APPENDIX 4-I
MITCHELL DEPOSIT
GEOTECHNICAL CHARACTERIZATION

December 13, 2012

REPORT ON

Mitchell Deposit
Geotechnical Characterization

Submitted to:
Seabridge Gold Inc.
Suite 400, 106 Front Street East
Toronto, ON M5A 1E1

Attention: Mr. Jim Smolik

REPORT

Project Number: 1114390002-001-R-Rev0-10000

Distribution:

2 Hard Copies - Golder Associates Ltd.

2 Hard Copies - Seabridge Gold Inc.

Golder Associates

Study Limitations

Golder Associates Ltd. (Golder) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, has been prepared by Golder for the sole benefit of Seabridge Gold Inc. It represents Golder's professional judgement based on the knowledge and information available at the time of completion. Golder is not responsible for any unauthorized use or modification of this document. All third parties relying on this document do so at their own risk.

The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific project, site conditions, design objective, development and purpose described to Golder by Seabridge Gold Inc., and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to the entire document.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder. Seabridge Gold Inc. may make copies of the document in such quantities as are reasonably necessary for those parties conducting business specifically related to the subject of this document or in support of or in response to regulatory inquiries and proceedings. Electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore no party can rely solely on the electronic media versions of this document.

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Seabridge Gold Inc.'s (Seabridge) KSM project involves several major gold-copper deposit located in northwest British Columbia (BC), approximately 40 kilometres southwest of the Bell II lodge on Highway 37, and 21 km south-southeast of the Eskay Creek Mine (Figure 1.1). An aerial view looking to the east is shown in Figure 1.2. The site characteristics are described in detail in the KSM pre-feasibility study (PFS) report (Seabridge 2011).

Figure 1.1: Location of the Mitchell, Kerr and Sulphurets (KSM) property

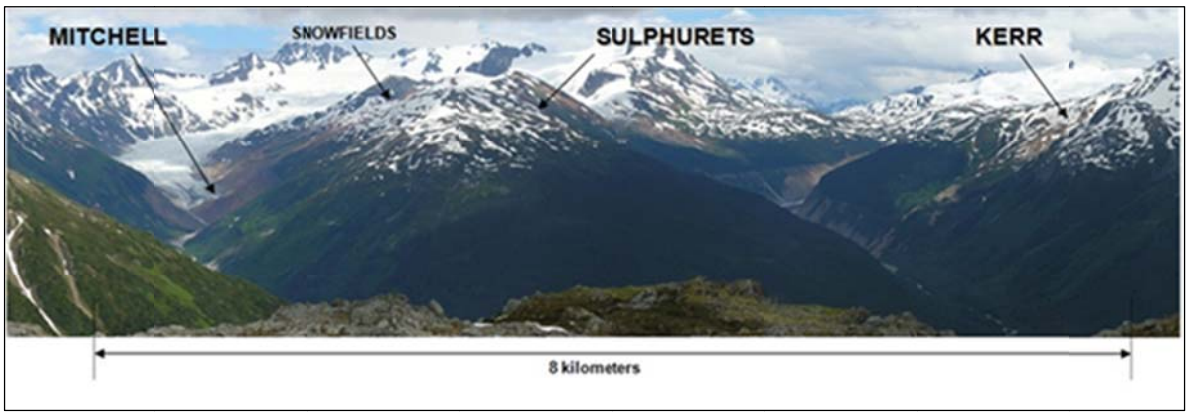


Figure 1.2: Aerial view of the general area of the Mitchell deposit (looking east)

The KSM property contains the Kerr, Sulphurets, Mitchell, and Iron Cap deposits. The deposits will be mined by a combination of open pit and underground mining methods. Golder Associates Ltd. (Golder) has completed the pre-feasibility level assessment of block cave mining for the Mitchell and Iron Cap deposits. This report presents a compilation of available geological and geotechnical data for the Mitchell deposit and the geotechnical characterization of the rock mass for block cave mine design. A similar evaluation for the Iron Cap deposit has been prepared under separate cover under separate cover.

The Mitchell deposit is a porphyry type intrusion that has been deformed by subsequent tectonic processes. The deposit outcrops at the base of the Mitchell valley just to the west of the Mitchell glacier. The Mitchell site terrain is shown in Figure 1.3.

Figure 1.3: Mitchell Valley, looking west

The proposed mine plan involves open pit mining to a pit floor elevation of 390 m followed by block cave mining from the underground. A prior prefeasibility study was undertaken to mine the Mitchell deposit by open pit means only and the geotechnical design for this pit is presented in the report entitled "KSM Project: Mitchell Zone - Open Pit Slope Design – FINAL" (BGC 2010). This geotechnical pit design report is included as an appendix to the PFS (Wardrop 2011).

The focus of this study is limited to the mineralized rock between the block cave extraction level and the pit floor. The extraction level elevation was established in preliminary studies at 235 m, approximately 135 m below the pit floor. Detailed designs of the block caving mine, based in part on the geotechnical characterization contained in this report, will be presented under separate cover.

A plan view and cross-section showing the proposed open pit, gold mineralization, and proposed block cave extraction level are shown in Figure 1.4 and Figure 1.5, respectively.

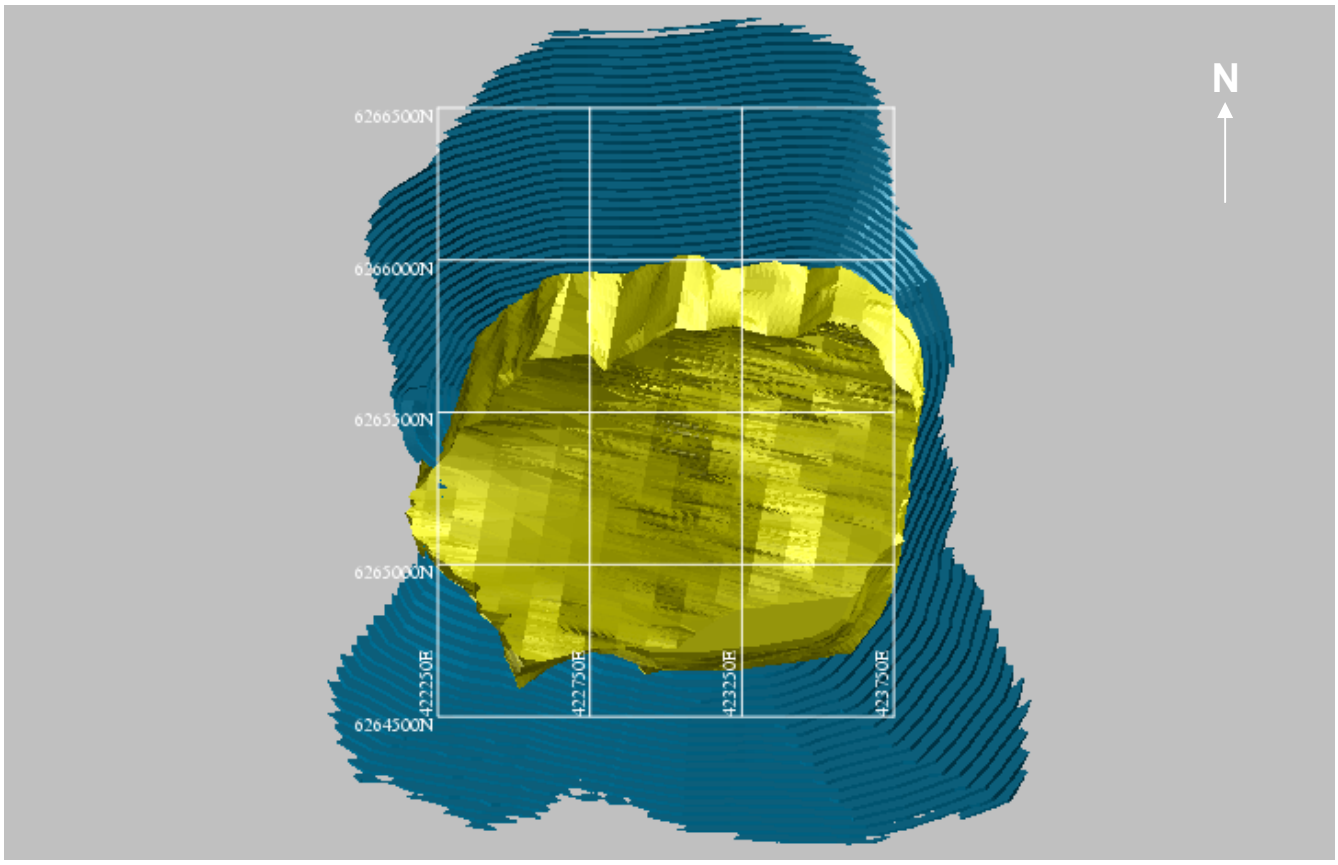


Figure 1.4: Plan showing proposed open pit and 0.25 g/t Au grade shell

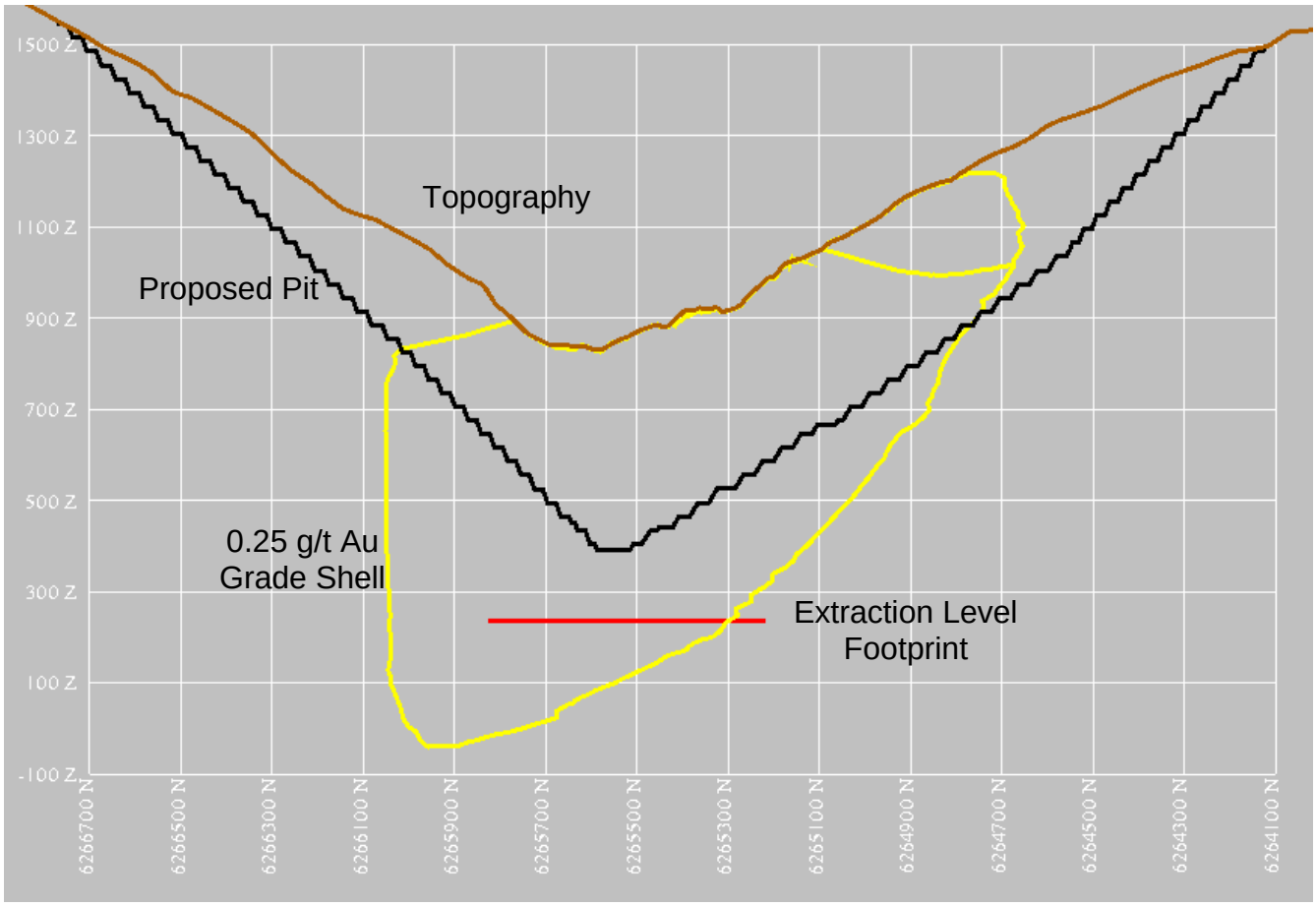


Figure 1.5: Vertical cross-section (423100 Easting) showing topography, proposed pit, 0.25 g/t Au grade shell and block cave extraction level footprint

Note that the 0.25 g/t Au grade shell provided by Seabridge is presented in Figure 1.4 and Figure 1.5 to provide a general reference of the location of the deposit.

2.0 AVAILABLE DATA

A significant amount of geotechnical and geological data have been collected for the Mitchell deposit since exploration began in 2006. These data consist of core photographs, geotechnical core logs, geological core logs, and field mapping. A summary of the data used in this geotechnical assessment is described in this section.

2.1 Exploration Drilling

A total of 114 exploration boreholes were drilled and logged geologically by Seabridge between 2006 and 2010. The borehole IDs are as follows:

- M-06-001 to M-06-024;
- M-07-024E to M-07-060;
- M-08-061 to M-08-094;
- M-09-103 to M-09-114; and
- M-10-115 to M-10-121.

A plan view of the exploration drillholes overlain on the 0.25% Au ore grade shell are shown in Figure 2.1.

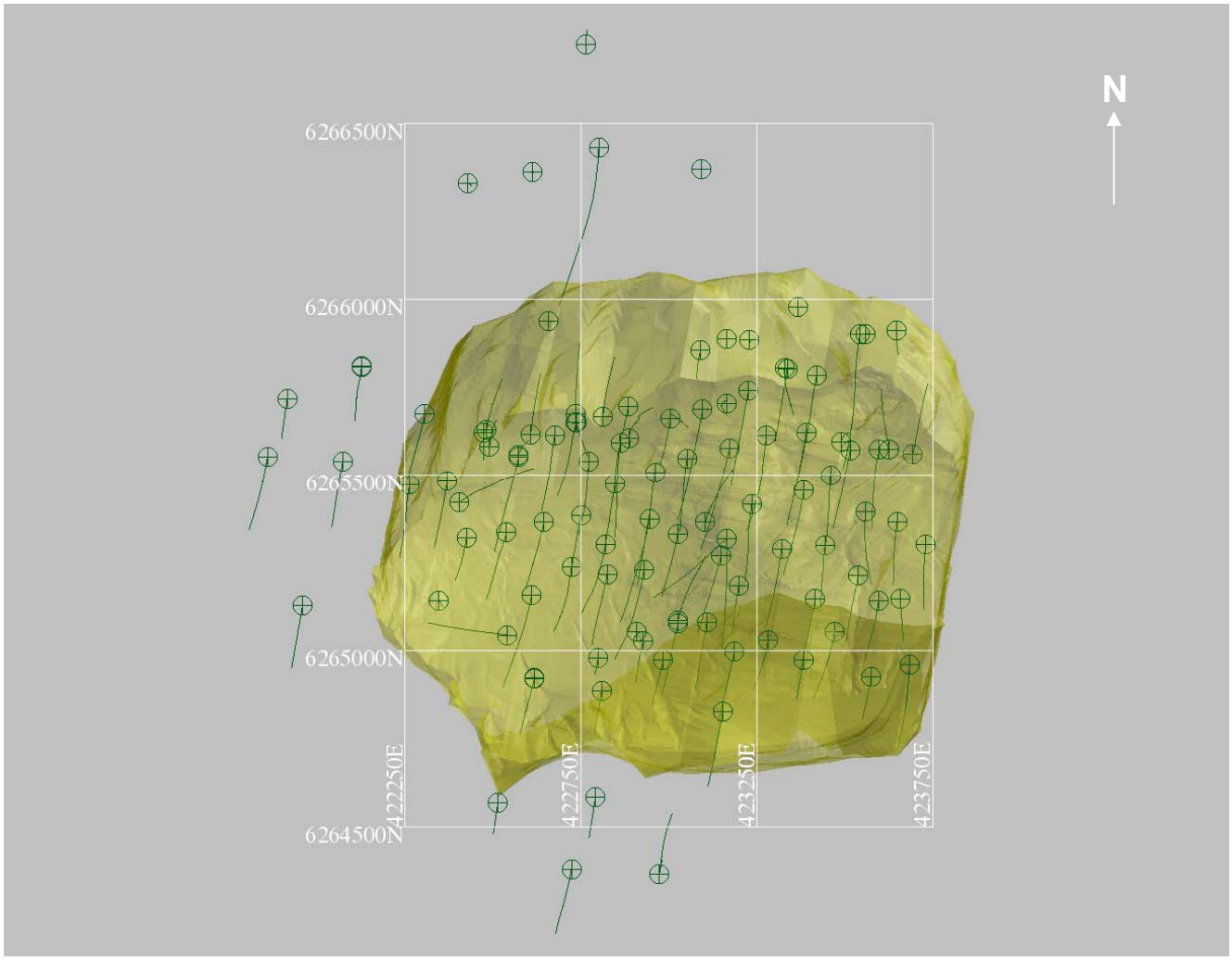


Figure 2.1: Exploration boreholes and Mitchell 0.25% g/t Au grade shell

The information available from these boreholes includes a count of fractures per run, lithology, alteration type and intensity, and Rock Quality Designation (RQD). RQD (Deere et al. 1967) is a common parameter describing fracture density and is defined as follows:

$$\text{RQD} = \frac{\sum \text{Length of core pieces}}{\text{Total length of core run}} \times 100\%$$

Core photographs for all exploration holes were provided to Golder by Seabridge.

2.2 Geotechnical Drilling

2.2.1 2009 Drilling

In 2009, BGC Engineering Inc. (BGC) logged nine boreholes, M-09-095 to M-09-102A, for geotechnical parameters to be used in open pit design. These boreholes are summarized in Table 2.1 and shown in Figure 2.2.

Table 2.1: 2009 Geotechnical Boreholes

Hole ID	Easting[1] (m)	Northing[1] (m)	Elevation[1] (m)	Total Depth (m)	Intersects Mineralization?
M-09-095	423183.1	6265325	969.5	650.4	Y
M-09-096	423567.3	6265465	911.7	300.1	Y
M-09-097	423129.1	6266387	1334.2	400.5	N
M-09-098	422873.3	6266065	1200.7	404.0	N
M-09-099	422885.1	6265700	892.5	681.3	Y
M-09-100	422339.8	6265242	793.2	354.3	Y
M-09-101	423404.1	6264793	1251.9	401.0	Y
M-09-102	422386.6	6264664	1246.6	163.3	N
M-09-102A	422386.6	6264664	1246.6	399.8	N

Notes:

1) NAD83, UTM Zone 9 Grid North.

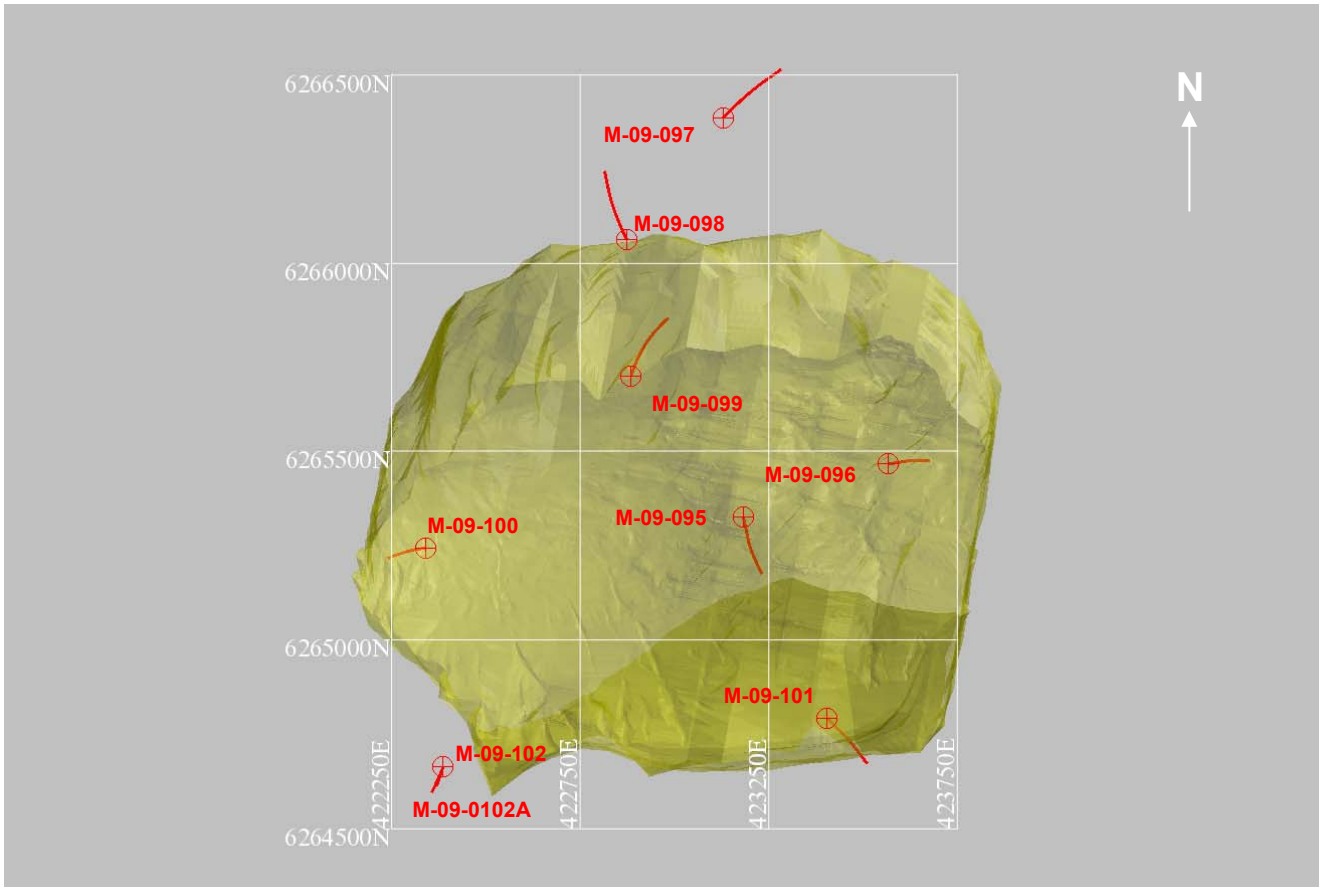


Figure 2.2: 2009 Geotechnical boreholes and Mitchell 0.25 g/t Au grade shell

The geotechnical parameters logged by BGC are outlined in "KSM Project: Mitchell Zone - Open Pit Slope design - FINAL" (BGC 2010). These include the following parameters for the characterization of rock mass properties according to the Rock Mass Rating (RMR) system by Bieniawski (1976):

- Core recovery;
- RQD;
- Number of discontinuities per interval;
- Discontinuity characteristics;
- Strength rating (ISRM); and
- Weathering rating.

Oriented core logging was done for all of the core from M-09-095 and M-09-101, and on selected sections of M-09-099 and M-09-100. These data were combined with televiewer data from all nine holes to provide fracture orientations.

Core photographs were provided to Golder by BGC and used in the geotechnical characterization.

2.2.2 2011 Drilling

In 2011, Golder geotechnically logged five boreholes drilled into the Mitchell deposit. Details on these holes are summarized in Table 2.2 and shown in Figure 2.3. All five holes intersect the Mitchell 0.25 g/t Au Grade Shell.

Table 2.2: 2011 Geotechnical Boreholes

Hole ID	Easting[1] (m)	Northing[1] (m)	Elevation[1] (m)	Total Depth (m)
M-11-122	423050.5	6265605.3	824.0	636.0
M-11-123	422756.1	6265429.6	781.4	631.5
M-11-124	422828.4	6265537.4	799.5	687.0
M-11-125	423361.3	6265483.2	885.9	810.0
M-11-126	422650.7	6265354.6	776.9	636.0

Notes:

1) NAD83, UTM Zone 9 Grid North.

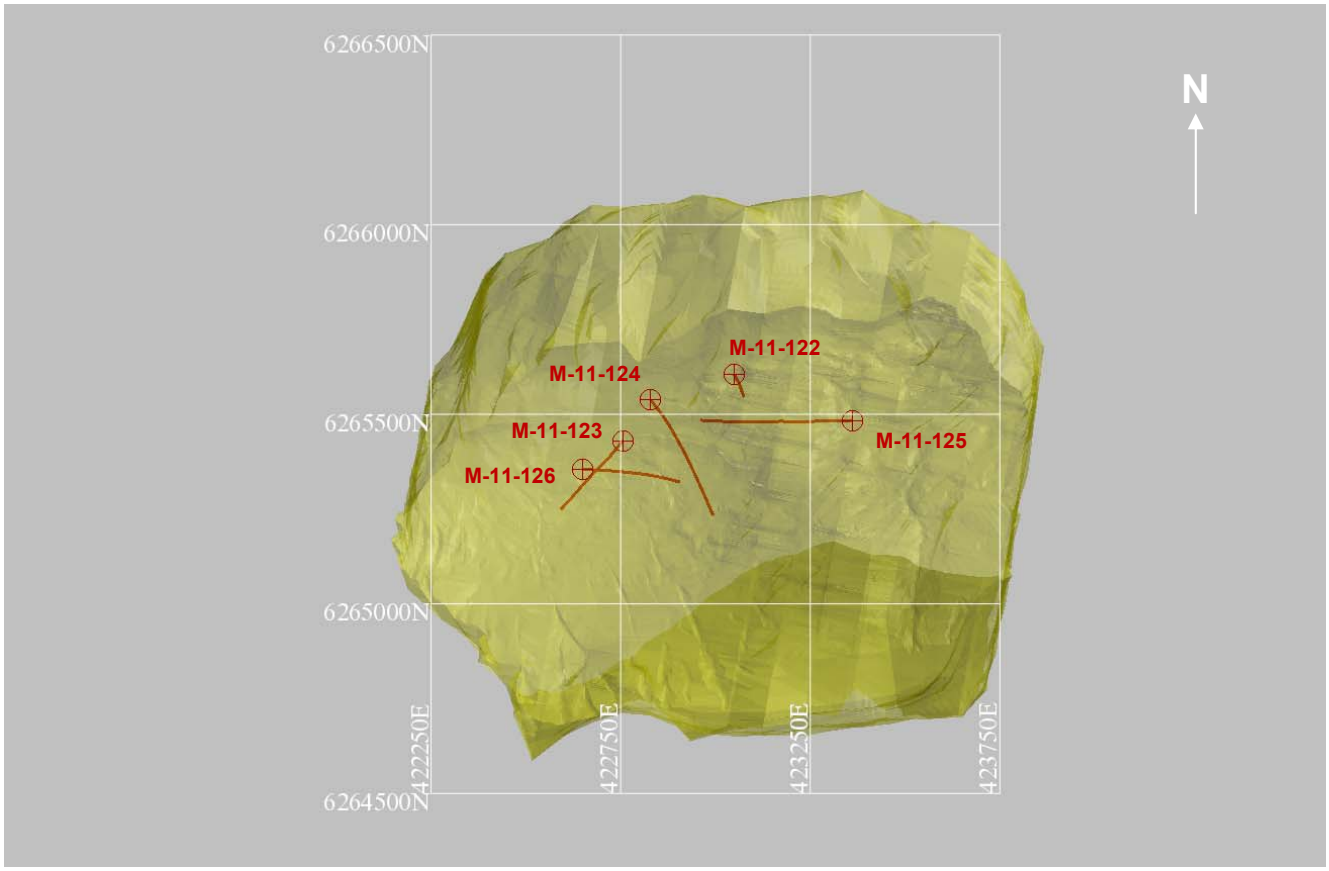


Figure 2.3: 2011 Geotechnical boreholes and Mitchell 0.25 g/t Au grade shell

As described in the factual report titled "2011 Geotechnical and Hydrogeological Field Investigation - Mitchell Project" (Golder 2012), the 2011 drilling program was focused on parameters for use in the design of a block cave mine rather than pit wall stability. In addition to collecting geotechnical parameters for rock mass classification using the Q (Barton et al. 1974) and RMR systems, more detailed information on the rock structure and fabric was collected. This included information on:

- Rock fabric (i.e., "massive", "foliated' or "stockwork");
- Micro-defect intensity; and
- Frequency and orientation of veins.

Detailed descriptions of these parameters are contained in the field investigation report (Golder 2012).

Core photographs of the 2011 boreholes were taken by Golder and used in the geotechnical characterization.

2.3 Geological Model

Seabridge developed an interpreted geological model based on geological logging data. Three-dimensional surfaces representing topography and faults, and three-dimensional interpreted shapes for lithology, alteration and ore grade shells were incorporated into the model. The proposed open pit shell for the combined open pit and underground block caving concept was provided by Moose Mountain Technical Services.

2.4 Laboratory Data

Laboratory testing was performed at the Golder laboratory in Burnaby, B.C. Detailed laboratory test results are available in the field investigation reports for the 2009 and 2011 geotechnical programs (BGC 2010; Golder 2012).

Uniaxial Compressive Strength (UCS) tests were performed on 14 core samples from the 2009 geotechnical program and 21 core samples from the 2011 geotechnical program. Five samples from the 2009 boreholes were indicated to have failed along foliation or a discontinuity. These results were discarded. Some samples from the 2011 boreholes were also recorded as having failed along foliation or a discontinuity. However, upon visual examination, the foliation or discontinuity did not appear to have an influence on failure.

Triaxial Compressive Strength (TRX) tests were performed on six core samples taken from the 2011 program at confining stresses of 0.5 to 6 MPa.

2.5 Geotechnical Surface Mapping

As part of the 2011 field investigation program, Golder conducted geotechnical surface mapping at Mitchell on four rock outcrops. Traverse locations, mapping photographs and geotechnical mapping sheets are included in the field investigation report (Golder 2012).

Data collected along the four mapping traverses include the following:

- Geotechnical data suitable for classifying rock quality based on the RMR System (Bieniawski 1976);
- Joint persistence and termination characteristics; and
- Structural orientation data.

3.0 GEOLOGY

The Mitchell deposit is a porphyry type intrusion that has been deformed by subsequent tectonic processes, resulting in a footwall contact dipping at approximately 40 degrees to the north. The deposit outcrops at the base of the Mitchell valley just to the west of the Mitchell glacier.

A general view of the outcrop of the Mitchell deposit and the surface expressions of relevant geological features are shown in Figure 3.1.

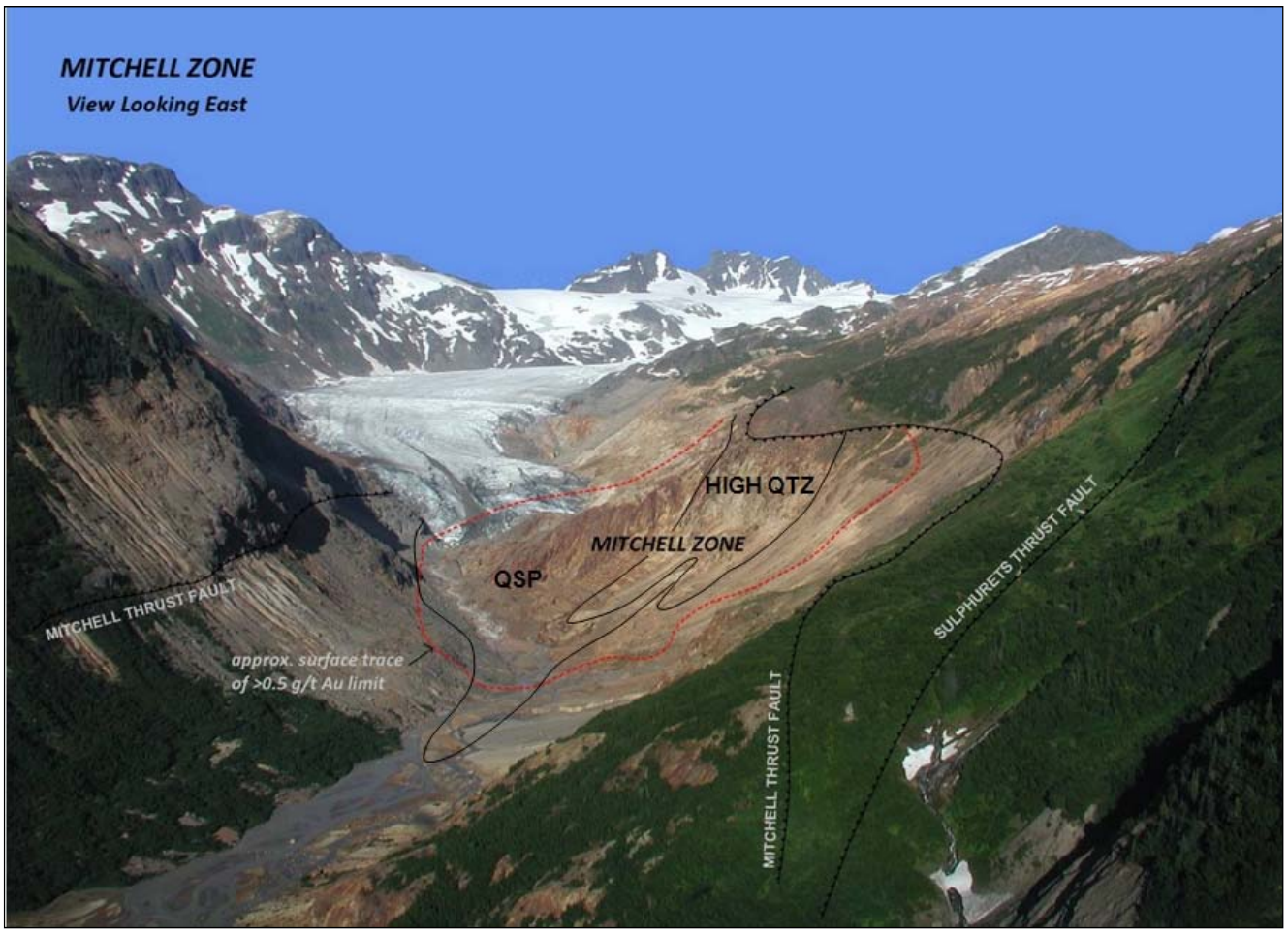


Figure 3.1: Aerial view showing the outcrop of the Mitchell deposit and surface expressions of relevant geological features

The geological information for the Mitchell deposit provided by Seabridge included the following:

- Lithology;
- Alteration;
- Major faulting; and
- Au and Cu grade shells of 0.25 g/t Au and 0.1% Cu.

The geometrical shapes of the 0.25 g/t Au and 0.1% Cu grade shells are very similar and superimpose one another. The deposit extends approximately 1,500 m east-west (along strike), approximately 400 m to 1400 m north-south (in plan in the down dip direction), and approximately 300 m to 900 m vertically (Figure 3.2). The deposit is massive and reasonably continuous, and in general geometrically suitable to mine by block caving. It is understood that the deposit remains open at depth.

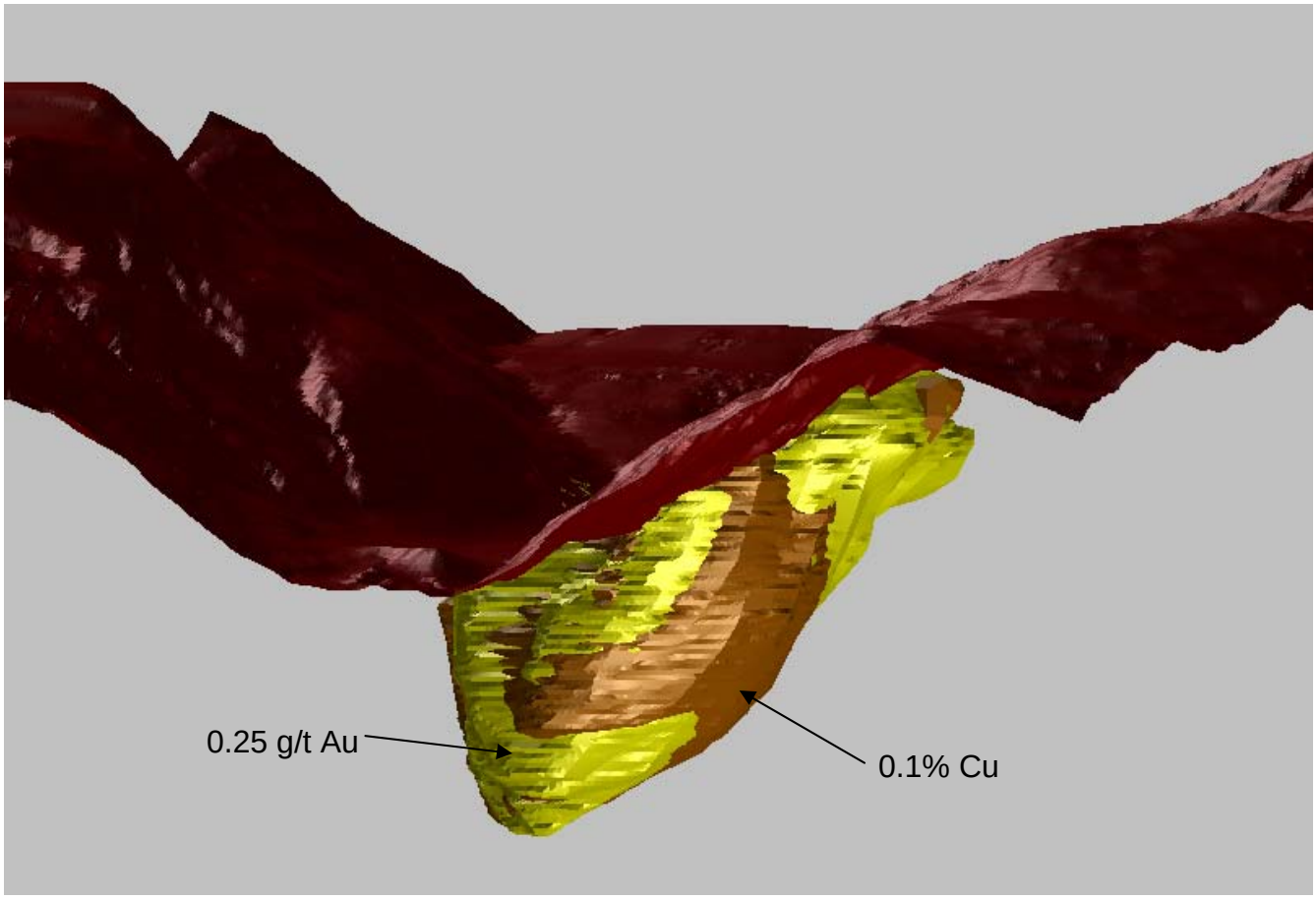


Figure 3.2: Isometric view 0.25 g/t Au and 0.1% Cu grade shells of the Mitchell deposit

A vertical cross-section towards the center of the deposit showing lithology, alteration, structure and grade shells is presented in Figure 3.3. The lithological units within the area of potential block cave mining (between the floor of the proposed pit and the underground extraction level) are primarily altered volcanics that lie beneath the Mitchell Thrust Fault (Table 3.1). Also as indicated in Table 3.2, these rocks are typically associated with intermediate argillic alteration (IARG), quartz-sericite-pyrite alteration (QSP), and chlorite-propylitic alteration (CL-PR). For the purpose of this study, the logged alteration codes have been classified into the above three alteration types (IARG, QSP, and CL-PR). Alteration types that did not fit these three broad categories have been classified as 'Other', as indicated in Table 3.2.

Table 3.1: Mitchell Lithology

Code	Description
MC-MONZ	MC Monzonite
SW-MONZ	SW Monzonite
NM-MONZ	NM Monzonite
NM-STUHI	NM Stuhini group rocks
MC-VOLC	MC Volcanic
SW-VOLC	SW Volcanic
NM-VOLC	NM Volcanic
HIGH-QUARTZ	High quartz

Table 3.2: Mitchell Alteration

Code	Description	Logged Codes	Percentage by Length of Logged Rock (%)
CL-PR	Chlorite-propylitic alteration	CL, CL2, CLSTW, CL2STW, PR	62.3
IARG	Intermediate argillic alteration	IARG	8.3
QSP	Quartz-sericite-pyrite alteration	QSP, QSPSTW	13.7
Other	Carbonate veining Hematization Hornfels or Skarn Potassic Late quartz veins Silicic	CARB HEM HFLS, SIH, MTH KP, PKBX, QB QTVN SI, SIL, PSBX	15.7

Taken from Wardrop (2010)

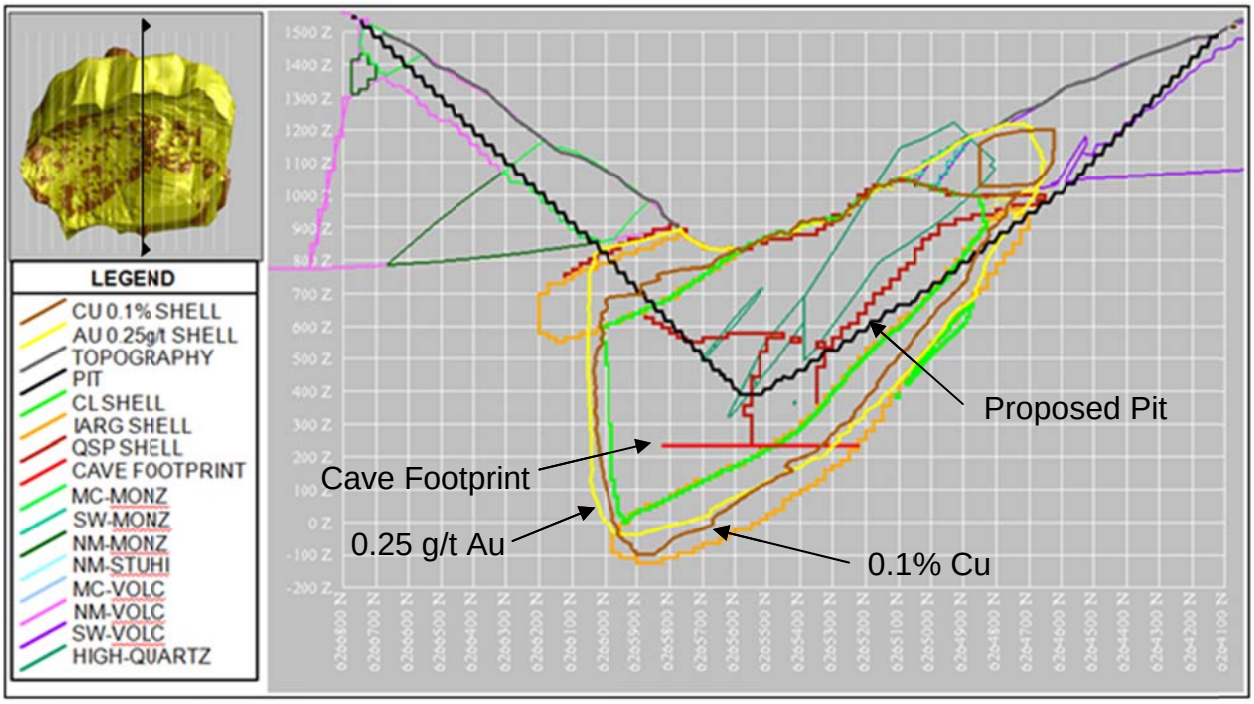


Figure 3.3: Vertical cross-section (423100 Easting) of the Mitchell deposit showing lithology, alteration and 0.25 g/t Au and 0.1% Cu grade shell

3.1 Rock Fabric

Observations of rock fabric were recorded by Golder field engineers during the 2011 field program with the intent to investigate any correlations between rock fabric and fracture frequency.

Logged intervals of core were classified into three categories of rock fabric as described in Table 3.3. Figure 3.4 to Figure 3.6 show typical core photographs of these three categories. There were also other rock fabric descriptors used during the logging (i.e., banded, contorted and laminated) but these comprised a very small portion of the rock mass.

Table 3.3: Rock Fabric Categories

Rock Fabric	Description
Massive	No discernable structure.
Foliated	Layering is exhibited.
Stockwork	More than 50% of the interval contains quartz stockwork veins.

Figure 3.4: Typical "massive" rock fabric

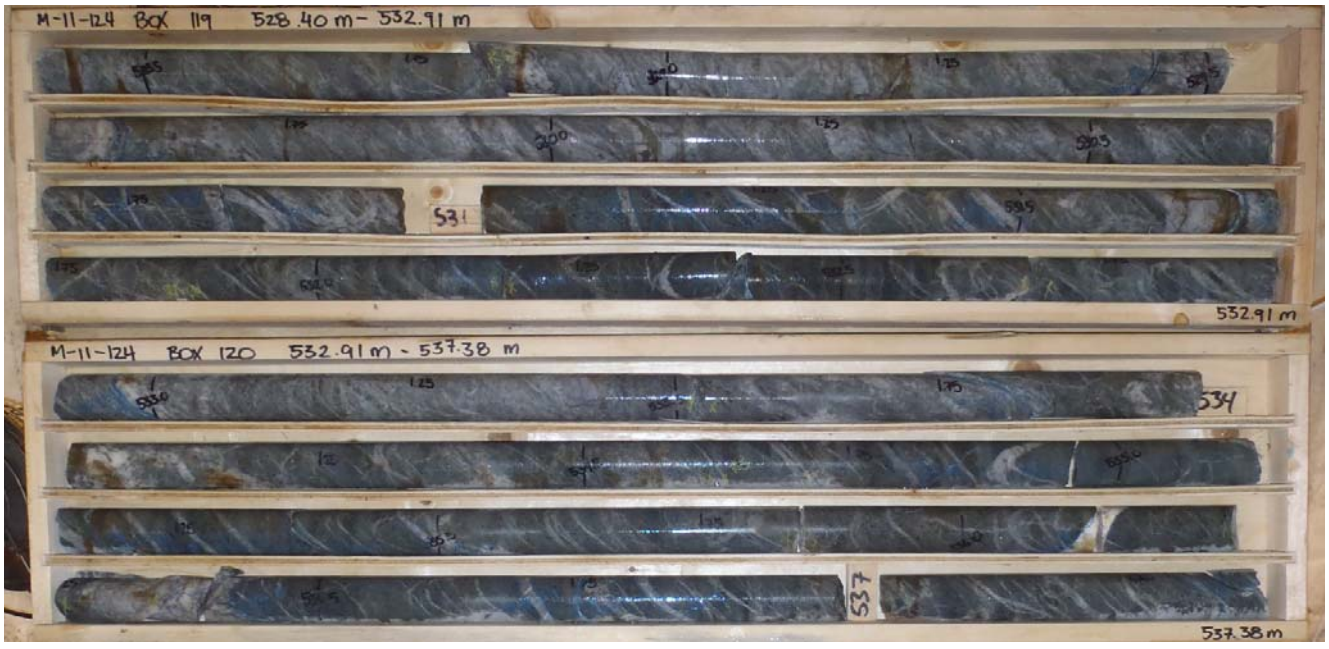


Figure 3.5: Typical "foliated" rock fabric

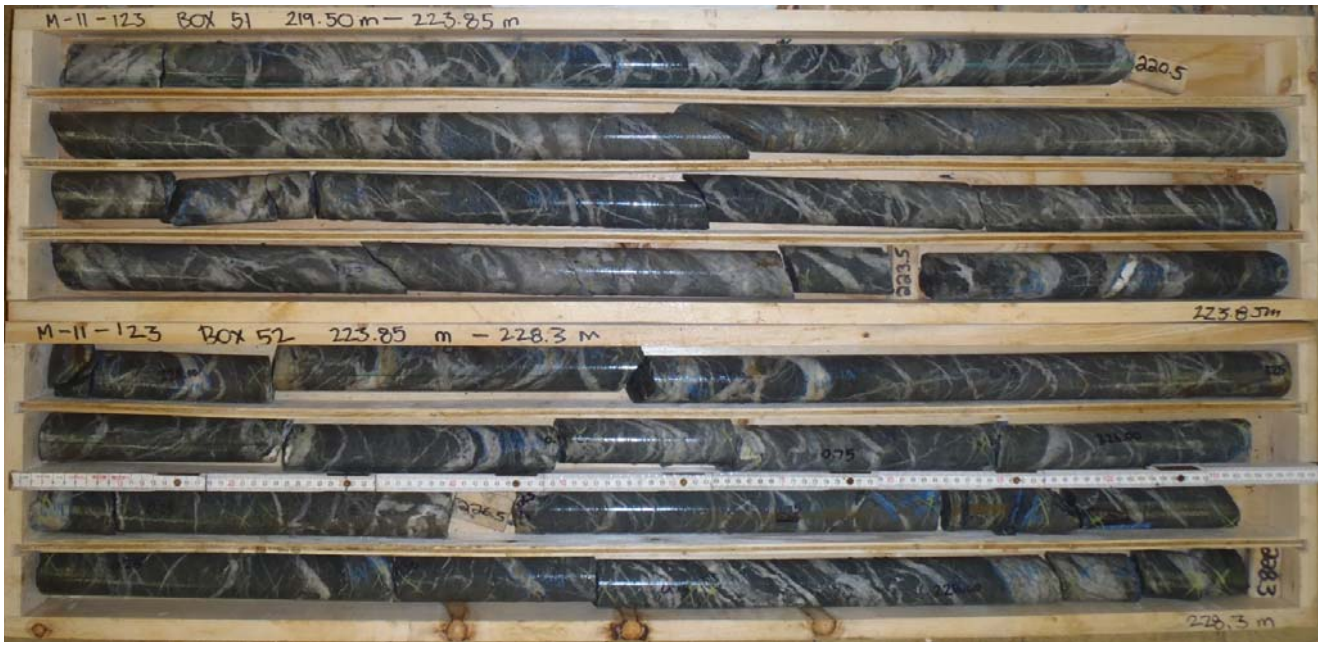


Figure 3.6: Typical "stockwork" rock fabric

3.2 Closed Veins

Logging of 2011 holes included collecting information on the frequency and characteristics of closed veins (no open fractures along the veins) since the presence of veins may affect the fragmentation of the rock mass. For the purpose of this study, closed veins are defined as continuous, closed, infilled features greater than 2 mm in thickness. Approximately 95% of the rock logged in 2011 contains closed veins.

3.3 Micro-Defects

For the 2011 boreholes, micro-defects were logged as potential weakness planes that may be continuous or discontinuous across a piece of core, but along which discrete fracturing has not occurred (i.e., the features are closed). They may be infilled (i.e., closed veinlets) or not infilled (i.e., microfractures). Any continuous veinlets thicker than 2 mm were logged as closed veins. The intensities of micro-defects have been grouped into categories (Table 3.4).

Table 3.4: Micro-defect Intensity

Micro-defect Intensity	Micro-defect Count (per metre)
None	0
Very Low	1 - 3
Low	4 - 10
Moderate	11 - 50
Intense	> 50

4.0 GEOTECHNICAL CHARACTERIZATION

The characterization of the rock mass has focused on the rock in and around the extraction and undercut levels of the proposed block cave mine and the mineralized rock above this that will be caved. A second area of interest involves the rock where the ramps, conveyor drifts, raises (and other mine infrastructure) will be excavated connecting the extraction level to surface.

Characterization of the rock was based on core photographs and data collected for exploration drillholes, detailed geotechnical data collected for drilling programs carried out by BGC in 2009 (BGC 2010) and Golder in 2011 (Golder 2012), outcrop mapping data (Golder 2012), laboratory testing data (Golder 2012), and the interpreted geological model provided by Seabridge.

As indicated earlier, there are a total of 114 exploration holes in the Mitchell deposit and 14 geotechnical holes. The hole locations are shown in Figure 4.1. Geotechnical holes are shown in red. Only those holes that are near, or intersect, the mineralized rock between the open pit floor (El. 390 m) and the proposed block cave extraction level (El. 235 m) are considered here. These holes are referred to in this report as the 'central' boreholes (Table 4.1).

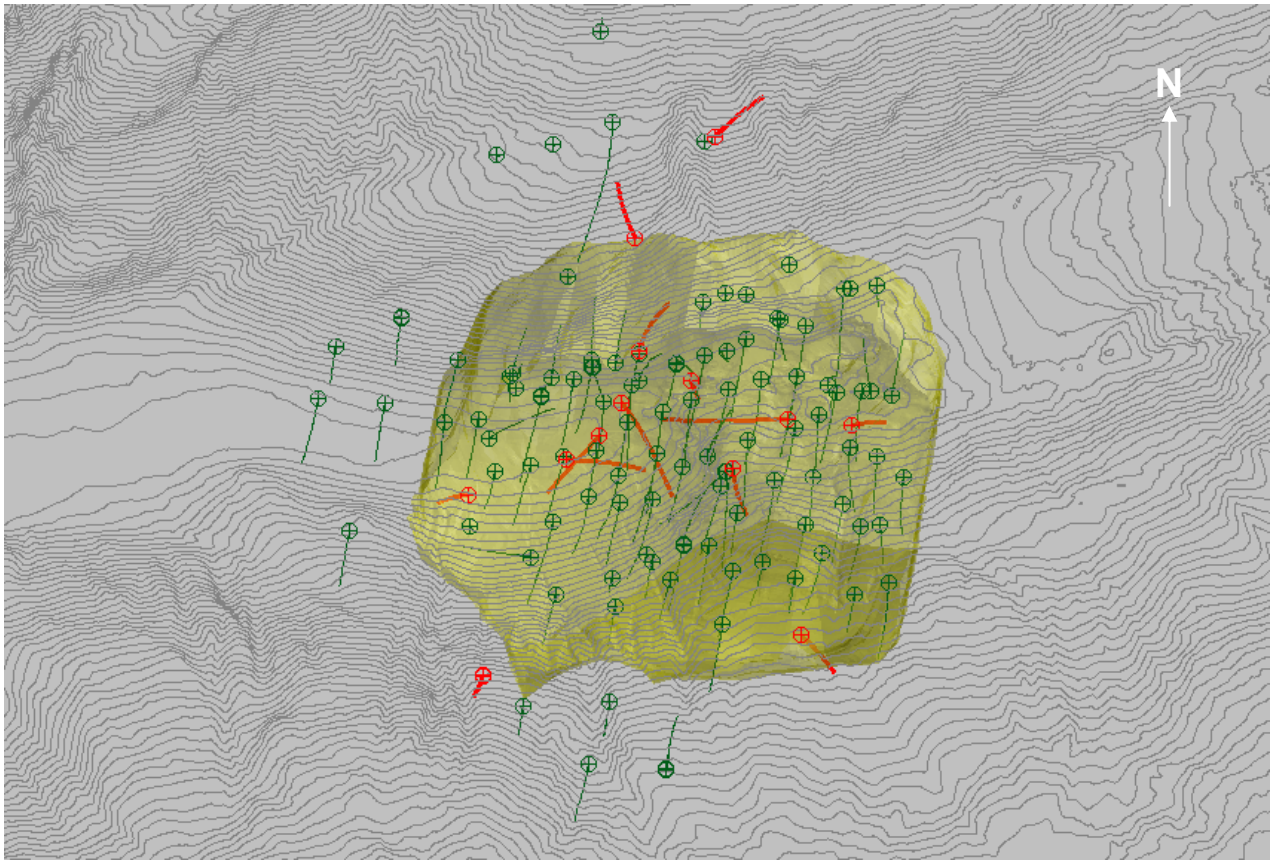


Figure 4.1: Mitchell exploration and geotechnical boreholes and 0.25 g/t Au grade shell

Table 4.1: Mitchell 'Central' Boreholes

Hole ID	Easting[1] (m)	Northing[1] (m)	Elevation[1] (m)	Total Depth (m)
M-09-095	423183.1	6265325.0	969.5	650.4
M-09-096	423567.3	6265465.0	911.7	300.1
M-09-099	422885.1	6265700.0	892.5	681.3
M-11-122	423050.5	6265605.3	824.0	636.0
M-11-123	422756.1	6265429.6	781.4	631.5
M-11-124	422828.4	6265537.4	799.5	687.0
M-11-125	423361.3	6265483.2	885.9	810.0
M-11-126	422650.7	6265354.6	776.9	636.0

Notes:

1) NAD83, UTM Zone 9 Grid North.

For the purpose of this study, host rock refers to the rock mass outside of the immediate area of mineralization. The host rock that the mine infrastructure (e.g., raises, conveyor drifts, ramps, etc.) will be excavated in has been assessed based on data collected from nearby drillholes. This infrastructure, including the access ramp and main conveyor, are shown in Figure 4.2.

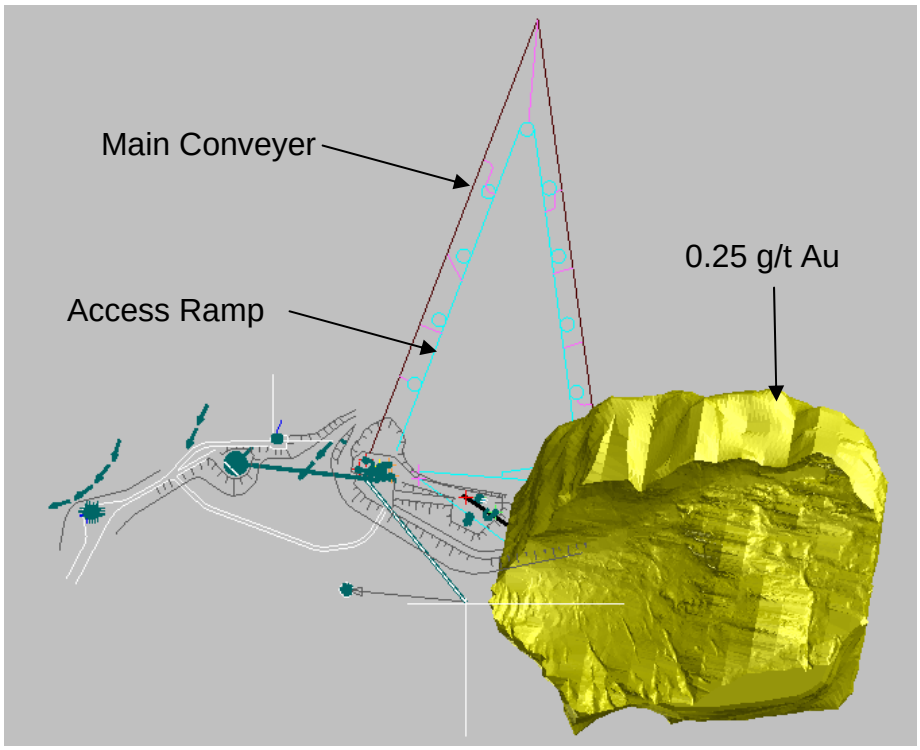


Figure 4.2: Plan showing mine infrastructure and 0.25 g/t Au grade shell

Figure 4.2 is included here for illustration purposes only to indicate where the mine infrastructure is planned relative to the orebody.

Note that further characterization of the site and geotechnical conditions are presented in BGC's prefeasibility report for the open pit (BGC 2010).

4.1 Rock Mass Rating

Geotechnical boreholes were logged for rock quality according to the Rock Mass Rating (RMR_{76}) system (Bieniawski 1976). Detailed criteria for the rating system are presented in Appendix A, along with example core photographs for each of the categories listed in Table 4.2 below.

Table 4.2: Rock Mass Rating System (Bieniawski 1976)

Rating	Description
0 – 20	Very poor rock
20 – 40	Poor rock
40 – 60	Fair rock
60 – 80	Good rock
80 – 100	Very good rock

The exploration boreholes were only logged for RQD data while the geotechnical boreholes had both RQD and RMR logged. Comparison between RQD and RMR data for the geotechnical boreholes (i.e., 'central' boreholes) indicated a good correlation between RQD and RMR. Since the rock is generally strong and fractures are unaltered, RMR is most strongly influenced by the degree of fracturing (i.e., RQD). Using the RQD and RMR data from the Mitchell 'central' boreholes (Figure 4.3) only, an exponential relationship was established for the correlation between RMR and RQD (Figure 4.4). This was then applied to the exploration holes to determine correlated RMR values from RQD.

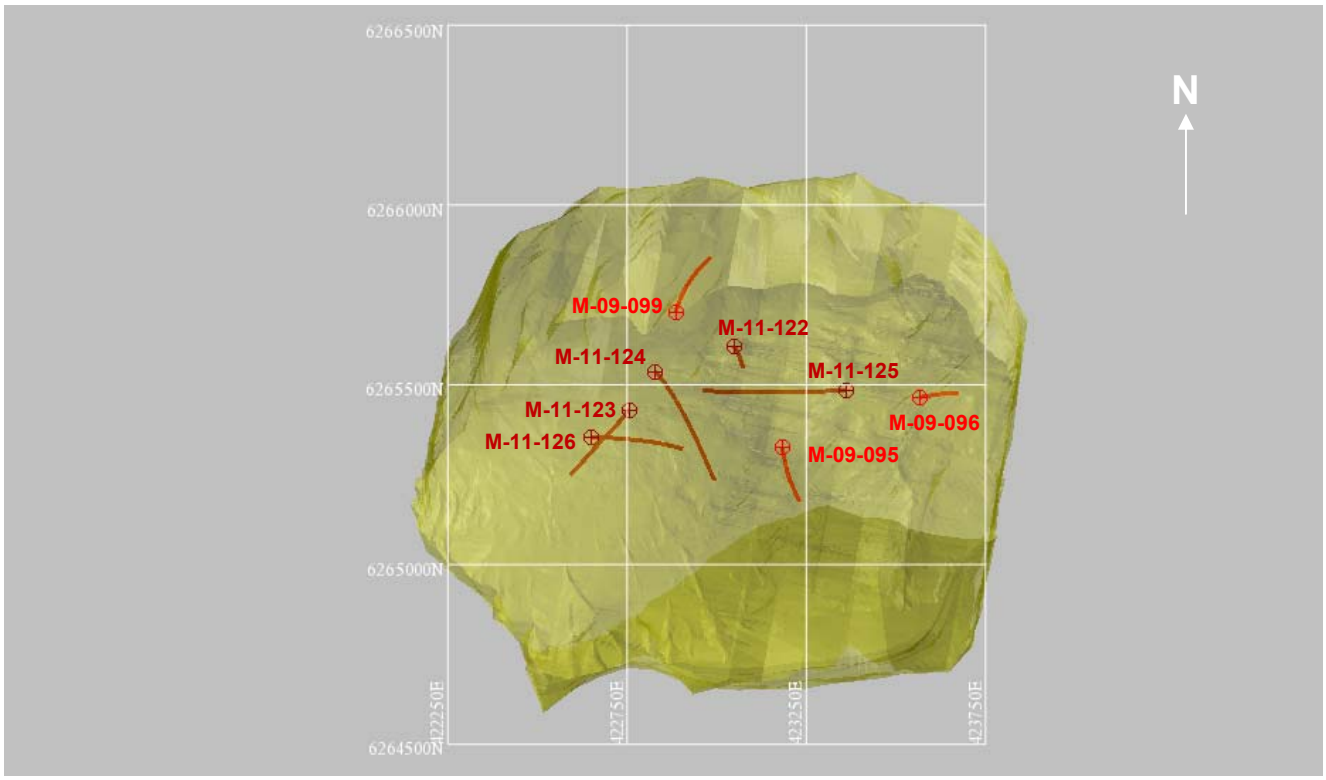


Figure 4.3: Central boreholes and 0.25 g/t Au grade shell

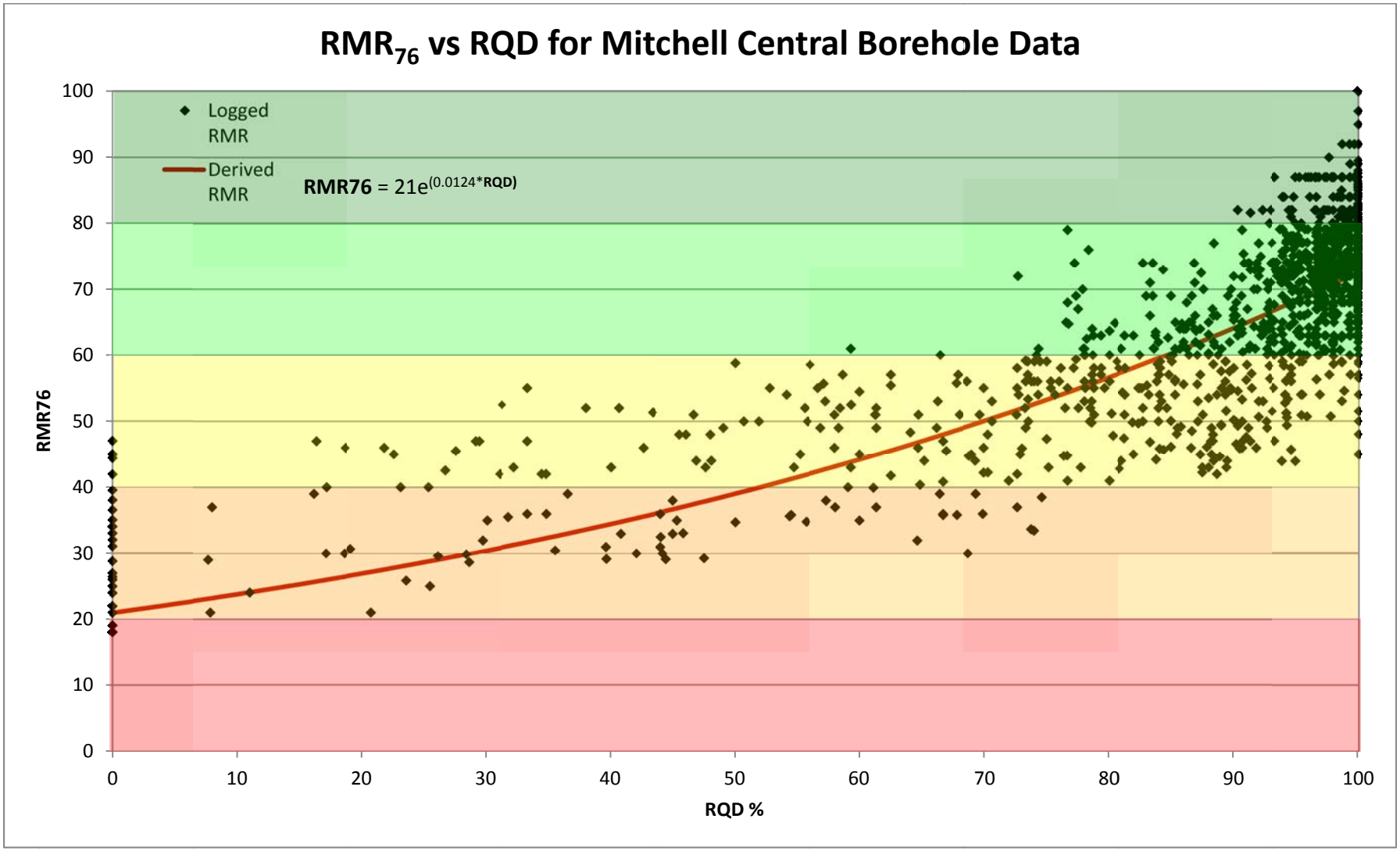


Figure 4.4: RQD-RMR Correlation

Figure 4.5 shows a typical cross-section with both correlated and logged RMR data. A complete set of sections through the deposit is shown in Appendix B.

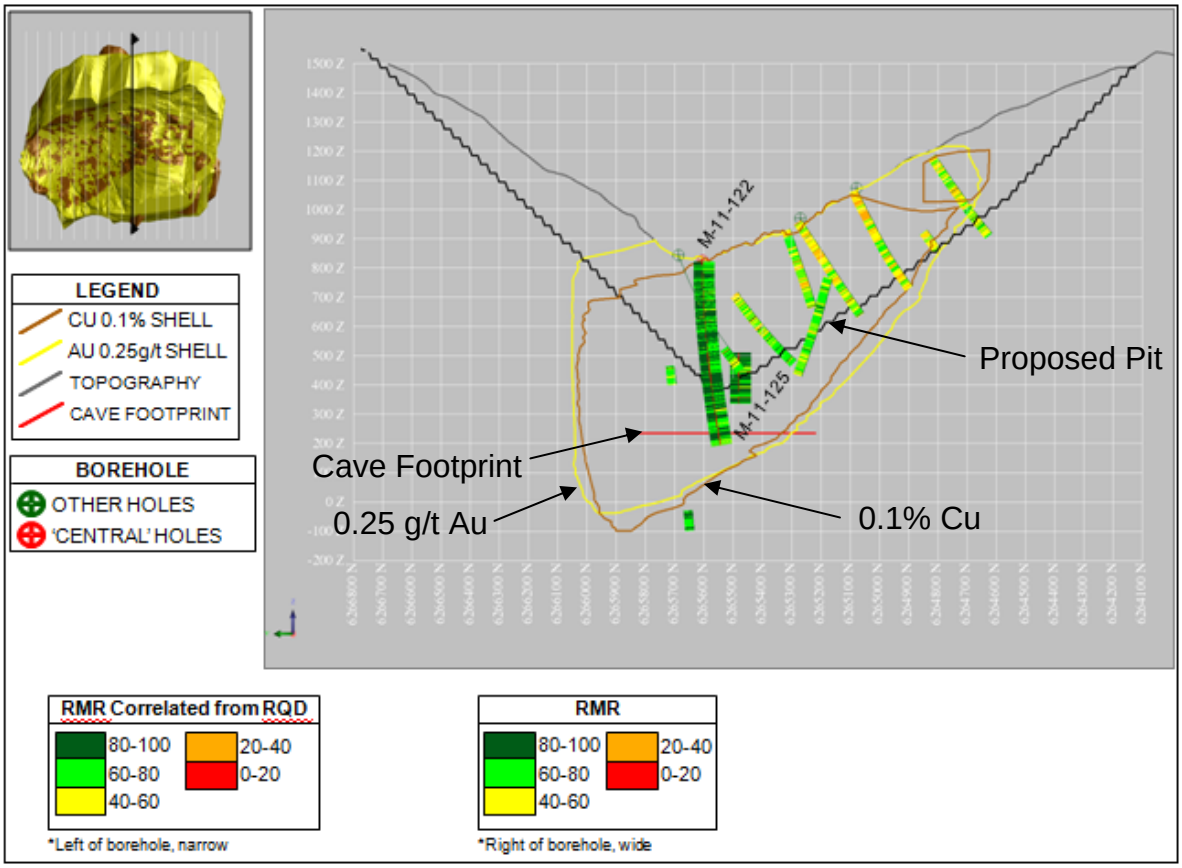


Figure 4.5: Vertical cross-section (423100 Easting) showing correlated RMR and logged RMR

A brief discussion of the typical rock quality for the mineralized rock and the surrounding host rock where some of the mine infrastructure will be located is presented in the following sections.

4.1.1 Mineralized Rock

The average RMR for the mineralized rock between the pit floor (El. 390 m) and the extraction level (El. 235 m) was determined to be approximately 77. The rock conditions are classified as 'good', as indicated in Table 4.2. RMR values are consistent with those described in 'Kerr-Sulphurets-Mitchell (KSM) Prefeasibility Study' (Wardrop 2010).

4.1.2 Host Rock

Details on the anticipated rock conditions where specific infrastructure excavations will be located are discussed in the prefeasibility underground mine design report completed by Golder that is presented under separate cover. The mine infrastructure is primarily located beneath the Mitchell Thrust Fault (MTF). Average RMR values are similar to the mineralized rock for each alteration type, and range from approximately 65 to 75, indicating good quality rock.

Rock quality is anticipated to be slightly poorer for infrastructure located above the MTF (e.g., the upper portion of the ramp). Average RMR values for each alteration type range from approximately 50 to 60 indicating fair quality rock.

4.2 Intact Strength

4.2.1 Laboratory Testing

A total of 30 UCS tests were conducted as part of the 2009 and 2011 field programs (BGC 2010; Golder 2012). The range in UCS is 38 to 205 MPa. The average UCS for all alteration types was found to be 97 MPa with a 25th percentile UCS of 74 MPa. A summary of the test results by alteration type is presented in Table 4.3. A histogram of UCS results for all alteration types is shown in Figure 4.6.

Table 4.3: UCS testing results from the 2009 and 2011 programs

Alteration Type	Number of Samples	Range (MPa)	Average (MPa)
Chloritic-Propylitic (CL-PR)	22	38.3 – 176.3	93.6
Phyllic: Quartz-Sericite-Pyrite (QSP)	4	68.9 – 87.4	75.8
Intermediate Argillic (IARG)	2	86.4 – 167.6	127.0
Other	2	93.5 – 204.8	149.1

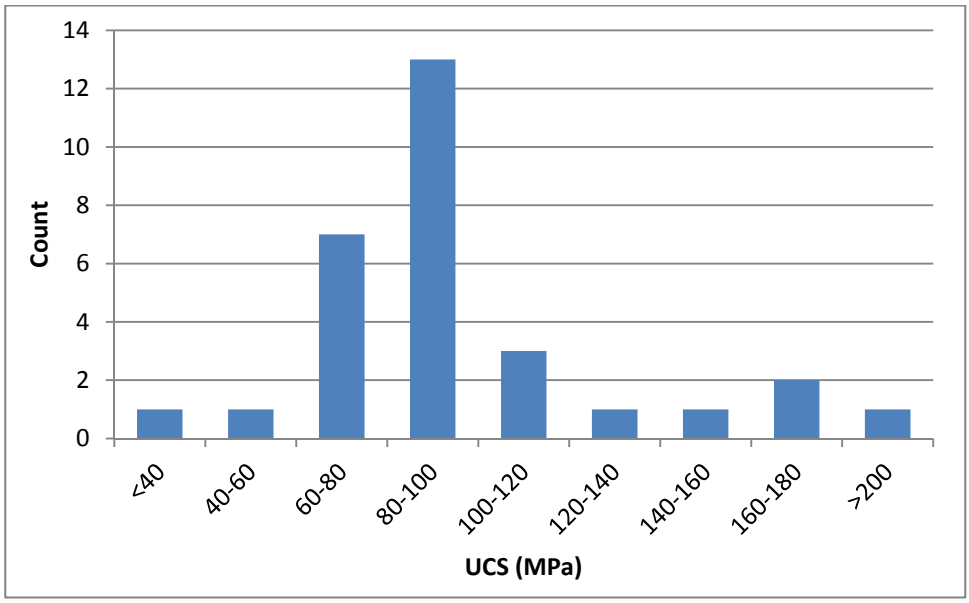


Figure 4.6: Distribution of UCS from laboratory testing

UCS test results are plotted by depth in Figure 4.7. The data do not indicate any clear correlation between strength and depth of sample below ground surface.

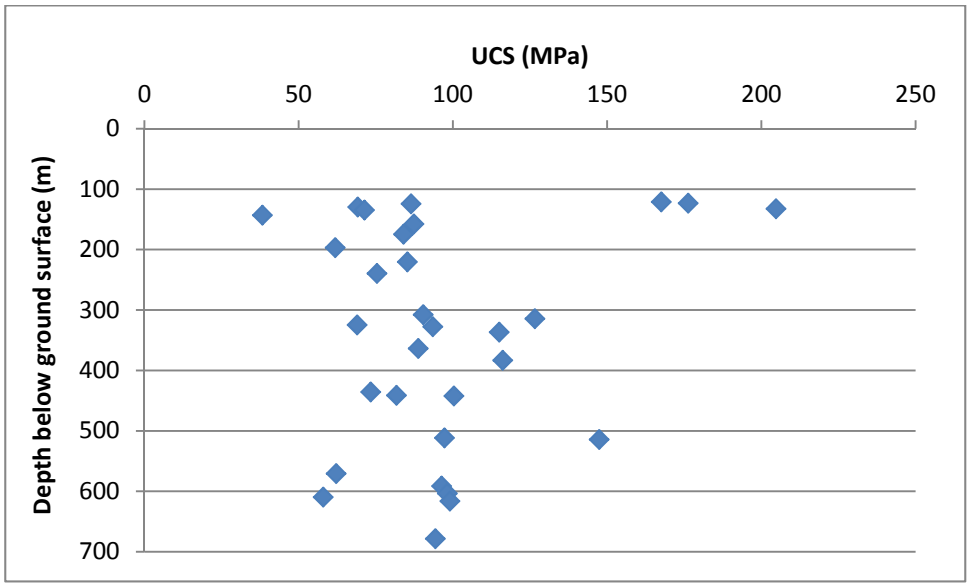


Figure 4.7: UCS test results by depth

A series of triaxial tests were carried out to estimate the failure envelope of the intact rock. All samples appeared generally consistent in appearance (colour, veining, etc.). Four samples were logged as CL-PR alteration (chlorite and propylitic alteration) and two samples were logged as QSP (phyllic alteration).

The tests were carried out at confining stresses between 0.5 and 6 MPa. These stresses were selected based on the results of simple three-dimensional elastic stress modeling to investigate the stresses around the block cave at various stages of cave development. The confining stress in the back of the cave is estimated to approach 6 MPa at approximately 5 m into the back of the uncaved rock.

Table 4.4 summarizes the results of the six triaxial tests that were performed. A plot of minimum vs. maximum principal stress at failure is shown in Figure 4.8. Note the exaggerated horizontal scale required to view all the data points.

Table 4.4: TRX Test Results

Hole ID	Sample Number	Depth From (m)	Depth To (m)	σ_1 (MPa)	σ_3 (MPa)	Alteration Type
M-11-124	2	246.3	246.5	126.0	0.5	QSP
M-11-124	6	671.5	671.8	128.3	2.0	CL-PR
M-11-125	5	408.5	408.7	133.7	3.0	QSP
M-11-125	6	568.3	567.5	199.9	4.5	QSP
M-11-126	1	276.5	276.7	99.0	1.0	QSP
M-11-126	7	633.5	633.8	136.7	6.0	QSP

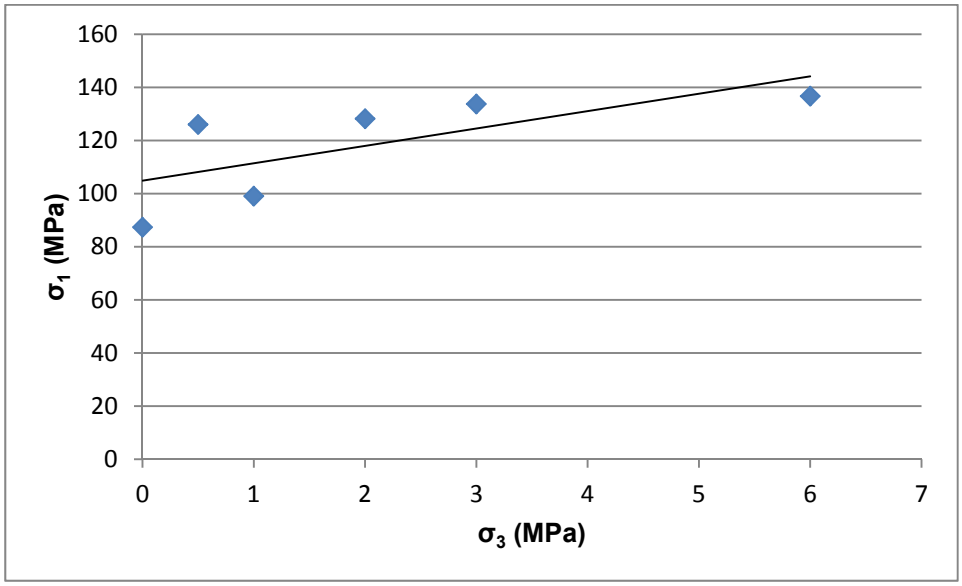


Figure 4.8: Plot of triaxial test minimum and maximum stresses

The estimated friction angle and cohesion for the rock mass are 47 degrees and 20.5 MPa, respectively. Note that one of the tests with an anomalously high peak stress (σ_1=199 MPa, σ_3=4.5 MPa) was excluded when estimating the Mohr-Coulomb strength parameters.

