APPENDIX 9-H
PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE

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Dear Mr. Smolik,

Re: Preliminary Geotechnical Assessment of the Snowfield Landslide

The Snowfield Landslide is a previously documented (Margolis, 1993; BGC, 2010; 2011) large bedrock slope instability located immediately east of the property boundary of the Seabridge Gold Inc.'s (Seabridge) KSM Project (Figure 1) and directly up-valley from the proposed Mitchell Open Pit. As part of ongoing project evaluations, we understand that Seabridge plans to conduct a project risk assessment that will include a review of risks associated with the Snowfield Landslide. The purpose of this letter is to:

- Summarize the available engineering geology data and our current understanding of the Snowfield Landslide.
- Review the landslide deformation history and estimate ongoing displacement rates.
- Estimate the potential runout length and area if the Snowfield Landslide were to suddenly collapse.
- Review potential options to reduce the ongoing deformation of the Snowfield Landslide.
- Recommend further assessments to improve the understanding of the Snowfield Landslide, allowing improved predictions of its behavior in the future.

Based on the results of this assessment, it is BGC's opinion that the Snowfield Landslide will continue to deform if no mitigating actions are undertaken as part of the development of the mine. If the magnitude of slope deformation increases to where sudden collapse of landslide occurs, the runout of the failed mass may extend down the Mitchell Valley and could reach the area of the proposed Mitchell Open Pit. Further assessments recommended to improve the understanding of the Snowfield Landslide hazard include slope monitoring, geotechnical drilling, and numerical modeling. If, after the project risk assessment, the Snowfield Landslide is considered an intolerable risk some or all of the possible mitigative actions discussed in this letter may be warranted.

1.0 ENGINEERING GEOLOGY OF THE SNOWFIELD LANDSLIDE

1.1. Surface Extent and Geomorphology

The Snowfield Landslide is located on the south slope of the Mitchell Valley, directly above the current terminus of the Mitchell Glacier (Drawing 1). The toe of the landslide is coincident with the valley floor at approximately 960 m above sea level (ASL). The current back scarp, as identified from aerial photographs taken in 2010, is at approximately 1,420 mASL. The current height of the unstable mass of the landslide is approximately 500 m. The maximum width of the presently identified unstable zone is approximately 920 m. The slope angle in the area of the landslide toe is approximately 35°; between the valley floor to 1,140 mASL. The slope angle in the area of the landslide above 1,140 mASL to the current back scarp is approximately 25°.

Several landforms typical of large landslides are observed within the limits of the Snowfield Landslide. Up-hill facing or "obsequent" scarps are found between the toe of the slope and 1,140 mASL elevation. Down-hill facing or "normal" scarps (Figure 2) and tension cracks are found between elevations 1,140 mASL and 1,420 mASL. On the basis of the distribution of these landforms, the Snowfield Landslide has been divided into two zones (Drawing 1):

1. Toppling Zone – encompassing the area of the obsequent scarps.
2. Sliding Zone – encompassing the area of normal scarps and tension cracks.

The observed landforms are inferred to be related to the dominant mode of displacement in each of the zones. The possible kinematics and displacement modes of the Snowfield Landslide are discussed further in Section 3.0.

1.2. Bedrock and Structural Geology of the Landslide Area

The bedrock geology of the landslide area has been previously characterized through mineral exploration work completed by Silver Standard Resources Inc. (SSR) from 1999 to 2010. The rocks surrounding and making up the Snowfield Landslide are Lower Jurassic aged andesitic volcanics of the Hazelton Group; including volcanic flows, lithic tuffs, crystal tuffs, and lapilli tuffs. These rocks have been metamorphosed to lower greenschist facies and hydrothermally altered (P&E Mining Consultants Inc., 2009). Phyllic (quartz-sericite-pyrite) and argillic alteration types are observed in the area of the landslide. These alterations have reduced the strength of the rocks in and around the area of the landslide.

The rocks of the landslide area are foliated and faulted. The orientation of the foliation varies, but generally dips 60° toward 345° (Figure 3). At least two major faults are adjacent to the Snowfield Landslide: the Brucejack Fault and the Mitchell Thrust Fault (Drawing 1). The Brucejack Fault is a near vertical fault observed as a well-defined topographic lineament to the south of the Snowfield Landslide and is interpreted to project through the eastern limit of the Snowfield Landslide. The Mitchell Thrust Fault dips gently (<30°) to the west and has been identified from exploration drilling and mapping in the Mitchell Valley west of the

Snowfield Landslide; it is interpreted to project into the toe of the Snowfield Landslide (Drawing 1).

1.3. Rock Mass Characterization

As part of work BGC completed for SSR in 2010, geotechnical drill holes were completed in the area of the Snowfield Landslide (Drawing 1). Drill hole MZ-095 is located near the center of the landslide mass at the northern edge of the zone of sliding; immediately above the zone of toppling. The rock mass intersected in the first 150 m of the drill hole (Figure 4) is generally fractured and medium strong (25 – 50 MPa) with an estimated average rock mass rating (RMR) of 44; classified as “Fair” rock mass quality. The rock mass is less fractured at depth while remaining medium strong; the average RMR of the rock mass at depth is 71, classified as “Good” rock quality. A similar reduction in fracturing with depth is observed in the RQD data collected from exploration drill holes in the area of the Snowfield Landslide.

The reduction of rock mass quality at shallow depths is inferred to be related to the landslide deformation and weathering. The 150 m of reduced rock mass quality observed in MZ-095 may represent the maximum thickness of the landslide; other holes show a thinner zone of disturbed rock mass (Drawing 2). Based on the available data, an average thickness of 75 m is estimated for the Snowfield Landslide. The thickness of the disturbed rock mass in the zone of toppling is generally greater than 75 m; while the disturbed rock mass in the zone of sliding is generally less than 75 m.

1.4. Hydrology and Hydrogeology of the Landslide Area

Sources of surface water that could infiltrate the slope and cause a rise in pore pressures in the area of the landslide include rain and snow melt. Water from snow melt is stored in small lakes near the top of the valley slope which are drained by at least two streams that flow into the area of the landslide. The western stream intersects the current head scarp of the Snowfield Landslide; the stream is captured and flows into rock mass of the landslide. The eastern stream flows along the eastern limit of the landslide to the valley flow and the base of the Mitchell Glacier.

Groundwater seeps are observed near the toe of the slope in the toppling zone. At least three seepage points can be seen in the 2010 aerial photography (Drawing 1); water from these seeps flows over the toppled material to the valley floor. In addition to the flowing seepage points, water is ponded behind some of the obsequent scarps in the toppling zone. This ponded water may also be related to groundwater seepage from the landslide.

2.0 SNOWFIELD LANDSLIDE DEFORMATION HISTORY AND RATE

2.1. Historic Development

BGC has reviewed aerial photographs of the area of the Snowfield Landslide from 1949, 1956, 1972, and 2010. Three-dimensional models of the valley slope where the Snowfield

Landslide is currently located have been created from the available aerial photographs from 1956, 1972, and 2010 (Figure 5):

1. 1956 – No landforms indicative of the Snowfield Landslide are visible. Some sloughing of moraine material above the glacier surface may be occurring.
2. 1972 – Obsequent scarps are found at the northeast limit of the Snowfield Landslide; tension cracks are visible at the mid-slope bench.
3. 2010 – Obsequent scarps are well developed in lower slope of the landslide. Tension cracks define a back scarp at the southern limit of the unstable mass.

From the available data, it is estimated the Snowfield Landslide is approximately 50 years old.

The recession of the Mitchell Glacier is likely one of several factors resulting in the development of the Snowfield Landslide. In 1956, the elevation of the Mitchell Glacier surface was approximately 1,080 mASL in the area of the landslide. By 2010, the glacier surface had been reduced through ice loss to 960 mASL elevation at the toe of the Snowfield Landslide. The ice surface reduction of approximately 100 m of ice from the toe of the valley slope occurred over a period of 54 years with an average rate of approximately 2 m/year.

2.2. Current Slope Deformation Rates

BGC has interviewed former staff of SSR to obtain their observations of the Snowfield Landslide during their time working in the area. The following anecdotal information was provided by Mr. Ken McNaughton, now of Pretium Resources Inc.:

1. Some drill hole collars appeared to move downslope between 0.75 m to 1 m from one field season to the next.
2. During the 2008 exploration drilling campaign, four drill rigs were operating in close proximity to each other near the middle of the Snowfield Landslide. As part of the typical drilling process, the rigs were all pumping water into the sub-surface. While drilling, each rig experienced squeezing hole conditions followed by breakage of their drill strings at approximately the same time. SSR inferred that the drilling activated a slip plane within the landslide mass, resulting in these issues.

The anecdotal evidence suggests that the Snowfield Landslide is actively deforming. Deformation may be accentuated by periods of sudden rupture and intermittent slow deformation.

In an attempt to quantify the amount of displacement over a year, BGC has analyzed drill collar survey data from SSR. Drill hole collars were surveyed with high resolution GPS in 2008 and 2009 (Drawing 1). BGC compared the 2008 and 2009 collar surveys for drill holes outside of the landslide area; the differences in these surveys were assumed to represent an average “stable error” vector due to the survey process. This “stable error” was removed from the differences in the surveyed positions of the drill hole collars inside the landslide area; the remaining difference in the location of the drill hole collars inside the landslide area is assumed to be caused by landslide movements (Table 1). The data suggests that parts of the landslide have moved approximately 1 m between 2008 and 2009 toward the north-east (Drawing 1) which confirms the anecdotal observations of the Snowfield Landslide displacement. The Snowfield Landslide can presently be classified as “very slow” to “slow” moving (Cruden and Varnes, 1996).

