Newmont CANADA

Floor 8, 1066 West Hastings Street
V6E 3X8
Vancouver, BC

P 604.213.8823
newmont.com

DATE: April 2, 2025

SUBJECT: Detailed Note No. 031 – Red Chris Block Cave Production Phase
Detailed Response to THREAT Technical Memorandum on the Red Chris Block Cave Feasibility Study Numerical Modelling Report

1.0 Introduction

This detailed note is provided in response to the Technical Memorandum dated February 27, 2025 (Technical Memorandum) provided by the Tahltan Heritage Resource Environmental Assessment Team (THREAT) as part of the March 5, 2025, Red Chris Geotech Subsidence Modeling Meeting arranged by the BC Environmental Assessment Office. The Technical Memorandum presents a review of the document "Red Chris Block Cave Feasibility Study Numerical Modelling Report (ITASCA 2023)" (Numerical Modelling Report), which has been provided during the review of Newcrest Red Chris Mining Limited's (NRCML) "Application for an Amendment to Environmental Assessment Certificate M05-02 (Amendment Application) for the Red Chris Porphyry Copper-Gold Mine (Mine/the Mine [also Red Chris])," dated December 13, 2024.

2.0 Comment and Response

2.1. Comments

Information requests and comments from the Technical Memorandum are presented in **Attachment 1**.

2.2. Responses

Responses to THREAT's Technical Memorandum (Attachment 1) are prepared by ITASCA Consulting Group in **Attachment 2.**

2.3. Plan View Figures of Isosurface Fracture Limits

In addition to the written request made in THREAT is Section 2.1 – Definition of fielded Zone (Cave) and Fracturing Zone (Subsidence), NRCML is also providing plan view figures of the fracture limits associated with the 'Base Case' and 'Sensitivity Case' isosurfaces at 0.3% and 0.5% total strain limits to address the request made by THREAT during the March 5th Red Chris Geotechnical Subsidence Model meeting between NRCML, THREAT, the BC Ministry of Mines and Critical Minerals, and the BC Environmental Assessment Office.
These figures are shown below, and include the following:

- Figure 1: Fracture Limits for Base Case at 0.3% and 0.5% Total Strain;
- Figure 2: Fracture Limits for Sensitivity Case at 0.3% and 0.5% Total Strain; and
- Figure 3: Fracture Limits for Base Case at 0.5% Total Strain (Least Conservative) and Sensitivity Case at 0.3% Total Strain (Most Conservative).

Between all modelled fracture limits, the extent varies by less than 70 meters and remains primarily within the existing Open Pit, and completely within the ultimate extent of the Open Pit for the Permitted Case. Beyond the ultimate extent of the Open Pit for the Permitted Case, there is no incremental deformation in the previously distributed small-scale displacement zone or the 200 m Closure / Post-Closure exclusion area described in the Amendment Application.

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V6E 3X8
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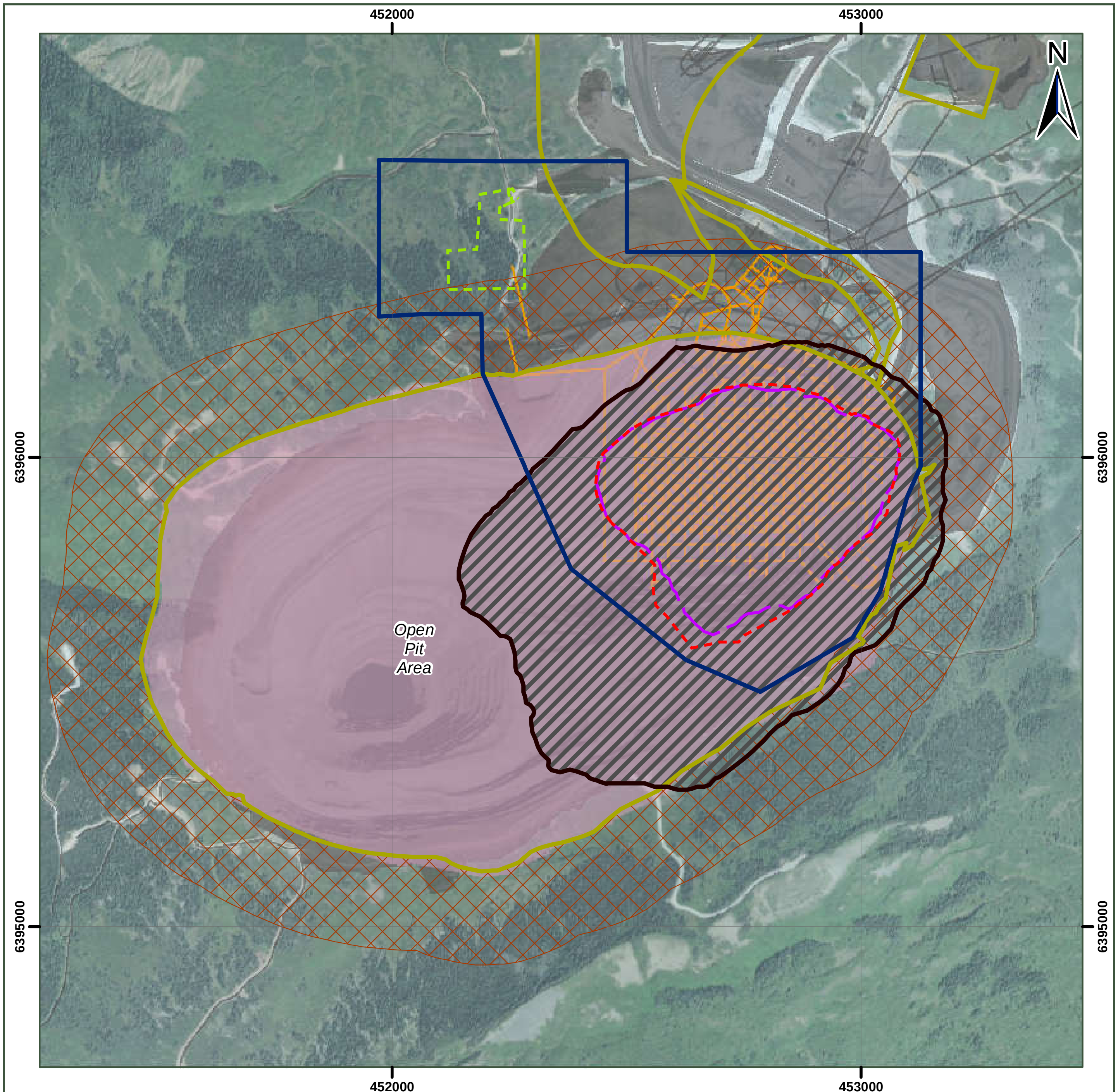
P 604.213.8823
newmont.com

Attachments: Figures

Attachment 1 Technical Memorandum: Review of the Red Chris Block Cave Feasibility Study Numerical Modelling Report dated February 27, 2025

Attachment 2 Technical Memo: Responses to Subsidence Report (ITASCA March 28, 2025)



LEGEND:

- EXISTING MINE
- AS PERMITTED COMPONENTS

PRODUCTION COMPONENTS

- UNDERGROUND WORKS
- PROJECT FOOTPRINT
- VENTILATION RAISE 4
- FRACTURE LIMIT – BASE CASE, 0.3% TOTAL STRAIN
- FRACTURE LIMIT – BASE CASE, 0.5% TOTAL STRAIN
- SMALL SCALE DISPLACEMENT ZONE
- PHASE 6 OPEN PIT OUTLINE
- CLOSURE/POST CLOSURE EXCLUSION AREA (200M)

NOTES AND SOURCES:

1. THIS MAP IS FOR CONCEPTUAL PURPOSES ONLY AND SHOULD NOT BE USED FOR NAVIGATION
2. BACKGROUND DATA FROM BC DATA CATALOGUE HTTPS://CATALOGUE.DATA.GOV.BC.CA/ ACCESSED SEPTEMBER 2023. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE – BRITISH COLUMBIA
3. BACKGROUND IMAGERY - MAXAR 2023
4. COORDINATES: -129.758121W, 57.727226N
5. PROJECT NTS MAP SHEET: 104H116
6. FOOTPRINT DATA SUPPLIED BY NEWMONT 05/2024
7. SMALL SCALE SUBSIDENCE ZONE DATA SUPPLIED BY NEWMONT 02/12/2025
8. PREPARED BY SLR

0 100 200 400 600 m

SCALE 1:12,500

DATA: NAD 1983 UTM Zone 9N

GRID: NAD1983 UTM ZONE 9N

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REPORT TITLE

DETAILED NOTE – 031 THREAT TECHNICAL MEMORANDUM RESPONSE – NUMERICAL MODELLING REPORT

FIGURE TITLE:

