APPENDIX 9-G
KSM PROJECT TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

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BGC ENGINEERING INC.
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SEABRIDGE GOLD INC.

KSM PROJECT

TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

DRAFT

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August 1, 2012
Project No: 0638-013

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

Dear Mr. Murphy

Re: KSM Project - Terrain Stability Field Assessment of the Proposed Treaty Creek Access Road, North Treaty Lower and Upper Road, Cut-off Ditch Access, and Tunnel Adit Access - DRAFT

Please find attached an electronic copy of the above referenced draft report. It contains geotechnical design prescriptions resulting from helicopter and ground review of select sections of the proposed access roads.

The report will be finalized at the end of August 2012.

Yours sincerely,

BGC ENGINEERING INC.
per:

Sam Fougère, M.Sc., P.Geo.
Senior Engineering Geologist

EXECUTIVE SUMMARY

Seabridge Gold Inc. (Seabridge) is developing the Kerr-Sulphurets-Mitchell (KSM) copper-gold deposit located approximately 70 km north of Stewart in the Coast Mountains of British Columbia. Seabridge retained BGC Engineering Inc. (BGC) to complete a terrain stability field assessment (TSFA) for the propose mine access roads. McElhanney Consulting Services Inc. (McElhanney) designed the proposed access roads and the TSFA was completed for select sections of the proposed roads to help refine the road design and minimize construction triggered slope instability and watercourse sedimentation.

The assessment and recommendations documented in this report are intended to support Seabridge's permit application to the Ministry of Forests who provides the construction and operation authority for the proposed access roads. The TSFA methodology adopted in this report is in general conformance with the Government of B.C.'s Forest Practices Code – Mapping and Assessing Terrain Stability Guidebook (MoF 1999), the Forest Road Engineering Guidebook (MoF 2002), the Association for Professional Engineers and Geoscientists of British Columbia's Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments (APEGBC 2010), Worksafe B.C. regulations for road cut slope stability and generally accepted geotechnical practices in the B.C. forest industry.

This report provides a TSFA of the proposed Treaty Creek, North Treaty Lower, North Treaty Upper, Cut-off Ditch, Tunnel Adit and Tunnel Adit Spur access roads for the proposed KSM project and includes a description of the methodology, results and geotechnical prescriptions for each road section.

Prescriptions for the Treaty Creek, North Treaty Upper, North Treaty Lower, Tunnel Adit and Tunnel Adit Spur access roads are summarized referencing the May 17, 2012 P-Line road design chainage (Appendix A - McElhanney 2012a). Prescriptions for the Cut-off Ditch access road are summarized referencing the July 6, 2012 P-Line road design chainage (Appendix A - McElhanney 2012b).

The TSFA did not identify any road sections that require detailed design, mitigation and construction planning at this stage. Further geotechnical review is recommended in advance of construction for the following sections:

- Treaty Creek: debris flow fan crossing structures at Km 4+500, Km 14+300, Km 16+200, Km 25+300, Km 26+800, and Km 28+800.
- North Treaty Lower: potential small landslide scarps (covered in snow at the time of field review) at Km 7+890 and Km 8+770.

BGC recommends that rock cut slope design and support provisions be refined by a qualified professional during construction in advance of the road heading to minimize the potential for cut slope failures that could disrupt the road construction schedule or expose construction personnel to unsafe working conditions. For rock and soil cuts greater than 10 m height, or where adverse geologic structure is suspected, we recommend that regular geotechnical review of rock cuts be conducted during construction to confirm cut slope design and stabilization recommendations are appropriate.

In addition, BGC recommends that road sections meeting the following criteria undergo detailed geotechnical design and construction planning several months before any road construction commences:

- Rock cuts greater than 20 m height.
- Rock cuts traversing slopes greater than 50^{o}.
- Soil cuts traversing slopes greater than 34^{o}.
- Fill slopes greater than 20 m height.

The design and planning of these cut and fill slopes is required to ensure slope stability is maintained during and after construction in the most economical manner while minimizing impact to the environment.

Also, for planning purposes it should be assumed that all rock cut faces will be scaled concurrently with construction, and a qualified registered professional engineer or geoscientist will inspect the scaling and make a determination during construction as to whether additional slope stabilization measures are required.