3.0 LANDSLIDE KINEMATICS AND RUNOUT

3.1. Slope Deformation Kinematics

The Snowfield Landslide has two apparent modes of displacement:

1. The lower slope appears to be mainly toppling; columns or slabs of rock defined by persistent geological structures are tilting and rotating toward the former Mitchell Glacier surface.
2. The upper slope, behind the toppling zone, appears to be sliding and down-dropping into the space made available due to the toppling of the lower slope.

The landslide appears to be retrogressive: failure has initiated as toppling in the lower slope and deformation has progressed up-slope as sliding. The lower north-east corner of the landslide, adjacent to the Brucejack Fault, is the likely initiation location of the slope instability; based on the review of the aerial photographs (Figure 5). The ground in this area appears more chaotic and disturbed than other parts of the landslide; the Mitchell and Brucejack Fault may intersect in this area.

3.2. Sudden Collapse Potential

Estimating the likelihood of a sudden collapse of a large natural bedrock landslide is difficult without detailed and long term deformation monitoring data. Signals for imminent catastrophic failure noted in research literature include displacement rates (Fell et al, 2000) or strain (Brox and Newcomen, 2004). In 2009 the Snowfield Landslide had an average displacement rate of approximately 3 mm/day which is below the velocity threshold of 10 mm/day to 50 mm/day typically considered to indicate imminent collapse of a rock slope (Fell et al, 2000). This estimated displacement rate is based on only two measurements; it is not known if the landslide moves faster during some periods of the year and slower during others. If the displacement rate were tripled or increased by an order of magnitude, collapse of the Snowfield Landslide could be expected.

Recent work by Jaboyedoff et al. (2012) has attempted to provide a rapid assessment tool for the susceptibility of a large bedrock landslide to collapse suddenly (Figure 6). The current “deformation state” and “activity” of the landslide have been compared to the database used to develop Figure 6. Based on this comparison, it appears that the Snowfield Landslide may be susceptible to sudden collapse; i.e. it is reasonable to expect the sudden collapse of the Snowfield Landslide sometime in the future.

3.3. Preliminary Landslide Runout Estimate

The potential consequences of the sudden collapse of the Snowfield Landslide are directly related to the landslide travel distance and lateral spread upon collapse. Landslide travel distance has been assessed at a preliminary level to define the maximum, expected travel distance of debris that originates from the collapse of the Snowfield Landslide; assuming the collapse of the entire landslide volume. Considering the average dimensions of the landslide and assuming an average thickness of 75 m, the volume of the landslide is approximately:

Slope length x Slope width x Thickness = 900 m x 850 m x 75 m = 57 x 10^6 m^3

The landslide travel distance has been estimated using an empirical method that is based on case histories published by Li (1983). The method relates the landslide volume to the travel distance by the ‘angle of reach’ concept (Heim, 1932). The ‘angle of reach’ is defined by a line that connects the top edge of the landslide source area with the distal edge of the deposit (Figure 7). Drawing 3 outlines the estimated runout extent on this volume and the relationships discussed below.

Li (1983) presents a plot that compares landslide volume to the angle of reach for 76 rock avalanches and an equation for the best fit lines through the data points. The expected angle of reach can be estimated for a given landslide volume from the best fit line. There is considerable scatter of the data points around this best fit line as a result of unique physical aspects of each case. To reduce this scatter, lines have been drawn that define the runout exceedance probability for the data set (Figure 7). The best fit line defines the 50% exceedance probability as it is drawn through the center of the data set, and half of the case studies traveled farther than indicated by the best fit. Similarly, 10%of the landslides included in the database ran out farther than would be estimated from the 10% exceedance probability line.

The travel path of Snowfield Landslide debris is uncertain. Initial displacement of the landslide may be perpendicular or oblique to the axis of Mitchell Valley. In the analysis it has been assumed that the initial landslide travel path will be oriented at a 60° angle to the valley axis; this is the most oblique travel direction that appears likely and maximizes the debris runout down Mitchell Valley, resulting in a more conservative result. Figure 8 illustrates the travel path used in the analysis and the travel distance for the 50% and 10% runout exceedance probability.

The elevation profile along the travel path is shown in Figure 8. The expected maximum reach of the landslide is the point where the angle of reach line intersects the ground surface. The angle of reach line has been drawn from the top of the interpreted landslide source zone at 1,420 mASL. The results of the empirical travel distance assessment indicate that a ‘rock avalanche’ with a 10% runout exceedance probability would likely runout into the area of the proposed Mitchell Pit.

A rock avalanche could cause secondary hazard scenarios such as debris flow of saturated valley sediments or landslide dam outburst flood if portions of the landslide impound Mitchell

Creek. Depending on the stage of the project and the timing of the landslide collapse, an outbreak flood could report to the Mitchell Open Pit or create flooding conditions tens of kilometers downstream. The extent of such an event is dependent largely on landslide dam height, impounded water volume and landslide dam breach rates. The likelihood and potential travel distance of these secondary hazards is highly uncertain; the associated consequences and risk with these scenarios will have to be addressed in a separate assessment.

4.0 LANDSLIDE MITIGATION OPTIONS

There are two general options to reduce the hazard posed by a sudden collapse of the Snowfield Landslide if, after Seabridge completes the project risk assessment, the landslide is considered an intolerable risk:

1. Remove parts or the entire landslide.
2. Reduce slope deformation rates via depressurization of the slope, decreasing the susceptibility of the slope to sudden collapse.

The economic feasibility of either option will require further consideration and assessments.

4.1. Landslide Removal

The Snowfield Landslide could be removed with the mining equipment available during the first phases of mine production. Mining would have to be undertaken from the top down to not undercut the landslide mass; first removing the sliding zone, then the toppling zone. An excavation plan could be optimized with additional work; the entire landslide volume may not require removal. Some slope stability assessments would be required as part of this work to confirm that the excavation plan does not destabilize sections of the rock mass left behind.

4.2. Landslide Depressurization

The deformation rates of several large landslides have been reduced by removing ground water to depressurize the landslide mass. Most of the examples identified in the Table 2 rely on drainage adits with inclined drain holes from galleries. Vertical wells may also be an option; these are regularly used as part of the management of large open pit slope instabilities.

It may be possible to develop a depressurization adit for the Snowfield Landslide off of the Mitchell Diversion Tunnel. This tunnel is planned to pass through the Mitchell-Sulphurets Ridge to convey water from the Mitchell Glacier into the Sulphurets Valley. Alternatively, an attempt to construct and maintain vertical pumping wells could be made at the outer limits of the landslide. If the deformation rates are not quickly reduced after the installation of the wells, there is potential to lose the wells due to shearing of the casing. The pumps will require maintenance and electricity throughout the life of the project. The handling of the water drained from the landslide will require some consideration. The rocks of the landslide are mineralized and the water from the landslide may require treatment prior to discharge to meet the water quality requirements during mining.

Prior to the construction of the depressurization adit or vertical wells, some effort could be spent on improving the surface water management around the landslide. Berms could be constructed to divert snowmelt and rain from the upper slope area away from the existing tension cracks of the Snowfield Landslide.

5.0 SUMMARY AND RECOMMENDATIONS

5.1. Summary

The Snowfield Landslide presently is an active, retrogressive, complex, slow moving, rock slide and flexural topple. This slope has been deforming noticeably for approximately 50 years; possibly in response to the retreat of the Mitchell Glacier. The slope will very likely continue to deform if no mitigative actions are undertaken as part of the mine development and the Snowfield Landslide appears susceptible to sudden collapse. The runout of the failed mass may extend down the Mitchell Valley or be intercepted by the Mitchell Open Pit.

The hazard associated with the sudden collapse of the Snowfield Landslide could be reduced, if required. The landslide could be excavated and removed using the equipment available during the first years of the mine. Alternatively, depressurization of the Snowfield Landslide via an adit or vertical wells and the re-direction of surface water away from existing cracks at the limit of the landslide may slow the rate of slope deformation and reduce the likelihood of sudden collapse of the slope.

5.2. Recommendations

5.2.1. Geotechnical Drilling

Additional geotechnical drilling should be undertaken to:

1. Improve the current estimates of the landslide thickness.
2. Attempt to identify the basal failure surfaces of the landslide.
3. Provide data for engineering analyses needed to optimize any planned mitigation.

Two drill holes are currently planned for the 2012 field season (Table 3). One hole is located in the Sliding Zone; one hole is located in the Toppling Zone. Once the drilling program has been completed, the data should be reviewed and integrated into an updated assessment of the Snowfield Landslide.