4.2.2 Field Estimated Strength

Field estimated intact strength estimates were logged for the 2009 and 2011 boreholes according to the International Society for Rock Mechanics standard field identification methods (ISRM 1981). A description of each strength category from the field logging is described in Table 4.5.

Table 4.5: Field Identification Methods for Description of Rock Strength (ISRM 1981)

Grade	Description	Field Identification	Approximate Range of UCS (MPa)
R0	Extremely weak rock	Indented by thumbnail.	0.25 – 1.0
R1	Very weak rock	Crumbles under firm blows with point of a geological hammer, can be peeled by a pocket knife.	1.0 – 5.0
R2	Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0 – 25
R3	Medium strong rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25 – 50
R4	Strong rock	Specimen requires more than one blow of geological hammer to fracture it.	50 – 100
R5	Very strong rock	Specimen requires many blows of geological hammer to fracture it.	100 – 250
R6	Extremely strong rock	Specimen can only be chipped with geological hammer.	> 250

Logged ISRM strength estimates were found to be generally consistent with laboratory test results. Cross-sections showing logged ISRM strength indices are contained in Appendix C.

It is interesting to note that the rock does not appear to preferentially break along veins or foliation. Field observations indicate that the veins and foliation are not obvious planes of weakness. When hit with a geological hammer, fractures were observed to just as likely form across veins as along veins.

4.3 Fracture Orientations

Oriented core logging was part of the 2009 and 2011 geotechnical drilling programs. Detailed descriptions and stereographic projections of fracture orientations are available in the 2010 and 2012 field investigation reports (BGC 2010; Golder 2012).

Figure 4.9 shows a stereographic projection of combined structural orientation data from the 'central' boreholes (with the exception of M-11-122, which was non-oriented). Data are referenced to true north. Foliation (Joint Set 1) appears to be prominent, dipping steeply to the north. A second joint set (Joint Set 2) that was not specifically logged as foliation is oriented roughly parallel to foliation. The data suggest a second, less prominent, joint set (Joint Set 3) dipping at intermediate angles to the south-southeast.

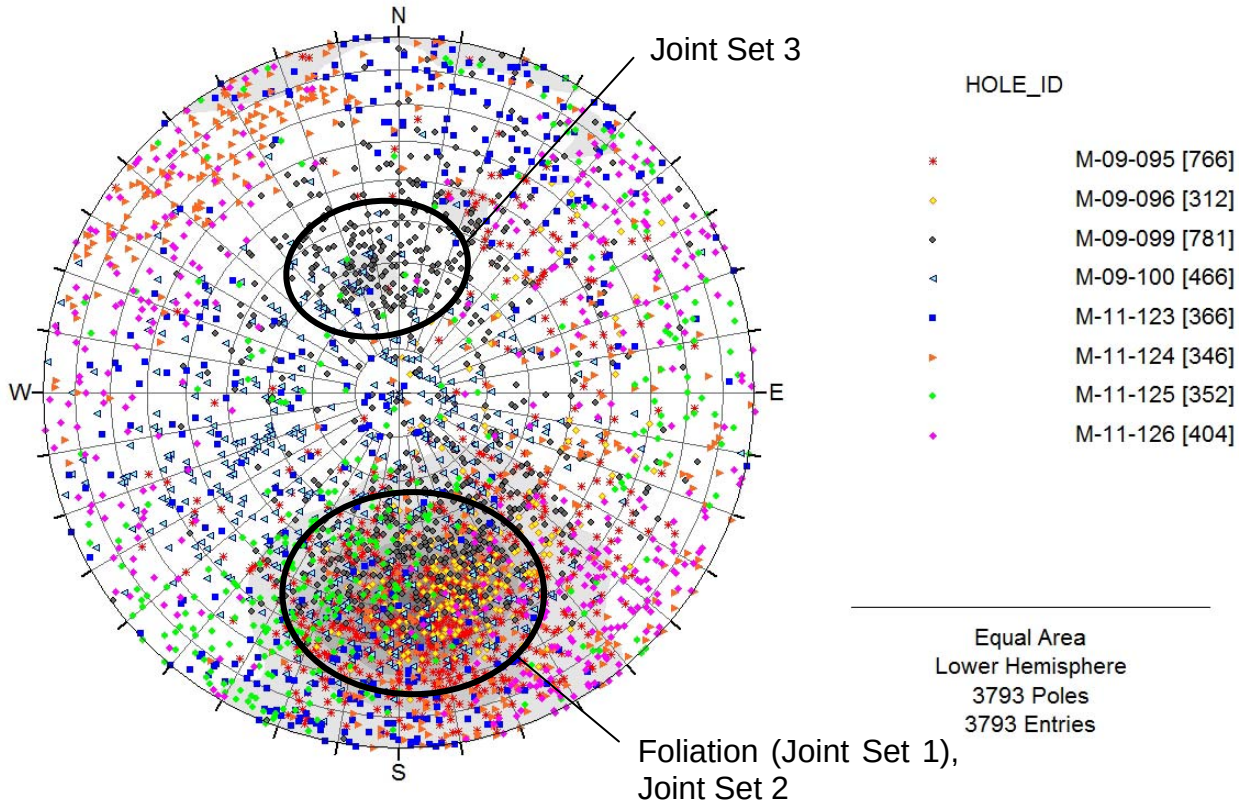


Figure 4.9: Stereographic projection showing open features classified by borehole

4.4 Fracture Intensity

Fracture intensity is characterized by the fracture frequency logged per interval, defined as:

$$\text{Fracture Frequency } (/m) = \frac{\text{Number of Fractures in Interval}}{\text{Length of Interval}}$$

Fracture frequency is generally uniform throughout the Mitchell deposit. It does not appear to vary by location or correlate with other logged parameters. The median fracture frequency in the deposit is approximately 1 fracture per metre. A plot showing cumulative fracture frequency for the central boreholes is shown in Figure 4.10. Note that only the portions of the boreholes below the proposed pit shell are included in this plot.

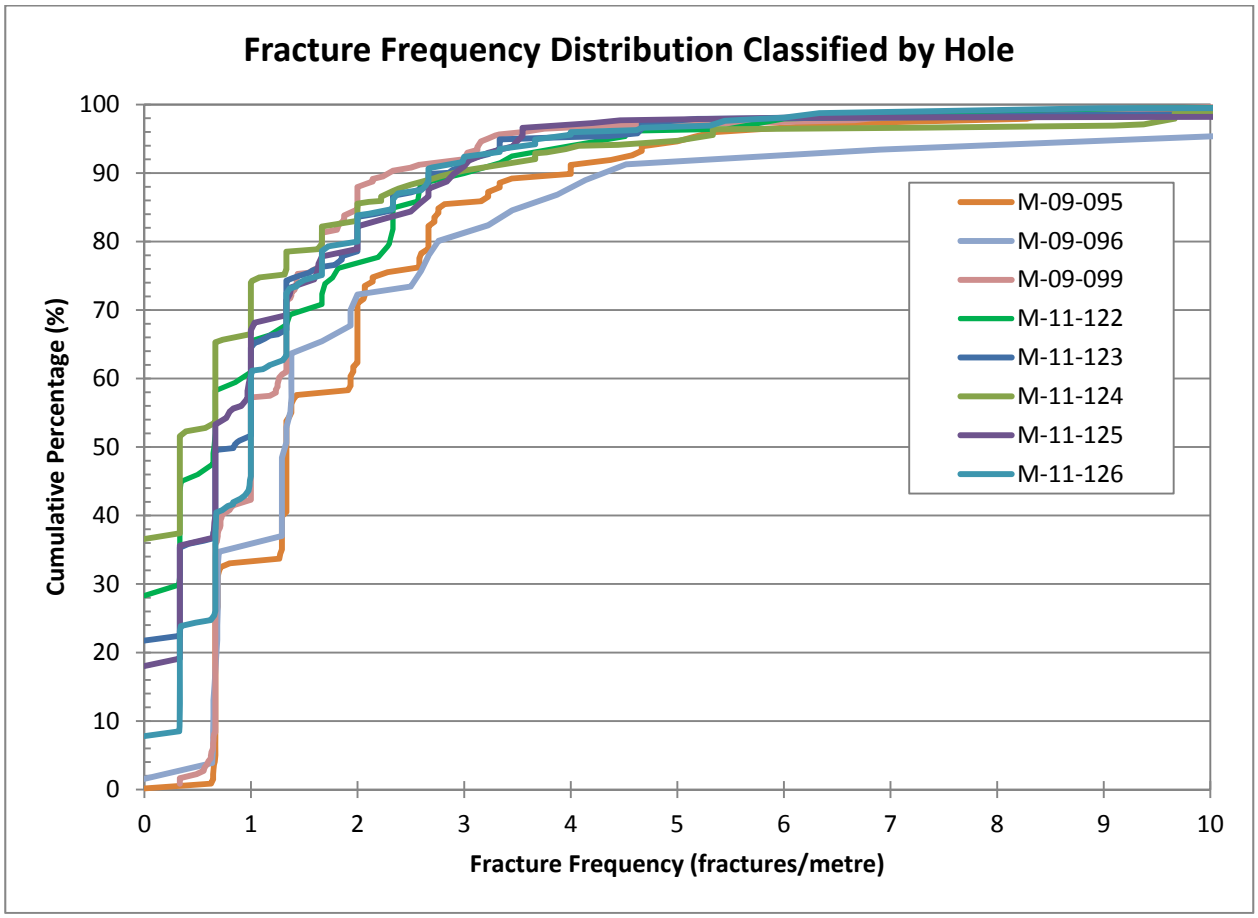


Figure 4.10: Cumulative fracture frequency of central boreholes

4.4.1 Effect of Alteration

The percentages of alteration types logged in each of the 'central' boreholes are shown in Table 4.6.

Table 4.6: Alteration Type by Borehole

Rock Fabric	Percentage by Length [1] (%)
CL-PR	62.3
IARG	8.3
QSP	13.7
Other	15.7

Notes:

1) Data above proposed pit shell are excluded.

Logged alteration types and fracture frequency are shown in the cross-sections contained in Appendix D. A cumulative frequency plot of fracture frequency classified by alteration type is shown in Figure 4.11. Note that only the portions of the boreholes below the proposed pit shell are included in this plot. The data suggest that rock with intermediate argillic (IARG) alteration is slightly more fractured than rock exhibiting other types of alteration. This IARG rock represents only a small percentage of the mineralized rock that will be caved mined, generally at the periphery of the deposit, and the increased fracture frequency of this rock is of little consequence.

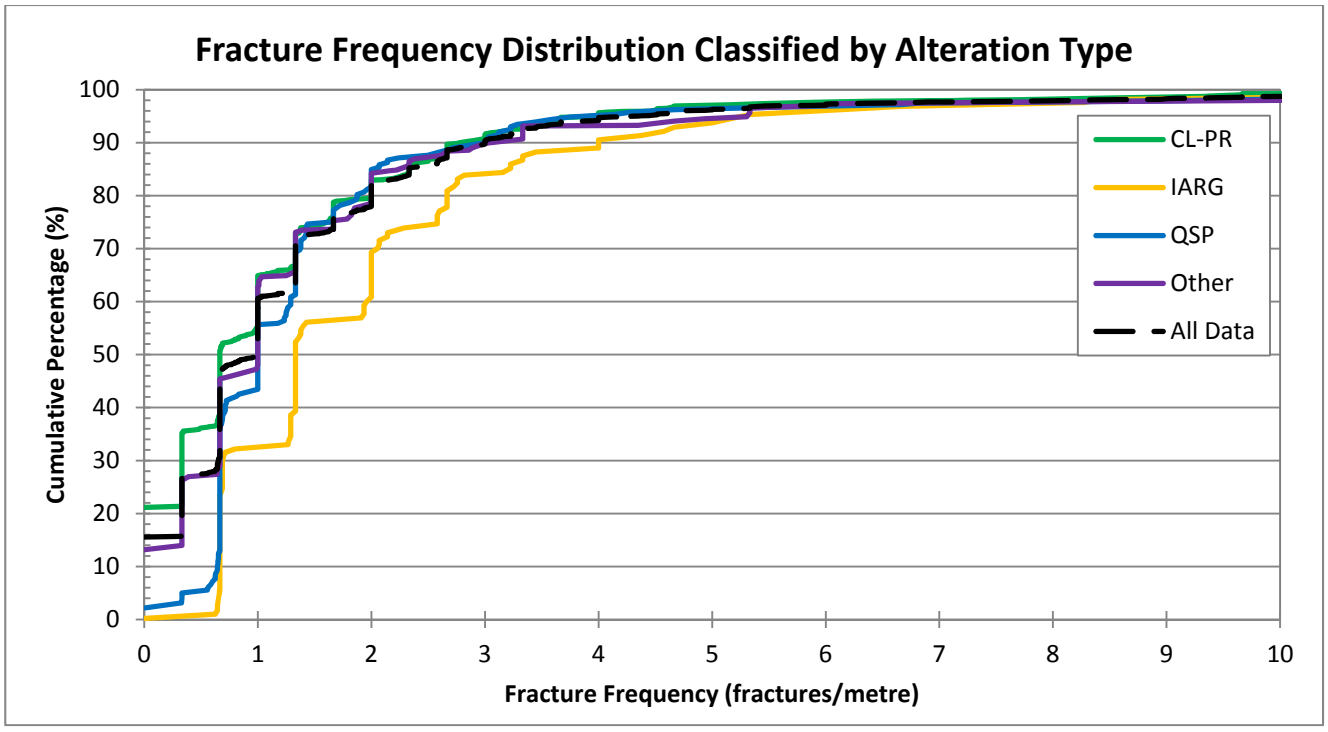


Figure 4.11: Cumulative percentage of fracture frequency by alteration types

4.4.2 Effect of Rock Fabric

Table 4.7 shows the distribution of rock fabric logged in the 2011 boreholes. Cross-sections showing rock fabric and fracture frequency are shown in Appendix E.

Table 4.7: Rock Fabric Distribution

Rock Fabric	Percentage by Length [1] (%)
Massive	19.4
Foliated	18.6
Stockwork	60.6
Other	1.4

Notes:

1) Data above proposed pit shell are excluded.

A cumulative frequency plot of fracture frequency classified by rock fabric is shown in Figure 4.12. Note that only the portions of the boreholes below the proposed pit shell are included in this plot. The data suggest that rock with stockwork veining has a slightly lower fracture frequency than the massive or foliated rock.

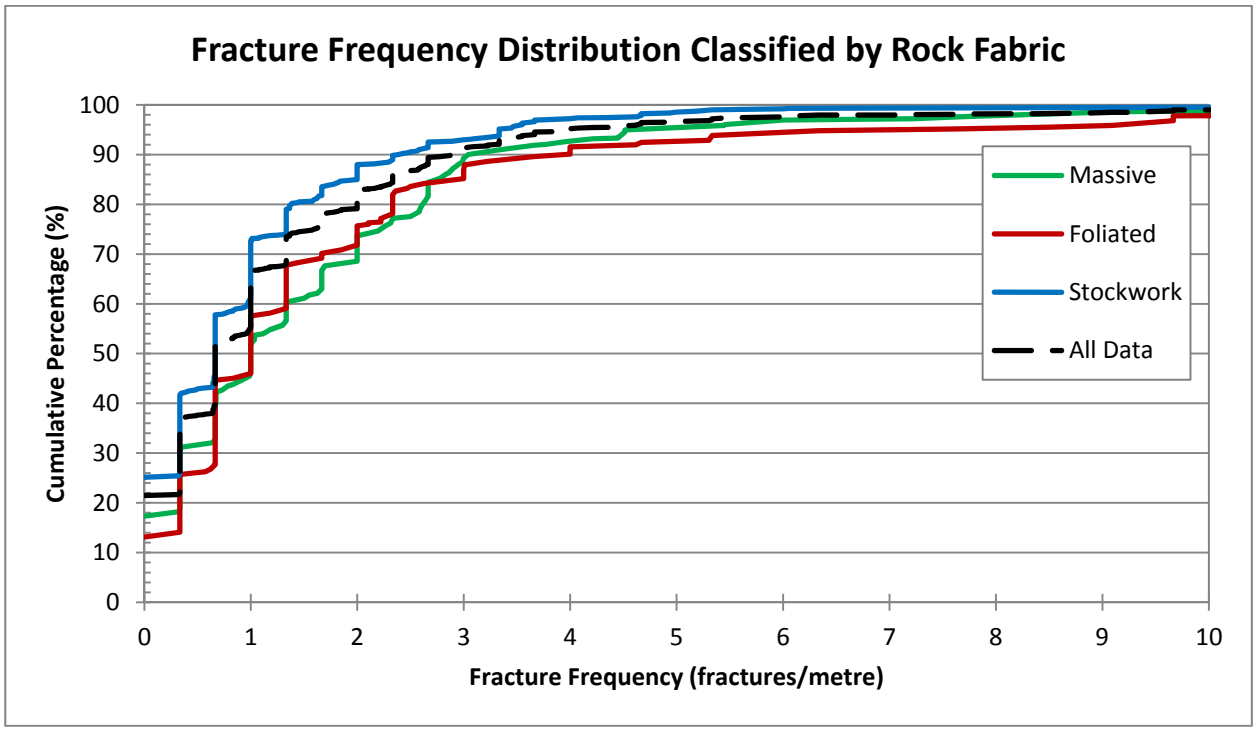


Figure 4.12: Cumulative percentage of fracture frequency by rock fabric

4.4.3 Effect of Closed Veins

Figure 4.13 shows that the closed veins do not appear to have a preferential orientation. There is a slight concentration of closed veins sub-parallel to foliation.

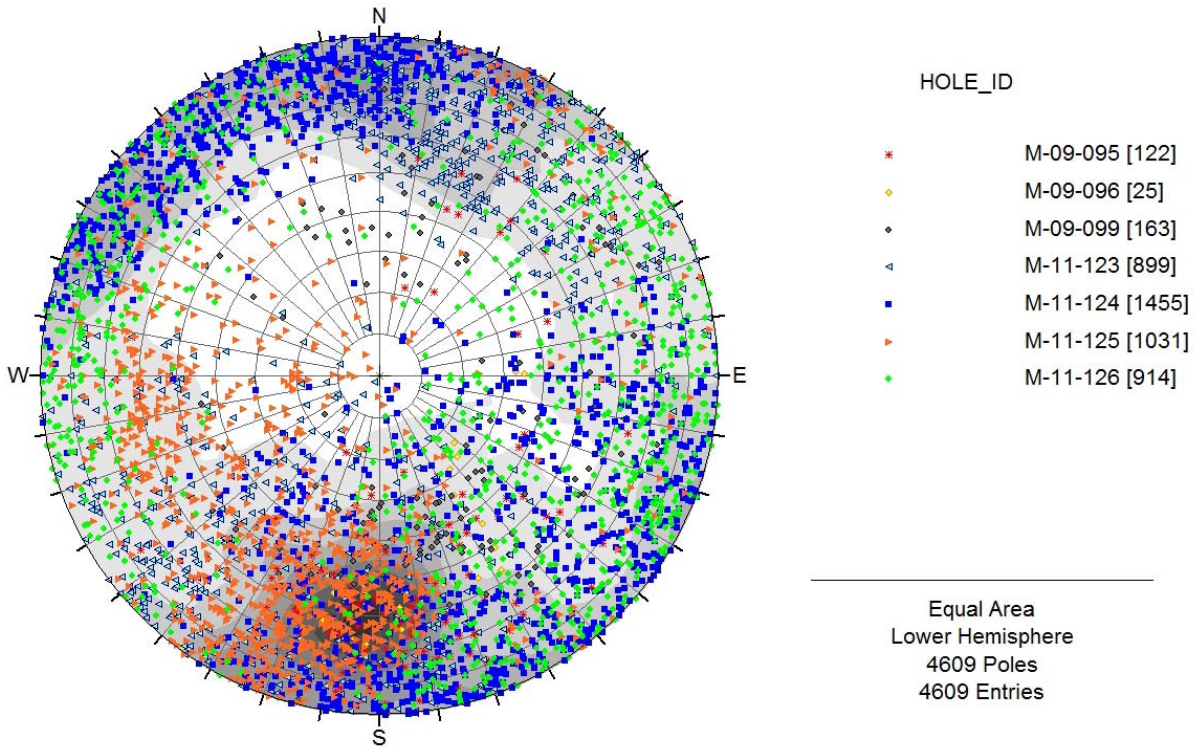


Figure 4.13: Stereographic projection showing closed veins classified by borehole

Most of the closed veins occur at frequencies of about four or less veins per metre, as shown in Figure 4.14. This is based only on data from the 2011 holes below the proposed pit shell.

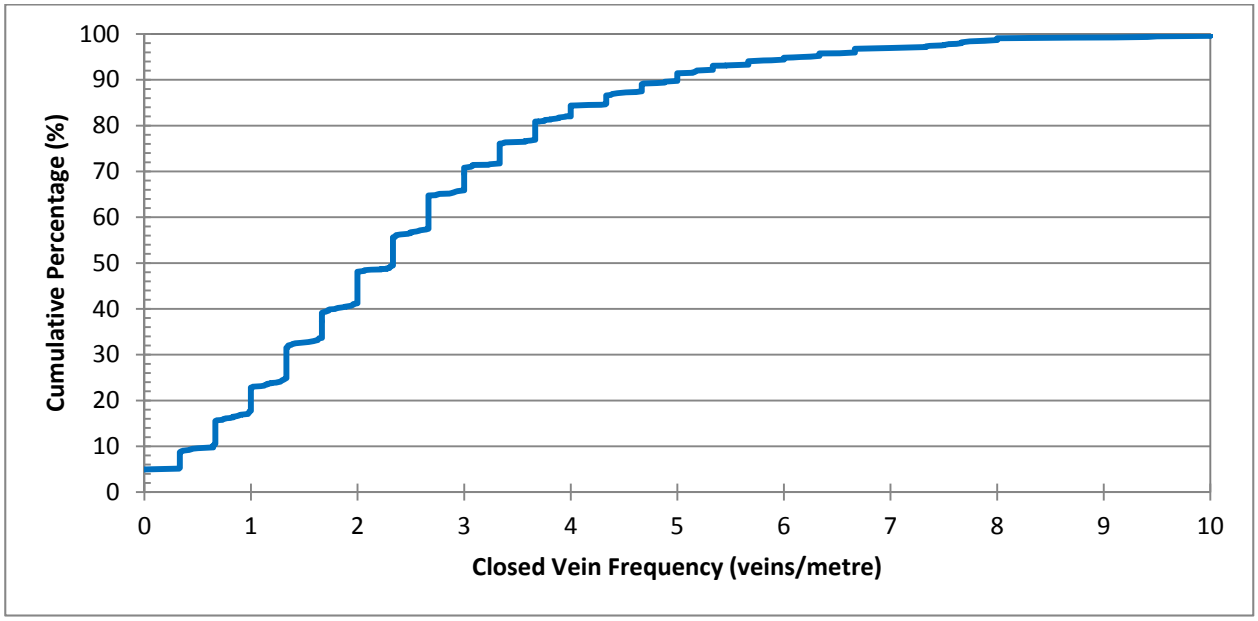


Figure 4.14: Distribution of closed vein frequency

Appendix F shows downhole plots of fracture frequency and closed vein count. No clear correlation can be identified between the two parameters.

As noted in Section 4.2, the rock does not appear to preferentially break along veins or foliation. Field observations indicate that the veins and foliation are not obviously planes of weakness. When hit with a geological hammer, fractures are just as likely to form across veins as along veins.

4.4.4 Effect of Micro-defect Intensity

Almost half of the core logged in 2011 exhibited moderate micro-defect intensity (Table 4.8).

Table 4.8: Micro-defect Intensity Distribution

Micro-defect Intensity	Micro-defect Count (per metre)	Percentage by Length [1] (%)
None	0	0.04
Very Low	1 - 3	2.5
Low	4 - 10	23.8
Moderate	11 - 50	48.9
Intense	> 50	24.8

Notes:

1) Data above proposed pit shell are excluded.

A cumulative frequency plot of fracture frequency classified by micro-defect intensity is shown in Figure 4.15. Note that only the portions of the boreholes below the proposed pit shell are included in this plot. The data indicate only very subtle differences in fracture frequency between rock with very few (low) micro-defects and rock with abundant (intense) micro-defects.

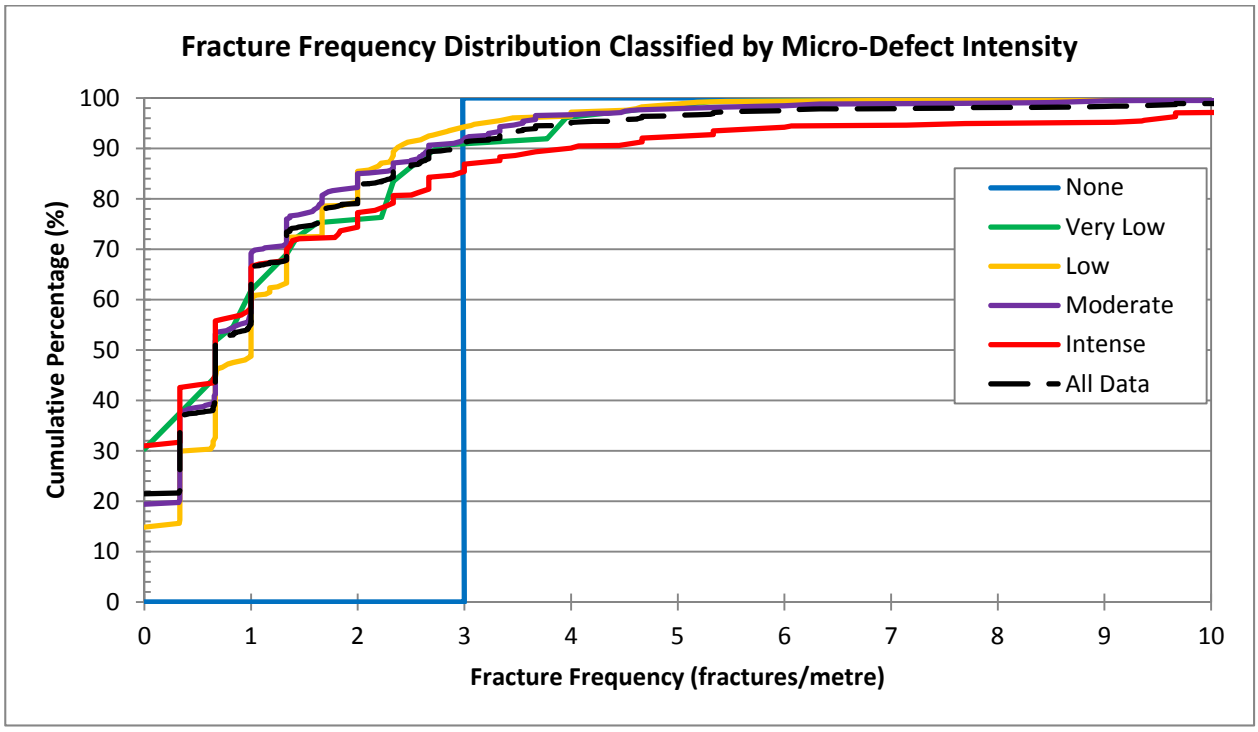


Figure 4.15: Cumulative distribution of fracture frequency by micro-defect intensity

4.5 Fracture Persistence

In June 2011, Golder conducted geotechnical mapping along four traverses on rock outcrops at Mitchell. Traverse locations, mapping photographs and geotechnical mapping data sheets are included in the field investigation report (Golder 2012).

Two of the traverses had dominant phyllic (QSP) alteration and two had dominant phyllic alteration with stockwork quartz veining (QSPSTW). Mapped features were characterized by the number of termination ends visible in the outcrop (i.e., 0, 1 or 2). Most features had a persistence of 3 m or less, as shown in Figure 4.16. However, the data are limited and strongly influenced by the size of the outcrops that were mapped (approximately 12 m by 2 m). It is recognized that there may be more continuous structures in the rock mass than indicated by the data, particularly intermediate or steeply dipping structures that would have been truncated by the mapping window. An allowance was made for this in developing the fracture model of the rock mass discussed in Section 5.6.1. The distribution of features for which either no terminations were visible (termination = 0), one end of the structure was visible (termination = 1), or both ends of the structure were visible in the mapping window (termination = 2) is contained in Table 4.9.

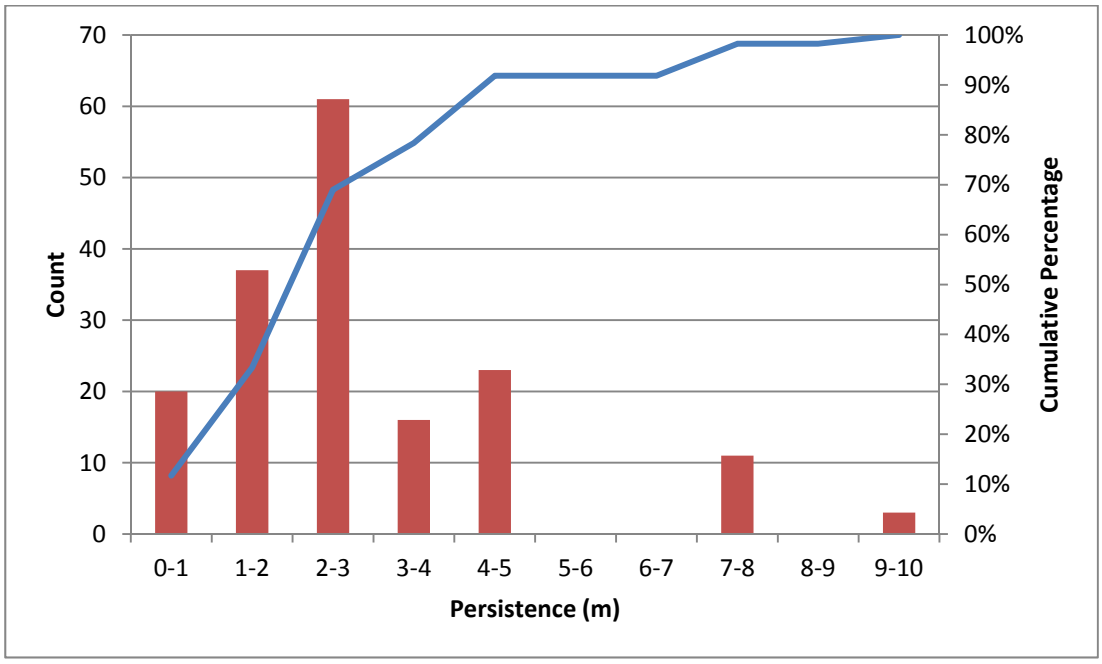


Figure 4.16: Persistence distribution of all mapped features

Table 4.9: Distribution of Termination of Mapped Features

Termination	Number of Mapped Features
0	12
1	30
2	26

5.0 IN SITU STRESS

Hydraulic fracturing testing was performed in borehole M-11-122. Detailed methodology, analyses and test results are provided in the 2011 field investigation report (Golder 2012).

A summary of estimated in situ stresses is presented in Table 5.1.

Table 5.1: Summary of In Situ Stress Values from Hydraulic Fracturing in Borehole M-11-122

Field Test No.	Depth (m)	Alteration[1]	σ_{HMax} (MPa)	σ_{HMin} (MPa)	σ_v[2] (MPa)	Tensile Strength[3] (MPa)	Pore Pressure[4] (MPa)
7	158.0	QSP	19.5	8.6	4.4	11.2	1.6
6	384.5	CL-PR	47.2	20.5	10.7	11.6	3.8
5	442.0	CL-PR	34.8	16.0	12.3	13.3	4.5
4	511.0	CL-PR	37.7	16.5	14.2	13.1	5.2
3	570.9	CL-PR	39.3	19.5	15.9	12.1	5.8
2	604.4	CL-PR	30.3	15.0	16.8	12.4	6.1
1	608.9	CL-PR	37.9	20.3	16.9	10.9	6.1

Notes:

1) Alteration types were provided by Seabridge.

2) Vertical stress was calculated based on the average overburden thickness over the test interval using an estimated density of 2781 kg/m^3.

3) Determined from laboratory testing.

4) Pore pressure was calculated based on the column of water at each test interval depth.

Hydraulic fractures were identified in three intervals using impression packers. The orientations of these hydraulic fractures are summarized in Table 5.2.

Table 5.2: Summary of Fracture Orientation in Borehole M-11-122

Field Test No.	Fracture Depth (m)	Alteration[1]	Fracture Configuration	
			Strike Orientation[2] (°)	Dip (°)
7	157.6	QSP	26	75
7	158.2	QSP	20	80
7	158.4	QSP	33	47
5	442.1	CL-PR	29	81
5	442.3	CL-PR	20	76
4	510.7	CL-PR	36	69
4	510.8	CL-PR	48	63

Notes:

1) Alteration types were provided by Seabridge.

2) Fracture orientations are referenced to true north.

Hydraulic fracture orientations suggest that principal stresses are oriented near vertical/horizontal and calculations were carried out based on this assumption for all intervals in the borehole. Although it is considered unlikely, in some cases stress orientations may vary in discrete areas as a result of geological influences such as faults. If that is the case here, some of the estimates of stress magnitudes presented above may be unreliable.

The magnitude and orientation of the principal stresses are governed by the geologic processes that formed the valley and led to the mineralization located below the valley floor. In very simple terms, the most likely orientation of the maximum horizontal stress will be across the valley (roughly north-south) and the minor horizontal stress will be oriented along the valley (east-west). The results of the hydraulic fracturing are broadly consistent with this assumption.

6.0 ESTIMATES OF IN SITU BLOCK SIZE

6.1 Discrete Fracture Network Modelling

A Discrete Fracture Network (DFN) model was developed from the structural information collected on site using the proprietary Golder DFN code FracMan. Detailed methodology and results are shown in Appendix G. The model provides a depiction of the structural features within the rock mass developed from a combination of larger deterministic structures mapped in outcrops with smaller stochastically inferred fractures. The model depicts both the geometry and connectivity of the fracture network, and provides a representation of the geometry of the associated intact rock blocks. Monte Carlo simulations were used in a stochastic process to create multiple but equi-probable realisations of the structural features.

Input parameters used to develop the DFN model included the following:

- Fracture orientations;
- Fracture intensities; and
- Fracture persistence distributions.

Fracture termination information (i.e., one fracture set preferentially terminating against another fracture set) is another important parameter which influences block forming potential. No conclusive data were collected on this at site and therefore it was not considered as part of the current analyses.

An underlying spatial model was used that incorporates different distribution laws to simulate fracture orientation and location. The Enhanced Baecher spatial model was used in the current analyses, according to which fracture centres are randomly located in space using a Poisson process.

6.2 DFN Model Input

6.2.1 Fracture Orientation

Fracture data used in the DFN model for the Mitchell deposit was based upon core logging data from the 'central' boreholes (with the exception of M-11-122, which was non-oriented). A comparison of fracture orientations from core logging data and fracture orientations in the DFN model are shown in Figure 6.1. The stereographic projection produced from core logging data excludes faults and broken core, and features above the proposed pit shell.

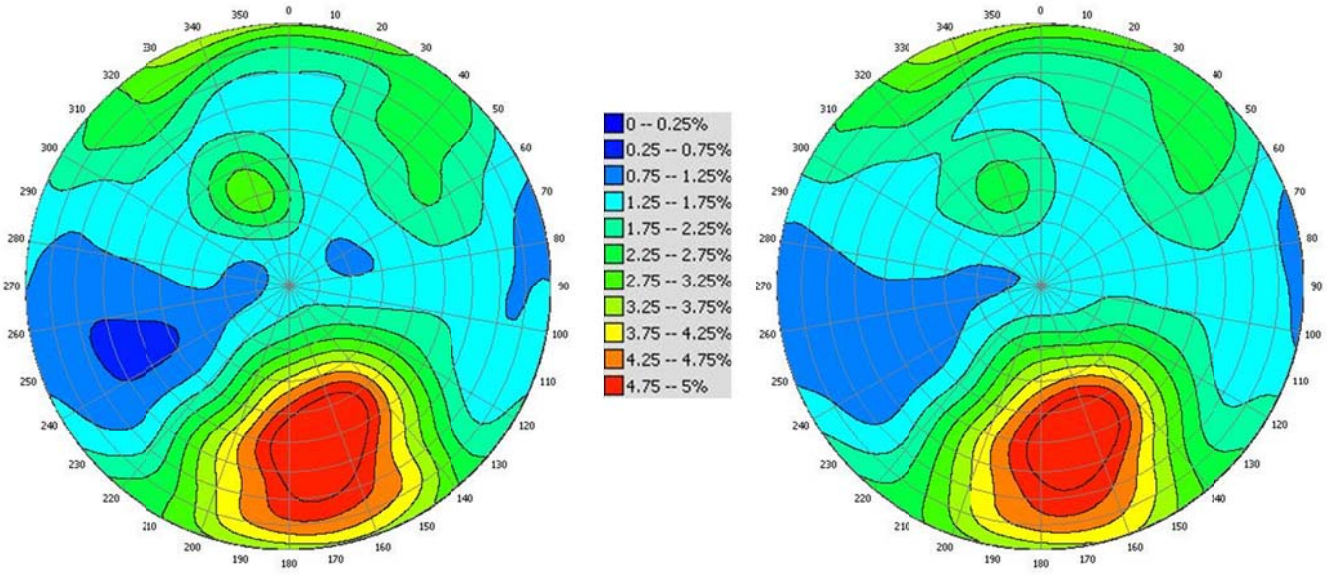


Figure 6.1: Stereographic projections of mapped (left) and simulated (right) fracture orientations

6.2.2 Fracture Intensity

The fracture intensity input to the model was obtained from the fracture frequency information in the geotechnical logs (expressed as number of fractures per metre). The methodology adopted to estimate the fracture intensity was as follows:

- Cumulative Fracture Intensity (CFI) plots were initially generated to establish variation of linear fracture frequency with depth (Appendix H).
- A correction was applied to the fracture frequency data as part of the conversion from linear intensity to volumetric intensity to account for the fracture frequency being defined relative to a borehole or scanline trajectory, which may introduce sampling biases.

6.2.3 Fracture Persistence

Outcrop mapping was carried out on exposures of varying dimensions. The mapping data was strongly influenced by the size of the mapped area, making it difficult to use an analytical approach to account for the truncation bias associated with the size of the outcrop. Accordingly, a distribution of fracture radii was initially assumed in the model. Trace maps were subsequently simulated and compared qualitatively with photographs of the mapped outcrops to ensure a reasonable agreement between simulated and mapped data. The analyses indicated that an exponential distribution for fracture radii (mean of 2 m) provided a good agreement between the simulated and the mapped fracture persistence data.

The data obtained from surface mapping included the actual persistence of fractures that extended outside the mapped area. Simulated trace maps were generated from the DFN model for different cell sizes (Cell_1, Cell_2 and Cell_3) and these were compared to the mapped data, as shown in Figure 6.2. Cell_1 was 7 x 2 m, Cell_2 was 7 x 4 m and Cell_3 was 12 x 12 m. The results show that there is a reasonably good agreement between the mapped and simulated fracture persistence over a range of simulated outcrop surfaces in the model.

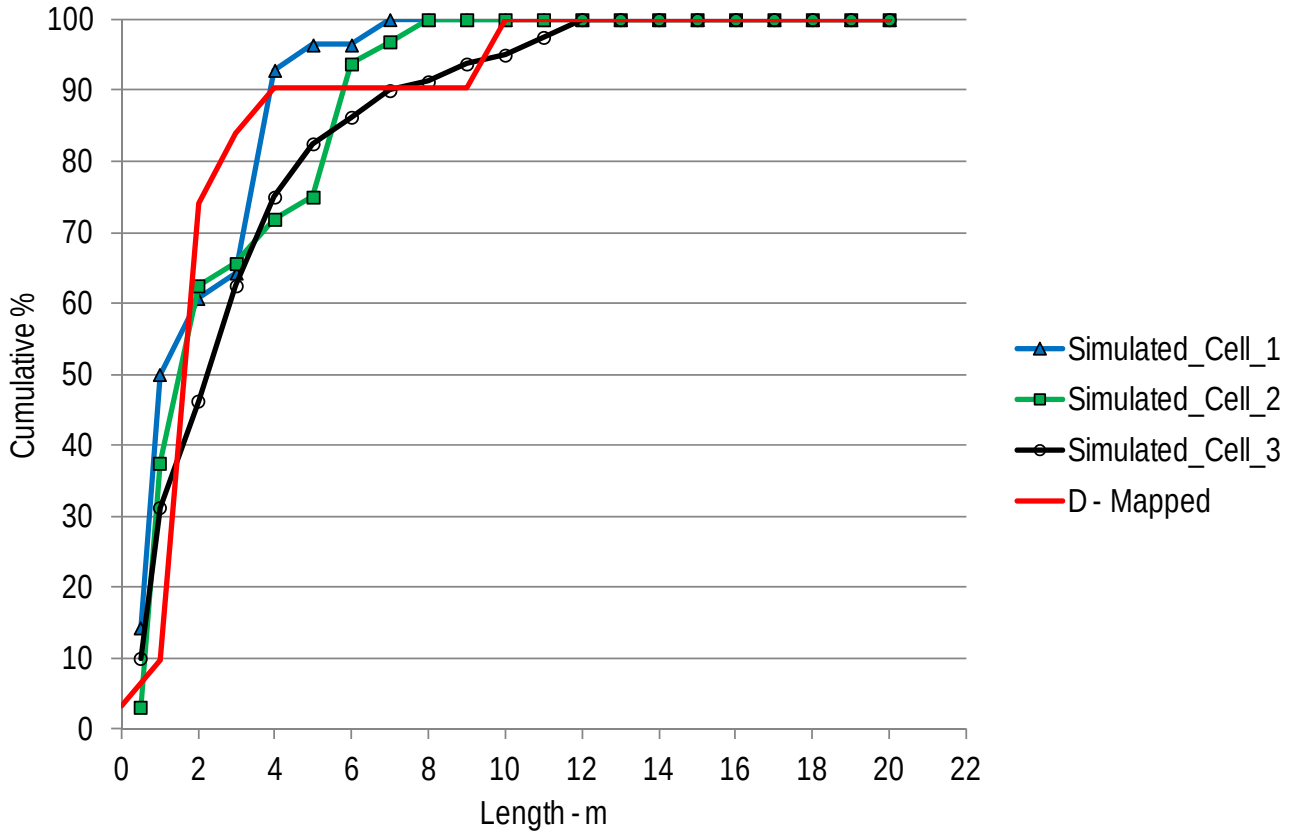


Figure 6.2: Comparison between mapped trace length over the mapped Cell D for the Mitchell deposit and simulated trace length data in the DFN model. Cell_1 is 7 x 2 m, Cell_2 is 7 x 4 m and Cell_3 is 12 x 12 m

6.3 DFN Model Results

The DFN model was used to estimate the distribution of in-situ block sizes in the rock mass using an algorithm that defines all fracture intersections. This is then used to identify fully formed blocks. The in-situ block size analyses were carried out for a volume with dimensions 5 x 5 x 5 m.

The estimated distribution of volumetric block sizes is shown in Figure 6.3. This curve represents the 'weighted' average taking into account the varying fracture intensity indicated for the various Mitchell boreholes. The block volume size equivalent to 50% passing was estimated at 6.0 m^3.

Note that the in-situ block sizes determined from the DFN analyses refer to the three-dimensional blocks that are fully formed by existing fractures in the simulated rock mass (i.e., the assessment does not consider blocks that may almost completely form, say 99% formed by non-persistent fractures, and it does not consider the impact of any stress induced fractures that may form during the caving process).

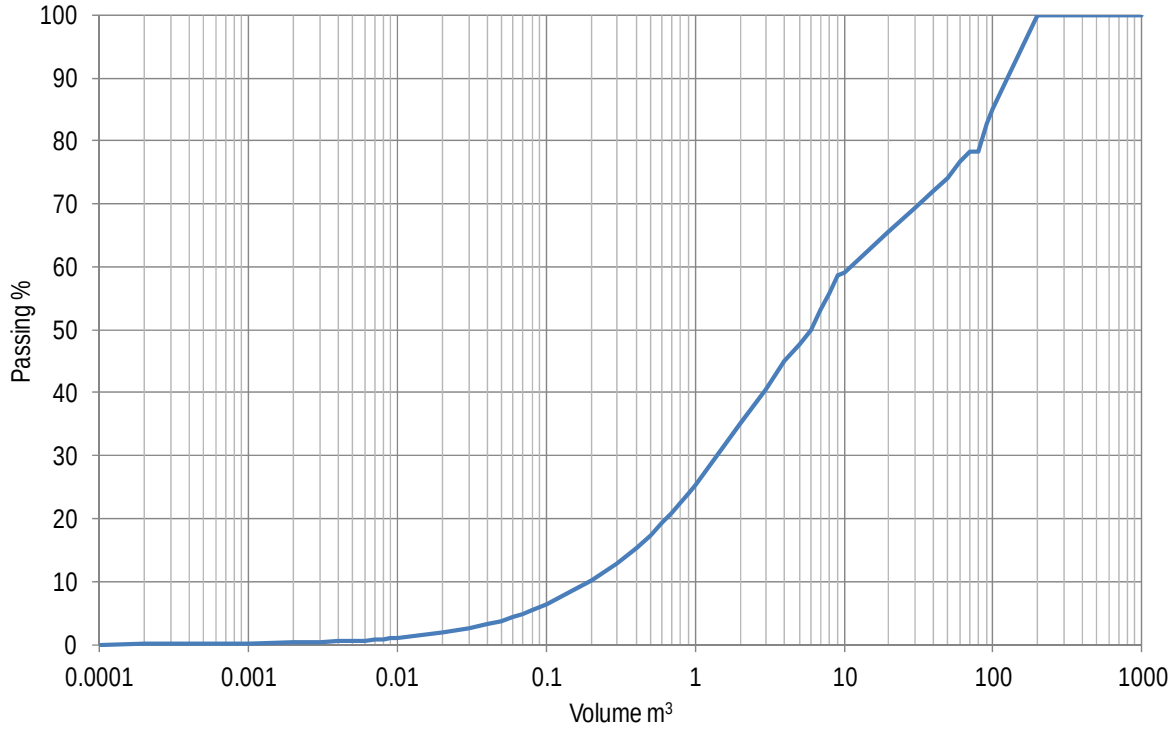


Figure 6.3: Block size percent passing averaged curve estimated for the Mitchell deposit

7.0 HYDROGEOLOGICAL CHARACTERIZATION

Hydrogeological testing was carried out as part of the 2009 field program (BGC 2010) and the 2011 field program (Golder 2012).

In 2009, BGC conducted a total of nine hydrogeological tests below the MTF in the 'central' boreholes (M-09-095, M-09-096 and M-09-099). Hydraulic conductivity values calculated from these tests were presented in BGC's report (BGC 2010), and are summarized in Table 7.1.

Table 7.1: Summary of 2009 Single Well Test Results

Borehole	Midpoint Vertical Depth (m from collar)	Midpoint Elevation (masl)[1]	Hydraulic Conductivity (m/s)
M-09-095	240.4	729.6	3×10^{-09}
M-09-095	397.4	572.6	2×10^{-09}
M-09-096	90.4	820.6	1×10^{-07}
M-09-096	165.1	745.9	Very low [2]
M-09-096	215.8	695.2	2×10^{-09}
M-09-096	260.4	650.6	1×10^{-09}
M-09-099	71.4	820.6	1×10^{-07}
M-09-099	140.6	751.4	3×10^{-09}
M-09-099	296.3	595.7	2×10^{-09}

Notes:

1) Metres above sea level.

2) During test, water could not be injected at 130 psi.

Hydraulic conductivity values for tests conducted below the MTF in the 2009 'central' boreholes ranged from 1×10^{-09} to 1×10^{-07} m/s. The highest hydraulic conductivities (1×10^{-07} m/s) were calculated from tests conducted at the highest elevations (greater than 800 metres above sea level).

In 2011, Golder conducted a total of 21 hydrogeological tests in five geotechnical boreholes (M-11-122, M-11-123, M-11-124, M-11-125 and M-11-126). The results of the hydrogeological investigation were discussed in the field investigation report (Golder 2012). Hydraulic conductivity values were calculated for 18 of the tests and static hydraulic head values were calculated for 19 of the tests, as summarized in Table 7.2.

Table 7.2: Summary of 2011 Single Well Test Results

Borehole	Test	Interval Top (m from collar)	Interval Bottom (m from collar)	Interval Length (m)	Hydraulic Conductivity (m/s)	Vertical Static Water Level Below or Above Ground Surface (m) [1] [2]
M-11-122	Test 3	159.0	308.1	149.1	2×10^{-07}	-9.6
M-11-122	Test 4	303.4	449.1	145.7	1×10^{-07}	-9.8
M-11-122	Test 5	447.0	634.8	187.8	5×10^{-10}	-25.6
M-11-123	Test 1	20.7	124.5	103.8	See Note 4	-9.1
M-11-123	Test 2	114.0	286.5	172.5	4×10^{-07}	-14.1
M-11-123	Test 3	283.5	463.5	180.0	1×10^{-08}	-26.2
M-11-123	Test 4	453.4	631.8	178.4	9×10^{-09}	-21.1
M-11-124	Test 1	9.3	148.8	139.6	4×10^{-06}	-15.7
M-11-124	Test 2	147.3	301.8	154.6	1×10^{-06}	-16.0
M-11-124	Test 3	294.3	469.8	175.6	2×10^{-07}	-16.4
M-11-124	Test 4	459.3	685.8	226.6	9×10^{-08}	-20.9
M-11-125	Test 1	65.8	200.0	134.2	4×10^{-07}	33.8
M-11-125	Test 2	195.3	388.7	193.4	3×10^{-09}	34.9
M-11-125	Test 3	384.3	581.0	196.7	1×10^{-09}	27.2
M-11-125	Test 4	576.5	809.0	232.5	3×10^{-10}	35.2
M-11-126	Test 1	27.6	149.3	121.7	2×10^{-06}	-22.4
M-11-126	Test 2	138.5	299.3	160.8	9×10^{-07}	-28.3
M-11-126	Test 3	288.5	449.3	160.8	3×10^{-07}	-33.2
M-11-126	Test 4	435.4	635.3	199.8	1×10^{-07}	-28.3

Notes:

1) Vertical metres below or above ground surface.

2) Negative value indicates artesian aquifer conditions (hydraulic head above ground surface).

3) Irregular pressure response. Test could not be analyzed.

Artesian conditions were observed in boreholes M-11-122, M-11-123, M-11-124 and M-11-126, with vertical static water levels ranging from 9.1 to 33.2 metres above ground surface. Vertical static water levels in M-11-125 ranged from 27.2 to 35.2 metres below ground surface.

Hydraulic conductivity values calculated from the 2011 hydrogeological tests ranged from 3×10^{-10} to 4×10^{-6} m/s. As shown in Figure 7.1, the results indicate a general trend of increasing hydraulic conductivity with elevation. This trend generally agrees with the 2009 data presented in Table 7.1.

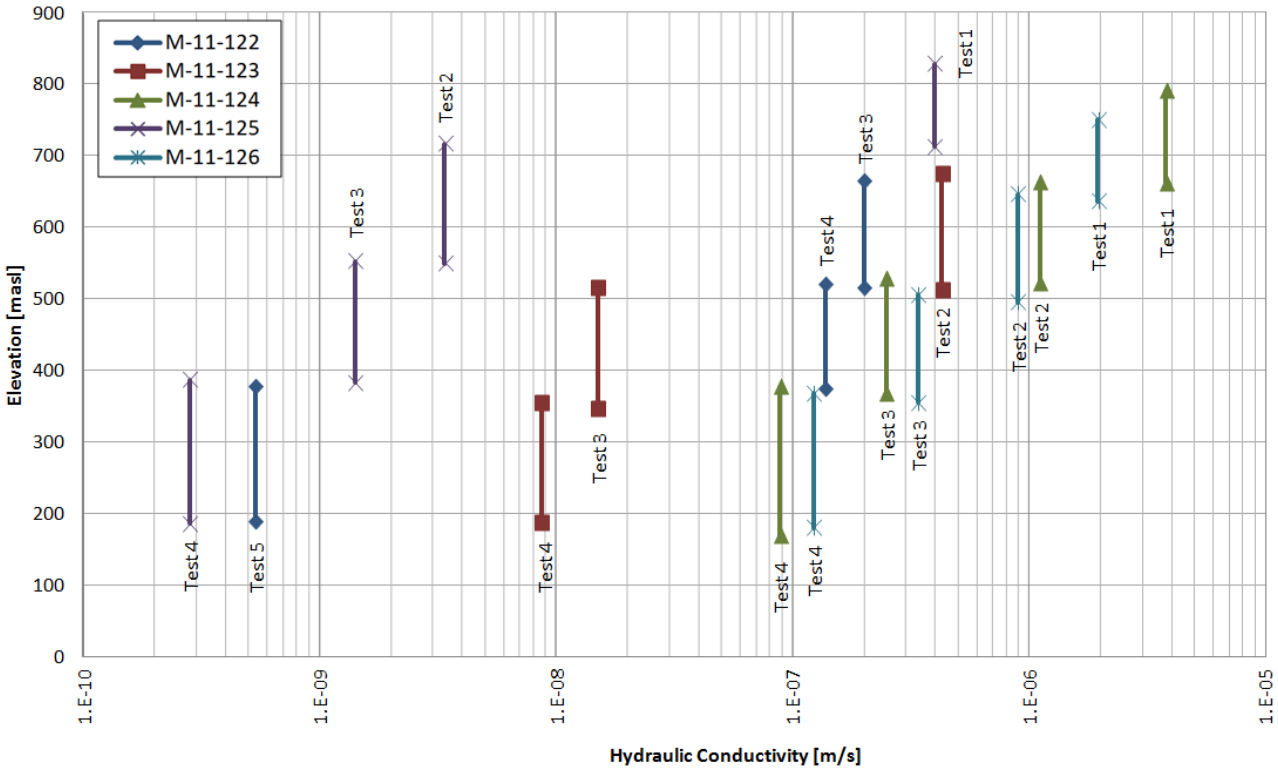


Figure 7.1: Hydraulic conductivity vs. elevation for 2011 hydrogeological tests

Cross-sections showing downhole RMR and hydraulic conductivity for 2011 geotechnical boreholes are presented in Appendix I. The data indicate no clear correlation between hydraulic conductivity and RMR.

8.0 CLOSURE

The geotechnical and hydrogeological characterization presented in this report has been based on all data collected to date. It should be updated as new information becomes available.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Karen Moffitt, P.Eng. (BC)
Associate, Senior Geotechnical Engineer

ORIGINAL SIGNED

Ross Hammett, P.Eng. (BC, NWT)
Principal, Senior Civil/Mining Engineer

KMM/RDH/np/aw/rs/cf

\\golder.gds\gal\burnaby\final\2011\1439\11-1439-0002\1114390002-001-r-rev0-10000\1114390002-001-r-rev0-10000 mitchell geotechnical characterization 13dec_12.docx

REFERENCES

Barton, N., R. Lien and J. Lunde. 1974. *Engineering Classification of Rock Masses for Design of Tunnel Support.* Rock Mechanics, 6, p. 189-236.

Bieniawski, Z.T. 1976. *Rock Mass Classification in Rock Engineering*. In: Exploration for Rock Engineering, Proceeding of the Symposium (Edited by Bieniawski, Z.T.) 1, 97-10. Cape Town, Balkema.

BGC (Bruce Geotechnical Consultants). 2010. *KSM Project: Mitchell Zone - Open Pit Slope Design - FINAL.* Prepared for Seabridge Gold Inc. Submitted April 16, 2010.

Deere, D.U., A.J. Hendron, F.D. Patton and E.J. Cording. 1967. *Design of surface and near surface construction in rock*. In Failure and breakage of rock, proc. 8th U.S. symp. rock mech., (ed. C. Fairhurst), 237-302. New York: Soc. Min. Engrs, Am. Inst. Min. Metall. Petrolm Engrs.

Golder Associates Ltd. 2012. *2011 Geotechnical and Hydrogeological Field Investigations, Mitchell Project.* Prepared for Seabridge Gold Inc. Submitted February 15, 2012.

ISRM (International Society of Rock Mechanics). 1981. *Rock Characterization, Testing and Monitoring.* In: Brown, E.T., ISRM Suggested Methods. Pergamon Press. Oxford, p. 211.

Seabridge. 2011. Kerr-Sulphurets-Mitchell (KSM) *Prefeasibility Study Update,* NI43-101 Report.

Wardrop. 2010. *Kerr-Sulphurets-Mitchell (KSM) Prefeasibility Study*. Prepared for Seabridge Gold Inc. Submitted March 31, 2010.

APPENDIX A

RMR_{76} Classification Criteria and Example Core Photographs

Table A-1: Rock Mass Rating (RMR_{76}) System

Parameter			Ranges of Values						
1	Strength of intact rock material	Point load strength index	> 8 MPa	4-8 MPa	2-4 MPa	1-2 MPa	For this low range uniaxial		
		Uniaxial compressive strength	> 200 MPa	100-200 MPa	50-100 MPa	25-50 MPa	10-25 MPa	3-10 MPa	1-3 MPa
	Rating		15	12	7	4	2	1	0
2	Drill core quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%		
	Rating		20	17	13	8	3		
3	Spacing of joints		>3 m	1-3 m	0.3 – 1 m	50 – 300 mm	<50 mm		
	Rating		30	25	20	10	5		
4	Condition of joints		Very rough surfaces Not continuous No Separation Hard joint wall rock	Slightly rough surfaces Separation <1 mm Hard joint wall rock	Slightly rough surfaces Separation <1 mm Soft joint wall rock	Slickensided surfaces OR Gouge <5 mm thick OR joint	Soft gouge >5 mm thick OR Joints open >5 mm continuous joints		
	Rating		25	20	12	6	0		
5	Groundwater	Inflow per 10 m per tunnel length	None		<25 litres / min	25-125 litres / min	>125 litres / min		
		Raito joint water pressure / major principal stress	0		0.0 – 0.2	0.2 – 0.5	>0.5		
		General conditions	Completely dry		Moist only (interstitial water)	Water under moderate pressure	Server water problems		
	Rating		10		7	4	0		

n:\final\2011\1439\11-1439-0002\1114390002-001-r-rev0-10000\appendix a - rmr classification\01 - rmr classification criteria.docx

VERY POOR ROCK (RMR = 0-20)

M-11-125: 705.07 – 705.58 m

POOR ROCK (RMR = 20-40)

M-11-125: 76.70 – 78.50 m

PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY MITCHELL PROJECT, BRITISH COLUMBIA				
TITLE	EXAMPLE CORE PHOTOGRAPHS OF VERY POOR AND POOR ROCK				
Golder Associates	PROJECT No.11-1439-0002			PHASE No. 10000	
	DESIGN	MV	10FEB12	SCALE NTS	REV.0
	CADD	MV	10FEB12	FIGURE A-1	
	CHECK	KMM	15FEB12		
	REVIEW	RDH	15FEB12		

FAIR ROCK (RMR = 40-60)

M-11-125: 188.25 – 190.88 m

GOOD ROCK (RMR = 60-80)

M-11-125: 297.00 – 299.01 m

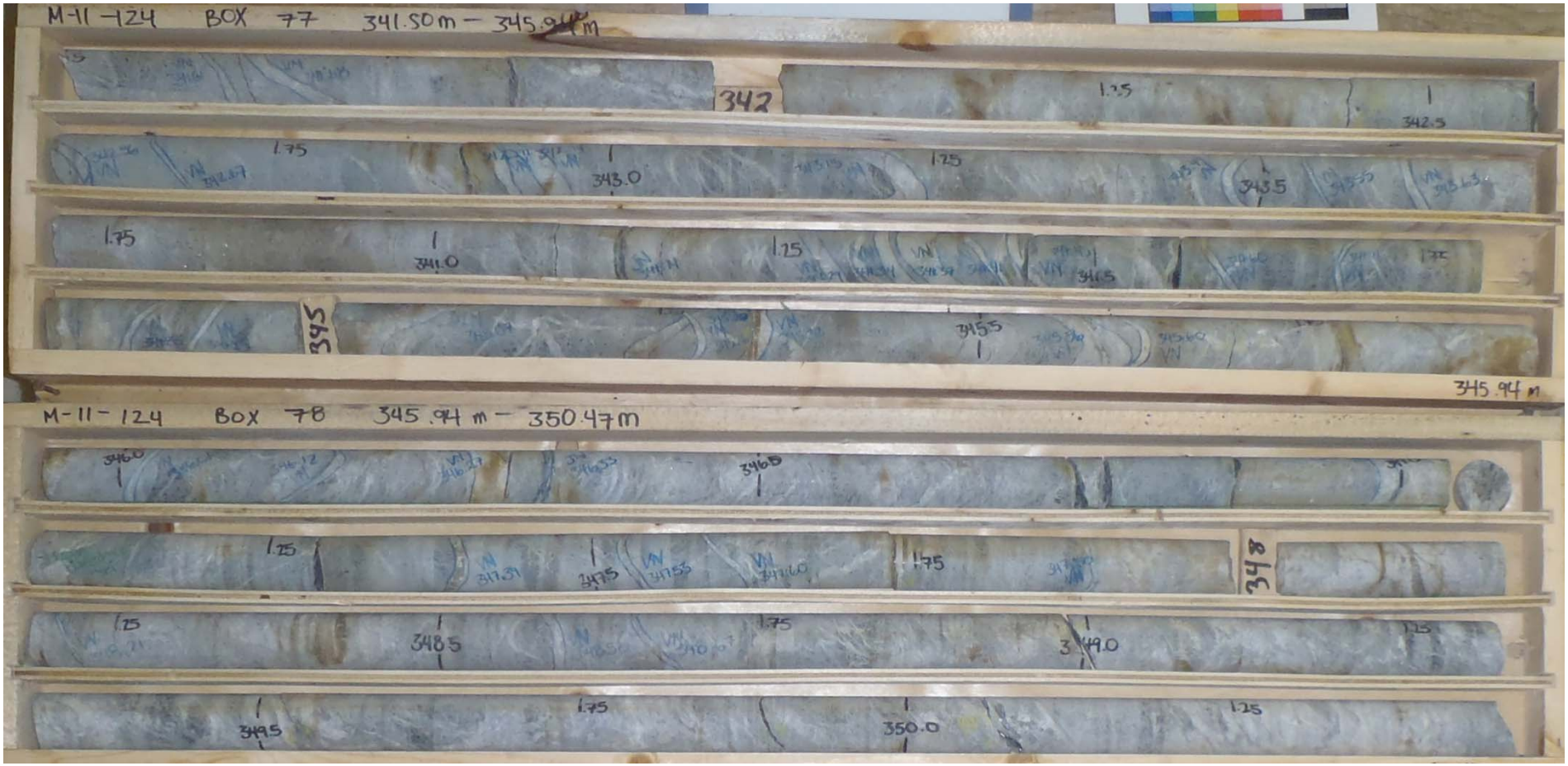
PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY MITCHELL PROJECT, BRITISH COLUMBIA
TITLE	EXAMPLE CORE PHOTOGRAPHS OF FAIR AND GOOD ROCK

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	MV	10FEB12	SCALE NTS	REV. 0	
CADD	MV	10FEB12	FIGURE A-2		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

VERY GOOD ROCK (RMR = 80-100)

M-11-124: 341.50 – 350.47 m

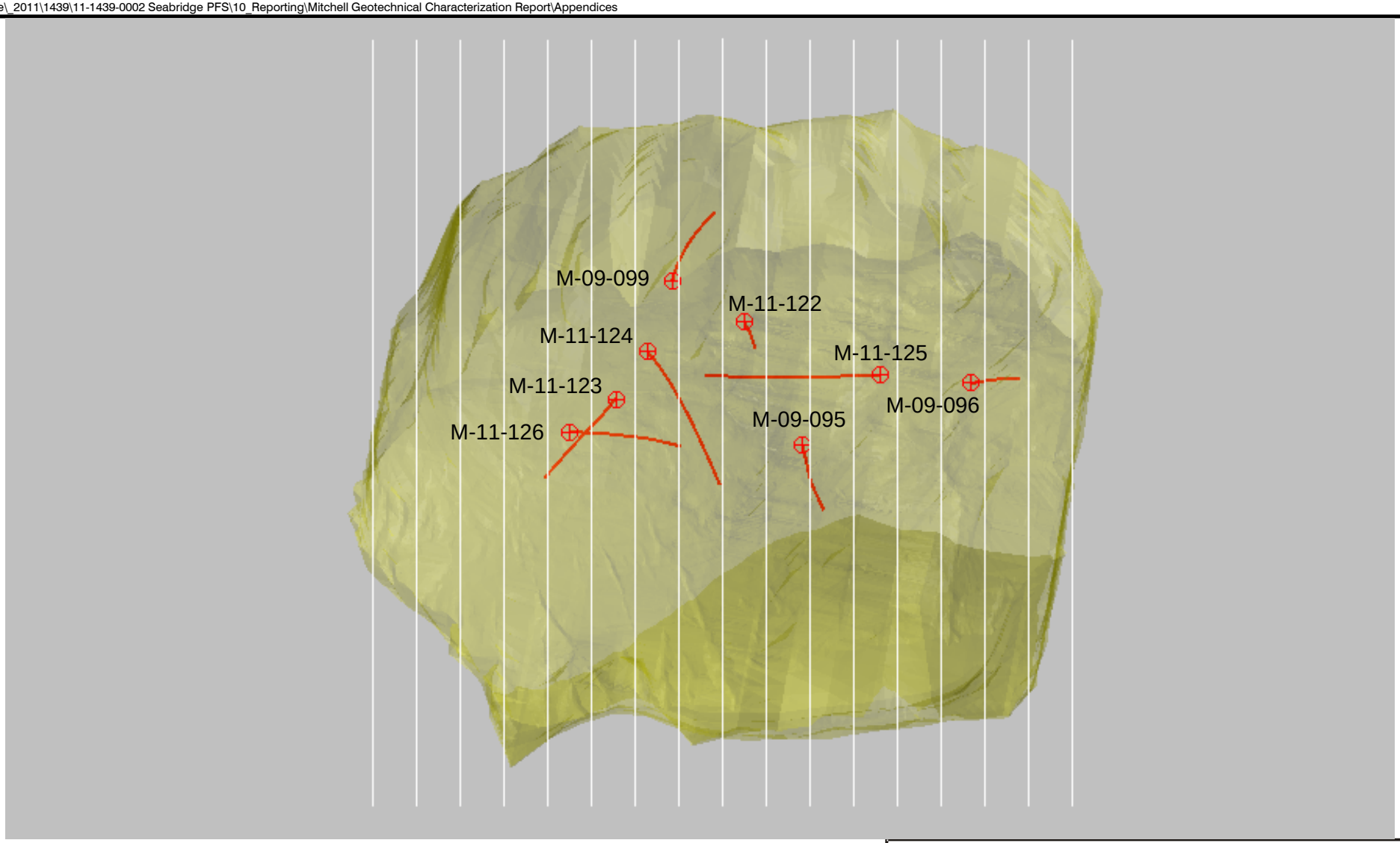


PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY MITCHELL PROJECT, BRITISH COLUMBIA				
TITLE	EXAMPLE CORE PHOTOGRAPH OF VERY GOOD ROCK				
Golder Associates	PROJECT No.11-1439-0002			PHASE No. 10000	
	DESIGN	MV	10FEB12	SCALE NTS	REV.0
	CADD	MV	10FEB12	FIGURE A-3	
	CHECK	KMM	15FEB12		
	REVIEW	RDH	15FEB12		

APPENDIX B

Cross Sections Showing Logged and Correlated RMR

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

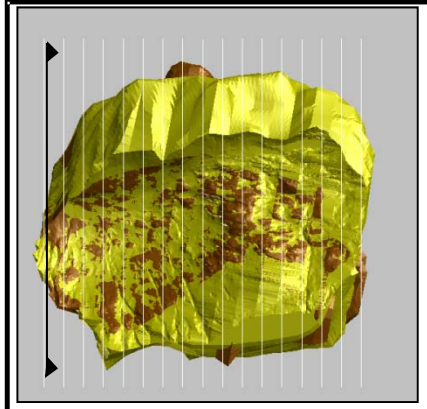
MITCHELL - PLAN
CENTRAL GEOTECHNICAL BOREHOLES

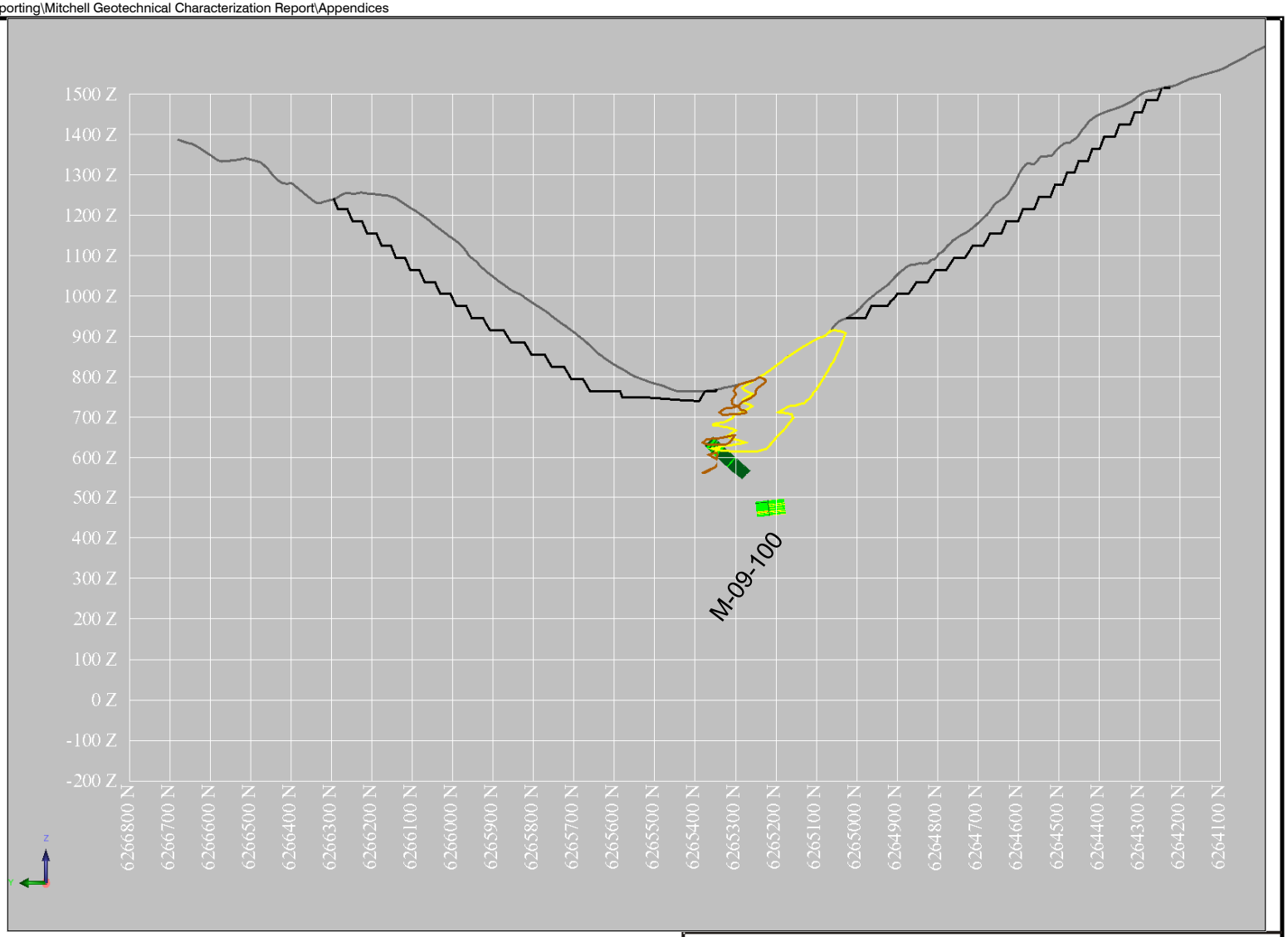
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	01NOV11	SCALE NTS	REV.0
CADD	CY	01NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE B-1

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

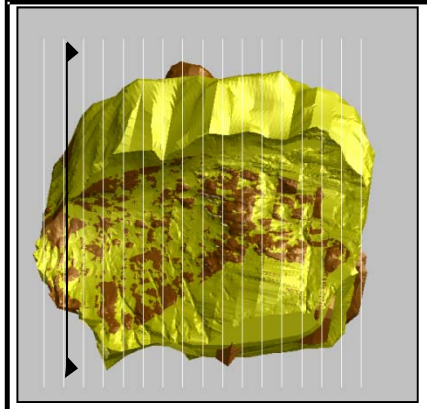
MITCHELL - 422200 EASTING
CORRELATED RMR AND LOGGED RMR

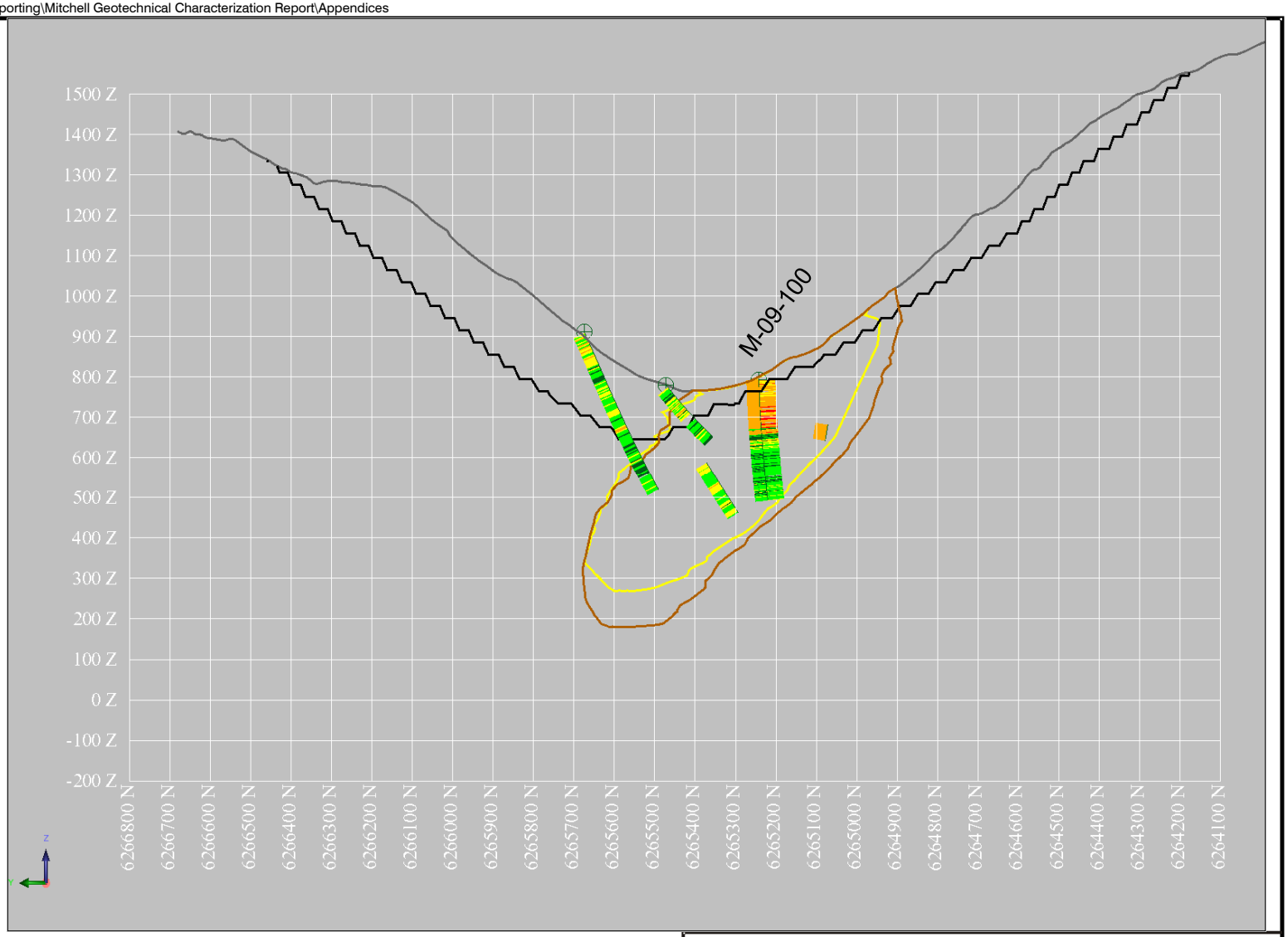
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-2

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

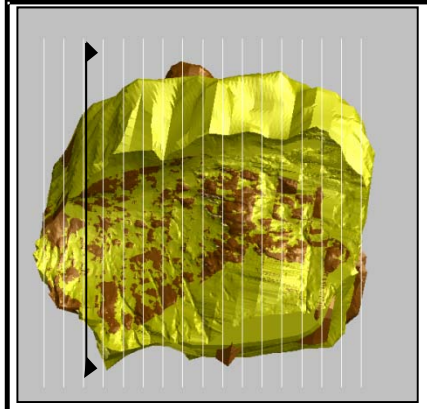
MITCHELL - 422300 EASTING
CORRELATED RMR AND LOGGED RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-3

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

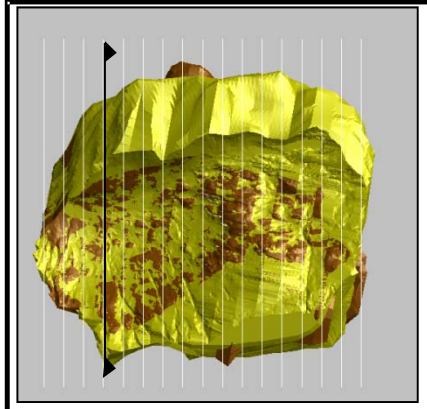
MITCHELL - 422400 EASTING
CORRELATED RMR AND LOGGED RMR

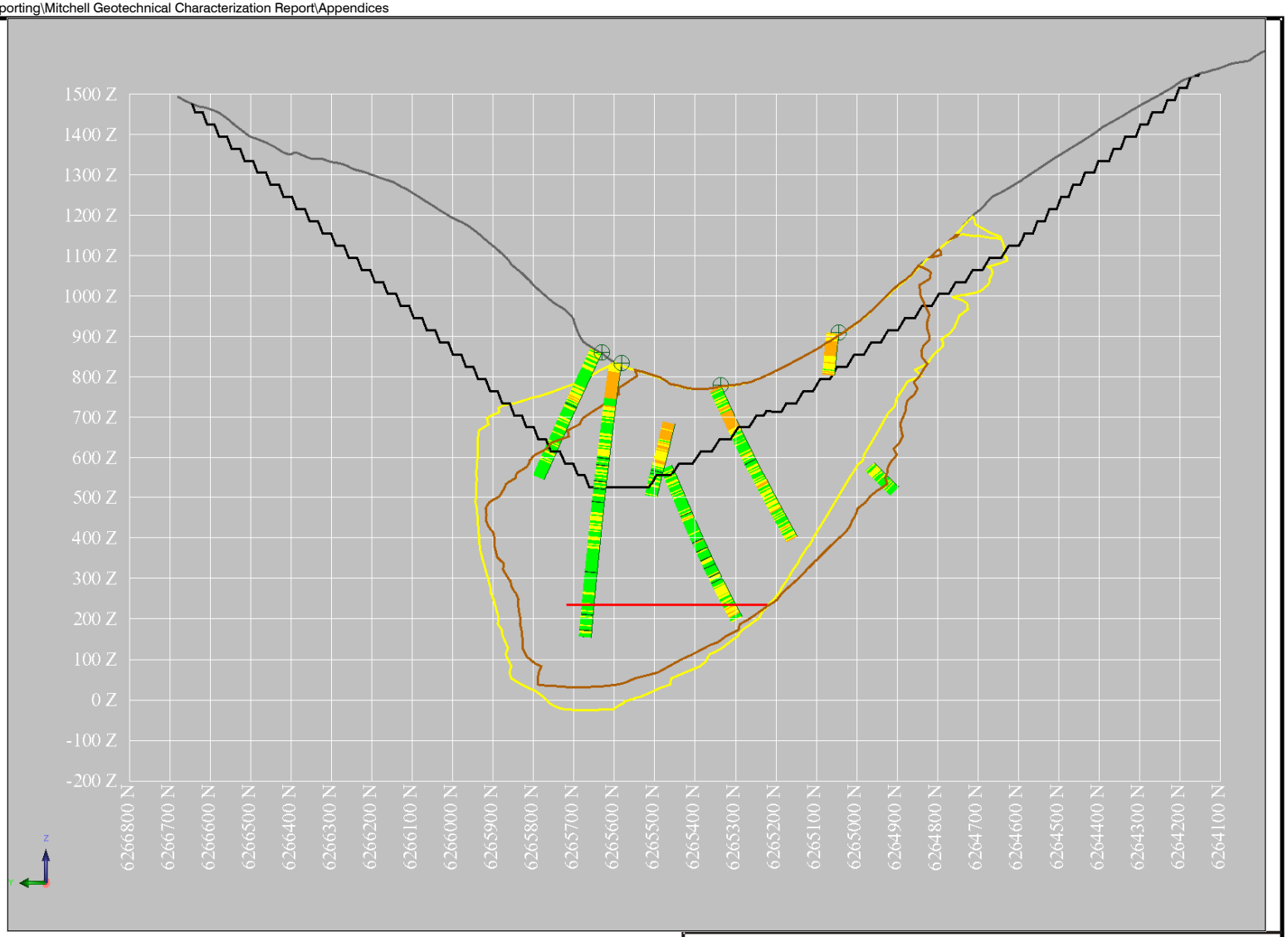
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-4