Finally, despite the development of a sound road design and the addition of geotechnical prescriptions for minimizing slope instability and soil erosion, the best designs will not be effective unless the design concepts and prescriptions are effectively communicated to, and implemented by machinery operators and blasting contractors. BGC recommends full-time supervision of machine operators and blasting contractors by personnel who understand road design principals in order to maximize the benefits of this road design and set of prescriptions.

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LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Seabridge Gold Inc. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

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1.0 INTRODUCTION

Seabridge Gold Inc. (Seabridge) retained BGC Engineering Inc. (BGC) to complete a terrain stability field assessment (TSFA) for the proposed Treaty Creek, North Treaty Lower, North Treaty Upper, Cut-off Ditch, Tunnel Adit and Tunnel Adit Spur access roads of the proposed Kerr-Sulphurets-Mitchell (KSM) project in northwest B.C. (Table 1; Figure 1). McElhanney Consulting Services Ltd. (McElhanney) designed the proposed roads and the TSFA was completed for select sections of the proposed roads to help refine the road design and minimize construction triggered slope instability and watercourse sedimentation. The Ministry of Forests (MoF) provides the construction and operation authority for the proposed access roads and this assessment and recommendations are intended to support Seabridge's permit application.

BGC's initial terms of reference are based on a work task summary submitted to Seabridge December 20, 2011, and approved December 21, 2011. Recommendations for log landing sites, borrow areas and waste areas along several sections of the proposed roads are provided under separate cover. The Terrain Stability Field Assessment for the Coulter Creek, Teigen Creek and Tunnel Spur access roads is included in BGC (2010). Snow avalanche consultants Alpine Solutions Avalanche Services identified areas along the road alignments subject to snow avalanches (BGC 2012). Geotechnical review may be required if snow avalanche mitigation is necessary.

This report presents the recommendations from office and field based assessments. This Section is an introduction to the project and background work. Section 2.0 describes the project scope and methodology. Section 3.0 summarizes the results of the TSFA. Geotechnical prescriptions are tabulated in Appendix A, Appendix B contains photos of select road sections, and Appendix C includes maps of the reviewed road sections.

Table 1. Summary of Proposed Access Roads for the KSM Project

Access Road	Length (km)	Purpose	Color (Fig. 1)
Treaty Creek	33.0	Access to the plant site and east portal of the Mitchell-Teigen Twin Tunnel (MTT)	Orange
North Treaty Lower	11.7	Access to the Tailings Management Facility (TMF) for the first 25 years of mine life	Yellow
North Treaty Upper	8.0	Access to TMF after the first 25 years of mine life	Green
Cut-off Ditch	3.8	Maintenance access and construction of cut-off drainage ditch at the TMF	Light Blue
Tunnel Adit	2.9	Access to saddle area for tunnel construction	Dark Blue
Tunnel Adit Spur	0.7	Access to saddle area for tunnel construction	Purple