5.2.2. Slope Monitoring

Additional slope deformation monitoring data for the Snowfield Landslide is required to understand: correlations between seasonal climate changes and movement rates, the distribution of deformation across the landslide, the distribution of deformation with depth, and the annual changes in the landslide. These data will assist with further evaluations of the likelihood of the sudden collapse of the landslide. Three monitoring methods are proposed for implementation in 2012:

1. Time domain reflectometry (TDR) cables should be installed in the planned geotechnical drill holes. These instruments will allow the identification of discrete shear planes within or at the base the landslide mass. Monthly readings should be made using these instruments once they are installed through the completion of the 2012 field season. Readings should be attempted in 2013 once the sites are accessible. However, considering the estimated year to year deformation rates, these instruments may be sheared through by 2013.
2. Consideration should be given to the use of data loggers at each installation. A data logger and 300 m long TDR cable would cost approximately $15,000; the data logger represents approximately ½ of the cost. BGC can provide a final cost estimate for this equipment on request.
3. Permanent survey markers should be cemented into bedrock outcrops around the area of the landslide. The markers should be approximate 1.5 m square; large enough to be seen via a 200 mm telephoto lens from the Iron Cap Zone. The centers of these permanent survey markers should be located with a high resolution GPS survey and re-surveyed at the beginning and end of future field seasons in the Mitchell Valley.
4. Photogrammetric surveys of the Snowfield Landslide should be completed on a yearly basis starting in 2012. Photography can be undertaken from the Iron Cap Zone, capturing the complete landslide extent. The digital terrain models and high resolution images from the photogrammetry will be used to further understand the kinematics and displacement of the Snowfield Landslide.

Based on the previous review of InSAR monitoring for the project area, it is not recommended at this time as a tool appropriate for the Snowfield Landslide. The travel path of the satellite compared to the displacement direction of the landslide and the limited archive of historic satellite imagery for the area are not expect to produce high quality results. InSAR may still be an appropriate technique to monitor other slopes in the KSM Project area.

5.2.3. Groundwater Monitoring

Seven vibrating wire piezometers (VWPs) with data loggers were installed by BGC in the area of the Snowfield Landslide as part of previous work for SSR to monitor groundwater pressures in the valley slope. During the 2012 field season, the data from these instruments should be downloaded and reviewed. Maintenance should be performed on the data loggers and the instruments should be setup to continue collecting information.

If the VWP in MZ-095 is broken, it should be replaced with a new instrument in the proposed 2012 geotechnical drill hole BGC12-A.

5.2.4. Numerical Modeling

At this stage of study, there is adequate data to development preliminary three-dimensional numerical models of the landslide. A model of the slope may be used to explore theories of the landslide kinematics, the response of the landslide to a further reduction in ice elevation of Mitchell Glacier, or the response of the landslide mass to depressurization. The engineering analyses conducted with this model can be used to further assess the likelihood of sudden collapse of the slope or optimize the landslide depressurization or excavation plans. The preliminary models may be improved over time as additional geotechnical data for the rock mass of the landslide and additional deformation monitoring data is available for model calibration.

Additional numerical analyses of potential landslide runout could also be undertaken to improve the empirical runout estimates made in the current work.

5.2.5. Update the Geohazard and Risk Mitigation Reports

Based on the results of this and any additional assessments of the Snowfield Landslide, the previously completed geohazard reports (BGC, 2012) and risk mitigation reports (BGC, 2011) should be revised and updated.

6.0 CLOSURE

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We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

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TABLES

TABLE 1. COLLAR DISPLACEMENT DATA

Landslide Zone	Collar ID	2008 Easting (NAD83)	2008 Northing (NAD83)	∆ Eastings (2008-2009)	∆ Northings (2008-2009)	Eastward Displacement[1]	Northward Displacement[2]	Total Displacement (m)	Azimuth (°)
Sliding	MZ-002	424443.43	6264990.59	-0.45	0.91	-0.01	1.32	1.32	359.8
	MZ-006	424216.30	6264894.94	-0.06	0.88	0.38	1.28	1.34	16.5
	MZ-001	424443.43	6264990.59	-0.35	1.48	0.09	1.89	1.89	2.7
	MZ-020	424715.85	6264898.01	-0.17	0.26	0.27	0.67	0.72	21.9
Toppling	MZ-017	424602.67	6265186.36	-0.23	0.77	0.22	1.18	1.20	10.3
	MZ-013	424615.63	6265076.19	-0.22	0.35	0.22	0.76	0.79	16.5
	MZ-019	424709.56	6265116.18	-0.22	0.50	0.22	0.91	0.94	13.6

NOTES
1. Change in easting less mean stable zone error (0.441 m west)
2. Change in northing less mean stable zone error (0.408 m west)
3. In Drawing 1, 2008 survey data used as absolute original location

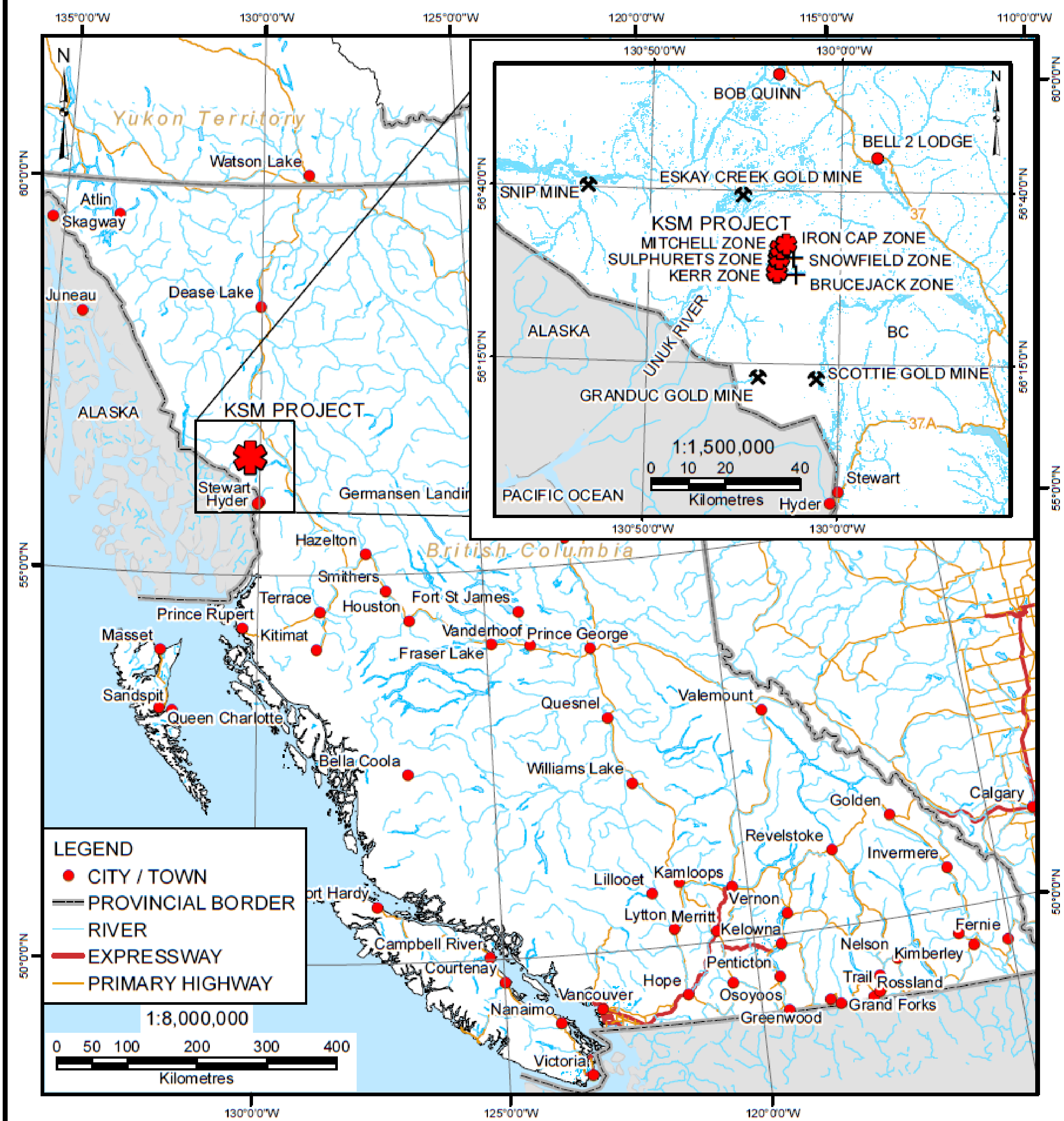
TABLE 2. EXAMPLES OF LANDSLIDE MITIGATION FOR LARGE INFRASTRUCTURE PROJECTS

Project	Landslide Details	Risks	Landslide Mitigation	Reference
Revelstoke Dam; BC Hydro, Canada	Downie Slide; 1.5 billion m^3; planar sliding on fault zone in metamorphic rock	Landslide generated wave overtops dam	Drainage to reduce groundwater pressures - 2.4 km of drainage adits and 13.9 km of drainholes	
Mica Dam; BC Hydro, Canada	Dutchman's Ridge landslide; 115 million m^3; planar sliding on fault zone in metamorphic rock	Landslide generated wave overtops dam	Drainage adits and drainholes to reduce groundwater pressures	
Campo Vallemaggia; Switzerland	Deep-seated, creeping (5 cm / yr) landslide; 800 million m^3 of weathered and fractured crystalline rock	Villages located on top of landslide	Drainage adits to drawdown water levels; river erosion protection at toe of landslide	Eberhardt et al. 2007
Clyde Dam; New Zealand	Cairnmuir Landslide; 20 million m^3; translational slide of 40 to 70 m thick schist debris; moving up to 1 m/yr prior to drainage	Landslide generated wave overtops dam	Drainage adits and drainholes to drawdown water levels; surface water infiltration protection by sealing the surface of the landslide with polymer modified bitumen	Watts, CR. 1995
Tablachaca Dam, Peru	Landslide at right abutment; 3 million m^3 rock slide in phyllite; creeping	Damage to or failure of dam abutment	Earth berm at toe of slope; prestressed rock anchors; drainage adits	Schuster, R.L. 2006
Betze-Post Open Pit, Barrick Gold, USA	Southeat wall; 18 million m^3 rockslide on argyllically altered gouge filled shear zone; wedge zone shearing	Pit wall failure; compromised operations; loss of life	Drainholes and wells to drain compartmentalized groundwater; engineered waste rock buttresses; redesigned slope geometry	Rose, N.D. & Hungr, O. 2006

