TETRA TECH WARDROP

SEABRIDGE GOLD

Appendix F6

KSM Transmission Line: Preliminary Geotechnical Review

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

SEABRIDGE GOLD INC.

KSM PROJECT

TEIGEN CREEK - KSM TRANSMISSION LINE: PRELIMINARY GEOTECHNICAL REVIEW

DRAFT

PROJECT NO:	0638-005
DATE:	February 7, 2012
DOCUMENT NO:	

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February 7, 2012
Project No: 0638-005

Brent Murphy, M.Sc., P.Geo.
Seabridge Gold Inc.
106 Front Street East
Toronto, Ontario, M5A 1E1

Dear Mr. Murphy,

Re: KSM Project Teigen Creek - KSM Transmission Line: Preliminary Geotechnical Review

Please find attached a copy of the above referenced report dated February 7, 2012.

Should you have any questions or comments, please do not hesitate to contact the undersigned. We appreciate having the opportunity to continue working on such an interesting and challenging project

Yours sincerely,

BGC ENGINEERING INC.
per:

Kris Holm, M.Sc., P.Geo
Project Manager

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LIMITATIONS

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1.0 INTRODUCTION

BGC Engineering Inc. (BGC) was retained by Seabridge Gold Inc. (Seabridge) to assess geohazard risks for the Kerr-Sulphurets-Mitchell (KSM) project in northwestern British Columbia. In earlier stages of geohazard risk assessment for the KSM project, BGC completed a geohazard and risk assessment for the KSM mine-site, tailings management facility, and access roads for the project areas (BGC, 2011) as well as a terrain stability field assessment (TSFA) for KSM mine access roads including the Teigen Creek access road (BGC, 2010). Earlier work did not include geotechnical assessment of the transmission line alignment. As an extension of the earlier work, BGC was requested by Seabridge in an April 18, 2011 email to review available data for the proposed Teigen Creek – KSM 287 kV transmission line from Snowbank Creek to KSM substation #1 and comment on potential geotechnical constraints for the transmission line.

This memorandum provides preliminary geotechnical assessment of the Teigen Creek - KSM transmission line alignment and provides geotechnical comments on the conceptual design for reinforced concrete tower foundations proposed for sites subject to geohazards. No detailed subsurface investigations of soil and rock conditions, groundwater conditions, or material testing were carried out as part of this work.

Routing and design for the transmission line is being led by W.N. Brazier and Associates Inc. (WN Brazier). Routing and design of the access road is being led by McElhanney Consulting Services Ltd. (McElhanney).

1.1. Scope of Work

The following work was completed for this report:

- Summarizing available terrain and geohazard information with respect to the current transmission line alignment, considering proximity to the access road alignment, planned road-cut and fill slope locations, terrain assessment units, geologic units, and slope angles at tower sites.
- Supplementing geotechnical observations from previous BGC terrain and geohazard risk assessments by completing a field assessment of the transmission line including hand-held GPS guided helicopter fly-over and ground traverse of key locations. This was completed in conjunction with WN Brazier between September 12 and 15, 2011.
- Summarizing preliminary geotechnical comments on the transmission line alignment.
- Evaluating conceptual designs for reinforced concrete foundations prepared by WN Brazier for areas subject to geohazards.

1.2. Work Procedure

The work procedure followed in this assessment used terrain and geohazard mapping from previous BGC work (BGC 2010, 2011) combined with an initial transmission line alignment (Rev 2, dated September 2, 2011) by WN Brazier to make an office based assessment of anticipated geotechnical and geohazard conditions at tower sites. This work was used to

prioritize sites for field assessment that was completed jointly with WN Brazier. The field assessment resulted in an adjusted alignment (Rev D, dated October 2011) by WN Brazier that avoids some identified geohazards or undesirable geotechnical conditions reviewed in the field.

The adjusted Rev D, October 2011, alignment is documented in this report. Other proposed project facilities incorporated in drawings are based on the June 14, 2011 KSM project facility layout assessed in BGC (2011). LiDAR topography and ortho-images collected in 2009 and sourced from McElhanney were used as base map information for the transmission line study area.

2.0 SITE AND TRANSMISSION LINE DESCRIPTION

2.1. Transmission Line Alignment

The proposed Teigen Creek - KSM transmission line is routed to closely follow the Teigen Creek access road. The proposed transmission line is 12 km long and would connect with BC Hydro's planned 287 kV Northwest Transmission Line at Snowbank Creek on Highway 37. Following a crossing of Highway 37, the transmission line generally parallels the proposed Teigen Creek access road ascending southward along the west (left) side of Teigen Creek until transmission line chainage km 3. The alignment then crosses to the east (right) side of Teigen Creek and continues towards transmission line chainage km 8 where the line again crosses to the west (left) side of Teigen Creek. Continuing south, the transmission line parallels the southern Teigen Creek tributary and ascends gently sloping (3° to 15°) terrain terminating at KSM Substation #1 near the proposed plant site area at transmission line chainage km 12.

2.2. Climate, Geology, and Geomorphic Setting

The TSFA report (BGC, 2010) and the preliminary geohazard report (BGC, 2011) provide a description of climate, geology and geomorphic setting within the study area.

In summary, the KSM property encompasses temperate or northern coastal rainforest in the coastal mountains of northwest BC, with subarctic conditions at high elevations. Elevations range from 550 masl where Teigen Creek intersects Highway 37 to over 2,300 masl at the nearby highest peaks. The Teigen Creek valley is a broad, steep-sided basin with forested lower valley slopes. The valley bottom floor contains a 50 to 400 m wide floodplain with organic and fluvial deposits. Lower valley slopes are typically underlain by colluvium and glacial till with some discontinuous segments of the lower valley underlain by remnant depositional glaciofluvial terraces. Debris flow fans extend across the proposed access road and transmission line alignment at 4 locations. Mid to upper valley slopes consist of gullied bedrock partially covered in thin (< 1 m) colluvium or glacial till. A glacially scoured bedrock plateau with organic deposits infilling shallow depressed lineaments is present at the southern end of the transmission line alignment, near the proposed plant site. Teigen Creek

valley and the glacially scoured bedrock plateau are underlain by interbedded sandstones and siltstones of the Bowser Lake Group.

2.3. Transmission Tower Structures

WN Brazier proposes steel (un-guyed) monopole structures with multi-pole structures considered for dead-end pole structures for the alignment.

In areas subjected to avalanches, WN Brazier proposes a steel (unguyed) monopole structure fixed atop a concrete pier with an adjacent steel deflector post facing into the direction of the avalanche path and with ground anchors grouted into rock or solid below (see Appendix A). The height of the concrete pier would be dependent on the magnitude of the avalanche hazard. The steel deflector post would be designed to protect against less dense avalanche snow flows. The lower concrete pier would be designed to protect against dense snow and general debris impacts (mud and rock).

Tower foundation design loads and foundation performance criteria have not been detailed for this design stage.

3.0 PRELIMINARY GEOTECHINICAL ASSESSMENT

3.1. Compilation of Existing Geotechnical Data

Drawings 1 and 2 show the current Rev D, October 2011 transmission line alignment combined with terrain mapping, landslide and snow avalanche geohazards mapped in BGC (2011). Drawing 3 outlines different slope classes for the study area using 2009 LiDAR obtained from McElhanney and Geobase topography where LiDAR is not available. Adjectives used to describe ranges of slope classes include:

- Plain slopes: 0 to 3° (0 to 5%)
- Gentle slopes: 3 to 15° (6 to 26%)
- Moderate slopes: 15 to 26° (27 to 49%)
- Moderately Steep slopes: 26 to 35° (50 to 70%)
- Steep slopes: 35 to 45° (71 to 100%)
- Very Steep slopes: >45° (>100%)

Table B-1 in Appendix B summarizes terrain and geohazard conditions at each proposed tower site for the October 2011 Rev D alignment. This includes terrain and geologic units, natural slope gradients, proximity of tower sites to planned access road-cut or fill slope, and the potential for snow avalanche or landslide geohazards. Where towers intersect geohazard areas, Table B-1 shows geohazard risk levels estimated by BGC (2011) and identifies tower sites where WN Brazier proposes reinforced concrete tower foundations to mitigate against snow avalanche hazard. BGC (2011) provides more detailed descriptions of terrain stability mapping and geohazard nomenclature referred to in Table B-1.

3.2. Transmission Line Field Reconnaissance Review

Helicopter and ground based field geotechnical assessments of tower sites were carried out by Mr. Greg Hunchuk P.Eng., P.Geo., and Mr. Philip LeSueur, E.I.T. of BGC between September 12 and 15, 2011. BGC personnel were accompanied by the transmission line lead designer, Mr. Neil Brazier, P.Eng., of WN Brazier.

The entire length of the Rev 2, September 2, 2011 transmission line alignment was inspected by helicopter, and 25 of 56 tower sites were inspected on the ground (see Table B-1). Ground-based assessments included characterization of terrain and soil conditions based on surface mapping and by shallow hand-dug test pits.

BGC's selection criteria for ground based inspection sites was based upon general requirements to visit representative terrains covering the transmission line alignment and to visit specific tower sites located on terrains with attributes suggesting potentially challenging design and / or construction conditions. Tower sites that were selected for ground-based field inspection included those:

- located within terrain showing evidence of slope instability;
- located on steeper slopes or adjacent to slope breaks;
- situated on poorly drained sites;
- located on active debris flow fans; and / or
- obscured by heavy vegetation.

Following the field assessment and considering desk study and field observations by BGC and WN Brazier, WN Brazier provided an update to the Teigen Creek - KSM Transmission Line, Rev. D alignment dated October 2011 as discussed in Section 1.2. Additional geohazard and terrain observations from the field inspection are included in Table B-1.

4.0 DISCUSSION

4.1. Preliminary Geotechnical Comment

A summary of preliminary geotechnical comments for the Teigen Creek – KSM transmission line is provided in Table C-1 in Appendix C. The current Rev D, October 2011 alignment is the basis for Table C-1.

4.1.1. Transmission Line Alignment Route

No geotechnically unfavorable ground conditions were identified that would preclude construction of the Teigen Creek – KSM transmission line.

Suggested tower structure location adjustments are described in Table B-1 for structures TP21-1, TP25-1 to TP27-1, TP34-1, TP35A-1, and TP40-2 with respect to the Rev D alignment. These suggested adjustments would move structures onto flatter sloping terrain or further away from stream channels. The most significant line alignment deviation suggested is related to tower structures TP25-1, TP26-1, and TP27-1 which are located on Moderately Steep to Steep slopes within inferred deeper soils. Special foundations such as

micropiles, (discussed in Section 4.1.4) may be required if the tower structures are maintained in their present position. An alternative option to constructing special foundations for these sites would be to adjust the transmission line alignment and locate towers approximately 80 m upslope (east) of the present alignment on Gentle to Moderate slopes.

Near tower structures TP 35-1 and TP36-1 (between KP 8.8 and KP 9.7 of the access road), McElhanney and WN Brazier could consider re-aligning the Teigen Creek Access Road and associated towers approximately 10 m to 15 m west. Adjusting the road and transmission line alignments in this section would allow tower structures along the road edge to maintain a greater set-back from the Moderately Steep to Steep slope break located immediately adjacent thereby reducing the potential for any future slope retrogression to impact the structure locations.

4.1.2. Transmission Line and Access Road Design Integration

For the majority of the Teigen Creek - KSM Transmission Line alignment, tower structures are located upslope of the Teigen Creek Access Road. Review and integration of tower structure and access road design will be required in locations where tower structures are located in close proximity to steeper access road cut slopes. Towers located adjacent to access road cuts situated on Moderately Steep to Steep slopes include tower structures TP12-1, TP23-1 to TP29-1, and TP34-1.

Access road drainage structures, such as culverts and ditches, can divert and concentrate surface water flows downslope. Review and integration of access road and transmission line design will be required where tower structures are located downslope of access roads and there is the potential to direct surface waters from the access road to near transmission tower locations. Tower structures located downslope of the access road include TP3-1 to TP6-1, TP35-1 to TP36-1, and TP37-1 to TP40-2. Similarly, equipment access trails for tower construction will need to be deactivated to reduce their potential for surface water re-direction.

4.1.3. Snow Avalanche Foundation Structures

With respect to the Rev D alignment, snow avalanche foundation structures are proposed by WN Brazier for tower sites TP4-2, TP6-1 to TP8-1, TP10-1, TP13-1 to TP18-1, TP20-1 to TP23-1, TP29-1, and TP30-1 as summarized in Table B-1.

We note that WN Brazier identified snow avalanche foundations for tower structures TP8-1 and TP10-1 but BGC (2011) did not map these towers as being located within snow avalanche hazard areas. Conversely, tower structures TP4-1, TP19-1, and TP24-1 to TP27-1 are in areas mapped as snow avalanche hazard by BGC (2011), but are not identified within the Rev D alignment as tower sites requiring snow avalanche foundations. In the next stage of study, field review of tower sites in mapped avalanche areas by an avalanche expert and numerical modeling to estimate impact pressures will be necessary to confirm avalanche potential and effects at each tower site.

4.1.4. Foundation Types

Foundation and topographic conditions in combination with design loading conditions, foundation performance requirements, the construction schedule, and available construction access will affect the type of tower foundation design selected and construction method for individual tower sites.

Preliminary geotechnical comments regarding potential foundation types for sections along the transmission line alignment are provided in Table C-1. As discussed in Section 4.3, subsurface investigations are necessary as part of prescribing specific foundation types for each tower location. Subject to the pole structure type at each location, at this design stage the following foundation types can be considered to cover the range of terrain conditions that have been observed along the transmission line alignment:

- Concrete spread footing, including being a massive buried block
- Drilled caissons
- Rock anchor foundations
- Special foundation - driven piles
- Special foundations - micropiles

Concrete spread footing or drilled caissons:

These foundation types are a potential option for sites with sufficient soil depth and soil strength to allow sufficient burial for lateral restraint and sufficient bearing capacity and adequate settlement. These will typically be in compact granular soils or stiffer cohesive soils.

Rock anchor foundations:

This foundation type is considered a potential option for sites where surficial soils are too shallow to provide a minimum foundation embedment depth for concrete spread footings or drilled caissons.

Special foundations - driven piles:

This foundation type is considered a potential option for sites comprised of low bearing capacity near surface soils and where it is not practical to construct stable excavations to reach an adequate bearing stratum at depth or to install a concrete foundation or caisson to have adequate lateral stability. Driven piles of sufficient length and diameter would bridge into soils with sufficient capacity to resist design loads. Tower structures located within alluvial floodplain terrains with weak or loose near-surface soils and with a high water table may require driven pile foundations.

Special foundations - micropiles:

This foundation type is considered a potential option for sites where it may be not be practical to maintain stable excavations in soil to construct a concrete spread footing

foundations or reach bedrock, but the soil depth is too shallow for driven piles to achieve sufficient foundation lateral stability.

Transmission tower structures founded in deeper soils on Moderately Steep to Steep slopes may require micropile foundations. Micropiles are typically a small-diameter pile constructed within a drilled borehole.

4.2. Conceptual Geohazard Mitigation Structures Designs

Preliminary geotechnical comments regarding potential geohazard mitigation structures for sections along the Teigen Creek – KSM transmission line are summarized in Table C-1.

4.2.1. Snow Avalanches

Snow avalanches affecting transmission towers sites can damage towers by snow impact loading or by impact from rock or tree debris carried with the avalanche. Potential for damage depends on the potential avalanche magnitude, but also on the height of impact. The height needs to consider the accumulation of snow pack and avalanche deposits at the tower site over an appropriate design return period winter as each successive avalanche flows over the previous deposits. In addition to risks to towers, transmission lines can be affected by avalanche air blast. The clearance of transmission lines from the ground needs to consider not only accumulated late winter snowpack and avalanche deposits and debris, but also a late winter avalanche event overtop of the accumulated snow deposits encroaching on and reaching the lines.

In areas subjected to snow avalanches hazards WN Brazier proposes to use a steel monopole structure fixed atop a concrete pier with an adjacent steel deflector post facing into the direction of the avalanche path. The concrete pier height would be dependent on the magnitude of the avalanche hazard. From a geohazard mitigation perspective, the proposed snow avalanche mitigation foundation option should be a suitable solution, subject to the design considerations described above. Geotechnically, the practicality of ground anchors will depend on the site conditions. Such anchors will be practical to install on rock foundations, but less practical if the foundation consists of loose colluvial soils. Detailed design of reinforced foundations in snow avalanche hazard areas will require further analysis of avalanche design loads and geotechnical site conditions (e.g. soil or bedrock foundation characteristics at site).

For tower structures TP 14-1 to TP22-1 and TP25-1 to TP26-1, BGC (2011) identified snow avalanche paths that extend from the opposite valley side to the tower location as well as from slopes above the towers. If adjustment of the tower positions cannot be used to avoid these hazards, snow avalanche foundation design for these tower locations will need to consider snow avalanche loads from multiple directions.

4.2.2. Debris Floods / Debris Flows

Debris flows and debris floods have the potential to damage transmission tower sites through direct impact as well as by erosion of tower foundations.

Debris flow mitigation (e.g. avoidance or deflection berms) will be required upslope of tower sites where the unmitigated debris flood of debris flow risk is considered unacceptable. Tower structures TP2-2 and TP22-1 are identified by BGC (2011) as having a high unmitigated risk to a debris flow or debris hazards. Tower structures TP20-1 and TP21-2 are identified by BGC (2011) as having a moderate unmitigated risk to a debris flow or debris flood hazards.

For tower structures with proposed WN Brazier snow avalanche foundations that are also exposed to debris flow or debris flood risk, it may be possible for the foundation design to mitigate against both hazards, but this would depend on additional analysis of the impact forces of both types of hazards. Similarly, detailed design of any debris flow deflection berms will require further analysis of debris flow magnitude and flow characteristics at each site.

4.3. Subsurface Investigations

No detailed subsurface investigations of soil and rock conditions, groundwater conditions, or material testing were completed as part of this work. For detailed design, subsurface investigations will be necessary to provide foundation engineers with information to:

- Select the types of foundations most suitable at each structure location.
- Determine the size and depth of the selected foundations to adequately support the transmission tower / pole structures.
- Evaluate potential problems during construction.

It is understood that the Teigen Creek Access Road would be pioneered ahead of the transmission line. As the project schedule allows, an evaluation of suitable locations for geotechnical borings and or test pits should be completed following surficial mapping of access road cuts. Soil and bedrock exposed in the construction of the access road can also be used to confirm foundation conditions at pole locations where appropriate.

5.0 RECOMMENDATIONS FOR FURTHER WORK

BGC recommends the following work for feasibility level design of the proposed transmission line.

<u>Alignment Refinement:</u>

- Review the potential to re-align the Teigen Creek access road (between KP 8.8 and KP 9.7) 10 to 15 m west allowing adjacent tower structure to maintain a greater set-back from the adjacent slope crest.

- Review the potential to adjust locations of tower structures TP21-1, TP25-1 to TP27-1, TP34-1, TP35A-1, and TP40-2 as described in Table B1 to move structures onto flatter sloping terrain or further away from stream channels.
- Review access road cut slope design in conjunction with transmission line tower foundation design specifically near tower structures TP12-1 and TP34-1 and between TP23-1 to TP27-1.
- Avalanche specialist review of avalanche hazard and magnitude for pole locations for the alignment confirmed by the work above. Avalanche work should include estimate of late winter snowpack and avalanche deposits along the alignment.

Feasibility Design

With a feasibility level alignment confirmed, additional feasibility design work should include:

- Characterization of design debris flows / debris floods at tower structures TP2-2 and TP22-1 where the unmitigated risk from debris flows and debris floods is High. Develop feasibility level mitigation as required.
- Detailed analysis of avalanche design loads at tower structures TP4-2, TP6-1 to TP8-1, TP10-1, TP13-1 to TP18-1, TP20-1 to TP23-1, TP29-1, and TP30-1 where the unmitigated risks of snow avalanche hazards are considered High.
- Confirmation of tower design type(s) and height(s), foundation design loads, and foundation performance criterion for all tower structures. Use of the avalanche design loads to confirm the tower foundation design for avalanche risk areas.
- Evaluation of recommended locations for geotechnical borings and or test pits following surficial mapping of the access road during construction. Construction of the access road can also be used to confirm foundation conditions at pole locations where appropriate.
- Completion of feasibility level foundation design for the alignment that:
  - develops standard foundation designs and any necessary site specific foundation designs;
  - assigns foundation designs to tower locations; and
  - includes geohazard mitigation designs as necessary for foundation locations;

Other

- Update BGC's Geohazard Risk Assessment (BGC 2011) to include the current transmission line alignment. This could be included as part of any future revisions to this report.

6.0 CLOSURE

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,

BGC ENGINEERING INC.
per:

Greg Hunchuk, M.Eng., P.Eng., P.Geo
Project Geotechnical Engineer

Reviewed by:

Mark Pritchard, M.A.Sc., P.Eng., P.Geo.
Senior Geotechnical Engineer

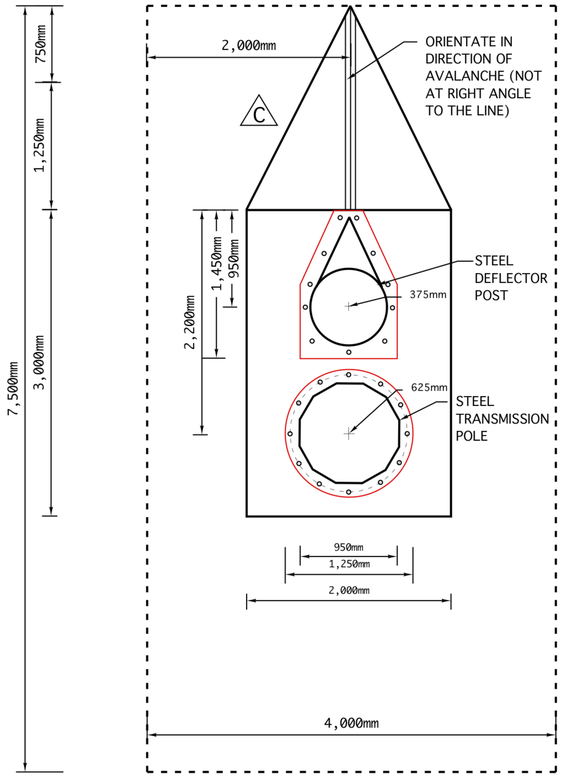
Kris Holm, M.Sc., P.Geo
Senior Geoscientist and Project Manager

REFERENCES

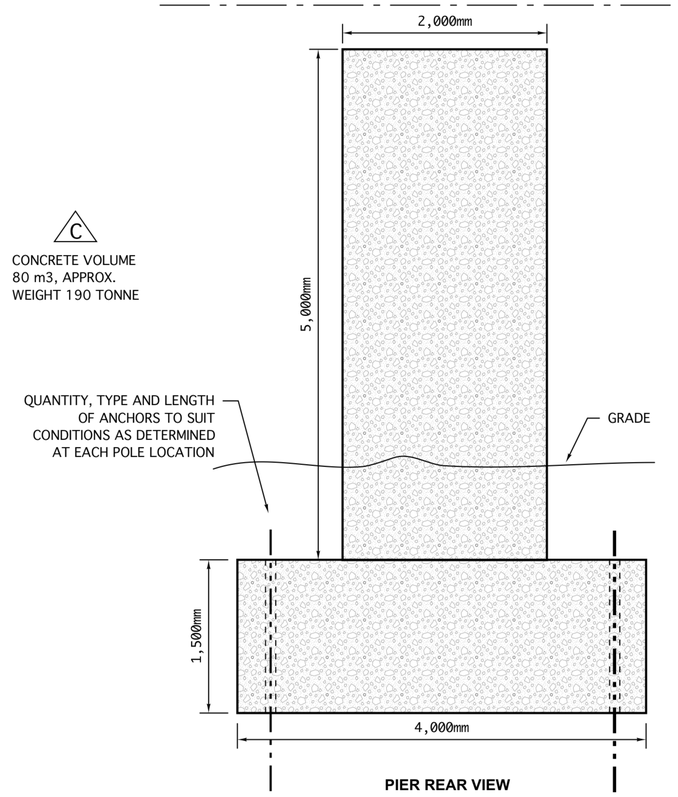
BGC Engineering Inc. 2010. KSM Terrain Stability Field Assessment. Final Report Prepared for Seabridge Gold Inc. dated November 30, 2010.