FRACTURE LIMITS FOR BASE CASE AT 0.3% AND 0.5% TOTAL STRAIN

FIGURE NO: **1**

DATE: March 25, 2025

PROJECT NO: 233.30000.00007

REV.	BY	CHK	DATE (M/DD/YYYY)	COMMENTS
A	AL	MG	03/25/2025	FIRST ISSUE

GIS PATH: G:_Projects\233\233_30000_RCBC\1_Maps\RPT\ItascaBlockCaveModellingReport\20250314_ItascaBC_01_BaseCase.mxd

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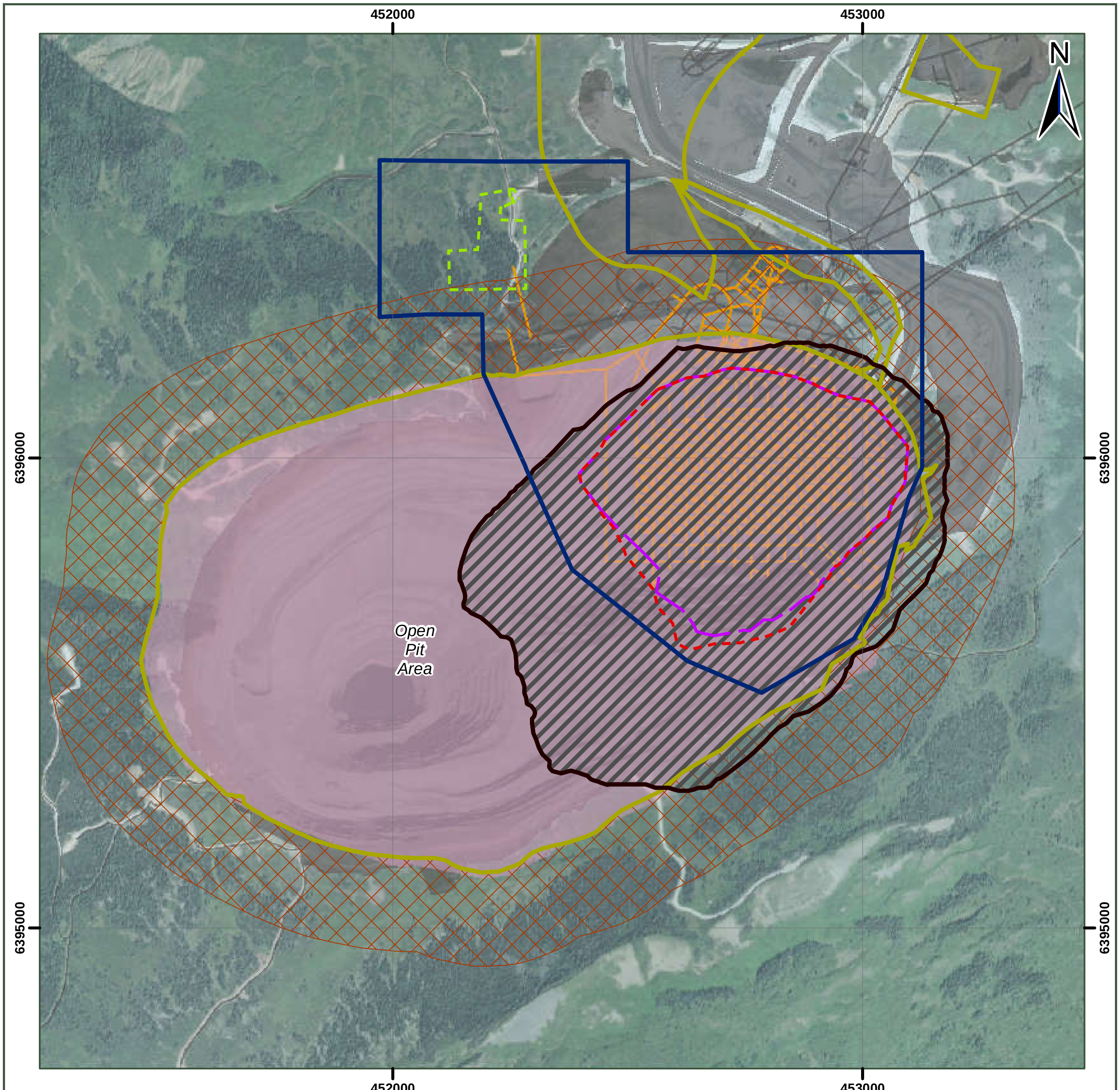

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LEGEND:

- EXISTING MINE
- AS PERMITTED COMPONENTS

PRODUCTION COMPONENTS

- UNDERGROUND WORKS
- PROJECT FOOTPRINT
- VENTILATION RAISE 4
- FRACTURE LIMIT – SENSITIVITY CASE, 0.3% TOTAL STRAIN
- FRACTURE LIMIT – SENSITIVITY CASE, 0.5% TOTAL STRAIN
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REPORT TITLE

DETAILED NOTE – 031 THREAT TECHNICAL MEMORANDUM RESPONSE – NUMERICAL MODELLING REPORT

FIGURE TITLE:

FRACTURE LIMITS FOR SENSITIVITY CASE AT 0.3% AND 0.5% TOTAL STRAIN

FIGURE NO: **2**

DATE: March 25, 2025

PROJECT NO: 233.30000.00007

REV.	BY	CHK	DATE (M/DD/YYYY)	COMMENTS
A	AL	MG	03/25/2025	FIRST ISSUE

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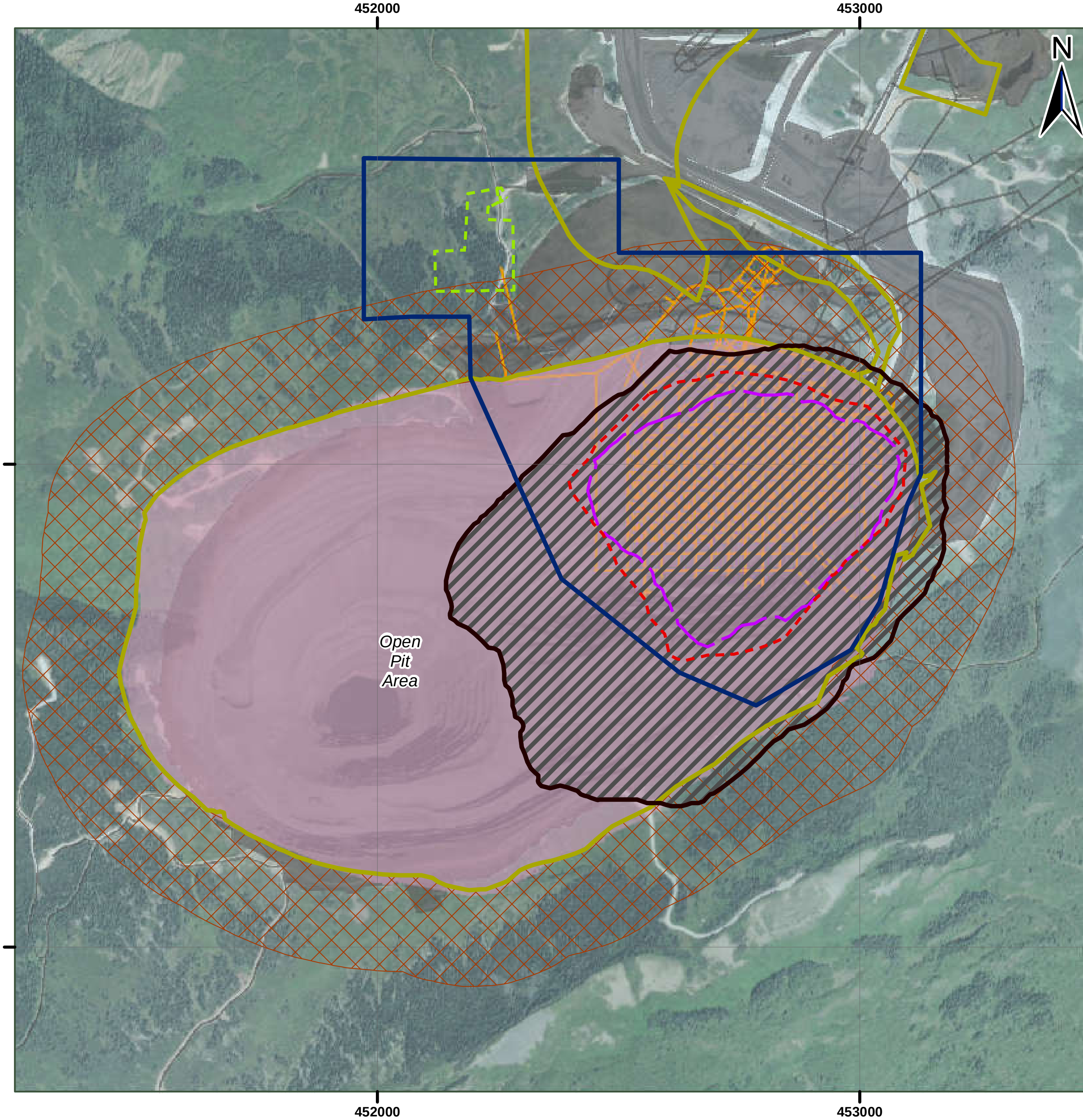

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SCALE 1:12,500

DATA: NAD 1983 UTM Zone 9N

GRID: NAD1983 UTM ZONE 9N

REPORT TITLE

DETAILED NOTE – 031 THREAT TECHNICAL MEMORANDUM RESPONSE – NUMERICAL MODELLING REPORT

FIGURE TITLE:

FRACTURE LIMITS FOR BASE CASE AT 0.5% TOTAL STRAIN AND SENSITIVITY CASE AT 0.3% TOTAL STRAIN

FIGURE NO: **3**

DATE: March 25, 2025

PROJECT NO: 233.30000.00007

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TECHNICAL MEMORANDUM

To:	Anna Osborne	**Date:**	February, 27, 2025
From:	Davide Elmo		
Subject:	Subsidence Report		

1 Introduction

This document concerns the review of the document "Red Chris Block Cave Feasibility Study Numerical Modelling Report" (herein referred to as Subsidence Report) on behalf of the Talhtan Central Government (TCG). The scope of the review is to identify critical geotechnical aspects that may impact studies concerning the ongoing Application for an Amendment to the Environmental Assessment Certificate (#M05-02) and future applications.

1.1 Use of confidential reports not available to TCG TRHEAT team

Several documents cited in the Subsidence Report appear instrumental in forming conclusions concerning cave development and subsidence. However, these documents are confidential, which limits the ability of the Subject Matter Expert (SME) appointed by TCG to undertake a comprehensive review. Furthermore, confidential technical reports and publications fail to satisfy academic and scientific standards for validating a proposed method or approach.

The following is confidential (or unpublished) work that is required to conduct a comprehensive review of the conclusions described in the Susidence Report:

- *Lorig, L & Pierce, M 2000, Methodology and Guidelines for Numerical Modelling of Undercut and Extraction Level Behaviour in Caving Mines, Itasca Consulting Group Inc., Minneapolis, report to the International Caving Study.*
- *Sainsbury, D & Lorig, L 2005, Caving Induced Subsidence at the Abandoned Grace Mine, confidential Itasca Consulting Group report to Arcadia Land Company.*
- *Andina, Venetia, and Pampa Escondida (Itasca confidential reports)*.

The principle of informed consent "*requires full disclosure of information regarding all aspects of a proposed project or activity in a manner that is accessible and understandable to the people whose consent is being sought.*"[1]. As such, it is recommended that confidential reports or technical publications not form the basis of any study used pursuant to an environmental/mine permit approval unless those confidential reports and technical publications can be shared with TGC.

[1] Quote from: https://earthworks.org/issues/fpic/

2 Comments Impacting #M05-02 Application

The comments provided in Section 2 refer to specific geotechnical questions that may impact studies completed as part of the Application for an Amendment to the Environmental Assessment Certificate (#M05-02). For instance, surface subsidence could directly impact infrastructure and services, land use, groundwater, surface water, and wildlife habitat.

2.1 Definitions of Yielded Zone (Cave) and Fracturing Zone (Subsidence)

Are the Yielded Zone (Cave) and Fracturing Zone (Subsidence) definitions based on the same strain criterion? Since the total strain criterion threshold results from a calibration exercise, how would the results change if using a different threshold, for example, 0.4%? We understand that 0.5% total strain is beyond the elastic limit of most rocks and in the damage zone for brittle rocks. However, the report by Sainsbury and Lorig (2005) is confidential and unavailable; therefore, TCG cannot review and confirm the impact of total strain in the calibration process used to justify using a 0.5% threshold. Our review is based on the following accepted principles:

- Intact rock typically fails at axial strains between 0.1 - 0.5%
- The elastic limit is often lower, around 0.1 - 0.2%. Beyond these values, permanent damage accumulates rapidly.
- Brittle rocks like granite might fail at 0.2 - 0.3%.
- While a 0.5% total strain indicates significant rock damage, it is not clear how conservative that threshold would be.
- The paper by Cavieres et al. (2003), cited in the Subsidence Report, does use a 0.3% to 0.5% range for total strain (See Figure 1 below). Furthermore, the same authors state that "*At this point, it is probably reasonable to establish that the 5e-3 "total" strain contour is a representation of the fracturing limit for* ***average conditions****, but* ***this limit doesn't always coincide with the observed subsidence damage***." The highlighted text introduces important limitations to the total strain criterion and reinforces the recommendation that a larger range be considered pursuant to application #M05-02.

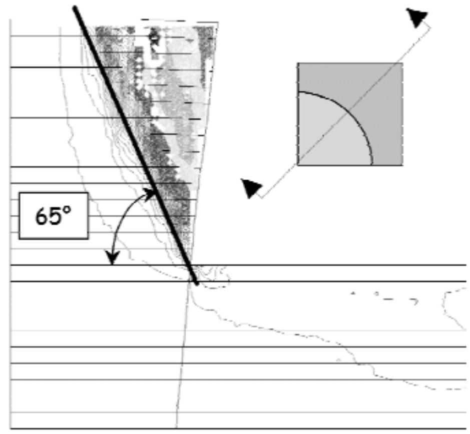


Figure 5. Contours of "total" strain (ε_t). The solid line sloping 65° from the horizontal corresponds to a "total" strain of approximately 3e-3 to 5e-3.

Figure 1. Illustration of how Cavieres et al. (2003) interpreted results of subsidence modelling by plotting strain contours in the range of 0.3% to 0.5%.

- The Subsidence Report refers to several case studies. However, which of those would be directly comparable to the proposed Red Chris block cave is unclear.
    - Kiruna (Sainsbury and Stockel, 2012) – sublevel caving, steeply dipping deposit (iron ore?).
    - Grace Mine (Sainsbury and Lorig, 2005) – tabular deposit (iron ore?).
    - Century Mines (Sainsbury et al., 2016) – No information available.
    - Cadia East (Ghazvinian et al., 2020) – No open pit above the cave.
    - Andina, Venetia, and Pampa Escondida – No information available.

CLARIFICATION/ACTION (IMPORTANT): Based on this, we are asking for iso-surfaces corresponding to a larger range of total strain (0.3% to 0.5%) to understand the long-term impacts of cave-induced subsidence (i.e., damage does not remain constant over time, as demonstrated by satellite images of Palabora cave-induced pit failure).

COMMENT: How does the adopted total strain criterion relate to the extensile strain criterion developed by Stacey (1981) and Stacey et al. (2003) for slope stability analysis? Both criteria claim to represent damage, so what would an iso-surface of extensile (ε_{33}) strain be like for the Red Chris East pit post-caving? A pit slope exceeding 300 m in height justifies looking more carefully at slope instability caused by caving (e.g. Palabora mine in South Africa).

2.2 Faults and Lithological Domains

Figure 12 in the Subsidence Report indicates the lithological domains and faults included in the Flac3D model. Arguably, several significant structures in the East Pit are not included in the model (See Figure 2 below). Without a model that includes those features, it is impossible to conclude they would not play a significant part in pit wall instability due to cave-pit interaction (as in the case of the Palabora mine). We cannot rely solely on engineering judgment as evidence that those features will not control cave-pit interaction

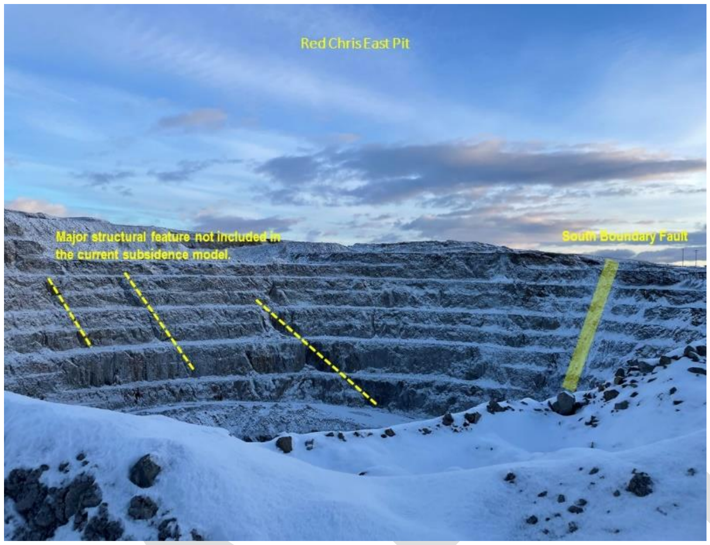


Figure 2. Photo of Red Chris East Pit (October 2024).

CLARIFICATION: Why did the Flac3D model not include large deterministic features visible in the East Pit? There is the risk that the modelling results are not fully representative of possible cave-pit interaction scenarios. This reinforces the need to adopt a more conservative total strain threshold to somewhat account for larger deformations that may occur because of different failure mechanisms in the East Pit.

ACTION: This is a carry-forward action. There should be a condition in the following permitting applications that requires a new cave-pit interaction model to be developed that fully accounts (deterministically) for significant geological structure in the East pit.

2.3 Principal Stress Contours (Mobilised Zone)

Figure 46 (page 56) in the Subsidence Report does not include principal stress contours within the mobilised zone. The contours appear to stop at the boundary with the mobilised zone, even though the caved material is not weightless and, therefore, should display stresses.

CLARIFICATION: Was a decision made not to display the principal stress contours in the mobilised zone? What is the reason behind the apparent abrupt changes in principal stress magnitudes and direction at the contact with the mobilesed zone?

CLARIFICATION: When looking at the section through the pit at the end of MB1 (See Figure 3 below), how much deformation is expected in the zones indicated by the red circles? The results point toward slopes that are steeper than the existing pit walls. A detailed model, including deterministic structures, will be required to confirm the stability of the resulting slopes. It is reasonable to assume that the slope profiles shown in Figure 3 are not more stable than the current pit slopes. If they were, we could conclude that it is possible to safely steepen the current pit walls and continue with open pit mining down to lower depths.

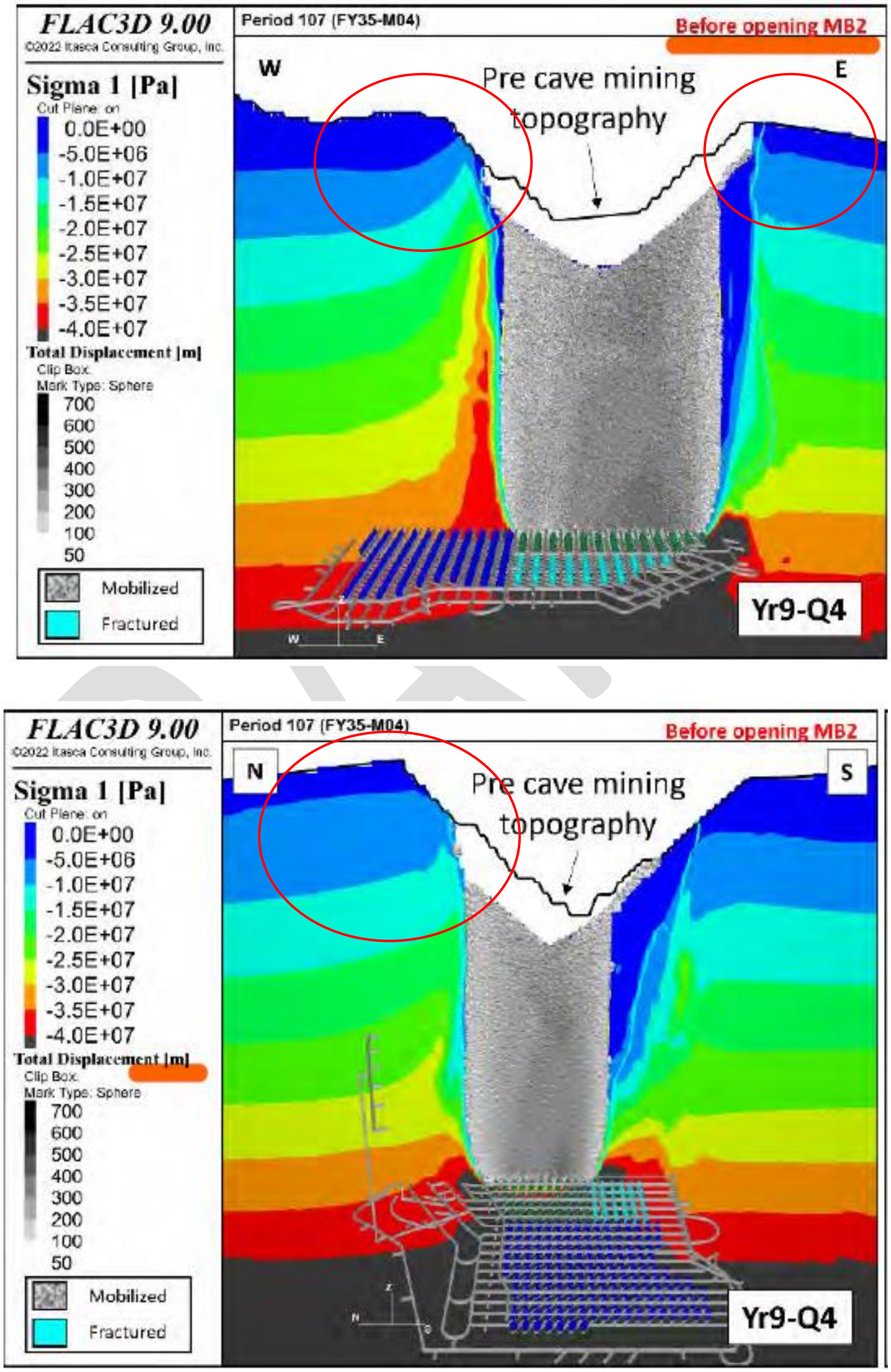
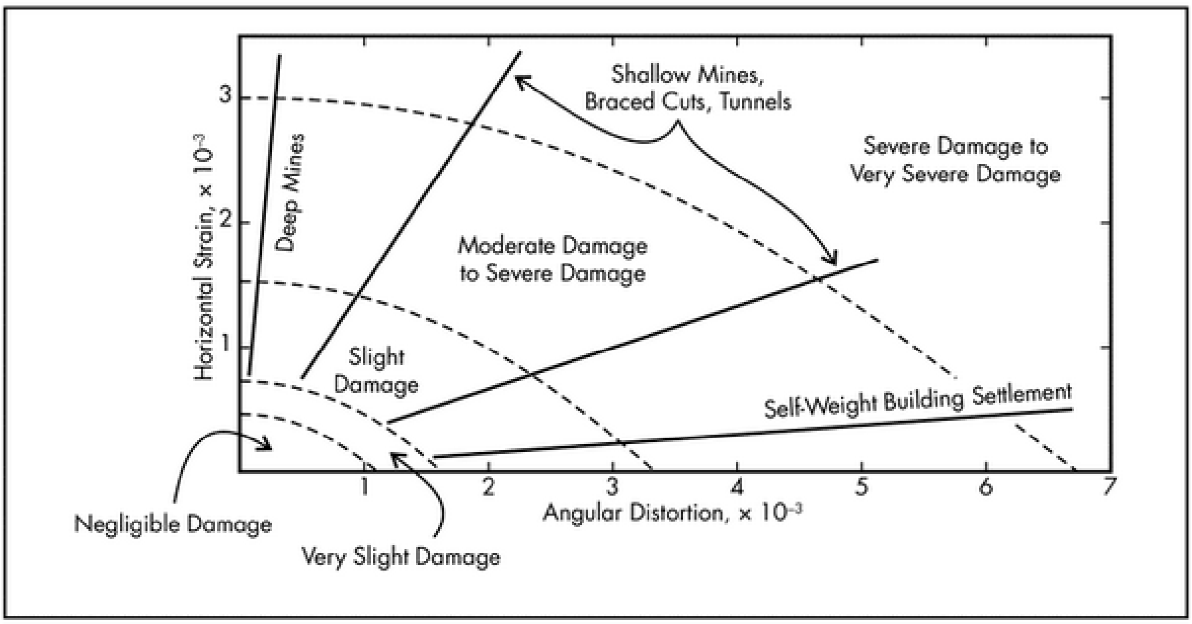


Figure 3. EW (Top) and NS (Bottom) cross-section at the end of MB1 showing breakthrough and subsidence in terms of fracture limit and crater geometry.

2.4 Definition of Damage

CLARIFICATION: Figure 48 in the Subsidence Report shows the different categories of building damage as determined from a combination of horizontal strain and angular distortion (modified after Harrison, 2011). Using these qualitative categories is reasonable for early screening but not for the final design. Furthermore, Figure 48 specifically refers to damage to infrastructures. Are these qualitative categories suited to studying the impact of subsidence and establishing a non-entry zone specific to land use and wildlife post mining? The Environmental Assessment applications concern impacts beyond structural damage to infrastructures.

CLARIFICATION: The same damage categories are used to define qualitative contour in Figure 49 of the Subsidene Report. Please confirm what the pink-dashed line is representing. It does not appear to represent a non-entry zone since it is offset toward areas showing less damage instead of be equidistant around the crests of two open pits.



Source: Adapted from Boscardin and Cording 1989.

Figure 8.9-13 Building damage in terms of angular distortion and horizontal strain

Figure 4. Original Figure from Harrison (2011).

CLARIFICATION/ACTION: The y-axis of Figure 48 in the Subsidene Report uses values of strain (horizontal) that are much lower than the assumed total strain threshold of 0.5%. There is further justification to request plots with iso-surfaces of total strain in the range 0.3% to 0.5%. Additionally, plots of horizontal strain using a range of [0.15%, 0.35% [should be displayed for the same cross-sections used in Figure 46 and Figure 57 of the Subsidece Report.

CLARIFICATION: On page 59, the following conclusions are stated [quote]:

- *Damage categories are tight with the fracture limit, specifically in the north and northeast due to high rock mass modulus.*
- *Damage categories in the south of the fracture limit are further extended due to the presence of Bowser (low rock mass modulus).*
- *At the end of LoM, the Influence Zone, defined by Newcrest based on PFS results, contains the fracture limit and a large part of the predicted damage, except in the southeastern part of the crater. The extent of negligible damage (in blue in Figure 49) south of the crater is associated with the Bowser unit. This level of predicted damage, as discussed earlier in this section, is not critical for* surface infrastructure.

The deformation is directly linked to the assumed deformation modulus in a continuum model. Therefore, the conclusions above raise the importance of the assumptions concerning the values of rock mass moduli used in the model (see later comment concerning E_{rm} sensitivity analysis). Since the current model only includes 3 major structures out of the 70 included in the structural geological model developed by WSP, how would the results differ if those structures were added to the continuum model or a discrete model was used that better accounts for structurally controlled failure?

CLARIFICATION: The modelling results (Figure 49 in the Subsidene Report) show that damage would generally not extend beyond the dashed pink line (except for a zone associated with the Bowser unit) under the assumed rock mass conditions. This raises several questions:

- What does the dashed pink line represent?
- Which zones were used to carry out groundwater studies? How were they defined at depth?
- Is there any closure or post-closure activity that depends on accessing zones inside the dashed pink line?
- The subsidence model does not consider a detailed slope analysis. Will further studies examine slope stability in more detail (ideally using a discrete model)?
- What are the blue zones outside of the dashed pink line (Northeast sector)?,

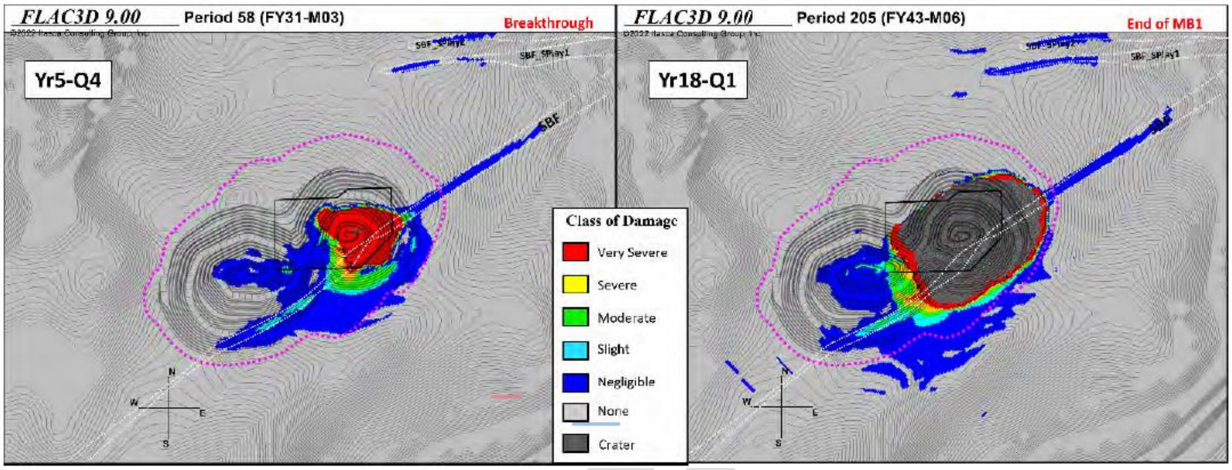


Figure 5. Damage categories for MB1 (From Figure 49 in the subsidence report).

2.5 Sensitiity Analysis (Rock Mass Moduli)

CLARIFICATION: On pages 61-62, the Subsidence Report states that "*In order to assess the influence of the rock mass modulus on subsidence only, cave shapes of the base case were used in this sensitivity (i.e., same propagation rates).*" Does this mean that the models used in the sensitivity analysis assume the same cave shapes of the base model rather than simulate them independently?

CLARIFICATION: The statement above could indicate that cave shapes are independent of the assumed rock mass moduli. Confirmation is required that the sensitivity analysis was conducted exactly as the base case model and that new cave shapes were generated in the model as an output of the sensitivity models. Please provide a comparison of the cave shapes between the base case and the case with reduced deformation moduli.

CLARIFICATION/ACTION: Page 61. While the magnitude of the results (E_{rm} reduced up to 30%) is reasonable, there are several important concerns about using Equations (4) and (5) for future sensitivity analysis purposes. It is recommended that this approach not be used for future models concerning the proposed block cave at Red Chris. Please see the detailed discussion below.

- If GSI does not apply to the rock mass at Red Chris except for Bowser and SBF, then using Equations (4) and (5) is not reasonable. The report correctly assumes that GSI should not be used to define the rock mass strength for Porphyry and host rock. Therefore, the same assumption should be extended to any method that relies on GSI, including Equations 4 and 5.
- Why not simply reduce the Young's modulus of all the non-GSI units by 10%, 20% and 30%, etc? Alternatively, we could set a range of sensitivity (e.g. -10% to -30%) and assign the reduction randomly to all the different cells in the Flac3D model. This approach would require running several models to account for variability in the "randomised" scenarios.
- Mathematically, Equation 5 is incorrect since it relies on the assumption that a = 0.5 for all GSI conditions. While we understand that for GSI > 55, the error could be acceptable

(error < 2%), it rapidly increases for GSI less than 50 (error > 3%). For example, for GSI 40, the error increases to 8%. More importantly, if we accept the assumption of a = 0.5 on the basis of the small errors, does it mean we can also abandon the original definition of the parameter "a" given by Hoek and Brown when using their criterion?

- Equation (5) assumes that there exists only one unique GSI (and GSI_{eq}) for a given ratio of uniaxial rock mass strength (UCS_{rm}) to uniaxial compressive strength (UBC_{int}) value. However, when considering several SRM models of the same rock mass quality (i.e., same GSI), there is no guarantee they will always yield the same rock mass strength value. Modelling experiments in which a few fractures were moved around in the DFN model (i.e., changing the underlying network connectivity) showed that it is possible to obtain quite different rock mass strength values under equivalent uniaxial loading conditions for the same rock mass quality. For example, when using the values of those experiments in Equation (5) - SRM models of Middleton (Li and Elmo, 2024) – we obtain a GSI_{eq} between 71 and 78 for the same rock mass quality. For those results, Equation (4) then yields E_{rm}/E_i ratios increasing from 0.75 to 0.86.
- Equation (5) assumes that the Hoek-Brown formula is an analytical solution and not an empirical formula. The semantic difference is very important since the Hoek-Brown formula considers GSI an input and rock mass strength an output and not vice versa. Reversing the Hoek-Brown formula to derive Equation (5) introduces a unique relationship between UCS, rock mass strength and GSI that incorrectly suggests that GSI is an indirect measurement of rock mass strength.
- Equation (5) Derivation:

$$UCSrm = \sigma_{ci}(s)^a$$
$$UCSint = \sigma_{ci}$$

This yields:

$$\frac{UCSrm}{UCSint} = \frac{\sigma_{ci}(s)^a}{\sigma_{ci}} = (s)^a$$

Assuming D=0, then:

$$s = Exp\left(\frac{GSI-100}{9}\right) \text{ and } \quad a = \frac{1}{2} + \frac{1}{6}\left(e^{-\frac{GSI}{15}} - e^{-\frac{20}{3}}\right)$$

But

$$\frac{GSI_{eq}-100}{9} = ln\frac{UCSrm}{UCSint} \text{ and therefore } Exp\left(\frac{GSI_{eq}-100}{9}\right) = s = \frac{UCSrm}{UCSint}$$

Mathematically, the parameter "a" should not be removed since like the parameter "s" it is also a function of GSI.

2.6 DFN Based Characterisation.

CLARIFICATION: The Subsidence Report (Page 12) states that *"the rock mass categories for the porphyry, defined by Golder based on P32 of open structure, weak veins, and 15% of carbonate veins, was prescribed into the models using the geotechnical block model."* There is a need to address the sensitivity of the modelling results to the assumed rock mass characterization shown in Figure 4, Figure 5 and Figure 6. Please confirm this methodology did not impact the extent of the simulated mobilised and fracturing zones.

The "matrix" shown in Figure 4 of the Subsidence Report adopts arbitrary ranges for P32 (open structures) and P32 (veins). For example, the rows and columns of the "matrix" follow two different scales with different rates of change between the bins. For example, in Figure 4 of the Subsidence Report, the P32 (open structures) lumps all values of P32 greater than 2 m^{-1} into a single bin. Figure 5 of the Subsidence Report shows that the P32 (open structures) bin [2, 3 m^{-1}] contains about 12% of the data, while the bin [3, 4 m^{-1}] contains 10% of the data. Figure 5 does not include data less than P32 of 1 m^{-1}, so it is unclear how the bins for P32 of 0.675 m^{-1} and 0.125 m^{-1} were established in Figure 4.

Similarly, the rock mass category model shown in Figure 6 of the Subsidence report adopts somewhat arbitrary bins. How can the DFN model detect blocks of 0.001 m^3? That would mean a search region with an edge length of 0.33 mm. We understand this is not feasible in the block search algorithm of the DFN model. The minimum grid size used was likely 0.3 m (yielding a 0.027 m^3).

3 Closure

Thank you for the opportunity to comment on the Red Chris Block Cave Feasibility Study Numerical Modelling Report. Please feel free to contact me with any questions regarding these comments.

References

Cavieres P., Gaete S., Lorig L., Gómez P. 2003. Three-dimensional analysis of fracturing limits induced by large scale underground mining at El Teniente mine. Conference: Soil and Rock America. 893.

Harrison, JP. 2011. Mine subsidence. SME Mining Engineering Handbook, 3rd edn, Society for Mining, Metallurgy & Exploration. Englewood.

Li Y., Elmo D. 2024. A Critical Discussion on the Use of Discrete Fracture Network Models in Rock Engineering Practice: Why Rock Mass Characterisation Methods can Benefit from Considering Fracture Connectivy. Rock Mechanics and Rock Engineering, 1-19.

TECHNICAL MEMO

ITASCA

Date: 28 March 2025

To: Ian Austen and Aleksander Purba, Newmont

From: Miguel Fuenzalida and Ehsan Ghazvinian

Re: Responses to Subsidence Report

Ref: 2-5273-02:25TM13

1.0 INTRODUCTION

This document summarizes the responses to actions and/or clarifications listed in the technical memorandum with subject "Subsidence Report" authored by Davide Elmo (herein referred to as "reviewer").

2.0 RESPONSES

2.1 Section 2.1 - Definitions of Yielded Zone ("Cave") and Fracturing Zone (Subsidence)

The yielded and fracturing zones are similar in the numerical modeling report (ITASCA, 2023) and are defined using a strain-based criterion, where the total strain measure exceeds 0.5%. This measure is calculated as:

$$\sqrt{\varepsilon_{11}^2 + \varepsilon_{22}^2 + \varepsilon_{33}^2}.$$

This criterion has been widely applied in ITASCA projects, supported by back analyses conducted in multiple mines, including Kiruna, Grace, Century Mines, Cadia East, Andina, Venetia, and Pampa Escondida. The "Cave" refers to the mobilized zone (muck pile) in ITASCA (2023) and calculated in MassFlow (cave flow simulator) by tracking the growth of the movement zones and the internal material movement associated with draw (extraction of material).

In response to reviewer comments, and as requested at the March 5, 2025, meeting, ITASCA has generated additional iso-surfaces and plan views using a more conservative threshold of 0.3% total strain for the base and sensitivity cases. The base case assumes a higher rock modulus (stiffer, harder rock) and the sensitivity case assumes a lower rock modulus (more compressible, softer rock). The fracture limit associated with the base case at a 0.5% total strain threshold was presented in the Amendment Application. The differences between the 0.3% and 0.5% limits are minimal, as expected (see Figures 1–4). The 'Class of Damage' scale included in the iso-surfaces corresponds to the Harrison damage classifications presented on page 58 and 59 of ITASCA (2023).

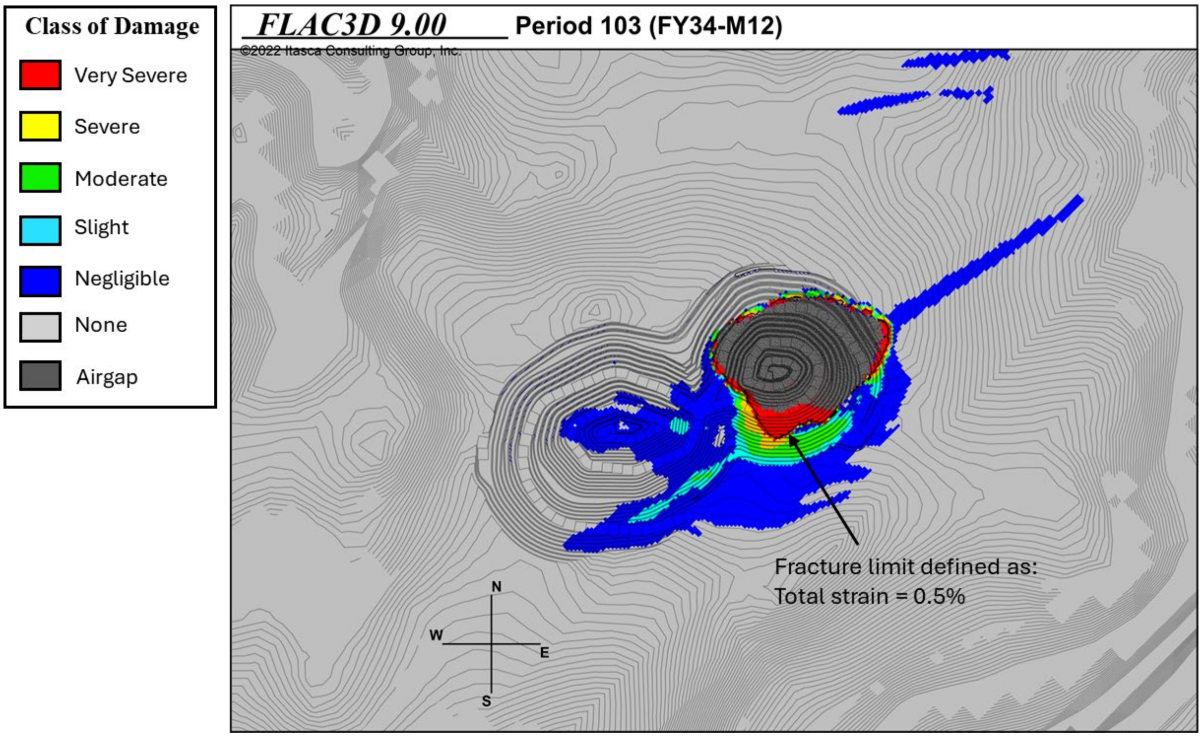


Figure 1 ***Base case, fracture limit contour defined as 0.5% strain limit.***

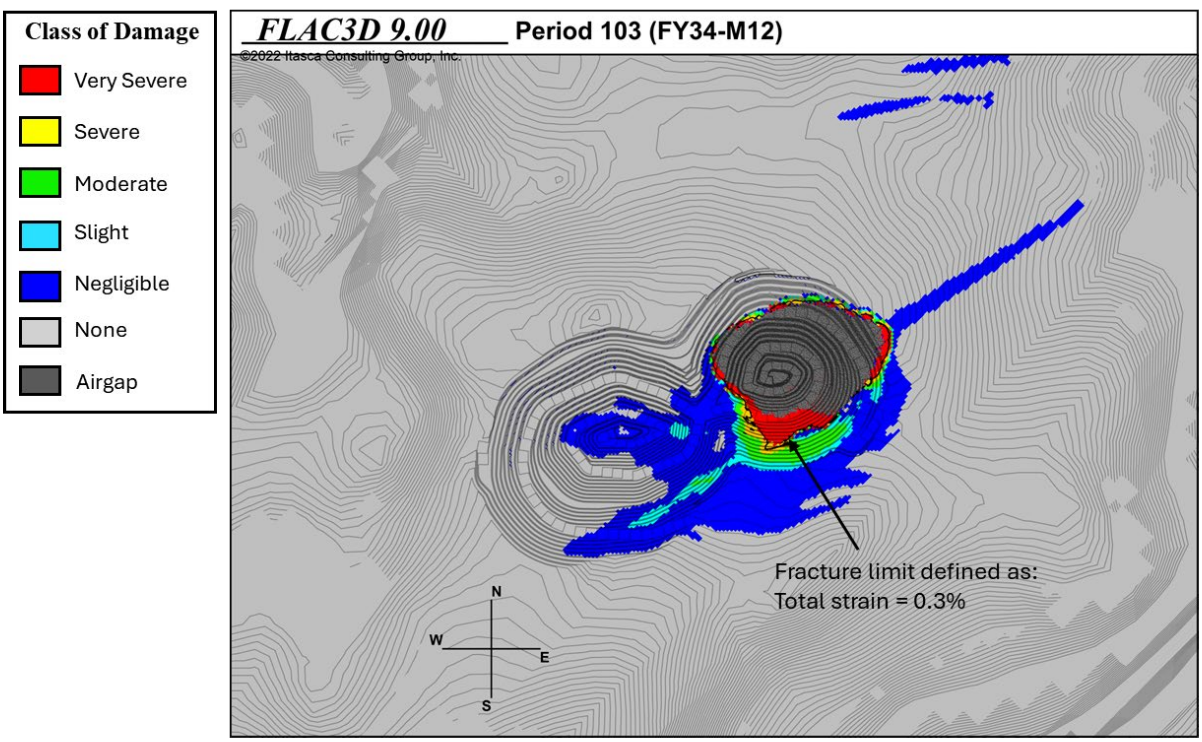


Figure 2 ***Base case, fracture limit contour defined as 0.3% strain limit.***

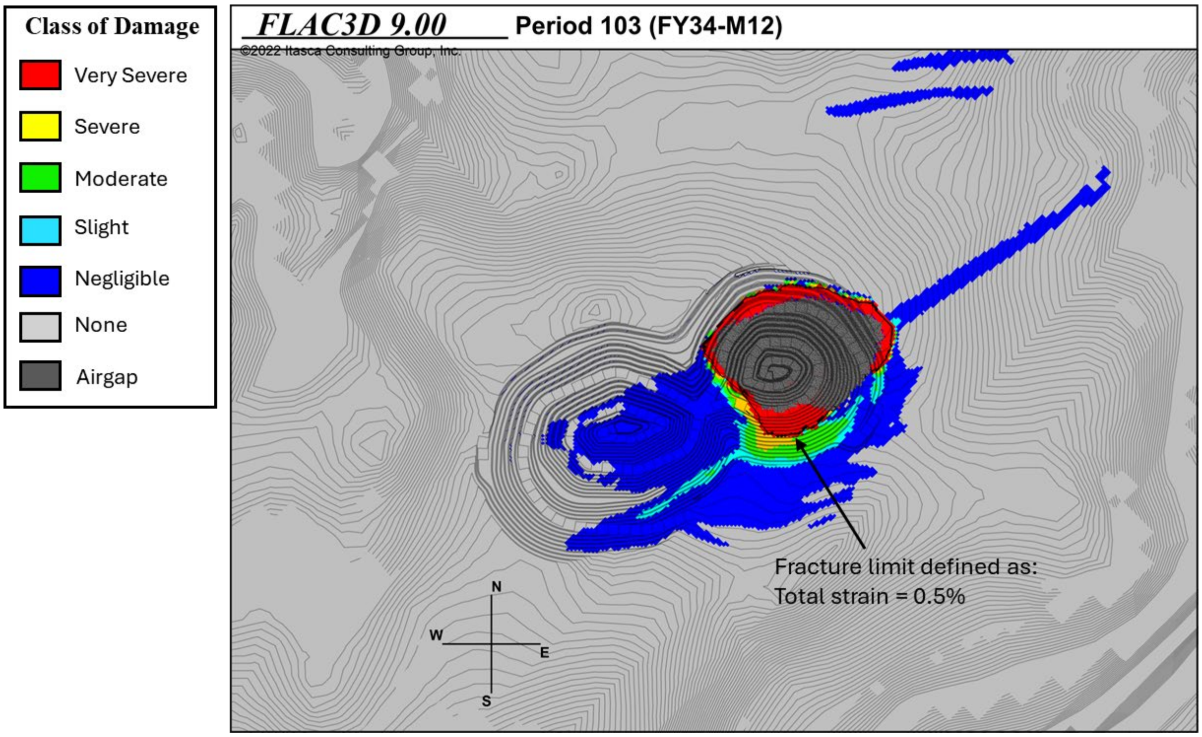


Figure 3 ***Lower Rock Mass Modulus, fracture limit contour defined as 0.5% strain limit.***

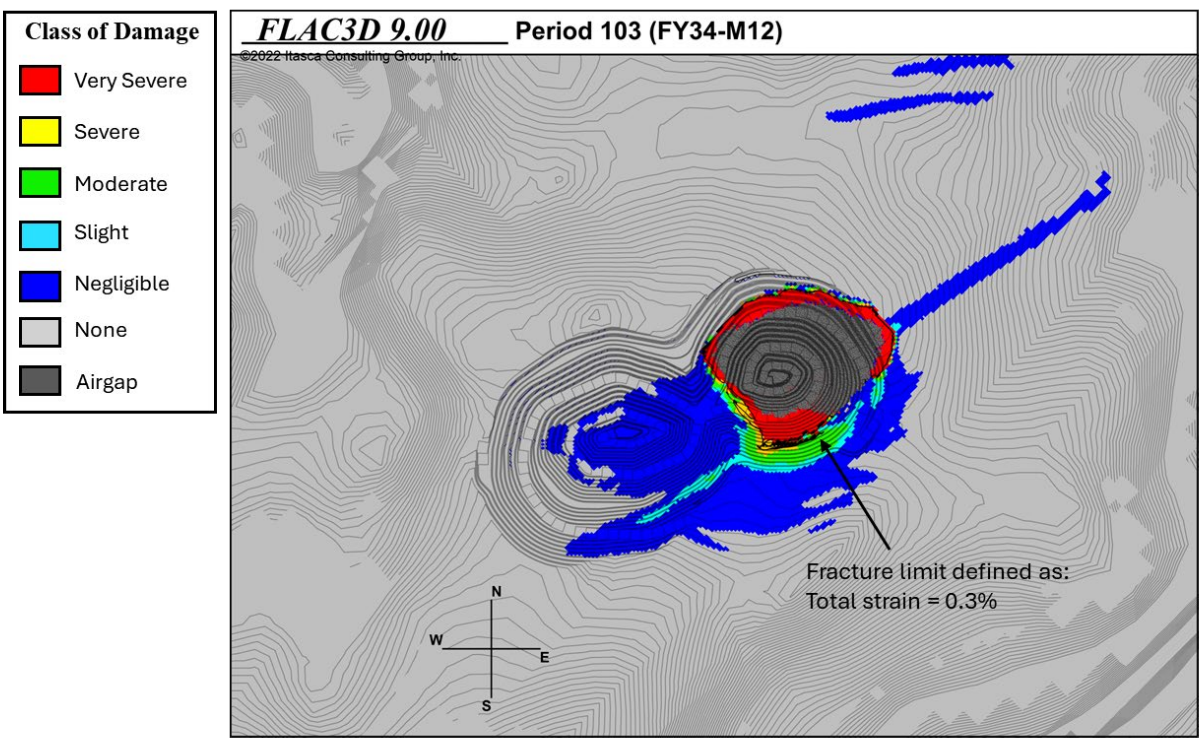


Figure 4 ***Lower Rock Mass Modulus, fracture limit contour defined as 0.3% strain limit.***

2.2 Section 2.2 – Faults and Lithological Domains

The numerical modeling report (ITASCA 2023) is a large-scale cave model designed to analyze cave initiation, propagation, and cave-induced subsidence. To account for potential impacts on cave behavior and subsidence, the model incorporates large regional-scale faults. The faults included in the modeling completed to date were selected based on their relevance in understanding the expected extent of cave-induced subsidence.

2.3 Section 2.3 – Principal Stress Contours (Mobilized Zone)

There is no specific reason why principal stress contours are not shown within the mobilized zone. ITASCA determined that showing caved rock displacements due to draw was more informative than displaying lower stress values within this region.

The changes in principal stress inside and around the movement zone align with expected behavior. Figure 5 presents the stress distribution around the movement zone at varying distances.

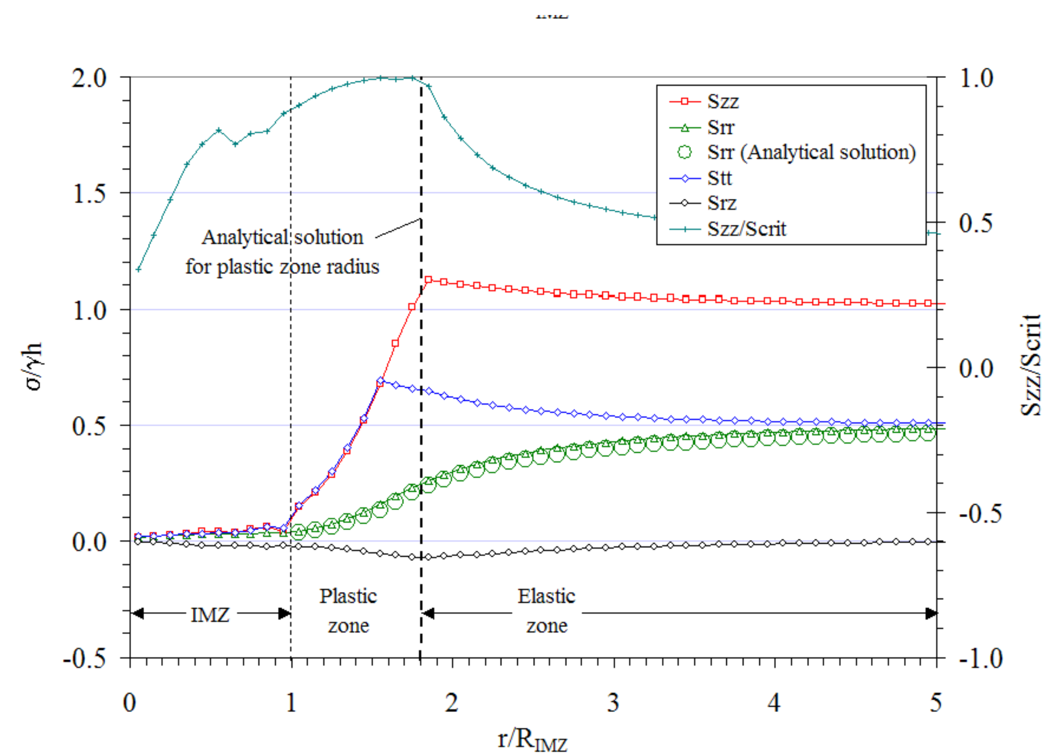


Figure 5 ***Example of stress distribution in and around the IMZ using FLAC axisymmetric models. Stresses are profiled along a line radiating from the drawpoint center into the surrounding stagnant material at an elevation 25 m above the model base (from Pierce, 2010).***

2.4 Section 2.4 - Definition of Damage

For comments regarding the 0.3% to 0.5% strain range, please refer to Section 2.1 responses.

For comments regarding the confluence of lower rock mass modulus and inclusion of the entire structural catalogue in the model, please refer to Section 2.2 responses.

2.5 Section 2.5 – Sensitivity Analysis (Rock Mass Moduli)

The sensitivity analysis assumed the same cave shapes as the base case, as no significant differences were expected. This is because cave growth is primarily driven by stress-induced caving rather than gravitational caving.

ITASCA considers the ~30% reduction in Young's modulus for brittle units to be a justified and defensible approach. This reduction was based on a rational methodology rather than an arbitrary selection, ensuring a sound basis for modifying the modulus values.

2.6 Section 2.6 – DFN Based Characterization

A sensitivity analysis on rock mass strength was performed to assess cave initiation and propagation. This was achieved by excluding disturbed samples from the calculation of the SRM-based strength equation provided by Pierce Engineering (2022), as referenced in Section 8.3 of ITASCA (2023).

ITASCA understands that the rock mass characterization for the Red Chris deposit, conducted by Golder (2022), was reviewed by the Newcrest Caving Advisory Panel, a competent independent review consisting of mining and geotechnical subject matter experts, before being used in the numerical model analysis. Therefore, it is considered a reliable representation of the rock mass at Red Chris.

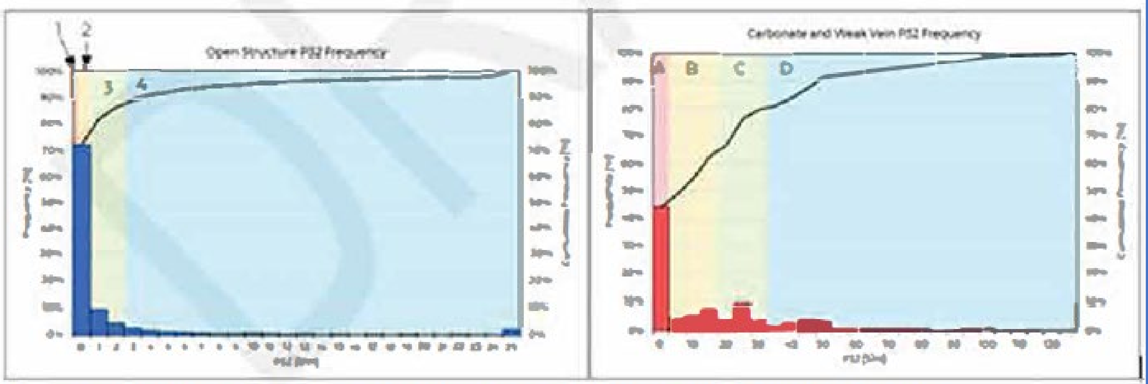
The following refers to Golder's report regarding DFN generation and fragmentation assessment (Golder, 2021 and Golder, 2022):

> *The CDFs were divided into classes based on where rates of change occur along the CDF curve. Where the change along the curve was rapid, the bins were smaller and where the change along the curve was less steep the bins were larger. Please note that bins of 0.675 and 0.125 both fall into class 1 and would not be meaningful to adjust further. The bin classes were based on the CDFs in Figure 6.*
>
> *In order to avoid edge effects of the DFN model due to generating fractures using centers and clipping on the outer region, a generation region is utilized that is typically a factor of two to three times large than the region of interest (the sampling region). The Sybil-Frac algorithm is computed on the smaller sampling region. In Red Chris case, a sampling region of 15m by 15m was used to in order to match the size of a block modelling grid cell, and therefore, a generation region 30m by 30m by 30m was used to create the DFN. The Sybil-*

Frac grid utilized was 150 x150 x150 cells meaning that each cell represents a volume of 0.1m by 0.1m by 0.1m or 0.001m^3. The model set-up is illustrated in Figure 7.

Intensity ranges for vein rock mass matrix and the proportion of drilled length within the 400m zone above the Extraction Level

Structure Type	Category	Min Intensity (1/m)	Max Intensity (1/m)	Modelled Intensity (1/m)	% of Logged Length in 400 m Zone
OS	1	0	0.25	0.125	52%
	2	0.25	1	0.675	20%
	3	1	3	2	15%
	4	3	25	10	13%
WV+CV Reduced Intensity	A	0	5	2.5	44%
	B	5	20	12.5	18%
	C	20	35	22.5	17%
	D	35	125	50	20%



Ranges of P32 intensities modelled for open structures (left); and carbonate and weak veins (right)

Figure 6 ***CDFs to develop bin classes for use in defining in-situ fragmentation (Golder, 2022).***

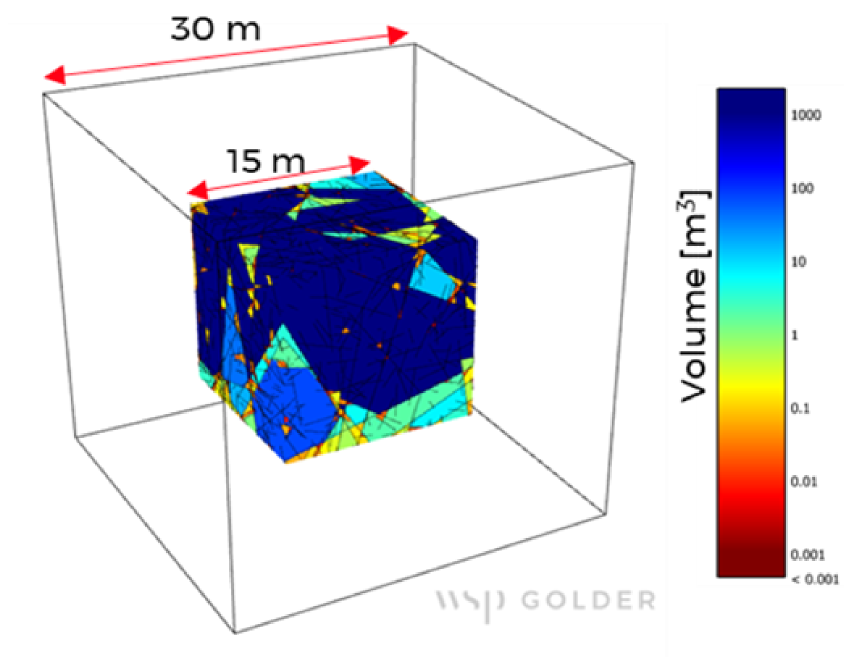
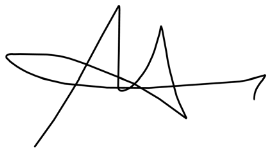


Figure 7 The DFN model set-up (Golder, 2021).

3.0 CLOSURE

We trust the information provided herein is sufficient for your present needs. Should you require anything further, please contact the undersigned.



Miguel Fuenzalida, MSc
Principal Geomechanics and Mining Engineer
ITASCA Minneapolis

Ehsan Ghazvinian, PhD, PEng (ON)
Senior Geomechanics Engineer
ITASCA Minneapolis

4.0 REFERENCES

ITASCA. (2023). Red Chris Block Cave Feasibility Study. Ref. 2-3906-22:23R13. (August 2023).

Golder. (2022). Rock Mass Characterisation – Red Chris Mine. Golder Doc. No. 21498202-2022-041-L-RevA-2000.

Golder. (2021). NCRM – In situ Fragmentation Prediction. Ref. 21453201-2021-146-PP-RevD (February 2021).

Pierce, M. (2010). A model for gravity flow of fragmented rock in block caving mines. PhD Thesis, Sustainable Minerals Institute, The University of Queensland.

Pierce Engineering. (2022). Application of Synthetic Rock Mass Testing to Cave-Scale Rock Mass Strength Estimation at Red Chris. Report Number PE631R2.