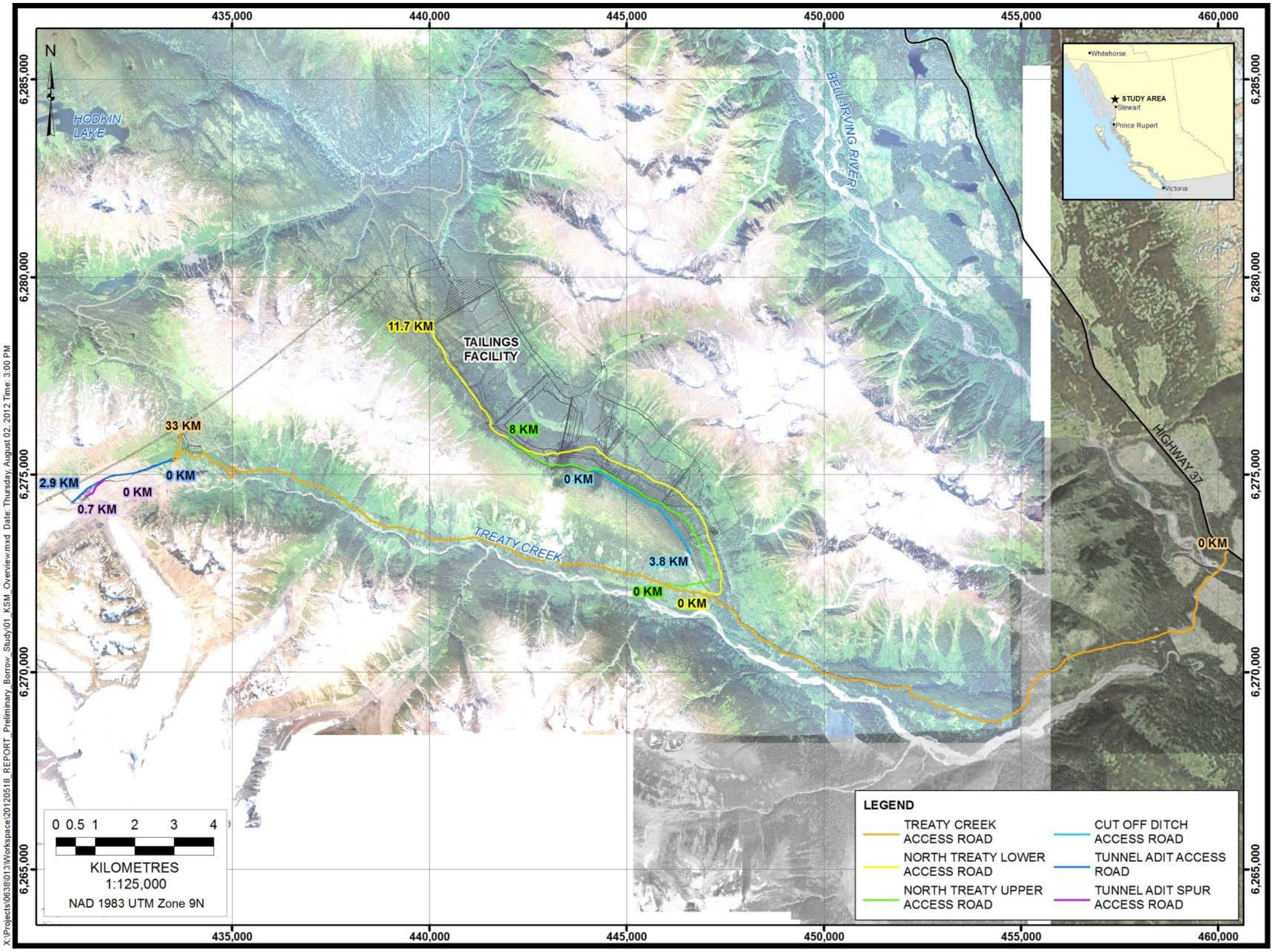

Figure 1. KSM Project Location Map

1.1. Study Area

The proposed 33 km long Treaty Creek access road begins at Highway 37 (Cassiar Highway) approximately 19 km south of Bell II (Figure 1). From Highway 37, the proposed Treaty Creek access road traverses the north side of Treaty Creek to the Treaty saddle. From Km 32 of the Treaty Creek access road the proposed 3 km long Tunnel Adit and 0.7 km long Tunnel Adit Spur access roads head west on the north side of the valley to the MTT tunnel saddle construction access portal near the toe of the current Treaty glacier.

At approximately 17 km and 18 km two proposed roads enter the North Treaty tributary to access the TMF and east portal of the MTT tunnel. The 12 km long North Treaty Lower road turns north from approximately Km 17 on the Treaty Creek access road and heads eastward for approximately 1 km before switching back to the proposed plant site and TMF area. The 8 km long North Treaty Upper access road (pink line) leaves Treaty Creek access road at approximately Km 18 adjacent to the lower alignment. From Km 8 to the TMF, the same road alignment for the North Treaty Upper and North Treaty Lower access roads is proposed. At Km 5.8 of the North Treaty Upper access road, a 4 km Cut-off Ditch access road (blue line) heads southeast along the upper portion of the valley.

1.1.1. Climate and Weather

Climate within the study area is a temperate or northern coastal rainforest, with subarctic conditions at high elevations. The major climatic processes during the fall and winter months include storm fronts arriving from the Pacific Ocean, resulting in precipitation as moist air masses are forced upwards over the Coast Mountains. Most of the precipitation from October through May falls as snow. A more detailed summary of climate at KSM is provided by Rescan (2009).

1.1.2. Bedrock Geology and Physiography

The study area lies within the Stikinia Terrane (southwest) and the Bowser Group (northeast). The Stikinia is one of many fault-bounded blocks of Triassic and Jurassic volcanic arcs that were accreted onto the Paleozoic basement of the North American continental margin in the Middle Jurassic and now form part of the Canadian Cordillera (Monger and Price 2002). The Bowser Basin formed in the Late Jurassic and mid-Cretaceous and filled with thick accumulations (approximately 5 km) of clastic sedimentary rocks of the Bowser Lake Group (Evenchick and Thorkelson 2005).

