GOLDER

REPORT

Stability Analysis for the Waste Rock Dumps (Surge Piles)

Soledad Mountain Mine

Submitted to:

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Submitted by:

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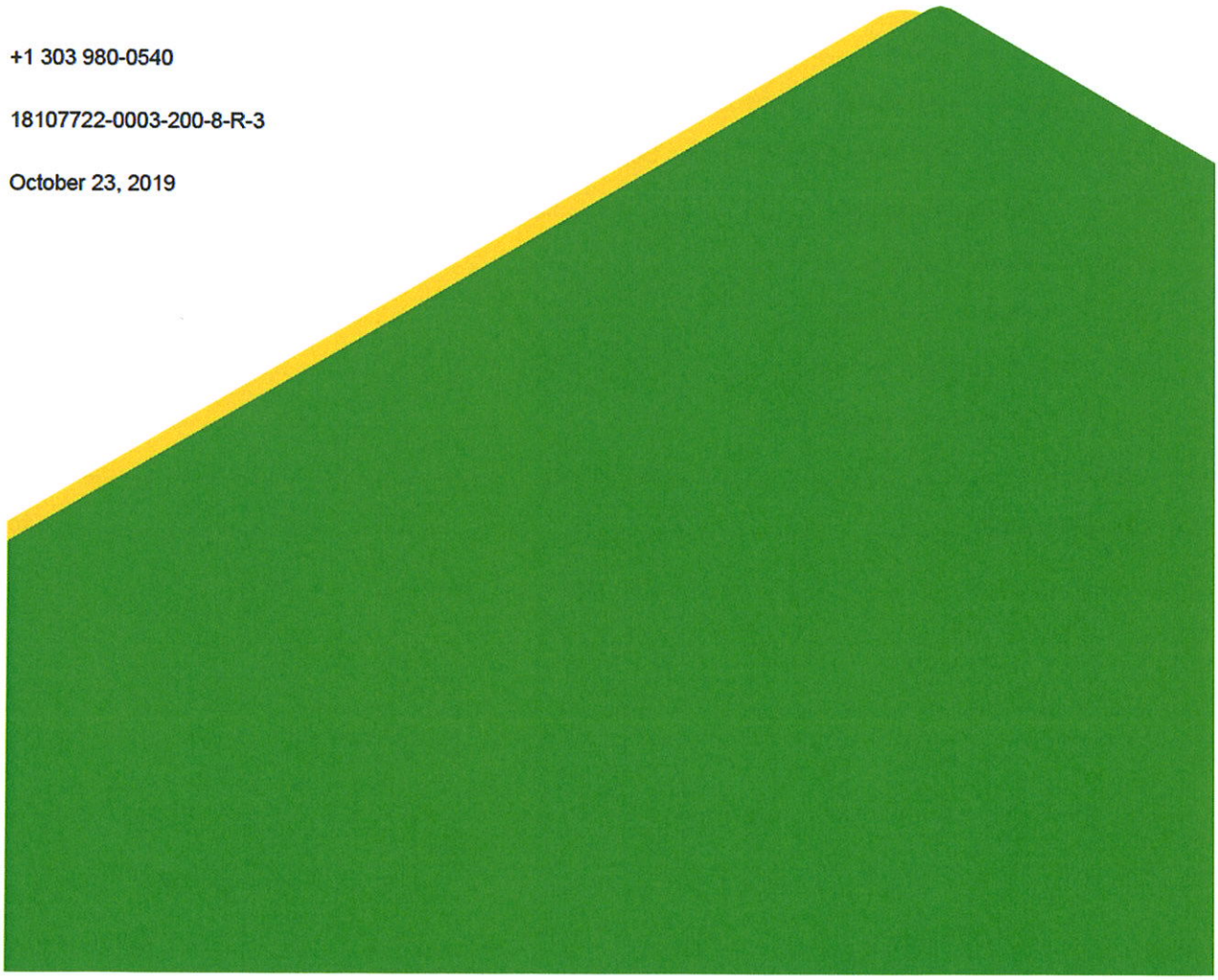
18107722-0003-200-8-R-3

October 23, 2019



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1.0 INTRODUCTION

This report presents a stability analysis for the waste rock dumps, otherwise known as Surge Piles, conducted for the Soledad Mountain Mine by Golder Associates Inc. (Golder) for Golden Queen Mining Company, LLC (GQM). Golder was retained by GQM to evaluate the stability of the West, South and East Surge Piles and the waste rock slopes developed as part of mine reclamation in the reclaimed portions of the backfilled pits. Our analysis was performed for two scenarios: 1) End of Excavation (or active mining); and 2) Final Reclaimed Contours. The expansion of the Surge Piles and revised pit backfilling and aggregate sales is planned as part of a revised mine plan being considered by GQM which will require an update to current permits issued through the Kern County Planning Department. Stability analyses were conducted for two scenarios based on design provided by WestLand Resources, Inc. (WestLand), which we understand were originally prepared by GQM. Those designs were designated as the "End of Excavation" design and the "Final Reclaimed Contours" design.

For the End of Excavation design, the stability analyses were conducted considering three sections at the Surge Piles: one through each of the West Surge Pile, South Surge Pile and East Surge Pile. The sections were placed at locations to evaluate the worst-case scenario for each Surge Pile. For the Surge Pile stability analysis, only the conditions at the end of active excavation, which will consist of composite slopes steeper than 2H: 1V, were considered in the stability analysis. Golder did not evaluate conditions of interim operating slopes.

For the Final Reclaimed Contours design, the waste rock will be backfilled into existing pits, but will later be processed by crushing and screening and sold commercially as aggregate in the market. Stability analyses were conducted considering seven sections through waste rock placed in and above the existing pits. In addition, Golder evaluated the final closure conditions for this design that includes overall, global failures of the composite slope as well as veneer, surficial failures of the inter-bench slopes of the Surge Piles. Stability of existing and exposed pit highwalls that will remain in the open pits was not evaluated under this study and will be considered under a separate pit stability analysis to be conducted by Golder's Mine Stability group.

GQM will be required to evaluate the operational conditions for the Surge Piles on an annual basis and submit a report on slope stability prepared by a California Registered Engineering Geologist or Professional Civil Engineer to Kern County in accordance with Exhibit "B" of the Conditional Use Permits. The final post-mining closure conditions evaluated for this study are believed to represent conservative conditions since the waste rock placed in the Surge Piles will ultimately be further crushed, screened, and processed to be sold as aggregate for a period of up to 20 years after the end of excavation. Towards the end of the 20-year period, the remaining Surge Piles will ultimately be graded and reclaimed, which is defined in this report as the Final Reclaimed Contours design.

2.0 MATERIAL PROPERTIES

A representative conceptual stratigraphic model is necessary for modeling of the material profile characteristics representative of those for the proposed reclamation of the Surge Piles. The conceptual stratigraphy used to model the Surge Piles can be summarized as follows:

- Mine waste materials – consisting of well-graded mine waste rock ranging in size from blocky boulders to coarse granular materials, the majority consisting of rhyolite porphyry and flow-banded rhyolite (68.1%) and quartz latite porphyry (21.3%) (GQM 2007)
- Foundation materials – consisting primarily of colluvium and alluvium
- In situ bedrock

Material properties used in the stability analysis were developed based on Golder's April 2010 geotechnical investigation and Golder's March 2019 site inspection findings as well as Golder's experience with similar waste rock properties.

Golder performed a site investigation in April 2010 and in March 2019 and excavated a total of ten shallow test pits to evaluate and classify the foundation soils and bedrock near the Surge Piles. Test pit locations are shown on Figure 1. Test pit logs developed from the April 2010 geotechnical investigation are presented in Golder's *Soledad Mountain Project, Waste Rock Storage and Aggregate Production Area Stability Analysis* report that is attached to the 2007 GQM report. Field classification and information from March 2019 site inspection are interpreted for this report. Data collected and interpreted during the March 2019 investigation is consistent with the April 2010 investigation; data presented below is a collaboration of both geotechnical investigation findings.

2.1 Foundation Soil and Bedrock Characterization

The foundation soils consist largely of shallow desert alluvium and colluvium deposits covering the slopes of the Soledad Mountain located above bedrock.

A composite sample of the typical foundation soils obtained from test pits TP-1A and TP-3A (from the April 2010 investigation) was tested in a large-scale (12-inch x 18-inch) shear box in accordance with ASTM D5321 to determine the shear strength of the foundation soils under the design normal loads. The test results indicated a shear strength of 46 degrees. Cone penetration testing performed by Glasgow Engineering as part of the original heap leach pad design (Glasgow 1997) indicated a range of shear strength for foundation soils near the proposed Phase 2 heap leach pad from 33 to 40 degrees. To provide a conservative estimate of the slope stability, the foundation was assumed to consist entirely of soils with a friction value of 38 degrees with low cohesion (cohesion of 0.1 psf was used for stability analyses).

Bedrock is interpreted to be shallow (within 5 feet of the existing ground surface) within the majority of the Surge Piles footprints, as evidenced by visual inspection and test pit refusal depths. For this analysis, Golder has assumed a depth of bedrock of 5 feet.

2.2 Waste Rock Characterization

Golder has developed conservative estimates of shear strength parameters for the mine waste materials that will comprise the Surge Piles for stability evaluations to be conducted based on our experience and knowledge of the site geological conditions. Based on the nature of proposed waste materials and Golder's experience with mine waste on other, similar projects, professional judgment indicates that the shear strength of these materials can be characterized by a curvilinear shear strength envelope with zero cohesion. The shear strength envelope is a result of the following:

- Particle size distribution (increasing with increasing particle size and degree of grading)
- Particle shape (increasing with angularity)
- Strength and specific gravity of individual particles (increasing with degree of silicification)
- Applied stress level (decreasing with increasing normal stress, resulting in a curvilinear envelope passing through the origin)

2.2.1 Theoretical Background

The distribution of the various sized particles plays a significant role in determining the physical properties of the waste rock materials. Research conducted by Fragaszy, et al. (1992) indicates that the strength of the mine waste materials that include larger oversize particles may conservatively be characterized by the strength of the matrix materials, if the oversize particles are truly in the floating state. Conversely, the strength of the materials may be characterized by the properties of the oversize particles if there is sufficient oversize particle to particle contact. Various researchers suggest that the shear strength properties of a soil having less than 40% oversize material are controlled largely by the soil matrix and that the strength properties of a soil with over 65% oversize material are controlled primarily by the properties of the oversize material. The strength properties of the soils have between 40 and 65% oversize material are controlled by both the soil matrix and oversize material. It has long been recognized (Holtz and Gibbs 1956) that an increase in the proportion of the coarse material in an otherwise fine-grained granular soil results in increased shear strength. Simons and Albertson (1960) present data that show, for instance, that the effect of scalping to allow laboratory testing may reduce the indicated angle of repose for the scalped material by 6 degrees compared with the field value for the full-sized material. Alternatively, when the voids in a coarse-grained rock fill are filled with finer grained soils, the friction angle can be increased by as much as 10 degrees. The amount of granular fines required to have a significant beneficial effect on the shear strength of waste rock is relatively small (Stratham 1974). Leps (1970) presented friction angle data based on triaxial strength testing of large size (up to 200 mm) rockfill particles. This data demonstrates that the friction angle of durable compacted rock fill could be as high as 55 degrees at low normal stress levels and is likely to be at least 50 degrees at moderate stress levels. The above data suggests that durable mine waste materials could be expected to have peak shear strengths of about 40 to 45 degrees.

Based on the material properties described in the GQM 2007 report and based on our visual observations, the waste rock material consists of durable rock ranging in size from blocky boulders to coarse granular materials. As noted above, Golder anticipates that the shear strength friction angle for the mine waste placed in the Surge Piles will be about 40 to 45 degrees. We have evaluated the Surge Piles stability assuming friction angles selected at the average limits of the Leps strength envelope (Figure 1 from Leps 1970) resulting in a 40-degree angle of friction for the sections where average normal stresses were estimated to be approximately 70 psi. In addition, zero cohesion for the waste rock material was used for stability analyses since no site-specific mine waste have been tested.

2.3 Material Properties Summary

Table 1 provides a summary of the waste rock and foundation material properties used to evaluate the stability of the Surge Piles.

Table 1: Summary of Strength Parameters

Material Type	Shear Strength Parameters	
	Cohesion (psf)	Friction Angle (deg)
Waste Material	Shear-Normal function (Leps – Average)	
Foundation Soil	0.1	38

3.0 STABILITY ANALYSIS AND CONSIDERATIONS

A stability analysis was performed for selected Surge Pile sections to evaluate the Surge Piles stability based on the design criteria established in the GQM 2007 report.

3.1 Method of Stability Analysis

Two methods of stability analyses were conducted for the Surge Pile closure configurations: analyses to assess 1) overall, global failures and 2) surficial, veneer failures. The global failure analyses were conducted for both the End of Excavation design and the Final Reclaimed Contours design. The veneer failure analyses were only conducted for the Final Reclaimed Contours design since the configuration has final, benched slopes greater than 2(H):1(V) slopes.

