November 2, 2012

GIANT MINE REMEDIATION PROJECT - UNDERGROUND

Review and Update of Near Surface Non-Arsenic Stope Stability Assessments

Submitted to:
Public Works and Government Services Canada
5101 - 50th Ave
P.O. Box 518 Yellowknife, NT
X1A 2N4

Attention: Dave Colbourne

REPORT

Project Number: 09-1427-0006/6000

AECOM Doc. No.: 313-UG-13-RPT-0005-Rev1_20121102

GAL Doc. No.: 091

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Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is developing a preliminary design and cost estimate to implement the closure concepts associated with underground work outlined in the Giant Mine Remedial 'Action' Plan (RAP) (SRK 2007). The Giant Mine site is located in Yellowknife, NWT as shown in the key plan in Figure 1.1. This document represents a technical support document to the Underground Preliminary Design Report (Underground PDR, Golder 2012a). A glossary of underground terms has been developed for the project (Golder 2012b) which is included in Appendix A, but the following key definitions apply to the main subject of this report:

- Stopes: a large underground excavation from which ore was extracted.
  - *Non-arsenic Stope:*
    - These may remain open or are partially backfilled with classified tailings or occasionally waste rock.
  - *Near Surface Non-arsenic Stope:*
    - A non-arsenic stope less than 35 m deep the surface (vertical depth of 35 m) or the bedrock / overburden contact where surface soils are present.

The objectives of the work presented herein were twofold: 1) to provide comment on risks associated with near surface non-arsenic stopes; and 2) to understand characteristics of the near surface non-arsenic stopes, such as geometry, to develop designs outlined in the Underground PDR.

Golder reviewed the following previous assessments of near surface non-arsenic stope stability:

- Giant Mine – Geotechnical Assessment (SRK 2000);
- Geotechnical Review of Giant Yellowknife Mine (Golder 1993); and
- Site Wide Crown Pillar Stability Investigation (SRK 2006).

The Site Wide Crown Pillar Stability Investigation report is the last and most comprehensive assessment of the stability of near surface non-arsenic stopes and is the focus of Golder's review.

Updates to the existing stability analyses were executed when previous approaches were deemed inappropriate, insufficient, or unclear. Some re-work of existing information recommended previously to improve confidence in the stability assessments were carried out. Golder staff inspected accessible non-arsenic stopes and the observations influence the conclusions presented. No new geotechnical information on the rock crown pillars has been collected since the Site Wide Crown Pillar Stability Report was written.

Predictions on the probability of failure presented in this report are preliminary in nature due to the lack of information on the geometry of the crown pillars and the material properties of the rock. These predictions form the basis of a relative risk assessment that can be used to develop priorities for future investigations, if deemed appropriate or for remediation by backfilling of the stope. Recommendations to address any potential immediate public and worker health and safety associated with the updated understanding of the stability of the near surface non-arsenic stopes was provided, where appropriate.

It is noted that stopes that have fully, or have partly been intersected by open pit mining (e.g., the crown pillars have been wholly or partly mined out) are generally not addressed in this assessment. The exception is non-arsenic stopes with long strike lengths that were only partially daylighted by open pit mining. The potential for backfill to exit these stopes, potentially creating subsidence and hazards in the open pits exist, but are not specifically addressed.

2.0 GEOMETRY OF NEAR SURFACE NON-ARSENIC STOPES

Key mine geometry information utilised in the review of the near surface non-arsenic stope stability included:

- Giant Yellowknife Mines Ltd., Royal Oak Mines Ltd., and Miramar Giant Mine Ltd., 2-D level plan drawings. Some are AutoCAD format and many are scans of mylar hardcopies.
- Giant Yellowknife Mines Ltd. 2-D geology cross-sections that include underground development and stope geometry information.
- 3-D GEMS (Gemcom) models of the arsenic stopes and chambers, non-arsenic stopes, and nearby underground development openings.
- Cavity monitoring surveys (CMS) carried out to assess void geometry in select near surface non-arsenic stopes.
- Updates to the 3-D mine geometry information by Golder as described in "Giant Mine Underground Geometry – Giant Mine Remediation Project" (Golder 2012c) and included in a Surpac model.

Updates and additions made by Golder to the existing 3-D GEMS model are described in detail (Golder 2012c). This updated mine geometry information was used in the stability assessments presented herein.

Figure 2.1 shows a plan map with the general location of the near surface non-arsenic stopes in the project area. Some non-arsenic stopes deeper than 35 m, which underlie important surface elements or are adjacent to arsenic stopes, are also shown. Note that this figure is for general location purposes only, and future detailed work, for example planning investigation boreholes, requires use of the updated 3-D model.

Table 2.1 summarises the estimated geometry of the various near surface non-arsenic stopes determined from the information reviewed. The particular Giant Yellowknife Mines Ltd. 2-D geology cross-sections used to determine the geometry of the near surface non-arsenic stopes are listed in Table 2.1. The geometry information includes an estimate of the thickness of rock between the back (top) of the non-arsenic stope and the base of the bedrock / overburden contact, or the crown pillar thickness. Additional discussion on the delineation of the bedrock / overburden contact used to determine the thickness of the rock crown pillar is described in Section 4.2.

3.0 MINING METHODS AND GROUND SUPPORT

The mine opened in 1948 and development of the historical mine was carried out by driving drifts and cross-cuts 2.4 m by 2.4 m in size up to the late 1960's. Mining was dominated by shrink-stoping methods and some cut and fill stoping (Giant, 1968). The mine was mechanised in the late 1960's and ramp development was used to carry out primarily mechanised cut and fill stoping. Room-and-pillar mining was encountered during Golder's underground inspections. Mechanised drifts were typically excavated with dimensions 4.0 m wide by 3.5 m high.

Records on stope backfilling are rare and/or have not yet be gleaned from the existing extensive historical geology and engineering drawing database present in digital format or at the mine site itself in paper or linen format. Most cut-and-fill and room-and-pillar stopes inspected were filled with classified tailings (sand) to within 3 m to 5 m from the stope back and an open void remains on top of the sand fill (i.e., the back is not supported). Shrink stopes are variably filled but many likely remain open voids.

The existing underground development openings are supported with a mix of different ground support types owing to historical practices when the openings were first excavated. Most of the openings excavated for the tracked mining style when the mine opened were small (3 m by 3 m) and the backs were spot bolted with mechanical end-anchored rockbolts. More recent excavations created when the mechanised mining style was adopted in the early 1970's were larger (4.5 m wide by 3.5 m high) and backs were spot bolted using mechanical end-anchored rockbolts but in some places, the rockbolting was systematic. The backs of the cut-and-fill and room-and-pillar stopes inspected by Golder were typically systematically supported by mechanical end anchored rockbolts (length unknown). Mechanical end-anchored rockbolts are subject to corrosion and gradual reduction of capacity and over time the support provided by them will dwindle. This results in a time dependant reduction in the stability of the backs of the stopes that could lead to wedge falls, reduction in crown thicknesses, and expansion of the spans of the non-arsenic stopes.

4.0 GEOLOGY

The geology of the Giant Mine has been discussed in several project related documents (SRK 2002, INAC, 2010, Golder 2012d, e, f) and the information presented in this section is summarised from these. The geotechnical investigation considered the geology of the site based on the Regional Geology Plan (Royal Oak, 1995) that was provided to Golder by PWGSC as shown in Figure 4.1.

The Giant Mine site is bounded by a series of major Proterozoic faults and lies within altered volcanic rocks of the north-trending Yellowknife Greenstone Belt. The two main bounding faults near the mine are the West Bay fault, which bounds the Giant Mine site to the west, and the Akaitcho fault, which bounds the mine site to the east. The volcanic rocks are bounded to the west by granodioritic plutonic rocks that are in fault contact, and bounded to the east by unconformably overlying sedimentary rocks along the shoreline of Yellowknife Bay.

The gold mineralisation historically mined at Giant was hosted within a major brittle-ductile shear that cross-cuts massive and pillowed mafic volcanic rocks (basalt) that are variably altered to chlorite schist. The basalt represents the majority of the rocks in the project area, with metamorphic sediments, volcanic tuffs, and diabase dikes comprising minority lithologies. The basalt has been altered to greenstone through chloritisation of the original basalt.

The underground stoping targeted gold bearing quartz-carbonate-sericite schist zones located within the main shear zone noted in Figure 4.1. The Giant Yellowknife Mines Ltd. 2-D geology sections show lithological changes, detailed information on the distribution of ore grade, and an approximation of underground mine geometry.

The chlorite and sericite altered rocks associated with the periphery of the mineralised bodies (e.g., the non-arsenic stope walls) can lose strength over the long term when subjected to freeze-thaw action, and changes in water content. This will have a degrading effect on the backs and walls of the non-arsenic stopes over the long term.

4.1 Rock Structure

Previous workers developed structural geology models for the project (SRK, 2002). They developed a series of lithostructural domains which exhibit similar structural characteristics and dominant rock types (Figure 4.2). Major faults, including the major bounding faults in the area noted above, are also shown in Figure 4.2. The near surface non-arsenic stopes are present in lithostructural domains 1, 4, 5, and 7 as summarised in Table 4.1.

Table 4.1: Summary of Lithostructural Domains of the Giant Mine Site for Non-Arsenic Stopes

Litho-structural Domain	Open Pits in Area	Near Surface Non-Arsenic Stope	Description (Reference: SRK, 2002)
1	A1 and A2	DWC 2-01 North Storage 2-01 2-01 #3 2-02 3-70	*"Domain 1 is bound by the West Bay and Townsite Faults. The dominant NNW-SSE trend of minor faults in this domain is clearly governed by the two bounding major faults. Exposed rock in this domain exhibits a very high density of faulting."*
4	B1, B2, and C1	2-19 2-18 1-18EA 1-18EB 1-18#1 2-15 2-06	*"Domain 4 hosts the arsenic chambers and much of the ore sequence in the Giant mine. The dominant fault directions here are parallel to the volcanic stratigraphy and the penetrative tectonic fabric that encloses the ore. This NNE-SSW trend also dominates in Domain 7, where the penetrative fabrics associated with the mineralization are also well-developed. The NNW-SSE trend is therefore interpreted to have been strongly controlled by the orientation of the pre-existing fabrics and the deformed stratigraphy."*
5	B4	1-26 1-36/1-35 1-37 1-43 1-43#1 1-43 Upper 1-43 Lower	*"In Domain 5, the fault orientations tend to swing towards the NNW. The change in orientations occurs fairly abruptly at a lithological boundary between the mafic volcanic and sediments (Townsite Fm.) of Domain 4 and 7, and a large gabbro intrusive. Rheological contrasts between the gabbro of Domain 5, and the mafic volcanic/sediments of Domains 4 and 7, is likely responsible for this change in fault behaviour. The boundary between these two domains is thus drawn along the lithological contact between the two."*
7	B3	1-31	*"Domain 7 is very similar to Domain 4, as discussed above, but is separated from it by the 3-12 fault. They were separated in this interpretation, since the 3-12 fault is a fairly significant structure in the Giant Mine workings, and may influence the hydraulic conductivity between the two domains. From a hydrogeological perspective, these two regions may therefore behave differently."*

In general, a strong persistent foliation influences all lithologies in the area which predominantly trends north-northeast and dips steeply; however, some folded shallow sections are present. Hence, stope orientation in the area tends to be predominantly steep while shallow dipping sections exist near tight fold noses.

Detailed structural mapping carried out near the arsenic stopes and chambers was described by previously (SRK 2000, 2002). The rock mass fabric in the area is parallel to the volcanic stratigraphy and the folded foliation that encloses the ore as described above. Therefore, the dominant structural trend will be assumed to be parallel to the trend of the ore in any particular area for the purposes of stability assessment.

Systematic mapping of the geology and / or rock mass geotechnical parameters in the non-arsenic stopes was not carried out for the purposes of assessment of stability of these openings. Inspections of the non-arsenic stopes were mostly carried out from adjacent development openings that had been check scaled and the cut and fill stopes were rarely entered. Systematic mapping of the stopes would require extensive check scaling and possible ground support rehabilitation.

4.2 Overburden / Bedrock Contact

The surface conditions vary considerably between the various locations above the arsenic-filled chambers and stopes, ranging from boggy to bedrock outcrops. Current conditions are generally dominated by either bedrock or fill material with the original vegetative cover and organic layer having generally been stripped. The surficial deposits that are present above some of the arsenic filled chambers and stopes consist primarily of clay and silt with some sand and gravel. These deposits reach a thickness of 32 m in some areas as described in the DAR (INAC 2010 p. 7-27).

Because overburden soils are not considered in the estimate of crown pillar strength, the position of the overburden / bedrock contact is a critical input to assessment of the geometry of the rock crown pillar, specifically thickness.

The overburden / bedrock contact is often sketched on the Giant Yellowknife Mines Ltd. 2-D geology sections and this information was often used to determine the geometry (thickness) of the rock crown pillar. In some cases, the overburden / bedrock contact delineated in the geology section appears to have been based on drilling information but in others, it is not. In some cases, the section does not include an estimate or interpretation of the position of the overburden / bedrock contact.

The existing historical drillhole database was used to develop 3-D overburden / bedrock contact surfaces near the arsenic stopes and chambers for the stability assessment update of these openings. These surfaces are useful for non-arsenic stopes nearby the arsenic stopes and chambers. A similar exercise was executed for the 2-01 complex of non-arsenic stopes north of A2 open pit area due to previously identified risks by Golder in 1995 and a digital bedrock / overburden 3D surface was created.

The position of the bedrock / overburden contact was not confirmed or investigated for the purposes of this review. Improvements in the confidence of the probability of failure presented later in the report would require a geotechnical investigation.

4.3 In-Situ Stress

In-situ stress testing was carried out in deep (1065 m and 1735 m below surface) portions of the nearby Con Mine (Intera, 1997). These tests suggested that the major principal stress (σ_1) is sub-horizontal and is oriented east-west, the intermediate principal stress (σ_2) is sub-horizontal and is oriented north-south and the minor principal stress (σ_3) is near vertical. The ratio of σ_1 / σ_3 measured ranged from 1.5 to 2, and the ratio of σ_2 / σ_3 ranged from 1.1 to 1.4. It is unknown if these deep stress testing results at Con Mine reflect conditions in the shallow regions of Giant Mine as no stress testing has been carried out there. The data suggests that crustal stress conditions near Yellowknife are similar to those encountered in the Canadian shield and shallow stress conditions observed in other regions can be applied to Giant.

4.4 Hydrogeology

The mine water is currently maintained at the bottom of 750 level (5th level), which is approximately 240 m deep. At some point in the future, after the remediation is complete the mine will be allowed to flood to the base of the deepest open pit.

5.0 GEOTECHNICAL MODEL

The evaluation of the stability of the non-arsenic crown pillar and stope stability assessments makes use of estimates of intact rock mass strength, rock mass quality, and geological structure collected during various campaigns by different workers. Mapping by Golder of the open pits, Golder and SRK underground mapping in areas near the non-arsenic stopes, and SRK's geotechnical core logging data collected in boreholes drilled near arsenic stopes and chambers are examples of these efforts (as described in Golder [2012d, e, f] and references therein).

Significant geotechnical information has been collected for the rock mass near the arsenic stopes and chambers and the general geotechnical condition of non-arsenic stopes near them is relatively well understood.

The majority of the geotechnical information used for the near surface non-arsenic stopes comes from the open-pit mapping carried out to assess their stability and to develop preliminary designs and closure costing. Figures 5.1 (A1 and A2 open pits), 5.2 (C1, B2, and B1 open pits), and 5.3 (B3 and B4 open pits) show the location of open pit geotechnical scan line and window mapping stations in relatively close proximity to subsurface non-arsenic stopes.

No detailed geotechnical information has been collected on the rock that forms the crown pillar between the back (top) of the non-arsenic stopes and ground surface. This information must be obtained from geotechnical logging of drill core collected in diamond drill holes. In order to reduce the uncertainty in the geotechnical conditions of the crown pillars, an investigation is required. Recommendations to do so have been provided to the project team.

The following sections summarize geotechnical parameters collected in the various investigation campaigns to be used as input in the stability assessment.

5.1 Intact Rock Strength

Ranges and typical intact rock strength mapped for various geotechnical domains at each non-arsenic stope during the 2010 field investigation are described in this section. Intact rock mapping was carried out according to guidelines provided in Table 5.1 (ISRM, 1981).

Table 5.1: ISRM (1981) Range of Uniaxial Compressive Strength for R Grades

Grade	Description	Field Identification	Approx. Range of Uniaxial Compressive Strength MPa and (psi)
R0	Extremely weak rock	Indented by thumbnail.	0.25 – 1.0
R1	Very weak rock	Crumbles under firm blows with point of 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

Table 5.2 provides a summary of the estimate of intact rock strength in the various geotechnical zones outlined above in each of the open pits to be used as input for the near surface non-arsenic stope stability assessment. The data were subdivided into mineralised zones and waste rock, with the differentiation based on the presence of schist rocks associated with the gold bearing shear zone. The mineralised zone mapping data are likely representative of the conditions of the backs, floors and end-walls of the stopes. The waste rock mapping is representative of conditions in the hangingwall and footwalls of the non-arsenic stopes.

Table 5.2: Typical Intact Rock Strength from 2010 Field Investigation

Open Pit Area	Geotechnical Domain	Mapped Intact Rock Strength
A1	Mineralized Zone - Schist	R4-R5
	Waste Rock - Schist and/or Basalt	R3
A2	Mineralized Zone - Schist	R5
	Waste Rock - Schist and/or Basalt	R3
C1	Mineralized Zone - Schist	R5
	Waste Rock - Schist and/or Basalt	R3+
B1	Mineralized Zone - Schist	R5
	Waste Rock - Schist and/or Basalt	R3+
B3 and B4	Mineralized Zone - Schist	R5
	Waste Rock - Schist and/or Basalt	R3+

Note that the intact rock strength mapped in the open pits appears to be somewhat reduced at the south end of the project site, specifically near A1 open pit.

5.2 Rock Mass Quality

The Q rock mass classification system (described in Barton et al, 1974) was chosen to describe the rock quality as this system is used as key crown pillar and open stope stability assessment input data (described later).

The Q classification system is an empirical method of classifying rock masses, developed by Barton et al. for the Norwegian Geotechnical Institute in 1974 and is based on a series of tunnelling case histories. The Q system uses the six input parameters: percent RQD, number of joint sets (Jn), joint roughness (Jr), joint alteration (Ja), groundwater (Jw), and a stress reduction factor (SRF). During the geotechnical data collection, the RQD, Jn, Jr, and Ja values were collected for each feature. The Jw and SRF values were estimated based on qualitative information in a desktop review in the office. Equation 5.1 was used to determine the rock mass quality (Q) is as follows:

$$Q = \left(\frac{RQD}{Jn}\right) x \left(\frac{Jr}{Ja}\right) x \left(\frac{Jw}{SRF}\right) \qquad (5.1)$$

Where:

RQD is the Rock Quality Designation

Jn is the Joint Set Number

Jr is the Joint Roughness Number

Ja is the Joint Alteration Number

Jw is the Joint Water Reduction Factor

SRF is the Stress Reduction Factor

RQD, Jn, Jr, and Ja values represent the rock quality, referred to as Q prime (Q'), and is used when comparing rock mass qualities. To calculate Q' the last two parameters, Jw and SRF, are removed from equation (5.1).

Table 5.3 (attached at end of report) summarises the calculated Q' value for locations near various near surface non-arsenic stopes.

Golder observed few open fractures in multiple non-arsenic openings and therefore assumed an SRF value of 1.0 for all calculations of Q where required to assess the current stability of the non-arsenic stopes. SRK had assumed an SRF of 2.5 in the calculation of Q (see equation 5.1).

Since the mine has been depressurised by drawing the water table down to the 750 Level, both Golder and SRK assumed a Jw value of 1.0 for all calculations of Q. This assumption may not be valid during future mine flooding away from frozen areas.

Table 5.4 describes the estimated distribution of rock mass quality (Q' or Q) for the various near surface non-arsenic stopes.

Table 5.4: Summary of Rock Quality (Q' and Q) Estimates for Non-Arsenic Stopes

AREA	Near Surface Non-Arsenic Stope(s)	Range of Rock Quality (Q' and Q)		
		Q' = Q Low (20%)	Q'=Q Median (50%)	Q' = Q High (80%)
A2 Pit	DWC, 2-01 North Storage, 2-01, 2-01 NFW, 3-02, 3-01, 2-01 #3, 2-02	8.0	11.0	17.0
A1 Pit	3-70	8.0	12.0	18.0
C1 Pit	2-19, 2-18	15.0	30.0	65.0
B1 Pit	1-18 Upper, 1-18 Lower, 1-18 #1, 1-18 EB, 1-18 EA, 2-15, 2-06, UBC stope	18.0	30.0	65.0
B3 Pit	1-31W / 1-31 #2, 2-35, 1-33 / 1-27	9.0	12.3	19.0
B4 Pit	1-29, 1-34, 1-35, 1-26#5U, 1-26#4, 1-26#5, 1-38 Upper, 1-38 Lower, 1-43#1, 1-43 Upper, 1-43 Lower	9.0	18.6	21.0

Variability in the rock mass quality is reflected in Table 5.4 which presents estimated median (50^{th}%) Q values and bounding lower (20^{th}%) and upper (80^{th}%) Q values. Note that the rock quality values derived for the C1 and B1 open pit areas are generally higher than other areas.

Although the mapping data and the observations in the stopes (discussed later) suggest that the rock quality may differ on the various walls of the non-arsenic stopes (e.g., the hangingwall may exhibit slightly lower rock quality than the back), the uniform rock quality values listed in Table 5.3 were assumed for open span stability assessments. This is due to the lack of specific geotechnical information from each stope.

The distribution of rock quality is not anticipated to be uniform throughout a particular crown pillar and the minimal rock quality reported could dominate stability depending on the failure mechanism present. However, Golder will focus on the median (Q 50th%) values when summarising conclusions from the stability assessment, albeit that the low range of rock quality could eventually dictate stability as noted previously (SRK, 2005).

The Q' values developed by Golder are generally greater than the values reported by SRK which is not always a reflection of the lower SRF values assumed by Golder.

5.3 Rock Structure

The rock structure described in Section 4.1 will dominant kinematic stability issues. In particular, foliation parallel structures appear to dominate wedge formation near the ore zones and structures of high persistence (up to 10 m) parallel to the orientation of the hangingwall of the arsenic stopes were visible nearby. It was reported previously (SRK 2000) that in the chlorite schist, joints and fractures rarely develop more than one or two regular sets. They are commonly curved and discontinuous. Mine workings in this unit typically require limited ground support. The sericite schist, on the other hand, appears to coincide with regions where wedge failure has occurred in the backs, and more effort is required to stabilize the drifts. These areas are characterized by at least 3 regular joint sets.

These shear zone parallel structures present in the sericite schist that was the target of mining are anticipated to dominate non-arsenic stope hangingwall and footwall stability given the low ratio of ground stress to intact rock strength. As such, the long-axis of the stopes and shear zone orientations indicated in the Giant Yellowknife mines cross-sections will be used to determine the dominant discontinuity orientation where required for input into the stability analyses.

6.0 OBSERVED CONDITIONS NEAR NON-ARSENIC STOPES

Golder carried out underground inspections in October 2010, and February 2011. Accessible non-arsenic stopes included those close to the arsenic stope and chamber areas between B1 and C1 open pits, and areas between B3 and B4 open pits. Accessibility was challenging as access into most areas had not been check scaled and if excessive rockfall was observed on the floor or any potentially unstable wedges were observed in the back, entry was not possible and only distal observation was possible. Historical man-entry stoping areas, specifically the cut and fill and room and pillar stopes in which the backs were supported with rockbolts, represent the majority of areas inspected.

In general, the rock exposed in accessible non-arsenic stoping areas showed no sign of stress induced spalling or fracturing, and few open discontinuities were observed. These observations suggest that neither excessively high, nor low, ground stresses that would tend to promote instability are present. Observations in near surface non-arsenic stopes suggest that time dependant degradation of the rock is minimal, but do and can occur. Slabs have spalled off the back and walls of some stopes but the deterioration is minimal and is likely to have occurred over the last 10-15 years. Rock that includes micaceous minerals, including chlorite and sericite, which is present at Giant Mine, have shown the tendency to degrade over the long term when exposed to changing atmospheric (ventilation), temperature (freeze-thaw) and groundwater (percolation in spring) conditions.

One area inspected that did exhibit some potential rock failure associated with crown pillar instability was in the area of non-arsenic stoping under and adjacent to the west wall of B1 open pit. Crown pillars are thin in this area and there is evidence in the mine plans and some anecdotal evidence that these stopes were partially intersected by the pit mining.

A Golder report from 1993 provided the following recommendation related to 2-01 #3 near surface non-arsenic stope *"Because of the proximity to surface, the area should be filled as soon as possible in order to "choke off" further sloughing of the back, and to minimise the risk of any back failure stoping through the surface".*

One important observations made during the underground inspections by Golder was the presence, or lack thereof, type and position of backfill in the non-arsenic stopes. Observations indicate that the cut and fill and to some extent the room and pillar stopes were backfilled with classified sand tailings to enable mining but the backfill was rarely observed to be tight to the back or hangingwall in the case of dipping stopes. In accessible stopes the distance between the sand backfill and the top (back or hangingwall) of the non-arsenic stope was between 3 m and 10 m. Shallow dipping non-arsenic stopes (e.g., dipping less than 40°) were typically observed with sand only in partial contact to the hangingwall (some gaps visible).

As noted in Section 3.0, the installed ground support in stope accesses and in the backs and hangingwalls of man entry non-arsenic stopes appears to be performing long after it was installed but given its nature it will degrade with time.

Time dependant degradation of the rocks exposed in the openings and the currently installed ground support will occur over the long term. Even localised spalling of hangingwalls could eventually lead to a reduction in crown pillar thickness and expansion of the spans, possibly leading to eventual failure in some cases.

7.0 STABILITY ASSESSMENT UPDATE

The previous near surface non arsenic stope crown pillar stability assessment (SRK, 2006) assessed the crown pillar stability using the Carter empirical “Scaled Crown Pillar Span Concept” (Carter 1992, Hutchinson et al 2001). SRK recommended that 3-D models be built for several non-arsenic stoping areas and this work was completed by Golder. Golder reviewed SRK’s approach to the stability assessment along with their recommendations and determined certain aspects required revisiting. For example SRK’s assessment did not include a check of the stability of the open stope spans and focussed on the scaled crown pillar span method. However, any stope wall could exhibit instability that could lead to crown pillar. For example, many crown pillar collapses have resulted from hangingwall slab failure that increases the span of the back of a stope leading to crown pillar collapse.

Updates to the stability assessment input information included the following:

- The original 3-D Gems model information and Golder’s updates to the 3-D Surpac model.
- Synthesis of open-pit and underground geotechnical mapping.
- Underground inspections of accessible non-arsenic stopes and associated development openings.
- Use of the overburden / bedrock contact information in the Giant Yellowknife Gold Mines Ltd. 2-D geology sections to produce 3-D surfaces of this contact.

Golder applied two stability assessments approaches common in underground mining design: 1) the Mathews open stope span stability method (Golder 1981, Stewart and Forsyth 1995); and 2) the updated scaled crown pillar span approach (Carter et al 2002).

7.1 Open Stope Stability Assessment

Mathew’s method is an empirical approach that involves comparing proposed stope dimensions to both stable and unstable cases elsewhere in similar rock conditions. Using this chart, the hydraulic radius (area/perimeter of the exposed surface) of a particular wall (e.g., back or hangingwall) is plotted versus the stability number, N. The stability number calculated using the Q rock mass classification value, which is modified to account for stress condition, joint orientations, and failure mechanism according to the following relationship:

$$N = Q' x\ A\ x\ B\ x\ C$$

Where:

A = Rock Stress Factor

B = Rock Defect Orientation Factor

C = Design Surface Factor

The following assumptions with regard to in-situ stresses were made in the analyses:

- Vertical stress is equivalent to overburden load (e.g., overburden and rock).
- The ratio of horizontal to vertical stress (K) is assumed to be 1.5, both perpendicular and parallel to the long axis of the openings.

The outcome of the analysis shows the hydraulic radius (H) vs. the stability number (N) on a chart that separates potential behaviour of the wall in question (e.g., stope back or hangingwall) based on case studies subdivided into the following broad categories that describe worsening stability conditions.

- Stable
- Unstable
- Major Failure
- Caving

The Mathew's approach assesses the potential stability of a stope in isolation and does not take into account the potential stress effects from nearby openings. This is not considered an important factor in the interpretation of the results of this analyse given the relatively high rock strength compared to the low in-situ stresses.

The Mathews approach is valid for open spans only. As the quantity of backfill in the non-arsenic stopes is not known, the assessed stability of the end walls, hanging walls and footwalls are likely conservative, as the hydraulic radius used in the calculation did not take into account any confinement to the walls by backfill.

Appendix B includes the Mathews open span analysis sheets for all the near surface non-arsenic stopes. The results of the analysis are summarised in Table 7.1. Ranges of both rock quality and non-arsenic stope span are included in the analyses, resulting in a range of predictions.

Shaded zones represent potential areas of concern with respect to back or wall (hangingwall or footwall) failure.

Definitions of stable, unstable, and major failure are shown on the design charts, (Stewart and Forsyth, 1995) but they are made in the context of an open stope at an active mining operation. Stope surfaces plotting in the unstable zone would be subjected to local failure that would likely reach a stable configuration. Surfaces plotting in the major failure zone would exhibit larger scale failures that may eventually reach a stable configuration. Surfaces plotting in the caving zone could exhibit an uncontrollable caving situation that could propagate to surface under certain conditions.

Stope surfaces plotting in the stable zone would generally be considered stable in an unsupported condition over the long term. Surface plotting in the unstable zone would typically be supported with regular cable bolts to ensure long term stability in a mining context. Support of large stope walls that will last 100-200 years would be cost prohibitive as corrosion protection would be required and backfilling the void to limit the progression of failure is standard practice for mine closure.

Table 7.1: Open Span Stope Stability (Mathew's Method) - Unfilled Non Arsenic Stopes

Open Pit Area	Non-Arsenic Stope	Distribution of Stope Back Rock Mass Quality *			Back Span Hydraulic Radius		Hangingwall/ Footwall Hydraulic Radius		Stability Assessment Chart, Anticipated Typical Rock Conditions
		Q' = Q Low (20%)	Q'=Q Med. (50%)	Q' = Q High (80%)	Min.	Max.	Min.	Max.	
A2 Pit	DWC	8.0	11.0	17.0	1.9	3.0	12.7	14.6	Back stable, walls unstable
	2-01 N Storage	8.0	11.0	17.0	3.5	4.1	3.3	4.1	Stable
	2-01	8.0	11.0	17.0	4.8	6.4	6.0	6.4	Back and ends stable, footwall stable, hanging wall unstable
	2-01 NFW	8.0	11.0	17.0	2.5	2.8	2.8	2.8	Stable
	3-02	8.0	11.0	17.0	6.9	8.0	13.7	11.8	Back unstable, walls unstable, ends stable
	3-01	8.0	11.0	17.0	6.9	8.0	6.9	5.6	Back unstable, walls stable
	2-01 #3	8.0	11.0	17.0	3.6	4.0	5.6	5.8	Stable
	2-02	8.0	11.0	17.0	4.7	6.4	6.9	6.9	Back stable to unstable, walls stable
A1 Pit	3-70	8.0	12.0	18.0	4.3	6.4	23.5	23.5	Back and ends stable, hanging wall and foot wall major failure
C1 Pit	2-19	15.0	30.0	65.0	1.2	2.2	3.0	8.8	Stable
	2-18	15.0	30.0	65.0	2.2	5.8	14.3	19.6	Back, hanging wall and foot wall stable to unstable, ends stable
B1 Pit	1-18 Upper	18.0	30.0	65.0	4.0	6.0	4.3	11.1	Back and ends stable, hanging wall and foot wall stable to unstable
	1-18 Lower	18.0	30.0	65.0	5.8	6.3	6.8	8.8	Stable
	1-18 #1	13.0	25.0	45.0	1.2	1.7	2.6	2.9	Stable
	1-18 EB	13.0	25.0	45.0	3.8	4.0	2.1	3.8	Stable
	1-18 EA	9.0	16.0	39.0	5.3	4.4	6.9	9.0	Back and ends stable, hanging wall and foot wall stable to unstable
	2-15	18.0	30.0	65.0	6.3	5.0	5.8	6.8	Stable
	2-06	13.0	25.0	45.0	2.1	2.6	5.0	5.0	Stable

Table 7.1: Open Span Stope Stability (Mathew's Method) - Unfilled Non Arsenic Stopes…continued

Open Pit Area	Non-Arsenic Stope	Distribution of Stope Back Rock Mass Quality *			Back Span Hydraulic Radius		Hangingwall/ Footwall Hydraulic Radius		Stability Assessment Chart, Anticipated Typical Rock Conditions
		Q' = Q Low (20%)	Q'=Q Med. (50%)	Q' = Q High (80%)	Min.	Max.	Min.	Max.	
B3 Pit	1-31 #2	9.0	12.3	19.0	6.2	7.5	4.5	5.0	Stable
	2-35	9.0	12.3	19.0	8.4	6.0	6.8	12.5	Back, hanging wall and foot wall stable to unstable, ends stable
	1-33 / 1-27	9.0	12.3	19.0	5.6	6.7	6.9	8.0	Back, foot wall and ends stable, hanging wall unstable
B4 Pit	1-29	9.0	18.6	21.0	3.6	2.3	2.8	2.8	Stable
	1-34	9.0	18.6	21.0	4.1	3.4	5.3	5.3	Stable
	1-35	9.0	18.6	21.0	2.4	3.2	4.1	4.5	Stable
	1-26#5U	9.0	18.6	21.0	3.4	4.1	3.4	3.4	Stable
	1-26#4	9.0	18.6	21.0	3.2	4.1	6.4	6.4	Stable
	1-26#5	9.0	18.6	21.0	1.7	2.1	4.7	4.7	Stable
	1-38 Upper	9.0	18.6	21.0	4.9	6.9	2.6	3.0	Stable
	1-38 Lower	9.0	18.6	21.0	5.6	3.5	9.7	9.7	Back and ends stable, foot wall stable to unstable, hanging wall unstable
	1-43 #1	9.0	18.6	21.0	4.0	7.1	2.7	4.8	Stable
	1-43 Upper	9.0	18.6	21.0	5.6	10.9	2.0	3.6	Walls stable, back stable to unstable
	1-43 Lower	9.0	18.6	21.0	2.3	4.5	5.0	13.0	Back and ends stable, footwall stable to unstable, hanging wall stable to major failure
N/A	UBC	Was not assessed – remote stope							

The ground support types observed at Giant, which are assumed the typical support method used, cannot be counted on to provide any long-term support and they do not change the conclusions of the analyses presented.

As noted previously, the analysis presented above assumes no backfill in the stopes and this may or may not be the case. Also, the focus of the report is on crown pillar stability and the stability of the potentially open span of the non-arsenic stopes will simply be used to influence the results of the crown pillar analysis presented below. For example, if a crown pillar stability was marginal and the stability of the back or hangingwall of the open span was in question, the probability of the failure of the crown pillar alone would be upgraded.

7.2 Scaled Span Crown Pillar Stability Assessment

Golder checked the stability of the non-arsenic stope crown pillars using the updated approach outlined in "Extending Applicability of the Crown Pillar Scaled Span Method to Shallow Dipping Stopes" (Carter ,2002) using updated estimates of rock mass quality, stope size, and crown pillar thickness based on updates to the 3-D model. This method was also used for previous assessments (SRK, 2006).

The empirically based Carter scaled span method found that crown pillar instability would occur if the scaled crown pillar span (Cs) was greater than the critical span (Sc). A 'Scaled Span (Cs)' is determined by scaling the actual span to account for the influence of various parameters (e.g., horizontal stress, rock quality, etc.). The Scaled Span (C_s) is determined using equation (7.1).

$$C_s = S\left[\frac{\gamma}{t(1+S_r)(1-0.4\cos\theta)}\right]^{0.5} \quad (7.1)$$

Where:

S = crown pillar span (m)

L = crown pillar length (m)

T = crown pillar thickness (m)

γ = specific gravity of the rockmass

θ = orebody/foliation dip (degrees)

Prior to 2002, it was recommended that for shallow dipping stops the hangingwall length be used as the crown pillar span in the critical span calculation. However, this often led to conservative evaluations of the stability of the crown pillar.

A large database was compiled of crown pillars from many mines and underground excavations and this empirical data was used to make the scaled span applicable for defining crown pillar stability. The Critical Scaled Span (S_c) term was developed to fit the non-linear trend of varying rockmass competences, equation (7.2).

$$S_c = 3.3Q^{0.43}\sinh(Q)^{0.0016} \quad (7.2)$$

The empirical data was again used (Carter et al 2008) and S_c/C_s ratios were plotted cumulative frequency distribution, which then enabled an error destitution function to be applied. The probability of failure is given in equation (7.3).

$$P_f = 1 - erf[\frac{2.9Fc-1}{4}] \quad (7.3)$$

Where:

Fc = Sc / Cs

Therefore if the factor of safety is approximately equal to 1, the probability of failure is approximately equal to 50%.

Application of an estimation of the probability of failure was not included in SRK's report (SRK 2006). This may have been done due to a lack of specific geotechnical information for each non-arsenic stope but Golder applied it to help guide discussion of risk and on setting priorities on future investigations.

Appendix C includes the scaled span analyses of the crown pillars of the near surface non-arsenic stopes at the project site. The plots show the range of scaled span (C_s) of the crown pillars which is based on geometry vs. the range of rock quality (Q) for each crown pillar superimposed on a plot showing iso-probability of failure contours developed empirically.

The range of the probability of failure *(P_f)* of each non-arsenic stope in its current known condition determined from the analyses included in Appendix C is outlined in Table 7.2. The variability in the rock mass quality (Q) and the geometry of the crown pillar influences the probability of failure of the crown pillar. At this stage of the stability assessment, Golder will focus on the analyses of the median rock quality (Q 50%) and the average non-arsenic stope geometry (shaded) but worse conditions could be present.

The irregular shape of the non-arsenic stopes, the variable rock mass quality, the variable thickness of rock between the back of the stopes and the overburden / bedrock contact, and other factors make interpretation of the results an exercise in engineering judgement. However, the range of probability of failure shown in Table 7.2 is representative of relative current conditions when different non-arsenic stopes are compared.

The information is also useful when discussing current risk factors on the site. When public or worker safety is at risk, the higher probability of failure values suggested by larger than average opening sizes and lower bound rock mass quality should be considered.

The approach compares the non-arsenic stopes from Giant to those at other sites. However, as all individual sites are unique, the approach cannot be thought of as a definitive assessment of whether any one crown pillar at Giant will fail or not given the uncertainties in the critical factors of rock stress, strength, opening geometry (which is complex and somewhat unknown at Giant) and the orientation and nature of critical discontinuities.

Also, although the probability of failure of some shallow dipping stopes (1-38 and 1-43 stopes near B4 pit for example) are relatively high, resulting surface disturbance could be minimal as any spalling rock off the back of the stope would land on the sand backfill present there and bulking of the rock would choke off the failure. The presence, and long term security of the backfill, is an important aspect of long term closure.

Table 7.2: Results of the Scaled Span Crown Pillar Stability Assessment - Non Arsenic Stopes

Open Pit Area	Non-Arsenic Stope	Probability of Failure for Range of Rock Mass Quality and *Average* Opening Geometry			Probability of Failure for Range of Rock Mass Quality and *Largest* Opening Geometry		
		Q Low (20%)	Q Med. (50%)	Q High (80%)	Q Low (20%)	Q Med. (50%)	Q High (80%)
A2	DWC	0.1%	0.7%	2.1%	18.9%	31.0%	40.4%
	2-01 N Storage	0.0%	0.2%	0.8%	0.0%	0.4%	1.5%
	2-01	8.8%	18.8%	27.9%	17.9%	30.6%	40.7%
	2-01 NFW	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
	3-02	5.2%	12.6%	20.0%	24.9%	37.7%	47.2%
	'3-01	4.8%	11.8%	19.0%	22.0%	35.2%	45.2%
	2-01 #3	1.4%	5.1%	10.0%	3.8%	10.1%	16.8%
	2-02	0.0%	0.0%	1.3%	2.3%	7.6%	14.1%
A1	3-70	1.3%	4.4%	10.5%	12.2%	21.9%	33.4%
C1	2-19	0.0%	0.0%	0.0%	12.9%	36.1%	57.2%
	2-18	0.0%	0.0%	0.0%	0.1%	3.9%	16.1%
B1	1-18 Upper	0.0%	1.7%	8.0%	1.3%	11.5%	26.3%
	1-18 Lower	0.0%	2.0%	8.8%	0.9%	9.8%	23.5%
	1-18 #1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	1-18 EB	1.7%	8.8%	24.1%	8.6%	22.9%	42.4%
	1-18 EA	1.6%	14.3%	29.3%	19.9%	47.0%	63.4%
	2-15	0.0%	0.0%	2.0%	11.3%	33.6%	51.5%
	2-06	2.1%	10.2%	26.9%	16.5%	34.1%	54.4%
B3	1-31 #2	3.4%	9.4%	15.9%	7.8%	16.7%	24.8%
	2-35	0.0%	0.0%	1.5%	2.3%	7.2%	12.8%
	1-33 /1-27	11.2%	21.4%	30.1%	19.7%	31.9%	41.2%

Table 7.2: Results of the Scaled Span Crown Pillar Stability Assessment - Non Arsenic Stopes…continued

Open Pit Area	Non-Arsenic Stope	Probability of Failure for Range of Rock Mass Quality and *Average* Opening Geometry			Probability of Failure for Range of Rock Mass Quality and *Largest* Opening Geometry		
		Q Low (20%)	Q Med. (50%)	Q High (80%)	Q Low (20%)	Q Med. (50%)	Q High (80%)
B4	1-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	1-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	1-35	1.8%	2.6%	11.1%	3.7%	5.1%	16.6%
	1-26#5U	0.1%	0.2%	2.6%	2.2%	3.2%	12.4%
	1-26#4	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
	1-26#5	1.7%	2.5%	11.2%	1.7%	2.5%	11.2%
	1-38 Upper	9.4%	11.8%	27.4%	27.9%	31.5%	50.2%
	1-38 Lower	23.8%	27.3%	46.6%	29.2%	32.9%	52.2%
	1-43 #1	8.6%	10.8%	26.0%	35.3%	39.1%	57.4%
	1-43 Upper	8.7%	11.0%	26.3%	32.2%	35.9%	54.4%
	1-43 Lower	9.4%	11.9%	28.0%	43.7%	47.6%	65.7%
N/a	UBC	Was not assessed – remote stope					

Engineering judgement of the predictions provided by the approach and the land-use of the site are important aspects of interpretation of these results. For example, a crown pillar with a probability of failure of 49.9% is by definition stable, but long term empirical data suggest that crown pillars plotting in this zone fail with time. The analytical approach does not include time but the empirical data does. Also, the chosen method of assessment of rock quality (Q) does not explicitly assess the potential for rock strength to degrade with time. Two basic, quite different crown pillar rock mass behavioural characteristics and both of these extremes are included in the empirical crown pillar behaviour data:

- Non-degradable competent rock types (igneous and metamorphic types as well as cemented sedimentary units) tend not to spall over time and; and
- Degradable, weathering susceptible, weak or highly fragmented rocktypes most commonly fail in due course, due to disintegration and spalling.

The majority of the rock at Giant is likely in the first category, which suggests that crown pillars that are shown to plot in relatively high probability of failure zones may not fail. However, given the presence of micaceos minerals associated with the mineralisation (e.g., sericite schist), freeze thaw action, percolating groundwater, and variably humid mine ventilation air, time dependant degradation of the rock mass will occur.

7.2.1 Comparative Significance of Probability of Non-Arsenic Stope Crown Pillar Failure Estimates for Mine Closure

Carter and Miller (1995) developed long-term closure guidelines for post-closure public access over crown pillars as outlined in Table 7.3. There is elevated level of concern with increasingly onerous limitations on access and monitoring requirements as the probability of crown pillar failure (P_f) worsens. Public access restrictions are recommended for crown pillars with > 5% P_f.

The guidance is not suitable for active mines as they often have different approaches to dealing with the potential failure of crown pillars. Many active operational mines design crown pillars to factor of safety values of 1.2 or lower, with corresponding probability of failure values as high as 40%. The difference in approaches between a closed mine and an active one is due to the presence of in-house mining, engineering and technical services expertise, historical knowledge, and the ability to react quickly and decisively when required at a typical active mining operation. Although Giant is in care and maintenance mode, only some of the in-house expertise required to manage a complex and dynamic situation like a crown pillar movement exists.

The project poses unique challenges in interpretation of the prediction as in some areas it can be an active mine as it is care and maintenance mode, yet non-arsenic stopes underlie publicly accessible areas and an important transportation route (Highway 4). Non-arsenic stopes are also present under Baker Creek which is a fish bearing waterway and poses the unique risk associated with flooding of the mine and the arsenic stopes and chambers.

The probability of failure values presented in Table 7.2 and the guidance provided in Table 7.3 can be used with engineering judgement to develop a comprehensive non-arsenic stope remediation and closure plan.

Table 7.3: Comparative Significance of Crown Pillar Failure (from Carter and Miller, 1995) for Long-Term Public Access Table

Class	Prob. Of Failure (%)	Reliability (%)	Min F of S	Design Criteria for Acceptable Probability of Failure				
				Serviceable Life of Crown Pillar (Years)		Public Access	Regulatory Closure Attitude	Operating Surveillance Required
A	50-100	0-50	<1	Effectively zero	<0.5	Forbidden	Totally Unacceptable	Ineffective
B	20-50	50-80	1.0	Very very short term (temporary mining purposes only - untenable risk of failure for temporary civil portals)	1.0	Forcibly prevented	Not Acceptable	Continuous Sophisticated Monitoring
C	10-20	80-90	1.2	Very short term (quasi-temporary stope crowns - undesirable risk of failure for temporary civil works)	2-5	Actively prevented	Very Concerned	Continuous Monitoring with Instruments
D	5-10	90-95	1.5	Short term (semi-temporary crowns, *e.g.*, under non-sensitive mine infrastructure)	5-10	Prevented	Concerned	Continuous Simple Monitoring
E	1.5-5	95-98.5	1.8	Medium term (semi-permanent crowns, possibly under structures)	15-20	Discouraged	Somewhat Concerned	Conscious Superficial Monitoring
F	0.5-1.5	98.5-99.5	2	Long term (quasi-permanent crowns, civil portals, near - surface sewer tunnels)	50-100	Allowed	Of Limited Concern	Incidental Superficial Monitoring
G	Less than 0.5	Greater than 99.5	>>2	Very long term (permanent crowns over civil tunnels)	>100	Free	Of No Concern	Monitoring Not Required

8.0 CONCLUSIONS AND RECOMMENDATIONS

Golder reviewed and updated previous stability assessment for the near surface non-arsenic stopes (SRK, 2006). Golder had no new information, other than that gathered during underground site inspections, to base the update on but additional effort in adding existing information to the 3D model and delineating the bedrock / overburden contact from historical boreholes, as was recommended by SRK and was carried out. A relative assessment of the likelihood of crown pillar failure and the potential impact on surface was developed but because of a lack of geotechnical investigation for these crown pillars, the stability assessments can only be described as conceptual. The relative risk of crown pillar failure provided in the stability update can be used for prioritising future investigation priorities.

Other non-arsenic stopes below 35 m depth that were not assessed for the preliminary design effort could fail and impact surface. Stope failure in areas mined using shrink stoping and longhole open stoping mining methods would represent the largest potential risk of causing surface impacts. In the areas that were cut and fill mining methods were applied the risk is lower as they are partially backfilled but timber barricades commonly used will fail over time and the stabilizing effect of backfill could be reduced if movement of it occurs. This situation could worsen if and when the mine is flooded.

8.1 Priority Level Rating of Non-Arsenic Stopes

In order to develop a preliminary non-arsenic stope crown pillar risk assessment, Golder proposes to use the probability of failure of a non-arsenic stope crown pillar and a preliminary assessment of the consequence of such a failure into a priority level rating. Failure consequence was given a Low, Moderate and High rating based on proximity to the non-arsenic stope to critical surface elements such as Baker Creek, Highway 4, and publicly accessible areas. The open span assessments outlined in Section 7.1 and the potential for crown pillar failure to choke off quickly due to the presence of partial backfill in the stope influence the priority level assessment. Table 8.1 (included at end of report) summarises the results of this assessment. Table 8.2 summarises the highest priority non-arsenic stopes. Note in Table 8.2 that the lowest priority level represents the highest risk.

The non-arsenic stope priority level approach outlined in Table 8.1 and 8.2 are not formal risk assessments as a comprehensive consequence study was not carried out and the uncertainties in the geotechnical situation are significant.

Table 8.2: Priority Non-Arsenic Stopes and Recommendations

Open-Pit Area	Stope	Priority Level (Risk)*	Recommendation
A2	2-01	**3**	Stope should be inspected or geotechnical drilling to confirm backfill, until then access should be limited. Develop monitoring program.
	2-01 #3	**4**	
	3-01	**6**	Priority for investigation to check rock quality and backfill position. Develop monitoring program including monitoring of Highway 4.
	3-02	**6**	
A1	3-70	**5**	Priority for investigation to check rock quality and backfill position. Develop monitoring program.
B1	1-18 Upper	**5**	Priority for investigation, could be backfilled now. Develop monitoring program. Underground inspection, pit slope monitored with prisms.
	1-18 Lower	**5**	
	1-18 EB	**4**	
	1-18 EA	**6**	
B3	1-33 / 1-27	**6**	Develop monitoring program.
B4	1-35	**5**	Develop monitoring program, including monitoring of Highway 4.
	1-38 Upper	**6**	
	1-38 Lower	**4**	
	1-43 #1	**6**	
	1-43 Upper	**6**	

*Note: Lower values equal higher risk.

8.2 Immediate Concerns to Worker and Public Safety

Golder has recommended public access restrictions in areas considered to be an immediate potential risk to public safety which at this time included the 2-01 non-arsenic stope complex area near A2 pit. These Golder recommendations were made under separate cover. The stopes under Highway 4 north of A2 pit pose a moderate concern and a monitoring program including underground inspection, checking for cracks in the highway, and survey monitoring settlement of the highway should be implemented.

Areas considered to be a potential risk to worker safety include those associated with B1 Pit perimeter mine road around the south end and the South access road, paralleling Highway 4 and East of B4 open pit. A monitoring program including underground inspection, checking for cracks in the road, and survey monitoring settlement of the mine access road should be developed.

8.3 Impact on Preliminary Design Estimate

Non-arsenic stopes distal to the arsenic stope areas were not slated for backfilling to stabilise crown pillars in the RAP and the DAR. The preliminary design outlined herein and in the Underground PDR (Golder, 2012a) includes backfilling all of the distal stopes. For the preliminary design, a near surface non-arsenic stope is described as an underground stope that is situated within 35 m of the surface or the bedrock / overburden contact where surface soils are present. Only these stopes were assessed for the preliminary design effort.

Some slightly deeper stopes where potentially large voids spans are present were assessed and included in the backfilling scheme if they were situated under critical surface elements. For example, stopes situated under and near B1 open pit, which is critical to the arsenic remediation project.

Several backfill options are being considered but lightly cemented paste backfill is the current material assumed in the preliminary design.

These openings do not necessarily need to be backfilled tight to the back. Rather there needs to be enough backfill to limit the progression of any future long-term back instability to surface. Once future investigations outlined in this report are carried out it is expected that stability assessments to support detailed designs may possibly conclude that not all of these near surface non-arsenic stopes require backfilling.

Long-term stability of the backfilled non-arsenic stopes may depend on future mine water management strategies and the post closure land use plan. The current approach to stabilisation of the remaining stopes for the long term is to backfill them after the freezing is complete (post remediation). Alternative arrangements could include fencing and monitoring.

If the mine water is allowed to re-flood, the backfill already in place could exit the stopes through connected development thereby reducing stability. The backfill added during the remediation will be lightly cemented and will not flow out of the stopes. Assessments of the long-term potential for existing sand backfill to exit stopes through connected development will need to be assessed. Possible remediation solutions include placement of waste rock or cemented paste plugs at the exits to the stopes.

These design details will be assessed in the future when the geotechnical situation at each near surface non-arsenic stope is understood, the long term mine water management strategy has been finalised, and the post closure land use plan has been developed.

8.4 Recommendations for Future Work

Recommended investigations, testing, surveying, and monitoring to enhance the understanding of non-arsenic stope stability and to develop detailed mitigation and remediation plans are set out below. Details for each area will be developed as required but general recommendations are outlined below.

Recommendations for geotechnical drilling investigations and surveys, as described below, have been made by Golder under separate cover.

8.4.1 Geotechnical Investigations, Surveys, Inspections and Mapping

Geotechnical investigation of the near surface non-arsenic stopes is required to reduce uncertainty and better assess the potential risk of crown pillar failure affecting critical surface features. The goal of the investigations includes:

- Understanding the thickness of overburden and the geometry of the bedrock / overburden contact.
- The geometry of the open void (if any).

- The position of the backfill and the type of backfill. For shallow stopes, the tightness of the backfill should be assessed.
- The rock mass quality and structural geology of the crown pillar.

Additional underground inspections and mapping should be carried out, but only after stope accesses and man-entry stopes are check scaled and re-bolted (spot-bolting may be suitable) as required for safe routine access by geotechnical personnel.

At least one geotechnical borehole will be required to be drilled into each non-arsenic stope to quantify the thickness of overburden, the quality of the rock, and the position and type of the backfill. Additional holes may be required if the stope is not accessible for design of the backfilling system. Oriented HQ triple-tube drilling, borehole televiewer, borehole camera, and cavity monitoring survey work are required, particularly in the inaccessible stopes.

For detailed design and backfill purposes, comprehensive cavity monitoring surveys will be required for each non-arsenic stope. These are required to check for instability and to assess the shape of the back for detailed design and development of “for construction” drawings and specifications for placement of void filling backfill holes.

Stopes, accessible by foot, should have camera and cavity monitoring surveys (CMS) carried out. For stopes that are inaccessible, boreholes should be drilled into the top of the stope and the CMS survey carried out. The entire stope back must be accurately profiled and multiple boreholes may be required. This program could be carried out at the same time as the geotechnical investigation (core recovery) but percussion holes drilled from surface or underground would also suffice in some cases.

Geophysical surveys over the arsenic stopes and crowns should be carried out to confirm the thickness of the rock crown pillar over each of them. Light seismic (*e.g.,* with a sledgehammer), resistivity, or electrical methods could all potentially develop useful information on the position of the bedrock / overburden contact.

8.4.2 Testing

A suite of laboratory strength tests should be carried out for use in future geotechnical stability assessments. Instrumented uniaxial compressive strength tests to determine Young’s Modulus, Poisson’s ratio, and peak strength values should be carried out. Golder recommends that a minimum of 10 tests per dominant rock lithology be done. Some of these tests will be required for the stage of open-pit closure design and the two programs should be combined for efficiency.

Backfill testing, as discussed in the Underground PDR is also required prior to implementation of the mitigation and remediation work described in this report.

8.4.3 Monitoring

There is limited evidence at this time to suggest that the stability condition of non-arsenic stopes under any important surface elements is critical or degrading. However, there is almost no systematic monitoring and some should be developed.