Within the study area the country rock is composed mainly of folded and faulted sediments (e.g. sandstones, siltstones), volcaniclastics (e.g. tuffs, pyroclastic breccias), and volcanics (e.g. basalts, andesite flows). Major geological structures and fabrics of the study area include north-south striking steeply dipping faults, gently dipping thrust faults, and east-west striking, moderate to steeply dipping foliation/schistosity. Alteration and mineralization of these country rocks has occurred following intrusions of Jurassic monzonite, granite, and diorite porphyritic rocks.

1.1.3. Surficial Geology

The valleys in the project area are typical of glaciated valleys of the B.C. Cordillera, where gentle upper slopes drop into steeper valley walls that grade into broad and gently sloping valley floors. The principal valleys contain floodplain deposits of stratified, well-sorted fluvial gravels alternating with overbank silty deposits. In steeper valleys (e.g. Mitchell and Sulphurets valleys), these deposits form mostly narrow fringes along the active channel, with more extensive deposits bounding the larger channels in Treaty Creek and Unuk River. Thicker fluvial and colluvial deposits have also formed fans at the outlet of tributary creeks where they meet the main valley channel. Lower slopes above valley bottoms are mostly overlain by glacial till, with thin colluvium and bedrock exposed on steeper slopes. The till consists of poorly sorted, usually matrix-supported subangular or subrounded clasts in a silty-sand matrix. On steeper slopes and above treeline, most slopes are underlain by colluvium discontinuously overlying bedrock, with thicker colluvial deposits at the base of bedrock gullies.

1.1.3.1. Treaty Creek Access Road

From Highway 37, the proposed two-lane Treaty Creek access road heads south crossing the Bell-Irving River and gently sloping terrain to Treaty valley. From Km 18 to Km 33, the proposed access road changes to a single-lane, radio-controlled road intended to provide access to the west portal of the MTT. The road is intended for use during construction and will be maintained for service access once construction is complete. Through Treaty valley the road traverses moderate to steep terrain along the north side of the valley.

1.1.3.2. North Treaty Roads

A group of roads are proposed on the west side of North Treaty Tributary/Teigen Creek valley for TMF construction and operation. These roads include the North Treaty Lower and Upper access roads[1] which provide access to the north tailings dam, and the Cut-off Ditch access road which provides access for drainage ditch construction.

Both the Lower and Upper roads ascend the lower slopes on the west side of North Treaty Tributary/Teigen Creek valley up to a rock plateau where the proposed TMF is located. The Lower road has the benefit of reduced road grades and will be used during the first 25 years of mine operation while tailings are directed to the north cell of the TMF. After 25 years of operation, we understand that tailings will be directed to the south cell of the TMF, and that access to the south cell will be provided by the Upper road.

[1] Referred to as the Initial Phase Plant site access road and Ultimate Phase plant site access road, respectively, in BGC 2012.

The proposed Cut-off Ditch access road is intended for maintenance access and construction of the proposed uphill cut-off drainage ditch. This road leaves the North Treaty Upper access road at Km 6 traveling southeast along the upper slope of the west side of North Treaty Tributary/Teigen Creek valley.

1.1.3.3. Tunnel Adit and Tunnel Adit Spur Access Roads

The Tunnel Adit and Tunnel Adit Spur access roads are intended to provide access to the saddle laydown area for tunnel construction. The proposed roads are temporary and exit the Treaty Creek access road at Km 32.25 and head westward along steep rock slopes at an approximate elevation of 1,000 m on the north valley side to the current toe of Treaty Glacier.

1.2. Previous Studies – Terrain Stability Mapping

Terrain, terrain stability and erosion potential mapping along the road corridor was carried out at a detailed level (TSIL C) by BGC along the proposed road corridor using B.C. Provincial Terrain Stability Mapping standards (RIC 1996, Howes and Kenk 1997, and MoF 1999) and 1:15,000 scale aerial photographs. A report and accompanying 1:20,000 scale terrain and interpretive maps were originally produced in 2010 and have since been updated to include the most recent General Arrangement in BGC (2012). These reports and maps included the following information for each polygon:

- Surficial materials and their textures;
- Surface expression (slope shape);
- Geomorphological processes;
- Slope gradient;
- Slope drainage;
- Rating of the likelihood of landslides following road construction (terrain stability classification I to V); and,
- Rating of the potential for surface erosion to transport sediment to valley bottom streams (potential sediment delivery).