3.1.1 Global Failure

Global failure stability analyses were conducted using two-dimensional, limit-equilibrium modeling techniques. The software SLIDE version 8.014 (Rocscience 2018) was used to perform stability analyses. Spencer's method of slices was used to calculate the factor of safety for each trial failure surface deeper than 10 ft.

Both circular and non-circular (also referred to as "block" or "wedge") failure surfaces were evaluated for these analyses. Both types of failure surfaces utilized a searching method to determine the most critical failure surface (i.e., surface with the lowest factor of safety) for each section analyzed. For example, sections A through C used a non-circular failure surface along the weakest layer (the foundation material). Since sections D through K do not contain foundation material along the failure plane, an automatic non-circular failure was used to predict the failure surface. Static and seismic (pseudo-static) conditions were tested for each section and failure mode assumption. Non-circular failure analyses were set up to investigate the factors of safety for deep seated failures.

3.1.2 Veneer Failure

Veneer failure stability analyses for the Final Reclaimed Contours design were assessed using one-dimensional calculations. Since the waste rock material is assumed to be free draining, a simplified equation was used that does not include the effect of pore water pressure. See section 3.2.3 below for additional discussion on the phreatic surface. A minimum factor of safety for this analysis was set at 1.0 since input factors are reasonably accurate and the consequences of surficial slope failure is less catastrophic as a global failure. Veneer stability analyses for all interim benches were evaluated; slopes are shown on sections D through K as presented in Figures 5 and 6.

3.2 Stability Analysis Assumptions

Several assumptions were made to conduct these stability analyses, including those for stratigraphic profile, material properties, phreatic surface, and seismic conditions. The Surge Pile geometry for the End of Excavation design and for the Final Reclaimed Contours design were provided by WestLand Resources, Inc. (WestLand) on August 01, 2019, in AutoCAD file format (Autodesk 2013).

3.2.1 Surge Pile Critical Stability Section Geometries

The locations of the selected Surge Pile stability sections are shown on Figure 2 and Figure 3 in plan view and on Figure 4, Figure 5, and Figure 6 in section view. Additionally, the geometry and stability analysis results are shown on Figures 7 through 16. Stability sections were developed for the critical downhill sections for the proposed Surge Piles closure configurations.

3.2.2 Material Properties

Material properties are as discussed above in Section 2.0 of this report and are summarized in Table 1.

When pseudo-static stability analyses are conducted to evaluate the effect of seismic acceleration induced stresses on stability, as further discussed in Section 3.2.4, the US Army Corps of Engineers (USACE 1984) recommends a 20% strength reduction for fine-grained soils that may develop increases in pore water pressure during cyclic loading (i.e., strain softening susceptible materials). The alluvial foundation materials are generally coarse-grained and unsaturated. However, there is the potential for fine-grained layer(s) in these soils. Therefore 20% strength reduction factor was conservatively applied for foundation soils for the pseudo-static analyses. The waste rock materials are not considered to be susceptible to strain softening because they are assumed to be unsaturated and relatively loose upon placement and because of their coarse-grained nature. An additional consideration is that natural segregation of the waste rock during placement results in the larger diameter rock being placed at the base of the rock pile. This essentially results in a highly permeable drain zone at the base of the rock pile that will prevent the development of an elevated phreatic surface within the Surge Piles. Table 2 summarized the material property inputs assumed for the stability analyses.

Table 2: Material Design Properties for Stability Analysis

Material Type	Shear Strength Parameters	
	Cohesion (psf) Static (Pseudo-Static)	**Friction Angle (deg) Static (Pseudo-Static)**
Waste Material	Shear-Normal Function (Leps – Average)	
Foundation Soil	0.1 (0.1)	38 (32)

3.2.3 Phreatic Surface

A phreatic surface was not considered in the stability analysis of the Surge Piles. Both the waste rock and foundation soils are anticipated to be free draining and the site is located in an arid climate (average precipitation of 5.74 inches per year). The *Report of Waste Discharge* (ROWD) report (GQM 2012) and subsequent evidence from groundwater monitoring wells indicates that near surface groundwater is not present at the site with groundwater depths typically greater than 200 feet below surface.

3.2.4 Seismic Conditions

A peak ground acceleration (PGA) of 0.37 g (where g is the gravitational acceleration) was used for the Surge Piles stability analyses for the Final Reclaimed Contours and a PGA of 0.28 g was used for End of Excavation case. A discussion of the seismic conditions of the site is presented in the GQM 2007 report by Golder dated November 2006 which is included as Appendix 2 in the ROWD (GQM 2012).

It is important to note that in an actual seismic event, the peak acceleration would be sustained for only a fraction of a second. Pseudo-static stability analysis conservatively model seismic events as a force with constant acceleration and directions (i.e., an infinitely long pulse). Consequently, it is standard practice for geotechnical engineers to take only a fraction of the predicted peak maximum acceleration when modeling seismic events using a pseudo-static analysis. A factor of safety of 1.0 is typically considered appropriate for water retention structures, when the structures are modeled using one-half the peak acceleration generated from the maximum credible earthquake (USACE 1984). This assumption is valid when a 20% reduction factor is applied to any material that may exhibit increases in pore pressure and strain softening during cyclic loading. Therefore, this

study has used a horizontal acceleration of 0.19 g (approximately one-half of PGA) for the pseudo-static analysis of Final Reclaimed Contours and 0.14g for the pseudo-static analysis of End of Excavation surface and has conservatively applied a 20% strength reduction to the alluvial foundation soils as noted in the discussion on material properties.

It is also important to note that a calculated pseudo-static factor of safety of less than 1.0 during a seismic event does not mean that failure of the Surge Piles will occur. Rather, in cases where the pseudo-static analyses indicate factors of safety less than 1.0, i.e., during the short periods when the horizontal acceleration exceeds the yield acceleration (the largest horizontal acceleration at which the embankment is still stable), movement will occur. When the direction of the acceleration is reversed, or shaking stops, the movement of the Surge Piles embankment will also stop. The amount of movement will depend on the height of the Surge Pile embankment, the inclination of the face, the quality of the waste rock in the Surge Piles, the inclination of the foundation and the strength of the foundation soil. More of the movement will occur on shallow surfaces oriented roughly parallel to the face of the Surge Pile embankment resulting in settlement and cracking of the dump surface and raveling of the face. Waste rock embankments supported on steep slopes are expected to undergo more movement than embankments supported on relatively flat slopes.

The Surge Piles are located in an arid region and the Surge Pile embankment and foundation soils are granular and expected to remain unsaturated. Therefore, a liquefaction type failure of the waste rock in the Surge Piles or of the granular foundation soil is considered highly unlikely and was not evaluated further in the Surge Pile stability analyses.

3.3 Results of Stability Analyses

This section discusses the results of slope stability analyses conducted for three sections through the End of Excavation design and seven sections through the Final Reclaimed Contours design. For the End of Excavation design, the West Surge Pile, South Surge Pile and East Surge Pile are represented by sections A, B and C, respectively. For the Final Reclaimed Contours design, the sections were cut through critical sections as represented by sections D through K.

The failure surface geometry was determined for the completed (i.e., post mining) condition. The results for the most critical stability surface (i.e., the least stable surfaces) are shown on Figures 7 through 16.

3.3.1 Summary of Stability Results

Table 3 presents results of slope stability analysis conducted for the Surge Piles. The locations of the selected critical stability sections for the End of Excavation design and the Final Reclaimed Contours design are shown on Figure 2 and Figure 3, respectively. Two-dimensional, global stability analyses results are shown as Figures 7 through 16. All indicated results incorporated the material waste rock and foundation shear strengths presented in Section 2.0 of this report. Final Reclaimed Contours closure design provided by WestLand on August 1, 2019.

Geometry for the sections were based on the data listed below:

- Natural topography provided by Norwest on March 1, 2010
- End of Excavation closure design provided by WestLand on August 1, 2019
- Final Reclaimed Contours closure design provided by Sespe on August 1, 2019

For the purpose of the global analysis, we have assumed a static factory of safety of 1.3 and a pseudo-static factor of safety of 1.0 to be considered stable. For the purpose of the surficial, veneer analysis (Final Reclaimed Contours design only), we have assumed a static factor of safety of 1.0. We have established our factors of safety based on our assessment of the end-use of this site as allowed based on the California Surface Mining and Reclamation Act guidance provided in Section 3704 (e).

The results indicate that each of the Surge Piles will be stable under both static and pseudo-static (seismic) conditions for the post-mining Final Reclaimed Contours (i.e., closure conditions). Table 3 summarizes the global static factor of safety for the closure designs. Pseudo-static analyses indicate that each of the selected Surge Pile sections will remain stable under the design seismic event.

For the End of Excavation case, the results indicate that each Surge Pile will be stable under both static and pseudo-static conditions except section B. For Section B, the pseudo-static factor of safety is below 1.0. However, as the aggregates are sold, waste rock material will be pushed down the slope and stabilized as shown in Section J for the Final Reclaimed Contours. In the event of an earthquake of the magnitude considered after the End of Excavation period and prior to closure, we estimate that movement on the Surge Pile would consist of minor raveling of the surface and do not foresee greater movement that would be of any concern. Again, as noted above at closure the analysis indicate all Surge Piles slopes will be stable and meet satisfactory factors of safety for the Final Reclaimed Contours.

Table 4 summarizes the lowest surficial, veneer static factor of safety for the closure designs. Calculations for the surficial, veneer failure are provided as an attachment. The lowest factor of safety is reported Table 4.

Table 3: Summary of Global Stability Analysis

Section (design)	Static Factor of Safety Circular (Block) > Required Factor of Safety	Pseudo-Static Factor of Safety Circular (Block) > Required Factor of Safety
A (End of Excavation design)	1.45 (1.44) > 1.3	1.12 (1.11) > 1.0
B (End of Excavation design)	1.25 (2.04) > 1.3	0.83 (0.74) < 1.0
C (End of Excavation design)	1.43 (1.41) > 1.3	1.10 (1.04) > 1.0
D (Final Reclaimed Contours design)	2.38 (2.34) > 1.3	1.57 (1.55) > 1.0
E (Final Reclaimed Contours design)	2.27 (2.27) > 1.3	1.51 (1.51) > 1.0
F (Final Reclaimed Contours design)	2.01 (2.01) > 1.3	1.34 (1.35) > 1.0
G (Final Reclaimed Contours design)	1.72 (1.72) > 1.3	1.21 (1.21) > 1.0
H (Final Reclaimed Contours design)	2.08 (2.07) > 1.3	1.38 (1.38) > 1.0
J (Final Reclaimed Contours design)	1.64 (1.64) > 1.3	1.15 (1.15) > 1.0
K (Final Reclaimed Contours design)	2.03 (2.03) > 1.3	1.36 (1.36) > 1.0

Table 4: Summary of Veneer Failure Stability Analysis

Section (design)	Static Factor of Safety > Required Factor of Safety
D (Final Reclaimed Contours design)	1.21 > 1.0
E (Final Reclaimed Contours design)	1.67 > 1.0
F (Final Reclaimed Contours design)	1.68 > 1.0
G (Final Reclaimed Contours design)	1.12 > 1.0
H (Final Reclaimed Contours design)	1.68 > 1.0
J (Final Reclaimed Contours design)	1.15 > 1.0
K (Final Reclaimed Contours design)	1.68 > 1.0

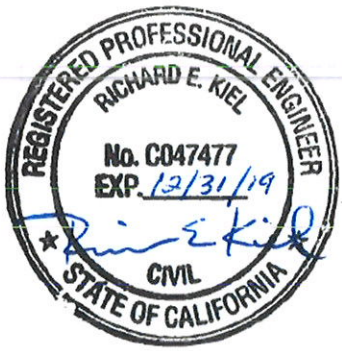
4.0 CLOSING

This report has been prepared exclusively for Golden Queen Mining Company, LLC. The preceding summary of evaluations followed the standard of care expected of professionals undertaking similar work in the State of California under similar conditions. No warranty, expressed or implied, is made.

We appreciated the opportunity to continue working for the GQM in support of the Soledad Mountain Mine project. Please contact one of the undersigned should you have questions or comments regarding this report.

Signature Page

Golder Associates Inc.