Regular systematic visits by personnel familiar with underground ground conditions and ground control should visit any and all safely accessible underground openings. A photographic record and database should be kept of any changing conditions.

The existing system of manually surveying several prisms placed on surface above non-arsenic stopes on the west side of B1 pit has been implemented. This current monitoring approach for this area is suitable for the current situation, but additional survey points should be installed. In future, a robust prism monitoring survey system should be developed.

Annual level surveys of Highway 4 and mine access roads should be carried out to check for settlement which could be a sign of subsidence due to crown pillar failure of nearby near surface non-arsenic stopes.

Surface surveys of overburden materials that overlie the rock crown pillars do not provide suitable information to assess impending failure. One example rock movement monitoring program could include tell-tales installed in investigation boreholes, which are a simple way to determine if the stope back has moved. More sophisticated monitoring of crown pillar rock movement could include multi-point borehole extensometers or time-domain-reflectometry cables.

9.0 CLOSING

We trust that the above meets your requirements at this time. If you have any questions regarding the included material, please do not hesitate to contact us.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

ORIGINAL SIGNED

Ashley Pakula, P.Eng. (BC)
Intermediate Engineer

Darren Kennard, P.Eng. (BC)
Associate

Reviewed by:

ORIGINAL SIGNED

John A. Hull, P.Eng. (B.C., NWT/NU, YK)
Principal, Mining Division

AP/DTK/JAH/keh/rs

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Table 2.1: Summary of Stope and Crown Pillar Geometry for Near Surface Non-arsenic Stopes

Area	Stope	YGGM Section Book #	Approximate Range of YGGM Geology Sections, Engineering Grid Sections Noted			Pillars Present in Stope	Top of Stope Depth below G.S. - T (m)		O/B Thickness - to (m)		Rock Crown Pillar Thickness (m)		Stope Dip (deg)			Stope Height - H (m)		Rock Cover to Stope Floor - H (m)		Strike Length of Stope (m) - L			Average Stope Span (m) - S			Rock Crown Thickness / Span: Largest	Rock Crown Thickness / Span: Average	Comments
			Geology Section South	Geology Section North	Gross Stope Length (m)		Largest	Average	Largest	Average	Largest	Average	Largest	Average	Used for Shallow Stopes*	Largest	Average	Largest	Average	Largest	Average	w/o Pillars	Largest	Average	w/o Pillars			
A2	DWC	1	4425N (Eng.)	4700N (Eng.)	85	N	2.8	5.5	0	0	2.8	5.5	70	70	n/a	50	40	52.8	45.5	70	70	n/a	6.5	4	n/a	0.4	1.4	Stope has broken through to surface (failed crown?) in south, stability of crown to north checked
	2-01N	2,3	5700S (Book 2)	5500S (Book3)	60	Y	37	34	5	4	36	30	10	0	90	12	10	49	44	25	20	70	12	11	17	3.0	2.7	Stope connected to larger 2-01 stope, pillars present in stope and Golder crown size values assume they are stable
	2-01	3	5500S	5375S	40	Y	37	38	3	2	34	36	45	40	n/a	29	20	66	58	30	35	60	20	14	20	1.7	2.6	SRK assumed entire area was 2-01 stope, Golder sub-divided it into 2-01N, 2-01, and 2-01 #3, SRK likely meant 2-01#3
	2-01 NFW	3	5475S	5375S	30	N	33	29	5	4	28	25	85	85	n/a	7	7	40	36	30	30	n/a	7	6	n/a	4.0	4.2	Small stope under publicly accessible area, thick overburden above a relatively thin crown.
	3-02	2	5750S	5625S	40	N	38	38	0	0	38	38	79	70	n/a	70	50	108	88	45	45	n/a	35	20	n/a	1.1	1.9	3-02 stope connects to 3-02 stope under Highway 4, 3-02 stope is much higher in elevation, stope span may be larger in isolated areas
	3-01	2	5625S	5525S	30	N	47	47	5	2	42	45	33	50	n/a	20	15	67	62	45	45	n/a	25	20	n/a	1.7	2.3	Deeper portion of 3-02/3-01 complex, 3-01 also partly connected to 2-01 above and assumed to be backfilled
	2-01 #3	3	5325S	5150S	55	Y	18	19	5	5	13	14	0	0	90	30	30	48	49	19	18	45	14	12	40	0.9	1.2	Pillars break up the span but Golder photos from 1993 suggest that the pillar stability may be suspect, Likely what SRK referred to as 2-01.
	2-02	3	5150S	4950S	60	N	45	55	0	0	45	55	45	50	n/a	20	20	65	75	45	45	n/a	18	12	n/a	2.5	4.6	Span of 2-02 and southern section of 2-03 Upper used, stope deepens quickly at north end of 2-03 Upper
A1	3-70	5	7475N (Eng.)	7725N (Eng.)	80	N	18	18	4	4	14	14	80	80	n/a	105	105	123	123	85	85	n/a	15	9.5	n/a	0.9	1.5	Crown pillar may be slightly thinner to south than average values shown, larges span is below top of stope but CMS should be run to check
C1	2-19	12	2025S	1925S	30	N	0.5	3	0	0	0.5	3	80	80	n/a	35	35	35.5	38	35	35	n/a	5	3	n/a	0.1	1.0	Need to assess backfill position and whether this stope is connected to 2-20 below it or 2-18 north of it? Thin or non-existant crown !
	2-18	12	1950S	1700S	80	N	18	17	8	4	5	13	70	70	n/a	120	100	138	117	50	50	n/a	13	5	n/a	0.4	2.6	Stope height varies as upper and northern portion was not mined. Thinner crown in south as underneath C-1 Pit, stope span wider below top
B1	1-18 Upper	24	250S	000N	55	Y	22	12.5	0	3	20	9.5	45	45	90	35	12	57	25	70	65	n/a	16	11	n/a	1.3	0.9	some small pillars in area that may not be stable, difficult to inspect due to backfill and unsafe ground conditions, situation could be worse
	1-18 Lower	24	175S	025N	65	Y	19	22	1	3	18	19	60	60	n/a	25	25	44	47	60	30	60	19	16	n/a	0.9	1.2	Spans may be higher and the situation worse if smallpillars are no longer intact
	1-18 #1	24	025S	000N	10	N	17	20.5	8	9	9	11.5	60	60	n/a	14	11	31	32	10	10	n/a	5	3	n/a	1.8	3.8	Small drift off 1-01 stope raise in south end of stope may expand span there to 6m but does not impact stability
	1-18 EB	24	025S	075N	30	Y	21	26	17	22	4	4	65	77	n/a	10	5	31	31	30	30	n/a	13	10	n/a	0.3	0.4	Very thin pillar between 1-01 stope and/or B1 open pit and back of 1-18 EB, it should be filled to support the pit wall
	1-18 EA	24	075N	225N	45	N	28	26	24	18	4	8	50	50	n/a	30	20	58	46	45	45	n/a	14	11	n/a	0.3	0.7	Very thin pillar between top of 1-18EA stope and first level above, thin crown in turn between pit and first level
	2-15	24	275N	450N	55	N	29	20	17	0	12	20	40	40	n/a	25	15	54	35	24	24	n/a	26	15	n/a	0.5	1.3	Southern end of stope connects to 1st level which intersects the pit, northern portion is deeper under pit wall., checked 350N-425N
	2-06	24	475N	550N	25	N	10	24	0	0	10	24	45	45	n/a	30	30	40	54	15	15	n/a	8	6	n/a	1.3	4.0	Thin crown only for a small portion of the southern part of the stope, should check for cracking on B1 pit ramp above here
B3	1-31W / 1-31#2	46	3150N	3250N	30	N	29	29	0	0	29	29	0	20	90	14	12	43	41	35	35	n/a	23	19	n/a	1.3	1.5	some pillars between 1-31 W / 1-31 #2 and 1-31 stope (under pit) should be checked for stability
	2-35	46,48	3300N (Book 46)	3800N (Book 48)	150	N	54	50	0	0	54	50	65	65	n/a	30	20	84	70	150	150	n/a	19	12	n/a	2.8	4.2	Cover and stope spans decrease to north but the stope strike span is long (150m)
	1-27/1-33	46	3250N	3400N	50	N	35	35	0	0	35	35	35	40	n/a	25	20	60	55	45	45	n/a	19	15	n/a	1.8	2.3	The stope extends north of 3400N, but pillars begin to break up the span north of 3400N
B4	1-29	46	3425N	3675N	80	N	50	50	0	0	50	50	50	50	n/a	6	6	56	56	70	70	n/a	8	5	n/a	6.3	10.0	There is some visual evidence that this stope is large in some areas than shown on geology sections, need to check level plans
	1-34	48	3300N	3450N	45	N	38	38	4	4	34	34	75	75	n/a	14	14	52	52	45	45	n/a	10	8	n/a	3.4	4.3	Stope directly under shoulder of highway 4, fill level should be checked
	1-35	48	3525N	3600N	25	N	15	15	3	3	12	12	45	45	n/a	14	12	29	27	25	25	n/a	8.5	6	n/a	1.4	2.0	If pillar between 1-37 stope and small drift at top of stope near Section 3600 N is not stable conditions will be worse
	1-37	48	3650N	3700N	15	N	Crown pillar shown broken through on Section 3725N (Book 48)																					3725N in book 48 shows a breakthrough to surface indicating that the crown pillar was shot or failed
	1-26#5U	47	3850	3975N	45	N	17	16	8	4	9	12	90	90	n/a	8	8	25	24	45	45	n/a	10	8	n/a	0.9	1.5	Stope intersects pit at south, section 3875N suggests possible breakthrough to pit?
	1-26#4	47	4000N	4300N	90	N	35	35	2	2	33	33	65	65	n/a	15	15	50	50	90	90	n/a	9	7	n/a	3.7	4.7	Stope plunges north, much deeper cover
	1-26#5	47	4050N	4250N	60	N	35	35	3	3	32	32	35	35	n/a	15	15	50	50	25	25	50	5	4	n/a	6.4	8.0	Large hangingwall portion of stope is only 2-025m long so entire stope length not used, stope plunges to north
	1-38U	48	3750N	3925N	45	Y	12	17	2	4	10	13	90	90	n/a	7	7	19	24	45	20	45	20	19	n/a	0.5	0.7	Stope is connected to 1-38 Lower in some sections and to 1-43#1 at 3950N, complex geometry, pillars that reduce span need to be checked
	1-38L	48	3750N	3950N	55	N	24	24	5	3	19	21	45	45	n/a	30	30	54	54	55	55	n/a	14	8	n/a	1.4	2.6	Spans are greatest lower in stope so if backfilled results for wide spans may be conservative, need to check area near where stopes joined up.
	1-43#1	48,49	3950N (Book 48)	4125N (Book 49)	55	Y	13	14	5.5	5	7.5	9	0	0	90	12	8	25	22	50	16	50	20	16	20	0.4	0.6	Horizontal room and pillar area, both largest spans between pillars and spans if pillars not intact checked, pillars need to be viewed
	1-43U	48,49	3950N (Book 48)	4950N (Book 49)	300	Y	24	24	3	3	21	21	0	0	90	5	5	29	29	80	20	80	30	25	30	0.7	0.8	Horizontal room and pillar area, increasing cover to north, stability checked with no pillars. Pillar stability to be assessed
	1-43L	48,49	3950N (Book 48)	4775N (Book 49)	250	Y	32	32	2	2	30	30	35	35	n/a	35	25	67	57	100	20	100	10	6	n/a	3.0	5.0	Dipping room and pillar area, increasing cover to north, checked with no pillars, pillar stability and backfill to be assessed
UBC	UBC	21-UBC	400N	625N	225	N	35	35	0	0	35	35	75	75	n/a	45	45	80	80	70	70	70	6	4.5	n/a	5.8	7.8	Unknown overburden thickness

Table 5.3: Q' Values Derived from Golder Open Pit and Underground Mapping Data

Pit	Subdivision	Parameter			Q'
		RQD (%)	Jn	Jr/Ja	
A1	Basalt Waste Rock	90	12	1.90	14.3
	Schist - Wasterock	80	12	2.06	13.8
	Schist - Ore Zone	70	12	2.06	12.0
	Basalt	96	9	0.42	4.5
	Schist	75	12	0.54	3.4
A2	SL1 - Wasterock	80	12	1.73	11.5
	SL1 - Ore Zone	65	12	1.73	9.4
	SL2 - Wasterock	80	12	2.02	13.4
	SL2 - Ore Zone	65	12	2.02	10.9
	SL3 - Wasterock	80	12	1.62	10.8
	SL3 - Ore Zone	65	12	1.62	8.8
	SL4 - Wasterock	80	12	1.32	8.8
	Whole Pit - Wasterock	80	12	1.73	11.5
	Whole Pit - Ore	65	12	1.73	9.4
	SL1	71	12	1.07	6.3
	SL2	82	12	0.61	4.1
	SL3	85	12	0.35	2.5
	SL4	78	12	0.30	1.9
C1	Stations 1-4	80	12	1.93	12.8
	Stations 5-7	71	12	1.76	10.4
	FW Schist (1, 2, 6, 7)	90	12	1.84	13.8
	East Wall	96	12	1.75	14.1
B1	Stations 1-6	84	6	1.58	22.0
	Stations 7-10	75	12	1.50	9.4
	Stations 7-15	79	12	1.40	9.2
	Stations 11-15	82	12	1.32	9.1
B2	Stations 1-6	89	12	1.61	12.0
	Stations 7-9	89	12	1.59	11.8
	Stations 10-14	75	12	1.41	8.9
	Stations 15-18	90	12	1.58	11.8
B3	Schist/Basalt	79	12	1.88	12.3
B4	Gabbro	97	6	1.97	31.9
	Gabbro	85	9	1.97	18.6

Notes:

-The same Spacing, Jcon, and Strength values were used both for Wasterock and...
Ore Zone within each scanlinedifferred for the A pits
-RQD values were the only values which varied
-Joint spacings were found by taking the inverse of joint volumes
For C1 pit east wall, Jcon and Jr/Ja were assigned the average values...
of the west wall mapping data

For underground (TA13) [tan shading]
For open pits (TA16) [green shading]

Table 8.1: Near Surface Non-Arsenic Stope Stability Assessment and Risk Based Investigation Priority

Carter Probability of Crown Pillar Failure	Carter et al., 2008 Guidance on Probability of Failure		Carter Guidance for Public Access	Risk Matrix Approach – Consequence Assessment: Low	Moderate	High
				3	2	1
<0.5%	7	**<0.5%**	Free Public Access	21	14	7
0.5% - 1.5%	6	**0.5% - 1.5%**	Public Access Allowed	18	12	6
1.5% - 5%	5	**1.5% - 5%**	Public Access Discouraged - Signage	15	10	5
5% - 10%	4	5% - 10%	Public Access Prevented - Fence, Monitor	12	8	4
10% - 20%	3	10% - 20%	Public Access Actively Prevented	9	6	3
20% - 50%	2	20% - 50%	Public Access Forcibly Prevented	6	4	2
>50%	1	>50%	Public Access Forbidden	3	2	1

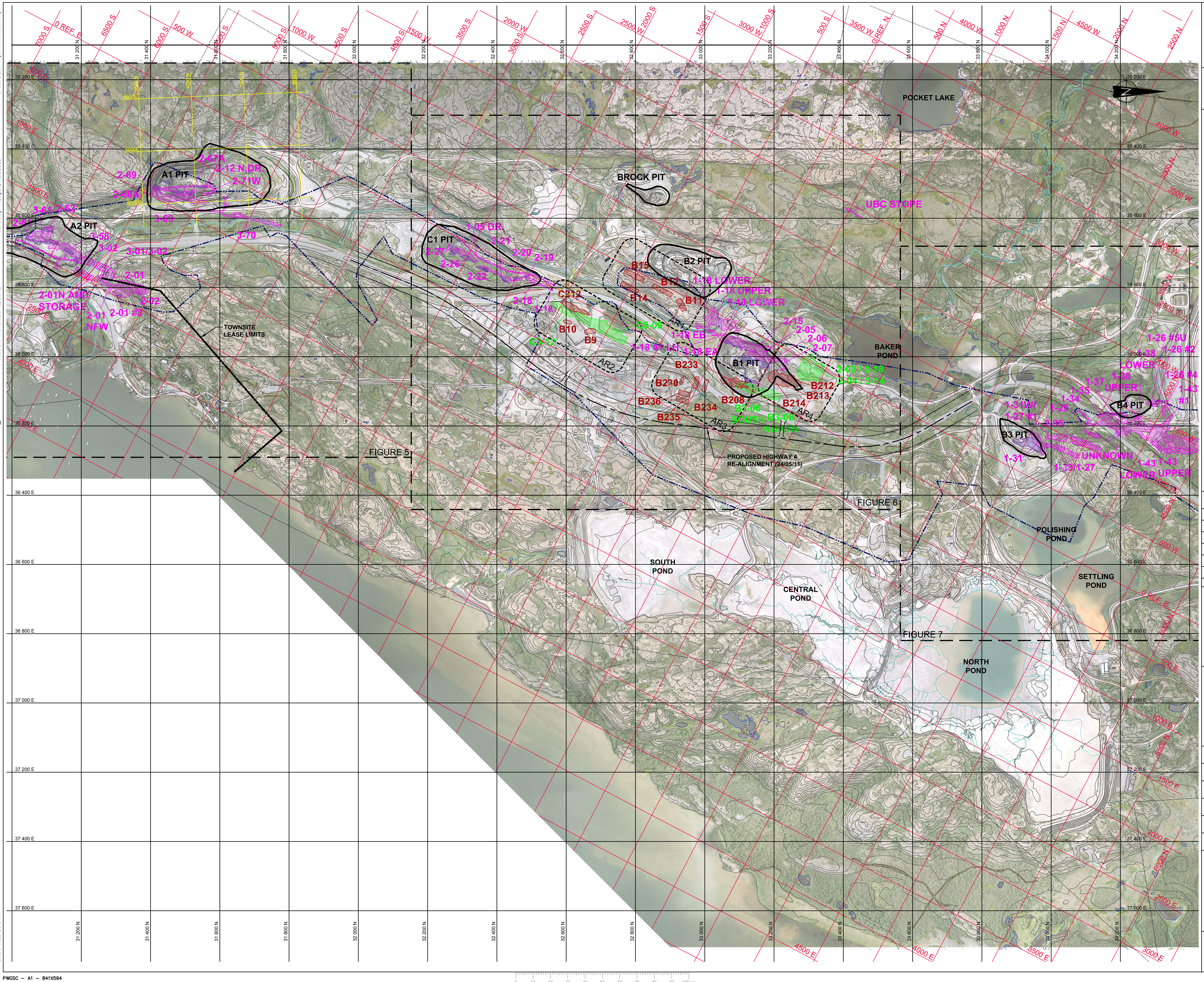
Near Surface Non-Arsenic Stope Description				Probability of Failure of Crown Pillar			Consequence of Crown Pillar Failure Assessment			Carter Crown Pillar Check, Risk Priority Level	Mathews' Stability Graph Assessment of Wall Stability			General Comments
Area	Stope	General Description of Crown Pillar Geometry	Stope Dip	Carter Crown Pillar Analysis Probability of Failure (Average, 50%Q)	Pillar Analysis Probability of Failure (Largest, 50%Q)	Carter Prob. Failure Rating (after Carter 2008)‡ (Using Prob. Average, 50%Q)	Stope Location (as a projection onto surface) and Rationale for Assignment of Consequence Rating Including Public Access Assumptions	Consequence of Failure	Consequence of Failure Rating with Adjustment		Stability Graph Position of Average Stope and 50% Q for Unfilled Stope	Critical Surface w.r.t. Stability	Stability Graph Rating	
A2 Pit	DWC	Very Thin Crown Pillar	70	0.7%	31.0%	6	beside hwy 4, public access possible	**Moderate**	1	6	Unstable to Major Failure	HW	4	Regular inspection of stope crown near breakthrough, u/g inspection or cms to assess fill position
	2-01 North Storage	Moderate Crown Pillar	0	0.2%	0.4%	7	**under hwy 4, common public access**	**High**	1	7	Stable		7	U/g inspection if possible
	2-01	Moderate Crown Pillar	40	18.8%	30.6%	3	**common public access**	**High**	1	3	Unstable	HW	5	U/g inspection if possible, public access should be prevented
	2-01 NFW	Moderate Crown Pillar	85	0.0%	0.0%	7	**common public access**	**High**	1	7	Stable		7	very small stope with thick crown, stability governed by unraveling of back
	3-02	Thick Crown Pillar	70	12.6%	37.7%	3	**under hwy 4, common public access**	**High**	2	6	Unstable	HW	5	Back / hw failure would likely choke off, u/g or surface monitoring required
	3-01	Thick Crown Pillar	50	11.8%	35.2%	3	**under hwy 4, common public access**	**High**	2	6	Stable to Unstable	Back	6	Back / hw failure would likely choke off, u/g or surface monitoring required
	2-01 #3	Moderate Crown Pillar	0	5.1%	10.1%	4	**common public access**	**High**	1	4	Stable		7	U/g inspection if possible, public access should be prevented
	2-02	Moderate Crown Pillar	50	0.3%	7.6%	7	public access possible	**Moderate**	2	14	Stable to Unstable	Back	6	u/g inspection if possible, failure would likely chock off
A1 Pit	3-70	Moderate Crown Pillar	80	4.4%	21.9%	5	**under Baker Creek,** public access possible	**High**	1	5	Unstable to Major Failure	HW	4	U/g inspection or cms to check fill position
C1 Pit	2-19	Thin Crown Pillar	80	0.0%	36.1%	7	under C1 open pit, public access restricted	**Moderate**	2	14	Stable		7	CMS showed stope was open, thin crown between pit and stope, regular inspection of pit areas
	2-18	Moderate Crown Pillar	70	0.0%	3.9%	7	**north side under public highway**	**High**	1	7	Stable to Unstable	HW	6	u/g inspection or smc so check condition, monitor surface for cracks and survey
	1-18 Upper	Moderate Crown Pillar	45	1.7%	11.5%	5	**under / near Baker Creek,** public access possible	**High**	1	5	Stable		7	u/g inspection monitoring to be carried out routinely.
	1-18 Lower	Moderate Crown Pillar	60	2.0%	9.8%	5	**under / near Baker Creek,** public access possible	**High**	1	5	Stable		7	u/g inspection monitoring to be carried out routinely.
	1-18 #1	Moderate Crown Pillar	60	0.0%	0.0%	7	**under B1 Pit Dyke,** public access restricted	**High**	1	7	Stable		7	sinkhole developed on surface approximately above stope
	1-18 EB	Thin Crown Pillar	77	8.8%	22.9%	4	**under B1 Pit Dyke,** public access restricted	**High**	1	4	Stable		7	Near south B1 pit sinkhole, regular inspection of pillar between pit and stope and inspection of pit wall required
B1 Pit	1-18 EA	Thin Crown Pillar	50	14.3%	47.0%	3	under B1 pit west wall, public access restricted	**Moderate**	2	6	Stable to Unstable	HW	6	Near south B1 pit sinkhole, regular inspection of pillar between pit and stope and inspection of pit wall required
	2-15	Moderate Crown Pillar	40	0.2%	33.6%	7	under B1 pit west wall, public access restricted	**Moderate**	2	14	Stable		7	Near south B1 pit sinkhole, regular inspection of pillar between pit and stope and inspection of pit wall required
	2-06	Very Thick Crown pillar	45	10.2%	34.1%	3	under B1 pit west wall, public access restricted	**Moderate**	3	9	Stable		7	Back / hw failure would likely choke off, u/g inspection if possible
B3 Pit	1-31 #2	Moderate Crown Pillar	20	9.4%	16.7%	4	beside nw wall of B3 pit, public access possible	**Low**	3	12	Stable to Unstable	Back	6	u/g inspection if possible
	2-35	Moderate Crown Pillar	65	0.4%	7.2%	7	beside nw wall of B3 pit, public access possible	**Low**	3	21	Stable to Unstable	Back	6	
	1-33 / 1-27	Very Thick Crown pillar	40	21.4%	31.9%	2	under transformer station, public access restricted	**Moderate**	3	6	Unstable	HW	5	Back / hw failure would likely choke off, u/g inspection if possible
B4 Pit	1-29	Very Thick Crown Pillar	50	0.0%	0.0%	7	near hwy 4, public access possible	**Moderate**	3	21	Stable		7	Back / hw failure would likely choke off, u/g inspection if possible
	1-34	Moderate Crown Pillar	75	0.0%	0.0%	7	**in hwy 4 r.o.w.,** public access possible	**Moderate**	1	7	Stable		7	u/g inspection if possible
	1-35	Moderate Crown Pillar	45	2.6%	5.1%	5	**in hwy 4 r.o.w.,** public access possible	**High**	1	5	Stable		7	u/g inspection if possible
	1-26#5U	Moderate Crown Pillar	90	0.2%	3.2%	7	under mine access road, public access restricted	**Moderate**	3	21	Stable		7	u/g inspection if possible
	1-26#4	Thick Crown Pillar	65	0.0%	0.0%	7	under nw pond dike toe, public access restricted	**High**	2	14	Stable		7	Stope is not high, back failure would likely choke off
	1-26#5	Thick Crown Pillar	35	2.5%	2.5%	5	under nw pond dike toe, public access restricted	**High**	2	10	Stable		7	Stope is not high, back failure would likely choke off
	1-38 Upper	Moderate Crown Pillar	90	11.8%	31.5%	3	under mine access road, public access possible	**Moderate**	2	6	Stable		7	u/g inspection and monitoring of mine access road on surface should be carried out.
	1-38 Lower	Thick Crown Pillar	45	27.3%	32.9%	2	**in hwy 4 r.o.w.,** public access possible	**Moderate**	2	4	Unstable	HW	5	u/g inspection required, surface monitoring in highway 4 right of way recommended
	1-43 #1	Moderate Crown Pillar	0	10.8%	39.1%	3	under mine access road, public access possible	**Moderate**	2	6	Stable		7	u/g inspection and monitoring of mine access road on surface should be carried out.
	1-43 Upper	Moderate Crown Pillar	0	11.0%	35.9%	3	under mine access road, public access possible	**Moderate**	2	6	Stable		7	u/g inspection and monitoring of mine access road on surface should be carried out.
	1-43 Lower	Thick Crown Pillar	35	11.9%	47.6%	3	under mine access road, public access possible	**Moderate**	3	9	Stable		7	u/g inspection and monitoring of mine access road on surface should be carried out, back / hw failure would likely choke off
N/A	UBC	Thick Crown Pillar	80											

(Light grey shading) Shallow stopes - hangingwall stability dominates carter approach so thickness of crown needs to be checked

(Light grey shading) Stopes with thick crown pillars, where a failure would be anticipated to bulk off are downgraded one or two consequence rating

(Dark grey shading) Potential for large wall failure as predicted by Mathews approach used to increase consequence

‡ Carter, T.G., Cottrell, B.E., Carvalho, J.L., Steed, C.M.. (2008). Logistic Regression improvements to the Scaled Span Method of dimensioning Surface Crown Pillars over civil or mining openings. American Rock Mechanics Association



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LEGEND

- 33000 N — GMRP COORDINATE SYSTEM
- 600 S — IMG COORDINATE SYSTEM
- 6200 S — IME COORDINATE SYSTEM
- ARSENIC CHAMBERS AND STOPES MAXIMUM EXTENT
- NON-ARSENIC STOPES NEAR SURFACE (<35m DEPTH)
- NON-ARSENIC STOPE DEEPER THAN 35m
- NON-ARSENIC STOPES ADJACENT TO AN ARSENIC STOPE
- NON-ARSENIC STOPE BREAKTHROUGH TO OPEN-PIT, BACKFILLED WITH UNKNOWN FILL
- PITS CREST OUTLINE (2009)
- APPROXIMATE MAXIMUM STOPING EXTENT AT DEPTH
- TOWNSITE LEASE LIMITS

NOTES

1. ALL UNITS ARE IN METERS UNLESS OTHERWISE NOTED. COORDINATE SYSTEM IS THE GMRP COORDINATE SYSTEM.
2. IMG GRID DISPLAYED IS IN IMPERIAL UNITS AND SHOWN FOR INFORMATION ONLY.
3. THE UNDERGROUND MINE GEOMETRY INFORMATION SHOWN CONTAINS ERRORS AND OMISSIONS WHICH NEED TO BE CONSIDERED WHEN USING IT FOR DESIGN PURPOSES.

REFERENCES

1. COMPOSITE LEVEL PLANS AND MINE LAYOUT PROVIDED BY "PWGSC"
2. AERIAL PHOTO AND EXISTING GROUND TOPOGRAPHY DATED 2009, PROVIDED BY "PWGSC"

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Revision/Revision	Description/Description	Date/Date
0	ISSUED WITH RPT-0005-REV1	2012-11-02
A	ISSUED WITH RPT-0005-REV0	2012-06-14

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.

UNDERGROUND

Approved by/Approuve par
DTK

Designed by/Concept par
NS

Drawn by/Dessine par
JK

PWGSC Project Manager/Administrateur de Projets TPSGC
DAVE COLBOURNE

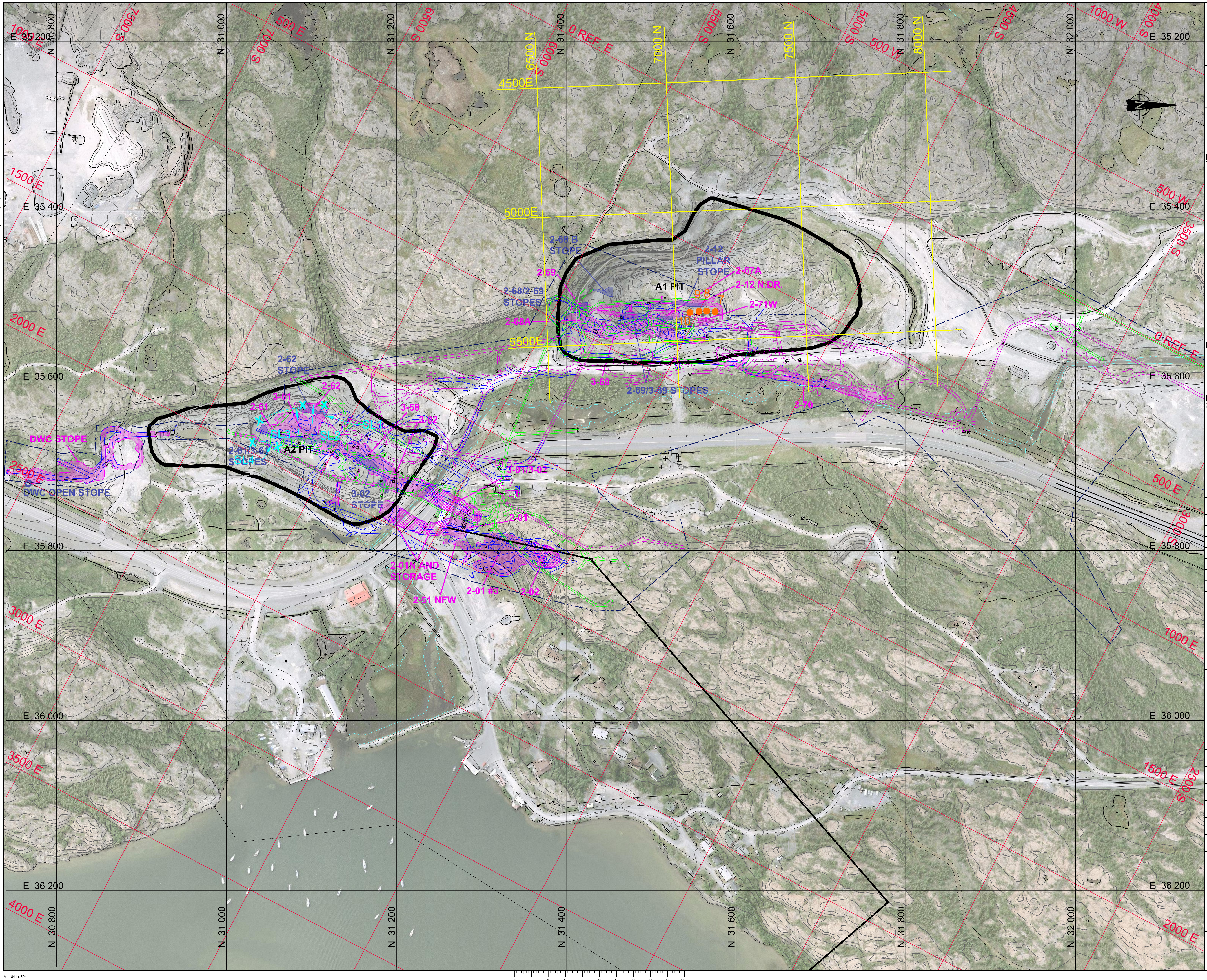
PWGSC, Architectural and Engineering Resources Manager/Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client
PWGSC

Drawing title/Titre du dessin

GENERAL SURFACE MAP SHOWING KEY UNDERGROUND STOPING

Project No./No. du projet	Sheet/Feuille	Revision no./La Révision no.
R.014204.313	FIGURE 2.1	0



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LEGEND

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- IMG COORDINATE SYSTEM (600 S)
- IME COORDINATE SYSTEM (6200 S)
- ARSENIC CHAMBERS AND STOPES MAXIMUM EXTENT
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- NON-ARSENIC STOPE DEEPER THAN 35m
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- APPROXIMATE MAXIMUM STOPING EXTENT AT DEPTH
- 1st LEVEL (100) UG. DEVELOPMENTS
- 2nd LEVEL (250) UG. DEVELOPMENTS
- 3rd LEVEL (425) UG. DEVELOPMENTS
- UG. RAMPS, DECLINES AND INCLINES
- NON-ARSENIC STOPE BREAKTHROUGH TO OPEN-PIT, BACKFILLED WITH UNKNOWN FILL
- CURRENT ACCESS POINT TO UNDERGROUND
- OPENING UNDER WASTE ROCK PILE
- SCANLINE WITH SCANLINE NUMBER
- STATION WITH STATION NUMBER
- TOWNSITE LEASE LIMITS

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4. DEEPER MINING LEVELS EXIST BUT ARE NOT SHOWN (FIGURES 5,6,7 AND 14,15,16)

REFERENCES

1. COMPOSITE LEVEL PLANS ,EXISTING GROUND TOPOGRAPHY, AERIAL PHOTO AND MINE LAYOUT PROVIDED BY "PWGSC

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Revision/ Revision	Description/Description	Date/Date
0	ISSUED WITH RPT-0005-REV1	2012-11-02
A	ISSUED WITH RPT-0005-REV0	2012-06-14

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.

UNDERGROUND

Approved by/Approuve par: **DTK**

Designed by/Concept par: **NSO**

Drawn by/Dessine par: **NSO**

PWGSC Project Manager/Administrateur de Projets TPSGC: **DAVE COLBOURNE**

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client: **PWGSC**

Drawing title/Titre du dessin

GENERAL SURFACE MAP A1 AND A2 PITS AREA WITH UNDERGROUND DEVELOPMENTS (LEVEL 1 TO 3) SURFACE GEOTECHNICAL MAPPING

Project No./ No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.014204.313	Figure 5.1	0

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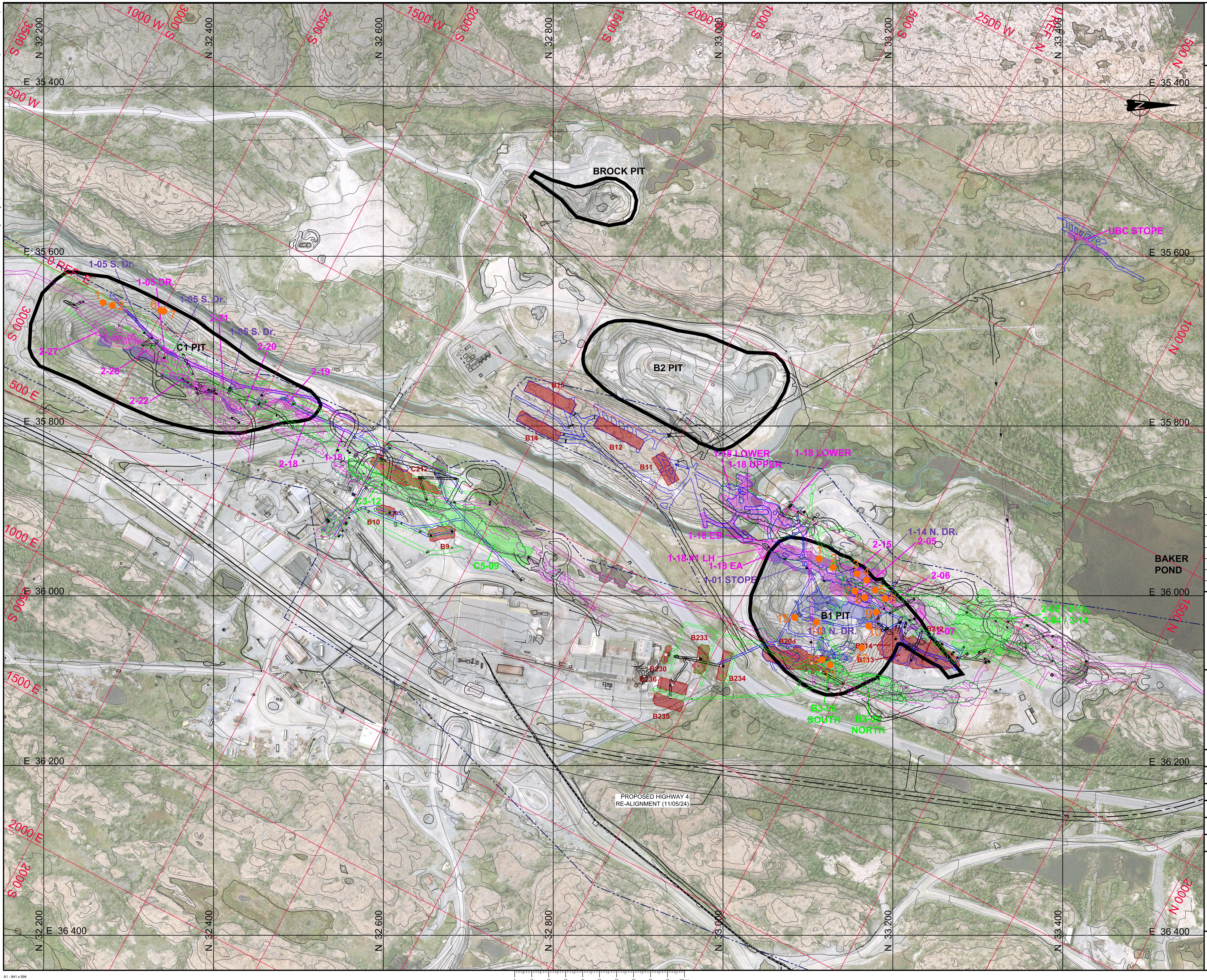

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Saved by: Horlyck, Rebecca
Plotted on: November 6, 2012

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LEGEND

- GMRP COORDINATE SYSTEM
- IMG COORDINATE SYSTEM
- IME COORDINATE SYSTEM
- ARSENIC CHAMBERS AND STOPES MAXIMUM EXTENT
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- 3rd LEVEL (425) UG. DEVELOPMENTS
- UG. RAMPS, DECLINES AND INCLINES
- INTERMEDIATE DEVELOPMENT BETWEEN LEVELS
- NON-ARSENIC STOPE BREAKTHROUGH TO OPEN-PIT, BACKFILLED WITH UNKNOWN FILL
- CURRENT ACCESS POINT TO UNDERGROUND
- OPENING UNDER WASTE ROCK PILE
- SCANLINE WITH SCANLINE NUMBER
- STATION WITH STATION NUMBER
- P-delivery-12 PLUG CONCRETE DELIVERY BOREHOLE (COLLAR)

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Revision/Revision	Description/Description	Date/Date
0	ISSUED WITH RPT-0005-REV1	2012-11-02
A	ISSUED WITH RPT-0005-REV0	2012-06-14

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.

UNDERGROUND

Approved by/Approuve par: DTK

Designed by/Concept par: NSO

Drawn by/Dessine par: NSO

PWGSC Project Manager/Administrateur de Projets TPSGC: DAVE COLBOURNE

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client: PWGSC

Drawing title/Titre du dessin

GENERAL SURFACE MAP B1, B2 AND C1 PIT AREA WITH UNDERGROUND DEVELOPMENTS (LEVEL 1 TO 3) SURFACE GEOTECHNICAL MAPPING

Project No./ No. du projet	Sheet/Feuille	Revision no./ La Révision no.
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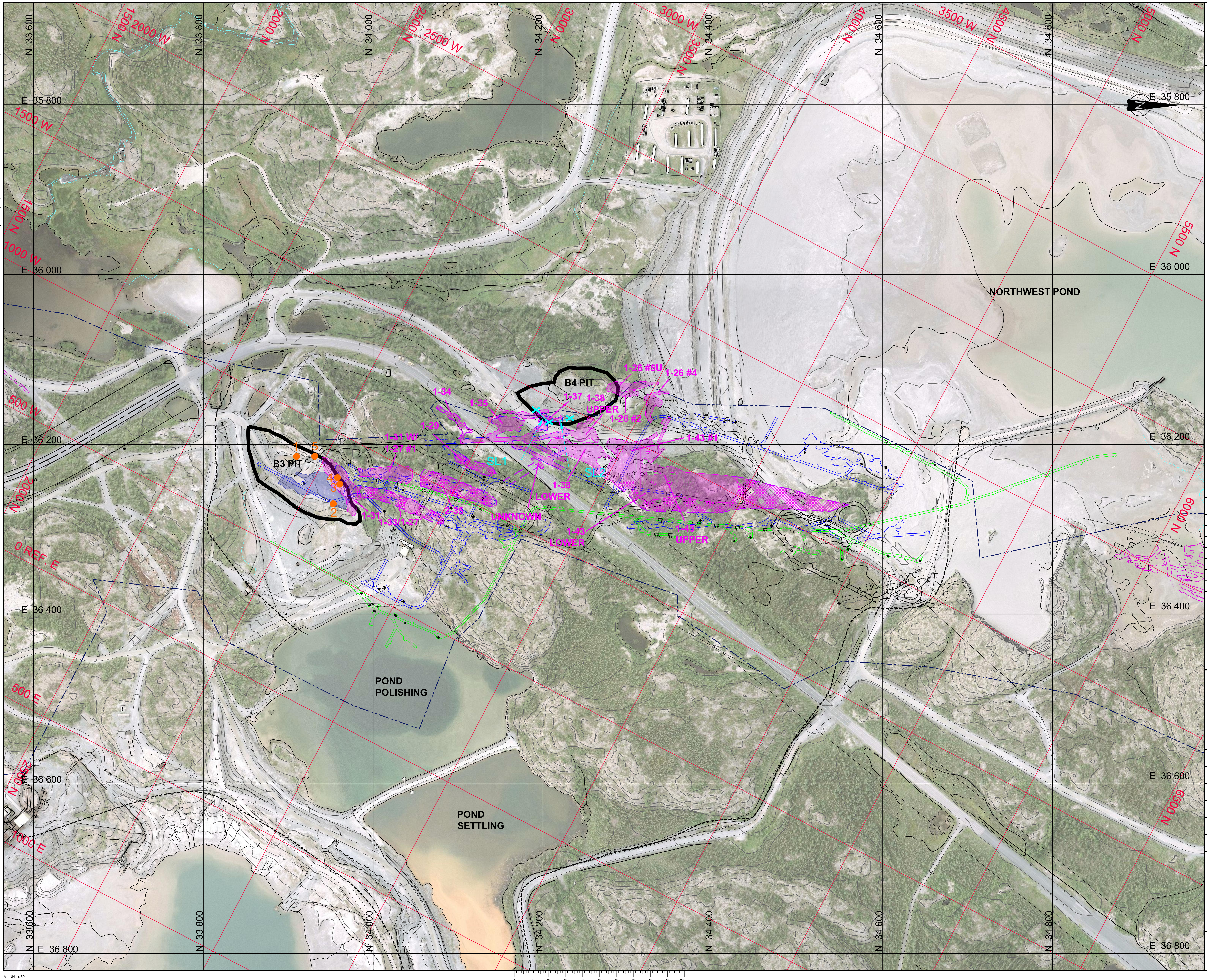

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LEGEND

- GMRP COORDINATE SYSTEM
- IMG COORDINATE SYSTEM
- IME COORDINATE SYSTEM
- ARSENIC CHAMBERS AND STOPES MAXIMUM EXTENT
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- NON-ARSENIC STOPE DEEPER THAN 35m
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- SCANLINE WITH SCANLINE NUMBER
- STATION WITH STATION NUMBER

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REFERENCES

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Revision/Revision	Description/Description	Date/Date
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A	ISSUED WITH RPT-0005-REV0	2012-06-14

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.

UNDERGROUND

Approved by/Approuve par: DTK

Designed by/Concept par: NSO

Drawn by/Dessine par: NSO

PWGSC Project Manager/Administrateur de Projets TPSGC: DAVE COLBOURNE

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client: PWGSC

Drawing title/Titre du dessin

GENERAL SURFACE MAP B3 AND B4 PITS WITH UNDERGROUND DEVELOPMENTS (LEVEL 1 TO 3) SURFACE GEOTECHNICAL MAPPING

Project No./No. du projet	Sheet/Feuille	Revision no./La Révision no.
R.014204.313	Figure 5.3	0

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Plotted on: November 6, 2012
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APPENDIX A

Glossary of Underground Terms and Schematic Drawings (Golder 2012d)

TECHNICAL MEMORANDUM

DATE June 14, 2012

PROJECT No. 09-1427-0006/6000/6200

TO David Colburne
Public Works and Government Services Canada

AECOM DOC. No. 313-UG-13-MEM-0006-Rev5_20120614

CC Rudy Schmidtke, AECOM

GAL DOC. No. 071

FROM Darren Kennard

EMAIL dkennard@golder.com

GLOSSARY OF UNDERGROUND TERMS AND SCHEMATIC DRAWINGS

The Giant Mine Remedial Action Plan (SRK, 2007) calls for the arsenic stopes and arsenic chambers to be remediated using the "frozen block" concept. The remediation involves adding water to the arsenic dust in the arsenic chambers and arsenic stopes and then freezing it, not necessarily in that order. Bulkheads were constructed during operations to isolate the dust in each chamber from other underground openings.

The following represents a glossary of underground terms and associated schematic drawings for future reference. An additional glossary of terms can be found in the "Giant Mine Remediation Project, Developer's Assessment Report" dated October 2010[1].

Figure 1 describes the existing underground situation and Figure 2 describes the planned pre-freezing remediation work. Arsenic chamber B-10 was used to illustrate the approach.

The following terminology and description of the current situation pictured in Figure 1 is outlined below.

- *Underground Openings:*
  - *Development Openings (Development):*
    - *Drift:*
      - Horizontal development opening excavated parallel to the strike of the orebody to provide mine access. Often part of the permanent infrastructure of the mine. Generally used for historical tracked mining generally used before the mid 1970's at Giant Mine.
    - *Cross-cut:*
      - Horizontal development opening excavated perpendicular to the strike of the orebody to provide mine access. Often part of the permanent infrastructure of the mine. Generally used for historical tracked mining.

[1] Indian and Northern Affairs Canada and Government of the Northwest Territories. 2010. Giant Mine Remediation Project, Developer's Assessment Report. Yellowknife, NWT.

- *Shaft:*
  - A vertical development opening excavated to provide mine access. Often part of the permanent infrastructure of the mine.
- *Ramp:*
  - Inclined development opening excavated to connect mine openings on different levels. Often part of the permanent infrastructure of the mine. Generally used for modern mechanized mining and at Giant mine often used to connect horizontal drifts used for historical tracked mining.
- *Portal:*
  - The point of connection between surface and underground development openings, or the entrance to underground.
- *Raise:*
  - A vertical to sub-vertical development opening excavated to provide mine access. Often used only during production but some form part of the permanent infrastructure of the mine.
- *Other Development Openings:*
  - Includes scram drifts, mill holes, man ways, ore passes, etc. Often part of the permanent infrastructure of the mine.

- *Arsenic Development Openings:*
  - *Upper Arsenic Drift*:
    - A former development drift that connects to the upper portion of an arsenic chamber or stope. The upper arsenic drifts are isolated from development openings and non-arsenic stopes with bulkheads that incorporate inspection hatches. These drifts were used to distribute arsenic dust to the arsenic stopes and chambers.
  - *Intermediate and Lower Arsenic Drift*:
    - A former development drift that connects to the lower portion of an arsenic chamber or stope. The connection between the lower arsenic drifts and the arsenic stope or chamber is often referred to as a draw point. The arsenic is contained within the drift by existing bulkheads. Lower arsenic drifts are partially or completely filled with arsenic dust.
  - *Other Arsenic Contaminated Drifts:*
    - Some drifts are contaminated with arsenic that are not contained by existing bulkheads. The contamination is primarily in the form of arsenic sludge of the floor or old arsenic dust distribution drifts.
  - *Arsenic Raise*:
    - A vertical or sub-vertical development opening connected to the arsenic stopes and chambers. The arsenic is contained within the raise by existing bulkheads. They are partially or completely filled with arsenic dust.

- Stopes: a large underground open space or cavity left after mineralized rock was extracted. The top or ceiling of a stope is typically referred to as the back.
  - *Non-arsenic Stope:*
    - These may remain open or are backfilled with classified tailings or occasionally waste rock.
  - *Near Surface Non-arsenic Stope:*
    - A stope that is situated within 35 m of the surface or the bedrock / overburden contact where surface soils are present. These may remain open or are backfilled with classified tailings or occasionally waste rock.
  - *Adjacent Non-arsenic Stope:*
    - A general term for a non-arsenic stope immediately adjacent to an arsenic stope or arsenic chamber, separated by a pillar.
  - *Arsenic Stope:*
    - Stopes that were partially filled with arsenic dust.
  - *Arsenic Chambers*:
    - An underground excavation built specifically to store arsenic dust. They are partially filled with arsenic dust.
- *Bulkhead / Plug*:
  - A water-resistant seal used in a mine where a wall is constructed across a mine access opening. Existing bulkheads at Giant were constructed of concrete or cemented tailings structure installed in development openings that are connected to an arsenic chamber or arsenic stope to isolate arsenic dust. Similar structures are also often termed plugs. For the purposes of the preliminary design existing structures will be termed bulkheads and any planned for the future will be termed plugs.
- *Pillar:*
  - *A term used to describe un-mined rock left behind to support the back (roof) and ribs (walls) of an underground opening.*
    - *Crown pillar:*
      - *A rock pillar between to back (roof) of an underground opening and ground surface.*
    - *Rib pillar:*
      - *A rock pillar between the walls of horizontally adjacent underground openings.*
    - *Sill pillar:*
      - *A rock pillar between the walls of vertically adjacent underground openings.*
- *Overburden:*
  - *Weathered rock and/or soil overlying solid bedrock.*

- *Waste Rock:*
  - Rock material that is excavated as part of the mining process but contains no economic mineralization. It usually takes the form of cobbles with sizes varying from cm's in diameter to meters in diameter. It is commonly used for surface and underground construction and backfill in underground voids.
- *Cemented Rock Fill (CRF):*
  - Waste rock material with cement added to create a backfill material with strength.
- *Tailings:*
  - Tailings are a mining waste product created after economically mineralized rock, or ore, is finely ground and processed into sand sized particles.
    - *Classified Tailings*: classified or de-watered tailings is created by reducing the high water content that often results from the milling process. The material is often used as backfill material and construction in the underground mine.
    - *Paste Tailings*: is a material can often be created from tailings by optimizing grain size distribution and water content to create a material that will not easily segregate during transport or pumping.
- *Backfill:*
  - Material used to refill an underground excavation or void. Typical backfill material includes waste rock, classified tailings, cemented paste tailings, cemented rockfill, etc.

Prior to flooding and freezing, the following underground activities will be carried out as shown in Figure 2 (not necessarily in this order):

1) Excavate horizontal freeze drift(s);
2) Backfill / stabilize potentially unstable non-arsenic stopes adjacent to arsenic stopes and chambers;
3) Excavate new development as needed to gain access for construction of plugs as needed;
4) Install lower arsenic drift plugs and arsenic raise plugs;
5) Backfill lower and upper arsenic drifts; and
6) Drill freeze holes.

The following terminology and explanation of the purpose of the various pre-freezing remedial activities is shown and described below.

- *Horizontal Freeze Drifts*:
  - New development openings are required to enable the drilling of horizontal drill holes under the arsenic stopes and chambers.