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

80-100	20-40
60-80	0-20
40-60	

*Left of borehole, narrow

Logged RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

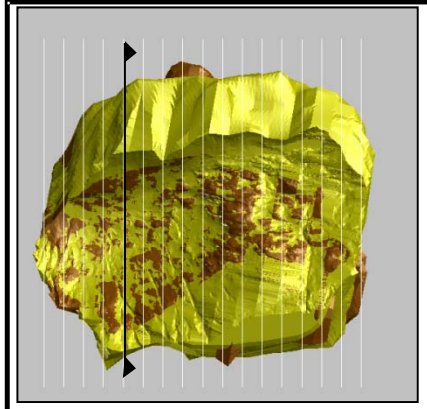
TITLE

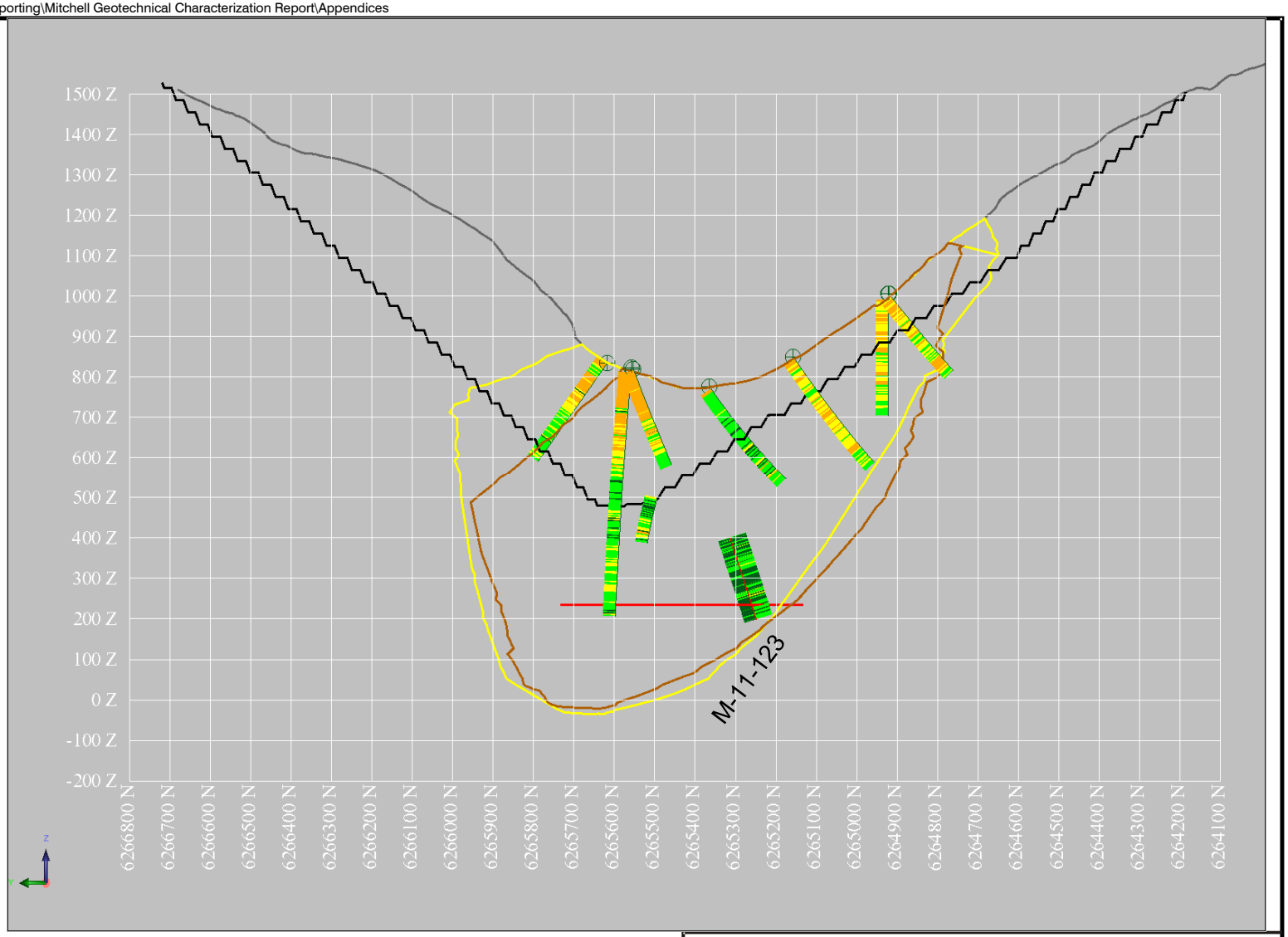
MITCHELL - 422500 EASTING
CORRELATED RMR AND LOGGED RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11	FIGURE B-5		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

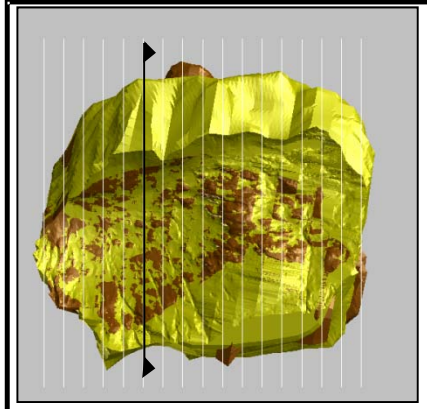
MITCHELL - 422600 EASTING CORRELATED RMR AND LOGGED RMR

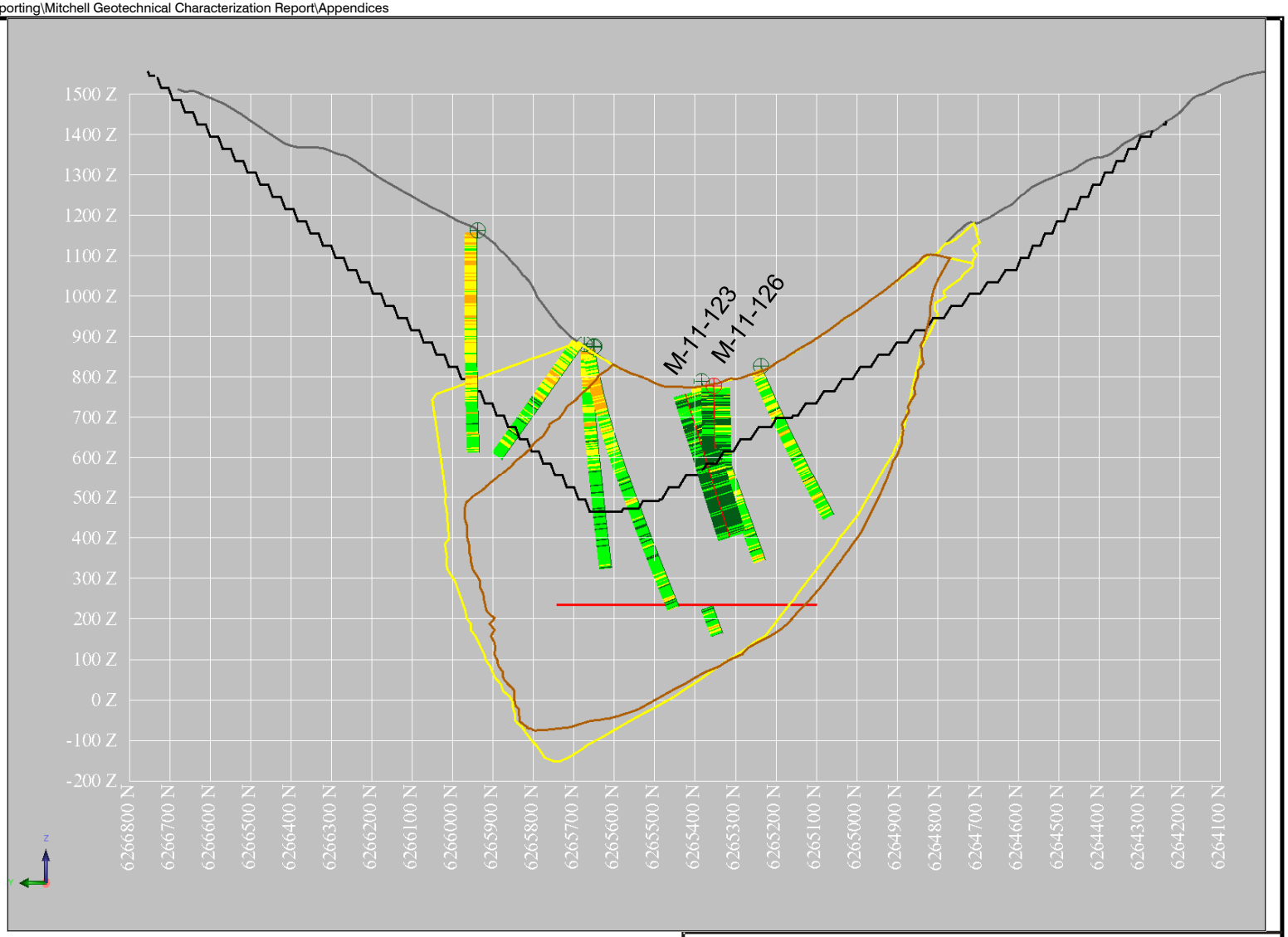
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE B-6

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

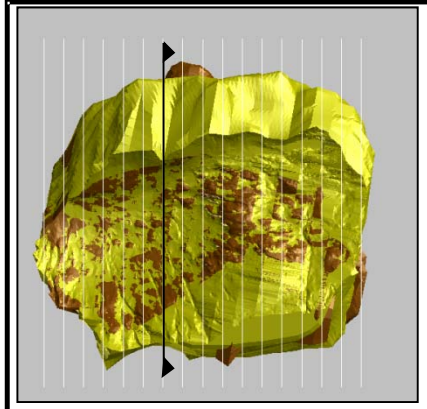
MITCHELL - 422700 EASTING
CORRELATED RMR AND LOGGED RMR

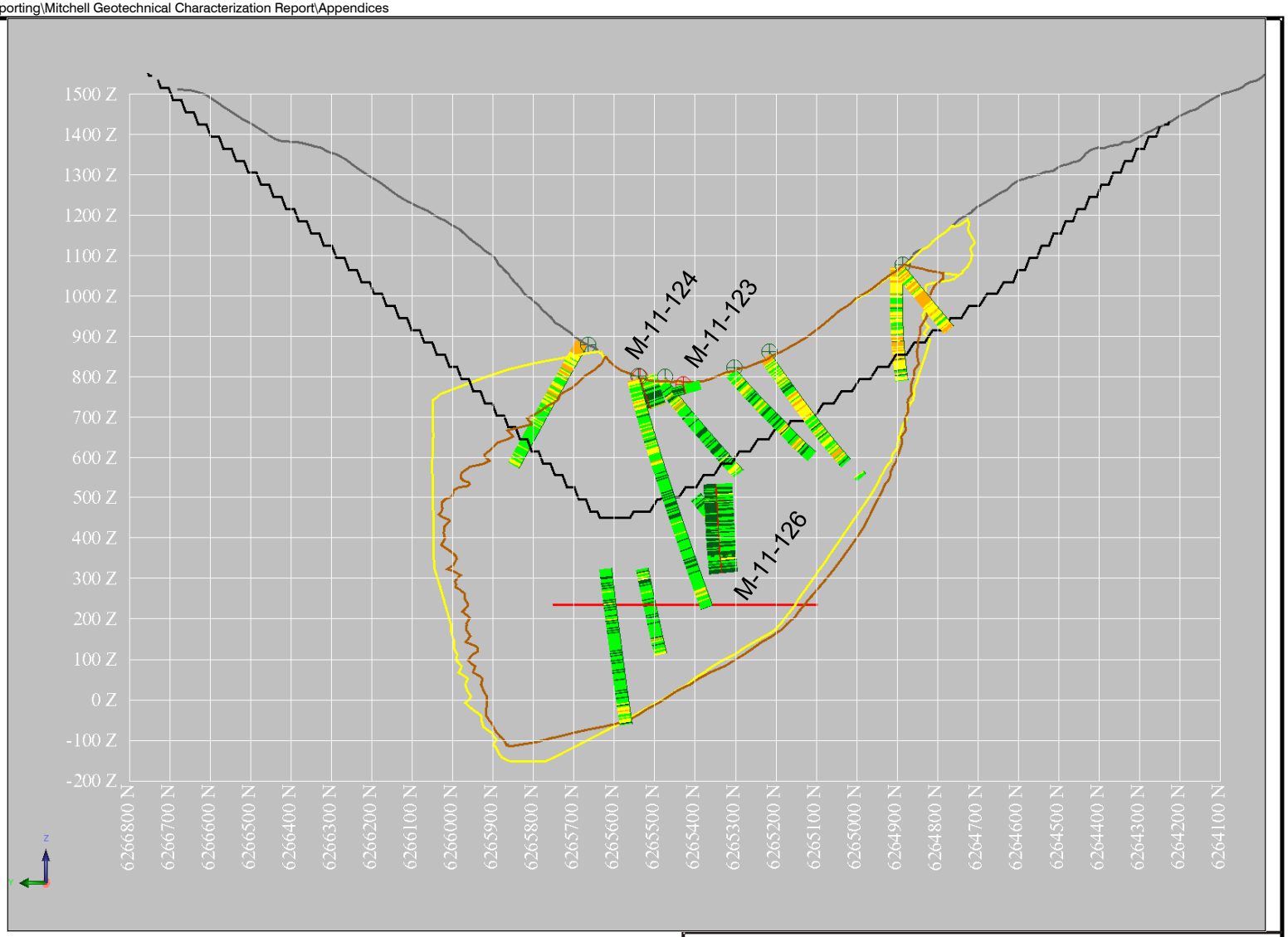
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE B-7

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

80-100	20-40
60-80	0-20
40-60	

*Left of borehole, narrow

Logged RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

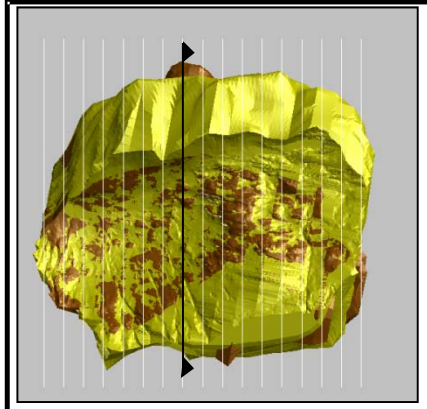
TITLE

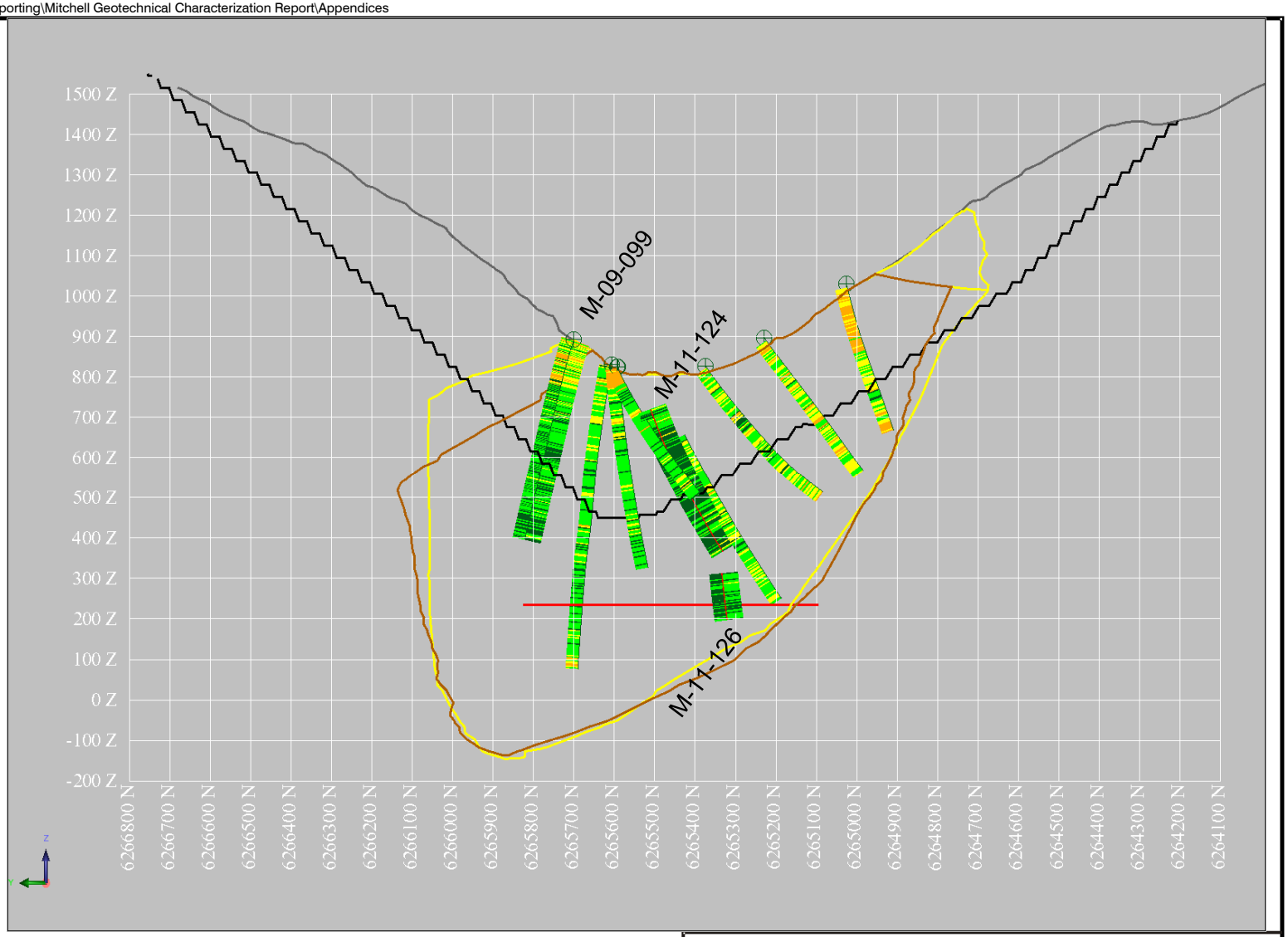
MITCHELL - 422800 EASTING
CORRELATED RMR AND LOGGED RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11	FIGURE B-8		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

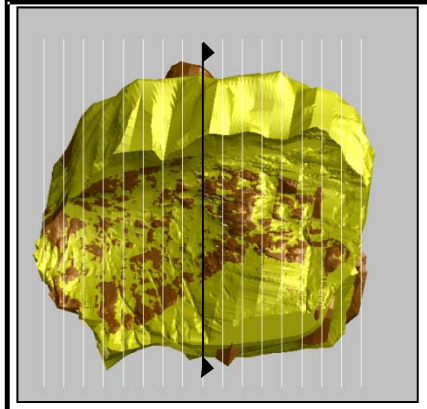
MITCHELL - 422900 EASTING
CORRELATED RMR AND LOGGED RMR

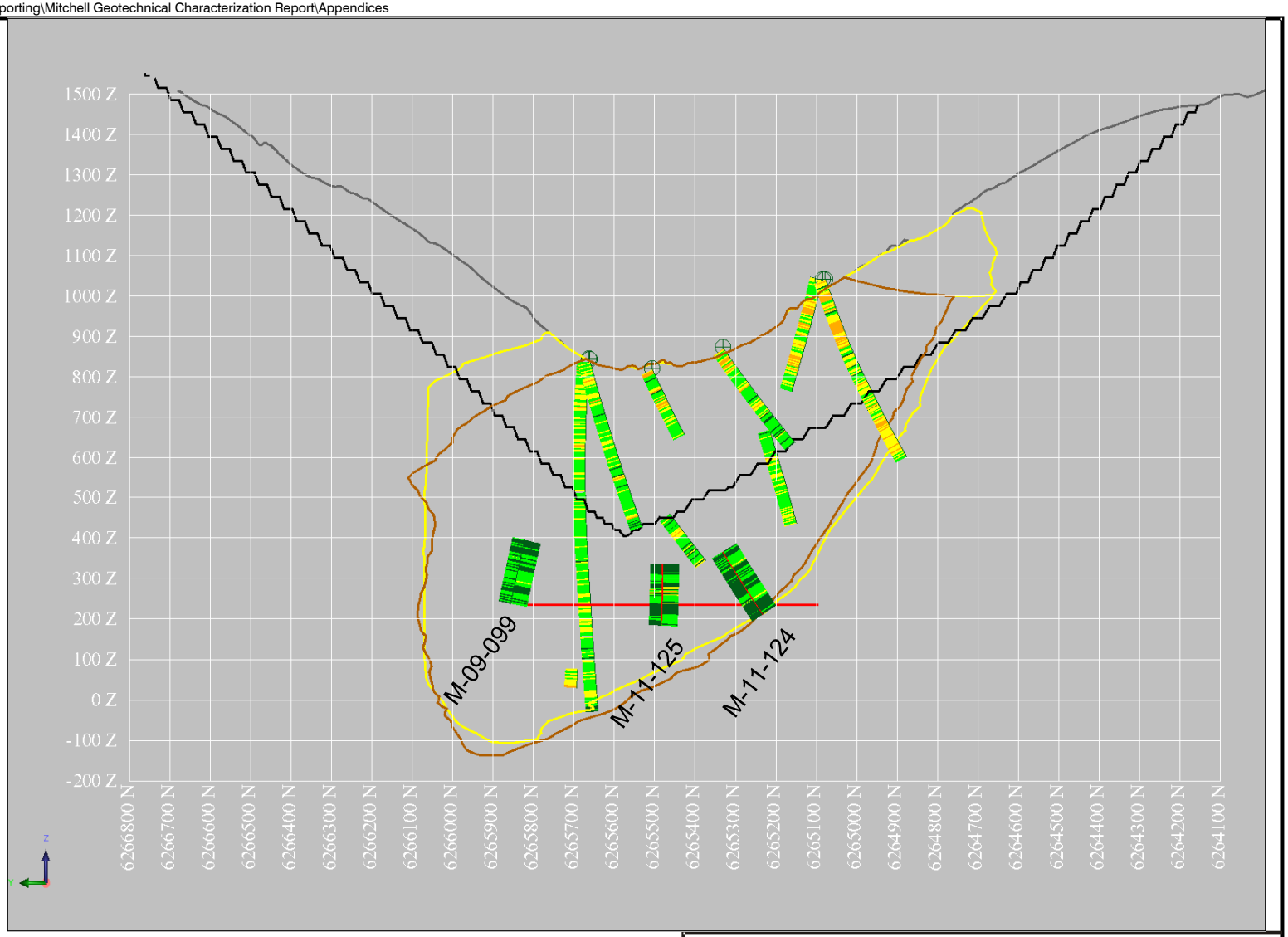
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-9

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

80-100	20-40
60-80	0-20
40-60	

*Left of borehole, narrow

Logged RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

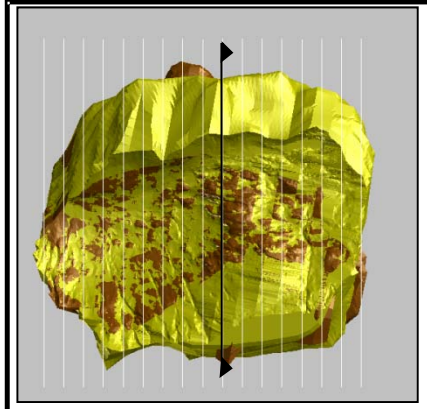
TITLE

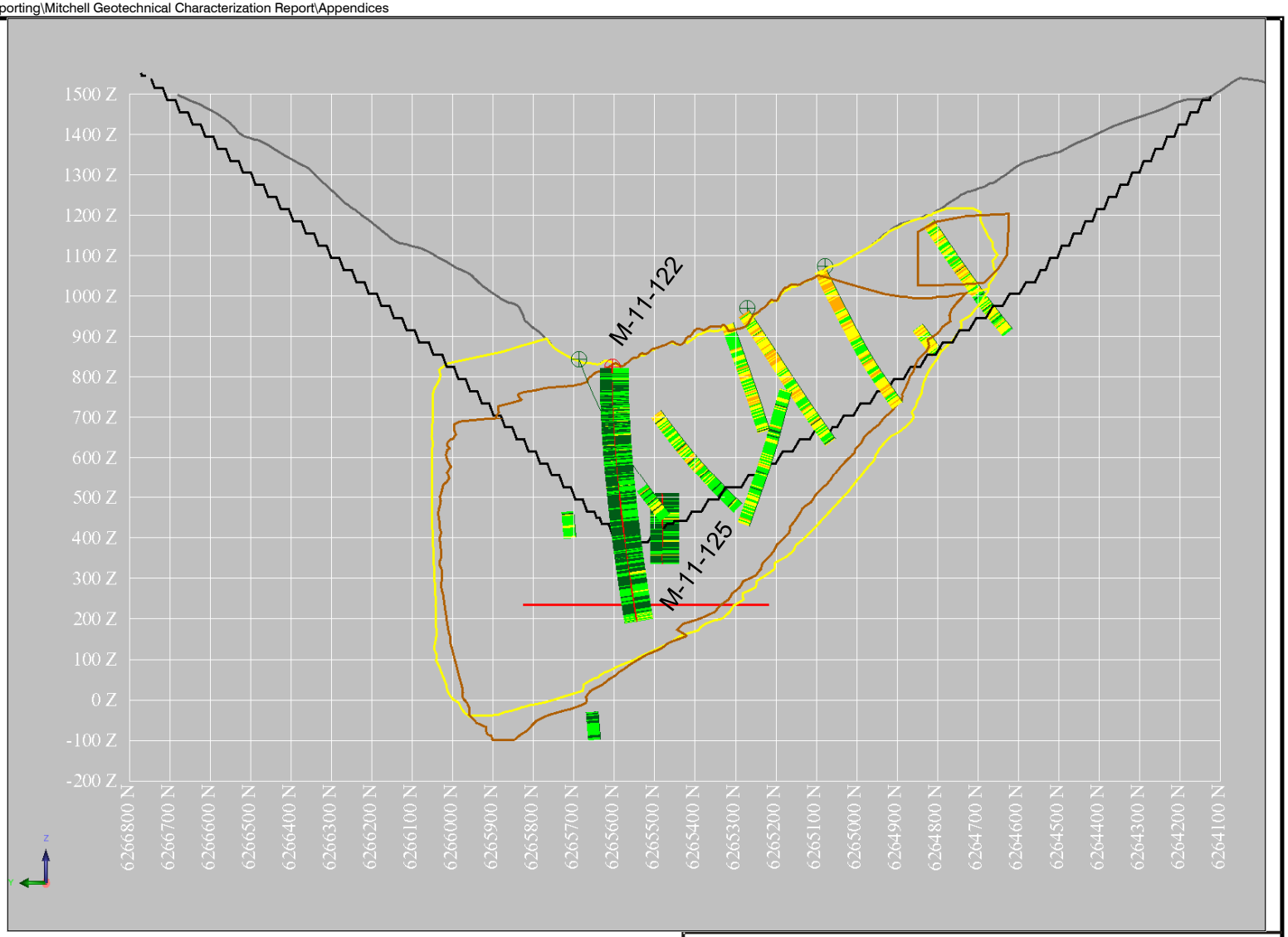
MITCHELL - 423000 EASTING CORRELATED RMR AND LOGGED RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11	FIGURE B-10		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

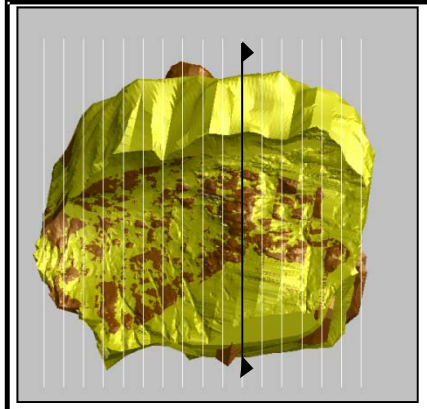
TITLE

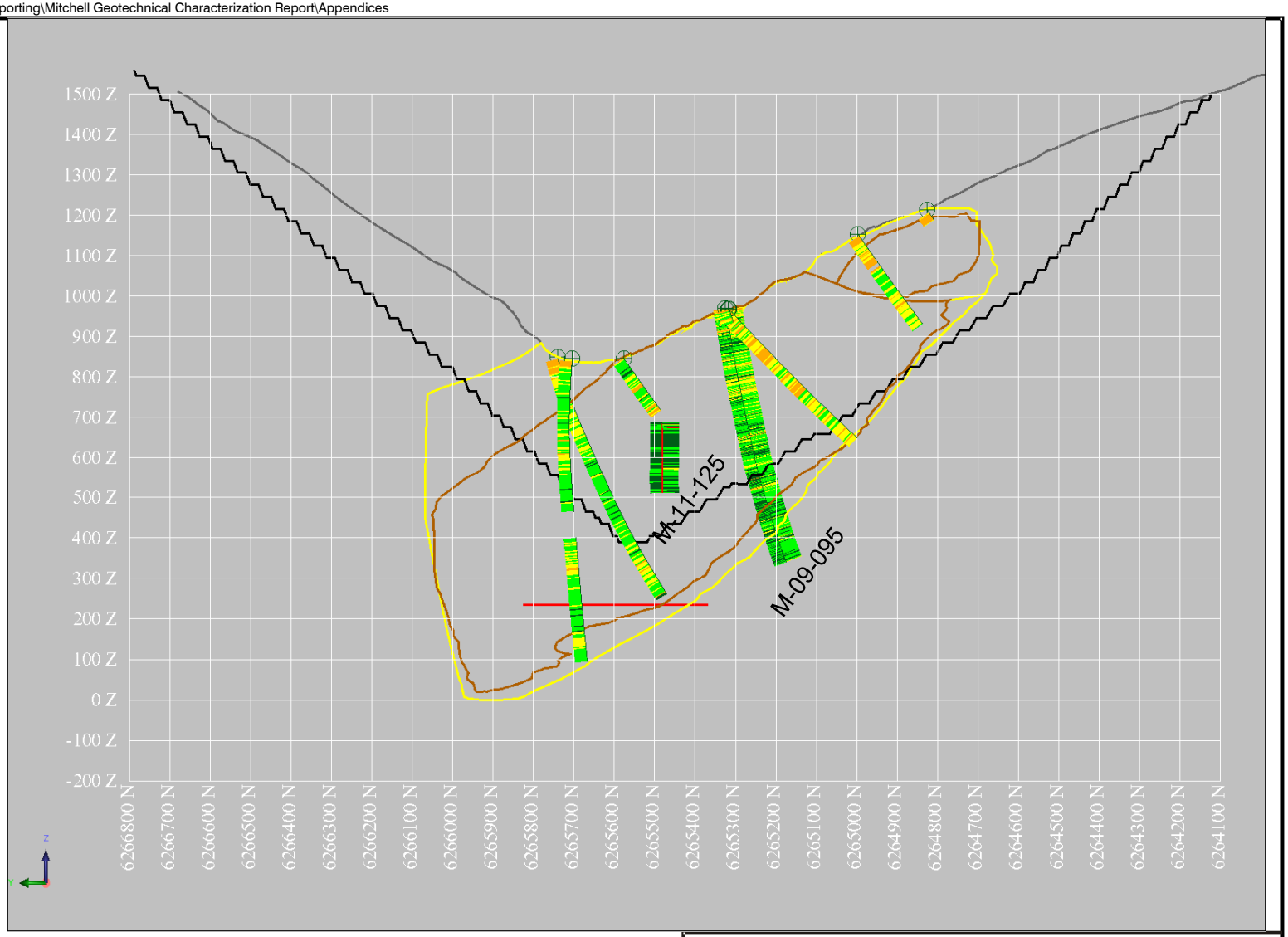
MITCHELL - 423100 EASTING CORRELATED RMR AND LOGGED RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11	**FIGURE B-11**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

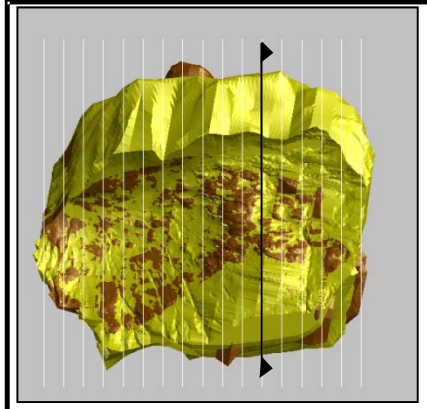
MITCHELL - 423200 EASTING
CORRELATED RMR AND LOGGED RMR

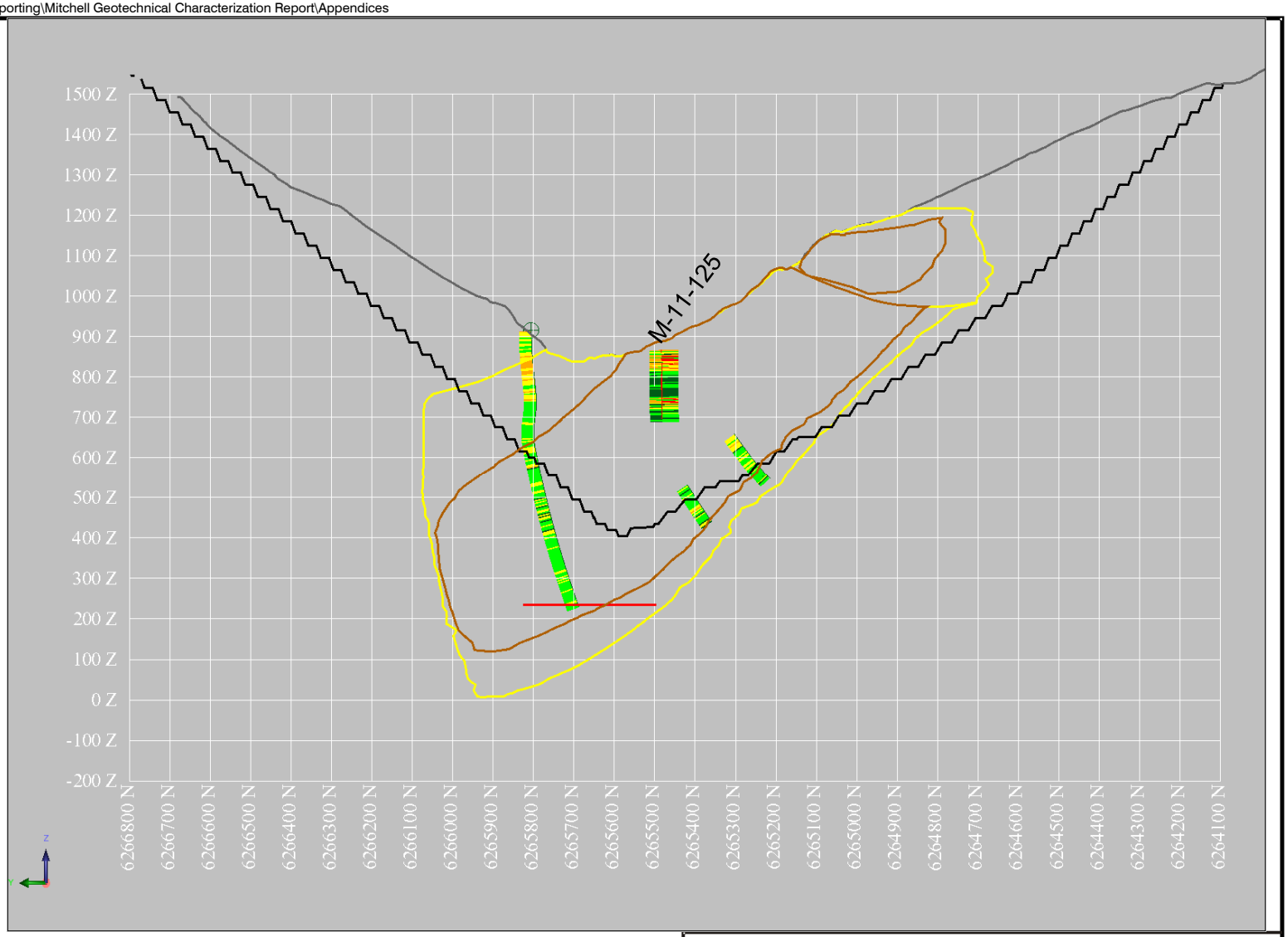
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-12

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

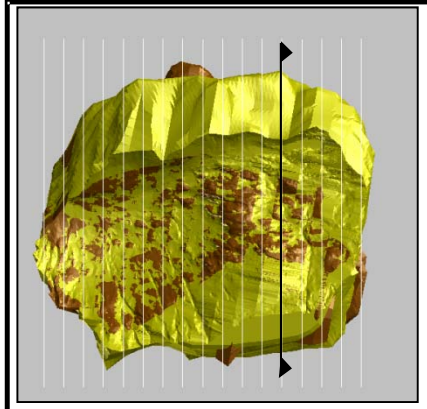
MITCHELL - 423300 EASTING
CORRELATED RMR AND LOGGED RMR

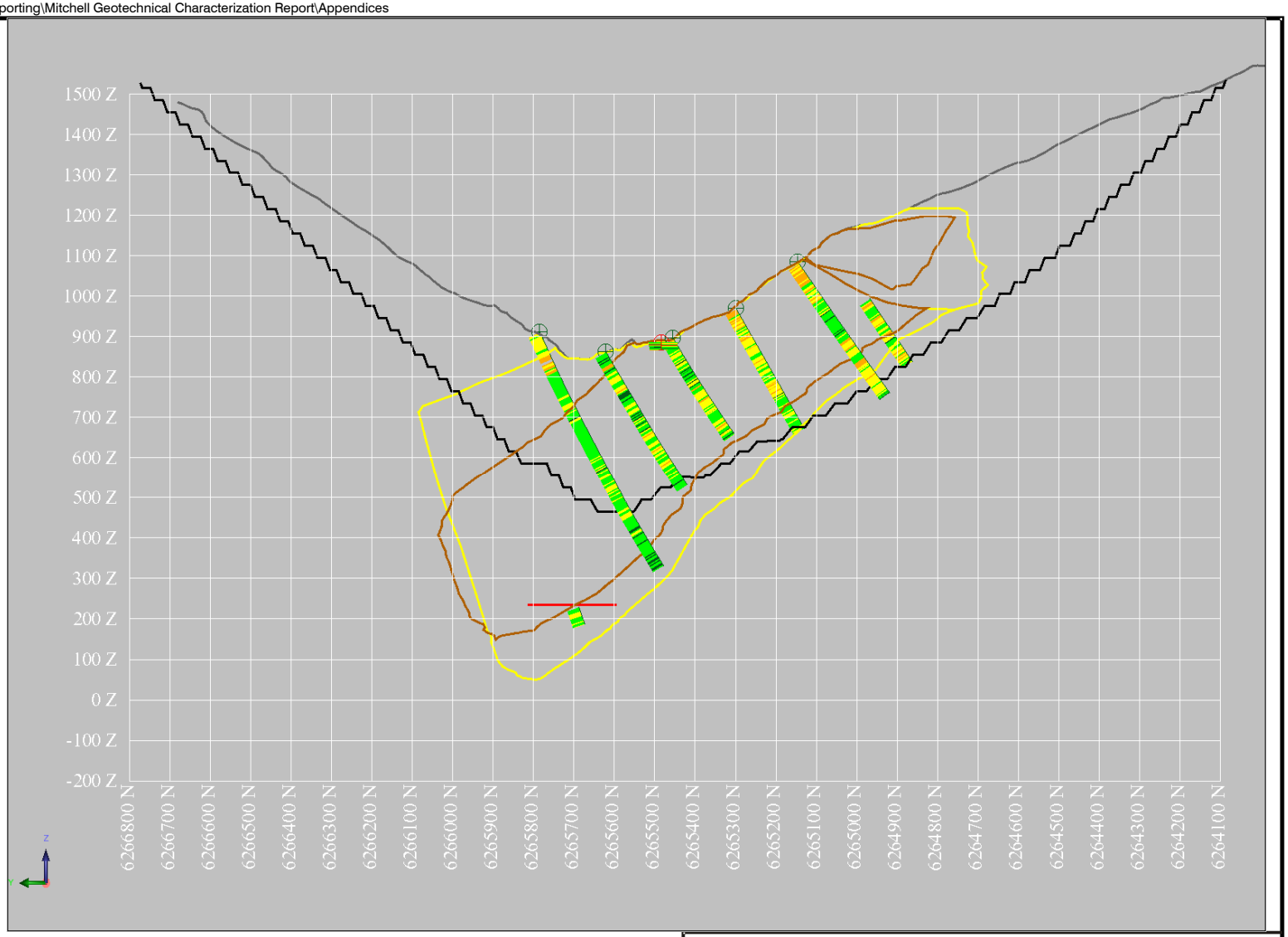
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-13

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

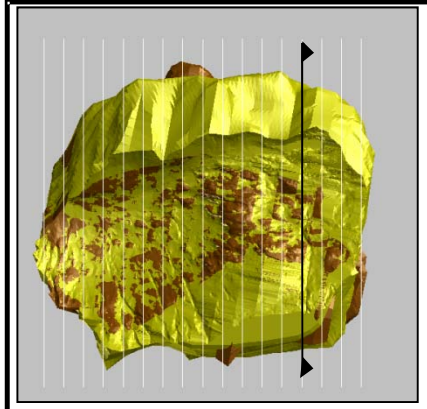
MITCHELL - 423400 EASTING CORRELATED RMR AND LOGGED RMR

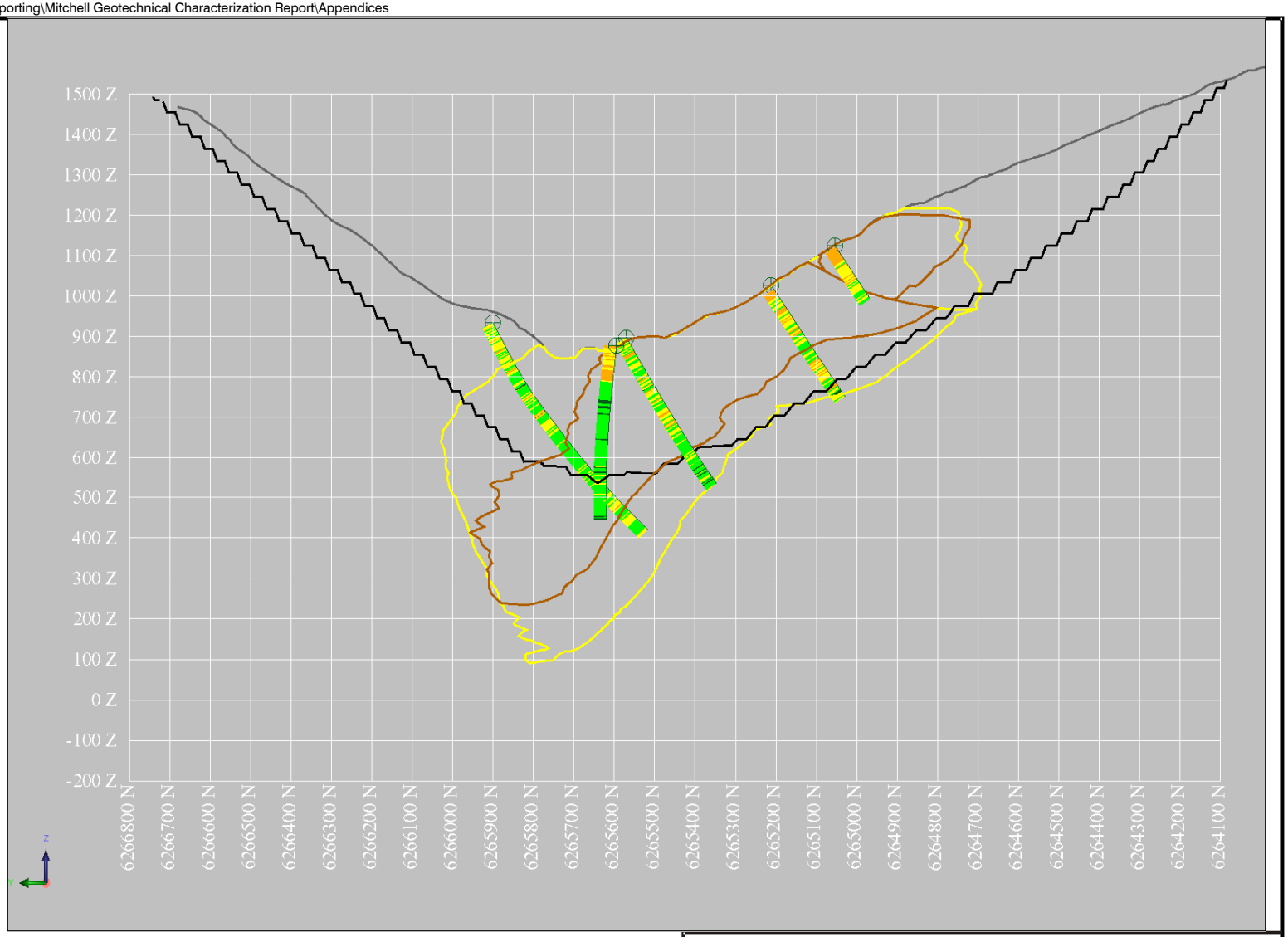
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-14

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

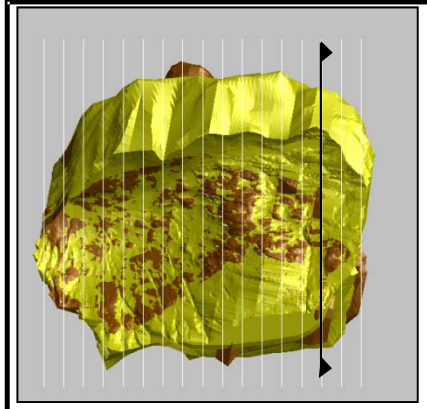
MITCHELL - 423500 EASTING CORRELATED RMR AND LOGGED RMR

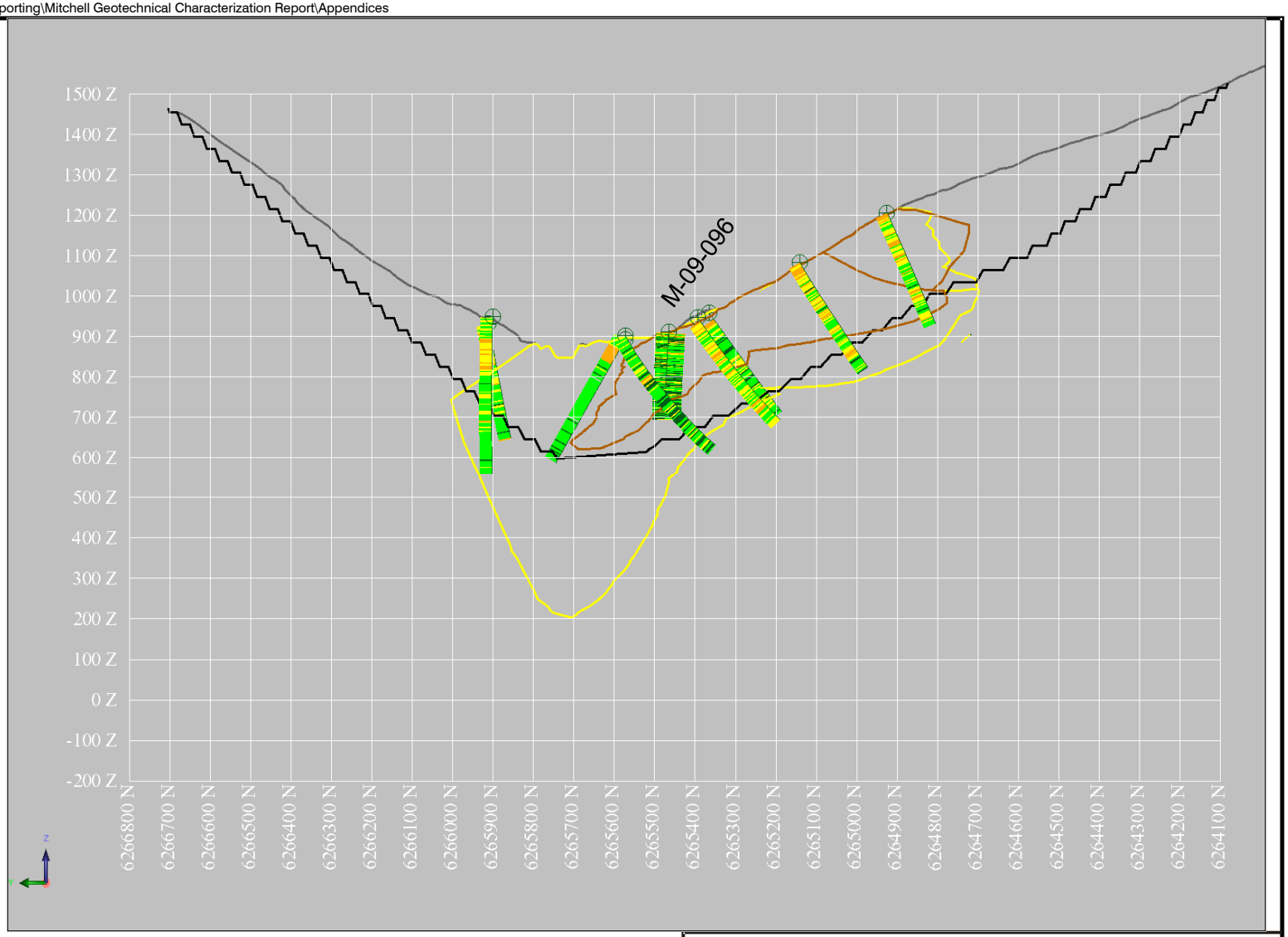
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-15

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

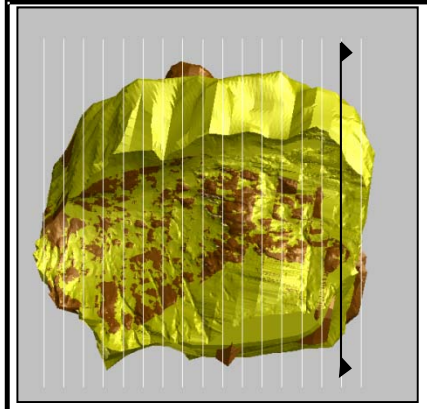
MITCHELL - 423600 EASTING
CORRELATED RMR AND LOGGED RMR

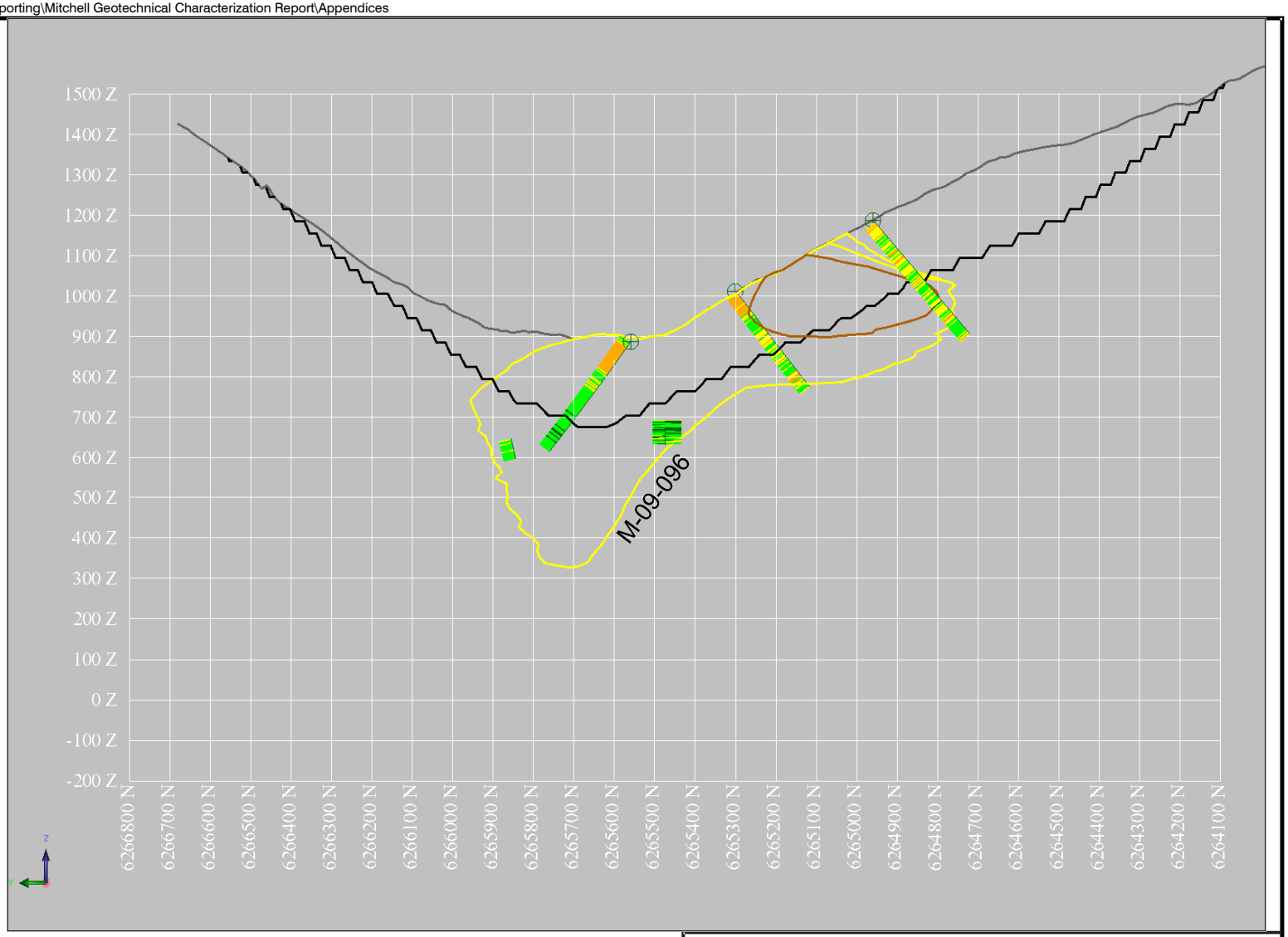
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-16

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

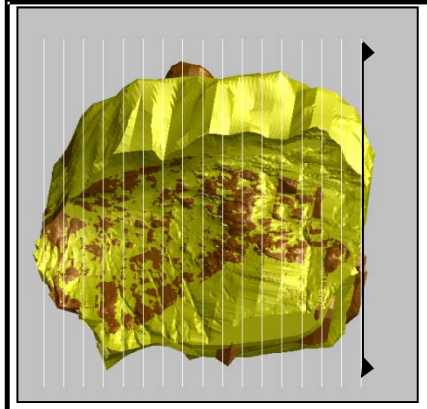
MITCHELL - 423700 EASTING
CORRELATED RMR AND LOGGED RMR

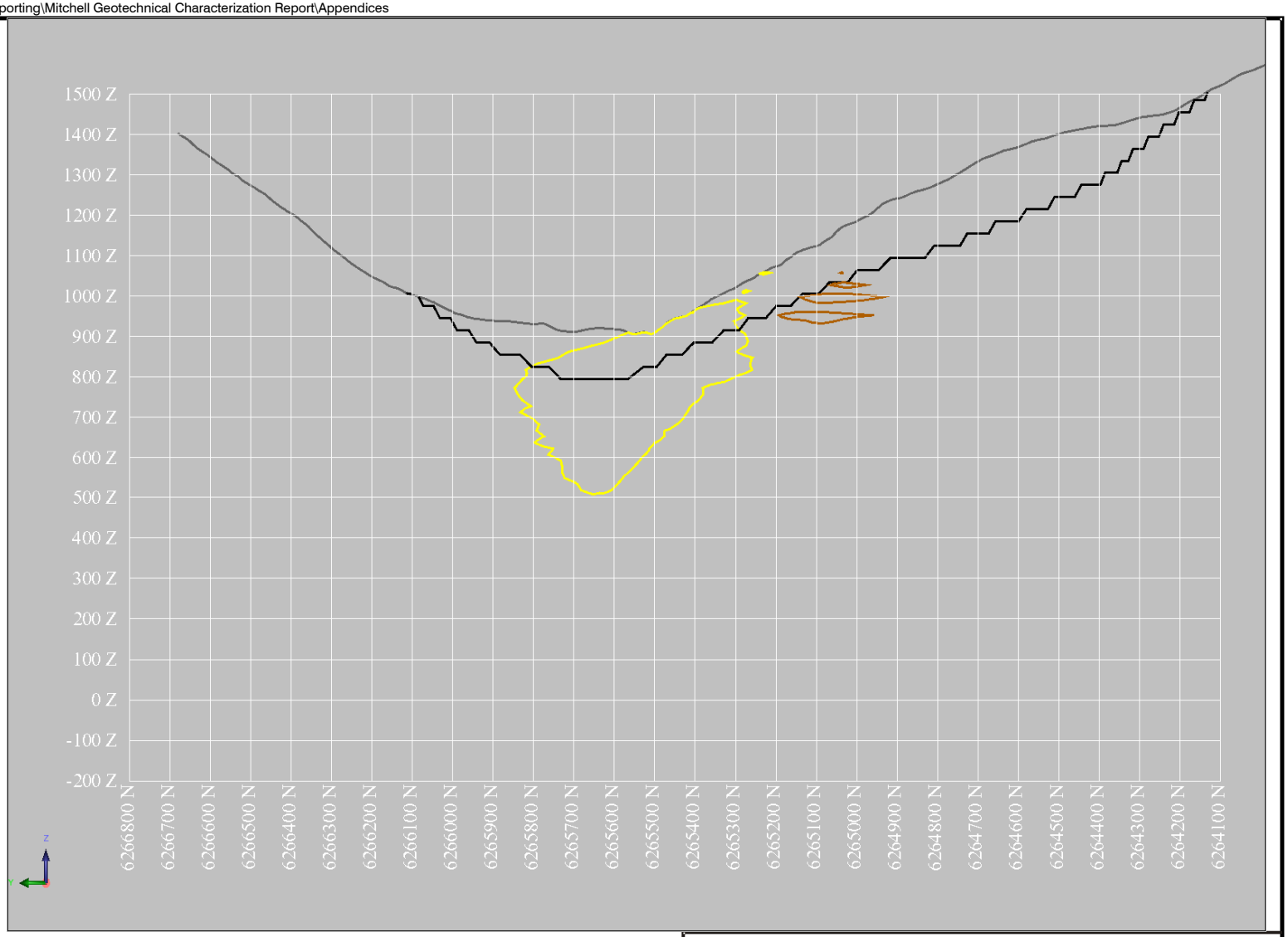
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-17

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- CAVE FOOTPRINT

BOREHOLE

- OTHER HOLES
- 'CENTRAL' HOLES

RMR Correlated from RQD

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Left of borehole, narrow

Logged RMR

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

MITCHELL - 423800 EASTING
CORRELATED RMR AND LOGGED RMR

Golder Associates

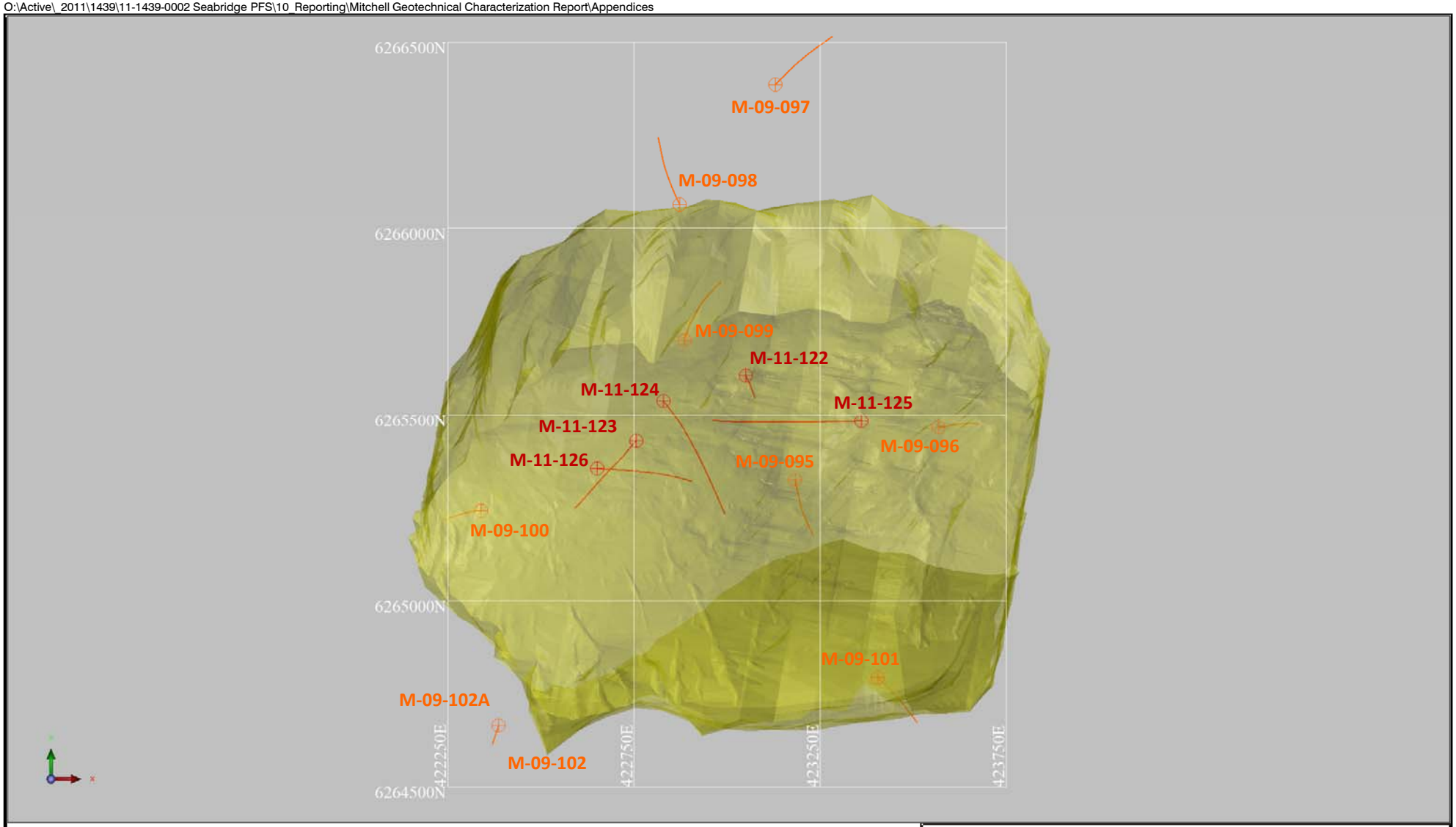
PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE B-18

APPENDIX C

Cross Sections Showing ISRM Strength

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



BOREHOLE
BGC LOGGED
2011 GOLDER HOLES

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

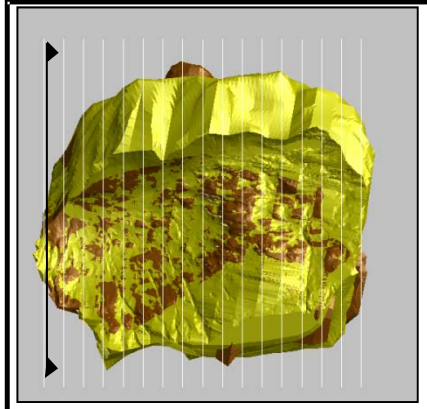
TITLE

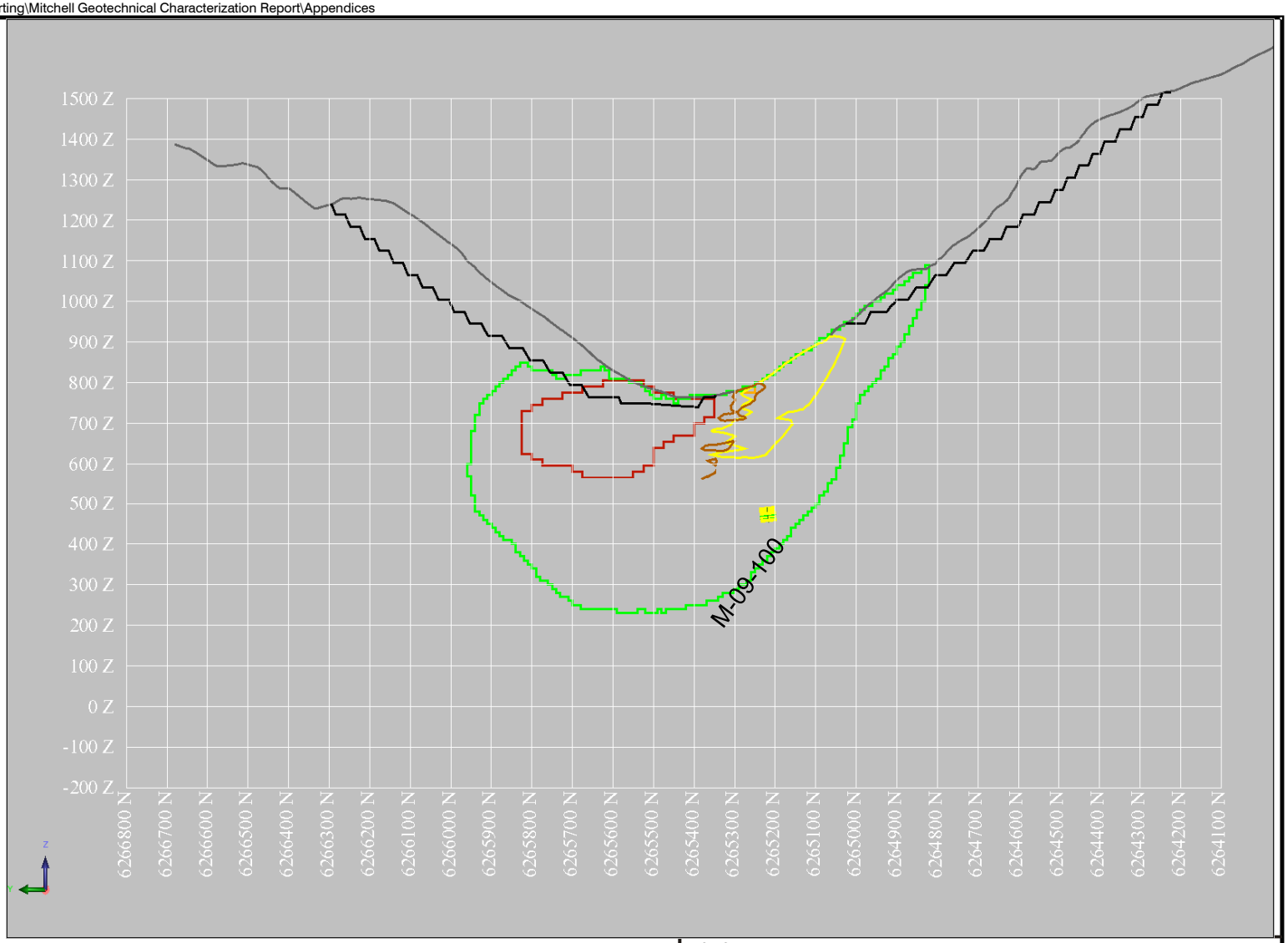
MITCHELL - PLAN GEOTECHNICAL BOREHOLES

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	17OCT11	SCALE NTS	REV.0	
CADD	CY	17OCT11	**FIGURE C-1**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

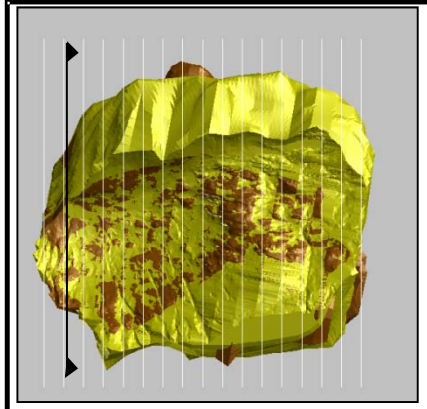
TITLE

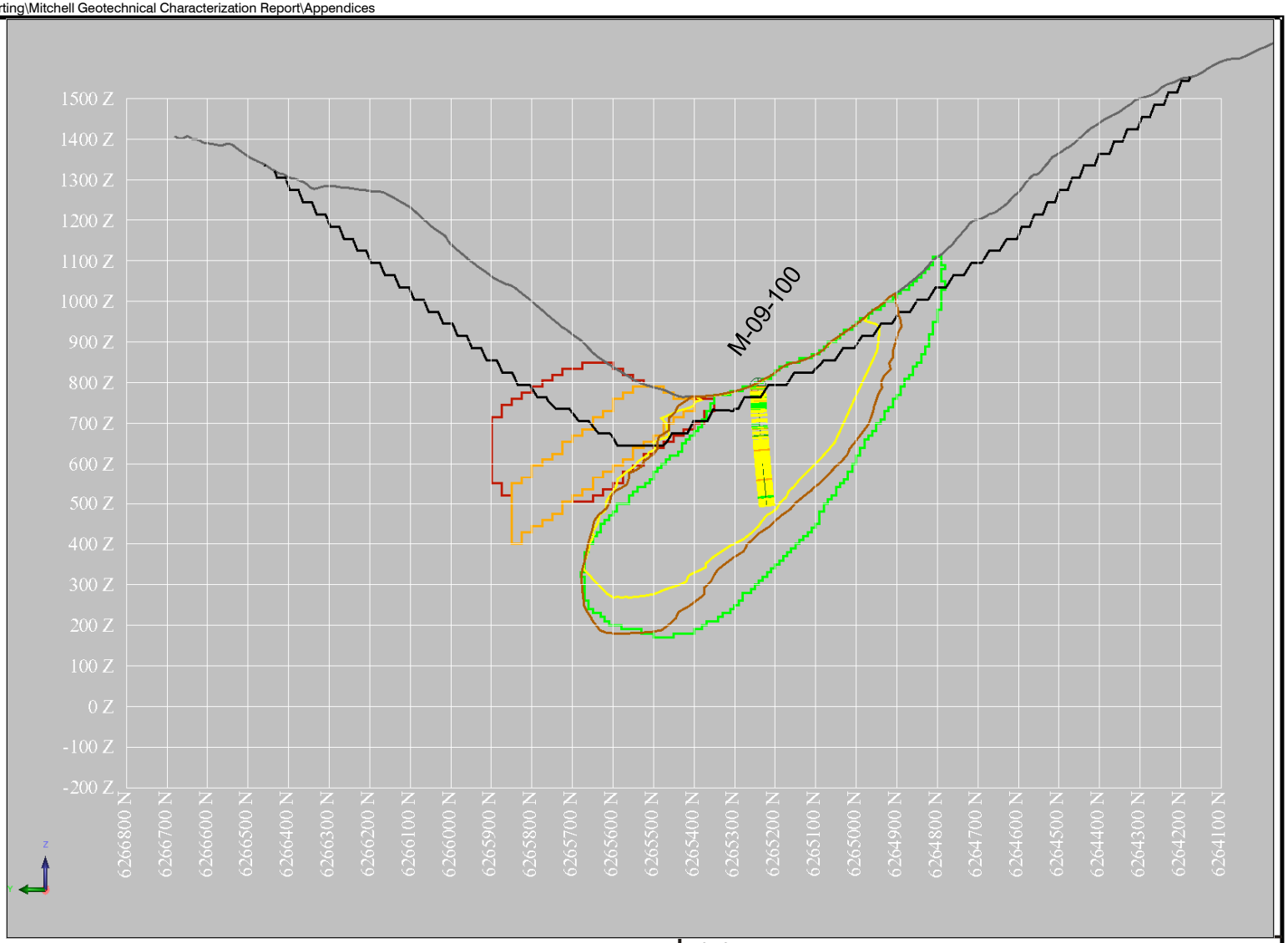
MITCHELL - 422200 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-2**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

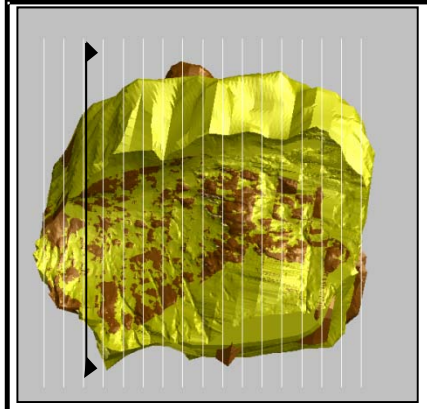
MITCHELL - 422300 EASTING ISRM ROCK STRENGTH

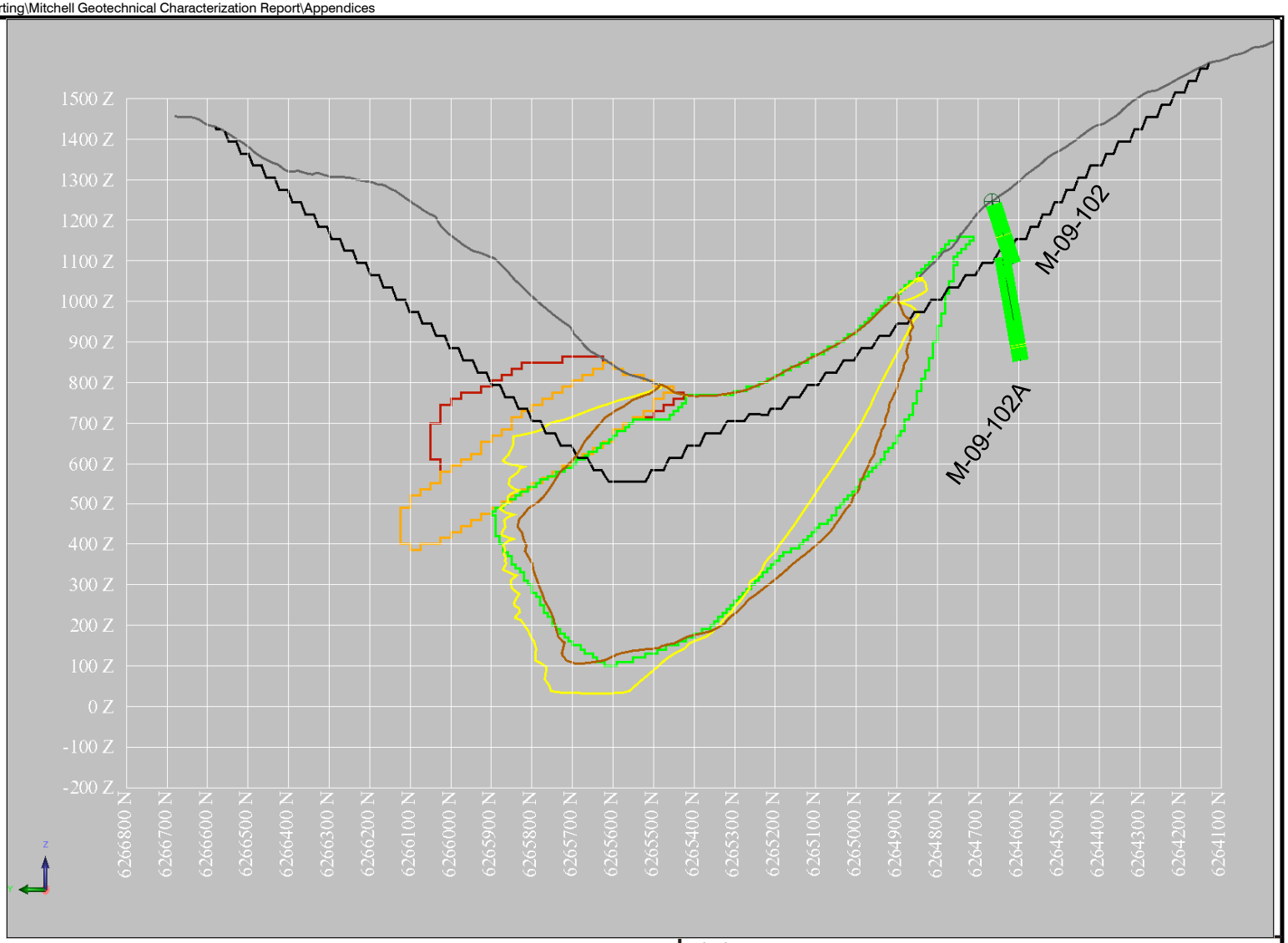
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-3

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

- R6
- R5
- R4
- R3
- R2
- R1
- R0

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

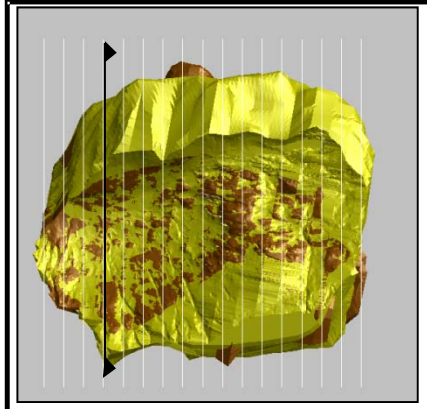
MITCHELL - 422400 EASTING ISRM ROCK STRENGTH