BGC Engineering Inc. 2011. Geohazard Risk Assessment, KSM Project: TMF & Teigen Creek Access: Revision B. Final report prepared for Seabridge Gold Inc., dated August 24, 2011

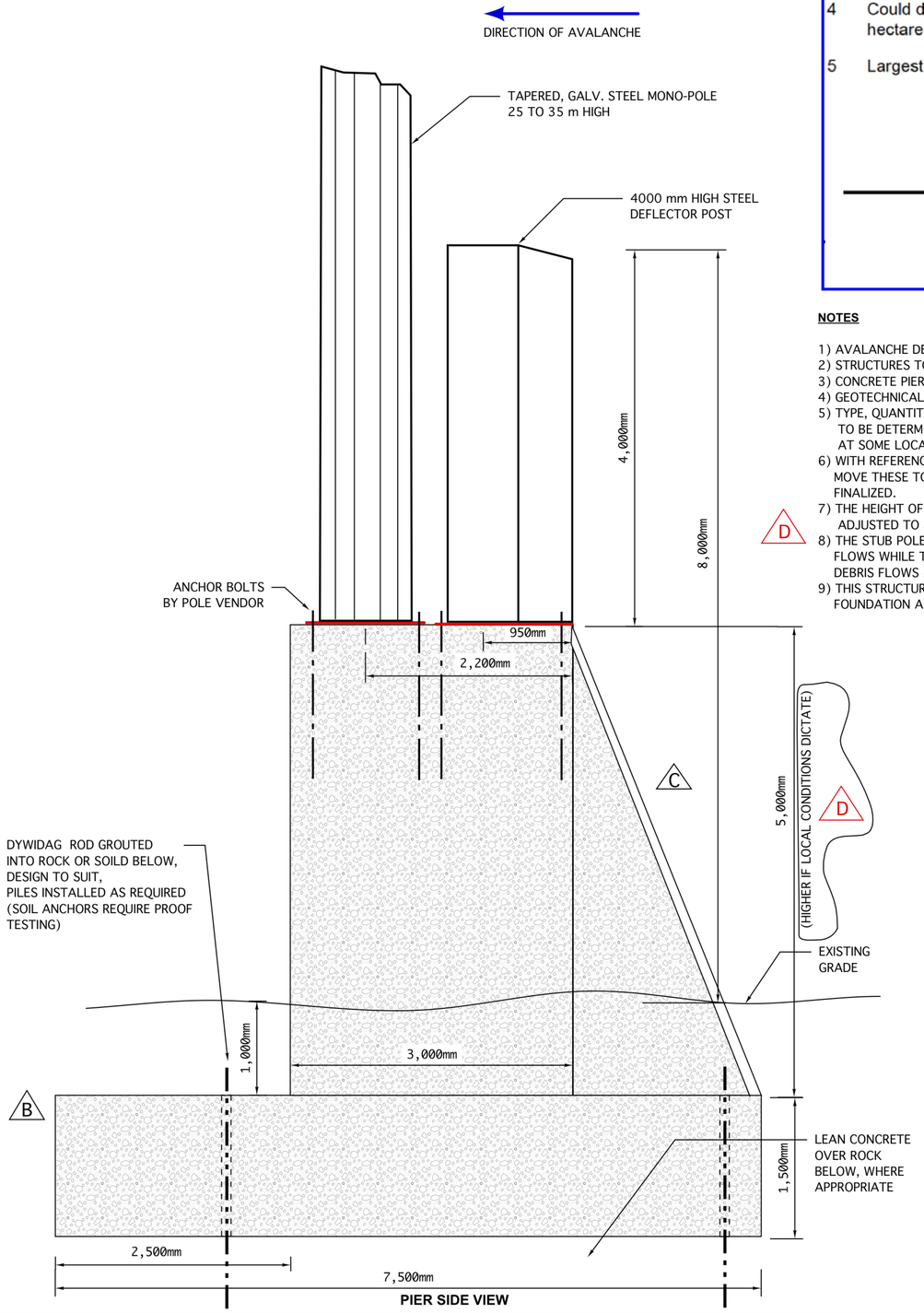
APPENDIX A
AVALANCHE AREA FOUNDATION TYPE AP-1



PIER AND POLE PLAN VIEW



PIER REAR VIEW



PIER SIDE VIEW

AVALANCHE CLASSIFICATION

0	No Avalanche
1	Relatively harmless to people
2	Could bury injure or kill a person
3	Could bury/destroy a car, damage a truck, destroy a timber frame house, break trees
4	Could destroy a railway car/large truck/several buildings/forest up to 4 hectares
5	Largest known avalanche. Could destroy a village/forest of 40 hectares

canadianavalancheassociation

NOTES C

1) AVALANCHE DESIGN FORCE IS TO BE CONFIRMED IN EACH CASE.
2) STRUCTURES TO BE ALIGNED WITH AVALANCHE PATH.
3) CONCRETE PIER HIEGHT TO BE ADJUSTED BASED ON AREA AVALANCHE HAZARD.
4) GEOTECHNICAL INVESTIGATIONS REQUIRED AT EACH POLE SITE.
5) TYPE, QUANTITY, AND LENGTH OF FOUNDATION ANCHORS REQUIRED FOR EACH POLR FOUNDATION TO BE DETERMINED BY A GEOTECHNICAL INVESTIGATION OF EACH POLE SITE. PILES MAY BE REQUIRED AT SOME LOCATIONS.
6) WITH REFERENCE TO THE STRUCTURE LOCATIONS, THERE IS USUALLY CONSIDERABLE LATITUDE TO MOVE THESE TO SUIT GROUND CONDITIONS, AT THE DESIGN STAGE BEFORE POLE HEIGHTS HAVE BEEN FINALIZED.
7) THE HEIGHT OF THE ILLUSTRATED STRUCTURE ABOVE EXISTING GRADE AT EACH LOCATION MAY BE ADJUSTED TO SUITE THE ANTICIPATED AVALANCHE DEPTH (ON TOP OF ACCUMULATED SNOW).
8) THE STUB POLE DEFLECTORS ARE DESIGNED TO PROTECT AGAINST AVALANCHE LESS DENSE SNOW FLOWS WHILE THE LOWER CONCRETE FOUNDATION PROTECTS AGAINST DENSE SNOW AND GENERAL DEBRIS FLOWS (MUD AND ROCK).
9) THIS STRUCTURE, TYPE AP-1, IS FOR THE WORST CASE PREDICTED AVALANCHE FORCES. STRUCTURE FOUNDATION AND PROTECTION TYPE AP-2 IS FOR LOWER RISK AREAS (SEE DRAWING 621-27-6551).

NOT FOR CONSTRUCTION
PRELIMINARY ONLY - FOR ESTIMATING

REV	ISSUED FOR	DESCRIPTION OF REVISION	DATE
D	PFS	REVISED TITLE & DRAWING #, AND AS MARKED	OCT. 22/11
C	PFS	AS MARKED	SEPT. 2/11
B	PFS	INCREASED LENGTH/MASS OF FOUNDATION	MAY 7/11
A	PRELIMINARY		APRIL/11

SEABRIDGE GOLD INC.
KSM PROJECT

TITLE:
ELECTRICAL
TEIGEN VALLEY 287 KV TRANSMISSION LINE
AVALANCHE AREA FOUNDATION TYPE AP-1

W.N. Brazier Associates Inc.