- *Non-arsenic Stope Backfill*:
  - Some non-arsenic stopes adjacent to arsenic stopes or arsenic chambers may exhibit instability in the long term. Some of these non-arsenic stopes are partially backfilled, some are fully open voids. These non-arsenic stopes will be backfilled (topped up) and/or stabilized to reduce the potential impact of any instability on the adjacent arsenic chambers and/or arsenic stopes.
- *Arsenic Drift Plugs*:
  - Drift plugs will be built to prevent arsenic dust from migrating from arsenic stopes and arsenic chambers. The arsenic drift plugs will be installed within the freeze pipe wall perimeter. The arsenic drift plugs will be designed to structurally withstand a full head of liquefied arsenic dust.
- *Arsenic Raise Plugs*:
  - As above for arsenic drift plugs.
- *Arsenic Drift Backfill:*
  - *Upper Arsenic Drift Backfill*:
    - Some form of backfill material will be placed in the upper arsenic drifts for long term safety and security reasons. It is not necessarily proposed to place the material tight to the back.
  - *Lower Arsenic Drift Backfill*:
    - Some form of backfill material will be placed in the lower arsenic drifts to limit migration of arsenic dust from the arsenic chamber or arsenic stope during the wetting process. It is not necessarily proposed to place the material tight to the back. The lower arsenic drifts may be partially, or in some isolated areas, fully filled with arsenic dust.
- *Freeze Pipe Wall*:
  - The perimeter created around the arsenic chamber and arsenic stopes when the vertical and horizontal freeze pipes are installed.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Darren Kennard, P.Eng. (BC)
Associate

ORIGINAL SIGNED

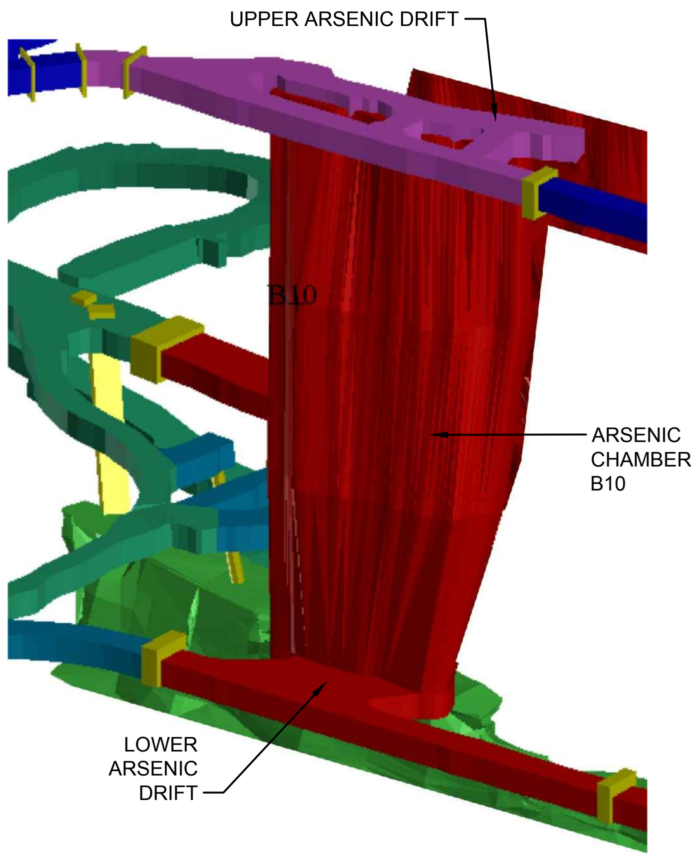
John A. Hull, P.Eng.
Principal

DTK/JAH/rs

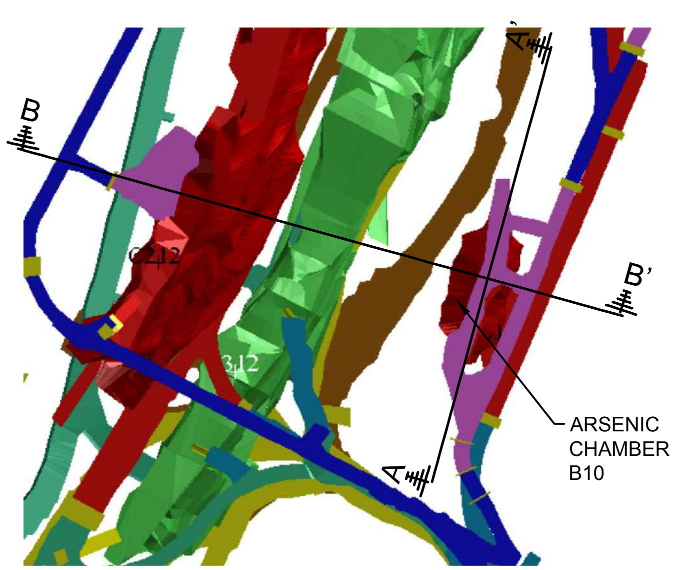
Attachments: Figures 1 and 2

o:\final\2009\1427\09-1427-0006\3. correspondence\2 issued documents\word\phase 2\doc 071 tm 0705_11\313-ug-13-mem-0006-rev5_20120614.doc

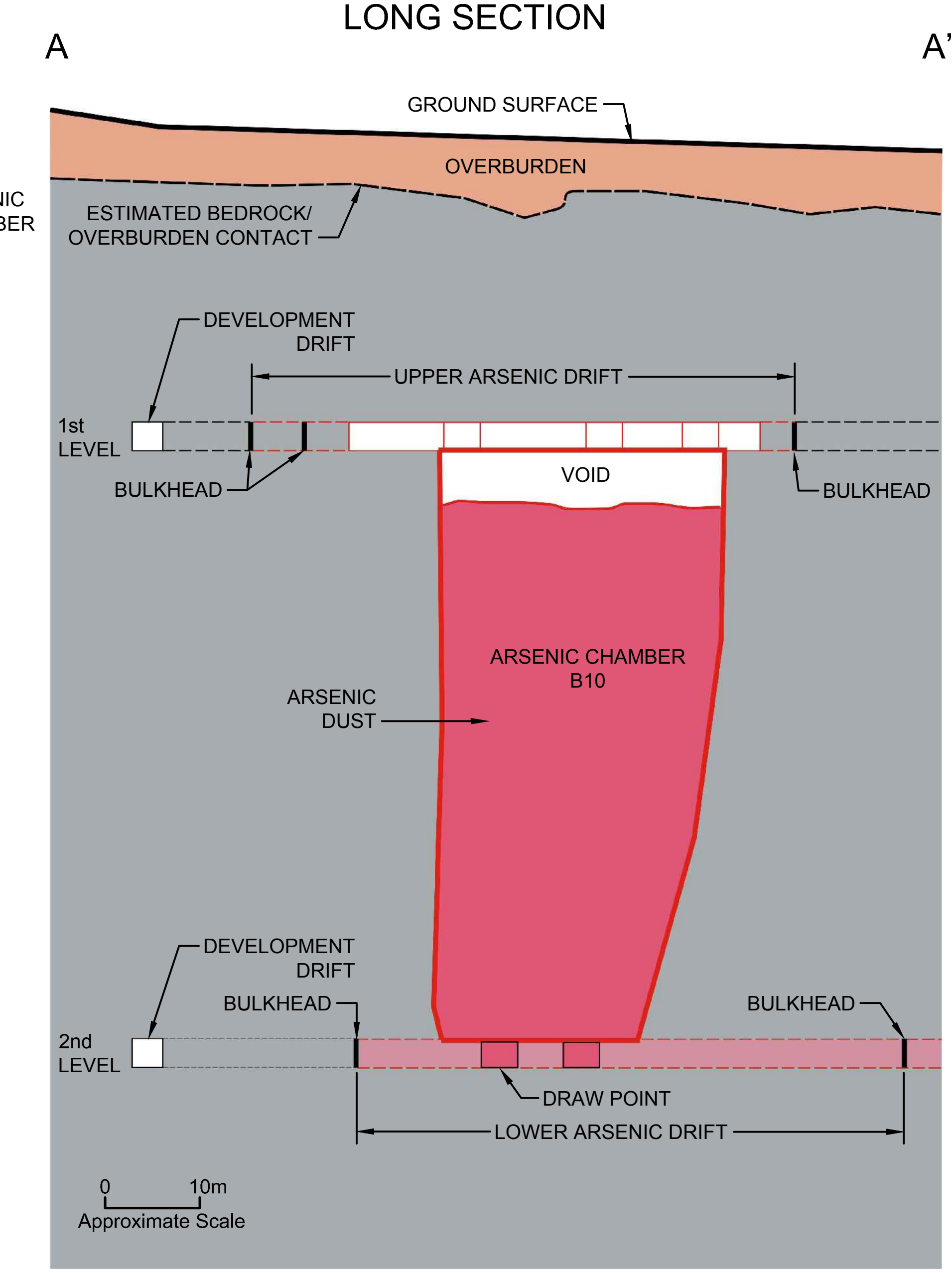
3-D ISOMETRIC



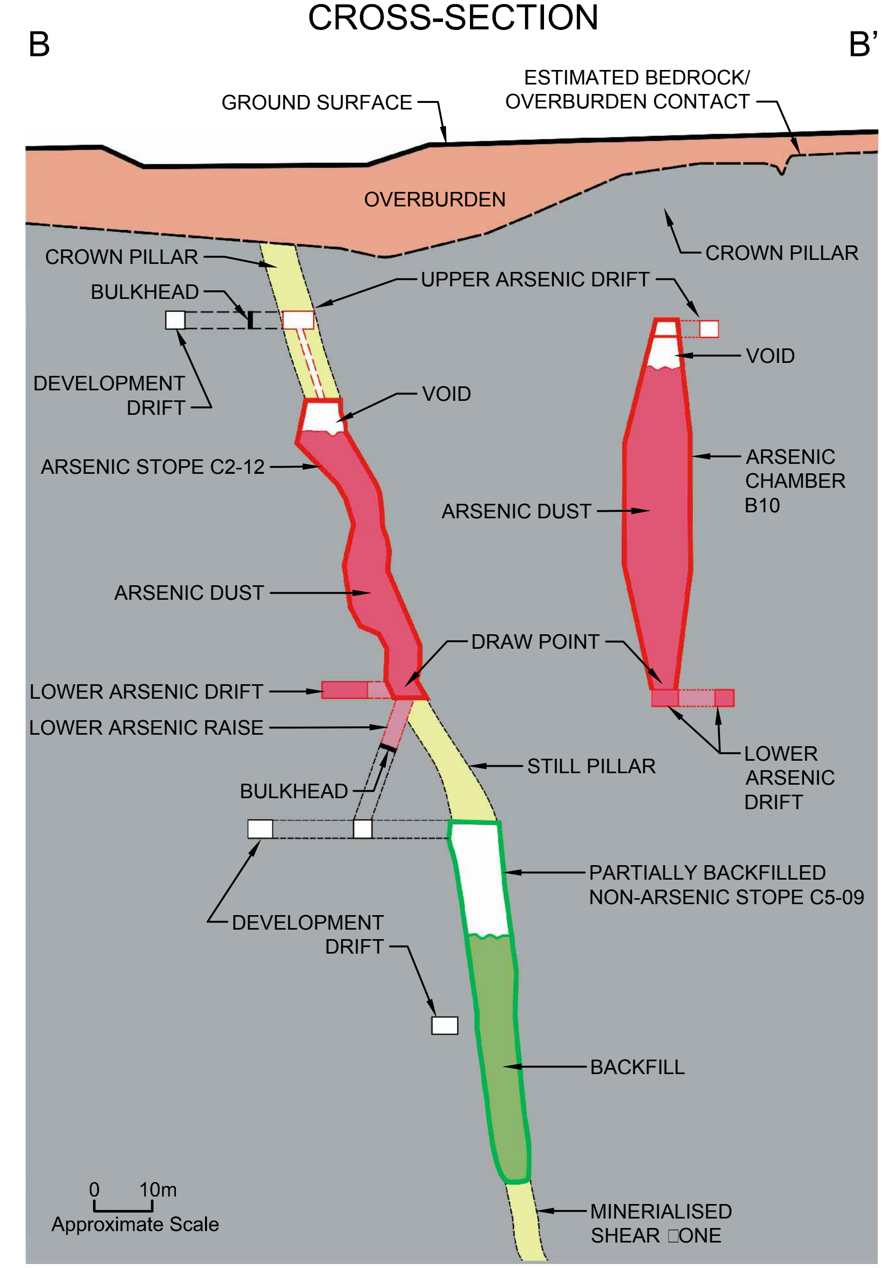
PLAN



LONG SECTION



CROSS-SECTION



NOTE:
SCHEMATIC DIAGRAM ONLY, SOME ELEMENTS ARE ADDED FOR GENERAL DESCRIPTION.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

PRELIMINARY
NOT FOR CONSTRUCTION

Golder Associates

DO NOT SCALE DRAWINGS

Revision/ Révision	Description/Description	Date/Date
1	ISSUED WITH RPT-0006-REV5	2012-06-14
0	ISSUED WITH RPT-0006-REV4	2011-11-10
A	ISSUED WITH RPT-0006-REV3	2011-11-08
A	ISSUED WITH RPT-0006-REV2	2011-11-04
A	ISSUED WITH RPT-0006-REV1	2011-07-14
0	ISSUED WITH RPT-0006-REV0	2011-07-05

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT
GIANT MINE REMEDIATION PROJECT, NWT

UNDERGROUND

Approved by/Approuvé par: DTK

Designed by/Concept par: DTK

Drawn by/Dessiné par: JK

PWGSC Project Manager/Administrateur de Projets TPSGC: DAVE COLBOURNE

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'ingénierie, TPSGC

Client/client: PWGSC

Drawing title/Titre du dessin

SCHEMATIC OF EXISTING UNDERGROUND SITUATION

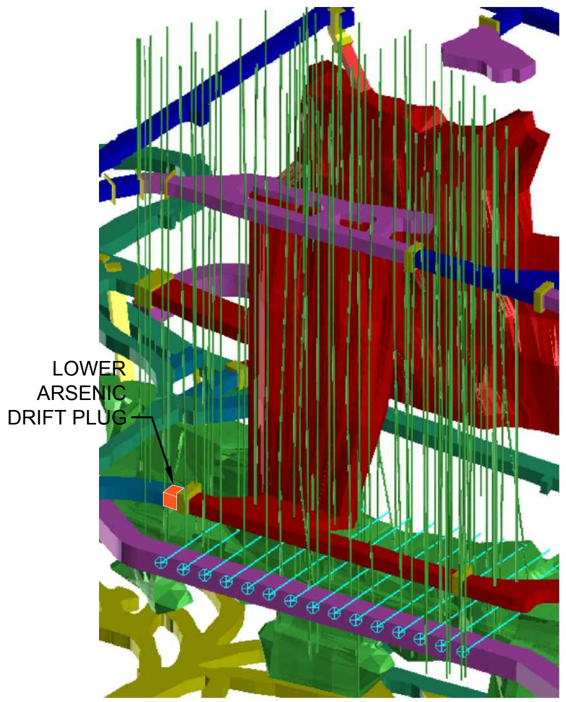
Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.014204.313	FIGURE 1 OF 2	1

Drawing File: N:\Bur-Graphics\Projects\2009\1427\09-1427-0006\Drafting\6000\6200\Figures\for CAD\60162479_R-014204-313-MEM-0006-CF01-R0.dwg Layout:FIGURE 1 Thursday, June 14, 2012 2:30:20 PM By: jkowncki

A0 – PWGSC – ANSI B-L1 – 11X17

60162479_R-014204-313-MEM-0006-CF01-R0

3-D ISOMETRIC



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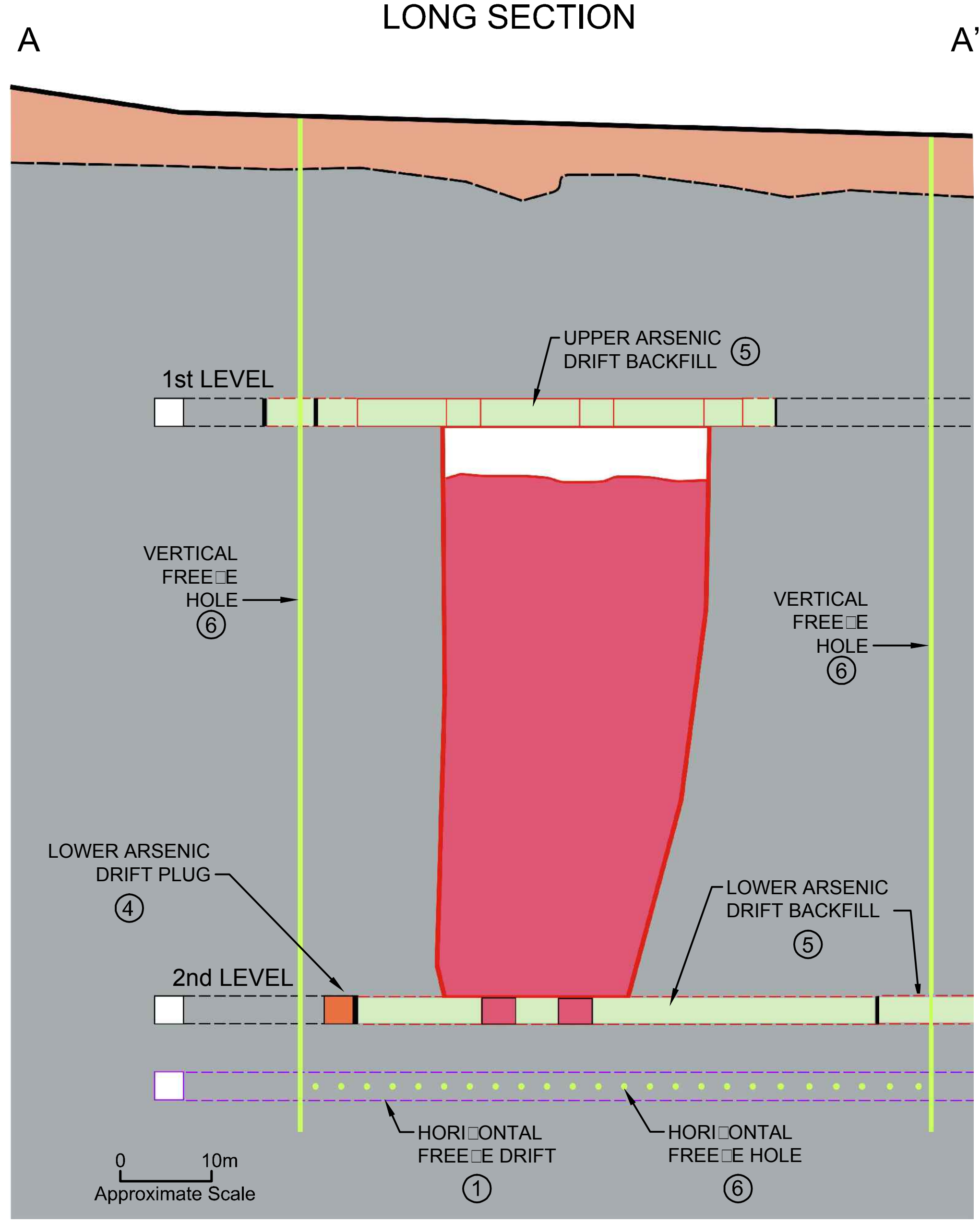
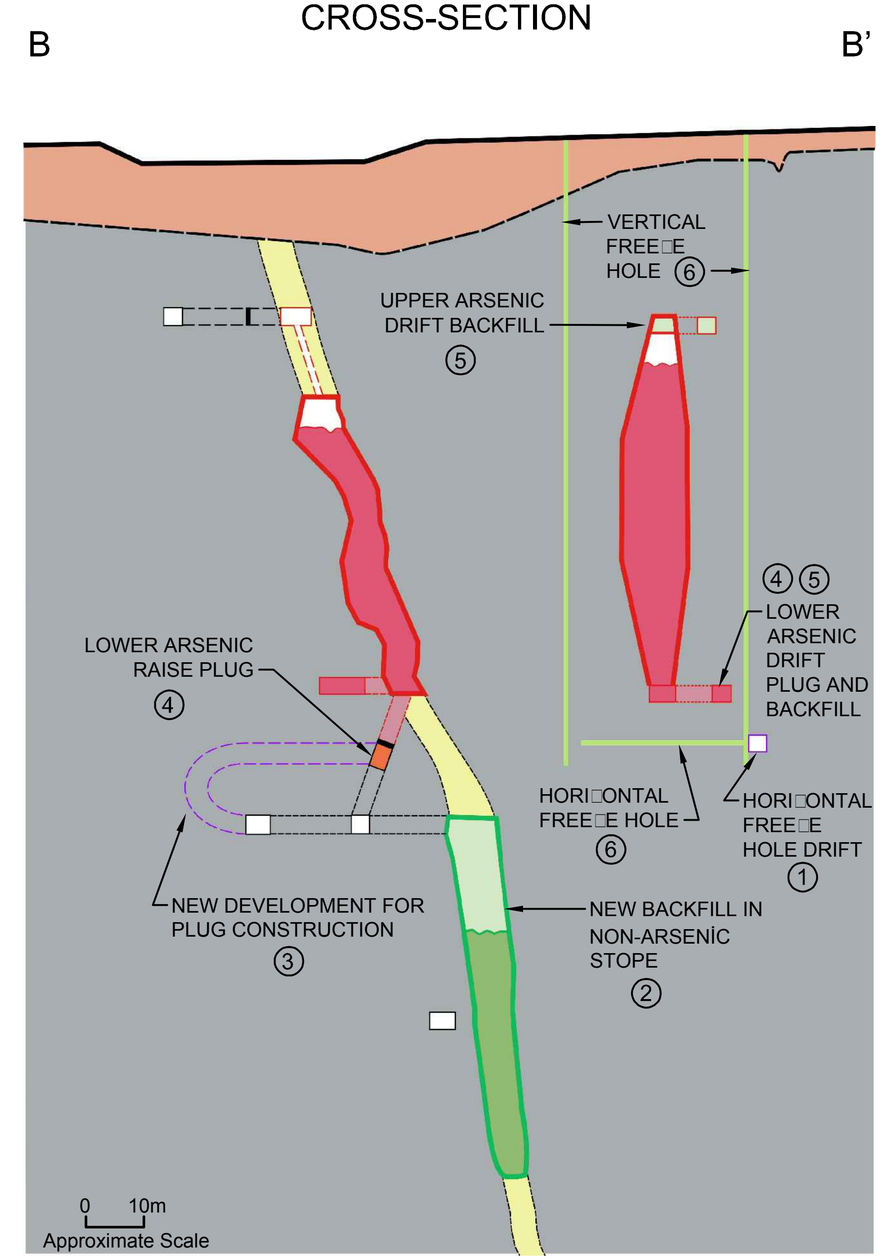
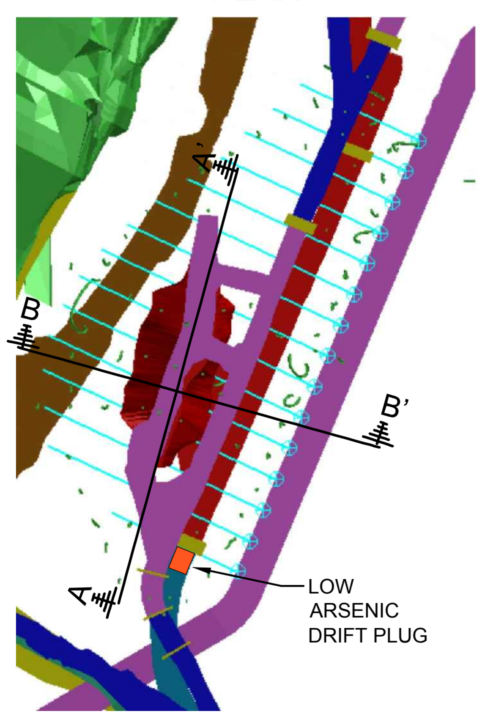


CROSS-SECTION



PLAN



REMEDIATION STEPS PRIOR TO FREE□ING (EXAMPLE CHAMBER B10) *

① EXCAVATE HORI□ONTAL FREE□E HOLE DRIFT
② BACKFILL/STABILI□E POTENTIALLY UNSTABLE NON-ARSENIC STOPES ADJACENT TO ARSENIC STOPES AND CHAMBERS
③ EXCAVATE NEW DEVELOPMENT TO GAIN ACCESS FOR PLUG CONSTRUCTION
④ INSTALL LOWER ARSENIC DRIFT PLUGS AND ARSENIC RAISE PLUGS
⑤ BACKFILL LOWER AND UPPER ARSENIC DRIFTS
⑥ DRILL FREE□E HOLES

* WORK FLOW NOT NECESSARILY IN THIS ORDER

NOTE:
SCHEMATIC DIAGRAM ONLY, SOME ELEMENTS ARE ADDED FOR GENERAL DESCRIPTION.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
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PRELIMINARY
NOT FOR CONSTRUCTION

Golder Associates

DO NOT SCALE DRAWINGS

Revision/Révision	Description/Description	Date/Date
1	ISSUED WITH RPT-0006-REV5	2012-06-14
0	ISSUED WITH RPT-0006-REV4	2011-11-10
A	ISSUED WITH RPT-0006-REV3	2011-11-08
A	ISSUED WITH RPT-0006-REV2	2011-11-04
A	ISSUED WITH RPT-0006-REV1	2011-07-14
0	ISSUED WITH RPT-0006-REV0	2011-07-05

Client/client
PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet
GIANT MINE REMEDIATION PROJECT
GIANT MINE REMEDIATION PROJECT, NWT

UNDERGROUND

Approved by/Approuvé par: DTK
Designed by/Concept par: DTK
Drawn by/Dessiné par: JK
PWGSC Project Manager/Administrateur de Projets TPSGC: DAVE COLBOURNE
PWGSC, Architectural and Engineering Resources Manager/Ressources Architectural et de Directeur d'ingénierie, TPSGC
Client/client: PWGSC

Drawing title/Titre du dessin
PRE-FREEZE SCHEMATIC OF UNDERGROUND REMEDIATION STEPS

Project No./No. du projet	Sheet/Feuille	Revision no./La Révision no.
R.014204.313	FIGURE 2 OF 2	1

APPENDIX B

Non-Arsenic Mathews Open Span Stability Assessment

STOPE INPUT DATA

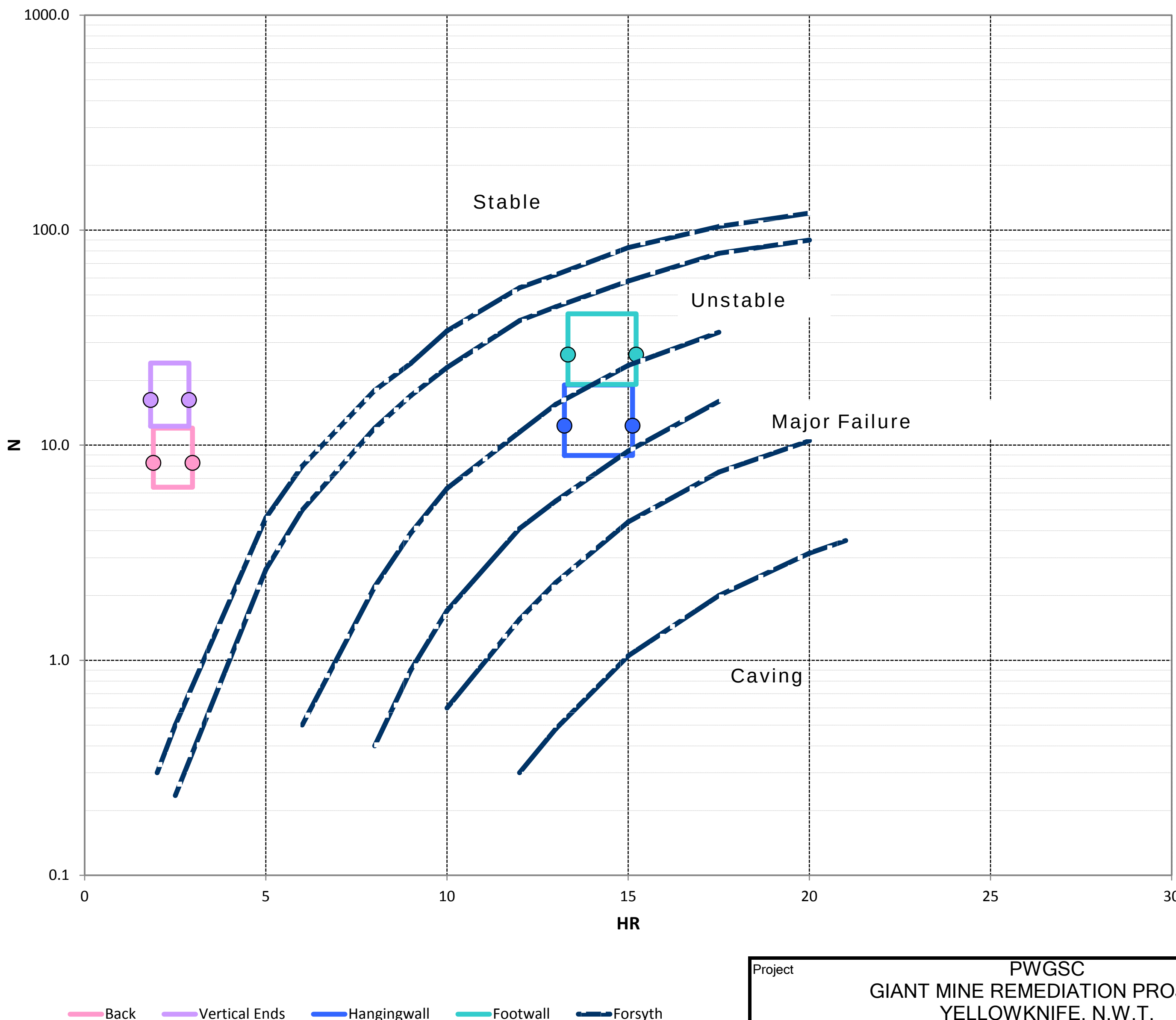
		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	40.0	50.0	m	VERTICAL (V)	0.9	*MPa*
	DIP HT(m)	42.6	53.2	m	HOR.-Strike (H1)	1.4	*MPa*
	SPAN (S)	4.0	6.5	m	HOR.-Dip (H2)	1.4	*MPa*
Orientation	LENGTH* (L)	70.0	70.0	m			
	DIP (D)	70.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High	Comments:
Back	8.0	11.0	17.0	0.89	0.78	0.9	1	1.9	3.0	6.4	8.3	12.0	
Vertical End	8.0	11.0	17.0	0.96	0.89	0.2	8	1.8	2.9	12.3	16.2	24.1	
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.2	6	13.2	15.1	9.0	12.3	19.1	Potential failure due to lack of confinement
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	13.2	15.1	19.2	26.4	40.8	Potential failure due to lack of confinement

Mathew's Stability



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	DWC			
Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-1
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

DIMENSIONS

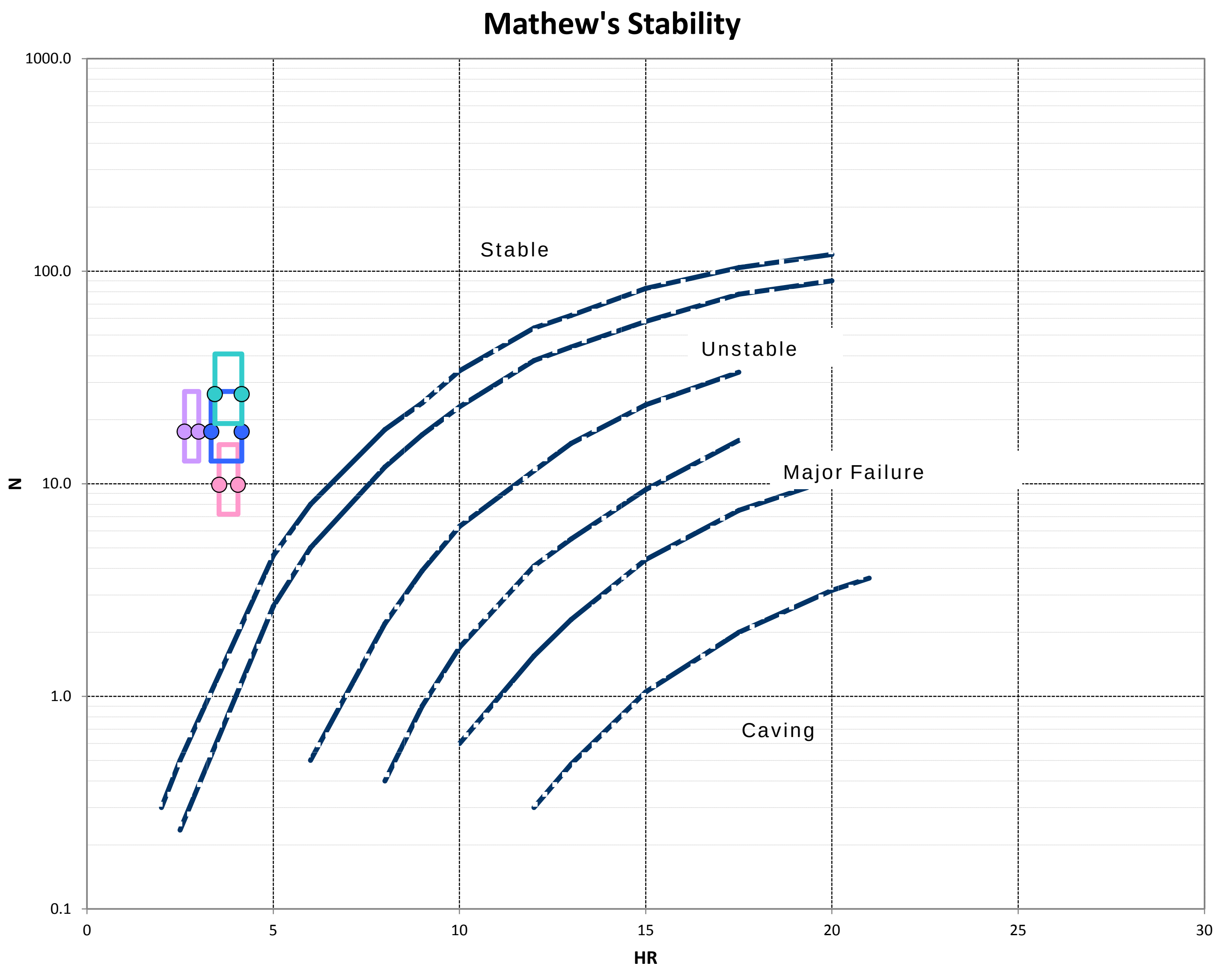
		min	max			**STRESSES**	
	VERT HT(m)	10.0	12.0	*m*	VERTICAL (V)	1.3	*MPa*
	DIP HT(m)	10.0	12.0	*m*	HOR.-Strike (H1)	2.0	*MPa*
	SPAN (S)	11.0	12.0	*m*	HOR.-Dip (H2)	2.0	*MPa*
Orientation	LENGTH* (L)	20.0	25.0	*m*			
	DIP (D)	90.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	1.00	1.00	0.9	1	3.5	4.1	7.2	9.9	15.3
Vertical End	8.0	11.0	17.0	1.00	1.00	0.2	8	2.6	3.0	12.8	17.6	27.2
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.2	8	3.3	4.1	12.8	17.6	27.2
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	3.3	4.1	19.2	26.4	40.8

Comments:



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	2-01 North Storage		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-2
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	20.0	29.0	*m*	VERTICAL (V)	1.6	*MPa*
DIP HT(m)	28.3	41.0	*m*	HOR.-Strike (H1)	2.4	*MPa*
SPAN (S)	14.0	20.0	*m*	HOR.-Dip (H2)	2.4	*MPa*
Orientation LENGTH* (L)	30.0	35.0	*m*			
DIP (D)	45.0		*deg.*	U.C.S.	37.5	*MPa*

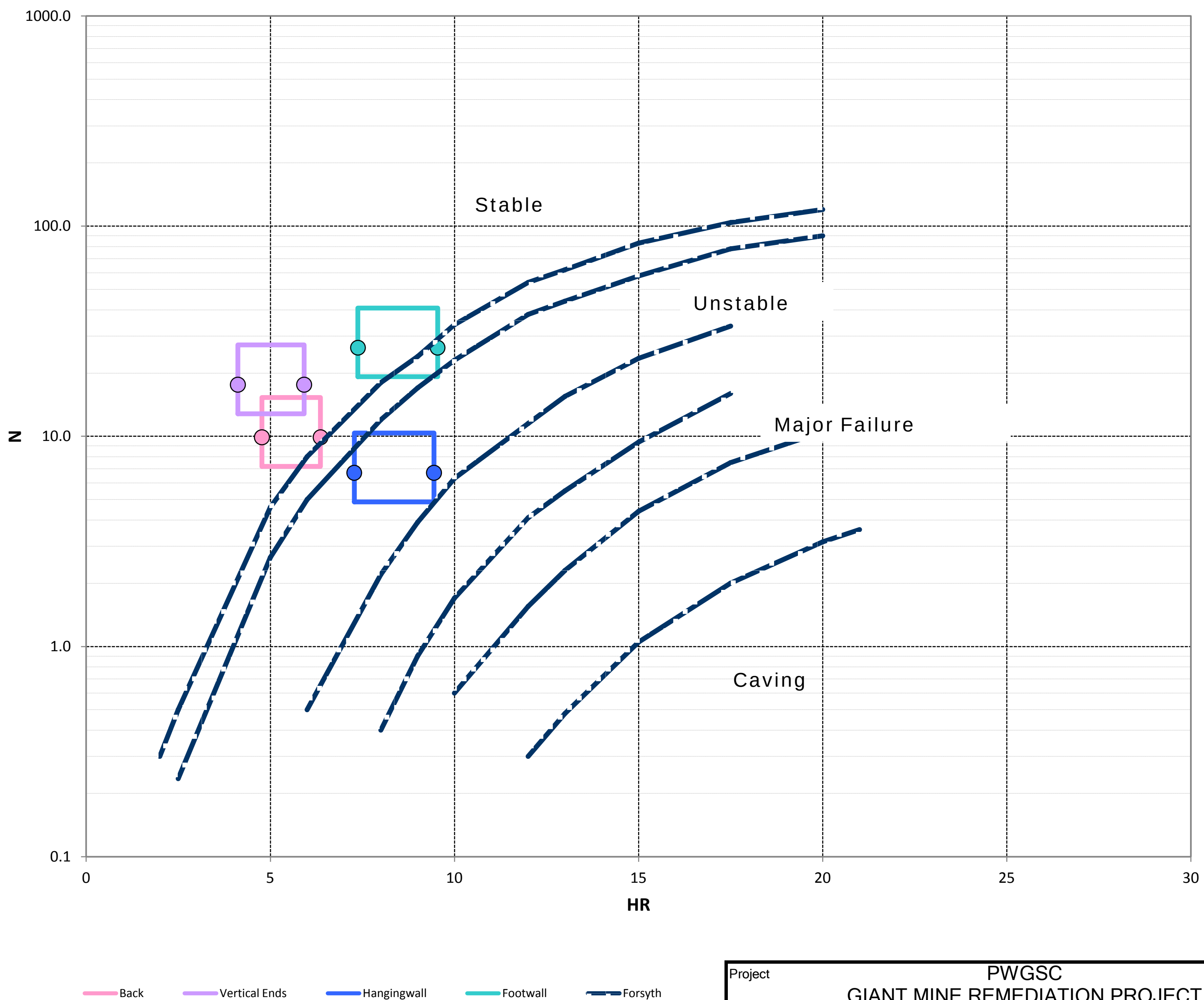
* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	1.00	1.00	0.9	1	4.8	6.4	7.2	9.9	15.3
Vertical End	8.0	11.0	17.0	1.00	1.00	0.2	8	4.1	5.9	12.8	17.6	27.2
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.2	3	7.3	9.4	4.9	6.7	10.4
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	7.3	9.4	19.2	26.4	40.8

Comments:

Mathew's Stability



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	2-01

Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200
	RUN ALP	14-Nov-11	Figure No. B-3
	CHECK DTK	14-Nov-11	
	REVIEW 0.00	0-Jan-00	

STOPE INPUT DATA

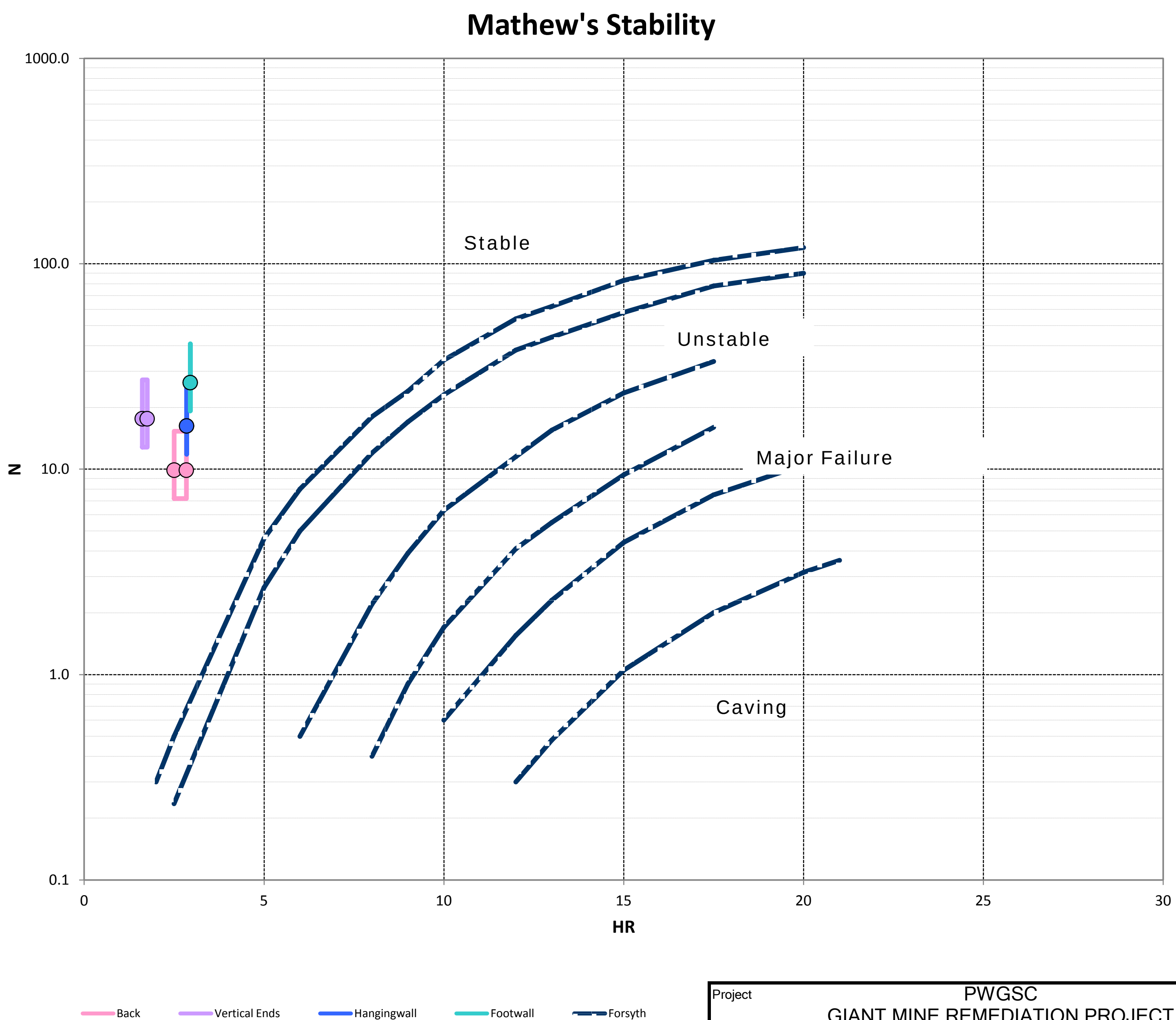
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	7.0	7.0	m	VERTICAL (V)	0.9	MPa
DIP HT(m)	7.0	7.0	m	HOR.-Strike (H1)	1.3	MPa
SPAN (S)	6.0	7.0	m	HOR.-Dip (H2)	1.3	MPa
Orientation LENGTH* (L)	30.0	30.0	m			
DIP (D)	85.0		deg.	U.C.S.	37.5	MPa

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	High	N Low	Avg	High
Back	8.0	11.0	17.0	1.00	1.00	0.9	1	2.5	2.8	7.2	9.9	15.3
Vertical End	8.0	11.0	17.0	1.00	1.00	0.2	8	1.6	1.8	12.8	17.6	27.2
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.2	7	2.8	2.8	11.8	16.3	25.1
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	2.8	2.8	19.2	26.4	40.8

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	2-01 NFW		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-4
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

	DIMENSIONS				STRESSES		
		min	max				
	VERT HT(m)	70.0	50.0	m	VERTICAL (V)	1.9	MPa
	DIP HT(m)	74.5	53.2	m	HOR.-Strike (H1)	2.9	MPa
	SPAN (S)	20.0	35.0	m	HOR.-Dip (H2)	2.9	MPa
Orientation	LENGTH* (L)	45.0	45.0	m			
	DIP (D)	70.0		deg.	U.C.S.	37.5	MPa

* - along strike

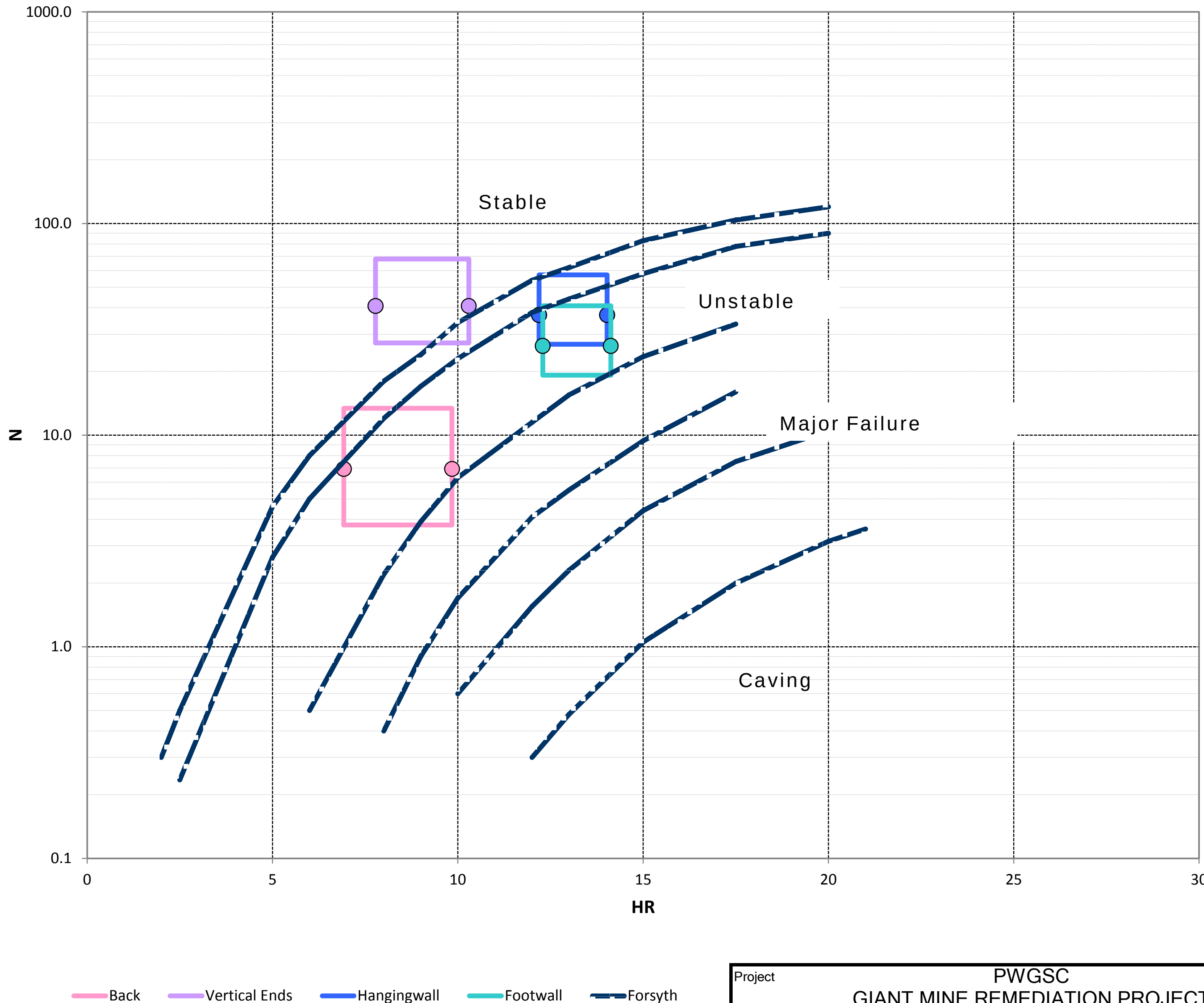
Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	0.52	0.88	0.9	1	6.9	9.8	3.8	6.9	13.4
Vertical End	8.0	11.0	17.0	0.85	1.00	0.5	8	7.8	10.3	27.3	40.8	68.0
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.6	6	14.0	12.2	26.9	37.0	57.2
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	14.0	12.2	19.2	26.4	40.8

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement

Mathew's Stability



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	3-02		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-5
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE INPUT DATA

Orientation

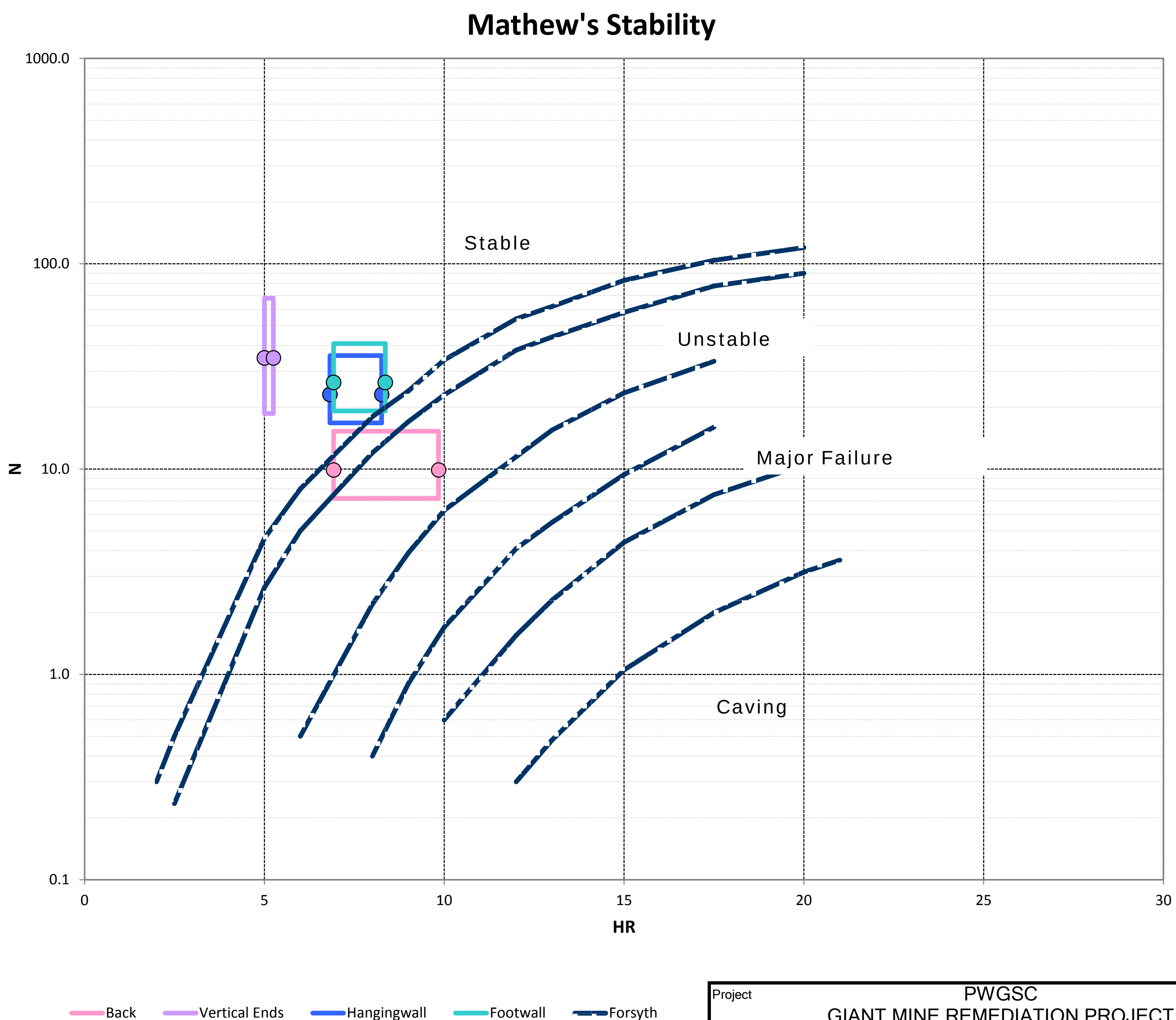
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	20.0	15.0	m	VERTICAL (V)	1.7	MPa
DIP HT(m)	26.1	19.6	m	HOR.-Strike (H1)	2.5	MPa
SPAN (S)	20.0	35.0	m	HOR.-Dip (H2)	2.5	MPa
LENGTH* (L)	45.0	45.0	m			
DIP (D)	50.0		deg.	U.C.S.	37.5	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	1.00	1.00	0.9	1	6.9	9.8	7.2	9.9	15.3
Vertical End	8.0	11.0	17.0	0.58	1.00	0.5	8	5.0	5.3	18.6	34.8	68.0
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.6	4	8.3	6.8	16.8	23.1	35.7
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	8.3	6.8	19.2	26.4	40.8

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	3-01		
Golder Associates	PROJECT No. 09-1427-0006	Phase/Task No. 6000-6200	
	RUN ALP 14-Nov-11	Figure No. B-6	
	CHECK DTK 14-Nov-11		
	REVIEW 0.00 0-Jan-00		

STOPE INPUT DATA

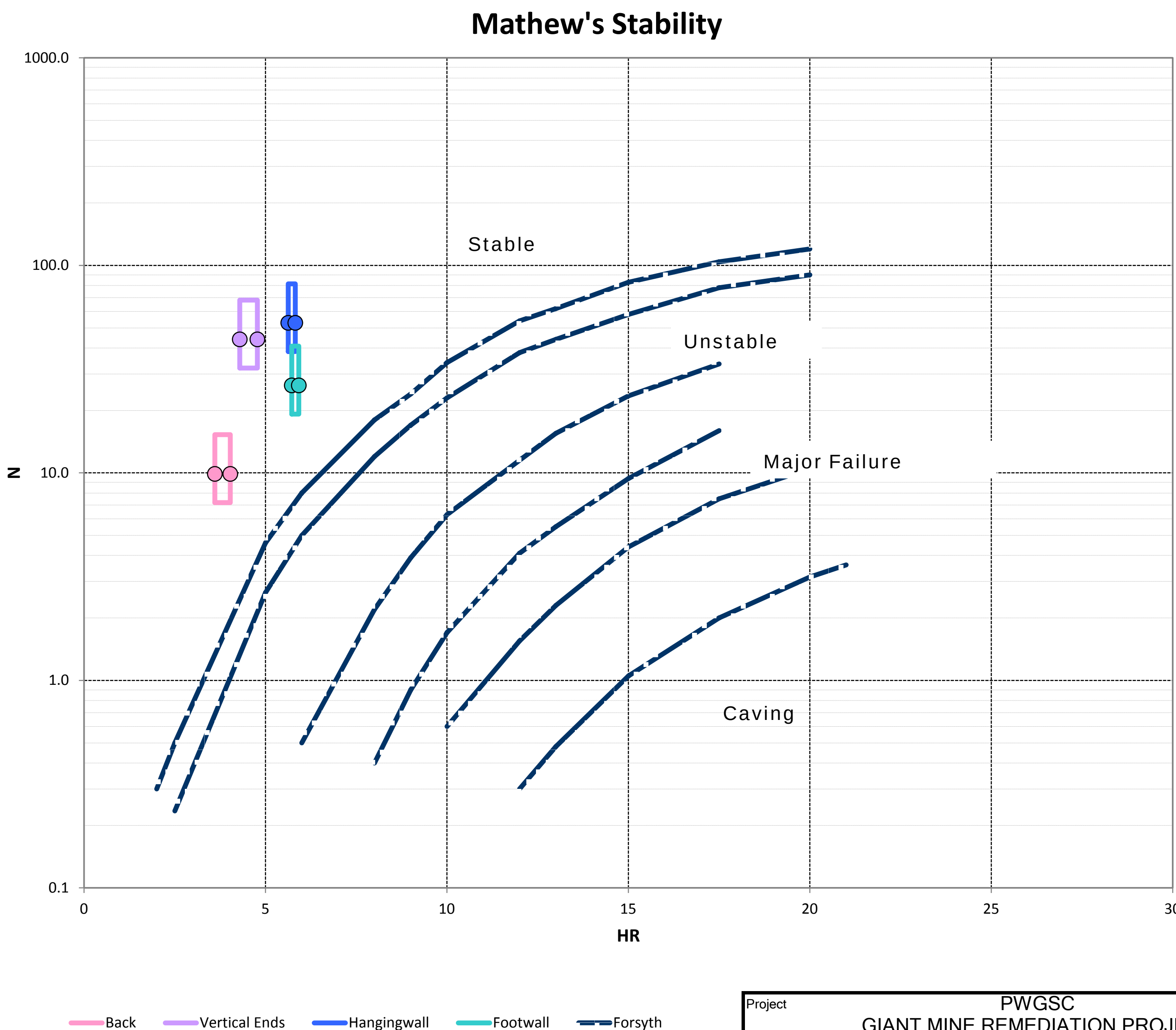
		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	30.0	30.0	*m*	VERTICAL (V)	1.0	*MPa*
	DIP HT(m)	30.0	30.0	*m*	HOR.-Strike (H1)	1.6	*MPa*
	SPAN (S)	12.0	14.0	*m*	HOR.-Dip (H2)	1.6	*MPa*
Orientation	LENGTH* (L)	18.0	19.0	*m*			
	DIP (D)	90.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	1.00	1.00	0.9	1	3.6	4.0	7.2	9.9	15.3
Vertical End	8.0	11.0	17.0	1.00	1.00	0.5	8	4.3	4.8	32.0	44.0	68.0
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.6	8	5.6	5.8	38.4	52.8	81.6
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	5.6	5.8	19.2	26.4	40.8

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	2-01 #3			
Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-7
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

DIMENSIONS

		min	max			
	VERT HT(m)	20.0	20.0	m		
	DIP HT(m)	27.3	27.3	m		
	SPAN (S)	12.0	18.0	m		
Orientation	LENGTH* (L)	45.0	45.0	m		
	DIP (D)	47.0		deg.		