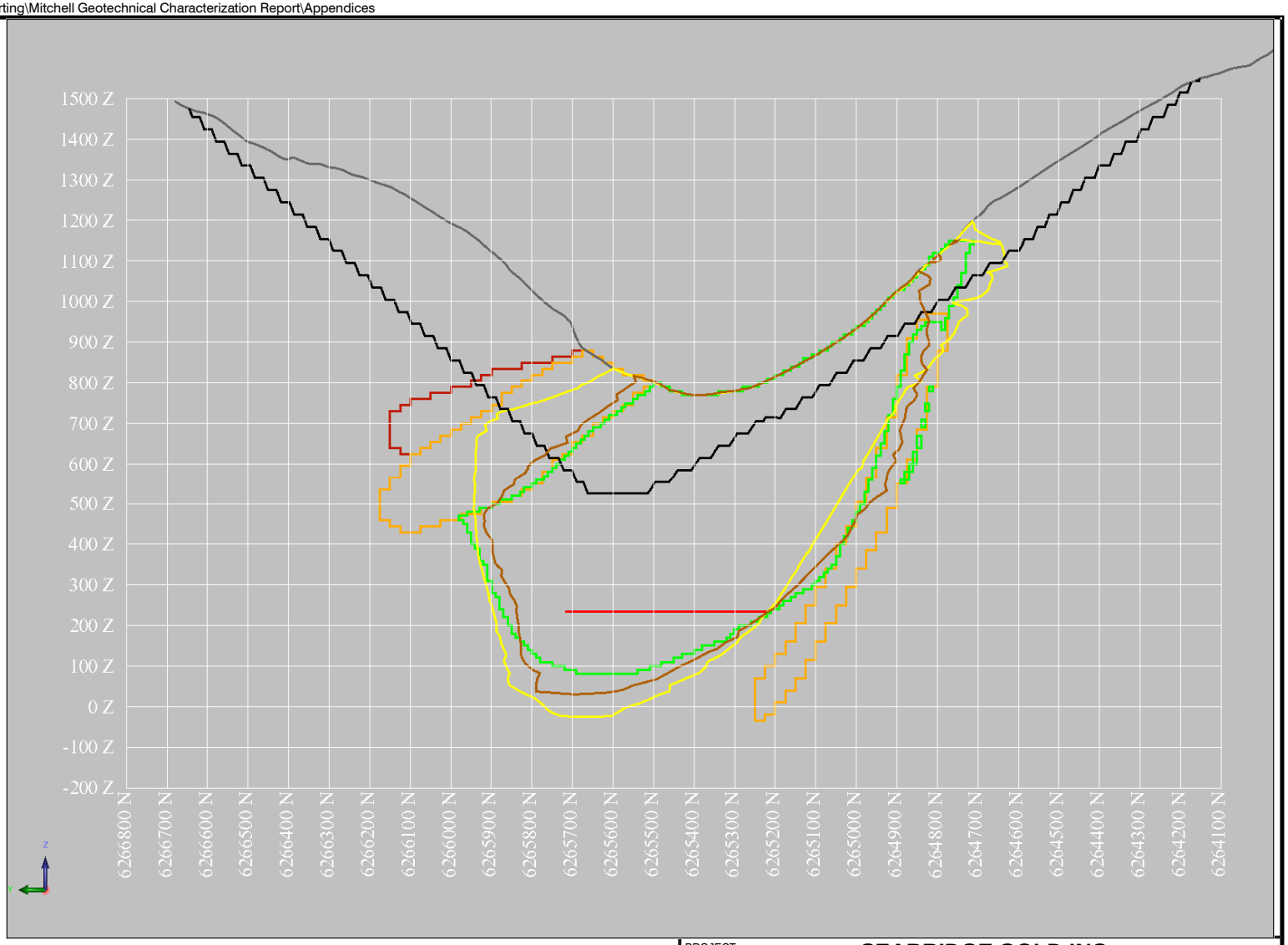
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE C-4

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

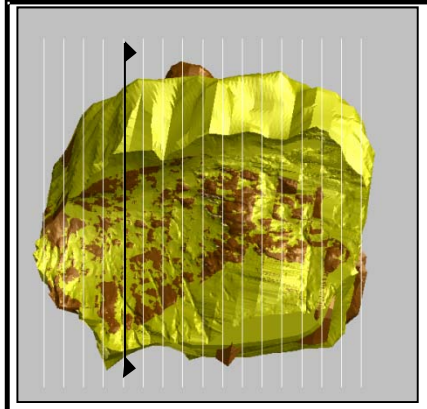
TITLE

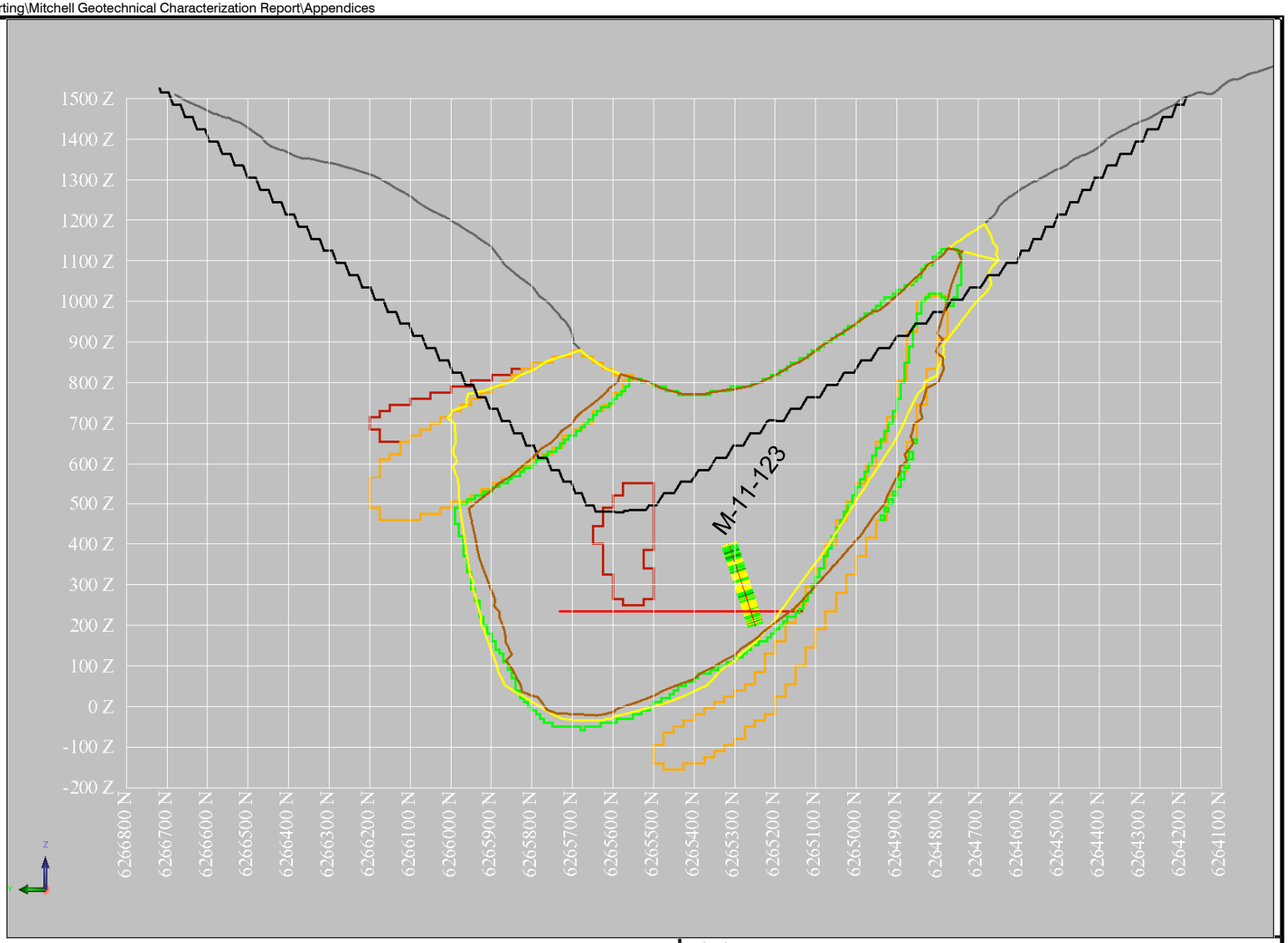
MITCHELL - 422500 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-5**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

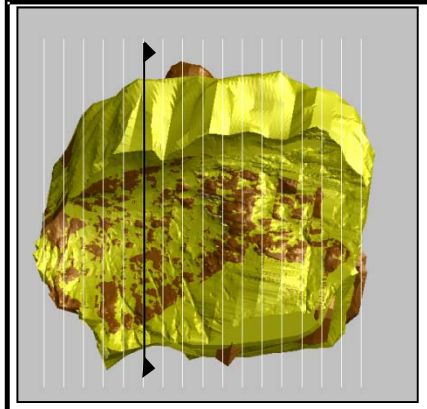
MITCHELL - 422600 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-6

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

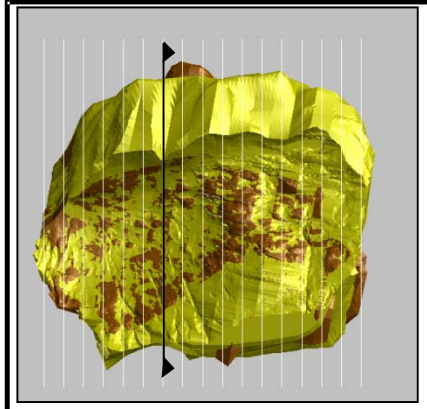
TITLE

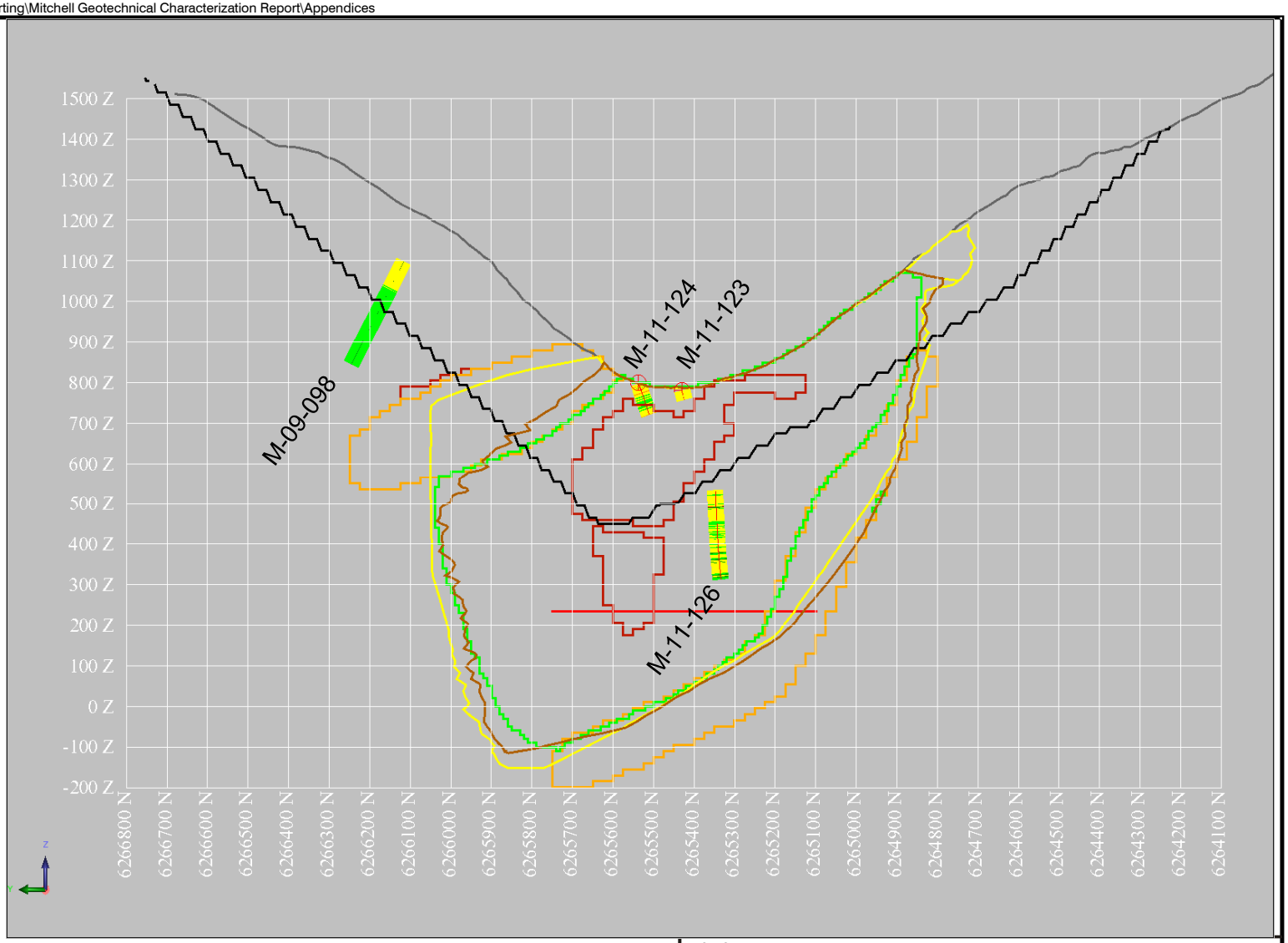
MITCHELL - 422700 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-7**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

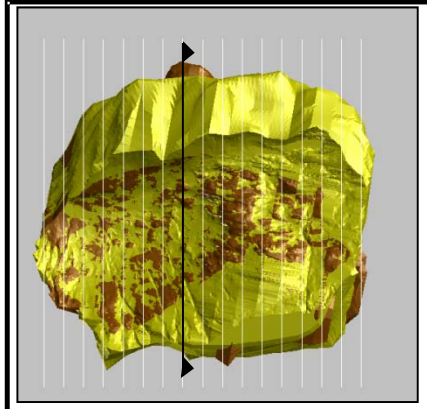
MITCHELL - 422800 EASTING ISRM ROCK STRENGTH

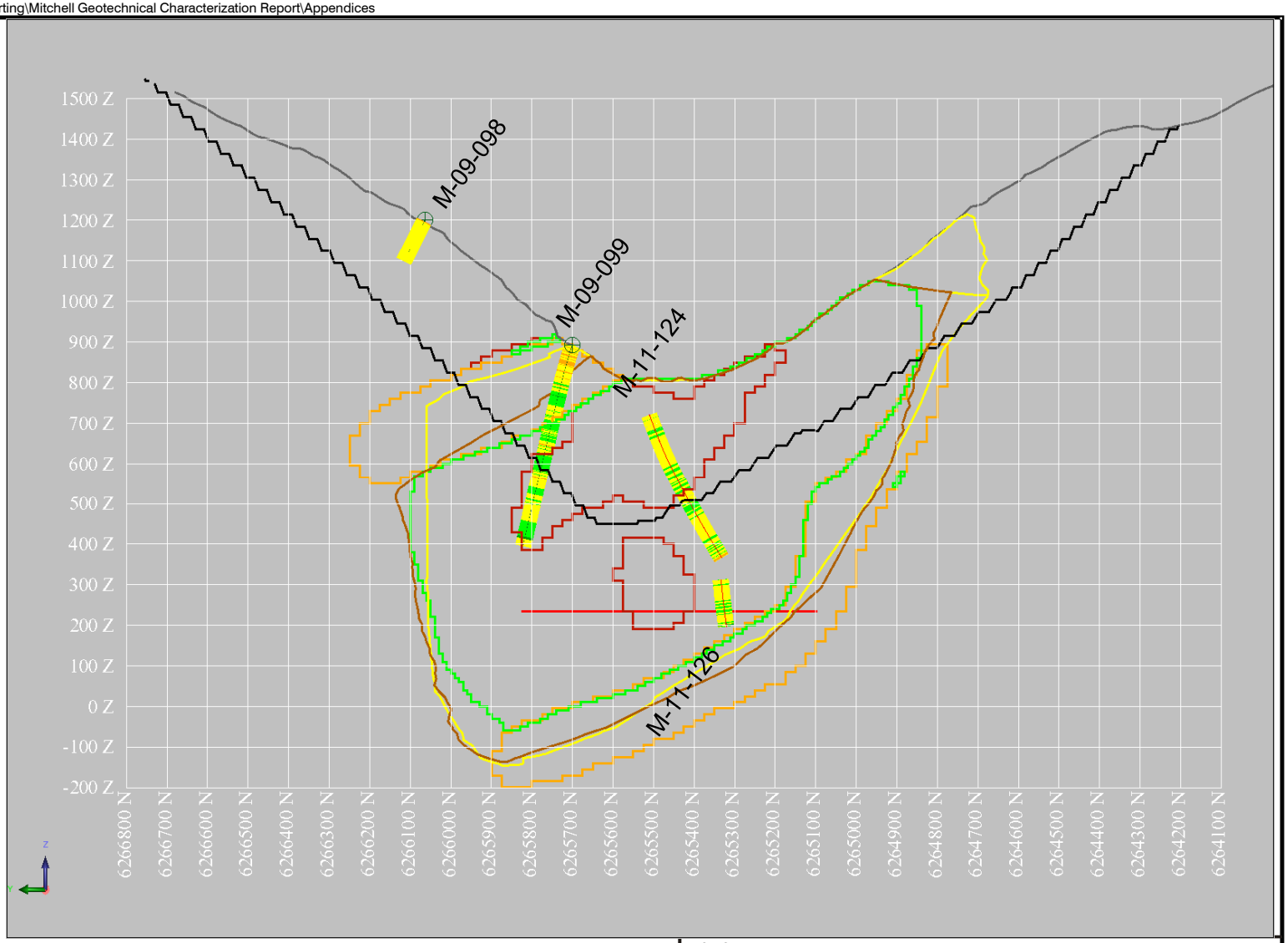
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-8

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

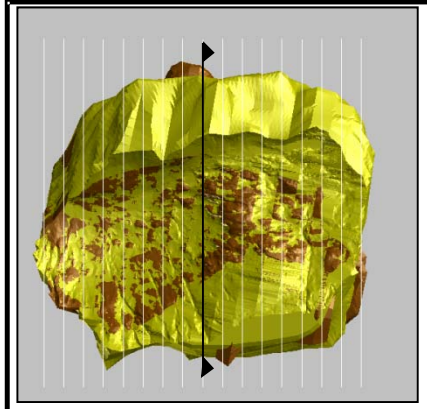
TITLE

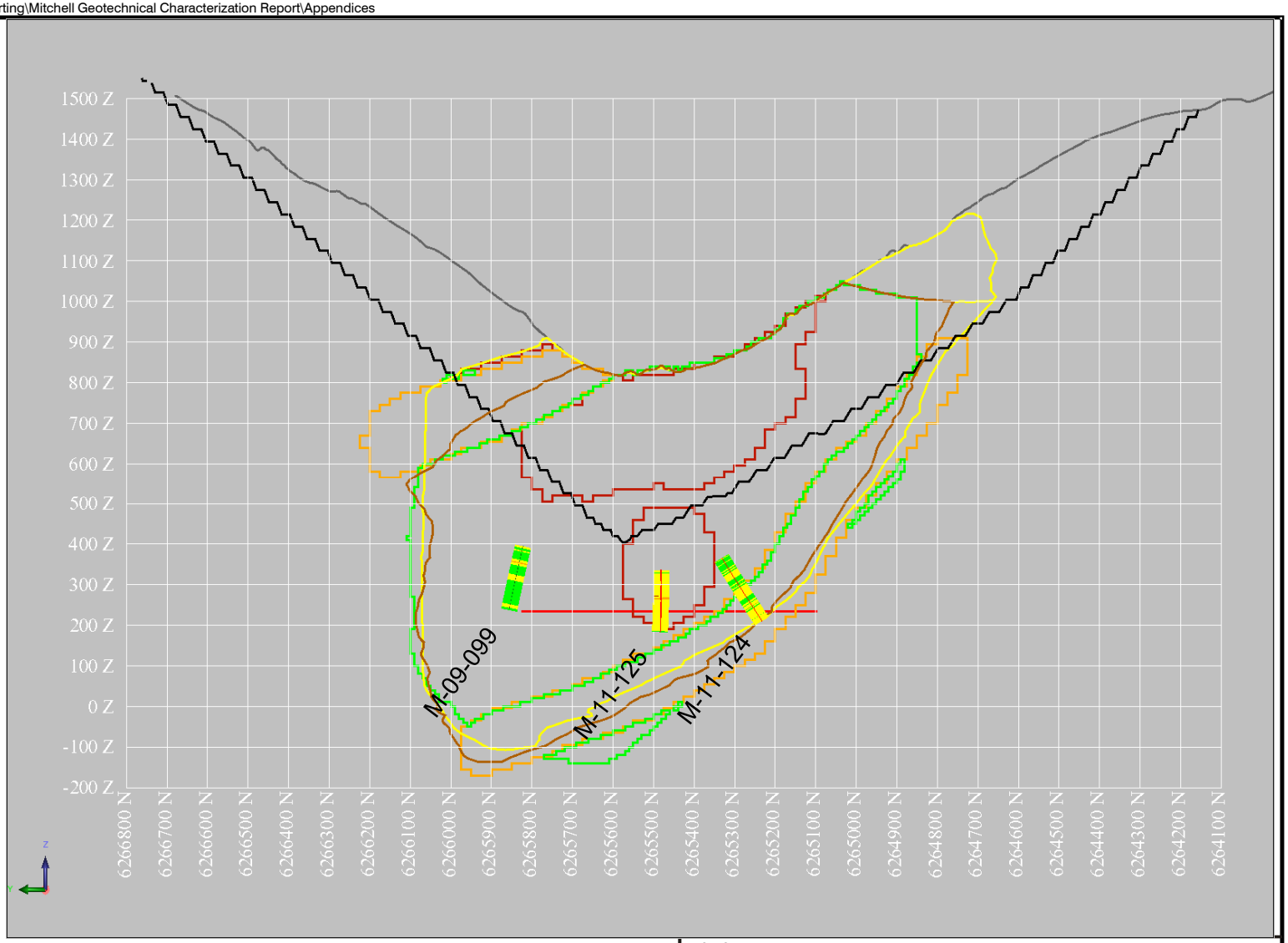
MITCHELL - 422900 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-9**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

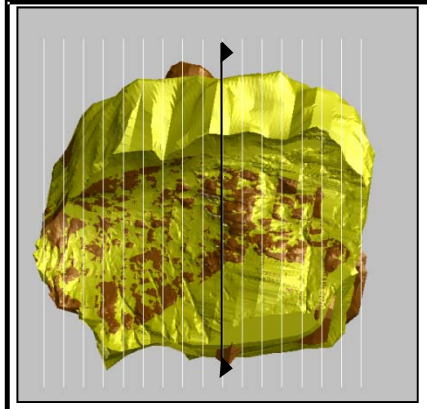
MITCHELL - 423000 EASTING ISRM ROCK STRENGTH

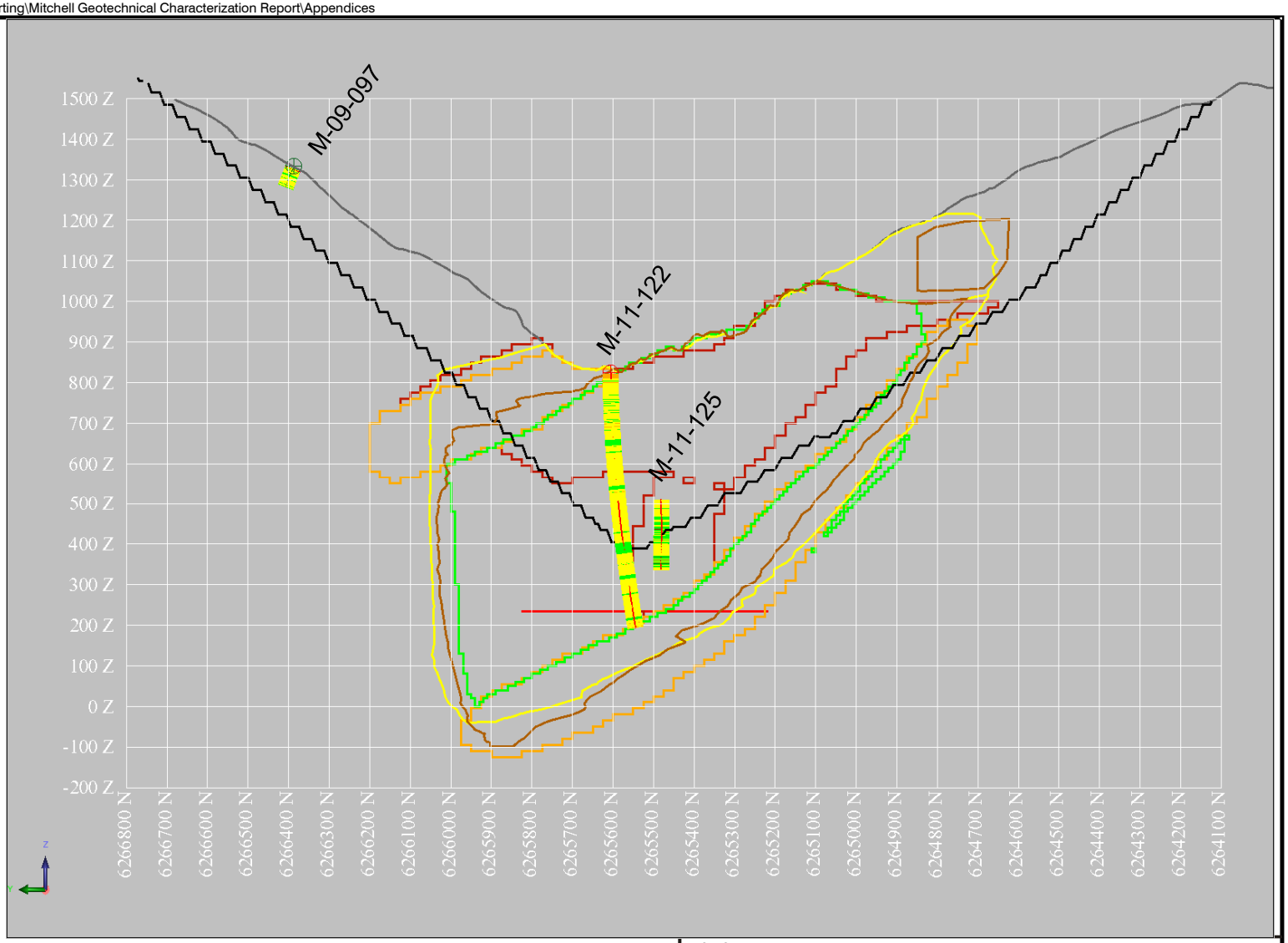
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-10

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

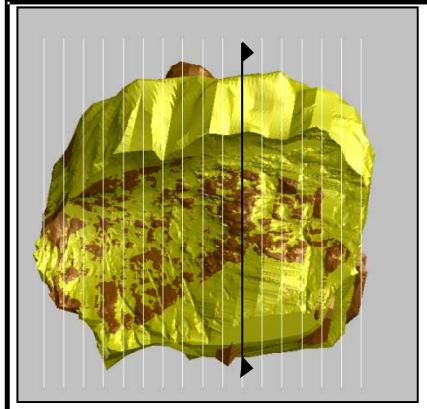
MITCHELL - 423100 EASTING ISRM ROCK STRENGTH

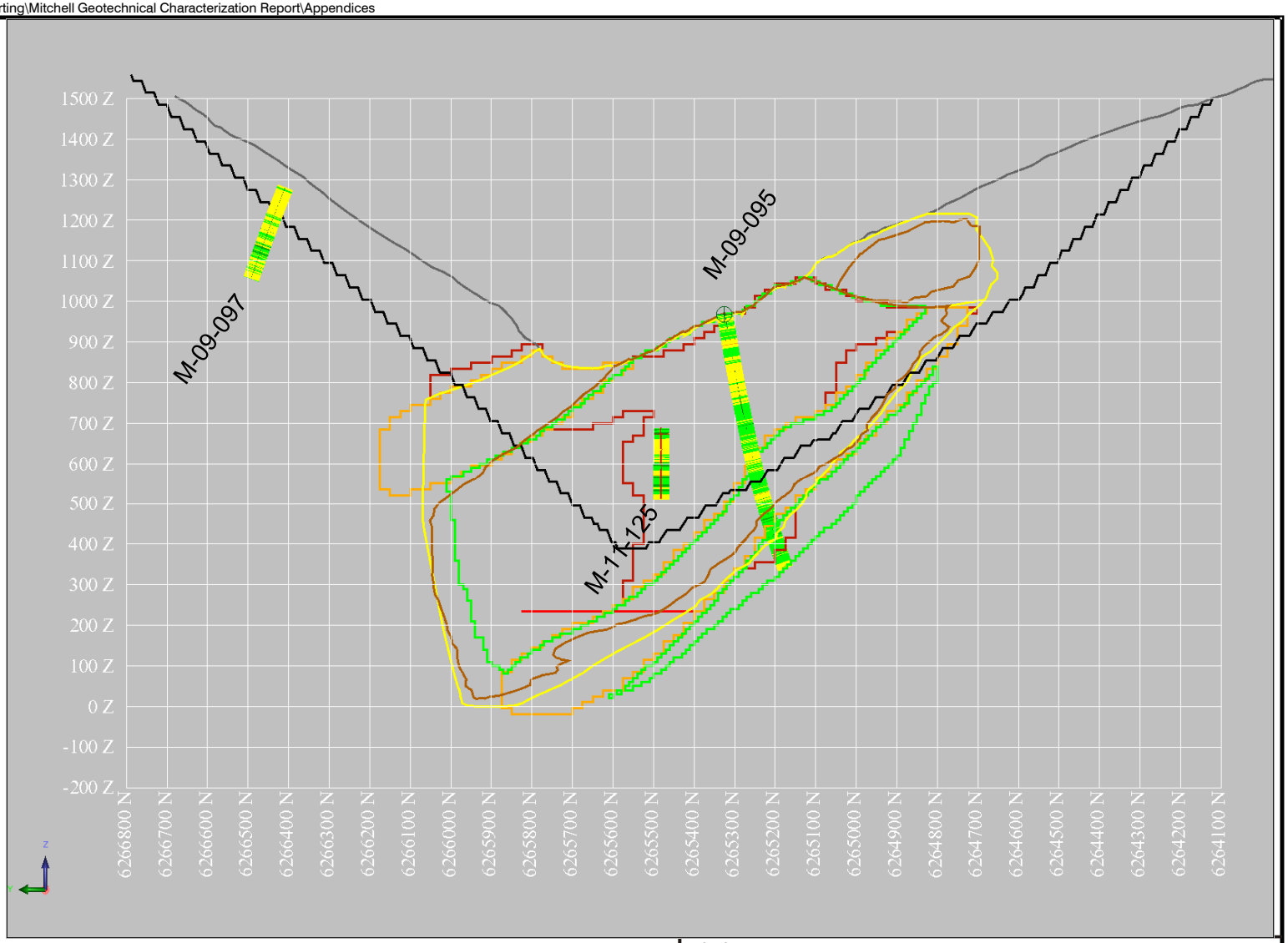
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-11

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

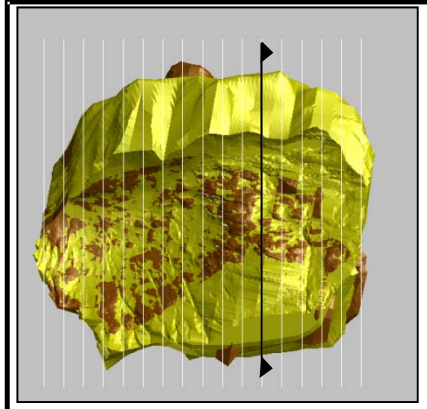
TITLE

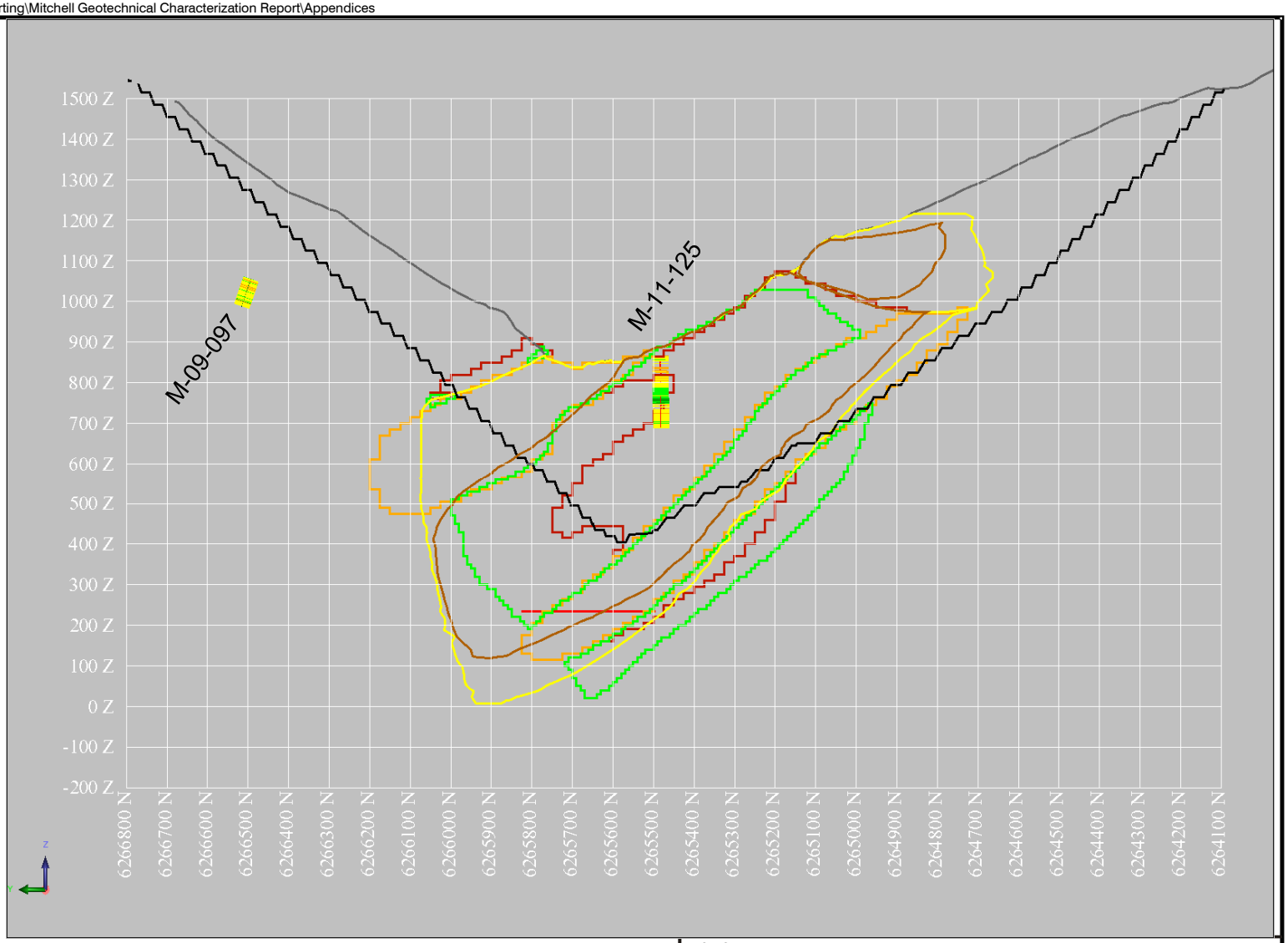
MITCHELL - 423200 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-12**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

- R6
- R5
- R4
- R3
- R2
- R1
- R0

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

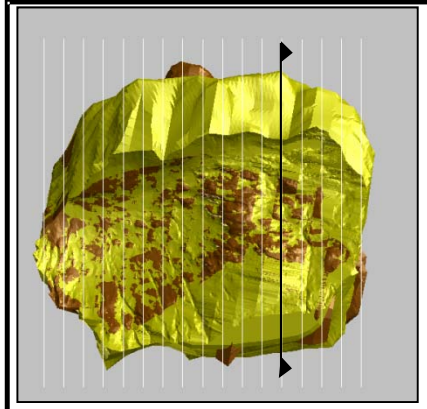
MITCHELL - 423300 EASTING
ISRM ROCK STRENGTH

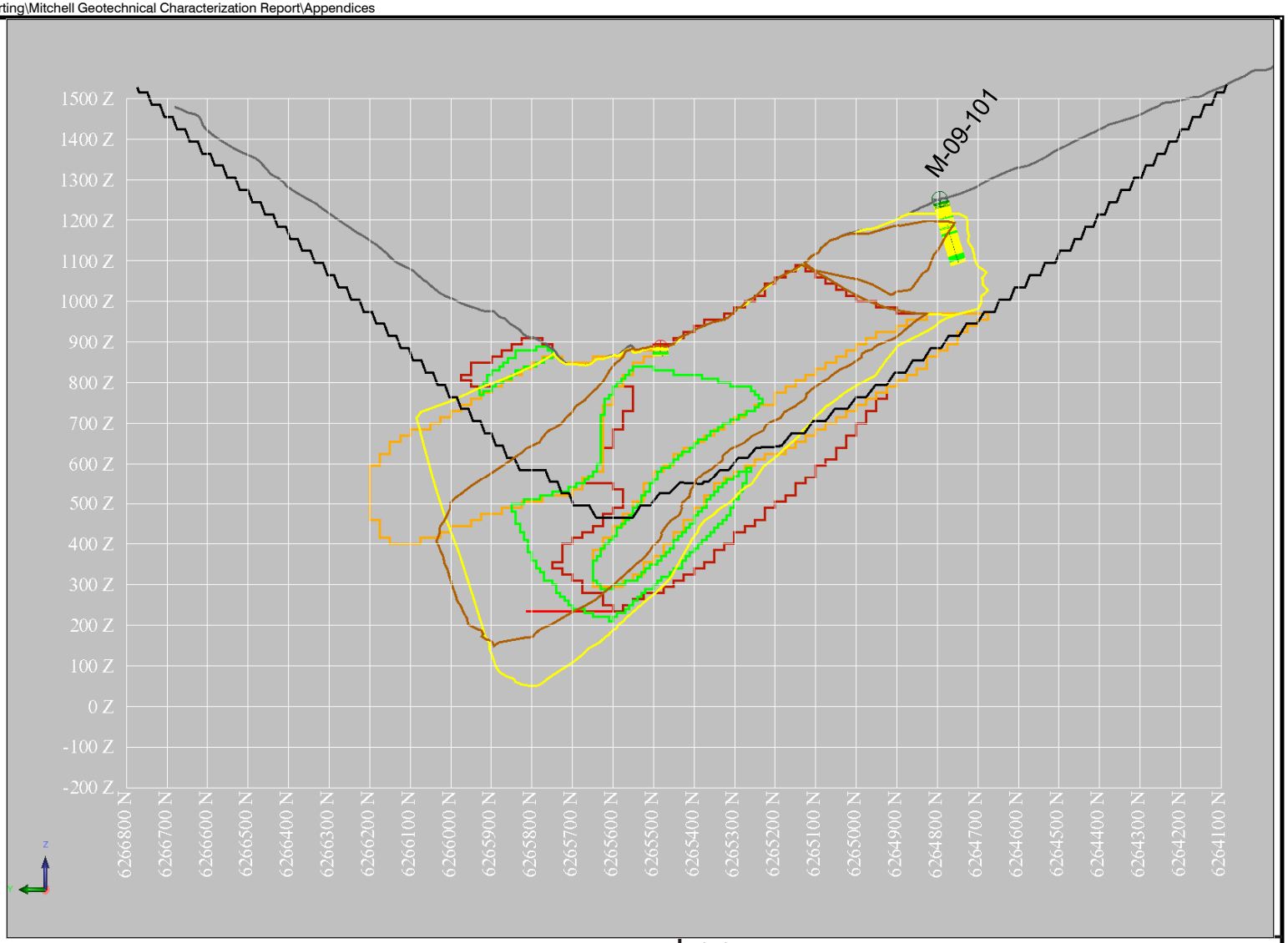
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-13

O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

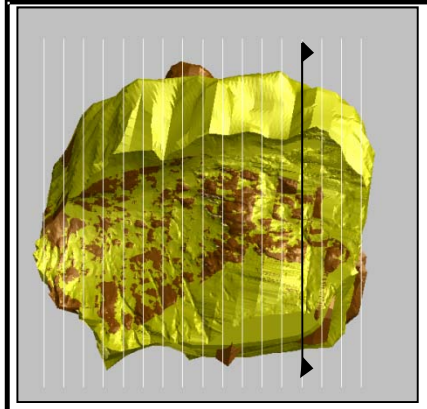
TITLE

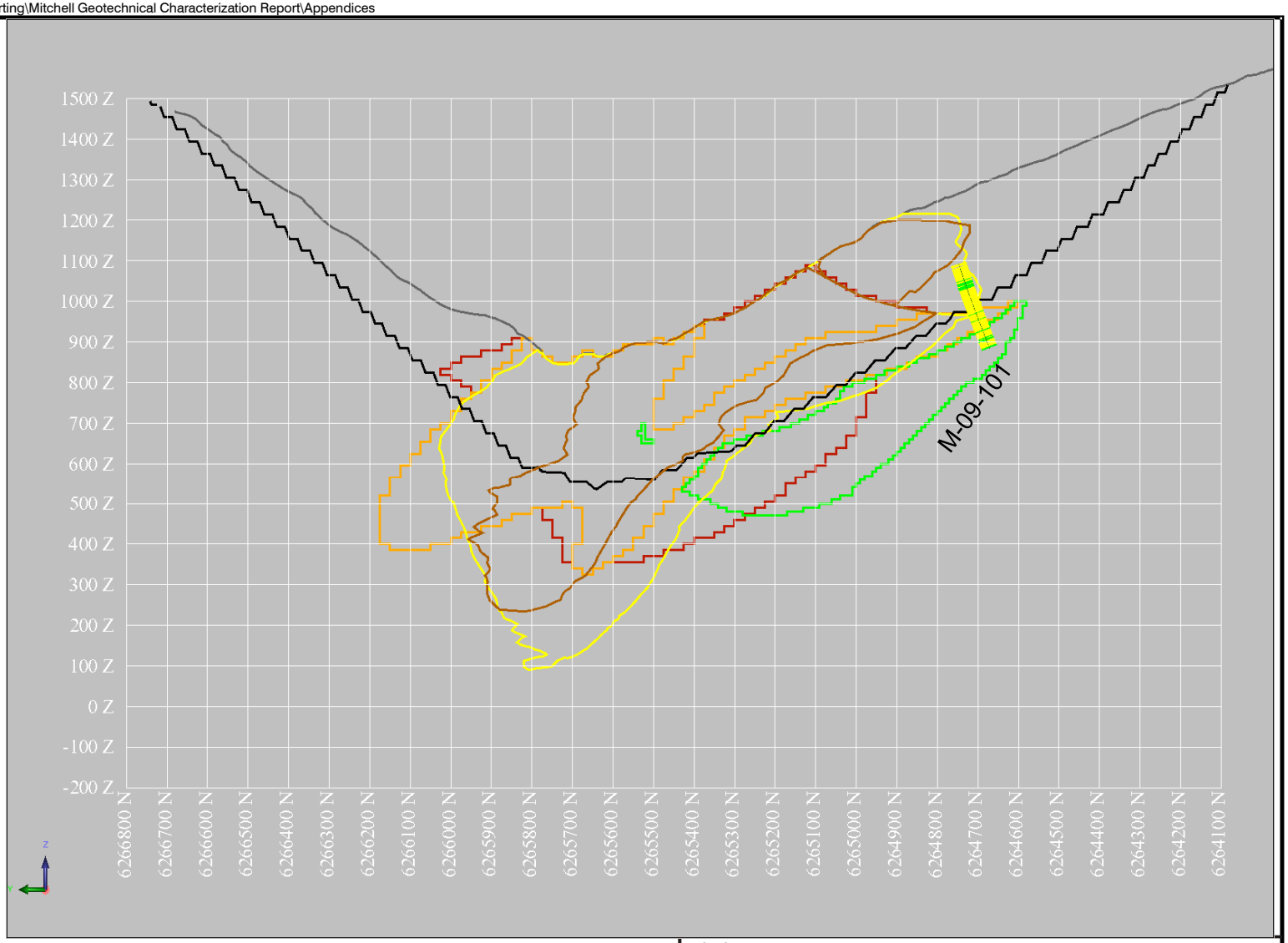
MITCHELL - 423400 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-14**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

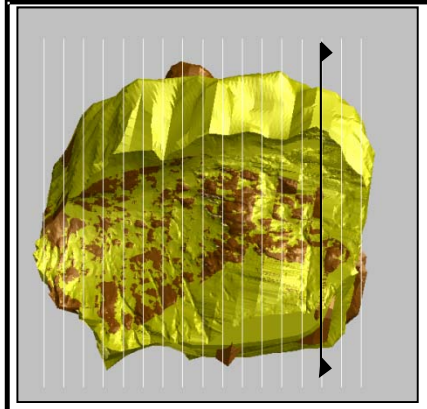
MITCHELL - 423500 EASTING ISRM ROCK STRENGTH

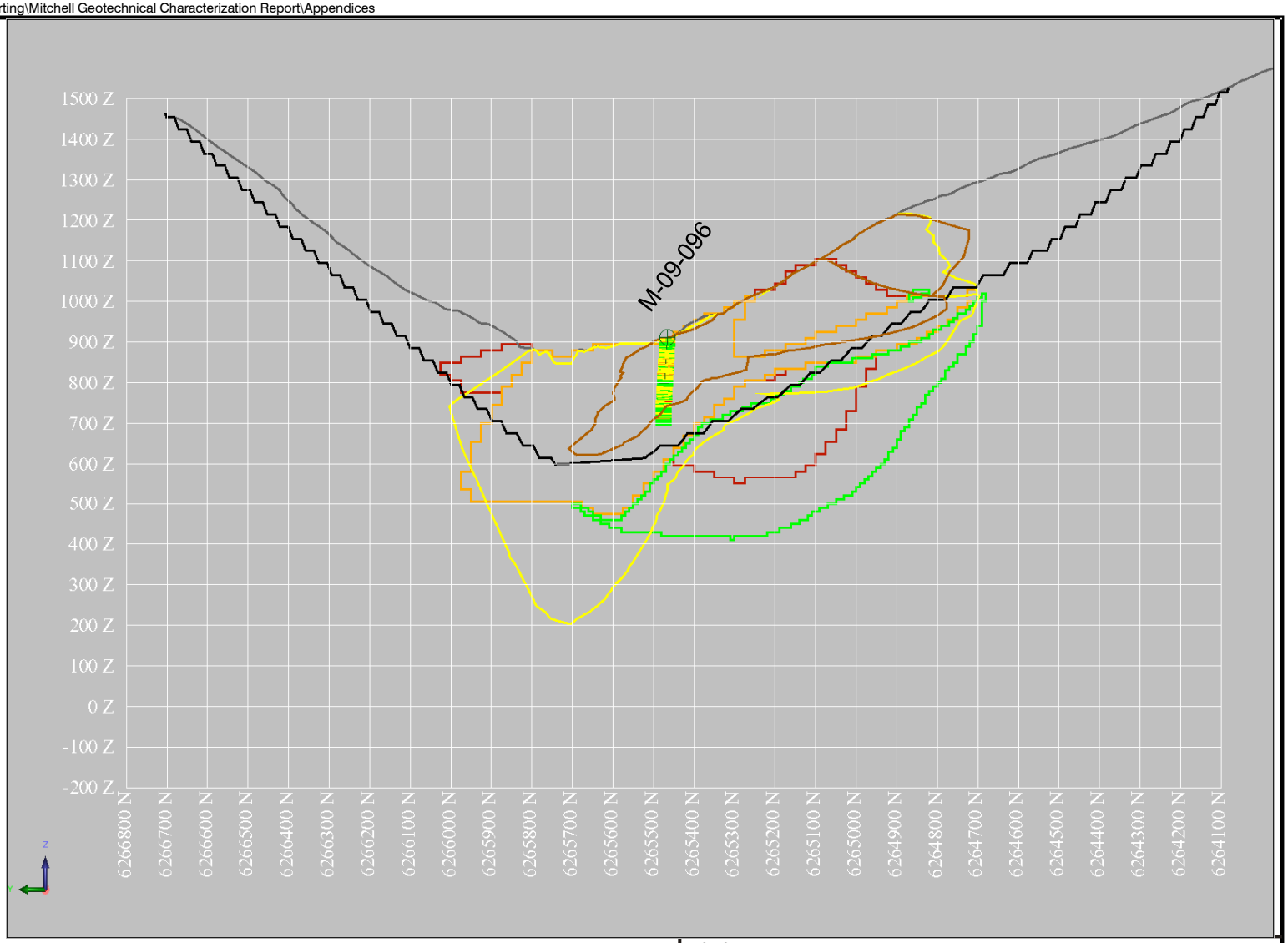
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-15

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

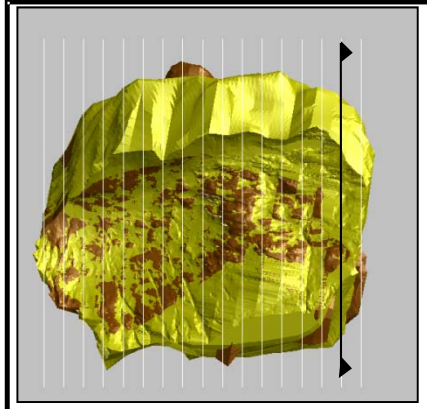
TITLE

MITCHELL - 423600 EASTING
ISRM ROCK STRENGTH

Golder Associates

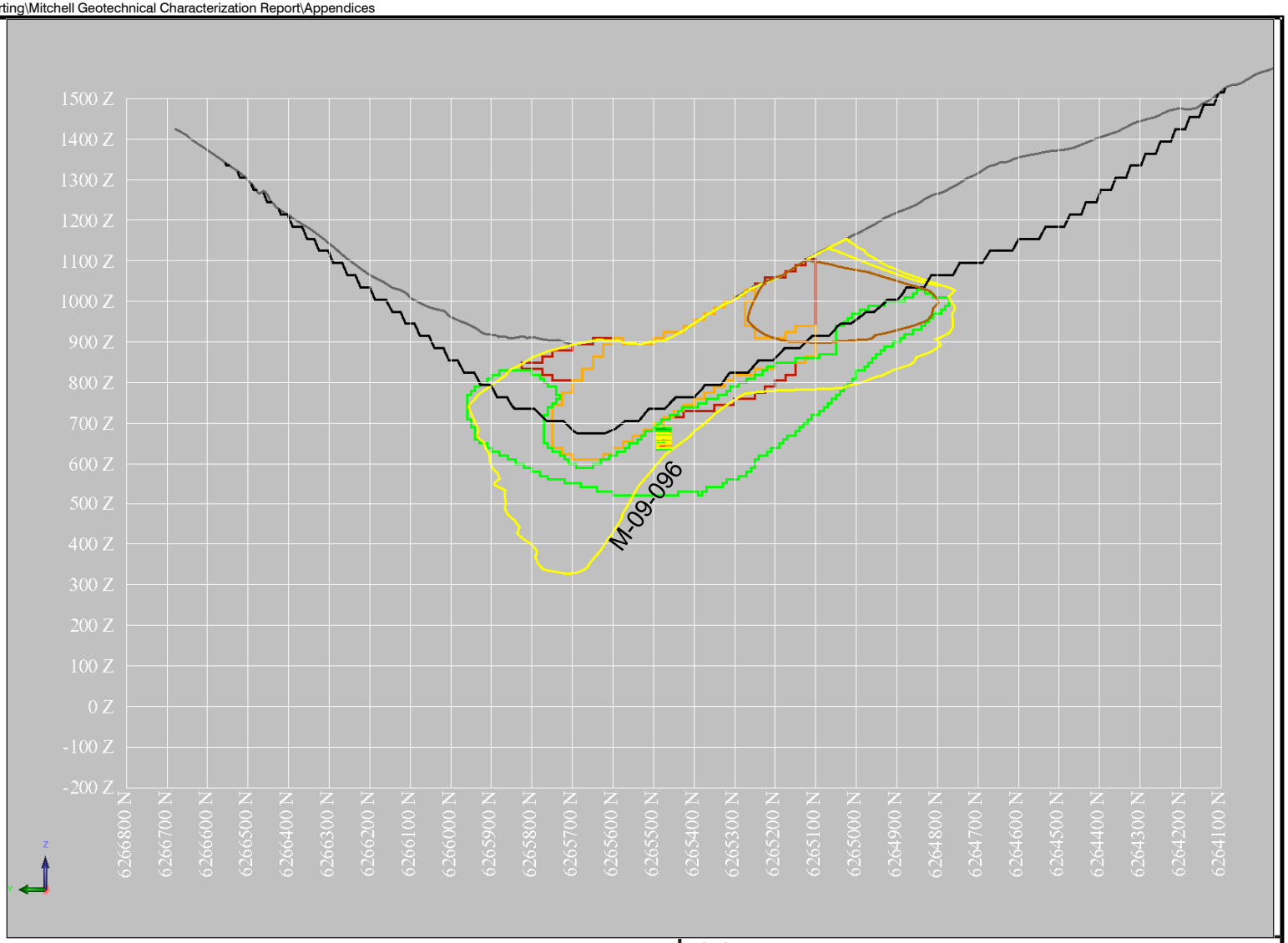
PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11	**FIGURE C-16**	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT



ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

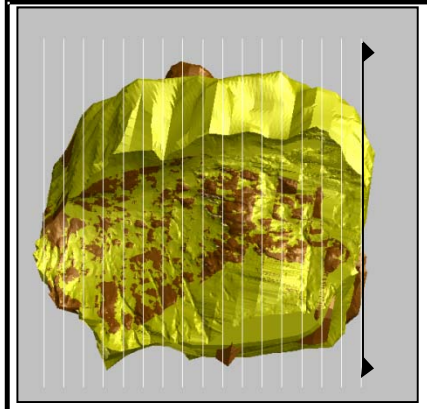
TITLE

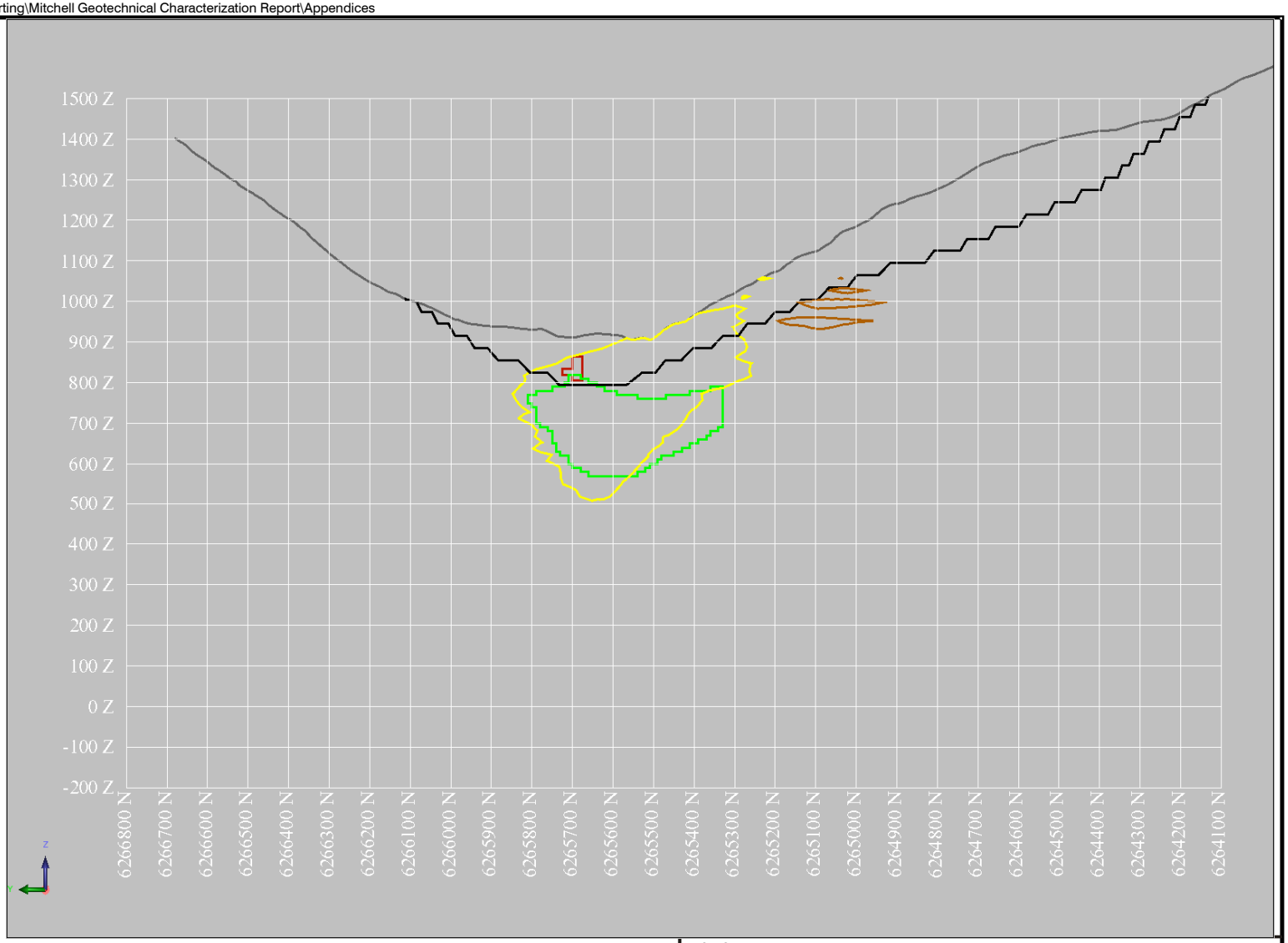
MITCHELL - 423700 EASTING ISRM ROCK STRENGTH

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	15DEC11	SCALE NTS		REV.0
CADD	CY	15DEC11	**FIGURE C-17**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

ISRM

R6	R2
R5	R1
R4	R0
R3	

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

MITCHELL - 423800 EASTING ISRM ROCK STRENGTH

Golder Associates

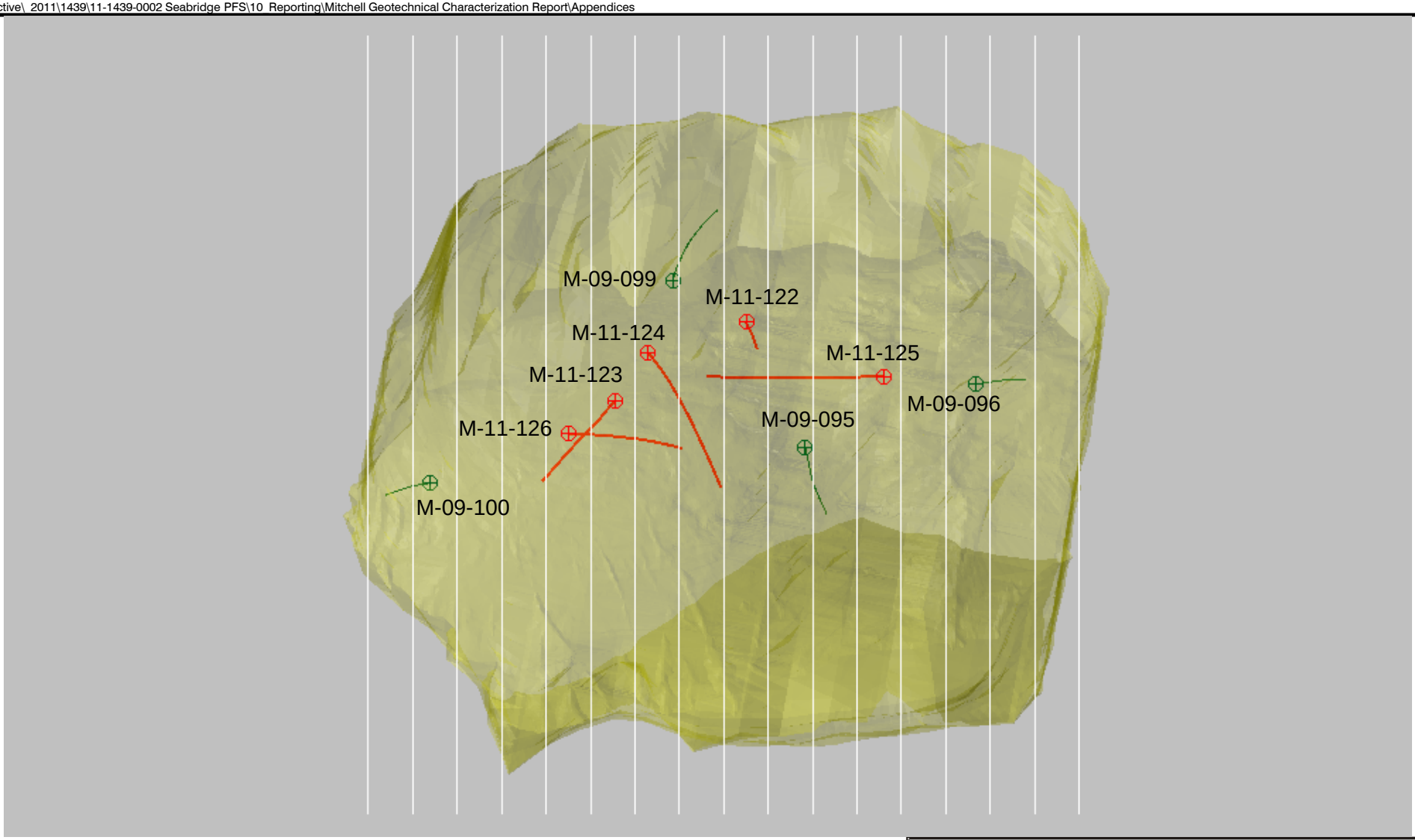
PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	15DEC11	SCALE NTS	REV.0
CADD	CY	15DEC11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE C-18

APPENDIX D

Cross Sections Showing Alteration Type and Fracture Frequency

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

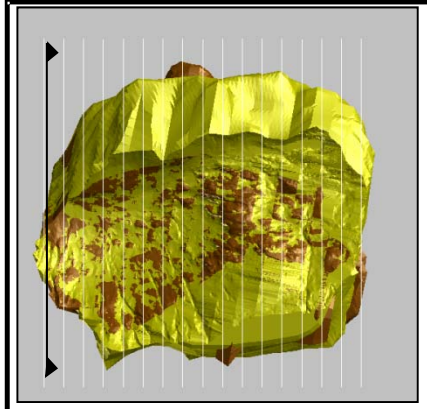
MITCHELL - PLAN
CENTRAL GEOTECHNICAL BOREHOLES

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	12OCT11	SCALE NTS	REV.0
CADD	CY	12OCT11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-1

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

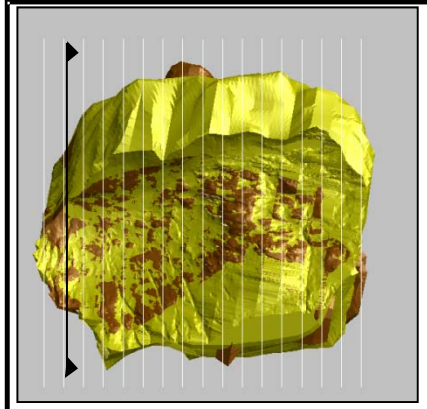
TITLE

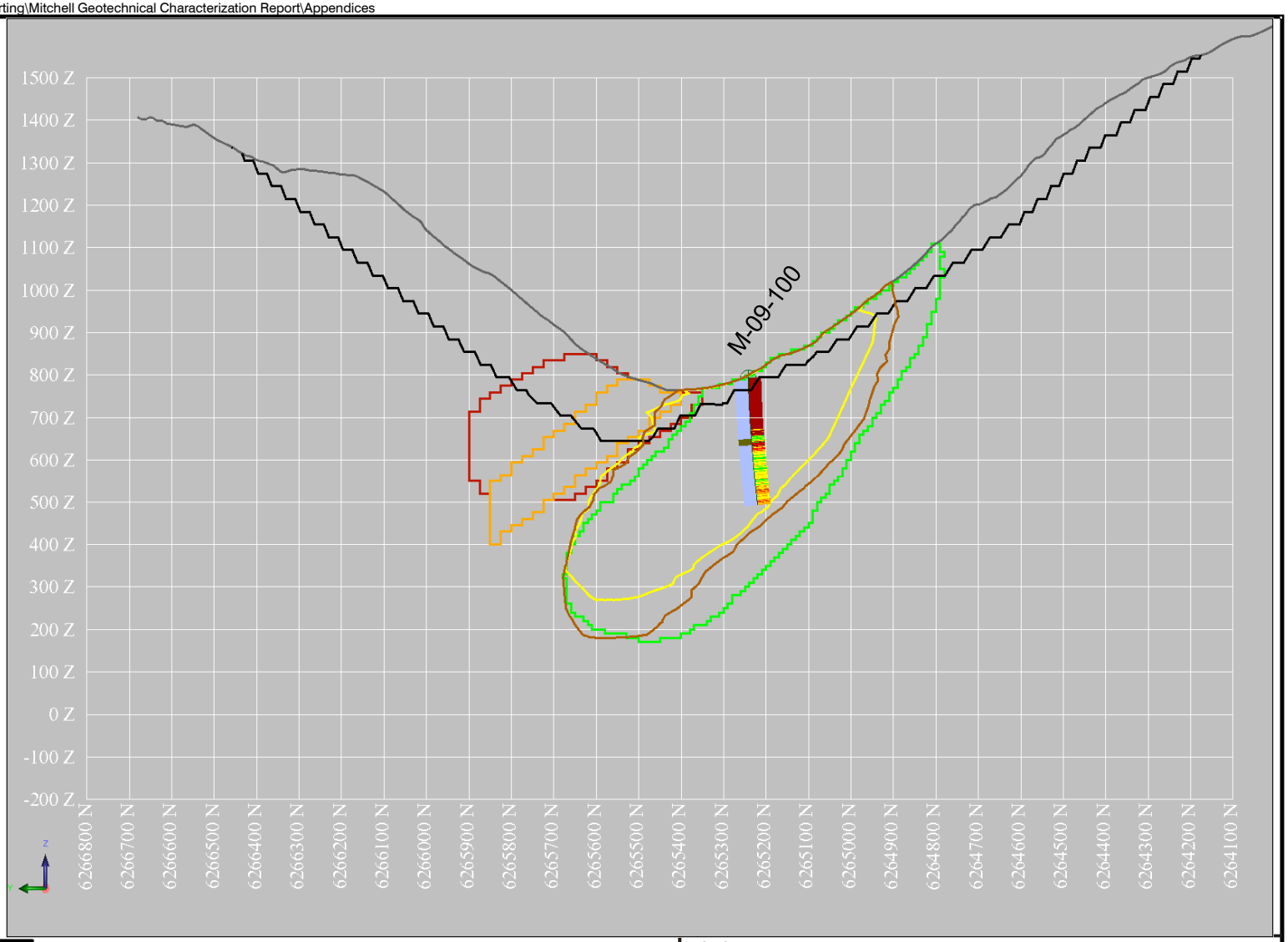
MITCHELL - 422200 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000		
DESIGN	CY	21NOV11	SCALE NTS		REV.0
CADD	CY	21NOV11	**FIGURE D-2**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

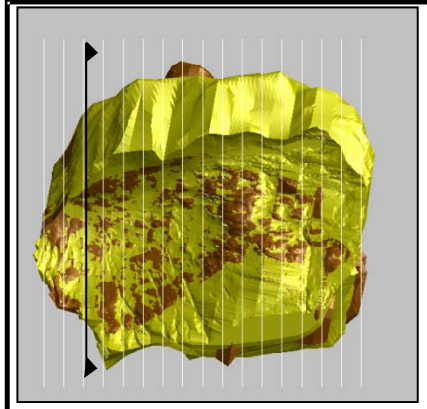
MITCHELL - 422300 EASTING ALTERATION and FRACTURE FREQUENCY

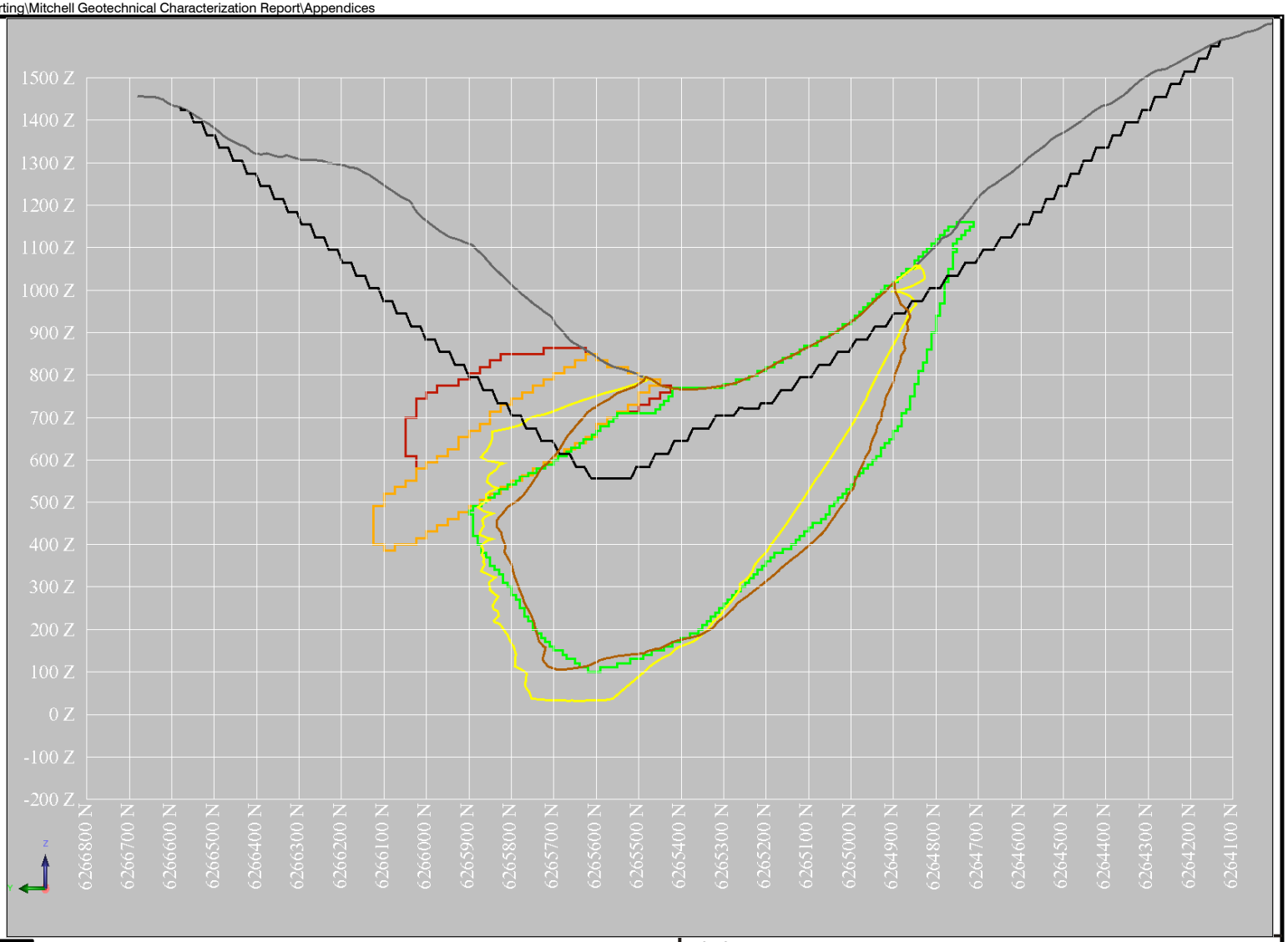
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-3

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

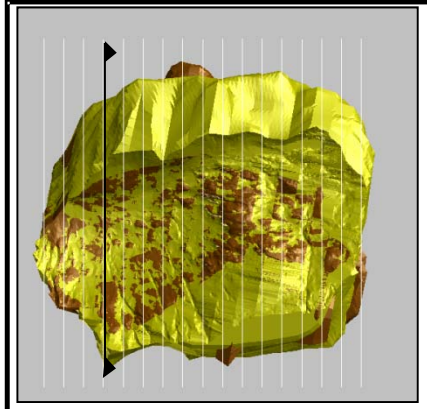
MITCHELL - 422400 EASTING
ALTERATION and FRACTURE FREQUENCY

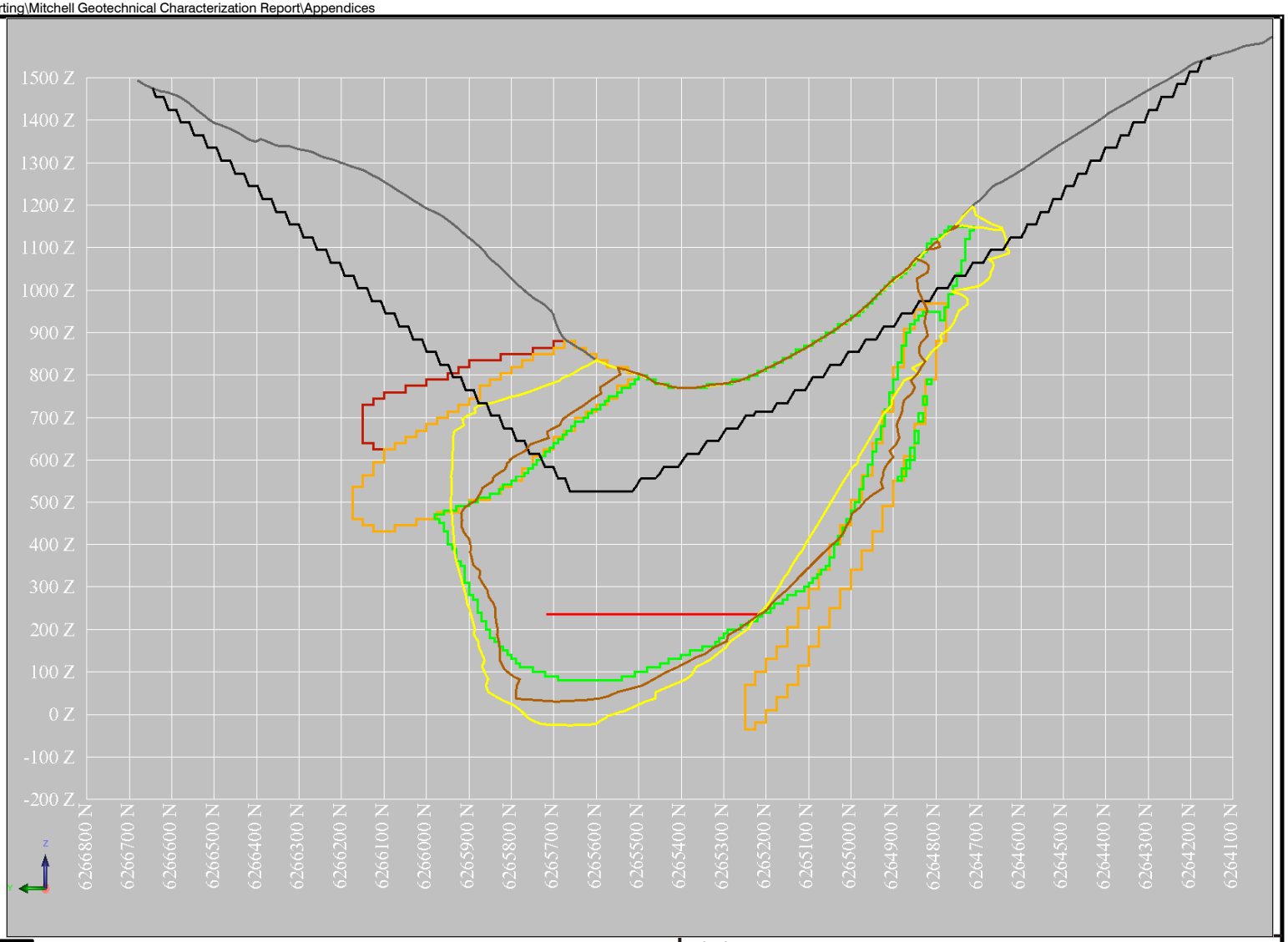
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-4

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

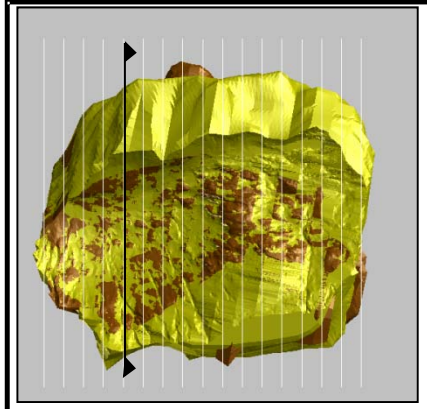
TITLE

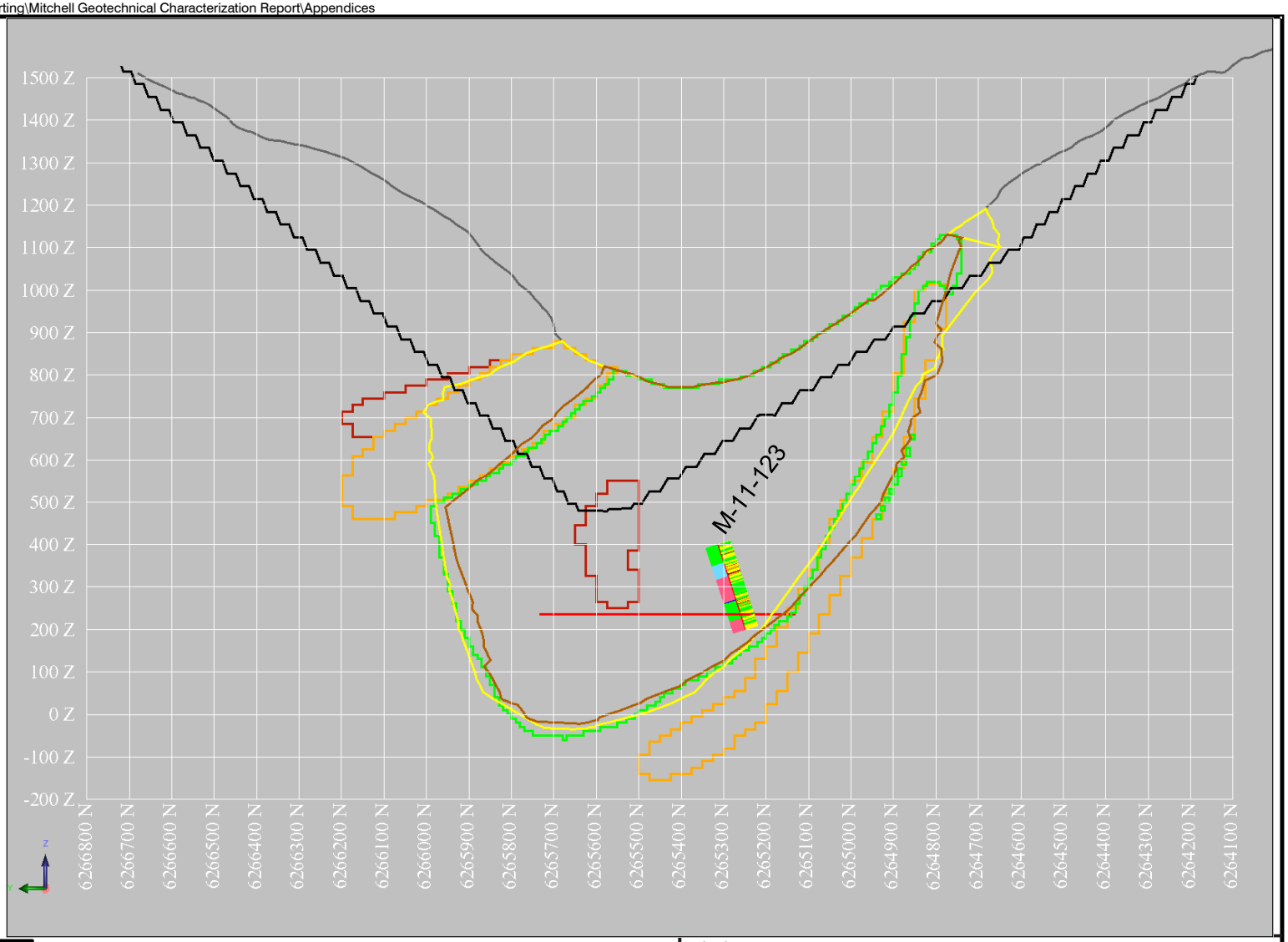
MITCHELL - 422500 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-5	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

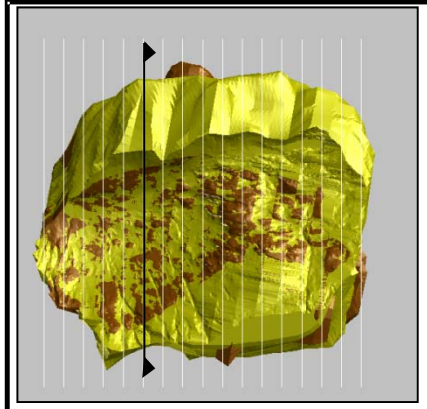
MITCHELL - 422600 EASTING
ALTERATION and FRACTURE FREQUENCY

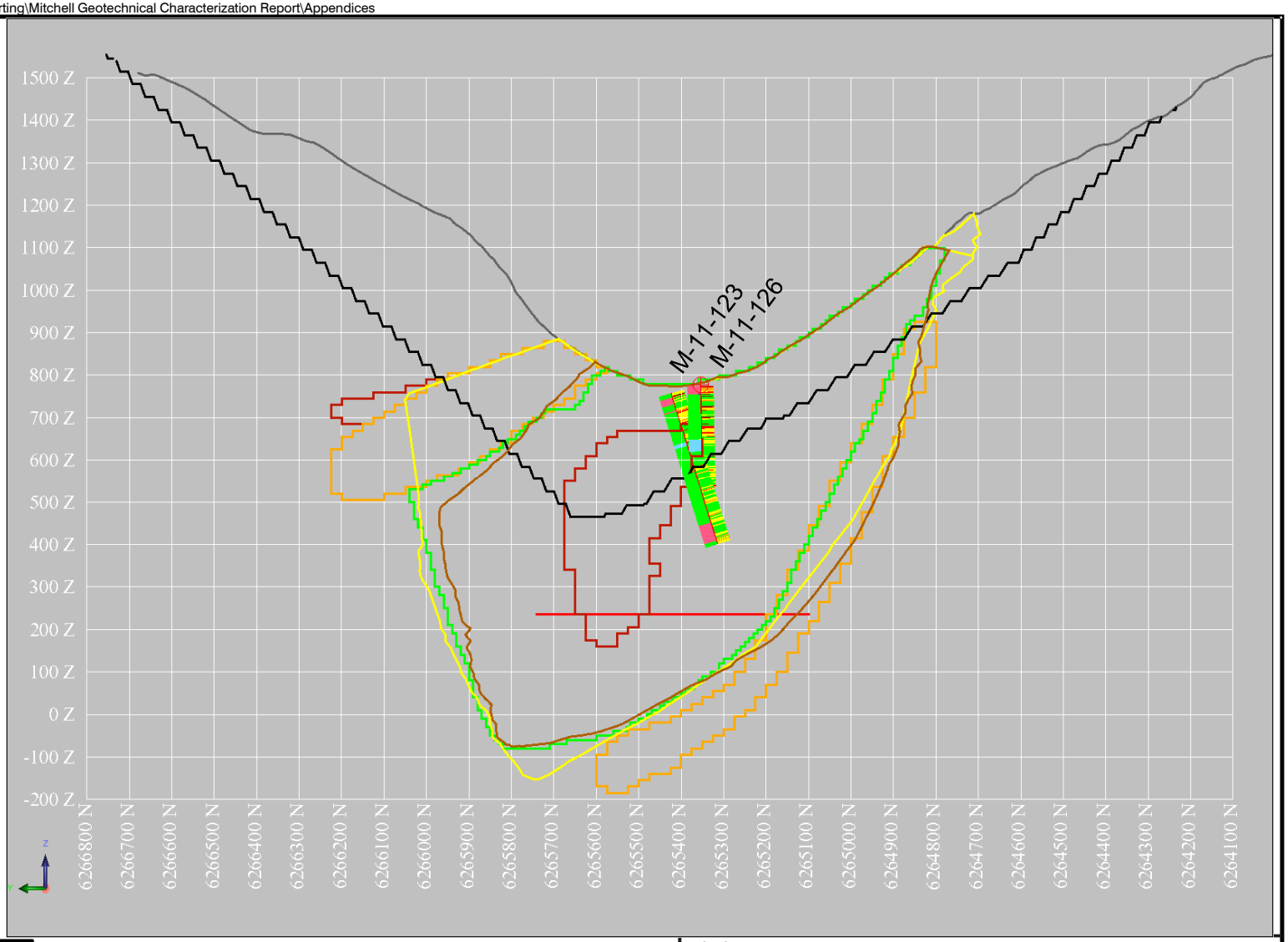
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-6

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

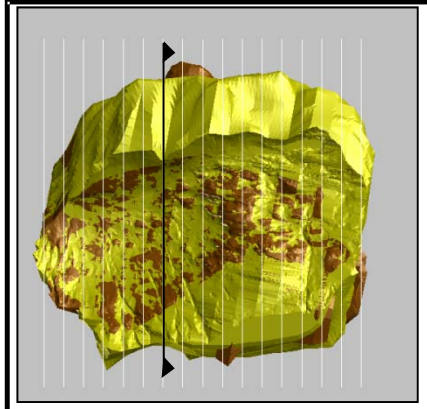
MITCHELL - 422700 EASTING
ALTERATION and FRACTURE FREQUENCY

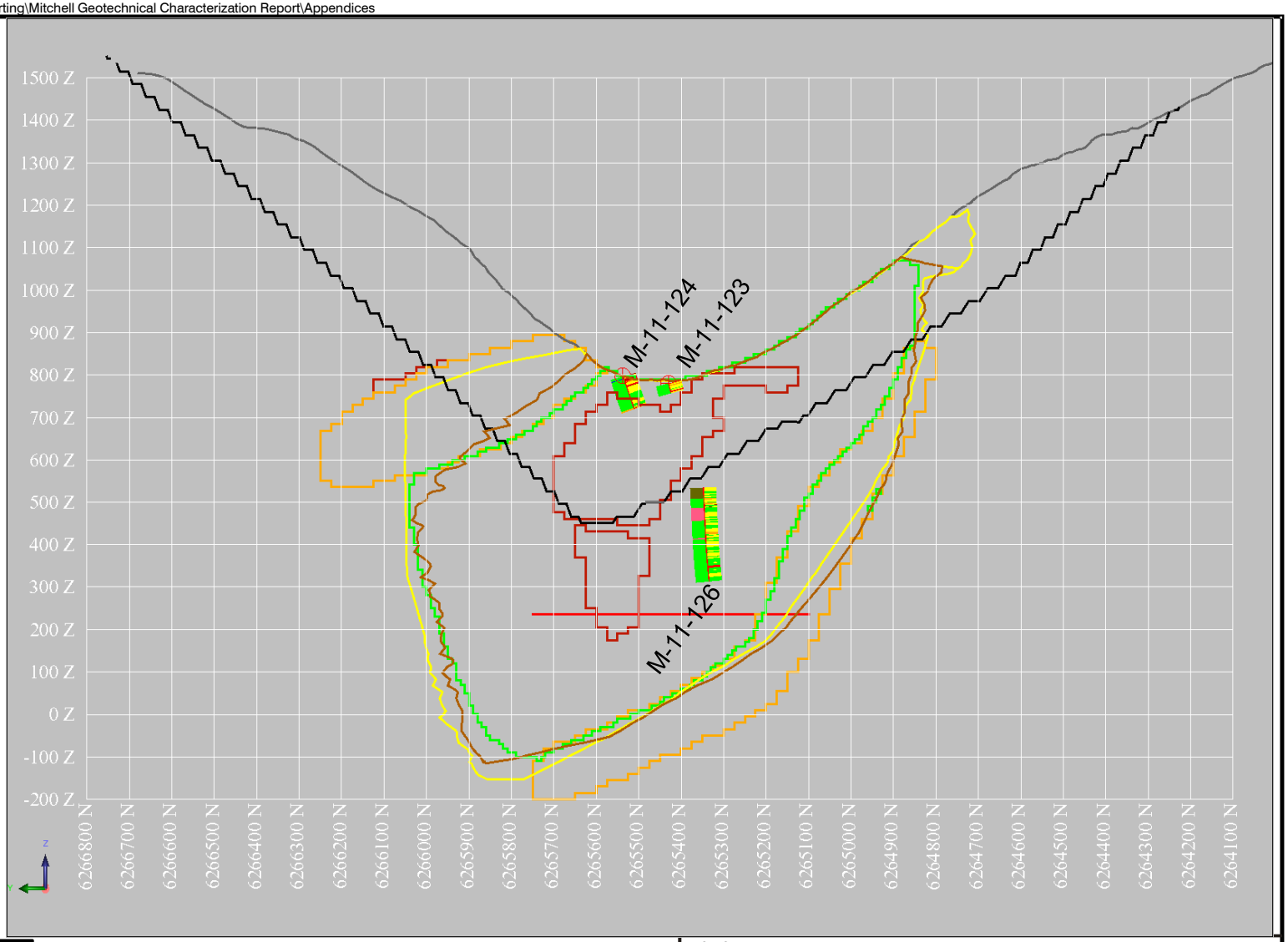
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-7

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

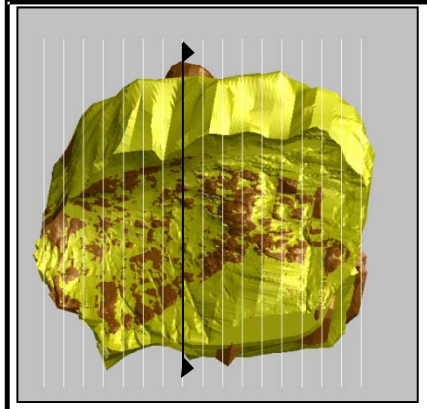
MITCHELL - 422800 EASTING ALTERATION and FRACTURE FREQUENCY

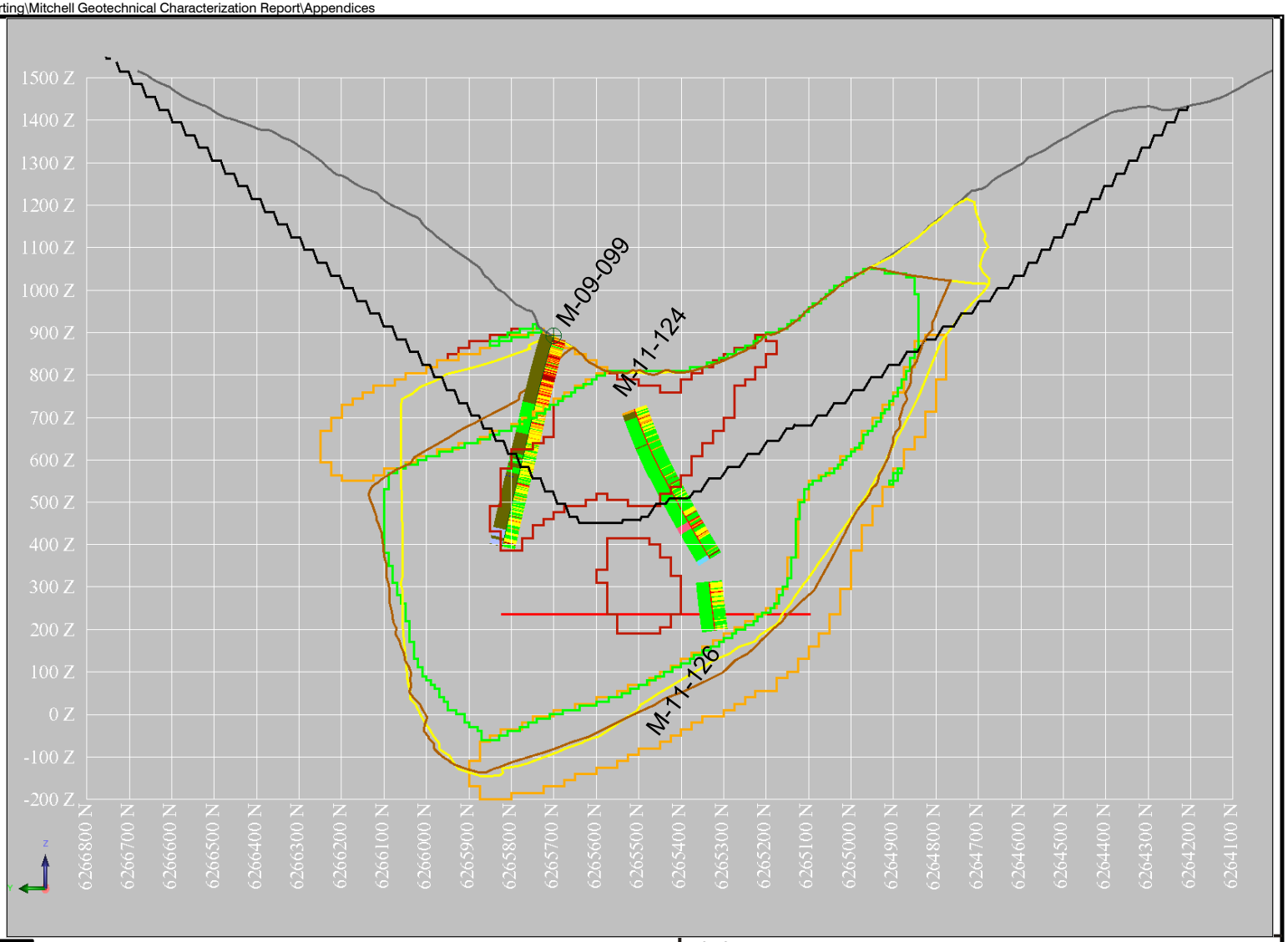
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-8

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

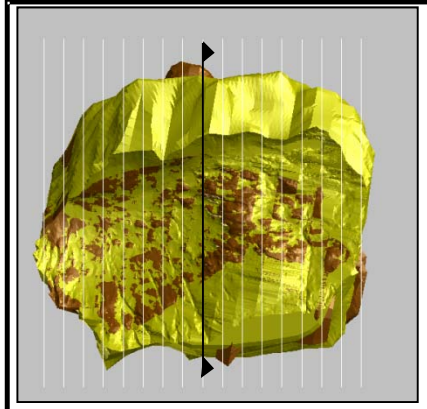
MITCHELL - 422900 EASTING
ALTERATION and FRACTURE FREQUENCY

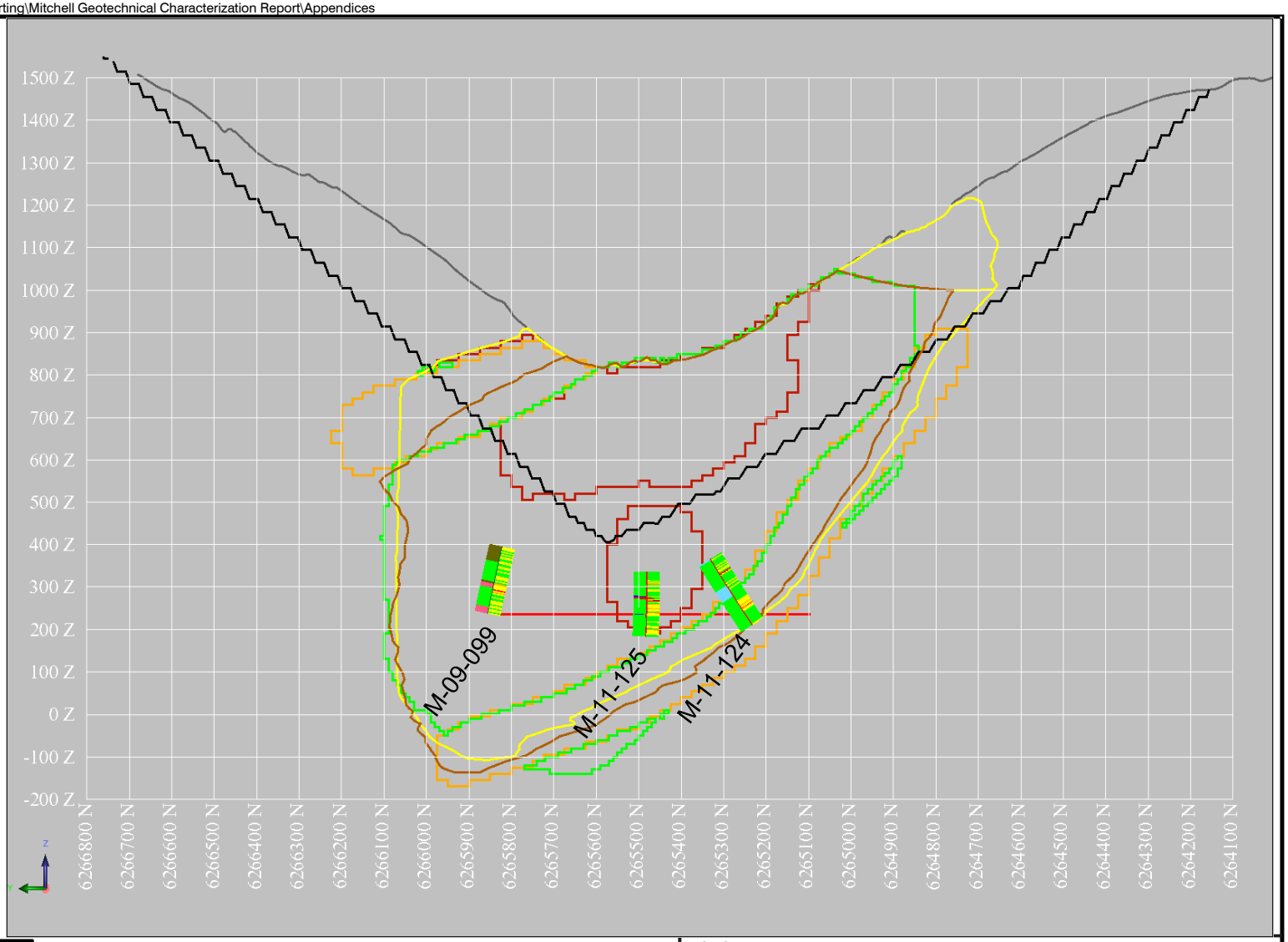
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE D-9

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

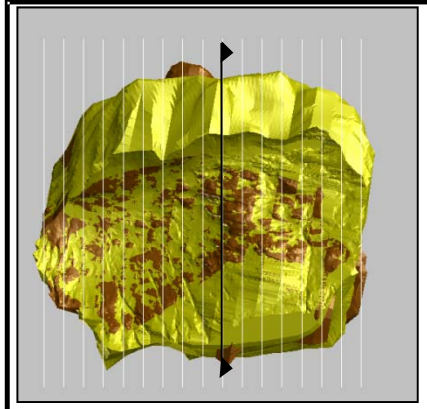
TITLE

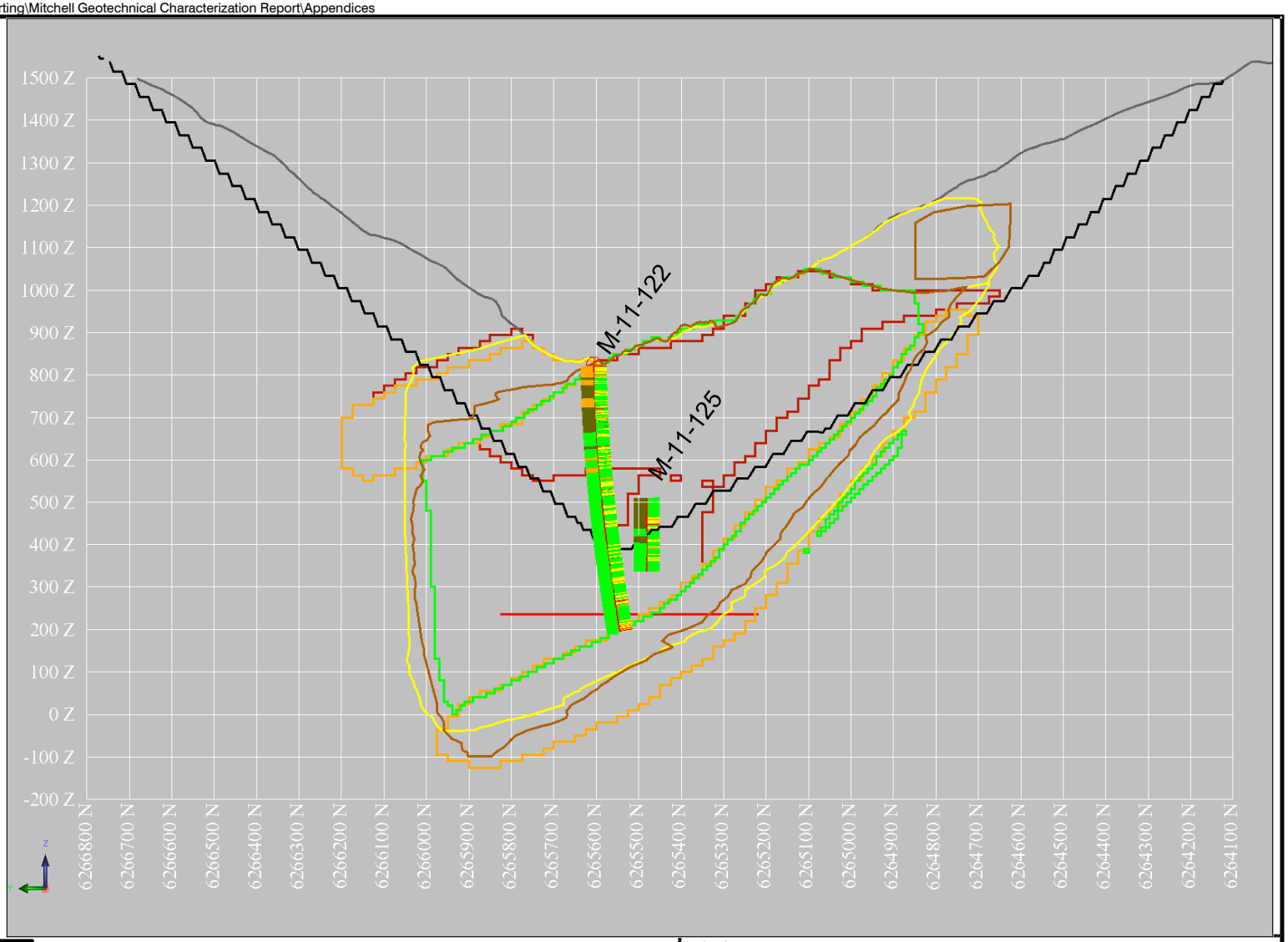
MITCHELL - 423000 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-10	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

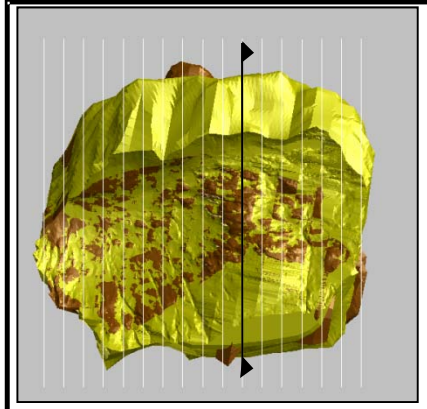
TITLE

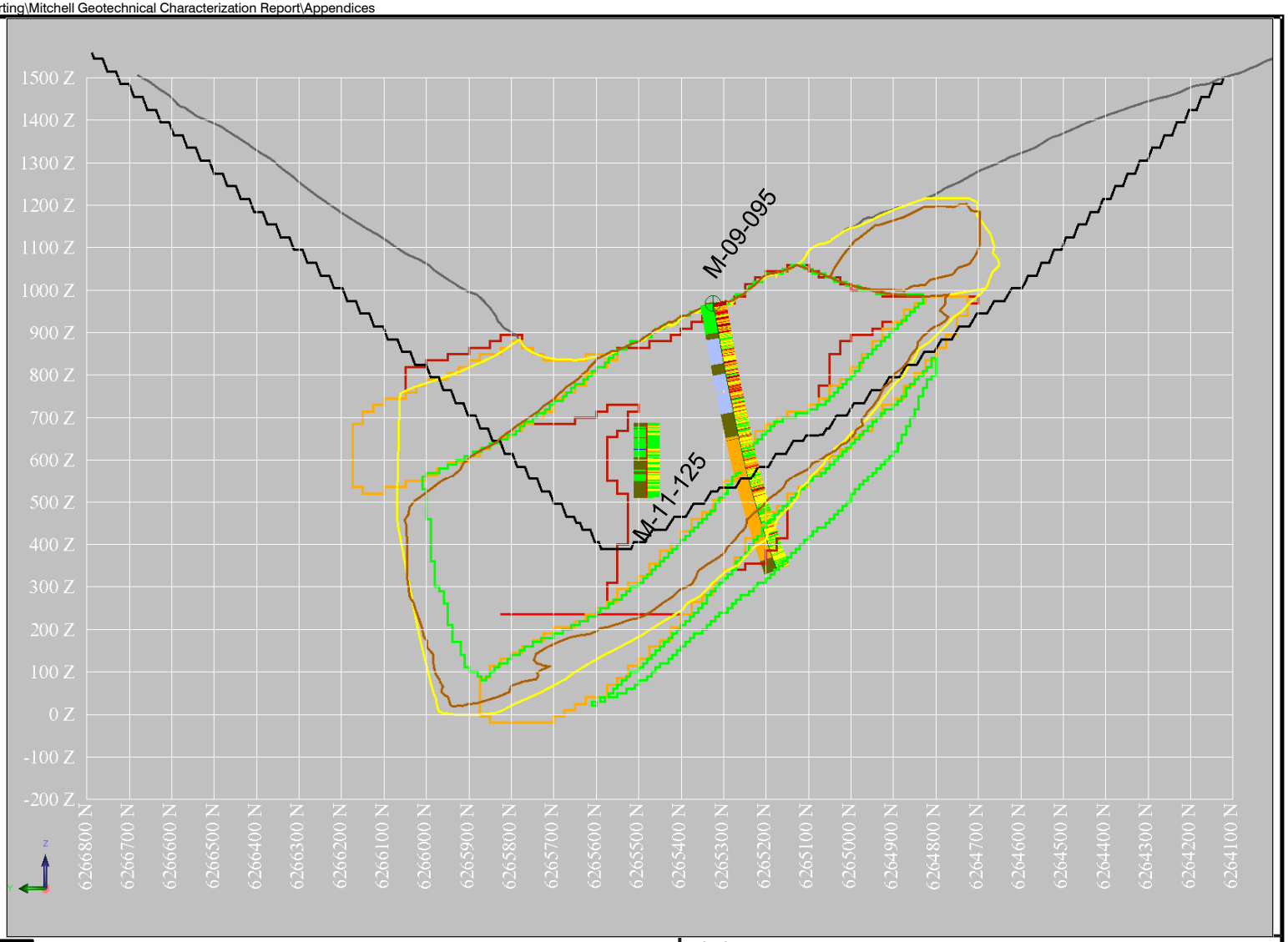
MITCHELL - 423100 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-11	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

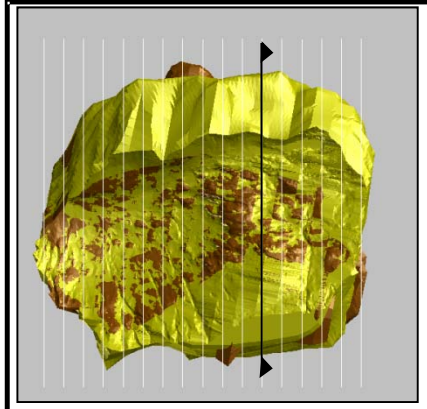
TITLE

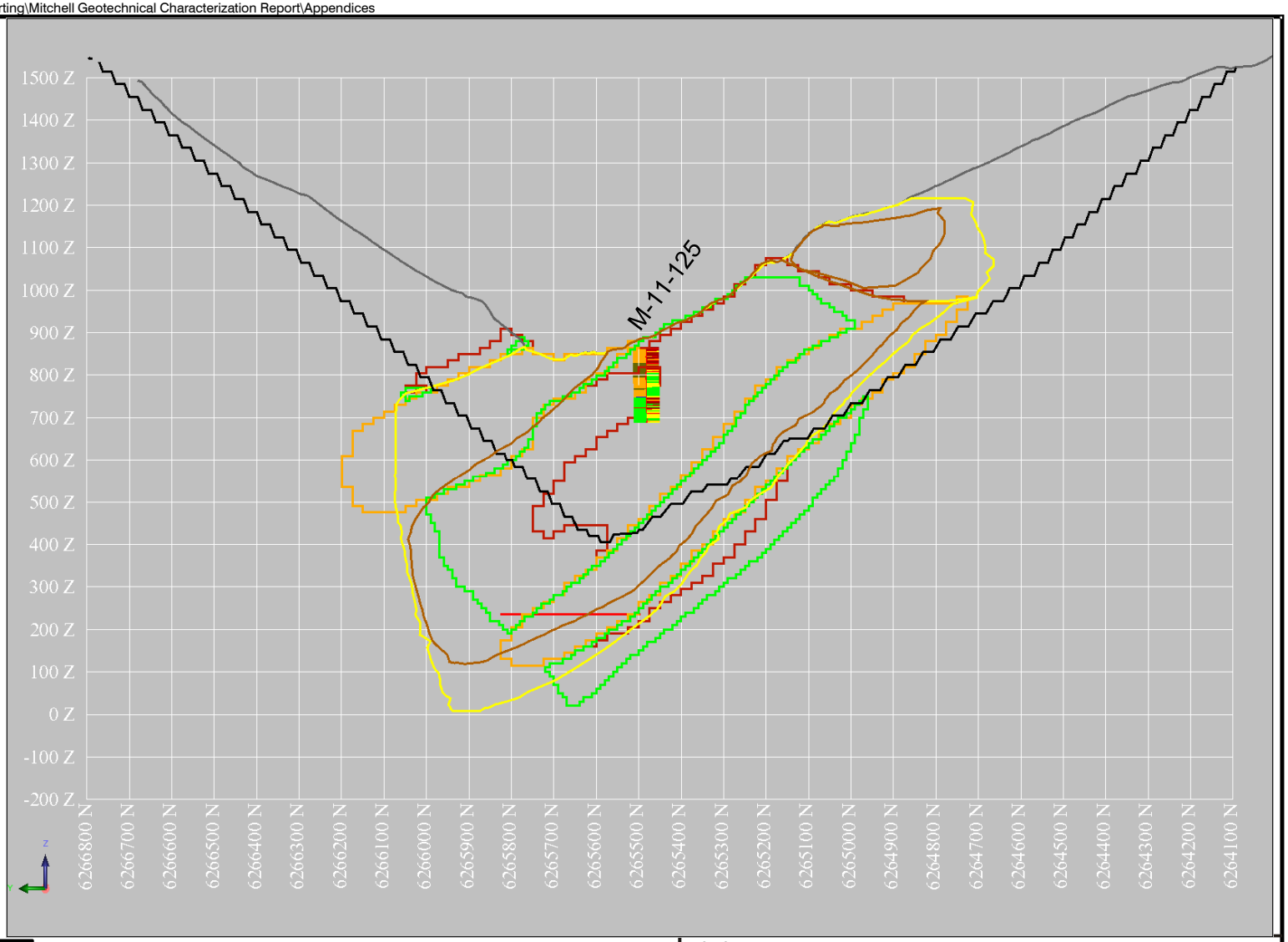
MITCHELL - 423200 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-12	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

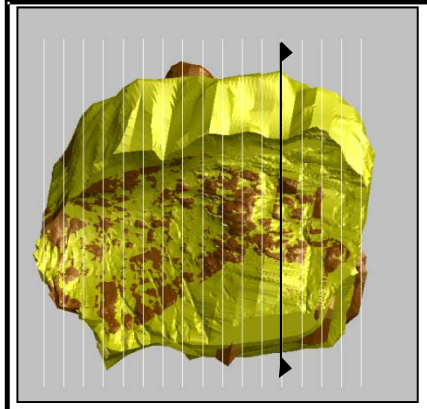
TITLE

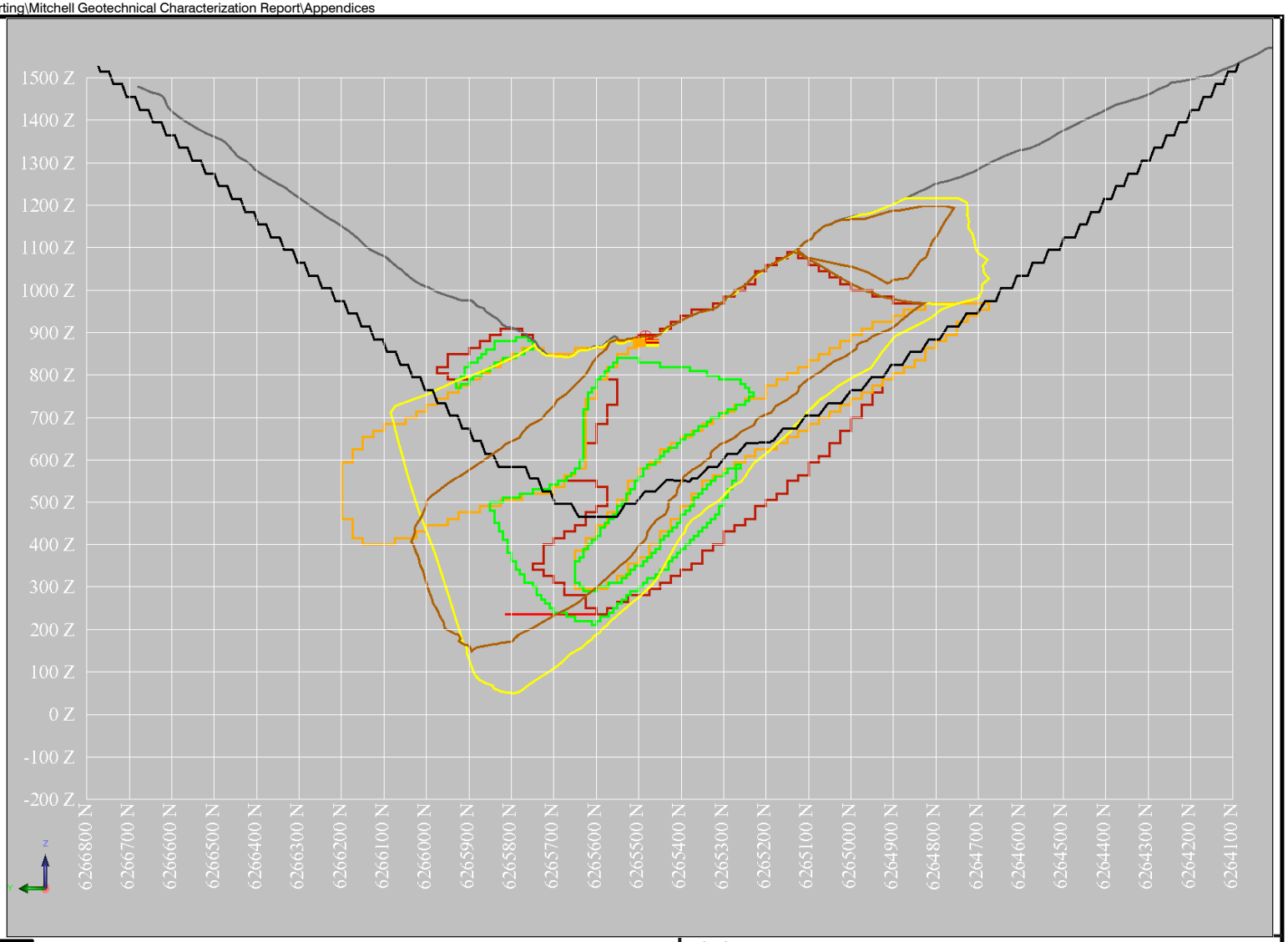
MITCHELL - 423300 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-13	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

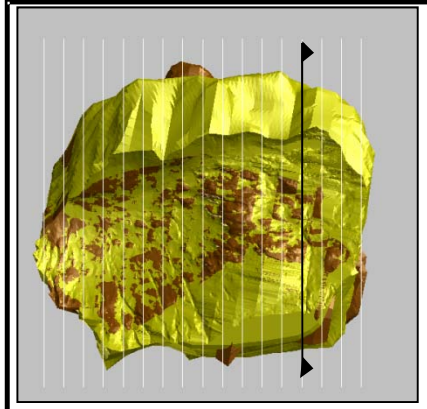
TITLE

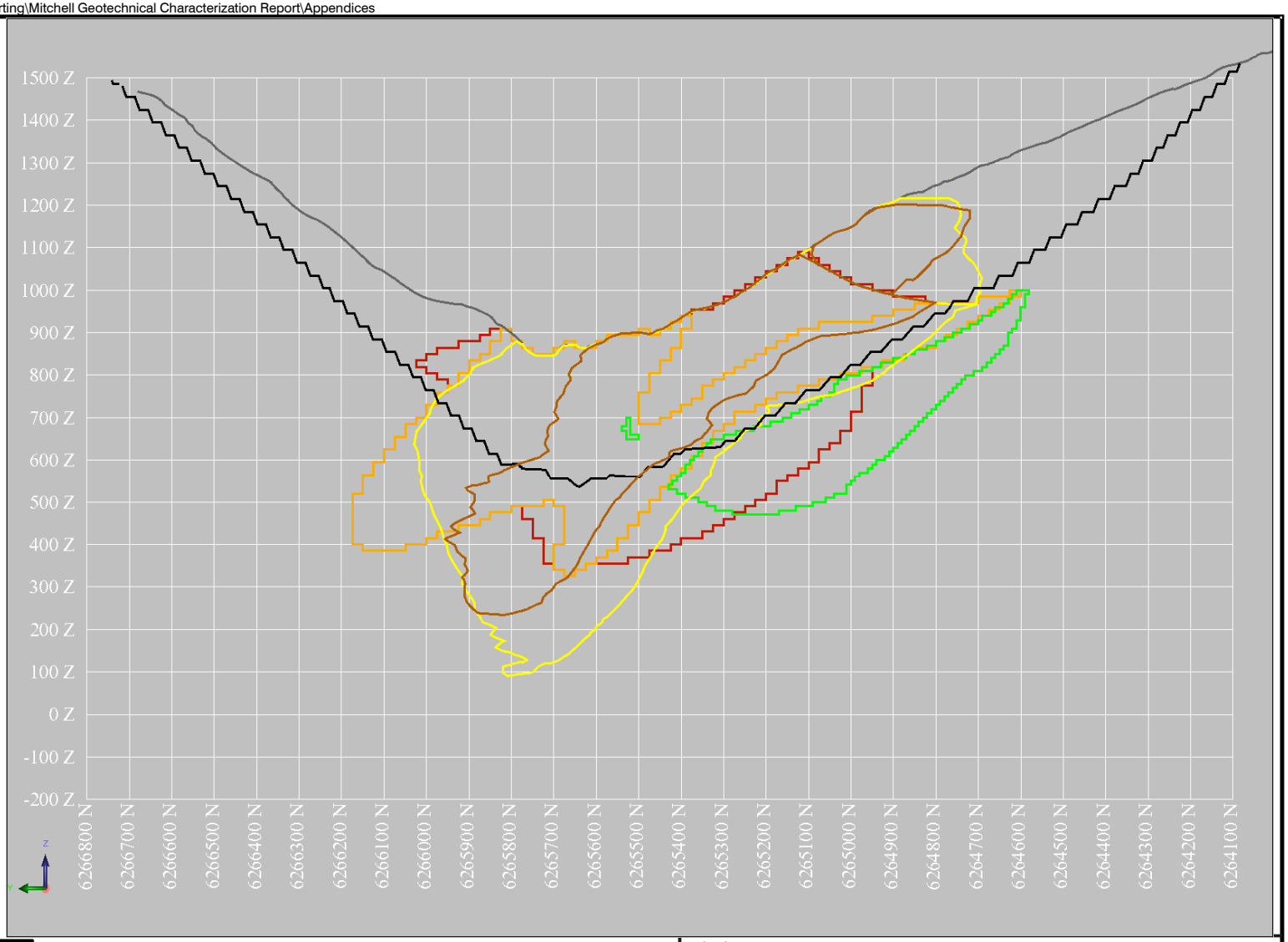
MITCHELL - 423400 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-14	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

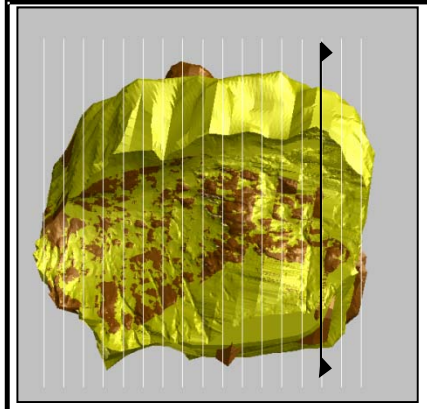
TITLE

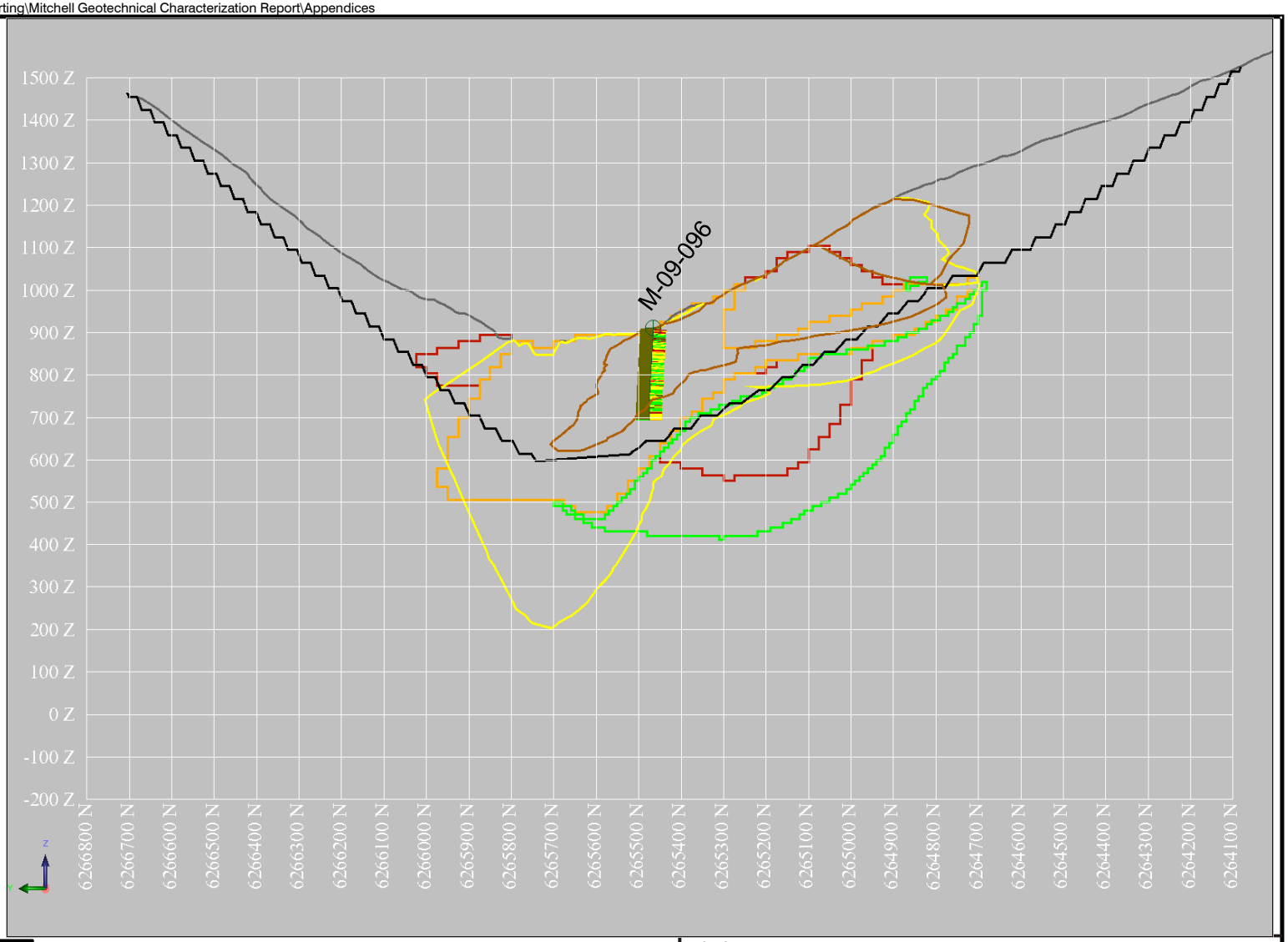
MITCHELL - 423500 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-15	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

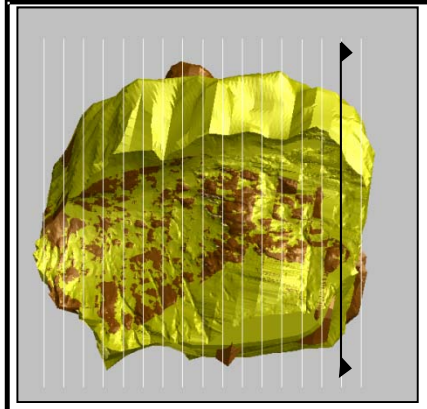
TITLE

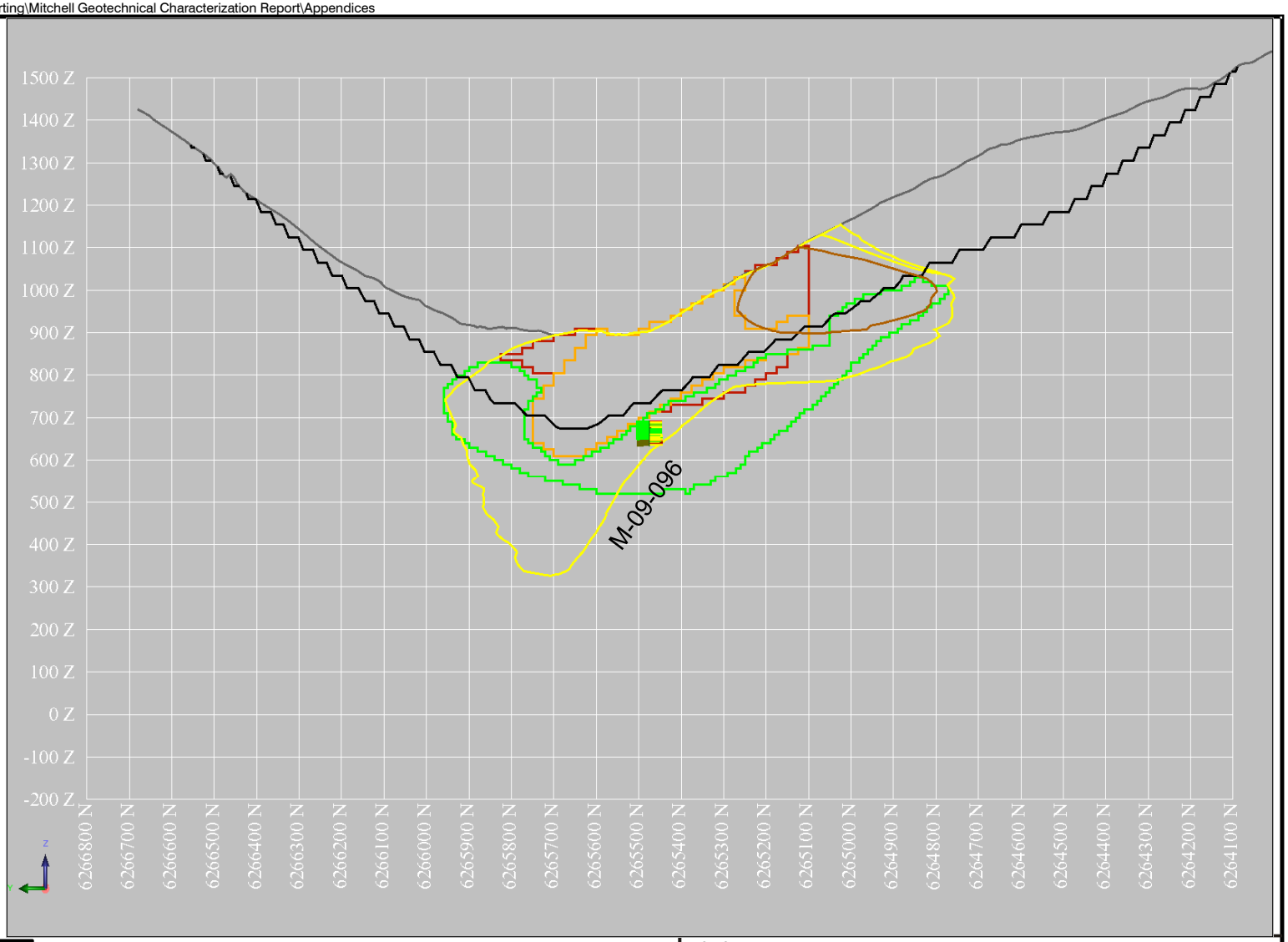
MITCHELL - 423600 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	**FIGURE D-16**	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

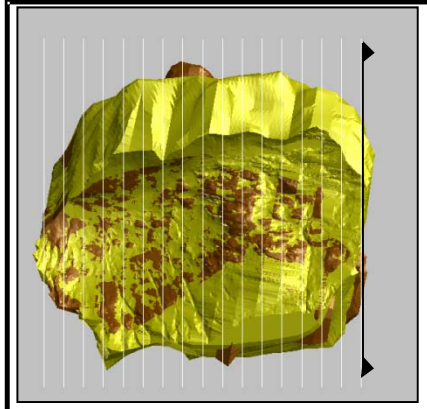
TITLE

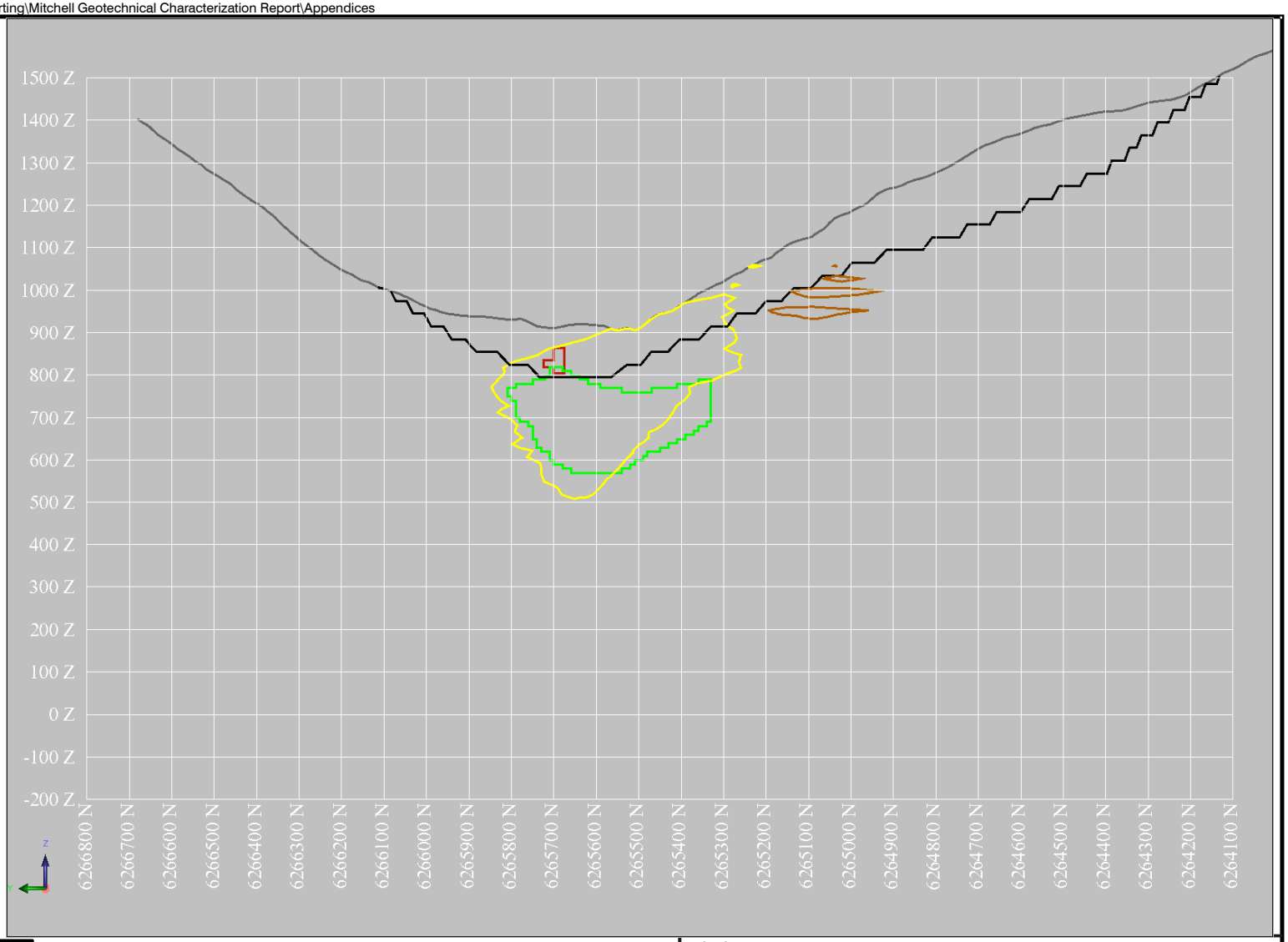
MITCHELL - 423700 EASTING
ALTERATION and FRACTURE FREQUENCY

Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-17	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Alteration

- Chloritic
- Carbonate
- Argillic
- Phyllic
- Potassic
- Silicic
- Skarn
- Quartz Vein
- Fault Zone

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

MITCHELL - 423800 EASTING
ALTERATION and FRACTURE FREQUENCY

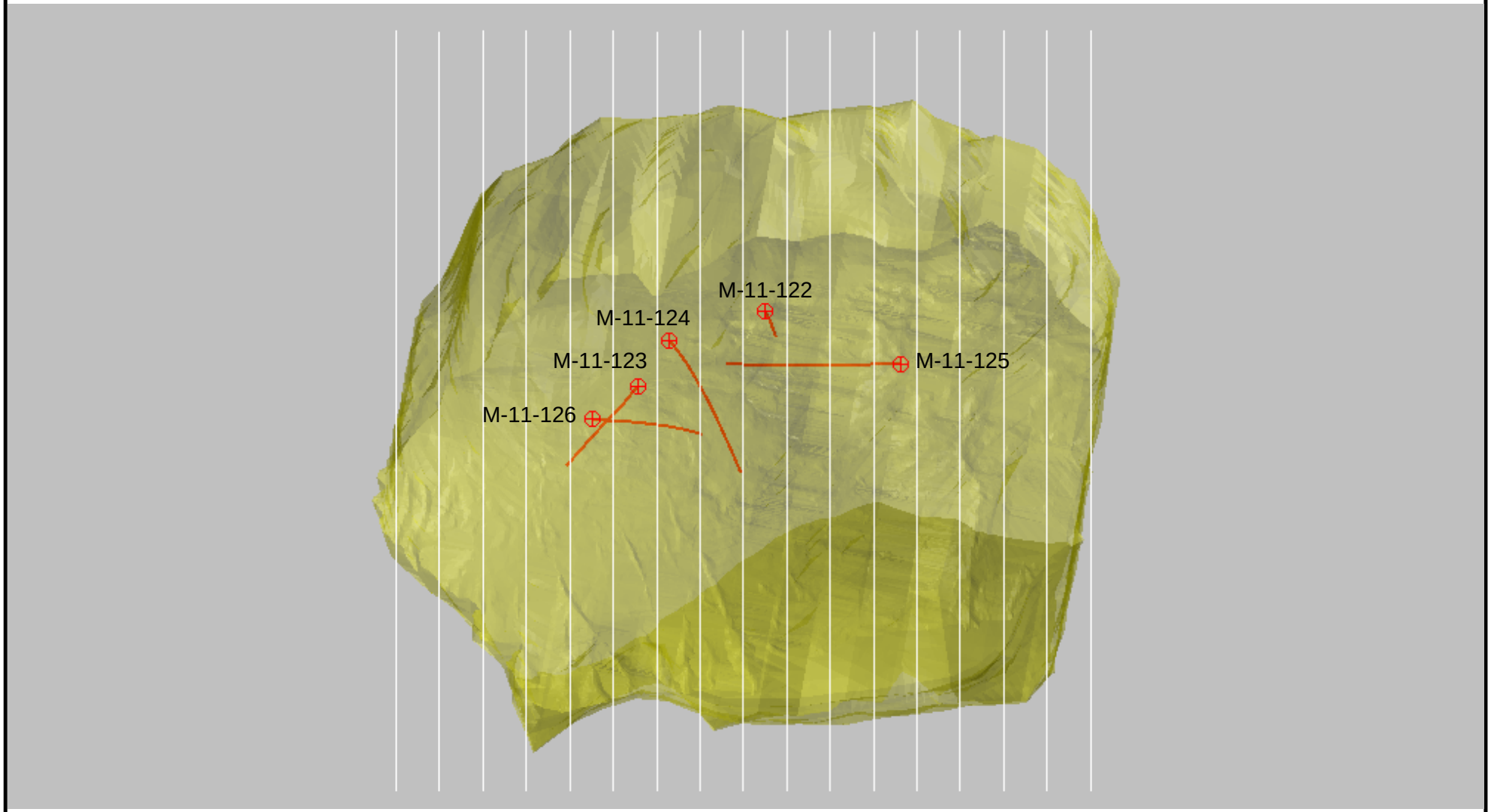
Golder Associates

PROJECT No.11-1439-0002			PHASE No. 10000	
DESIGN	CY	21NOV11	SCALE NTS	REV.0
CADD	CY	21NOV11	FIGURE D-18	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

APPENDIX E

Cross Sections Showing Rock Fabric and Fracture Frequency

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

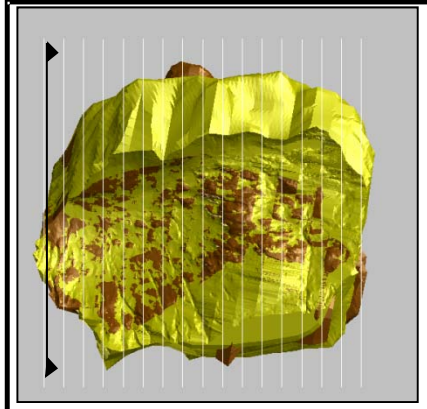
TITLE

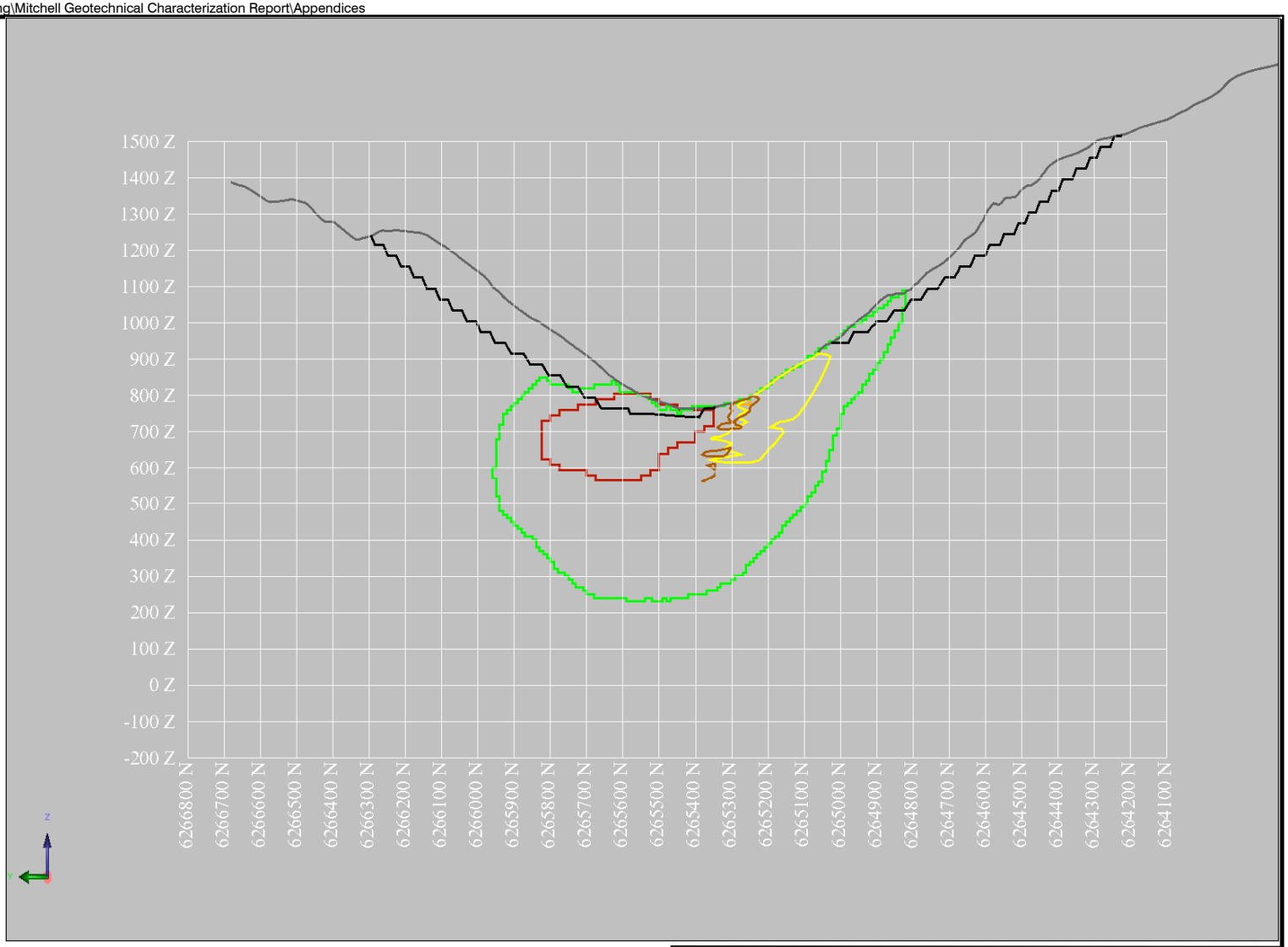
MITCHELL – PLAN
2011 GEOTECHNICAL BOREHOLES

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	12OCT11	SCALE NTS	REV.0
CADD	CY	12OCT11	**FIGURE E-1**	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

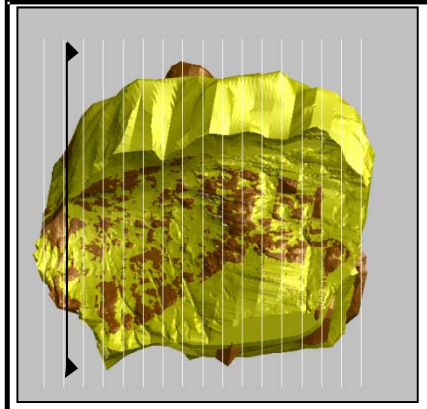
MITCHELL - 422200 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

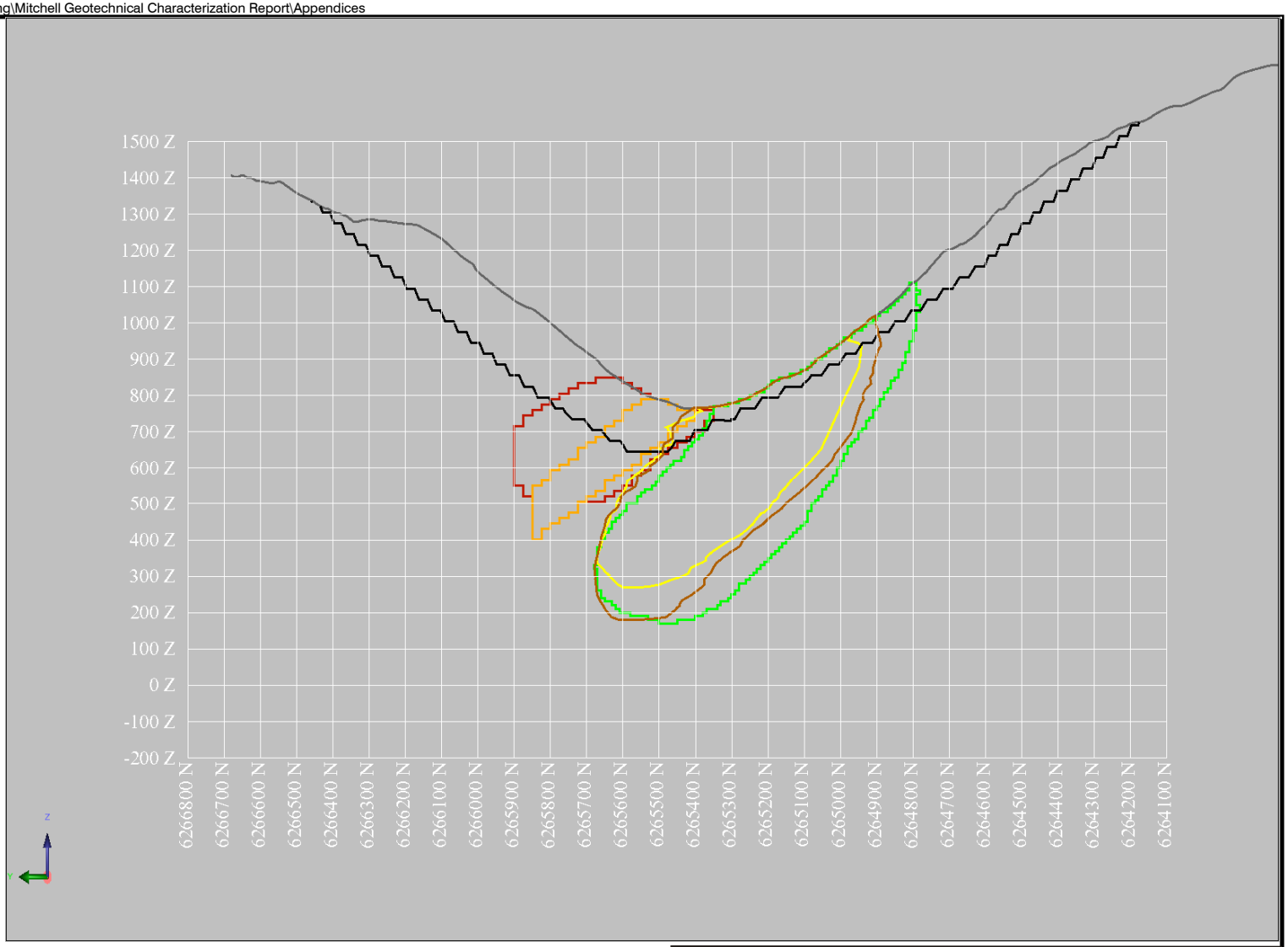
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-2

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

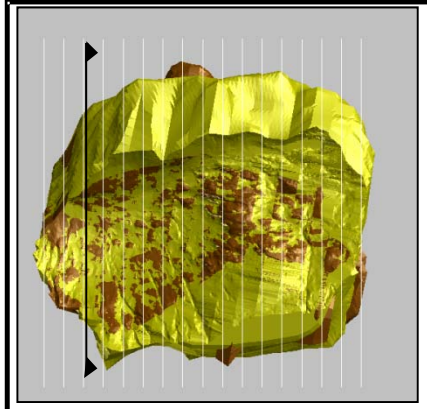
MITCHELL - 422300 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

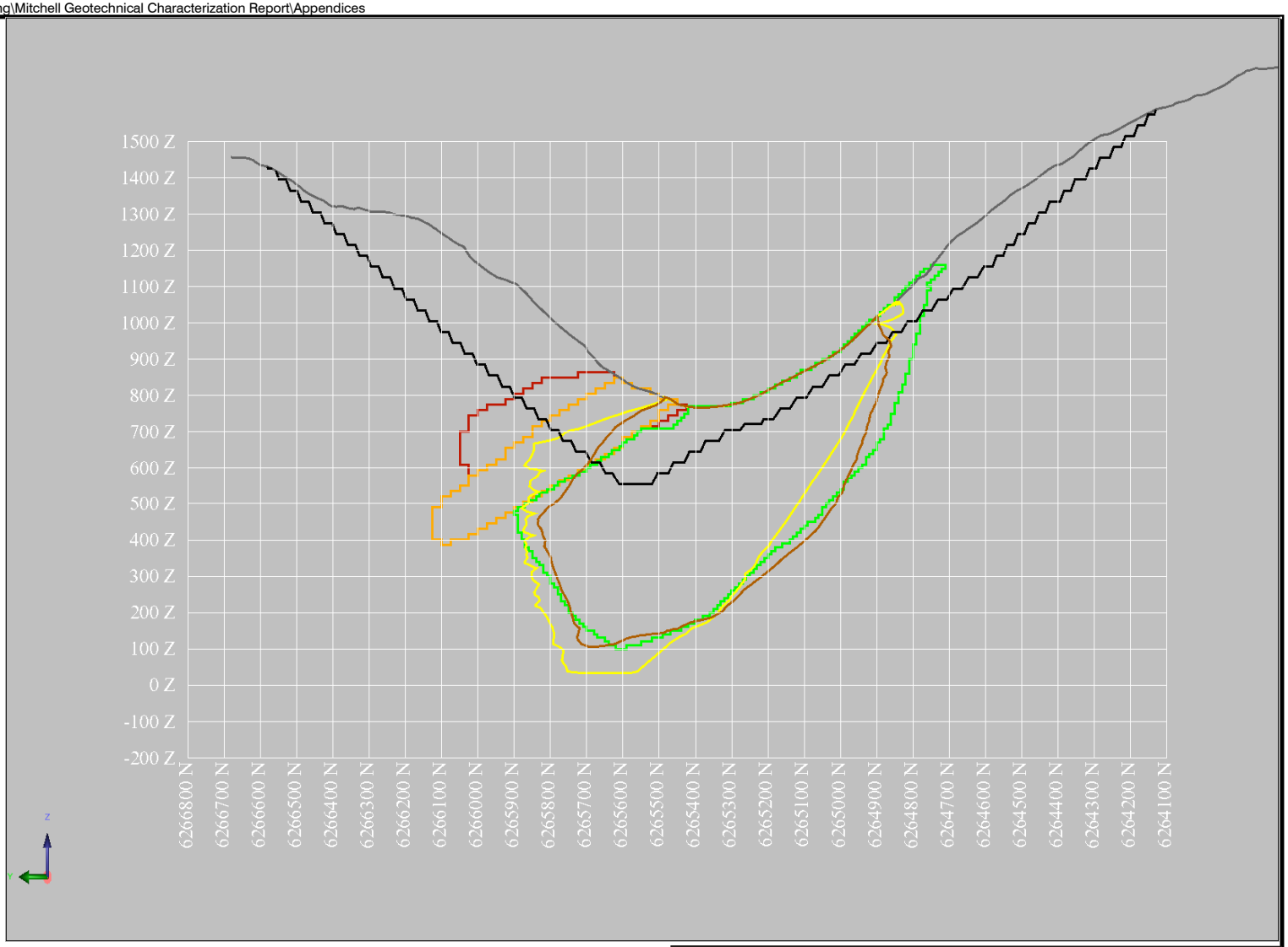
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-3

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

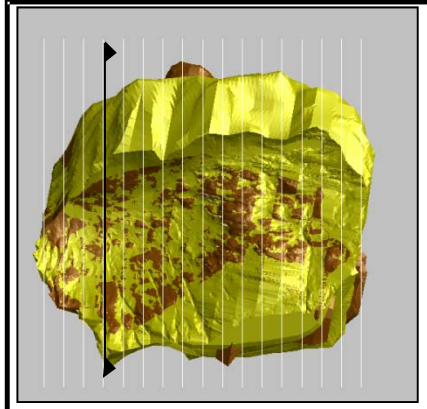
MITCHELL - 422400 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

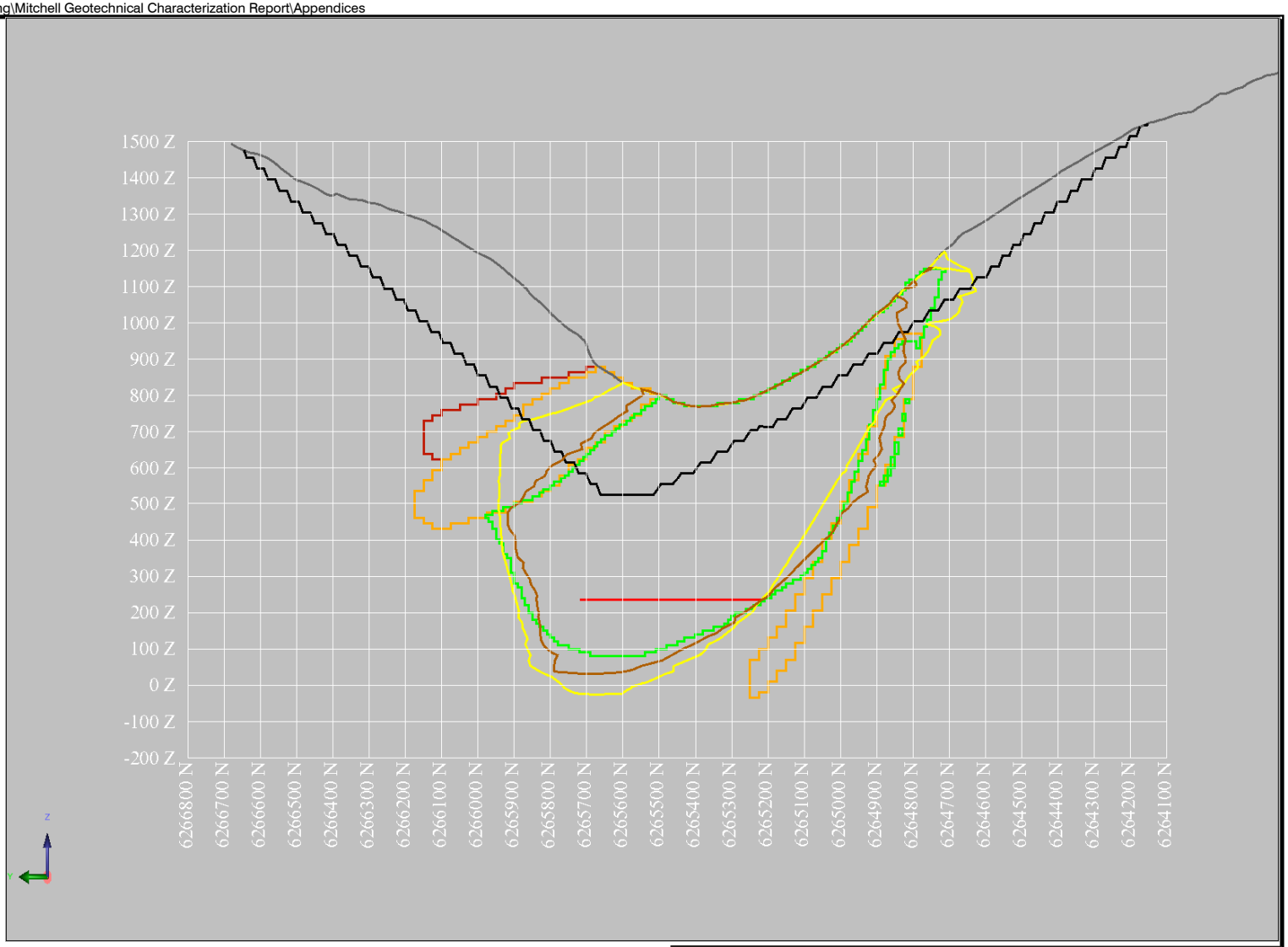
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-4

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

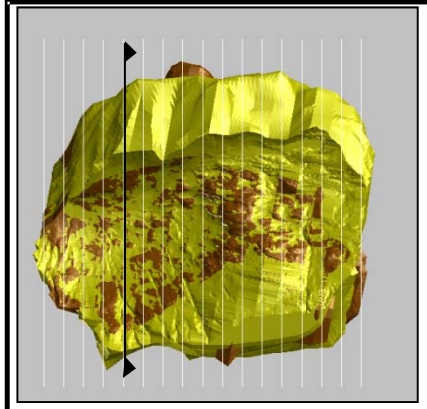
MITCHELL - 422500 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

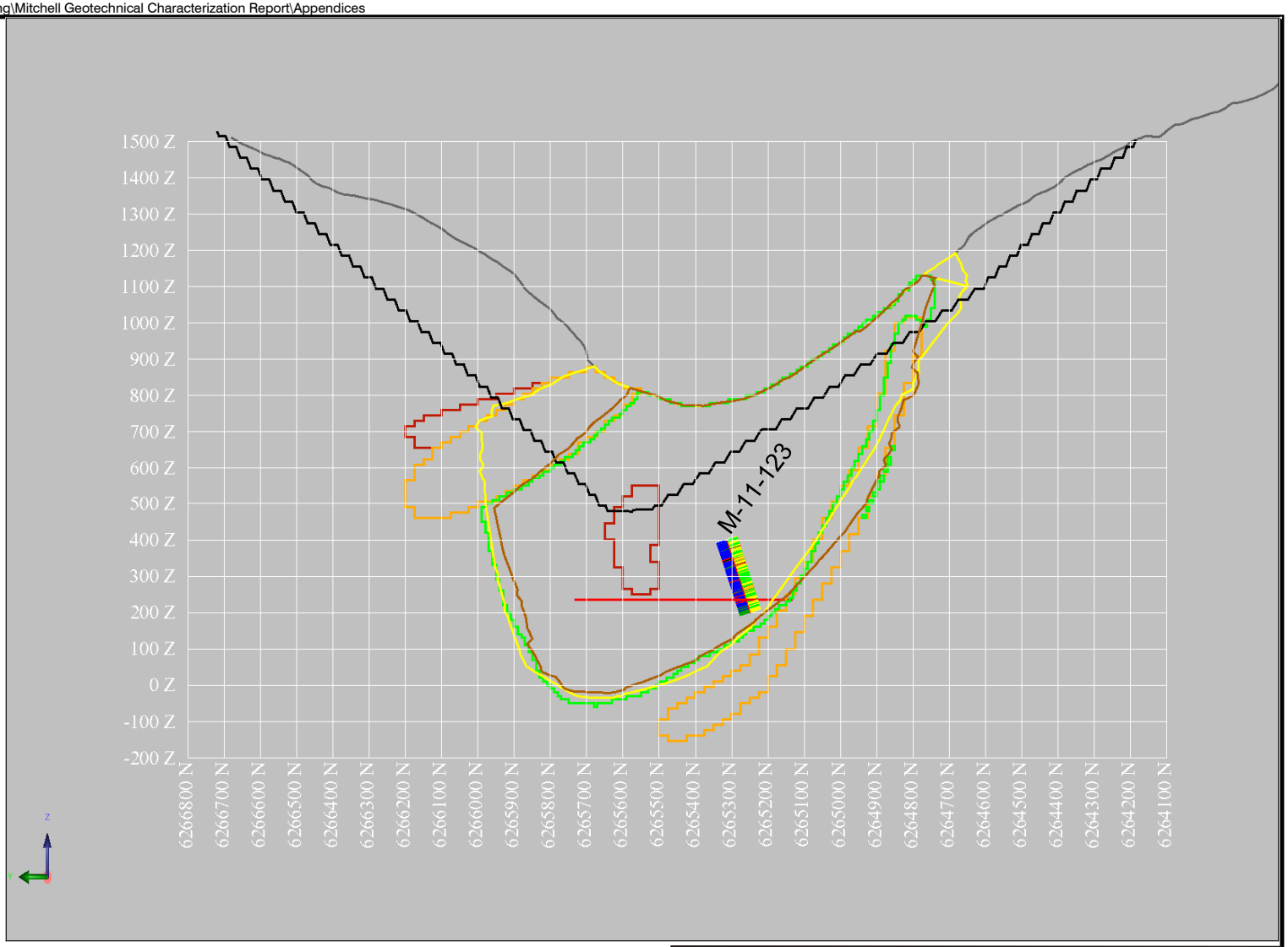
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-5

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

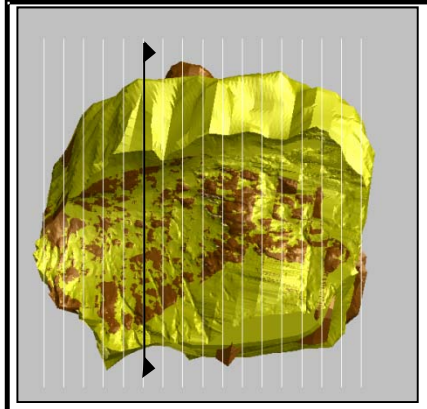
TITLE

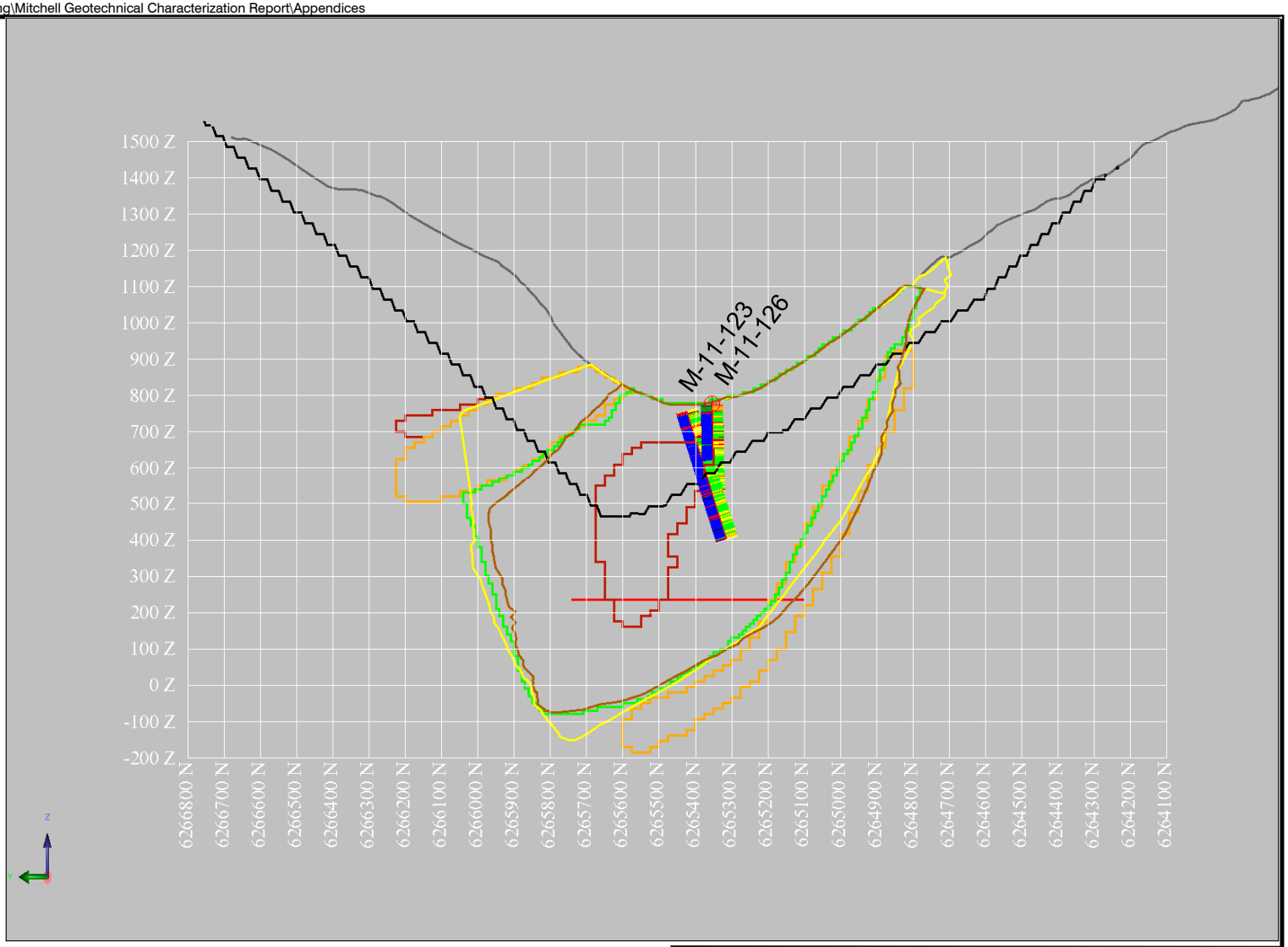
MITCHELL - 422600 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV. 0
CADD	LCC	17NOV11	FIGURE E-6		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

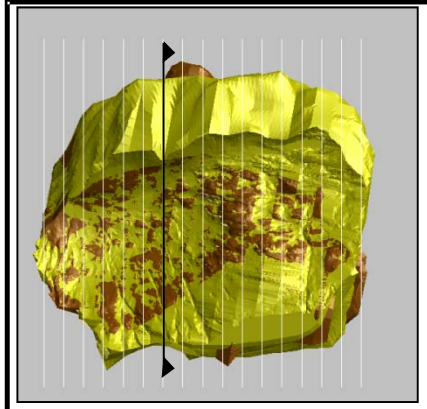
TITLE

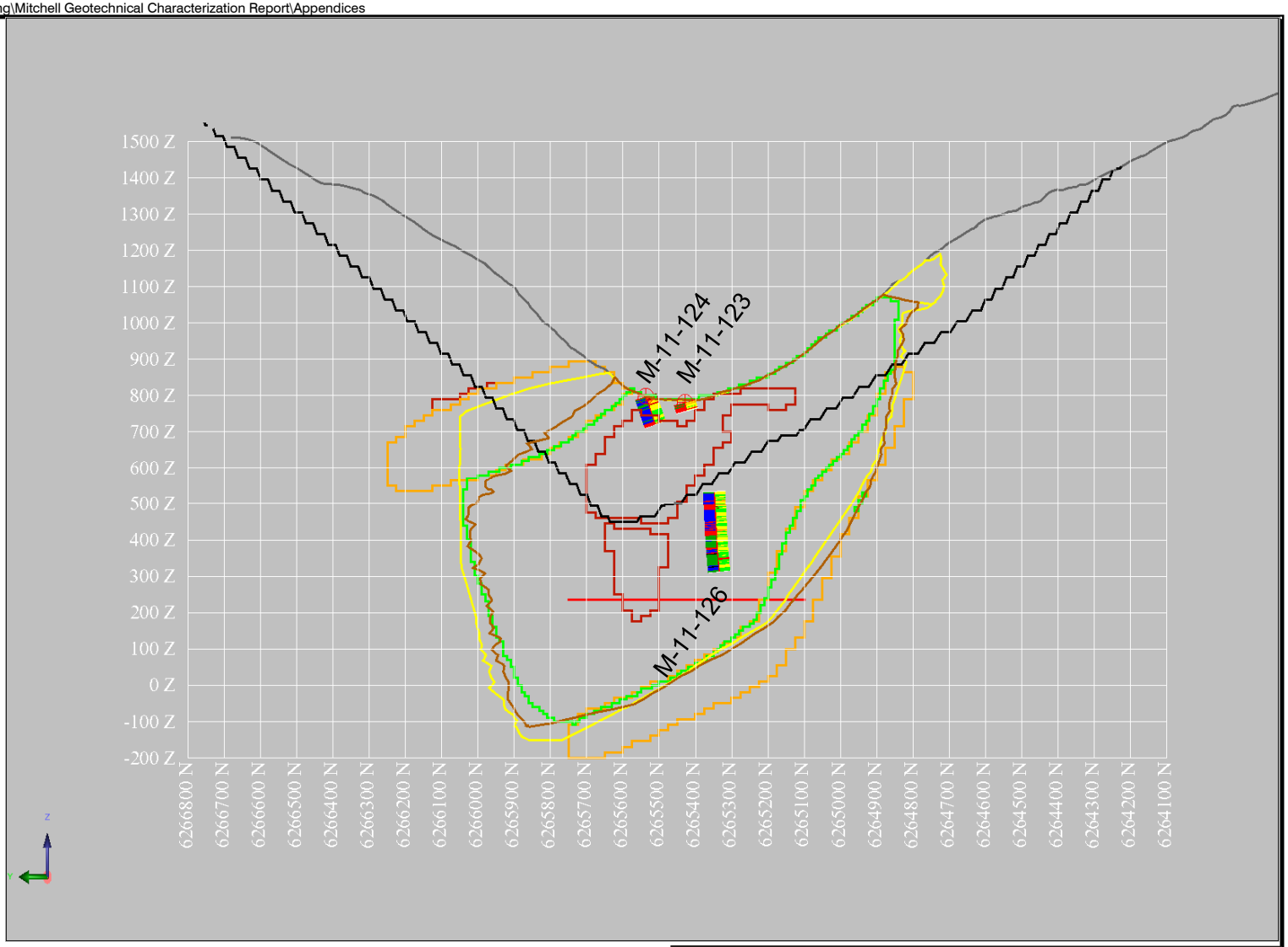
MITCHELL - 422700 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV. 0
CADD	LCC	17NOV11	FIGURE E-7		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

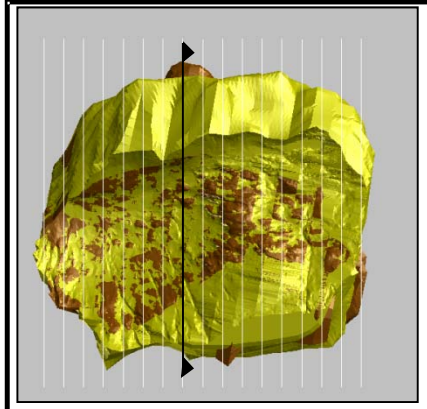
MITCHELL - 422800 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

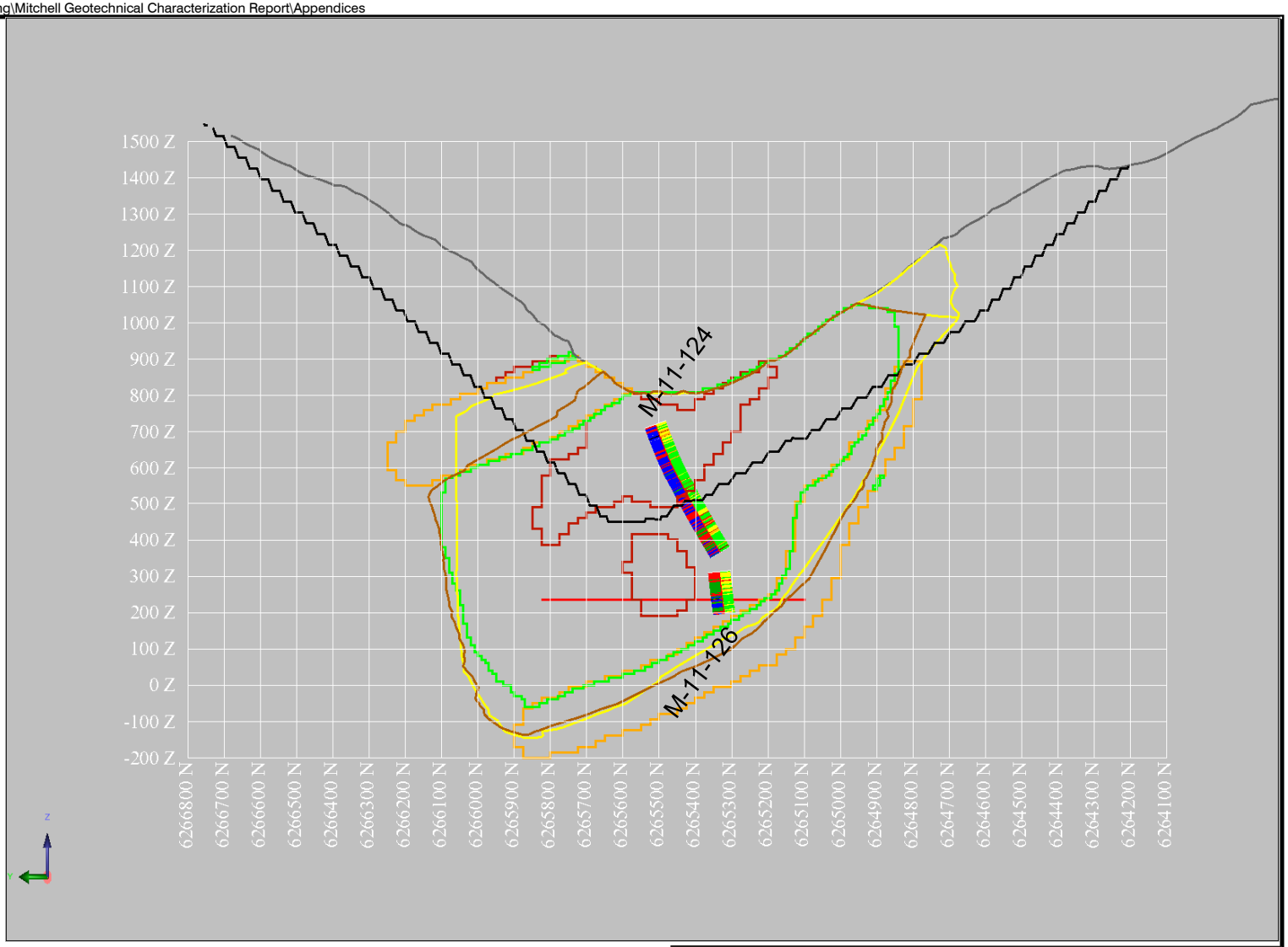
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-8

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

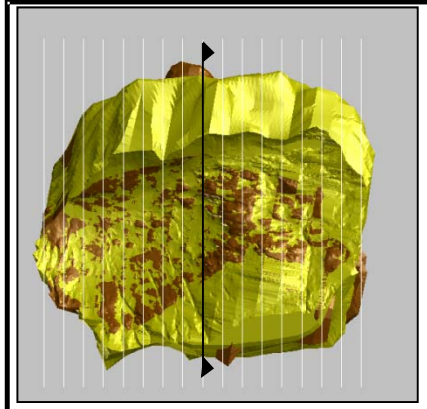
MITCHELL - 422900 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

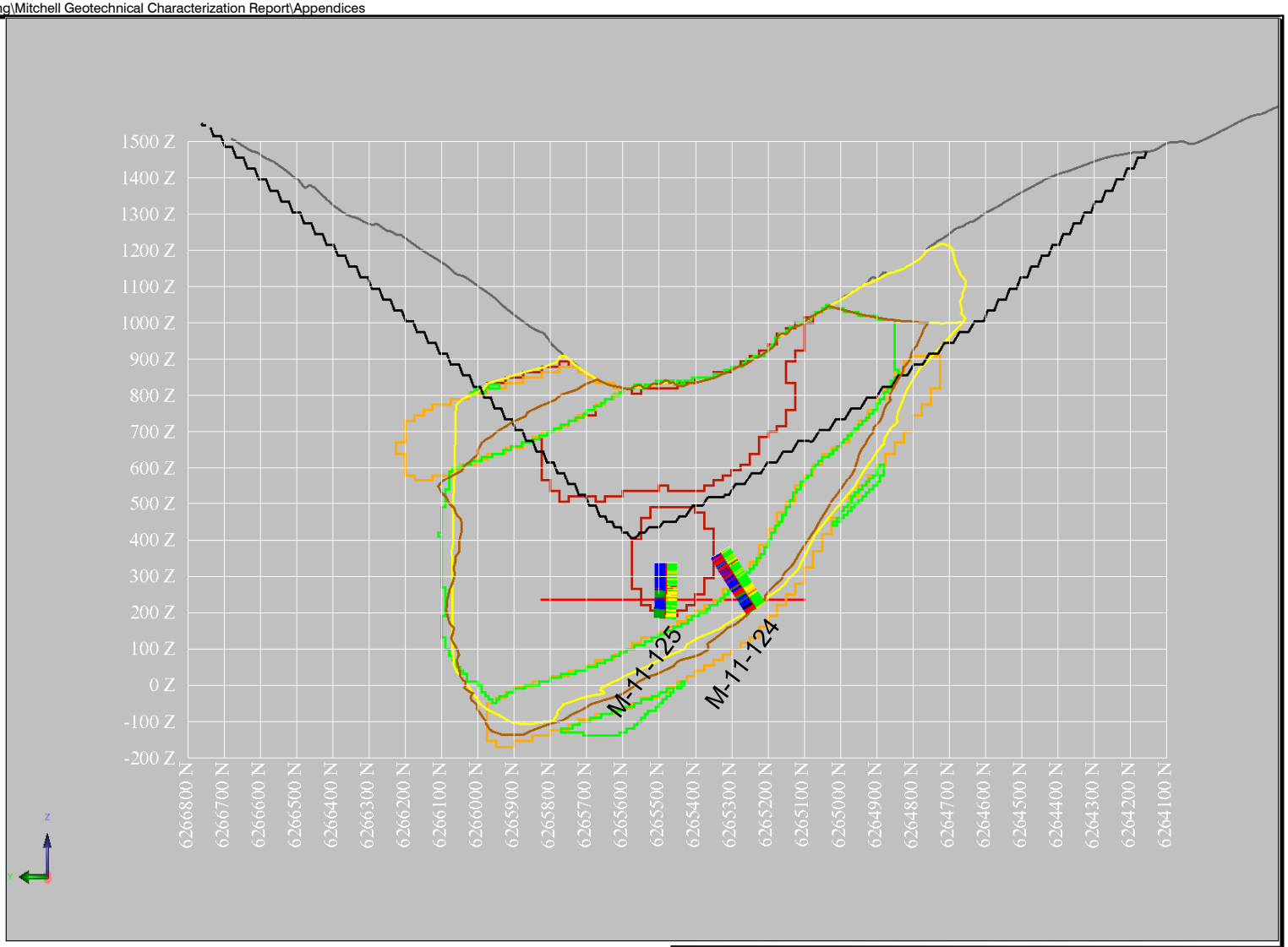
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-9

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

- Massive
- Stockwork
- Foliated
- Other

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

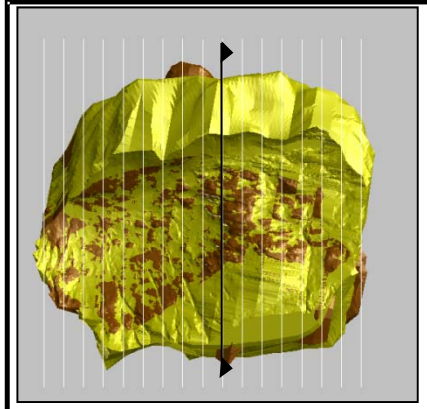
TITLE

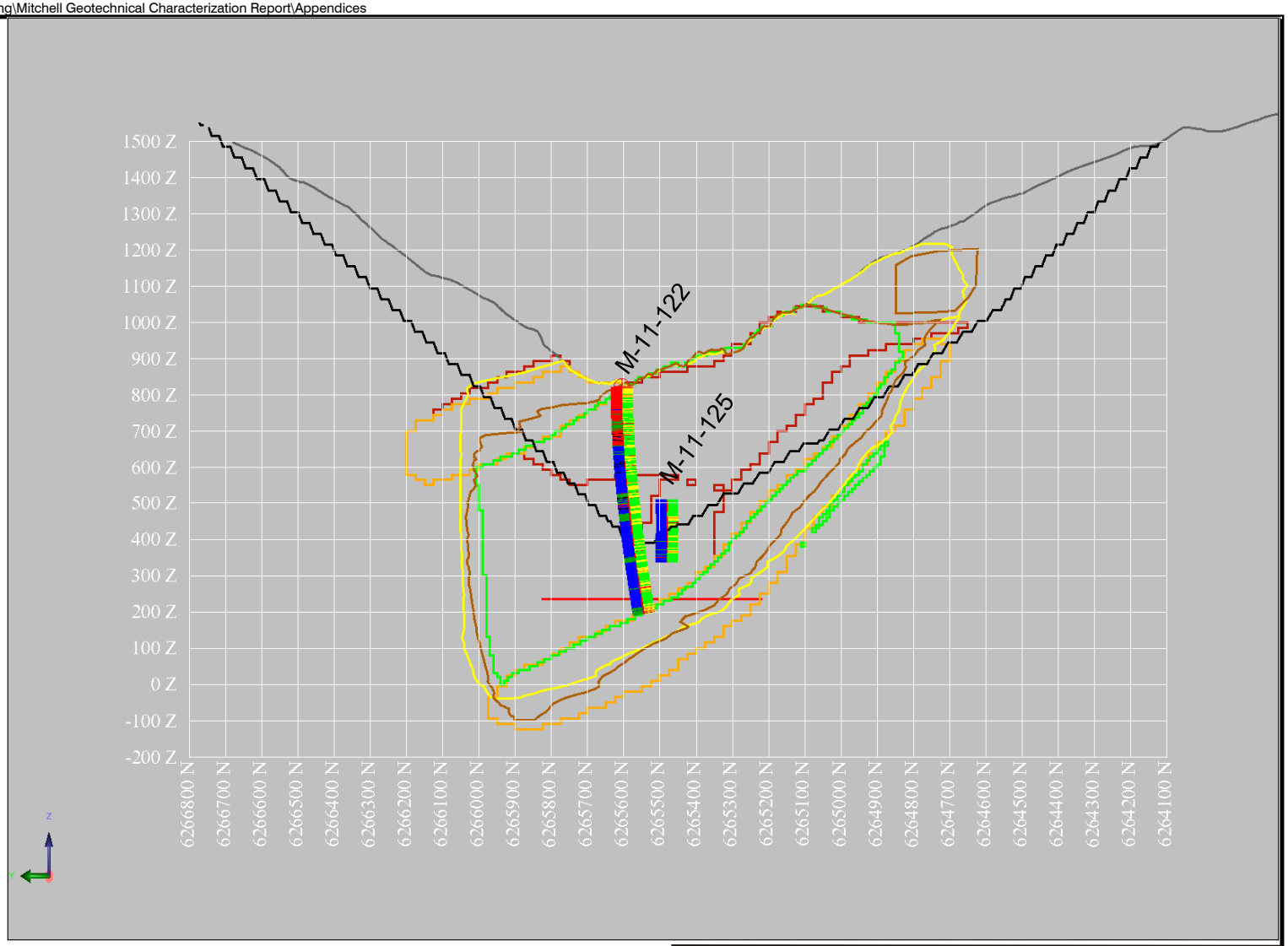
MITCHELL - 423000 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV. 0
CADD	LCC	17NOV11	**FIGURE E-10**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

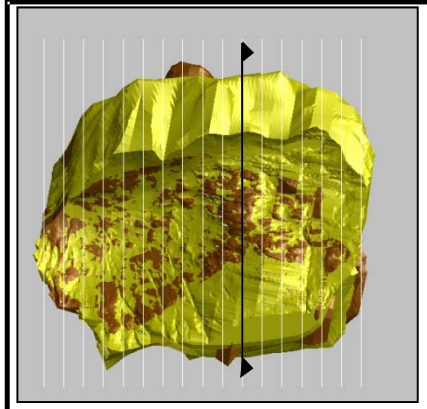
MITCHELL - 423100 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

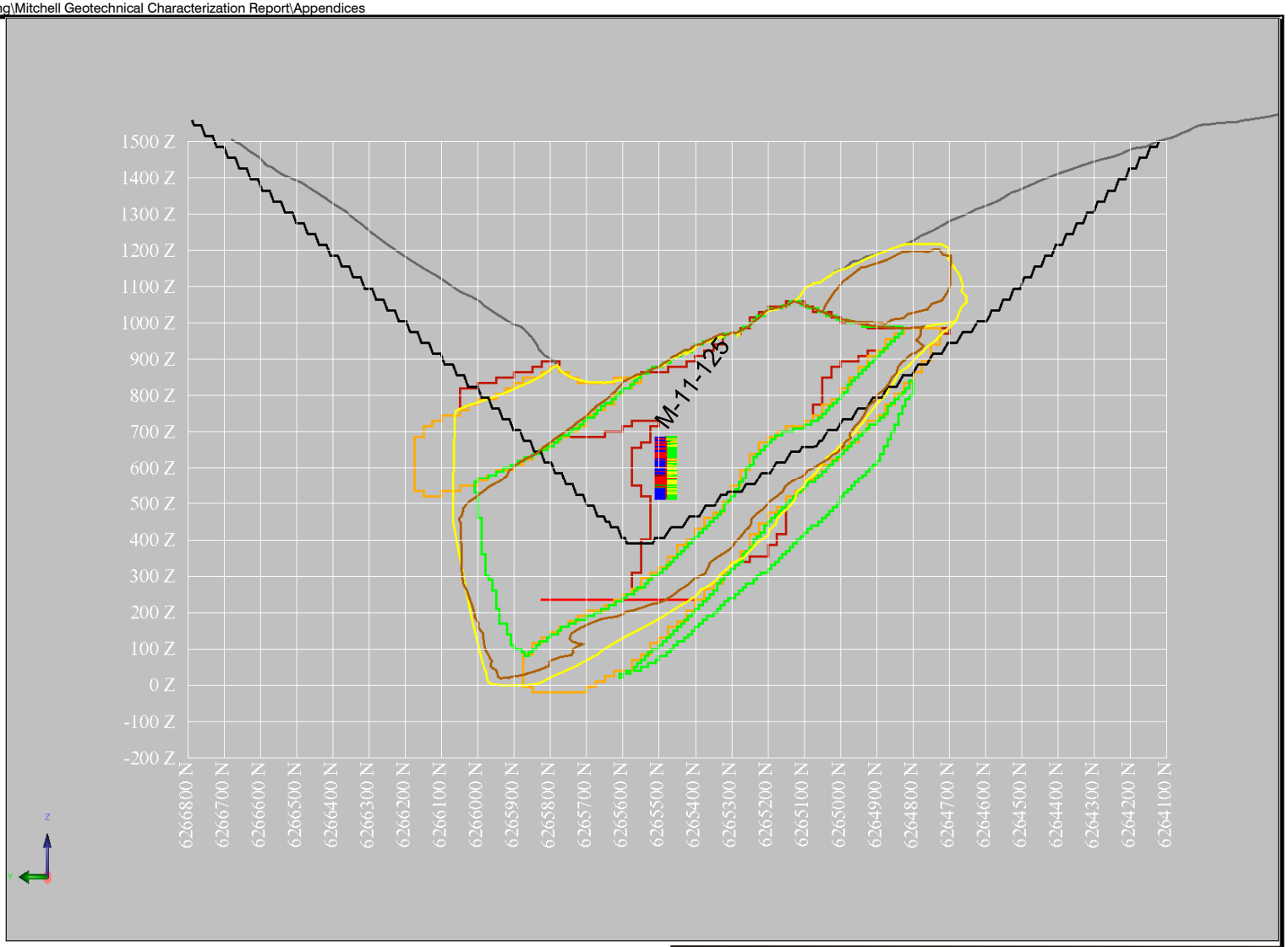
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-11

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

- Massive
- Stockwork
- Foliated
- Other

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

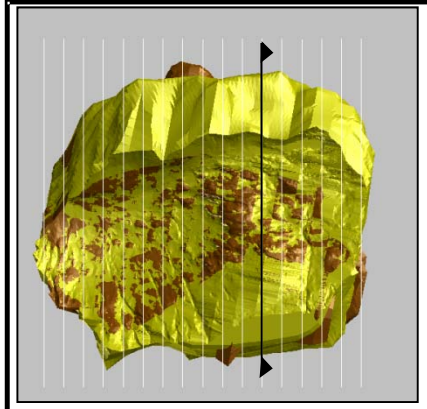
TITLE

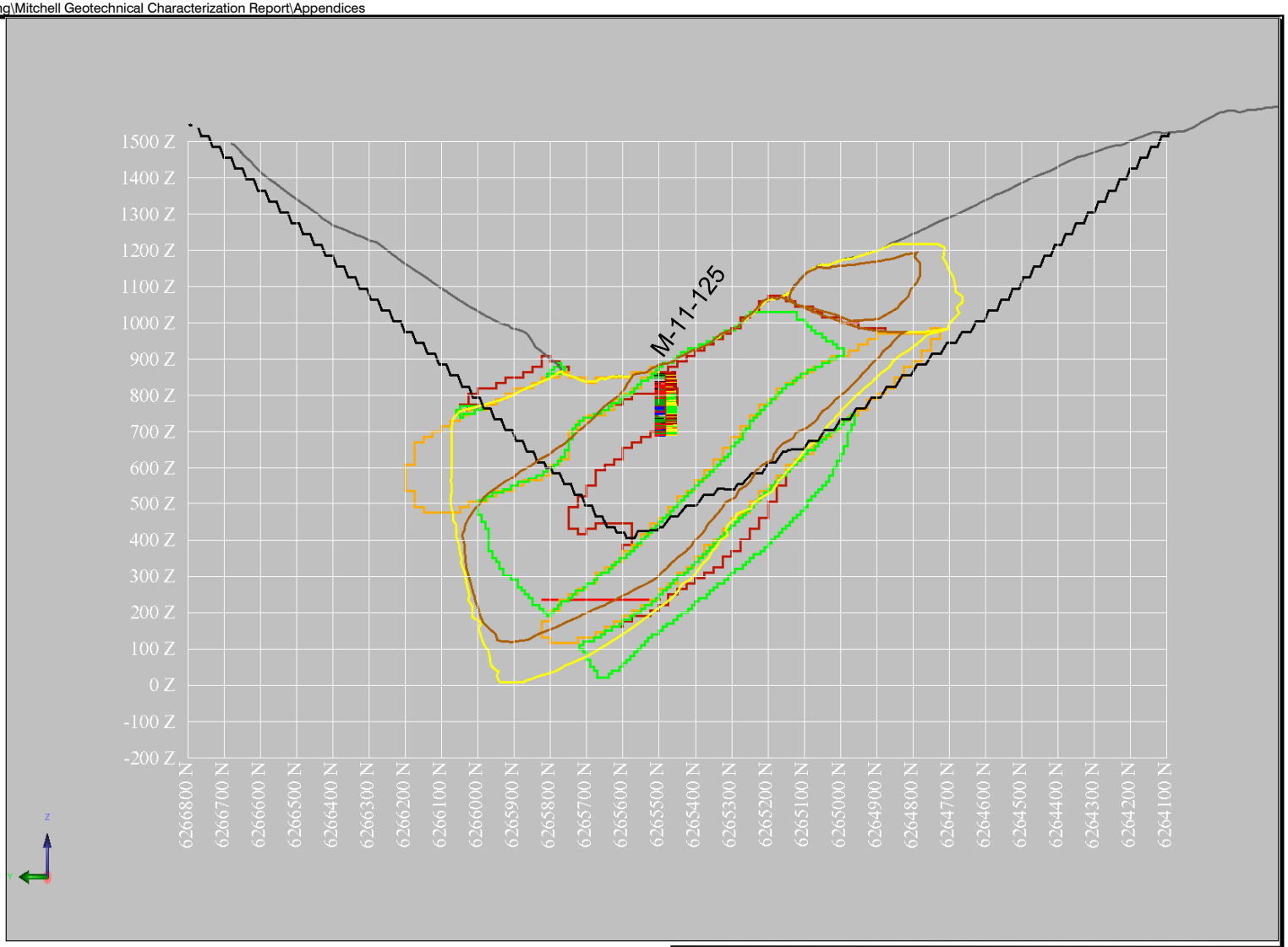
MITCHELL - 423200 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV. 0
CADD	LCC	17NOV11	**FIGURE E-12**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

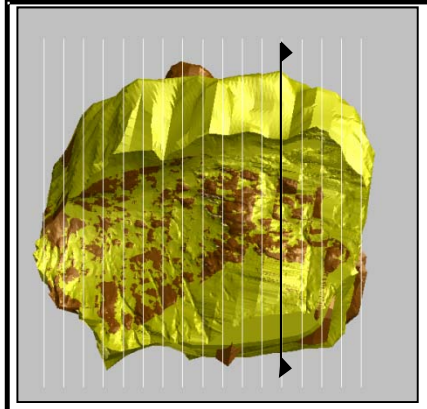
MITCHELL - 423300 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

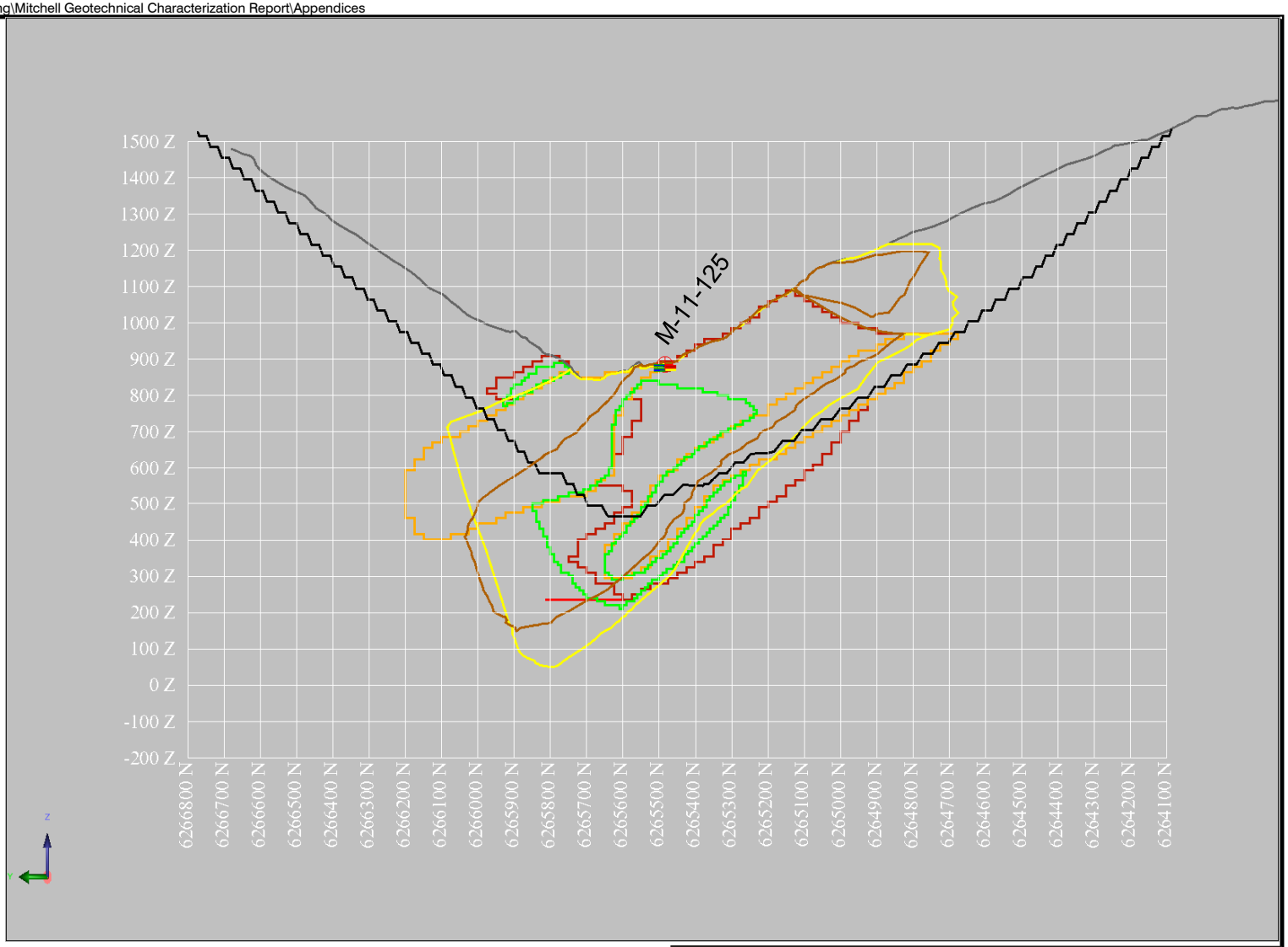
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-13

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

- Massive
- Stockwork
- Foliated
- Other

Fracture Frequency (/m)

- 0
- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

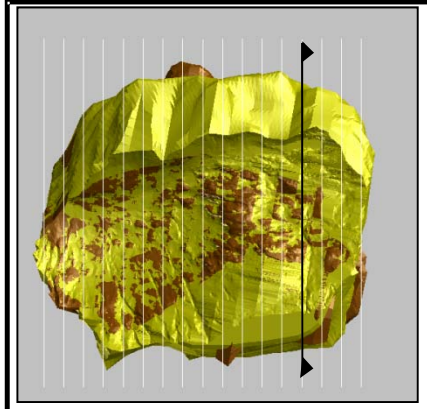
TITLE

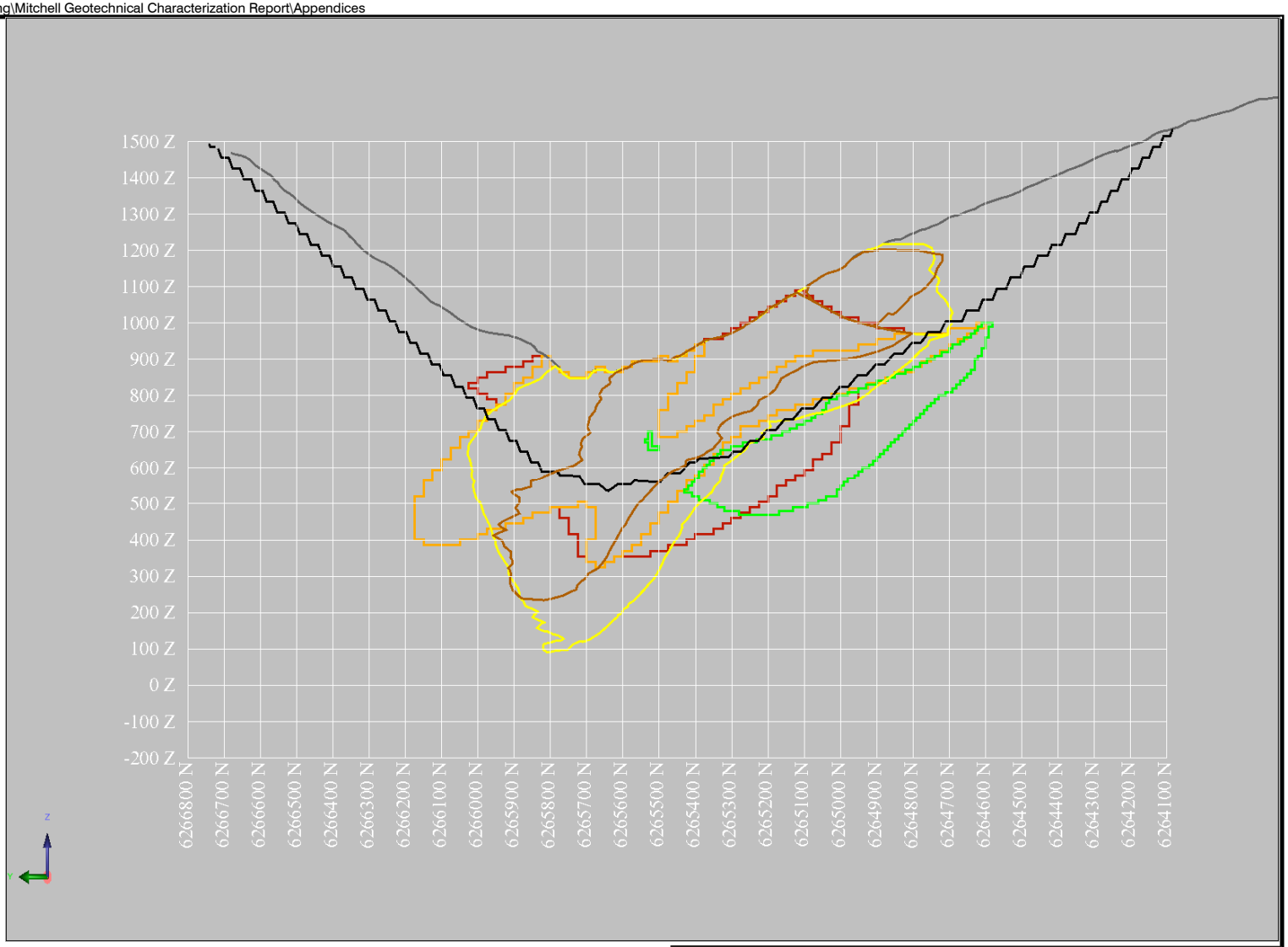
MITCHELL - 423400 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11	**FIGURE E-14**	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

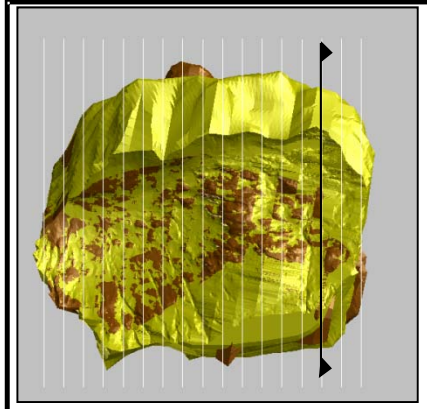
TITLE

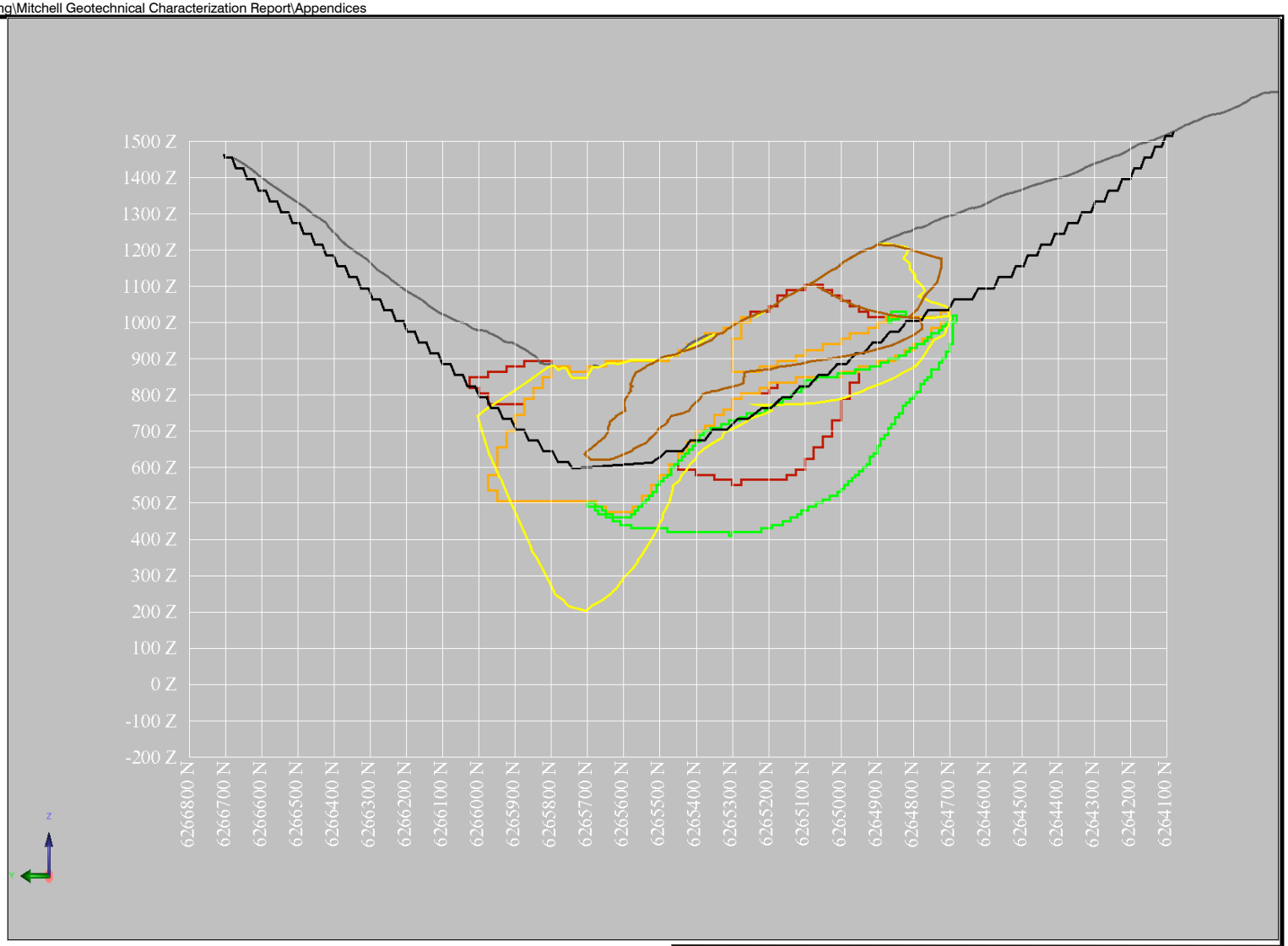
MITCHELL - 423500 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-15





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

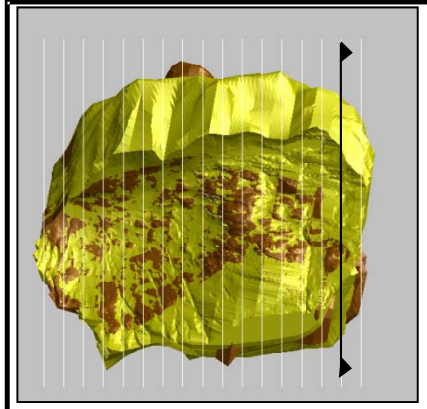
TITLE

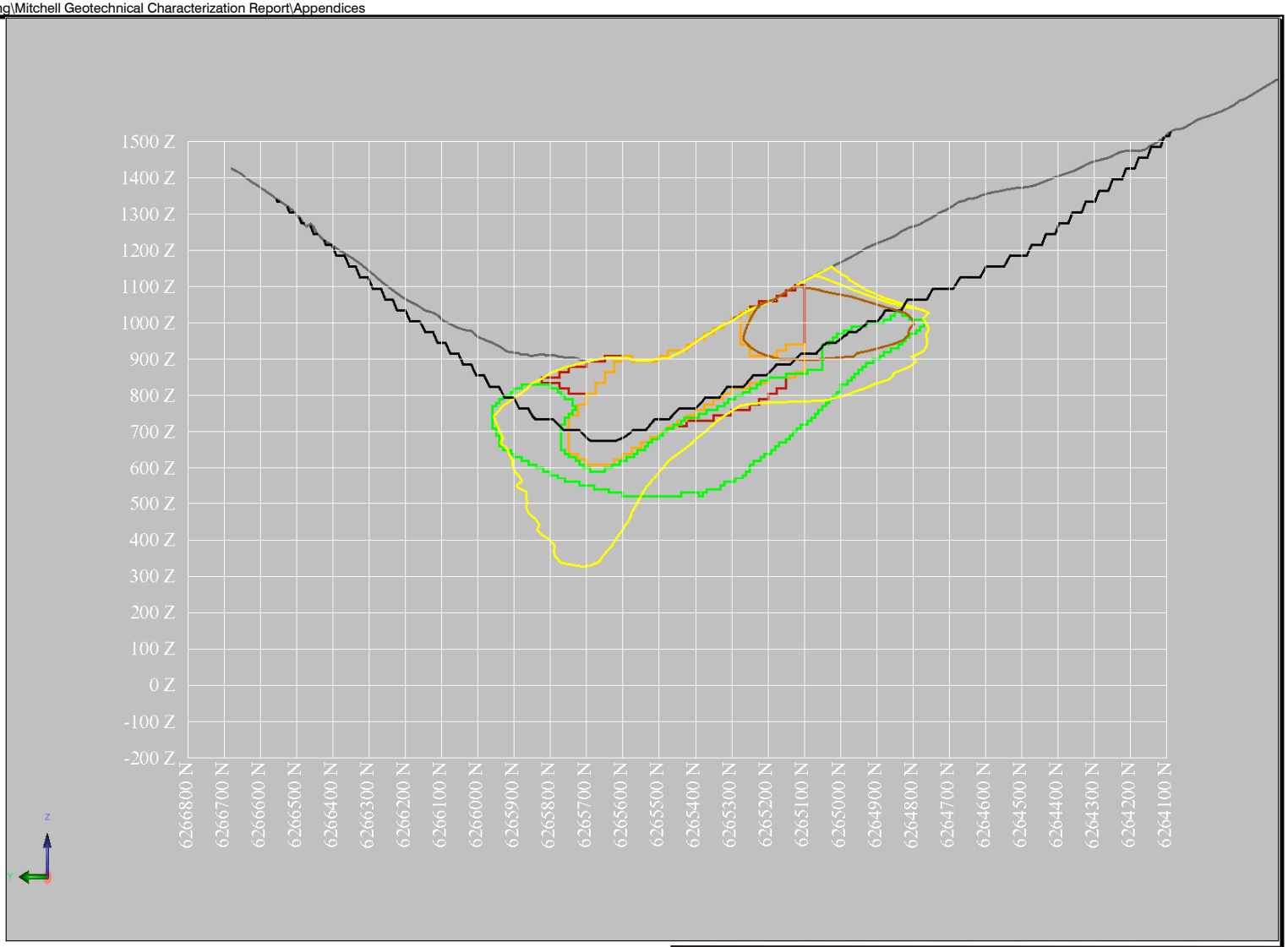
MITCHELL - 423600 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11	**FIGURE E-16**	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

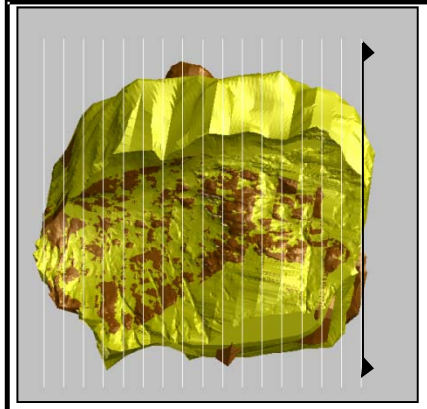
MITCHELL - 423700 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

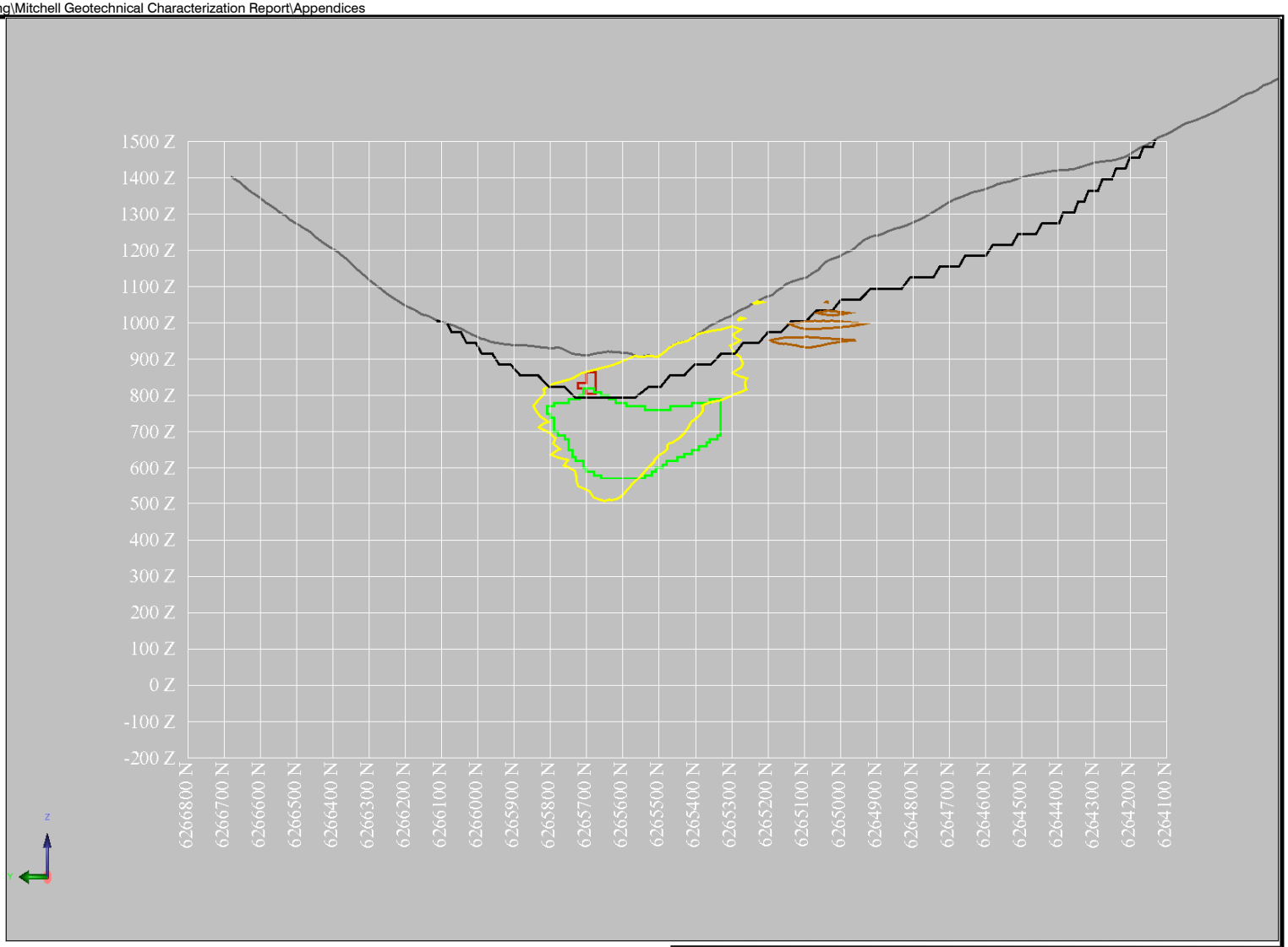
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV. 0
CADD	LCC	17NOV11		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE E-17

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CL SHELL
- IARG SHELL
- QSP SHELL
- CAVE FOOTPRINT

Rock Fabric

Massive	Foliated
Stockwork	Other

Fracture Frequency (/m)

0	3 - 5
0 - 1	5 - 10
1 - 3	> 10

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

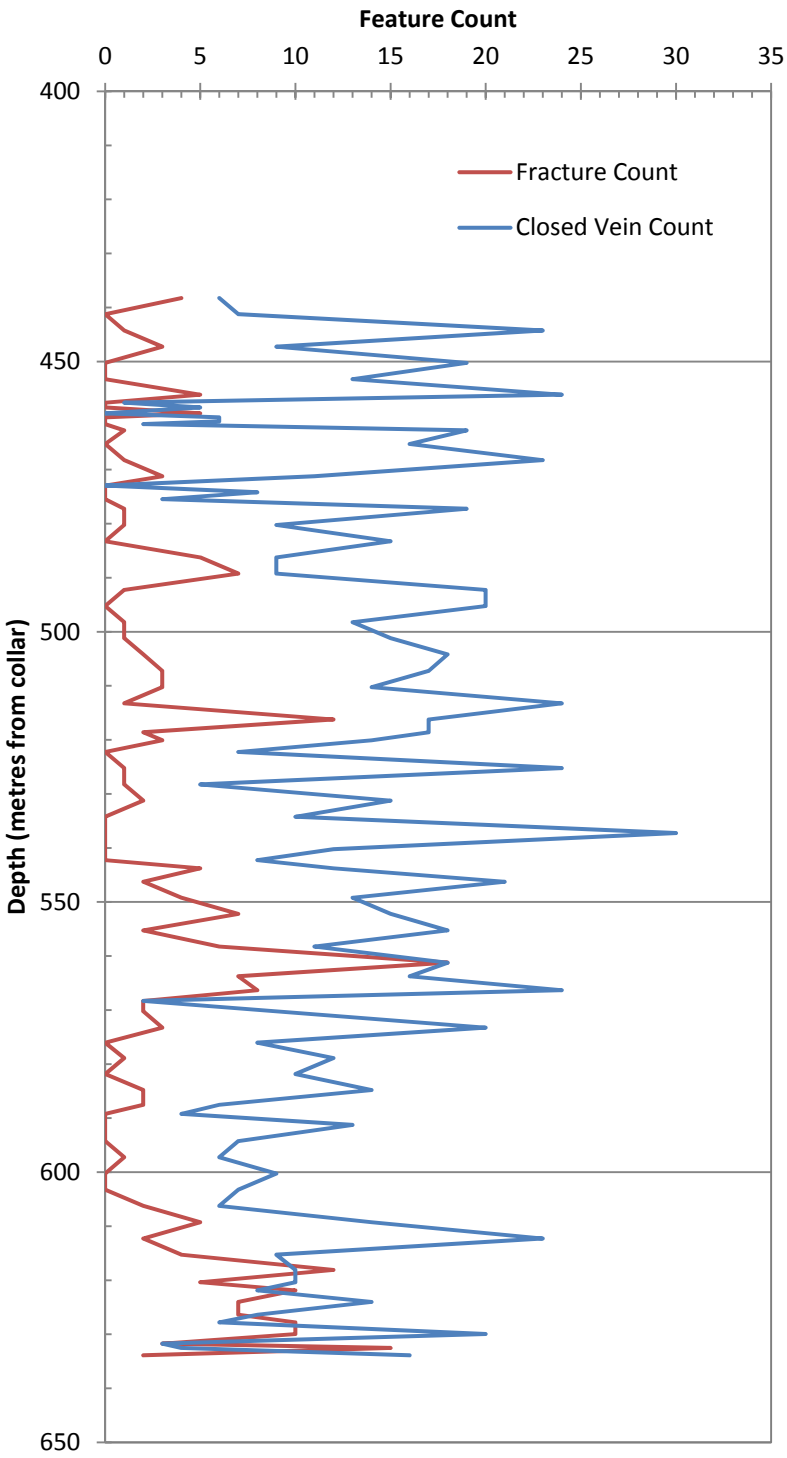
MITCHELL - 423800 EASTING
ROCK FABRIC and FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV. 0
CADD	LCC	17NOV11	**FIGURE E-18**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

APPENDIX F

Downhole Plots Showing Closed Vein Count and Fracture Frequency



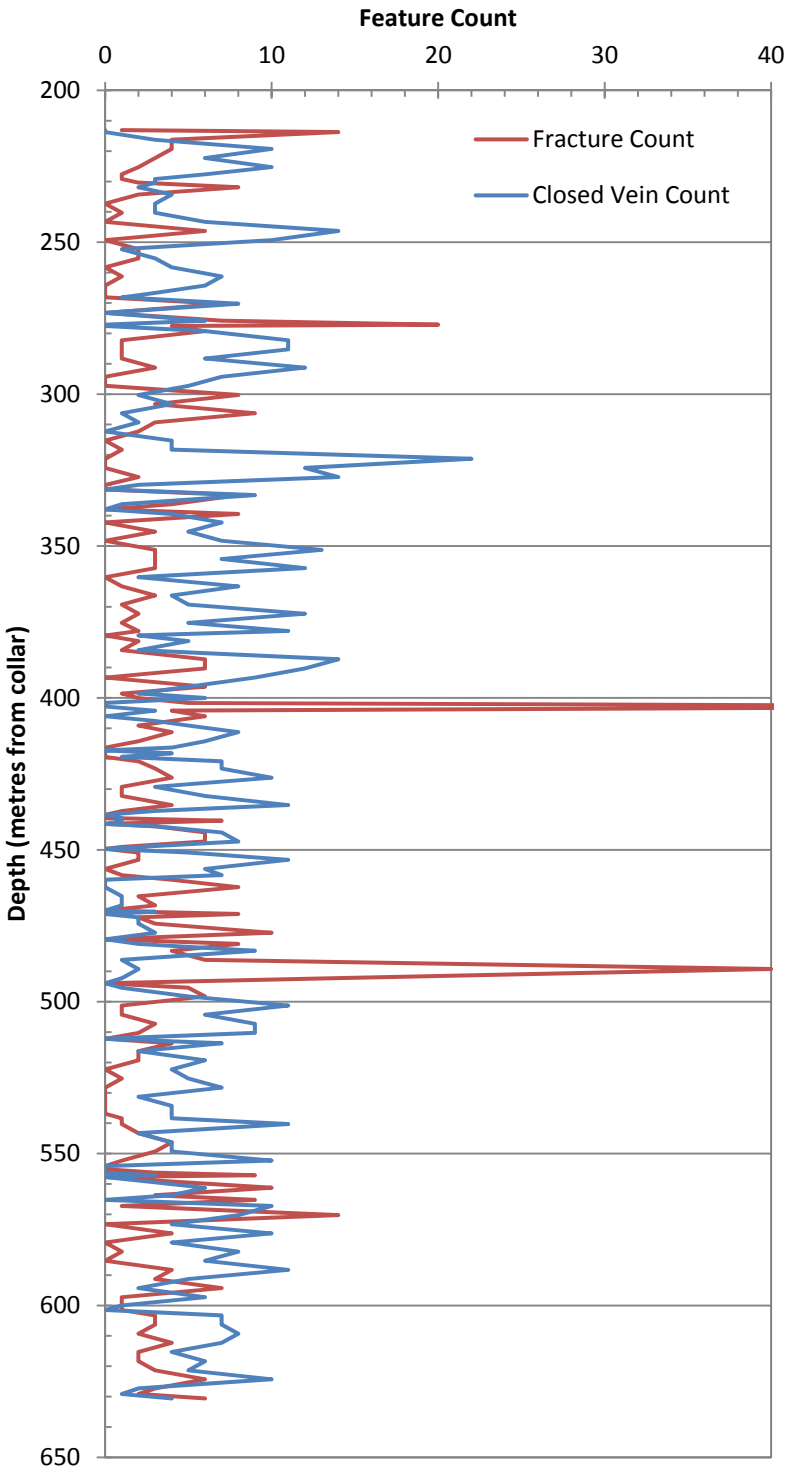
PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-11-122 CLOSED VEIN COUNT AND FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10JAN12	SCALE NTS	REV. 0
CADD	CY	10JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

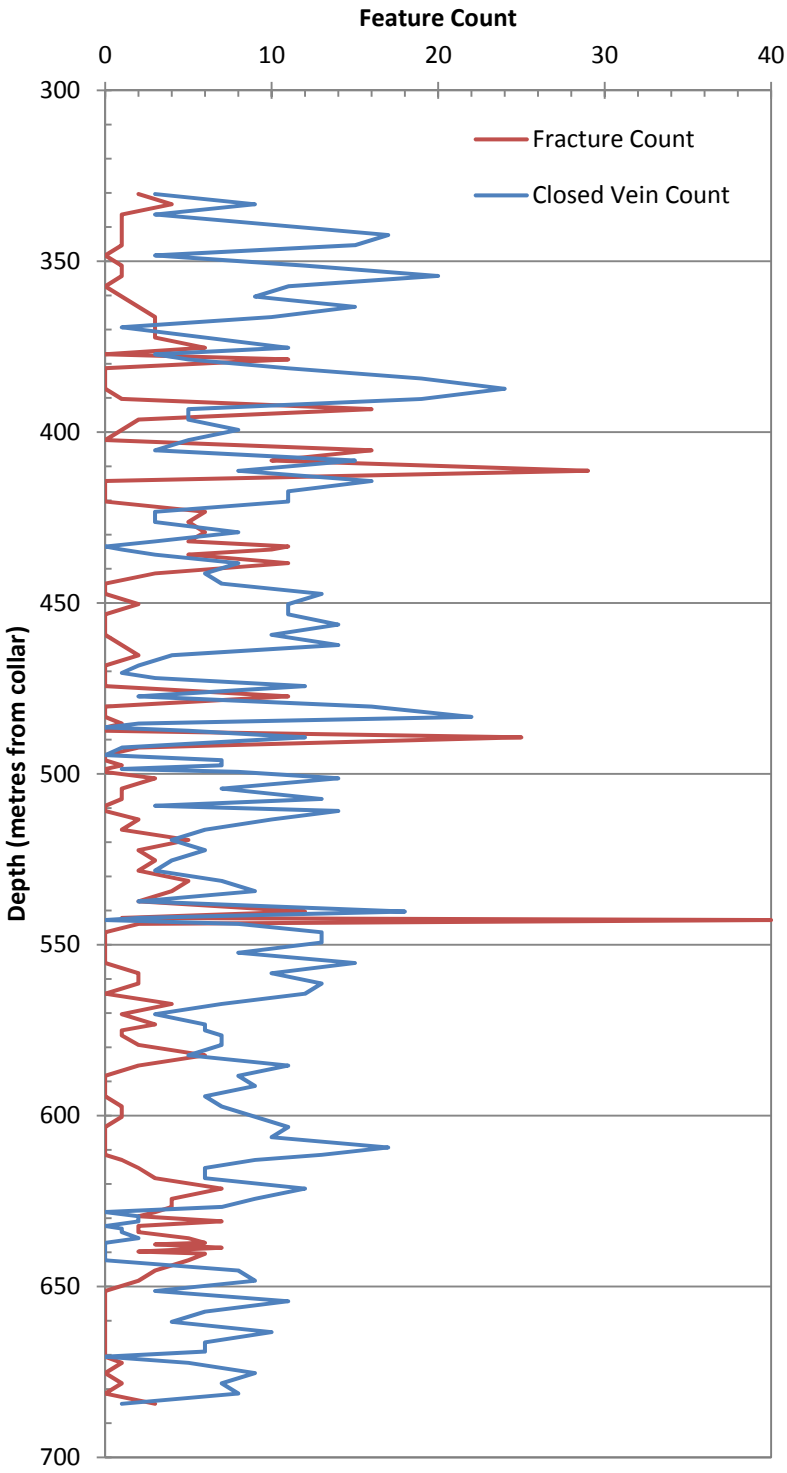
FIGURE F-1

REVISION DATE: 10JAN12 BY: CY FILE: O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA				
TITLE	M-11-123 CLOSED VEIN COUNT AND FRACTURE FREQUENCY				
Golder Associates	PROJECT No. 11-1439-0002			PHASE No. 10000	
	DESIGN	CY	10JAN12	SCALE NTS	REV. 0
	CADD	CY	10JAN12	FIGURE F-2	
	CHECK	KMM	15FEB12		
	REVIEW	RDH	15FEB12		

REVISION DATE: 10JAN12 BY: CY FILE: O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

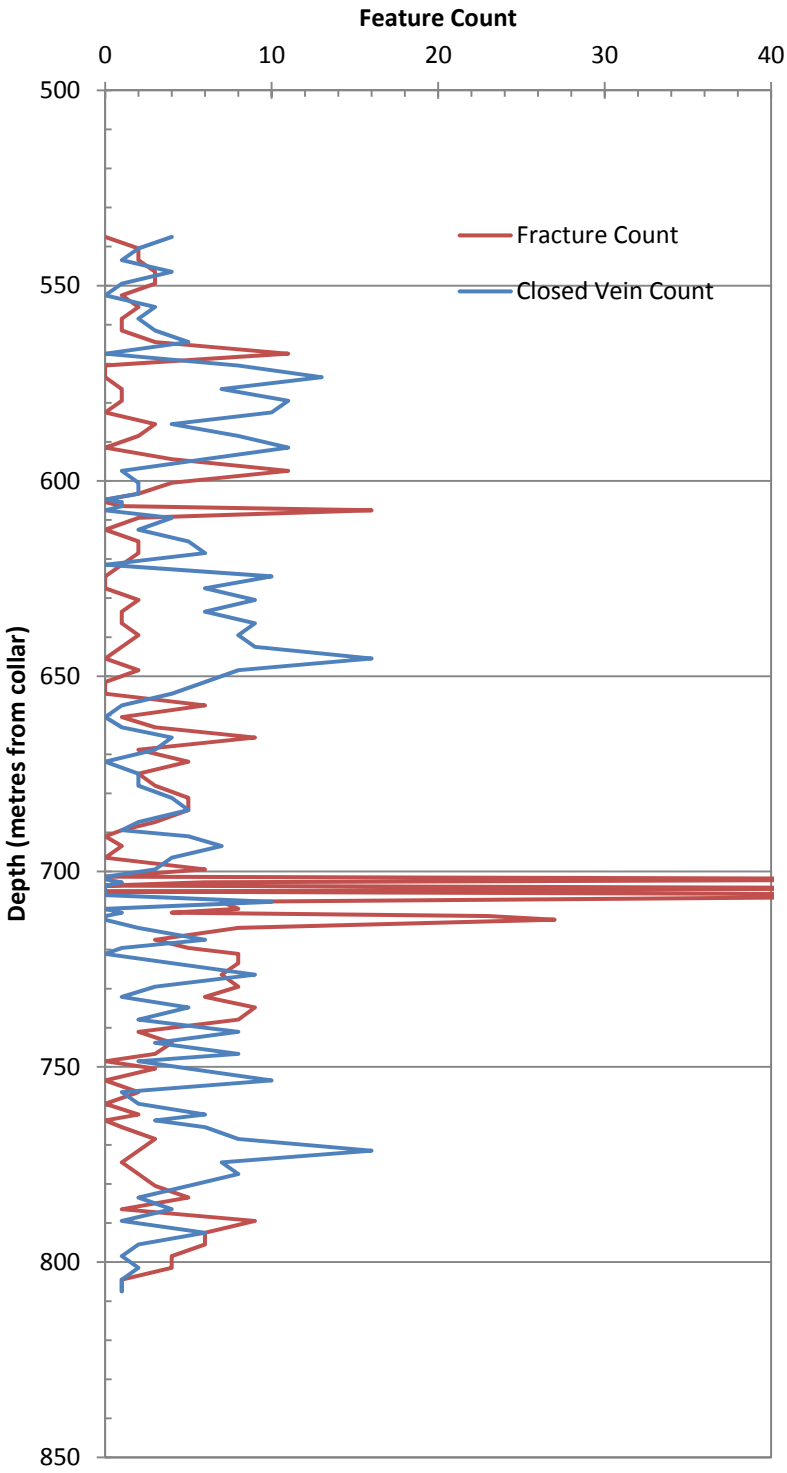
M-11-124
CLOSED VEIN COUNT AND FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10JAN12	SCALE NTS	REV. 0
CADD	CY	10JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE F-3

REVISION DATE: 10JAN12 BY: CY FILE: O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices

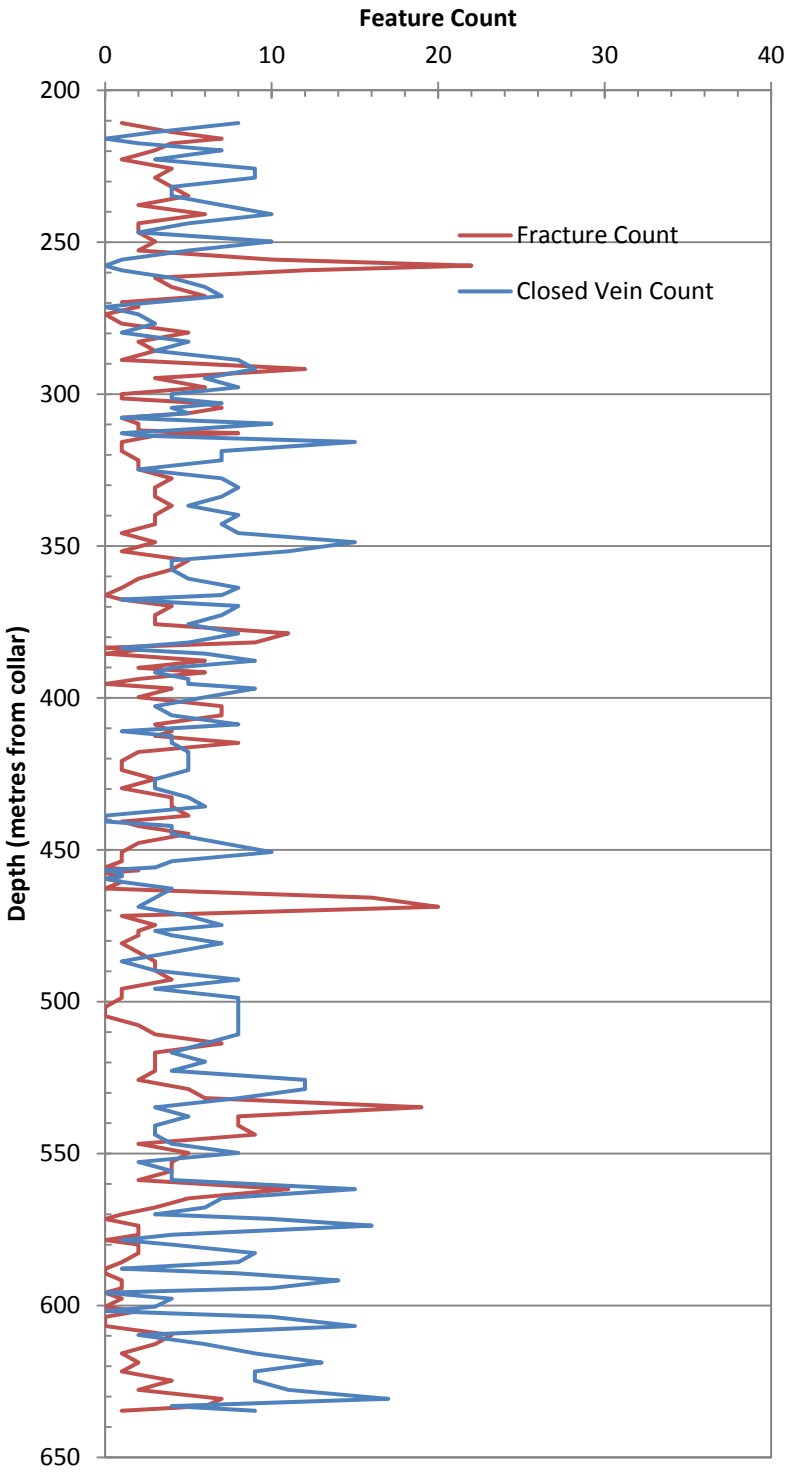


PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-11-125 CLOSED VEIN COUNT AND FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10JAN12	SCALE NTS	REV. 0
CADD	CY	10JAN12	FIGURE F-4	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

REVISION DATE: 10JAN12 BY: CY FILE: O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-11-126 CLOSED VEIN COUNT AND FRACTURE FREQUENCY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10JAN12	SCALE NTS	REV. 0
CADD	CY	10JAN12	FIGURE F-5	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

REVISION DATE: 10JAN12 BY: CY FILE: O:\Active_2011\1439\11-1439-0002 Seabridge PFS\10_Reporting\Mitchell Geotechnical Characterization Report\Appendices

APPENDIX G

DFN Modelling and In-Situ Fragmentation Assessment

Seabridge Gold Inc. – Mitchell

DFN Modelling and In-Situ Fragmentation Assessment

11-1439-0002 ph.10000

Golder Associates

Presentation Outline

- Introduction
- Methodology – Data Analysis
  - DFN Modelling and Workflow
  - Fracture Spatial Variation
  - Fracture Orientation Analysis
  - Fracture Size (Length) Analysis
  - Fracture Intensity Analysis
    - Cumulative Fracture Intensity
    - P32 Analysis
- Fragmentation Modelling Results

Discrete Fracture Network (DFN) Modelling

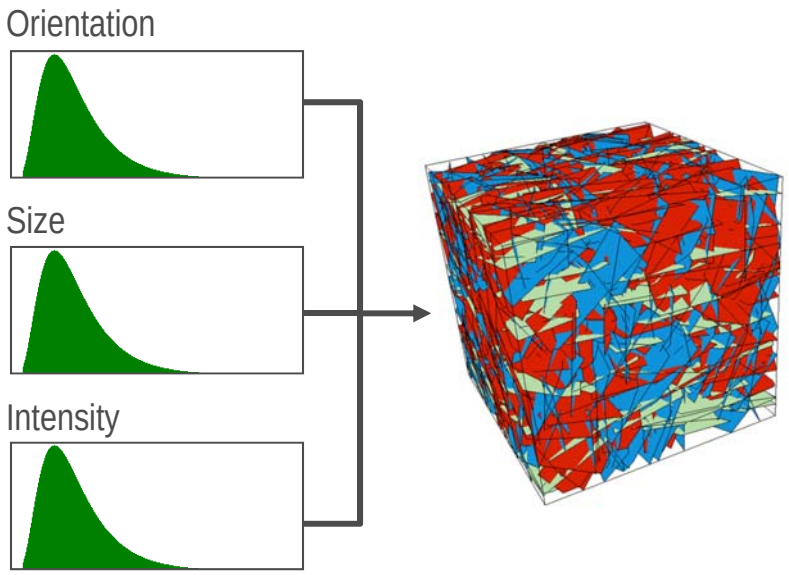
Introduction to DFN Modelling

- A key motivation for Golder's participation in the development of discrete fracture network modelling techniques was recognition of the generally poor way that conventional geotechnical characterization methods handle fracture data. In most applications, fracture properties are typically averaged or at best given unrepresentative geometric properties, often based upon unrealistic assumptions of fracture ubiquity, infinite length and parallel orientations. In contrast, DFN modelling attempts to model the rock mass fabric by describing the fracture system in a more realistic way, allowing a description of the fracture geometry that is driven by verifiable data.
- DFN models seek to describe the heterogeneous nature of fractured rock masses by explicitly representing key elements of the fracture system as discrete objects in space with appropriately defined geometries and properties. By building geologically realistic models that combine the larger observed deterministic structures with smaller stochastically inferred fractures, DFN models capture both the geometry and connectivity of the fracture network as well as the geometry of the associated intact rock blocks.

Discrete Fracture Network (DFN) Modelling

Parameters Required for a DFN Based Fragmentation Assessment

- The aim of the DFN modelling is to condition the fracture model as much as is possible to available data, and then use Monte Carlo simulations to quantify the uncertainty of extrapolation of the fracture pattern throughout the mine volume. It is a stochastic process allowing multiple but equi-probable realisations to be created.
- DFN models require certain fracture properties to be defined, namely:
  - Fracture Spatial Variation;
  - Fracture Orientation Distribution;
  - Fracture Size Distribution; and
  - Fracture Intensity.
  - Fracture termination (expressed as percentage) may also be defined for a given fracture set with respect to a primary one.



Fracture properties (orientation, size and intensity) can be defined by using various forms of distributions

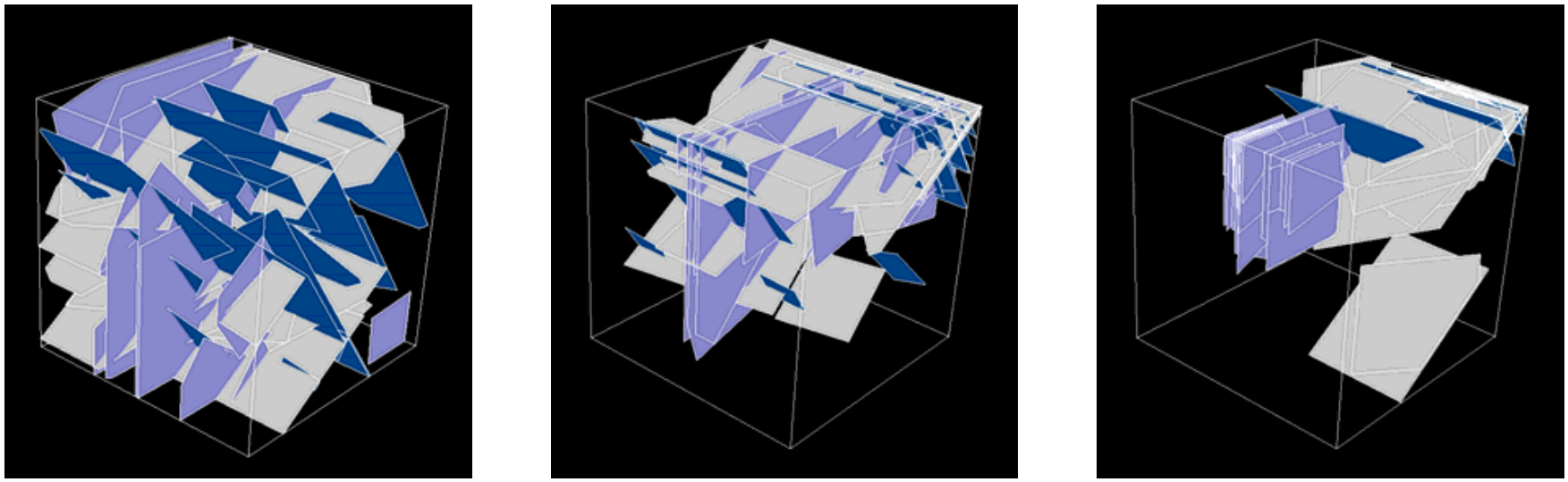
Discrete Fracture Network (DFN) Modelling

Fracture Spatial Variation

- A key parameter in the synthesis of a specific DFN model is the definition of a fracture spatial model. The main difference between DFN models is a function of the way fracture characteristics are considered (Dershowitz and Einstein, 1988; Staub et al., 2002; Rogers et al., 2007). Most of the models involve the same considerations for specific fracture characteristics, such as shape (generally polygons), size and termination at intersections. Fracture spatial models can be grouped according to the specific distribution laws utilised to simulate fracture orientation and fracture location. The choice of a specific fracture spatial model is typically based on assumptions made from field data and geological observations. The code FracMan used in the current study allows for the use of three different fracture spatial models:
- The Enhanced Baecher model, according to which fracture location may be defined by a regular (deterministic) pattern or a stochastic process. The stochastic approach assumes that the fracture centres are randomly located in space using a Poisson process.
- The Nearest-Neighbour model, which is a model particularly suited to model the tendency of fractures to be clustered around major points and faults by preferentially producing new fractures in proximity of earlier fractures (Dershowitz et al.,1998).
- The Fractal Levy-Lee model, which is a fractal model whose key features are that fracture centres are created sequentially and the size of a fracture is related to its distance from previous fractures (Staub et al., 2002).

Discrete Fracture Network (DFN) Modelling

Fracture Spatial Variation



Example of DFN models generated using different fracture spatial models for equivalent fracture orientation and radius distributions. Enhanced Baecher model (left), Nearest-Neighbour model (centered) and Fractal Levy-Lee model (right)

Discrete Fracture Network (DFN) Modelling

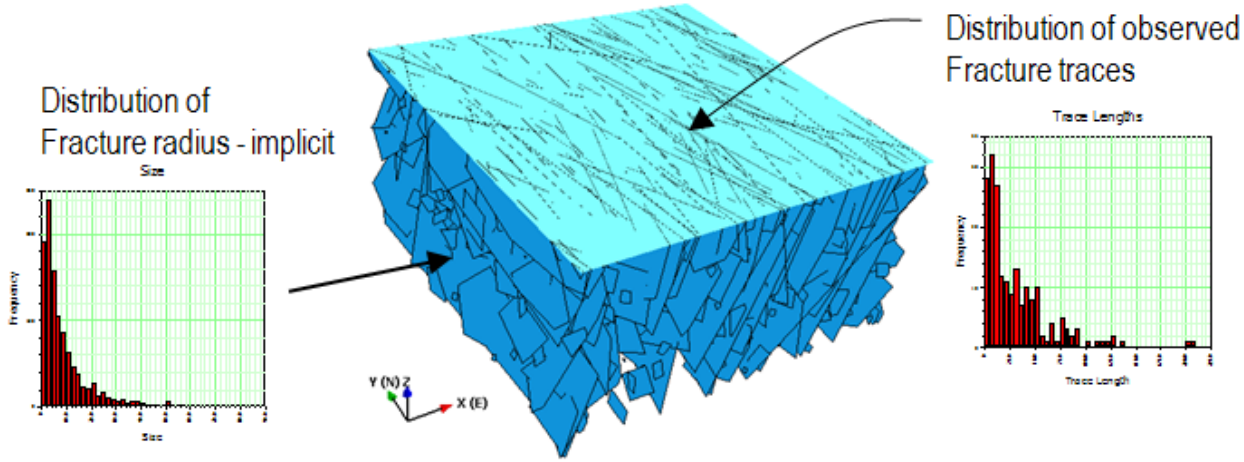
Fracture Orientation

- DFN models can be generated separately for each fracture set and then combined to obtain the overall representation of the fracture network. The application of separate statistical procedures to define fracture sets and, consequently the separate DFN models for each is known as a disaggregate approach. Distributions such as Fisher, Bingham, bivariate Fisher and bivariate Bingham can be used to represent fracture orientation. Alternatively, field data that do not conform to straight forward statistical methods (i.e. characterised by a highly dispersed scatter), can be analysed using a bootstrap approach, whereby a statistical method based upon multiple random sampling with replacement from an original sample is used to create a pseudo-replicate sample of fracture orientations.

Discrete Fracture Network (DFN) Modelling

Fracture Size Analysis

- The derivation of the fracture size distribution is critical to any DFN modelling campaign yet is generally among the most difficult parameter to constrain. The primary difficulty in determining fracture size is that it cannot be measured directly as any measurements relating to fracture size are actually measurements of the trace a fracture or fault make with a geological surface or mining exposure.



The problem in determining fracture size (radius) from observed fracture trace lengths

Methodology – Data Analysis

Fracture Intensity Analysis

- Defining fracture intensity within the mining industry is somewhat problematic as there are a wide range of possible measures, often with ambiguous definitions. In order get around this problem, the DFN community developed a series of fracture intensity measures

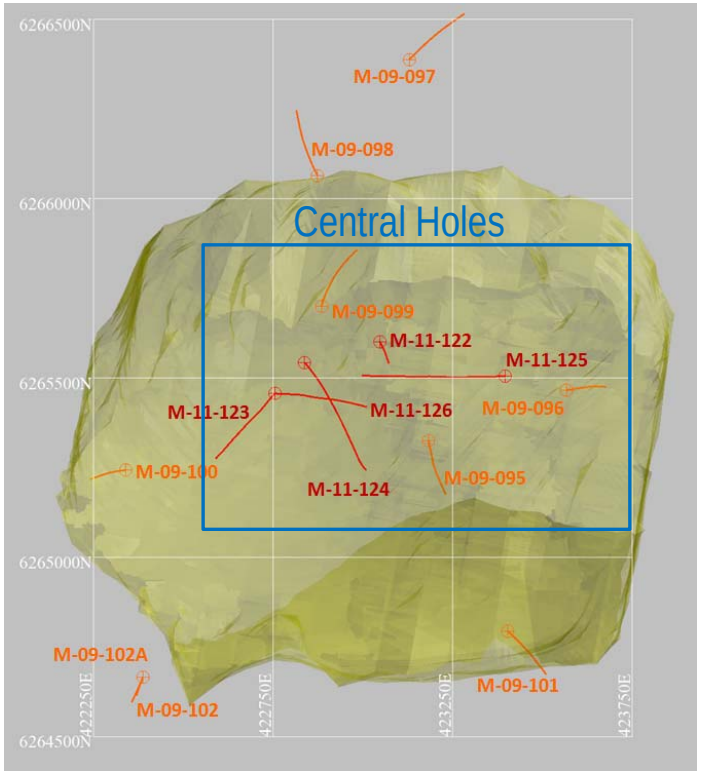
		Dimension of Measurement				
		0 (Count)	1 (Length)	2 (Area)	3 (Volume)	
Dimension of Sample	1D (e.g. borehole, scam line)	P10 *No of fractures per unit length of borehole*	P11 *Length of fractures per unit length*			*Linear Measures*
	2 (e.g. outcrop, bench mapping)	P20 *No of fractures per unit area*	P21 *Length of fractures per unit area*	*P22 Area of fractures per area*		*Areal Measures*
	3 (e.g. geophysical methods)	P30 *No of fractures per unit volume*		P32 *Area of fractures per unit volume*	P33 *Volume of fractures per unit volume*	*Volumetric Measures*
		Density		*Intensity*	*Porosity*	

Fracture intensity measures based upon the dimension of the sample and the dimension of the fracture measure

Primary Data Sources

Primary Data Sources

- The primary data used for this study are core logging data from boreholes M-09-095, M-09-096, M-09-099, M-11-123, M-11-124, M-11-125, M-11-126
- A map showing the location of the drilled boreholes for Mitchell is shown on the right



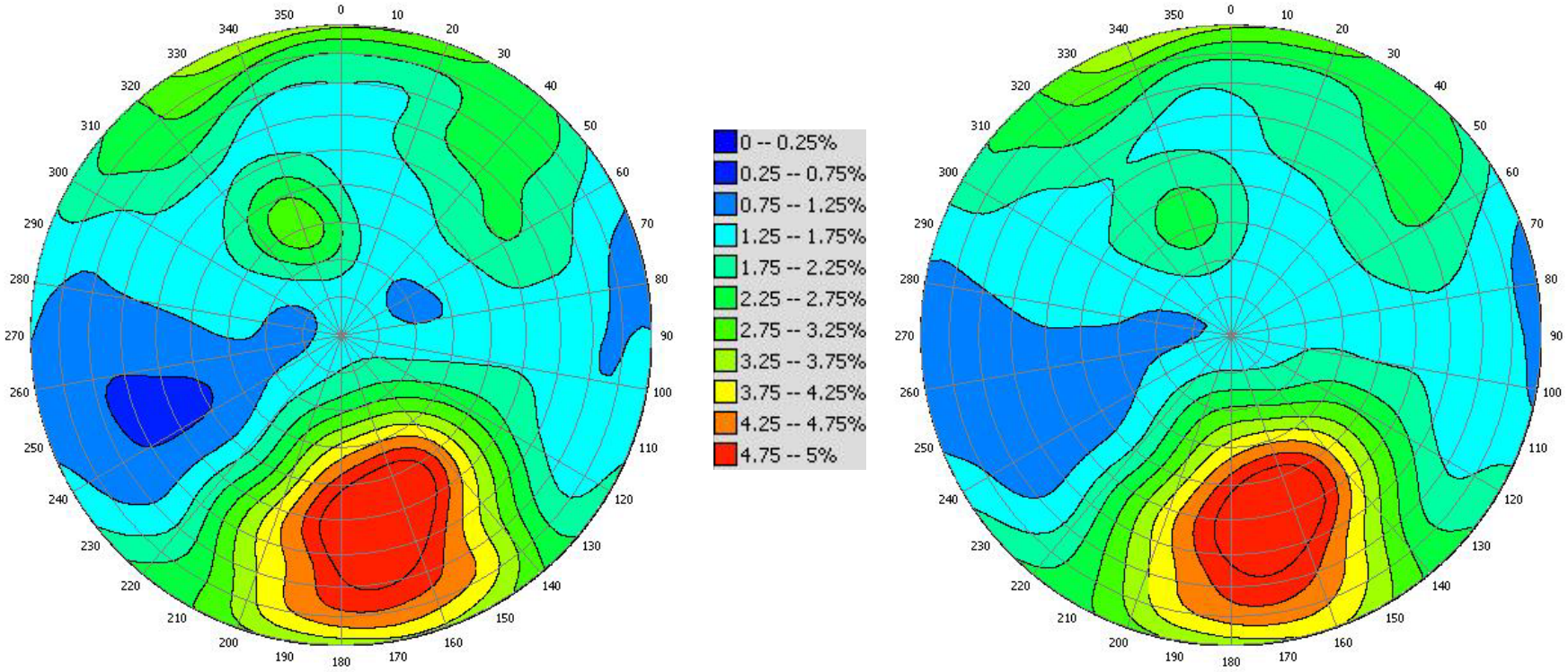
Map of geotechnical boreholes used in the analysis for Mitchell

Fracture Orientation Analysis

- The major objective of the analysis of the fracture orientation data is to derive parameters for conditioning and extrapolation of fracturing throughout the mine volume. The main fracture types identified that are relevant to this study are Joints and Open Veins. The primary data used are core logging data from boreholes M-09-095, M-09-096, M-09-099 (BGC), M-11-123, M-11-124, M-11-125, M-11-126 (Golder Associates)

Fracture Orientation Analysis

Fracture Orientation Analysis – Mitchell

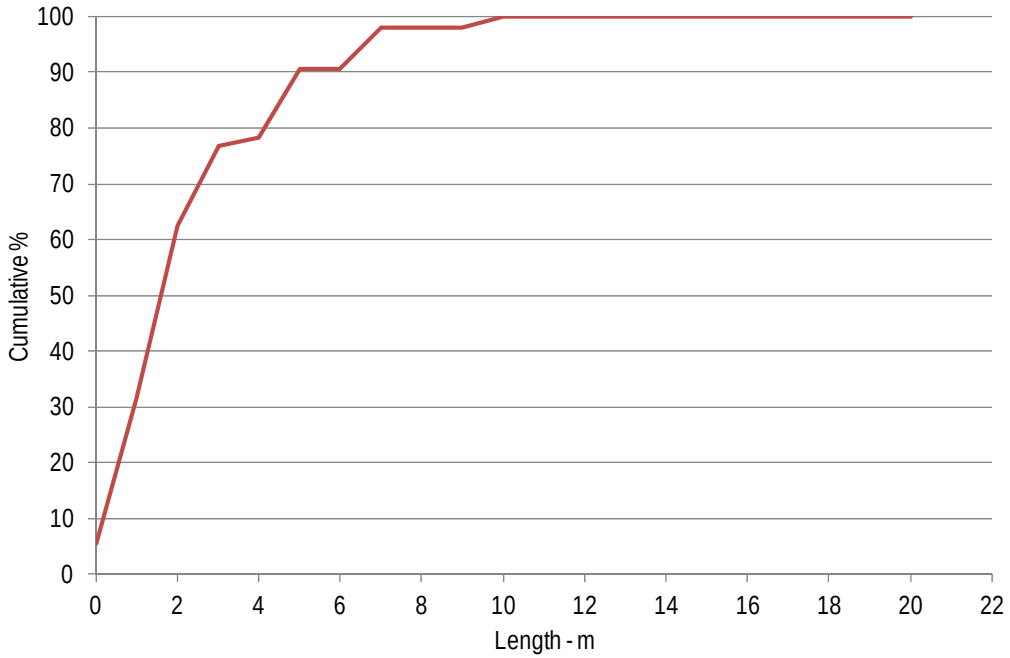


Stereonet projection of borehole data – comparison between mapped (left) and simulated (right) data for Mitchell

Fracture Size Analysis

Fracture Size Analysis

- The primary fracture length data are provided from mapping carried out around the site area (Mitchell data set).
- The main fracture types identified that are relevant to this study are Joints and Open Veins.
- As shown in the next two slides, it was found that an exponential distribution for fracture radius (mean of 2m) yielded a good agreement between the simulated and the mapped trace length data.

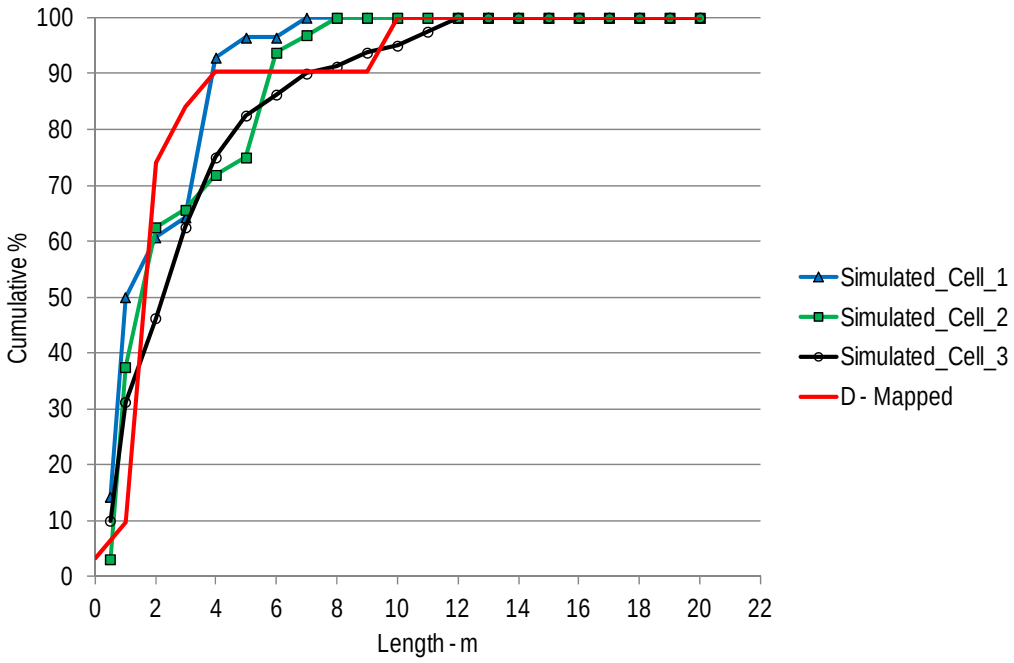


Cumulative frequency from mapped fracture trace lengths (Mitchell, all data)

Methodology – Data Analysis

Fracture Size Analysis

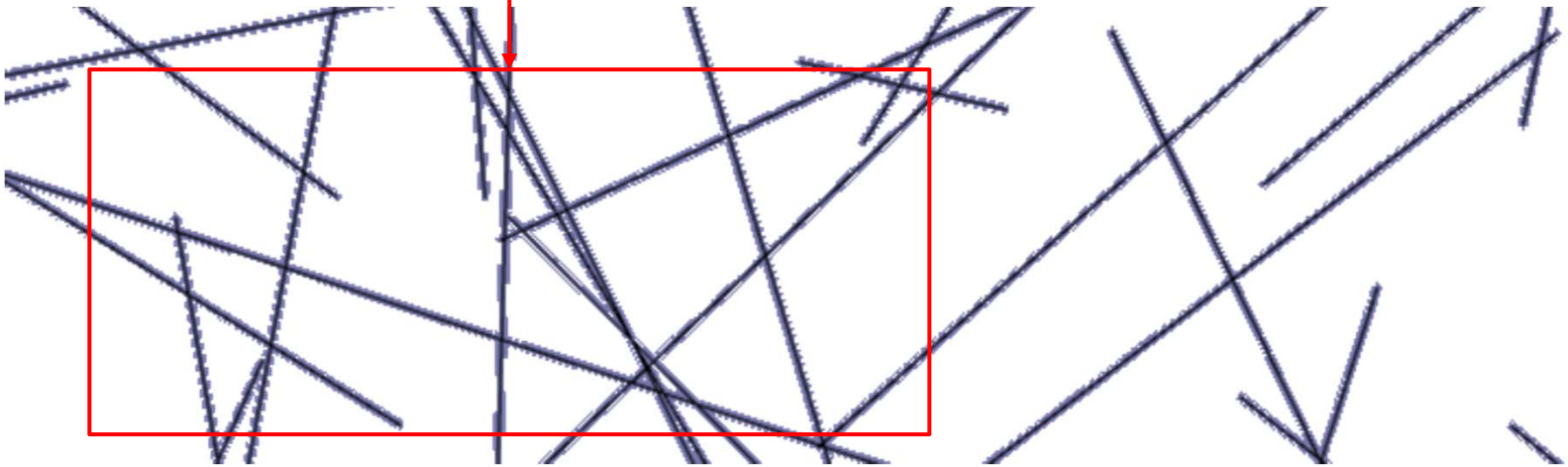
- The figure shows the comparison between the mapped data for Mitchell (Cell DD) and the simulated data in the DFN model.
- Since the mapped data included the actual length of traces extending outside the mapped cell, trace maps within a given cell (Cell_1, Cell_2 and Cell_3) were considered in the DFN model, and then compared to the mapped data.
- Cell_1 is 7 x 2 m, Cell_2 is 7 x 4 m and Cell_3 is 12 x 12 m
- The results show that there is a reasonably good agreement between the mapped and simulated fracture length over a range of simulated outcrop surfaces in the model.



Comparison between mapped and simulated traces
Cell DD (Mitchell)

Fracture Size Analysis

- Visual comparison between mapped (Cell DD, Mitchell) and simulated data (Cell_1)



Fracture Intensity Analysis

Fracture Intensity Analysis

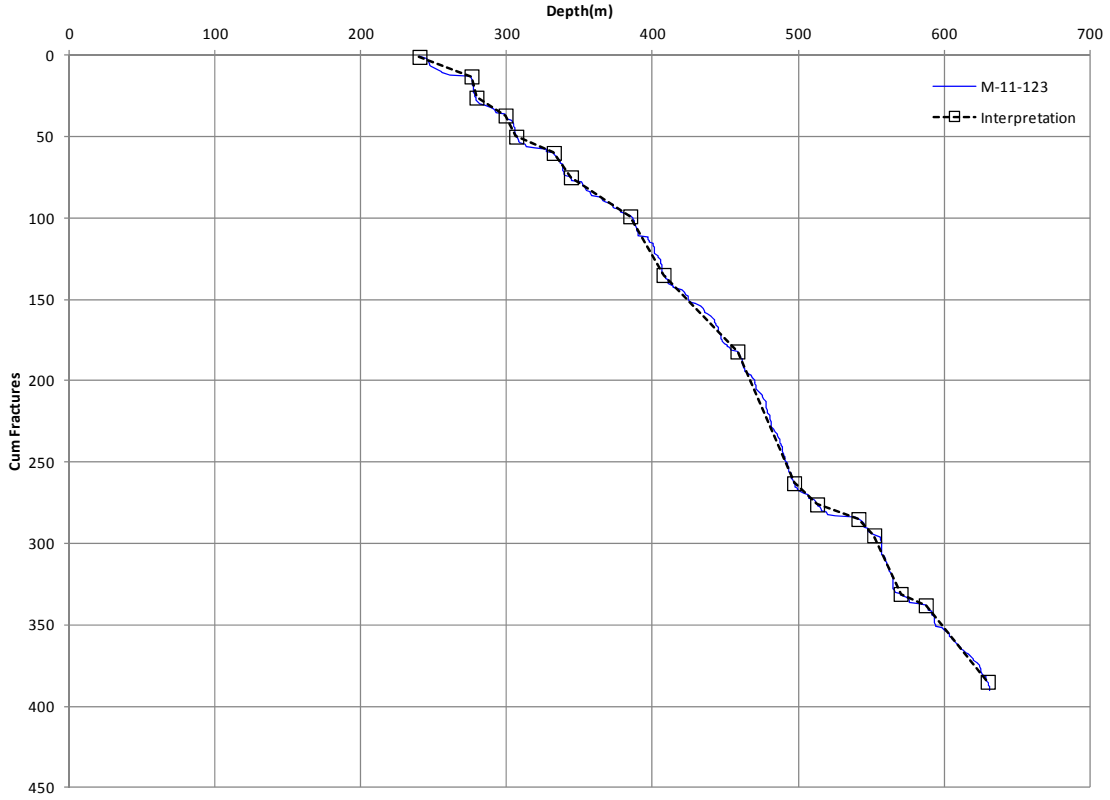
- The primary data for fracture intensity available for modelling is the fracture frequency information from the geotech logs (P10 from with units m^{-1}).
- The methodology adopted to estimate the corrected fracture intensity to be used in the DFN model is as follows:
  1. Cumulative Fracture Intensity (CFI) plots are initially generated to establish variation of fracture frequency (P10) with depth.
  2. Since fracture frequency is defined relative to a borehole or scanline trajectory, and this may be heavily influenced by the orientation of fractures relative to that trajectory, a correction is applied to the fracture frequency data as part of the conversion from linear intensity P10 to volumetric intensity P32 (C31 calculation).
  3. For each borehole, cumulative frequency (P32) curves are plotted and a relative weight calculated over a given range [$P32_i$, $P32_{i-1}$]. The relative weight is subsequently used to obtain an averaged, weighted, fragmentation curve.

Fracture Intensity Analysis – CFI

- Cumulative Fracture Intensity (CFI) plots have been generated for all of 6 Golder boreholes, with these displaying depths on the Y axis and cumulative fracture number on the X axis. They are interpreted as follows:
  - Where the slope (gradient) of the CFI curve is constant, the fracture frequency over that interval is constant. The measured gradient is the fracture frequency in fractures per metre (#/m);
  - Where the gradient of the curve is steepening, the fracture frequency is increasing; and
  - Where the gradient of the curve is flattening, the fracture frequency is decreasing.
- CFI plots emphasize common zones of fracture frequency rather than the variation and represent a practical way to approximate the variation of fracture frequency along the length of the boreholes.

Fracture Intensity Analysis

Fracture Intensity Analysis – CFI



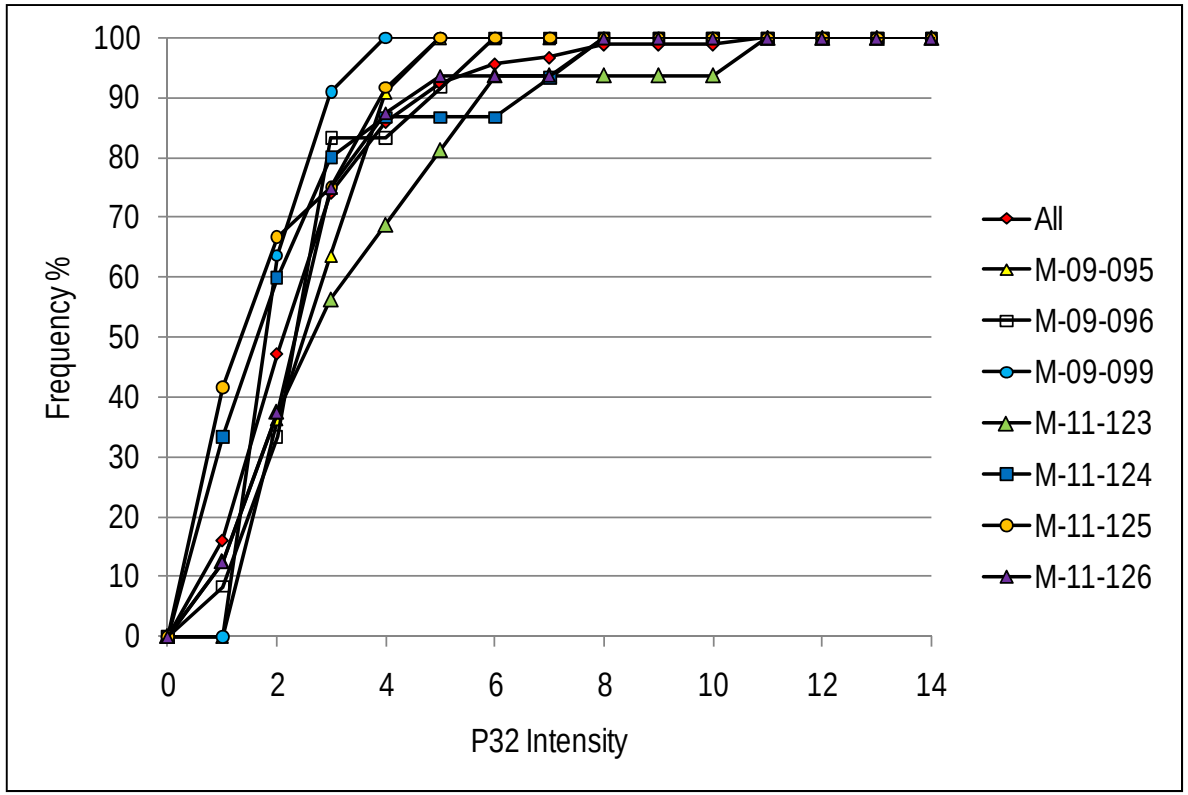
Example Cumulative Fracture Intensity plot showing both raw data (solid line) and interpretation (dashed line)

Fracture Intensity Analysis – P32 Computation

- Once the CFI curves and the P10 intervals have been completed for all boreholes a conversion factor (C31) is computed to be used to convert linear intensity (P10) to volumetric intensity (P32). This numerical approximation is based on the doctoral research by Wang (2005) on stereological relationships between fracture orientation and fracture intensity (for detail see FracMan Manual, 2011).

Fracture Intensity Analysis

Fracture Intensity Analysis – P32 Computation

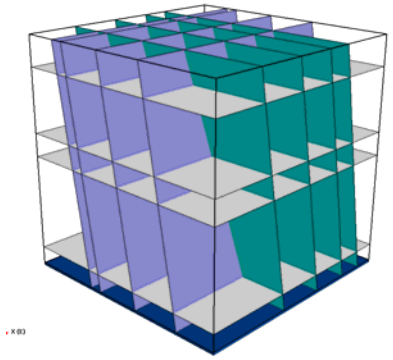


P32 Class	Class Weight
0-1	16.13%
1-2	31.18%
2-3	26.88%
3-4	11.83%
4-5	6.45%
5-6	3.23%
6-8	3.23%
8-10	0.00%
10-12	1.08%

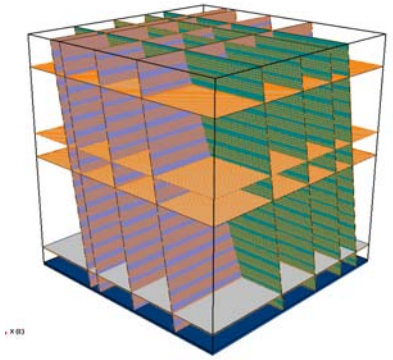
P32 frequency curves and table showing the relative P32 weights for different ranges (Mitchell data)

Fragmentation Analysis

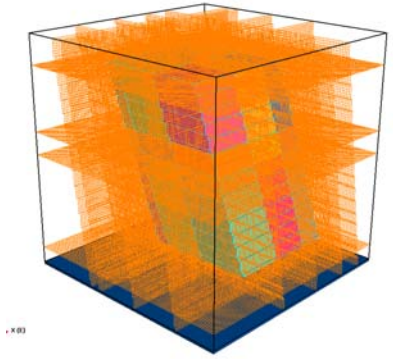
- Fragmentation is critical to the mining process, since fragmentation distribution strongly influences such issues as draw point sizing and equipment selection.
- The DFN model can be used to define the rock mass in situ (natural) fragmentation.
- An implicit cell mapping algorithm is used that identifies all fracture intersections with an underlying grid. This results in a collection of grid faces and connection information, which is then used to construct a rock block of contiguous grid cells.



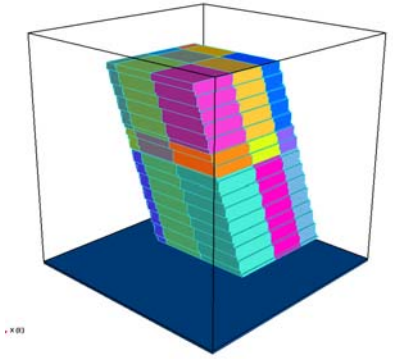
Initial fractures



Mapping fractures to grid cells



Regular block (Grid Block) is formed along grids with the initial fractures.

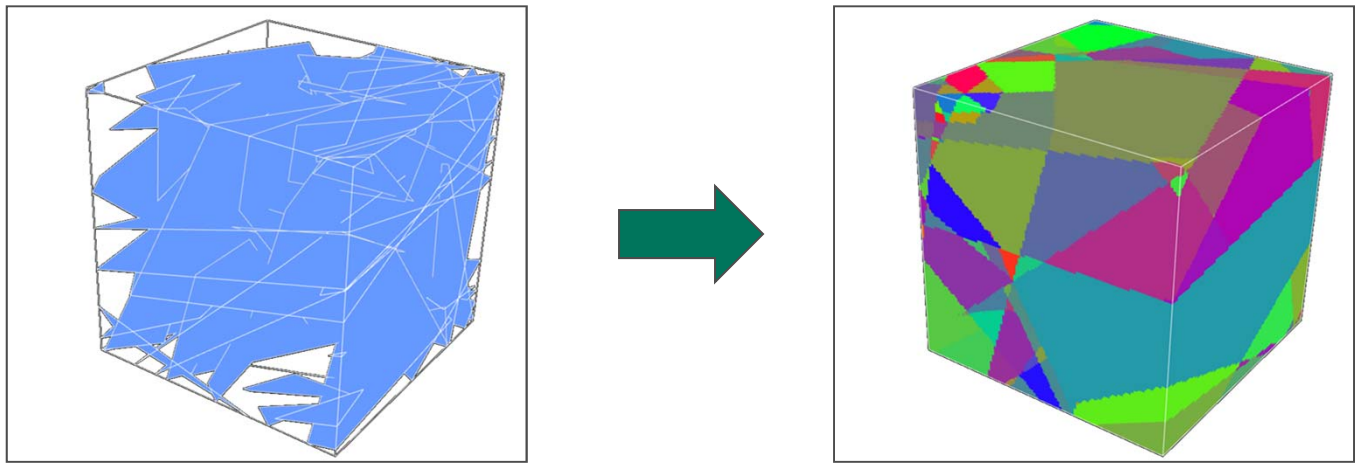


Grid Block

Cell mapping algorithm

Fragmentation Analysis

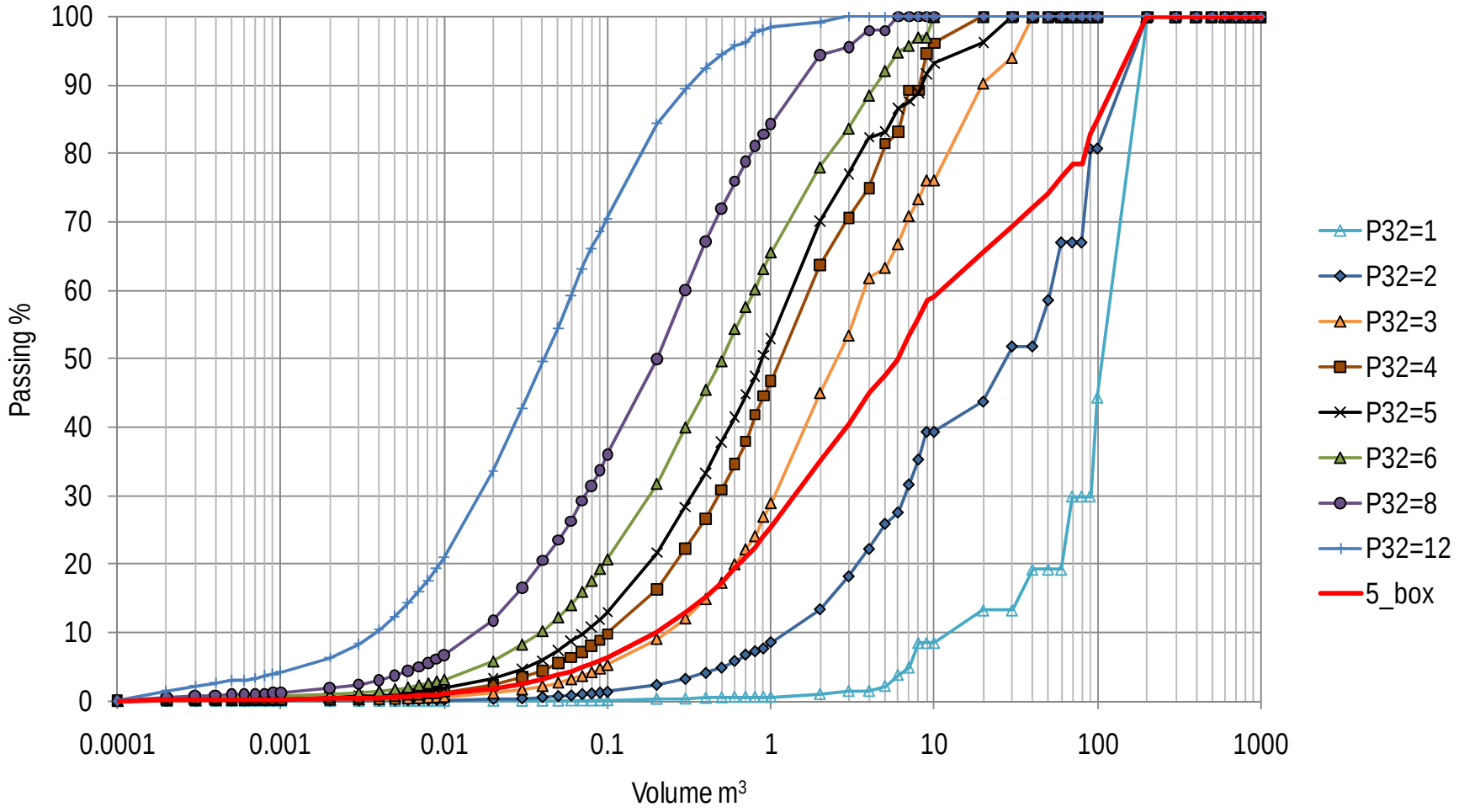
- The fragmentation analysis has been carried out within a volume with dimensions 5x5x5m.



Example of cell mapping algorithm (5x5x5 region)

Fragmentation Modelling Results

Fragmentation Curves for Varying Fracture Intensity



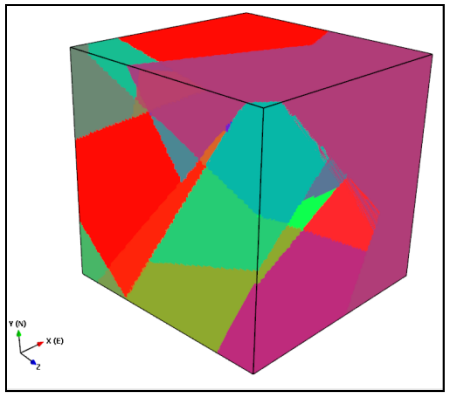
Block size percent passing curves

Mitchell

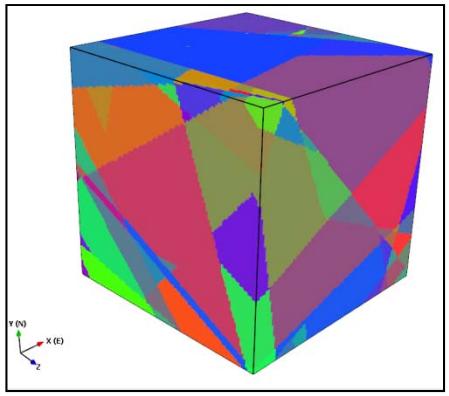
Golder Associates

Fragmentation Results for Varying Fracture Intensity

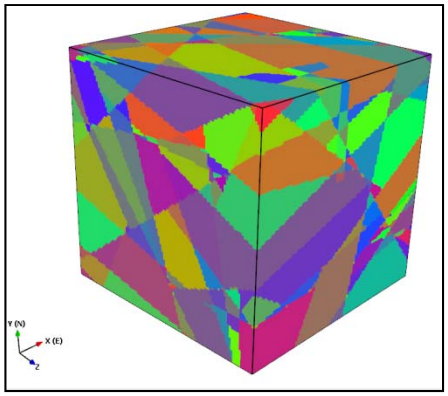
P32 =1



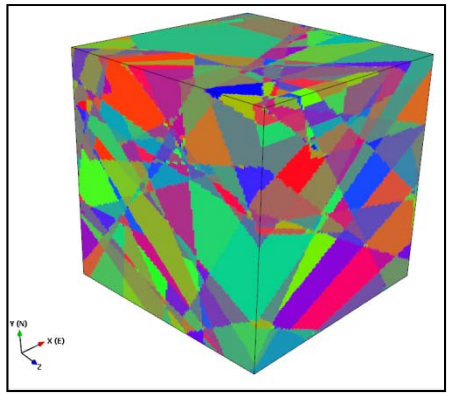
P32 =2



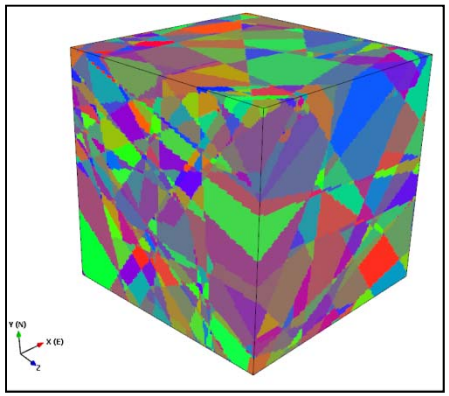
P32 =3



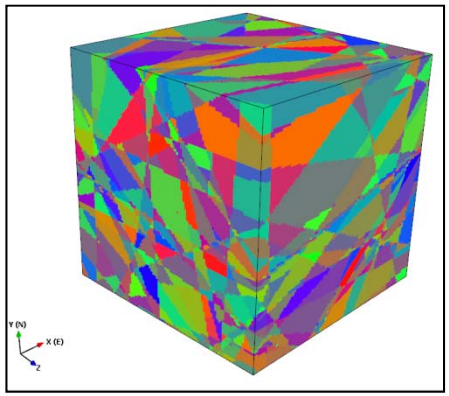
P32 =4



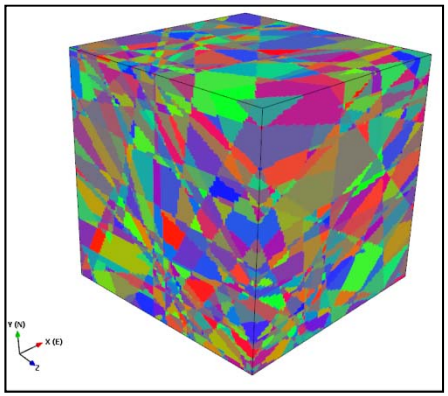
P32 =5



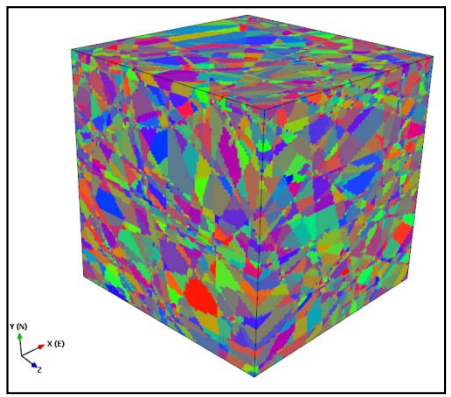
P32 =6



P32 =8

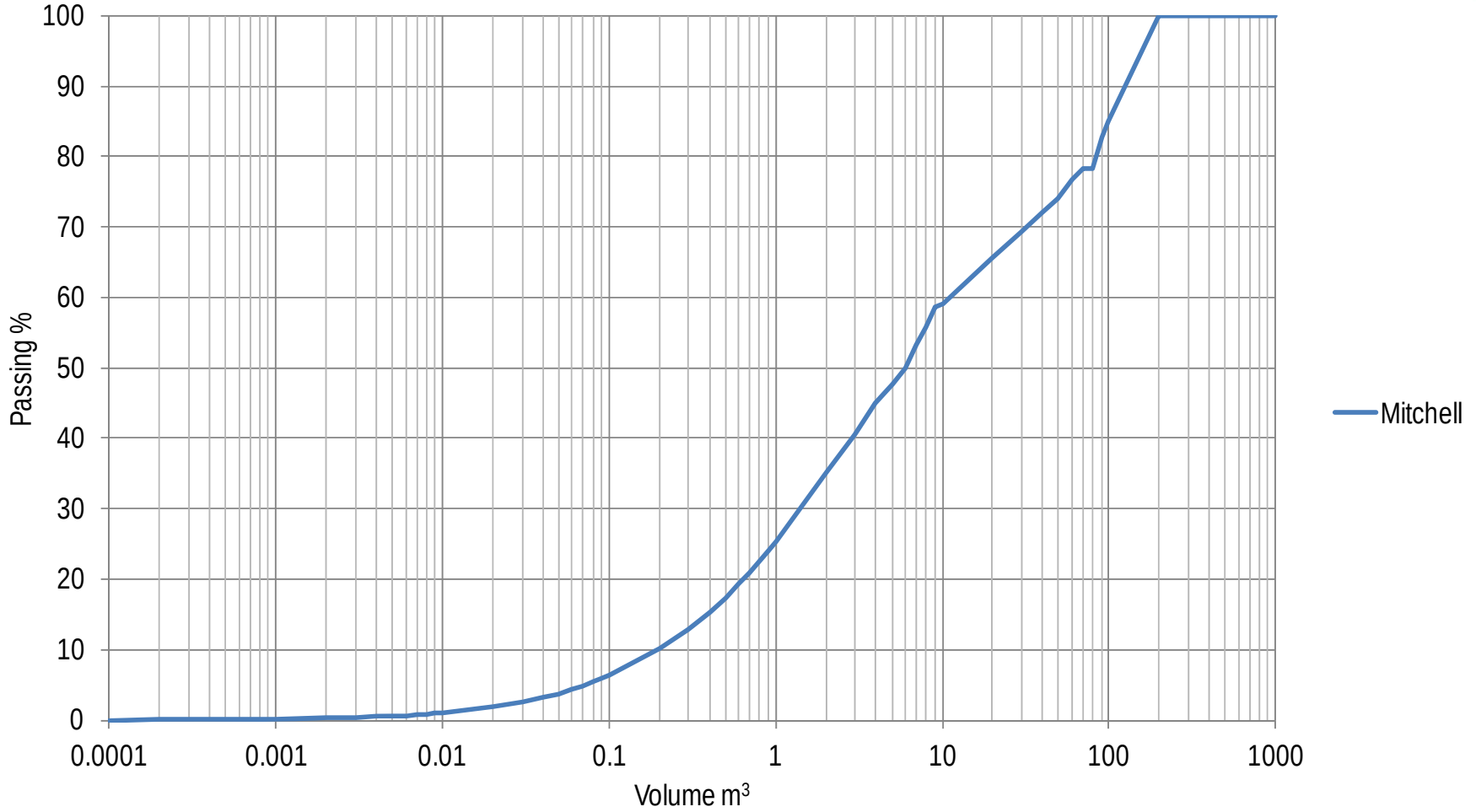


P32 =12



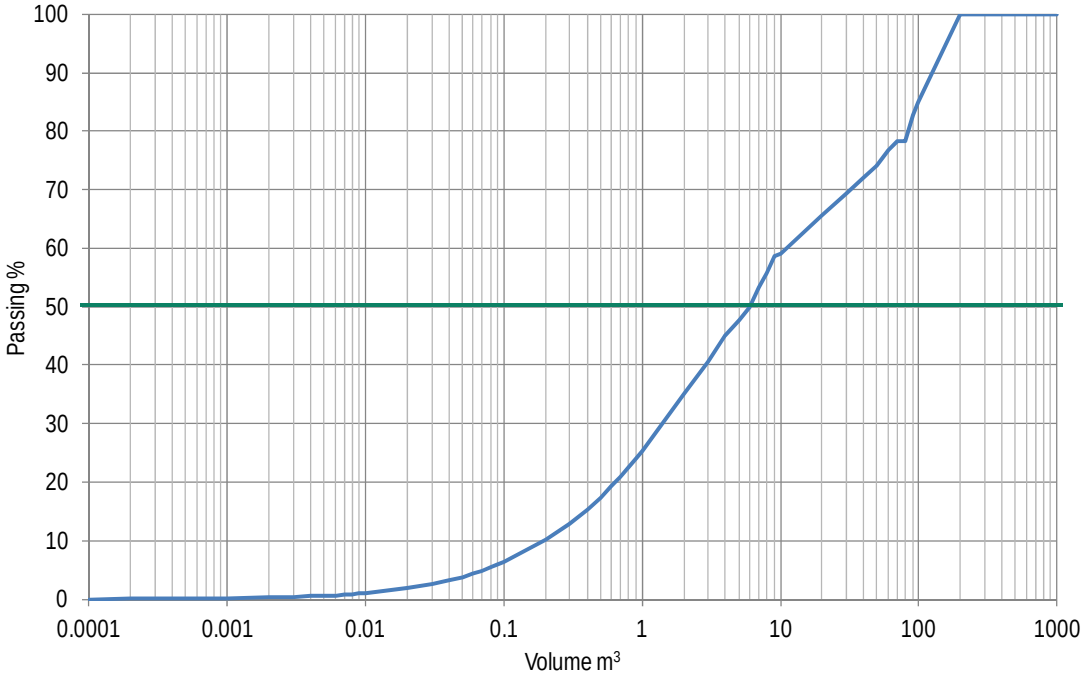
Block size generation for different P32 values based on DFN model

Fragmentation Results (Averaged Curve) - Mitchell



Block size percent passing averaged curve

Summary of Results

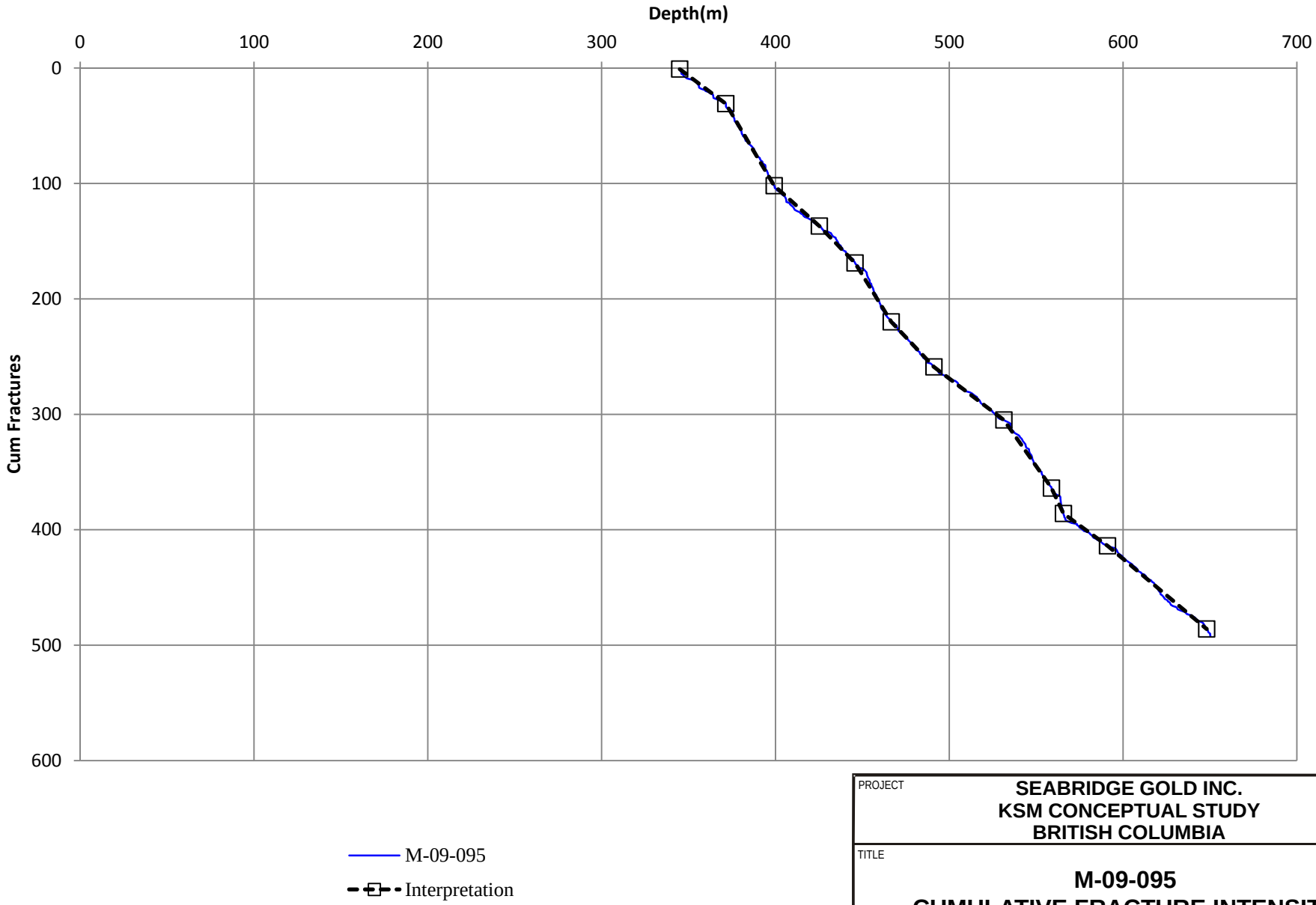


Percent Passing P50 (mean)	Region 5x5x5
Block Volume (m^3)	6.02

APPENDIX H

Cumulative Fracture Intensity Plots

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices

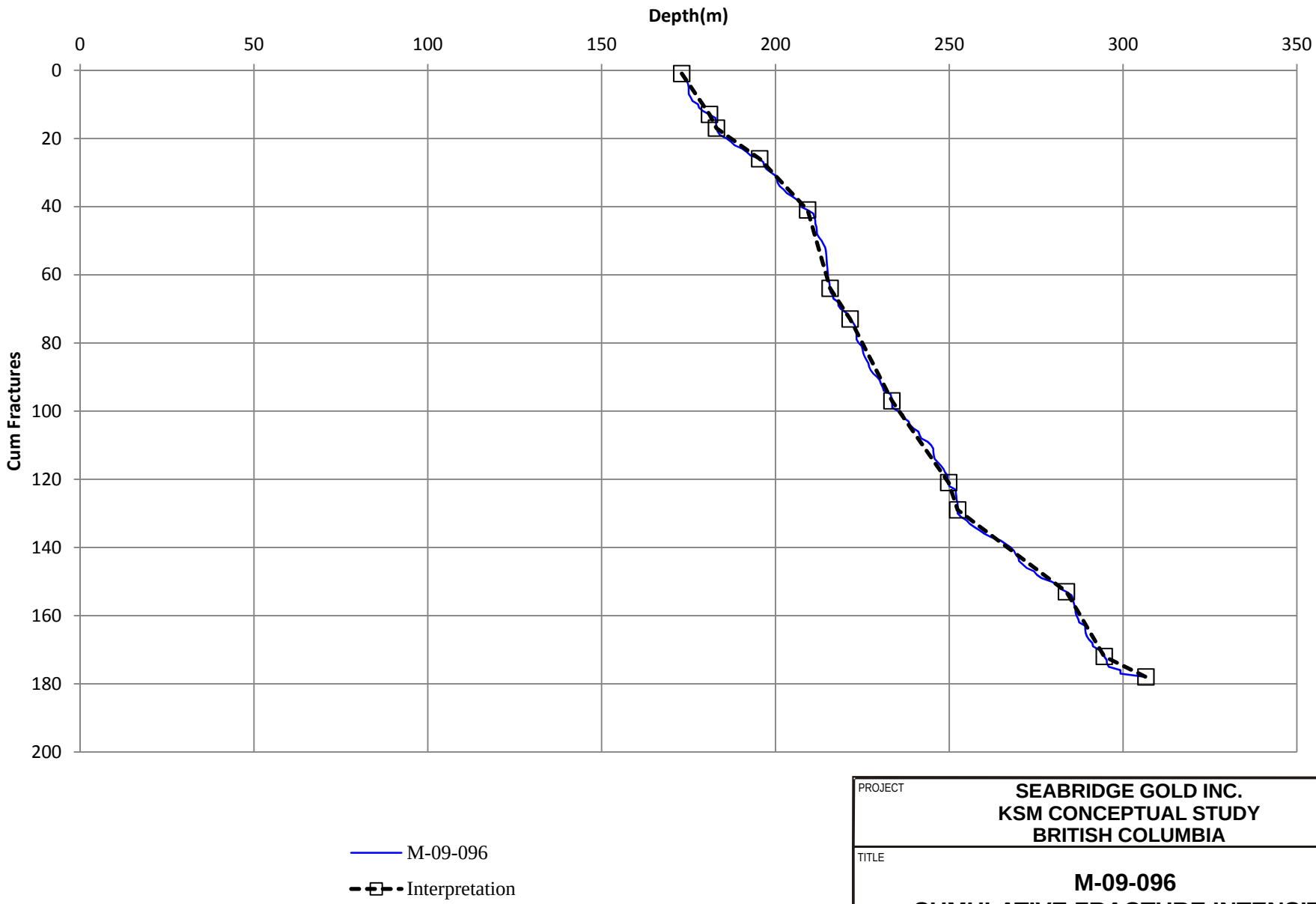


PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-09-095 CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	MV	30OCT11	SCALE NTS		REV.0
CADD	CY	06JAN12	FIGURE H-1		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

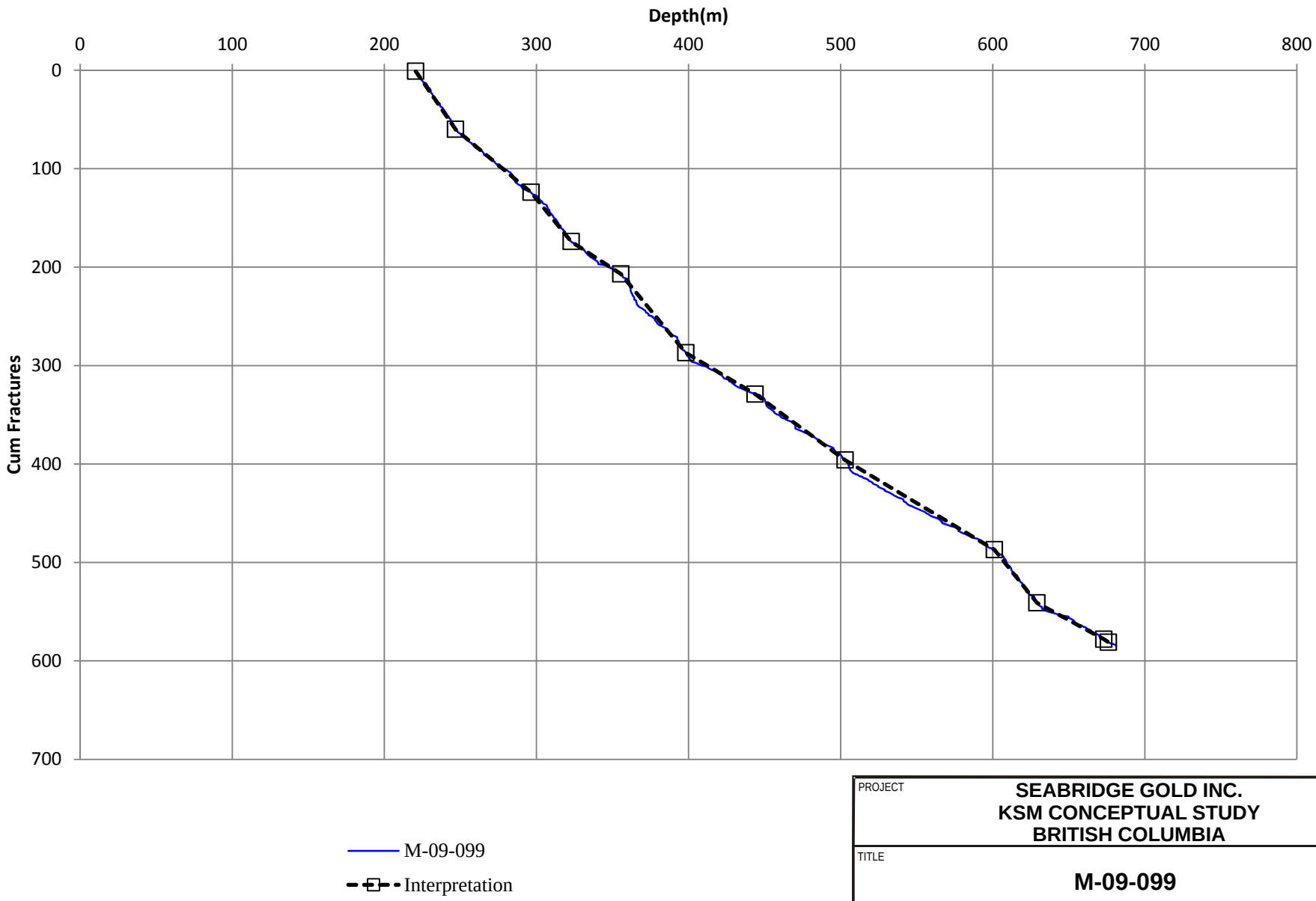
M-09-096
CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	MV	30OCT11	SCALE NTS		REV.0
CADD	CY	06JAN12			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE H-2

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

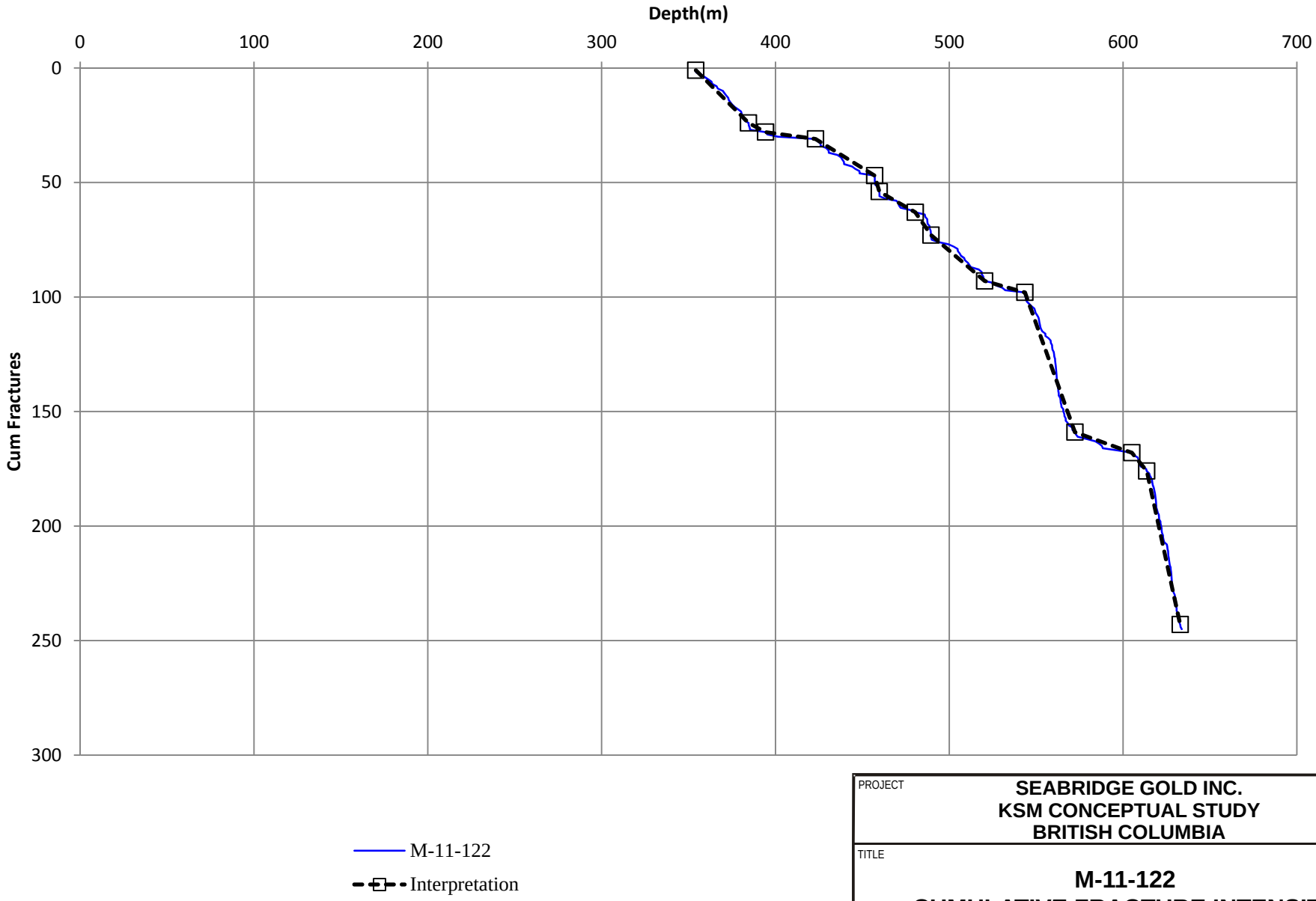
M-09-099
CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	MV	30OCT11	SCALE NTS	REV.0
CADD	CY	06JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE H-3

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices

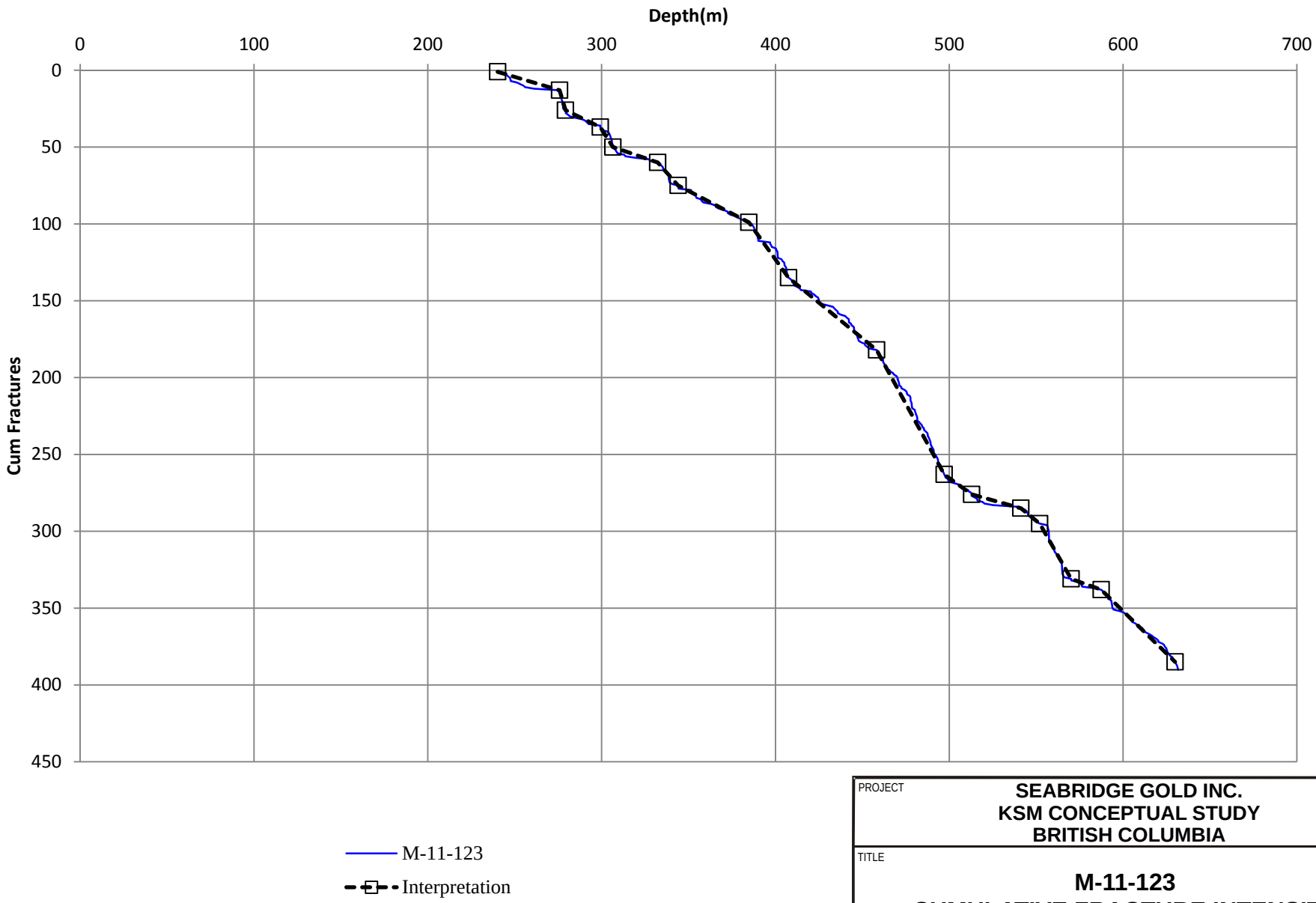


PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-11-122 CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	MV	30OCT11	SCALE NTS	REV.0
CADD	CY	06JAN12	FIGURE H-4	
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

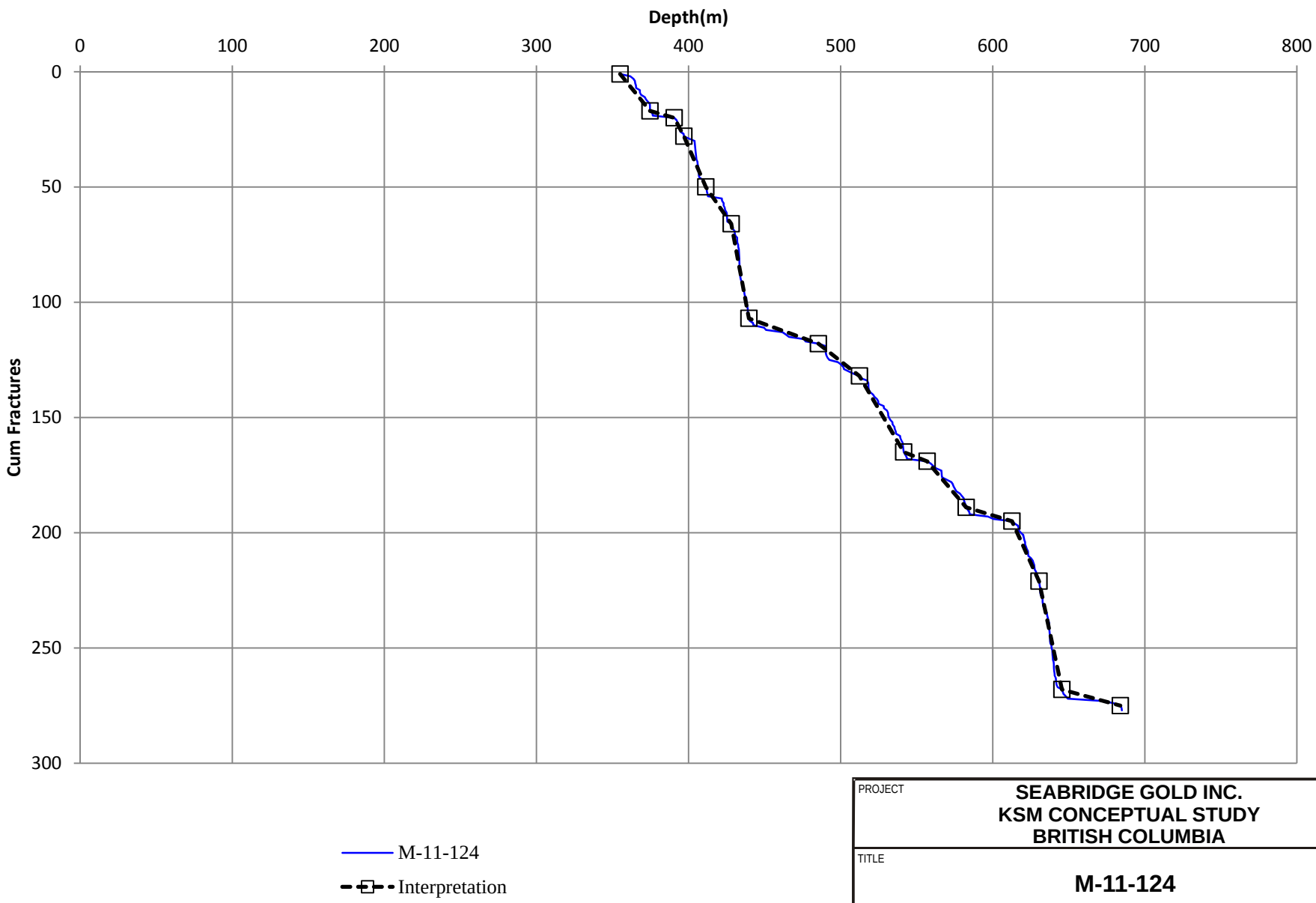
TITLE

M-11-123
CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	MV	30OCT11	SCALE NTS	REV.0
CADD	CY	06JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE H-5



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

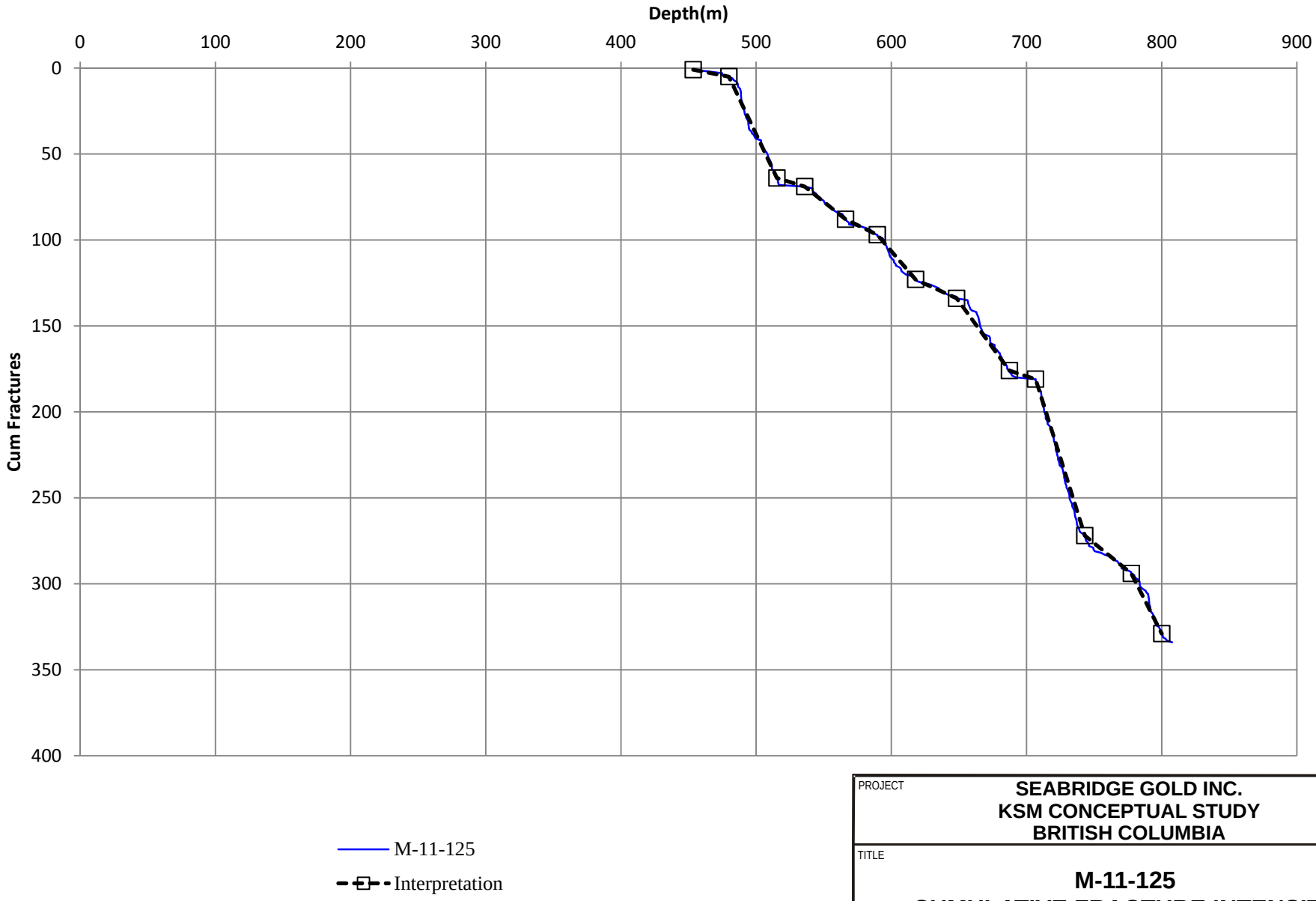
M-11-124
CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	MV	30OCT11	SCALE NTS		REV.0
CADD	CY	06JAN12			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE H-6

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



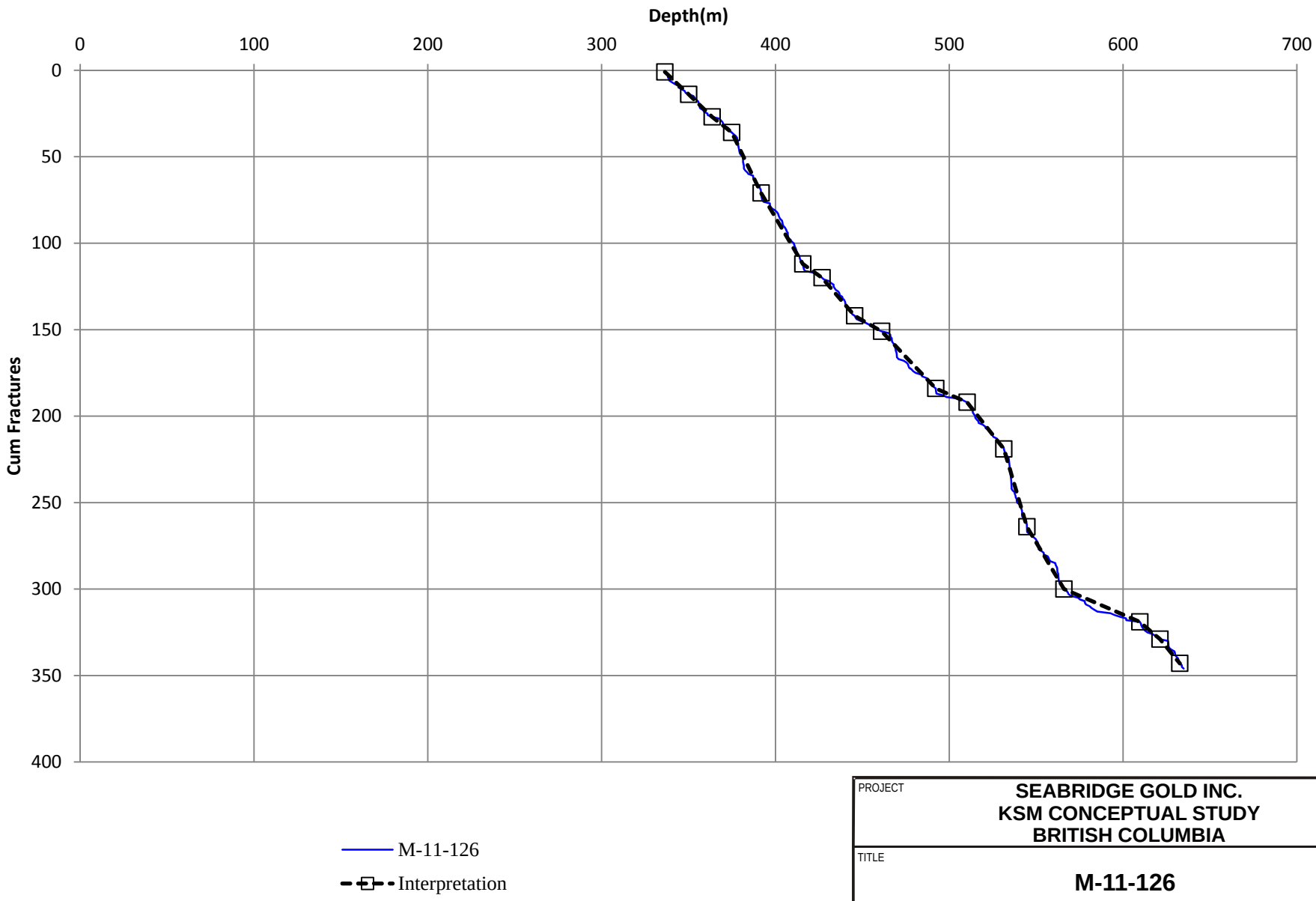
PROJECT	SEABRIDGE GOLD INC. KSM CONCEPTUAL STUDY BRITISH COLUMBIA
TITLE	M-11-125 CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	MV	30OCT11	SCALE NTS	REV.0
CADD	CY	06JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE H-7

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

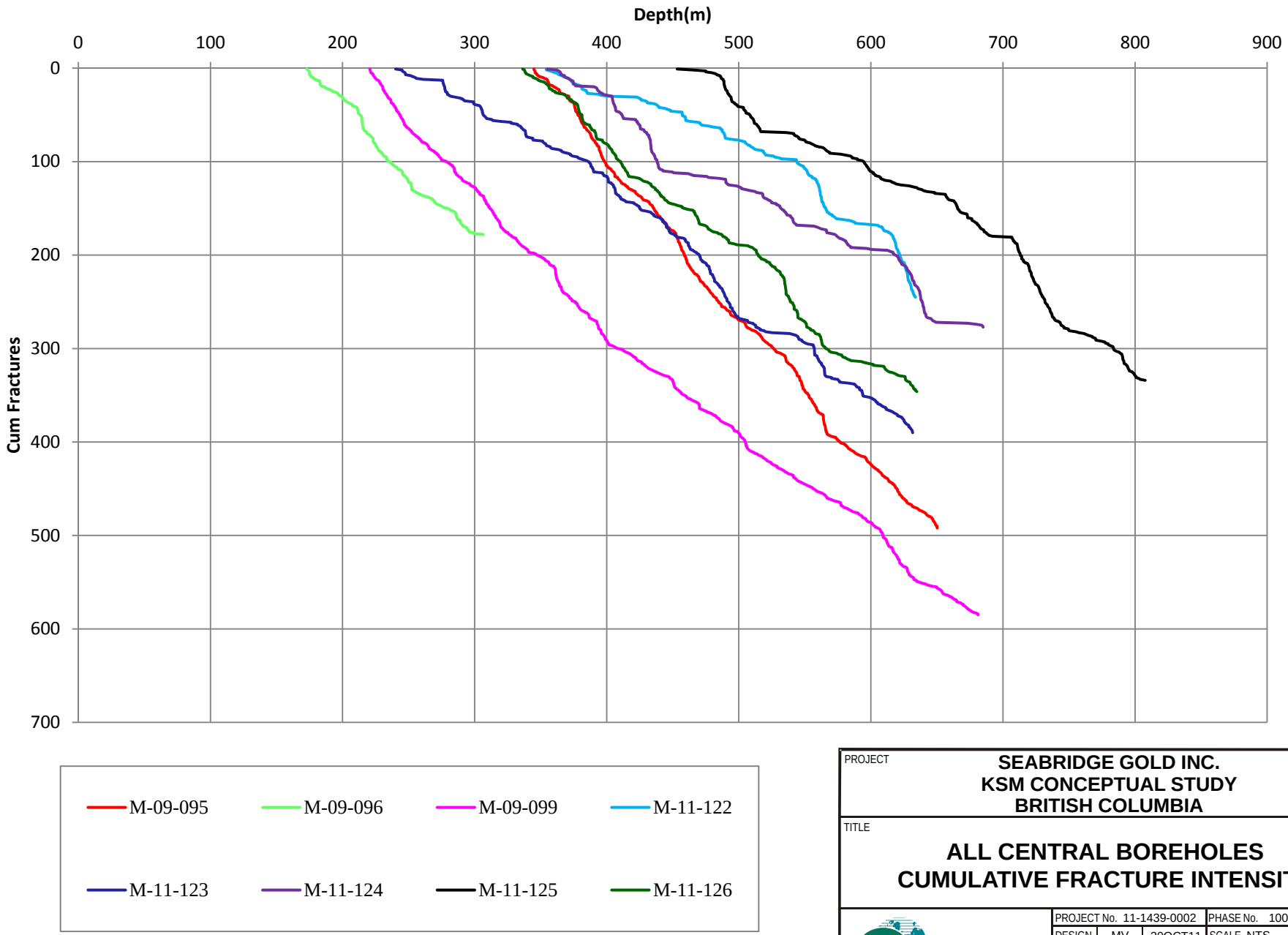
M-11-126
CUMULATIVE FRACTURE INTENSITY

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	MV	30OCT11	SCALE NTS	REV.0
CADD	CY	06JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE H-8

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

ALL CENTRAL BOREHOLES CUMULATIVE FRACTURE INTENSITY

Golder Associates

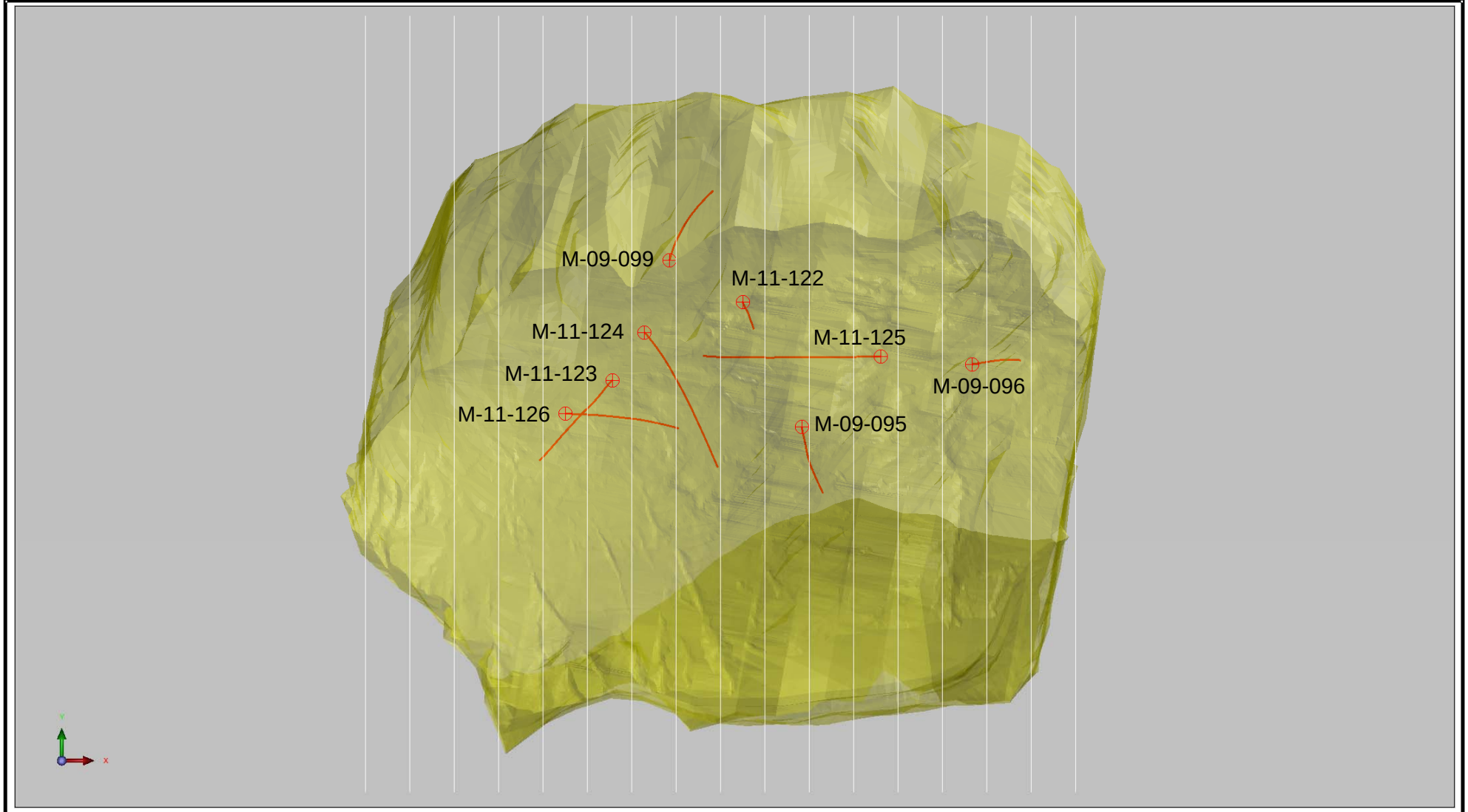
PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	MV	30OCT11	SCALE NTS		REV.0
CADD	CY	06JAN12			
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

FIGURE H-9

APPENDIX I

Cross Sections Showing Hydraulic Conductivity and RMR

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

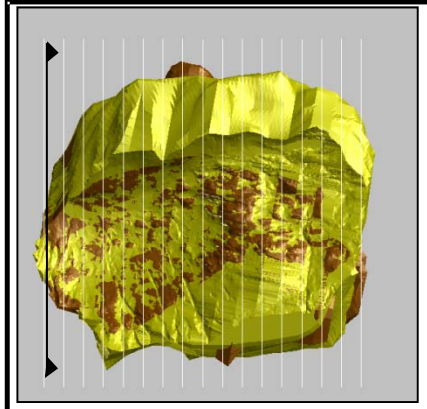
TITLE

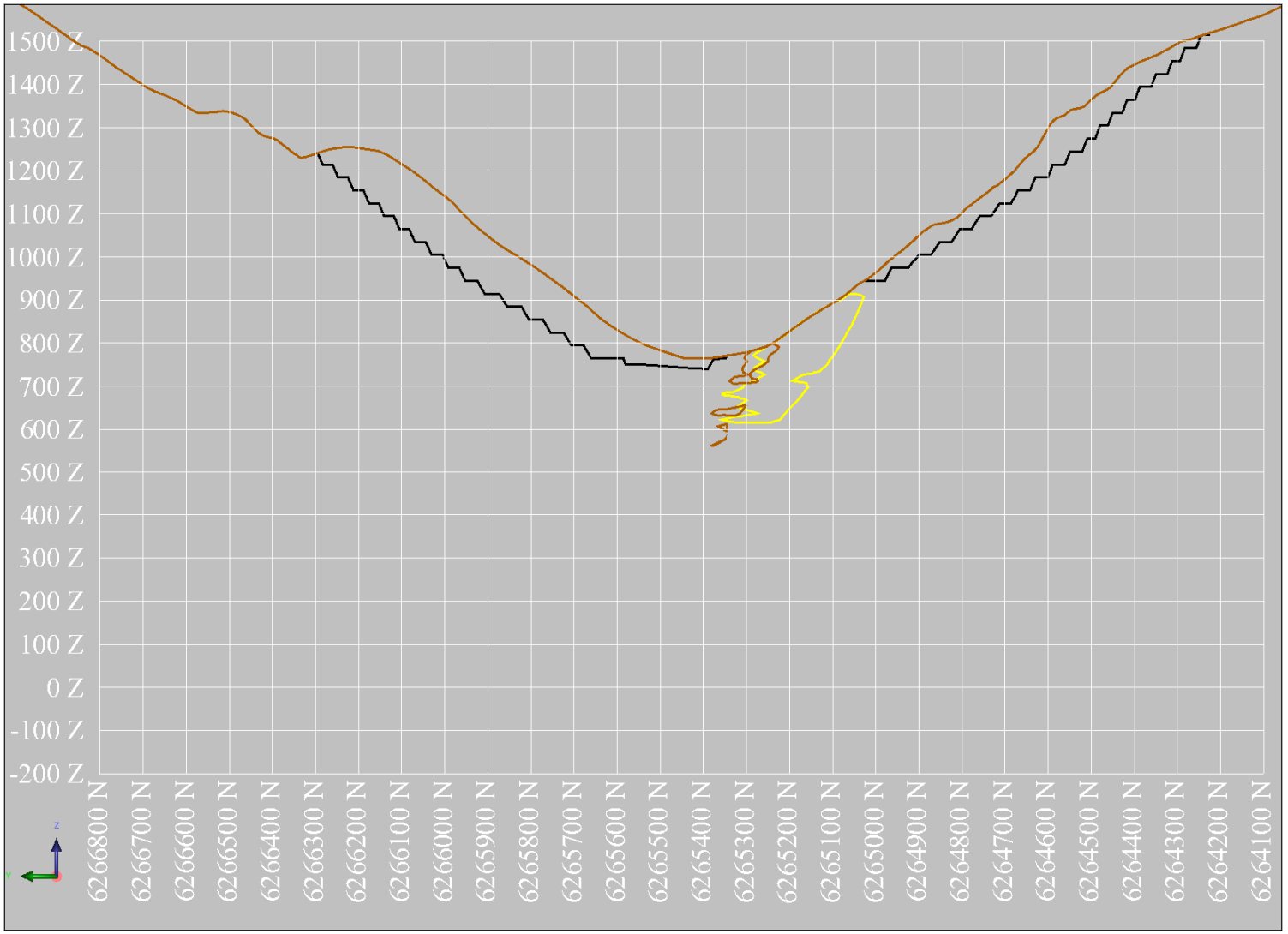
MITCHELL – PLAN
CENTRAL BOREHOLES

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	12OCT11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-1**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

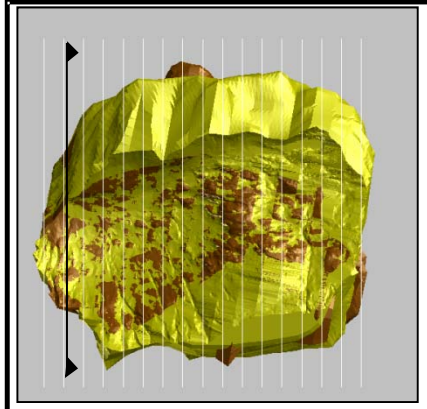
MITCHELL - 422200 EASTING HYDRAULIC CONDUCTIVITY and RMR

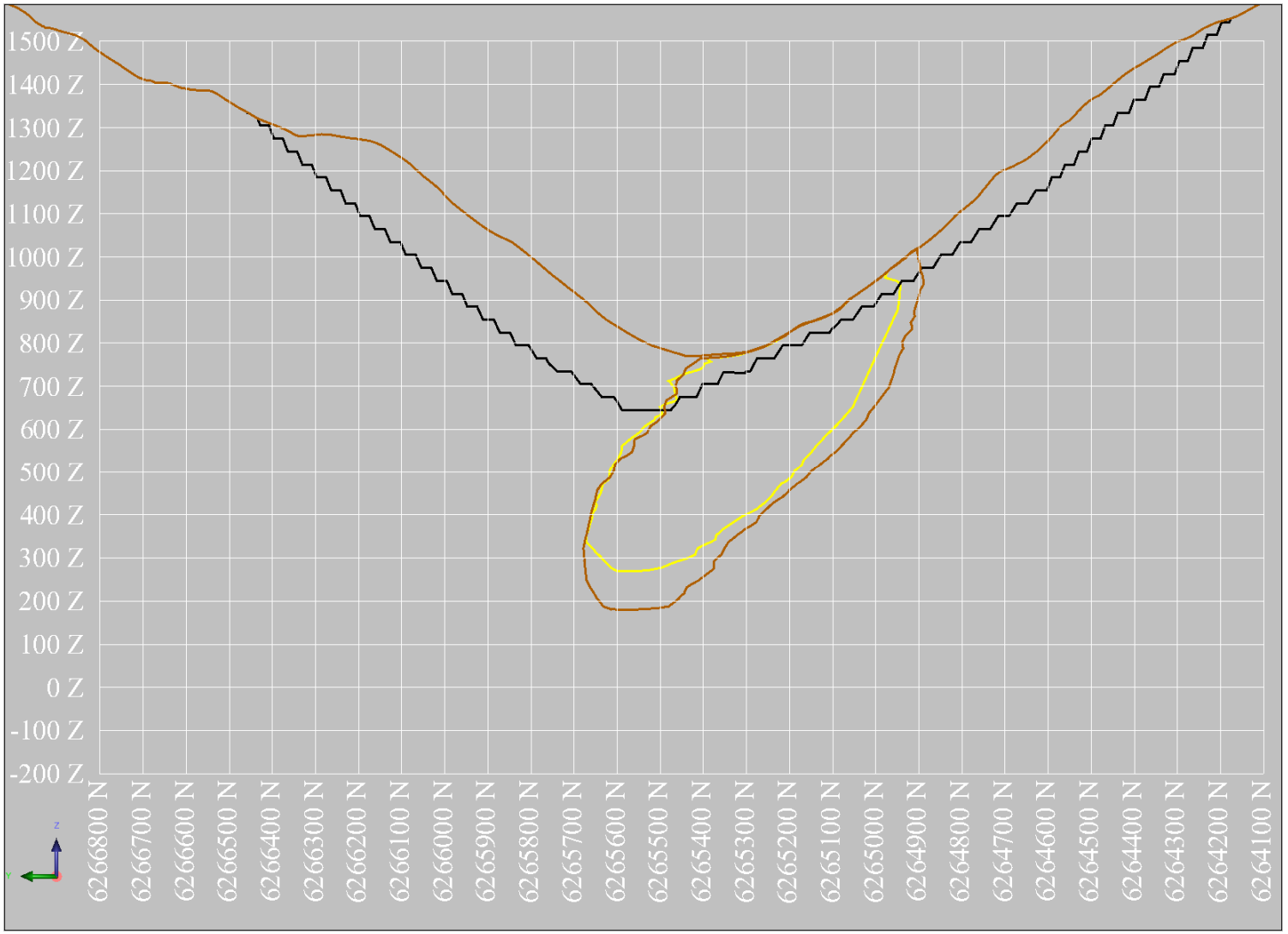
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-2

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

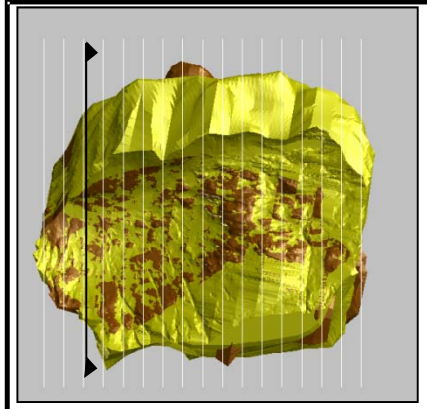
MITCHELL - 422300 EASTING HYDRAULIC CONDUCTIVITY and RMR

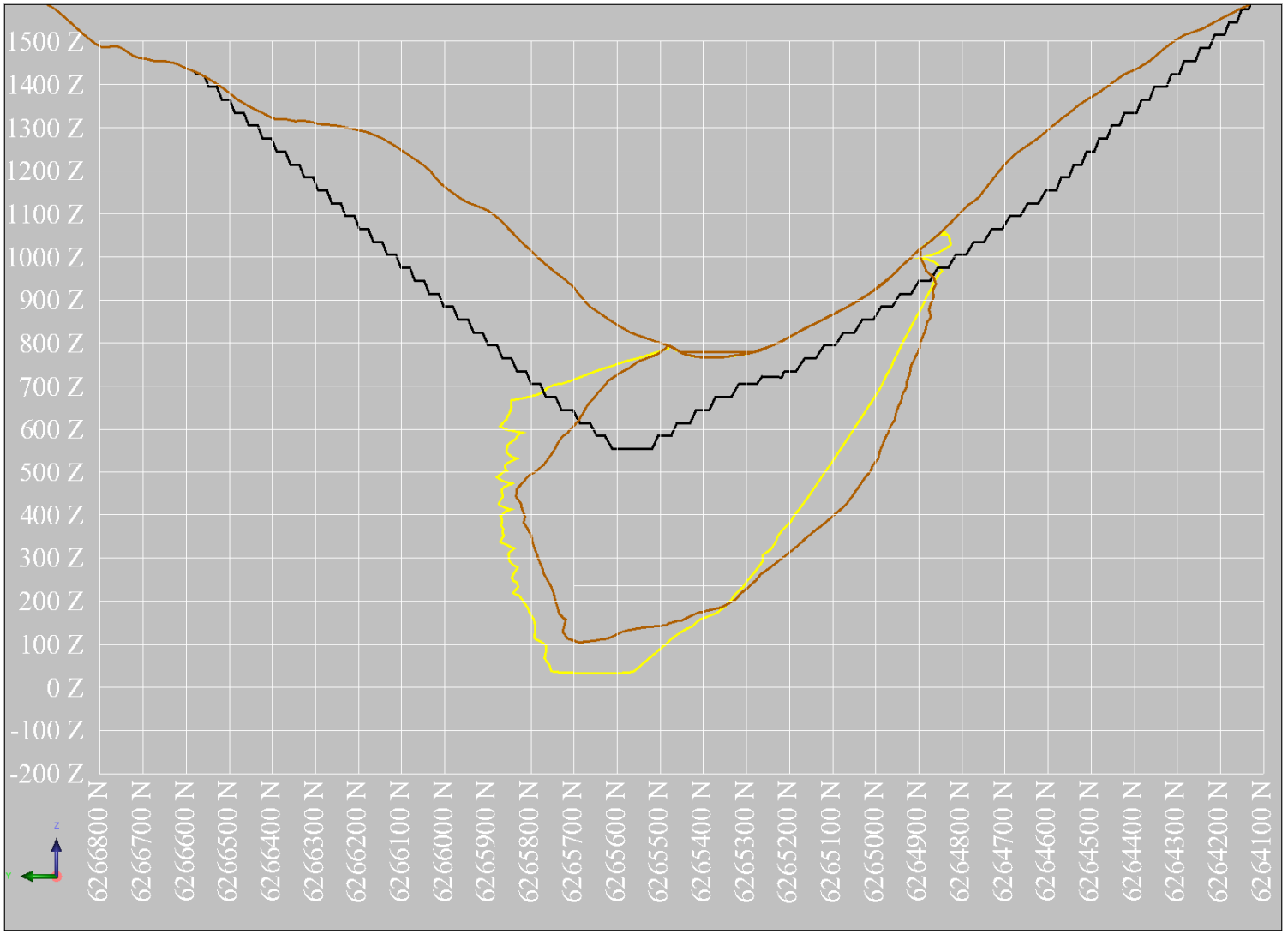
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-3

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

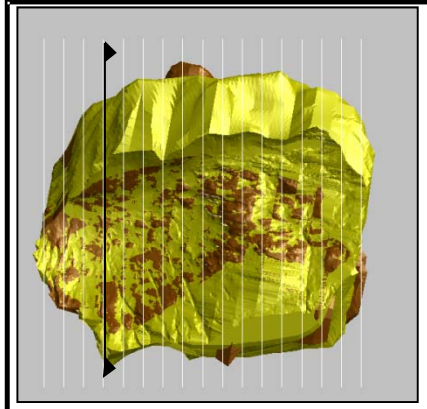
MITCHELL - 422400 EASTING
HYDRAULIC CONDUCTIVITY and RMR

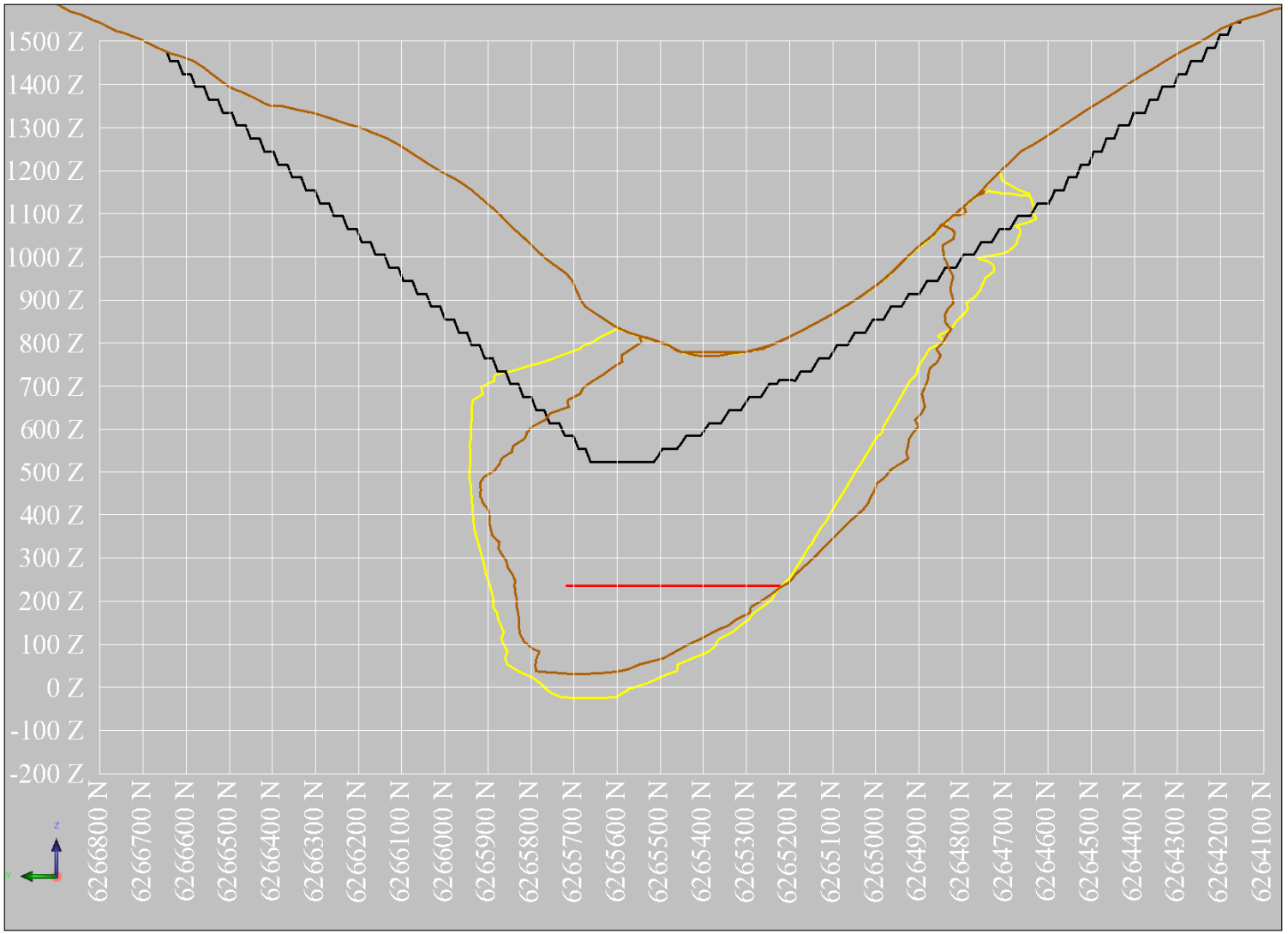
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-4

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

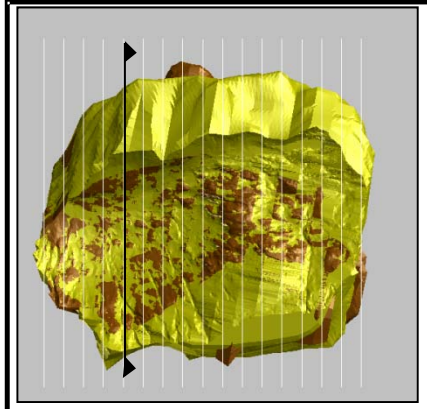
MITCHELL - 422500 EASTING
HYDRAULIC CONDUCTIVITY and RMR

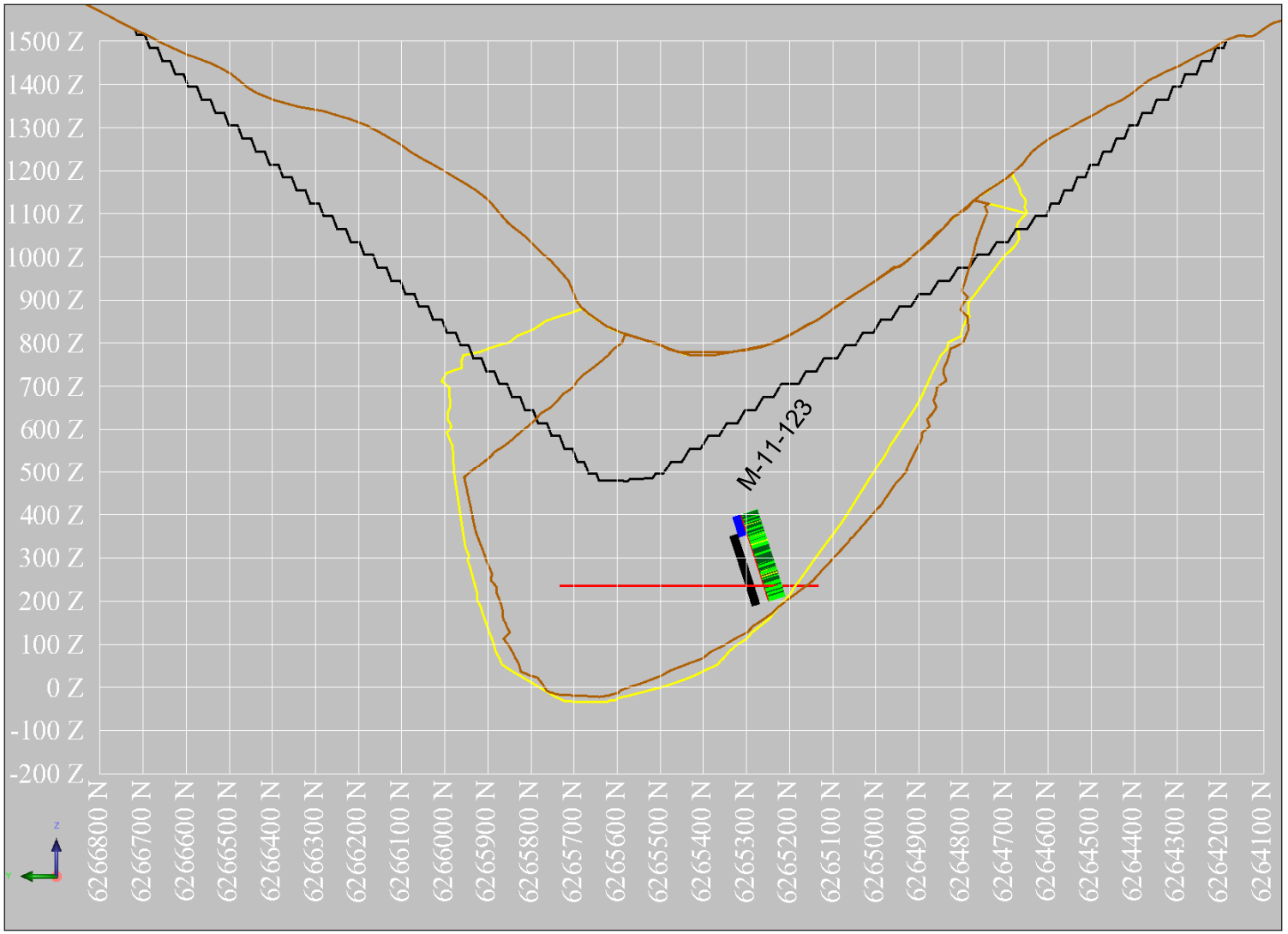
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-5

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

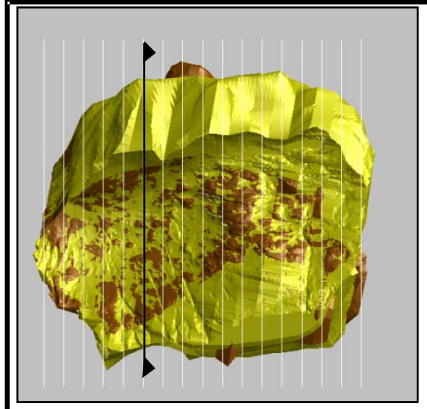
MITCHELL - 422600 EASTING
HYDRAULIC CONDUCTIVITY and RMR

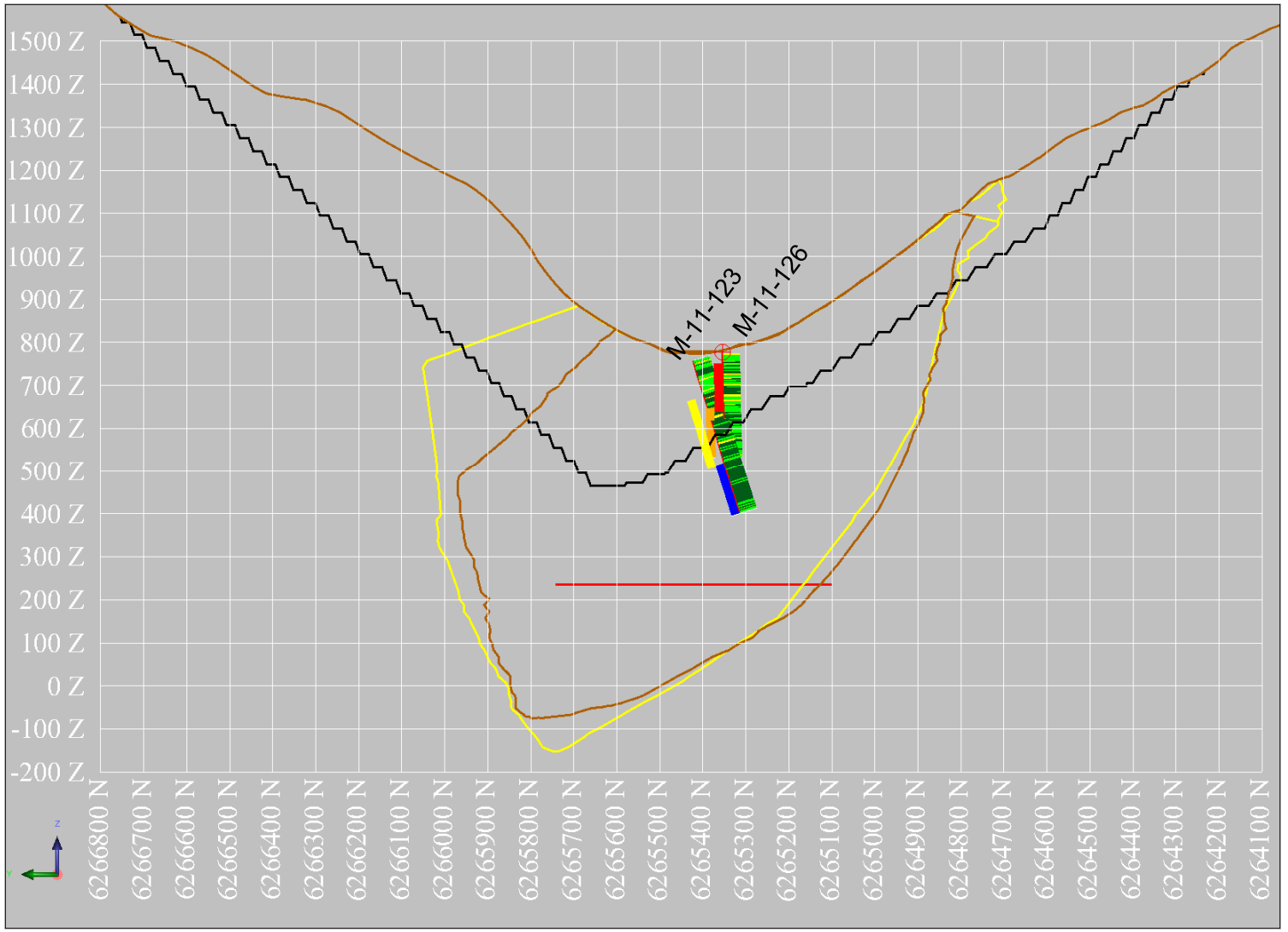
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-6

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

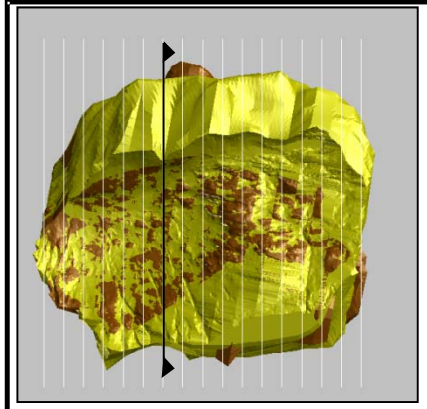
MITCHELL - 422700 EASTING HYDRAULIC CONDUCTIVITY and RMR

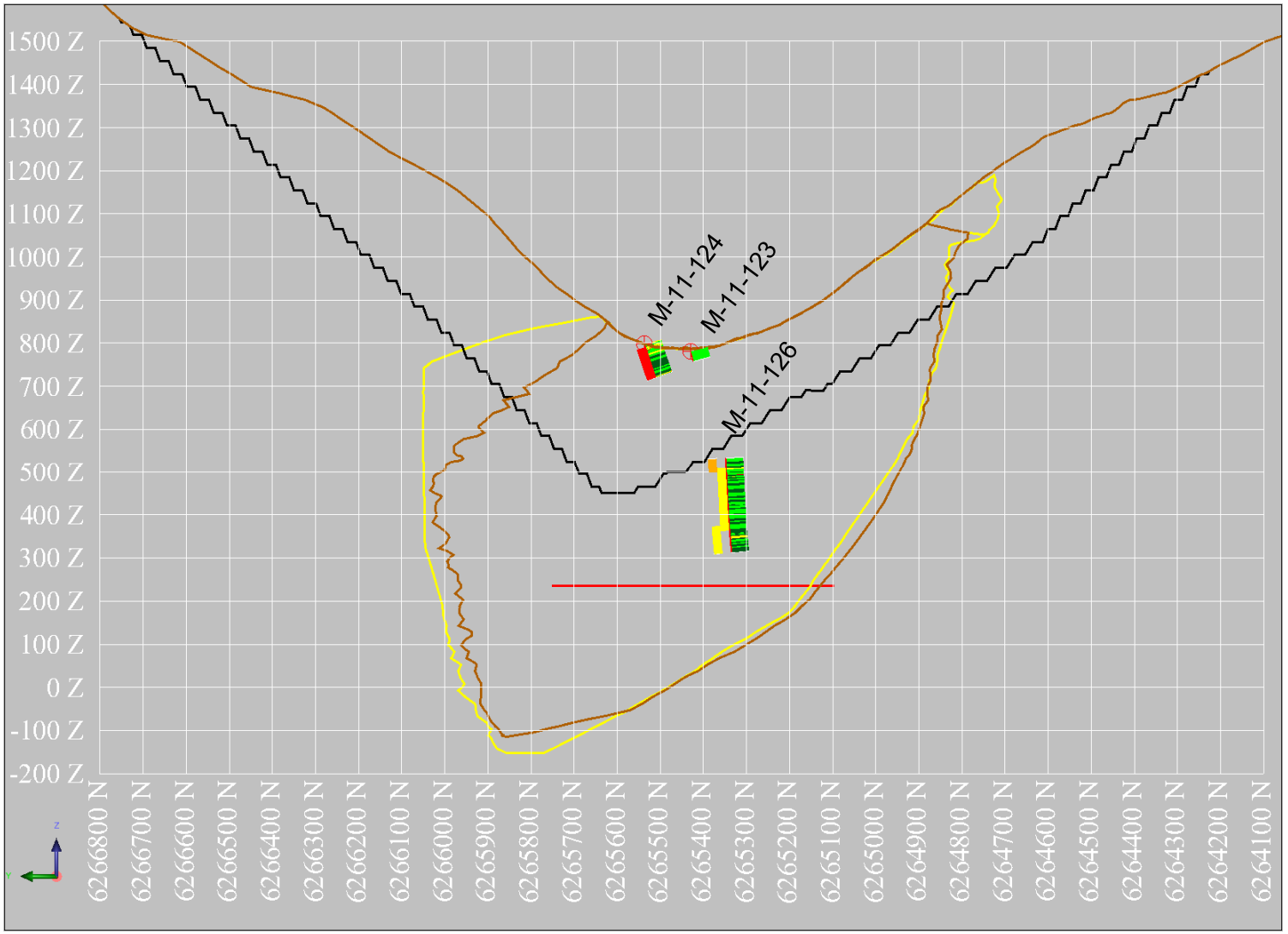
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-7

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

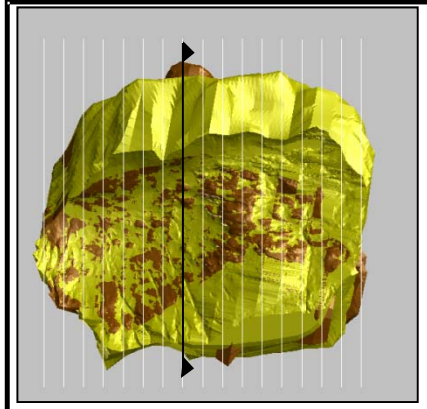
MITCHELL - 422800 EASTING HYDRAULIC CONDUCTIVITY and RMR

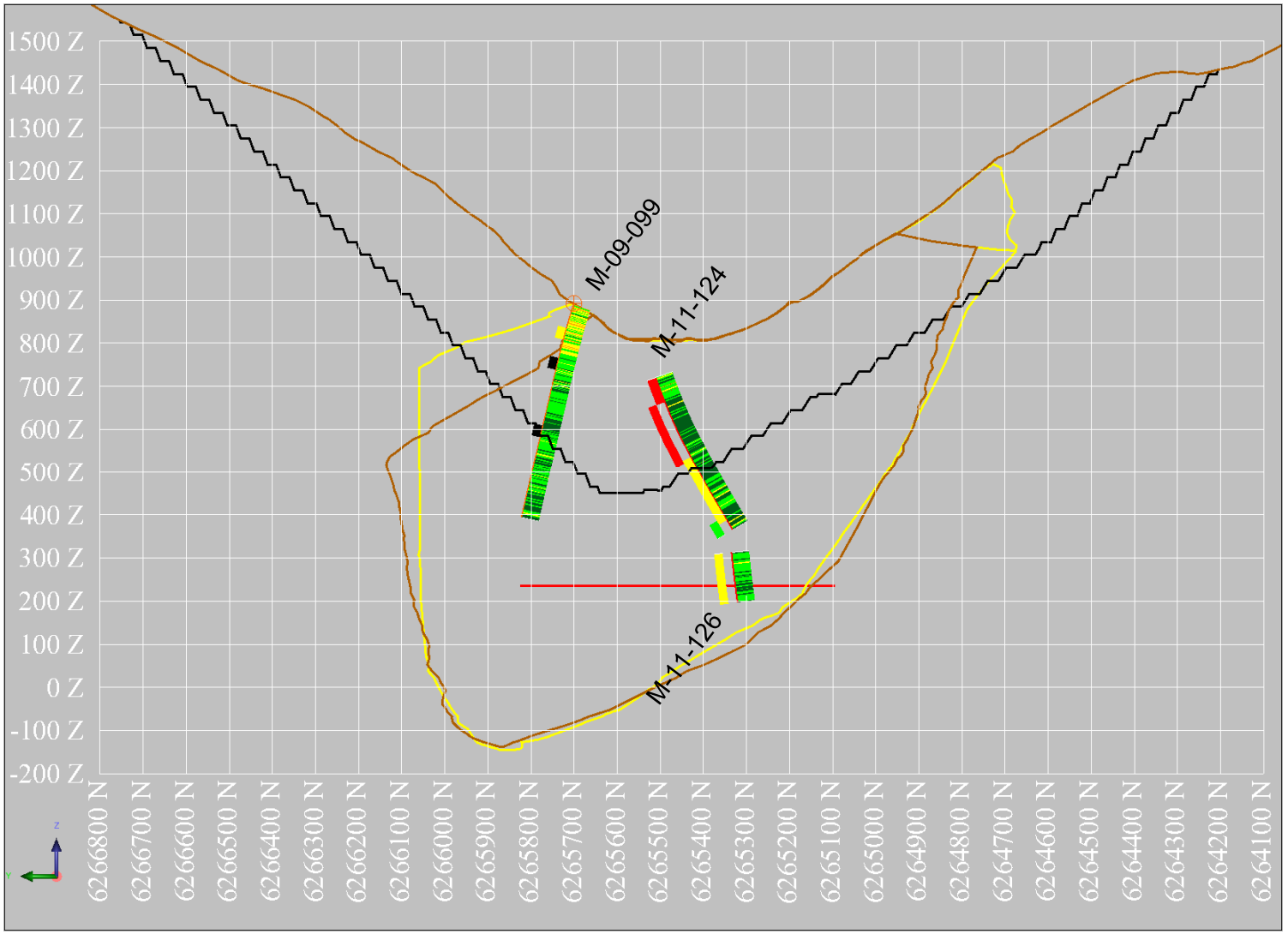
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-8

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

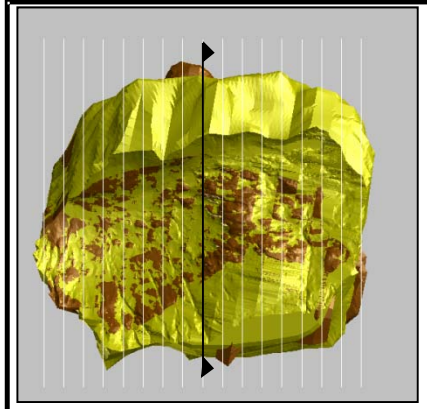
TITLE

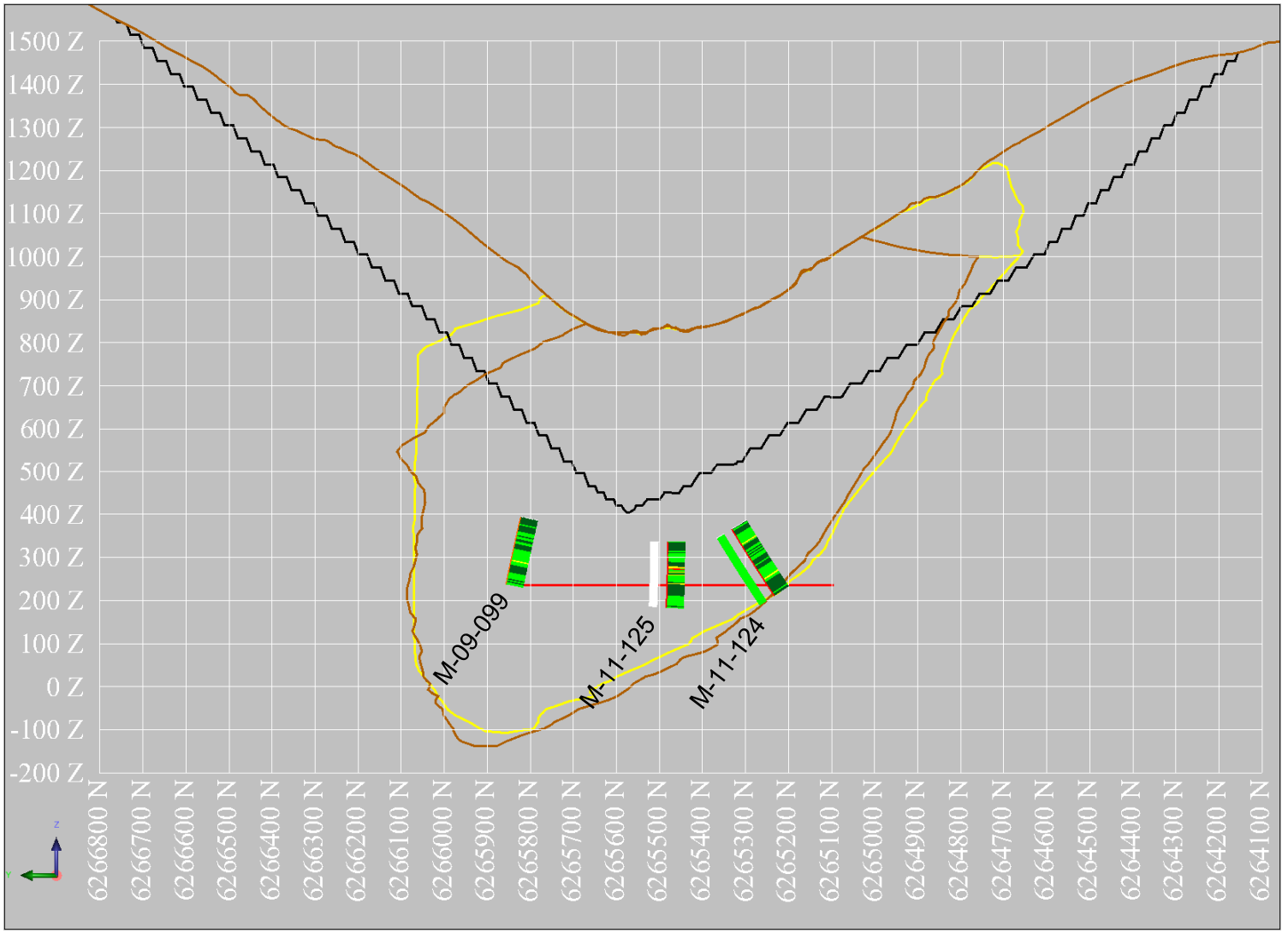
MITCHELL - 422900 EASTING HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-9**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

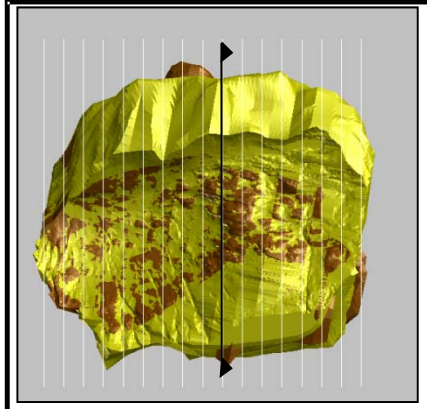
TITLE

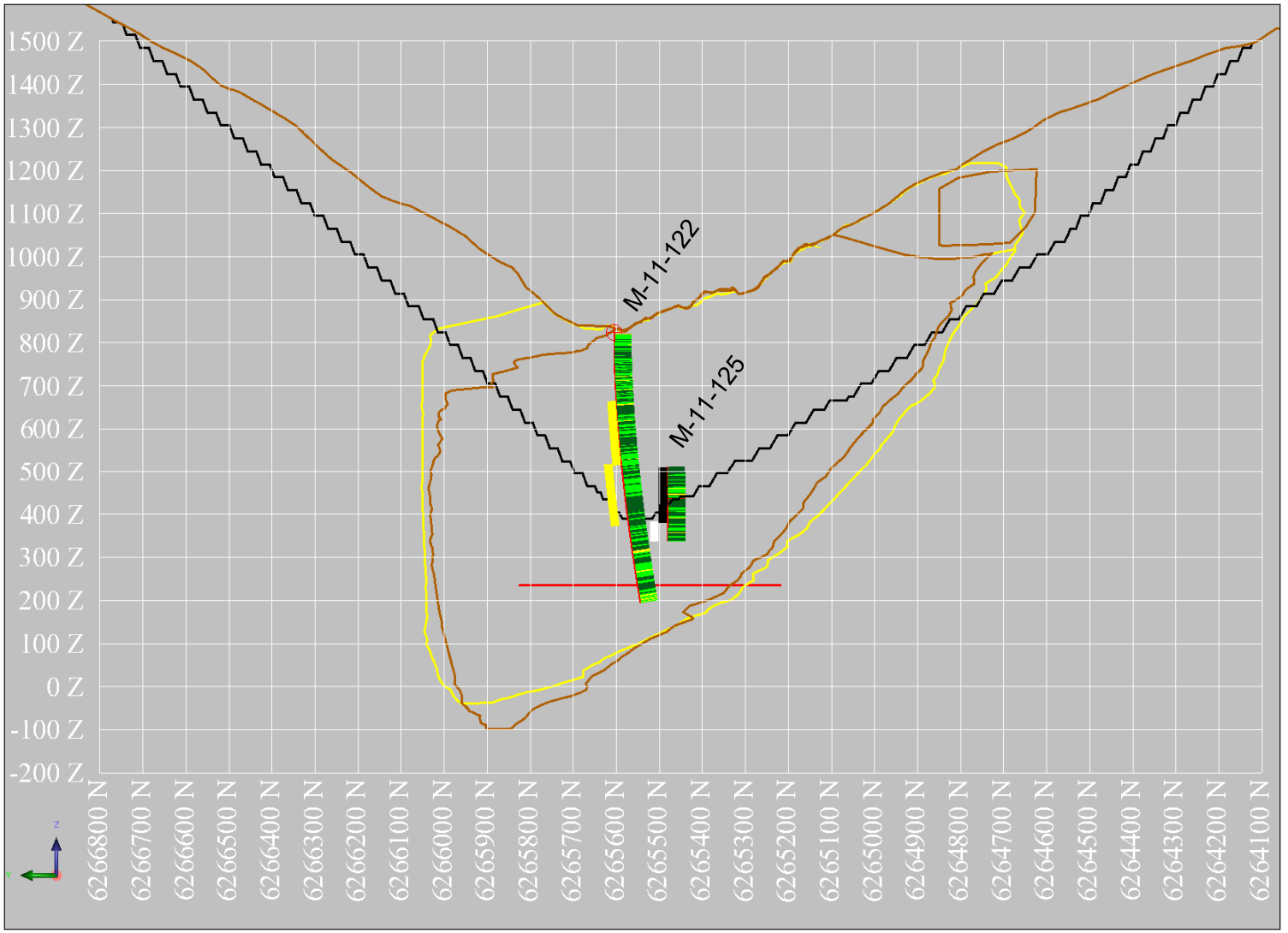
MITCHELL - 423000 EASTING
HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-10**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

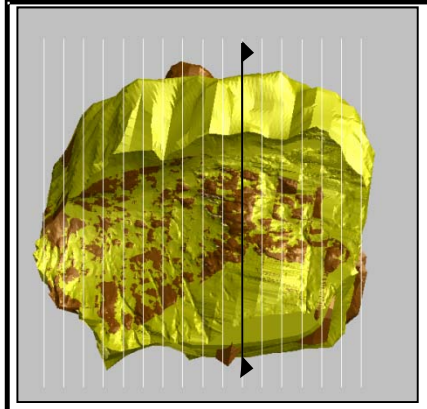
TITLE

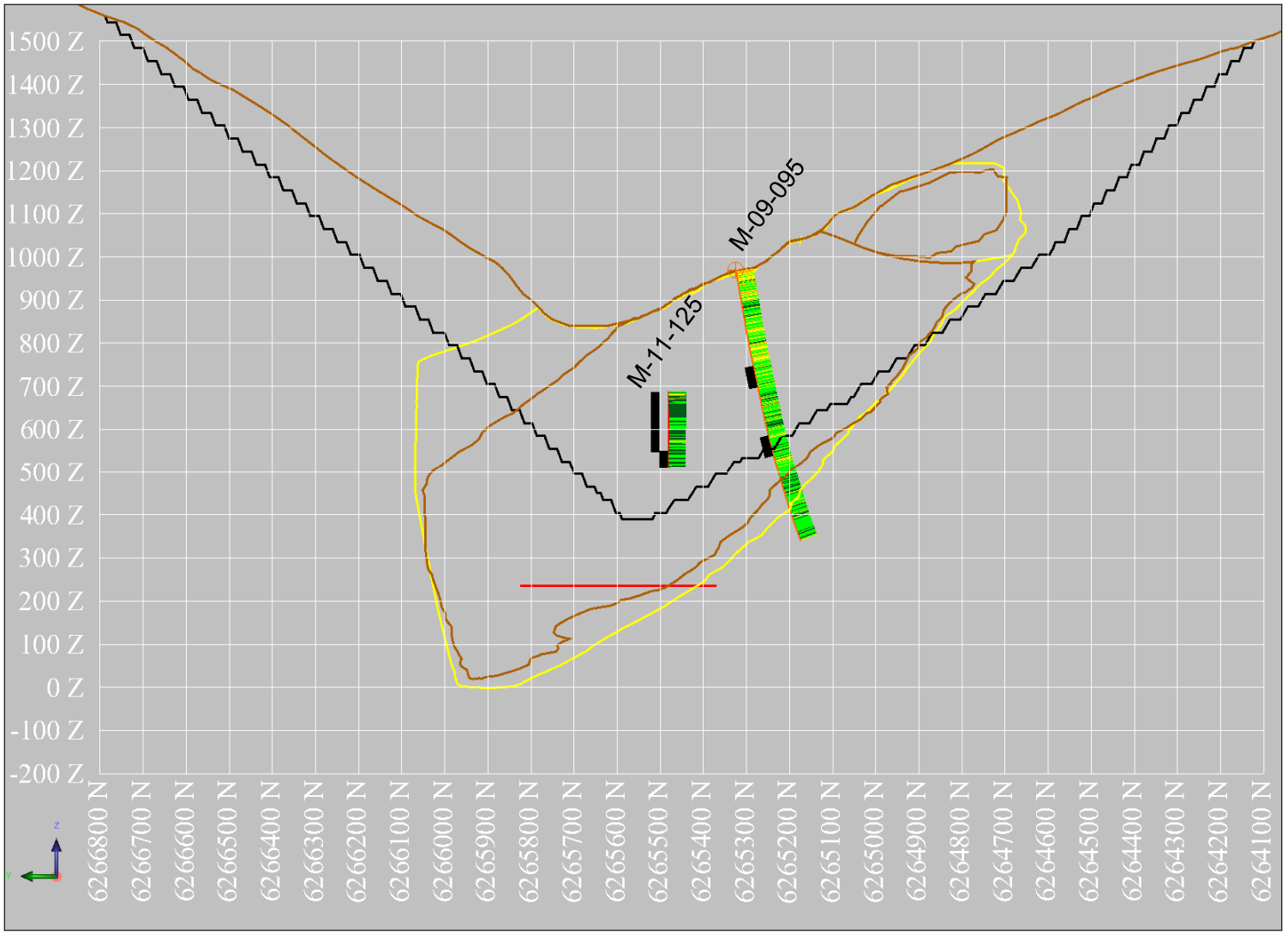
MITCHELL - 423100 EASTING HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-11**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

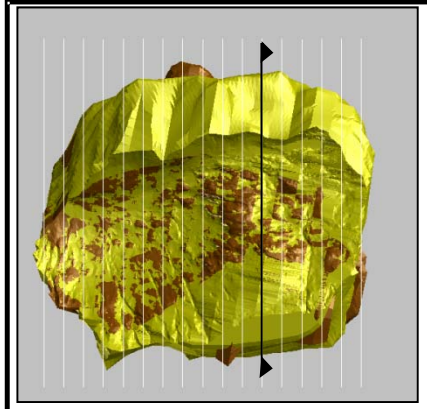
TITLE

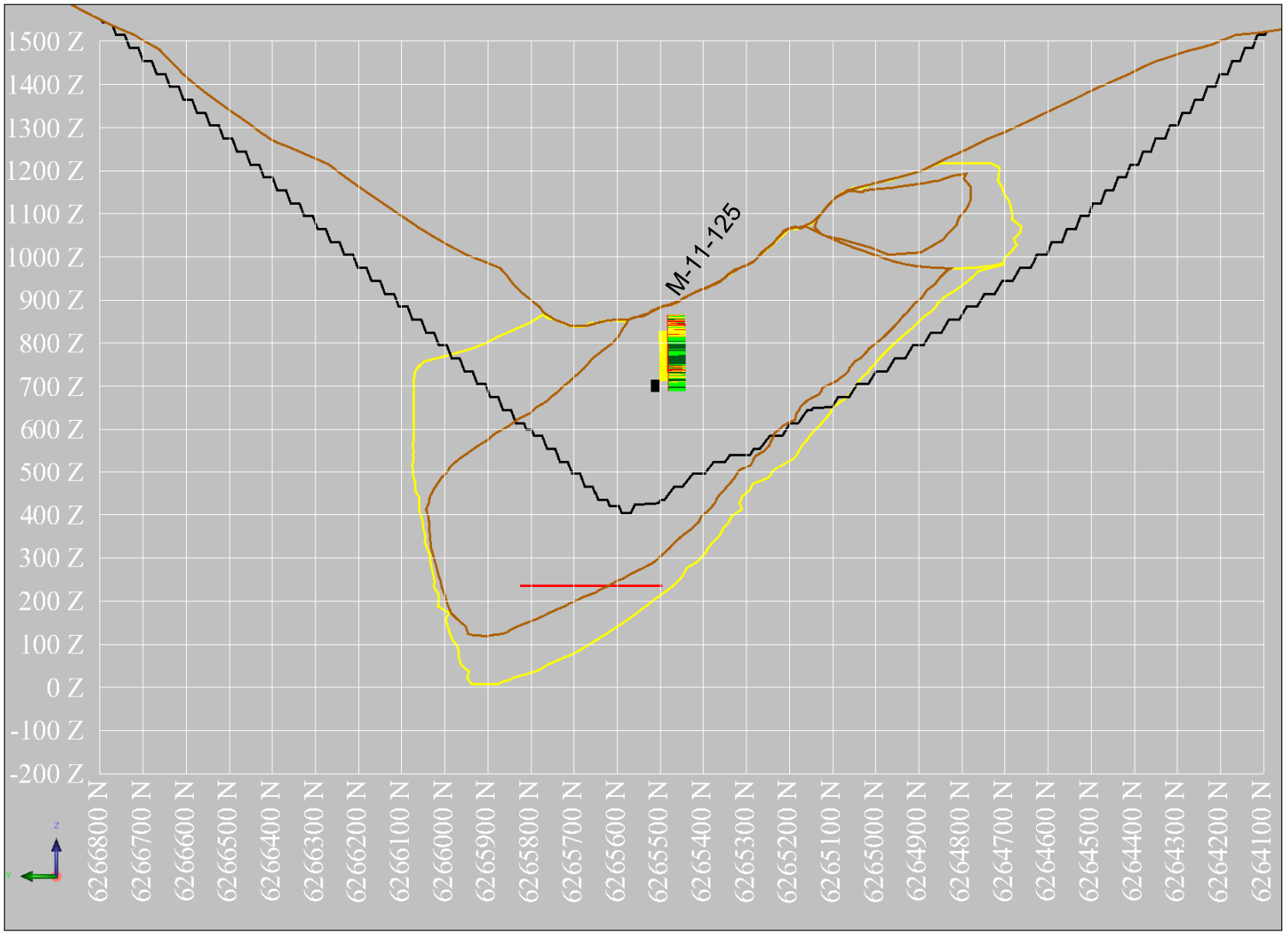
MITCHELL - 423200 EASTING
HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-12**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

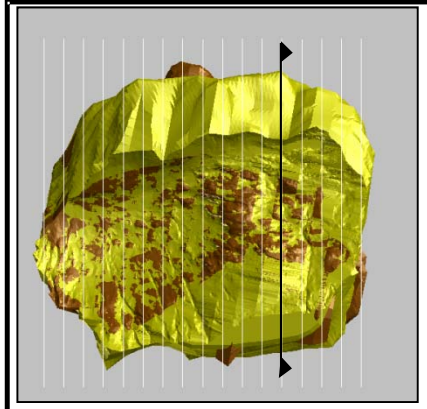
TITLE

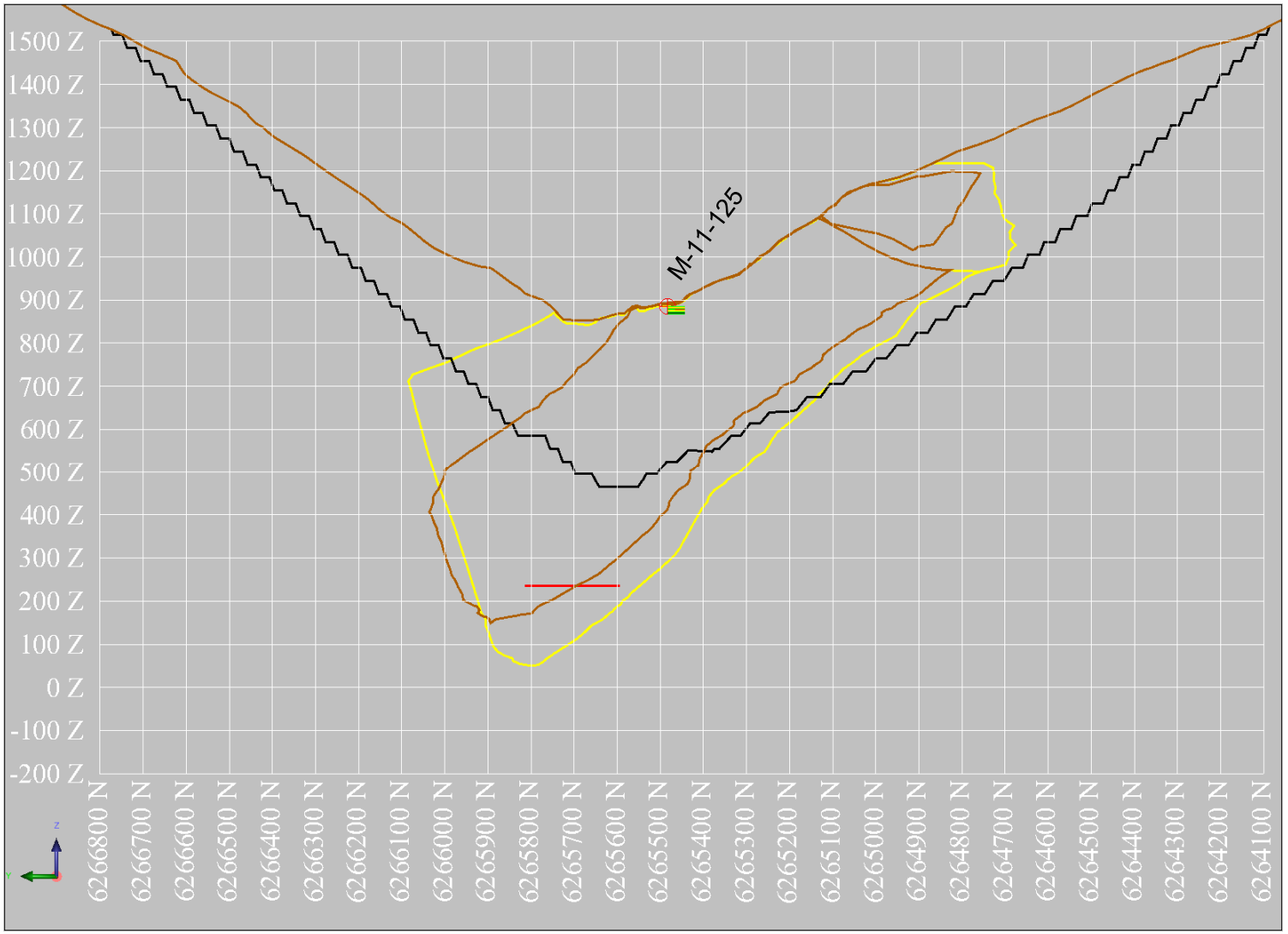
MITCHELL - 423300 EASTING
HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-13**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

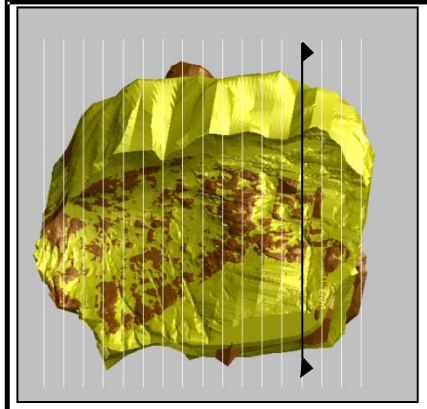
TITLE

MITCHELL - 423400 EASTING
HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-14**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices



LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

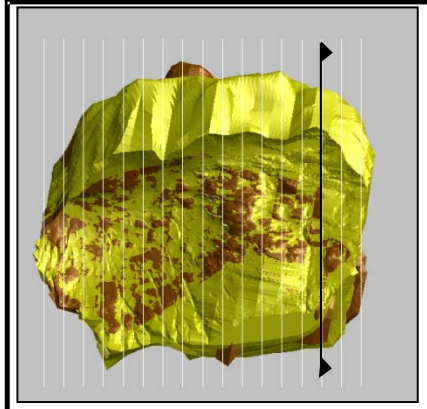
MITCHELL - 423500 EASTING
HYDRAULIC CONDUCTIVITY and RMR

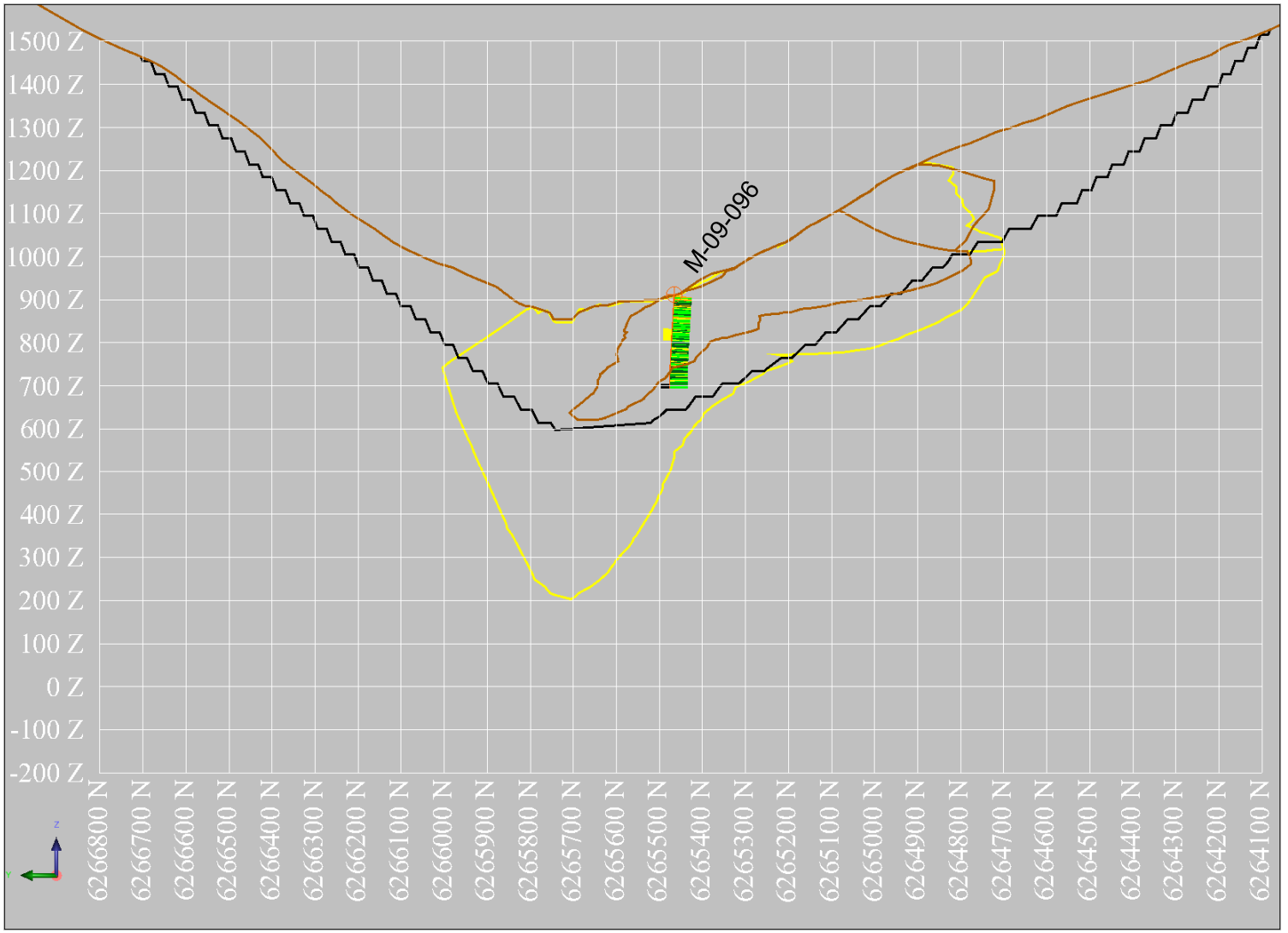
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-15

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

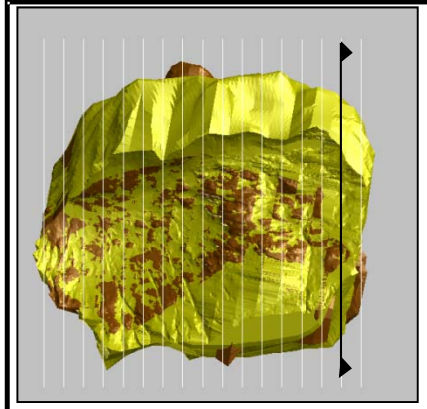
TITLE

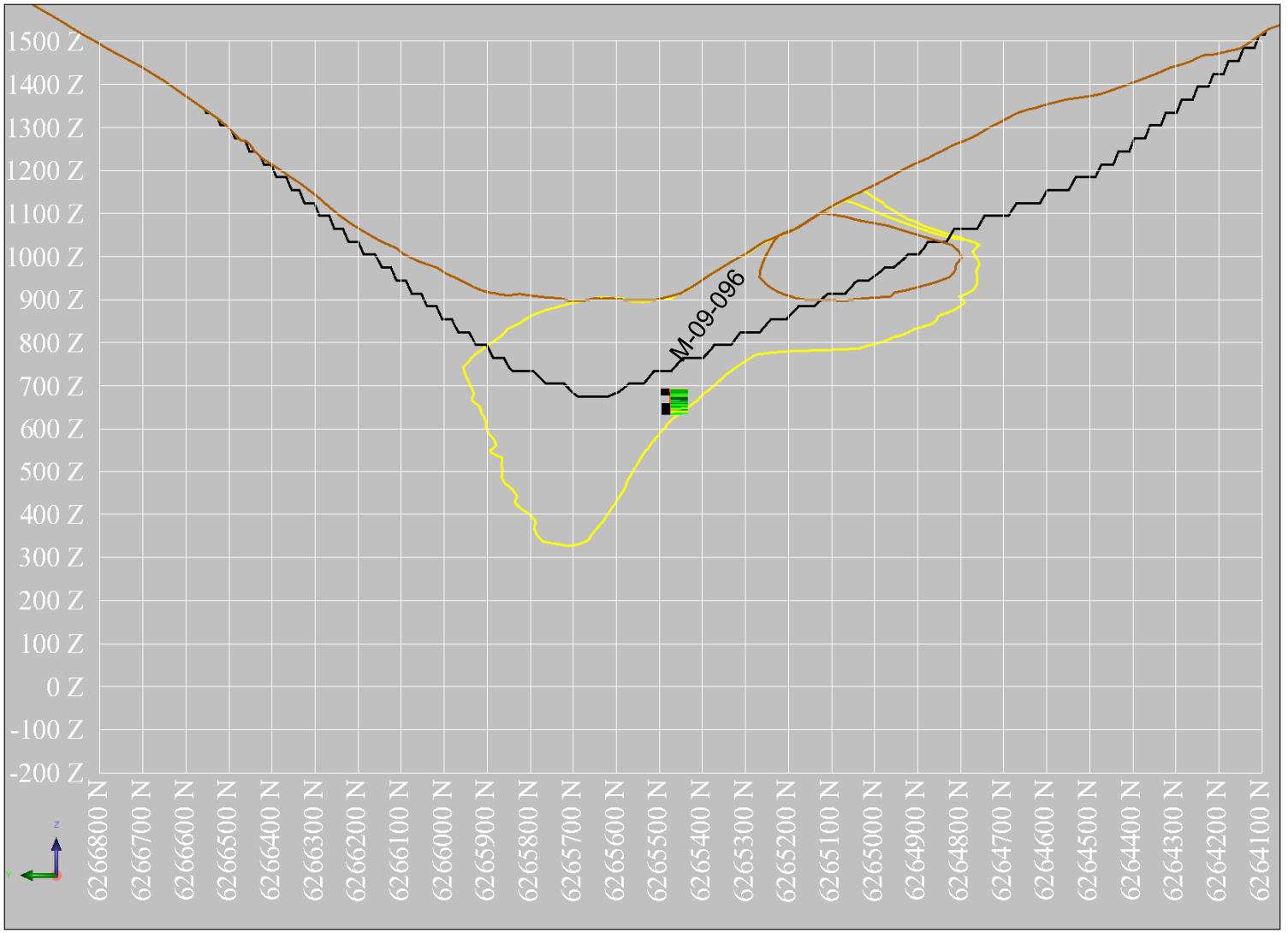
MITCHELL - 423600 EASTING HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000		
DESIGN	CY	10NOV11	SCALE NTS		REV.0
CADD	JMR	30JAN12	**FIGURE I-16**		
CHECK	KMM	15FEB12			
REVIEW	RDH	15FEB12			

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

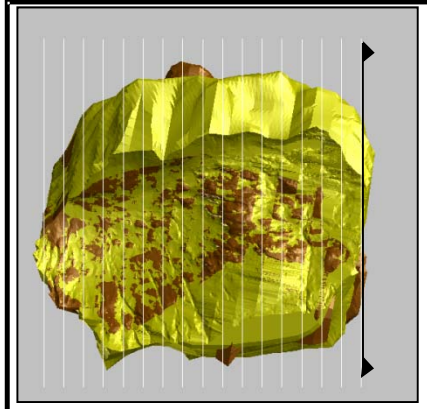
MITCHELL - 423700 EASTING
HYDRAULIC CONDUCTIVITY and RMR

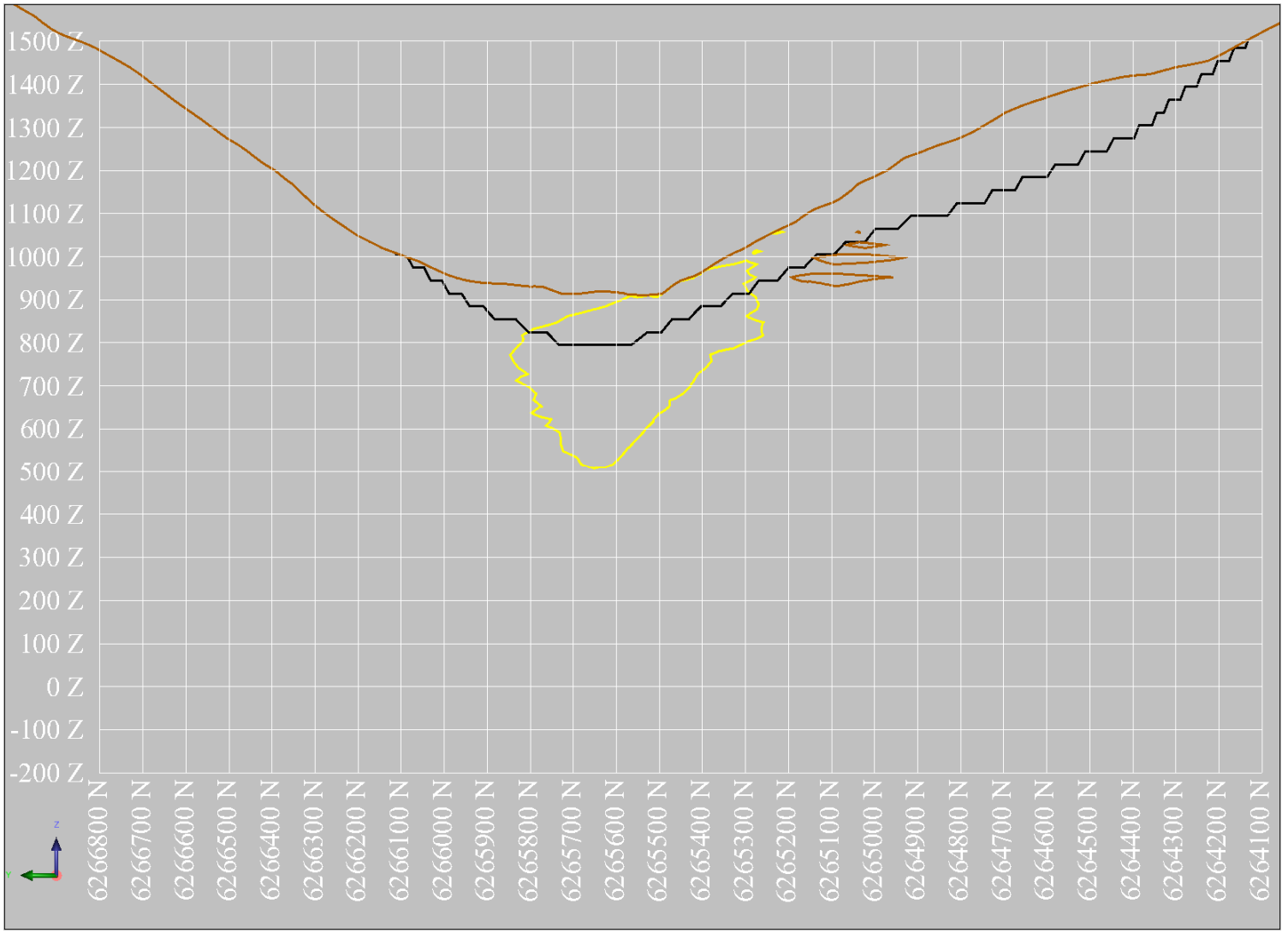
Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-17

O:\Active\ 2011\1439\11-1439-0002 Seabridge PFS\10 Reporting\Mitchell Geotechnical Characterization Report\Appendices





LEGEND

- CU 0.1% SHELL
- AU 0.25g/t SHELL
- TOPOGRAPHY
- PIT
- CAVE FOOTPRINT

HYDRAULIC CONDUCTIVITY (10^{-8} m/s)

< 0.1	5 - 10	> 100
0.1 - 1	10 - 50	
1 - 5	50 - 100	

*Left of borehole, narrow

RMR

80-100	20-40
60-80	0-20
40-60	

*Right of borehole, wide

PROJECT

SEABRIDGE GOLD INC.
KSM CONCEPTUAL STUDY
BRITISH COLUMBIA

TITLE

MITCHELL - 423800 EASTING HYDRAULIC CONDUCTIVITY and RMR

Golder Associates

PROJECT No. 11-1439-0002			PHASE No. 10000	
DESIGN	CY	10NOV11	SCALE NTS	REV.0
CADD	JMR	30JAN12		
CHECK	KMM	15FEB12		
REVIEW	RDH	15FEB12		

FIGURE I-18

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
500 - 4260 Still Creek Drive
Burnaby, British Columbia, V5C 6C6
Canada
T: +1 (604) 296 4200

Golder Associates