TABLE 3. PROPOSED 2012 GEOTECHNICAL DRILLHOLES

Hole ID	Easting (NAD83)	Northing (NAD83)	Dip (°)	Azimuth (°)	Depth (m)	Target	Prognosis
BGC12-A	424,365	6,265,375	-90	000	300	Mitchell Thrust Fault; Toppling zone	Poor to fair quality (RQD < 40) rock to 180 m; Mitchell Thrust Fault at 180 m; Fair to good quality rock from 200 to 300 m
BGC12-B	424,675	6,265,000	-90	000	250	Sliding / upper shear plane	Poor to fair quality (RQD < 40) rock to 75 m; potential landslide shear plane at 50 to 75 m; Fair to good quality rock from 75 to 250 m

FIGURES



BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE

FIGURE TITLE: PROJECT LOCATION MAP

CLIENT:	PROJECT No.:	FIGURE No.:
SEABRIDGE GOLD INC.	0638-013-31	1

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

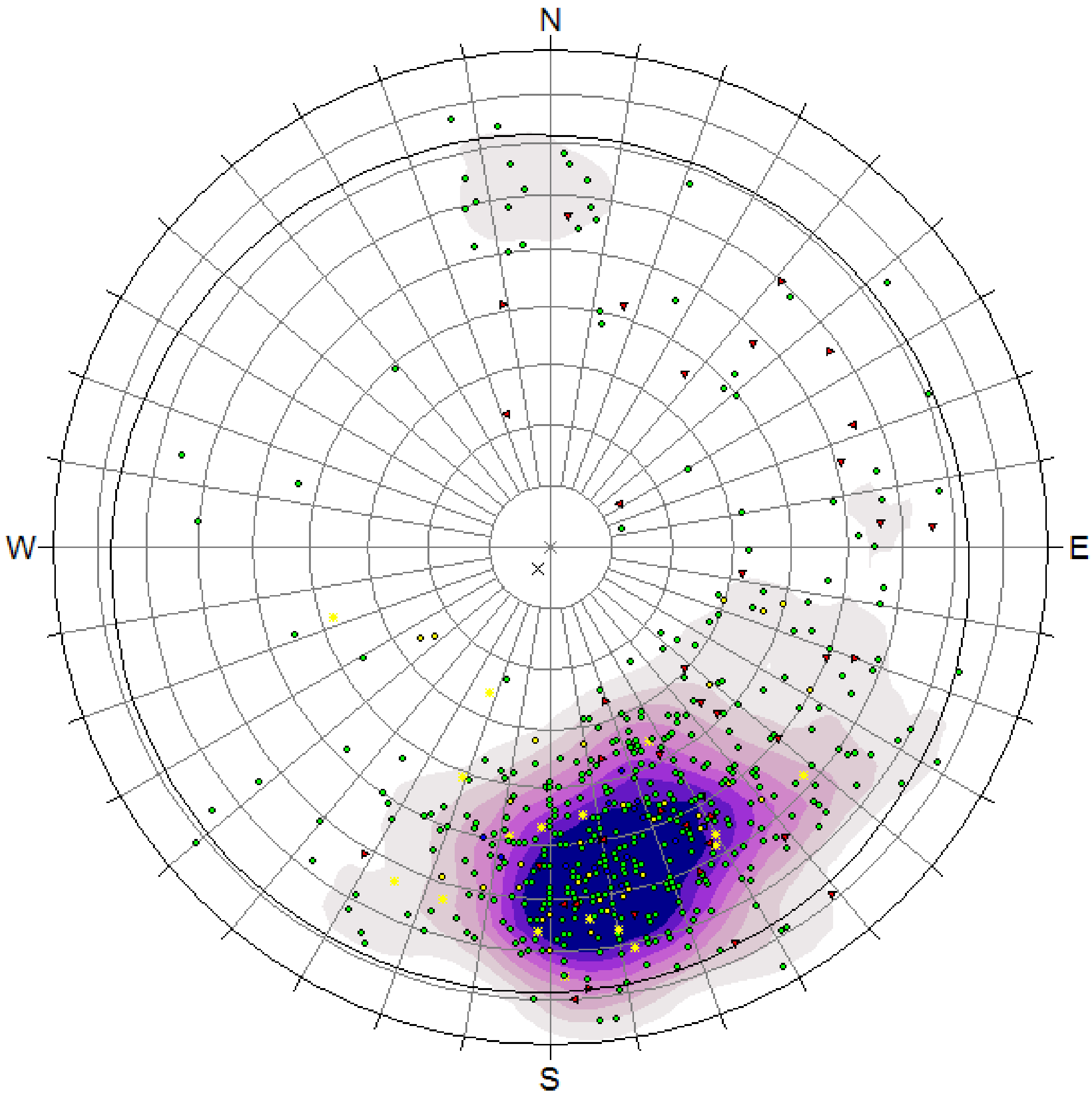
JULY 13, 2012

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE:	PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE
FIGURE TITLE:	FRESH SCARP DEVELOPMENT
CLIENT:	SEABRIDGE GOLD INC.
PROJECT No.:	0638-013-31
FIGURE No.:	2

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012



STRUCTURE TYPE

- FAULT
- FAULT (FOOTWALL)
- FAULT (HANGINGWALL)
- JOINT
- JOINT (ALONG FOLIATION)
- JOINT (ALONG VEIN)
- FOLIATION
- VEIN

Equal Area
Lower Hemisphere
533 Poles
533 Entries

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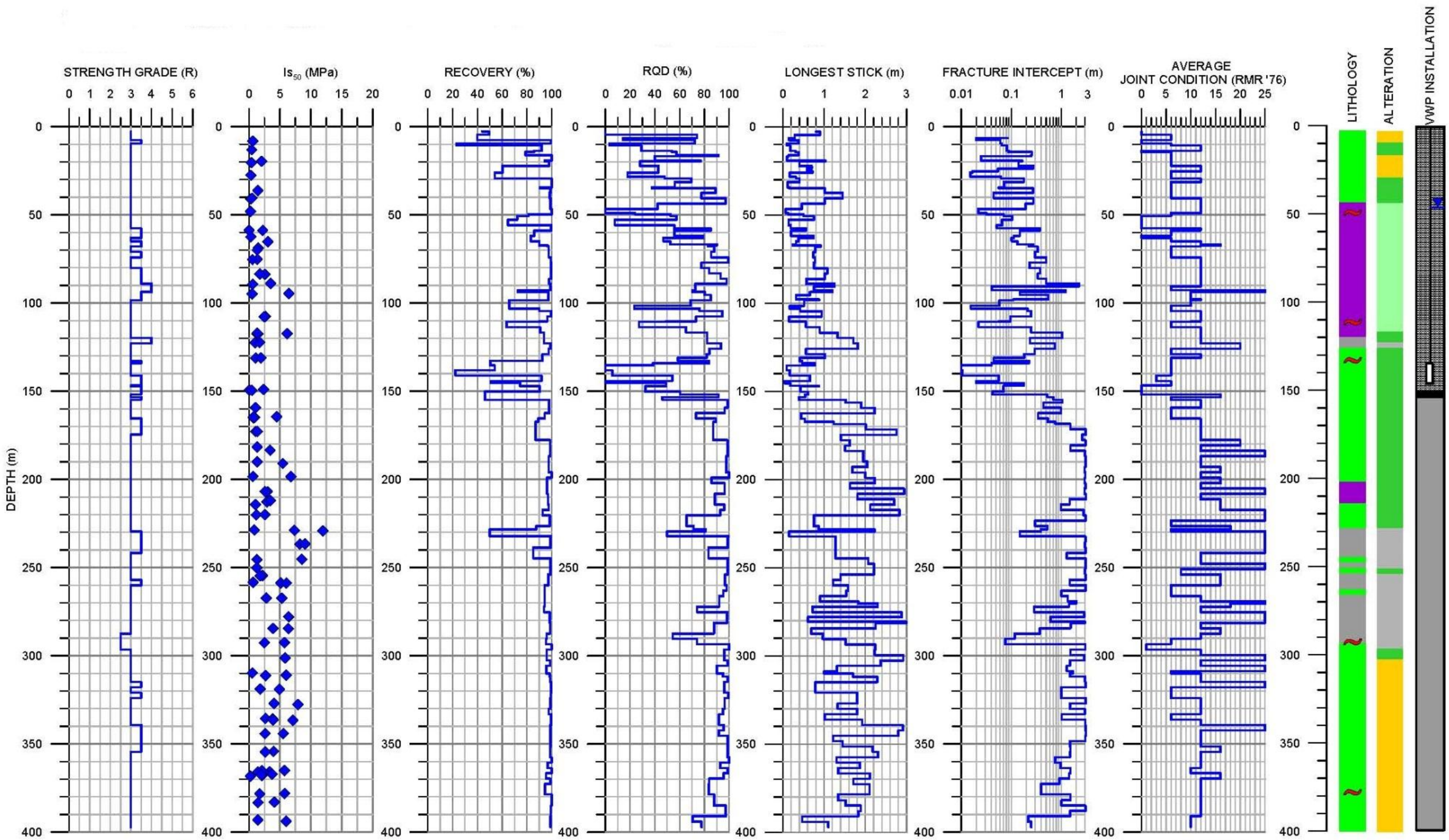
CLIENT: SEABRIDGE GOLD INC.	REPORT TITLE: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE
	FIGURE TITLE: MZ–095 TELEVIEWER DATA
	PROJECT No.: 0638-013-31 / FIGURE No.: 3