* - along strike

STRESSES

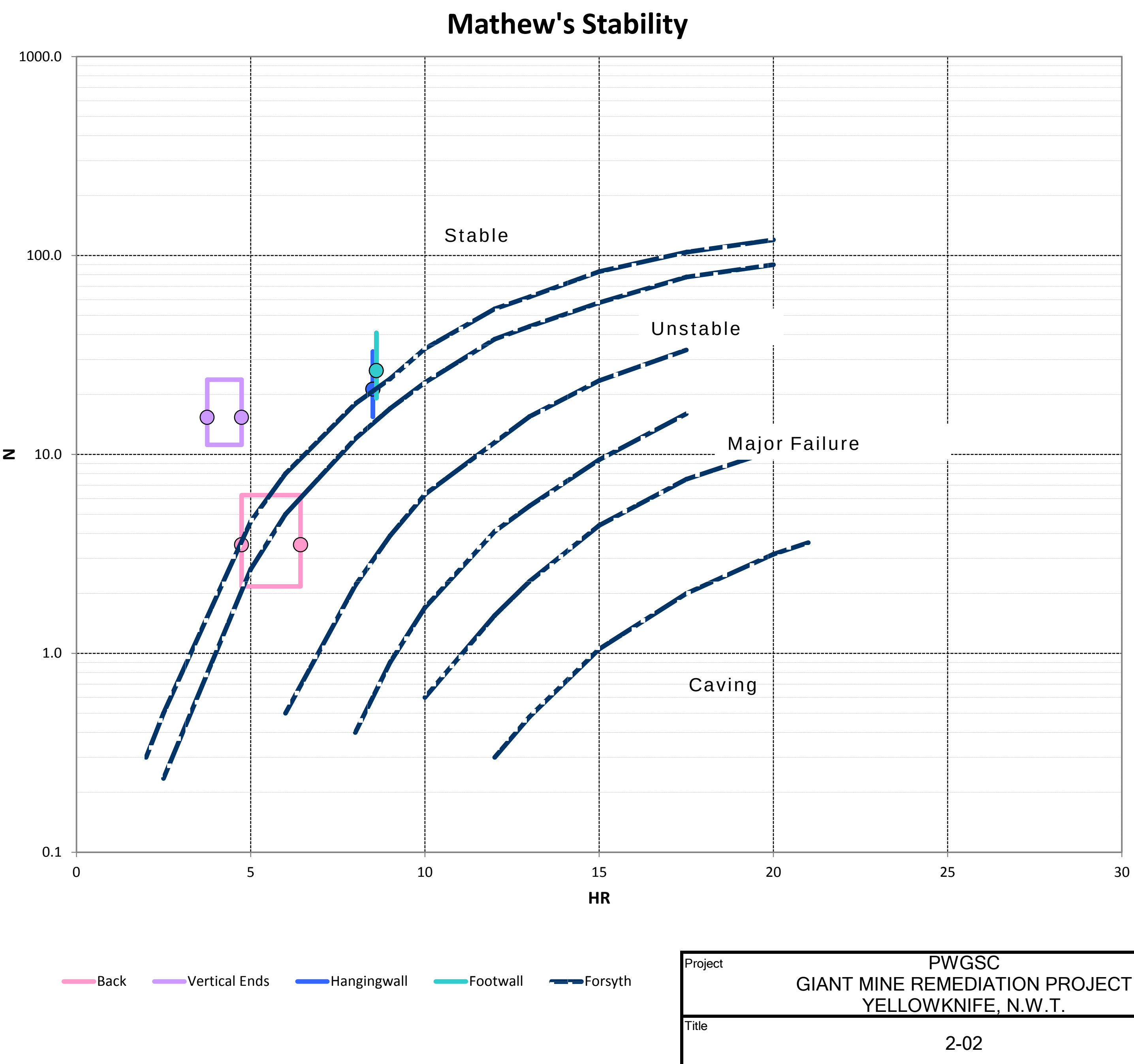
VERTICAL (V)	2.0	MPa
HOR.-Strike (H1)	3.0	MPa
HOR.-Dip (H2)	3.0	MPa
U.C.S.	37.5	MPa

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	8.0	11.0	17.0	0.30	0.41	0.9	1	4.7	6.4	2.2	3.5	6.3
Vertical End	8.0	11.0	17.0	0.35	0.35	0.5	8	3.8	4.7	11.2	15.4	23.8
Hangingwall	8.0	11.0	17.0	1.00	1.00	0.6	3	8.5	8.5	15.5	21.3	32.9
Footwall	8.0	11.0	17.0	1.00	1.00	0.3	8	8.5	8.5	19.2	26.4	40.8

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	2-02

PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
RUN	ALP	14-Nov-11	Figure No. B-8
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

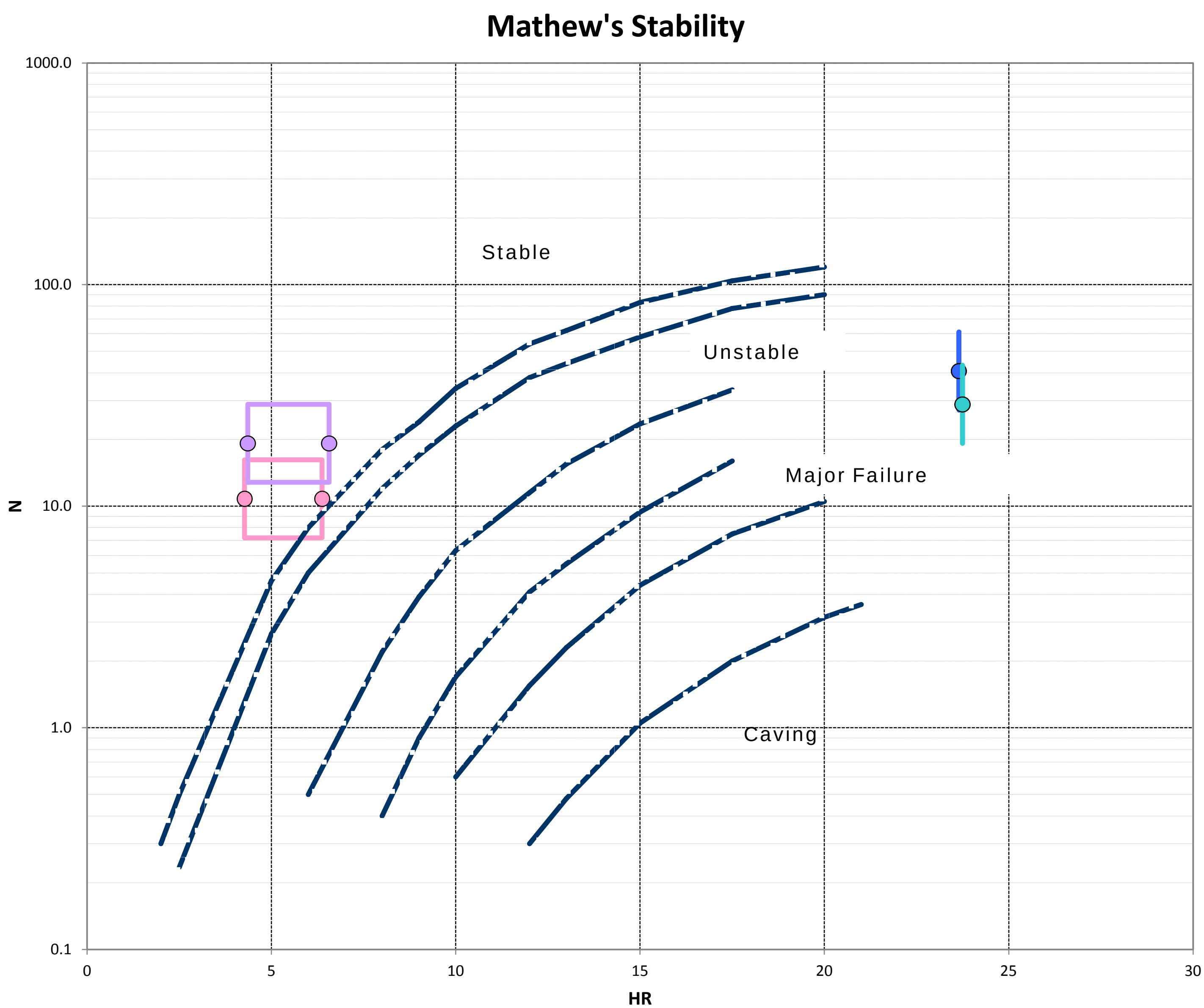
STOPE INPUT DATA

		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	105.0	105.0	m	VERTICAL (V)	2.1	MPa
	DIP HT(m)	106.6	106.6	m	HOR.-Strike (H1)	3.2	MPa
	SPAN (S)	9.5	15.0	m	HOR.-Dip (H2)	3.2	MPa
Orientation	LENGTH* (L)	85.0	85.0	m			
	DIP (D)	80.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High	Comments:
Back	8.0	12.0	18.0	1.00	1.00	0.9	1	4.3	6.4	7.2	10.8	16.2	
Vertical End	8.0	12.0	18.0	1.00	1.00	0.2	8	4.4	6.6	12.8	19.2	28.8	
Hangingwall	8.0	12.0	18.0	1.00	1.00	0.5	7	23.6	23.6	27.1	40.7	61.1	Potential failure due to lack of confinement
Footwall	8.0	12.0	18.0	1.00	1.00	0.3	8	23.6	23.6	19.2	28.8	43.2	Potential failure due to lack of confinement



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	3-70		
Golder Associates	PROJECT No. 09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11
	CHECK	DTK	14-Nov-11
	REVIEW	0.00	0-Jan-00
			Figure No. B-9

STOPE INPUT DATA

DIMENSIONS

		min	max			**STRESSES**		
	VERT HT(m)	15.0	35.0	*m*	VERTICAL (V)	0.7	*MPa*
	DIP HT(m)	15.2	35.4	*m*	HOR.-Strike (H1)	1.0	*MPa*
	SPAN (S)	3.0	5.0	*m*	HOR.-Dip (H2)	1.0	*MPa*
Orientation	LENGTH* (L)	10.0	35.0	*m*			
	DIP (D)	81.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

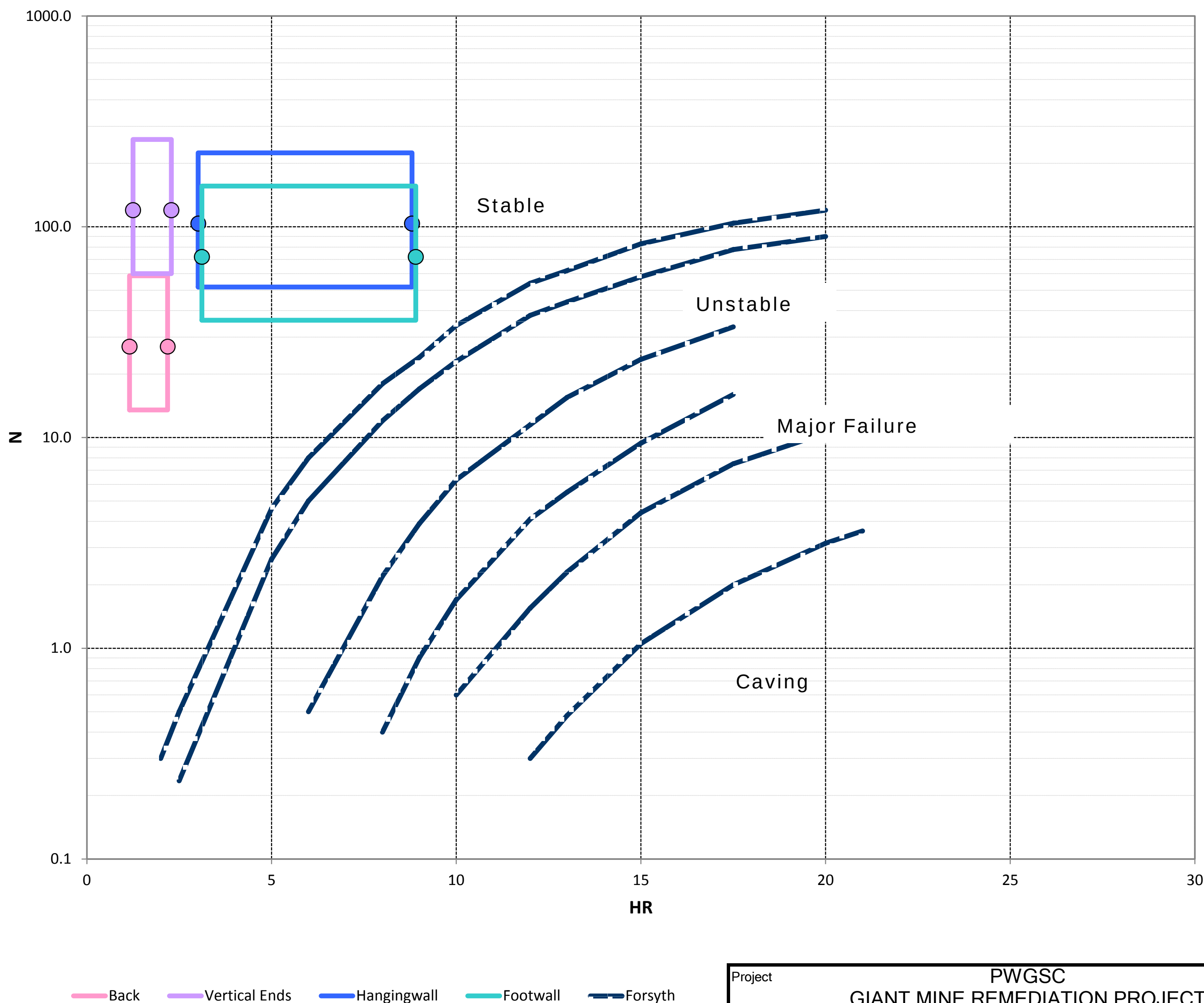
Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	15.0	30.0	65.0	1.00	1.00	0.9	1	1.2	2.2	13.5	27.0	58.5
Vertical End	15.0	30.0	65.0	1.00	1.00	0.5	8	1.3	2.2	60.0	120.0	260.0
Hangingwall	15.0	30.0	65.0	1.00	1.00	0.5	7	3.0	8.8	51.8	103.6	224.4
Footwall	15.0	30.0	65.0	1.00	1.00	0.3	8	3.0	8.8	36.0	72.0	156.0

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement

Mathew's Stability



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	2-19

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	14-Nov-11	Figure No. B-10
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Max
Average
Min

Range of stabilty number

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

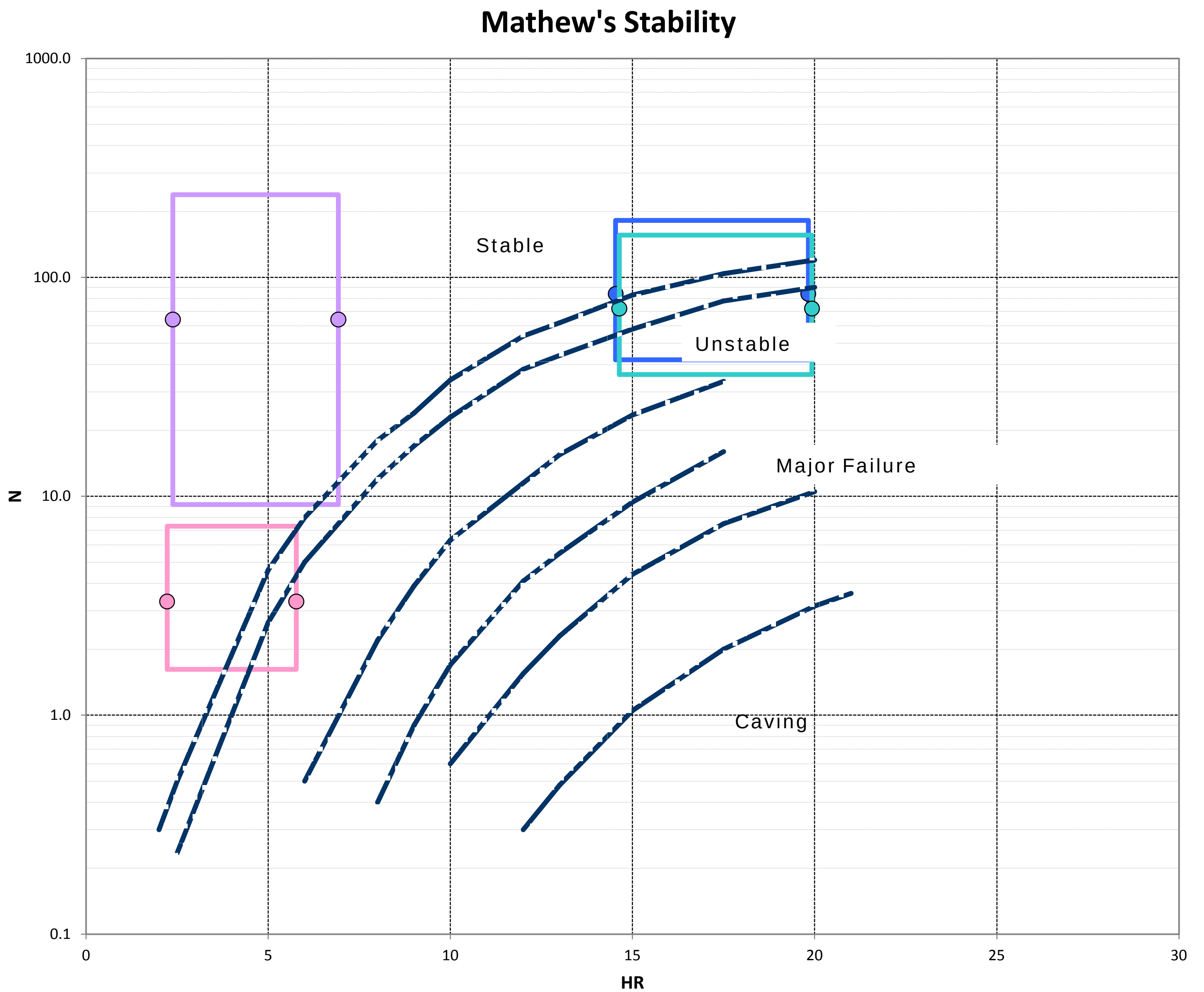
STOPE INPUT DATA

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	100.0	180.0	*m*	VERTICAL (V)	3.4	*MPa*
DIP HT(m)	106.4	191.6	*m*	HOR.-Strike (H1)	5.1	*MPa*
SPAN (S)	5.0	15.0	*m*	HOR.-Dip (H2)	5.1	*MPa*
Orientation LENGTH* (L)	40.0	50.0	*m*			
DIP (D)	70.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	High	N Low	Avg	High	Comments:
Back	15.0	30.0	65.0	0.12	0.12	0.9	1	2.2	5.8	1.6	3.3	7.3	
Vertical End	15.0	30.0	65.0	0.15	0.92	0.5	8	2.4	6.9	9.2	64.2	238.3	
Hangingwall	15.0	30.0	65.0	1.00	1.00	0.5	6	14.5	19.8	42.0	84.1	182.2	Potential failure due to lack of confinement
Footwall	15.0	30.0	65.0	1.00	1.00	0.3	8	14.5	19.8	36.0	72.0	156.0	Potential failure due to lack of confinement



Back | Vertical Ends | Hangingwall | Footwall | Forsyth

Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	2-18			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200	Figure No. B-11
	RUN	ALP	14-Nov-11	
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

DIMENSIONS

		min	max	
	VERT HT(m)	12.0	35.0	m
	DIP HT(m)	17.0	49.5	m
	SPAN (S)	11.0	16.0	m
Orientation	LENGTH* (L)	65.0	70.0	m
	DIP (D)	45.0		deg.

* - along strike

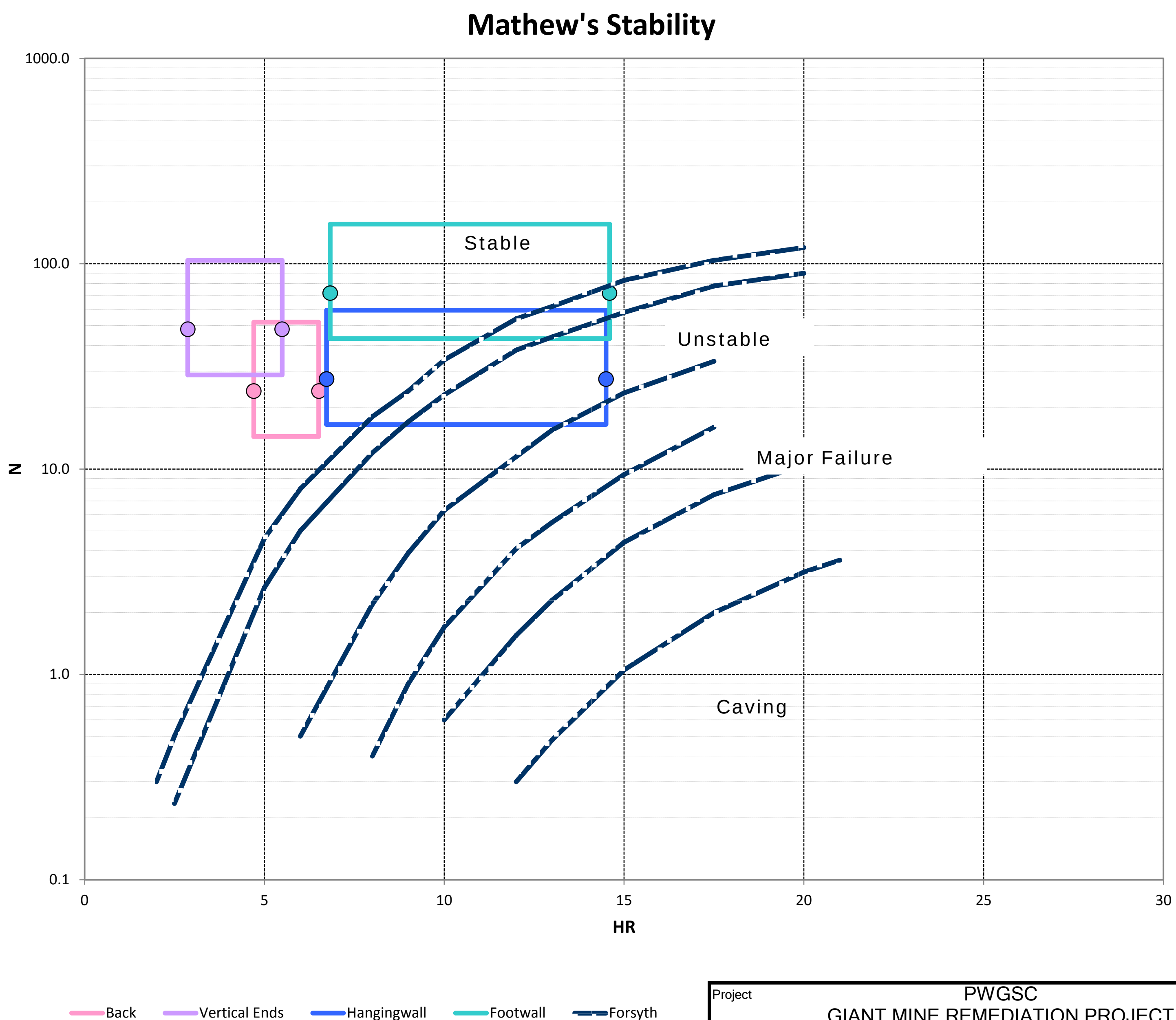
STRESSES

VERTICAL (V)	1.1	MPa
HOR.-Strike (H1)	1.7	MPa
HOR.-Dip (H2)	1.7	MPa
U.C.S.	175.0	MPa

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	18.0	30.0	65.0	1.00	1.00	0.8	1	4.7	6.5	14.4	24.0	52.0
Vertical End	18.0	30.0	65.0	1.00	1.00	0.2	8	2.9	5.5	28.8	48.0	104.0
Hangingwall	18.0	30.0	65.0	1.00	1.00	0.3	3	6.7	14.5	16.5	27.5	59.5
Footwall	18.0	30.0	65.0	1.00	1.00	0.3	8	6.7	14.5	43.2	72.0	156.0

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	1-18 Upper

PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-12
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

Orientation

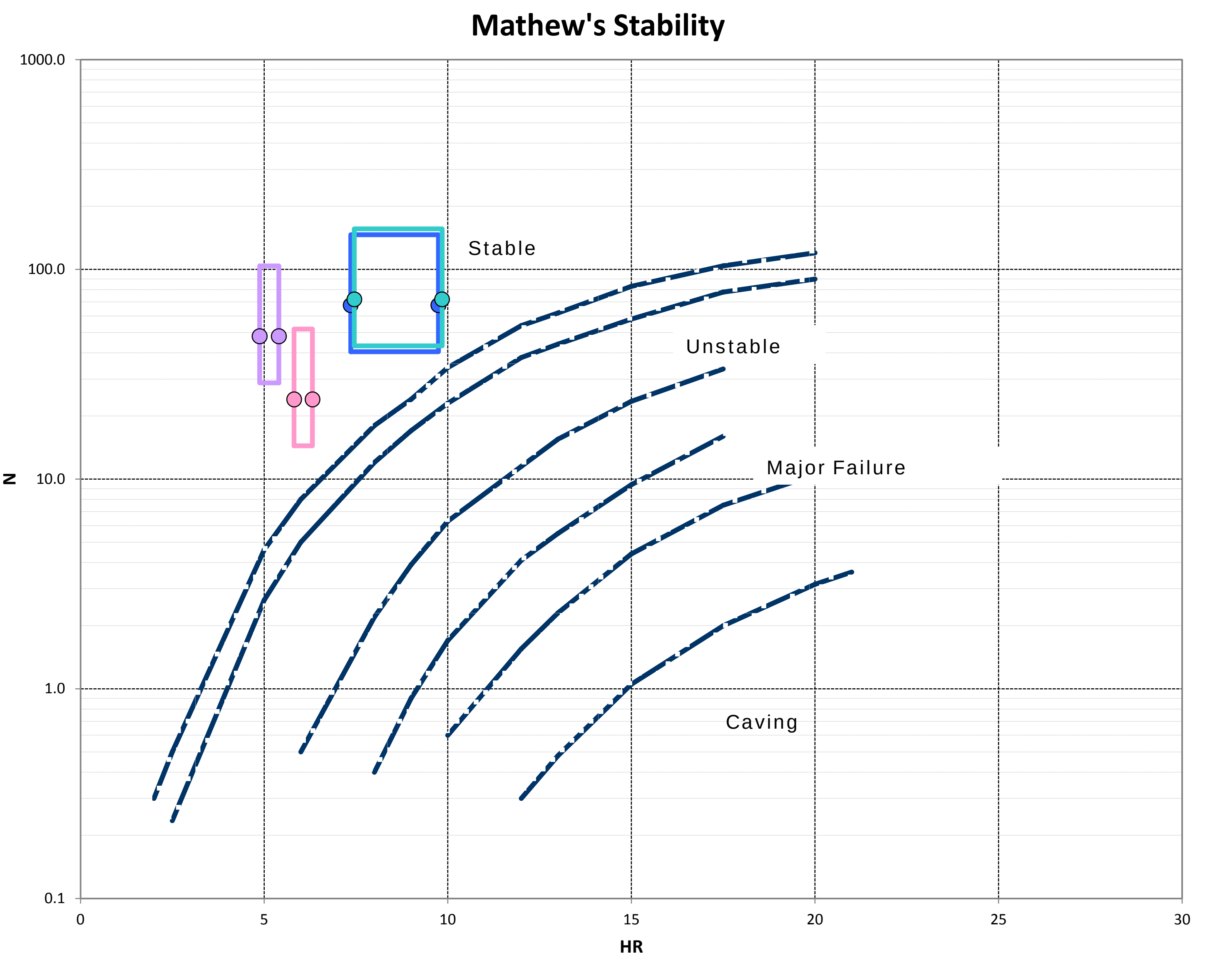
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	25.0	25.0	m	VERTICAL (V)	1.0	MPa
DIP HT(m)	28.9	28.9	m	HOR.-Strike (H1)	1.5	MPa
SPAN (S)	19.0	16.0	m	HOR.-Dip (H2)	1.5	MPa
LENGTH* (L)	30.0	60.0	m			
DIP (D)	60.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	High	N Low	Avg	High
Back	18.0	30.0	65.0	1.00	1.00	0.8	1	5.8	6.3	14.4	24.0	52.0
Vertical End	18.0	30.0	65.0	1.00	1.00	0.2	8	5.4	4.9	28.8	48.0	104.0
Hangingwall	18.0	30.0	65.0	1.00	1.00	0.5	5	7.4	9.7	40.5	67.5	146.3
Footwall	18.0	30.0	65.0	1.00	1.00	0.3	8	7.4	9.7	43.2	72.0	156.0

Comments:



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-18 Lower		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-13
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

Orientation

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	11.0	14.0	m	VERTICAL (V)	0.8	MPa
DIP HT(m)	12.7	16.2	m	HOR.-Strike (H1)	1.3	MPa
SPAN (S)	3.0	5.0	m	HOR.-Dip (H2)	1.3	MPa
LENGTH* (L)	10.0	10.0	m			
DIP (D)	60.0		deg.	U.C.S.	37.5	MPa

* - along strike

Stability Numbers

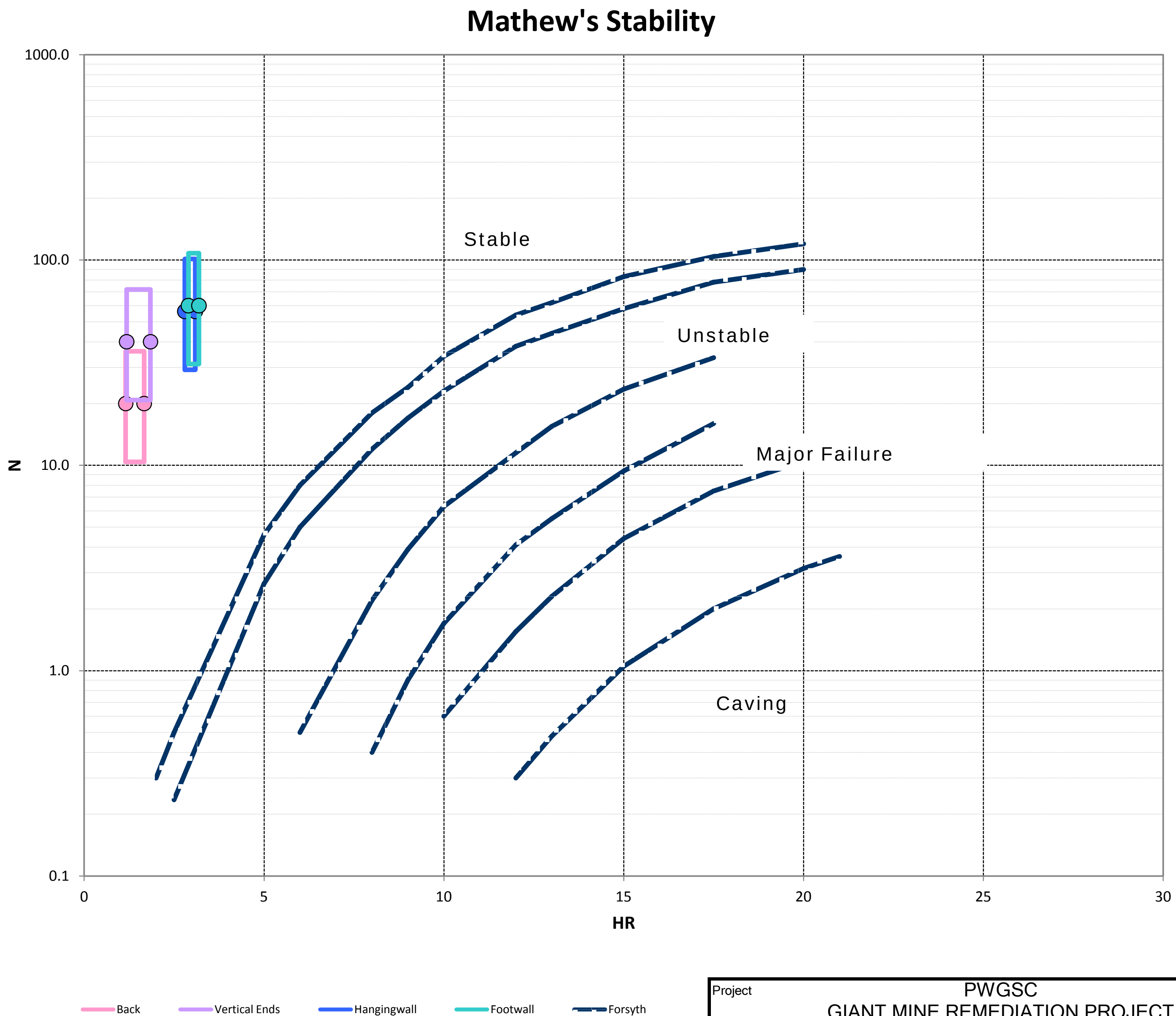
	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	13.0	25.0	45.0	1.00	1.00	0.8	1	1.2	1.7	10.4	20.0	36.0
Vertical End	13.0	25.0	45.0	1.00	1.00	0.2	8	1.2	1.8	20.8	40.0	72.0
Hangingwall	13.0	25.0	45.0	1.00	1.00	0.5	5	2.8	3.1	29.3	56.3	101.3
Footwall	13.0	25.0	45.0	1.00	1.00	0.3	8	2.8	3.1	31.2	60.0	108.0

Comments:

Potential failure due to lack of confinement

Potential failure due to lack of confinement

Mathew's Stability



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-18 #1		
Golder Associates	PROJECT No. 09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11
	CHECK	DTK	14-Nov-11
	REVIEW	0.00	0-Jan-00

Figure No. B-14

STOPE INPUT DATA

Orientation

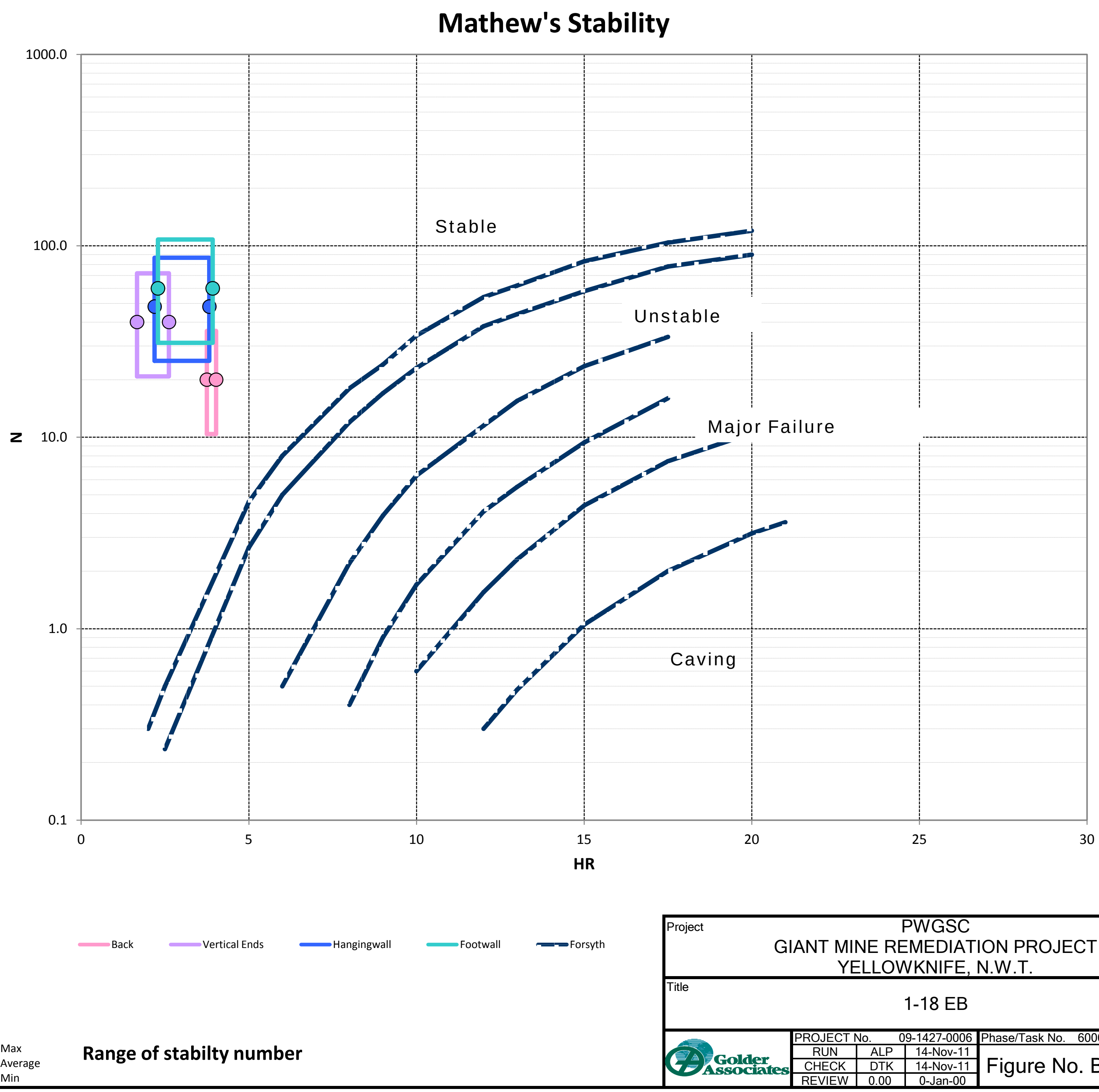
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	5.0	10.0	*m*	VERTICAL (V)	0.9	*MPa*
DIP HT(m)	5.1	10.3	*m*	HOR.-Strike (H1)	1.4	*MPa*
SPAN (S)	10.0	11.0	*m*	HOR.-Dip (H2)	1.4	*MPa*
LENGTH* (L)	30.0	30.0	*m*			
DIP (D)	77.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	13.0	25.0	45.0	1.00	1.00	0.8	1	3.8	4.0	10.4	20.0	36.0
Vertical End	13.0	25.0	45.0	1.00	1.00	0.2	8	1.7	2.6	20.8	40.0	72.0
Hangingwall	13.0	25.0	45.0	1.00	1.00	0.3	6	2.2	3.8	25.1	48.2	86.7
Footwall	13.0	25.0	45.0	1.00	1.00	0.3	8	2.2	3.8	31.2	60.0	108.0

Comments:



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	1-18 EB

Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-15
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

Orientation

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	20.0	30.0	*m*	VERTICAL (V)	1.3	*MPa*
DIP HT(m)	26.1	39.2	*m*	HOR.-Strike (H1)	2.0	*MPa*
SPAN (S)	14.0	11.0	*m*	HOR.-Dip (H2)	2.0	*MPa*
LENGTH* (L)	45.0	45.0	*m*			
DIP (D)	50.0		*deg.*	U.C.S.	75.0	*MPa*

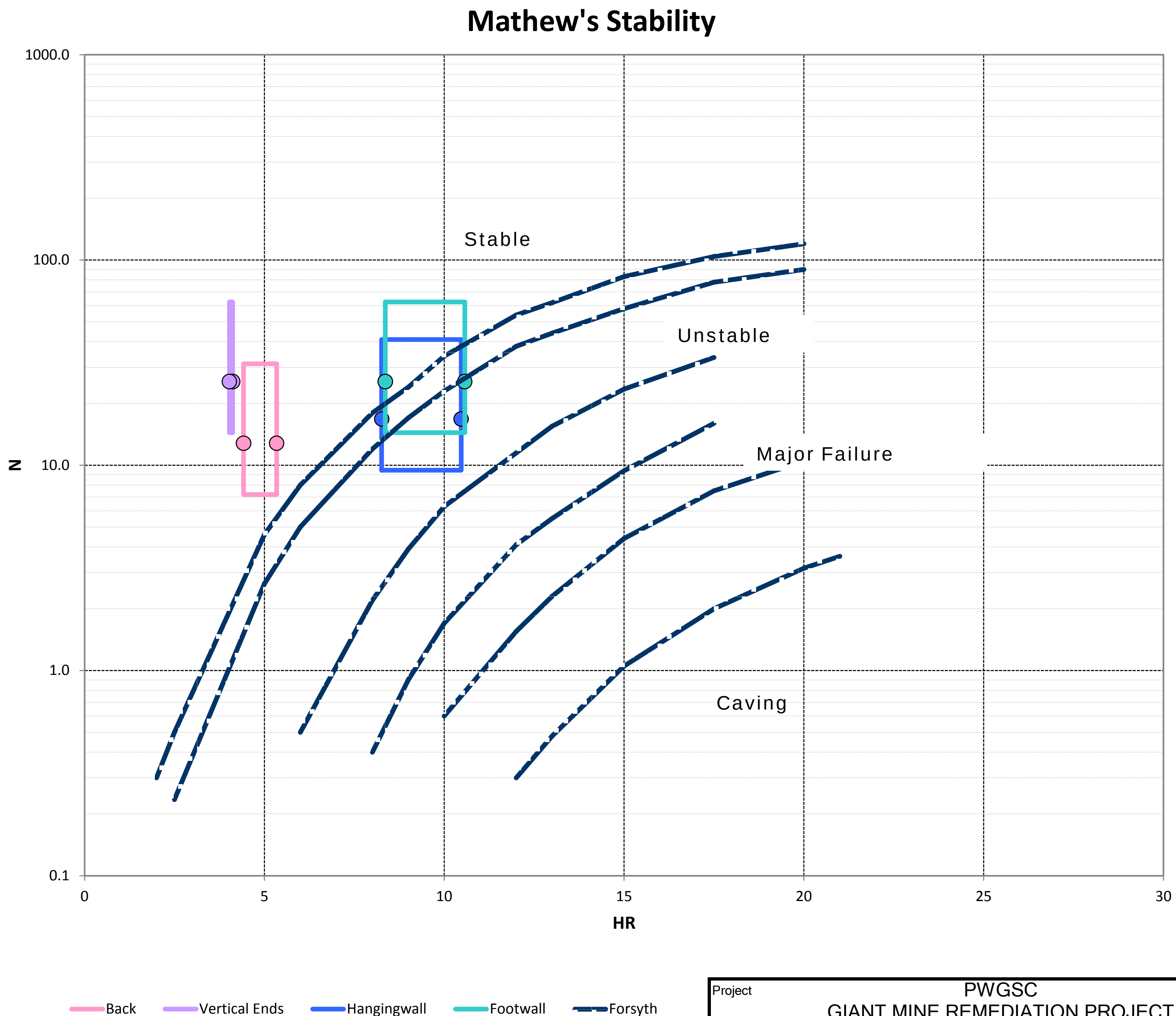
* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	16.0	39.0	1.00	1.00	0.8	1	5.3	4.4	7.2	12.8	31.2
Vertical End	9.0	16.0	39.0	1.00	1.00	0.2	8	4.1	4.0	14.4	25.6	62.4
Hangingwall	9.0	16.0	39.0	1.00	1.00	0.3	4	8.3	10.5	9.5	16.8	41.0
Footwall	9.0	16.0	39.0	1.00	1.00	0.2	8	8.3	10.5	14.4	25.6	62.4

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-18 EA		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-16
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

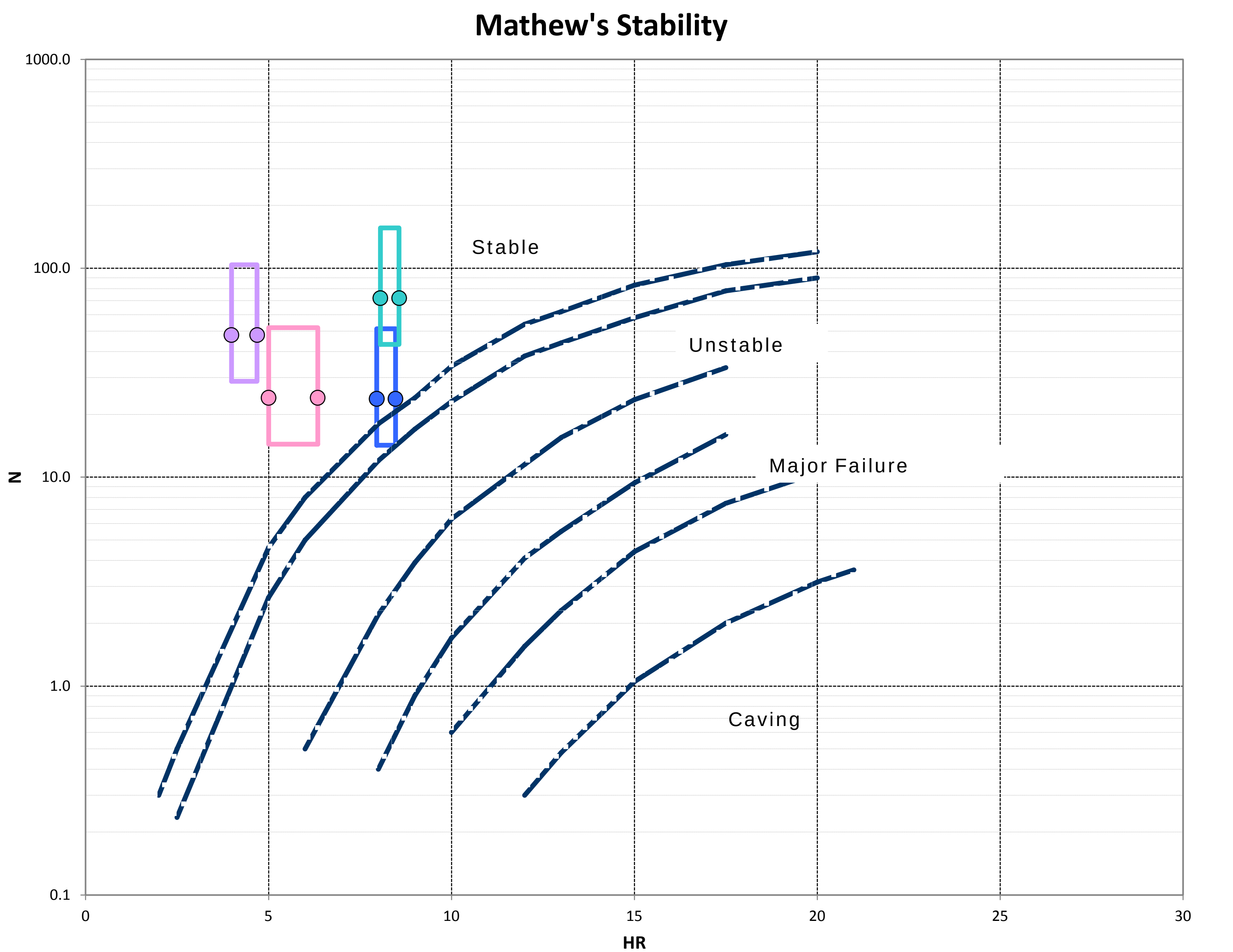
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	15.0	25.0	m	VERTICAL (V)	1.0	MPa
DIP HT(m)	23.3	38.9	m	HOR.-Strike (H1)	1.5	MPa
SPAN (S)	17.0	15.0	m	HOR.-Dip (H2)	1.5	MPa
Orientation LENGTH* (L)	50.0	30.0	m			
DIP (D)	40.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	18.0	30.0	65.0	1.00	1.00	0.8	1	6.3	5.0	14.4	24.0	52.0
Vertical End	18.0	30.0	65.0	1.00	1.00	0.2	8	4.0	4.7	28.8	48.0	104.0
Hangingwall	18.0	30.0	65.0	1.00	1.00	0.3	3	8.0	8.5	14.2	23.7	51.4
Footwall	18.0	30.0	65.0	1.00	1.00	0.3	8	8.0	8.5	43.2	72.0	156.0

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	2-15		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-17
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE INPUT DATA

Orientation

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	30.0	30.0	*m*	VERTICAL (V)	1.2	*MPa*
DIP HT(m)	42.4	42.4	*m*	HOR.-Strike (H1)	1.8	*MPa*
SPAN (S)	6.0	8.0	*m*	HOR.-Dip (H2)	1.8	*MPa*
LENGTH* (L)	15.0	15.0	*m*			
DIP (D)	45.0		*deg.*	U.C.S.	37.5	*MPa*

* - along strike

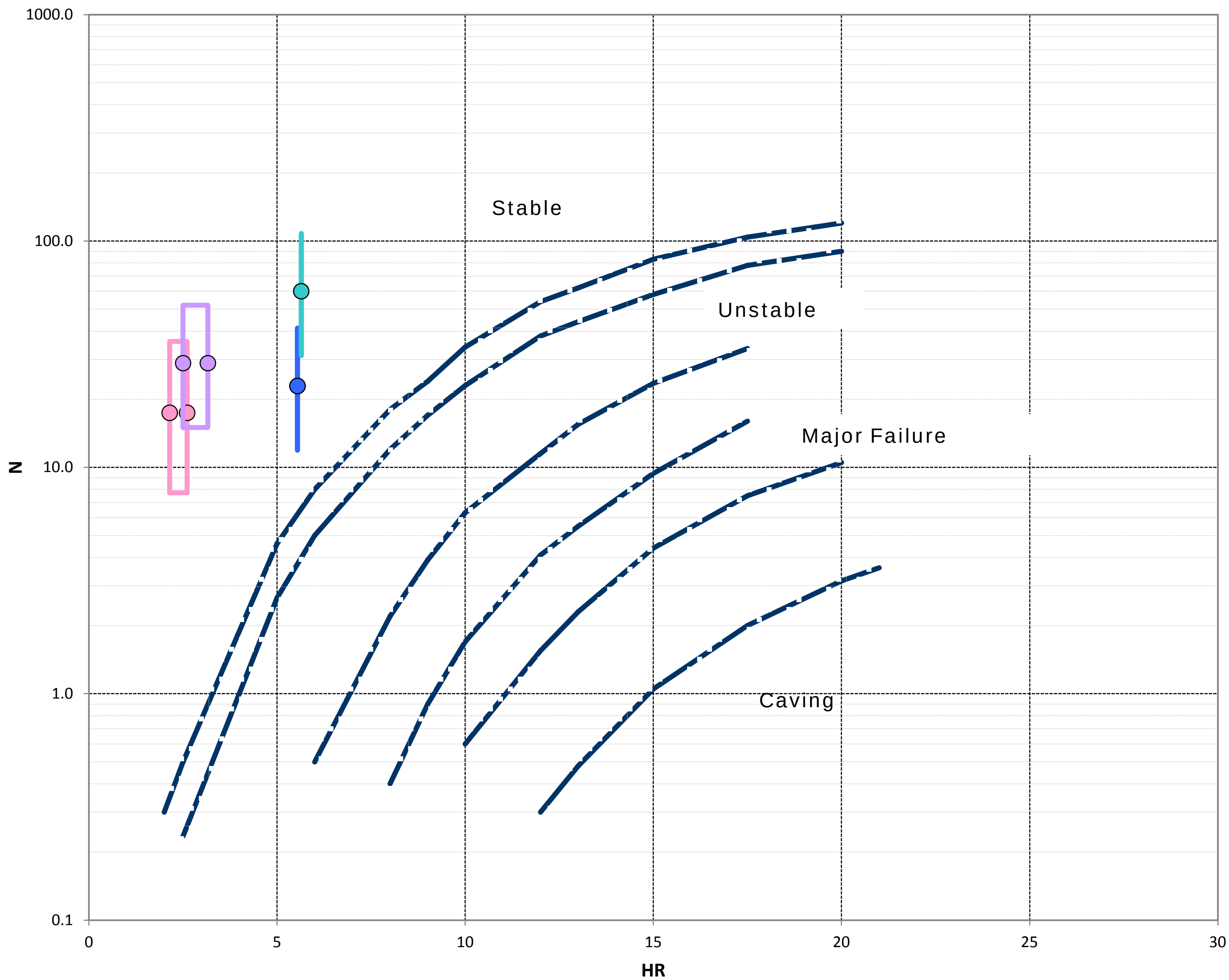
Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	High	N Low	Avg	High
Back	13.0	25.0	45.0	0.74	1.00	0.8	1	2.1	2.6	7.7	17.4	36.0
Vertical End	13.0	25.0	45.0	0.72	0.72	0.2	8	2.5	3.2	15.0	28.9	52.0
Hangingwall	13.0	25.0	45.0	1.00	1.00	0.3	3	5.5	5.5	11.9	22.9	41.2
Footwall	13.0	25.0	45.0	1.00	1.00	0.3	8	5.5	5.5	31.2	60.0	108.0

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement

Mathew's Stability



Back — Vertical Ends — Hangingwall — Footwall — Forsyth

Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	2-06		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-18
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

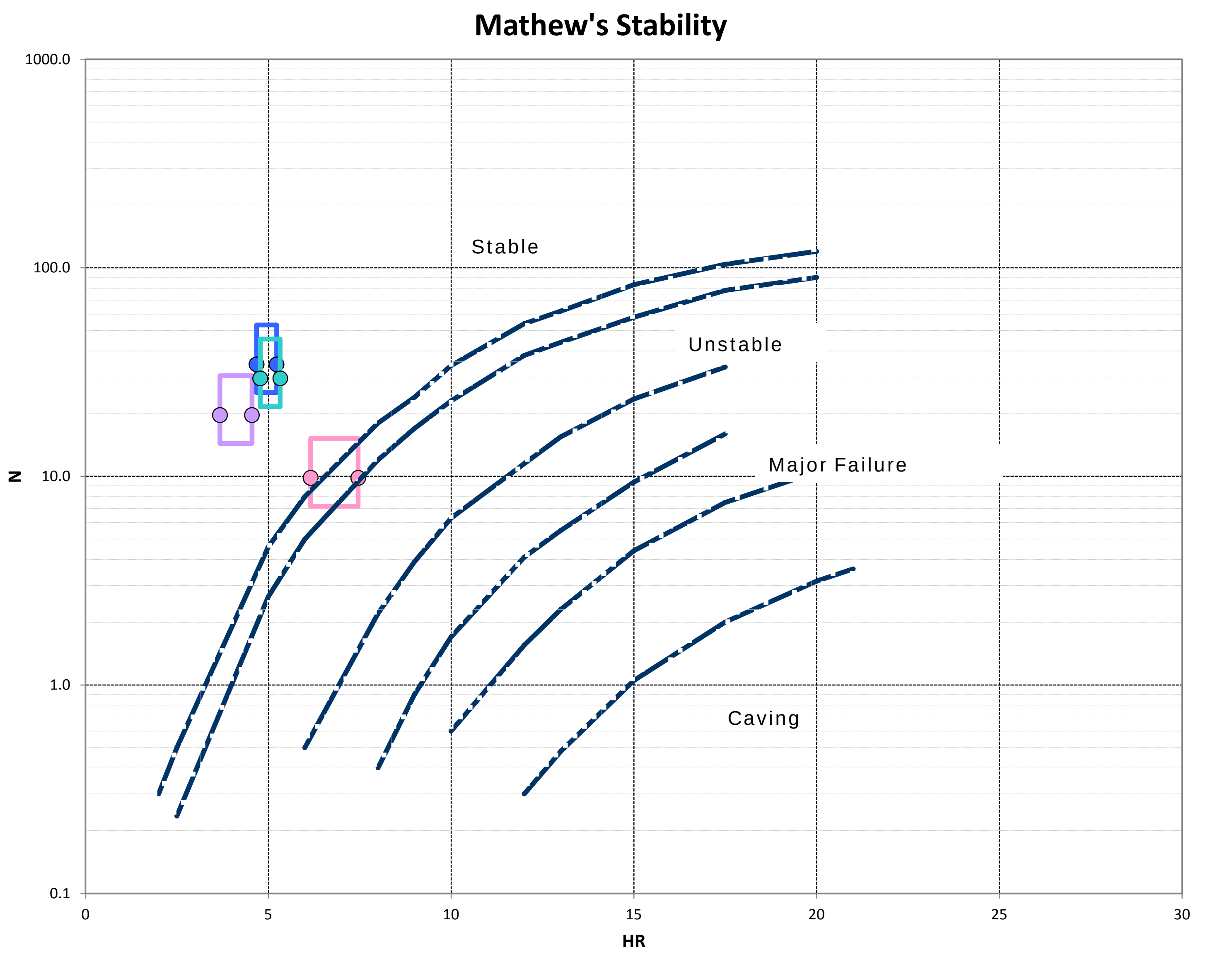
		DIMENSIONS			STRESSES		
STOPE INPUT DATA		min	max				
	VERT HT(m)	12.0	14.0	*m*	VERTICAL (V)	1.1	*MPa*
	DIP HT(m)	12.8	14.9	*m*	HOR.-Strike (H1)	1.6	*MPa*
	SPAN (S)	19.0	26.0	*m*	HOR.-Dip (H2)	1.6	*MPa*
Orientation	LENGTH* (L)	35.0	35.0	*m*			
	DIP (D)	70.0		*deg.*	U.C.S.	175.0	*MPa*

* - along strike

Stability Numbers

	Q'			Amin	Amax	B	C	HR		N		
	20%	50%	80%					Low	High	Low	Avg	High
Back	9.0	12.3	19.0	1.00	1.00	0.8	1	6.2	7.5	7.2	9.8	15.2
Vertical End	9.0	12.3	19.0	1.00	1.00	0.2	8	3.7	4.6	14.4	19.7	30.4
Hangingwall	9.0	12.3	19.0	1.00	1.00	0.5	6	4.7	5.2	25.2	34.5	53.3
Footwall	9.0	12.3	19.0	1.00	1.00	0.3	8	4.7	5.2	21.6	29.5	45.6

Comments:



Back
Vertical Ends
Hangingwall
Footwall
Forsyth

Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-31W / 1-31 #2		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-19
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE INPUT DATA

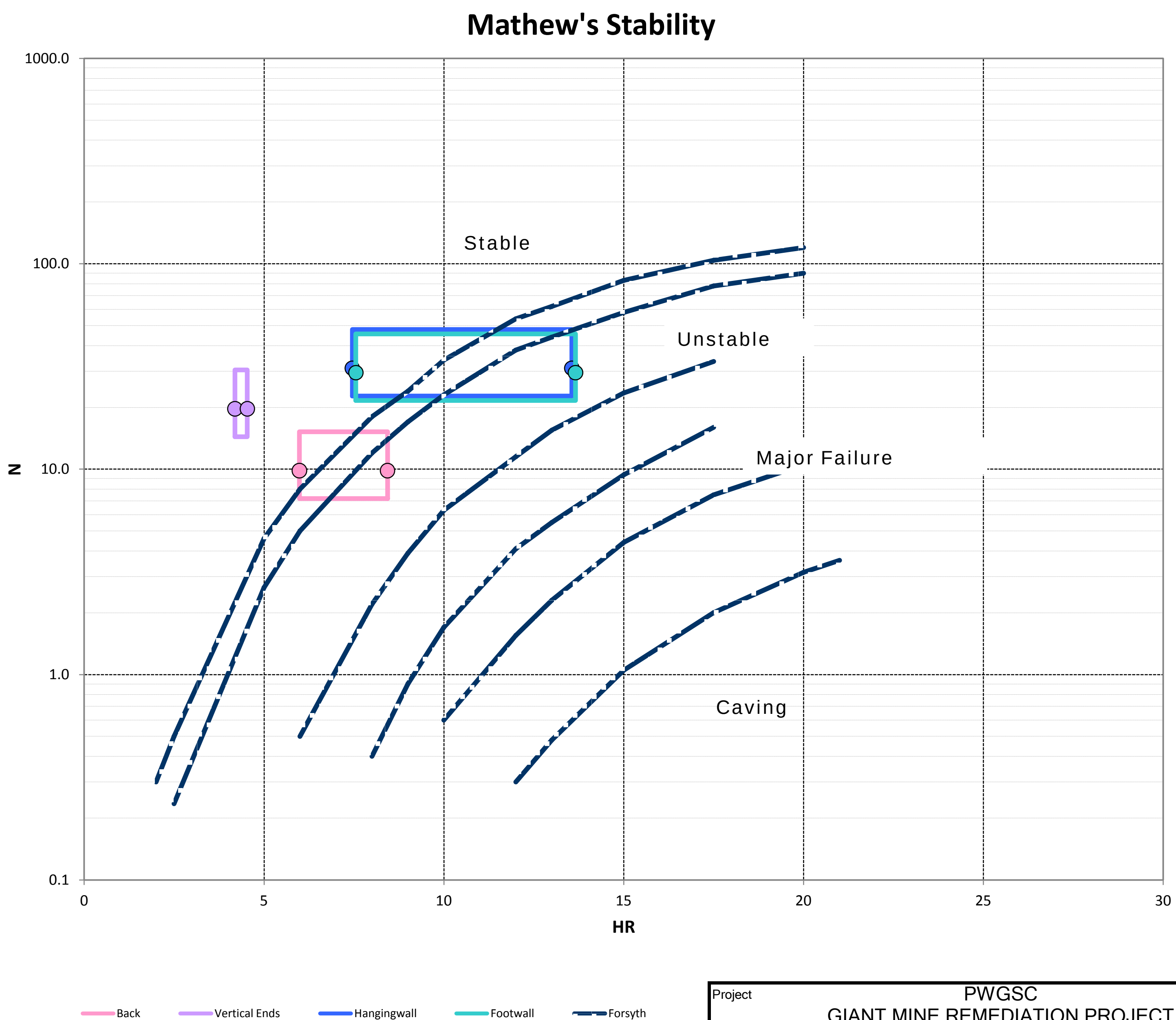
		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	15.0	30.0	m	VERTICAL (V)	3.2	MPa
	DIP HT(m)	16.6	33.1	m	HOR.-Strike (H1)	4.8	MPa
	SPAN (S)	19.0	13.0	m	HOR.-Dip (H2)	4.8	MPa
Orientation	LENGTH* (L)	150.0	150.0	m			
	DIP (D)	65.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	12.3	19.0	1.00	1.00	0.8	1	8.4	6.0	7.2	9.8	15.2
Vertical End	9.0	12.3	19.0	1.00	1.00	0.2	8	4.2	4.5	14.4	19.7	30.4
Hangingwall	9.0	12.3	19.0	1.00	1.00	0.5	5	7.5	13.6	22.7	31.0	47.9
Footwall	9.0	12.3	19.0	1.00	1.00	0.3	8	7.5	13.6	21.6	29.5	45.6

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	2-35		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-20
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

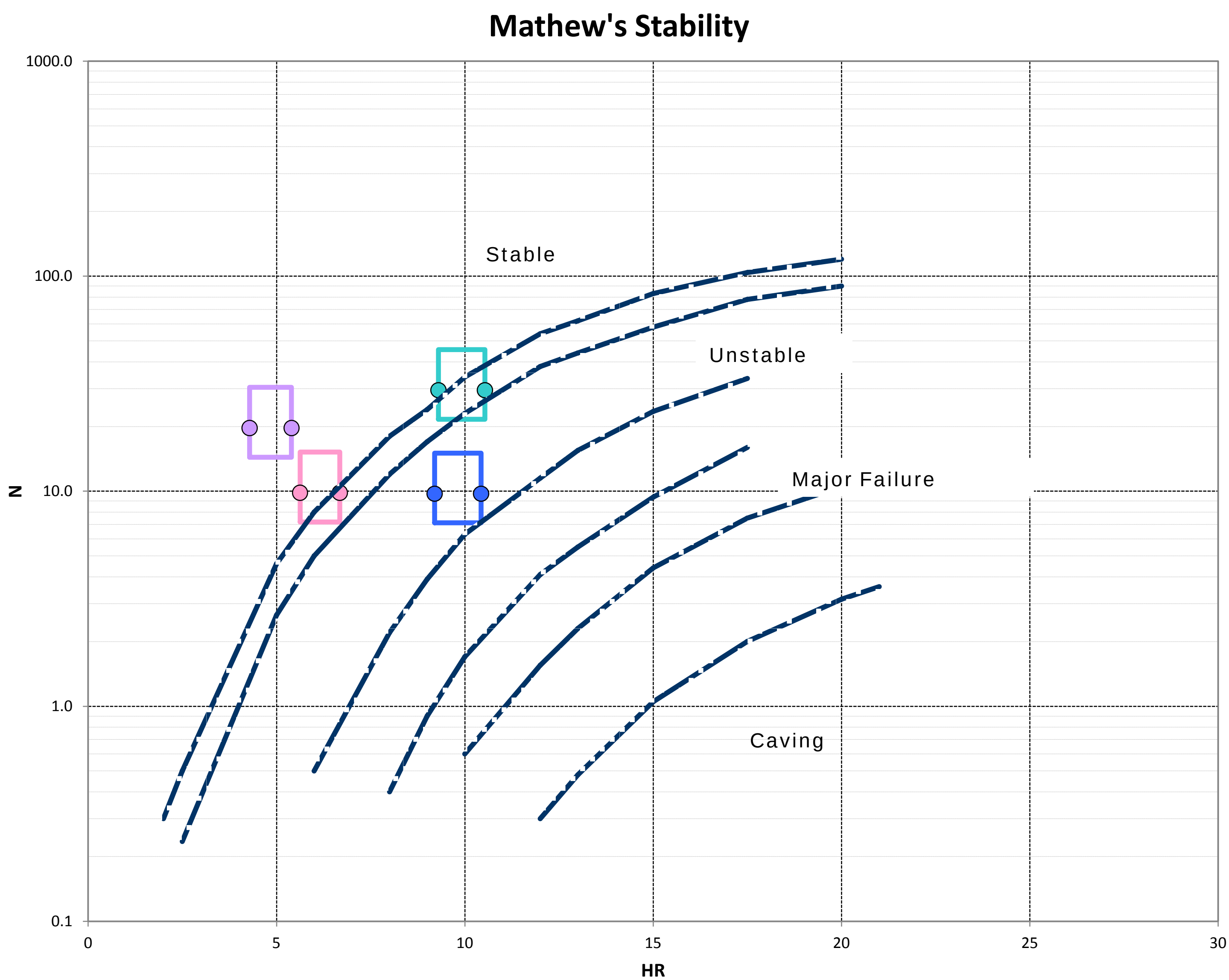
STOPE INPUT DATA		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	20.0	25.0	m	VERTICAL (V)	3.1	MPa
	DIP HT(m)	31.1	38.9	m	HOR.-Strike (H1)	4.7	MPa
	SPAN (S)	15.0	19.0	m	HOR.-Dip (H2)	4.7	MPa
Orientation	LENGTH* (L)	45.0	45.0	m			
	DIP (D)	40.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	12.3	19.0	1.00	1.00	0.8	1	5.6	6.7	7.2	9.8	15.2
Vertical End	9.0	12.3	19.0	1.00	1.00	0.2	8	4.3	5.4	14.4	19.7	30.4
Hangingwall	9.0	12.3	19.0	1.00	1.00	0.3	3	9.2	10.4	7.1	9.7	15.0
Footwall	9.0	12.3	19.0	1.00	1.00	0.3	8	9.2	10.4	21.6	29.5	45.6

Comments:



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-33 / 1-27		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-21
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE INPUT DATA

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	6.0	6.0	m	VERTICAL (V)	1.6	MPa
DIP HT(m)	7.8	7.8	m	HOR.-Strike (H1)	2.4	MPa
SPAN (S)	8.0	5.0	m	HOR.-Dip (H2)	2.4	MPa
LENGTH* (L)	70.0	70.0	m			
DIP (D)	50.0		deg.	U.C.S.	175.0	MPa

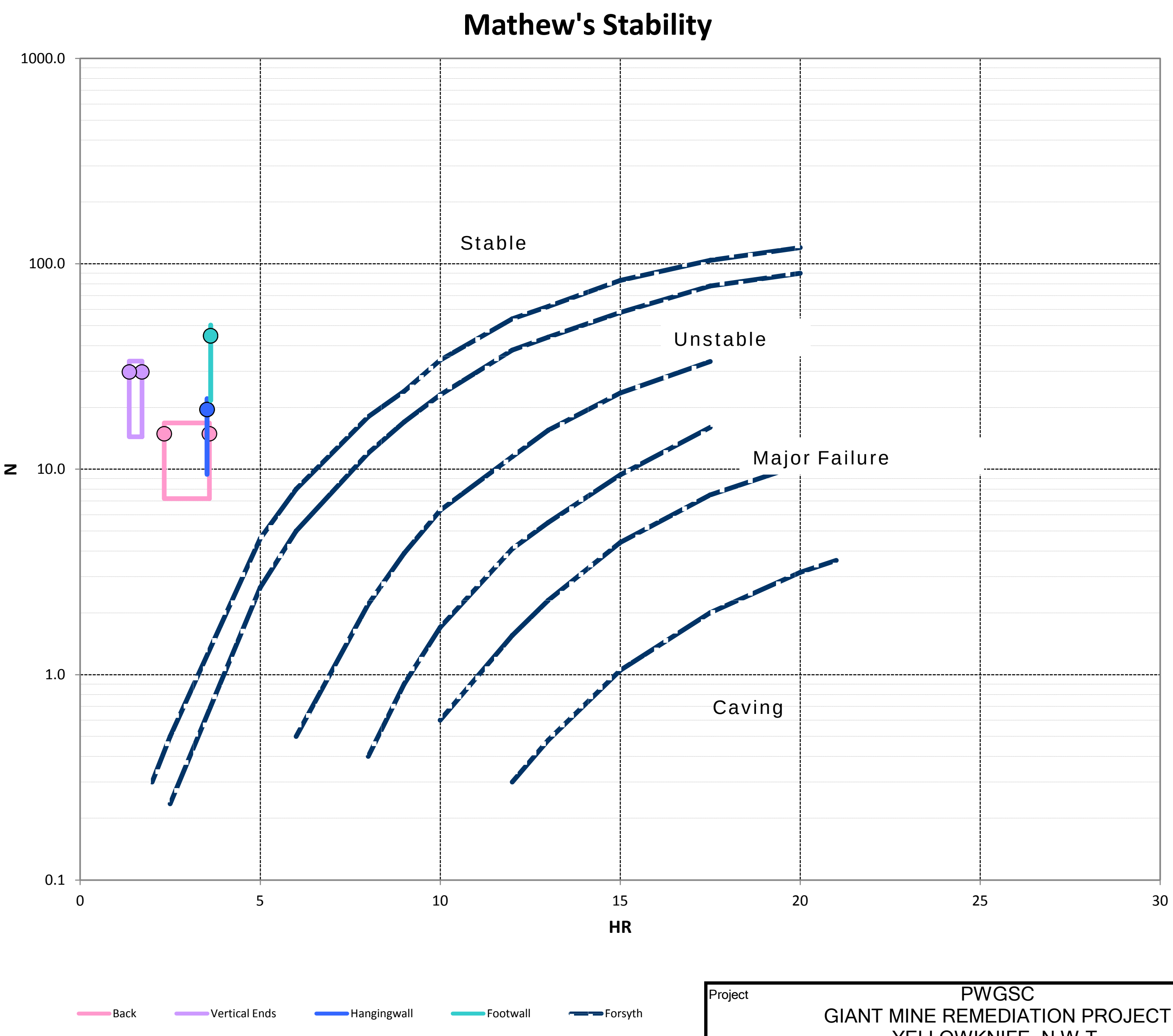
Orientation

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	3.6	2.3	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	1.7	1.4	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.3	4	3.5	3.5	9.5	19.5	22.1
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	3.5	3.5	21.6	44.6	50.4

Comments:



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	1-29

Golder Associates

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	14-Nov-11	Figure No. B-22
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

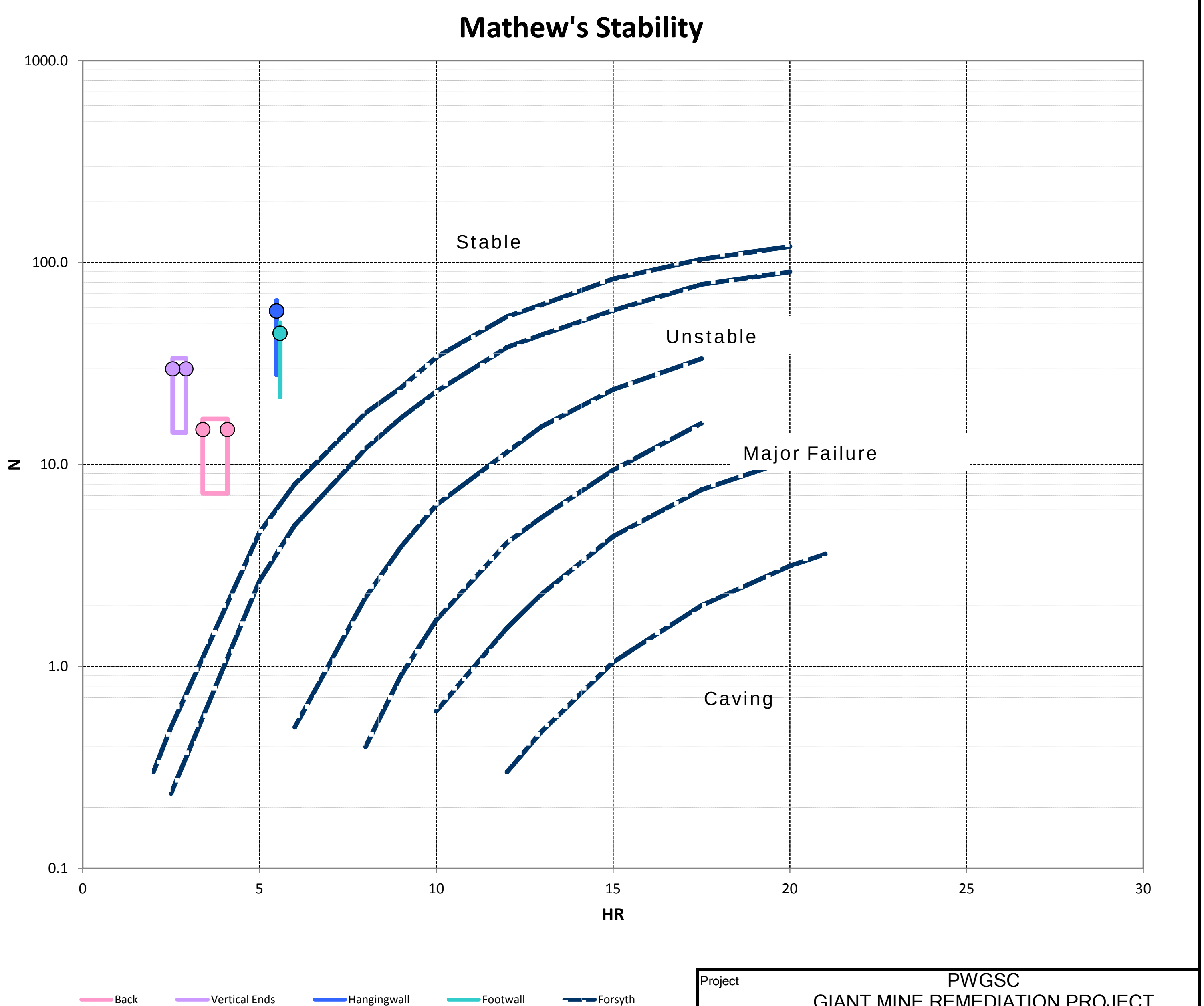
STOPE INPUT DATA		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	14.0	14.0	m	VERTICAL (V)	1.4	MPa
	DIP HT(m)	14.5	14.5	m	HOR.-Strike (H1)	2.1	MPa
	SPAN (S)	10.0	8.0	m	HOR.-Dip (H2)	2.1	MPa
Orientation	LENGTH* (L)	45.0	45.0	m			
	DIP (D)	75.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	4.1	3.4	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	2.9	2.5	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.5	6	5.5	5.5	27.8	57.6	65.0
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	5.5	5.5	21.6	44.6	50.4

Comments:



Max
Average
Min
Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-34		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-23
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE INPUT DATA

Orientation

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	12.0	14.0	m	VERTICAL (V)	0.7	MPa
DIP HT(m)	12.4	14.5	m	HOR.-Strike (H1)	1.0	MPa
SPAN (S)	6.0	8.5	m	HOR.-Dip (H2)	1.0	MPa
LENGTH* (L)	25.0	25.0	m			
DIP (D)	75.0		deg.	U.C.S.	175.0	MPa

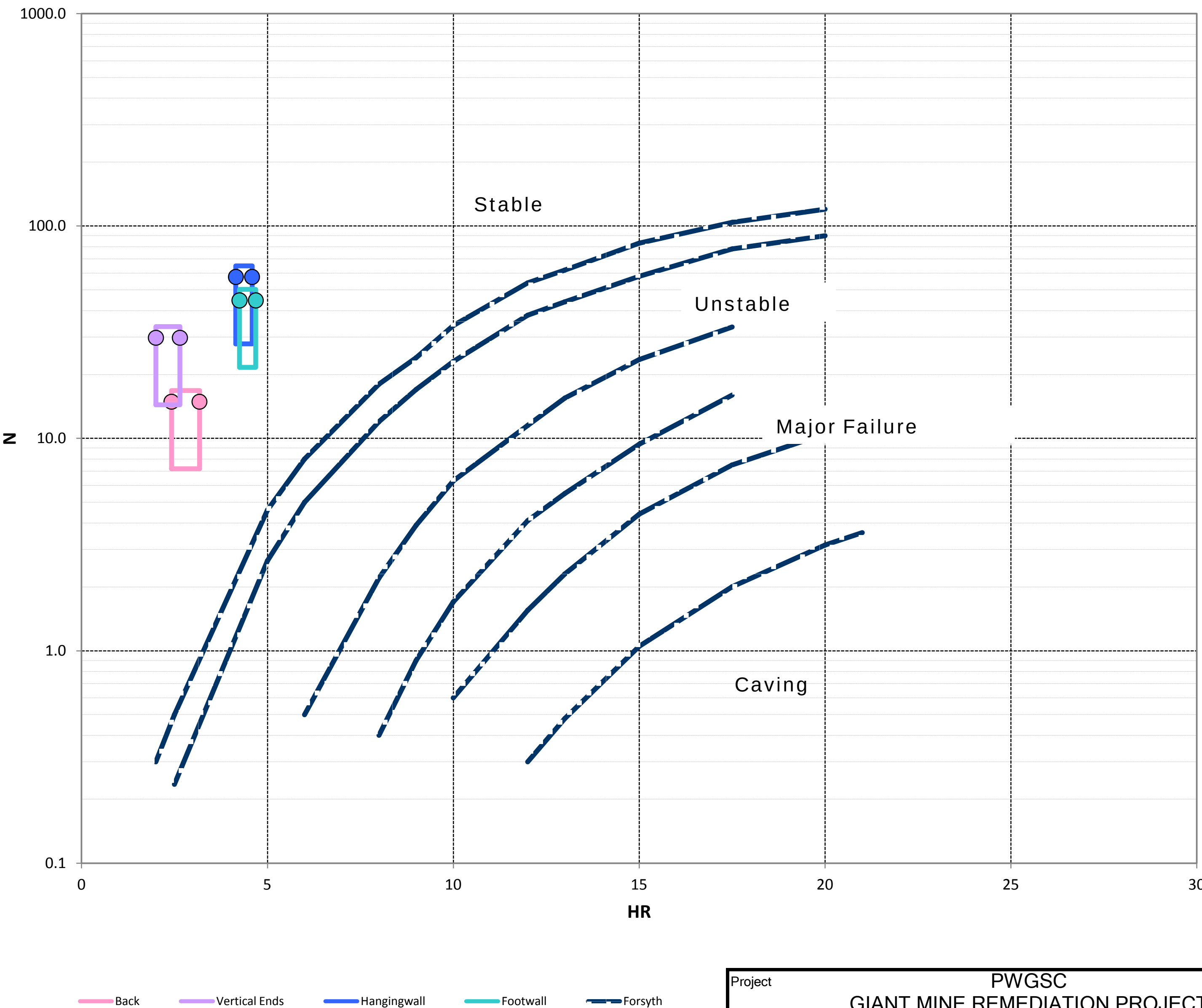
* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	2.4	3.2	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	2.0	2.6	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.5	6	4.1	4.6	27.8	57.6	65.0
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	4.1	4.6	21.6	44.6	50.4

Comments:

Mathew's Stability



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	1-35			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN ALP	14-Nov-11	Figure No. B-24	
	CHECK DTK	14-Nov-11		
	REVIEW 0.00	0-Jan-00		

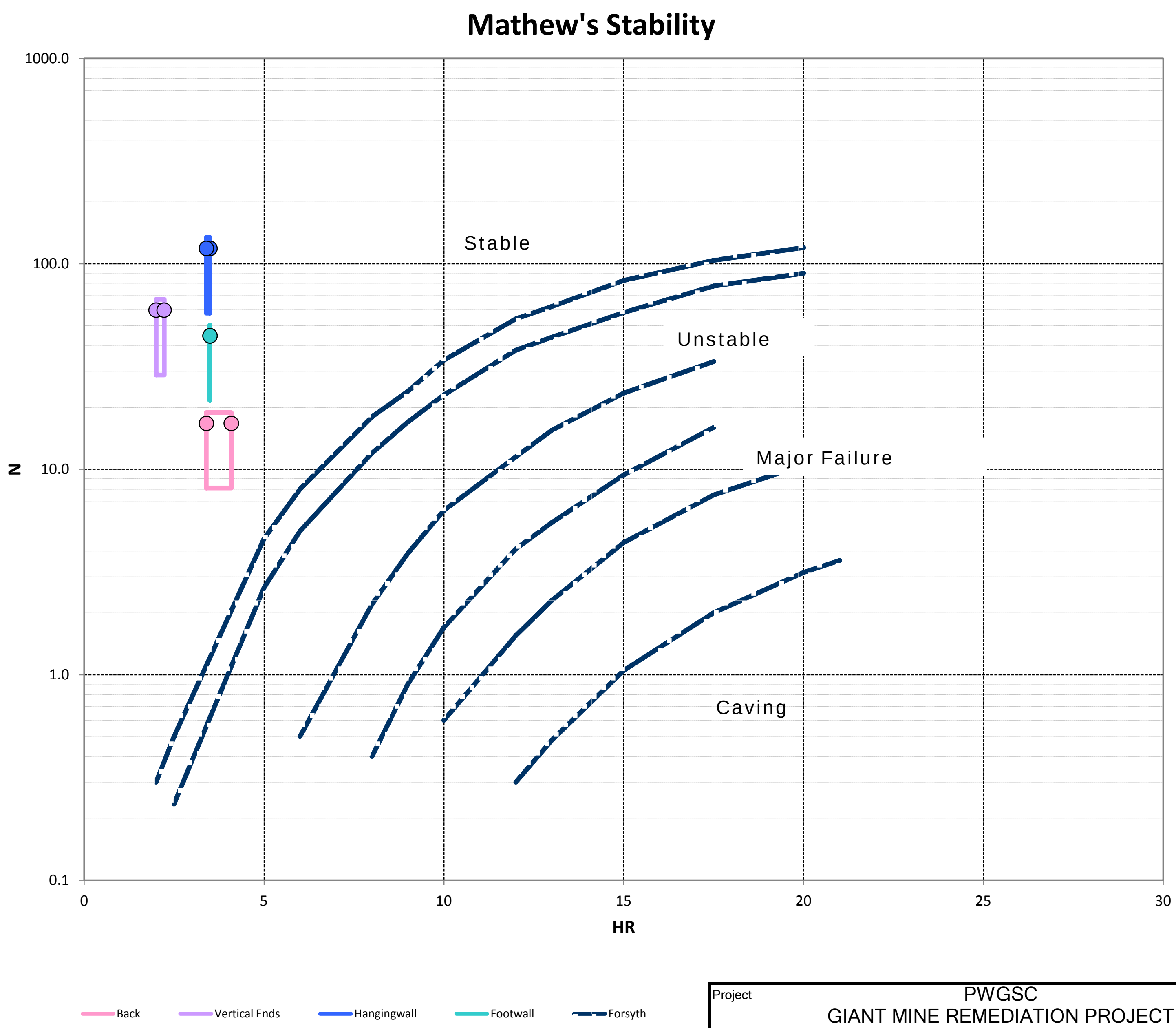
STOPE INPUT DATA		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	8.0	8.0	m	VERTICAL (V)	0.6	MPa
	DIP HT(m)	8.0	8.0	m	HOR.-Strike (H1)	0.9	MPa
	SPAN (S)	8.0	10.0	m	HOR.-Dip (H2)	0.9	MPa
Orientation	LENGTH* (L)	45.0	45.0	m			
	DIP (D)	90.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.9	1	3.4	4.1	8.1	16.7	18.9
Vertical End	9.0	18.6	21.0	1.00	1.00	0.4	8	2.0	2.2	28.8	59.5	67.2
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.8	8	3.4	3.4	57.6	119.0	134.4
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	3.4	3.4	21.6	44.6	50.4

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-26#5U		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-25
CHECK	DTK	14-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

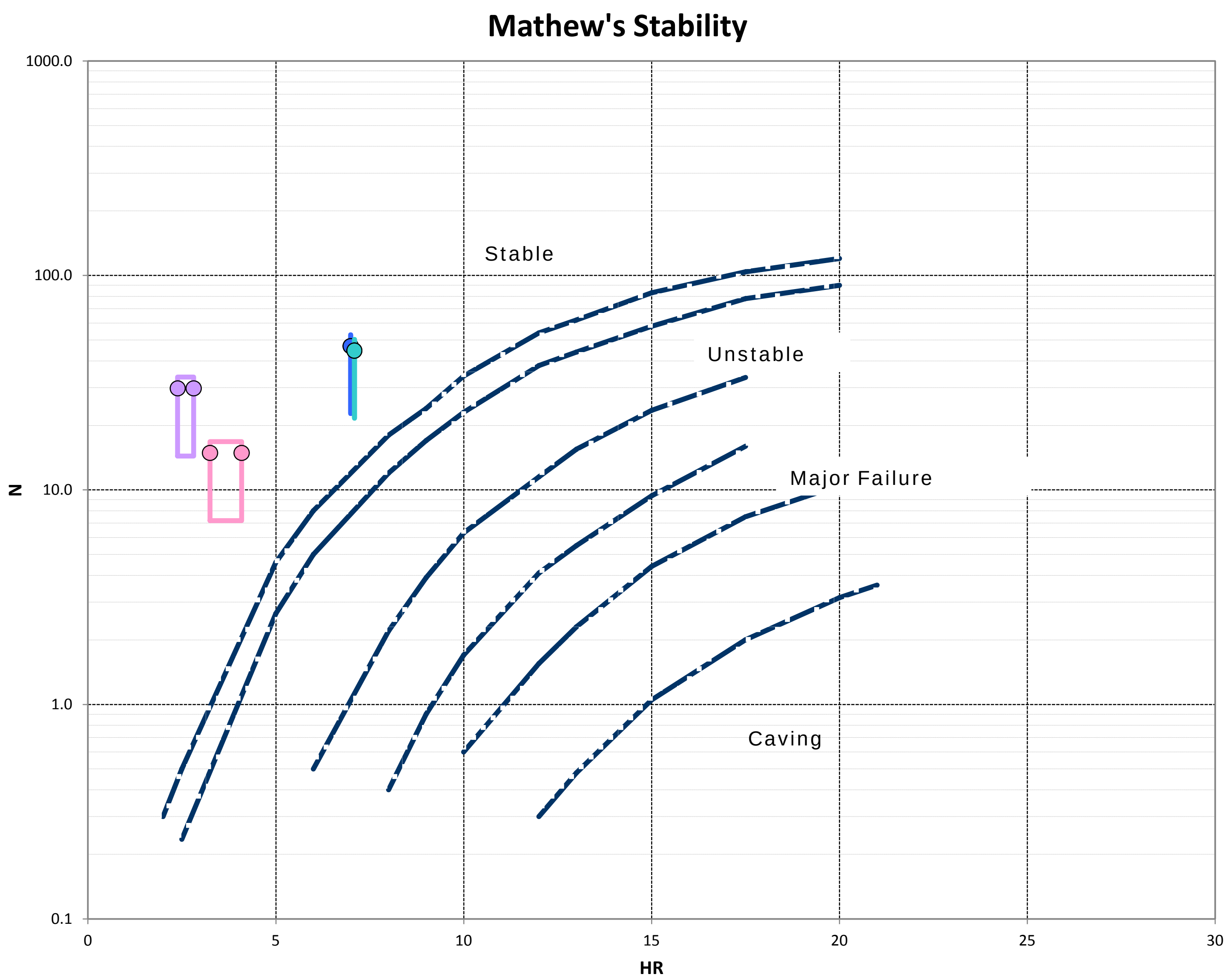
	DIMENSIONS min	max		STRESSES		
VERT HT(m)	15.0	15.0	m	VERTICAL (V)	1.2	MPa
DIP HT(m)	16.6	16.6	m	HOR.-Strike (H1)	1.8	MPa
SPAN (S)	7.0	9.0	m	HOR.-Dip (H2)	1.8	MPa
Orientation LENGTH* (L)	90.0	90.0	m			
DIP (D)	65.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	50%	80%	Amin	Amax	B	C	HR Low	High	N Low	Avg	High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	3.2	4.1	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	2.4	2.8	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.5	5	7.0	7.0	22.7	46.9	52.9
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	7.0	7.0	21.6	44.6	50.4

Comments:



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	1-26#4			
Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-26
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

		DIMENSIONS min	max		STRESSES		
	VERT HT(m)	15.0	15.0	*m*	VERTICAL (V)	1.3	*MPa*
	DIP HT(m)	26.2	26.2	*m*	HOR.-Strike (H1)	1.9	*MPa*
	SPAN (S)	4.0	5.0	*m*	HOR.-Dip (H2)	1.9	*MPa*
Orientation	LENGTH* (L)	25.0	25.0	*m*			
	DIP (D)	35.0		*deg.*	U.C.S.	175.0	*MPa*

* - along strike

Stability Numbers

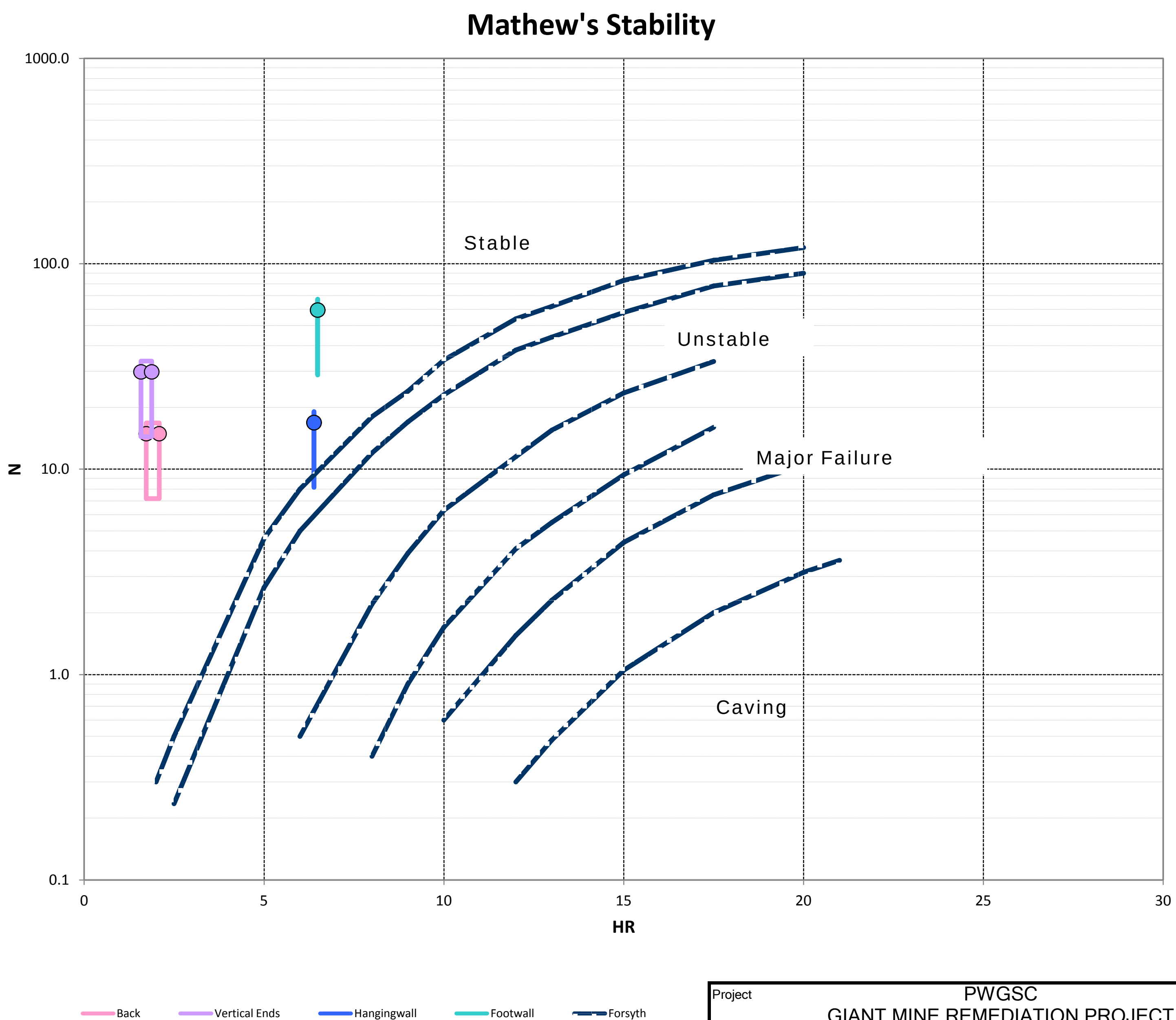
	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	1.7	2.1	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	1.6	1.9	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.4	2	6.4	6.4	8.2	16.9	19.0
Footwall	9.0	18.6	21.0	1.00	1.00	0.4	8	6.4	6.4	28.8	59.5	67.2

Comments:

Potential failure due to lack of confinement

Potential failure due to lack of confinement

Mathew's Stability



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.
Title	1-26#5

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-27
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

Orientation

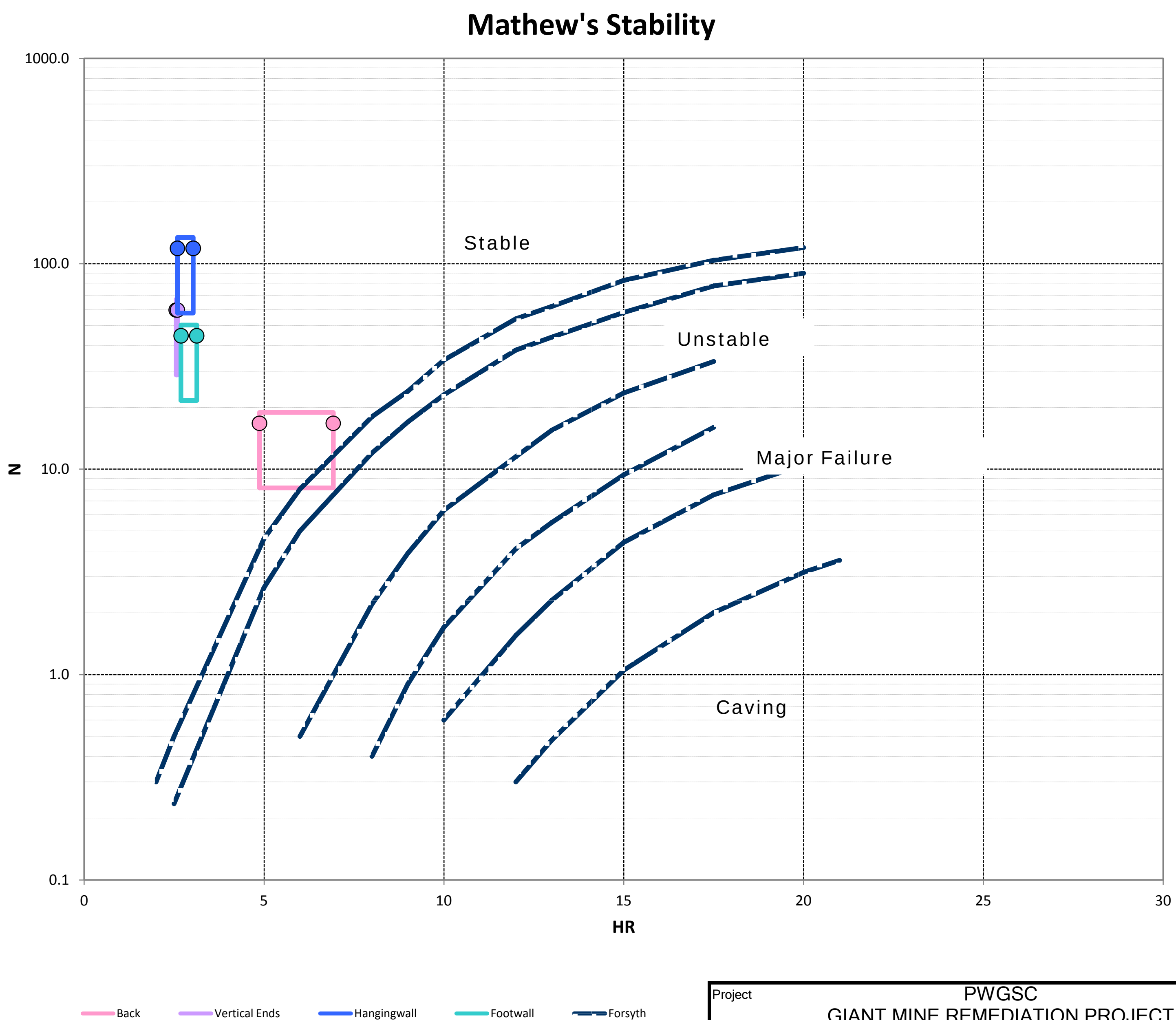
	DIMENSIONS min	DIMENSIONS max			STRESSES	
VERT HT(m)	7.0	7.0	*m*	VERTICAL (V)	0.7	*MPa*
DIP HT(m)	7.0	7.0	*m*	HOR.-Strike (H1)	1.0	*MPa*
SPAN (S)	19.0	20.0	*m*	HOR.-Dip (H2)	1.0	*MPa*
LENGTH* (L)	20.0	45.0	*m*			
DIP (D)	90.0		*deg.*	U.C.S.	175.0	*MPa*

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.9	1	4.9	6.9	8.1	16.7	18.9
Vertical End	9.0	18.6	21.0	1.00	1.00	0.4	8	2.6	2.6	28.8	59.5	67.2
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.8	8	2.6	3.0	57.6	119.0	134.4
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	2.6	3.0	21.6	44.6	50.4

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.	
Title	1-38 Upper	

Golder Associates

PROJECT No.	09-1427-0006		Phase/Task No.	6000-6200
RUN	ALP	14-Nov-11	Figure No. B-28	
CHECK	DTK	14-Nov-11		
REVIEW	0.00	0-Jan-00		

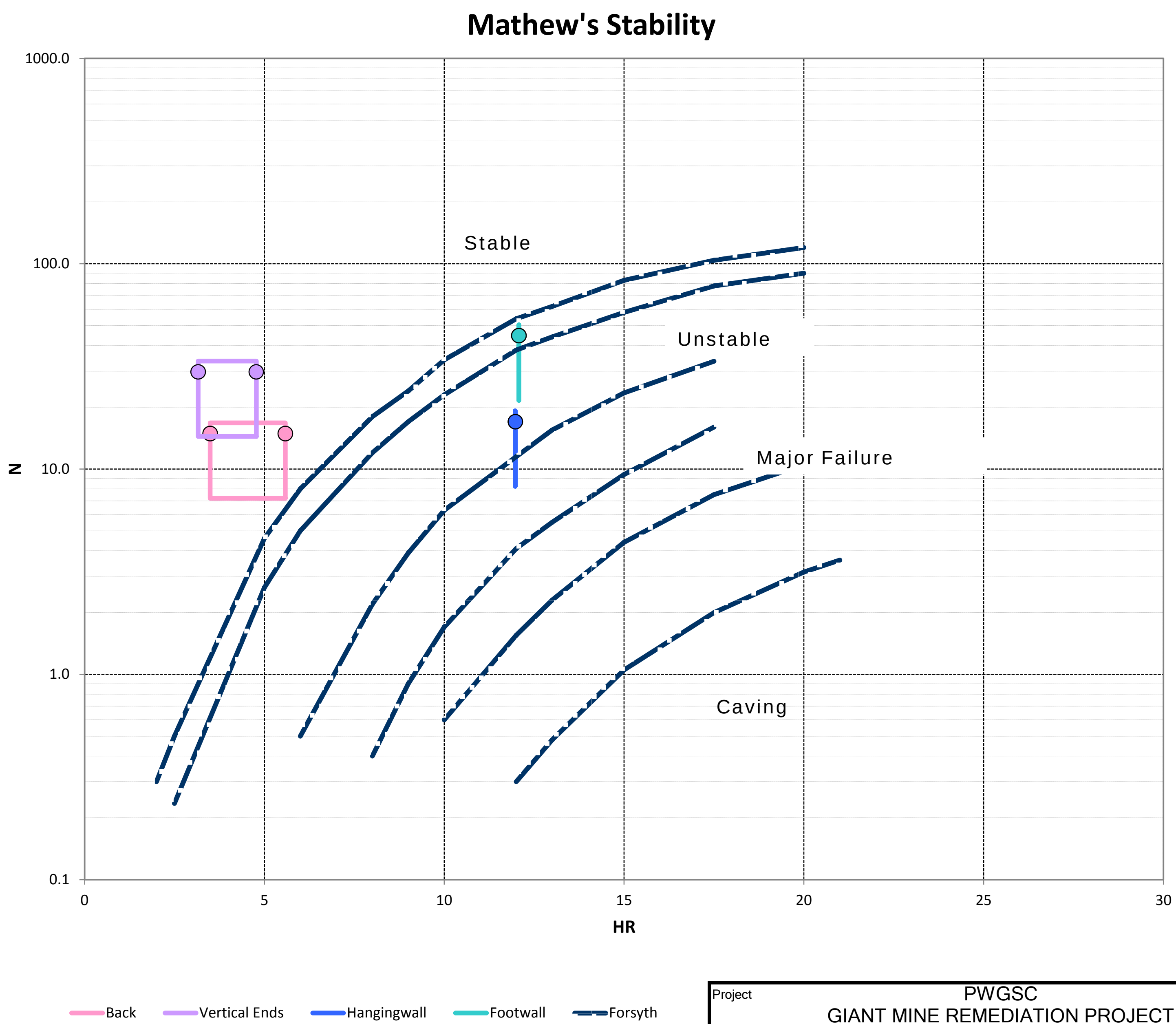
STOPE INPUT DATA	DIMENSIONS	min	max		STRESSES		
	VERT HT(m)	30.0	30.0	m	VERTICAL (V)	1.2	MPa
	DIP HT(m)	42.4	42.4	m	HOR.-Strike (H1)	1.9	MPa
	SPAN (S)	14.0	8.0	m	HOR.-Dip (H2)	1.9	MPa
Orientation	LENGTH* (L)	55.0	55.0	m			
	DIP (D)	45.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	5.6	3.5	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	4.8	3.2	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.3	3	12.0	12.0	8.2	17.0	19.2
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	12.0	12.0	21.6	44.6	50.4

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	1-38 Lower			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-29
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

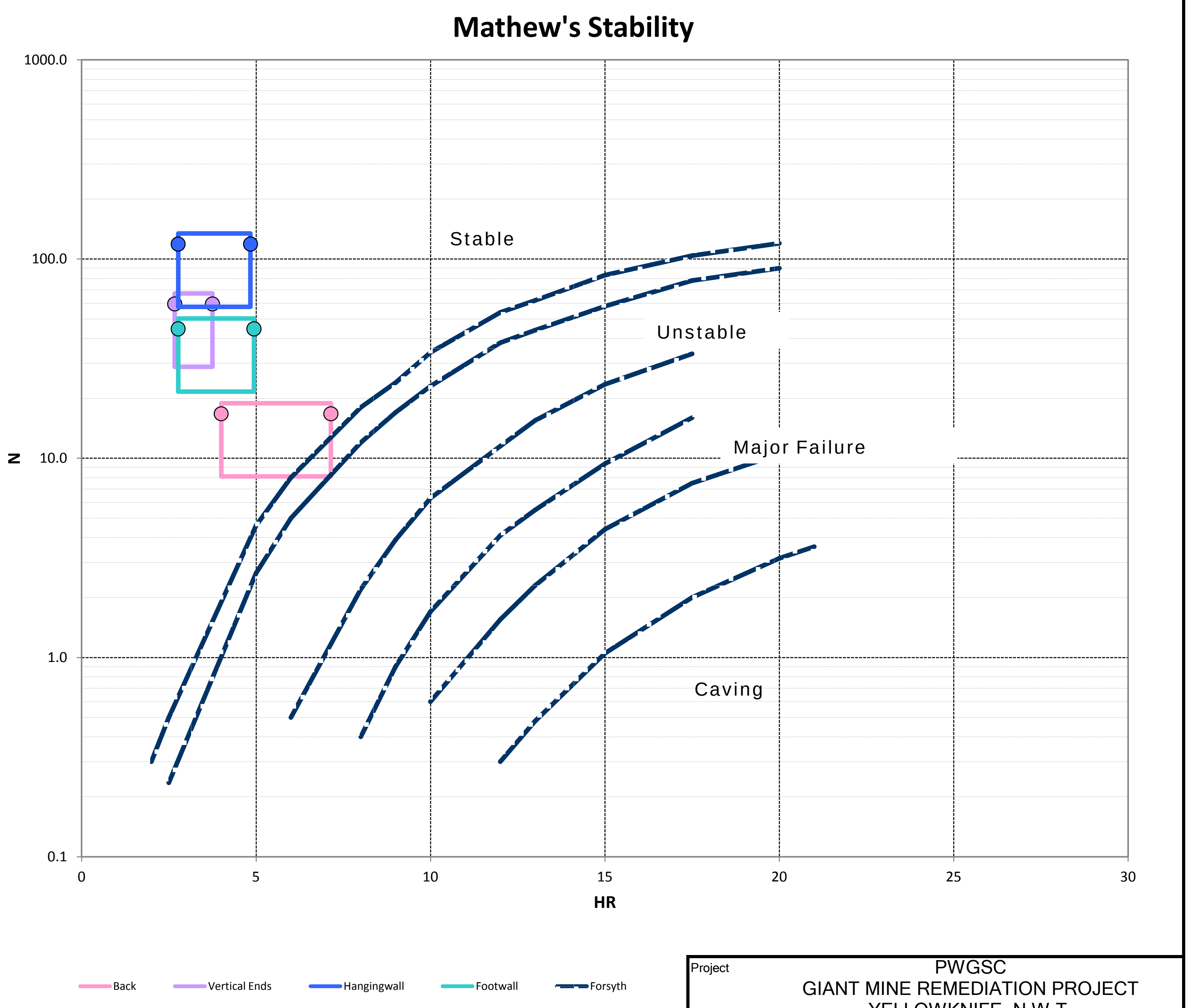
		DIMENSIONS			STRESSES		
STOPE INPUT DATA		min	max				
	VERT HT(m)	8.0	12.0	m	VERTICAL (V)	0.6	MPa
	DIP HT(m)	8.0	12.0	m	HOR.-Strike (H1)	0.9	MPa
	SPAN (S)	16.0	20.0	m	HOR.-Dip (H2)	0.9	MPa
Orientation	LENGTH* (L)	16.0	50.0	m			
	DIP (D)	90.0		deg.	U.C.S.	175.0	MPa

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.9	1	4.0	7.1	8.1	16.7	18.9
Vertical End	9.0	18.6	21.0	1.00	1.00	0.4	8	2.7	3.8	28.8	59.5	67.2
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.8	8	2.7	4.8	57.6	119.0	134.4
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	2.7	4.8	21.6	44.6	50.4

Comments:



Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	1-43#1			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-30
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 14-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App B - non ars mathews dec 7 2011.xlsm

STOPE INPUT DATA

DIMENSIONS

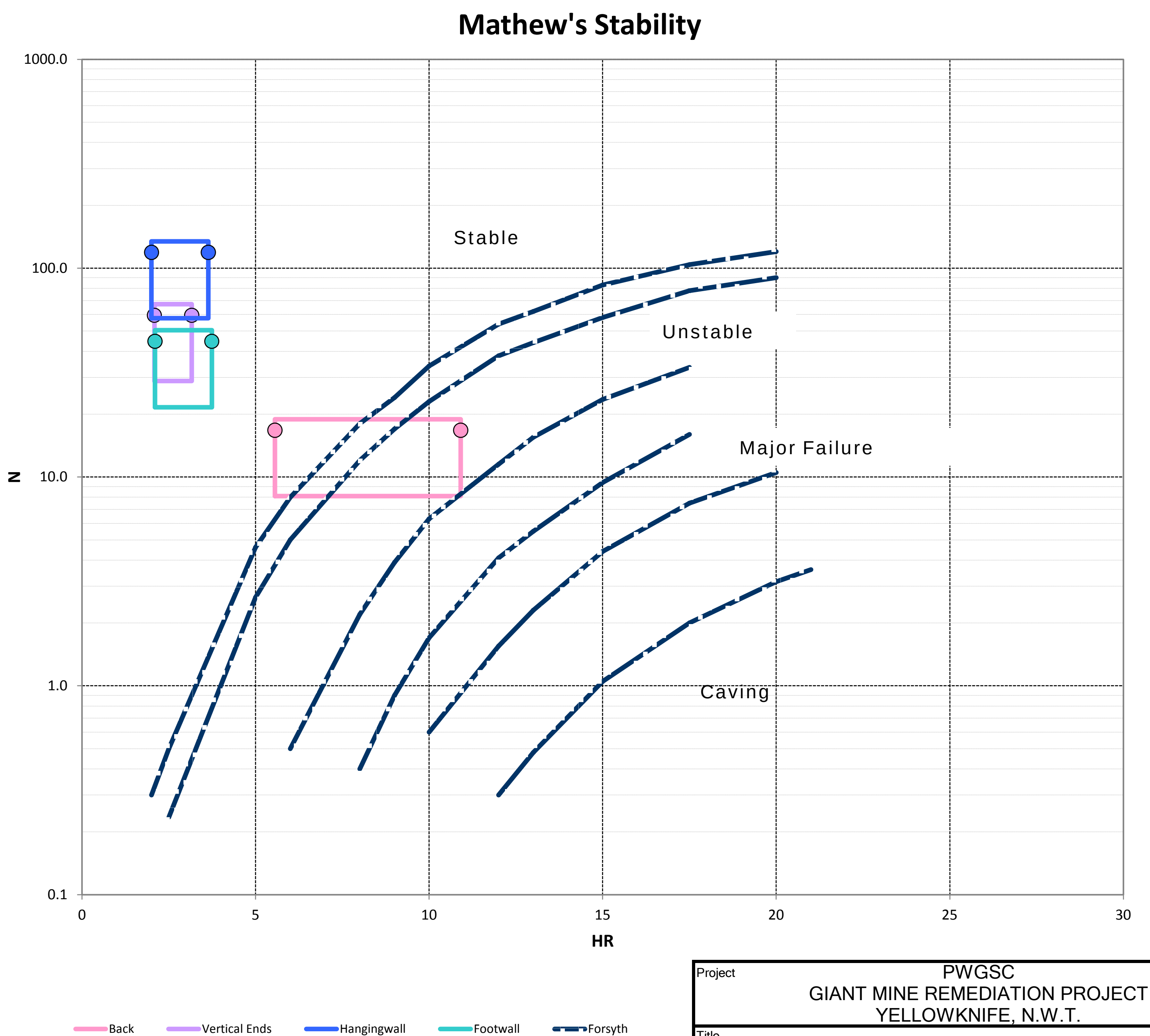
		min	max			STRESSES		
	VERT HT(m)	5.0	8.0	*m*	VERTICAL (V)	0.9	*MPa*
	DIP HT(m)	5.0	8.0	*m*	HOR.-Strike (H1)	1.3	*MPa*
	SPAN (S)	25.0	30.0	*m*	HOR.-Dip (H2)	1.3	*MPa*
Orientation	LENGTH* (L)	20.0	80.0	*m*			
	DIP (D)	90.0		*deg.*	U.C.S.	175.0	*MPa*

* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.9	1	5.6	10.9	8.1	16.7	18.9
Vertical End	9.0	18.6	21.0	1.00	1.00	0.4	8	2.1	3.2	28.8	59.5	67.2
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.8	8	2.0	3.6	57.6	119.0	134.4
Footwall	9.0	18.6	21.0	1.00	1.00	0.3	8	2.0	3.6	21.6	44.6	50.4

Comments:



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.			
Title	1-43 Upper			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN	ALP	14-Nov-11	Figure No. B-31
	CHECK	DTK	14-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE INPUT DATA

	DIMENSIONS min	max		STRESSES		
VERT HT(m)	20.0	35.0	m	VERTICAL (V)	1.5	MPa
DIP HT(m)	34.9	61.0	m	HOR.-Strike (H1)	2.3	MPa
SPAN (S)	6.0	10.0	m	HOR.-Dip (H2)	2.3	MPa
LENGTH* (L)	20.0	100.0	m			
DIP (D)	35.0		deg.	U.C.S.	175.0	MPa

Orientation

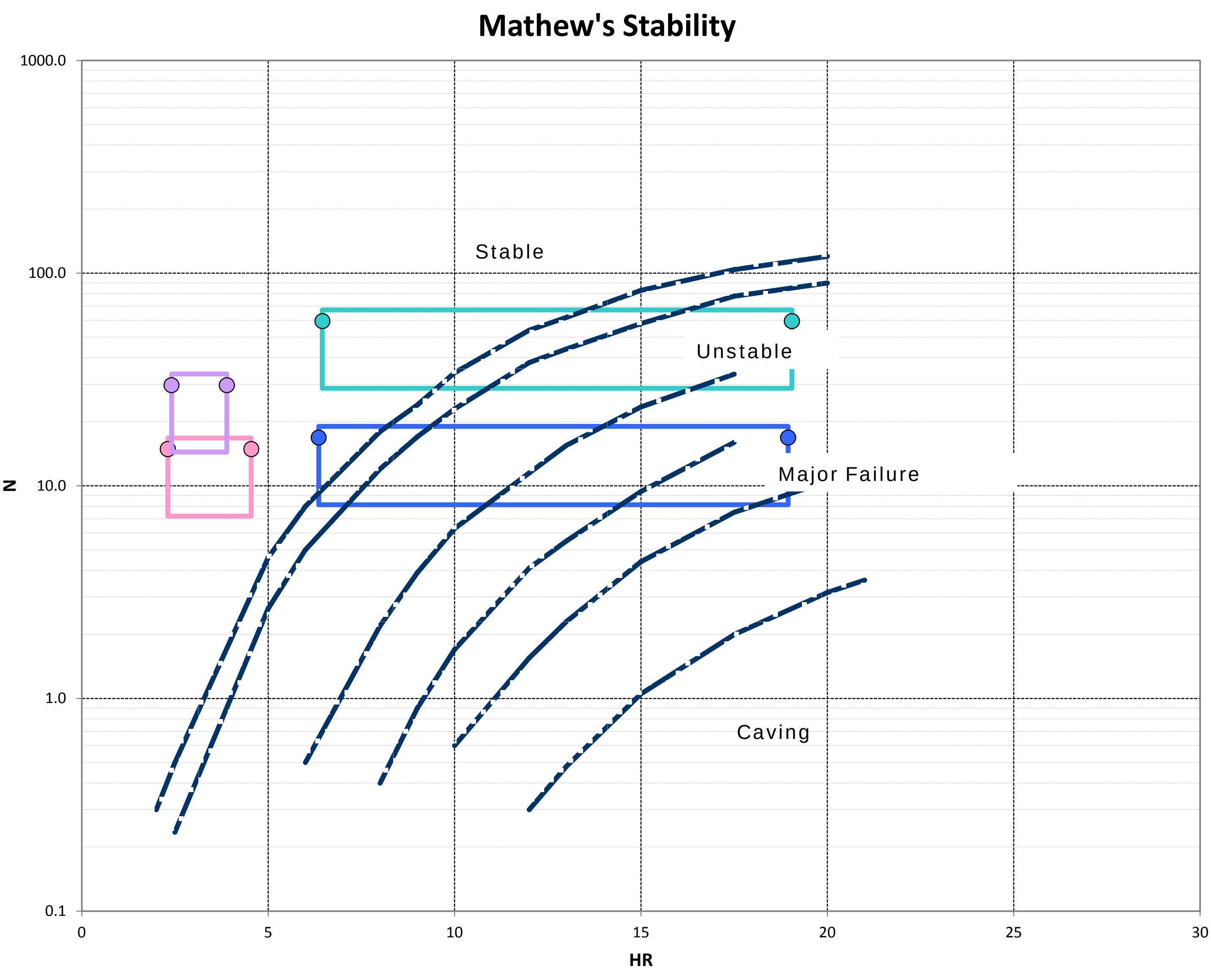
* - along strike

Stability Numbers

	Q' 20%	Q' 50%	Q' 80%	Amin	Amax	B	C	HR Low	HR High	N Low	N Avg	N High
Back	9.0	18.6	21.0	1.00	1.00	0.8	1	2.3	4.5	7.2	14.9	16.8
Vertical End	9.0	18.6	21.0	1.00	1.00	0.2	8	2.3	3.9	14.4	29.8	33.6
Hangingwall	9.0	18.6	21.0	1.00	1.00	0.4	2	6.4	18.9	8.2	16.9	19.0
Footwall	9.0	18.6	21.0	1.00	1.00	0.4	8	6.4	18.9	28.8	59.5	67.2

Comments:

Potential failure due to lack of confinement
Potential failure due to lack of confinement



Max
Average
Min

Range of stabilty number

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.		
Title	1-43 Lower		
Golder Associates	PROJECT No. 09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	14-Nov-11
	CHECK	DTK	14-Nov-11
	REVIEW	0.00	0-Jan-00
	Figure No. B-32		

APPENDIX C

Non-Arsenic Carter Crown Pillar Stability Assessment

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

DWC	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	70.0	6.5	2.8	70.0	0.0	0.0	3.1	2.1	2.5		25	38	53
Average	70.0	4.0	5.5	70.0	0.0	0.0	3.1	2.1	2.5		25	38	46

Rock Crown Thickness

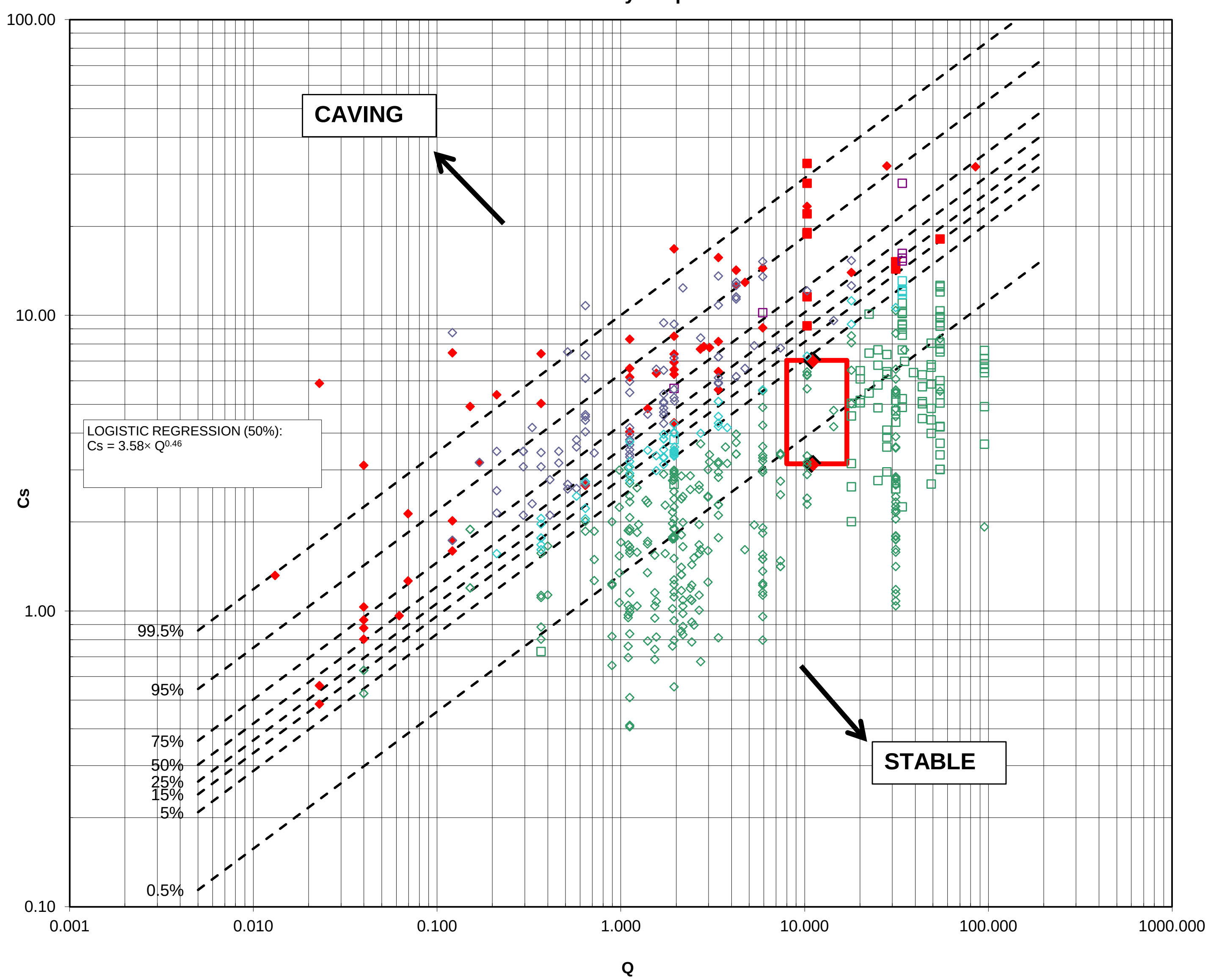
2.8	m
5.5	m

* Note stope is partly broken though near locaiton of thinnest crown in cross-sections

Factor of Safety | **Probability of Failure**

DWC	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	7.04	8.16	9.41	11.45	1.16	1.34	1.63	40.4%	31.0%	18.9%
Average	8.0	11.0	17.0	3.14	8.16	9.41	11.45	2.60	2.99	3.64	2.1%	0.7%	0.1%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
DWC

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit DWC Stope

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-1
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01 N	Dip*	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90	12	37	25	5	0	3.1	2.1	2.5		25	38	49
Average	90	11	34	20	4	0	3.1	2.1	2.5		25	38	44

Rock Crown Thickness

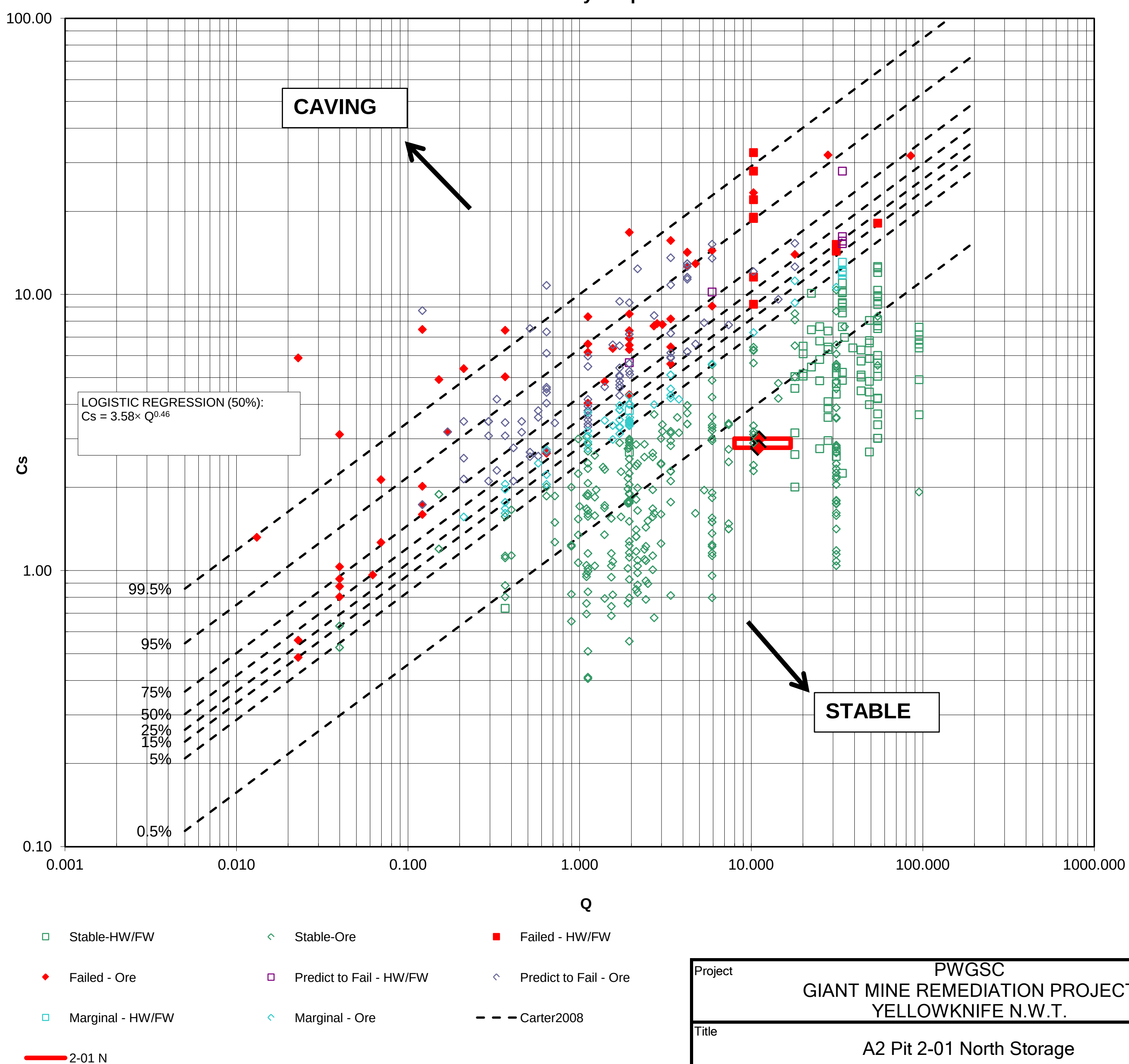
32.0	m
30.0	m

*Dip of orebody shallower here, but stope walls effectively 90 degrees

Factor of Safety | **Probability of Failure**

2-01 N	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	3.00	8.16	9.41	11.45	2.72	3.13	3.81	1.5%	0.4%	0.0%
Average	8.0	11.0	17.0	2.79	8.16	9.41	11.45	2.93	3.38	4.11	0.8%	0.2%	0.0%

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.		
Title	A2 Pit 2-01 North Storage		

Golder Associates

PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200
RUN ALP	19-Nov-11	Figure No. C-2
CHECK DTK	21-Nov-11	
REVIEW 0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45	20	37	30	3	0	3.1	2.1	2.5		25	38	66
Average	40	14	38	35	2	0	3.1	2.1	2.5		25	38	58

Rock Crown Thickness

34	m
36	m

*Crown stability influenced by hangingwall span, need to check if stope is backfilled

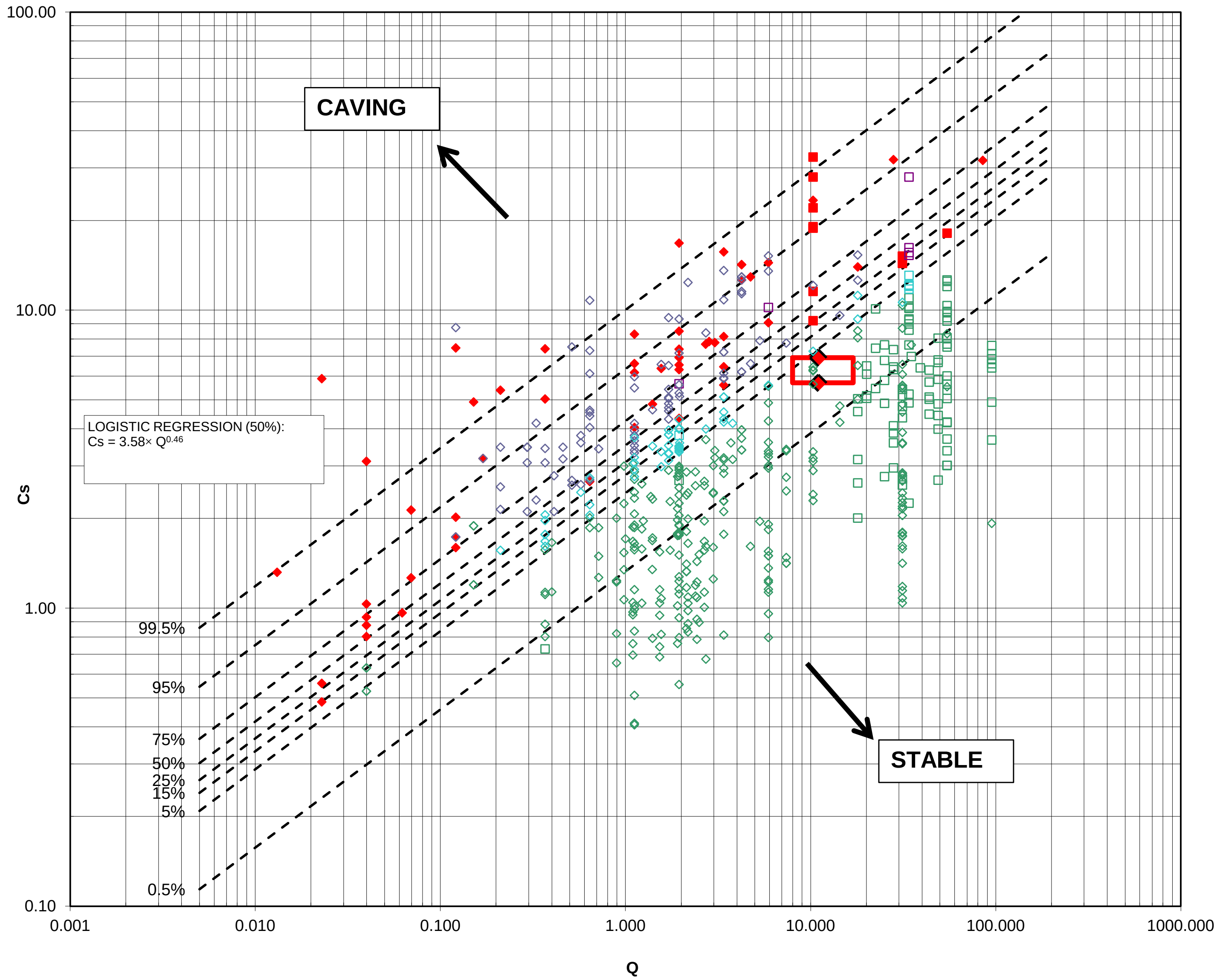
** Stability of stope back only is

Factor of Safety **Probability of Failure**

2-01	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	8.0	11.0	17.0	6.92	8.16	9.41	11.45	1.15	1.34	1.66	40.7%	30.6%	17.9%	OK	OK	OK
Average	8.0	11.0	17.0	5.70	8.16	9.41	11.45	1.40	1.63	2.01	27.9%	18.8%	8.8%	OK	OK	OK

90° dip = 1.4%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

2-01

Max / Average / Min — **Range of rock mass quality (Q)**

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	A2 Pit 2-01 Stope			
Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-3
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01*	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45	20	37	60	3	0	3.1	2.1	2.5		25	38	66
Average	40	20	38	35	2	0	3.1	2.1	2.5		25	38	58

Rock Crown Thickness

34	m
36	m

*This is a check on behaviour if pillars are not intact

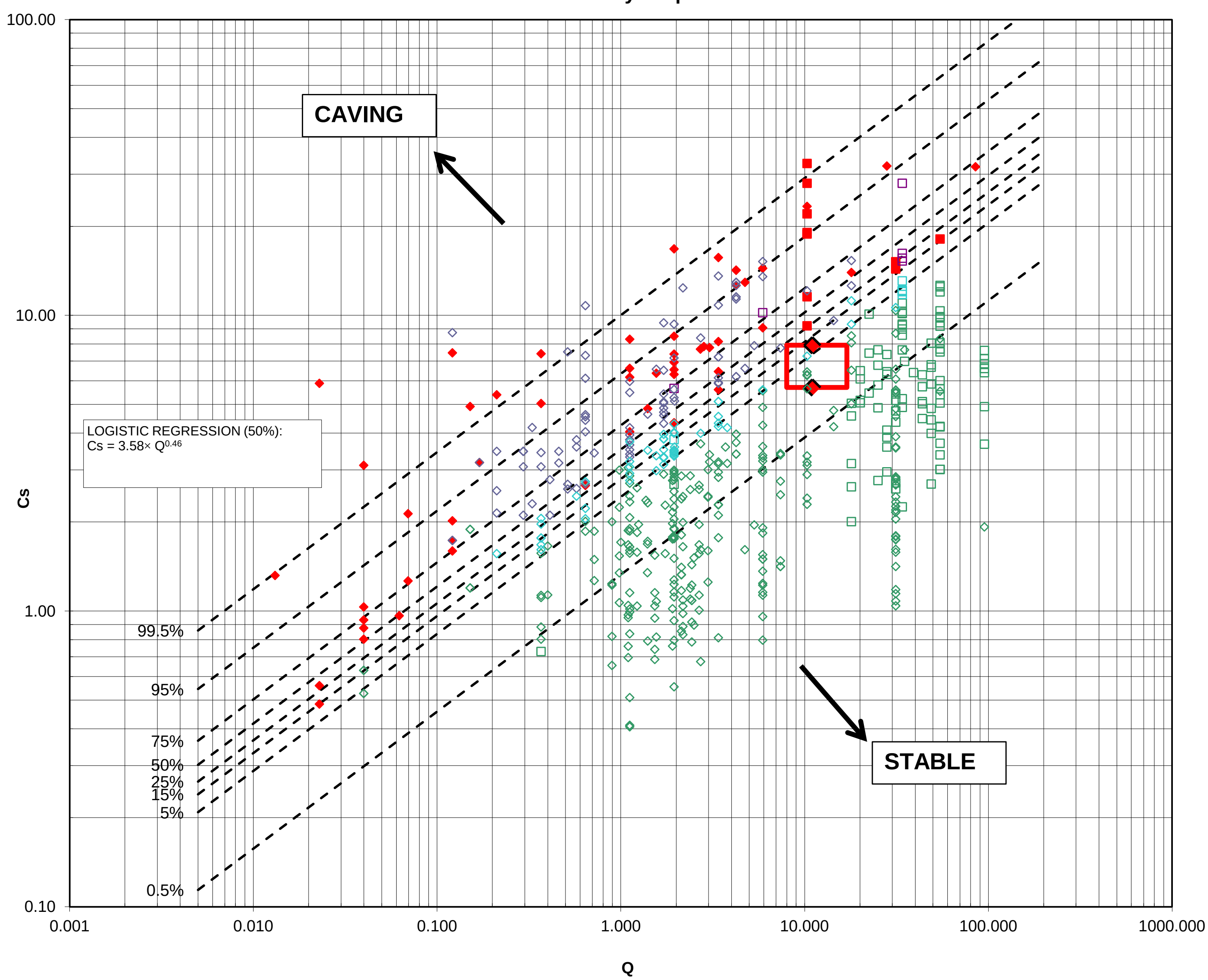
**Condition is slightly better if we check only the crown pillar stabiity over the back, thus includes the hangingwall

Factor of Safety **Probability of Failure**

2-01*	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	8.0	11.0	17.0	7.92	8.16	9.41	11.45	1.01	1.17	1.45	49.8%	39.7%	25.9%	OK	OK	OK
Average	8.0	11.0	17.0	5.70	8.16	9.41	11.45	1.40	1.63	2.01	27.9%	18.8%	8.8%	OK	OK	OK

90° dip = 7.4%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

2-01*

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.		
Title	A2 Pit 2-01 (Check with no pillars)		

Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-4
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01 NFW	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	85	7	28	30	5	0.0	3.1	2.1	2.5		25	38	35
Average	85	6	25	30	4	0.0	3.1	2.1	2.5		25	38	32

Rock Crown Thickness

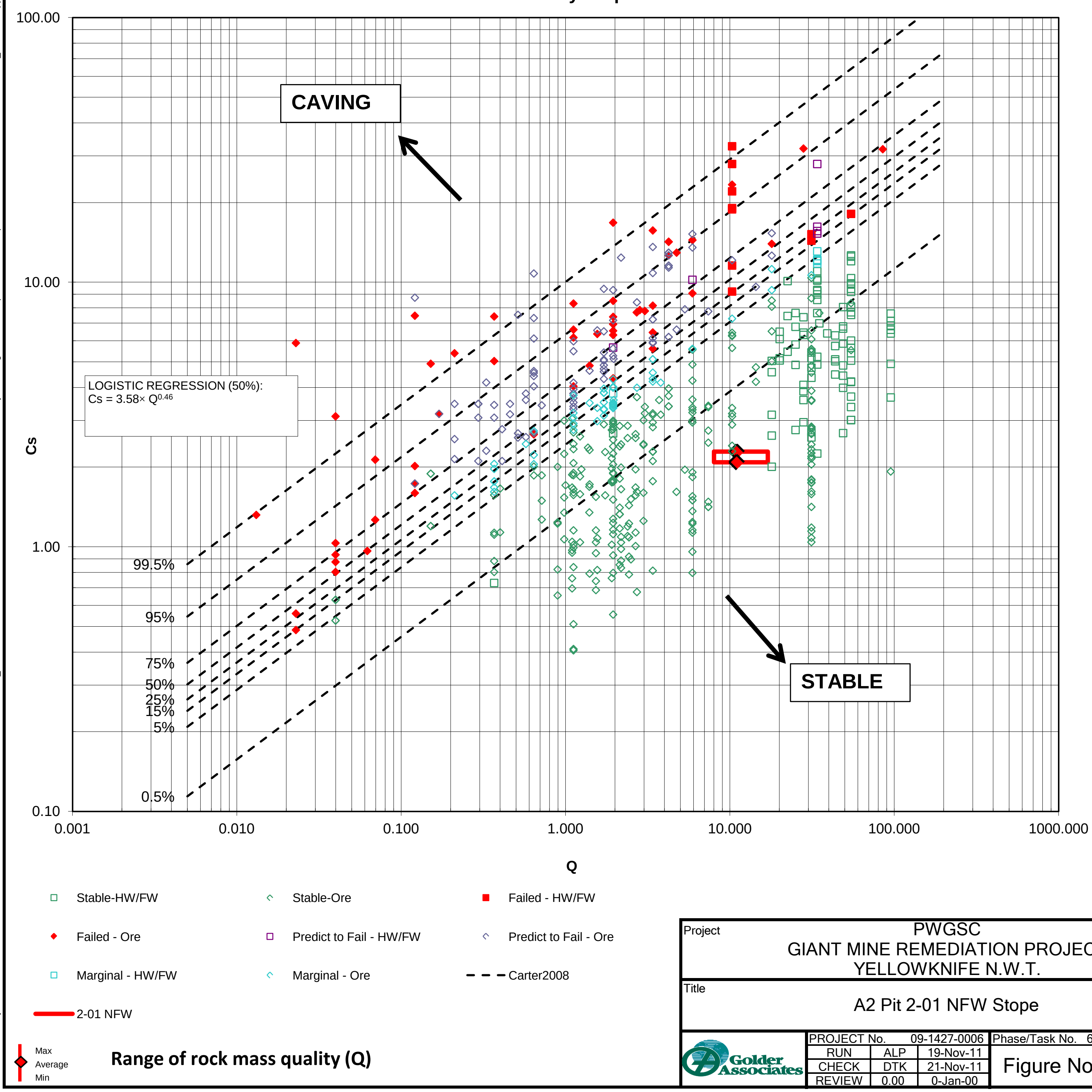
23	m
21	m

Need to check if stope backfilled

Factor of Safety | **Probability of Failure**

2-01 NFW	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	2.29	8.16	9.41	11.45	3.57	4.11	5.01	0.1%	0.0%	0.0%
Average	8.0	11.0	17.0	2.09	8.16	9.41	11.45	3.91	4.51	5.49	0.0%	0.0%	0.0%

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit 2-01 NFW Stope

Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200
	RUN ALP	19-Nov-11	Figure No. C-5
	CHECK DTK	21-Nov-11	
	REVIEW 0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

3-02	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	79	35	38	45	0	0	3.1	2.1	2.5		25	38	108
Average	70	20	38	45	0	0	3.1	2.1	2.5		25	38	88

Rock Crown Thickness

38	m
38	m

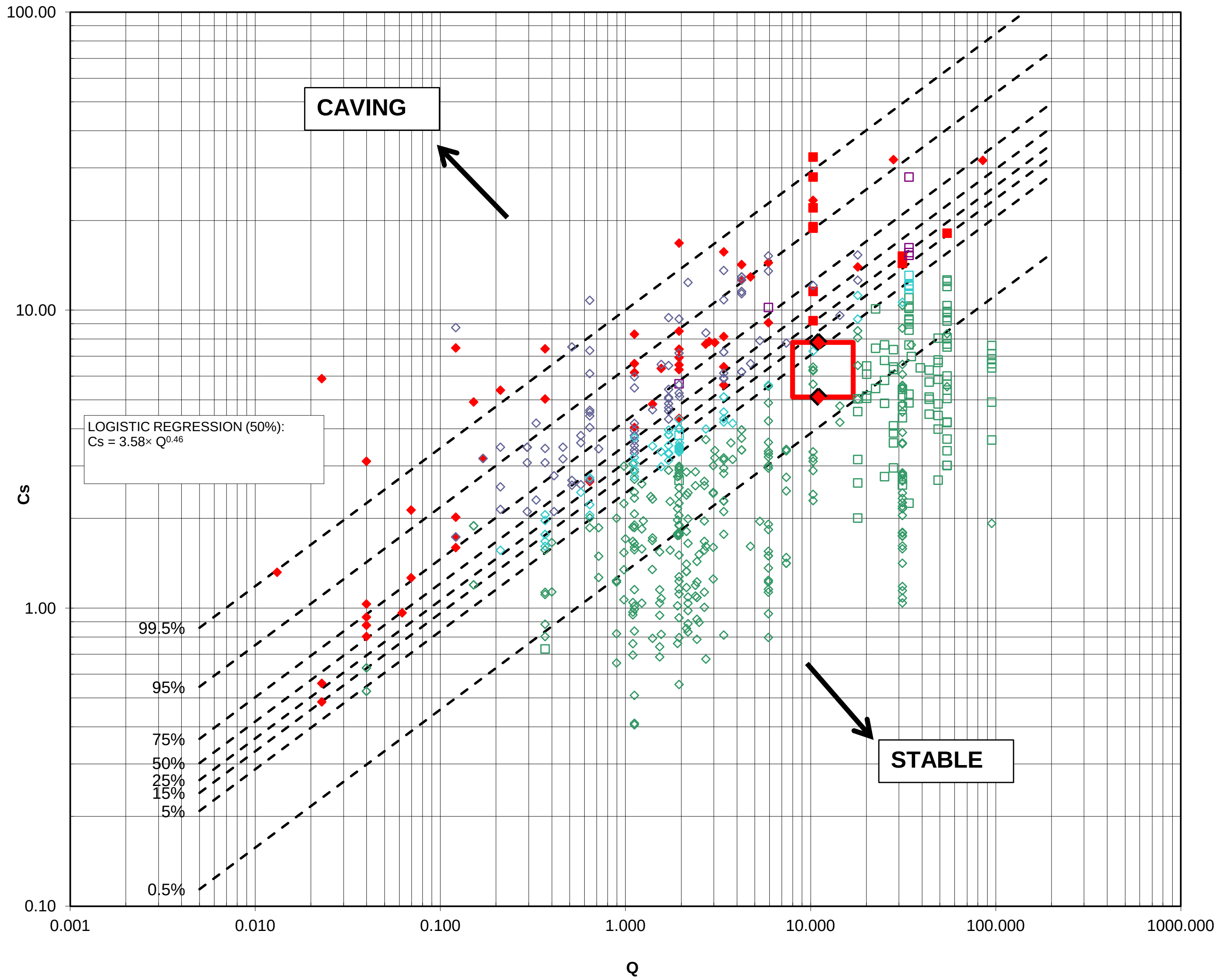
*Check if stope backfilled.

*Thinner wedge below pit should be checked

Factor of Safety | **Probability of Failure**

3-02	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	7.80	8.16	9.41	11.45	1.05	1.21	1.47	47.2%	37.7%	24.9%
Average	8.0	11.0	17.0	5.12	8.16	9.41	11.45	1.60	1.84	2.24	20.0%	12.6%	5.2%

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	A2 Pit 3-02			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200	
	RUN	ALP	19-Nov-11	Figure No. C-6
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

3-01	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	33	25	47	45	5	0	3.1	2.1	2.5		25	38	67
Average	50	20	47	45	2	0	3.1	2.1	2.5		25	38	61

Rock Crown Thickness

42	m
45	m

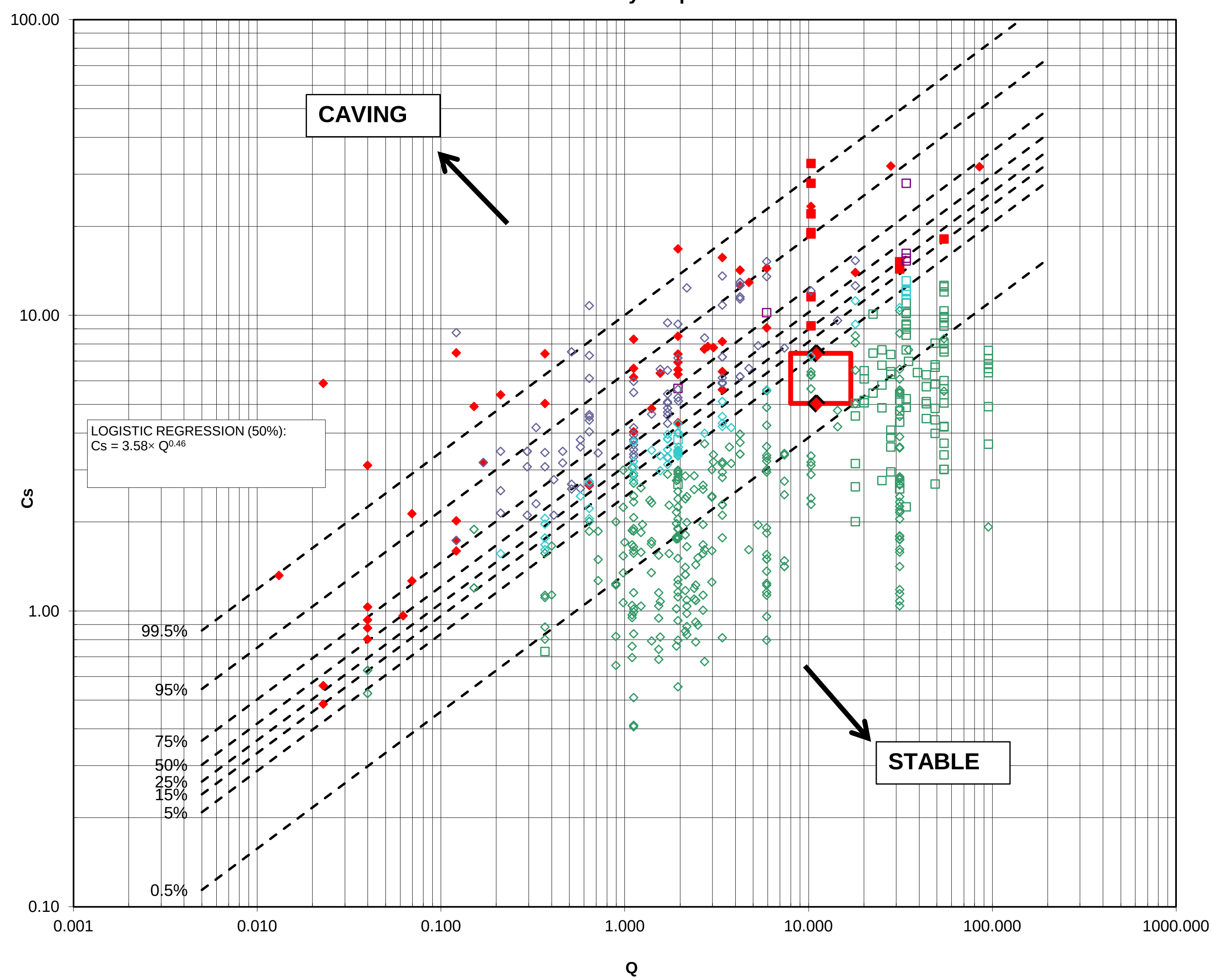
*Condition is slightly worse over hangingwall due to moderate dipping stope
*Check if stope backfilled, failure would chocke off quickly.

Factor of Safety | **Probability of Failure**

3-01	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	8.0	11.0	17.0	7.43	8.16	9.41	11.45	1.08	1.25	1.54	45.2%	35.2%	22.0%	OK	OK	OK
Average	8.0	11.0	17.0	5.03	8.16	9.41	11.45	1.62	1.87	2.28	19.0%	11.8%	4.8%			

Check if stope backfilled

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
3-01

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit 3-01

Golder Associates

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-7
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01 #3	Dip*	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90	14	22	19	9	0	3.1	2.1	2.5		25	38	52
Average	90	12	19	18	5	0	3.1	2.1	2.5		25	38	49

Rock Crown Thickness

13	m
14	m

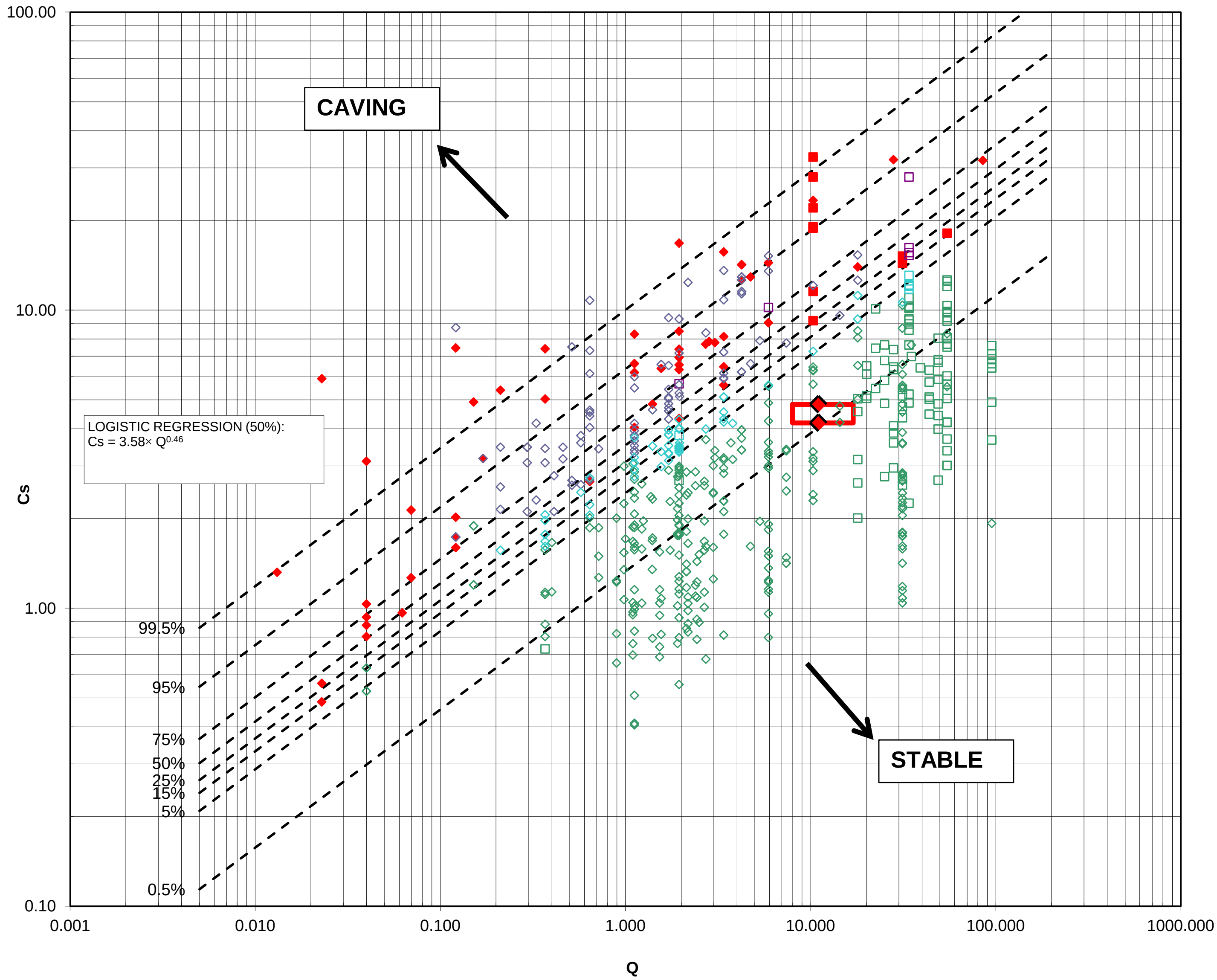
*Dip is flat here but walls are steep so checked as a vertical stope, this is a true check on crown stability

*Check if stope backfilled, pillar stability is questionable

Factor of Safety | **Probability of Failure**

2-01 #3	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	4.83	8.16	9.41	11.45	1.69	1.95	2.37	16.8%	10.1%	3.8%
Average	8.0	11.0	17.0	4.18	8.16	9.41	11.45	1.95	2.25	2.74	10.0%	5.1%	1.4%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

2-01 #3

Max / Average / Min — **Range of rock mass quality (Q)**

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit 2-01 #3 Stope

Golder Associates

PROJECT No.	09-1427-0006		Phase/Task No.	6000-6200
RUN	ALP	19-Nov-11	Figure No. C-8	
CHECK	DTK	21-Nov-11		
REVIEW	0.00	0-Jan-00		

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-01 #3*	Dip**	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90	40	22	45	9	0	3.1	2.1	2.5		25.0	37.5	52
Average	90	20	21	35	5	0	3.1	2.1	2.5		25.0	37.5	51

Rock Crown Thickness

13	m
16	m

*If pillars are conpromised, stope span is larger

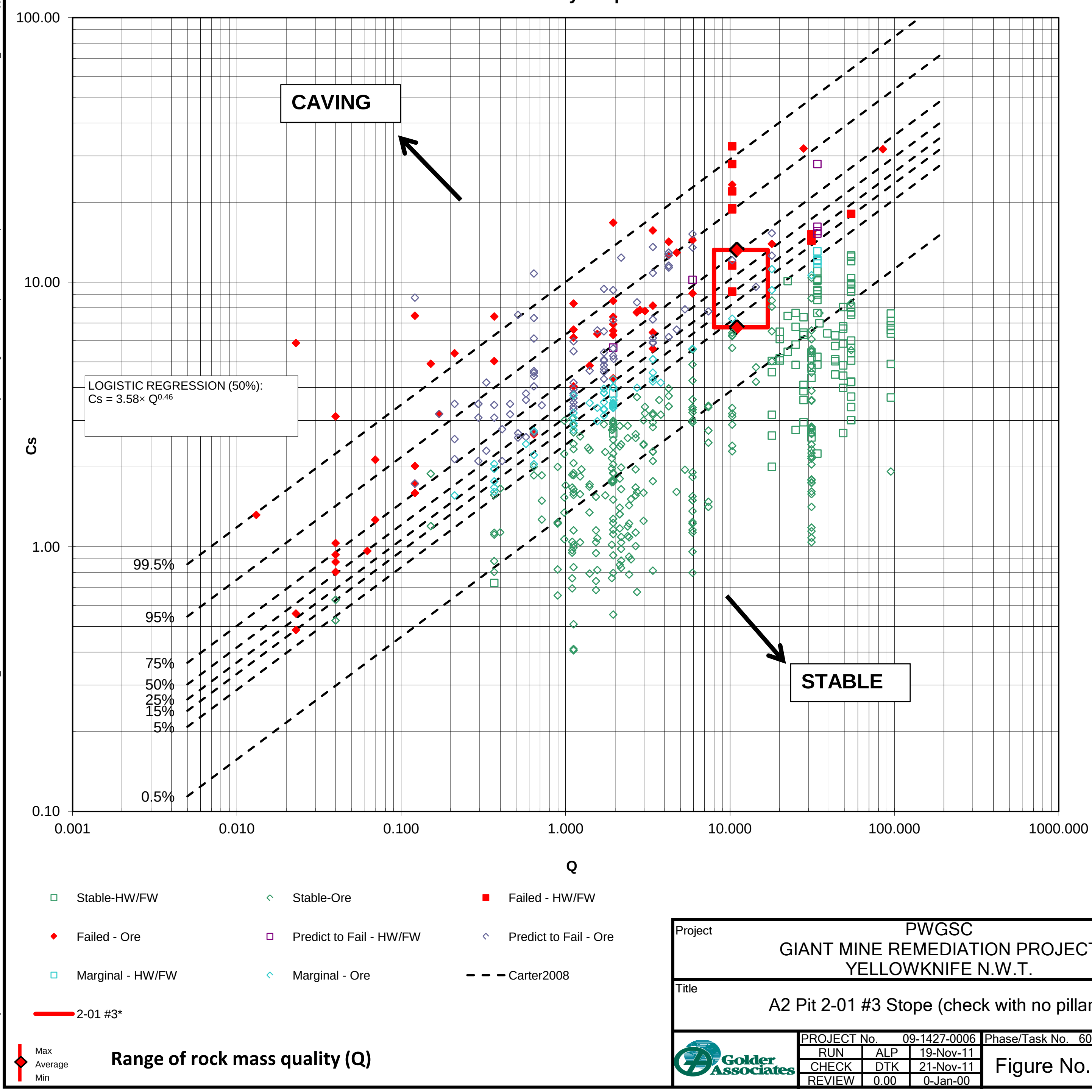
**Dip is flat here but walls are steep so checked as a vertical stope

***Check if stope backfilled

Factor of Safety | **Probability of Failure**

2-01 #3*	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	11.0	17.0	13.24	8.16	9.41	11.45	0.62	0.71	0.86	78.1%	70.8%	59.4%
Average	8.0	11.0	17.0	6.75	8.16	9.41	11.45	1.21	1.39	1.70	37.5%	28.2%	16.5%

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit 2-01 #3 Stope (check with no pillars)

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-9
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA

Specific Gravity

ADDITIONAL INPUT DATA FOR STOPES <50°

2-02	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45	18	45	45	0	0	3.1	2.1	2.5		25	38	65
Average	50	12	55	45	0	0	3.1	2.1	2.5		25	38	75

Rock Crown Thickness

45	m
55	m

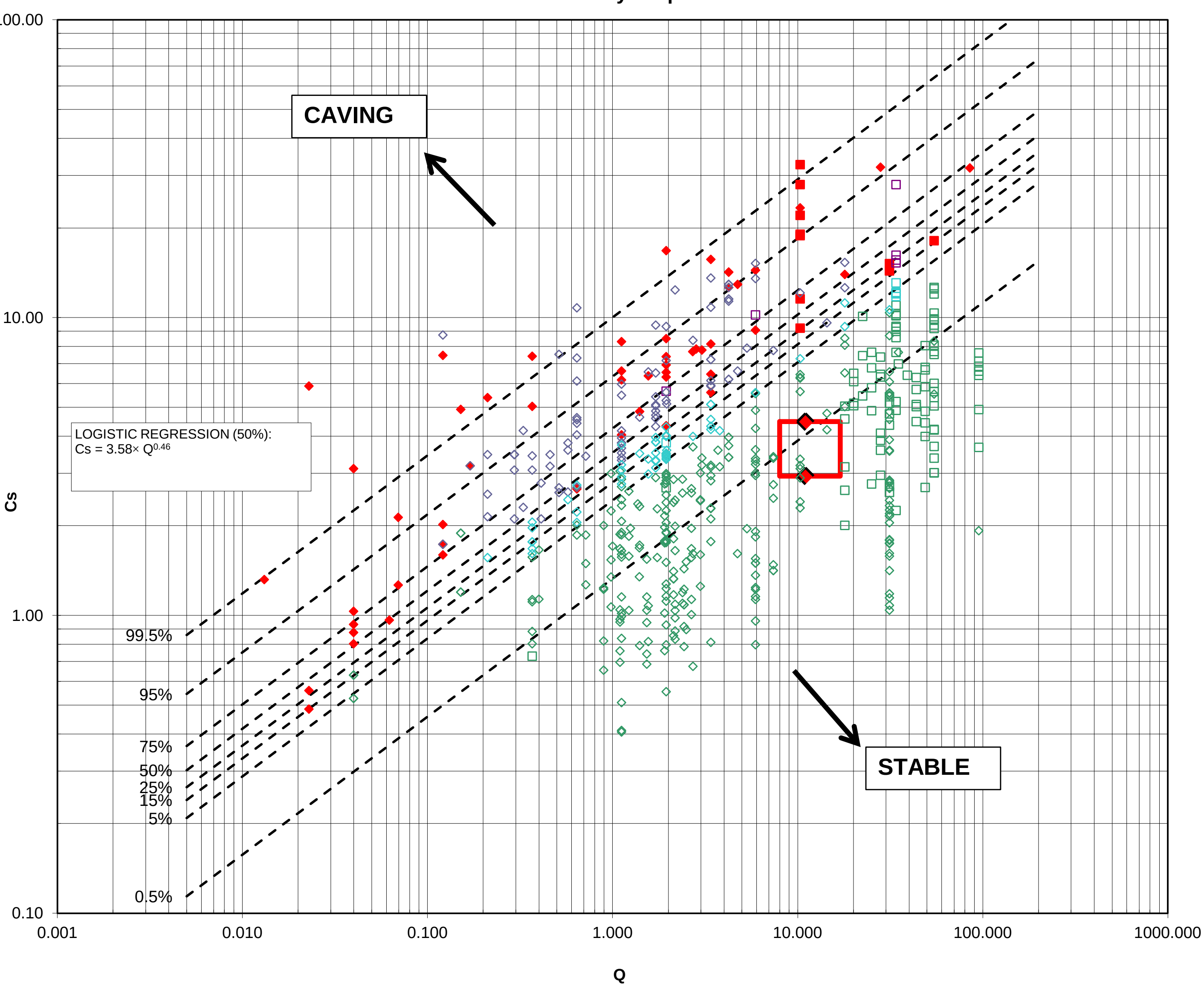
*Failure would likely choke off quickly

Factor of Safety

Probability of Failure

2-02	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	8.0	11.0	17.0	4.47	8.16	9.41	11.45	1.78	2.07	2.56	14.1%	7.6%	2.3%	OK	OK	OK
Average	8.0	11.0	17.0	2.94	8.16	9.41	11.45	2.78	3.20	3.90	1.3%	0.3%	0.0%			

Crown Stability Graph



Stable-HW/FW
Stable-Ore
Failed - HW/FW
Failed - Ore
Predict to Fail - HW/FW
Predict to Fail - Ore
Marginal - HW/FW
Marginal - Ore
Carter2008
2-02

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A2 Pit 2-02 Stope

Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-10
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

3-70	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	80	15.0	18	85	3	0	3.1	2.1	2.5				123.00
Average	80	9.5	18	85	4	0	3.1	2.1	2.5				123.00

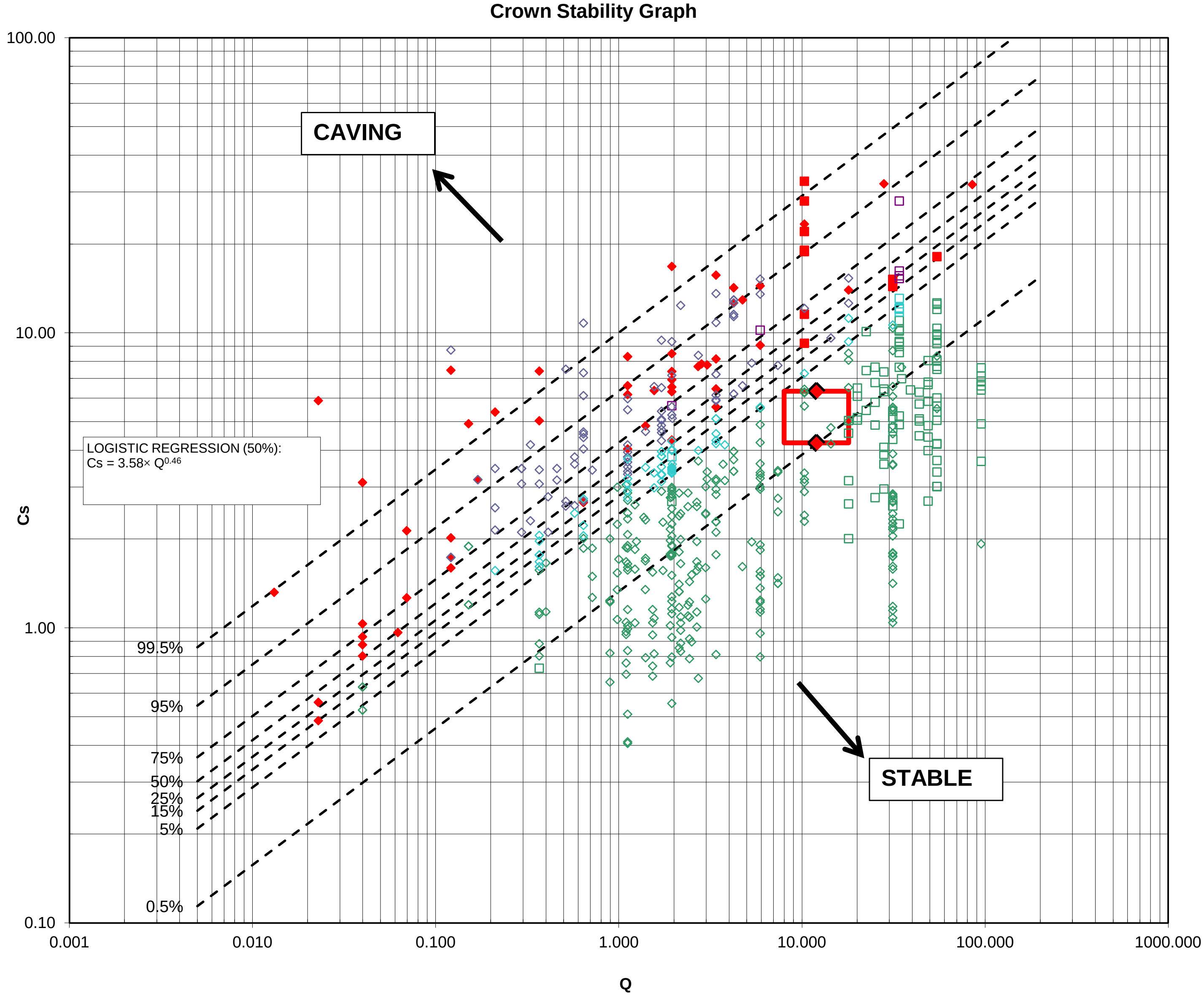
Rock Crown Thickness	
15.0	m
14.0	m

*Crown pillar may be slightly thinner in south

Factor of Safety | **Probability of Failure**

3-70	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	8.0	12.0	18.0	6.34	8.16	9.78	11.76	1.29	1.54	1.85	33.4%	21.9%	12.2%
Average	8.0	12.0	18.0	4.23	8.16	9.78	11.76	1.93	2.31	2.78	10.5%	4.4%	1.3%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

3-70

Max / Average / Min — **Range of rock mass quality (Q)**

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	A1 Pit 3-70 Stope

Golder Associates				
PROJECT No.	09-1427-0006		Phase/Task No.	6000-6200
RUN	ALP	19-Nov-11	Figure No. C-11	
CHECK	DTK	21-Nov-11		
REVIEW	0.00	0-Jan-00		

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-19	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	80.0	5.0	0.5	35.0	0.0	0.0	3.1	2.1	2.5				35.50
Average	80.0	3.0	3.0	35.0	0.0	0.0	3.1	2.1	2.5				38.00

Rock Crown Thickness

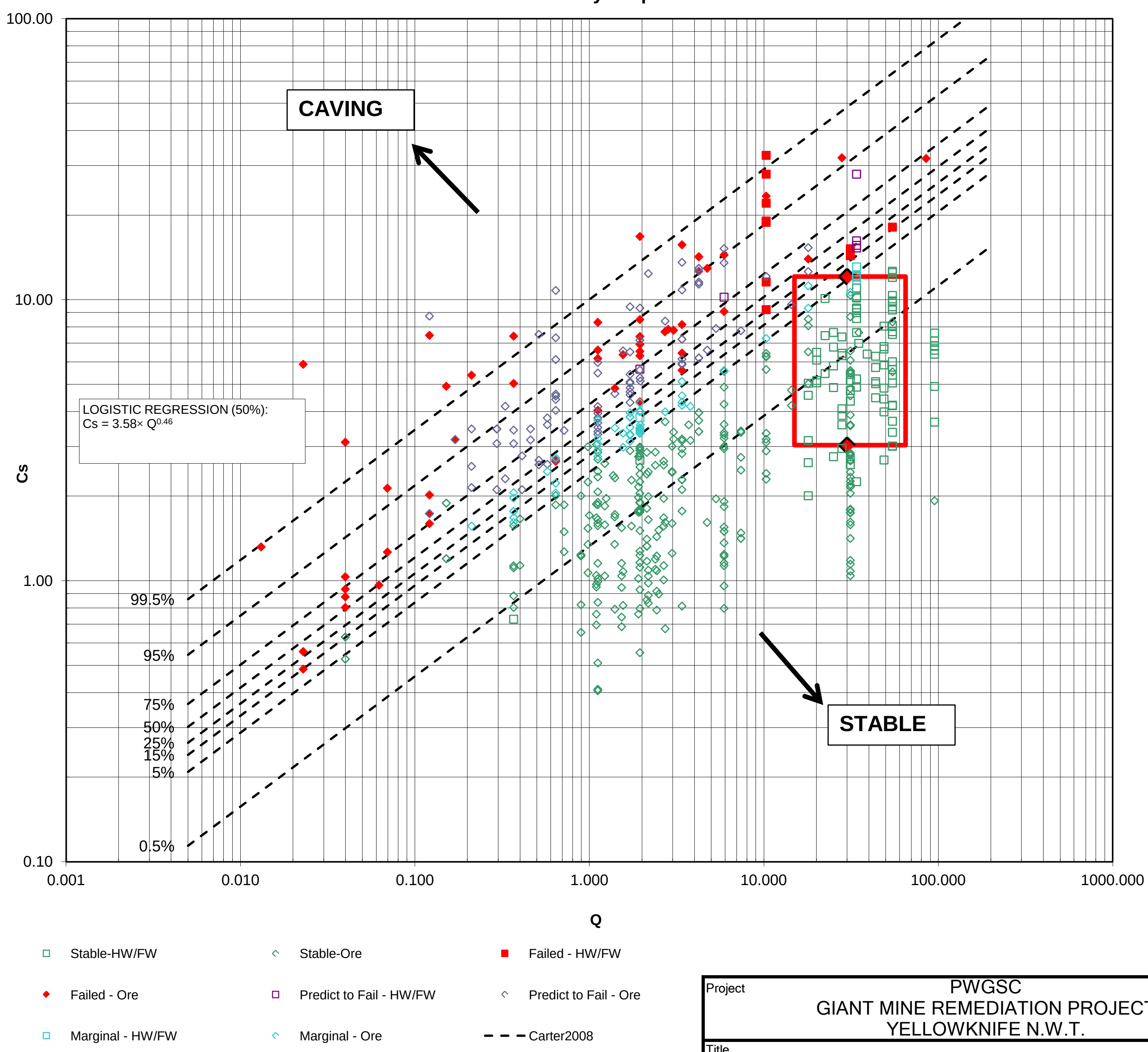
0.5	m
3.0	m

*Stope may be broken through pit already
*Predicted rock mass very high quality

Factor of Safety | **Probability of Failure**

2-19	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	15.0	30.0	65.0	12.07	10.82	14.93	22.02	0.90	1.24	1.82	57.2%	36.1%	12.9%
Average	15.0	30.0	65.0	3.03	10.82	14.93	22.02	3.57	4.92	7.26	0.1%	0.0%	0.0%

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	C1 Pit 2-19 Stope

Golder Associates

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-12
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-18	Dip	S	T*	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	70	13.0	18	50	8	0	3.1	2.1	2.5				138
Average	70	5.0	17	50	4	0	3.1	2.1	2.5				137

Rock Crown Thickness

10	m
13	m

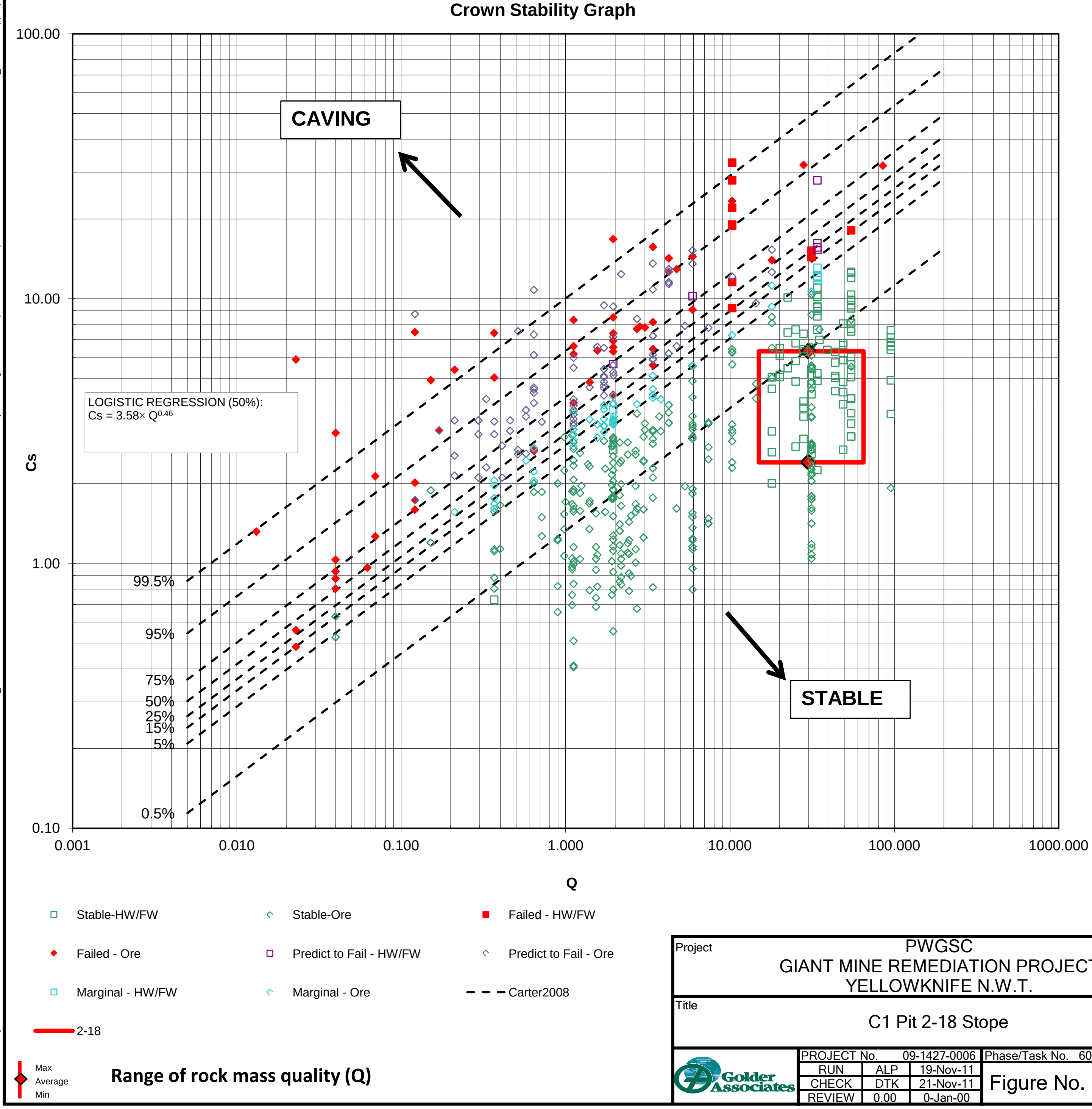
*Thinnest crown under C1 pit rim

**Predicted rock mass very high quality

Factor of Safety | **Probability of Failure**

2-18	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	15.0	30.0	65.0	6.33	10.82	14.93	22.02	1.71	2.36	3.48	16.1%	3.9%	0.1%
Average	15.0	30.0	65.0	2.41	10.82	14.93	22.02	4.49	6.20	9.14	0.0%	0.0%	0.0%

Crown Stability Graph



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	C1 Pit 2-18 Stope

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-13
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

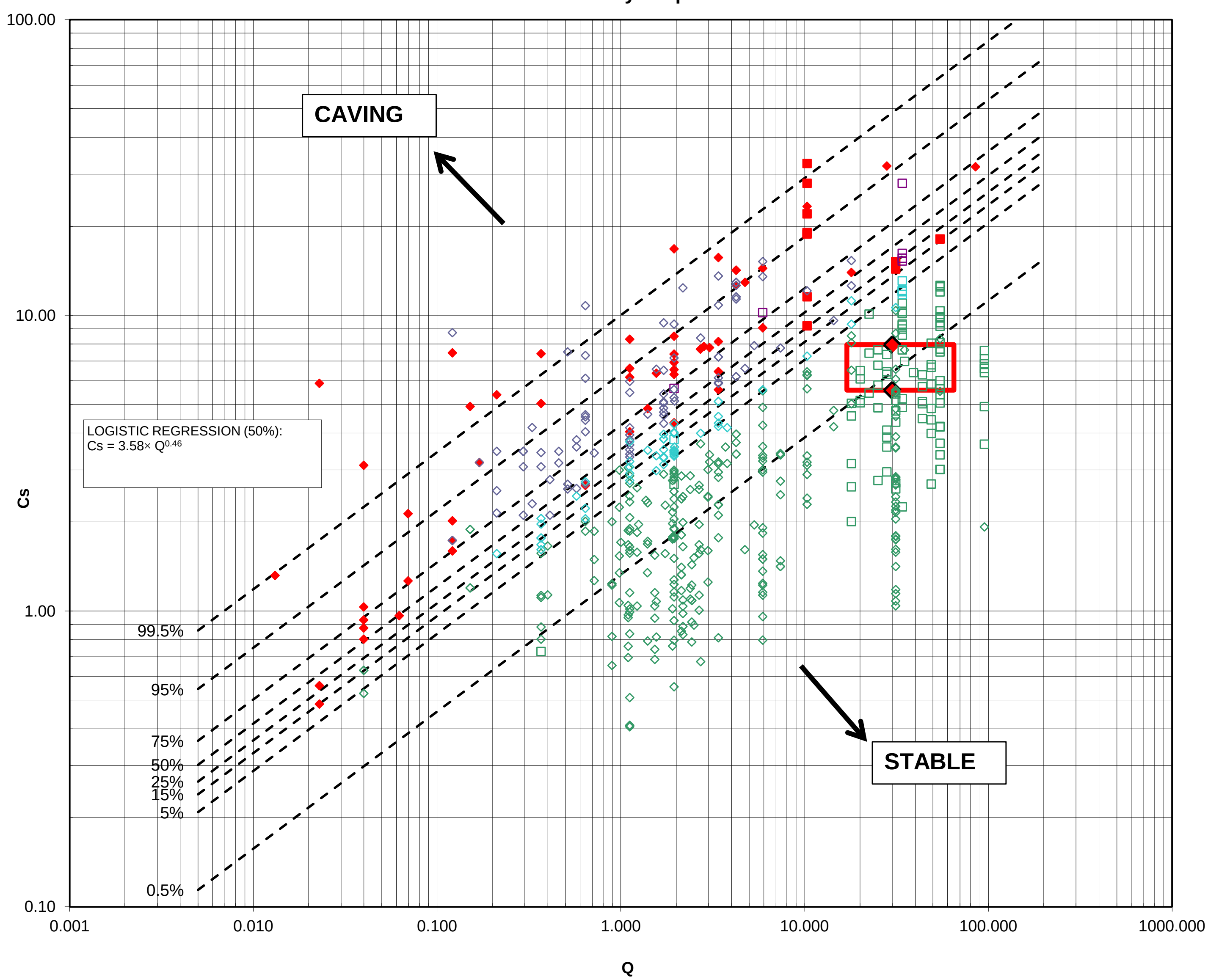
STOPE GEOMETRY DATA							Specific Gravity				ADDITIONAL INPUT DATA FOR STOPES <50°		
1-18 Up	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45.0	16.0	22.0	70.0	0.0	0.0	3.1	2.1	2.5		25	175	52
Average	90.0	11.0	12.5	65.0	3.0	0.0	3.1	2.1	2.5		25	175	25

Rock Crown Thickness	
22.0	m
9.5	m

*Stability situation could be worse if pillars in area are not competant

1-18 Up	Q			Cs	Sc			Fc (Factor of Safety)			Pfnew (Probability of Failure)					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	17.0	30.0	65.0	7.95	11.45	14.93	22.02	1.44	1.88	2.77	26.3%	11.5%	1.3%	OK	OK	OK
Average	17.0	30.0	65.0	5.58	11.45	14.93	22.02	2.05	2.67	3.94	8.0%	1.7%	0.0%			

Crown Stability Graph



□ Stable-HW/FW   ◇ Stable-Ore   ■ Failed - HW/FW

◆ Failed - Ore   □ Predict to Fail - HW/FW   ◇ Predict to Fail - Ore

□ Marginal - HW/FW   ◇ Marginal - Ore   - - - Carter2008

— 1-18 Up

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	B1 Pit 1-18 Upper Stope			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-14
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-18 Low	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	60	19.0	19.0	60.0	1.0	0.0	3.1	2.1	2.5			175.00	
Average	60	16.0	22.0	30.0	3.0	0.0	3.1	2.1	2.5			175.00	

Rock Crown Thickness

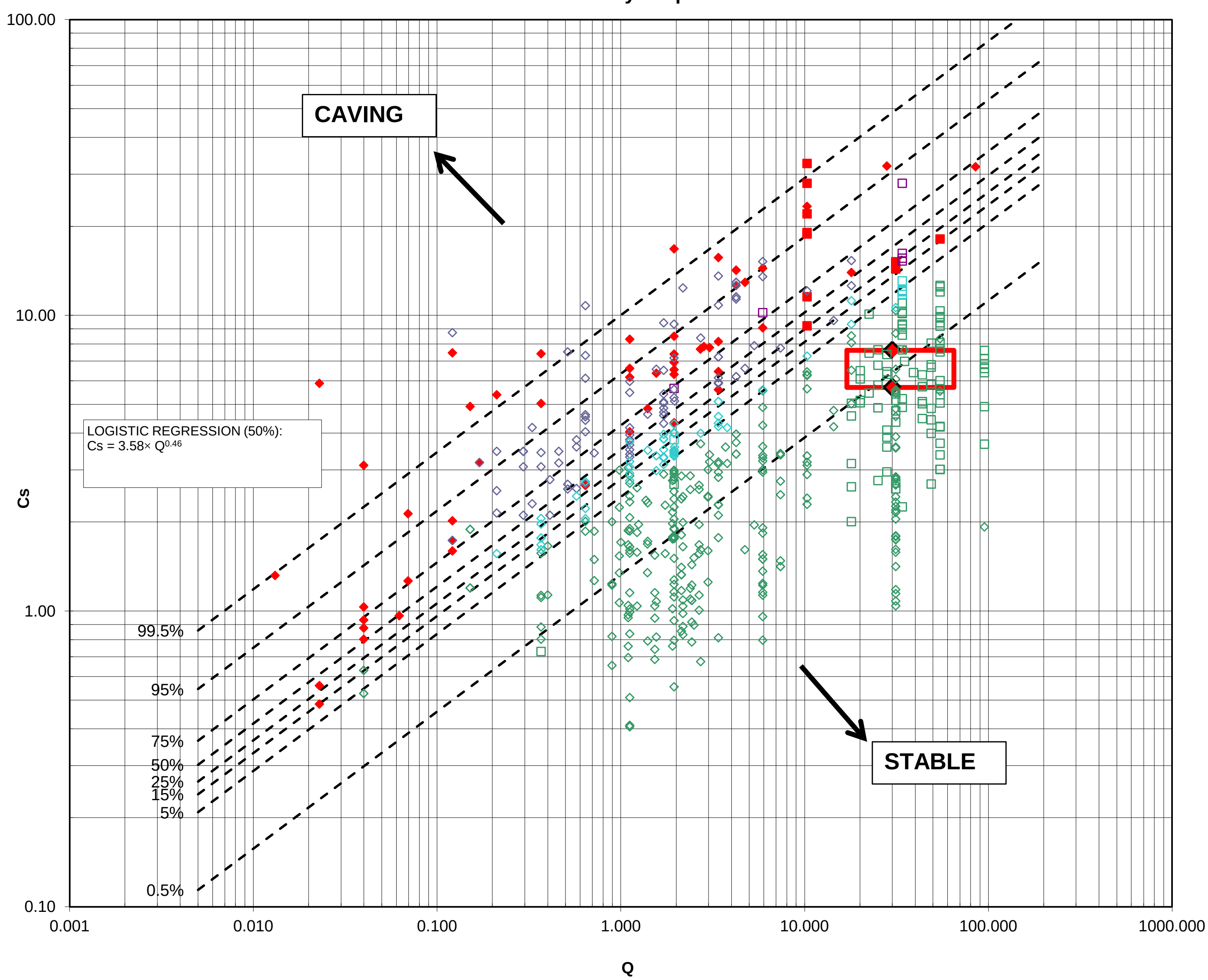
18.0	m
19.0	m

* These spans may be broekn up by small pillars but they cannot be checked

Factor of Safety | **Probability of Failure**

1-18 Low	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	17.0	30.0	65.0	7.62	11.45	14.93	22.02	1.50	1.96	2.89	23.5%	9.8%	0.9%
Average	17.0	30.0	65.0	5.71	11.45	14.93	22.02	2.01	2.62	3.86	8.8%	2.0%	0.0%

Crown Stability Graph



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B1 Pit 1-18 Lower Stope

Golder Associates					
PROJECT No.		09-1427-0006	Phase/Task No.	6000-6200	
RUN	ALP	19-Nov-11	Figure No. C-15		
CHECK	DTK	21-Nov-11			
REVIEW	0.00	0-Jan-00			

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-18 #1	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	60.0	5.0	17.0	10.0	8.0	0.0	3.1	2.1	2.5				
Average	60.0	3.0	20.5	10.0	9.0	0.0	3.1	2.1	2.5				

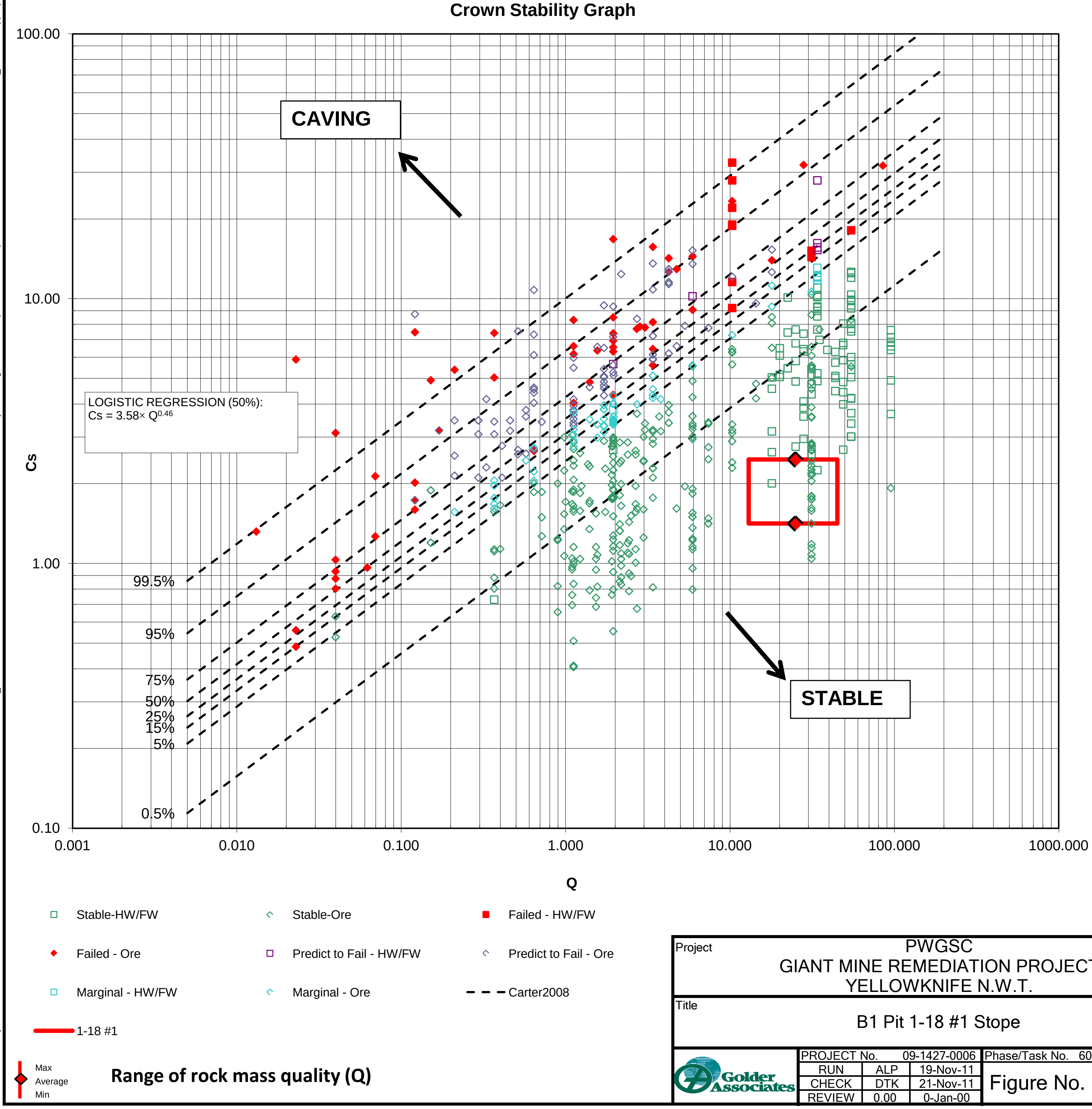
Rock Crown Thickness

9.0	m
11.5	m

Factor of Safety | **Probability of Failure**

1-18 #1	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	13.0	25.0	45.0	2.47	10.14	13.69	18.20	4.11	5.55	7.38	0.0%	0.0%	0.0%
Average	13.0	25.0	45.0	1.42	10.14	13.69	18.20	7.17	9.68	12.86	0.0%	0.0%	0.0%

Crown Stability Graph



Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.		
Title	B1 Pit 1-18 #1 Stope		
Golder Associates	PROJECT No. 09-1427-0006	Phase/Task No. 6000-6200	
	RUN ALP 19-Nov-11		Figure No. C-16
	CHECK DTK 21-Nov-11		
	REVIEW 0.00 0-Jan-00		

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-18 EB	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	65.0	13.0	21.0	30.0	17.0	0.0	3.1	2.1	2.5				
Average	77.0	10.0	26.0	30.0	22.0	0.0	3.1	2.1	2.5				

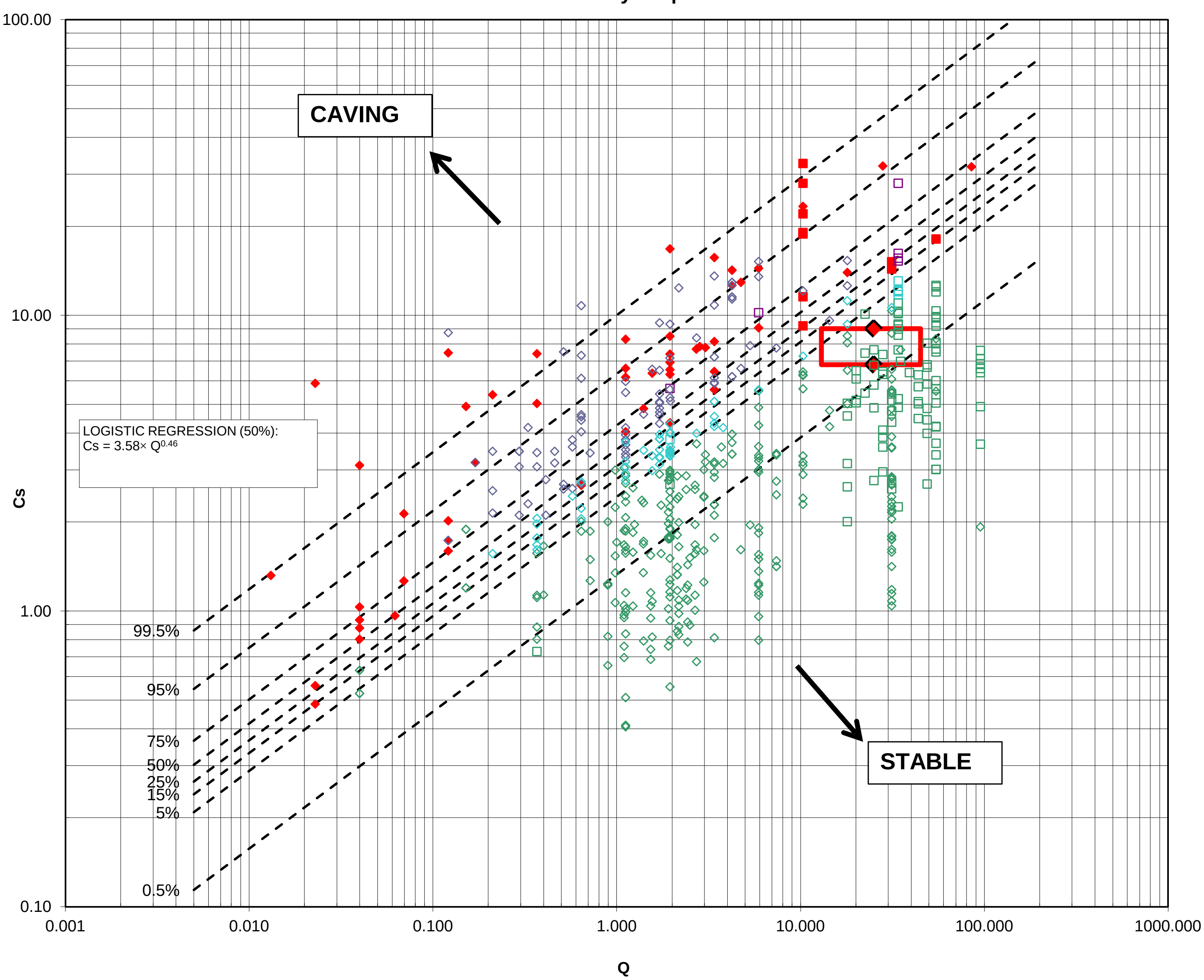
Rock Crown Thickness

4.0	m
4.0	m

Factor of Safety | **Probability of Failure**

1-18 EB	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	13.0	25.0	45.0	9.01	10.14	13.69	18.20	1.12	1.52	2.02	42.4%	22.9%	8.6%
Average	13.0	25.0	45.0	6.81	10.14	13.69	18.20	1.49	2.01	2.67	24.1%	8.8%	1.7%

Crown Stability Graph



- Stable-HW/FW
- Stable-Ore
- Failed - HW/FW
- Failed - Ore
- Predict to Fail - HW/FW
- Predict to Fail - Ore
- Marginal - HW/FW
- Marginal - Ore
- Carter2008
- 1-18 EB
- Max / Average / Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B1 Pit 1-18 EB Stope

Golder Associates

PROJECT No.	09-1427-0006	
RUN	ALP	19-Nov-11
CHECK	DTK	21-Nov-11
REVIEW	0.00	0-Jan-00

Phase/Task No. 6000-6200

Figure No. C-17

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-18 EA	Dip	S	T	L	t_o	t_w	$γ_r$	$γ_o$	$γ_w$		m_{value}	σc	H
Largest	50.0	14.0	28.0	45.0	24.0	0.0	3.1	2.1	2.5		10	75	58
Average	50.0	11.0	26.0	45.0	18.0	0.0	3.1	2.1	2.5		10	75	46

Rock Crown Thickness

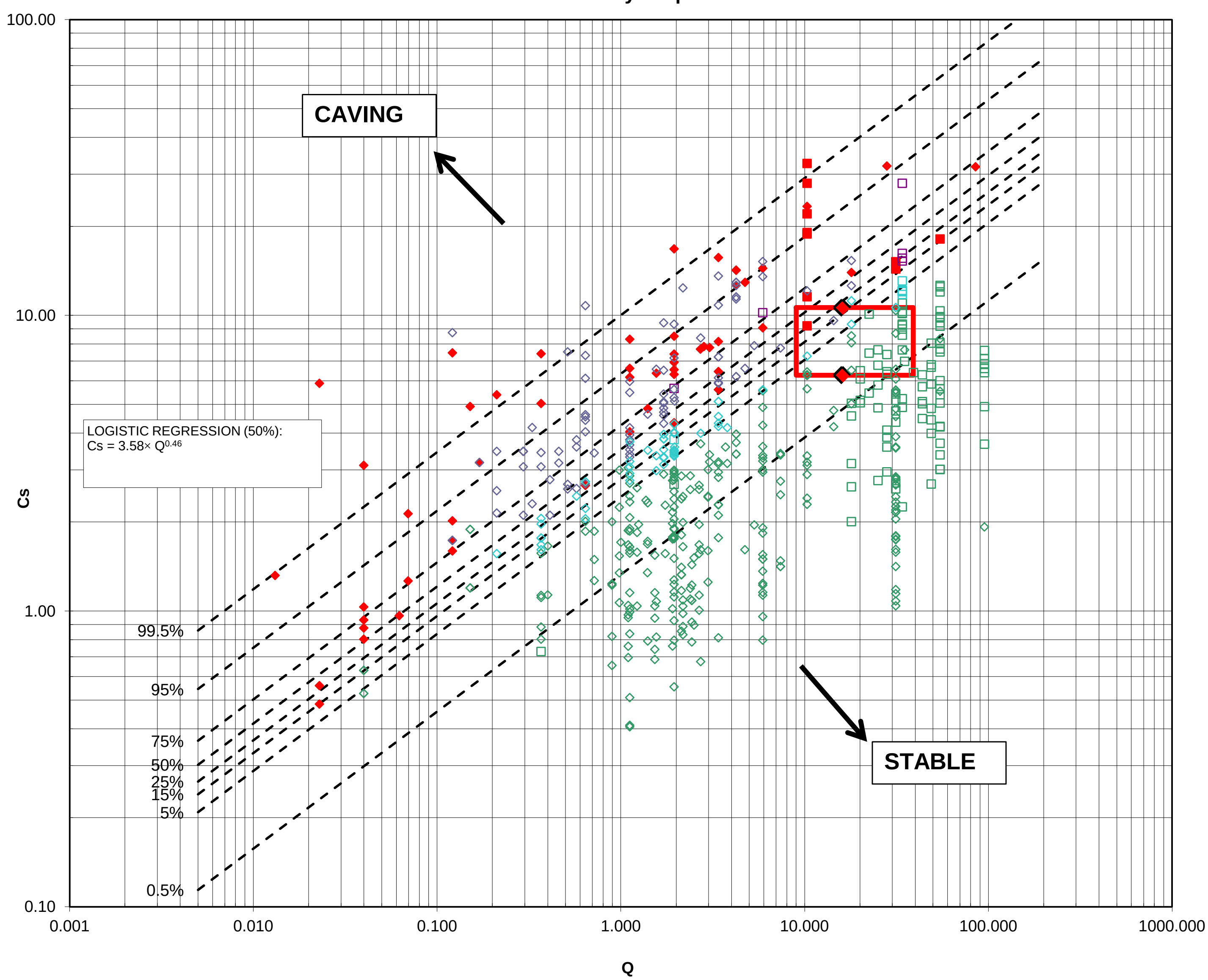
4.0	m
8.0	m

*Stope geometry is complex and variable, difficult to be confident in these values

Factor of Safety | **Probability of Failure**

1-18 EA	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	9.0	16.0	39.0	10.62	8.60	11.14	16.95	0.81	1.05	1.60	63.4%	47.0%	19.9%
Average	9.0	16.0	39.0	6.28	8.60	11.14	16.95	1.37	1.78	2.70	29.3%	14.3%	1.6%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

1-18 EA

Max
Average
Min

Range of rock mass quality (Q)

Project: PWGSC
GIANT MINE REMEDIATION PROJECT
YELLOWKNIFE N.W.T.

Title: B1 Pit 1-18 EA Stope

Golder Associates

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-18
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-15	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	40.0	26.0	29.0	24.0	17.0	0.0	3.1	2.1	2.5		25.0	175.0	54.0
Average	40.0	15.0	20.0	24.0	0.0	0.0	3.1	2.1	2.5		25.0	175.0	35.0

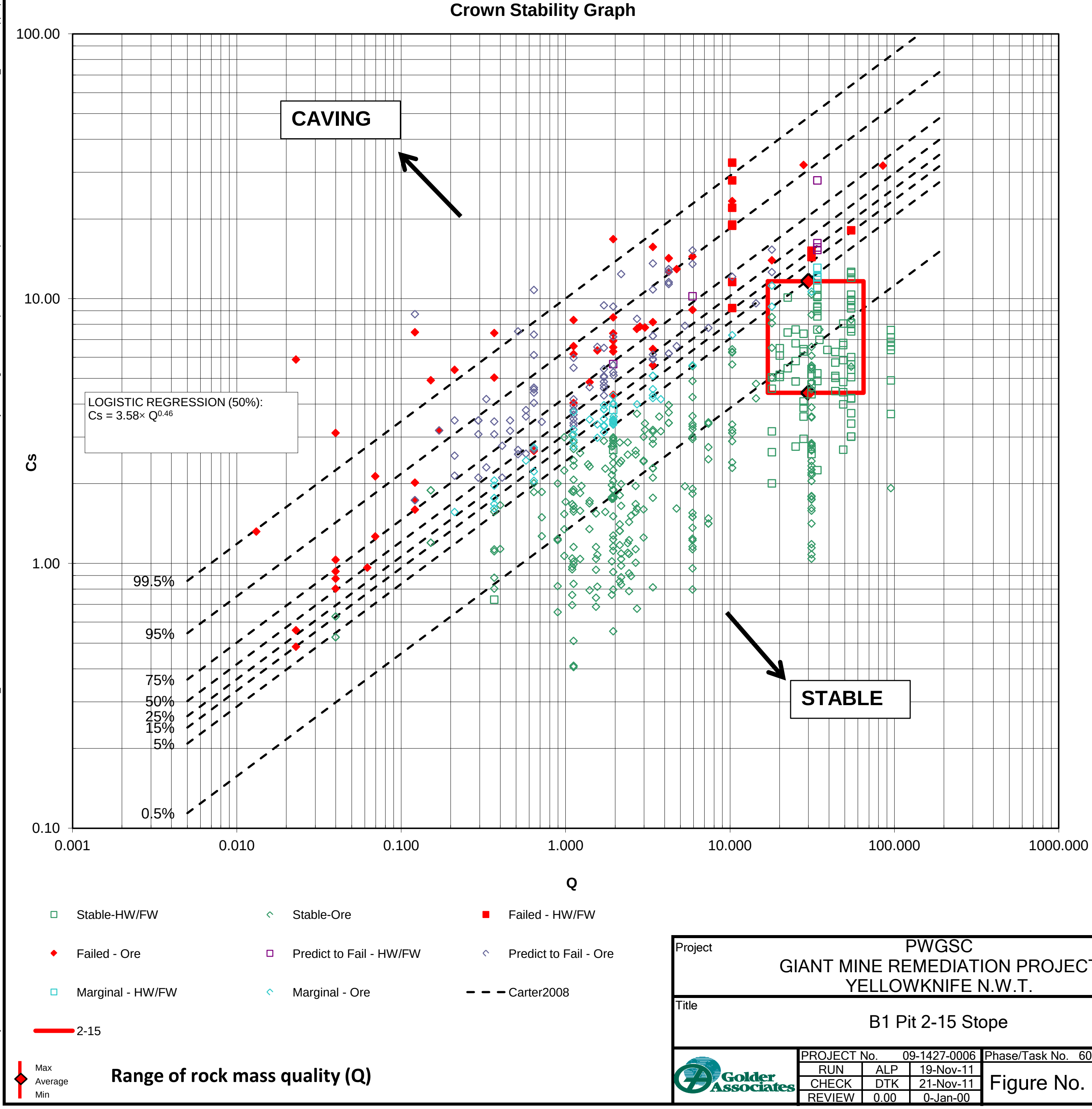
Rock Crown Thickness

12.0	m
20.0	m

Factor of Safety | **Probability of Failure**

2-15	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	17.0	30.0	65.0	11.64	11.45	14.93	22.02	0.98	1.28	1.89	51.5%	33.6%	11.3%	OK	OK	OK
Average	17.0	30.0	65.0	4.41	11.45	14.93	22.02	2.62	3.42	5.00	2.0%	0.2%	0.0%	OK	OK	OK

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B1 Pit 2-15 Stope

Golder Associates				
PROJECT No.	09-1427-0006		Phase/Task No.	6000-6200
RUN	ALP	19-Nov-11	Figure No. C-19	
CHECK	DTK	21-Nov-11		
REVIEW	0.00	0-Jan-00		

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-06	Dip	S	T*	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45.0	8.0	10.0	15.0	0.0	0.0	3.1	2.1	2.5		10.0	37.5	40.0
Average	45.0	6.0	24.0	15.0	0.0	0.0	3.1	2.1	2.5		10.0	37.5	54.0

Rock Crown Thickness

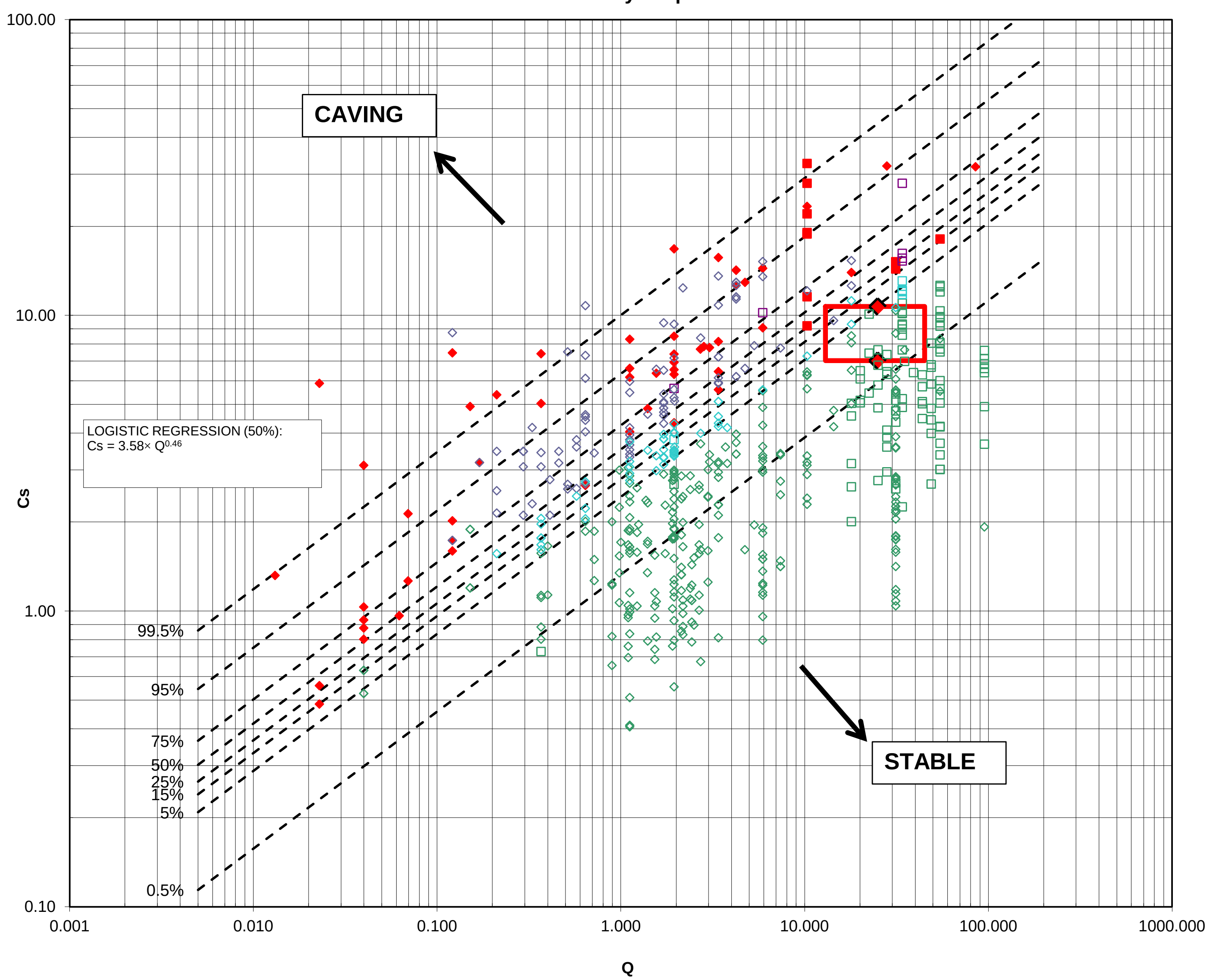
10.0	m
24.0	m

Only a localised area with thin corwn and 3d effects would make the situation for the largest span better than shown here

Factor of Safety | **Probability of Failure**

2-06	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	13.0	25.0	45.0	10.71	10.14	13.69	18.20	0.94	1.27	1.70	54.4%	34.1%	16.5%	OK	OK	OK
Average	13.0	25.0	45.0	7.02	10.14	13.69	18.20	1.42	1.94	2.59	26.9%	10.2%	2.1%	OK	OK	OK

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

2-06

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B1 Pit 2-06 Stope

Golder Associates

PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	19-Nov-11	Figure No. C-20
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-31 W/#2	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90	23	29	35	0	0	3.1	2.1	2.5				43
Average	90	19	29	35	0	0	3.1	2.1	2.5				41

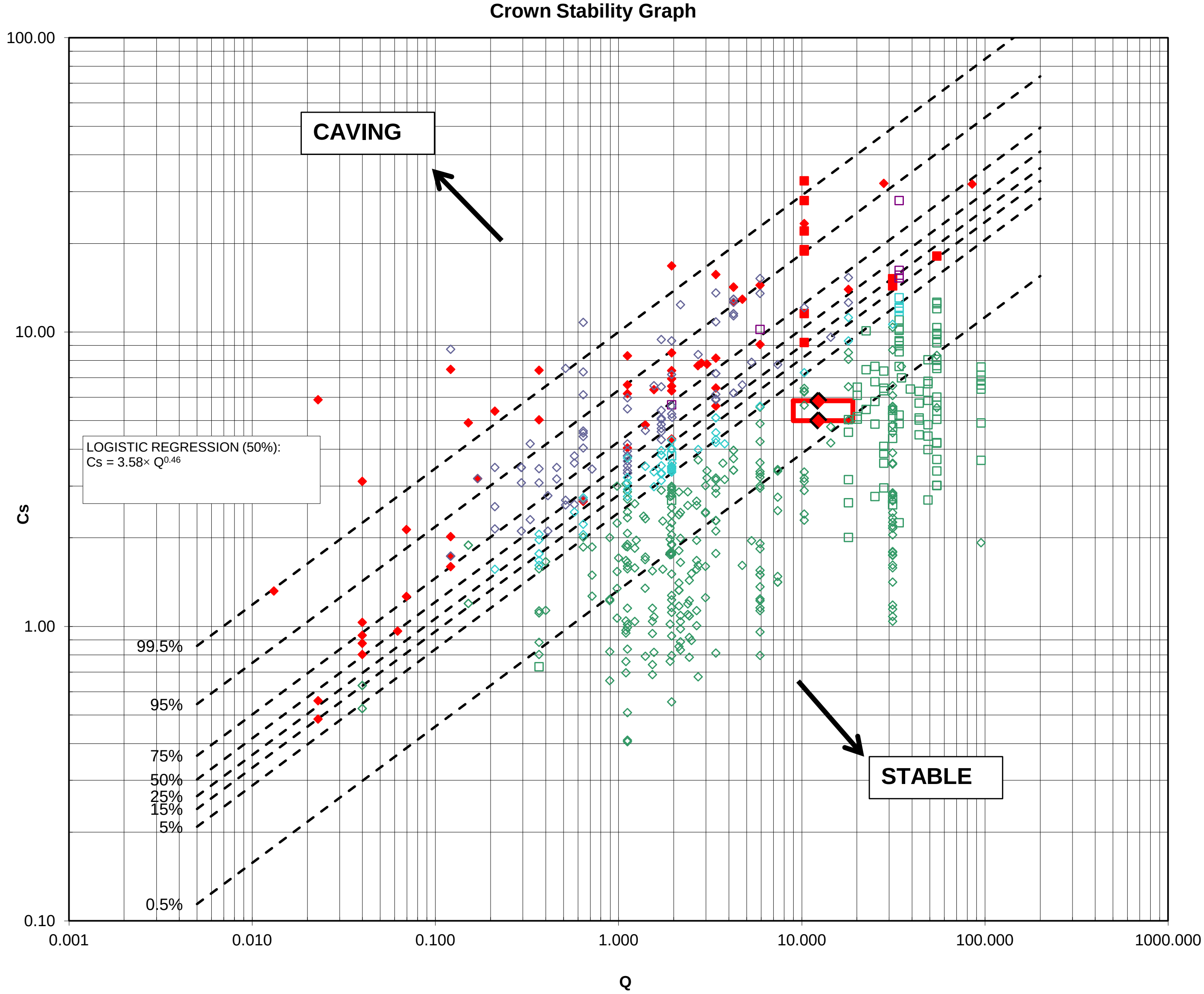
Rock Crown Thickness

29.0	m
29.0	m

Factor of Safety | **Probability of Failure**

1-31 W/#2	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	9.0	12.3	19.0	5.84	8.60	9.89	12.05	1.47	1.69	2.06	24.8%	16.7%	7.8%
Average	9.0	12.3	19.0	5.00	8.60	9.89	12.05	1.72	1.98	2.41	15.9%	9.4%	3.4%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

1-31 W/#2

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	B3 Pit 1-31 W / 1-31 #2			
	PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-21
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

2-35	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	65	19	54	150	0	0	3.1	2.1	2.5				84
Average	65	12	50	150	0	0	3.1	2.1	2.5				70

Rock Crown Thickness

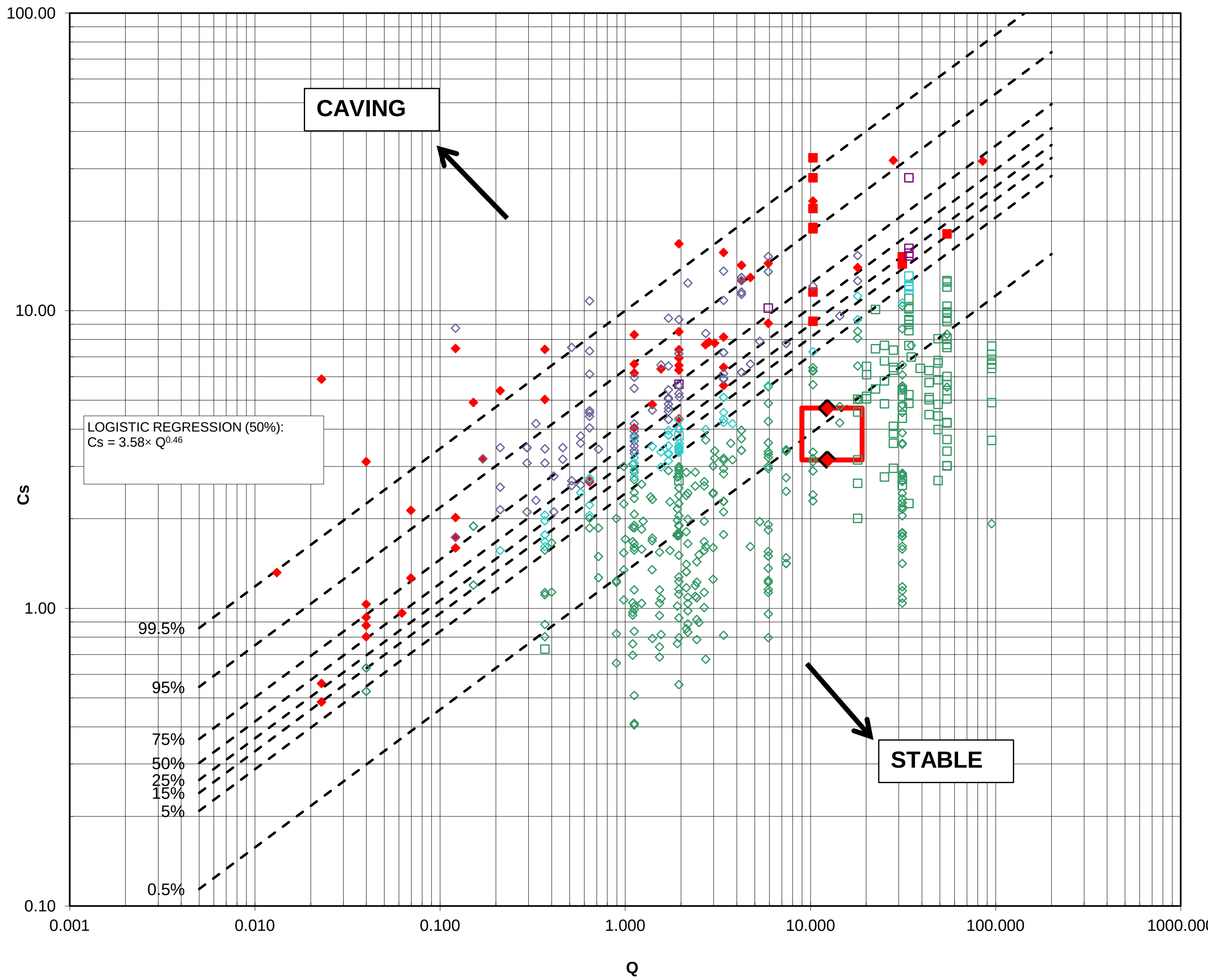
54.0	m
50.0	m

* Conditions representative of southern portion of stope, near 3300N to 3350N

Factor of Safety | **Probability of Failure**

2-35	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	9.0	12.3	19.0	4.70	8.60	9.89	12.05	1.83	2.10	2.56	12.8%	7.2%	2.3%
Average	9.0	12.3	19.0	3.15	8.60	9.89	12.05	2.73	3.14	3.82	1.5%	0.4%	0.0%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

2-35

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	B3 Pit 2-35			
Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-22
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-27/1-33	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	40.0	19.0	37.0	45.0	3.0	0.0	3.1	2.1	2.5		10	175	62
Average	40.0	15.0	37.0	45.0	3.0	0.0	3.1	2.1	2.5		10	175	57

Rock Crown Thickness

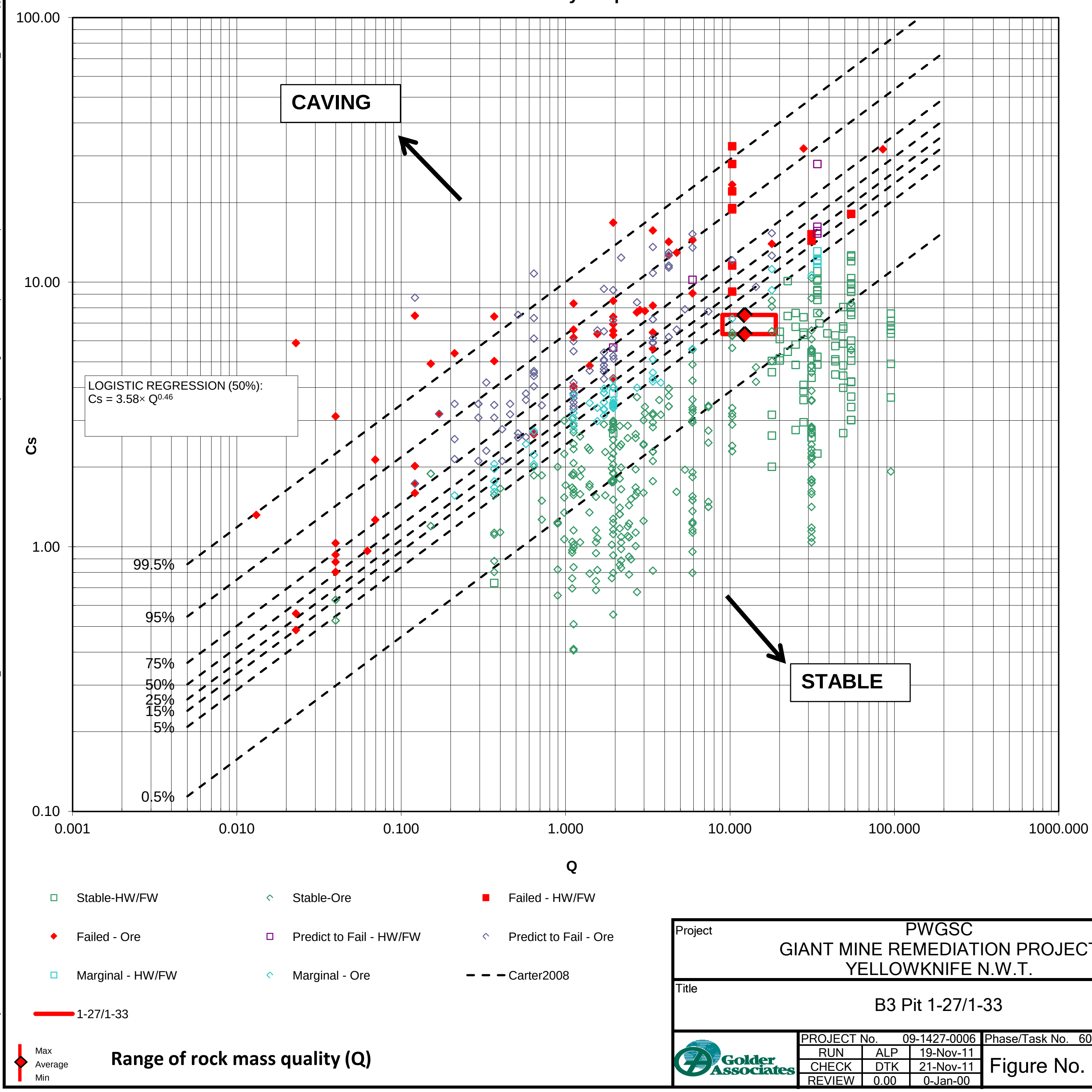
34	m
34	m

*Shallow dip, some probability of hangingwall failure but coveris high, choking of an y failure likley

Factor of Safety | **Probability of Failure**

1-27/1-33	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	9.0	12.3	19.0	7.51	8.60	9.89	12.05	1.15	1.32	1.60	41.2%	31.9%	19.7%	OK	OK	OK
Average	9.0	12.3	19.0	6.36	8.60	9.89	12.05	1.35	1.56	1.90	30.1%	21.4%	11.2%	OK	OK	OK

Crown Stability Graph



Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B3 Pit 1-27/1-33

Golder Associates

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-23
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA **Specific Gravity** **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-29	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	50.0	8.0	50.0	70.0	0.0	0.0	3.1	2.1	2.5		25	175	56
Average	50.0	5.0	50.0	70.0	0.0	0.0	3.1	2.1	2.5		25	175	56

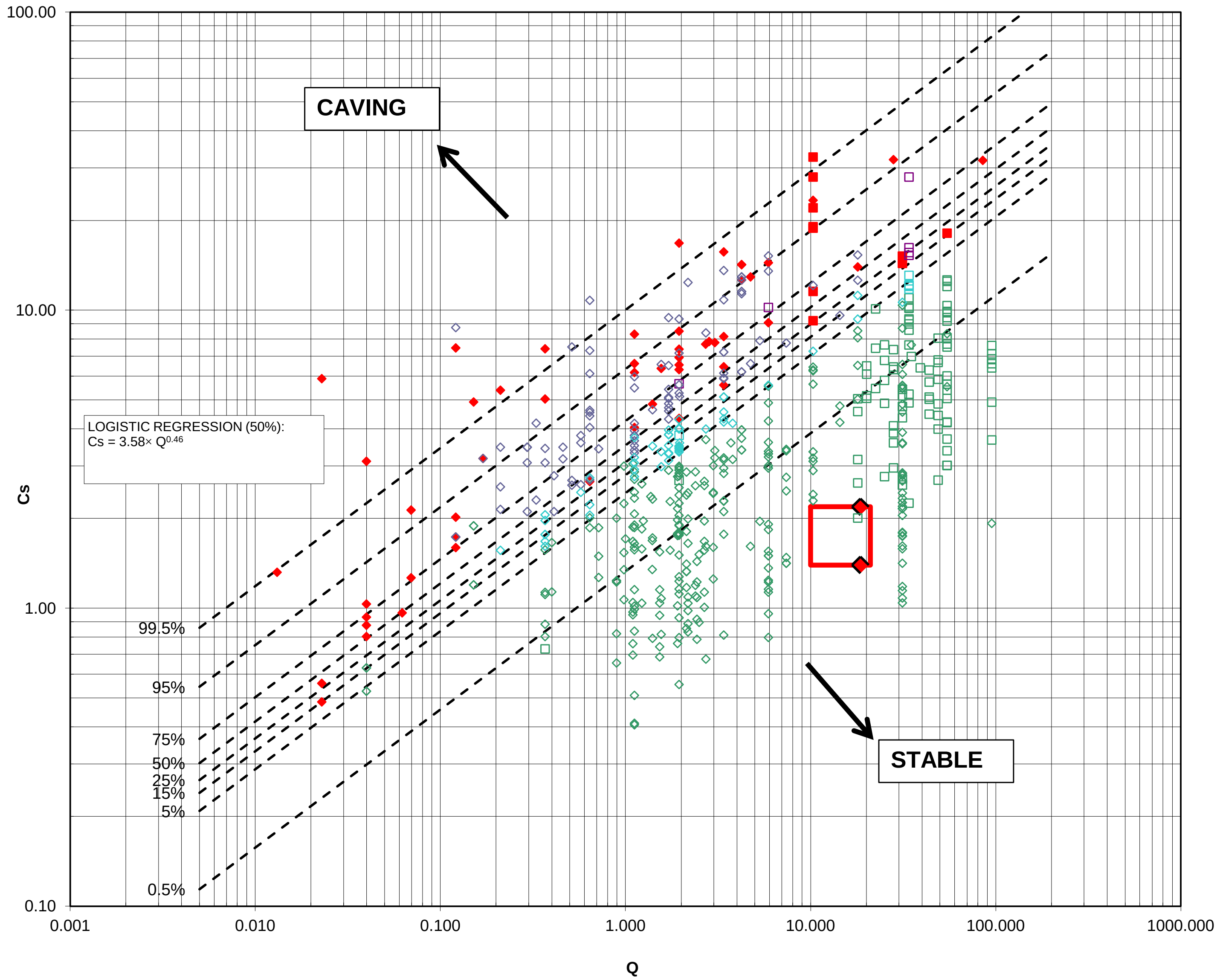
Rock Crown Thickness

50.0	m
50.0	m

Factor of Safety **Probability of Failure**

1-29	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	2.19	9.02	11.94	12.62	4.12	5.45	5.77	0.0%	0.0%	0.0%
Average	10.0	18.6	21.0	1.40	9.02	11.94	12.62	6.46	8.55	9.05	0.0%	0.0%	0.0%

Crown Stability Graph



Stable-HW/FW · Stable-Ore · Failed - HW/FW
Failed - Ore · Predict to Fail - HW/FW · Predict to Fail - Ore
Marginal - HW/FW · Marginal - Ore · Carter2008
1-29
Max / Average / Min — **Range of rock mass quality (Q)**

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.			
Title	B4 Pit 1-29			
Golder Associates	PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200	
	RUN	ALP	19-Nov-11	Figure No. C-24
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA

Specific Gravity | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-34	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	75.0	10.0	38.0	45.0	4.0	0.0	3.1	2.1	2.5		25	175	14
Average	75.0	8.0	38.0	45.0	4.0	0.0	3.1	2.1	2.5		25	175	14

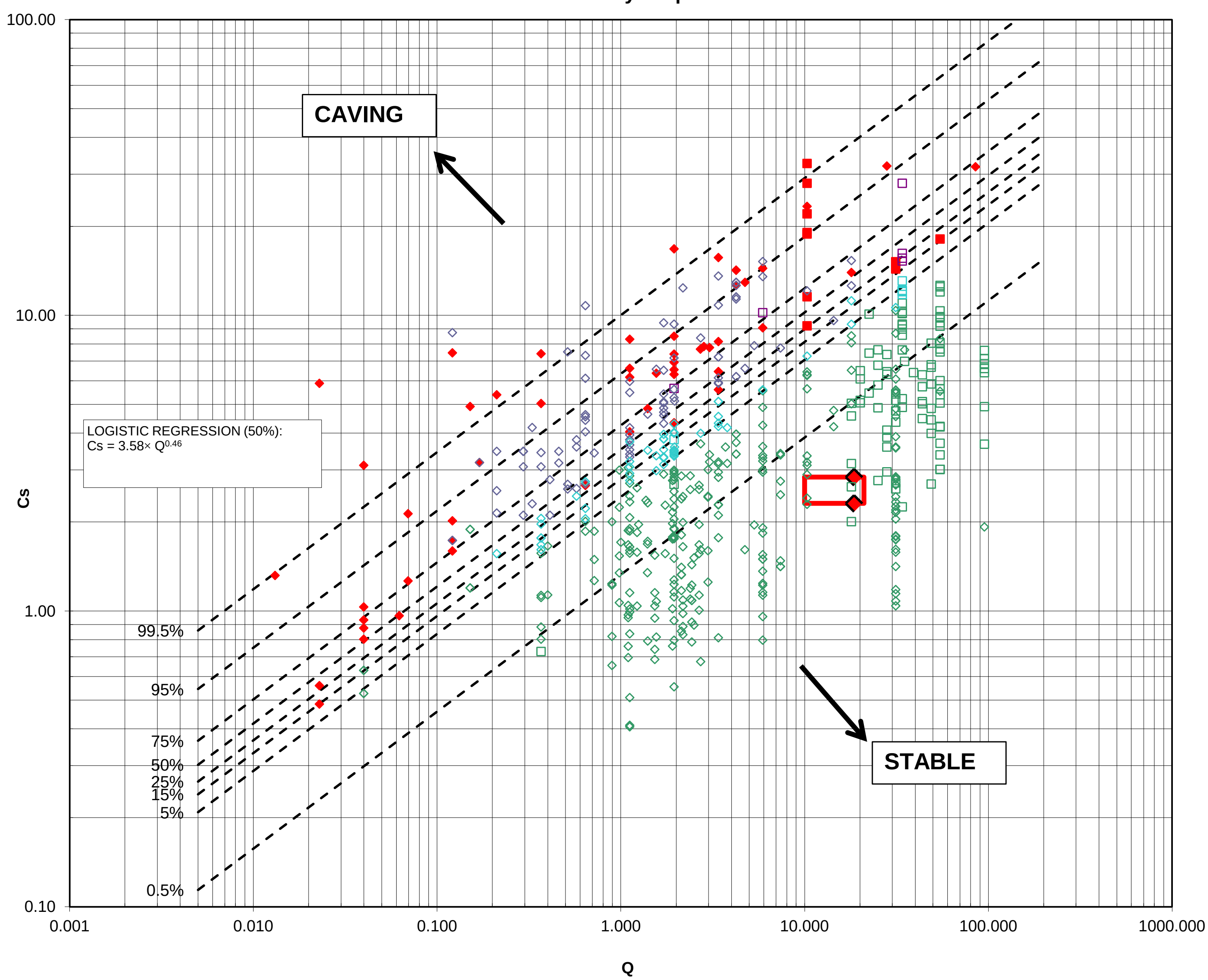
Rock Crown Thickness

34.0	m
34.0	m

Factor of Safety | **Probability of Failure**

1-34	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	2.84	9.02	11.94	12.62	3.18	4.21	4.45	0.4%	0.0%	0.0%
Average	10.0	18.6	21.0	2.31	9.02	11.94	12.62	3.90	5.17	5.46	0.0%	0.0%	0.0%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

1-34

Max / Average / Min — Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.		
Title	B4 Pit 1-34		
PROJECT No.	09-1427-0006	Phase/Task No.	6000-6200
RUN	ALP	19-Nov-11	Figure No. C-25
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-35	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	45.0	8.5	15.0	25.0	3.0	0.0	3.1	2.1	2.5		25	175	29
Average	45.0	6.0	15.0	25.0	3.0	0.0	3.1	2.1	2.5		25	175	27

Rock Crown Thickness

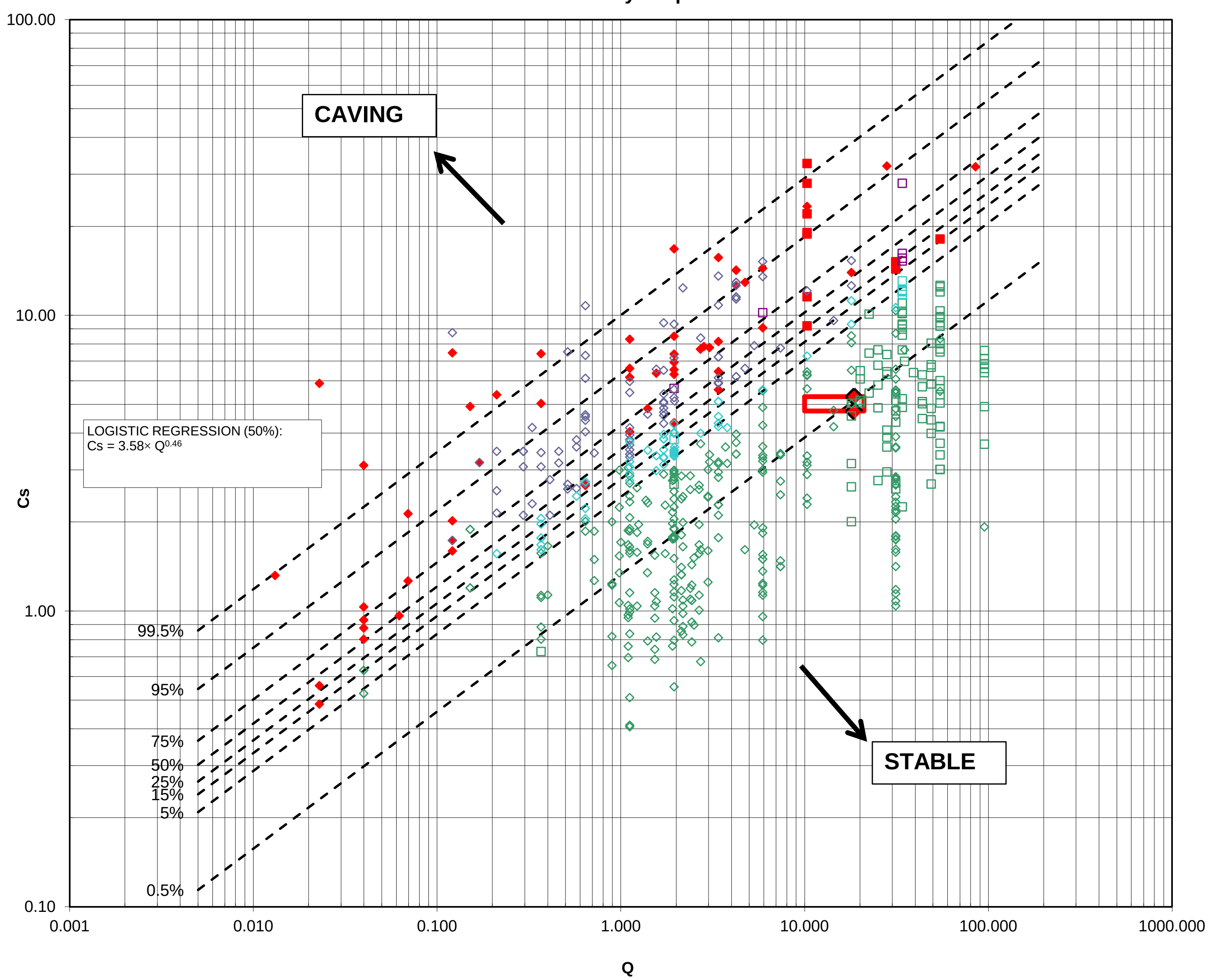
12.0	m
12.0	m

*If the drift between 1-35 stope and the small drift nea r the top of the stope is not intact conditions will be worse

Factor of Safety **Probability of Failure**

	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	10.0	18.6	21.0	5.31	9.02	11.94	12.62	1.70	2.25	2.38	16.6%	5.1%	3.7%	OK	OK	OK
Average	10.0	18.6	21.0	4.74	9.02	11.94	12.62	1.90	2.52	2.66	11.1%	2.6%	1.8%	OK	OK	OK

Crown Stability Graph



□ Stable-HW/FW | ◇ Stable-Ore | ■ Failed - HW/FW

◆ Failed - Ore | □ Predict to Fail - HW/FW | ◇ Predict to Fail - Ore

□ Marginal - HW/FW | ◇ Marginal - Ore | - - - Carter2008

1-35

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-35

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-26
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-26#5U	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90.0	10.0	17.0	45.0	8.0	0.0	3.1	2.1	2.5		25.00	175.00	
Average	90.0	8.0	16.0	45.0	4.0	0.0	3.1	2.1	2.5		25.00	175.00	

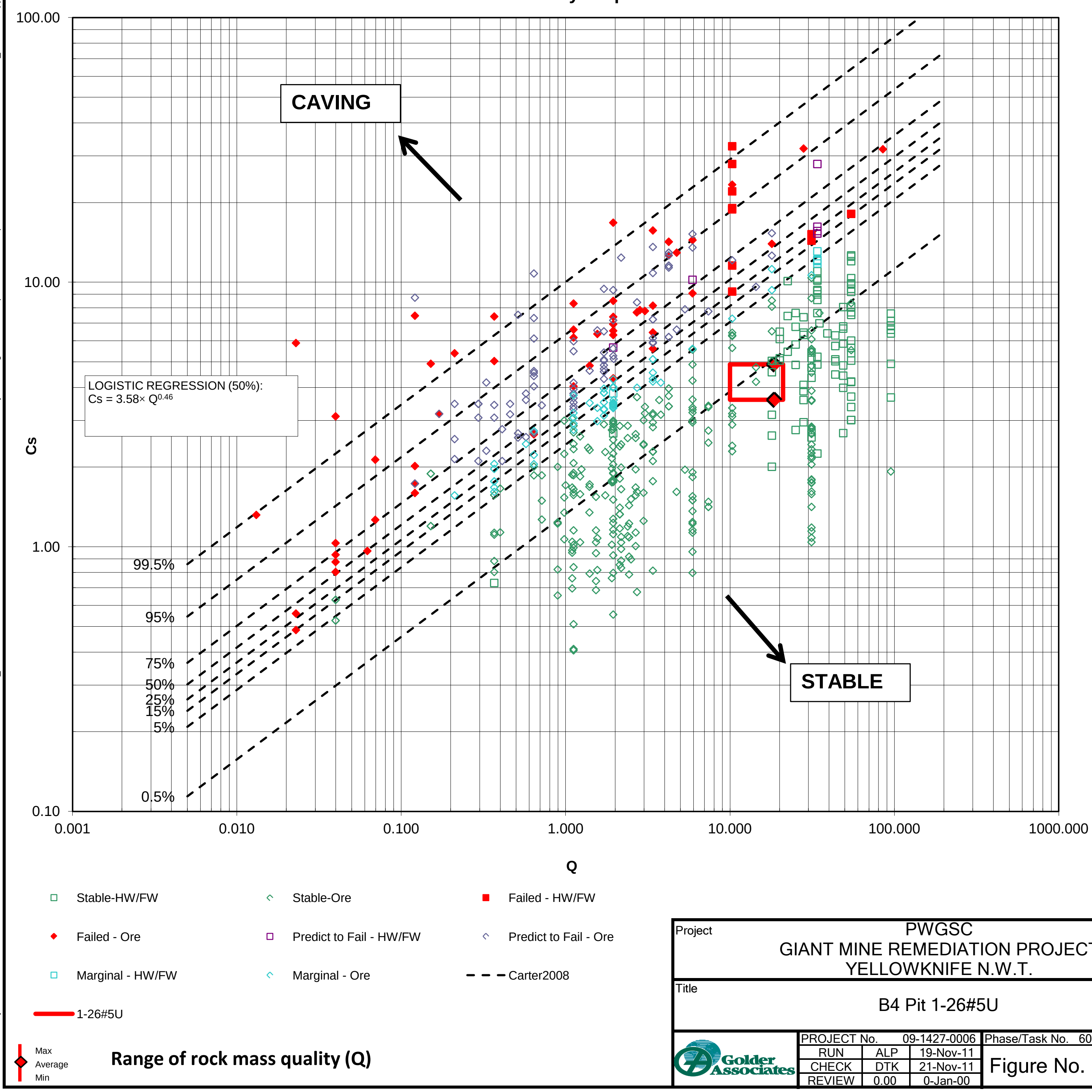
Rock Crown Thickness

9.0	m
12.0	m

Factor of Safety | **Probability of Failure**

1-26#5U	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	4.89	9.02	11.94	12.62	1.84	2.44	2.58	12.4%	3.2%	2.2%
Average	10.0	18.6	21.0	3.59	9.02	11.94	12.62	2.51	3.32	3.51	2.6%	0.2%	0.1%

Crown Stability Graph



Project: PWGSC
GIANT MINE REMEDIATION PROJECT
YELLOWKNIFE N.W.T.

Title: B4 Pit 1-26#5U

PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-27
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

Golder Associates

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-26#4	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	65.0	9.0	35.0	90.0	2.0	0.0	3.1	2.1	2.5		25.00	175.00	50.00
Average	65.0	7.0	35.0	90.0	2.0	0.0	3.1	2.1	2.5		25.00	175.00	50.00

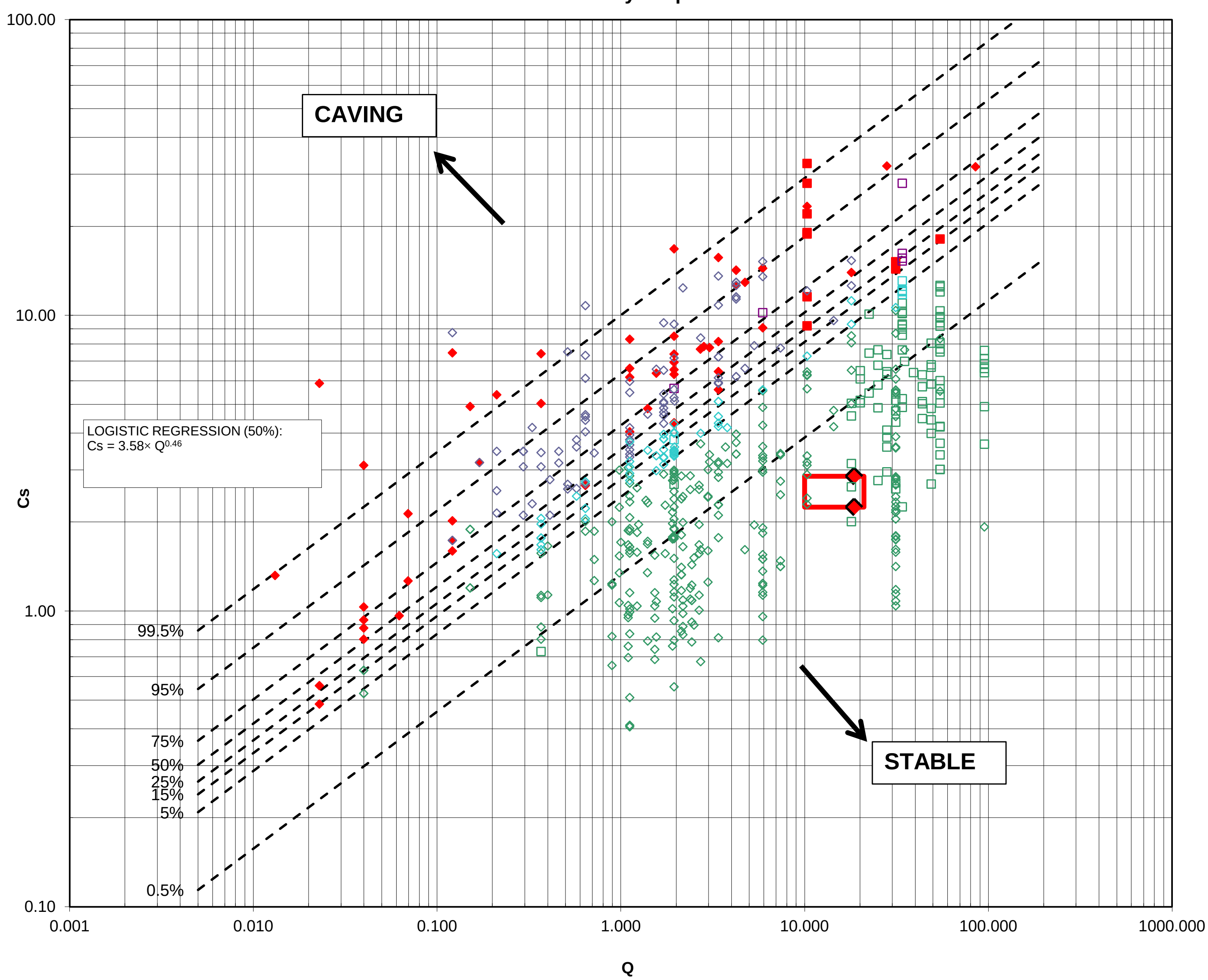
Rock Crown Thickness

33.0	m
33.0	m

Factor of Safety | **Probability of Failure**

1-26#4	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	2.86	9.02	11.94	12.62	3.15	4.18	4.42	0.4%	0.0%	0.0%
Average	10.0	18.6	21.0	2.25	9.02	11.94	12.62	4.01	5.31	5.62	0.0%	0.0%	0.0%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
1-26#4

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-26#4

Golder Associates

PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-28
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA **Specific Gravity** **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-26#5	Dip	S	T	L*	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	35.0	5.0	35.0	25.0	3.0	0.0	3.1	2.1	2.5		25.00	175.00	50.00
Average	35.0	4.0	35.0	25.0	3.0	0.0	3.1	2.1	2.5		25.00	175.00	50.00

Rock Crown Thickness

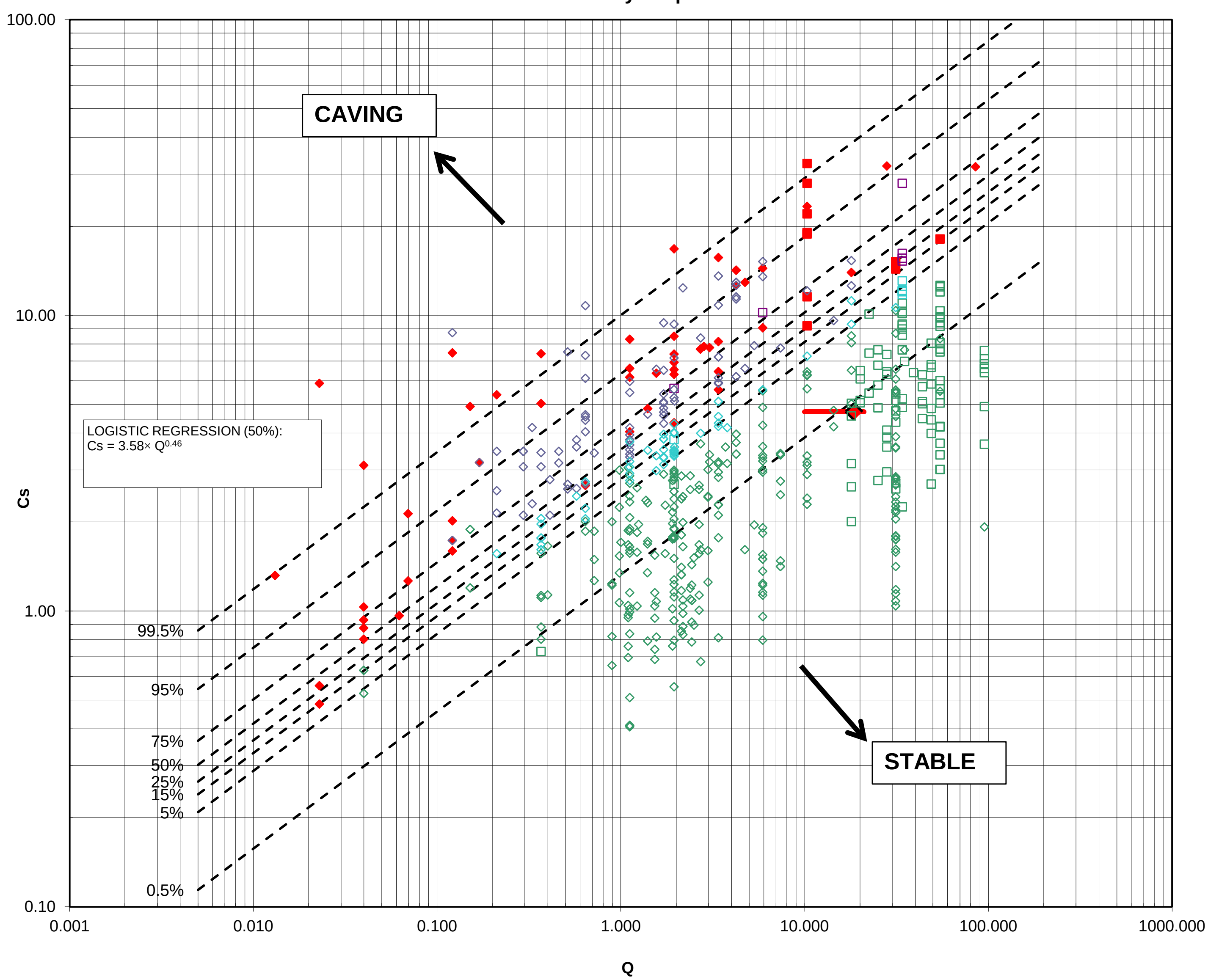
32.0	m
32.0	m

*Stope is lomger but length of large hangingwall span portion is less

Factor of Safety **Probability of Failure**

1-26#5	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	10.0	18.6	21.0	4.72	9.02	11.94	12.62	1.89	2.53	2.67	11.2%	2.5%	1.7%	OK	OK	OK
Average	10.0	18.6	21.0	4.72	9.02	11.94	12.62	1.89	2.53	2.67	11.2%	2.5%	1.7%	OK	OK	OK

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
1-26#5

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.				
Title	B4 Pit 1-26#5				
Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200	
	RUN	ALP	19-Nov-11	Figure No. C-29	
	CHECK	DTK	21-Nov-11		
	REVIEW	0.00	0-Jan-00		

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-38U	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90.0	20.0	12.0	45.0	2.0	0.0	3.1	2.1	2.5		25.00	175.00	19.00
Average	90.0	19.0	17.0	20.0	4.0	0.0	3.1	2.1	2.5		25.00	175.00	24.00

Rock Crown Thickness

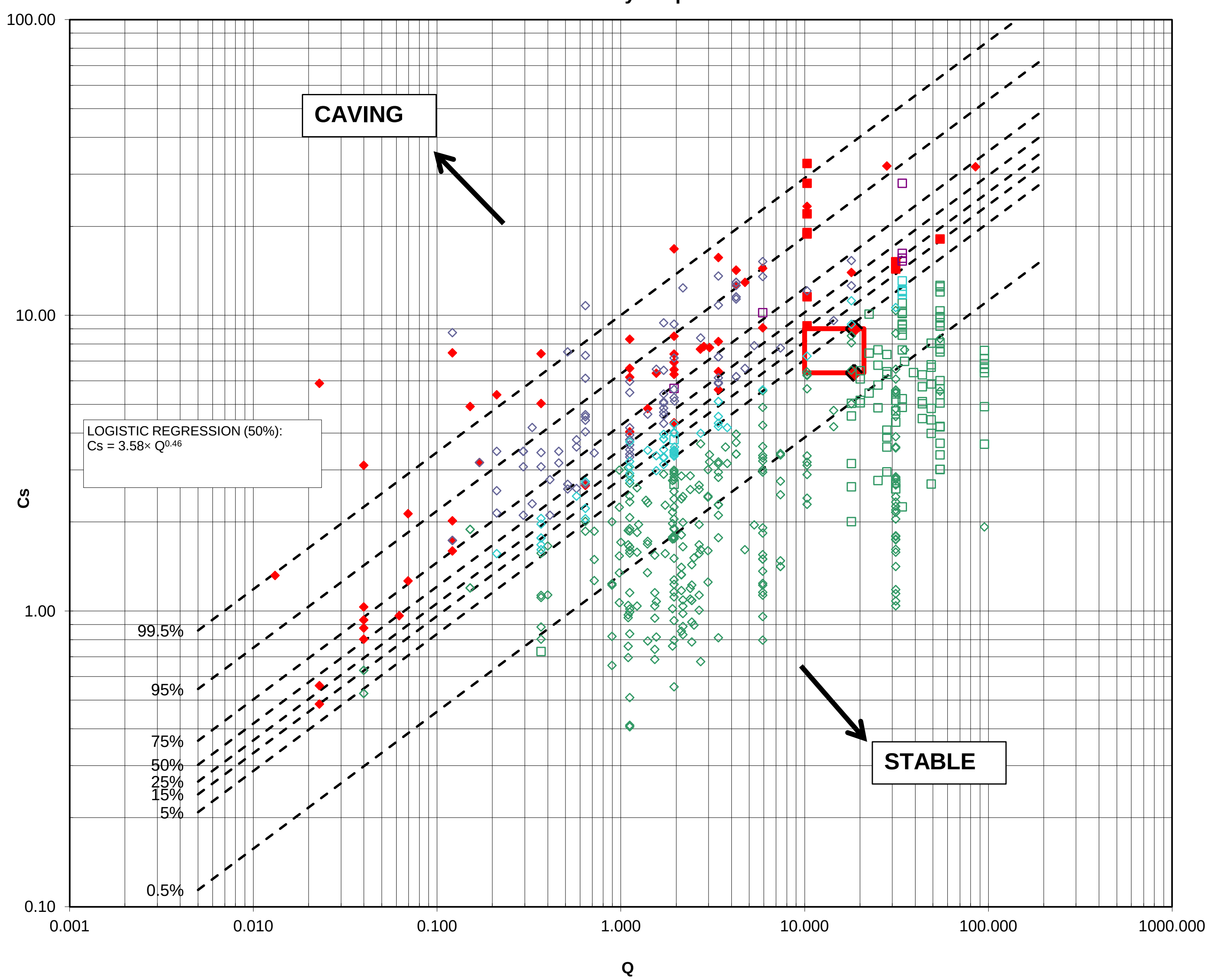
10.0	m
13.0	m

*Large span only exists if pillars unstable but they have not yet been inspected

Factor of Safety | **Probability of Failure**

1-38U	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	9.01	9.02	11.94	12.62	1.00	1.32	1.40	50.2%	31.5%	27.9%
Average	10.0	18.6	21.0	6.39	9.02	11.94	12.62	1.41	1.87	1.98	27.4%	11.8%	9.4%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
1-38U

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-38 Upper

Golder Associates

PROJECT No.	09-1427-0006	Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11
CHECK	DTK	21-Nov-11
REVIEW	0.00	0-Jan-00

Figure No. C-30

STOPE GEOMETRY DATA

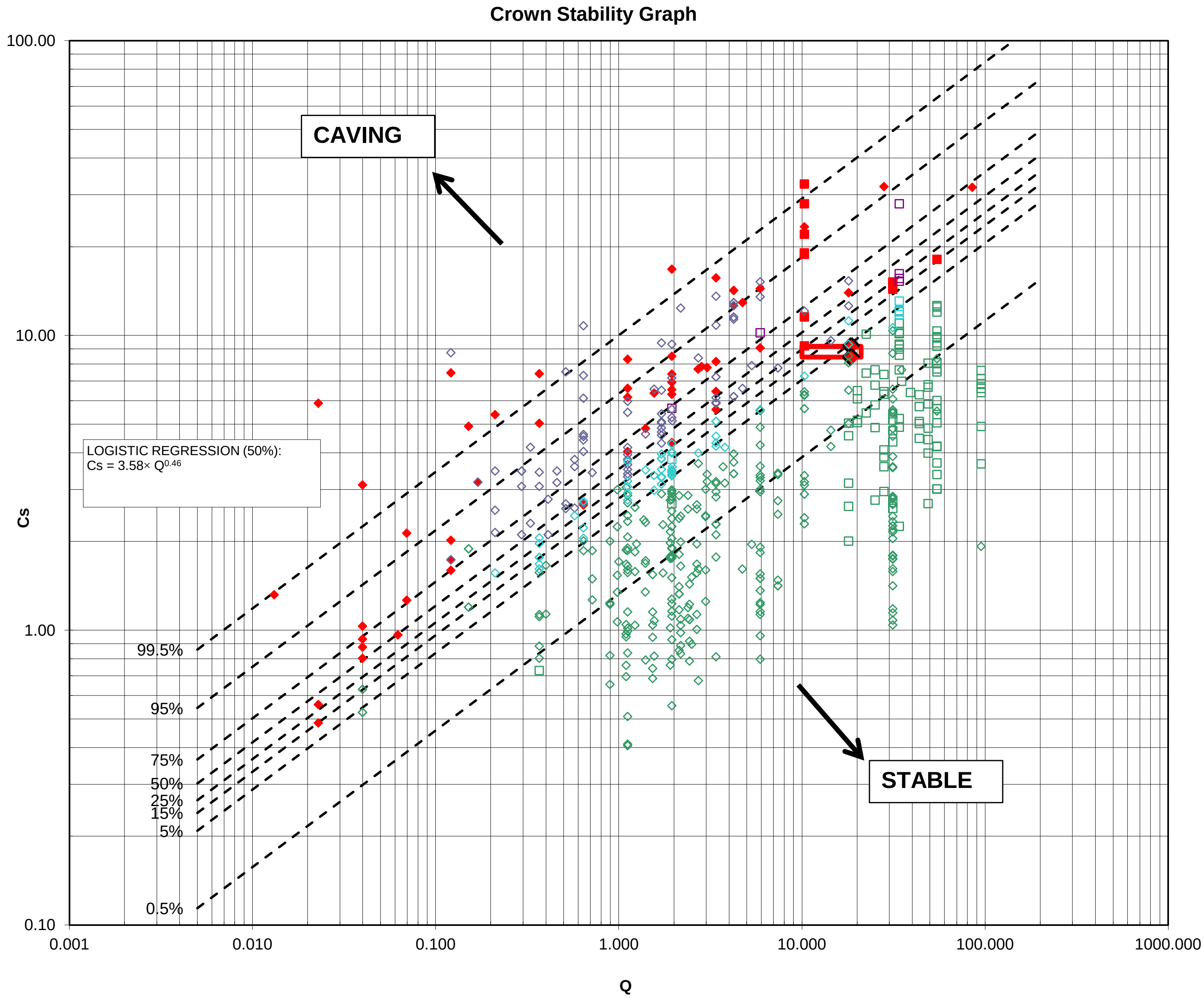
1-38L	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
							Specific Gravity				ADDITIONAL INPUT DATA FOR STOPES <50°		
Largest	45.0	14.0	24.0	55.0	5.0	0.0	3.1	2.1	2.5		25.00	175.00	54.00
Average	45.0	8.0	24.0	55.0	3.0	0.0	3.1	2.1	2.5		25.00	175.00	54.00

Rock Crown Thickness	
19.0	m
21.0	m

*Large span only exists if pillars unstable but they have not yet been inspected

1-38L	Q			Cs	Sc			Fc (Factor of Safety)			Pfnew (Probability of Failure)					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	10.0	18.6	21.0	9.19	9.02	11.94	12.62	0.97	1.30	1.37	52.2%	32.9%	29.2%	OK	OK	OK
Average	10.0	18.6	21.0	8.44	9.02	11.94	12.62	1.06	1.41	1.50	46.6%	27.3%	23.8%	OK	OK	OK

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
1-38L

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-38 Lower

Golder Associates	PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-31
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

Project no 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-43 #1	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90.0	20.0	13.0	50.0	5.5	0.0	3.1	2.1	2.5		25.00	175.00	25.00
Average	90.0	16.0	14.0	16.0	5.0	0.0	3.1	2.1	2.5		25.00	175.00	22.00

Rock Crown Thickness

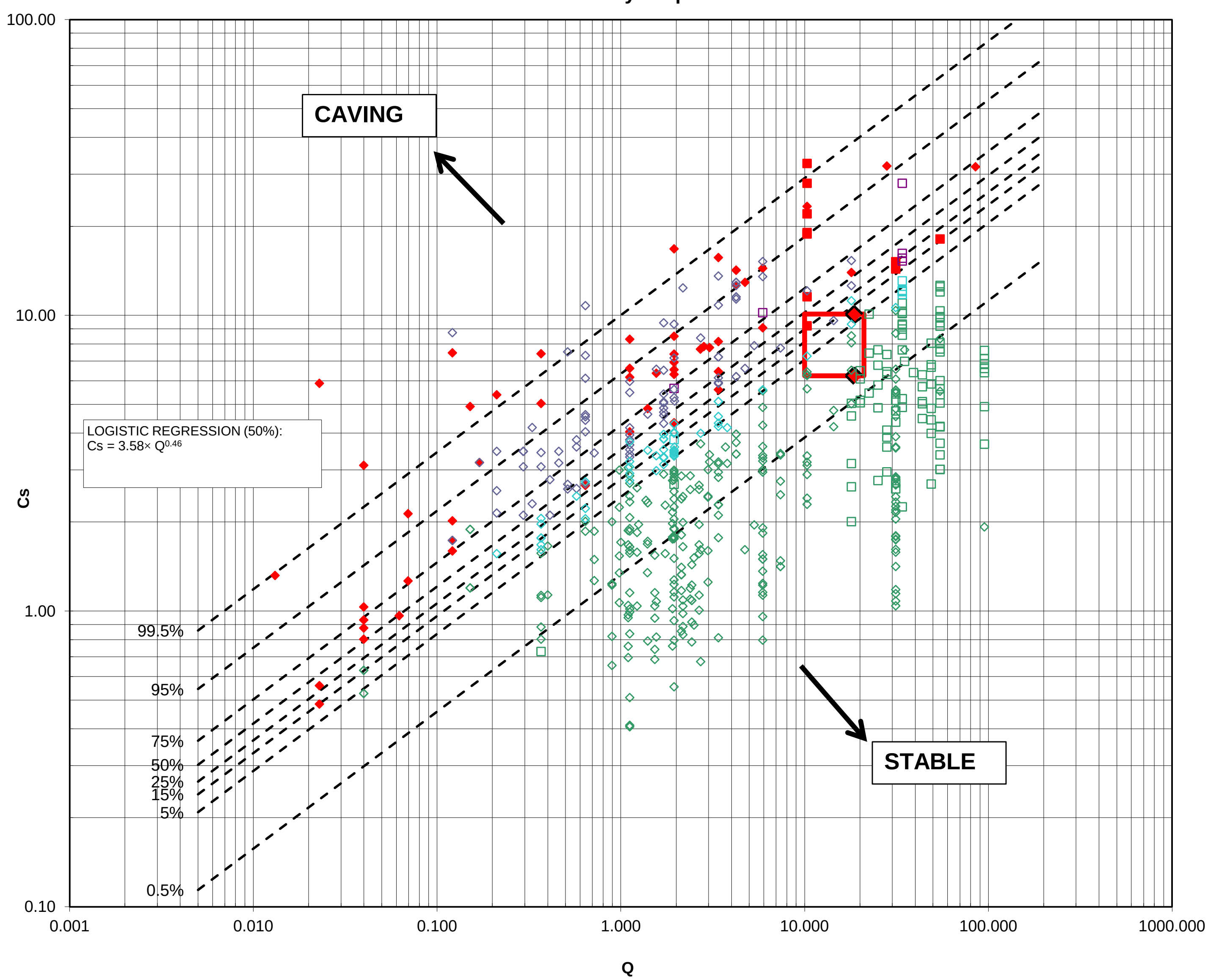
7.5	m
9.0	m

*Largest span only exists if pillars not intact

Factor of Safety **Probability of Failure**

1-43 #1	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	10.10	9.02	11.94	12.62	0.89	1.18	1.25	57.4%	39.1%	35.3%
Average	10.0	18.6	21.0	6.25	9.02	11.94	12.62	1.44	1.91	2.02	26.0%	10.8%	8.6%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

1-43 #1

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-43 #1

Golder Associates	PROJECT No.		09-1427-0006	Phase/Task No. 6000-6200
	RUN	ALP	19-Nov-11	Figure No. C-32
	CHECK	DTK	21-Nov-11	
	REVIEW	0.00	0-Jan-00	

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-43 upper	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	90.0	30.0	24.0	80.0	3.0	0.0	3.1	2.1	2.5		25.00	175.00	29.0
Average	90.0	25.0	24.0	20.0	3.0	0.0	3.1	2.1	2.5		25.00	175.00	29.0

Rock Crown Thickness

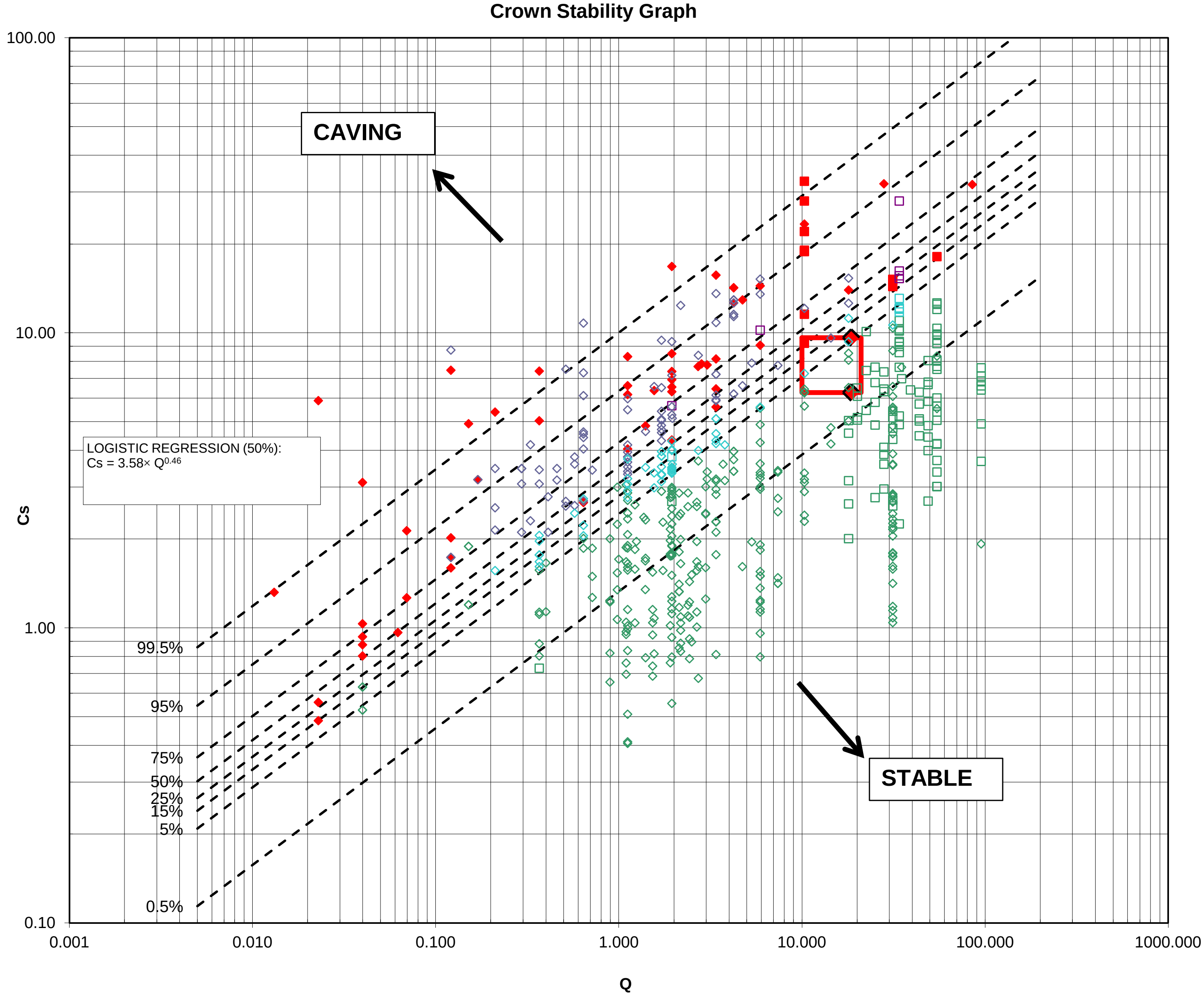
21.0	m
21.0	m

*If pillars in area are not stable failure is more likley

Factor of Safety | **Probability of Failure**

1-43 upper	Q			Cs	Sc			Fc			Pfnew		
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW
Largest	10.0	18.6	21.0	9.63	9.02	11.94	12.62	0.94	1.24	1.31	54.4%	35.9%	32.2%
Average	10.0	18.6	21.0	6.27	9.02	11.94	12.62	1.44	1.90	2.01	26.3%	11.0%	8.7%

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW

Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore

Marginal - HW/FW | Marginal - Ore | Carter2008

1-43 upper

Max / Average / Min — **Range of rock mass quality (Q)**

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.
Title	B4 Pit 1-43 Upper

Golder Associates

PROJECT No.	09-1427-0006		Phase/Task No. 6000-6200
RUN	ALP	19-Nov-11	Figure No. C-33
CHECK	DTK	21-Nov-11	
REVIEW	0.00	0-Jan-00	

Project no. 09-1427-0006 Run: ALP Review: Date: 19-Nov-11 Filename: O:\Active_2009\1427\09-1427-0006 Giant AECOM - PWGSC\Phase 2000\Project Management\Correspondence\Correspondence-Deliverables\Doc 091 RPT 0614_12\Rev 1 App\App C - Giant non_ars carter_dec 7 2011.xlsm

STOPE GEOMETRY DATA | **Specific Gravity** | **ADDITIONAL INPUT DATA FOR STOPES <50°**

1-43 Lower	Dip	S	T	L	t_o	t_w	γ_r	γ_o	γ_w		m_{value}	σc	H
Largest	35.0	10.0	32.0	100.0	2.0	0.0	3.1	2.1	2.5		25.00	175.00	67.00
Average	35.0	6.0	32.0	20.0	2.0	0.0	3.1	2.1	2.5		25.00	175.00	57.00

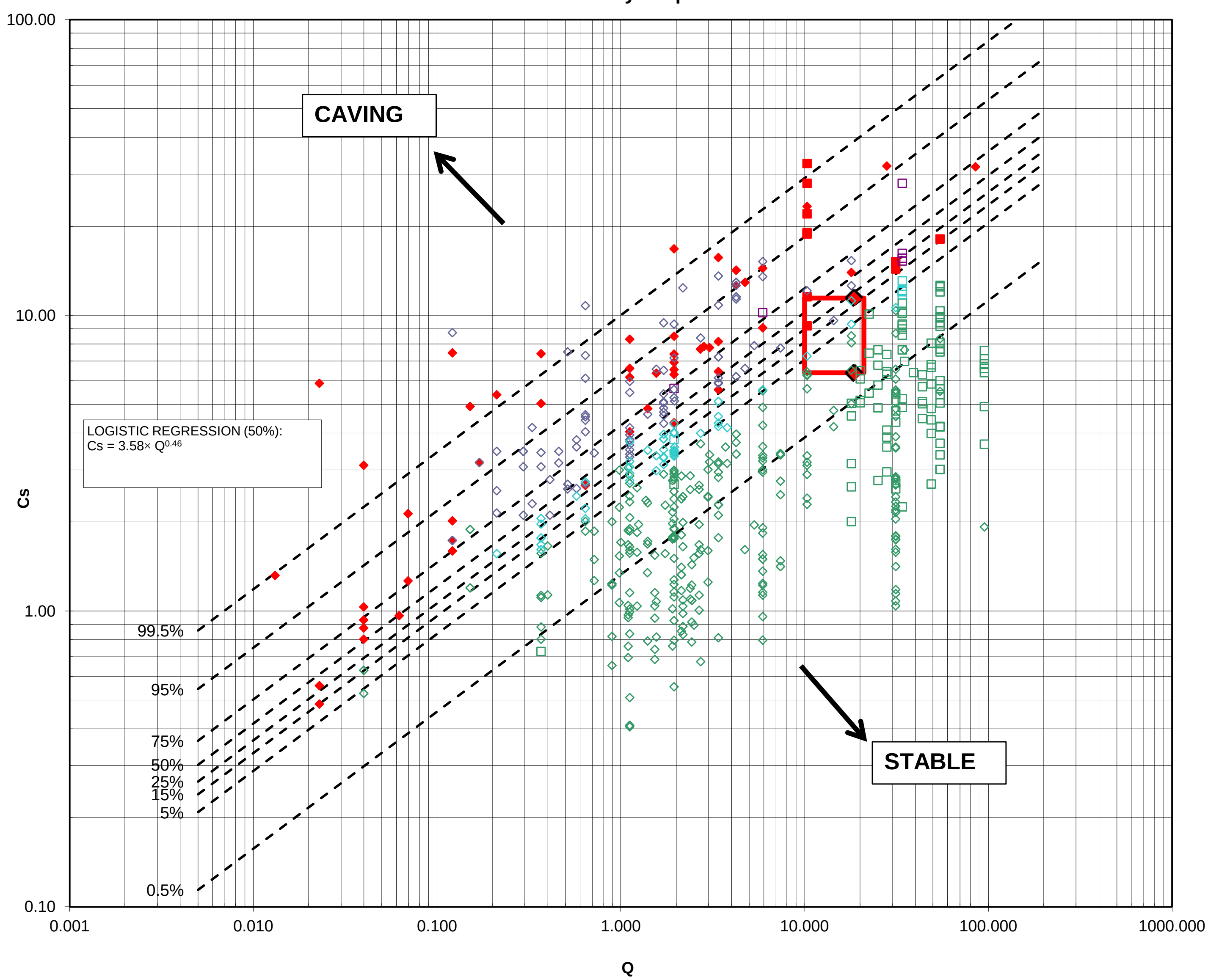
Rock Crown Thickness

30.0	m
30.0	m

Factor of Safety | **Probability of Failure**

1-43 Lower	Q			Cs	Sc			Fc			Pfnew					
	20%	50%	80%		LOW	AVG	HIGH	LOW	AVG	HIGH	HIGH	AVG	LOW			
Largest	10.0	18.6	21.0	11.45	9.02	11.94	12.62	0.78	1.04	1.10	65.7%	47.6%	43.7%	OK	OK	OK
Average	10.0	18.6	21.0	6.39	9.02	11.94	12.62	1.40	1.87	1.98	28.0%	11.9%	9.4%	OK	OK	OK

Crown Stability Graph



Stable-HW/FW | Stable-Ore | Failed - HW/FW
Failed - Ore | Predict to Fail - HW/FW | Predict to Fail - Ore
Marginal - HW/FW | Marginal - Ore | Carter2008
1-43 Lower

Max
Average
Min

Range of rock mass quality (Q)

Project	PWGSC GIANT MINE REMEDIATION PROJECT YELLOWKNIFE N.W.T.		
Title	B4 Pit 1-43 Lower		
Golder Associates	PROJECT No. 09-1427-0006	Phase/Task No. 6000-6200	
	RUN ALP 19-Nov-11	Figure No. C-34	
	CHECK DTK 21-Nov-11		
	REVIEW 0.00 0-Jan-00		

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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