SCALE: 1 : 30			
DRAWN:	WNB	DATE:	MARCH 11
CHECKED:	WNB	DATE:	SEPT./11
APPROVED:		DATE:	
DRAWING NO:	621-27-E-6550		D

GENERAL NOTES

1. REFER TO THE EXCEL SPREADSHEET 'STRUCTURE DATA' FOR COORDINATES OF POLE LOCATIONS, GROUND ELEVATIONS, DISTANCES BETWEEN STRUCTURES, ETC.
2. THE TRANSMISSION LINE IS DESIGNED TO, FOR THE MOST PART, TO CLOSELY FOLLOW THE ACCESS, THUS AVOIDING A SECOND RIGHT-OF-WAY, EXTENSIVE ACCESS ROADS TO TRANSMISSION LINE STRUCTURES, ETC.
3. TO FACILITATE CONSTRUCTION OF A 287 KV LINE ADJACENT TO THE ACCESS ROAD, STEEL (UN-GUYED) MONOPOLE CONSTRUCTION HAS BEEN SELECTED.
4. THE LOCATION OF DIFFICULT STRUCTURES ALONG THE ROUTE WAS SUBJECT TO EXTENSIVE GROUND TRUTHING BY GEOTECHNICAL ENGINEERS IN THE FALL OF 2011. IN THE FOLLOWING MAPPING, POLE LOCATIONS AND LINES SHOWN IN BLUE DESIGNATE THE SUBSEQUENT LINE REVISIONS.
5. THE TRANSMISSION LINE DESIGN, AS SHOWN ON THE PLAN DRAWINGS, IS FOR ESTIMATING AND PLANNING PURPOSES ONLY, NOT FOR TENDER OR CONSTRUCTION.
6. DUE TO CURRENT UNCERTAINTIES, THE LINE DESIGN HAS NOT BEEN ADVANCED TO INCLUDE PROFILE DRAWINGS.
7. MINIMAL TRANSMISSION LINE RIGHT-OF-WAY CLEARING IS PLANNED, ALTHOUGH THERE ARE MANY TALL "DANGER" ADJACENT TO THE PROPOSED TRANSMISSION LINE THAT WOULD HAVE TO BE REMOVED. AS THE PROPOSED LINE CLOSELY FOLLOWS THE TRACK OF THE PLANED ROAD FOR MUCH OF THE ROUTE, ADDITIONAL CLEARING WOULD GENERALLY ONLY APPLY TO ONE SIDE. AS THE RIGHT-OF-WAY WIDTH FOR A 287 KV TRANSMISSION LINE WOULD TYPICALLY BE 40 METRES, IT IS EXPECTED THAT 20 M ADDITIONAL CLEARING WOULD BE REQUIRED ON THE TRANSMISSION SIDE OF THE ROAD, BUT THIS CLEARING WOULD NOT REMOVE ALL TREES, ONLY THOSE HIGH ENOUGH TO BE A THREAT TO THE LINE WOULD BE CUT. ANNUAL CLEARING MAINTENANCE WORK WOULD BE SCHEDULED.
8. THE TRANSMISSION LINE ROUTE, IN CONJUNCTION WITH THE ROAD, HAS BEEN REVIEWED BY EXPERT CONSULTANTS WITH REGARDS TO GEOHAZARDS, IN PARTICULAR AVALANCHE HAZARDS.
9. A TYPICAL DESIGN HAS BEEN ORIGINATED FOR TRANSMISSION LINE STRUCTURES SUBJECT TO SEVERE AVALANCHE HAZARD. REFER TO THE DESIGN SKETCH. THE PRINCIPLE IS TO RAISE THE STEEL POLE BASES ABOVE THE LEVEL OF HAZARDOUS AVALANCHE FLOWS. SMALLER CONCRETE STRUCTURE FOUNDATIONS WOULD BE PROVIDED FOR POLES IN SEMI-HAZARDOUS AREAS.
10. THE TRANSMISSION LINE AVALANCHE HAZARD, ON A PRELIMINARY BASIS, HAS BEEN DETERMINED FROM BGC PROJECT # 0638-005 DRAWING # 10 REV. A, DEC 2010, AS PREPARED BY ALPINE SOLUTIONS, AVALANCHE SERVICES.
11. THE BASIC ROAD DRAWINGS, ON WHICH THE TRANSMISSION LINE ROUTE AND STRUCTURES HAVE BEEN ADDED, IS BASED ON THE MCELHANNEY TEIGEN ROAD DESIGN DRAWINGS, FALL 2010 REVISION.
12 THE LINE STRUCTURES HAVE BEEN LOCATED TO SUIT GROUND CONDITIONS, AS CONFIRMED IN THE FIELD, NOT TO PROVIDE LONG STRAIGHT LINE RUNS WHICH ARE OF NO IMPORTANCE WHEN USING STEEL MONO-POLES NEXT TO A ROAD. IT IS TO BE NOTED FROM THE EXCEL SPREADSHEET THAT SOME STRUCTURE LOCATIONS RESULT IN VERY SMALL LINE DEVIATIONS. EVEN THOUGH SUCH SMALL ANGLES DO NOT IMPACT STRUCTURE SELECTION AND COST, THESE LINE SEGMENTS MAY BE STRAIGHTENED AT A LATER STAGE FOR THE SAKE OF AESTHETICS, IF GROUND CONDITIONS PERMIT.

REV.	DATE	DESCRIPTION OF REVISION

SEABRIDGE GOLD INC.
KSM PROJECT

W.N. Brazier Associates Inc.

DRAWN BY: WNB	DATE: OCT. 2011
CHECKED BY:	DATE:
APPROVED BY:	DATE:

ELECTRICAL
287 KV TRANSMISSION - TEIGEN OPTION
GENERAL NOTES

DRAWING NO: **621-27-E-6500** REV. **A**

APPENDIX B
TOWER SITE GEOLOGIC AND GEOHAZARD CHARACTERIZATION SUMMARY

TABLE B-1. TOWER SITE GEOLOGIC AND GEOHAZARD CHARACTERIZATION SUMMARY FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

TOWER ALIGNMENT AND STRUCTURE DETAILS FROM WN BRAZIER[1]							TERRAIN UNIT, GEOLOGY UNIT DETAILS[2,3,4]											SLOPE CLASS RANGE WITHIN 10m OF STRUCTURE[8]		STRUCTURE LOCATION RELATIVE TO TEIGEN ROAD ALIGNMENT[9]		BGC COMMENTS FROM SEPTEMBER 12-15TH FIELD VISIT TO KSM TRANSMISSION LINE			
STRUCTURE NO.	EASTING (m)	NORTHING (m)	GROUND ELEVATION (m)	TL CHAINAGE (HORIZONTAL, APPROX.) (km)	AVALANCHE FOUNDATION (NO/YES & TYPE OF PROTECTION)	STRUCTURE NOTES	BEDROCK GEOLOGY UNIT[2,3]	TERRAIN SYMBOL[4,5]	GEOMORPHIC PROCESSES[4,5] (BLANK IF NONE)	DRAINAGE CLASS[4,5]	TERRAIN STABILITY CLASS[4,5]	EROSION POTENTIAL[4,5]	SNOW AVALANCHES[6]	GEOHAZARD PROCESS[7]	DIRECT CONSEQUENCE[7]	UNMITIGATED RISK[7]	RESIDUAL RISK[7]			UPSLOPE (U/S) OR DOWNSLOPE (D/S) OF TIEGEN ROAD	DISTANCE TO ACCESS ROAD	FIELD VISIT[10] Y/N	DATE OF FIELD VISIT[10]	SUGGESTED STRUCTURE LOCATION ADJUSTMENT	TOWER SITE OBSERVATIONS / COMMENTS
TP1-1	443,409	6,290,501	650	0.000	NO	3 POLE DEAD-END STRUCTURE	JBRA	Cvb		m	III			No credible geohazards				3°-15°		N/A	N/A	Y	13-Sep-11		
TP1-2	443,266	6,290,400	610	0.175	NO		JBRA	Cvb		m	III			No credible geohazards				3°-15°		N/A	N/A				
TP2-1	443,079	6,290,292	575	0.391	NO		JBRA	Fp-U	U	i-p		M		No credible geohazards				0°-3°		N/A	N/A	Y	13-Sep-11		Located 25 m away from Snowbank Creek right bank. Located 40 m downslope of HWY 37.
TP2-2	442,997	6,290,100	585	0.600	NO		JBRA	Ff.Cf-Rd	Rd	m	II	M		Debris Flood	Damage to tower & service interruption	High	Moderate	3°-15°		D/S	180	Y	13-Sep-11		Tower is located in debris flow / debris flood fan; trees located adjacent to tower site are mature (>80 years); associated stream channel (approximately 100m away) has approximately 2 to 5 m high channel banks; there is a potential that a debris flow / flow event could lead to channel avulsion towards site. Review whether unmitigated risk would continue to be high; could consider construction of upslope diversion berm to lower geohazard risk if unmitigated risk to is considered unacceptable.
TP3-1	442,913	6,289,904	600	0.814	NO		JBRA	Ff.Cf-Rd	Rd	m	II	M		Debris Flood	Damage to tower & service interruption	Low	Low	3°-15°		D/S	60	Y	13-Sep-11		Located on inactive colluvial fan feature; trees located adjacent to tower site are mature (>80 years); tower is located on raised terrain approximately 20 m elevation above the active stream channel.
TP4-1	442,881	6,289,682	600	1.037	NO		JBRA	Ff.Cf-Rd	Rd	m	II	M	A	Snow Avalanche (Size 3)	Damage to tower & service interruption	High	Moderate	3°-15°		D/S	30				Located on inactive colluvial fan feature; trees located adjacent to tower site are mature (>80 years); tower is located on raised terrain approximately 35 m elevation above the active stream channel. BGC (2011) identified as 'High' risk of impact from Size 3 snow avalanches; review whether avalanche protection measures are required.
TP4-2	442,940	6,289,483	608	1.245	YES AP1		JBRA	Ftu		m-i	II	M	A	Snow Avalanche (Size 3)	Damage to tower & service interruption	High	Moderate	3°-15°	15°-26°	D/S	35				
TP5-1	442,995	6,289,298	605	1.439	NO		JBRA	Ftu		m-i	II	M		No credible geohazards				15°-26°		D/S	35				
TP6-1	443,006	6,289,086	605	1.651	YES AP1		JBRA	Cvb		w-m	III		A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	3°-15°		D/S	45				Soil exposed in adjacent slope escarpment approximately 70 m to the south; tower is set back from slope escarpment
TP7-1	442,903	6,288,864	605	1.895	YES AP1		JBRA	Cvb		w-m	III		A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	3°-15°	15°-26°	U/S	16	Y	13-Sep-11		Soil exposed in adjacent slope escarpment approximately 70 m to the east; tower is set back from slope escarpment.
TP8-1	442,813	6,288,619	627	2.156	YES AP2		JBRA	Cvb		w-m	III			No scenarios identified				0°-3°	3°-15°	U/S	9	Y	13-Sep-11		Site is not identified in BGC (2011) as being a 'High' risk against snow avalanche. Review with snow avalanche specialist whether snow avalanche structures are necessary.
TP9-1	442,770	6,288,491	630	2.291	NO		JBRA	Cvb		w-m	III			No scenarios identified				3°-15°	26°-35°	D/S	9				
TP10-1	442,689	6,288,273	612	2.524	YES AP2		JBRA	Cvb		w-m	III			No scenarios identified				3°-15°		D/S	33				Soil exposed in adjacent slope escarpment approximately 40 m to the south; tower is set back from slope escarpment. Considering avalanche geohazard mapping, review with snow avalanche specialist whether snow avalanche structures are necessary.
TP11-1	442,579	6,288,183	600	2.666	NO		JBRA	Cvb		w-m	III			No scenarios identified				3°-15°	35°-45°	U/S	51				Located adjacent to slope break; potential for shallow soils.
TP12-1	442,478	6,287,931	580	2.938	NO	3 POLE DEAD-END	JBRA	Cv//Rks		w	III			No scenarios identified				26°-35°	35°-45°	U/S	14	Y	14-Sep-11		Steeper slopes, bedrock controlled. Vertical rock bluff with associated downslope talus field located 40m southwest from tower site. Site for future geotechnical investigation.
TP13-1	442,438	6,287,477	588	3.393	YES AP1	3 POLE DEAD-END	JBRA	Cv.Mw-V		m	IV	H	A	Snow Avalanche (Size 4)	Damage to tower & service interruption	High	Moderate	3°-15°	15°-26°	U/S	50				Mapped snow avalanche path travels towards site from opposite side of valley.

TABLE B-1. TOWER SITE GEOLOGIC AND GEOHAZARD CHARACTERIZATION SUMMARY FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

TOWER ALIGNMENT AND STRUCTURE DETAILS FROM WN BRAZIER[1]							TERRAIN UNIT, GEOLOGY UNIT DETAILS[2,3,4]										SLOPE CLASS RANGE WITHIN 10m OF STRUCTURE[8]		STRUCTURE LOCATION RELATIVE TO TEIGEN ROAD ALIGNMENT[9]		BGC COMMENTS FROM SEPTEMBER 12-15TH FIELD VISIT TO KSM TRANSMISSION LINE			
STRUCTURE NO.	EASTING (m)	NORTHING (m)	GROUND ELEVATION (m)	TL CHAINAGE (HORIZONTAL, APPROX.) (km)	AVALANCHE FOUNDATION (NO/YES & TYPE OF PROTECTION)	STRUCTURE NOTES	BEDROCK GEOLOGY UNIT[2,3]	TERRAIN SYMBOL[4,5]	GEOMORPHIC PROCESSES[4,5] (BLANK IF NONE)	DRAINAGE CLASS[4,5]	TERRAIN STABILITY CLASS[4,5]	EROSION POTENTIAL[4,5]	SNOW AVALANCHES[6]	GEOHAZARD PROCESS[7]	DIRECT CONSEQUENCE[7]	UNMITIGATED RISK[7]	RESIDUAL RISK[7]			UPSLOPE (U/S) OR DOWNSLOPE (D/S) OF TIEGEN ROAD	DISTANCE TO ACCESS ROAD	FIELD VISIT Y/N[10]	DATE OF FIELD VISIT[10]	SUGGESTED STRUCTURE LOCATION ADJUSTMENT	TOWER SITE OBSERVATIONS / COMMENTS
TP13-2	442,413	6,287,332	627	3.540	YES AP1		JBRA	Cv.Mw-V		m	IV	H	A	Snow Avalanche (Size 4)	Damage to tower & service interruption	High	Moderate	0°-3°	3°-15°	U/S	85				Mapped snow avalanche path travels towards site from opposite side of valley.
TP14-1	442,384	6,287,133	680	3.742	YES AP2		JBRA	Cv.Mw-V		m	IV	H	A	Snow Avalanche (Size 4)	Damage to tower & service interruption	High	Moderate	3°-15°	15°-26°	U/S	30				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP15-1	442,344	6,286,831	643	4.046	YES AP1		JBRA	Cv//Rsk		w	IV	M	A	Snow Avalanche (Size 4)	Damage to tower & service interruption	High	Moderate	0°-3°	15°-26°	U/S	38				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP16-1	442,213	6,286,646	643	4.273	YES AP2		JBRA	Cv//Rsk		w	IV	M	A	Snow Avalanche (Size 4)	Damage to tower & service interruption	High	Moderate	15°-26°		U/S	35				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP17-1	442,126	6,286,482	650	4.459	YES AP1		JBRA	Cv//Rsk		w	IV	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	15°-26°	35°-45°	U/S	90				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP18-1	441,991	6,286,382	650	4.627	YES AP1		JBRA	Cv//Rsk		w	IV	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	3°-15°	26°-35°	U/S	55				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP19-1	441,885	6,286,163	646	4.870	NO		JBRA	Cv//Rsk		w	IV	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	Moderate	Moderate	0°-3°	26°-35°	U/S	55				Mapped snow avalanche paths come from opposite side of valley and upslope of tower.
TP20-1	441,722	6,285,984	653	5.112	YES AP2		JBRA	Cf-Rd	Rd	m	II	M	A	Debris Flow	Damage to tower & service interruption	Moderate	Moderate	3°-15°	26°-35°	U/S	15	Y	14-Sep-11		Mapped snow avalanche paths come from opposite side of valley and upslope of tower. Tower is located below raised hummock between (covered with mature forest) that separates avalanche paths and debris flow paths; the raised hummock is offering additional protection against upslope debris flow events.
														Snow Avalanche (Size3-4)	Damage to tower & service interruption	High	Moderate								
TP21-1	441,593	6,285,818	633	5.322	YES AP2		JBRA	Cf-Rd	Rd	m	II	M	A	Debris Flow	Damage to tower & service interruption	Moderate	Moderate	3°-15°	35°-45°	U/S	16	Y	14-Sep-11	Tower site is adjacent to small ephemeral creek draw; consider moving tower 15m down-chainage or up-chainage.	Mapped snow avalanche paths come from opposite side of valley and upslope of tower. Tower is located below raised hummock between (covered with mature forest) that separates avalanche paths and debris flow paths; the raised hummock is offering additional protection against upslope debris flow events.
														Snow Avalanche (Size3-4)	Damage to tower & service interruption	High	Moderate								
TP22-1	441,516	6,285,585	615	5.567	YES AP2		JBRA	Cf-Rd	Rd	m	II	M	A	Debris Flow	Damage to tower & service interruption	High	Moderate	3°-15°	26°-35°	U/S	21				Mapped snow avalanche paths come from opposite side of valley and upslope of tower; tower is located at the margins of the debris flow path and snow avalanche path immediately adjacent to the forested terrain. Increase embedment of reinforced tower foundation and construction of a deflection berm / should be considered for increased protection against active upslope debris flows.
														Snow Avalanche (Size3-4)	Damage to tower & service interruption	High	Moderate								
TP23-1	441,388	6,285,424	610	5.773	YES AP2		JBRA	Fp-U	U	i-p	I	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	15°-26°	26°-35°	U/S	14				Tower site is located on lower slopes, away from adjacent floodplain. Mapped snow avalanche path travels towards site from opposite side of valley.
TP24-1	441,300	6,285,270	628	5.951	NO		JBRA	Cvb		m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	15°-26°	35°-45°	U/S	13	Y	14-Sep-11		Mapped snow avalanche paths come from opposite side of valley and upslope of tower. BGC (2011) identified as 'High' risk of impact from Size 3-4 snow avalanches; review whether avalanche protection measures are required.
TP25-1	441,149	6,285,084	604	6.190	NO		JBRA	Cvb		m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	26°-35°	35°-45°	U/S	4	Y	14-Sep-11	Alternate option to constructing special foundations for TP25-1, TP26-1, and TP27-1 is to locate towers locate 80 m upslope (east) from present alignment	Steep soil slopes anticipated; for tower foundation stability, structures may require a retaining wall else require special foundation types such as micro-piles or soil/rock anchors. Site for future geotechnical investigation. Mapped snow avalanche paths come from opposite side of valley and upslope of tower. BGC (2011) identified as 'High' risk of impact from Size 3-4 snow avalanches; review whether avalanche protection measures are required.
TP26-1	441,146	6,284,918	620	6.357	NO		JBRA	Ckv		w-m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	35°-45°		U/S	14			Refer to TP25-1 comment	Refer to TP25-1 comment

TABLE B-1. TOWER SITE GEOLOGIC AND GEOHAZARD CHARACTERIZATION SUMMARY FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

TOWER ALIGNMENT AND STRUCTURE DETAILS FROM WN BRAZIER[1]							TERRAIN UNIT, GEOLOGY UNIT DETAILS[2,3,4]										SLOPE CLASS RANGE WITHIN 10m OF STRUCTURE[8]		STRUCTURE LOCATION RELATIVE TO TEIGEN ROAD ALIGNMENT[9]		BGC COMMENTS FROM SEPTEMBER 12-15TH FIELD VISIT TO KSM TRANSMISSION LINE			
STRUCTURE NO.	EASTING (m)	NORTHING (m)	GROUND ELEVATION (m)	TL CHAINAGE (HORIZONTAL, APPROX.) (km)	AVALANCHE FOUNDATION (NO/YES & TYPE OF PROTECTION)	STRUCTURE NOTES	BEDROCK GEOLOGY UNIT[2,3]	TERRAIN SYMBOL[4,5]	GEOMORPHIC PROCESSES[4,5] (BLANK IF NONE)	DRAINAGE CLASS[4,5]	TERRAIN STABILITY CLASS[4,5]	EROSION POTENTIAL[4,5]	SNOW AVALANCHES[6]	GEOHAZARD PROCESS[7]	DIRECT CONSEQUENCE[7]	UNMITIGATED RISK[7]	RESIDUAL RISK[7]			UPSLOPE (U/S) OR DOWNSLOPE (D/S) OF TIEGEN ROAD	DISTANCE TO ACCESS ROAD	FIELD VISIT[10] Y/N	DATE OF FIELD VISIT[10]	SUGGESTED STRUCTURE LOCATION ADJUSTMENT	TOWER SITE OBSERVATIONS / COMMENTS
TP27-1	441,231	6,284,742	620	6.552	NO		JBRA	Ckv		w-m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	Moderate	Moderate	35°-45°		U/S	7			Refer to TP25-1 comment	Steep soil slopes anticipated; for tower foundation stability, structures may require a retaining wall else require special foundation types such as micro-piles or soil/rock anchors. Site for future geotechnical investigation. Mapped snow avalanche path travels towards site from opposite side of valley.
TP28-1	441,322	6,284,606	660	6.715	NO		JBRA	Ckv		w-m	III	M		No scenarios identified				26°-35°		U/S	18				
TP29-1	441,341	6,284,455	665	6.867	YES AP2		JBRA	Ckv		w-m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	High	Moderate	15°-26°	26°-35°	U/S	18	Y	14-Sep-11		
TP30-1	441,287	6,284,227	683	7.102	YES AP2		JBRA	Ckv		w-m	III	M	A	Snow Avalanche (Size 3-4)	Damage to tower & service interruption	Moderate	Moderate	3°-15°	26°-35°	U/S	48	Y	14-Sep-11		
TP31-1	441,192	6,284,040	690	7.311	NO		JBRA	Ckv		w-m	III	M		No scenarios identified				3°-15°	15°-26°	U/S	49				
TP32-1	441,099	6,283,843	697	7.529	NO		JBRA	Cv/Mw		w-m	IV			No scenarios identified				3°-15°	15°-26°	U/S	56				
TP33-1	441,062	6,283,608	707	7.767	NO		JBRA	Ckv		w	III	M		No scenarios identified				3°-15°	15°-26°	U/S	45				
TP34-1	441,004	6,283,354	650	8.028	NO		JBRA	Fp-U		i-p	I	M		No scenarios identified				3°-15°	26°-35°	D/S	29			Consider moving towards hillslope (east) and founding on bedrock if present and suitable.	Debris flow channel is located approximately 100m upstream from tower location; site could experience periodic flooding associated with debris flow/flood events. Site for future geotechnical investigation; potentially may require special foundations (driven piles).
TP35-1	440,832	6,283,167	700	8.282	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				3°-15°	15°-26°	D/S	30	Y	12-Sep-11		
TP35-2	440,843	6,282,983	750	8.467	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				0°-3°	3°-15°	D/S	2	Y	12-Sep-11		
TP35-3	440,853	6,282,811	755	8.639	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				0°-3°	3°-15°	D/S	6	Y	12-Sep-11		
TP35A-1	440,866	6,282,640	761	8.810	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				0°-3°	26°-35°	D/S	37			Tower site is located immediate to slope break; consider moving tower 10m east towards access road.	
TP35A-2	440,851	6,282,455		8.995	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				3°-15°	15°-26°	D/S	32				
TP36-1	440,838	6,282,275	773	8.995	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				3°-15°	15°-26°	D/S	22	Y	12-Sep-11		
TP36-2	440,717	6,282,077	812	9.227	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				3°-15°		U/S	55	Y	12-Sep-11		
TP36-3	440,594	6,281,879	840	9.460	NO		JBRA	Mw|Ru		m	II	L		No scenarios identified				3°-15°		U/S	170	Y	12-Sep-11		
TP37-1	440,470	6,281,677	852	9.697	NO		JBRA	Mb		m	II	L		No scenarios identified				3°-15°	15°-26°	D/S	17	Y	12-Sep-11		
TP38-1	440,402	6,281,442	867	9.942	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				3°-15°	15°-26°	D/S	15	Y	12-Sep-11		Tower site is located 20m away from slope break. Soil exposed in escarpment face ~80m to the east on slope escarpment

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TOWER ALIGNMENT AND STRUCTURE DETAILS FROM WN BRAZIER[1]							TERRAIN UNIT, GEOLOGY UNIT DETAILS[2,3,4]											SLOPE CLASS RANGE WITHIN 10m OF STRUCTURE[8]		STRUCTURE LOCATION RELATIVE TO TEIGEN ROAD ALIGNMENT[9]		BGC COMMENTS FROM SEPTEMBER 12-15TH FIELD VISIT TO KSM TRANSMISSION LINE			
STRUCTURE NO.	EASTING (m)	NORTHING (m)	GROUND ELEVATION (m)	TL CHAINAGE (HORIZONTAL, APPROX.) (km)	AVALANCHE FOUNDATION (NO/YES & TYPE OF PROTECTION)	STRUCTURE NOTES	BEDROCK GEOLOGY UNIT[2,3]	TERRAIN SYMBOL[4,5]	GEOMORPHIC PROCESSES[4,5] (BLANK IF NONE)	DRAINAGE CLASS[4,5]	TERRAIN STABILITY CLASS[4,5]	EROSION POTENTIAL[4,5]	SNOW AVALANCHES[6]	GEOHAZARD PROCESS[7]	DIRECT CONSEQUENCE[7]	UNMITIGATED RISK[7]	RESIDUAL RISK[7]			UPSLOPE (U/S) OR DOWNSLOPE (D/S) OF TIEGEN ROAD	DISTANCE TO ACCESS ROAD	FIELD VISIT[10] Y/N	DATE OF FIELD VISIT[10]	SUGGESTED STRUCTURE LOCATION ADJUSTMENT	TOWER SITE OBSERVATIONS / COMMENTS
TP39-1	440,295	6,281,216	885	10.192	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				15°-26°		D/S	20	Y	12-Sep-11		
TP40-1	440,224	6,280,984	897	10.435	NO		JBRA	Mw|Ru		w	II	L		No scenarios identified				3°-15°		D/S	16				
TP40-2	440,182	6,280,776	880	10.647	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				26°-35°	35°-45°	D/S	140			Consider moving tower 20m west to keep tower away from moderately steep to steep slopes.	
TP40-3	440,143	6,280,566	885	10.860	NO		JBRA	Cv//Rks-V		w	IV	H		No scenarios identified				15°-26°	26°-35°	N/A	-				
TP40-4	440,102	6,280,357	920	11.074	NO		JBRA	Cv/Mw		w	II			No scenarios identified				15°-26°	26°-35°	N/A	-				
TP40-5	440,061	6,280,147	980	11.287	NO		JBRA	Cv/Mw		w	II			No scenarios identified				15°-26°	26°-35°	N/A	-				
TP40-6	440,021	6,279,938	1035	11.500	NO		JBRA	Cv/Mw		w	II			No scenarios identified				15°-26°		N/A	-				
TP40-7	439,977	6,279,715		11.727			JBRA	Mw|Rm/Rm		w-m	II	L		No scenarios identified				3°-15°	15°-26°	N/A	-	Y	13-Sep-11		
TP41-1	439,955	6,279,600	1080	11.727	NO	3 POLE DEAD-END, (Last Structure Before Substation)	JBRA	Mw|Rm/Rm		w-m	II	L		No scenarios identified				3°-15°		N/A	-	Y	13-Sep-11		
TP42-1	439,993	6,279,534	1070	0.000	N/A	SUBSTATION NO. 1 STRUCTURE (In Substation Yard)	JBRA	Mw|Rm/Rm		w-m	II	L		No scenarios identified				3°-15°	15°-26°	N/A	-	Y	13-Sep-11		

NOTES:
1. Transmission line alignment details from WN Brazier, KSM Excel Structure Data Rev D. dated October 24, 2011
2. Data Source: Regional Location and Generalized Geology Map from BGC (2011), Figure 1-1
3. JBRA: Bowser Lake Group, Mesozoic - Sandstone, Siltstone, Rare Conglomerate
4. Data Source: Teigen Access Road Terrain Map and Landslide Geohazards from BGC (2011), Drawing 03
5. See Drawing 01 for a Description of Terrain Symbols.
6. Data Source: Teigen Access Road Avalanche Geohazards from BGC (2011), Drawing 04
7. Data Source: Snowbank Creek Switching Station and Transmission Line Risk Assessment from BGC (2011), Table B-3
8. Slope Classes determined from 2009 LiDAR Topography and Geobase DEM
9. Teigen Access Road alignment from McElhanney, Nov 2, 2010 road alignment
10. Field visit considering transmission line alignment from WN Brazier, KSM Excel Structure Data Rev 2. Dated September 2, 2011

APPENDIX C
PRELIMINARY GEOTECHNICAL COMMENTS

TABLE C-1. SUMMARY OF PRELIMINARY GEOTECHICAL COMMENTS FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

SECTION ID	SECTION	STRUCTURE ID		NUMBER STRUCTURES IN SECTION	CHAINAGE (KM)		TERRAIN DESCRIPTION	SLOPE CLASS[1]	ANTICIPATED SUBSURFACE CONDITIONS	RECOGNIZED GEOHAZARDS	STRUCTURE PROXIMITY TO ACCESS ROAD	GEOTECHNICAL COMMENTS[2]
		FROM	TO		FROM	TO						
A	Southwest facing slope upslope of HWY 37	TP1-1	TP-1-2	2	0	0.175	Colluvial blanket, gentle slope	Gentle slopes	Soils >3m deep; moderate to poor drainage		Away from HWY 37 and access road.	Spread footing / drilled pier foundations
B	HWY 37 Crossing between TP2-1 and TP2-2	TP2-1	-	1	0.391	-	Fluvial floodplain, flat slope	Plain slopes	Soils >3m deep, low bearing near surface soils, imperfect to poor drainage - high water table	Flooding	Downslope 40m from raised road-fill section of HWY 37.	Special foundation: driven piles.
C	Near Snowbank Creek - Teigen Creek Junction	TP2-2	-	1	0.599	-	Fluvial fan / colluvial fan, gentle slope	Gentle slopes	Soils >3m deep, moderate drainage, potentially higher water table	Debris flood: unconfined creek channel is located upslope of tower site; debris flood potential.	Downslope 180m from Teigen access road.	Spread footing / drilled pier foundations Construction of upslope debris flow deflection berm if unmitigated risk to is considered unacceptable.
D	West of Teigen Creek	TP3-1	TP6-1	5	0.814	1.650	Glaciofluvial terrace, gentle to moderate slopes	Gentle to Moderate slopes	Soils >3m deep, moderate drainage	Snow avalanches Located above active debris flood terrain	Downslope 30 to 50 m from Teigen access road. Review location of access road drainage structures with respect to tower locations	Spread footing / drilled pier foundations Review whether special snow avalanche foundations are required for TP4-1
E	West of Teigen Creek	TP7-1	TP10-1	4	1.895	2.525	Glaciofluvial terrace to colluvial blanket, gentle to moderate slopes	Gentle to Moderate slopes	Soils >3m deep, moderate to well drained	Snow avalanches	Upslope 10 to 20m from Teigen access road.	Spread footing / drilled pier foundations Review whether special snow avalanche foundations are required for TP8-1 and TP10-1
F	West of Teigen Creek	TP11-1	-	1	2.666	-	Glaciofluvial to colluvial veneer over bedrock, gentle slopes adjacent to steep slopes immediately upslope	Gentle slope adjacent to Steep slopes immediately upslope	Soils 1-3m deep, moderate drainage		Upslope 50m from Teigen access road.	Dependent upon depth of soil: potentially soil or rock foundations
G	West of Teigen Creek	TP12-1	-	1	2.937	-	Colluvial veneer over bedrock, steep slope	Steep slopes	Bedrock near surface, soils <1m deep.		Upslope 15m from Teigen access road.	Rock foundation Integrate access road and tower alignment design associated with with steep natural slopes and proximity of adjacent road cut
H	Teigen Creek crossing between TP12-1 and TP13-1	TP13-1	14-1	3	3.393	3.741	Terrace, gentle to moderate slope	Gentle to Moderate slopes	Soils >3m deep, moderate drainage	Snow avalanches paths from slopes above and from opposite side of valley	Upslope 30 to 85m from Teigen access road.	Spread footing / drilled pier foundations Review whether special snow avalanche foundations should consider snow avalanche paths that extend from the opposite valley side to the tower location as well as from slopes above the tower
I	East of Teigen Creek	TP15-1	TP18-1	4	4.046	4.626	Colluvial veneer over bedrock with some narrow benches, moderate to steep slope	Moderate to Steep slopes	Soils 1-3m deep, moderately drained	Snow avalanches paths from slopes above and from opposite side of valley	Upslope 35 to 90m from Teigen access road.	Dependent upon depth of soil overburden: potentially soil or rock foundations Review whether special snow avalanche foundations should consider snow avalanche paths that extend from the opposite valley side to the tower location as well as from slopes above the tower
J	East of Teigen Creek	TP19-1	-	1	4.870	-	Terrace, flat to gentle slope	Gentle slopes	Soils >3m deep, moderate to well drained		Upslope 55m from Teigen access road.	Spread footing / drilled pier foundations

TABLE C-1. SUMMARY OF PRELIMINARY GEOTECHICAL COMMENTS FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

SECTION ID	SECTION	STRUCTURE ID		NUMBER STRUCTURES IN SECTION	CHAINAGE (KM)		TERRAIN DESCRIPTION	SLOPE CLASS[1]	ANTICIPATED SUBSURFACE CONDITIONS	RECOGNIZED GEOHAZARDS	STRUCTURE PROXIMITY TO ACCESS ROAD	GEOTECHNICAL COMMENTS[2]
		FROM	TO		FROM	TO						
K	East of Teigen Creek	TP20-1	TP21-1	2	5.112	5.322	Colluvial fan, gentle to moderate slope	Gentle to Moderate slopes	Soils >3m deep, moderate to well drained	Snow avalanches / debris flows located within section Snow avalanches paths form from slopes above and from opposite side of valley Tower sites are generally located behind raised hummocks with mature forest cover; hummocks are offering additional protection against debris flows.	Upslope 15 to 20m from Teigen access road.	Spread footing / drilled pier foundations Review whether special snow avalanche foundations should consider snow avalanche paths that extend from the opposite valley side to the tower location as well as from slopes above the tower
L	East of Teigen Creek	TP22-1	-	1	5.567		Colluvial fan, gentle to moderate slope	Gentle to Moderate slopes	Soils >3m deep, moderate to well drained	Snow avalanches / debris flows located within section Snow avalanches paths form from slopes above and from opposite side of valley Tower site is located within immature forest and adjacent to mature forest; site may not be protected against debris flows.	Upslope 15 to 20m from Teigen access road.	Spread footing / drilled pier foundations Construction of upslope debris flow deflection berm to protect against debris flow scour Review whether special snow avalanche foundations should consider snow avalanche paths that extend from the opposite valley side to the tower location as well as from slopes above the tower
M	East of Teigen Creek	TP23-1	TP24-1	2	5.773	5.951	Terrace escarpment, moderate to steep slope	Moderate to Steep slopes	Soils >3m deep, moderate to well drained	Snow avalanches paths form from slopes above and from opposite side of valley	Upslope 15m from Teigen access road.	Spread footing / drilled pier foundations Review whether special snow avalanche foundations are required for TP24-1 Integrate access road and tower alignment design associated with with steep natural slopes and proximity of adjacent road cut.
N	East of Teigen Creek	TP25-1	TP27-1	3	6.190	6.552	Terrace escarpment - moderately steep to steep slope	Moderarately Steep to Steep slopes	Soils >3m deep, moderate to well drained.	Snow avalanches, form above TP25-1 and from opposite side of valley from TP25-1, TP26-1, and TP27-1.	Upslope 5 to 15m from Teigen access road.	Special foundations: micro-piles or soil anchors likely necessary associated with steep natural slopes and close proximity of Teigen Creek access road. Review whether special snow avalanche foundations are required for TP25-1 and TP26-1 Integrate access road and tower alignment design. Consider relocating transmission line alignment on terrace located 80m upslope to avoid construction of special foundations on steep slopes.
O	East of Teigen Creek	TP28-1	TP29-1	2	6.715	6.867	Colluvial veneer to blanket, moderate to moderately steep slope	Moderate to Moderately Steep slopes	Soils 1-3m deep, moderate to well drained.	Snow avalanche path upslope of TP29-1	Upslope 20m from Teigen access road.	Dependent upon depth of soil overburden: potentially soil or rock foundations Integrate access road and tower alignment design associated with with steep natural slopes and proximity of adjacent road cut.
P	East of Teigen Creek	TP30-1	TP33-1	4	7.102	7.767	Terrace - flat to gentle slope	Plain to Gentle slopes	Soils >3m deep, moderate to well drained	Snow avalanche path upslope of TP30-1	Upslope to 50m from Teigen access road.	Spread footing / drilled pier foundations

TABLE C-1. SUMMARY OF PRELIMINARY GEOTECHICAL COMMENTS FOR KSM TRANSMISSION LINE (ALIGNMENT REV. D, OCT 2011) - DRAFT

SECTION ID	SECTION	STRUCTURE ID		NUMBER STRUCTURES IN SECTION	CHAINAGE (KM)		TERRAIN DESCRIPTION	SLOPE CLASS[1]	ANTICIPATED SUBSURFACE CONDITIONS	RECOGNIZED GEOHAZARDS	STRUCTURE PROXIMITY TO ACCESS ROAD	GEOTECHNICAL COMMENTS[2]
		FROM	TO		FROM	TO						
Q	Teigen Creek crossing between TP34-1 and TP35-1; Near Seabee Camp	TP34-1		1	8.028		Floodplain, flat adjacent to steep slope escarpment	Plain slope immediately adjacent to Steep slope escarpment	Soils >3m deep, low bearing near surface soils, imperfect to poor drainage - high water table	Flooding Debris flow path located 100m upstream and in combination with raised access road crossing, could increase potential for flooding downstream	Upstream on floodplain 30m from Teigen access road	Special foundation: driven piles, else consider constructing tower closer to adjacent slope escarpment Integrate access road and tower alignment design.
R	West of Teigen Creek	TP35-1	TP36-1	6	8.282	8.995	Till plain adjacent to slope escarpment, flat to moderate slope	Plain to Moderate slopes	Soils 1-3m deep, moderate drainage.		Downslope 5 to 30m from Teigen access road. Review location of access road drainage structures with respect to tower locations	Dependent upon depth of soil overburden: potentially soil or rock foundations.
S	West of Teigen Creek	TP36-2	TP36-3	2	9.227	9.460	Till plain, gentle slope	Gentle slopes	Soils 1-3m deep, moderate drainage.		Upslope to 50 to 180 m from Teigen access road.	Dependent upon depth of soil overburden: potentially soil or rock foundations
T	West of Teigen Creek	TP37-1	TP40-2	5	9.697	10.647	Till plain adjacent to slope escarpment, gentle to moderate slope	Gentle to Moderate slopes	Soils <1m deep, moderate to well drained.		Downslope 15 to 20m from Teigen access road. Review location of access road drainage structures with respect to tower locations	Dependent upon depth of soil overburden: potentially soil or rock foundations
U	West of Teigen Creek	TP40-3	TP40-6	4	10.860	11.500	Till veneer to blanket, moderate to moderately steep slope	Moderate to Moderately Steep slopes	Soils <1m deep, well drained.		Away from Teigen access road	Dependent upon depth of soil overburden, anticipate rock foundations
V	Near KSM Plant Site	TP40-7	TP42-1	3	11.727		Bedrock plateau, flat to gentle slope	Plain to Gentle slopes	Bedrock at ground surface; adjacent low-lying depression sites with peaty organics		Away from Teigen access road	Rock foundations

NOTES:

1. Slope Classes:
 - Plain slope: 0-3° (0-5%)
 - Gentle slope: 3-15° (6-26%)
 - Moderate slope: 15-26° (27-49%)
 - Moderately Steep slope: 26-35° (50-70%)
 - Steep slope: 35-45° (71-100%)
 - Very Steep slope: >45° (>100%)

2. No detailed investigation of subsurface soil, rock, and groundwater conditions has been carried out. Terrain conditions and geotechnical comments are preliminary. Foundation conditions should be further evaluted through subsurface investigations with results incorporated into design.

DRAWINGS

LEGEND

- PROPOSED TRANSMISSION LINE
- TRANSMISSION LINE STRUCTURES
- Debris Flow (Rd, Rsd)
- Debris Avalanche (Rs)
- Rockfall (Rb)
- Slope Sagging (Fm)
- Rock Avalanche (Rr)
- Rock Slump (Rm)
- Rockfall and Debris Flow or Debris Avalanche (Rbd, Rbs)
- LANDSLIDE PATH
- LANDSLIDE SCARP
- SACKUNG
- STUDY BOUNDARY
- TERRAIN POLYGON (NUMBERED)

R" Rapid Landslide (Initiation Zone)
R Rapid Landslide (Runout Zone)
F" Slow Landslide (Initiation Zone)
F Slow Landslide (Runout Zone)

POLYGON LABELS

Terrain symbol — Cv/Rs – R"b

TERRAIN SYMBOLS

Simple Terrain Symbols: Used when one surficial material is present within a polygon

Example: Cb – Rb
- Surficial Material
- Surface expression
- Geomorphological process sub-type
- Geomorphological process (up to 3 may be assigned)

Composite Terrain Symbols: Used when 2 or 3 terrain types are present within a polygon

Cv.Mv	indicates that 'C' and 'M' are roughly equal in extent
Cv/Mv	indicates that 'C' is greater in extent than 'M' (about 60:40)
Cv//Mv	indicates that 'C' is much greater in extent than 'M' (about 80:20)

Stratigraphic Terrain Symbols

Cv|Mj	indicates that 'Cv' overlies 'Mj'
/Cv|Mj	indicates that 'Cv' partially overlies 'Mj'

Surficial Material Types

C	Colluvium	R	Bedrock	LG	Glaciolacustrine
L	Lacustrine	M	Glacial Till	FG	Glaciofluvial
F	Fluvial	O	Organic		

Surface Expressions

p	Plain (0-3°)	v	Veneer (0-2 m thick deposit)
j	Gentle Slope (4-14°)	b	Blanket (>2 m thick deposit)
a	Moderate Slope (15-26°)	w	Variable Thickness Deposit)
k	Moderately Steep Slope (27-35°)	m	Rolling
s	Steep Slope (>35°)	h	Hummocky
c	Cone (>15°)	f	Fan (<15°)
r	Ridge	u	Undulating
t	Terrace		

Geomorphologic Processes

R	Rapid landslide (runout zone)	V	Gully erosion
R"	Rapid landslide (initiation zone)	F"	Slow landslide (initiation zone)
U	Flooding		

Geomorphological Process Subtypes (May be Combined)

b	Rockfall	r	Rock slides (Rr, R"r)	c	Soil creep
d	Debris flows	s	Debris avalanches	m	Slump
e	Earthflow				

Examples

/Cv|Mb	Partial cover of a Colluvial Veneer over a till blanket
Rs//Cv – VR"bd	Steep bedrock with <20% cover of a colluvial veneer; gullied with initiation zones for rockfall and debris flows.

Drainage

r	Rapid	w	Well	m	Moderate
i	Imperfect	p	Poor	vp	Very Poor

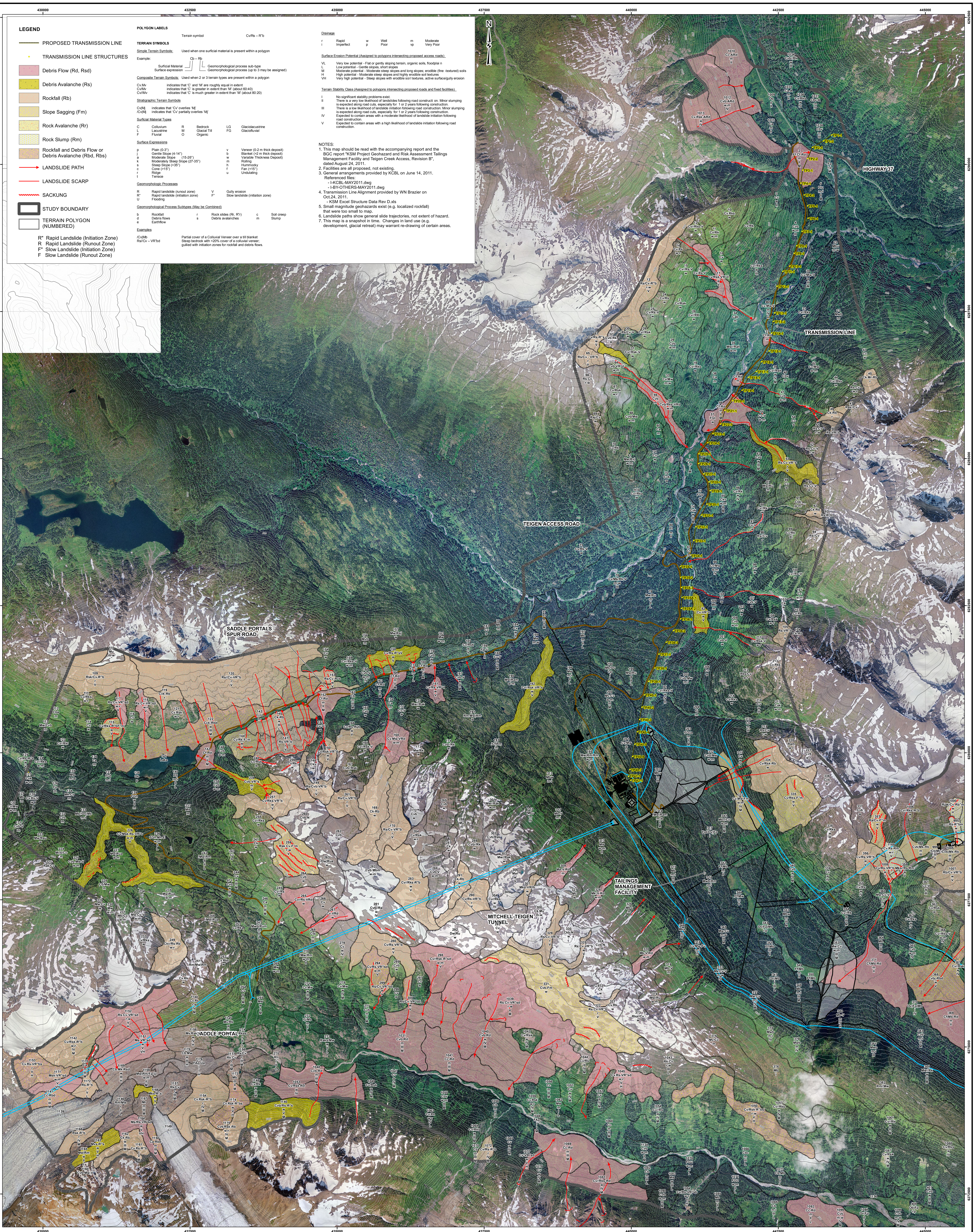
Surface Erosion Potential (Assigned to polygons intersecting proposed access roads)

VL	Very low potential - Flat or gently sloping terrain, organic soils, floodplain
L	Low potential - Gentle slopes, short slopes
M	Moderate potential - Moderate steep slopes and long slopes; erodible (fine -textured) soils
H	High potential - Moderate steep slopes and highly erodible soil textures
VH	Very high potential - Steep slopes with erodible soil textures, active surface/gully erosion

Terrain Stability Class (Assigned to polygons intersecting proposed roads and fixed facilities)

I	No significant stability problems exist.
II	There is a very low likelihood of landslides following road construction. Minor slumping is expected along road cuts, especially for 1 or 2 years following construction.
III	There is a low likelihood of landslide initiation following road construction. Minor slumping is expected along road cuts, especially for 1 or 2 years following construction.
IV	Expected to contain areas with a moderate likelihood of landslide initiation following road construction.
V	Expected to contain areas with a high likelihood of landslide initiation following road construction.

NOTES:
1. This map should be read with the accompanying report and the BGC report "KSM Project Geohazard and Risk Assessment Tailings Management Facility and Teigen Creek Access, Revision B", dated August 24, 2011.
2. Facilities are all proposed, not existing.
3. General arrangements provided by KCBL on June 14, 2011. Referenced files:
   - I-KCBL-MAY2011.dwg
   - I-BY-OTHERS-MAY2011.dwg
4. Transmission Line Alignment provided by WN Brazier on Oct.24, 2011.
   - KSM Excel Structure Data Rev D.xls
5. Small magnitude geohazards exist (e.g. localized rockfall) that were too small to map.
6. Landslide paths show general slide trajectories, not extent of hazard.
7. This map is a snapshot in time. Changes in land use (e.g. development, glacial retreat) may warrant re-drawing of certain areas.



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METRES
NAD 1983 UTM Zone 9N

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DWG TO BE READ WITH BGC REPORT TITLED "KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW" DATED FEBRUARY 2012

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:20,000
DATE:	FEB 2012
DRAWN:	LL
DESIGNED:	GH
CHECKED:	KH
APPROVED:	MAP

PROFESSIONAL SEAL:

DRAFT

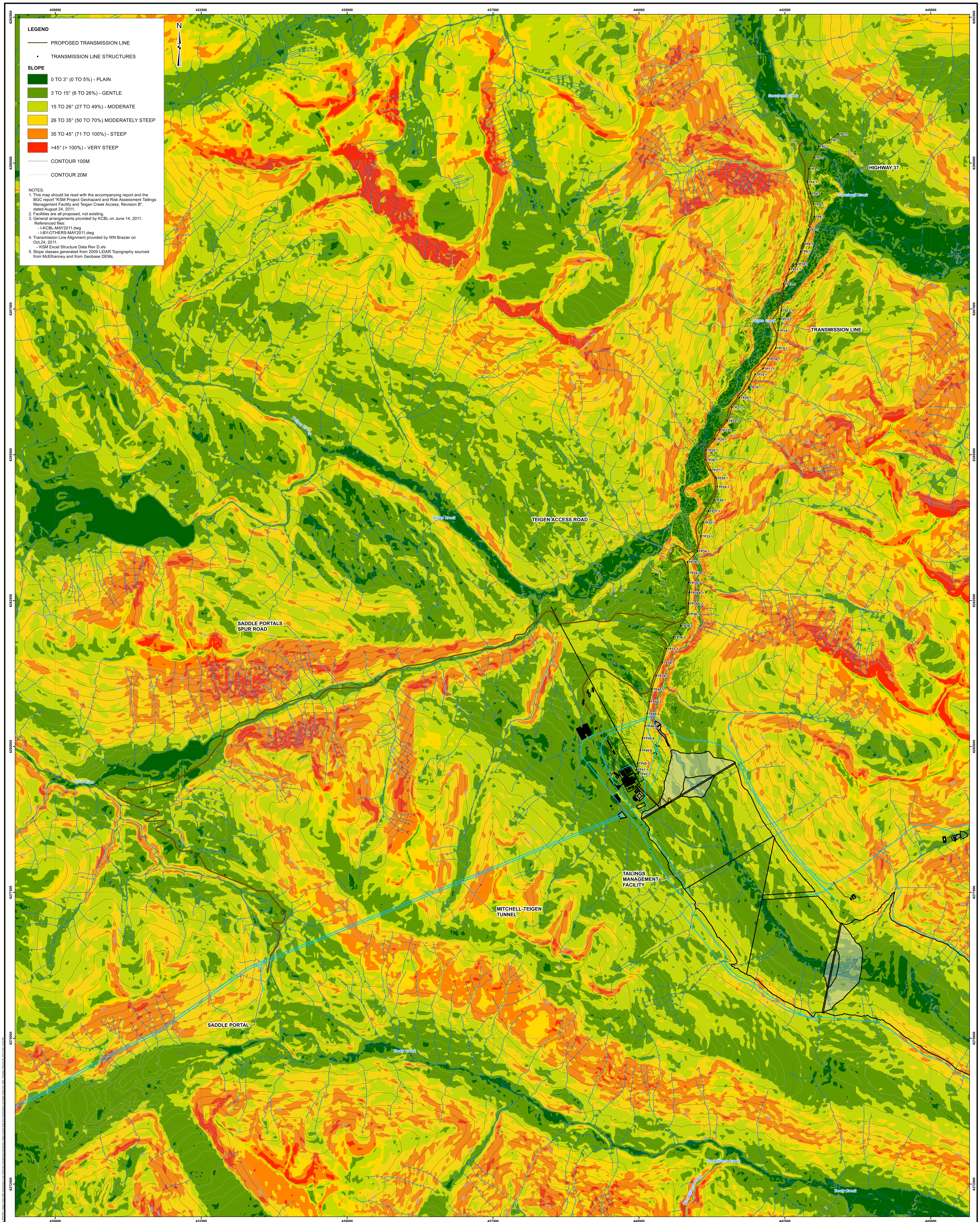
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW

TITLE: TEIGEN ACCESS ROAD AND TRANSMISSION LINE TERRAIN MAP AND LANDSLIDE GEOHAZARDS

PROJECT No.:	DWG No.:	REV.:
0638-005	01	


LEGEND
PROPOSED TRANSMISSION LINE
TRANSMISSION LINE STRUCTURES
SLOPE
0 TO 3° (0 TO 5%) - PLAIN
3 TO 15° (6 TO 26%) - GENTLE
15 TO 26° (27 TO 49%) - MODERATE
26 TO 35° (50 TO 70%) MODERATELY STEEP
35 TO 45° (71 TO 100%) - STEEP
>45° (> 100%) - VERY STEEP
CONTOUR 100M
CONTOUR 20M
NOTES:
1. This map should be read with the accompanying report and the BGC report "KSM Project Geohazard and Risk Assessment Tailings Management Facility and Teigen Creek Access, Revision B", dated August 24, 2011.
2. Facilities are all proposed, not existing.
3. General arrangements provided by KCBL on June 14, 2011. Referenced files:
- I-KCBL-MAY2011.dwg
- I-BY-OTHERS-MAY2011.dwg
4. Transmission Line Alignment provided by WN Brazier on Oct.24, 2011.
- KSM Excel Structure Data Rev D.xls
5. Slope classes generated from 2009 LiDAR Topography sourced from McElhanney and from Geobase DEMs.
N
HIGHWAY 37
Snowbank Creek
TRANSMISSION LINE
Teigen Creek
TEIGEN ACCESS ROAD
SADDLE PORTALS
SPUR ROAD
Unuk River
TAILINGS
MANAGEMENT
FACILITY
MITCHELL-TEIGEN
TUNNEL
SADDLE PORTAL
Treaty Creek
Tim Williams Creek
TP1-1
TP1-2
TP2-1
TP2-2
TP3-1
TP4-1
TP4-2
TP5-1
TP6-1
TP7-1
TP8-1
TP9-1
TP10-1
TP11-1
TP12-1
TP13-1
TP13-2
TP14-1
TP15-1
TP16-1
TP17-1
TP18-1
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METRES
NAD 1983 UTM Zone 9N

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:20,000
DATE:	FEB 2012
DRAWN:	LL
DESIGNED:	GH
CHECKED:	KH
APPROVED:	MAP

PROFESSIONAL SEAL:

DRAFT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW

TITLE: TEIGEN ACCESS ROAD AND TRANSMISSION LINE SLOPE CLASS

PROJECT No.:	DWG No.:	REV.:
0638-005	03	

DWG TO BE READ WITH BGC REPORT TITLED "KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW" DATED FEBRUARY 2012

LEGEND

- PROPOSED TRANSMISSION LINE
- TRANSMISSION LINE STRUCTURES
- AVALANCHE AFFECTED AREAS
- US-N-10 — NUMBERED AVALANCHE AREAS FOR CROSS REFERENCE IN REPORT WHERE A HIGH CONCENTRATION OF AVALANCHE PATHS AND FACILITIES EXIST
- FLOW DIRECTION

NOTES:
1. This map should be read with the accompanying report and the BGC report "KSM Project Geohazard and Risk Assessment Tailings Management Facility and Teigen Creek Access, Revision B", dated August 24, 2011.
2. Avalanche hazard interpretations were provided by Alpine Solutions Avalanche Services Ltd.
3. Facilities are all proposed, not existing.
4. General arrangements provided by KCBL on June 14, 2011.
   Referenced files:
   - I-KCBL-MAY2011.dwg
   - I-BY-OTHERS-MAY2011.dwg
5. Transmission Line Alignment provided by WN Brazier on Oct.24, 2011.
   - KSM Excel Structure Data Rev D .xls
6. Small avalanche paths (Size ≤ 2) exist outside the areas delineated but those are too small to be mapped at this scale.
7. Avalanche affected locations may be affected by more than one path. Dotted lines within selected avalanche affected areas indicate approximate individual path boundaries within areas that overlap.
8. Avalanche zones are mainly shown in the study area in which facilities are proposed. Any new facilities or relocation of existing facilities should be re-examined with respect to avalanche hazards
9. This map is a snapshot in time. Changes in topography through fill placement, cutslopes, glacial retreat or advance, landsliding as well as tree removal may require redrawing of avalanche zones in those areas.

N

HIGHWAY 37

TRANSMISSION LINE

TEIGEN ACCESS ROAD

SADDLE PORTALS SPUR ROAD

TAILINGS MANAGEMENT FACILITY

MITCHELL-TEIGEN TUNNEL

SADDLE PORTAL

TRN 39 TRN 37 TRN 36 TRN 34 TRN 38 TRN 35 TRN 33 TRN 31 TRN 32 TRN 30 TRN 29 TRN 28 TRN 27 TRN 26 TRN 25 TRN 24 TRN 23 TRN 22 TRN 21 TRN 20 TRN 19 TRN 18 TRN 17

TRS 18 TRS 17 TRS 16 TRS 19 TRS 15 TRS 13 TRS 12 TRS 11 TRS 14 TRS 10 TRS 9 TRS 8 TRS 7 TRS 6 TRS 5 TRS 4 TRS 3 TRS 2

UT 1 UT 2 UT 3 UT 4 UT 5 UT 6 UT 7

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6292500 6290000 6287500 6285000 6282500 6280000 6277500 6275000 6272500

500 0 500 1,000 1,500
METRES
NAD 1983 UTM Zone 9N

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE: 1:20,000
DATE: FEB 2012
DRAWN: LL
DESIGNED: GH
CHECKED: KH
APPROVED: MAP

PROFESSIONAL SEAL:

DRAFT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW

TITLE: TEIGEN ACCESS ROAD AND TRANSMISSION LINE AVALANCHE GEOHAZARDS

PROJECT No.: 0638-005
DWG No.: 02
REV.:

DWG TO BE READ WITH BGC REPORT TITLED "KSM PROJECT: TEIGEN CREEK – KSM TRANSMISSION LINE, PRELIMINARY GEOTECHNICAL REVIEW" DATED FEBRUARY 2012