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012



LITHOLOGY: METAMORPHIC, VOLCANIC, INTRUSIVE, SEDIMENTARY, HYDROTHERMAL, FAULT

ALTERATION: CHLORITIC, SERICITIC, CHLORITIC - SERICITIC, SILICEOUS

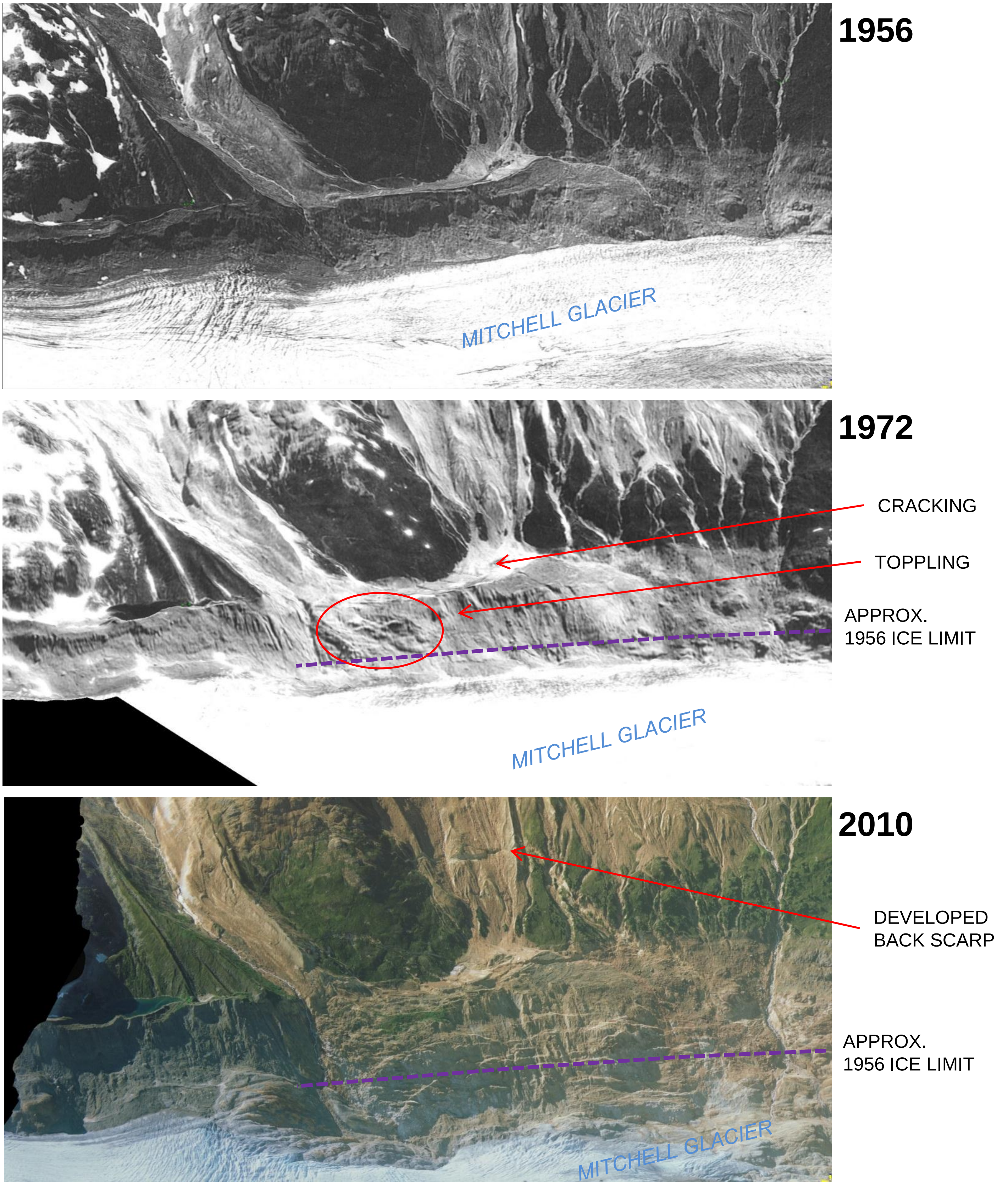
VWP INSTALLATION: GROUT, OPEN HOLE, PLUG, STATIC WATER LEVEL

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE:	PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE
FIGURE TITLE:	MZ–095 DOWNHOLE DATA
CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-013-31 / FIGURE No.: 4

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012

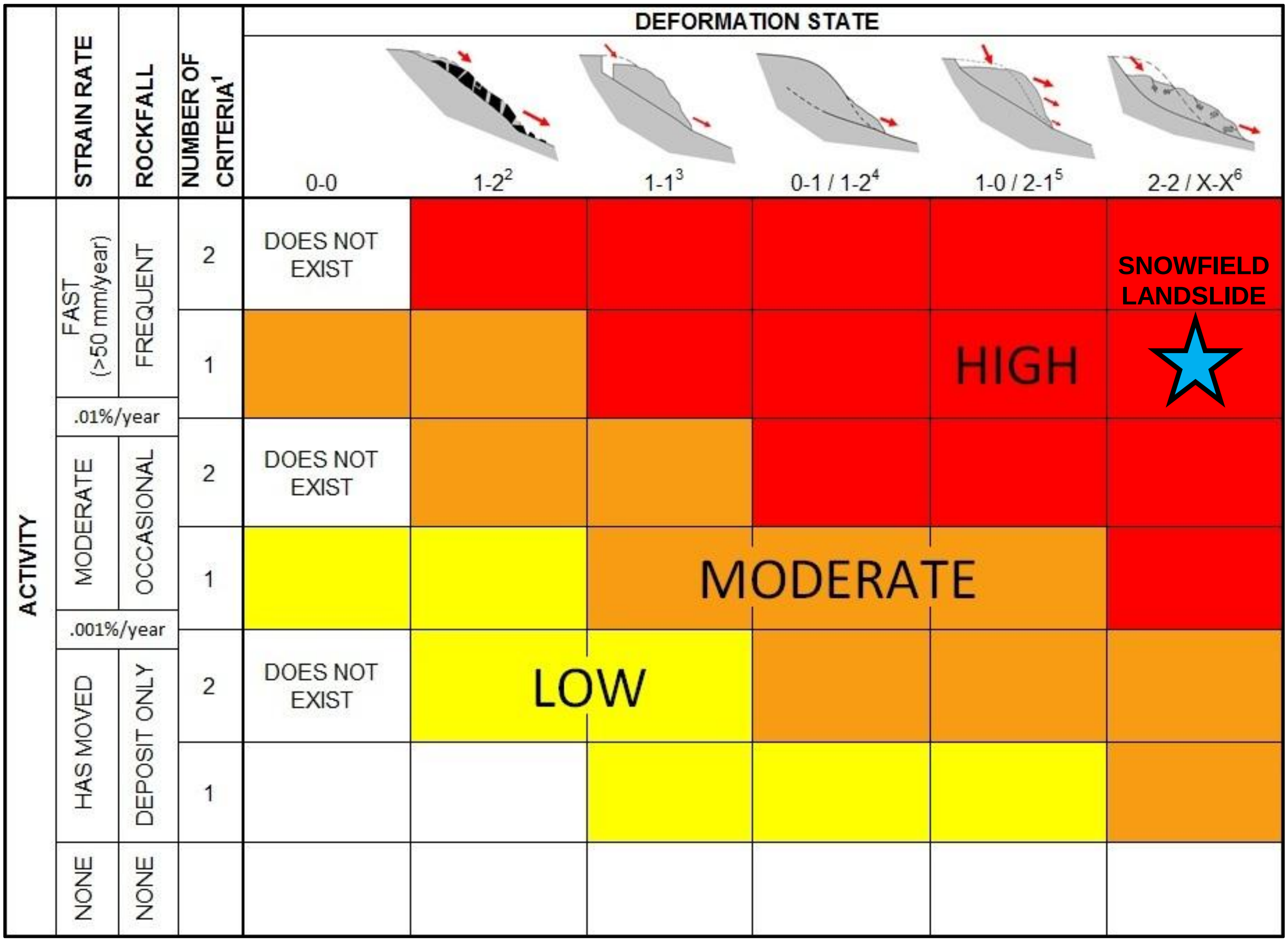


BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE:	PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE
FIGURE TITLE:	SNOWFIELD LANDSLIDE DEVELOPMENT - 1956 TO 2010
CLIENT:	SEABRIDGE GOLD INC.
PROJECT No.:	0638-013-31
FIGURE No.:	5

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012



AFTER JABOYEDOFF ET AL. 2012

NOTES:

1. CRITERIA BEING (A) PRESENCE OF ROCKFALL ACTIVITY AND (B) SUFFICIENT STRAIN RATE.
2. FAILURE IS LARGELY EXTENSIONAL; SITUATION LESS PRONE TO GLOBAL SLOPE FAILURE.
3. UNIFORM INTERMEDIATE SLOPE MOVEMENT
4. DEFORMATION LOCALIZED AT SLIDE TOE.
5. LARGE INTERNAL DEFORMATION THOUGH NOT VISIBLE AT SLOPE TOE.
6. LARGE UNIFORM DISPLACEMENTS LINKED WITH SIGNIFICANT INTERNAL DEFORMATION.

	INSIGNIFICANT TOE MOVEMENT	SIGNIFICANT TOE MOVEMENT	LARGE TOE MOVEMENT
INSIGNIFICANT HEAD MOVEMENT	0-0	0-1	0-2
SIGNIFICANT HEAD MOVEMENT	1-0	1-1	1-2
LARGE HEAD MOVEMENT	2-0	2-1	2-2

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE:
PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE

FIGURE TITLE:
ACTIVITY DEFORMATION CHART FOR PRELIMINARY CATASTROPHIC COLLAPSE SUSCEPTIBILITY ASSESSMENT

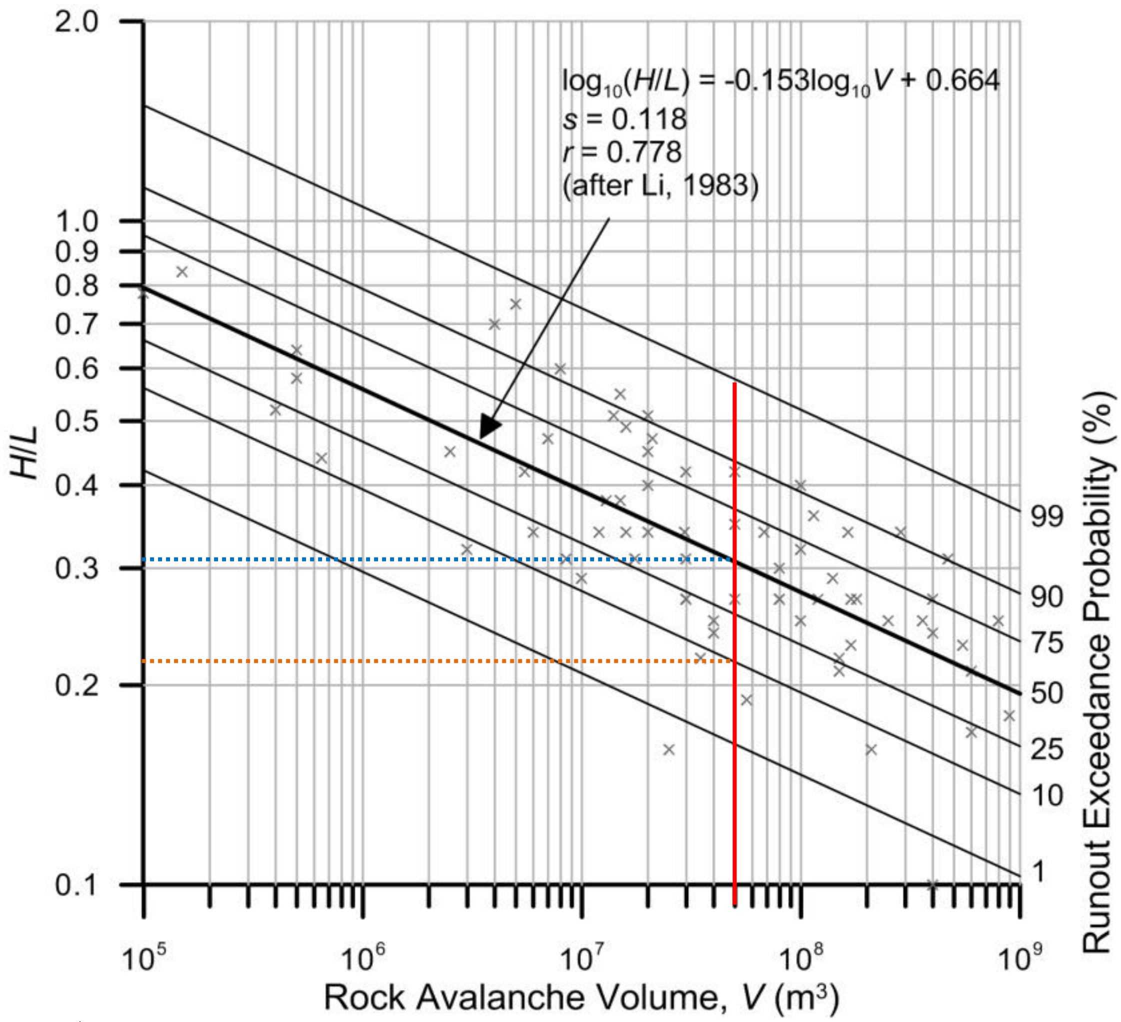
CLIENT: SEABRIDGE GOLD INC.

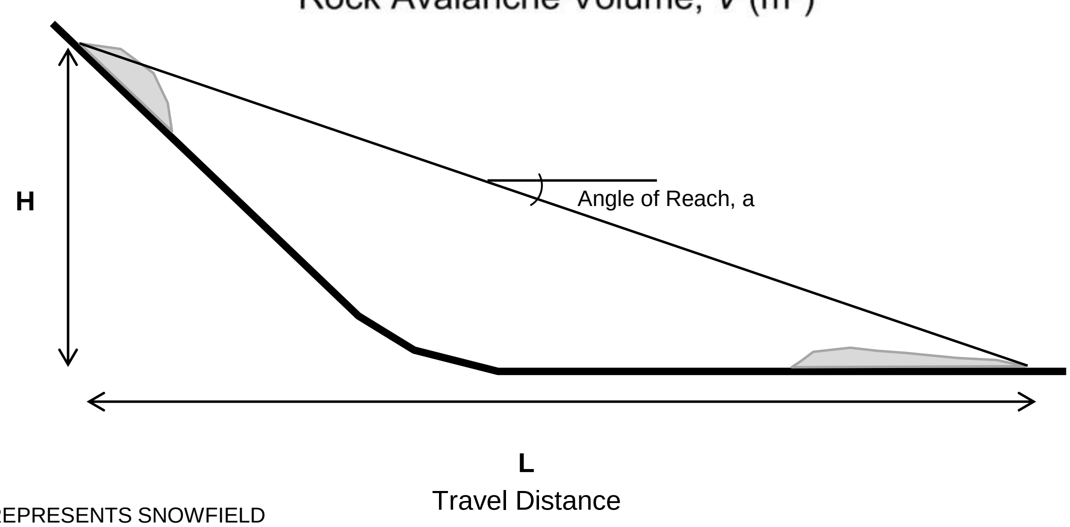
PROJECT No.: 0638-013-31

FIGURE No.: 6

JULY 13, 2012

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES





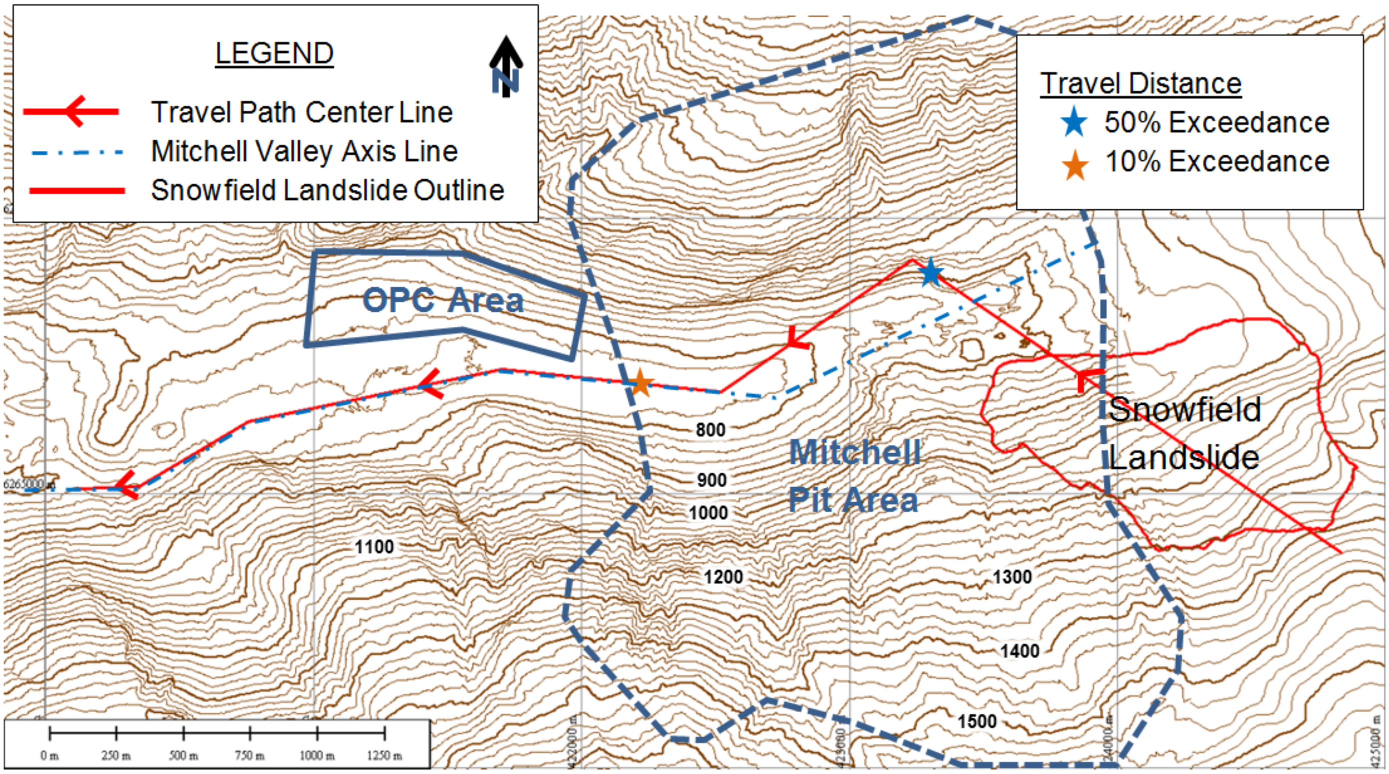
NOTES:

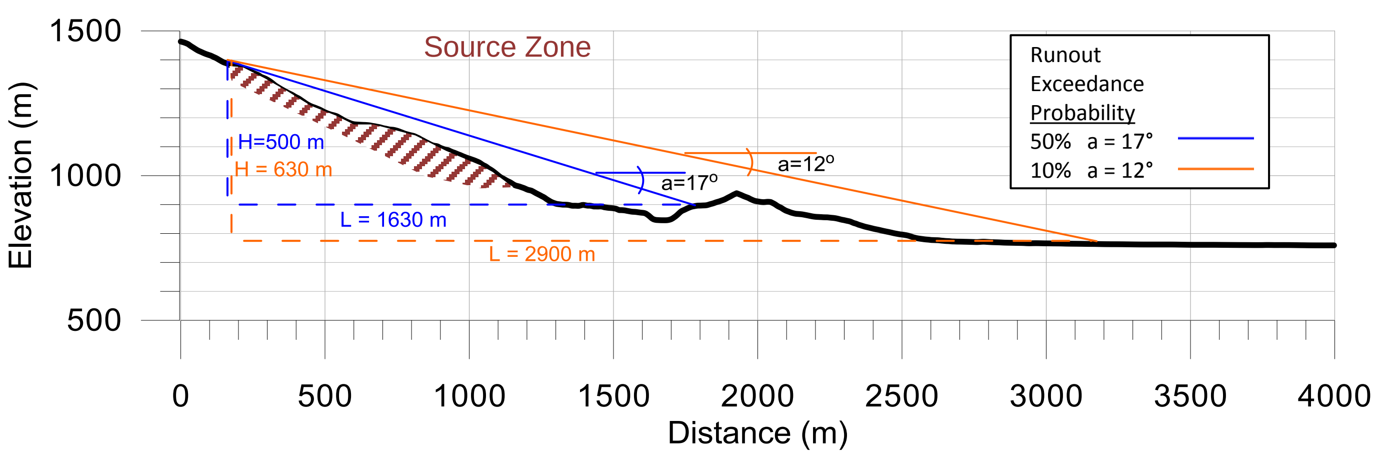
1. RED LINE REPRESENTS SNOWFIELD LANDSLIDE ESTIMATED VOLUME.

BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	REPORT TITLE: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE		
	FIGURE TITLE: RUNOUT ANALYSIS USING VOLUME AND ANGLE OF REACH RELATIONSHIP		
CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-013-31	FIGURE No.: 7	

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012





NOTES:

1. EXISTING TOPOGRAPHY SHOWN.

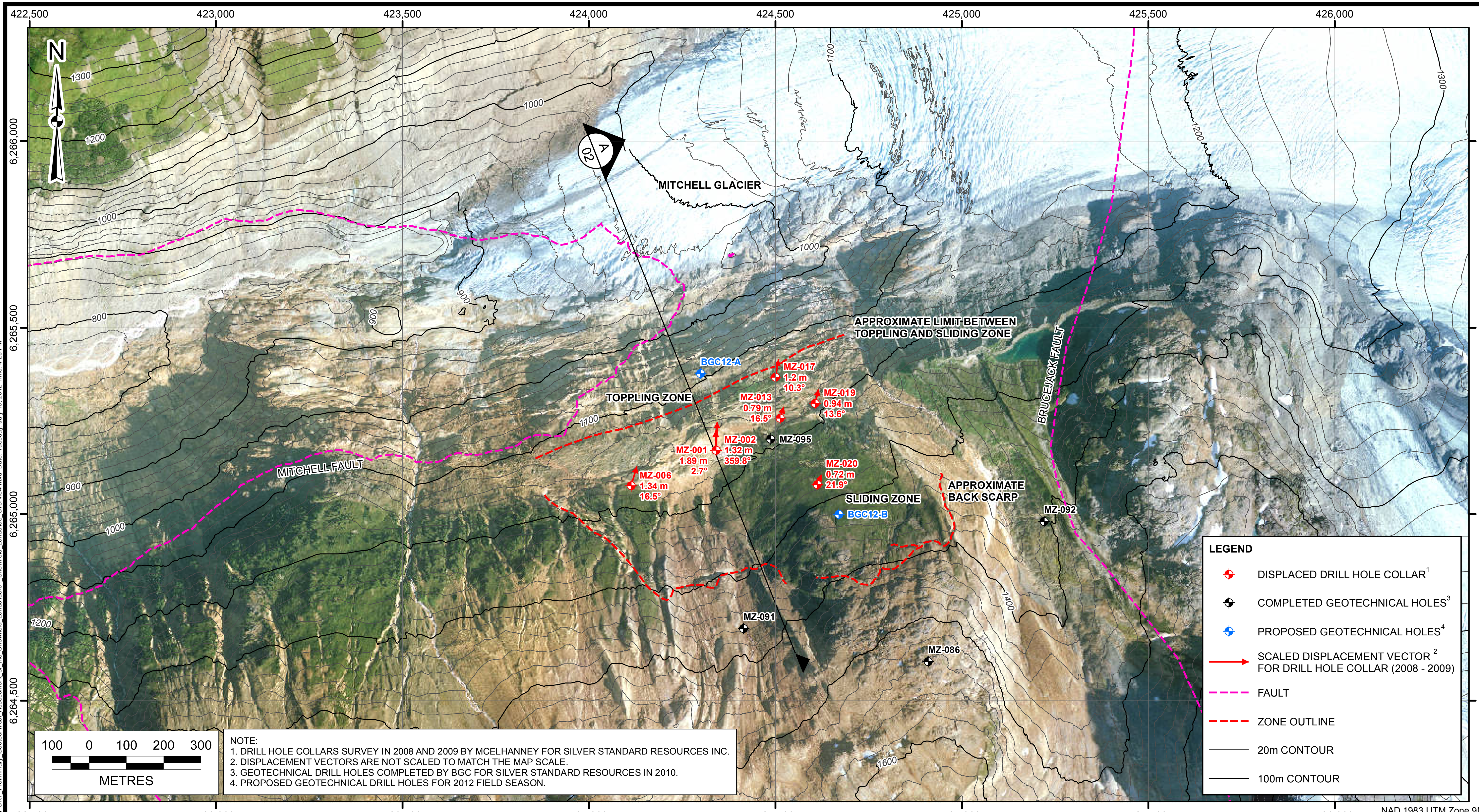
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

REPORT TITLE: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE	
FIGURE TITLE: ASSUMED LANDSLIDE TRAVEL PATH AND ASSOCIATED RUNOUT PROFILE	
CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-013-31 / FIGURE No.: 8

N:\BGC\PROJECTS\0638 SEABRIDGE\013 KSM PFS UPDATE AND EA SUPPORT\32. SNOWFIELD LANDSLIDE\90 LETTER REPORT\FIGURES

JULY 13, 2012

DRAWINGS



REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:10,000
DATE:	JUL 2012
DRAWN:	LL
DESIGNED:	DK, ML
CHECKED:	DK
APPROVED:	DK

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE

TITLE: SNOWFIELD LANDSLIDE OVERVIEW

PROJECT No.:	DWG No.:	REV.:
0638-013-31	01	

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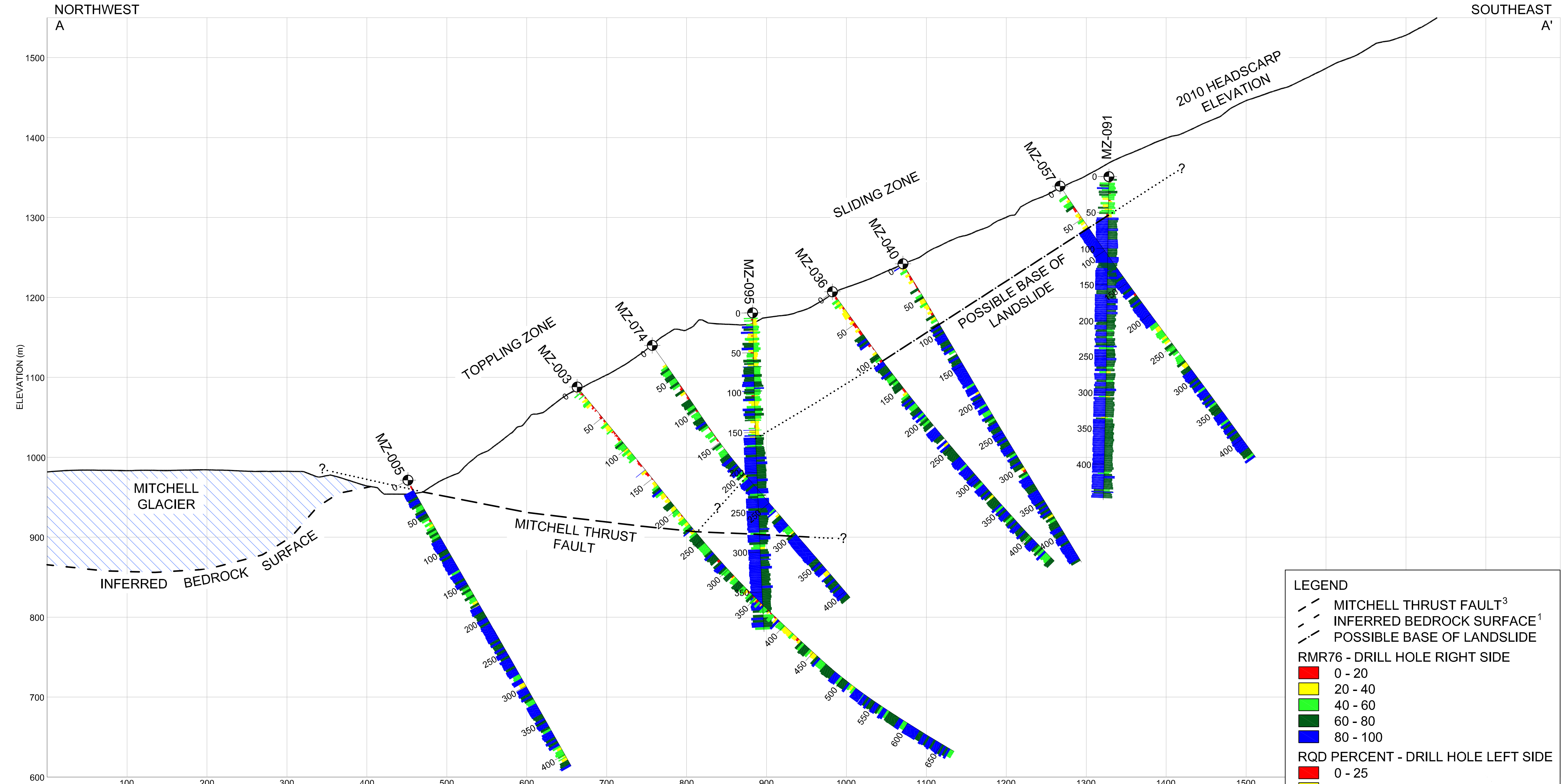
DWG TO BE READ WITH BGC REPORT TITLED "PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE" DATED JULY 13, 2012



SCALE 1:5000

100m 0 100m 200m 300m

METRES

NOTES:

1. THE BEDROCK SURFACE BELOW THE MITCHELL GLACIER IS INFERRED FROM DRILLING AND GEOPHYSICAL DATA.
2. ALL BOREHOLE DATA PROVIDED BY SILVER STANDARD RESOURCES INC.
3. THE LOCATION OF THE MITCHELL THRUST FAULT S BASED ON WORK BY MIKE SAVELL IN 2012 AND PREVIOUS WORK BY SILVER STANDARD RESOURCES INC.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	JUL 2012
DRAWN:	WKL
DESIGNED:	DK
CHECKED:	DK
APPROVED:	DK

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: PRELIMINARY GEOTECHNICAL ASSEESSMENT OF THE SNOWFIELD LANDSLIDE

TITLE: CROSS SECTION A

PROJECT No.:	DWG No.:	REV.:
0638-013-31	02	

DWG TO BE READ WITH BGC REPORT TITLED "PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE" DATED JULY 2013

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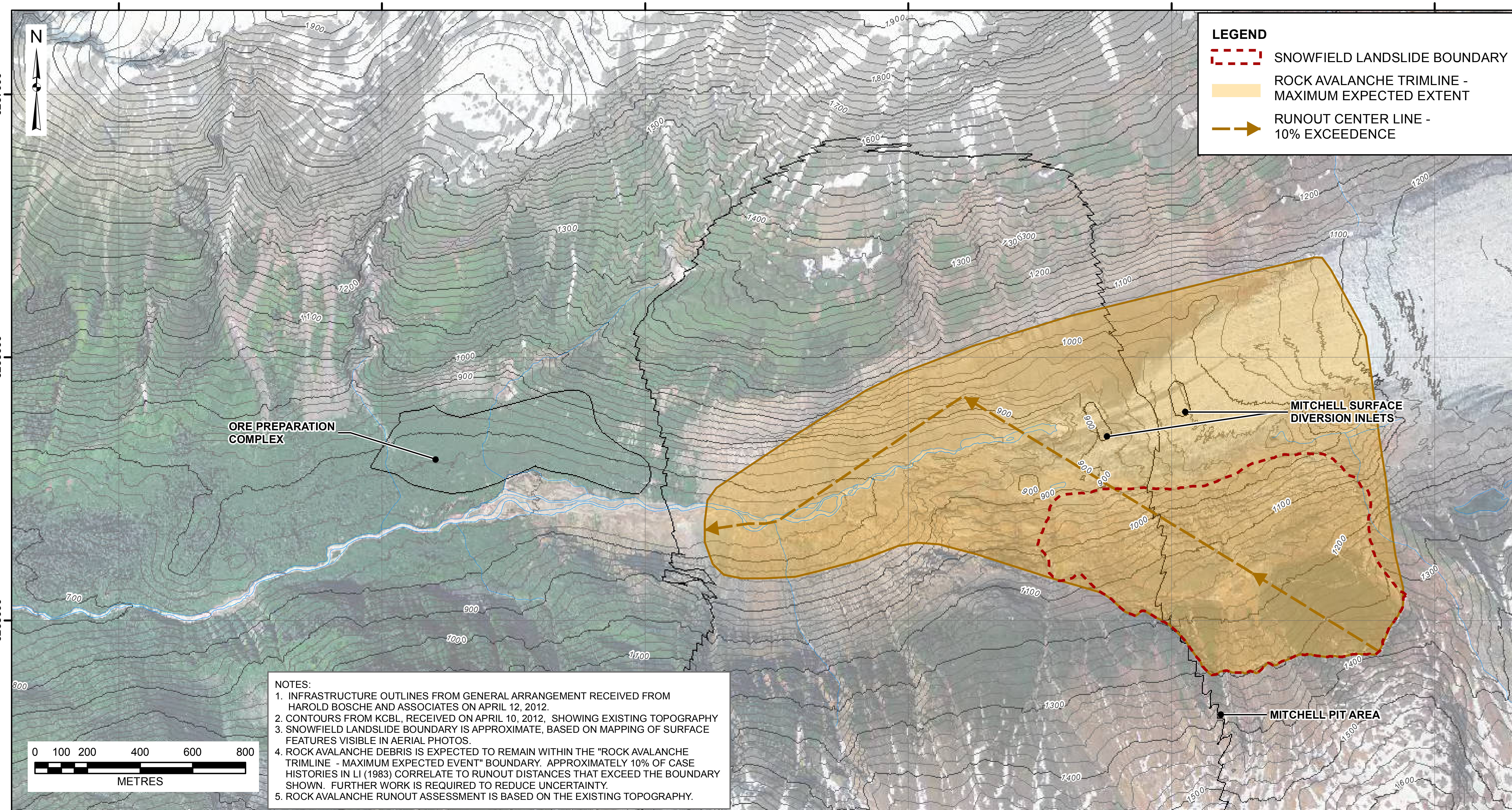

NOTES:
1. INFRASTRUCTURE OUTLINES FROM GENERAL ARRANGEMENT RECEIVED FROM HAROLD BOSCHE AND ASSOCIATES ON APRIL 12, 2012.
2. CONTOURS FROM KCBL, RECEIVED ON APRIL 10, 2012, SHOWING EXISTING TOPOGRAPHY
3. SNOWFIELD LANDSLIDE BOUNDARY IS APPROXIMATE, BASED ON MAPPING OF SURFACE FEATURES VISIBLE IN AERIAL PHOTOS.
4. ROCK AVALANCHE DEBRIS IS EXPECTED TO REMAIN WITHIN THE "ROCK AVALANCHE TRIMLINE - MAXIMUM EXPECTED EVENT" BOUNDARY. APPROXIMATELY 10% OF CASE HISTORIES IN LI (1983) CORRELATE TO RUNOUT DISTANCES THAT EXCEED THE BOUNDARY SHOWN. FURTHER WORK IS REQUIRED TO REDUCE UNCERTAINTY.
5. ROCK AVALANCHE RUNOUT ASSESSMENT IS BASED ON THE EXISTING TOPOGRAPHY.

CONTOUR INTERVAL 20 m
NAD 1983 UTM Zone 9N

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:15,000
DATE:	JUL 2012
DRAWN:	LL, WKL, JVC
DESIGNED:	ABS
CHECKED:	DK
APPROVED:	DK

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE

TITLE: PRELIMINARY RUNOUT ASSESSMENT

PROJECT No.:	DWG No.:	REV.:
0638-013-31	03	

DWG TO BE READ WITH BGC REPORT TITLED "PRELIMINARY GEOTECHNICAL ASSESSMENT OF THE SNOWFIELD LANDSLIDE" DATED JULY 13, 2012

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