Debris flows, debris floods, debris slides, rock falls, and rock slides impacting the proposed road corridors were identified and mapped to assist with route selection and follow-up studies.

The correlation between slope class (1 to 5), surficial material type, and terrain stability class (I-V) used in this work is presented in Table 2. A description of the terrain stability classes and their susceptibility to slope instability is presented in Table 3. The correlation between surface erosion potential, slope class (1 to 5), and proximity to an active watercourse is presented in Table 4.

Table 2. Slope Class and Terrain Stability Class Correlation (BGC 2012)

<table>
<tr><th rowspan="3">Terrain Stability Class</th><th colspan="6">Slope Class</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th colspan="2">4</th><th>5</th></tr>
<tr><th>0-5%
(0-3°)</th><th>6-27%
(3-15°)</th><th>28-49%
(15-26°)</th><th>50-60%
(26-30°)</th><th>61-70%
(31-35°)</th><th>>70%
(>35°)</th></tr>
<tr><td>I</td><td>Mv, Mb; F^{G}p, F^{G}u; Fp; L^{G}p, L^{G}u; Rp, Ru</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">II</td><td></td><td>Rj, Ru</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Mv, Mb; F^{G}f,
F^{G}u, F^{G}j; Ff, Fj;
Cf; Dv; L^{G}j, L^{G}u</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">III</td><td></td><td colspan="3">Ruh, Rum, Rur with Mw, Cv, Ra</td><td></td><td></td></tr>
<tr><td></td><td colspan="3">L^{G}a</td><td></td><td></td></tr>
<tr><td></td><td colspan="4">Mv, Mb; F^{G}ak, F^{G}a; Cv, Cb</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="2">aCk;Rk</td><td></td></tr>
<tr><td></td><td colspan="4">L^{G}a</td><td></td></tr>
<tr><td rowspan="3">IV</td><td></td><td></td><td></td><td colspan="3">L^{G}k, L^{G}s</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Mb-V; Cb-V; (-V refers to dissected slopes)</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Mv, Mb; F^{G}k, F^{G}s; Cv;
Cb, L^{G}k, Uks, Us</td></tr>
<tr><td rowspan="2">V</td><td></td><td></td><td></td><td></td><td colspan="2">Mks-V; FGks-V; Cvb-V;
L^{G}ks-V, L^{G}s-V, Uks-V</td></tr>
<tr><td colspan="6">all materials and landforms that are unstable (i.e. include the initiation zone of mass movements:
-F", -R"s, and/or –R"b*)</td></tr>
</table>

Note:

1. A legend for the individual symbols in Table 2 can be found in Appendix C.

Table 3. Terrain Stability Classification (BGC 2012)

Terrain Stability Class	Interpretation
I	No significant stability problems appear to 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.

Map users should be aware that the minimum size of terrain polygons in the TSIL study area is about 2 hectares (ha). Thus local variations in terrain conditions over areas of 2-3 ha, or over distances of less than about 150 m, were not identified or mapped separately. As a result, there may be variation in slope steepness, material characteristics and soil moisture within individual polygons. This implies that more detailed planning of road alignments will require careful ground checking in order to identify sites that may be more sensitive to disturbance than the average conditions mapped for an individual polygon. This local variability is one of the main reasons that site-specific TSFA work is conducted.

1.2.1. Potential Sediment Delivery

Estimates of potential sediment delivery to streams were made for polygons that were assigned high or very high surface erosion potential. Interpretations for potential sediment delivery to streams range from “very low” (vl) to “very high” (vh). It is the likelihood that sediment will be transported to a permanent stream, should soil erosion occur in a terrain polygon. This term is synonymous with the terms “sediment transfer” or “risk of sediment delivery” in some Ministry of Forests guidebooks (e.g. MoF 1999). The criteria used for assessment of potential sediment delivery are shown in Table 4 and involve three factors:

1. Polygon steepness. The potential sediment delivery interpretation is higher for steeper slopes, because steeper slopes have a relatively higher ability to transport sediment.
2. Period of flow of the nearest stream. The likelihood that sediment will be transported to a main creek depends on whether the stream flows for the entire year, or only during periods of snowmelt and storms. