Seismic - Liquefied Qa - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:7056	*Company*	Golder Associates
Date	1/2/2019	*File Name*	3A.slmd



Project
Tyrone Mine Closure Stockpile Stability - SECTION 3A LEACH

Analysis Description
Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)

Figure

Scale 1:6964

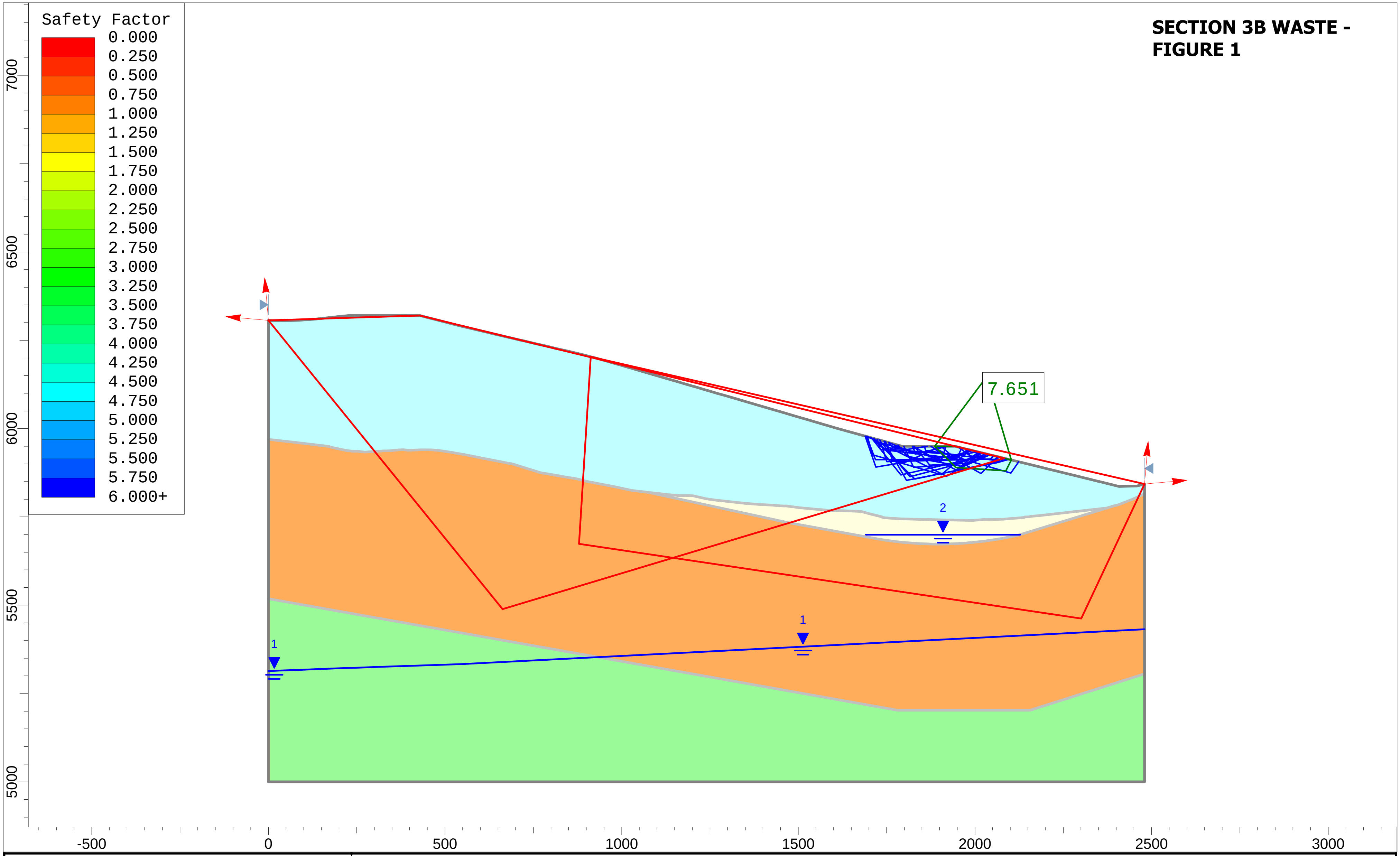
Company Golder Associates

Date 1/2/2019

File Name 3A.slmd

GOLDER

SLIDEINTERPRET 8.014



SECTION 3B WASTE - FIGURE 1

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 3B WASTE

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

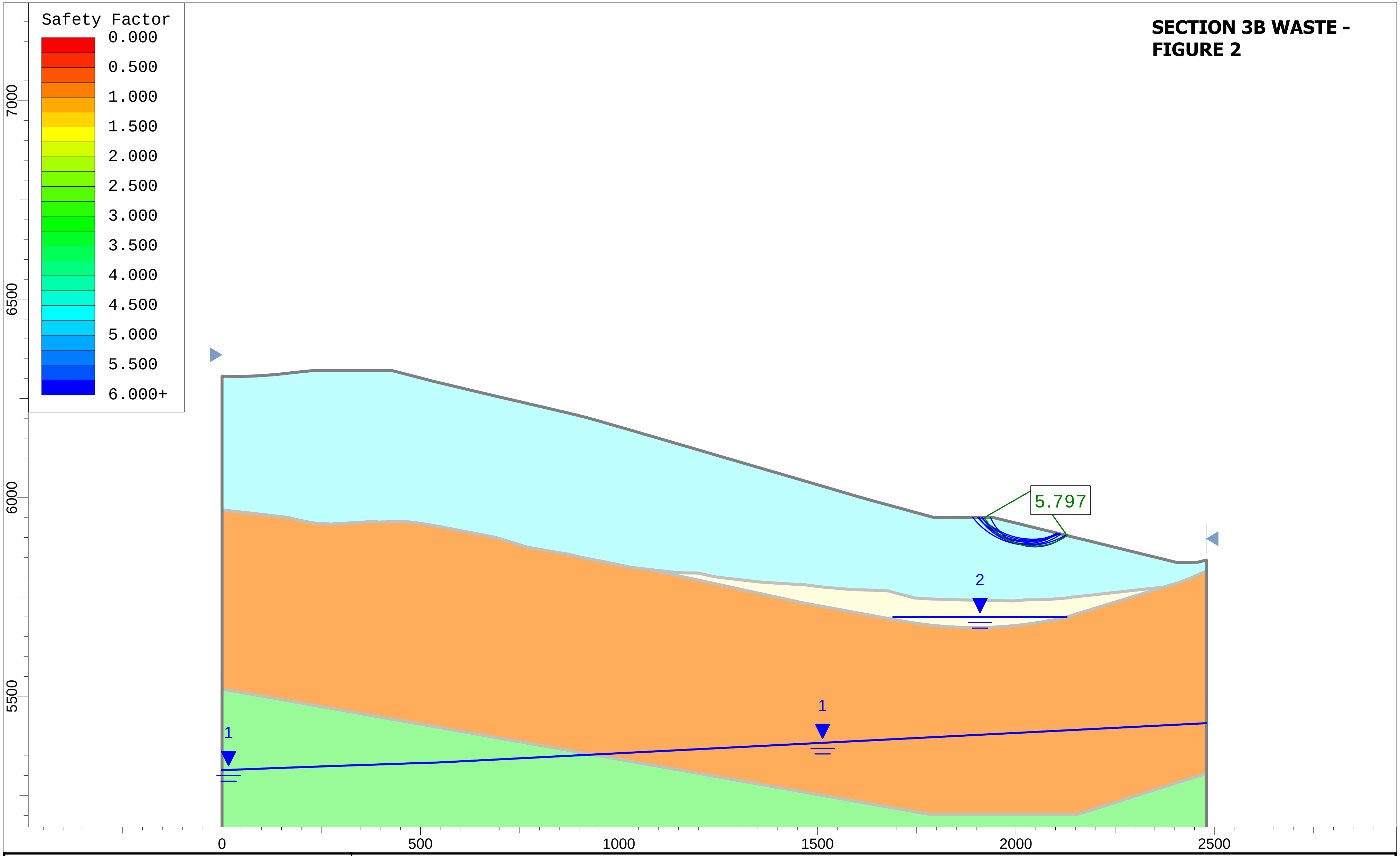
Scale 1:4510

Company Golder Associates

Date 1/2/2019

File Name 3B.slmd

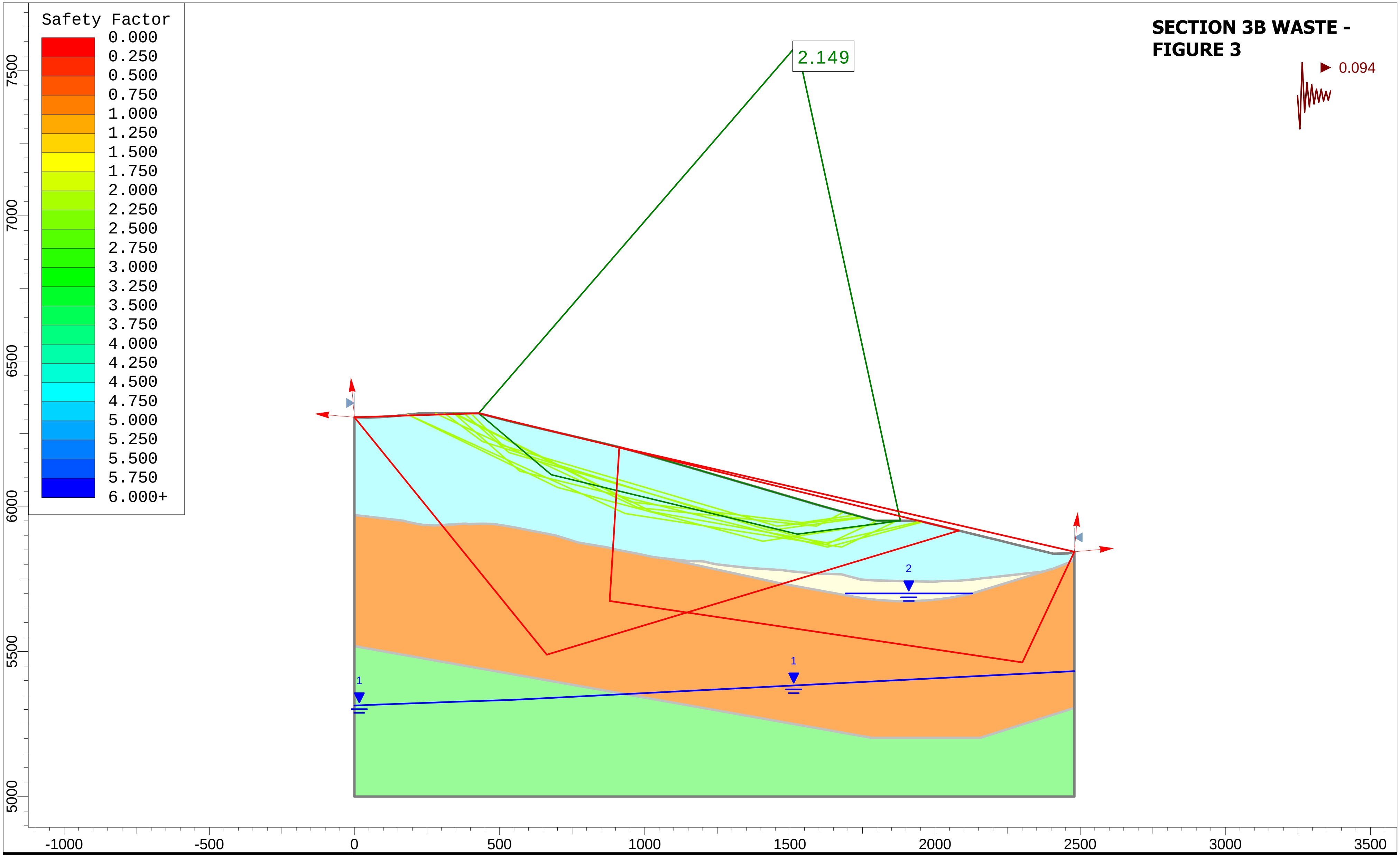
SECTION 3B WASTE - FIGURE 2



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4013	*Company*	Golder Associates
Date		*File Name*	3B.slmd

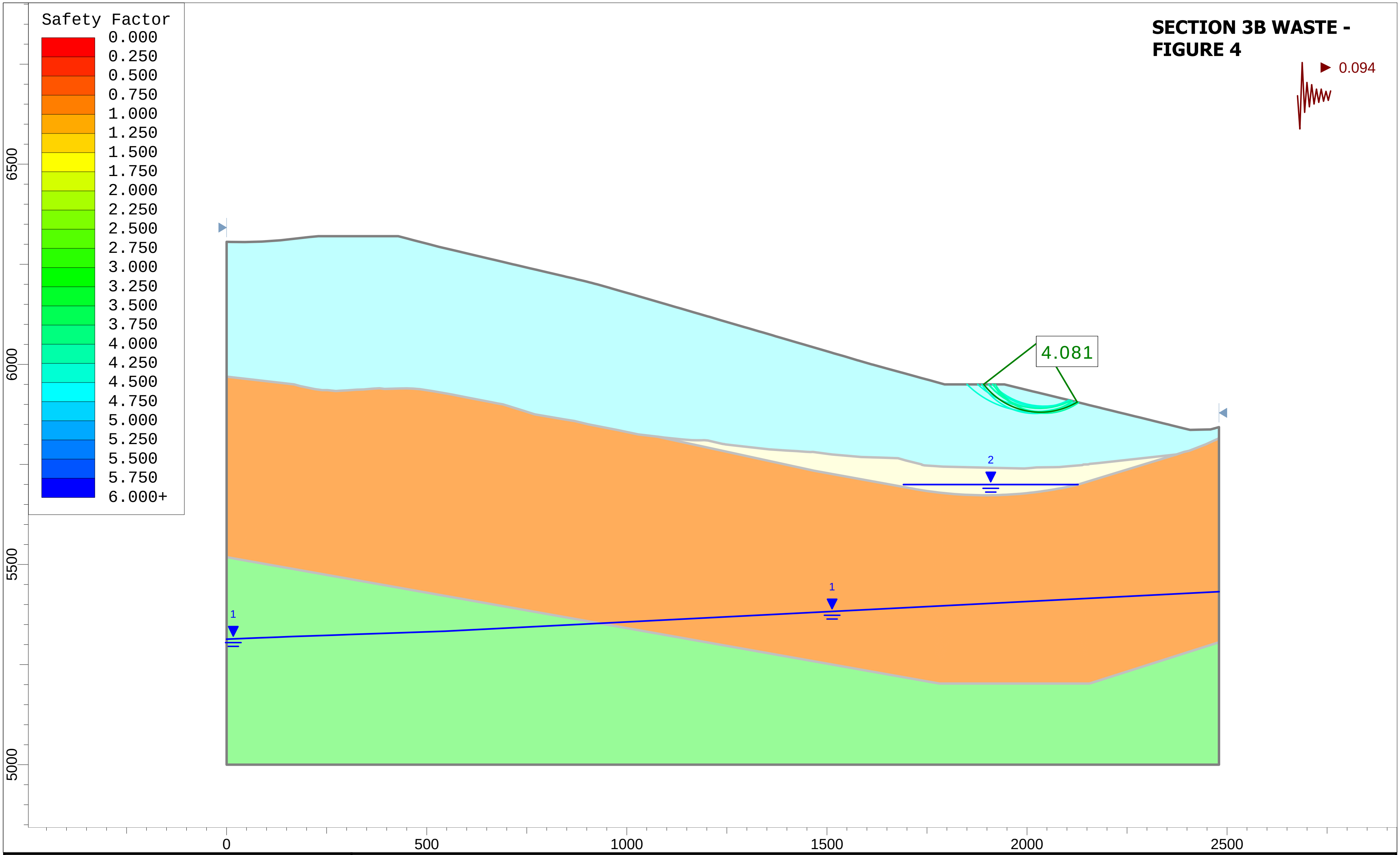


Project	Tyrone Mine Closure Stockpile Stability - SECTION 3B WASTE
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:5488	*Company*	Golder Associates
Date	1/2/2019			*File Name*	3B.slmd

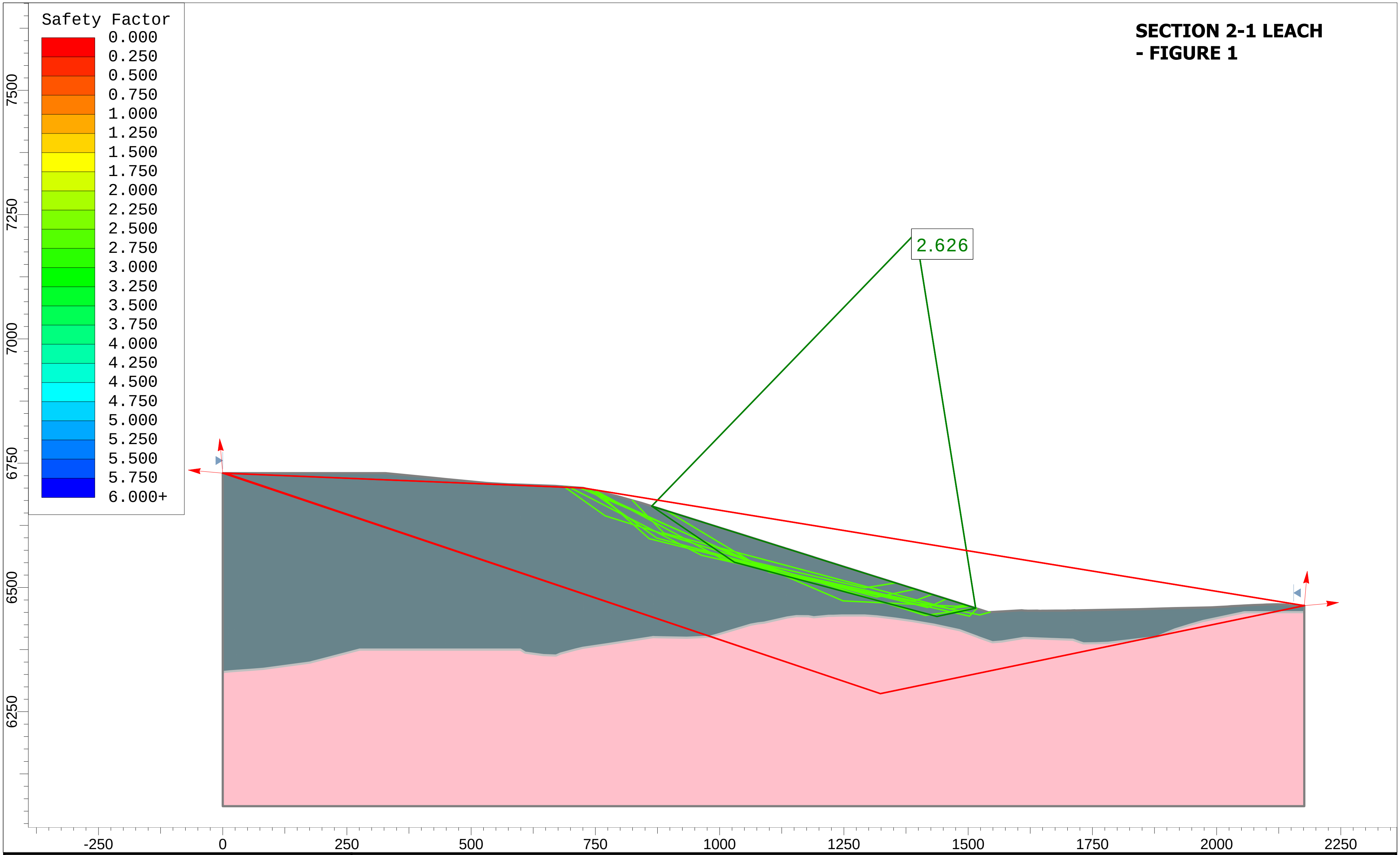
GOLDER

SLIDEINTERPRET 8.014



Project	Tyrone Mine Closure Stockpile Stability - SECTION 3B WASTE
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3981
Company	Golder Associates
Date	1/2/2019
File Name	3B.slmd

SLIDEINTERPRET 8.014

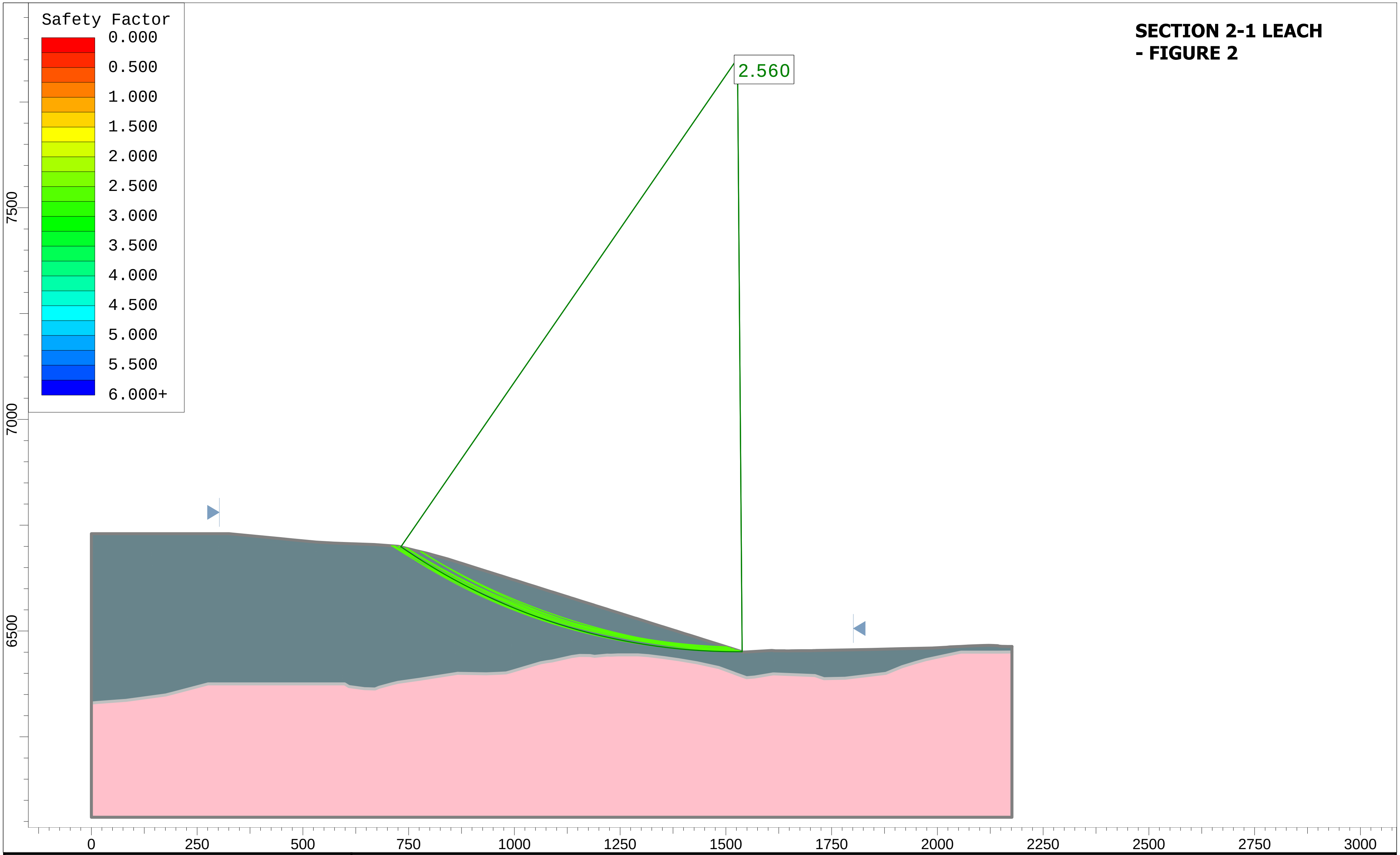


Project	Tyrone Mine Closure Stockpile Stability - SECTION 2 LEACH (Area 1)
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3206
Company	Golder Associates
Date	1/2/2019
File Name	4C-1.slmd

GOLDER

SLIDEINTERPRET 8.014

SECTION 2-1 LEACH - FIGURE 2



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 2 LEACH (Area 1)

Analysis Description Static - Circular Failure (GLE / Morgenstern-Price)

Figure

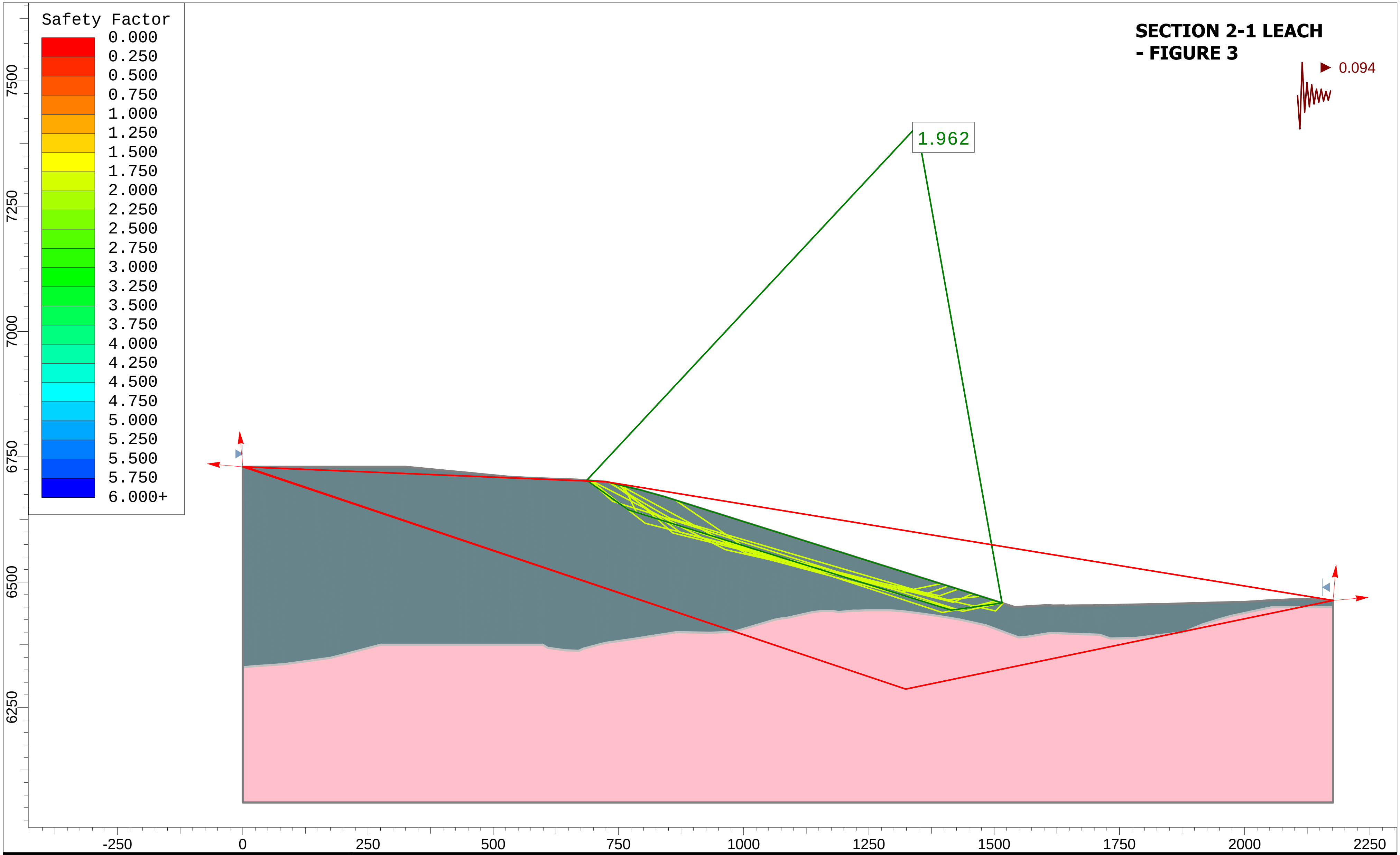
Scale 1:3766

Company Golder Associates

Date

File Name 4C-1.slmd

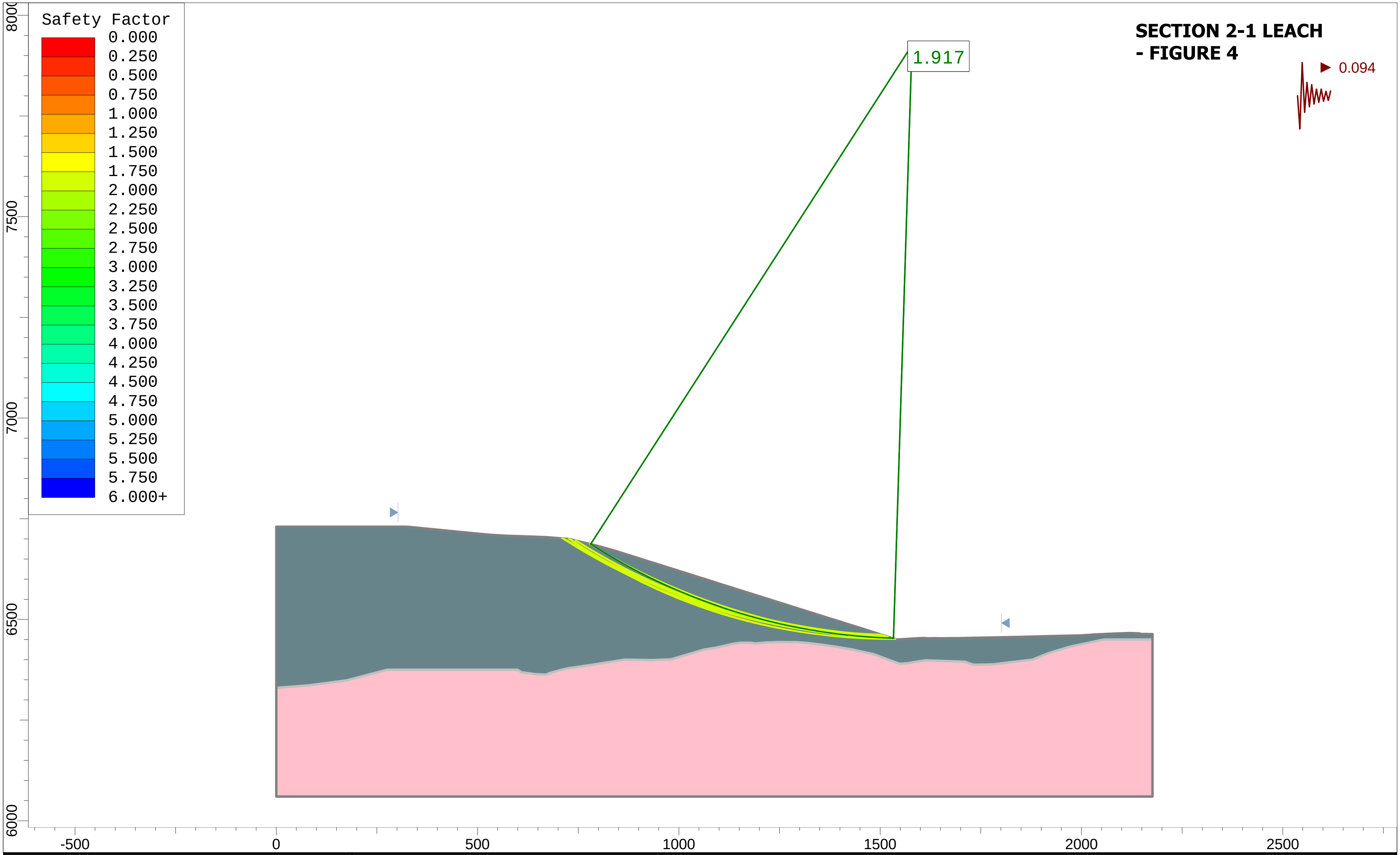
SECTION 2-1 LEACH - FIGURE 3



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 2 LEACH (Area 1)
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3180
Company	Golder Associates
Date	1/2/2019
File Name	4C-1.slmd

SLIDEINTERPRET 8.014



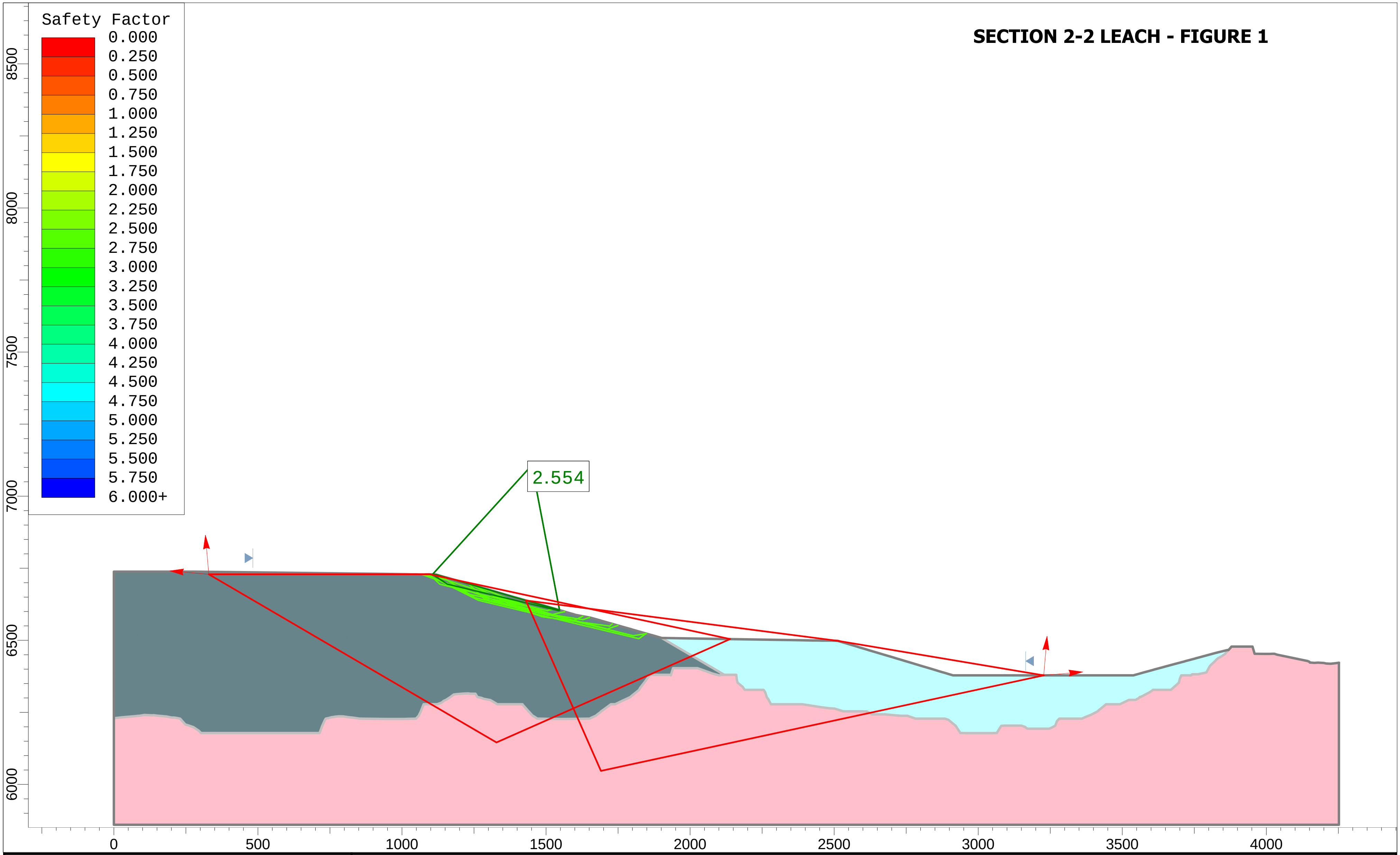
Project	Tyrone Mine Closure Stockpile Stability - SECTION 2 LEACH (Area 1)
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure	*Scale* 1:3958	*Company*	Golder Associates
Date 1/2/2019		*File Name*	4C-1.slmd

GOLDER

SLIDEINTERPRET 8.014

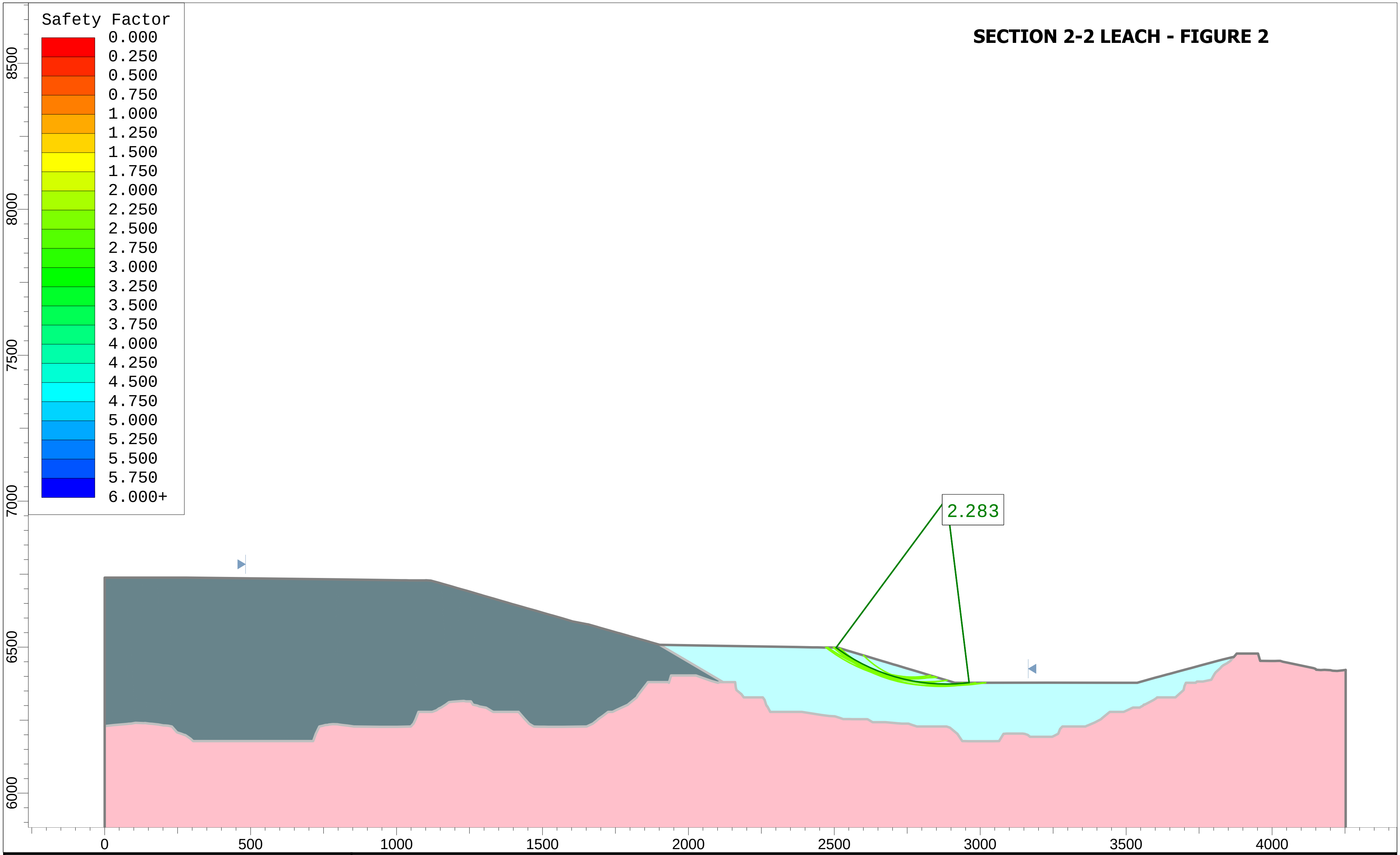
SECTION 2-2 LEACH - FIGURE 1



Project	Tyrone Mine Closure Stockpile Stability - 2 Leach (Area 2) and San Salvador In-Pit		
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:5530	*Company*	Golder Associates
Date	1/2/2019	*File Name*	SS.slmd

GOLDER

SLIDEINTERPRET 8.014



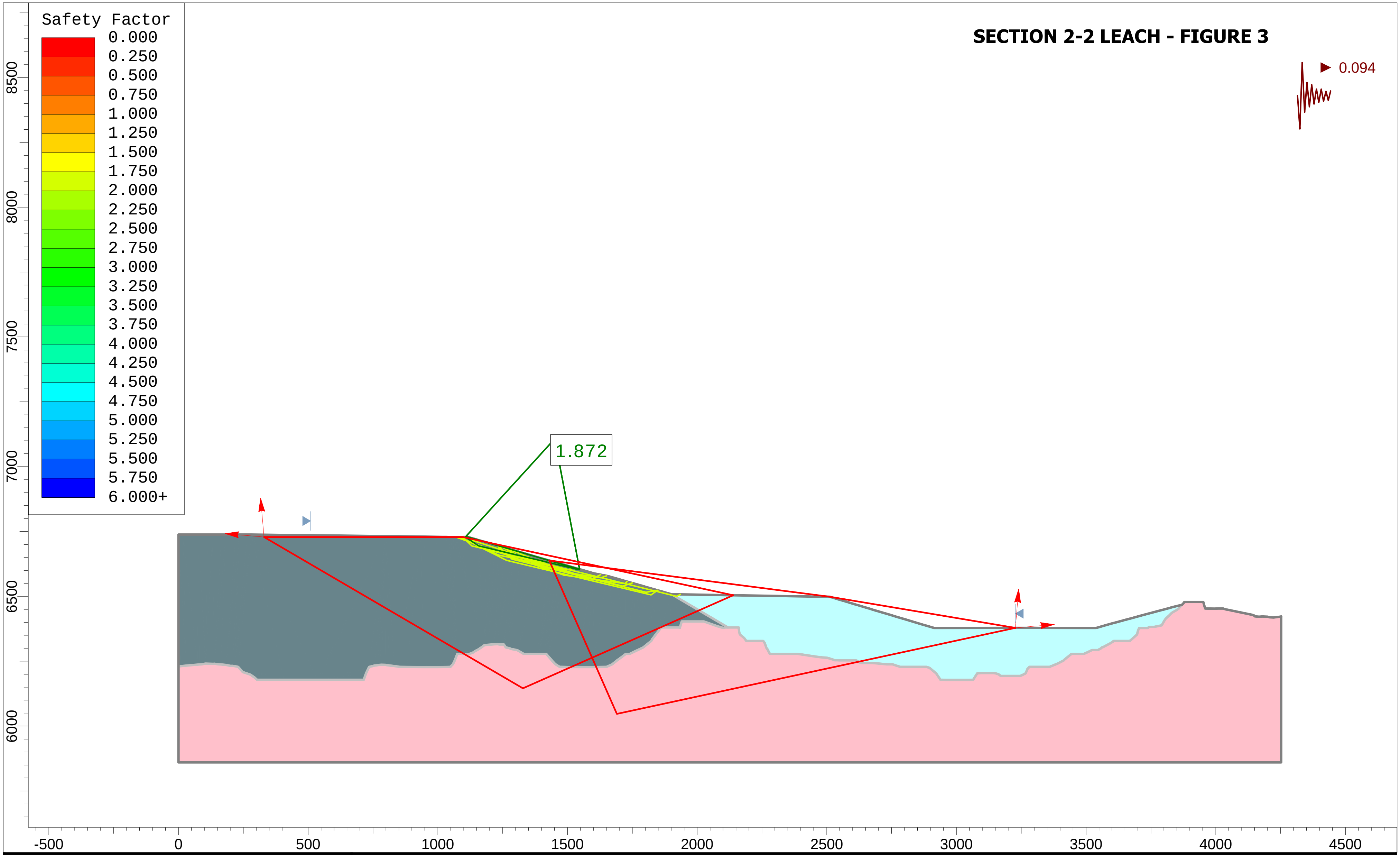
SECTION 2-2 LEACH - FIGURE 2

Project	Tyrone Mine Closure Stockpile Stability - 2 Leach (Area 2) and San Salvador In-Pit
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:5459
Company	Golder Associates
Date	
File Name	SS.slmd

GOLDER

SLIDEINTERPRET 8.014

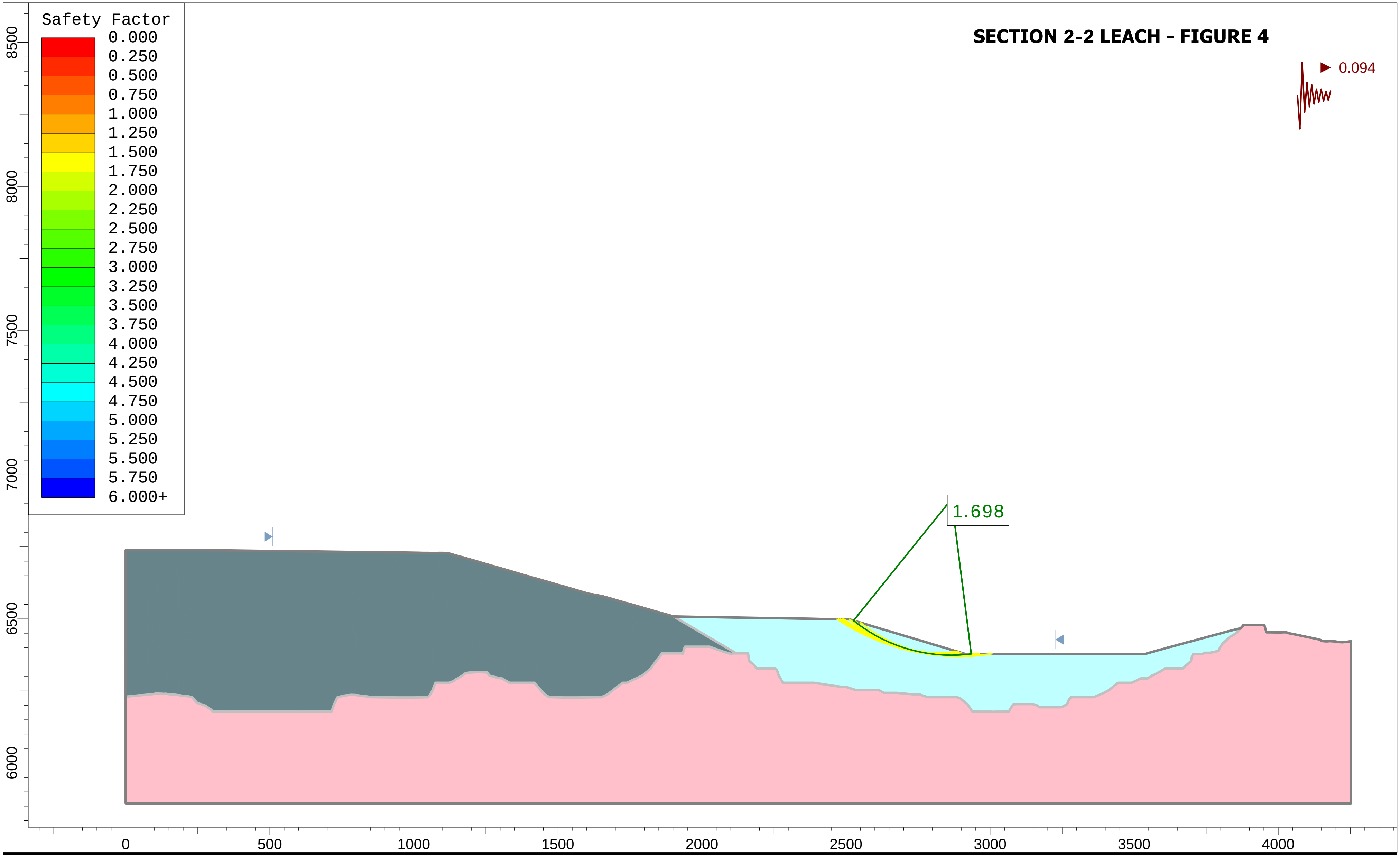
SECTION 2-2 LEACH - FIGURE 3



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - 2 Leach (Area 2) and San Salvador In-Pit
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:6144
Company	Golder Associates
Date	1/2/2019
File Name	SS.slmd

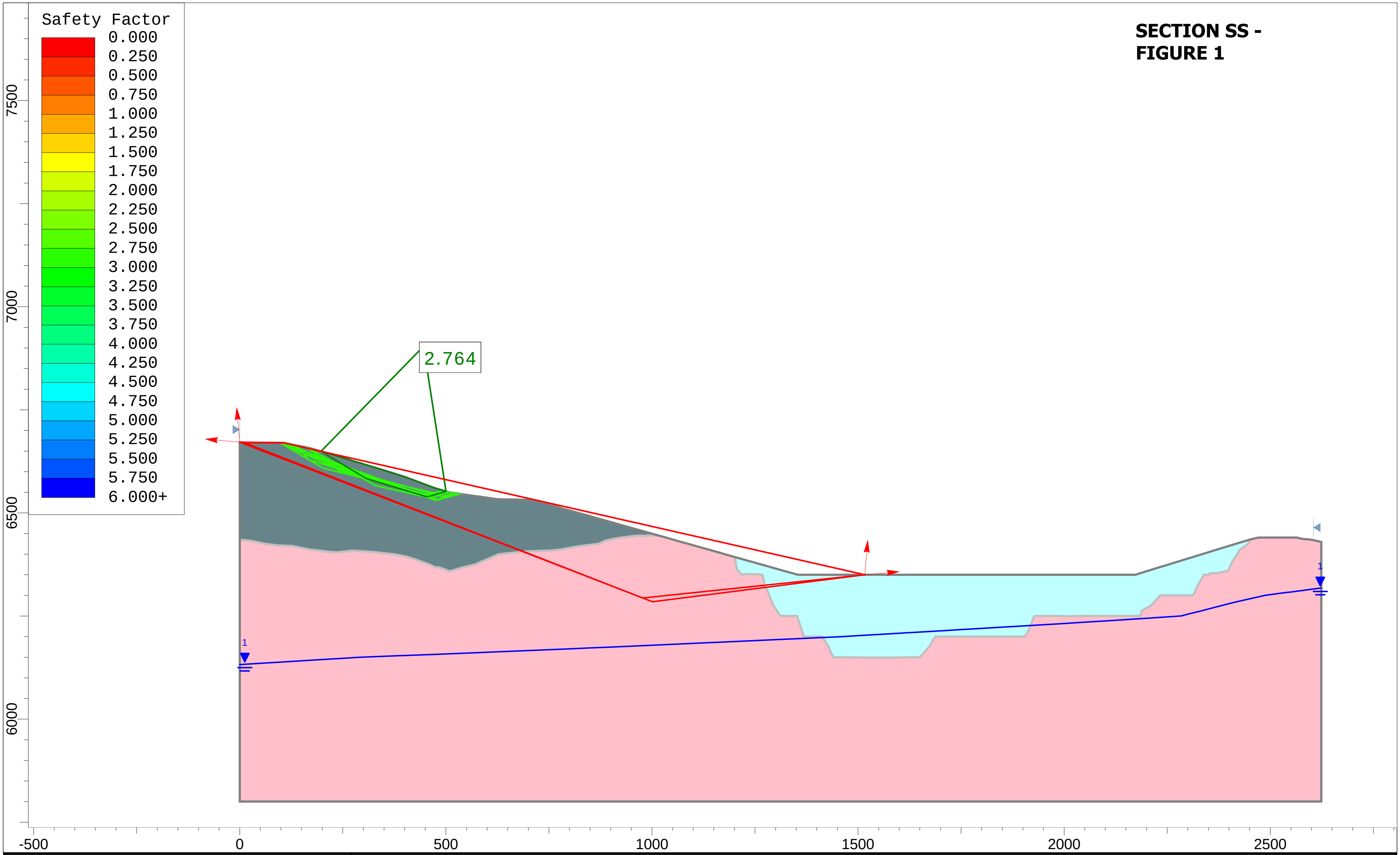


GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - 2 Leach (Area 2) and San Salvador In-Pit
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:5530	*Company*	Golder Associates
Date	1/2/2019			*File Name*	SS.slmd



**SECTION SS -
FIGURE 1**

GOLDER

Project: Tyrone Mine Closure Stockpile Stability - San Salvador Waste Backfill (2 Leach Area 1)

Analysis Description: Static - Block Failure (GLE / Morgenstern-Price)

Figure:

Scale: 1:3865

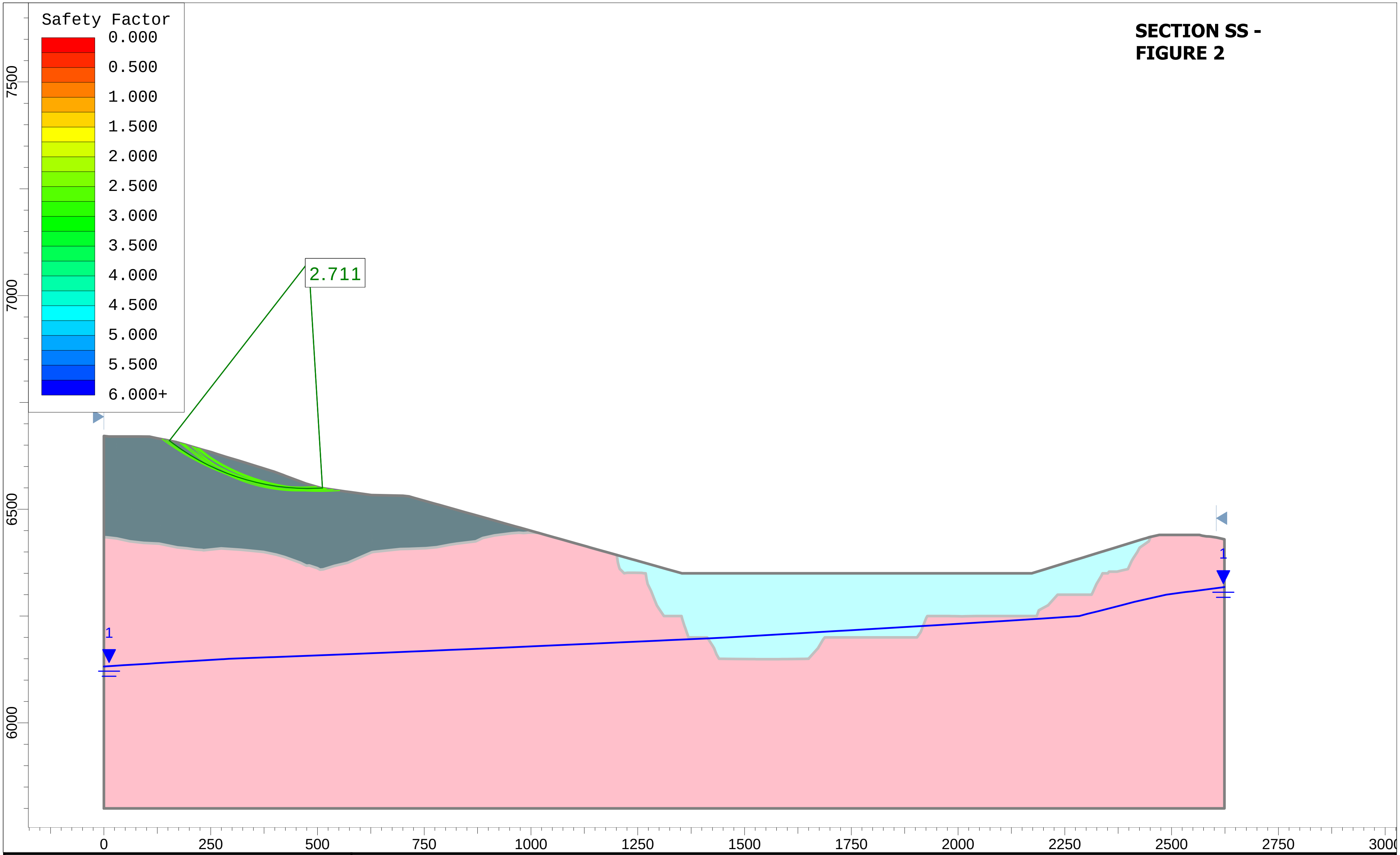
Company: Golder Associates

Date: 1/2/2019

File Name: 4C-2.slmd

SLIDEINTERPRET 8.014

SECTION SS -
FIGURE 2



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - San Salvador Waste Backfill (2 Leach Area 1)

Analysis Description
Static - Circular Failure (GLE / Morgenstern-Price)

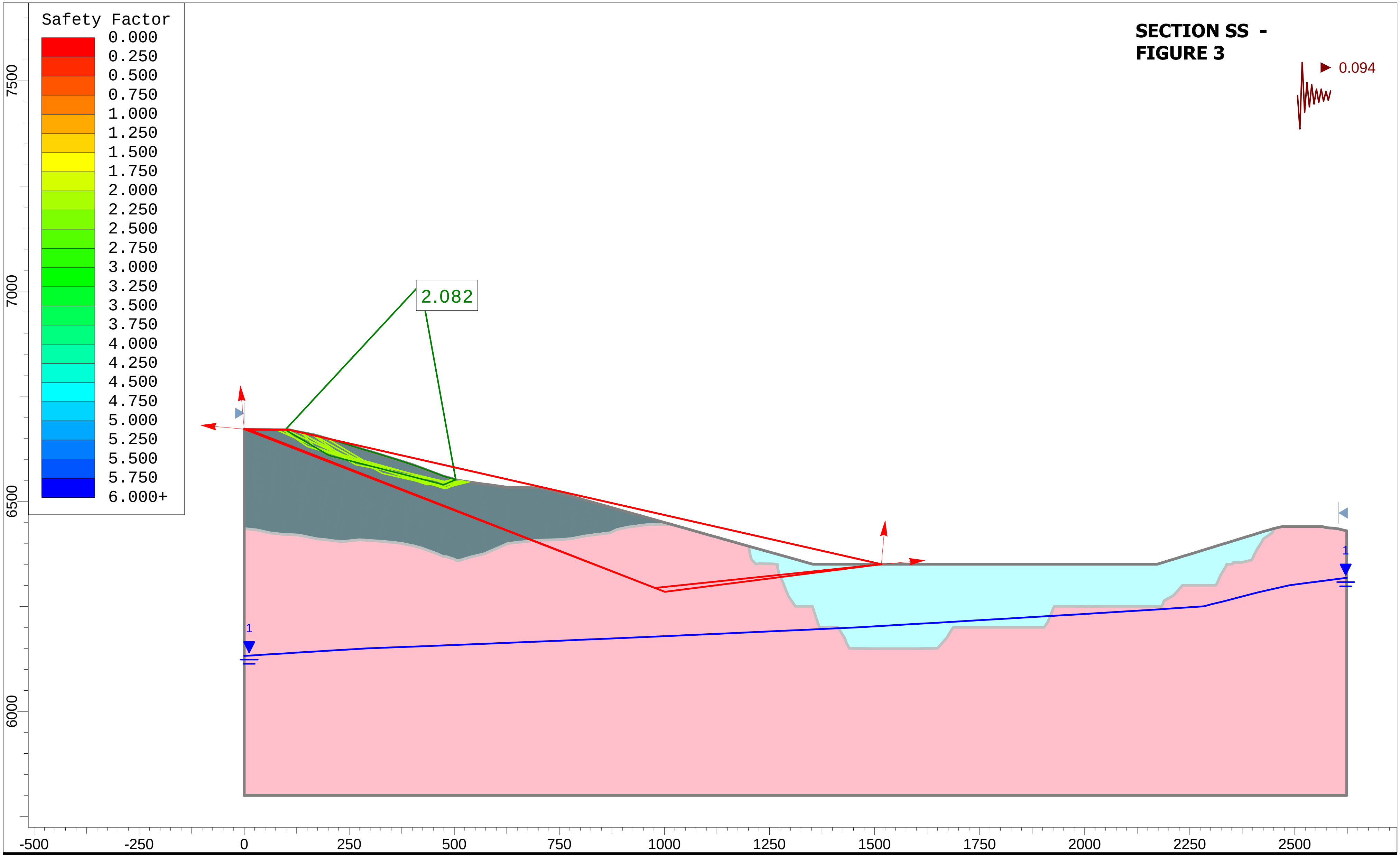
Figure

Scale 1:3730

Company Golder Associates

Date

File Name 4C-2.slmd



Project Tyrone Mine Closure Stockpile Stability - San Salvador Waste Backfill (2 Leach Area 1)

Analysis Description Seismic - Block Failure (GLE / Morgenstern-Price)

Figure

Scale 1:3791

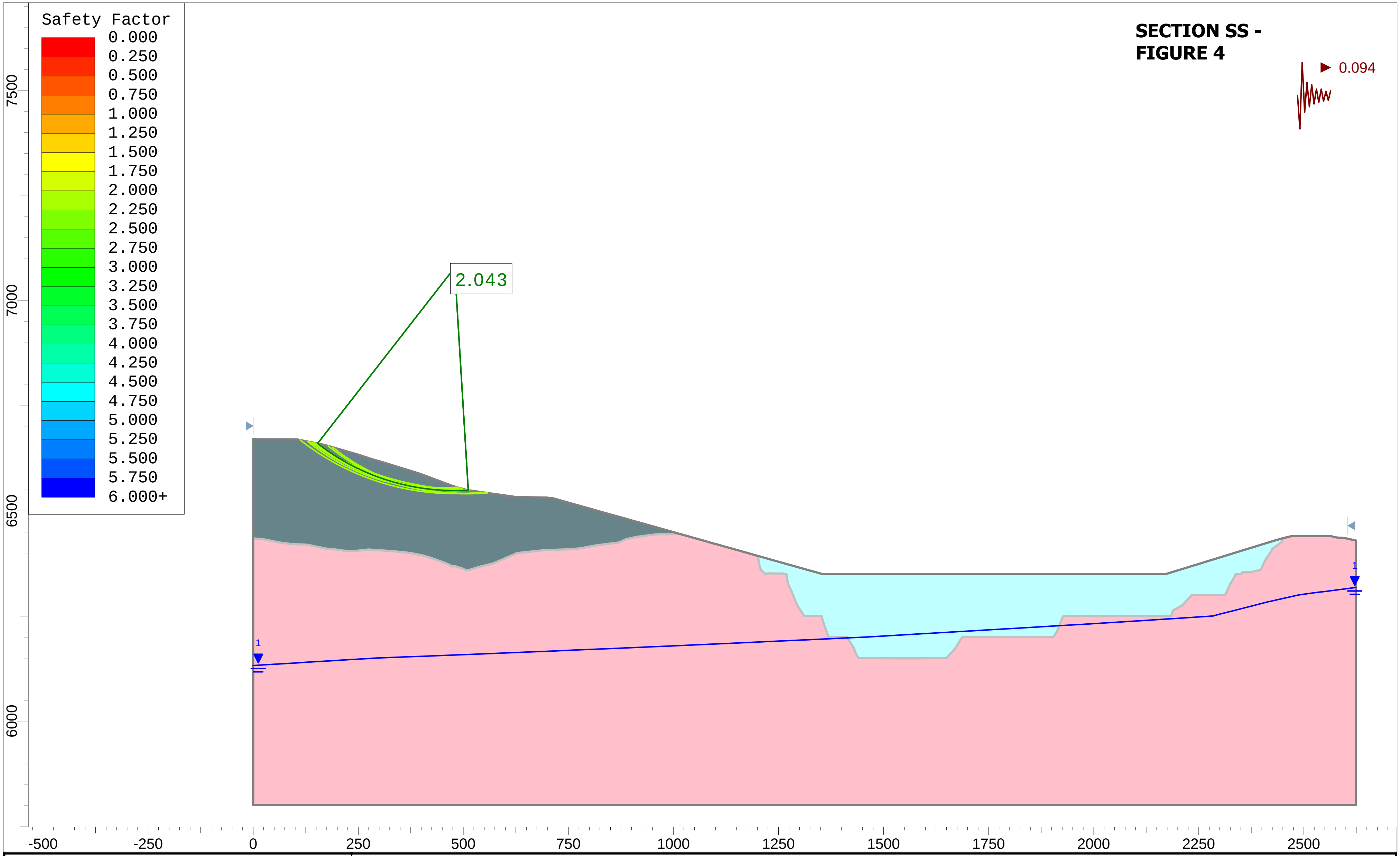
Company Golder Associates

Date 1/2/2019

File Name 4C-2.slmd

SLIDEINTERPRET 8.014

SECTION SS - FIGURE 4

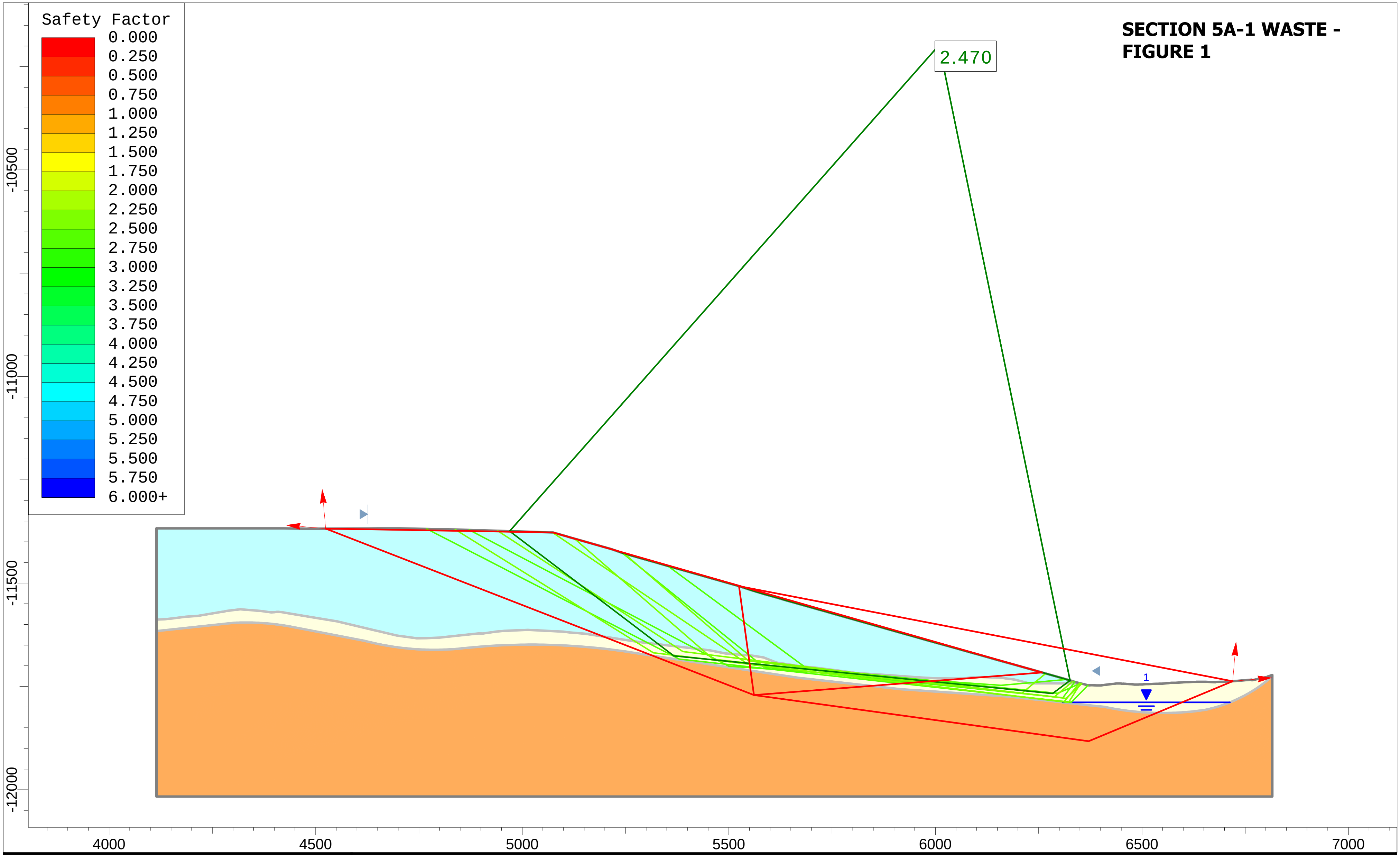


Project	Tyrone Mine Closure Stockpile Stability - San Salvador Waste Backfill (2 Leach Area 1)
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure	*Scale* 1:3791	*Company*	Golder Associates
Date 1/2/2019		*File Name*	4C-2.slmd

GOLDER

SLIDEINTERPRET 8.014



SECTION 5A-1 WASTE - FIGURE 1

GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE

Analysis Description
Static - Block Failure (GLE / Morgenstern-Price)

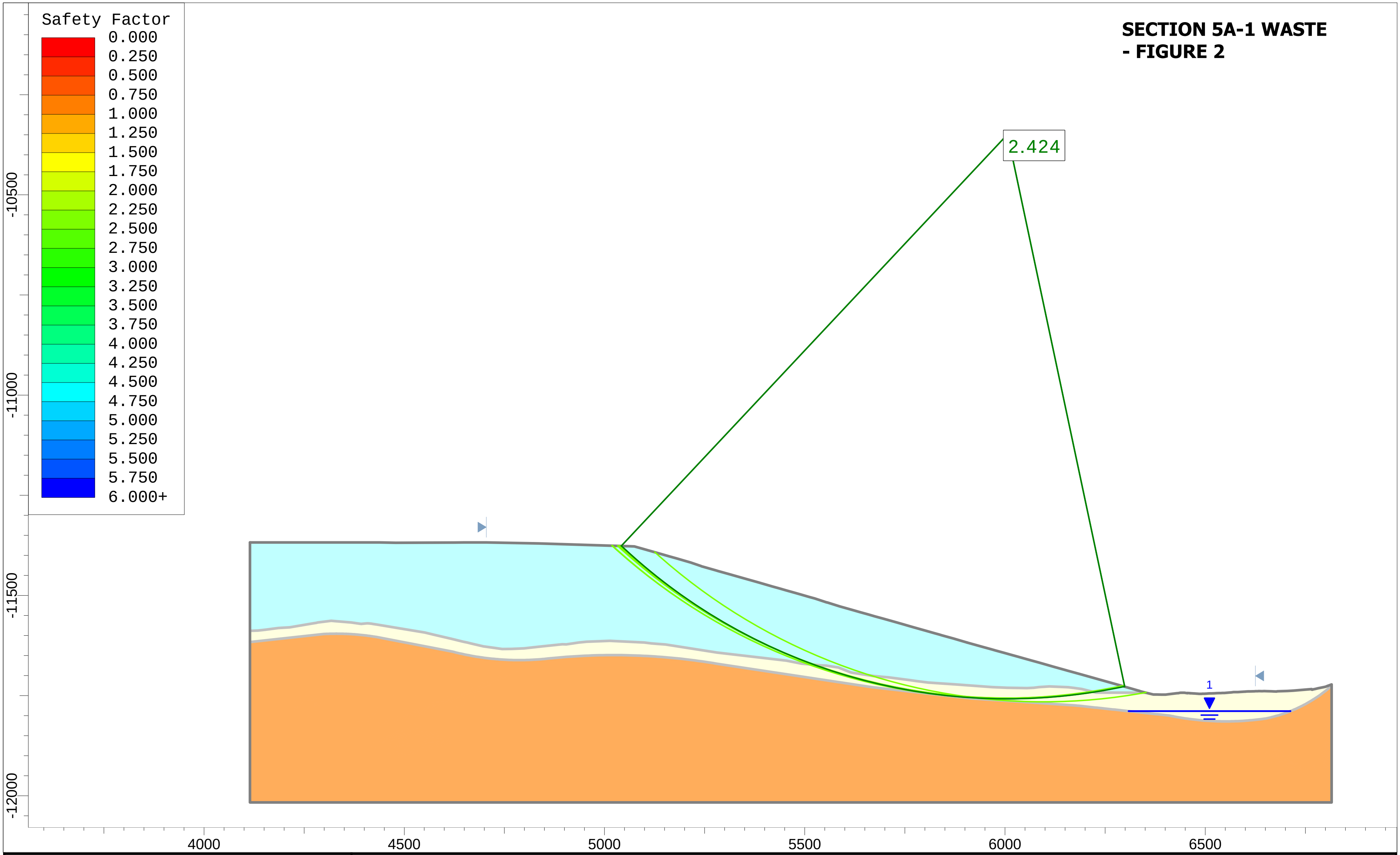
Figure

Scale 1:3857

Company

Date 4/8/2019, 10:08:36 AM

File Name 3c5a(2).slmd

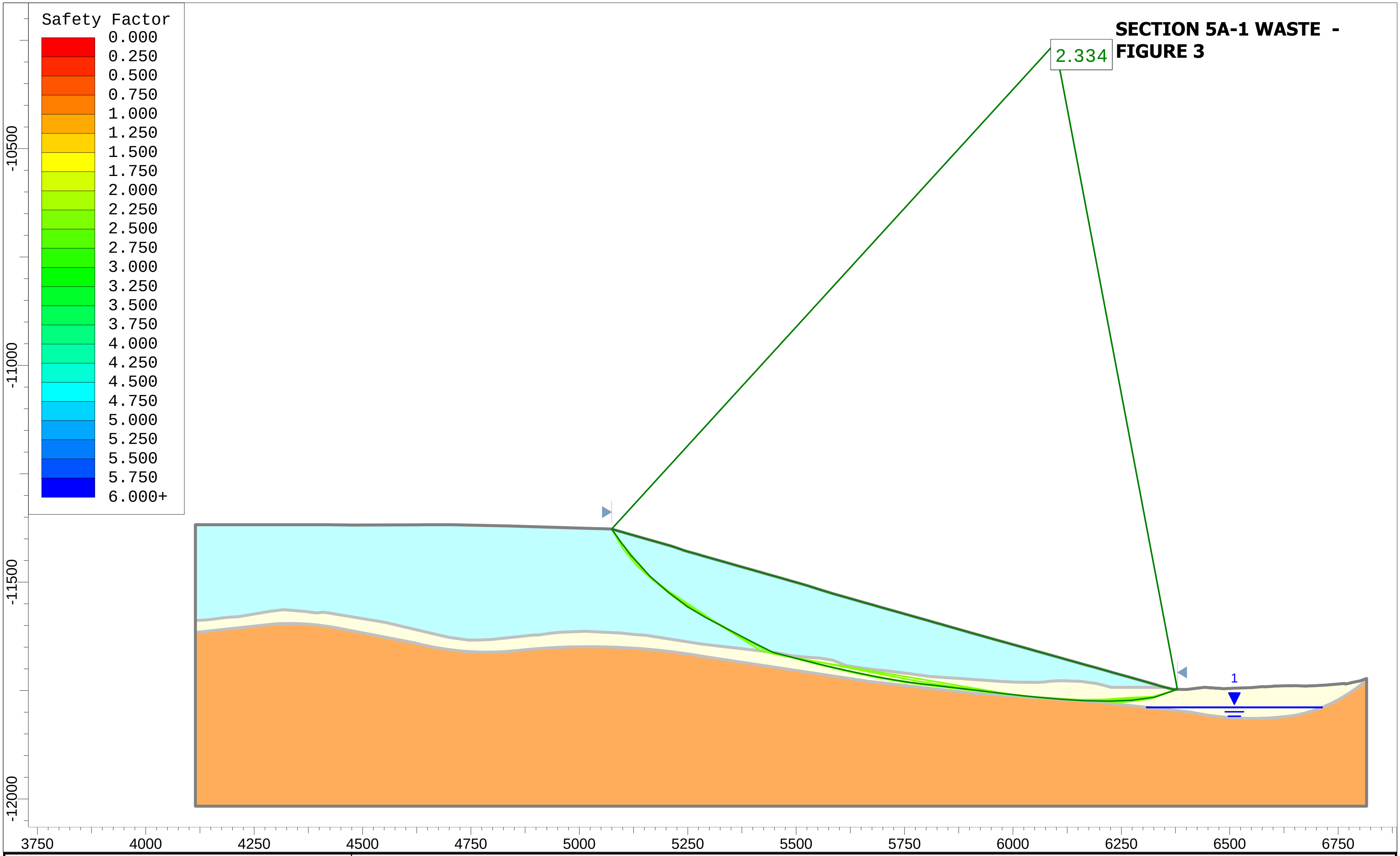


GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - SECTION 5A-1 WASTE
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:3978	*Company*	
Date	4/8/2019, 10:08:36 AM			*File Name*	3c5a(2).slmd



GOLDER

Project: Tyrone Closure Stockpile Stability - SECTION 5A-1 WASTE

Analysis Description: Static - Cuckoo Failure (GLE / Morgenstern-Price)

Figure:

Scale: 1:3675

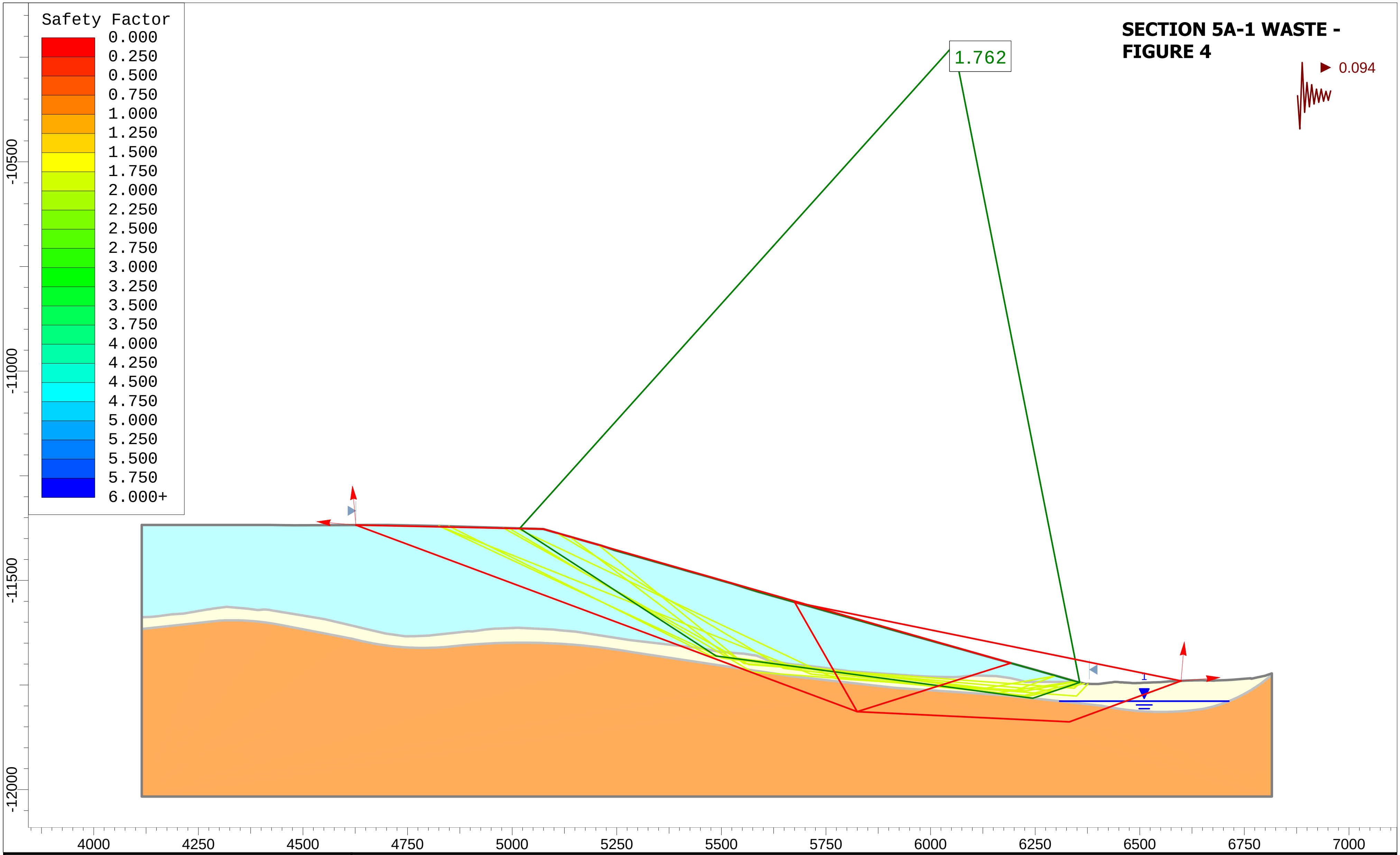
Company:

Date: 4/8/2019, 10:08:36 AM

File Name: 3c5a(2).slmd

SLIDEINTERPRET 8.014

SECTION 5A-1 WASTE - FIGURE 4



GOLDER

Project
Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE

Analysis Description
Seismic - Block Failure (GLE / Morgenstern-Price)

Figure

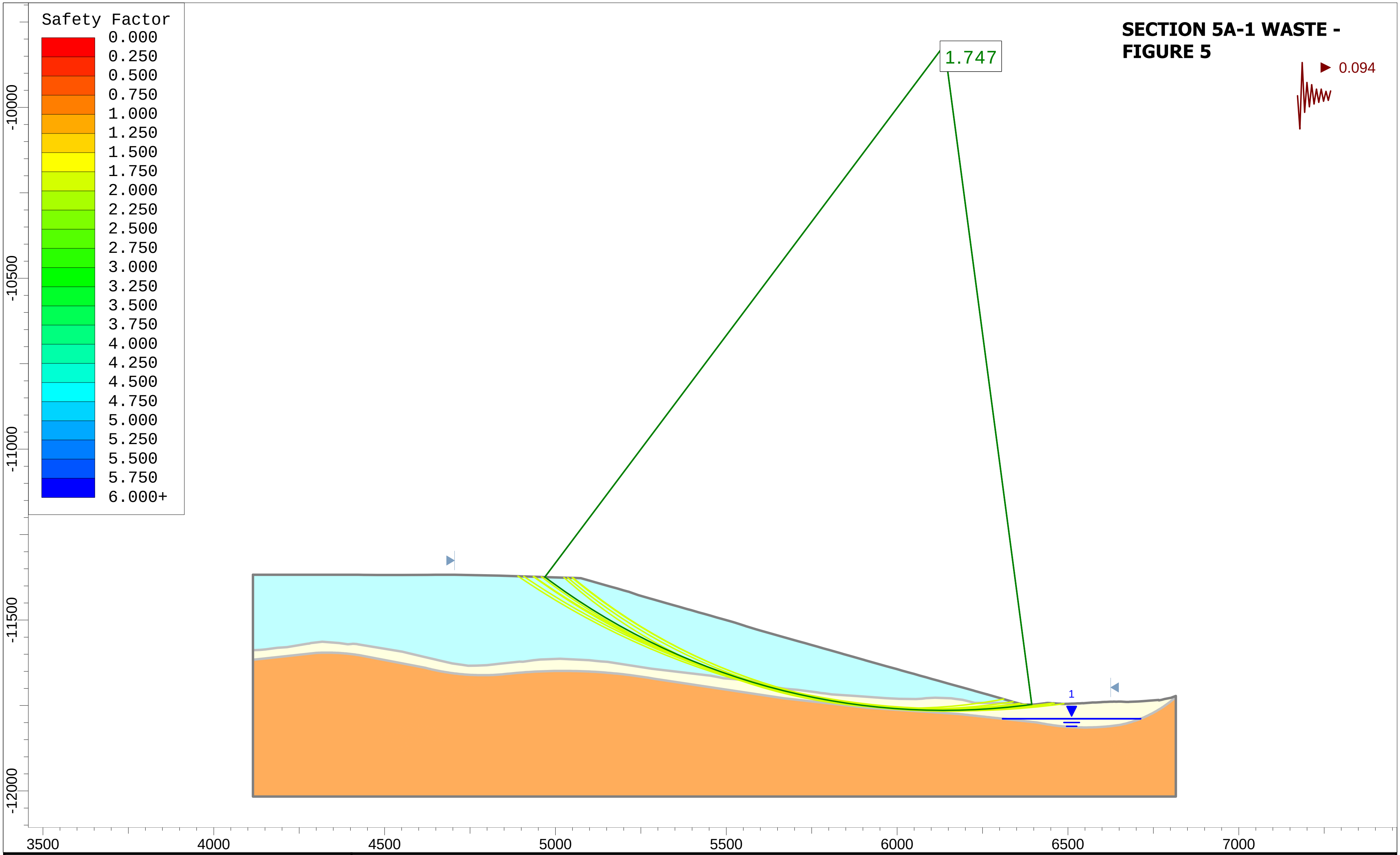
Scale 1:3808

Company

Date 4/8/2019, 10:08:36 AM

File Name 3c5a(2).slmd

SLIDEINTERPRET 8.014

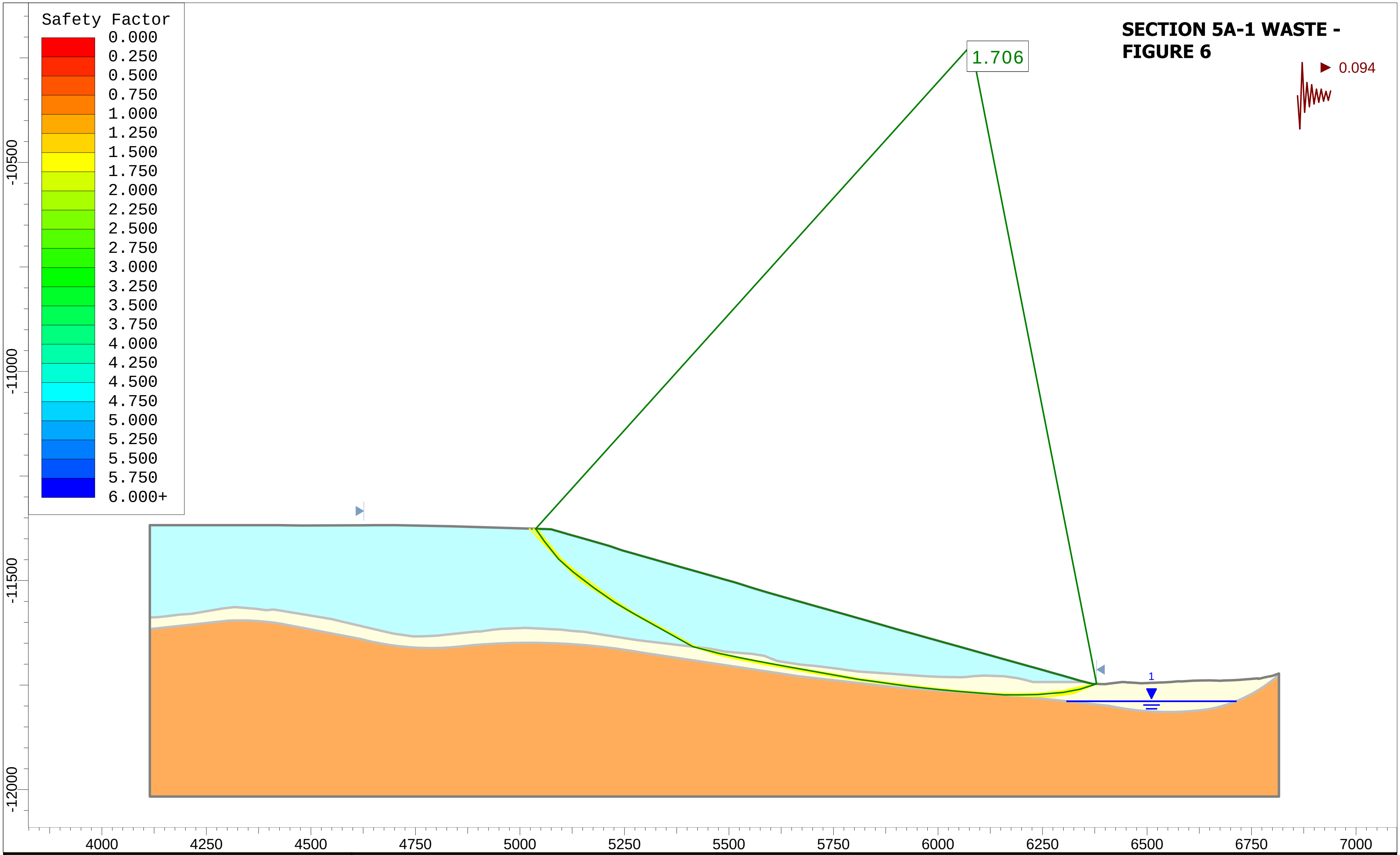

SECTION 5A-1 WASTE - FIGURE 5

GOLDER

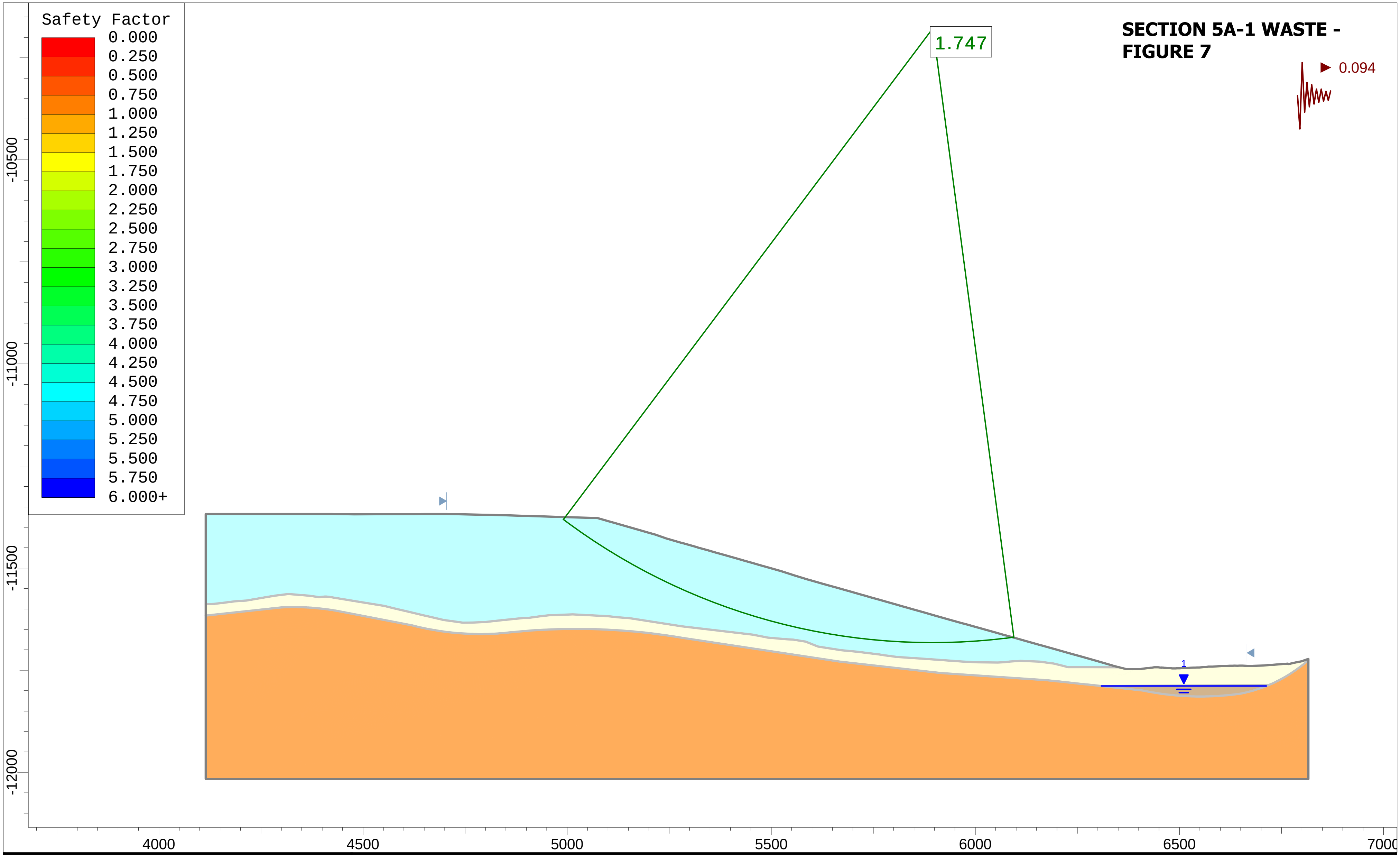
SLIDEINTERPRET 8.014

Project	Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure	*Scale* 1:4663	*Company*	
Date	4/8/2019, 10:08:36 AM	*File Name*	3c5a(2).slmd



GOLDER	*Project* Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE
	Analysis Description Seismic - Cuckoo Failure (GLE / Morgenstern-Price)
	Figure / *Scale* 1:3811 / *Company*
SLIDEINTERPRET 8.014	*Date* 4/8/2019, 10:08:36 AM / *File Name* 3c5a(2).slmd



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE

Analysis Description
Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)

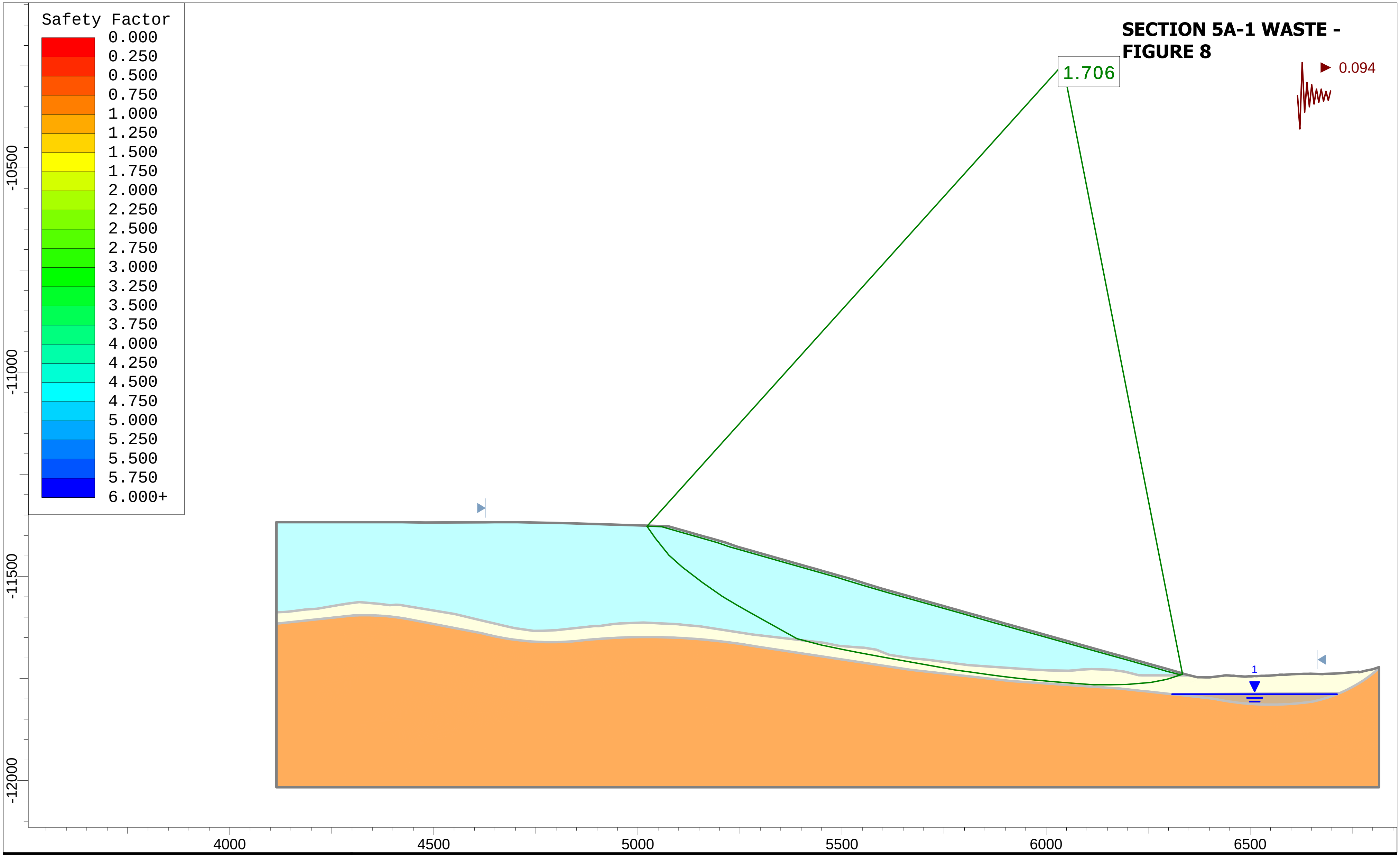
Figure

Scale 1:3903

Company

Date 4/8/2019, 10:08:36 AM

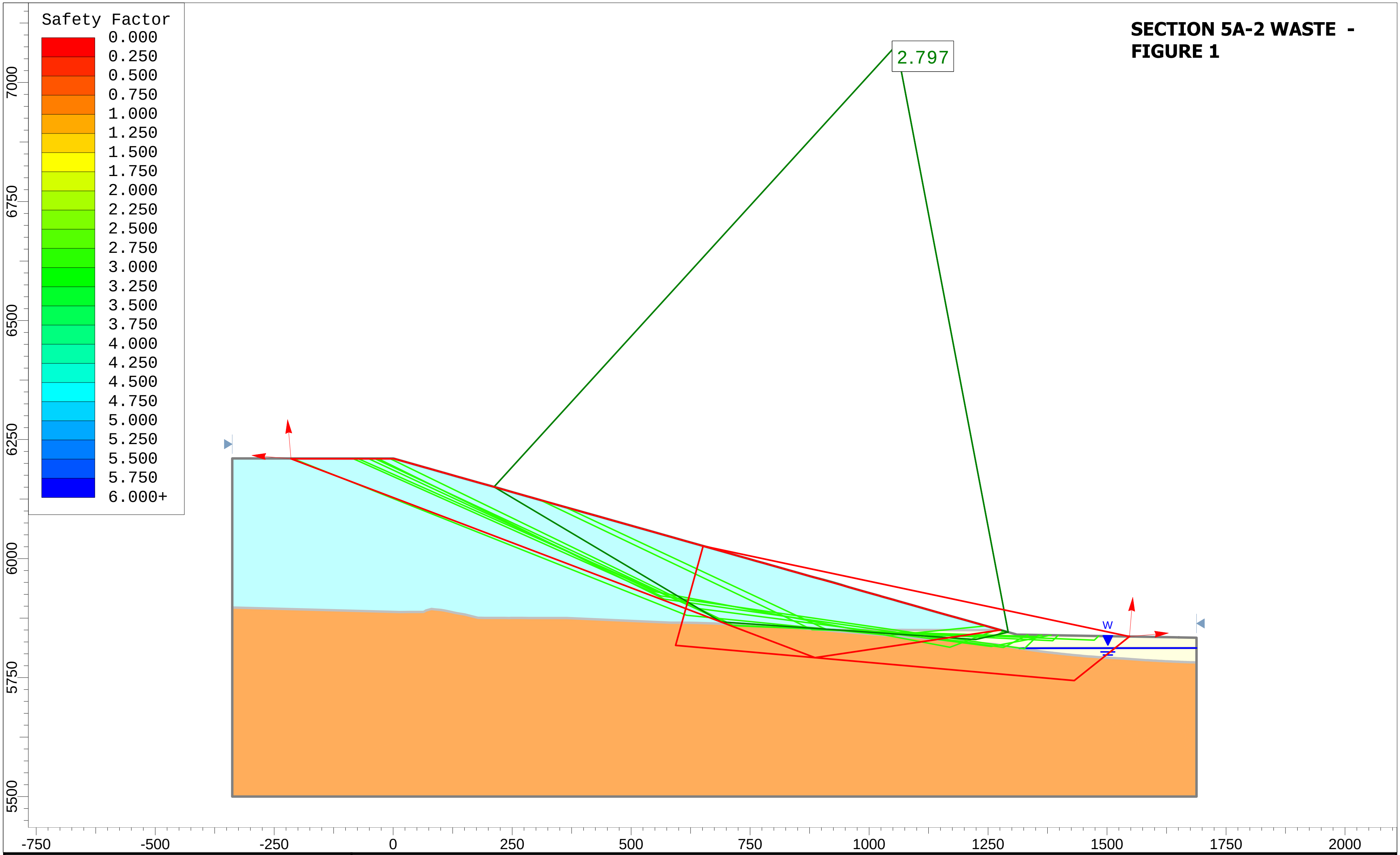
File Name 3c5a(2).slmd



SLIDEINTERPRET 8.014

Project	Tyrone Closure Closeout Stability Anaylsis - SECTION 5A-1 WASTE
Analysis Description	Seismic - Liquefied Qa - Cuckoo Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:3903	*Company*	
Date	4/8/2019, 10:08:36 AM			*File Name*	3c5a(2).slmd



SECTION 5A-2 WASTE - FIGURE 1

GOLDER

Project Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

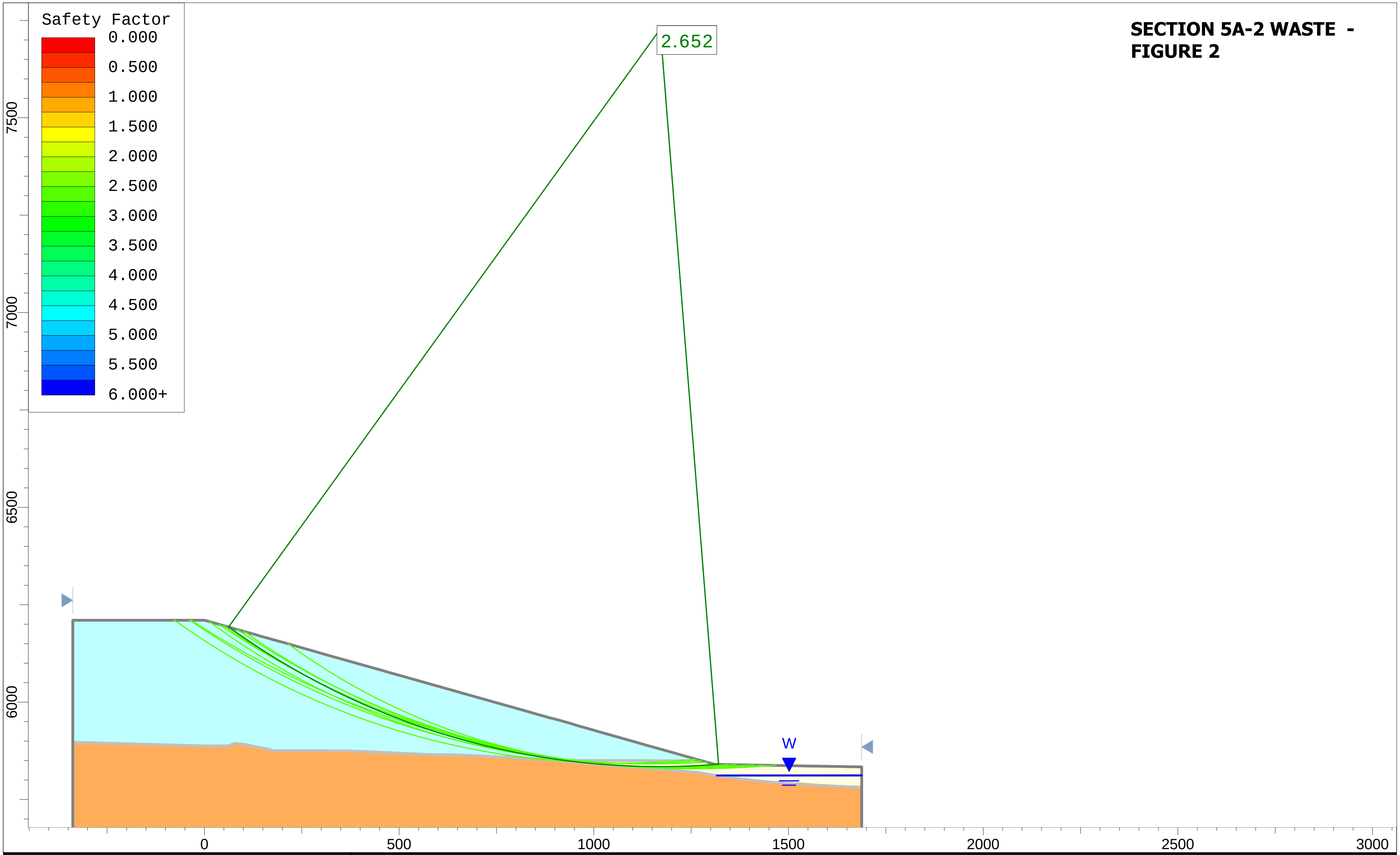
Scale 1:3348

Company Golder Associates

Date 1/2/2019

File Name 5B.slmd

SLIDEINTERPRET 8.014

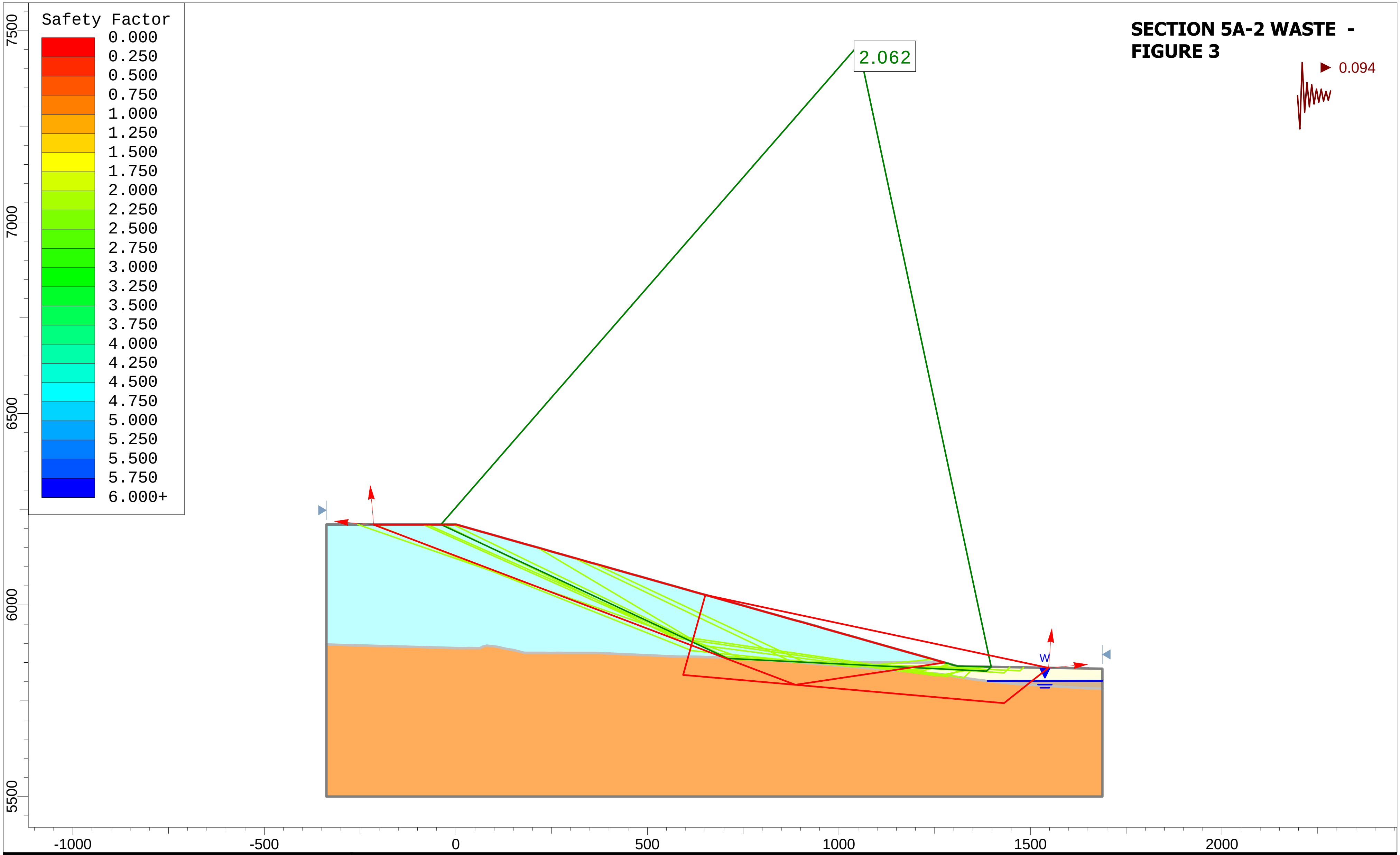


SECTION 5A-2 WASTE - FIGURE 2

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4091	*Company*	Golder Associates
Date		*File Name*	5B.slmd

SLIDEINTERPRET 8.014



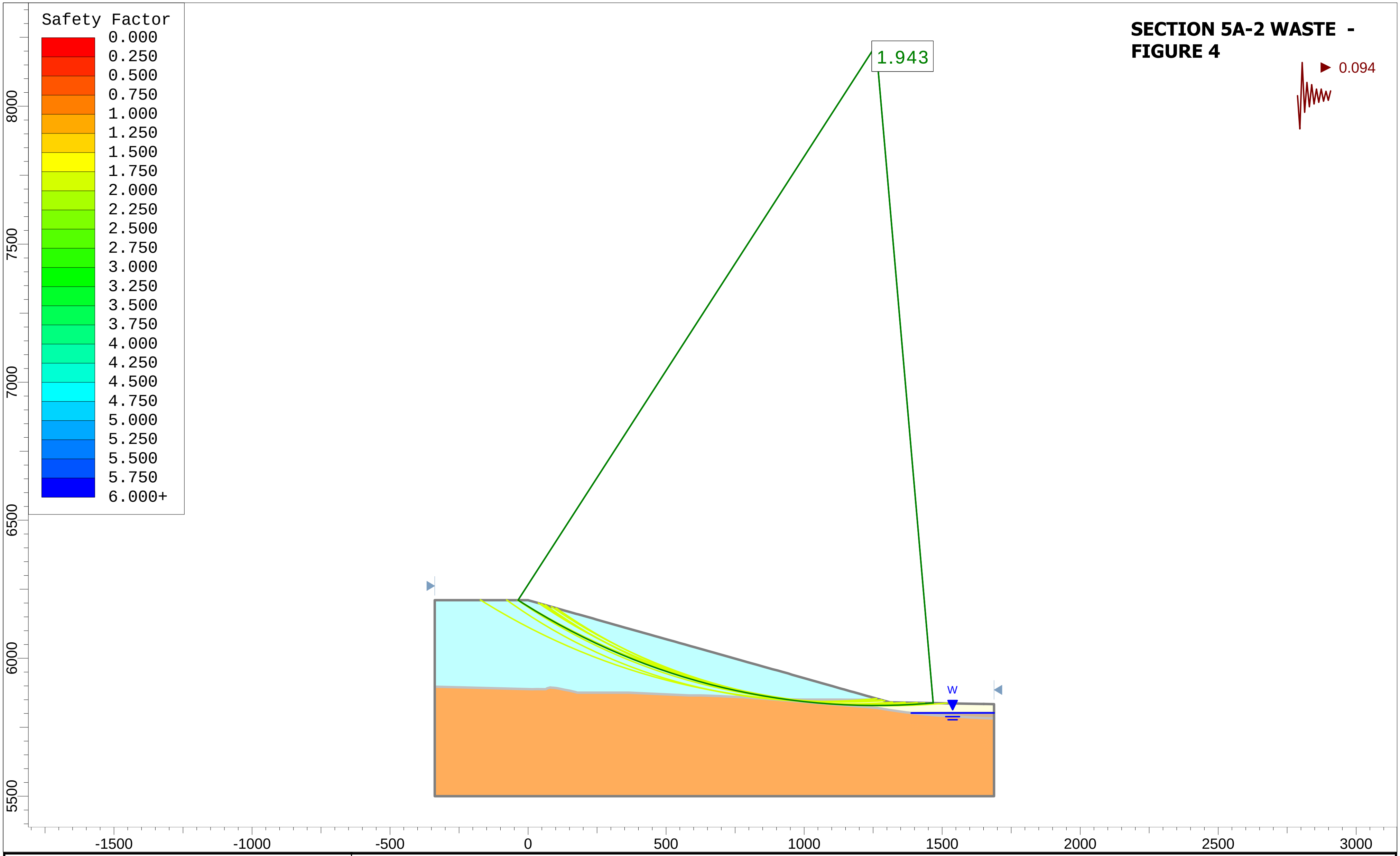
GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE

Analysis Description Seismic - Liquefied Qa - Block Failure (GLE / Morgenstern-Price)

Figure	*Scale* 1:4160	*Company*	Golder Associates
Date 1/2/2019		*File Name*	5B.slmd

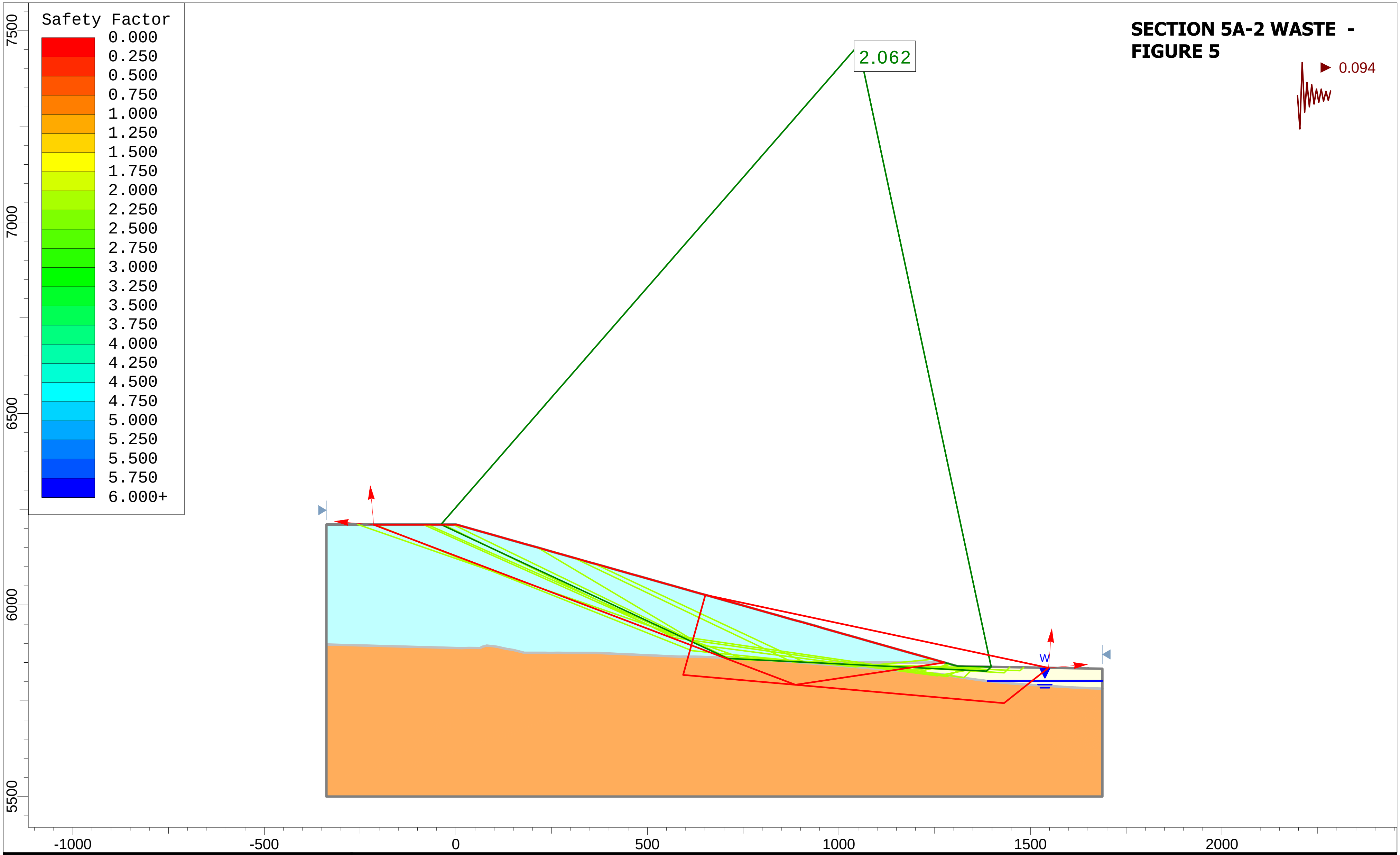


GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE
Analysis Description	Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:5772	*Company*	Golder Associates
Date	1/2/2019			*File Name*	5B.slmd

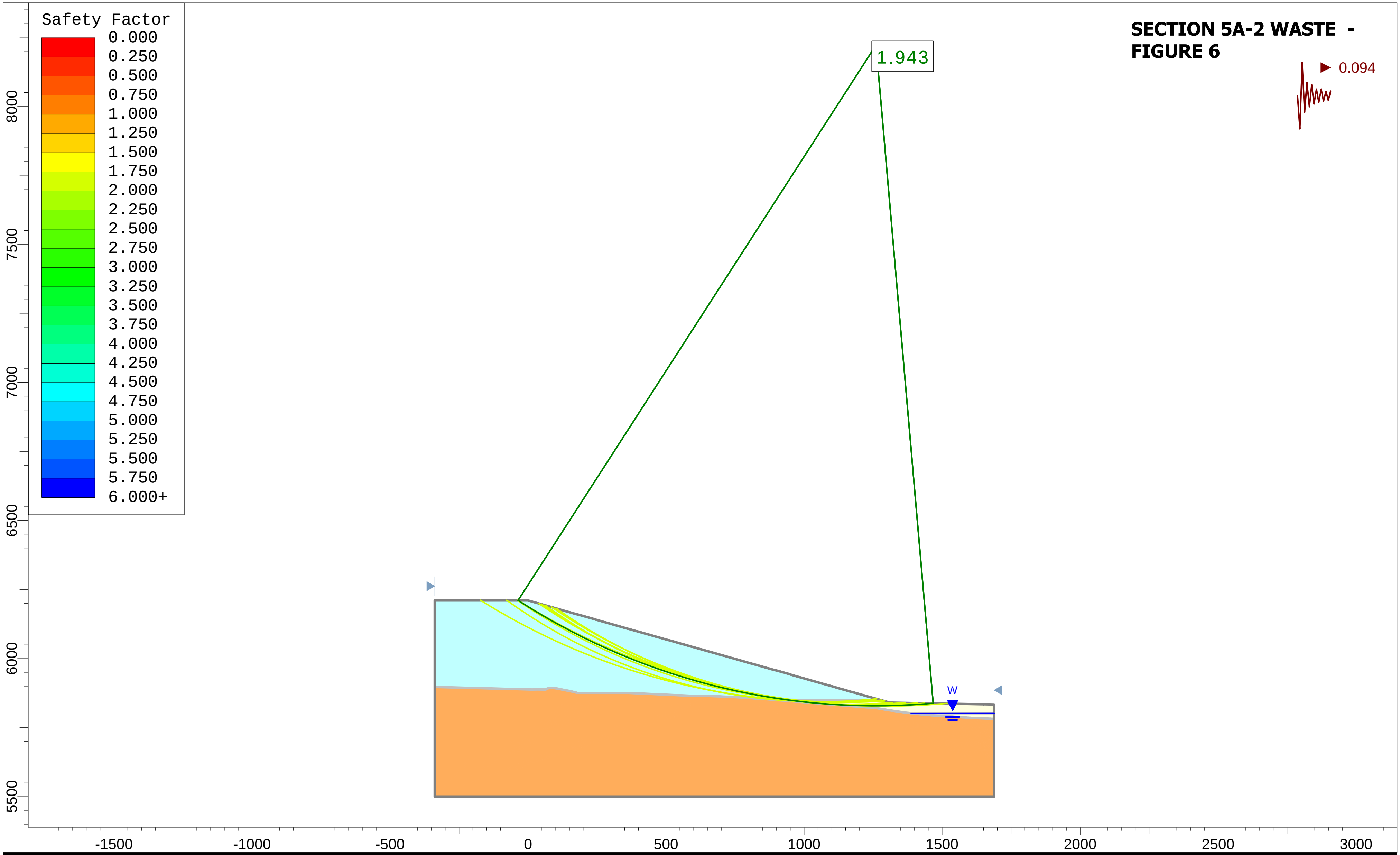
SLIDEINTERPRET 8.014



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4160	*Company*	Golder Associates
Date	1/2/2019	*File Name*	5B.slmd

SLIDEINTERPRET 8.014



SECTION 5A-2 WASTE - FIGURE 6

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 5A-2 WASTE

Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure

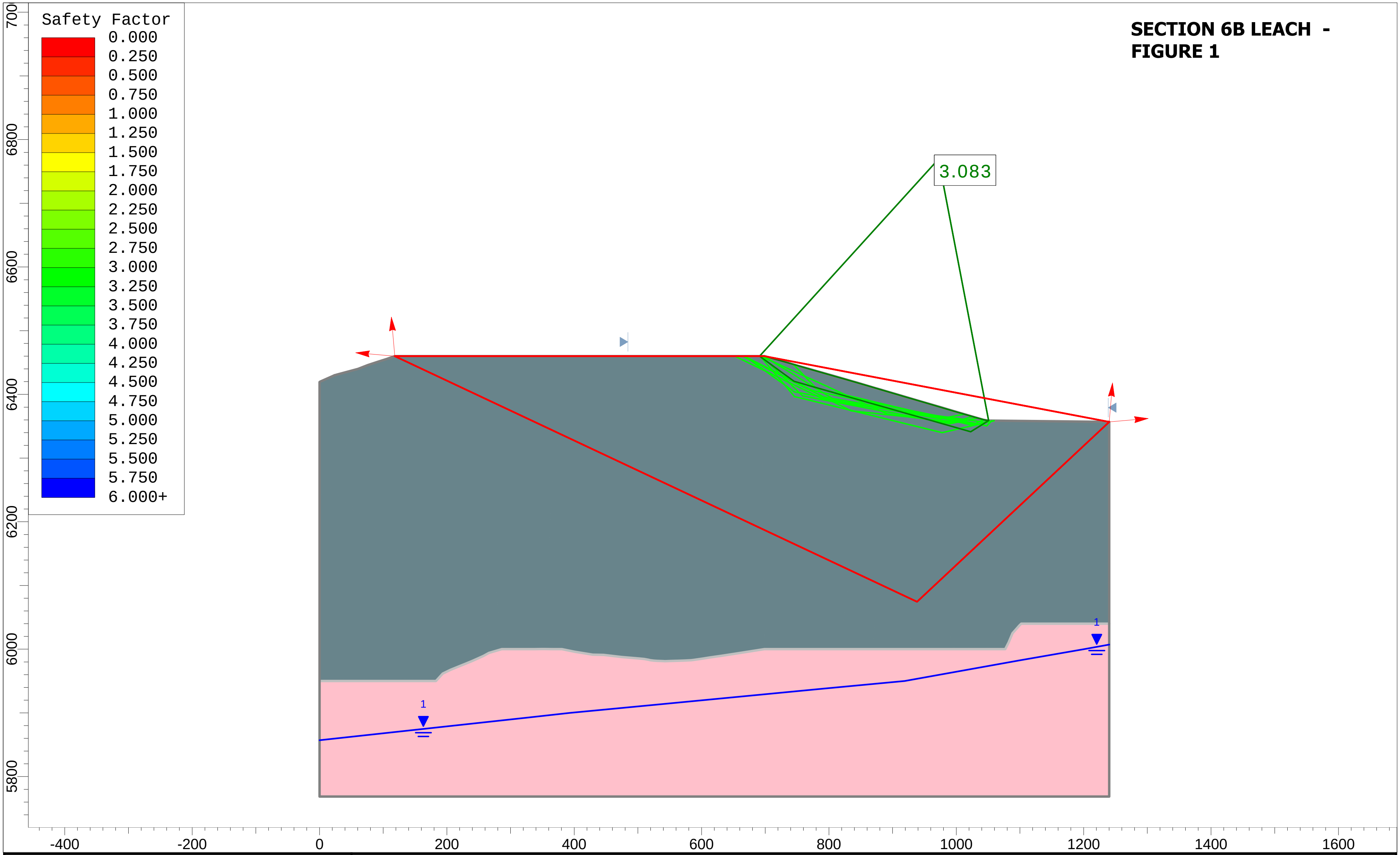
Scale 1:5772

Company Golder Associates

Date 1/2/2019

File Name 5B.slmd

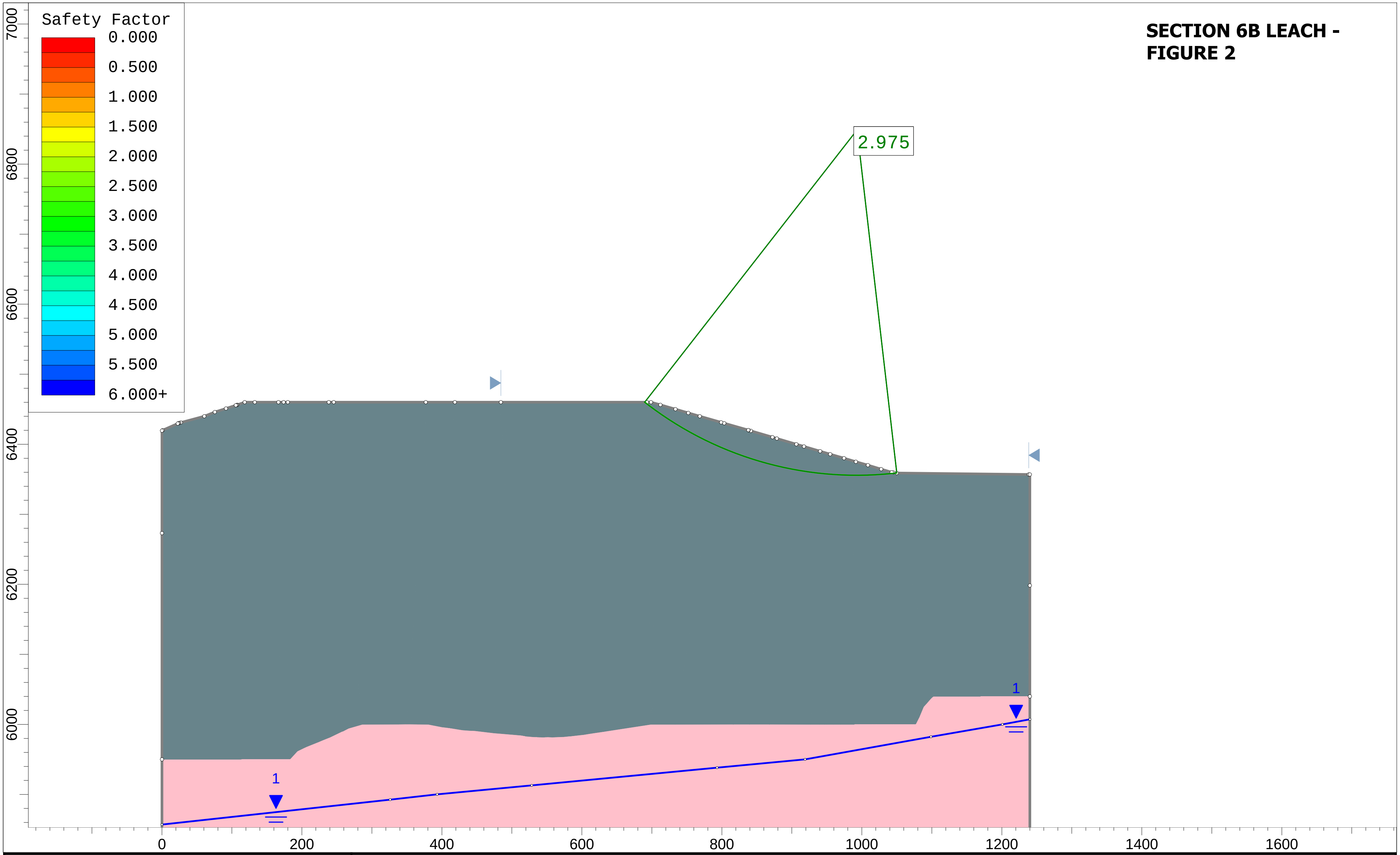
SECTION 6B LEACH - FIGURE 1



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 6B LEACH				
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)				
Figure		*Scale*	1:2502	*Company*	Golder Associates
Date	1/2/2019			*File Name*	6B.slmd

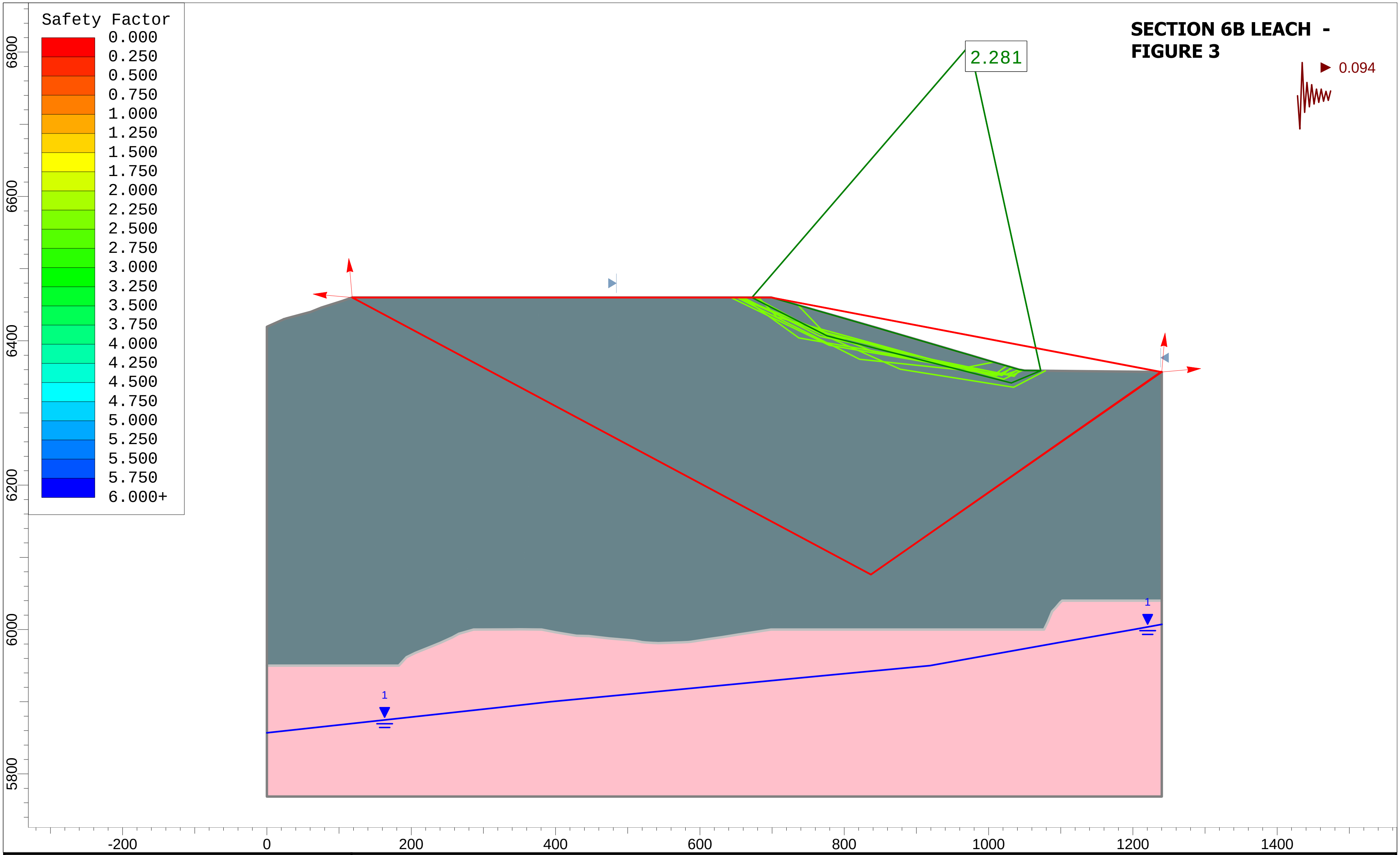
SLIDEINTERPRET 8.014



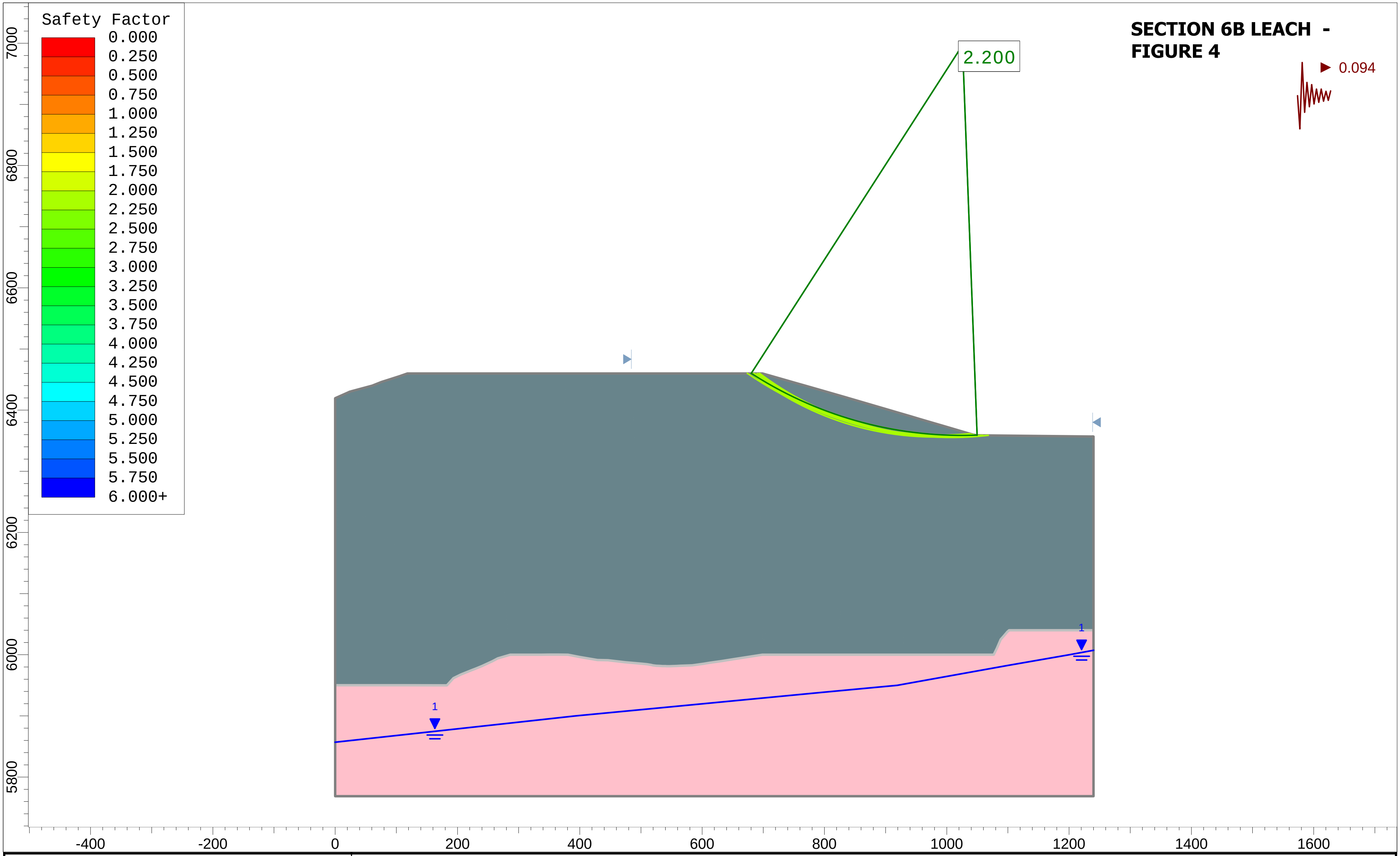
SECTION 6B LEACH - FIGURE 2

Project	Tyrone Mine Closure Stockpile Stability - SECTION 6B LEACH		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2276	*Company*	Golder Associates
Date		*File Name*	6B.slmd

SLIDEINTERPRET 8.014



GOLDER	*Project*	Tyrone Mine Closure Stockpile Stability - SECTION 6B LEACH	
	Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)	
	Figure	*Scale* 1:2208	*Company* Golder Associates
SLIDEINTERPRET 8.014	*Date* 1/2/2019		*File Name* 6B.slmd



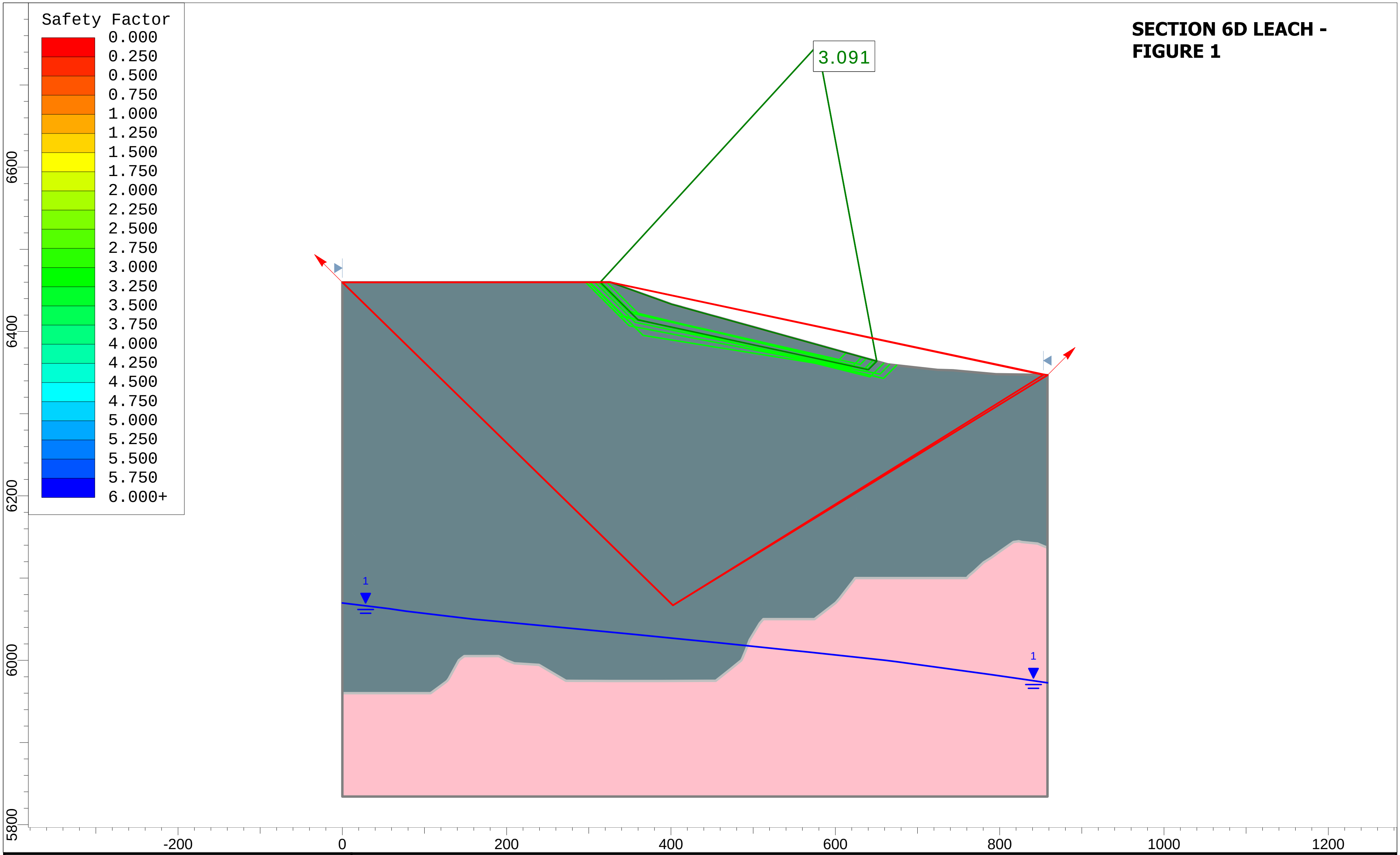
SECTION 6B LEACH -
FIGURE 4

GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - SECTION 6B LEACH		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2605	*Company*	Golder Associates
Date 1/2/2019		*File Name*	6B.slmd

SECTION 6D LEACH - FIGURE 1



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 6D LEACH

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

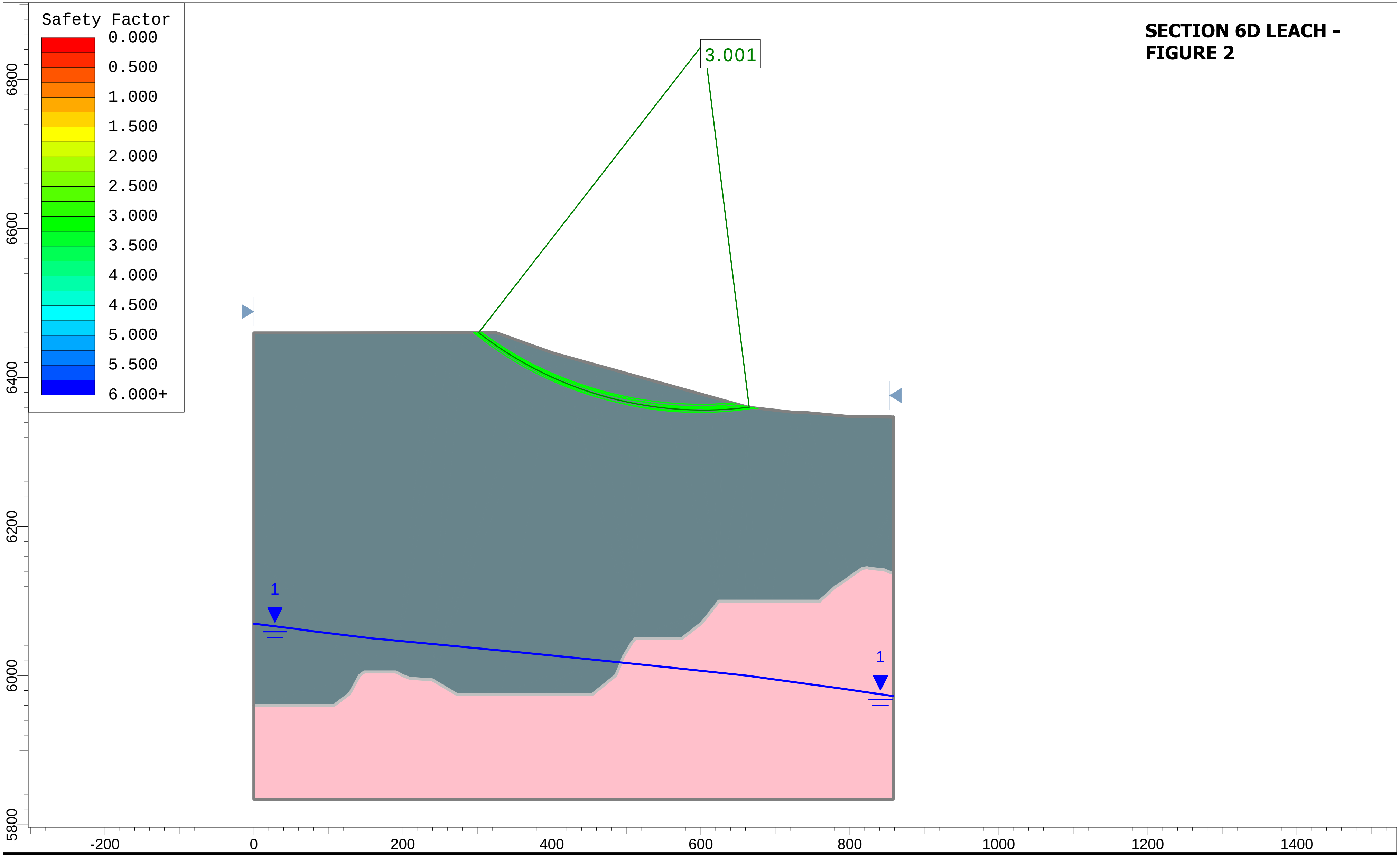
Figure

Scale 1:1939

Company Golder Associates

Date 1/2/2019

File Name 6C.slmd



SECTION 6D LEACH - FIGURE 2

Project
Tyrone Mine Closure Stockpile Stability - SECTION 6D LEACH

Analysis Description
Static - Circular Failure (GLE / Morgenstern-Price)

Figure

Scale 1:2138

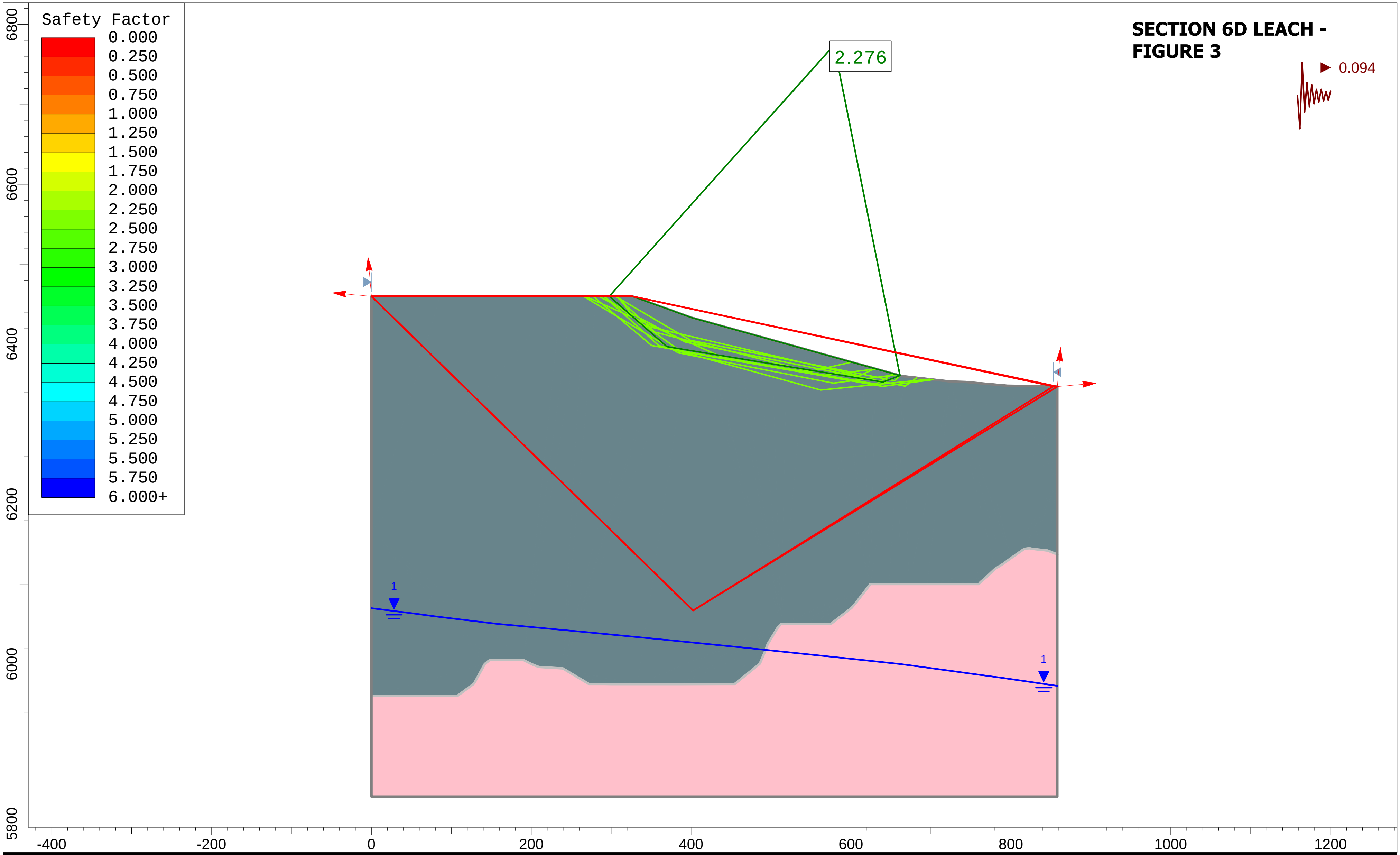
Company Golder Associates

Date

File Name 6C.slmd

GOLDER

SLIDEINTERPRET 8.014

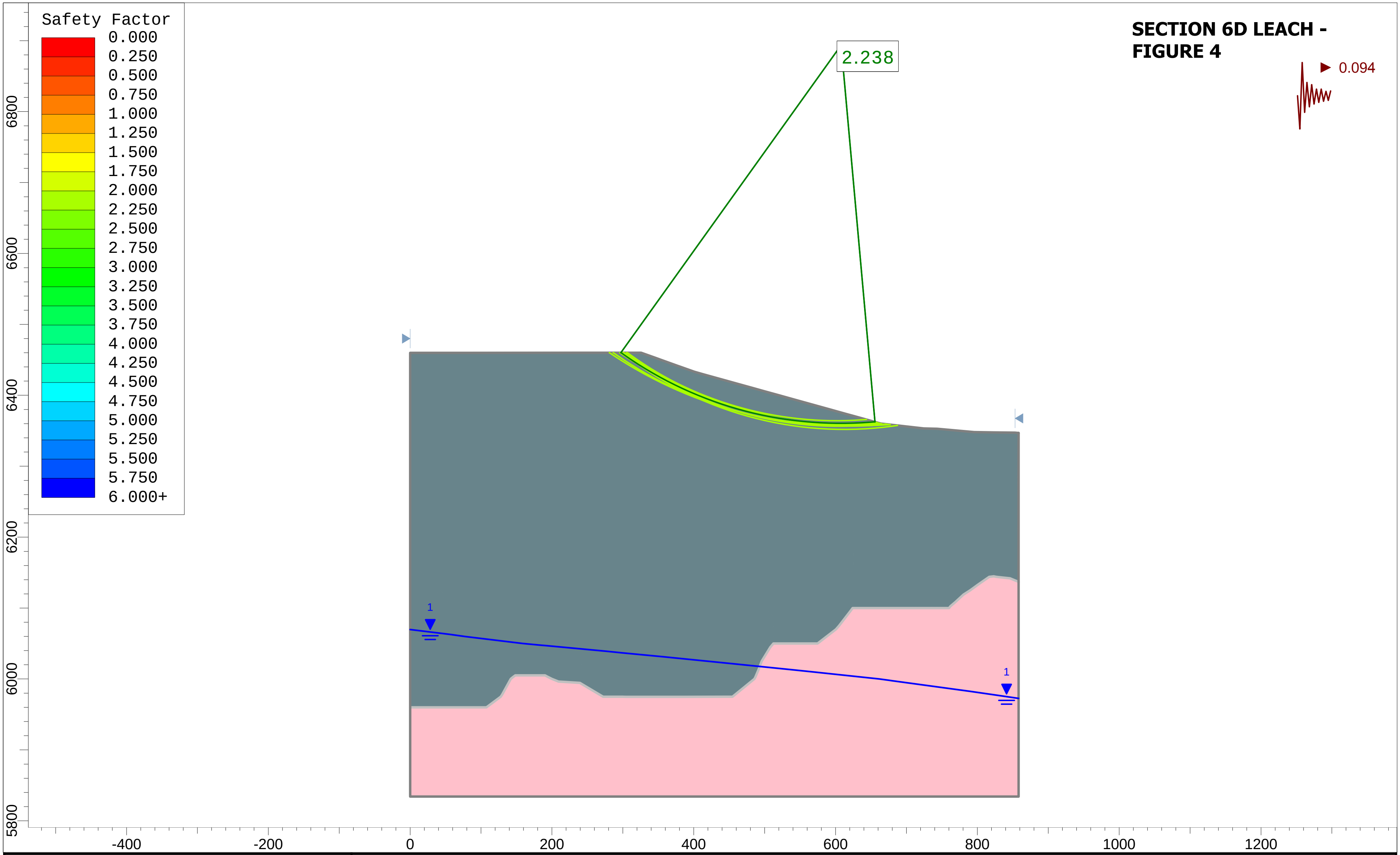


SECTION 6D LEACH - FIGURE 3

GOLDER

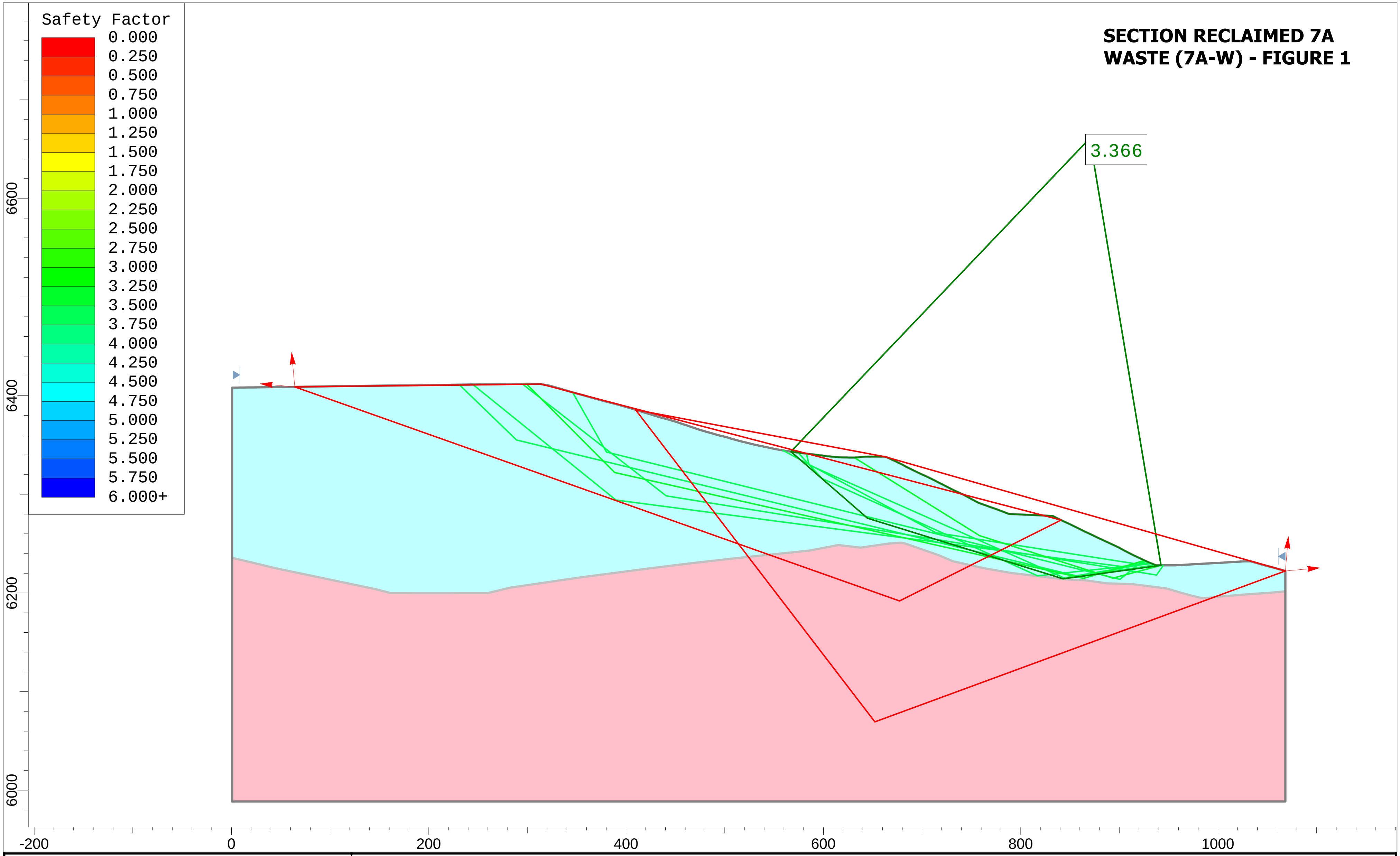
Project	Tyrone Mine Closure Stockpile Stability - SECTION 6D LEACH
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:1993
Company	Golder Associates
Date	1/2/2019
File Name	6C.slmd

SLIDEINTERPRET 8.014



SECTION 6D LEACH - FIGURE 4

GOLDER	*Project* Tyrone Mine Closure Stockpile Stability - Section 6D Leach		
	Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)		
	Figure	*Scale* 1:2247	*Company* Golder Associates
SLIDEINTERPRET 8.014	*Date* 1/2/2019		*File Name* 6C.slmd



SECTION RECLAIMED 7A WASTE (7A-W) - FIGURE 1

GOLDER

Project Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-W)

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

Scale 1:1615

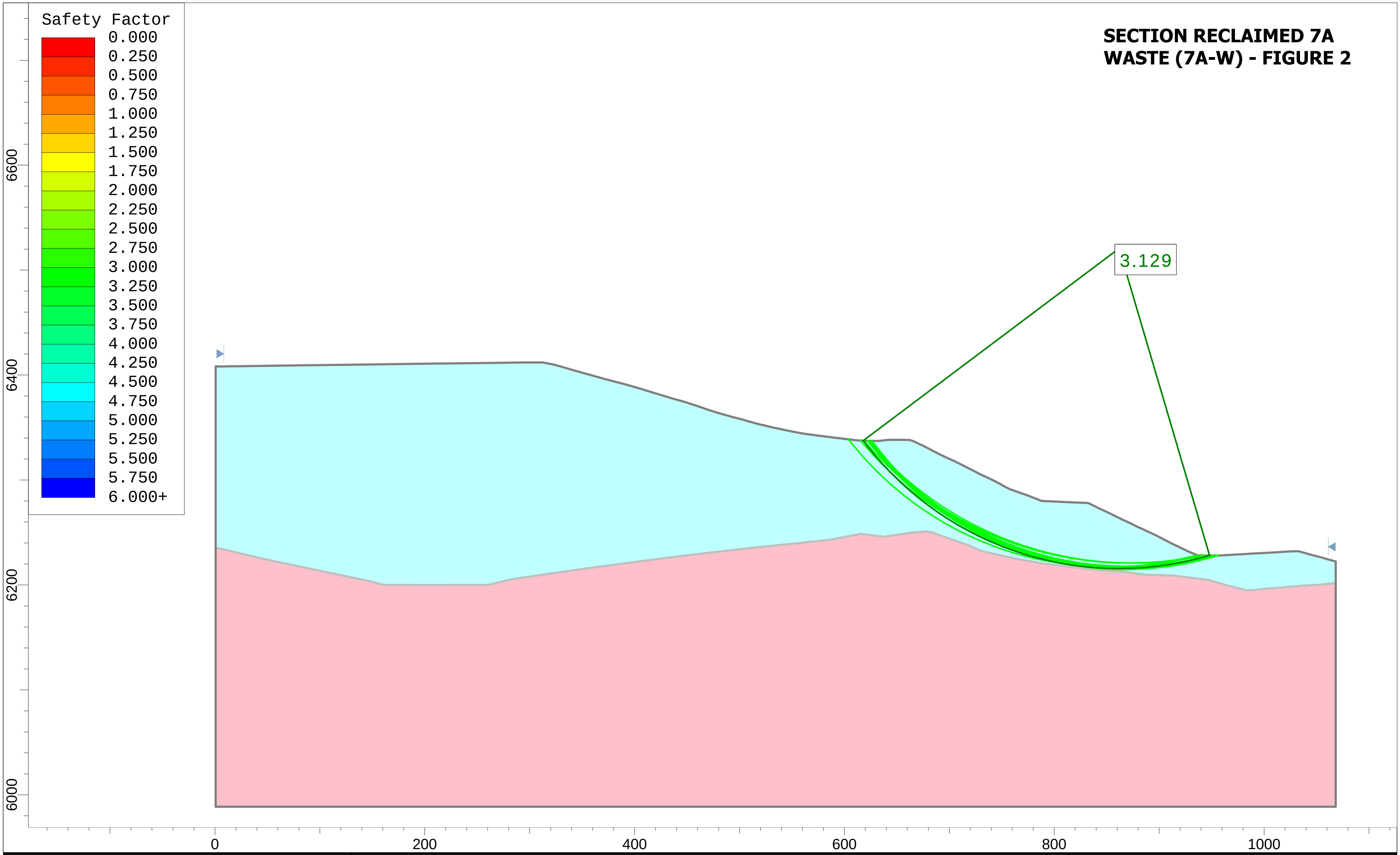
Company Golder Associates

Date 1/2/2019

File Name 7A west (2).slmd

SLIDEINTERPRET 8.014

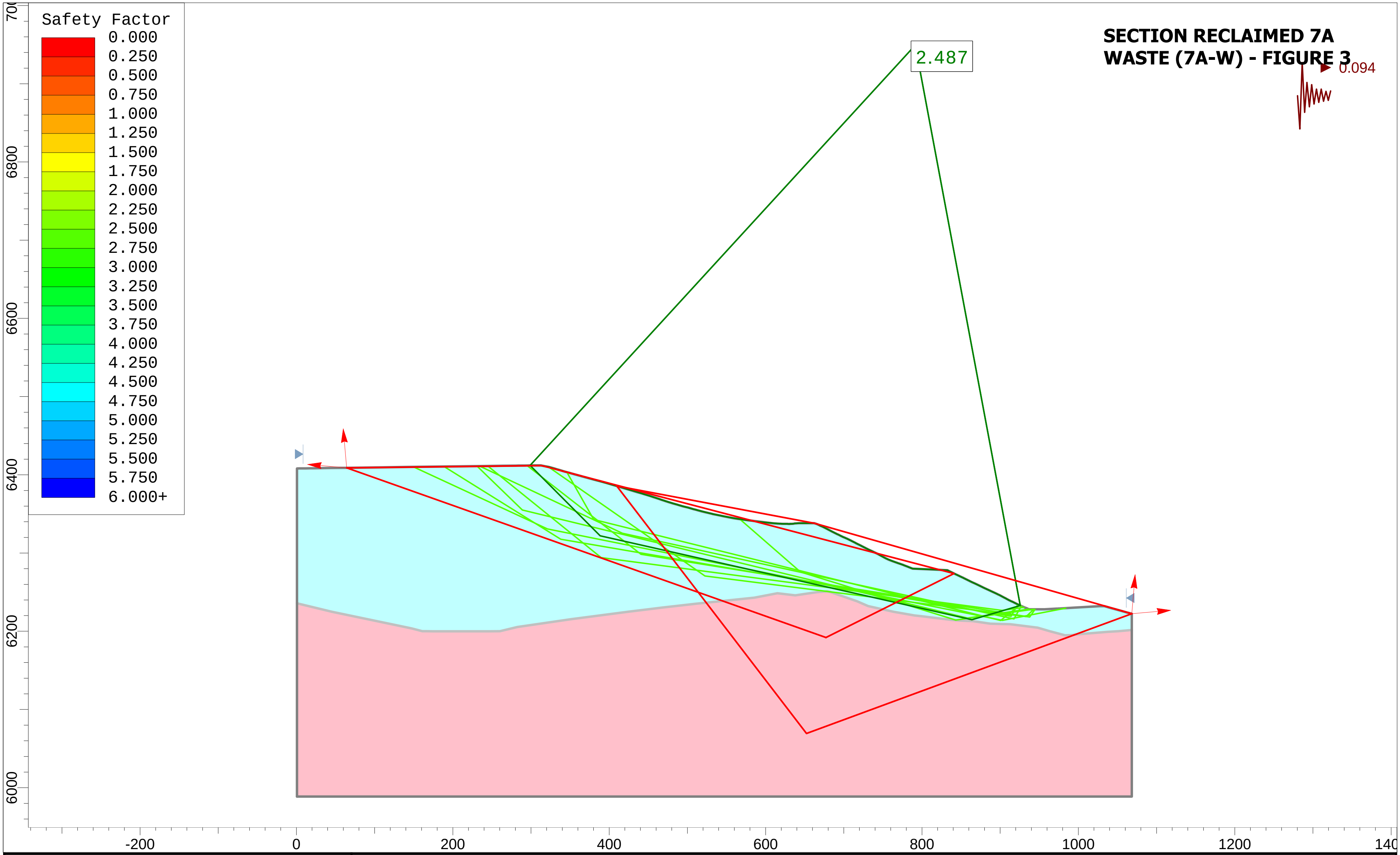
SECTION RECLAIMED 7A WASTE (7A-W) - FIGURE 2



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-W)		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:1519	*Company*	Golder Associates
Date	1/2/2019	*File Name*	7A west (2).slmd

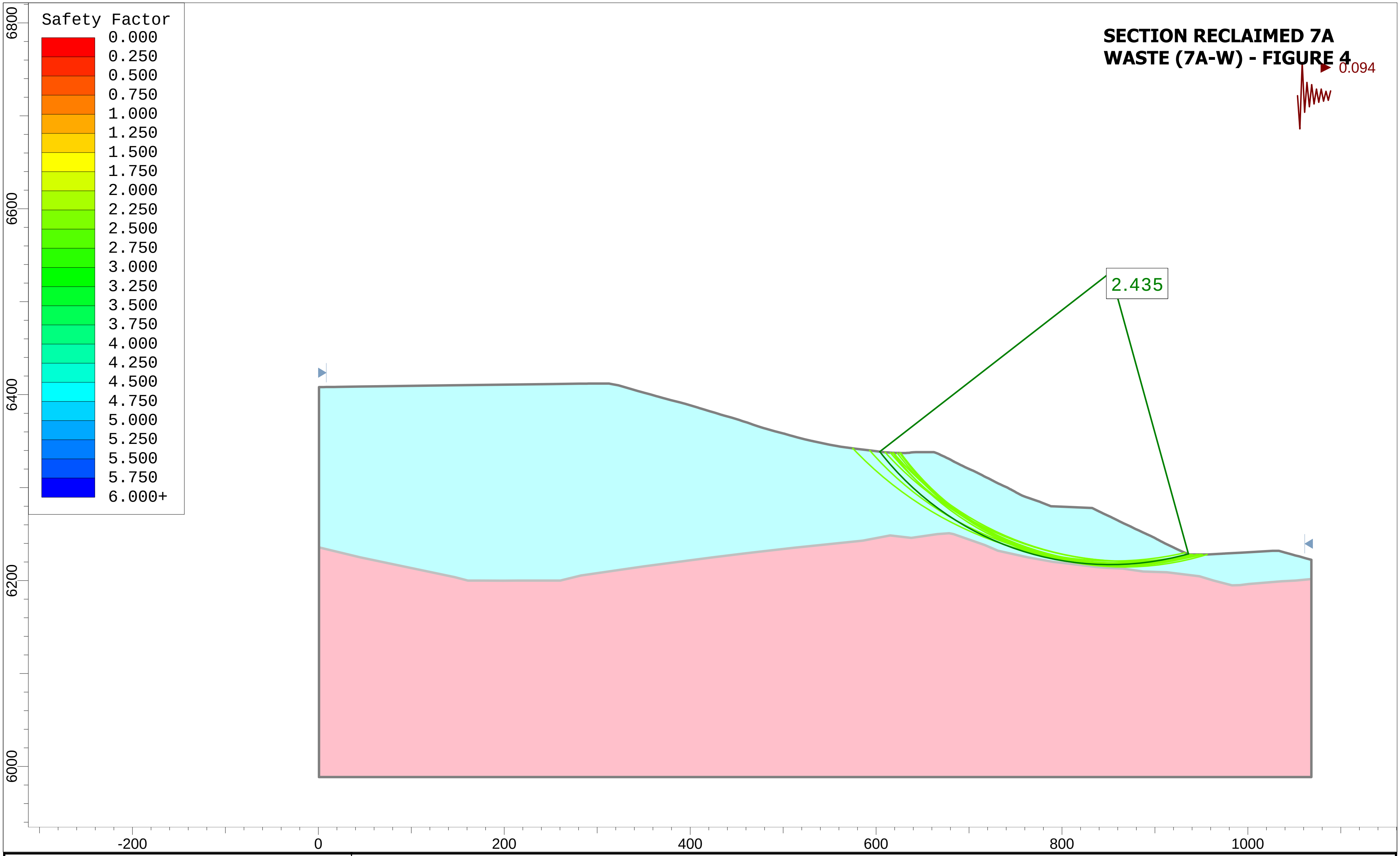
SLIDEINTERPRET 8.014



Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-W)		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2038	*Company*	Golder Associates
Date 1/2/2019		*File Name*	7A west (2).slmd

GOLDER

SLIDEINTERPRET 8.014



SECTION RECLAIMED 7A WASTE (7A-W) - FIGURE 4

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-W)

Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)

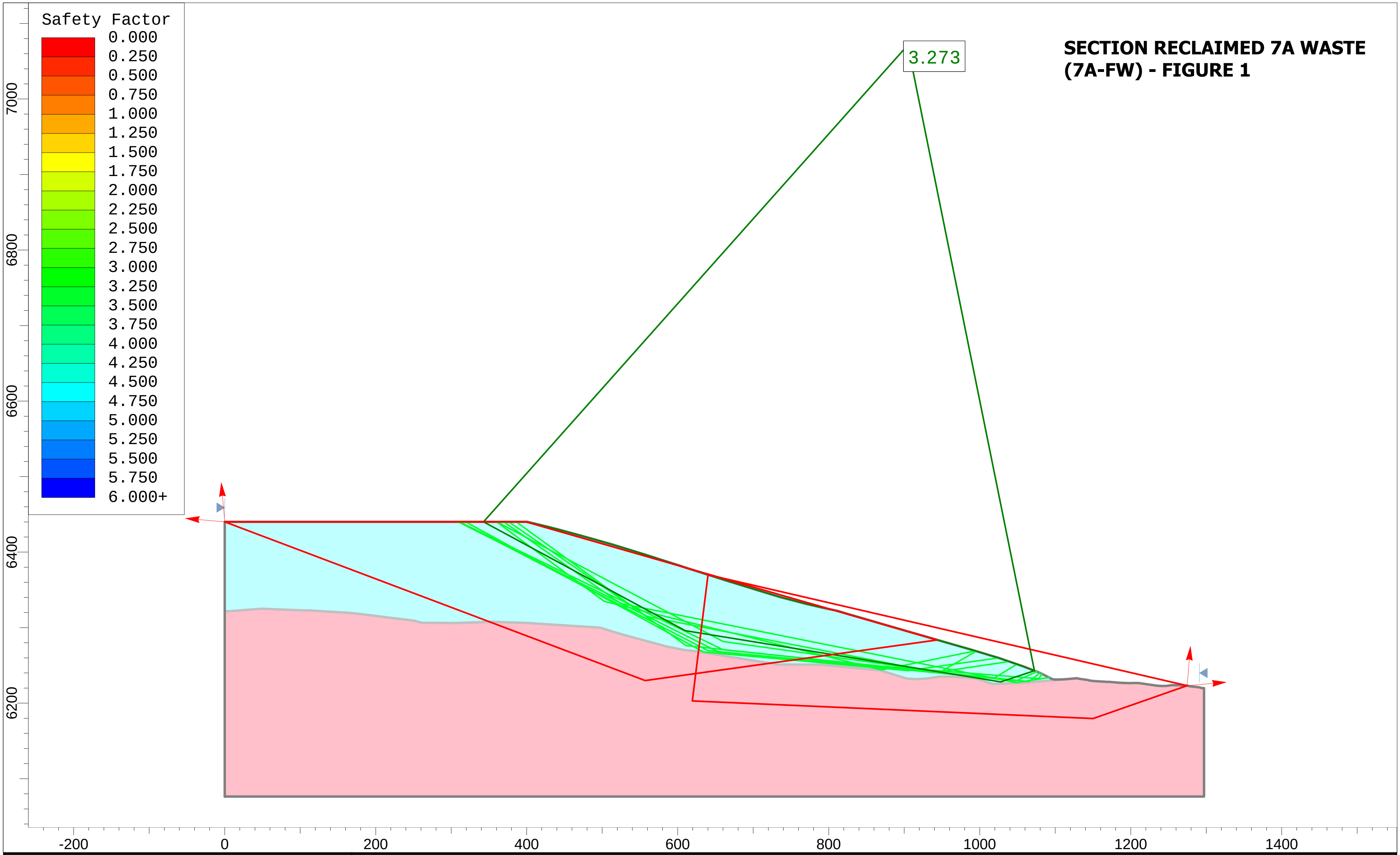
Figure

Scale 1:1714

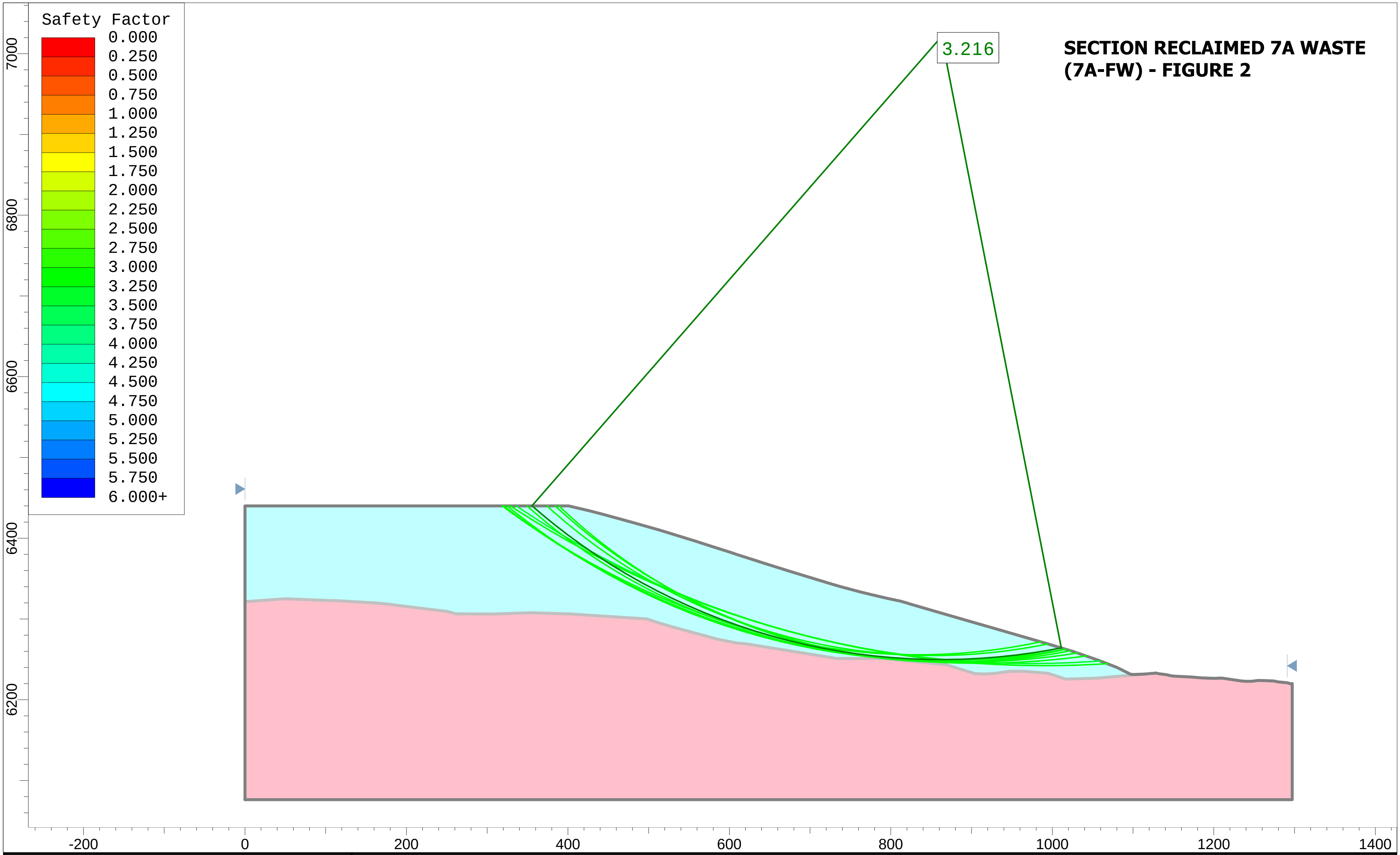
Company Golder Associates

Date 1/2/2019

File Name 7A west (2).slmd



GOLDER	*Project* Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-FW)		
	Analysis Description Static - Block Failure (GLE / Morgenstern-Price)		
	Figure	*Scale* 1:2110	*Company* Golder Associates
SLIDEINTERPRET 8.014	*Date* 1/2/2019		*File Name* 7A-FW.slmd



SECTION RECLAIMED 7A WASTE (7A-FW) - FIGURE 2

GOLDER

Project: Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-FW)

Analysis Description: Static - Circular Failure (GLE / Morgenstern-Price)

Figure:

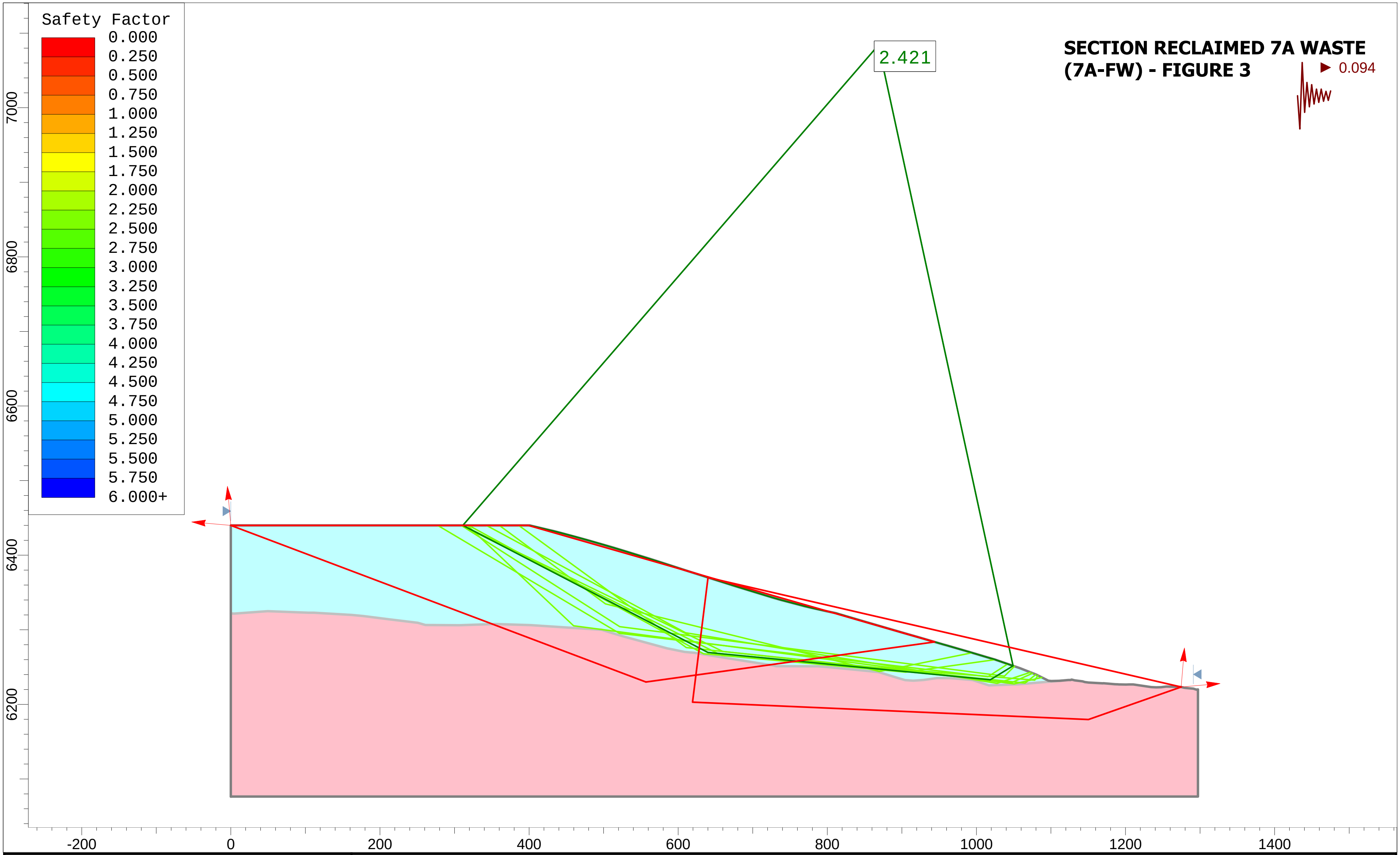
Scale: 1:1973

Company: Golder Associates

Date:

File Name: 7A-FW.slmd

SLIDEINTERPRET 8.014

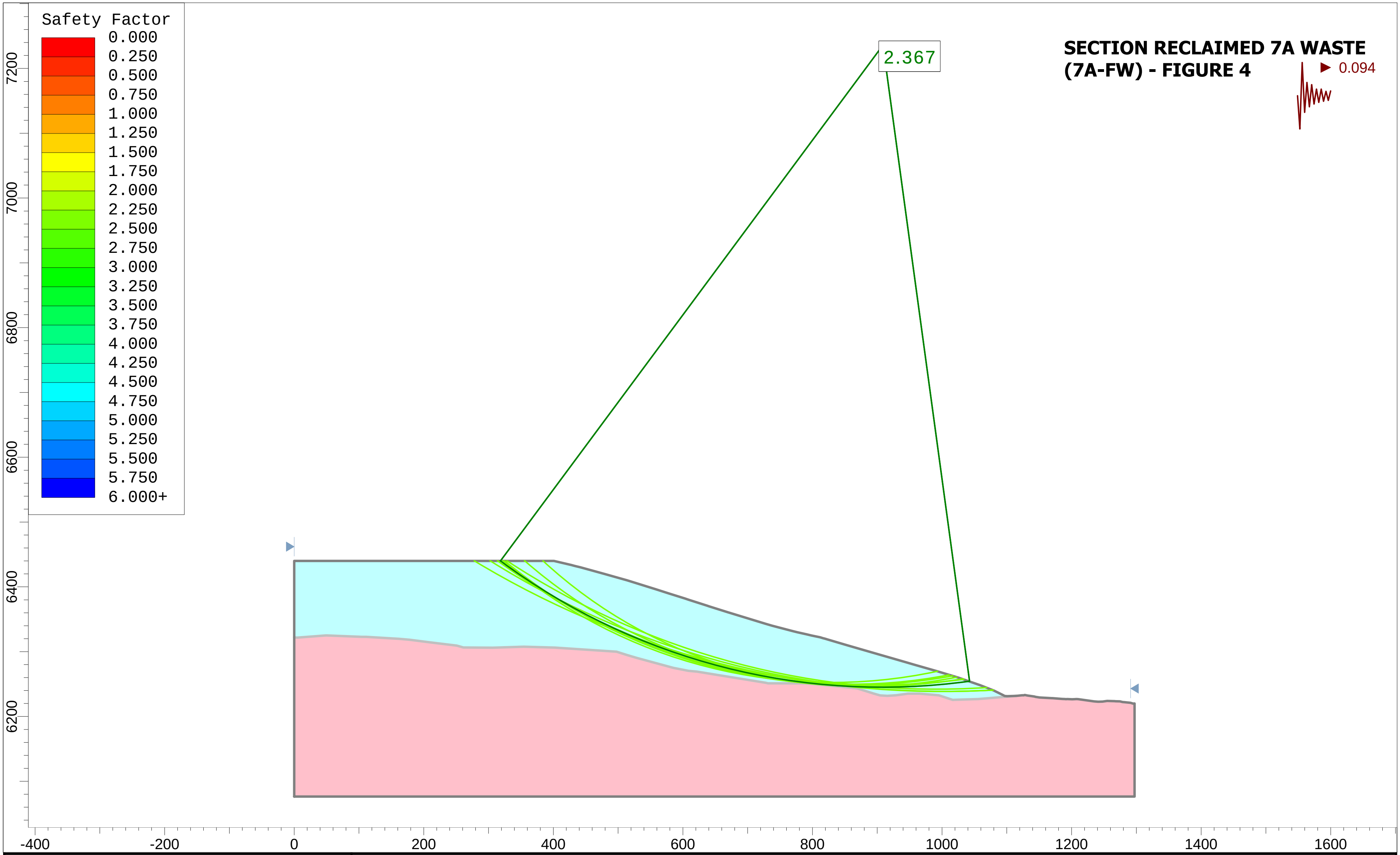


SECTION RECLAIMED 7A WASTE (7A-FW) - FIGURE 3

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-FW)		
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:2137	*Company*	Golder Associates
Date	1/2/2019	*File Name*	7A-FW.slmd

SLIDEINTERPRET 8.014

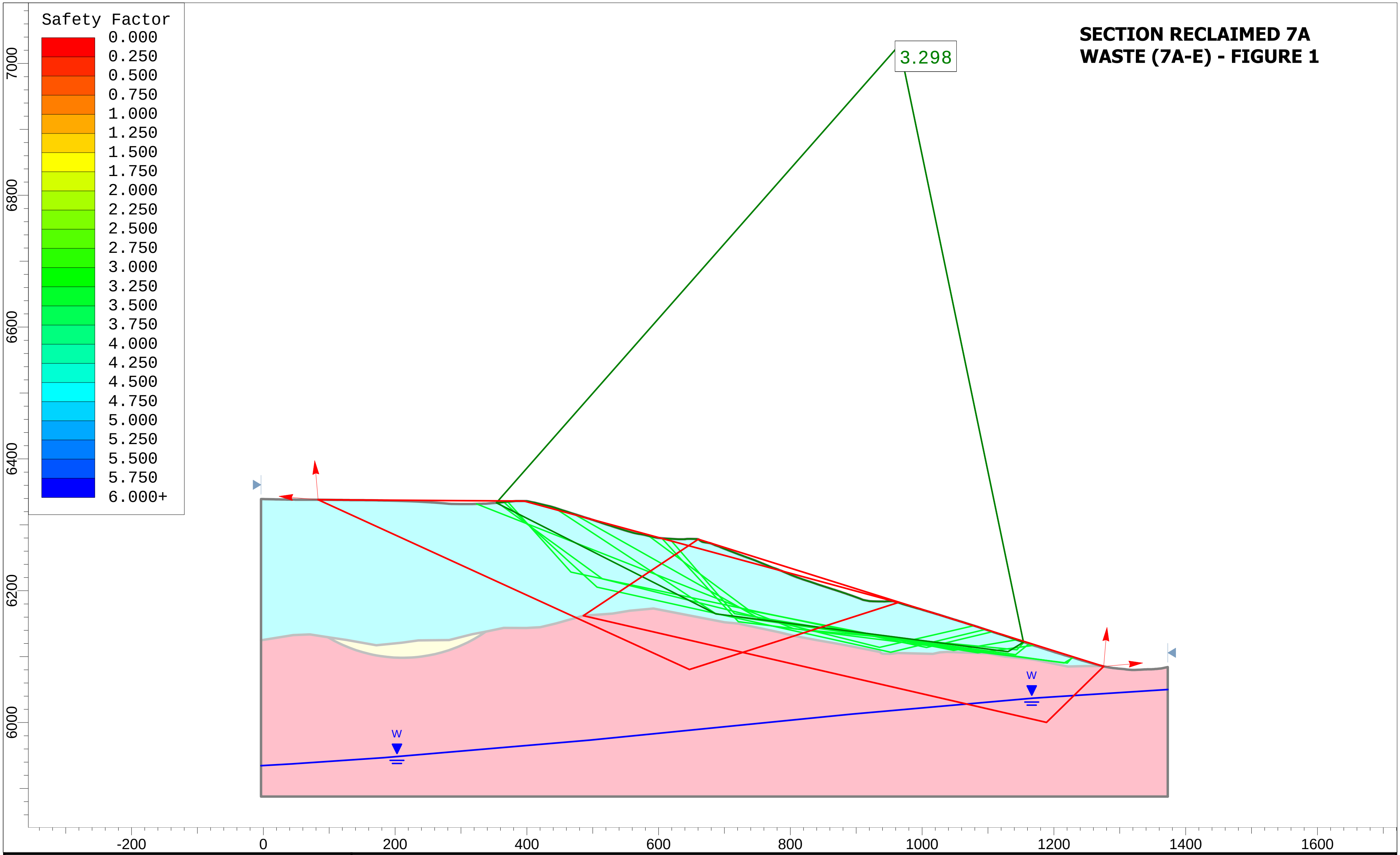


SECTION RECLAIMED 7A WASTE (7A-FW) - FIGURE 4

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-FW)
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:2459
Company	Golder Associates
Date	1/2/2019
File Name	7A-FW.slmd

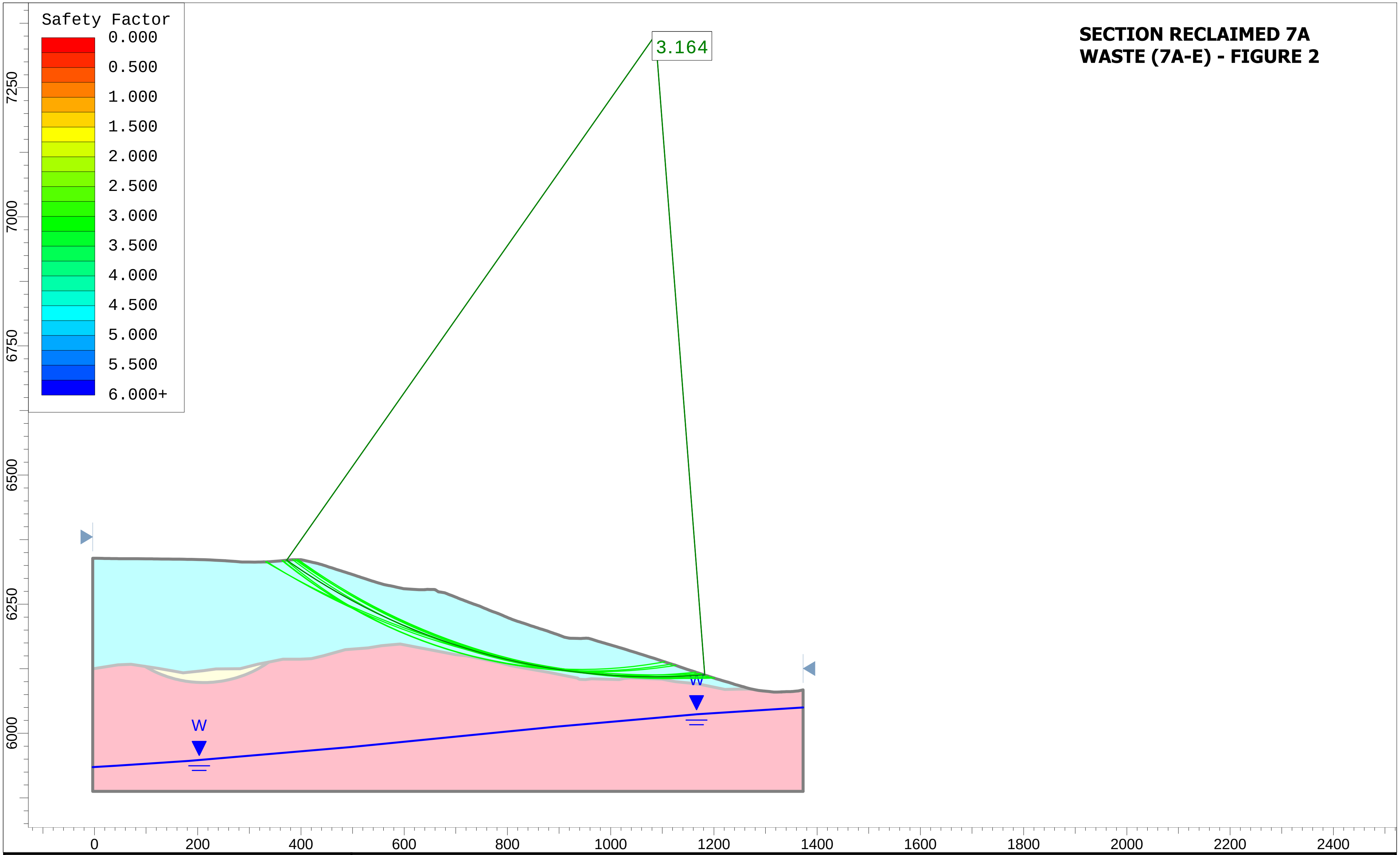
SLIDEINTERPRET 8.014



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-E)				
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)				
Figure		*Scale*	1:2418	*Company*	Golder Associates
Date	1/2/2019			*File Name*	7A-E(2).slmd

SLIDEINTERPRET 8.014

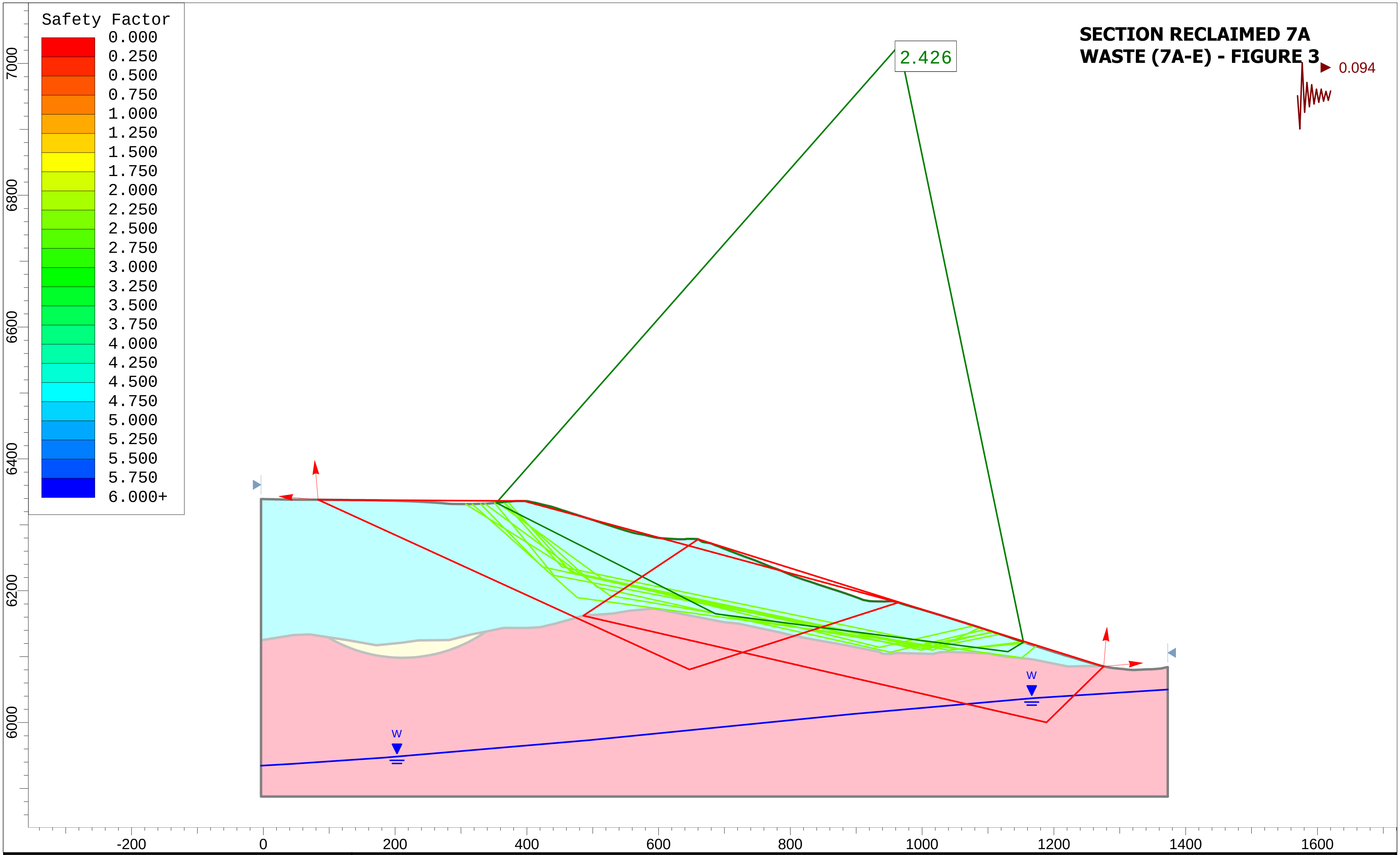


SECTION RECLAIMED 7A WASTE (7A-E) - FIGURE 2

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-E)
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3086
Company	Golder Associates
Date	
File Name	7A-E(2).slmd

GOLDER

SLIDEINTERPRET 8.014

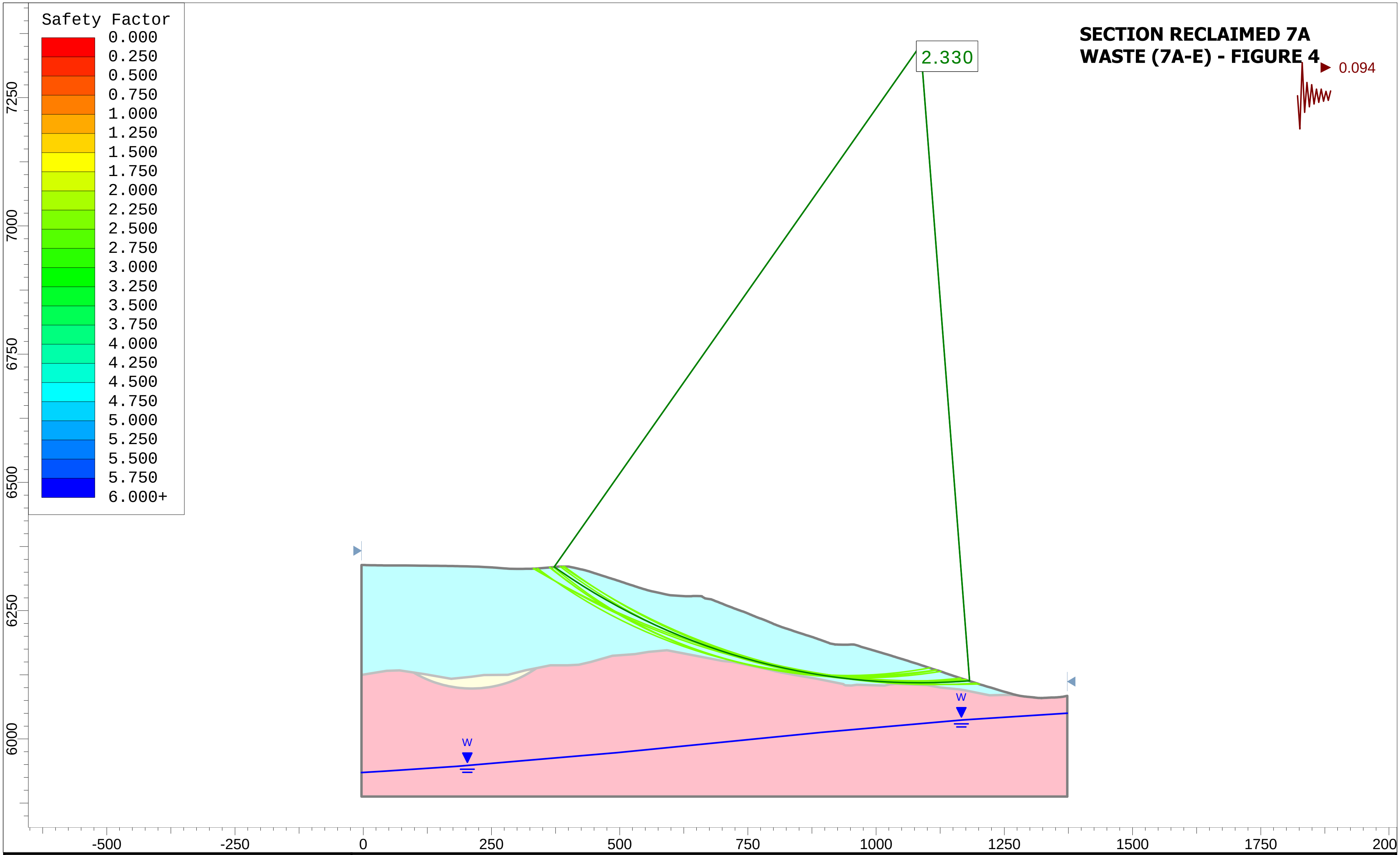

SECTION RECLAIMED 7A
WASTE (7A-E) - FIGURE 3

Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-E)
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:2418
Company	Golder Associates
Date	1/2/2019
File Name	7A-E(2).slmd

GOLDER

SLIDEINTERPRET 8.014

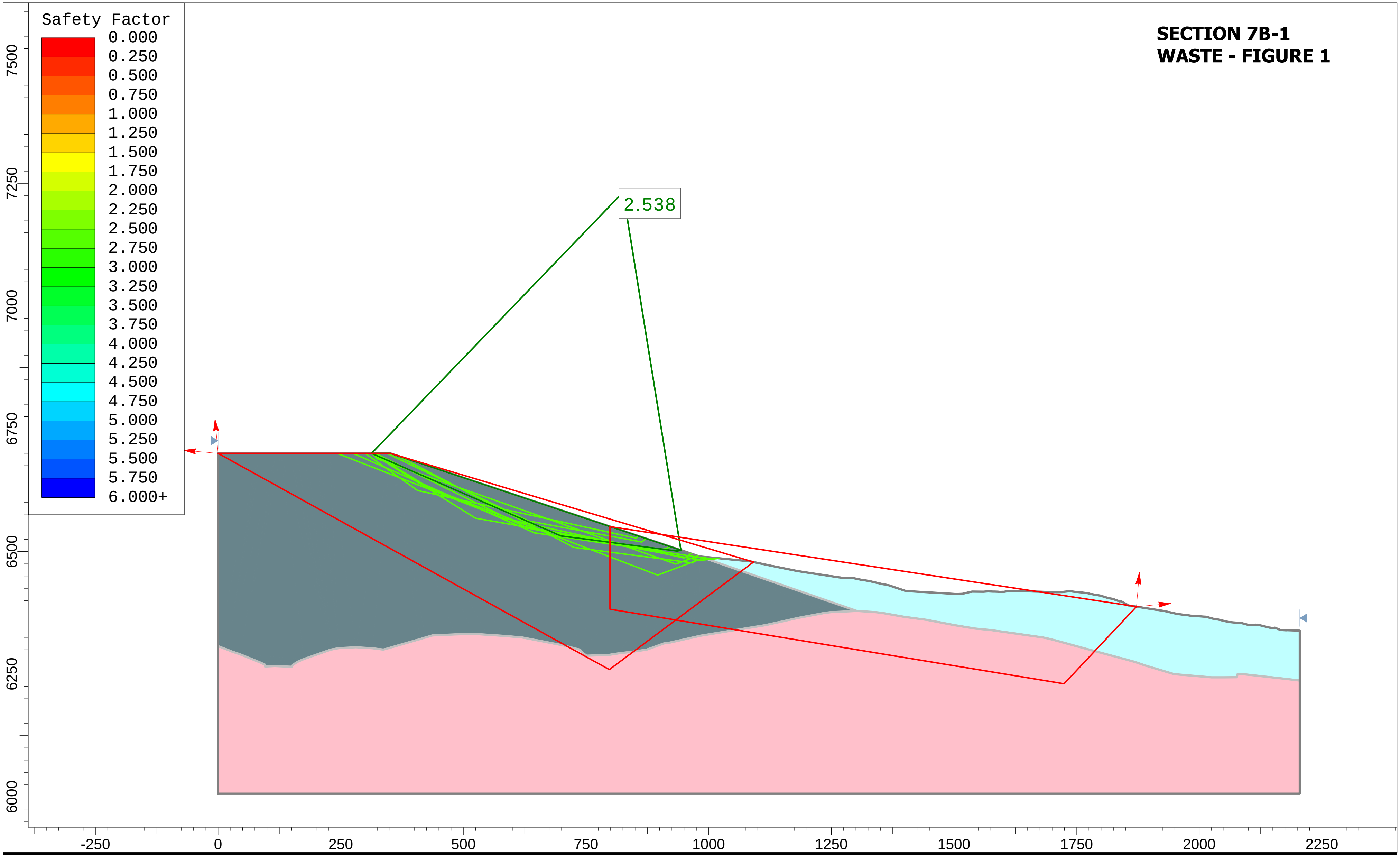
SECTION RECLAIMED 7A WASTE (7A-E) - FIGURE 4



GOLDER

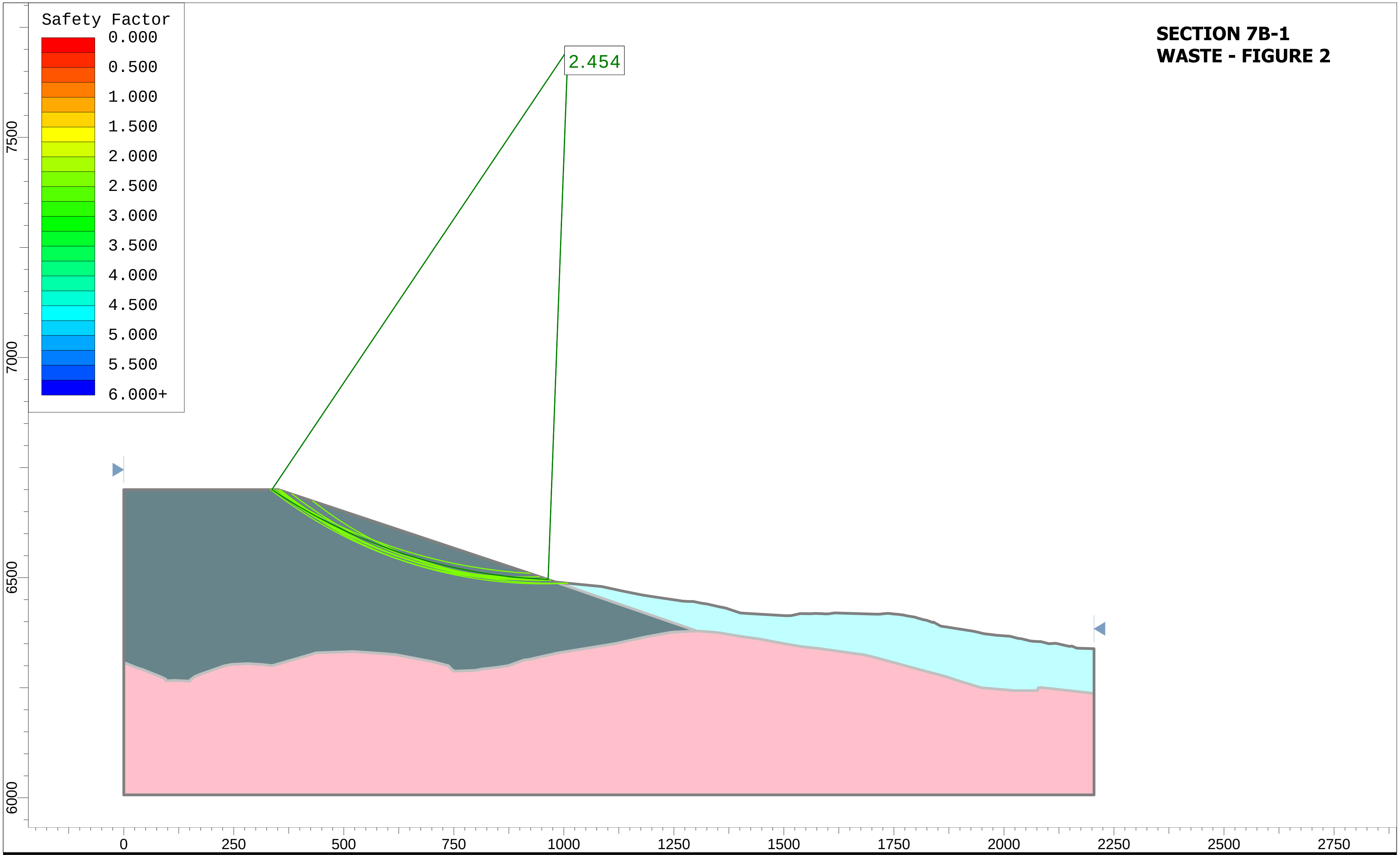
Project	Tyrone Mine Closure Stockpile Stability - SECTION RECLAIMED 7A WASTE (7A-E)		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3107	*Company*	Golder Associates
Date 1/2/2019		*File Name*	7A-E(2).slmd

SLIDEINTERPRET 8.014

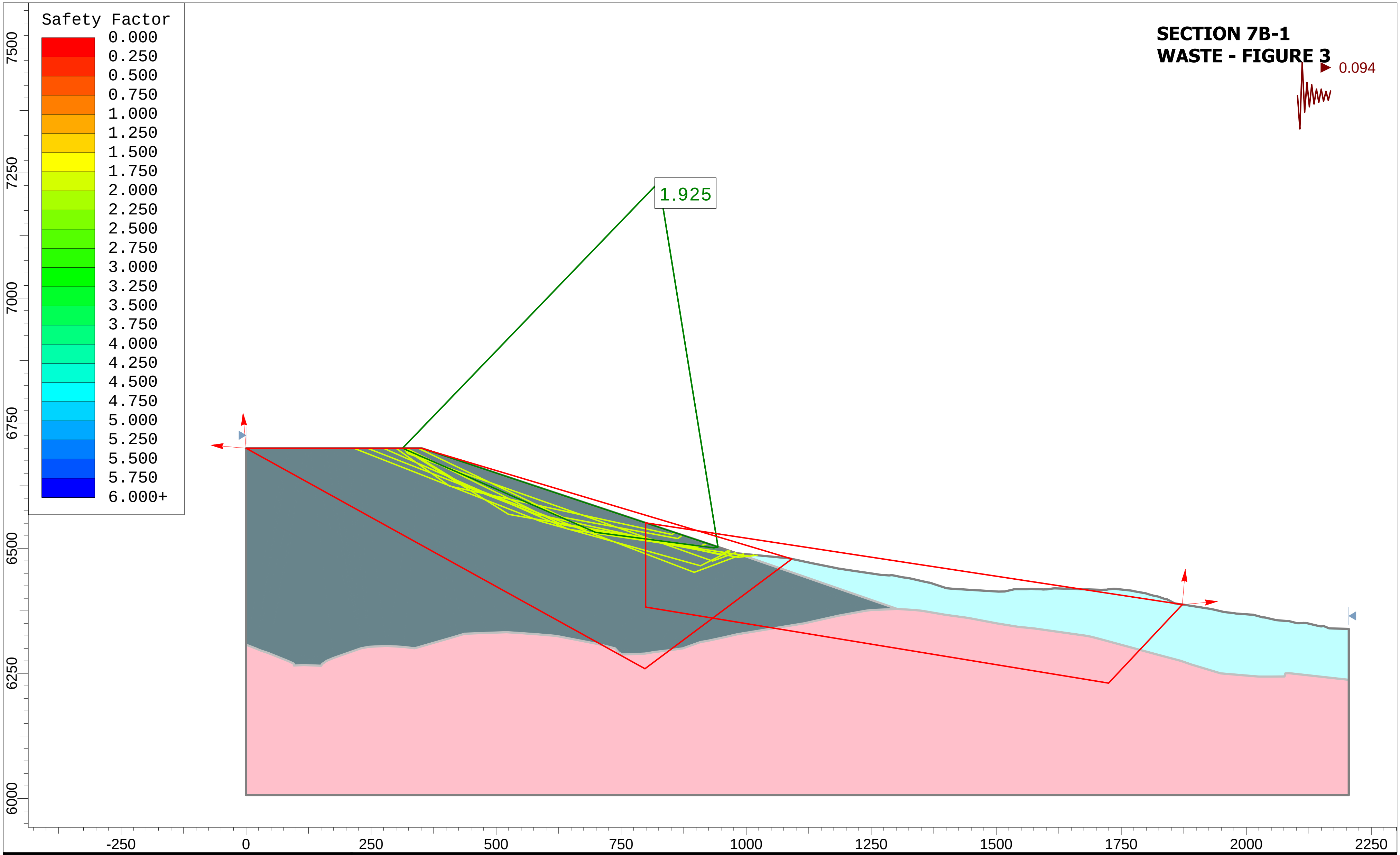

SECTION 7B-1
WASTE - FIGURE 1

Project	Tyrone Mine Closure Stockpile Stability - SECTION 7B-1 WASTE
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3248
Company	Golder Associates
Date	2/4/2019
File Name	7B.slmd

SLIDEINTERPRET 8.014



GOLDER	*Project*	Tyrone Mine Closure Stockpile Stability - SECTION 7B-1 WASTE	
	Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)	
	Figure	*Scale* 1:3619	*Company* Golder Associates
SLIDEINTERPRET 8.014	*Date*		*File Name* 7B.slmd

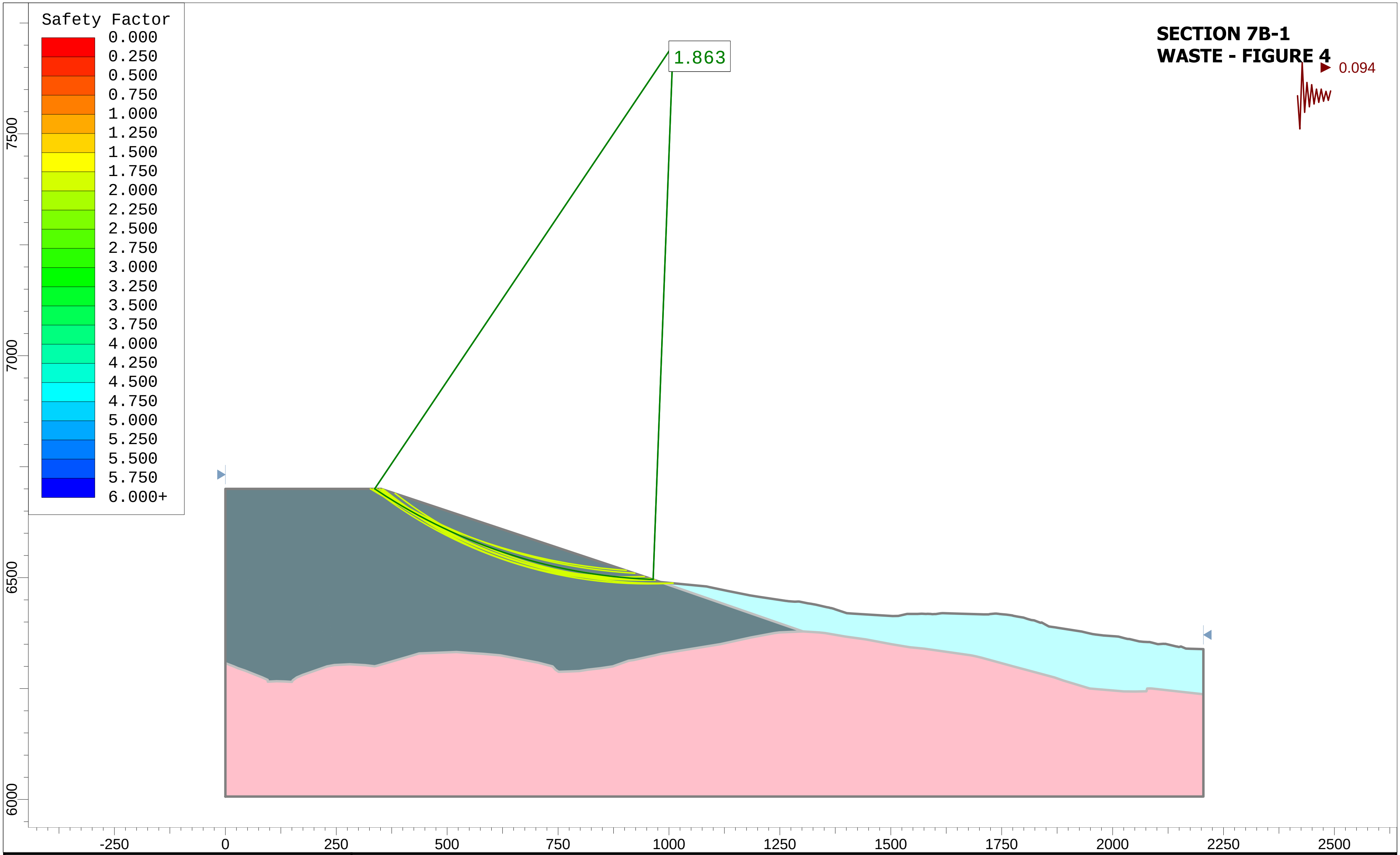


SECTION 7B-1
WASTE - FIGURE 3

GOLDER

SLIDEINTERPRET 8.014

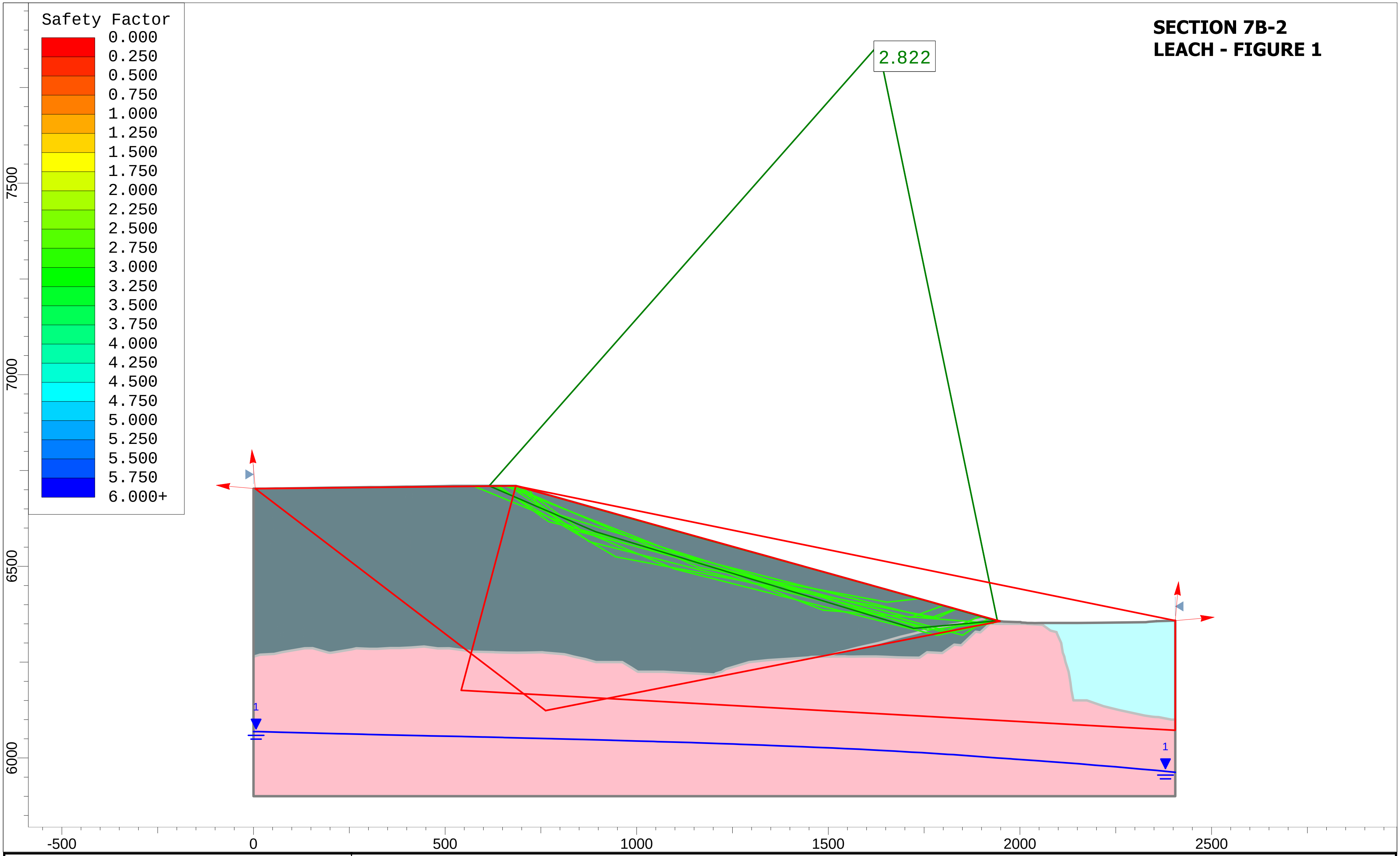
Project	Tyrone Mine Closure Stockpile Stability - SECTION 7B-1 WASTE
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:3186
Company	Golder Associates
Date	2/4/2019
File Name	7B.slmd



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 7B-1 WASTE		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3592	*Company*	Golder Associates
Date	2/4/2019	*File Name*	7B.slmd

SLIDEINTERPRET 8.014

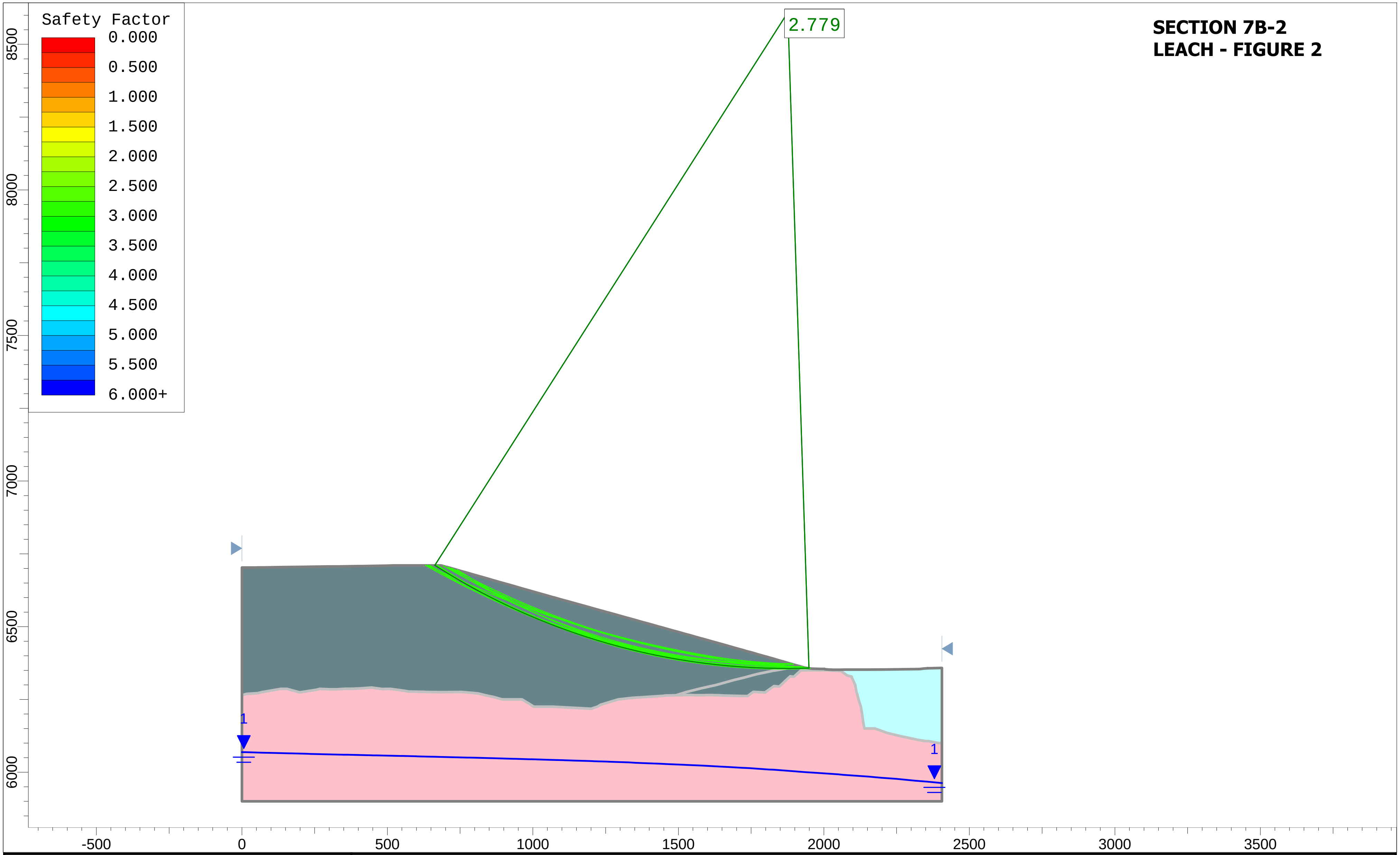


SECTION 7B-2
LEACH - FIGURE 1

GOLDER

SLIDEINTERPRET 8.014

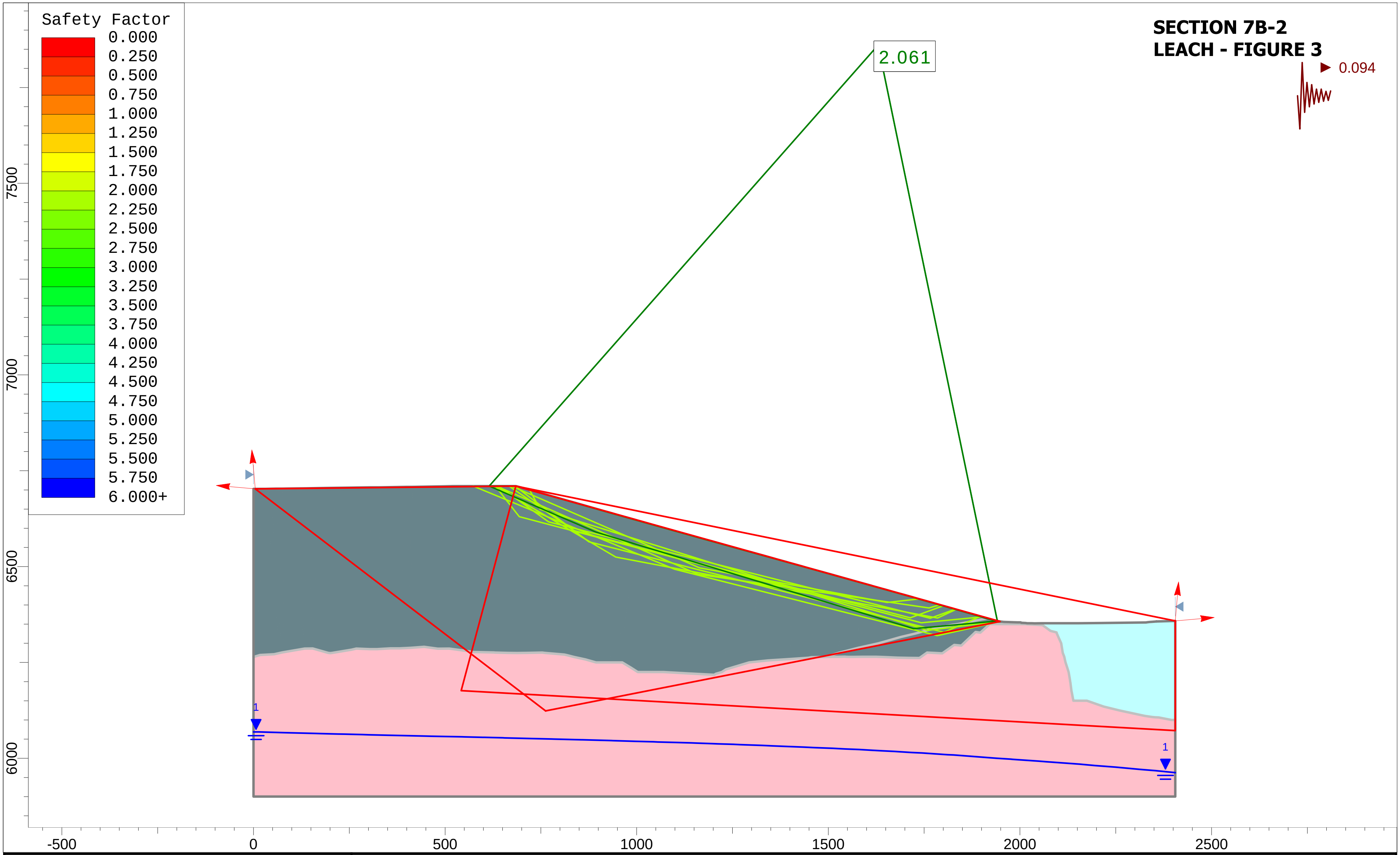
Project	Tyrone Mine Closure Stockpile Stability - SECTION 7B-2 LEACH		
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:4157	*Company*	Golder Associates
Date 1/2/2019		*File Name*	2C.slmd



SECTION 7B-2
LEACH - FIGURE 2

Project	Tyrone Mine Closure Stockpile Stability - SECTION 7B-2 LEACH
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:5474
Company	Golder Associates
Date	
File Name	2C.slmd

SLIDEINTERPRET 8.014



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 7B-2 LEACH

Analysis Description Seismic - Block Failure (GLE / Morgenstern-Price)

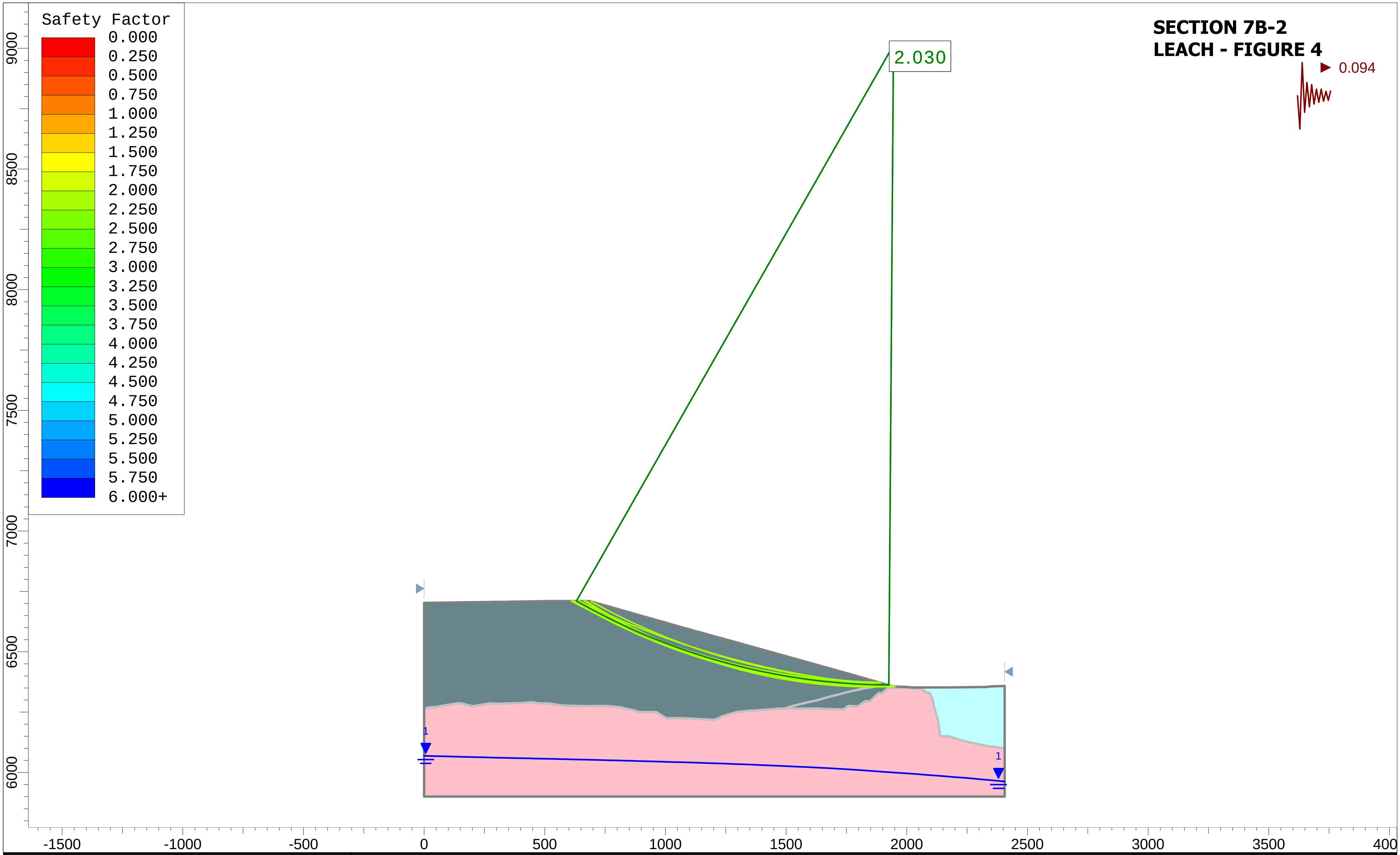
Figure

Scale 1:4157

Company Golder Associates

Date 1/2/2019

File Name 2C.slmd



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - SECTION 7B-2 LEACH

Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)

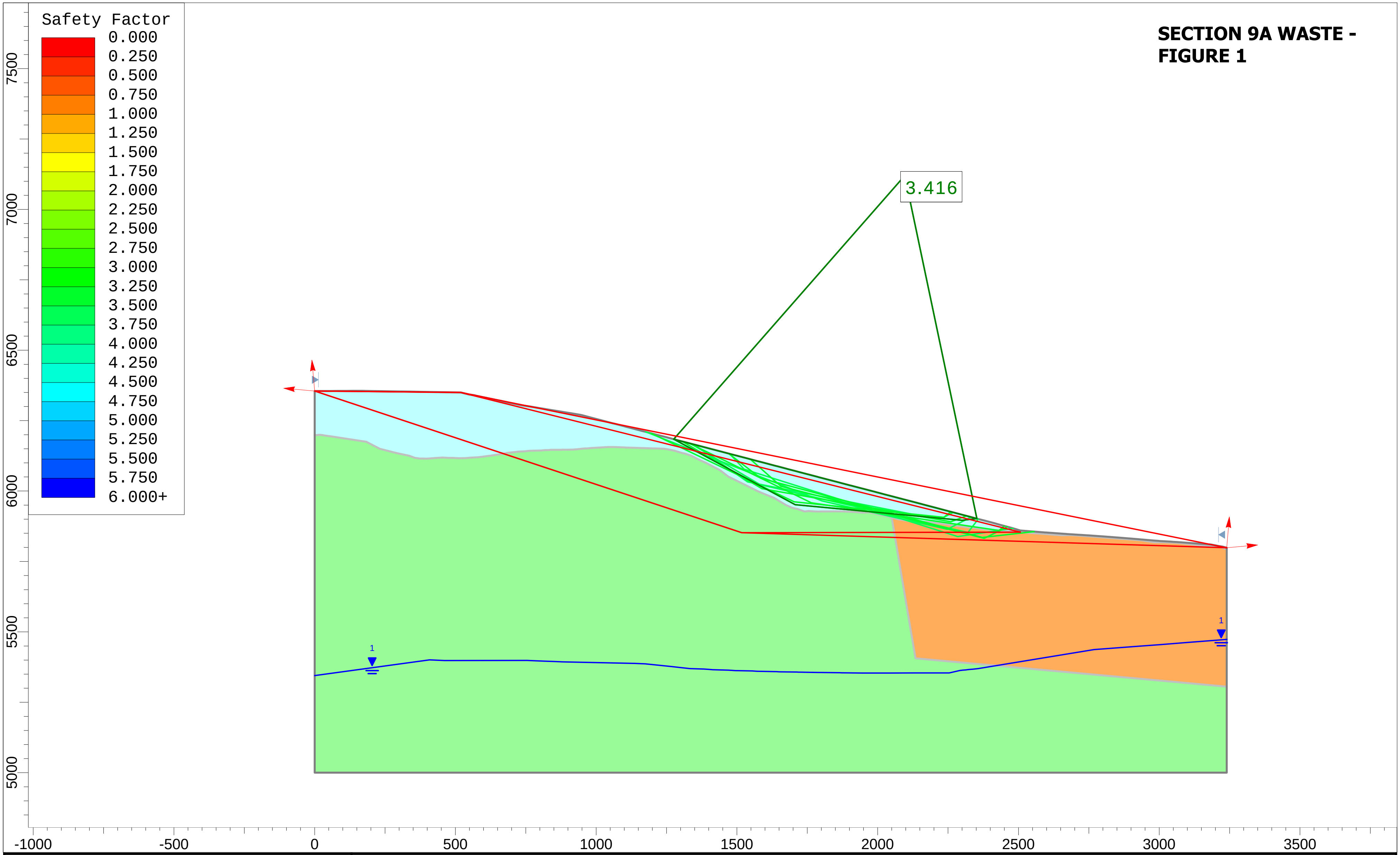
Figure

Scale 1:6602

Company Golder Associates

Date 1/2/2019

File Name 2C.slmd



SECTION 9A WASTE - FIGURE 1

GOLDER

Project Tyrone Mine Closure Stockpile Stability - SECTION 9A WASTE

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

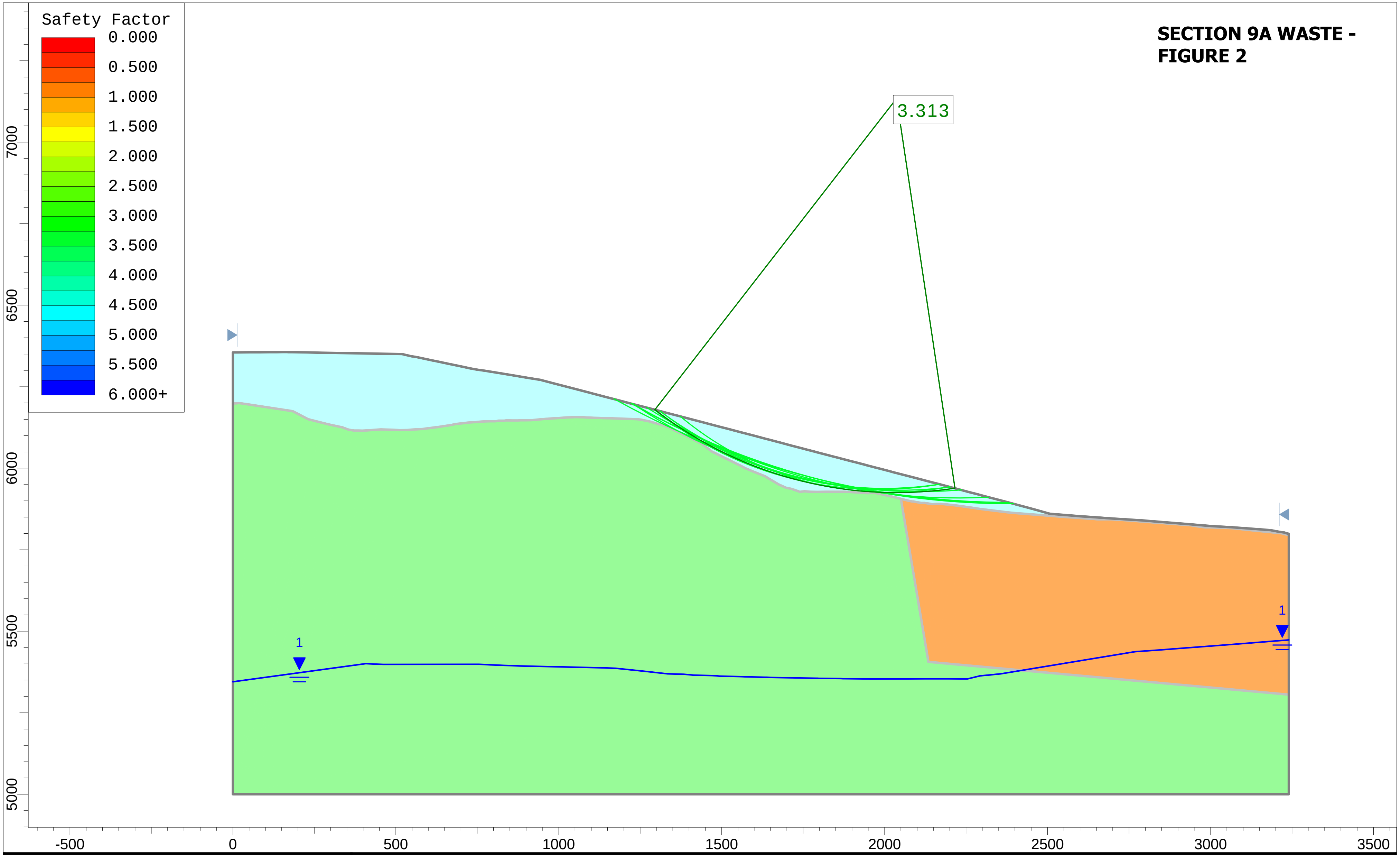
Scale 1:5660

Company Golder Associates

Date 1/2/2019

File Name 9A.slmd

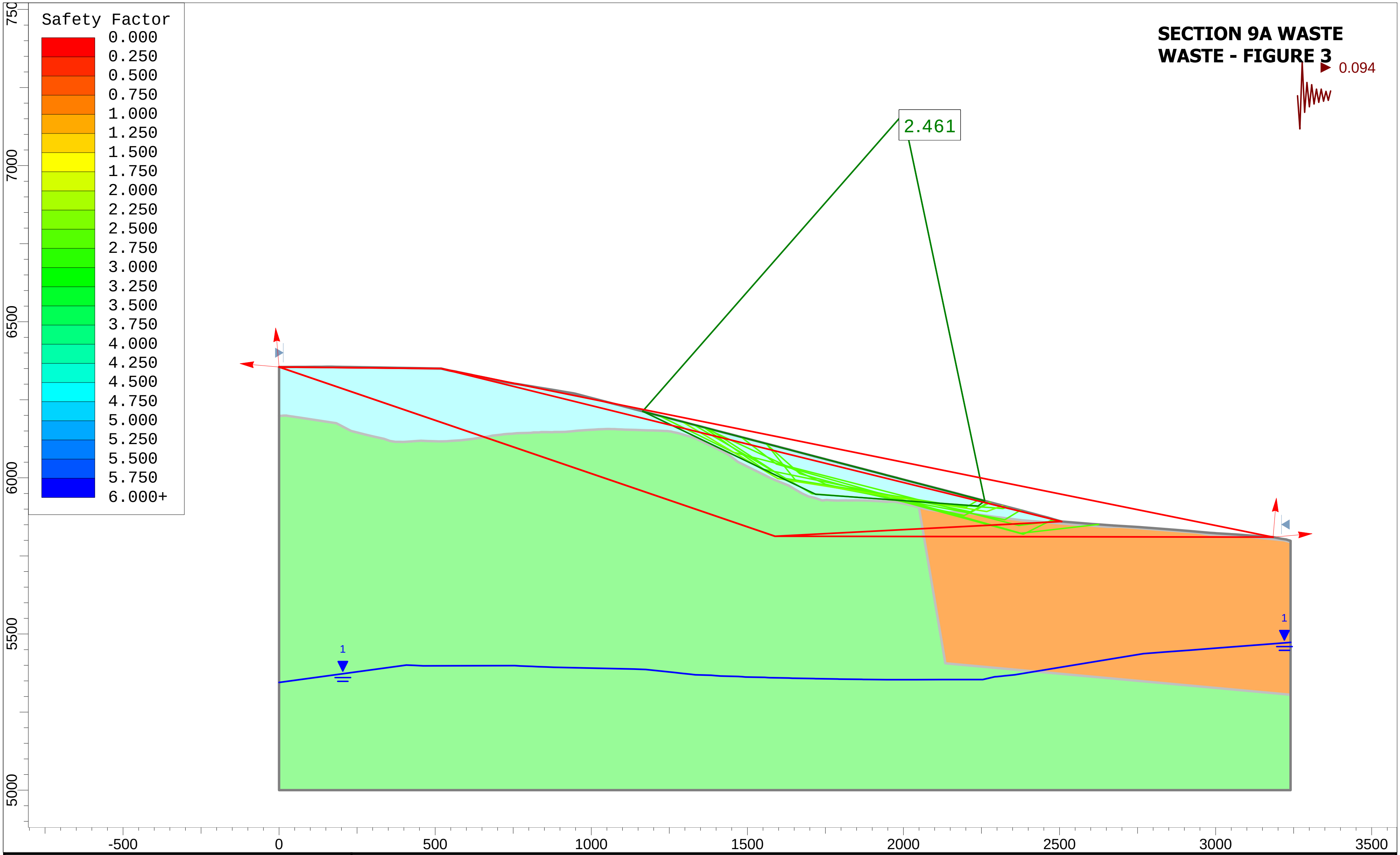
SLIDEINTERPRET 8.014



Project	Tyrone Mine Closure Stockpile Stability - SECTION 9A WASTE
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	*Scale* 1:4888
Company	Golder Associates
Date	
File Name	9A.slmd

GOLDER

SLIDEINTERPRET 8.014



Project
Tyrone Mine Closure Stockpile Stability - SECTION 9A WASTE

Analysis Description
Seismic - Block Failure (GLE / Morgenstern-Price)

Figure

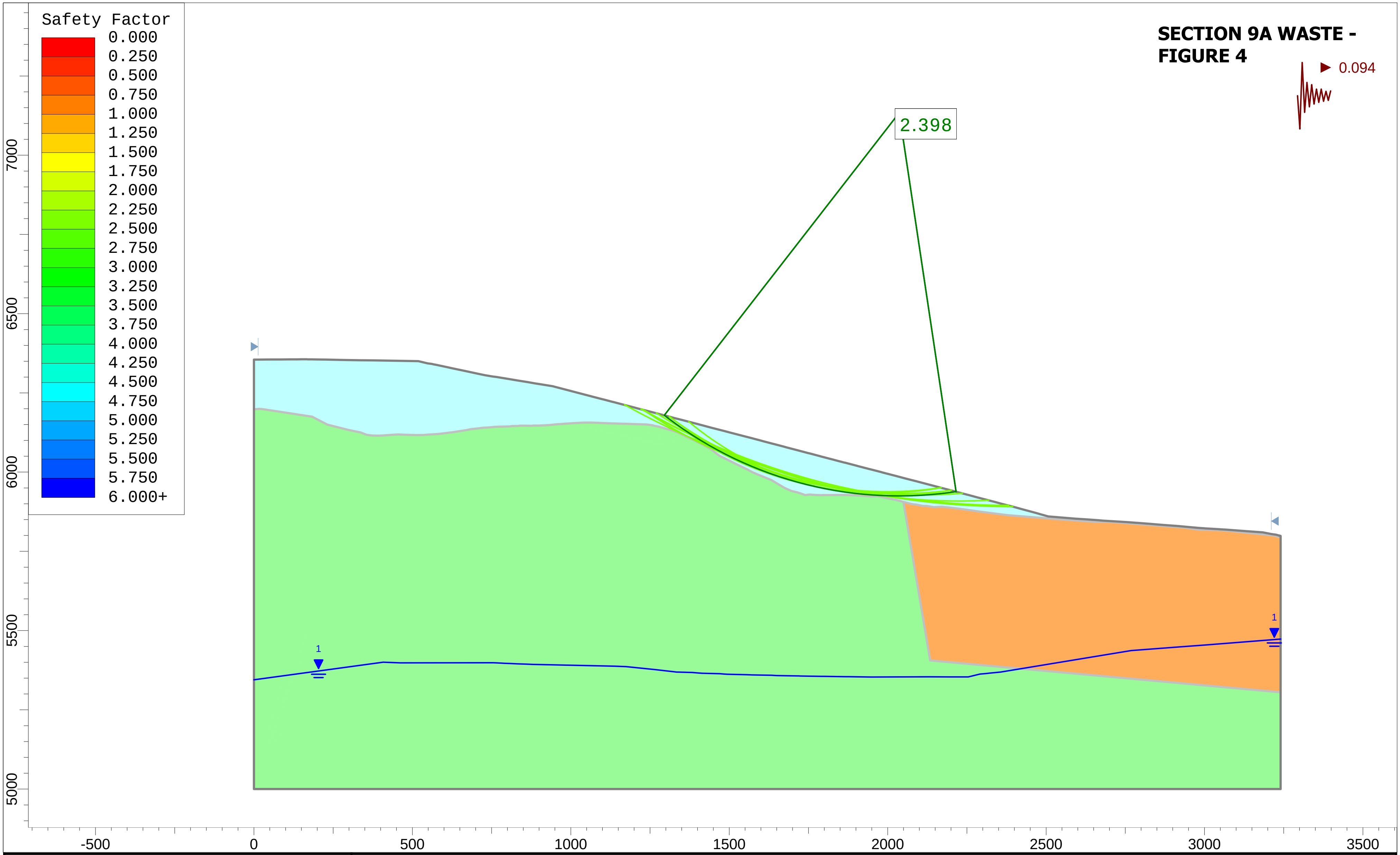
Scale 1:5104

Company Golder Associates

Date 1/2/2019

File Name 9A.slmd

SLIDEINTERPRET 8.014



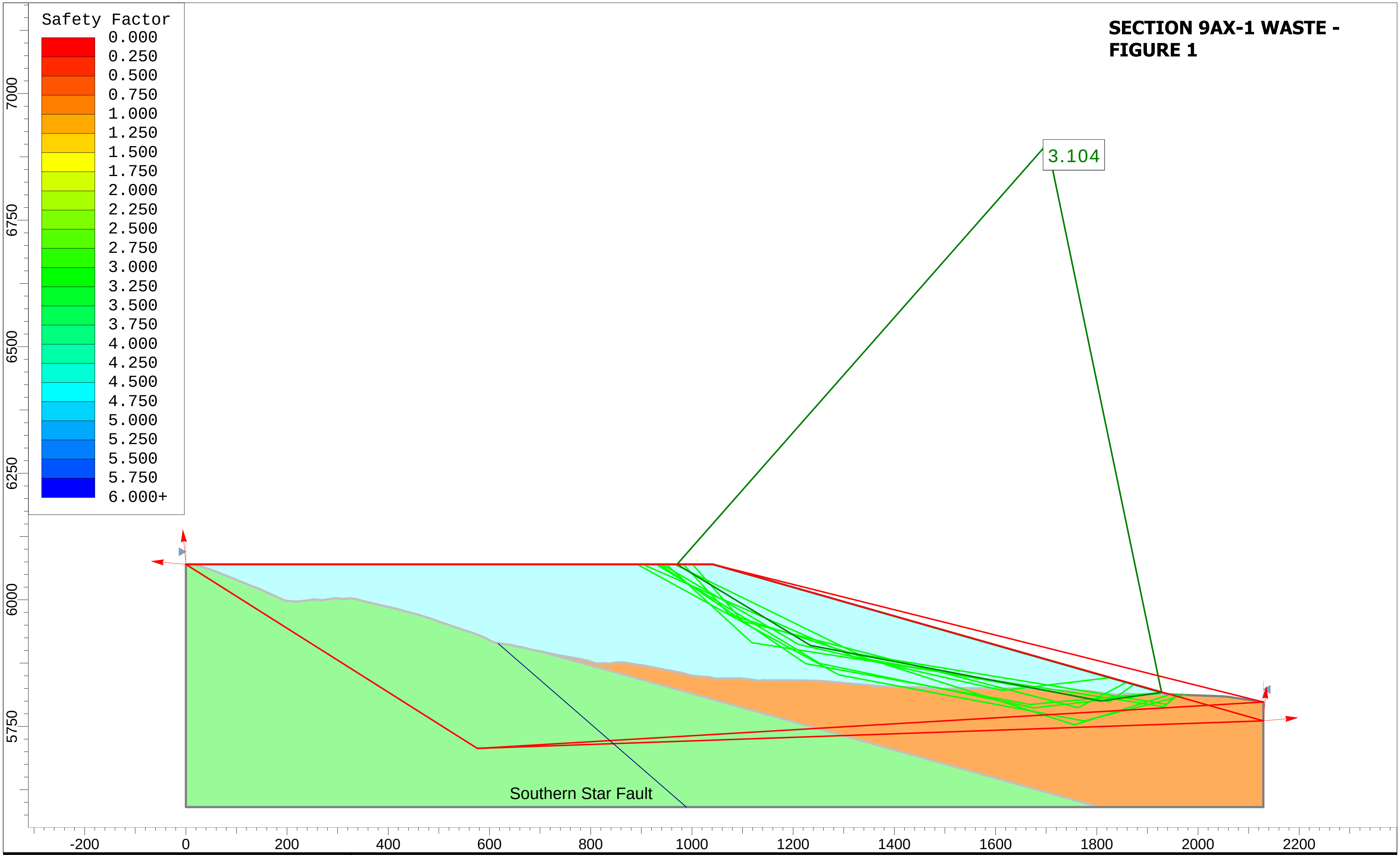
SECTION 9A WASTE - FIGURE 4

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION 9A WASTE
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)

Figure		*Scale* 1:5028	*Company* Golder Associates
Date 1/2/2019		*File Name* 9A.slmd	

SLIDEINTERPRET 8.014



SECTION 9AX-1 WASTE - FIGURE 1

GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - Section 9AX (1 of 2)

Analysis Description Static - Block Failure (GLE / Morgenstern-Price)

Figure

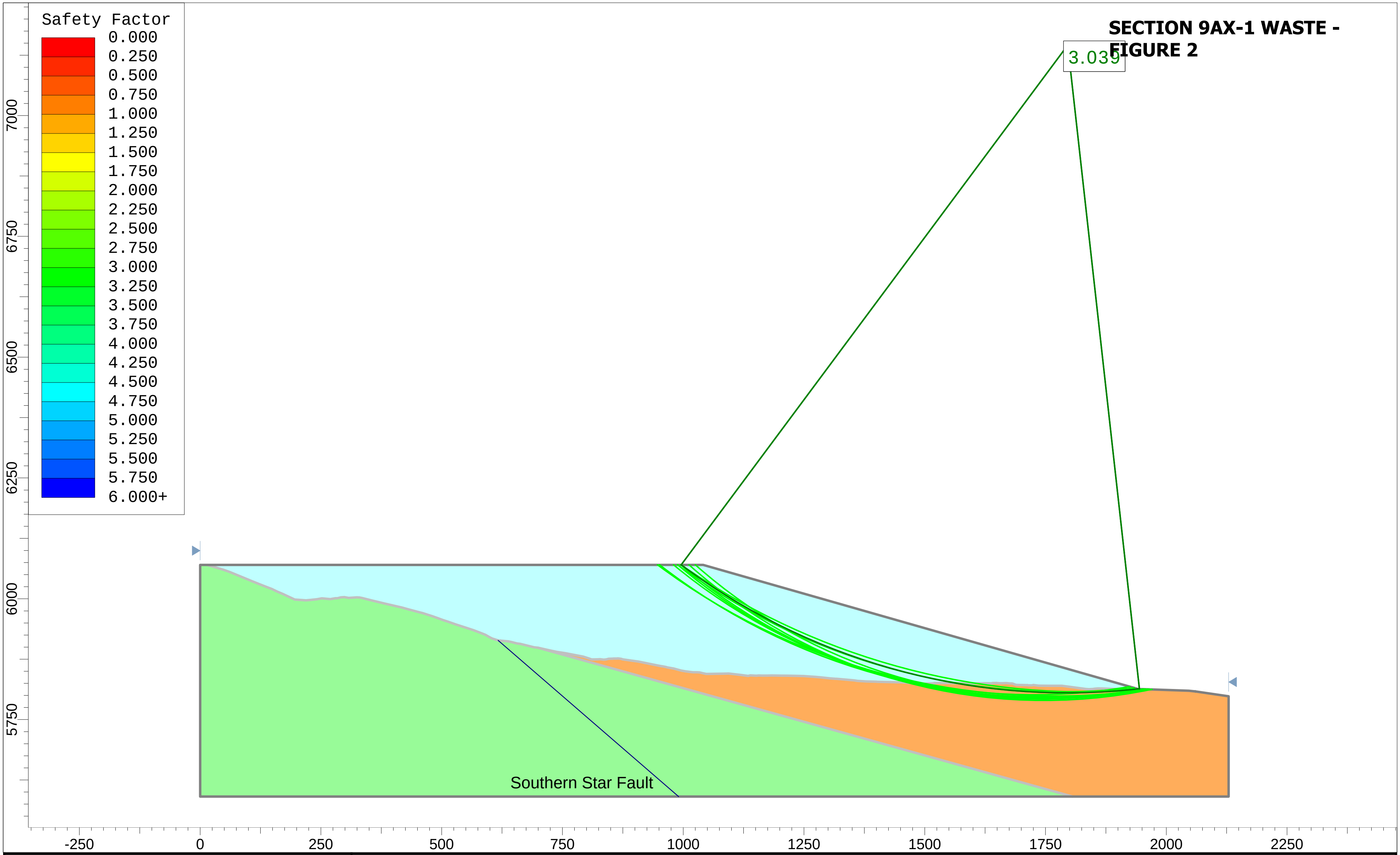
Scale 1:3148

Company Golder Associates

Date 1/2/2019

File Name 9AX-1().slmd

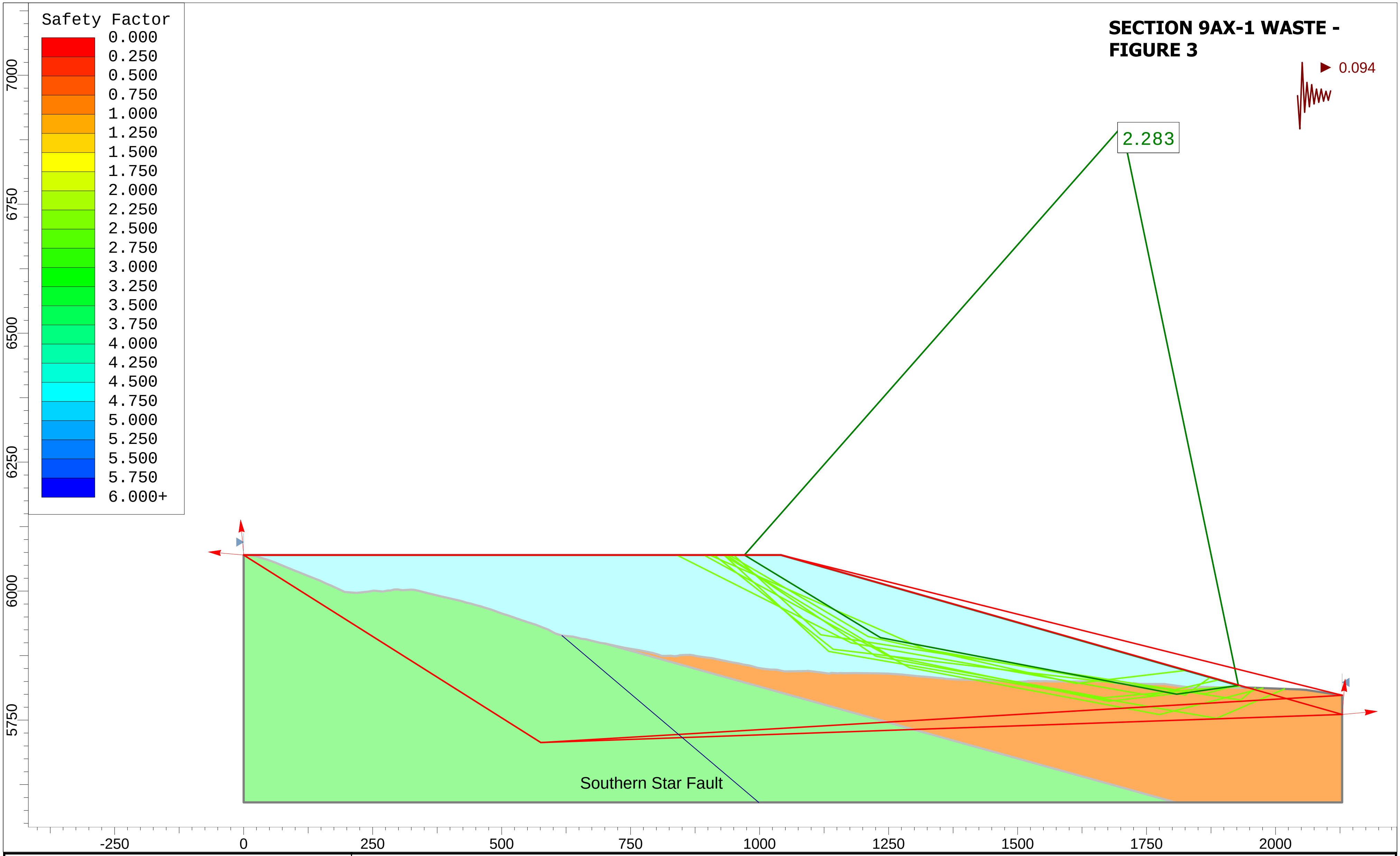
SECTION 9AX-1 WASTE - FIGURE 2



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (1 of 2)		
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3298	*Company*	Golder Associates
Date	1/2/2019	*File Name*	9AX-1().slmd



SECTION 9AX-1 WASTE - FIGURE 3

GOLDER

Project
Tyrone Mine Closure Stockpile Stability - Section 9AX (1 of 2)

Analysis Description
Seismic - Block Failure (GLE / Morgenstern-Price)

Figure

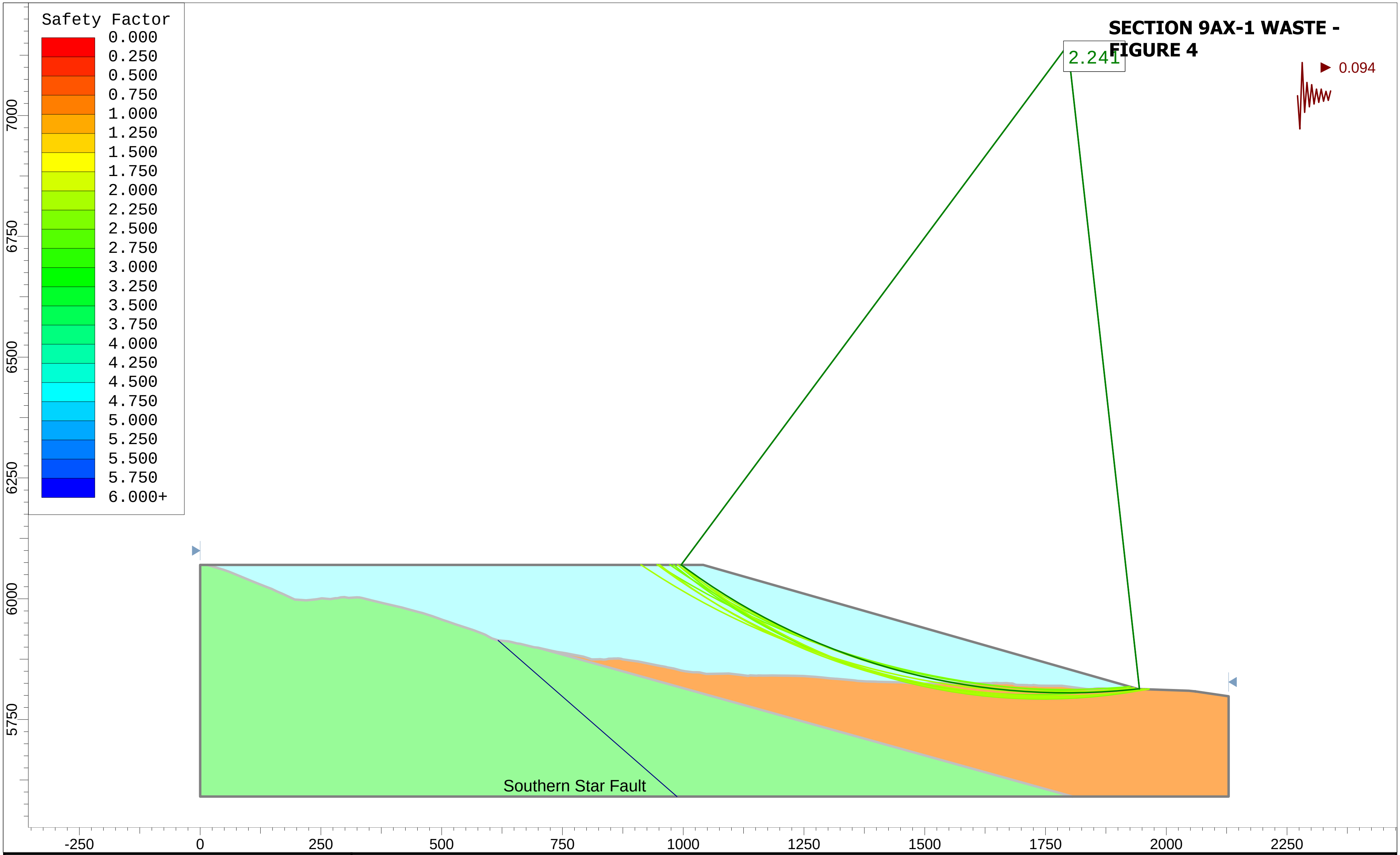
Scale 1:3088

Company Golder Associates

Date 1/2/2019

File Name 9AX-1().slmd

SLIDEINTERPRET 8.014

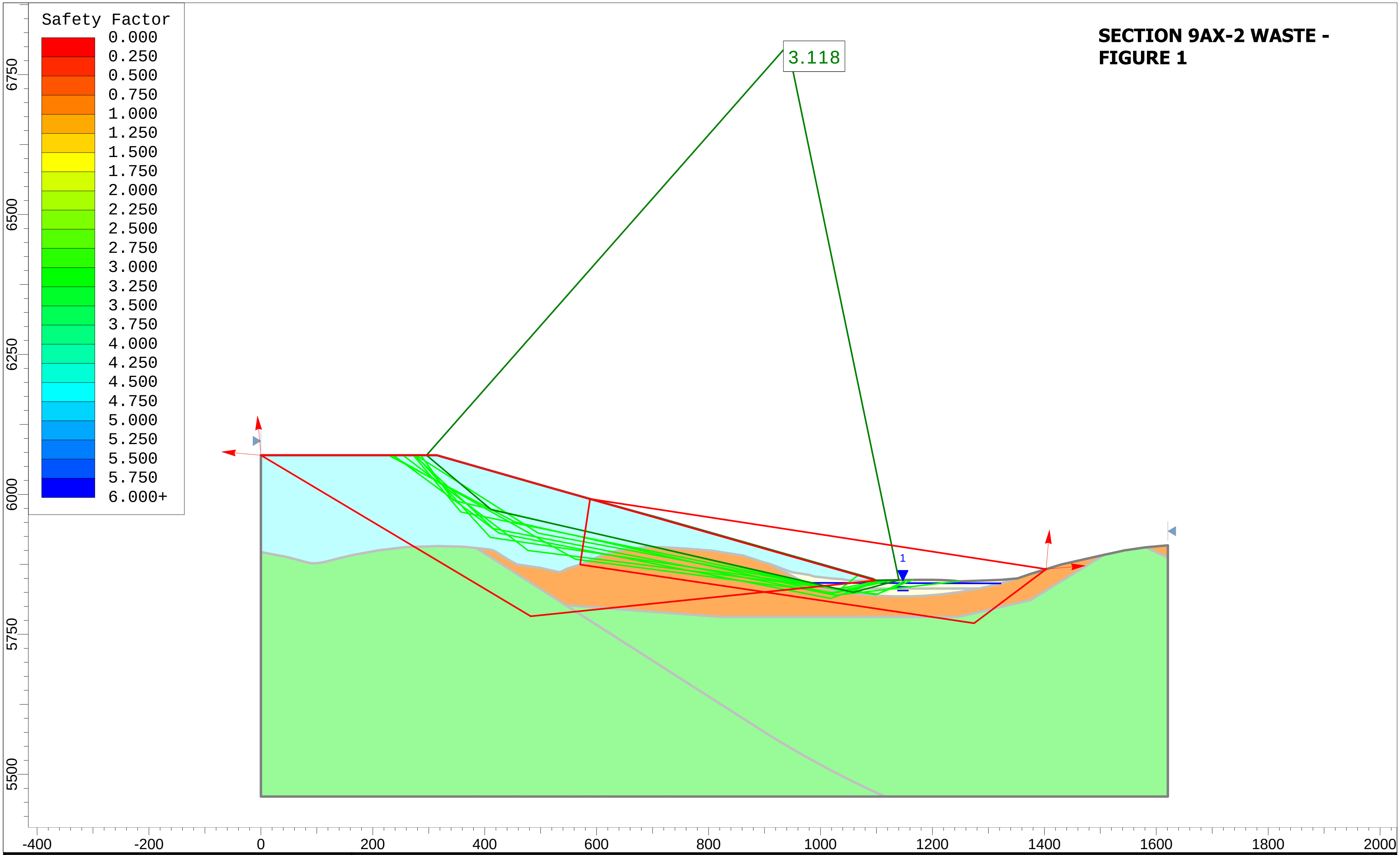


SECTION 9AX-1 WASTE - FIGURE 4

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (1 of 2)		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3298	*Company*	Golder Associates
Date	1/2/2019	*File Name*	9AX-1().slmd

SLIDEINTERPRET 8.014

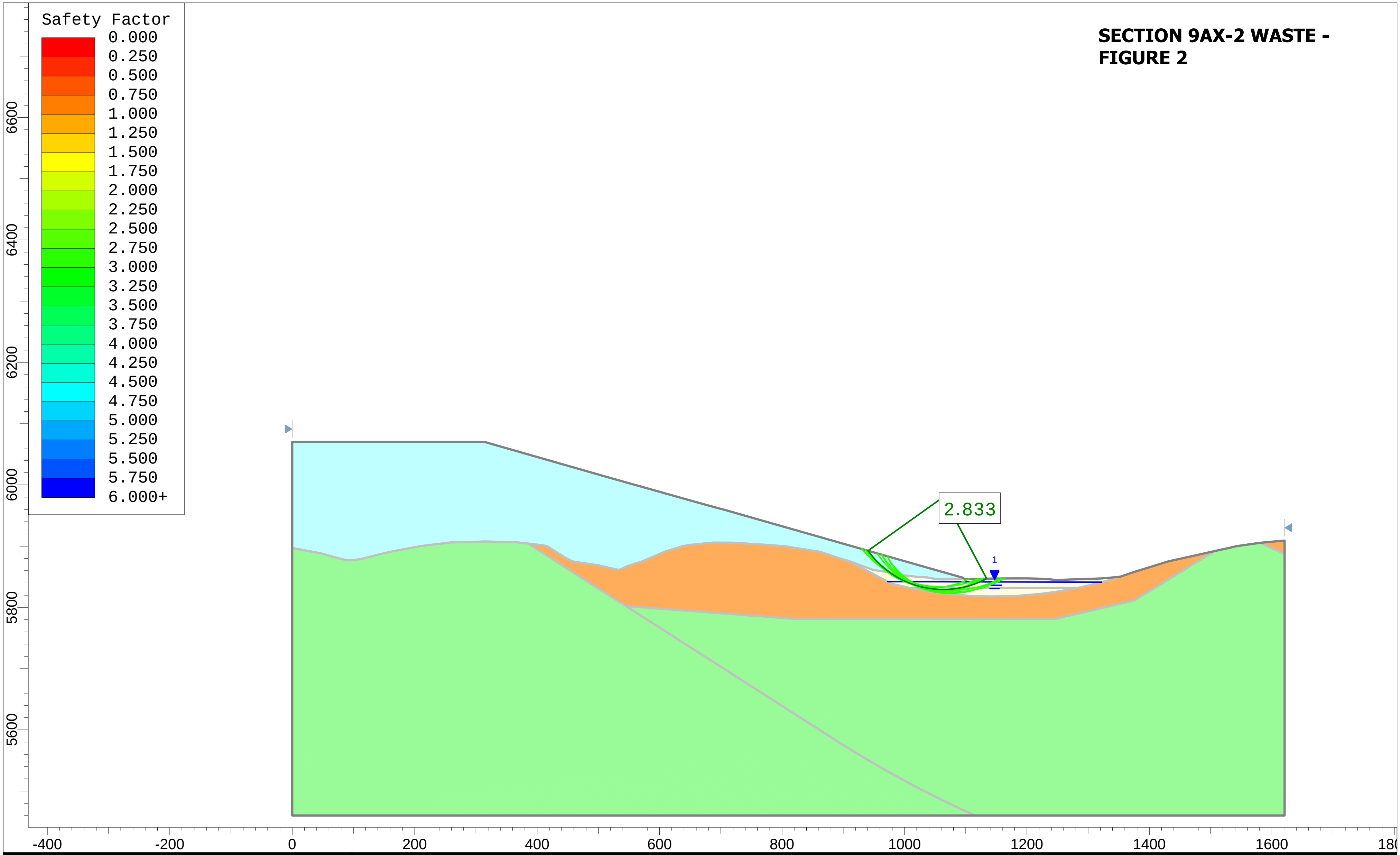


**SECTION 9AX-2 WASTE -
FIGURE 1**

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)
Analysis Description	Static - Block Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:2847
Company	Golder Associates
Date	1/2/2019
File Name	9AX-2.slmd

SLIDEINTERPRET 8.014



SECTION 9AX-2 WASTE - FIGURE 2

GOLDER

Project Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)

Analysis Description Static - Circular Failure (GLE / Morgenstern-Price)

Figure

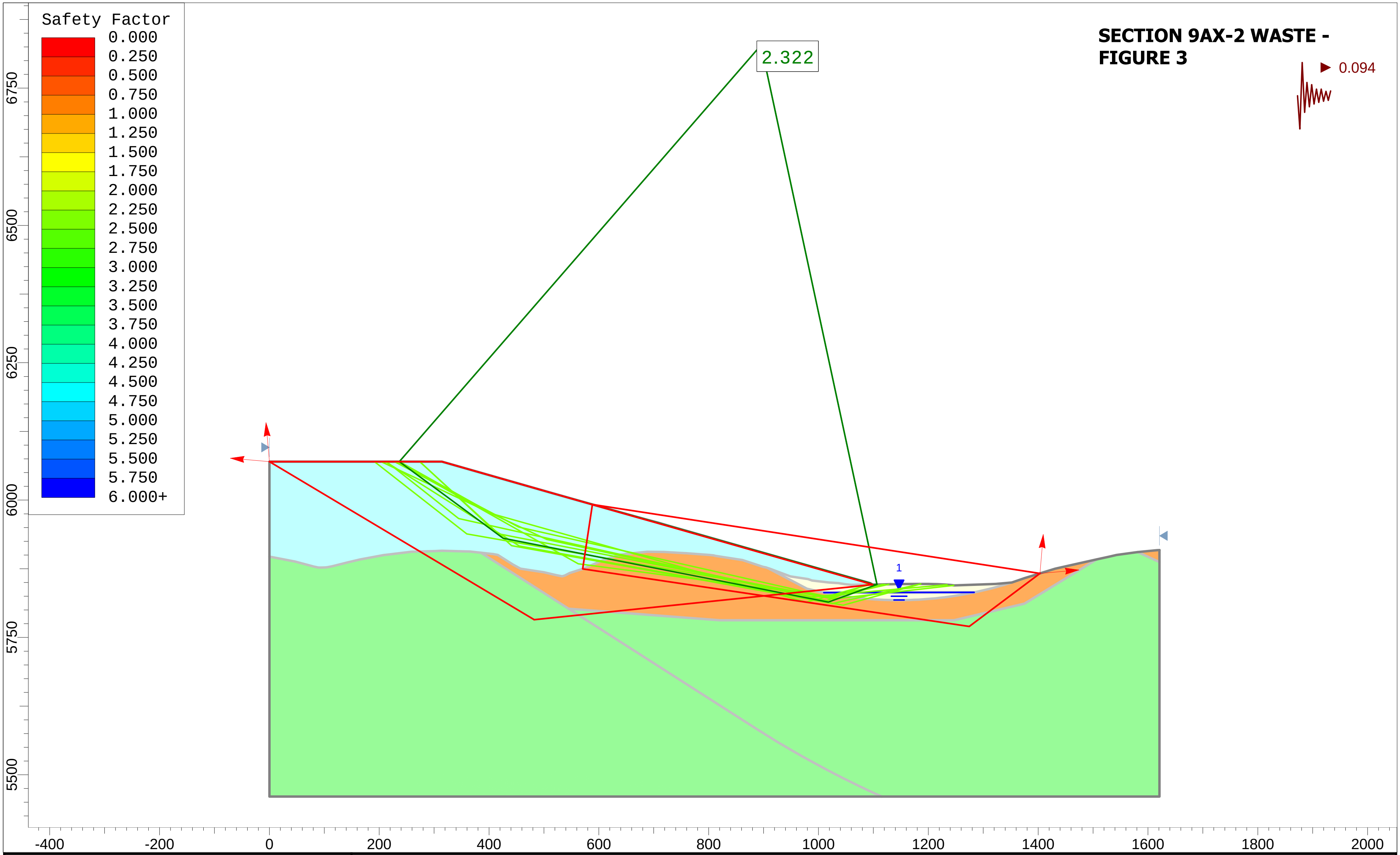
Scale 1:2602

Company Golder Associates

Date 1/2/2019

File Name 9AX-2.slmd

SLIDEINTERPRET 8.014

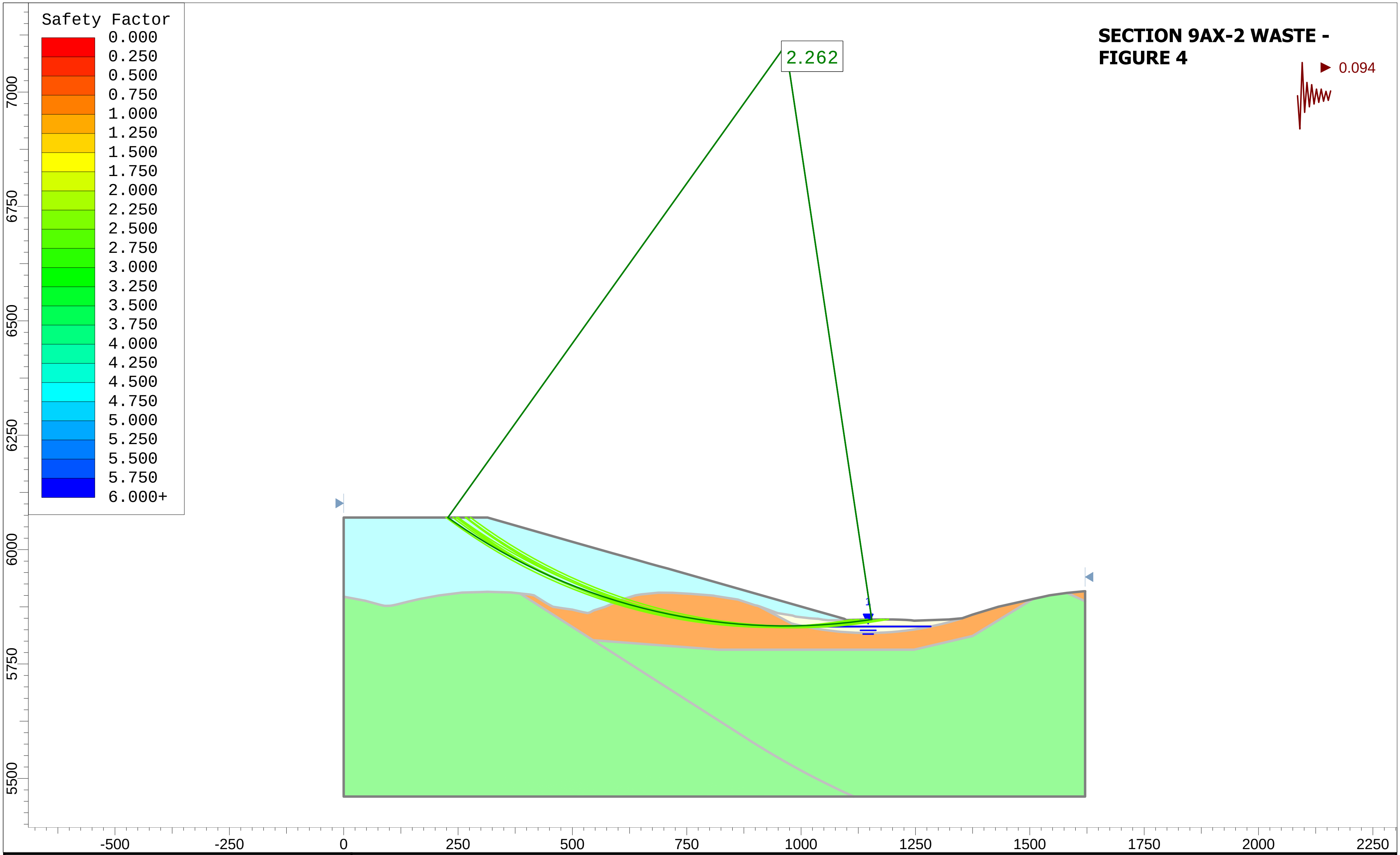


Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)
Analysis Description	Seismic - Block Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:2902	*Company*	Golder Associates
Date	1/2/2019			*File Name*	9AX-2.slmd

GOLDER

SLIDEINTERPRET 8.014



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)

Analysis Description Seismic - Circular Failure (GLE / Morgenstern-Price)

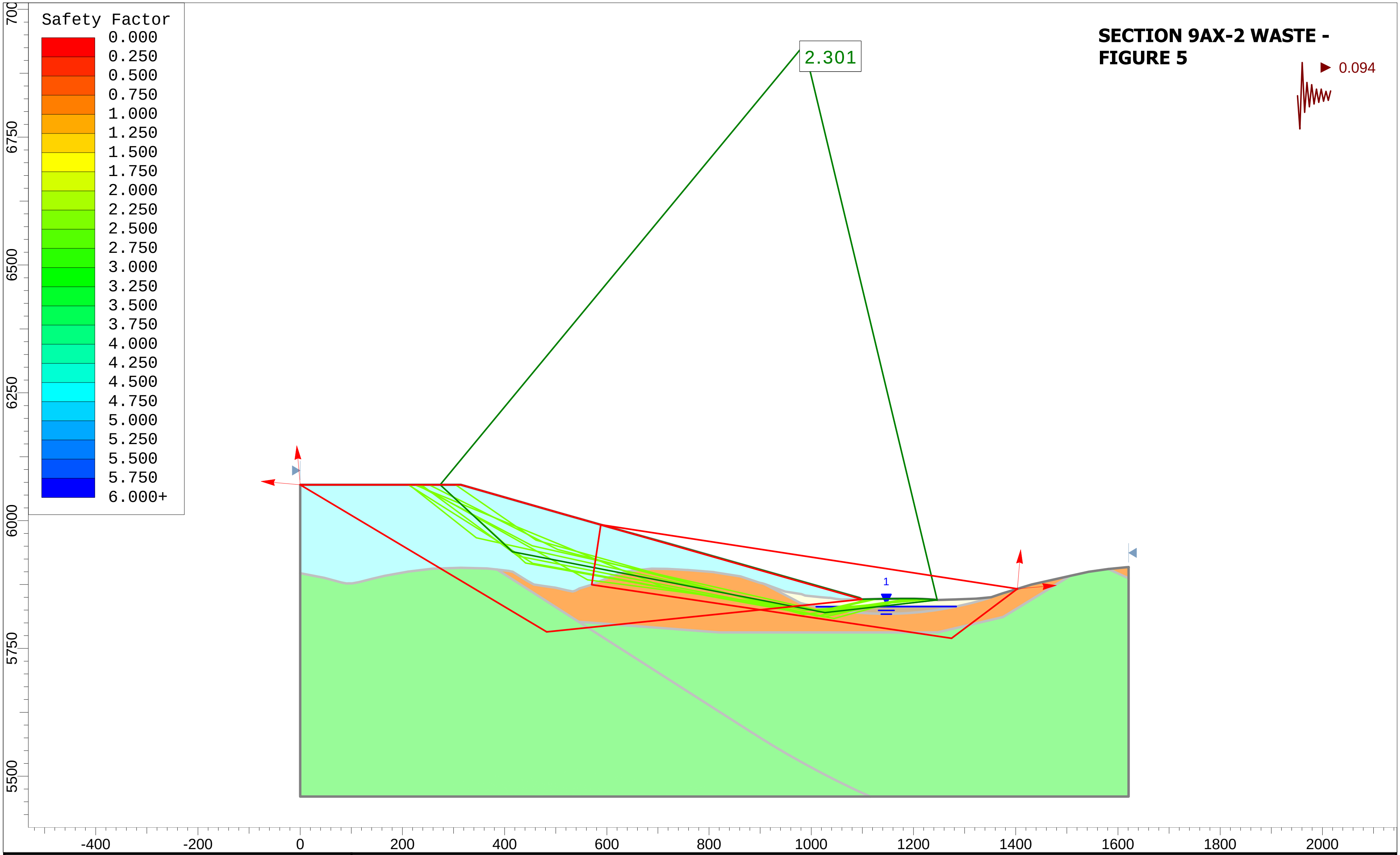
Figure

Scale 1:3483

Company Golder Associates

Date 1/2/2019

File Name 9AX-2.slmd

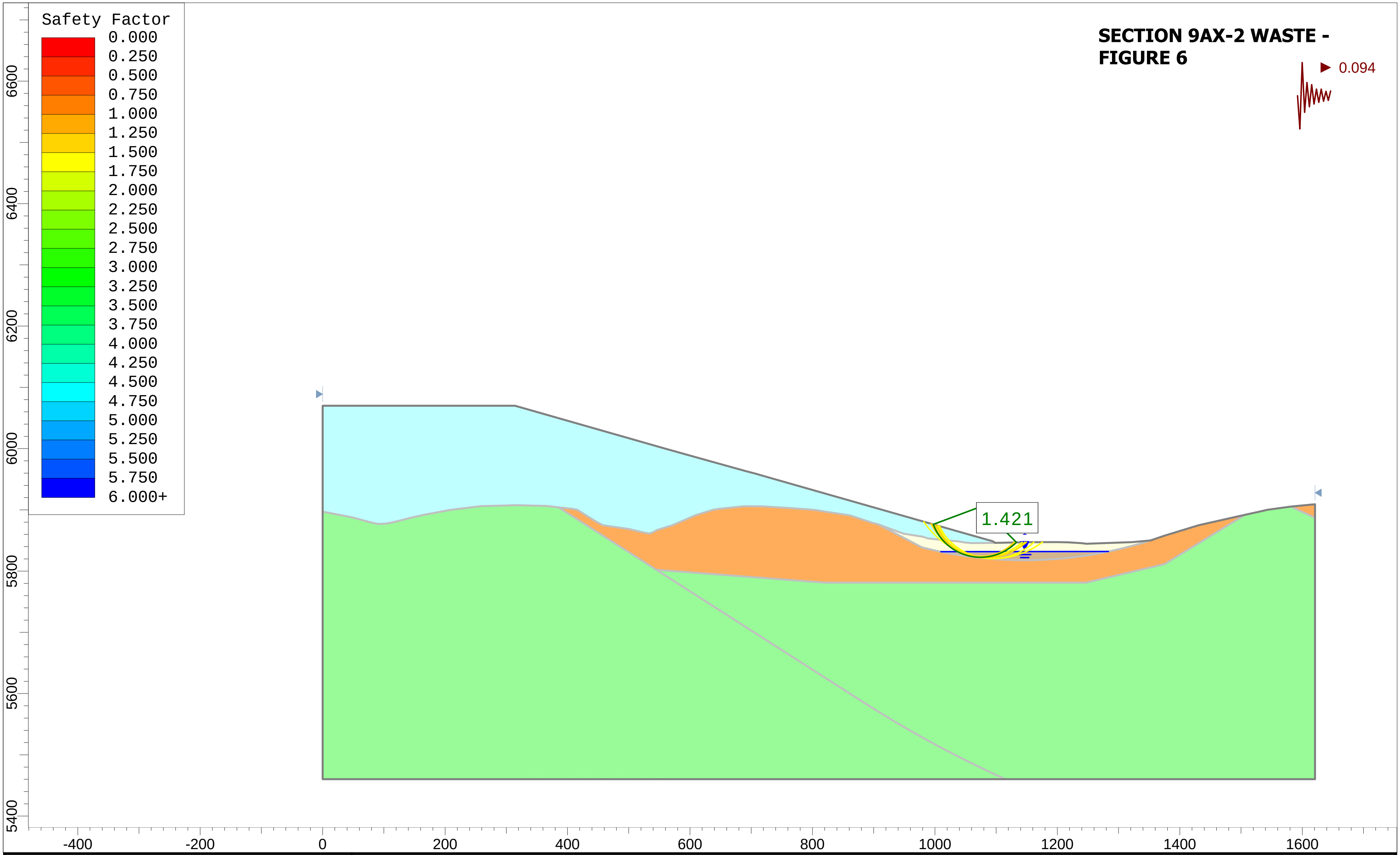


**SECTION 9AX-2 WASTE -
FIGURE 5**

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)		
Analysis Description	Seismic - Liquefied Qa - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3117	*Company*	Golder Associates
Date 1/2/2019		*File Name*	9AX-2.slmd

SLIDEINTERPRET 8.014

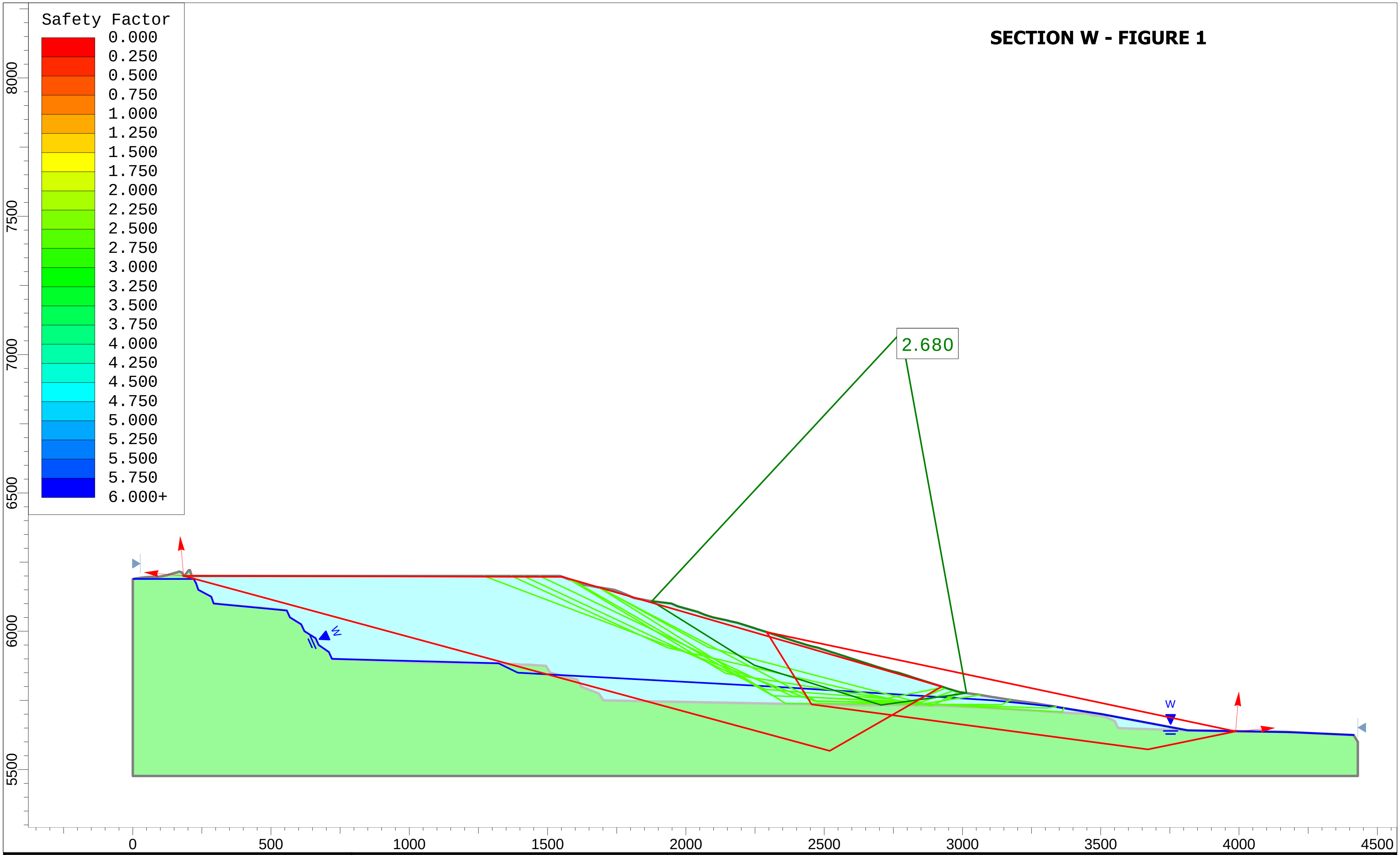


SECTION 9AX-2 WASTE - FIGURE 6

GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section 9AX (2 of 2)
Analysis Description	Seismic - Liquefied Qa - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:2602
Company	Golder Associates
Date	1/2/2019
File Name	9AX-2.slmd

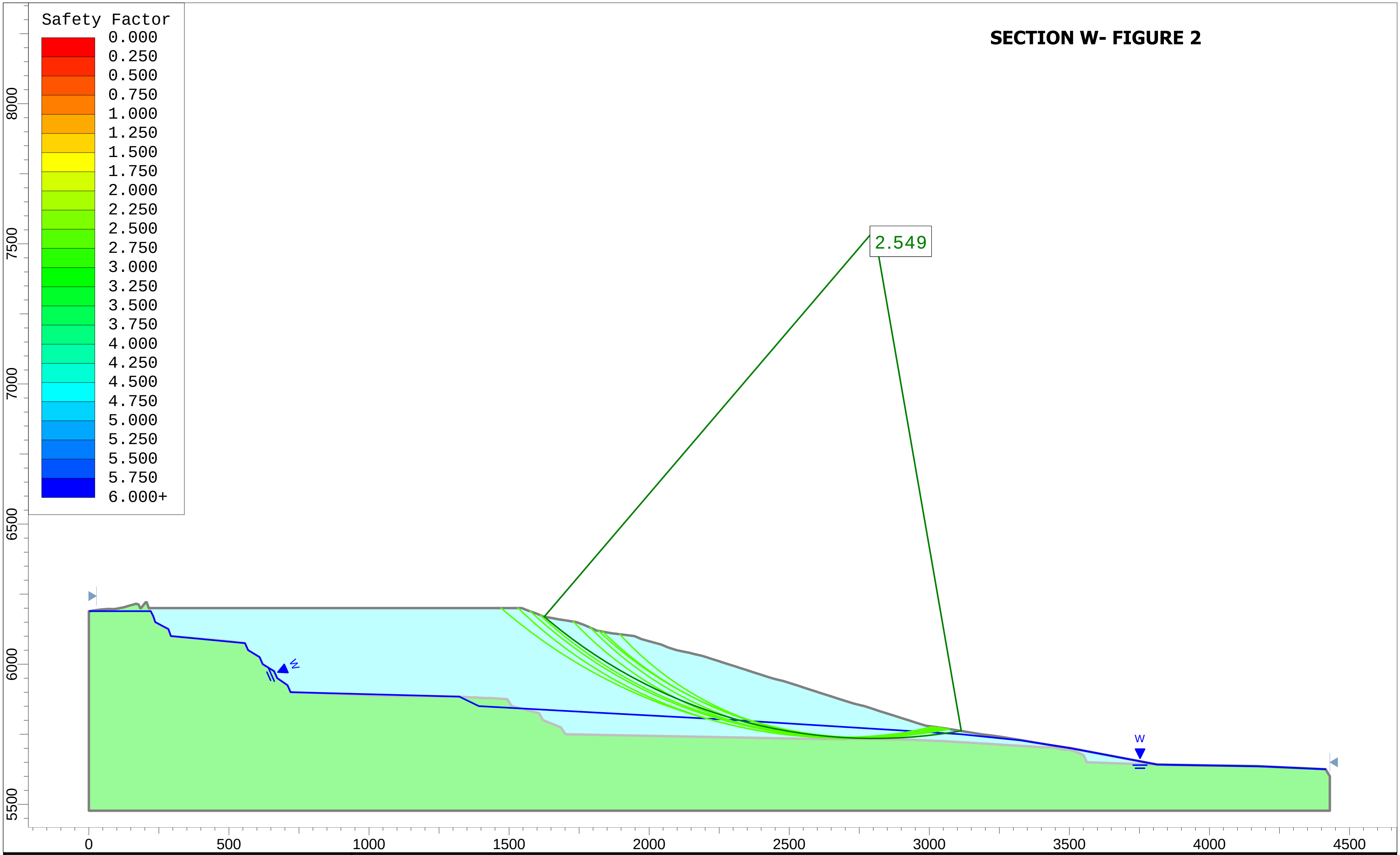
SLIDEINTERPRET 8.014



Project	Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)
Analysis Description	Static- No Pit Lake - Block Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:5761
Company	Golder Associates		
Date	1/2/2019	*File Name*	LR.slmd

SLIDEINTERPRET 8.014



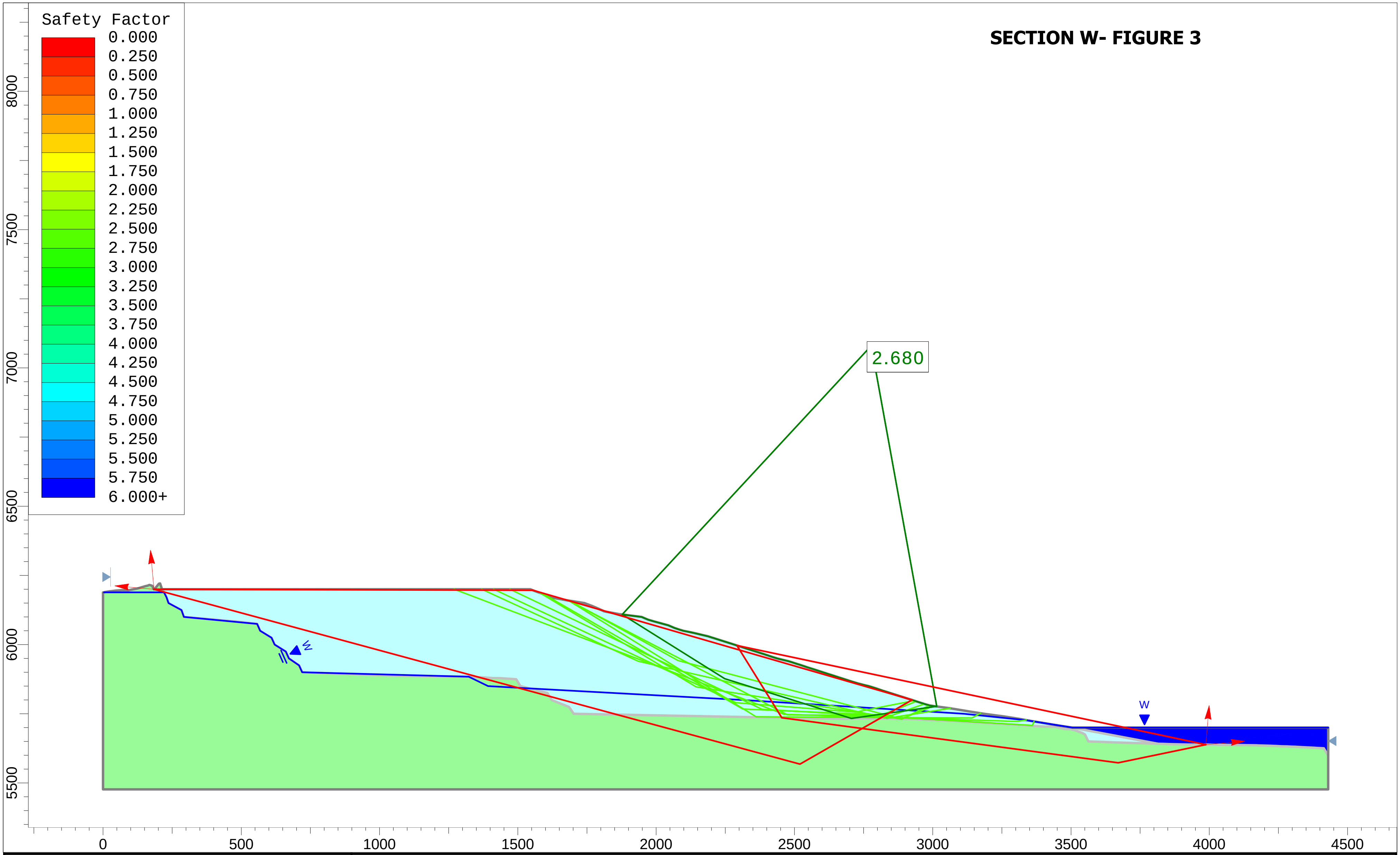
GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)
Analysis Description	Static- No Pit Lake - Circular Failure (GLE / Morgenstern-Price)

Figure		*Scale*	1:5687	*Company*	Golder Associates
Date	1/2/2019			*File Name*	LR.slmd

SECTION W- FIGURE 3



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)

Analysis Description
Static-Pit Lake 5700 ft - Block Failure (GLE / Morgenstern-Price)

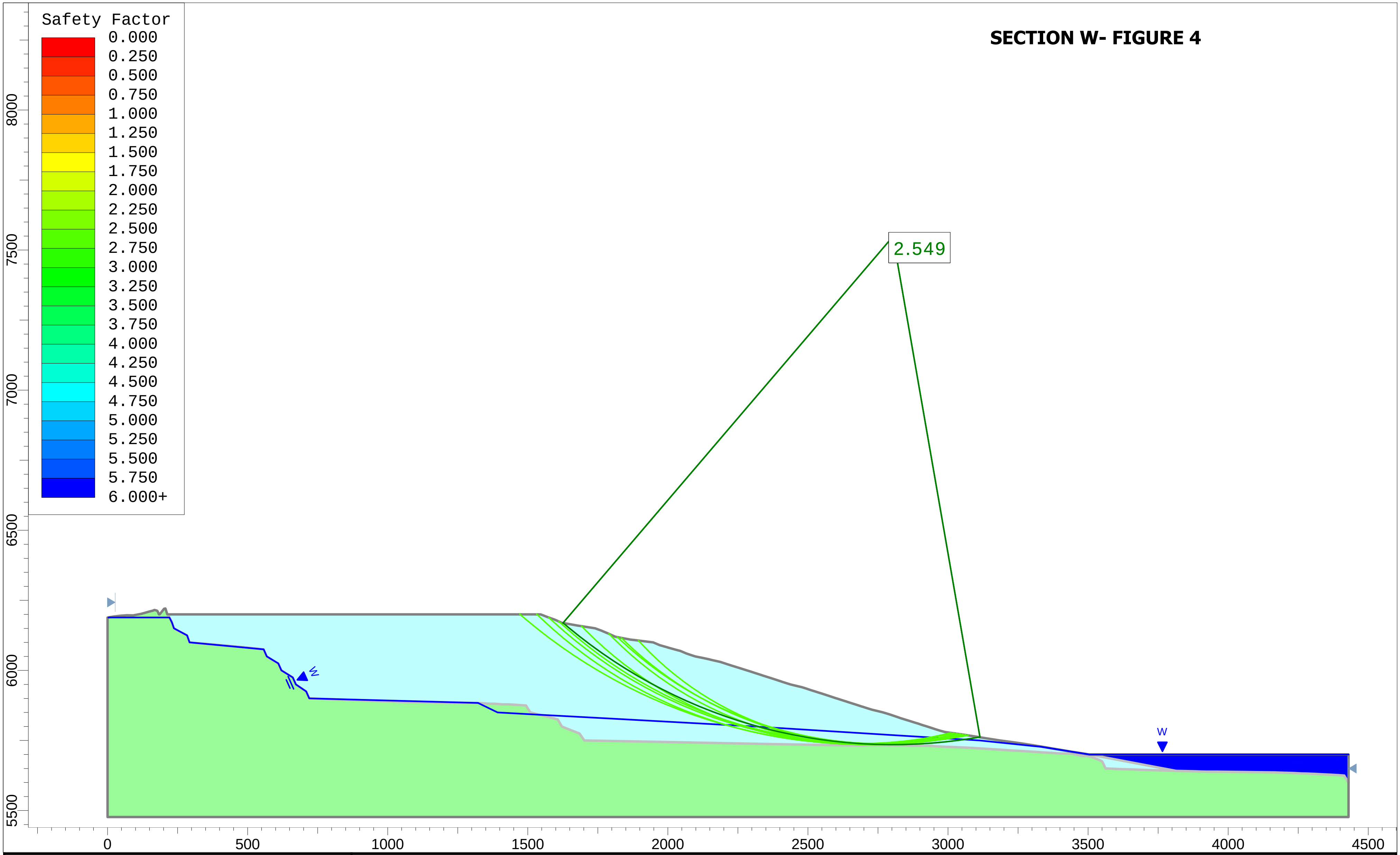
Figure

Scale
1:5761

Company
Golder Associates

Date
1/2/2019

File Name
LR.slmd

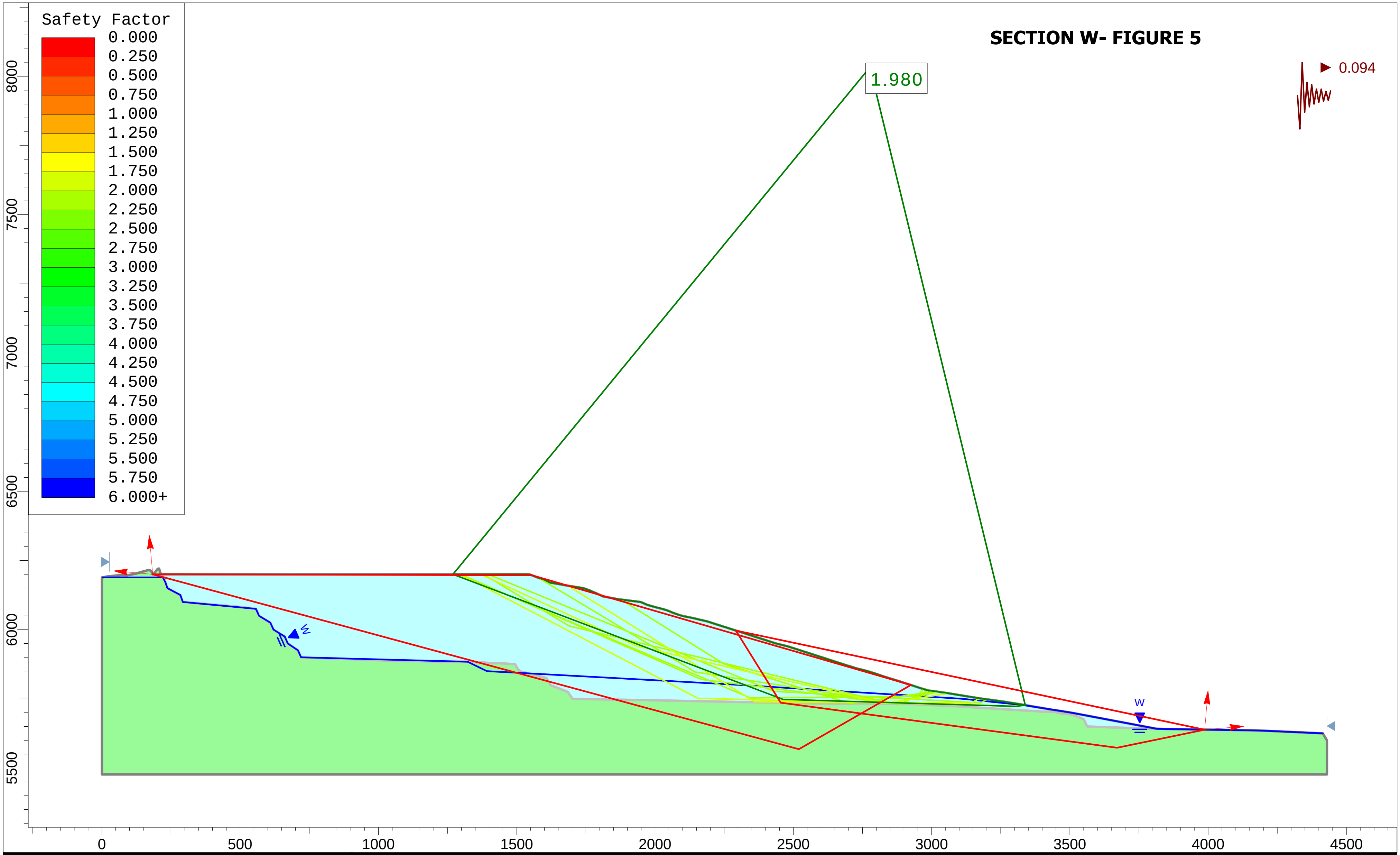


SECTION W- FIGURE 4

GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)		
Analysis Description	Static-Pit Lake 5700 ft - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:5687	*Company*	Golder Associates
Date	1/2/2019	*File Name*	LR.slmd



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)
Analysis Description	Seismic- No Pit Lake - Block Failure (GLE / Morgenstern-Price)

Figure

Scale 1:5761

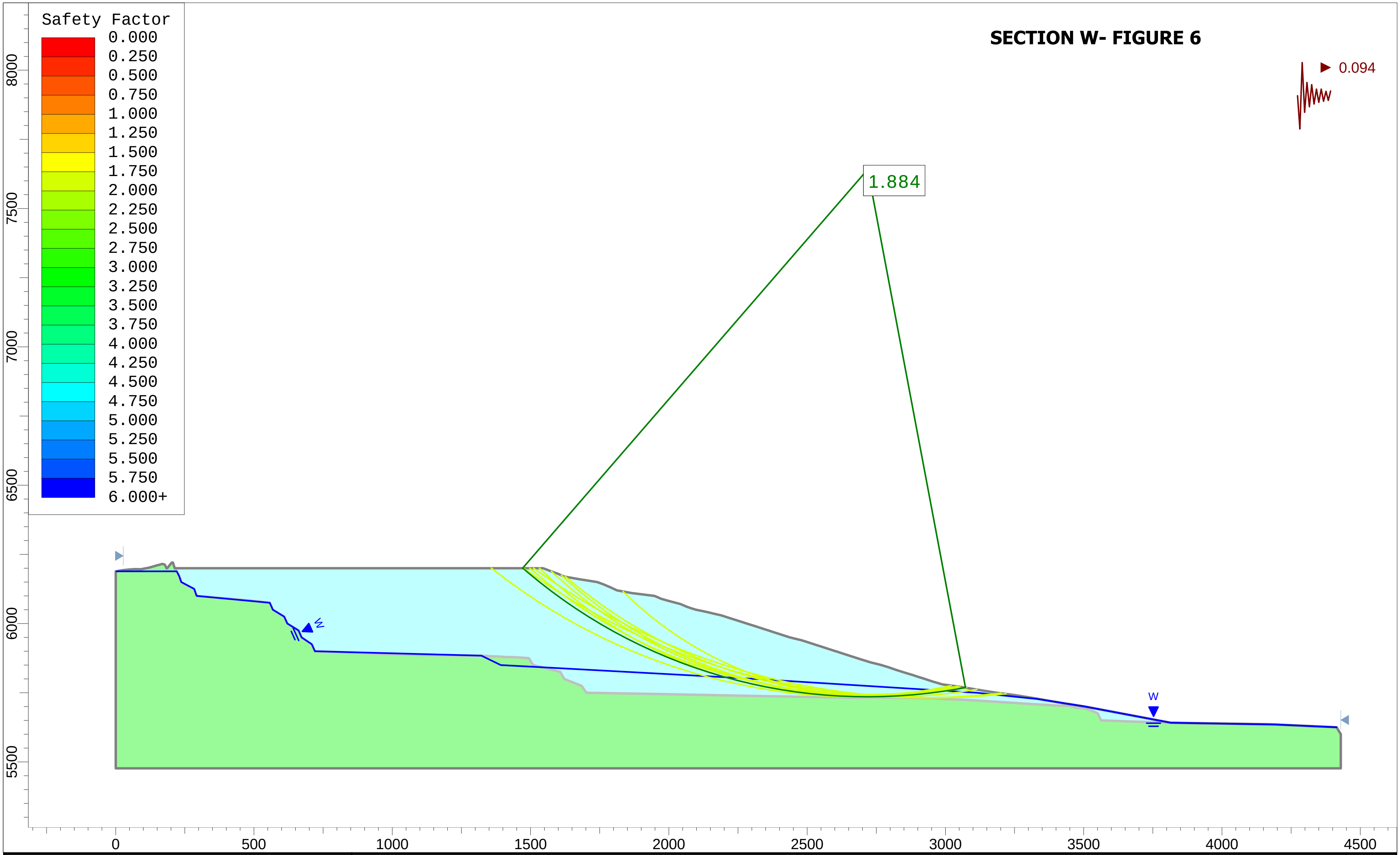
Company Golder Associates

Date 1/2/2019

File Name LR.slmd

SLIDEINTERPRET 8.014

SECTION W- FIGURE 6



GOLDER

Project Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)

Analysis Description Seismic- No Pit Lake - Circular Failure (GLE / Morgenstern-Price)

Figure

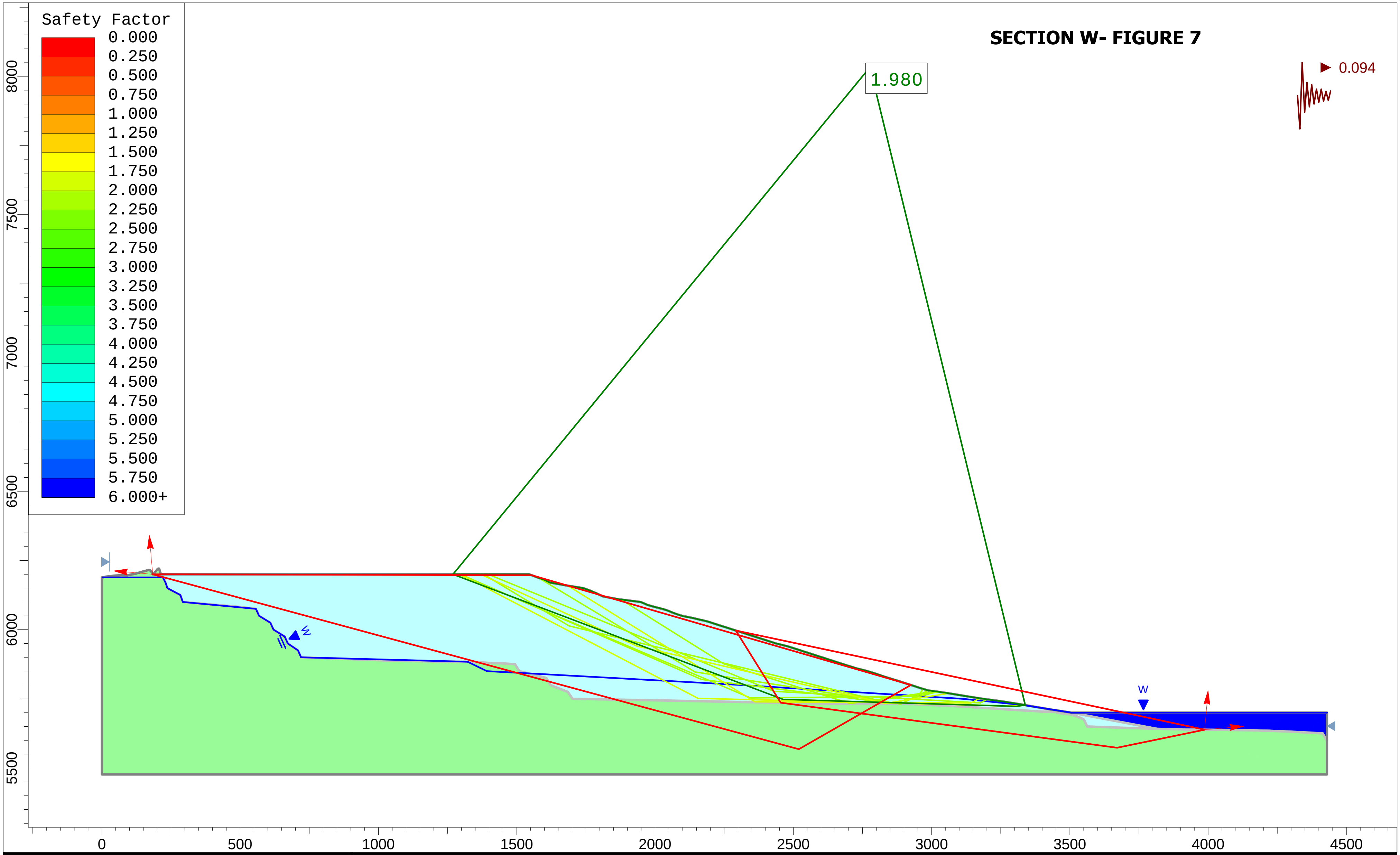
Scale 1:5761

Company Golder Associates

Date 1/2/2019

File Name LR.slmd

SLIDEINTERPRET 8.014



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)

Analysis Description
Seismic-Pit Lake 5700 ft - Block Failure (GLE / Morgenstern-Price)

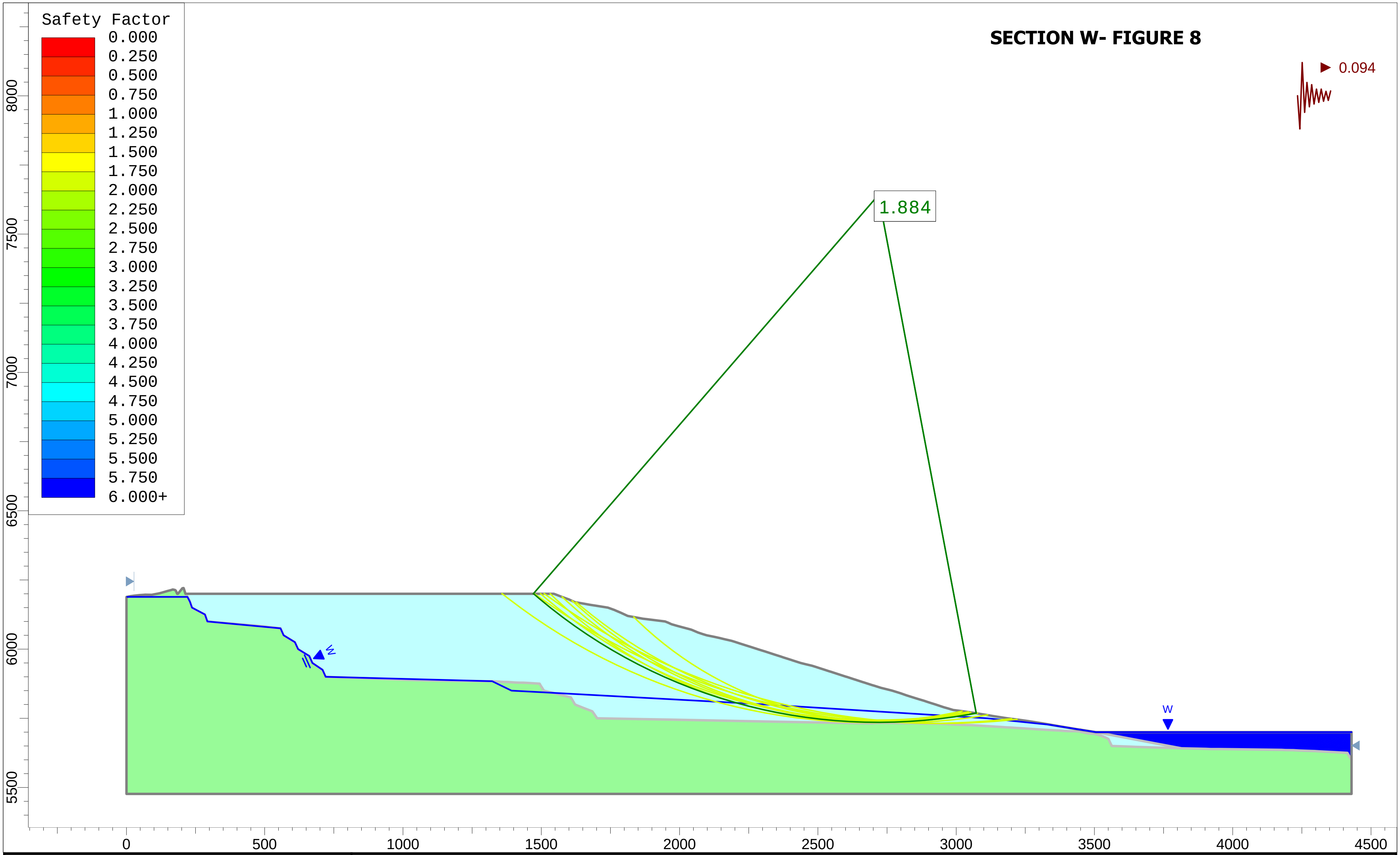
Figure

Scale 1:5761

Company Golder Associates

Date 1/2/2019

File Name LR.slmd



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - Section West In-Pit Waste (at Little Rock)

Analysis Description Seismic-Pit Lake 5700 ft - Circular Failure (GLE / Morgenstern-Price)

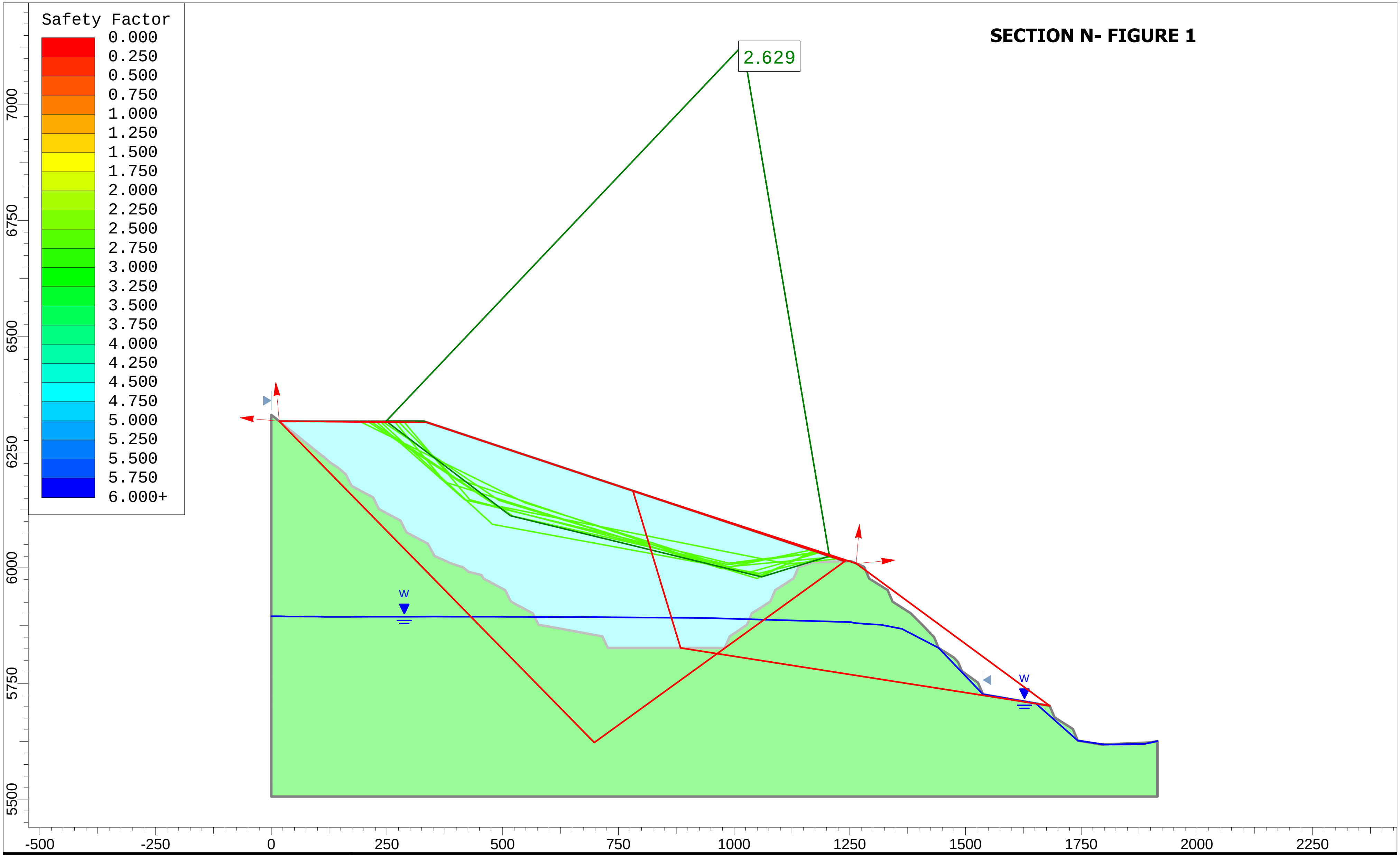
Figure

Scale 1:5761

Company Golder Associates

Date 1/2/2019

File Name LR.slmd



GOLDER

SLIDEINTERPRET 8.014

Project Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)

Analysis Description Static - No Pit Lake condition - Block Failure (GLE / Morgenstern-Price)

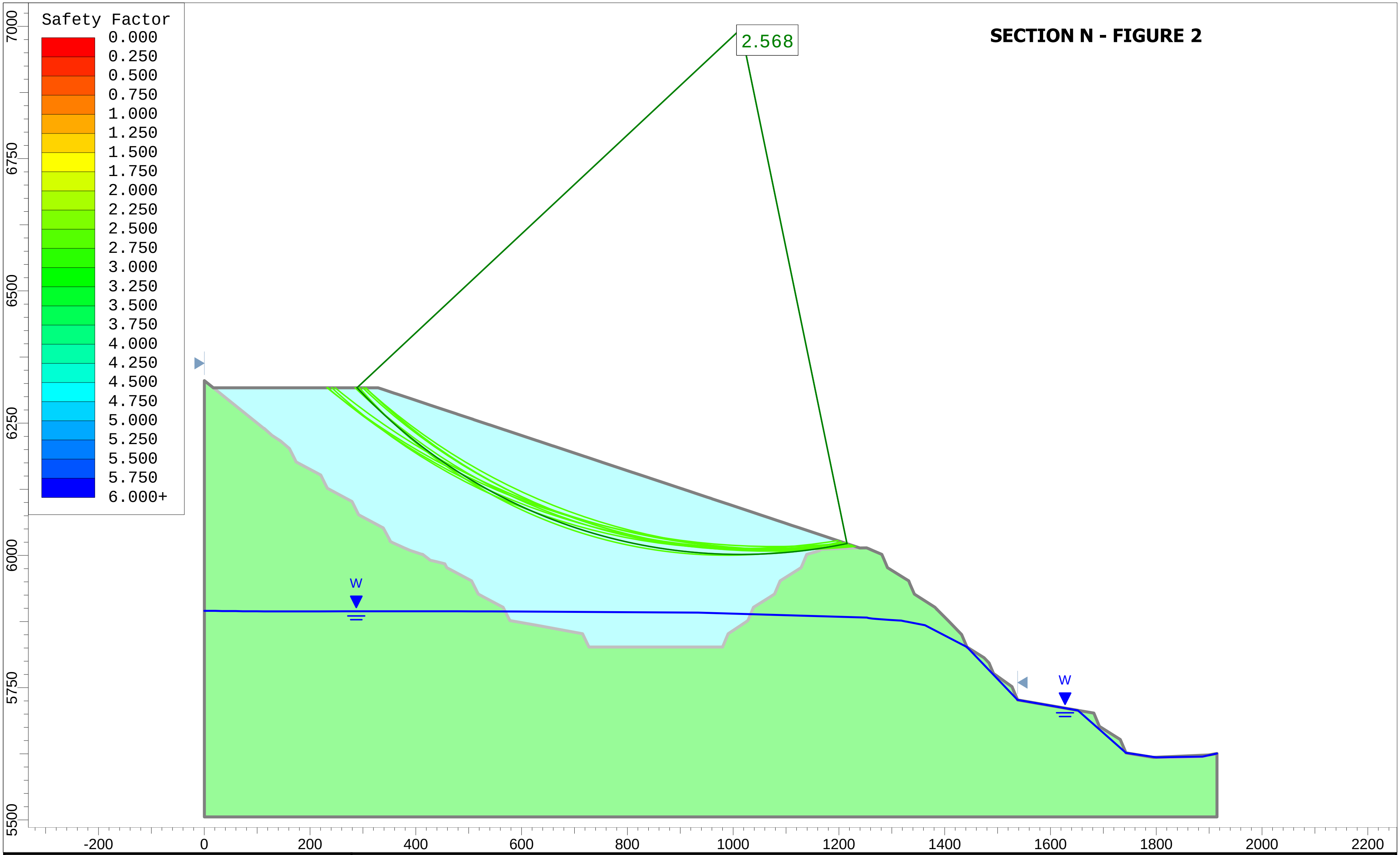
Figure

Scale 1:3443

Company Golder Associates

Date 1/2/2019

File Name LR-n.slmd



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)

Analysis Description
Static - No Pit Lake condition - Circular Fail (GLE / Morgenstern-Price)

Figure

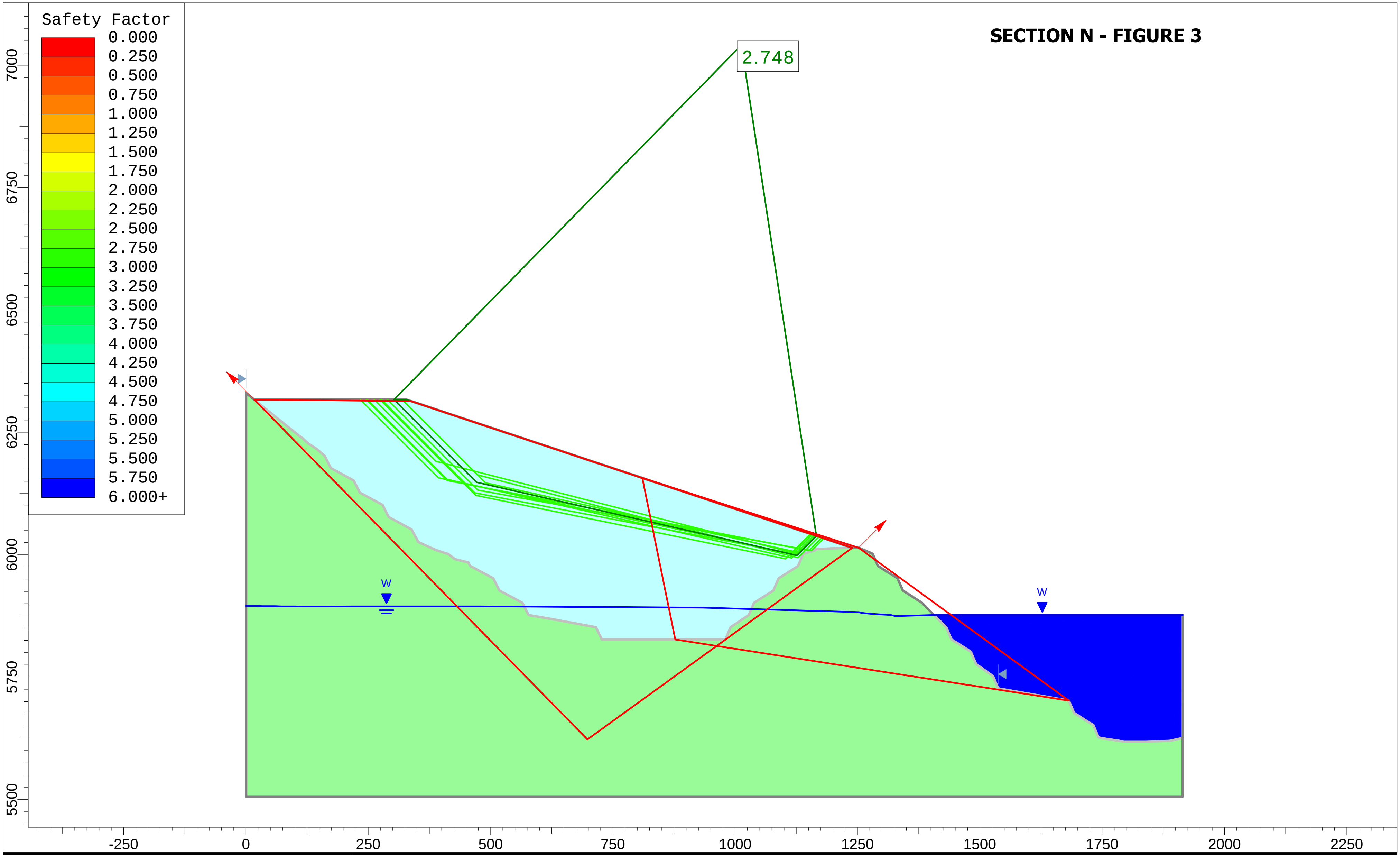
Scale 1:3013

Company Golder Associates

Date 1/2/2019

File Name LR-n.slmd

SECTION N - FIGURE 3



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)

Analysis Description
Static-Pit Lake 5700 ft - Block Failure (GLE / Morgenstern-Price)

Figure

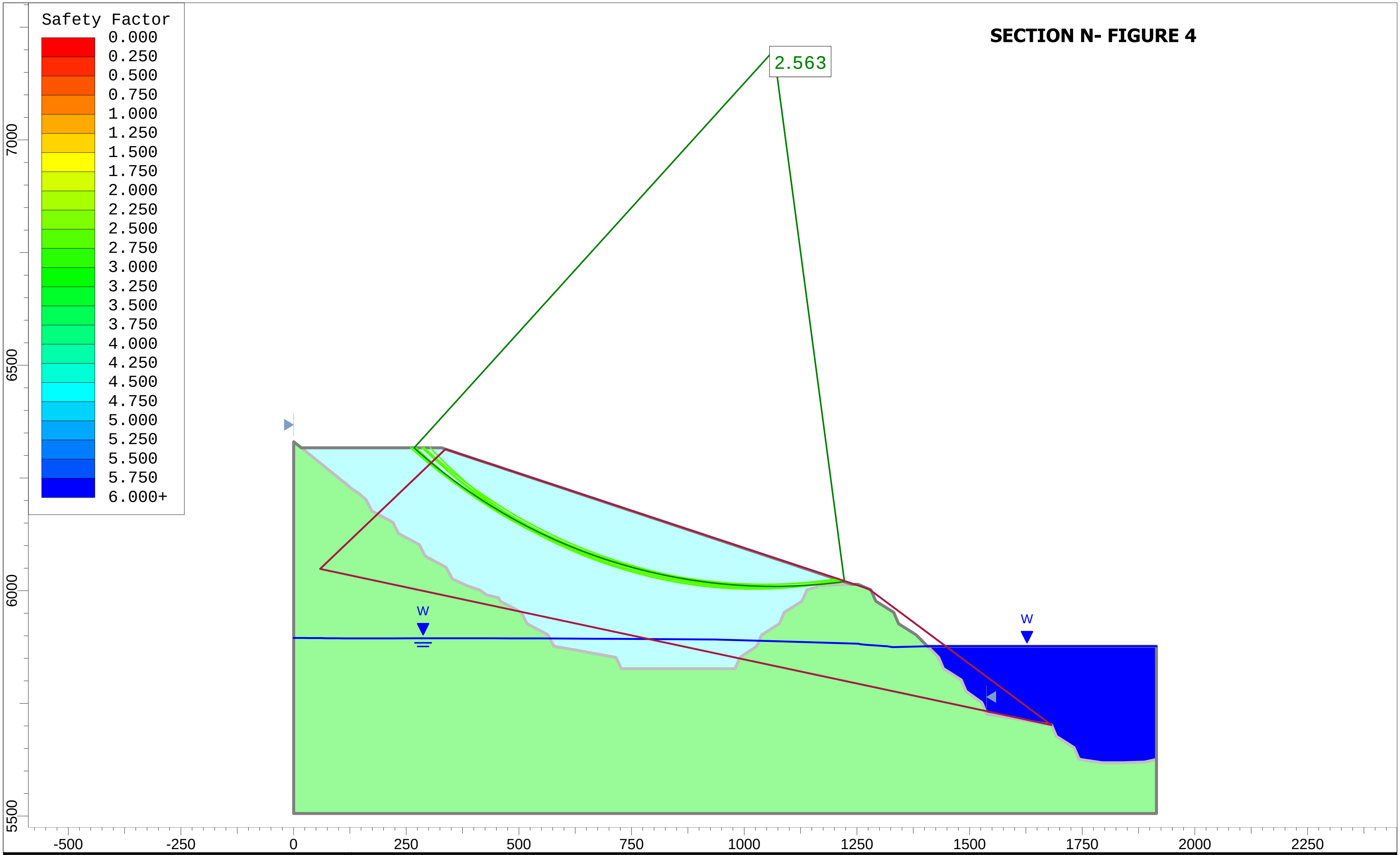
Scale 1:3257

Company Golder Associates

Date 1/2/2019

File Name LR-n.slmd

SECTION N- FIGURE 4

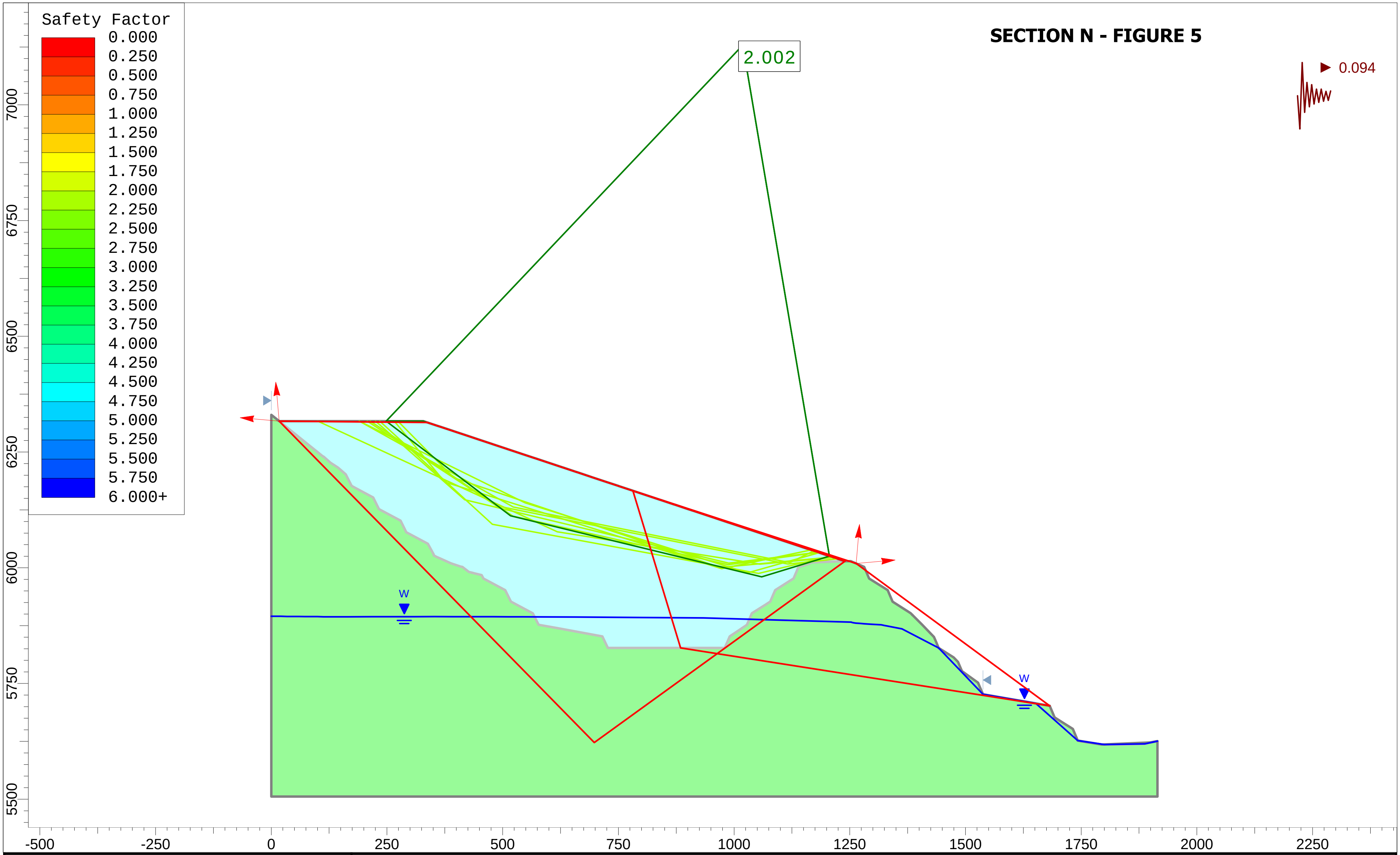


GOLDER

Project	Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)
Analysis Description	Static-Pit Lake 5700 ft - Circular Fail (GLE / Morgenstern-Price)
Figure	
Scale	1:3535
Company	Golder Associates
Date	1/2/2019
File Name	LR-n.slmd

SLIDEINTERPRET 8.014

SECTION N - FIGURE 5



GOLDER

Project Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)

Analysis Description Seismic - No Pit Lake condition - Block Failure (GLE / Morgenstern-Price)

Figure

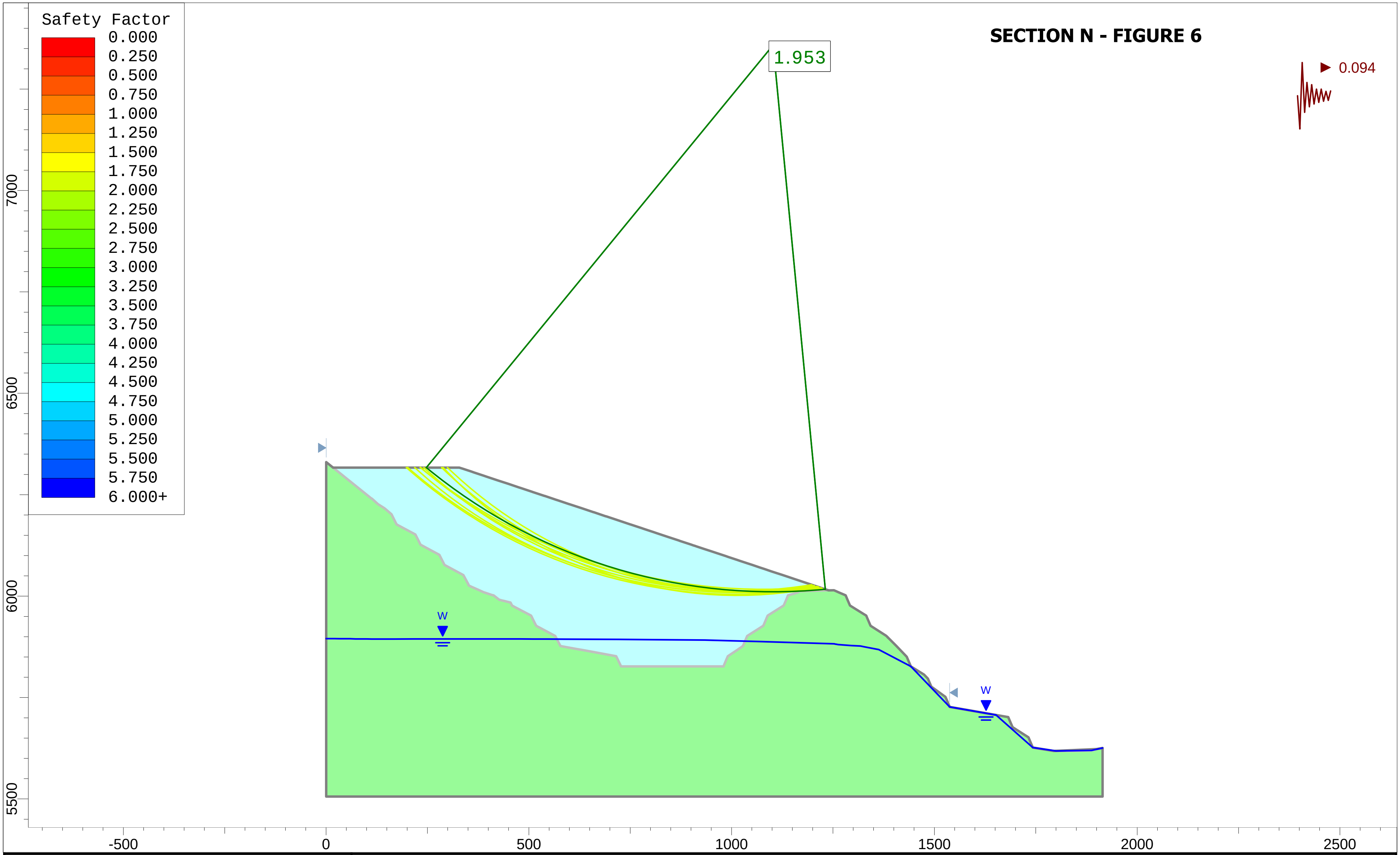
Scale 1:3443

Company Golder Associates

Date 1/2/2019

File Name LR-n.slmd

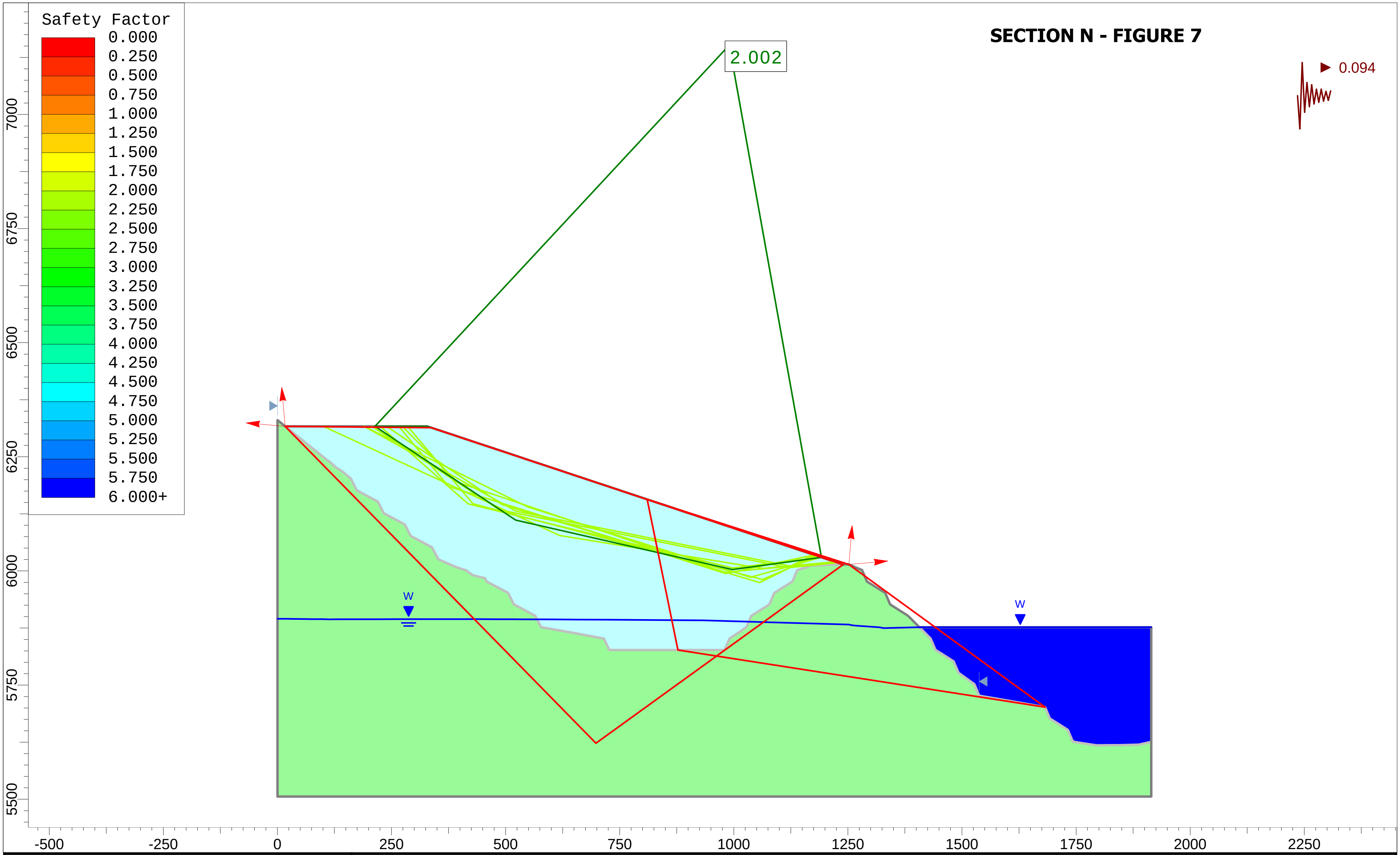
SLIDEINTERPRET 8.014



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)		
Analysis Description	Seismic - No Pit Lake condition - Circular Fail (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3929	*Company*	Golder Associates
Date	1/2/2019	*File Name*	LR-n.slmd

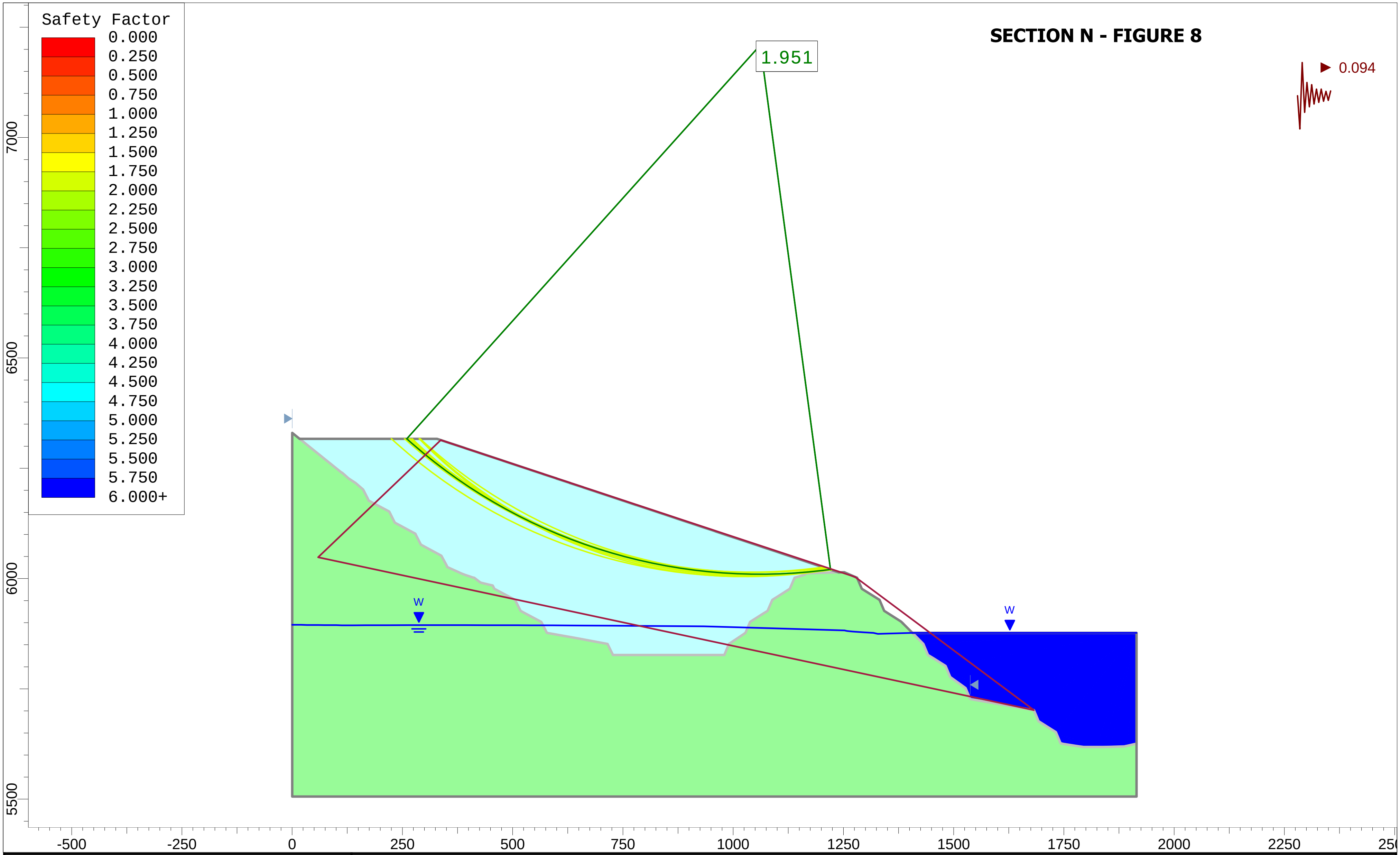


GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)		
Analysis Description	Seismic - Pit Lake 5700 ft - Block Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3491	*Company*	Golder Associates
Date	1/2/2019	*File Name*	LR-n.slmd

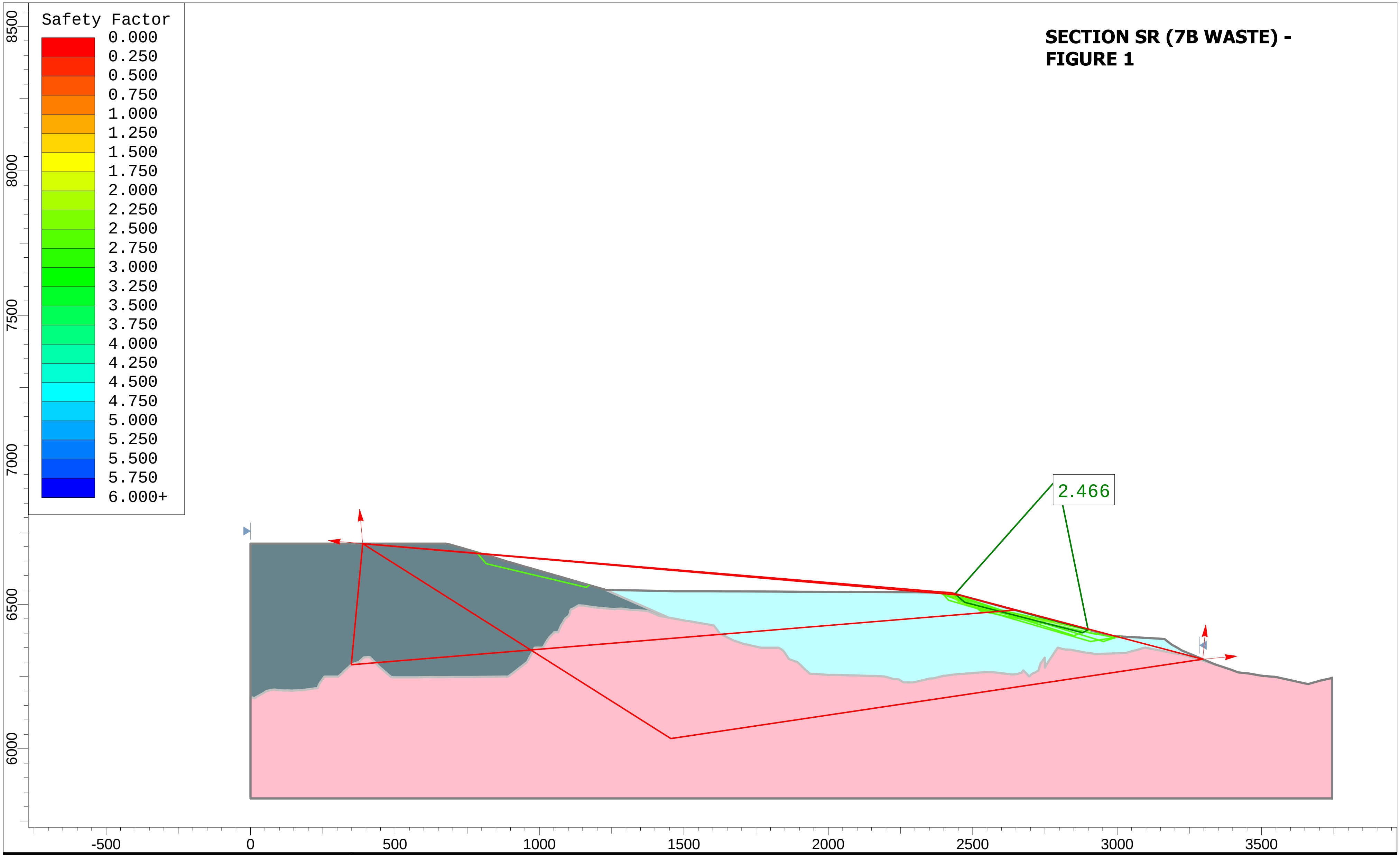
SECTION N - FIGURE 8



GOLDER

SLIDEINTERPRET 8.014

Project	Tyrone Mine Closure Stockpile Stability - Section North In-Pit Waste (at Little Rock)		
Analysis Description	Seismic - Pit Lake 5700 ft - Circular Fail (GLE / Morgenstern-Price)		
Figure	*Scale* 1:3613	*Company*	Golder Associates
Date	1/2/2019	*File Name*	LR-n.slmd



GOLDER

SLIDEINTERPRET 8.014

Project
Tyrone Mine Closure Stockpile Stability - SECTION SOUTH RIM IN-PIT (7B WASTE)

Analysis Description
Static - Block Failure (GLE / Morgenstern-Price)

Figure

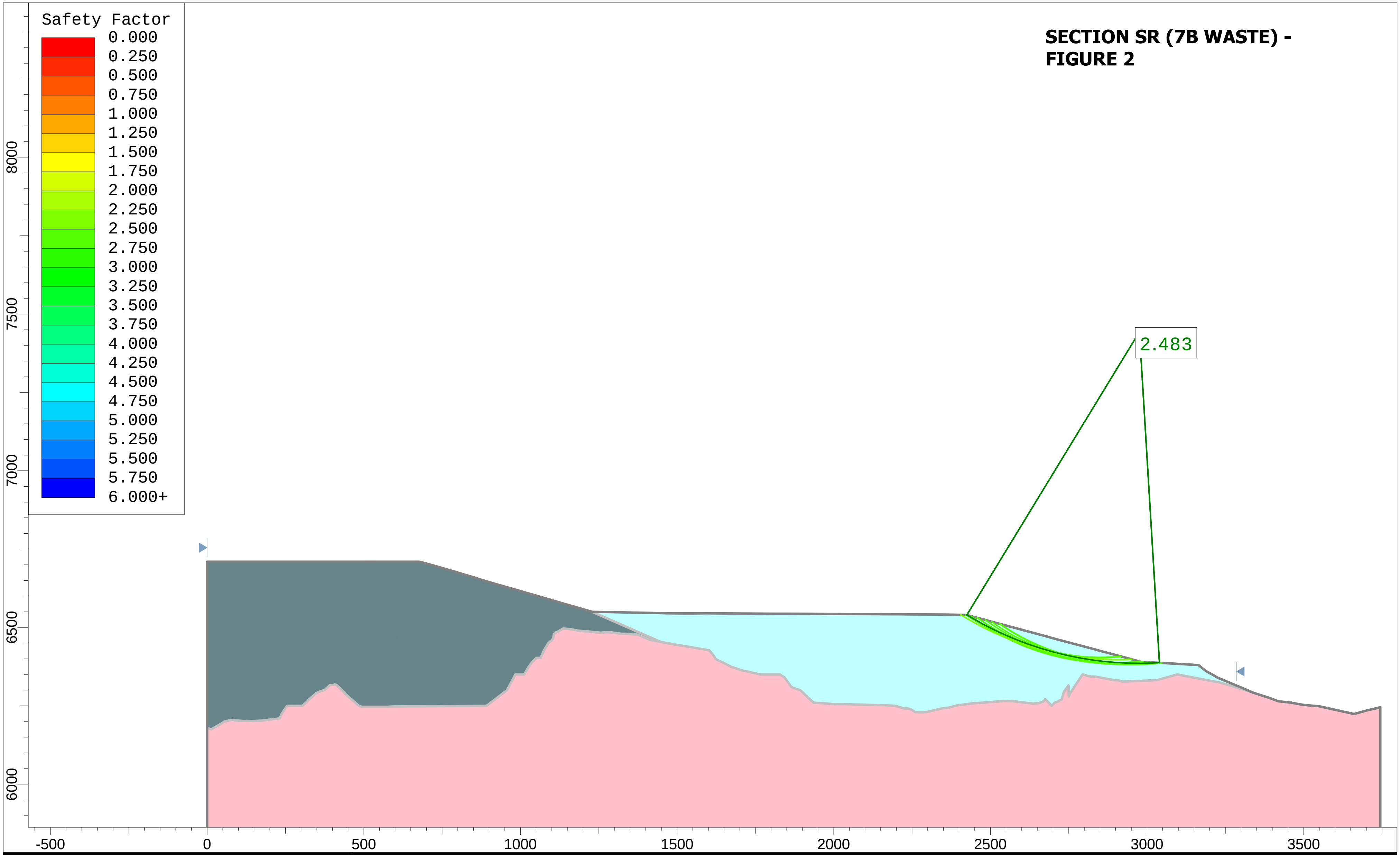
Scale
1:5516

Company
Golder Associates

Date
1/2/2019

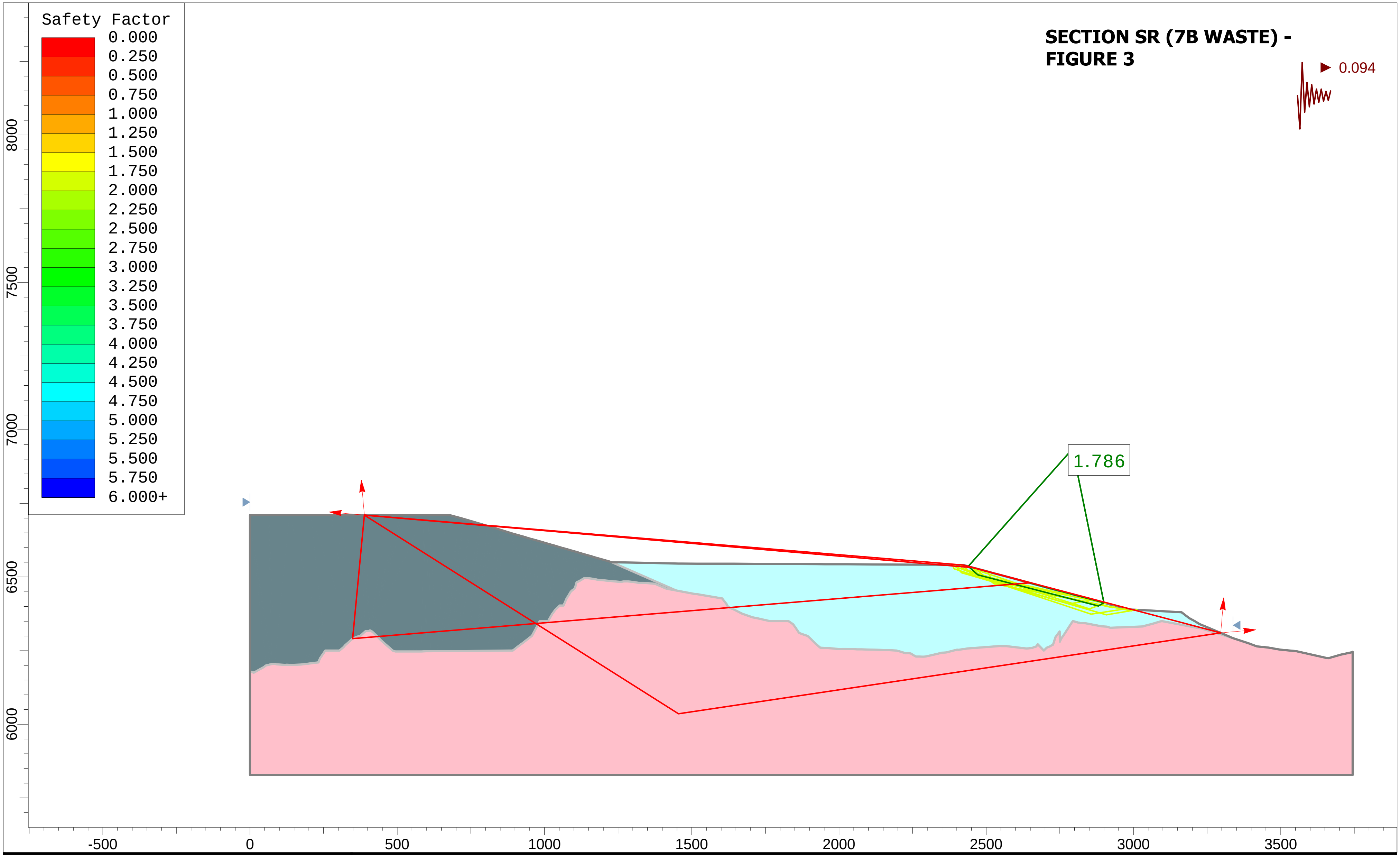
File Name
SR.slmd

SECTION SR (7B WASTE) - FIGURE 2



Project	Tyrone Mine Closure Stockpile Stability - SECTION SOUTH RIM IN-PIT (7B WASTE)
Analysis Description	Static - Circular Failure (GLE / Morgenstern-Price)
Figure	
Scale	1:5085
Company	Golder Associates
Date	
File Name	SR.slmd

SLIDEINTERPRET 8.014



Project
Tyrone Mine Closure Stockpile Stability - SECTION SOUTH RIM IN-PIT (7B WASTE)

Analysis Description
Seismic - Block Failure (GLE / Morgenstern-Price)

Figure

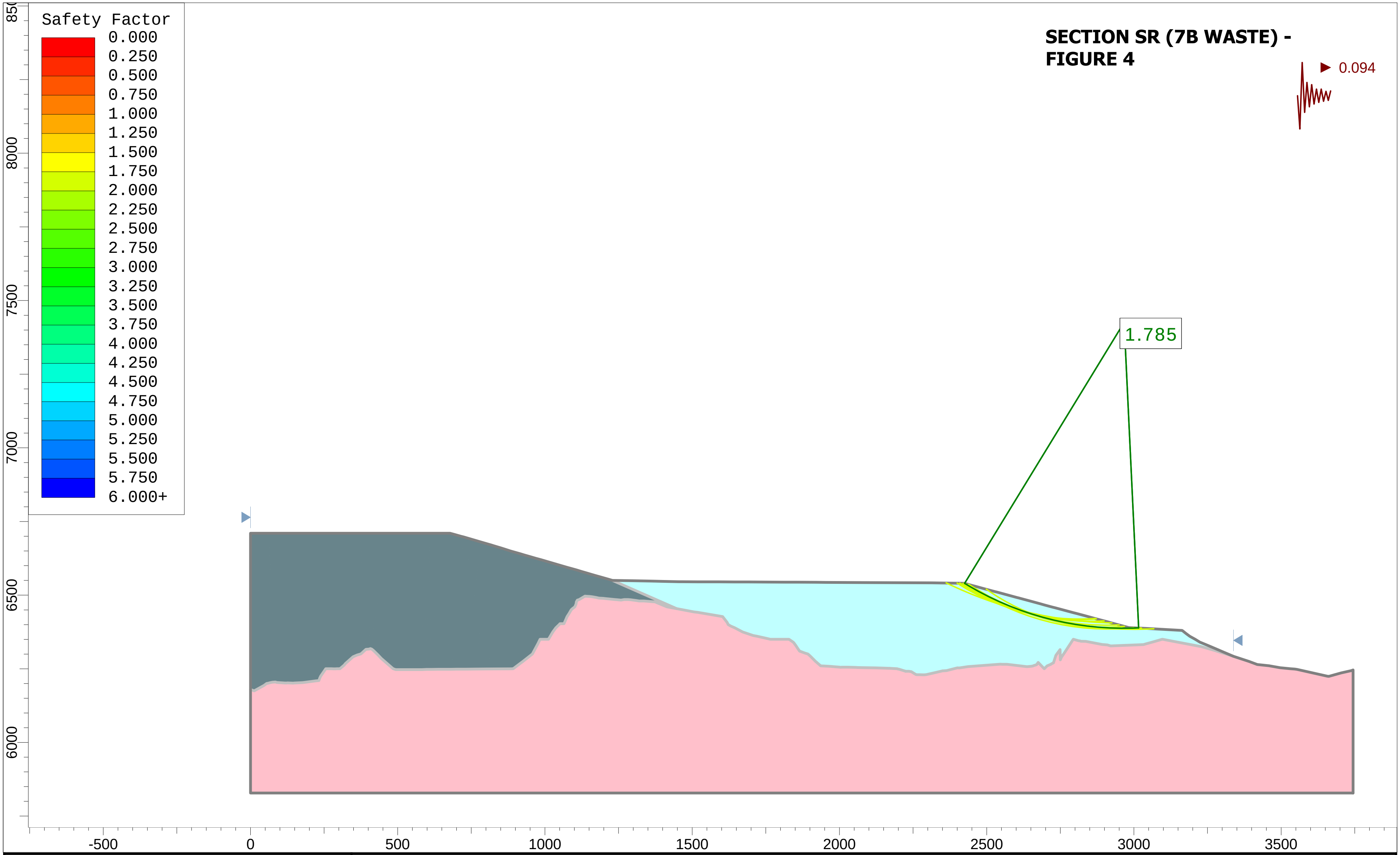
Scale 1:5410

Company Golder Associates

Date 1/2/2019

File Name SR.slmd

SLIDEINTERPRET 8.014



GOLDER

Project	Tyrone Mine Closure Stockpile Stability - SECTION SOUTH RIM IN-PIT (7B WASTE)		
Analysis Description	Seismic - Circular Failure (GLE / Morgenstern-Price)		
Figure	*Scale* 1:5410	*Company*	Golder Associates
Date	1/2/2019	*File Name*	SR.slmd

SLIDEINTERPRET 8.014