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Project Engineer

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HSE/REK/rjg

5.0 REFERENCES

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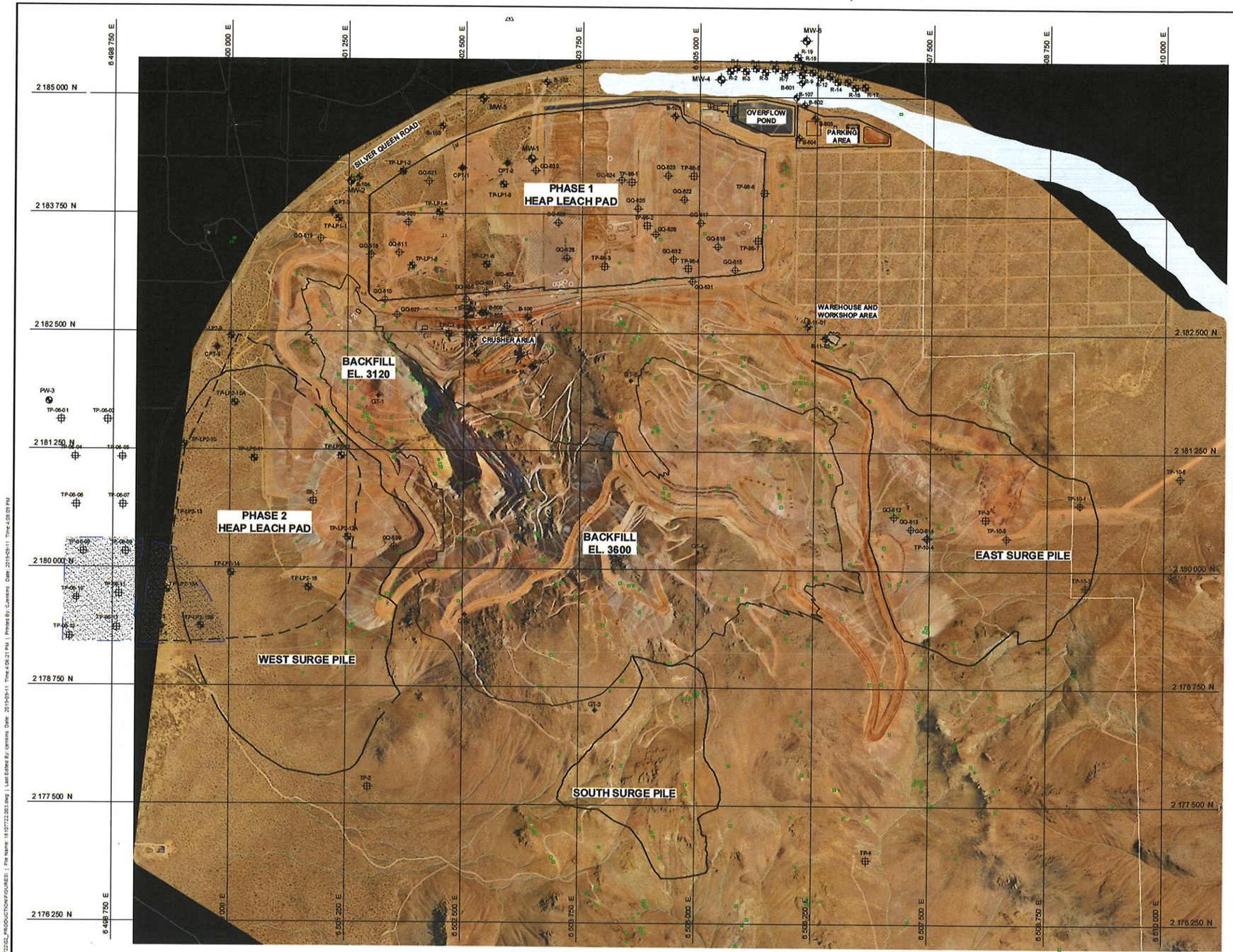
Figures



LEGEND

- EXISTING GROUP TOPOGRAPHY (REFERENCE 1)
- EXISTING DIRT ROADS
- PAVED ROADS
- POTENTIAL BORROW AREA (FEE LAND)
- TP-06-01 — TEST PITS (CLAY BORROW AREA) GOLDER ASSOCIATES INC., 2006
- B-601 — EXPLORATORY BORINGS GOLDER ASSOCIATES INC., 2006
- R-2 — TEST PITS (ACCESS ROAD AREA) FOR PAVEMENT EVALUATION GOLDER ASSOCIATES INC., 2006
- T-#1 — TAILINGS SAMPLES LOCATION APPROXIMATE GOLDER ASSOCIATES INC., 2006
- B-107 — EXPLORATORY HOLES GOLDER ASSOCIATES INC., 2004
- TP-LP-1 — TEST PIT EXCAVATED AUGUST 1995 BY GLASGOW ENGINEERING (PIT - PERMEABILITY TEST RUN IN OCTOBER 1996) (REFERENCE 3)
- TP-96-1 — TEST PIT EXCAVATED OCTOBER 1996 BY GLASGOW ENGINEERING (PIT - PERMEABILITY TEST RUN IN OCTOBER 1996) (REFERENCE 3)
- CPT-1 — CONE PENETRATION TEST HOLES, APRIL 1995 BY C.V. ALSTINE, P.E. (REFERENCE 4)
- GC-400 — EXPLORATORY HOLES BY GOLDEN QUEEN MINING COMPANY (NOTE 3)
- MW-1 — MONITORING WELL
- PW-1 — PRODUCTION WELL
- TP-10-4 — WASTE ROCK STORAGE AREA TEST PITS BY GOLDER ASSOCIATES INC., 2010
- TP-3 — TEST PITS BY GOLDER ASSOCIATES INC., 1998
- TP-3 — TEST PITS BY GOLDER ASSOCIATES INC., 1998
- GT-5 — DIAMOND DRILL HOLES, SEEGMILLER, 1997
- B-10-1 — GEOTECHNICAL BORINGS BY GOLDER ASSOCIATES INC., 2010
- B-11-01 — APPROXIMATE LOCATION OF GEOTECHNICAL BORINGS BY GOLDER ASSOCIATES INC., 2011
- PM-10 — AIR MONITORING STATION
- MINE SHAFT
- FEMA ZONE A 100-YEAR FLOODPLAIN
- APPROXIMATE LIMITS OF EXISTING TAILINGS

MONITORING AND PRODUCTION WELL COORDINATES (SEE NOTES)

NAME	DATE	GROUND EL.	COLLAR EL.	EASTING	NORTHING
MW-1	1996	2832.38	2834.63	6503205.25	2184328.55
MW-2	1996	2822.93	2825.35	6501276.64	2184086.27
MW-3	1996	2833.46	2835.86	6500686.59	2184227.59
MW-4	2007	2779.9	2775.0	6505222.30	2185182.50
MW-5	2007	2804.0	2805.6	6502681.40	2184966.10
MW-6	2010	2760.14	2763.27	6506125.30	2185599.20
PW-1	SEP-96	2759.14	2760.28	6506189.61	2187194.51
PW-2	MAR-05	2760.34	2761.84	6506193.69	2188315.94
PW-3	AUG-08	2855.22	2856.72	6498061.97	2181750.85

NOTE(S)

1. COORDINATES FOR MONITORING AND PRODUCTION WELLS PROVIDED BY DeWALT CORP.
2. CALIFORNIA STATE PLANE COORDINATES.
3. ELEVATIONS IN FEET AMSL.

REFERENCE(S)

1. EXISTING GROUND TOPOGRAPHY PROVIDED BY TRIATHLON (2004).
2. DESIGN BY NORWEST (2010).
3. LOCATIONS PROVIDED BY THE GLASGOW ENGINEERING GROUP INC.
4. SEE APPENDIX A OF HLF DESIGN REPORT (GOLDER, 2012) FOR LOCATIONS OF CPT-4,5,7 AND 8 LOCATED SOUTH AND WEST OF PROJECT.
5. IMAGERY FROM ENVIROMINE INC. FOR AERIAL TOPOGRAPHY DATED MAY 14-16, 2018.

NOT FOR CONSTRUCTION

DRAFT

0 500 1000
1" = 500' FEET

CLIENT
GOLDEN QUEEN

GOLDEN QUEEN MINING CO. INC.
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	NKR
PREPARED	NKR
REVIEWED	REK
APPROVED	REK

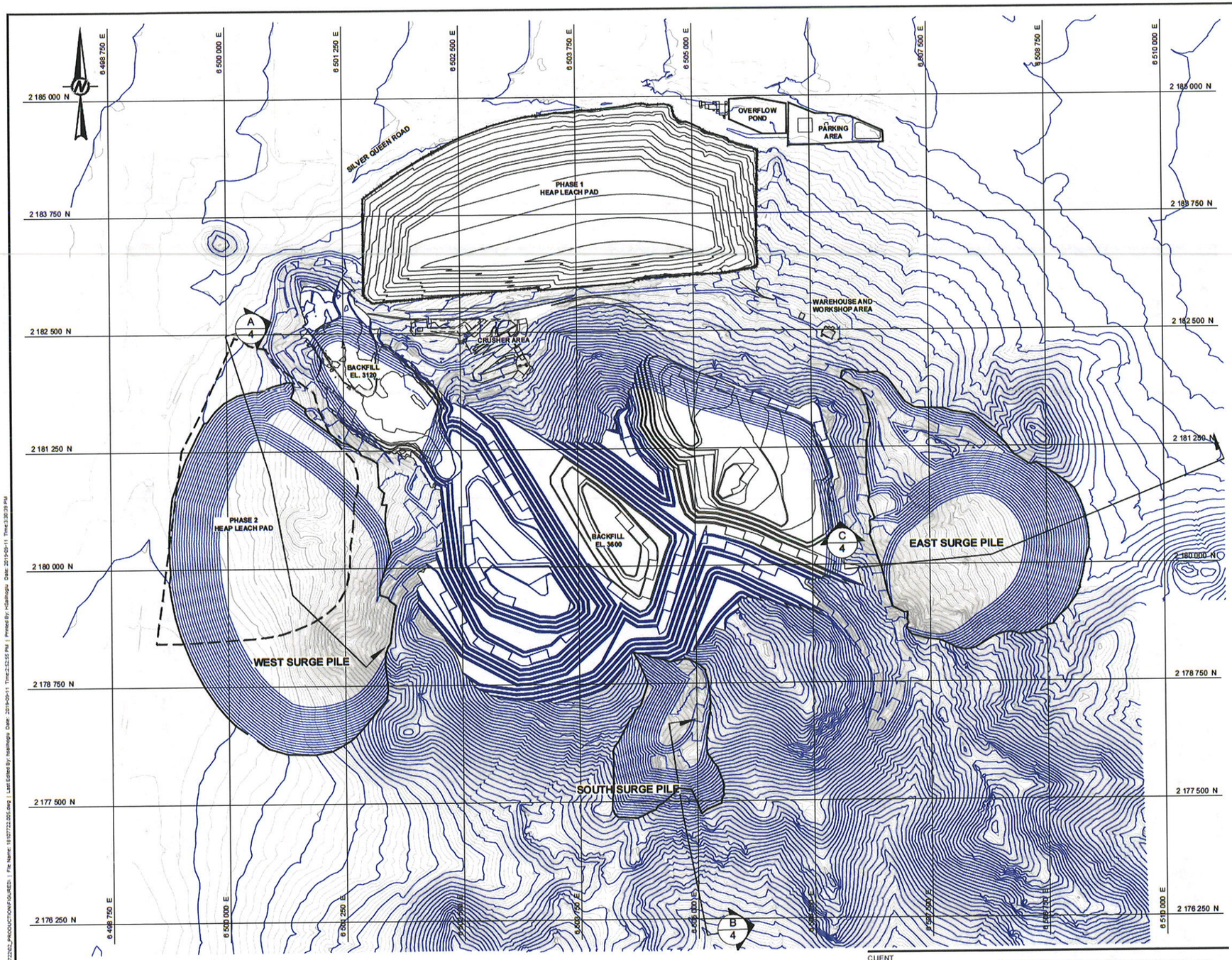
PROJECT
GOLDEN QUEEN MINING CO. INC.

TITLE
PLANNED SURGE PILE EXPANSION WITH FEB 2019 AERIAL IMAGE

PROJECT NO.	CONTROL	REV.	FIGURE
18107722		1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ARCH D

Path: \\Golder\active\GOLDEAD\95_PROJECTS\18107722\02_PRODUCTION\FIGURES | File Name: 18107722-203.dwg | Last Edited By: cjenkins Date: 2019-09-11 Time: 4:56:21 PM | Printed By: C.Jenkins Date: 2019-09-11 Time: 4:56:39 PM



LEGEND

- EXISTING TOPOGRAPHY (REFERENCE 1)
- PIT (REFERENCE 2)
- END OF EXCAVATION CLOSURE DESIGN (REFERENCE 3)
- PHASE 1 HEAP LEACH PAD

REFERENCE(S)

1. EXISTING GROUND TOPOGRAPHY PROVIDED BY TRIATHLON (2004).
2. PIT CONTOURS RECEIVED FROM Sespe Consulting, Inc. ON APRIL 29, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAMES GQM EOE Pre Max Post 4.29.19.dwg AND GQM Pref 20MT Pre Max Post 4 29 19.dwg. DESIGN SURFACE RE-BUILT FROM CONTOURS.
3. END OF EXCAVATION CLOSURE DESIGN RECEIVED FROM WestLand Resources, Inc. ON AUGUST 01, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAME Sequence-LOM-End of Excavation.dwg. DESIGN SURFACE RE-BUILT FROM 20-FT CONTOURS.
4. FINAL RECLAMATION CONTOURS DESIGN RECEIVED FROM SWestLand Resources, Inc. ON AUGUST 01, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAME Sequence-LOM-2to1-Slope-Final Reclaimed Contours.dwg. DESIGN SURFACE RE-BUILT FROM CONTOURS
5. IMAGERY FROM ENVIROMINE INC. FOR AERIAL TOPOGRAPHY DATED MAY 14-16, 2018.

NOT FOR CONSTRUCTION

DRAFT

0 500 1000
1" = 500' FEET

CLIENT
GOLDEN QUEEN
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

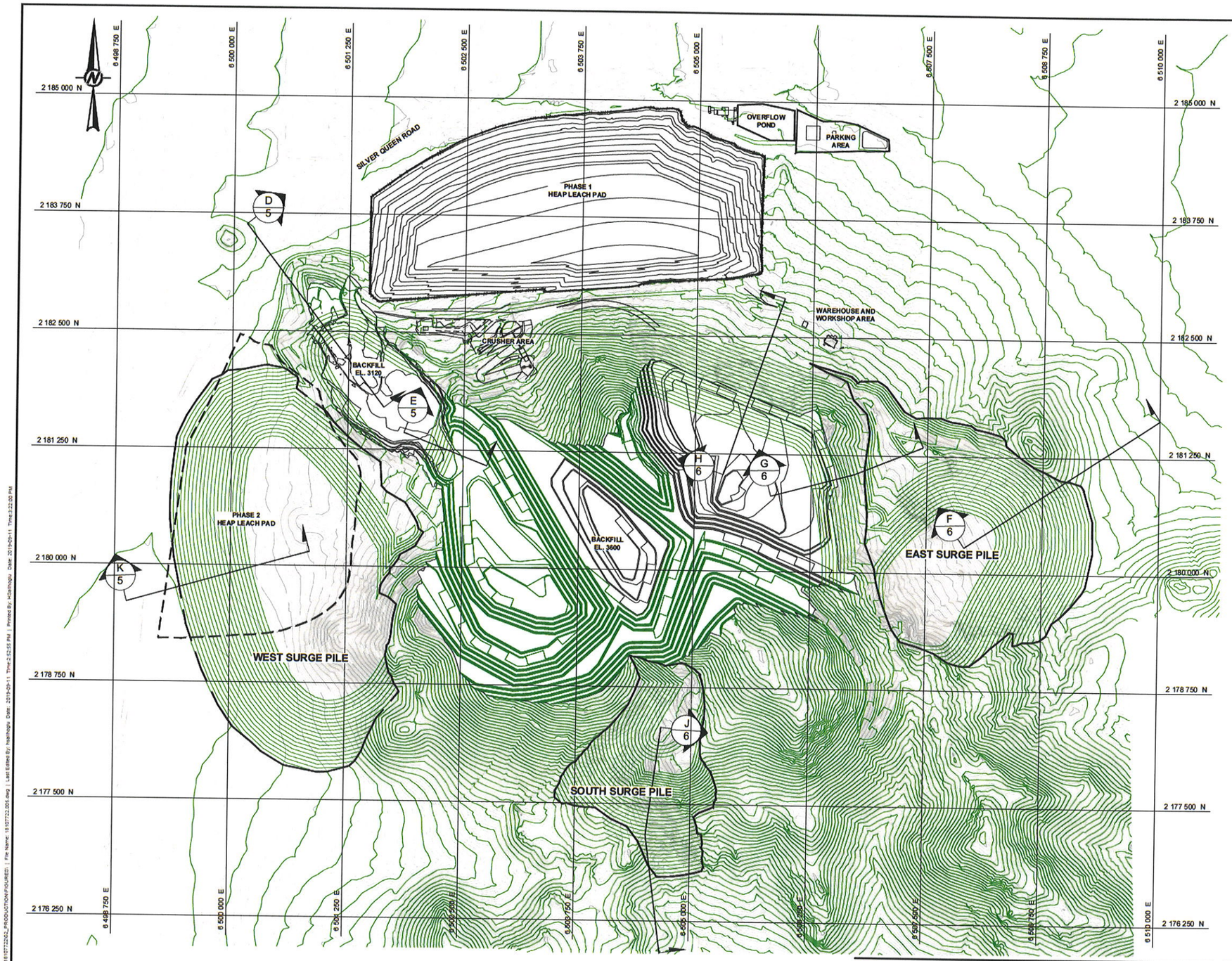
PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SURGE PILES CLOSURE TOPOGRAPHY *END OF EXCAVATION DESIGN*

PROJECT NO.	REV.	FIGURE
18107722	2	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 1in



LEGEND

- EXISTING TOPOGRAPHY (REFERENCE 1)
- PIT (REFERENCE 2)
- FINAL RECLAIMED CONTOURS DESIGN (REFERENCE 4)

REFERENCE(S)

1. EXISTING GROUND TOPOGRAPHY PROVIDED BY TRIATHLON (2004).
2. PIT CONTOURS RECEIVED FROM Sespe Consulting, Inc. ON APRIL 29, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAMES GQM.EOE.Pre.Max.Post.4.29.19.dwg AND GQM.Pref.20MT.Pre.Max.Post.4.29.19.dwg. DESIGN SURFACE RE-BUILT FROM CONTOURS.
3. END OF EXCAVATION CLOSURE DESIGN RECEIVED FROM WestLand Resources, Inc. ON AUGUST 01, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAME Sequence-LOM-End of Excavation.dwg. DESIGN SURFACE RE-BUILT FROM 20-FT CONTOURS.
4. FINAL RECLAMATION CONTOURS DESIGN RECEIVED FROM SWestLand Resources, Inc. ON AUGUST 01, 2019 IN AUTOCAD FILE 2013 FORMAT FILE NAME Sequence-LOM-2to1-Slope-Final Reclaimed Contours.dwg. DESIGN SURFACE RE-BUILT FROM CONTOURS
5. IMAGERY FROM ENVIROMINE INC. FOR AERIAL TOPOGRAPHY DATED MAY 14-16, 2018.

NOT FOR CONSTRUCTION

DRAFT

0 500 1000
1" = 500' FEET

CLIENT

GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT

GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

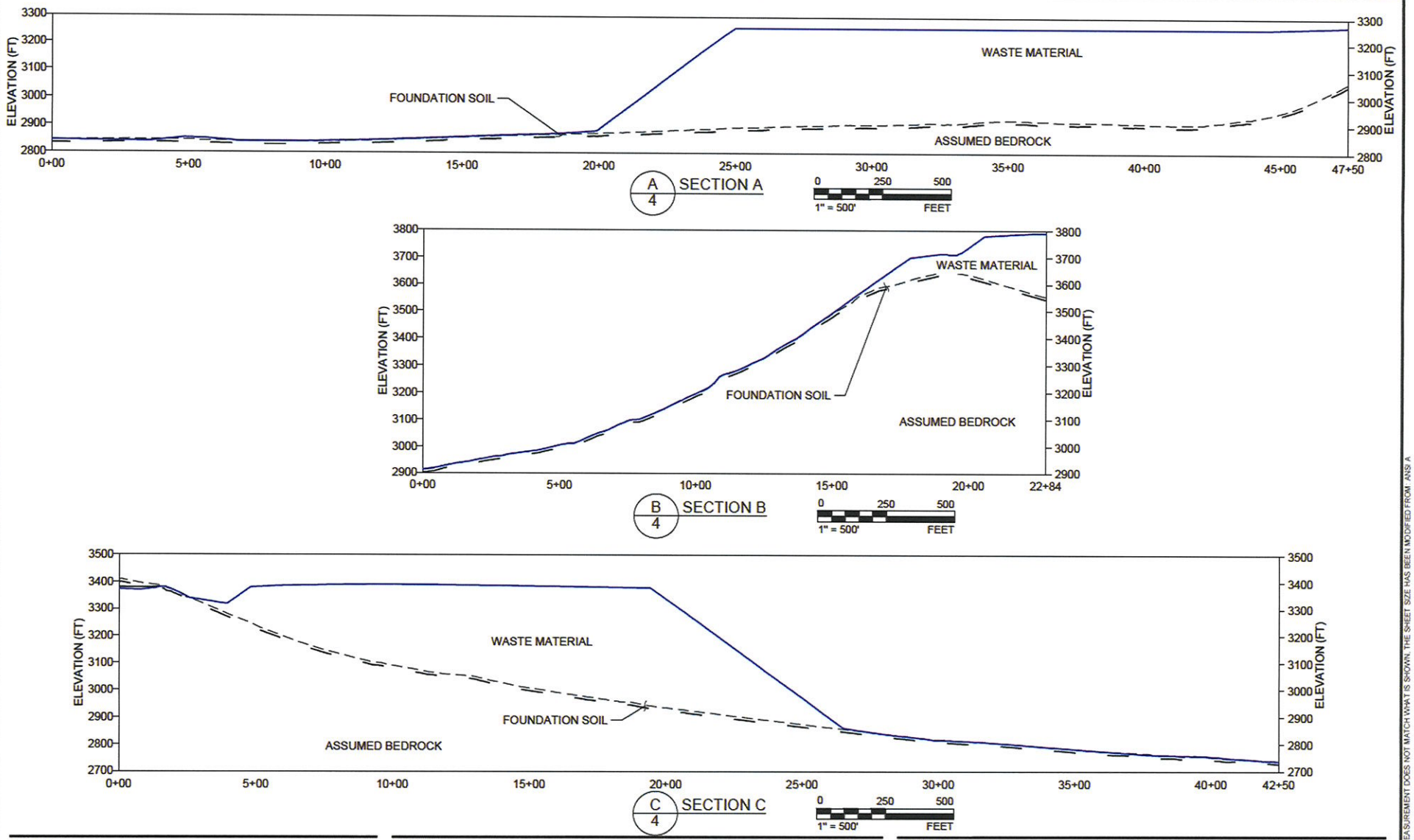
TITLE
SURGE PILES CLOSURE TOPOGRAPHY *FINAL RECLAIMED CONTOURS DESIGN*

PROJECT NO.	REV.	FIGURE
18107722	2	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 1 in

Last Edited By: hsalihoglu Date: 2019-09-09 Time:2:29:16 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:3:56:12 PM
Path: \\Denvernacad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722.006.dwg



LEGEND

- EXISTING TOPOGRAPHY
- BEDROCK (ASSUMED TO BE 10 FT BELOW EXISTING TOPOGRAPHY)
- END OF EXCAVATION CLOSURE DESIGN
- FINAL RECLAIMED CONTOURS DESIGN
- PIT TOPOGRAPHY

CLIENT

GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT

GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
STABILITY SECTIONS A THROUGH C

PROJECT NO.	REV.	FIGURE
18107722	2	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
0

Last Edited By: hsalihoglu Date: 2019-09-09 Time:3:57:00 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:4:02:10 PM
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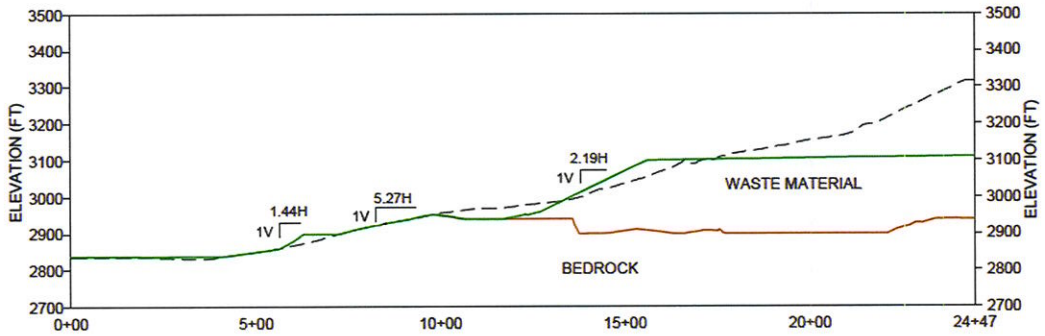
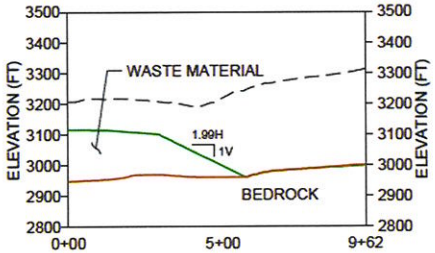


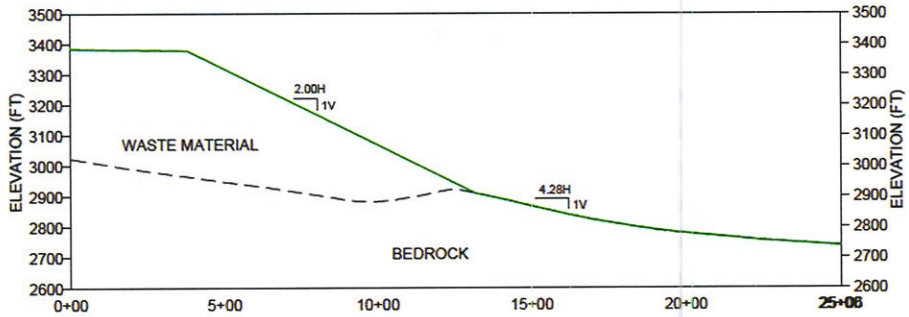
D/5 SECTION D

0 250 500
1" = 500' FEET



E/5 SECTION E

0 300 600
1" = 600' FEET



F/5 SECTION F

0 300 600
1" = 600' FEET

LEGEND

- EXISTING TOPOGRAPHY
- BEDROCK (ASSUMED TO BE 10 FT BELOW EXISTING TOPOGRAPHY)
- END OF EXCAVATION CLOSURE DESIGN
- FINAL RECLAIMED CONTOURS
- PIT TOPOGRAPHY

CLIENT

GOLDEN QUEEN

GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT

GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
STABILITY SECTIONS D, E AND F

PROJECT NO. 18107722 | REV. 2 | FIGURE 5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Last Edited By: hsalihoglu Date: 2019-09-09 Time:4:02:26 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:4:09:47 PM
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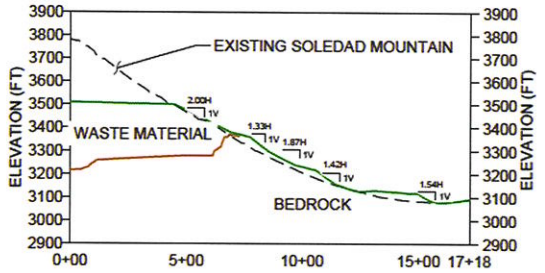
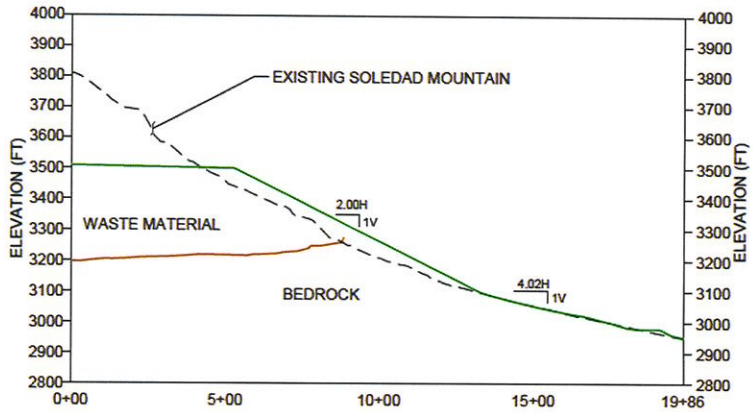


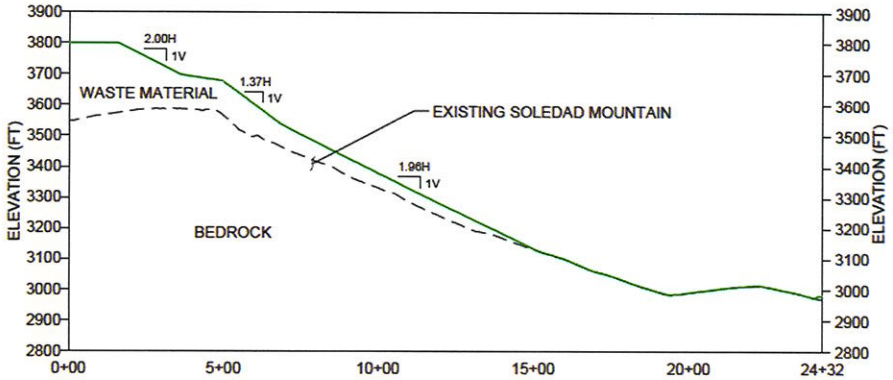
G 6 SECTION G

0 400 800
1" = 800' FEET



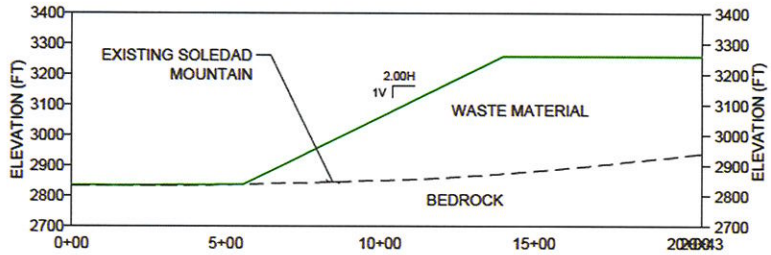
H 6 SECTION H

0 300 600
1" = 600' FEET



J 6 SECTION J

0 300 600
1" = 600' FEET



K 6 SECTION K

0 300 600
1" = 600' FEET

LEGEND

- EXISTING TOPOGRAPHY
- BEDROCK (ASSUMED TO BE 10 FT BELOW EXISTING TOPOGRAPHY)
- END OF EXCAVATION CLOSURE DESIGN
- FINAL RECLAIMED CONTOURS
- PIT TOPOGRAPHY

CLIENT
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

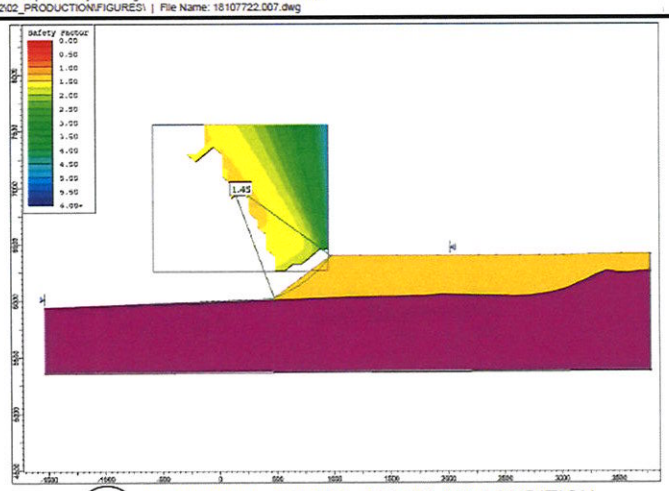
TITLE
STABILITY SECTIONS G, H, J AND K

PROJECT NO. 18107722 REV. 2 FIGURE 6

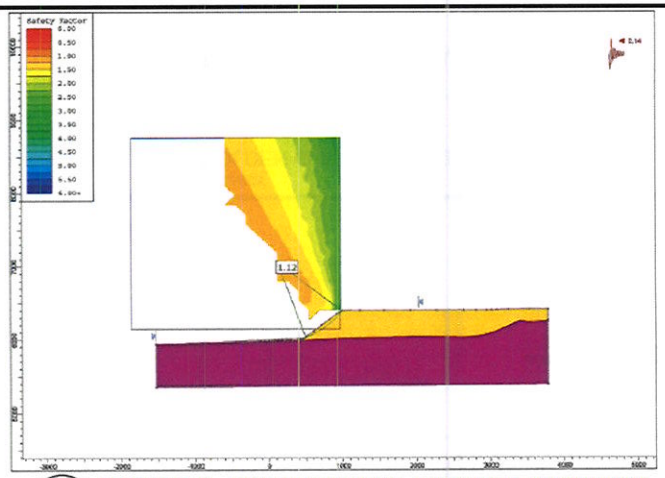
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 1in

Last Edited By: hsalihoglu Date: 2019-08-22 Time:5:01:45 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:2:58:09 PM
Path: \\Denver\acad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722.007.dwg

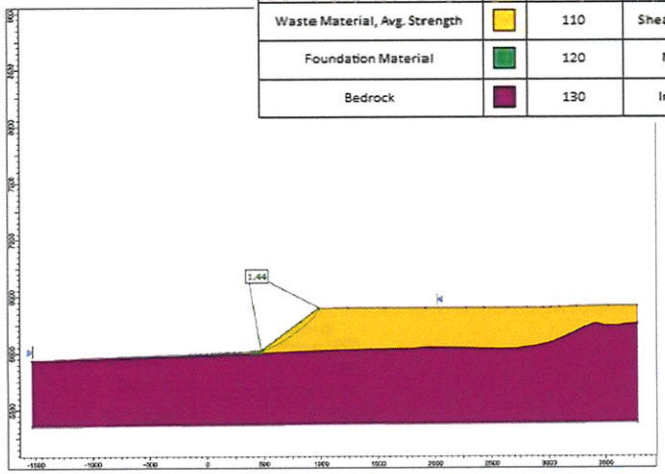


A/7 SECTION A - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

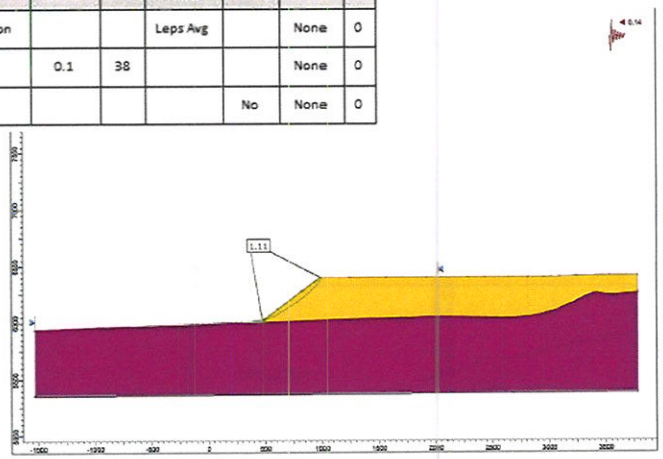


A/7 SECTION A - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Bedrock		130	Infinite strength				No	None	0



A/7 SECTION A - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



A/7 SECTION A - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

CLIENT
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

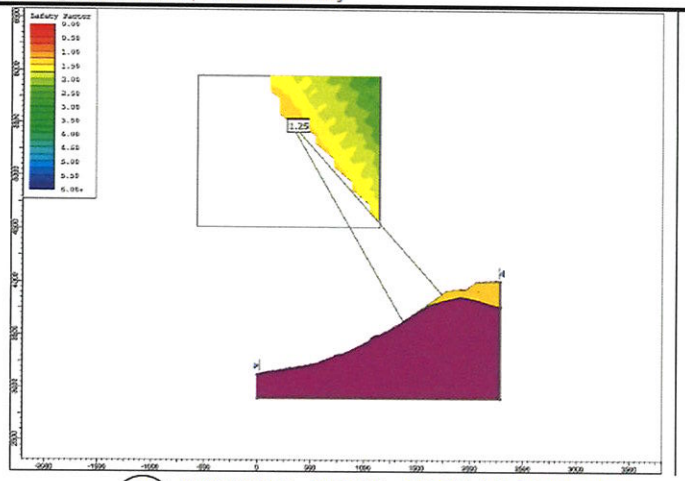
PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION A STABILITY ANALYSIS RESULTS

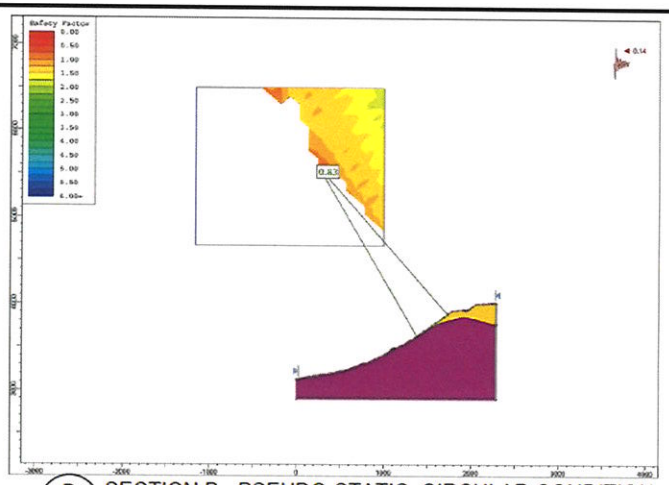
PROJECT NO. 18107722 | REV. 2 | FIGURE 7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Last Edited By: hsalihoglu Date: 2019-08-22 Time:5:01:45 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:3:09:58 PM
Path: \\Denver\acad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722.007.dwg

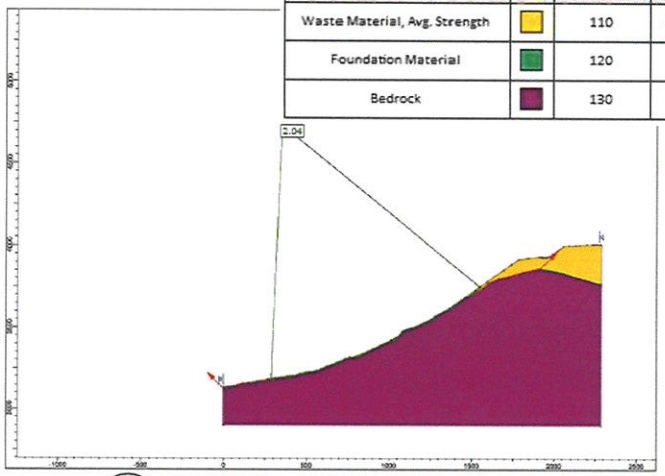


B/8 SECTION B - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

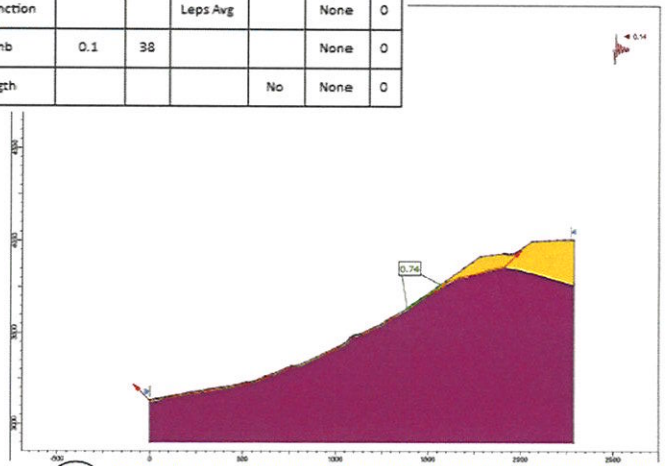


B/8 SECTION B - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Bedrock		130	Infinite strength				No	None	0



B/8 SECTION B - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



B/8 SECTION B - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

CLIENT
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION B STABILITY ANALYSIS RESULTS

PROJECT NO. 18107722 | REV. 2 | FIGURE 8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 1in

Last Edited By: hsalihoglu Date: 2019-08-22 Time:5:01:45 PM | Printed By: HSalihoglu Date: 2019-09-09 Time:3:11:29 PM
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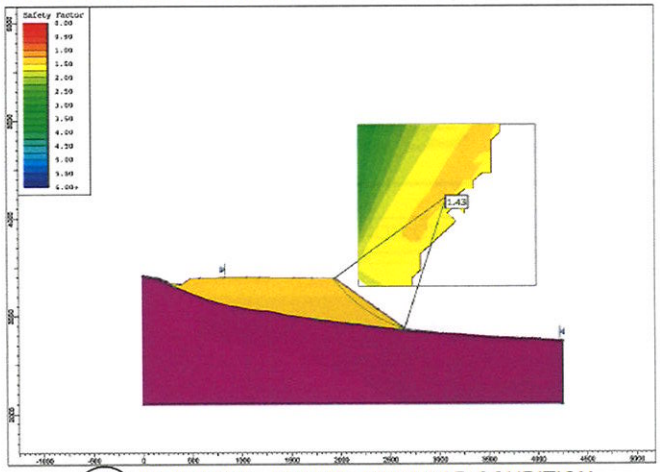
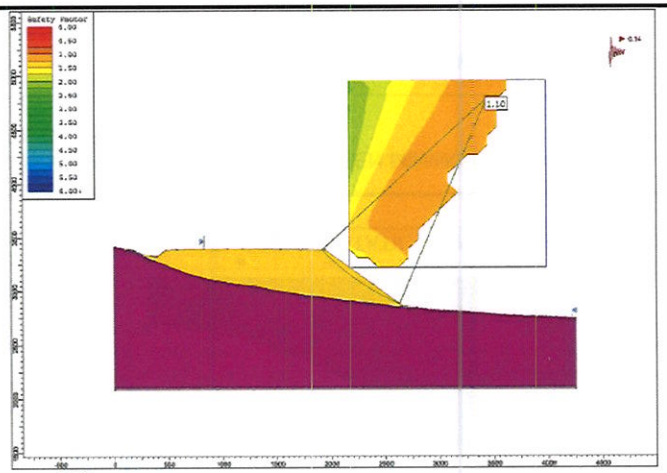
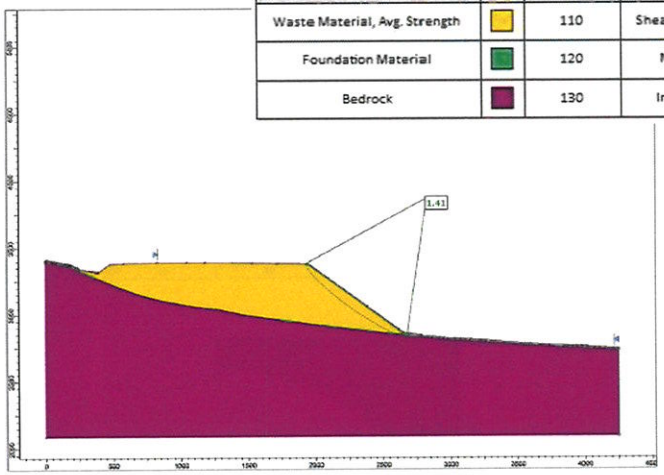


C 9 SECTION C - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

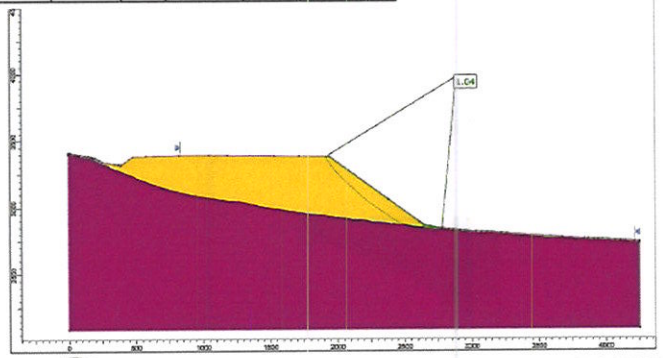


C 9 SECTION C - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Bedrock		130	Infinite strength				No	None	0



C 9 SECTION C - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



C 9 SECTION C - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

CLIENT
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
DESIGNED	HSE
PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION C STABILITY ANALYSIS RESULTS

PROJECT NO. 18107722 | REV. 2 | FIGURE 9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 1in

Last Edited By: hsallhoglu Date: 2019-08-28 Time:10:21:31 AM | Printed By: HSallhoglu Date: 2019-09-09 Time:3:14:07 PM
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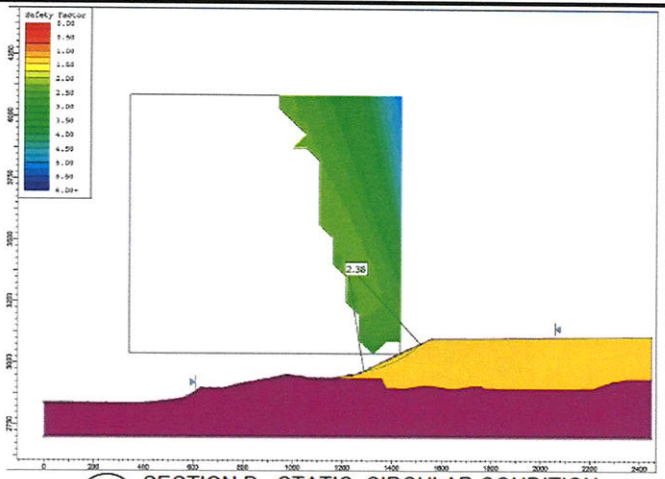
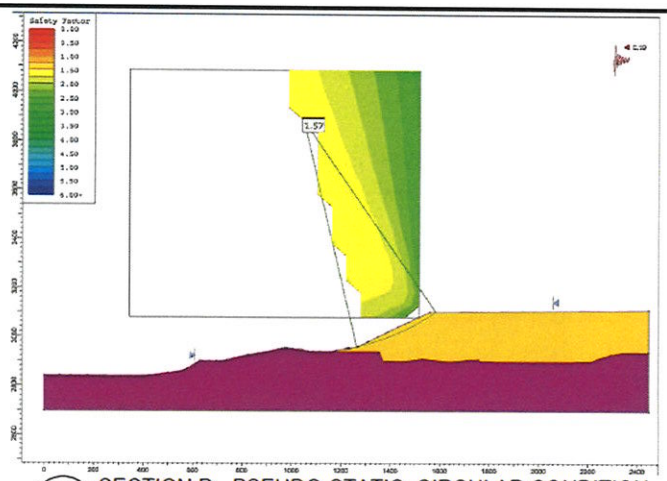
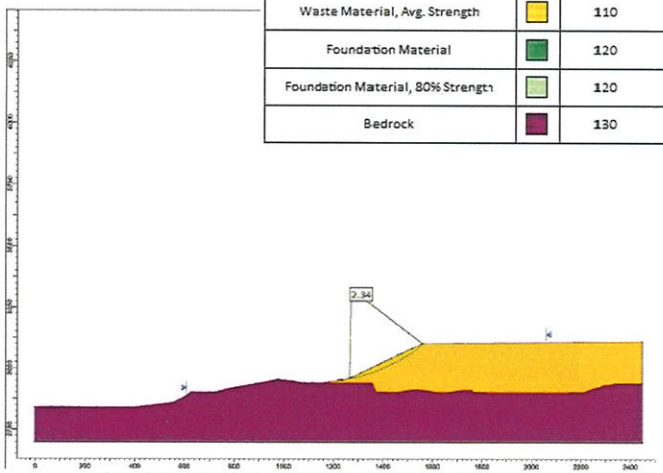


D 10 SECTION D - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

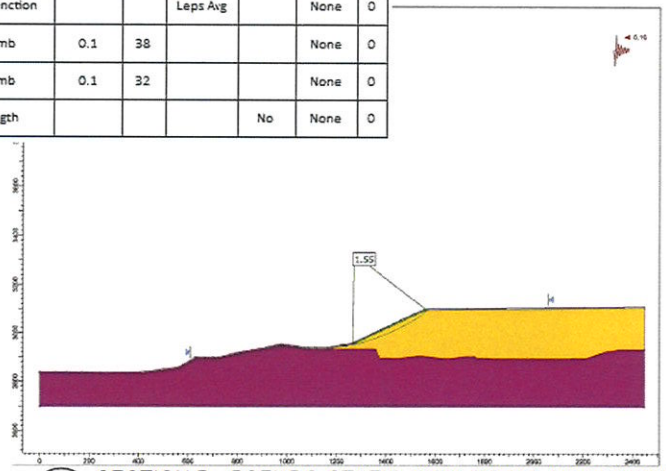


D 10 SECTION D - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



D 10 SECTION D - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



D 10 SECTION D - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

CLIENT
GOLDEN QUEEN MINING COMPANY, LLC
MOJAVE, KERN COUNTY, CALIFORNIA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-11
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PREPARED	HSE
REVIEWED	BMR
APPROVED	REK

PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION D STABILITY ANALYSIS RESULTS

PROJECT NO. 18107722 | REV. 2 | FIGURE 10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
0

Last Edited By: hsallhoglu Date: 2019-08-26 Time:10:21:31 AM | Printed By: HSallhoglu Date: 2019-09-09 Time:3:17:07 PM
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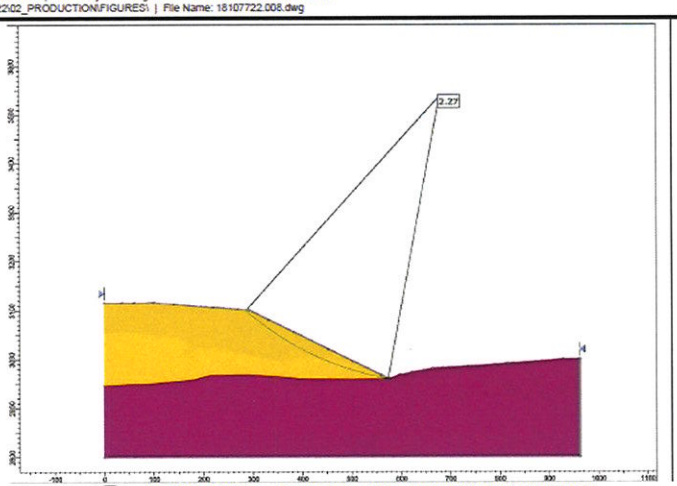
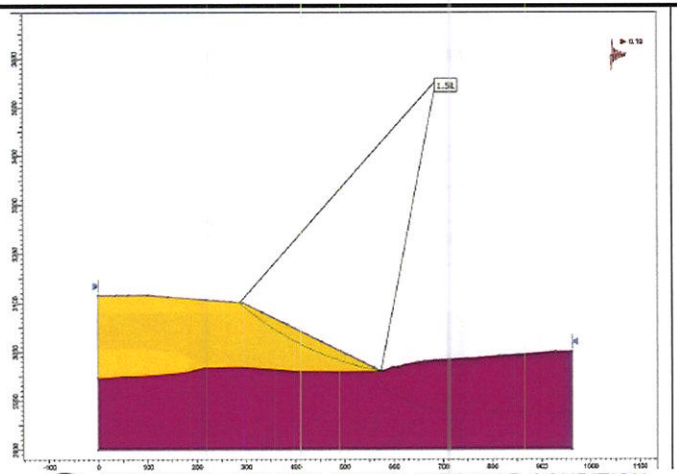
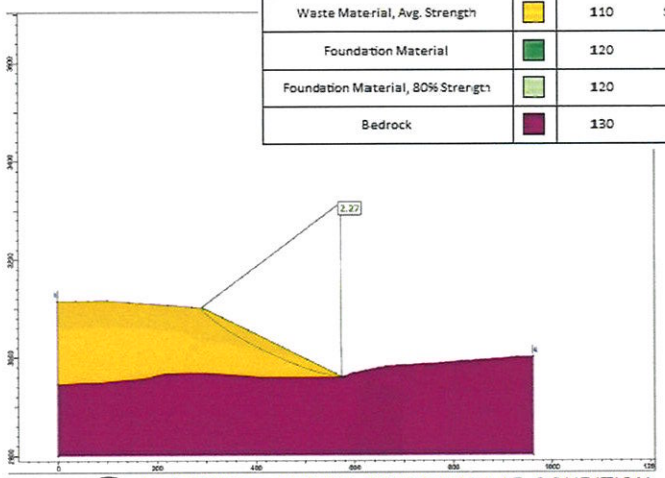


E 11 SECTION E - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

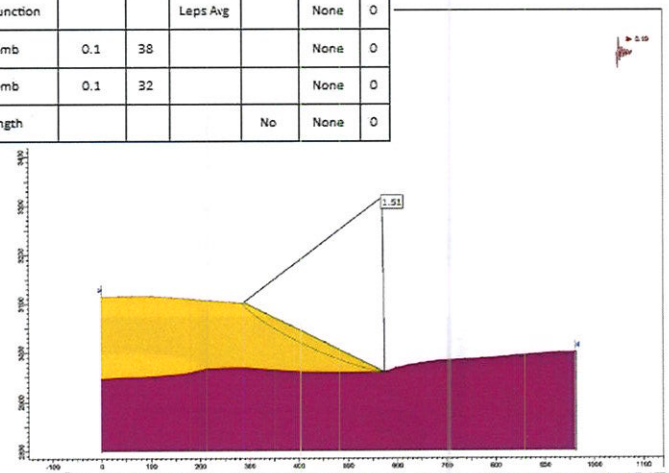


E 11 SECTION E - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



E 11 SECTION E - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



E 11 SECTION E - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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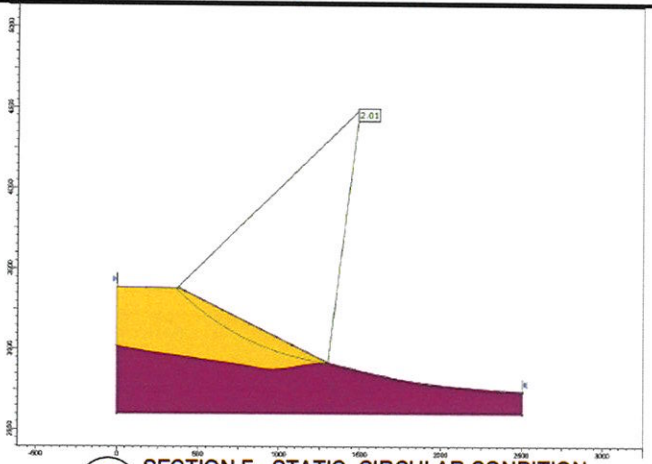
PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION E STABILITY ANALYSIS RESULTS

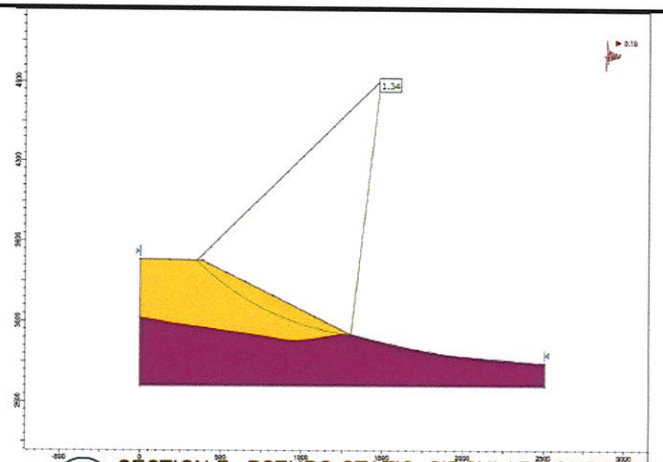
PROJECT NO. 18107722 | REV. 2 | FIGURE 11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1in
0

Last Edited By: hsalihoglu Date: 2019-08-28 Time:10:21:31 AM | Printed By: HSalihoglu Date: 2019-09-09 Time:3:18:45 PM
Path: \\Denvefiacad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722-008.dwg

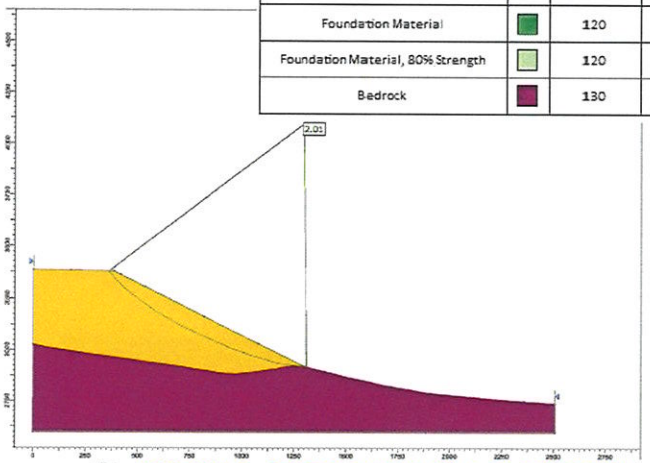


F 12 SECTION F - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

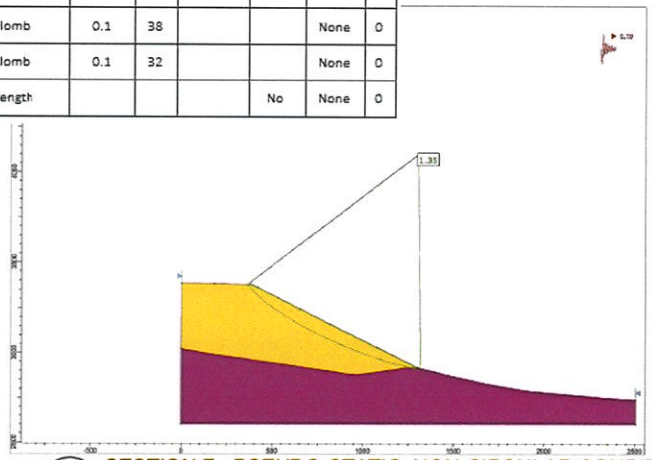


F 12 SECTION F - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Laps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



F 12 SECTION F - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



F 12 SECTION F - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION F STABILITY ANALYSIS RESULTS

PROJECT NO. 18107722 | REV. 2 | FIGURE 12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

Last Edited By: hsallhoglu Date: 2019-08-28 Time:10:21:31 AM | Printed By: HSallhoglu Date: 2019-09-09 Time:3:22:19 PM
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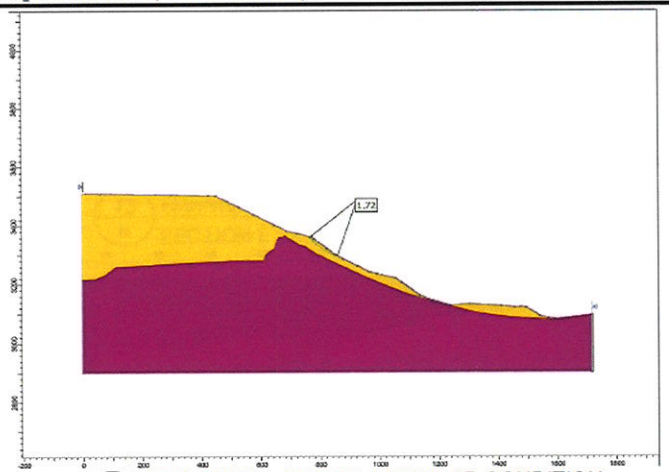
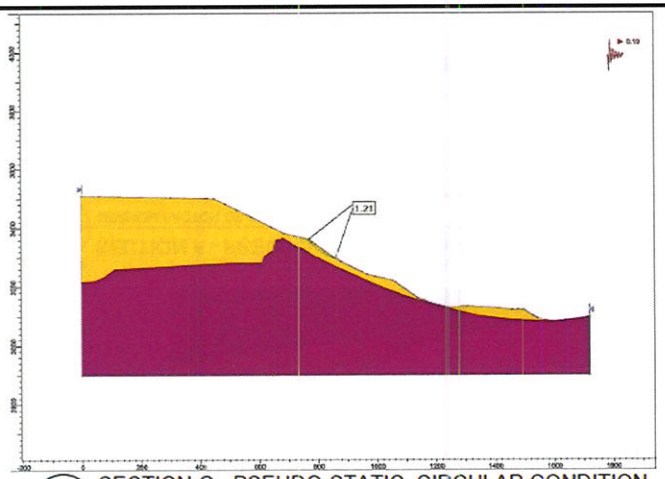
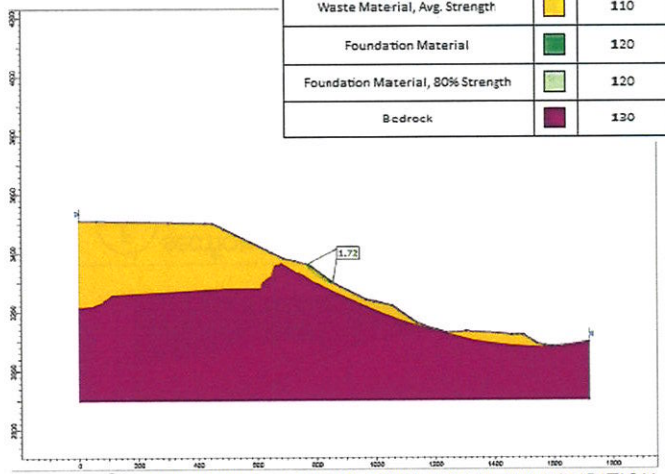


G 13 SECTION G - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

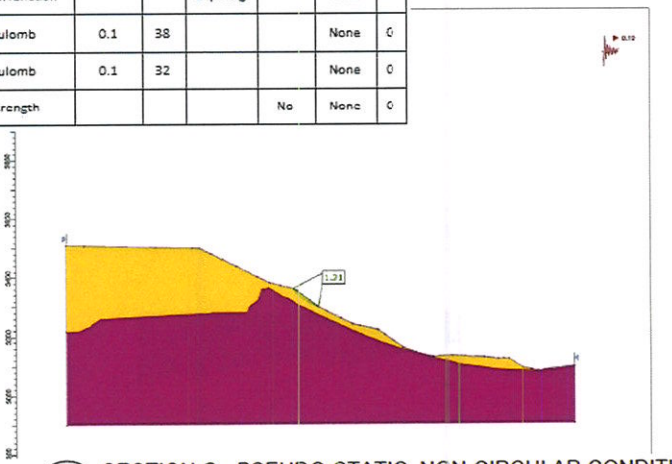


G 13 SECTION G - PSEUDO-STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



G 13 SECTION G - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



G 13 SECTION G - PSEUDO-STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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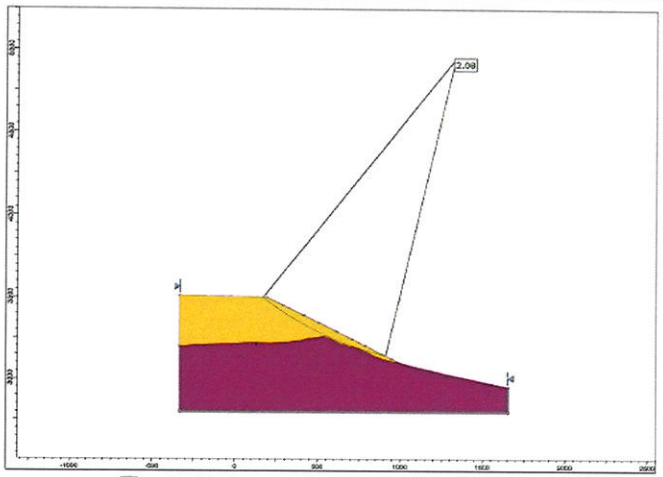
PROJECT
GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION G STABILITY ANALYSIS RESULTS

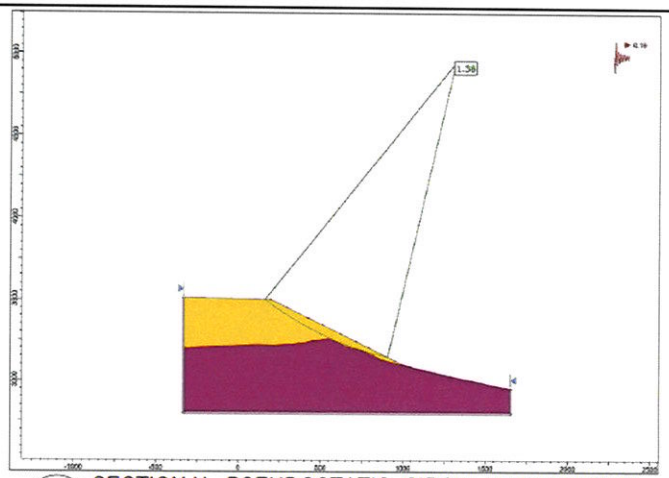
PROJECT NO. 18107722 | REV. 2 | FIGURE 13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

Last Edited By: cjenkins Date: 2019-10-23 Time:3:27:14 PM | Printed By: CJenkins Date: 2019-10-23 Time:3:28:26 PM
Path: \\Denver\acad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722.008.dwg

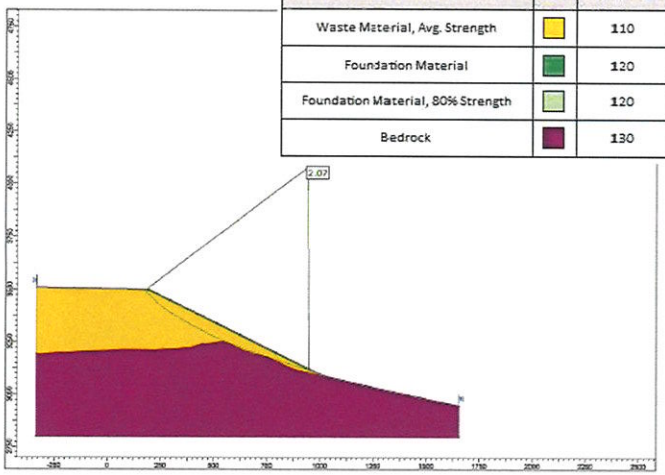


H 14 SECTION H - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

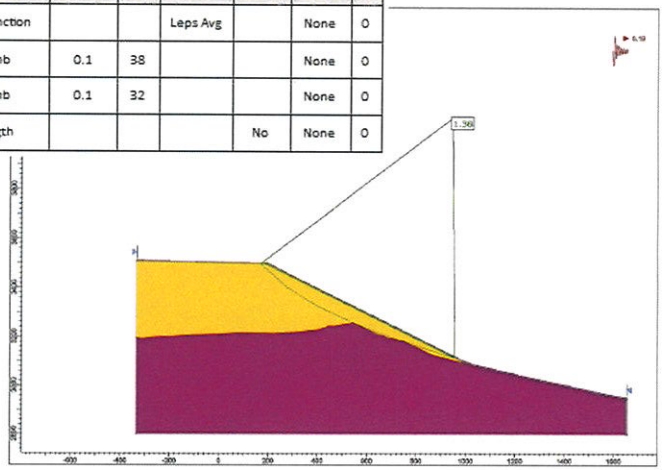


H 14 SECTION H - PSEUDOSTATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



H 14 SECTION H - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



H 14 SECTION H - PSEUDOSTATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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TITLE
SECTION H STABILITY ANALYSIS RESULTS

PROJECT NO. 18107722 | CONTROL | REV. 1 | FIGURE 14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

Last Edited By: cjenkins Date: 2019-10-23 Time:3:27:14 PM | Printed By: CJenkins Date: 2019-10-23 Time:3:28:33 PM
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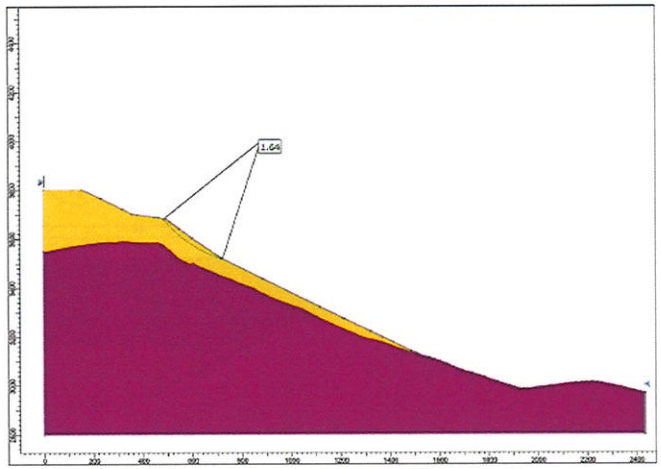
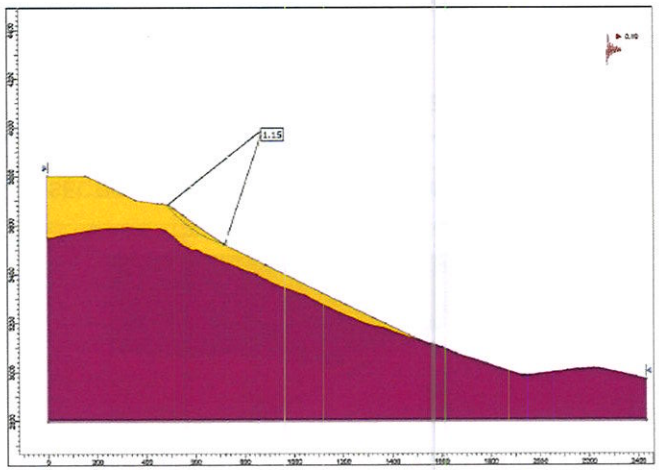
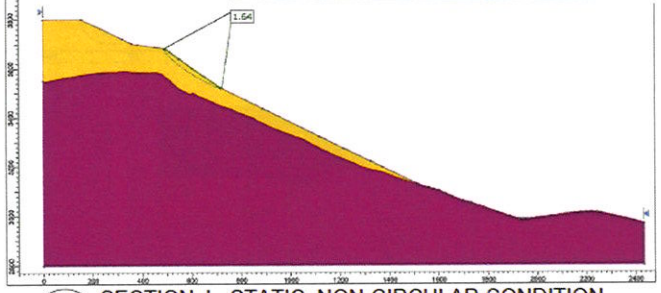


J 15 SECTION J - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

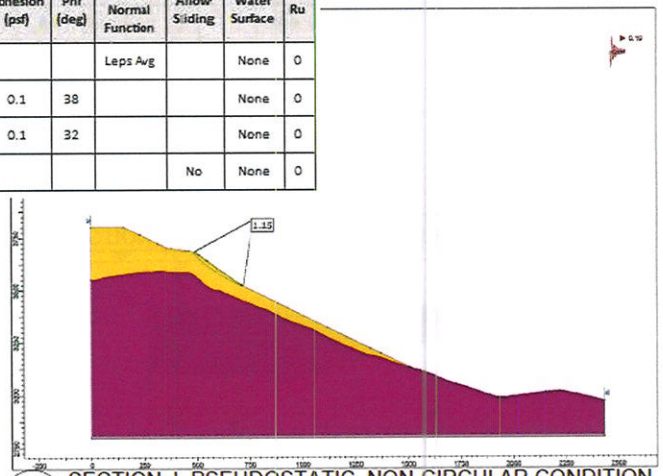


J 15 SECTION J- PSEUDOSTATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



J 15 SECTION J - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



J 15 SECTION J- PSEUDOSTATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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GOLDEN QUEEN MINING COMPANY, LLC

TITLE
SECTION J STABILITY ANALYSIS RESULTS

PROJECT NO.	CONTROL	REV.	FIGURE
18107722		1	15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

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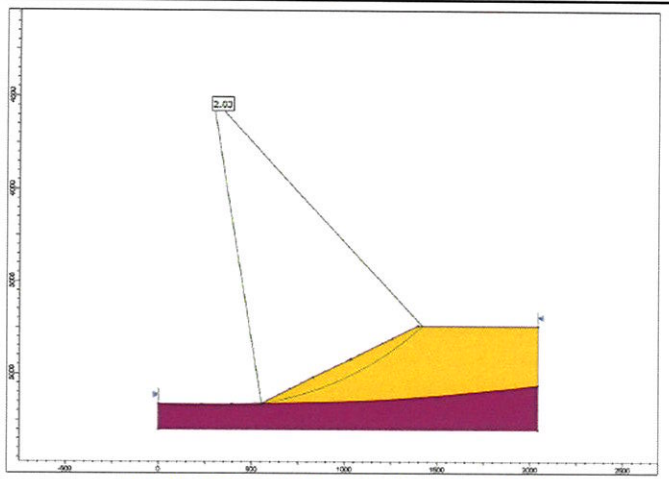
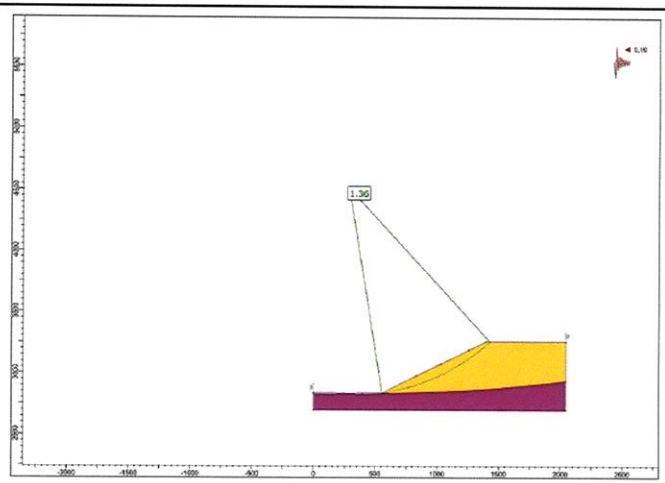
Path: \\Denver\acad\SOLEDAD\99_PROJECTS\18107722\02_PRODUCTION\FIGURES\ | File Name: 18107722.008.dwg

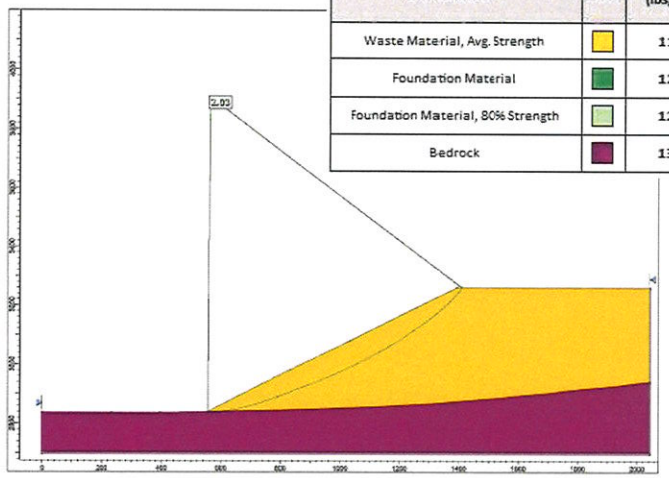


K 16 SECTION K - STATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3

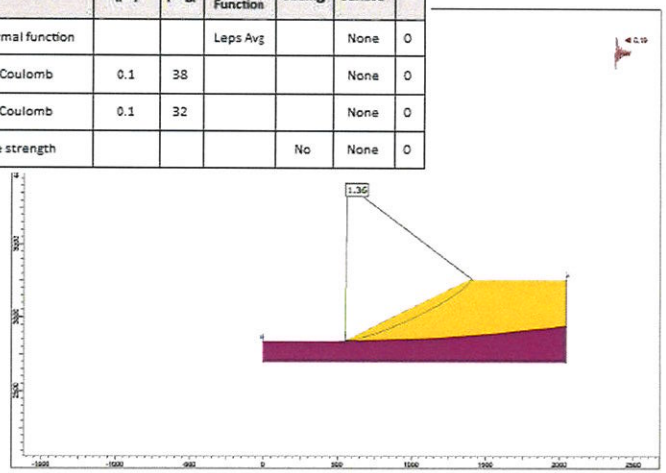


K 16 SECTION K- PSEUDOSTATIC, CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Allow Sliding	Water Surface	Ru
Waste Material, Avg. Strength		110	Shear Normal function			Leps Avg		None	0
Foundation Material		120	Mohr-Coulomb	0.1	38			None	0
Foundation Material, 80% Strength		120	Mohr-Coulomb	0.1	32			None	0
Bedrock		130	Infinite strength				No	None	0



K 16 SECTION K - STATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.3



K 16 SECTION K- PSEUDOSTATIC, NON-CIRCULAR CONDITION
MINIMUM FACTOR OF SAFETY 1.0

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GOLDEN QUEEN MINING COMPANY, LLC
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GOLDER

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APPROVED	REK

TITLE
SECTION K STABILITY ANALYSIS RESULTS

PROJECT NO.	CONTROL	REV.	FIGURE
18107722		1	16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
0

ATTACHMENT 1

Infinite Slope Stability Analysis

Infinite Slope Stability Analysis

Created by: Crystal Jenkins
Review by: Madeline Sova
Approved by: Jean Kugel

Lambe, T.W. and Whitman, R.V. 1979. Soil Mechanics. John Wiley & Sons, Inc., New York, ISBN 0471024910.

Factor of safety = Available Shear Strength/ Shear Stress Required for Equilibrium

$$FS = \frac{\tan\phi}{\tan i}$$

where ϕ = friction angle
i = slope angle

Minimum FS = 1.0

Friction angle, ϕ 40

Section	Slope H:1V	Slope angle, i	FS	Meets min. FS
D	1.44	34.778	**1.21**	yes
	5.27	10.744	**4.42**	yes
	2.19	24.542	**1.84**	yes
E	1.99	26.680	**1.67**	yes
F	2.00	26.565	**1.68**	yes
	4.28	13.151	**3.59**	yes
G	2.00	26.565	**1.68**	yes
	4.13	13.611	**3.47**	yes
	1.33	36.939	**1.12**	yes
	1.87	28.136	**1.57**	yes
	4.24	13.271	**3.56**	yes
	1.42	35.154	**1.19**	yes
	1.54	32.998	**1.29**	yes
H	2.00	26.565	**1.68**	yes
	4.02	13.969	**3.37**	yes
J	2.00	26.565	**1.68**	yes
	1.37	36.127	**1.15**	yes
	1.96	27.031	**1.64**	yes
K	2.00	26.565	**1.68**	yes