

DATE February 1, 2012**PROJECT No.** 09-1427-0006/20000/20100**TO** Dave Colbourne
DXB Projects / PWGSC**AECOM DOC. No.** 000-GEN-0-MEM-0006-Rev2_20120201**CC** Rudy Schmidtke, AECOM**GAL DOC. No.** 154**FROM** Darren Kennard**EMAIL** dkennard@golder.com**PUBLIC ACCESS CONTROLS ABOVE ARSENIC STOPE B2-08, GIANT MINE REMEDIATION PROJECT****1.0 B2-08 CROWN PILLAR STABILITY ASSESSMENT**

Golder Associates Ltd. (Golder) is engaged in development of a preliminary engineering design and cost estimating to facilitate closure of the underground portions of the Giant Mine Remediation Project. Golder's scope included a review and update of existing arsenic stope and chamber crown pillar stability assessments (Golder document 090).

Golder's work included an assessment of the probability of failure of the crown pillar above arsenic Stope B-208 which is located on the eastern side of the B1 open pit mine and west of and immediately adjacent to public Highway 4 (see key plan shown in Figure 1 and detail in Figure 2).

The predicted probability of failure of the rock crown pillar over arsenic Stope B2-08 for average rock mass conditions and typical stope geometry was 10%. Worse conditions could prevail due to the inherent variability of the mechanical properties of the rock mass and the complex geometry of the crown pillar. Further, there is a significant amount of soil overburden over the rock crown but the geology of these materials, which may contain significant amounts of fill, is not understood.

No obvious evidence of crown pillar failure has been observed near arsenic Stope B-208, but surface cracking on the mine access road situated at the crest of B1 open-pit has been observed and movement of existing monitoring points (see Figure 2) in the area has been measured. Although it has been postulated that the movement is associated with overburden soils moving towards B1 open-pit (Golder Document 051 and e-mail communication with PWGSC) the mechanism of this movement has not been fully investigated or confirmed.

2.0 POTENTIAL PUBLIC HAZARDS

Arsenic Stope B-208 which is located on the eastern side of the B1 open pit mine and west of and immediately adjacent to public Highway 4. Public access to the eastern crest of B1 open pit slope directly above arsenic Stope B2-08 has been observed and recorded within the last year.

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A 10% probability of crown pillar failure would be considered relatively low for an active mine site but given that public access in the area of arsenic Stope B2-08 occurs, tension cracks have been observed in the area, and the slope above the stope may be moving, elevated prudence is warranted.

The crown pillar of arsenic Stope B2-08 is noted in the current AANDC site risk register as a HIGH risk item (Risk 5.2.2, SM221, Giant Mine, ver. 2011-01-28). Golder concurs that this is appropriate.

In order to understand the zone of impact of a potential crown pillar failure, Golder delineated a subsidence zone by projecting an inverted cone from the top of arsenic stope B2-08 to surface using the following cave angles:

- 65° in rock from the top of the stope to surface; or
- 65° from the top of the stope to the rock / overburden contact, and 45° above that contact in soil to surface.

Any large scale crown pillar failure would be expected to manifest itself initially within the 65° perimeter with a gradual progression to the outer perimeter as the failure progressed in the overburden materials. Crown pillar failures can occur quickly and the current monitoring and reporting system is not sufficient to allow routine surface access in the area.

3.0 RECOMMENDATIONS ON SURFACE ACCESS CONTROLS NEAR ARSENIC STOPE B2-08

Golder recommends that public access to the area above arsenic Stope B2-08 be restricted as soon as practical. A typical solution could include erection of a fence between the portion of B1 open pit near arsenic Stope B2-08 and Highway 4 as shown in concept on Figure 2 (actual location to be confirmed in the field by AANDC).

Golder has previously recommended (Golder Document 090 and 051) that unnecessary vehicle and foot access by mine personnel near arsenic Stope B2-08 should be limited. We re-iterate this recommendation to allow critical foot access only after suitably trained personnel have reviewed the most recent survey of monitoring point MP2, MP3, and MP4, and carried out a visual survey of surface cracking to confirm no changes to the area above arsenic Stope B2-08 are occurring. Appropriate signage was in place but it should be checked and discussions with mine staff regarding access in this area should continue.

4.0 ADDITIONAL WORK

Soil and rock drilling geotechnical investigations and geophysical surveys aimed to better constrain the overburden and bedrock geometry and the engineering parameters of the materials encountered have been recommended to support future detailed engineering design studies of the overall remediation project. The information collected from such studies could be used to better constrain and define the stability of the area, but it would be some time before any conclusions could be reached.

Improving the slope monitoring system should be made a priority as the current system is likely subject to freeze/thaw effects and possible ice lens melting during the break-up period (early spring and late fall) that reduces the reliability of the system as an indicator of crown pillar and/or open-pit slope stability. The existing monitoring points should be replaced with more permanent pins or posts embedded securely in the ground topped with survey prisms. The accuracy of the survey system, the frequency of surveying, the timeliness of the analysis of the data and communication of any changes in slope behaviour need to be reviewed as part of the overall monitoring of this area.

5.0 CLOSURE

If you have any questions or concerns regarding this memo please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Darren Kennard, P.Eng. (BC)
Associate

DTK/JAH/keh

Attachments: Figure 1
Figure 2

ORIGINAL SIGNED

John A. Hull, P.Eng.
Principal

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REFERENCES

- Golder Associates Ltd. 2011. *Preliminary Design Report - Open Pit Closures* (DRAFT). Submitted December 6, 2011. GAL Document 051. AECOM Document 311-Open Pit-16-PDR-0003-Rev2-20111206.
- Golder Associates Ltd. 2011. *Review and Update of Arsenic Stope and Chamber Stability Assessments – Giant Mine Remediation Project* (DRAFT). Submitted September 7, 2011. GAL Document 090. AECOM Document 313-UG-13-RPT-0004-Rev2_20110907.
- Golder Associates Ltd. 2011. *Underground Preliminary Design Report – Giant Mine Remediation Project* (DRAFT). Submitted November 18, 2011. GAL Document 088. AECOM Document 313-UG-13-PDR-0003-Rev2_20111118.
- INAC (Indian and Northern Affairs Canada). 2011. *Risk Management Report Detailed*. Submitted January 28, 2011.

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KEY PLAN
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NOTES

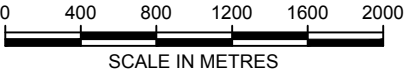
COORDINATES SHOWN ARE IN METRES GMRP GRID.

REFERENCE

TOPOGRAPHIC MAPS 85J08 AND 85J09 © 2002 HER MAJESTY THE QUEEN IN RIGHT OF CANADA. DEPARTMENT OF NATURAL RESOURCES. ALL RIGHTS RESERVED. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD83 COORDINATE SYSTEM: UTM ZONE 11.



PLAN
SCALE: 1:40000



 Public Works and
Government Services
Canada
Travaux publics et
Services gouvernementaux
Canada
REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

PRELIMINARY
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0	ISSUED WITH MEM-0006-R0	20120201
Revision/Revision	Description/Description	Date/Date

**PUBLIC WORKS
GOVERNMENT SERVICES
CANADA**

Project title/Titre du projet
**GIANT MINE
REMEDATION PROJECT
YELLOWKNIFE, N.W.T.**

**END LAND USE
TASK NO. 20**

Approved by/Approuvé par
JAH

Designed by/Concept par
DTK

Drawn by/Dessiné par
MSH

PWGSC Project Manager/Administrateur de Projets TPSGC
DAVE COLBURN

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

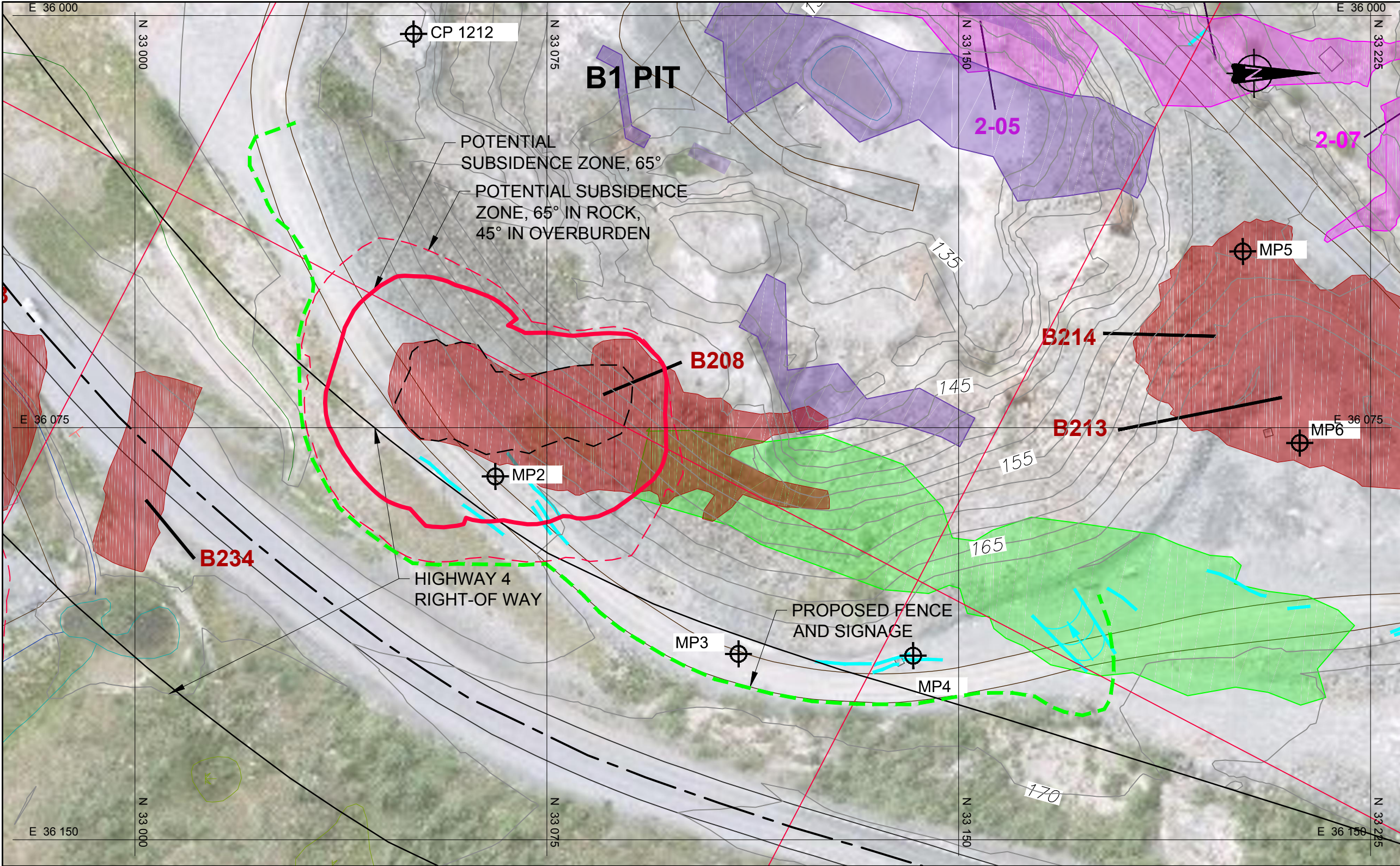
Client/client
PWGSC

Drawing title/Titre du dessin
KEY PLAN

Project No./No. du projet R-014204-320	Sheet/Feuille FIGURE 1 OF 2	Revision no./ La Révision no. 0
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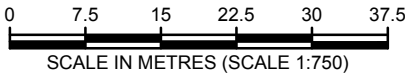
LEGEND

- ARSENIC CHAMBERS AND STOPE
- NEAR SURFACE NON-ARSENIC STOPE (POSITION APPROXIMATE)
- NON-ARSENIC STOPE ADJACENT TO AN ARSENIC STOPE (POSITION APPROXIMATE)
- UNDERGROUND STOPE BREAKTHROUGH TO OPEN-PIT, MAY BE BACKFILLED WITH UNKNOWN FILL (POSITION APPROXIMATE)
- SURVEY MONITORING POINT

- POTENTIAL CROWN PILLAR SUBSIDENCE ZONE, 65° IN ROCK, 45° IN OVERBURDEN
- POTENTIAL CROWN PILLAR SUBSIDENCE ZONE, 65°
- TOP OF STOPE
- OBSERVED SURFACE CRACKING
- PROPOSED FENCE AND SIGNAGE
- HIGHWAY CENTERLINE, ROW

NOTES

TOPOGRAPHIC CONTOUR INTERVAL IS 2.5m



PRELIMINARY
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1	ISSUED WITH MEM-0006-R1	20120201
0	ISSUED WITH MEM-0006-R0	20120120
Revision/Revision	Description/Description	Date/Date

PUBLIC WORKS
GOVERNMENT SERVICES
CANADA

Project title/Titre du projet
GIANT MINE
REMEDATION PROJECT
YELLOWKNIFE, N.W.T.

END LAND USE
TASK NO. 20

Approved by/Approuvé par
JAH
Designed by/Concept par
DTK
Drawn by/Dessiné par
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PWGSC Project Manager/Administrateur de Projets TPSGC
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Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client
PWGSC

Drawing title/Titre du dessin

POTENTIAL SURFACE SUBSIDENCE
ARSENIC STOPE B2-08,
RECOMMENDATION FOR FENCE
TO ADDRESS PUBLIC HAZARD

Project No./No. du projet	Sheet/Feuille	Revision no./La Révision no.
R-014204-320	FIGURE 2 OF 2	1

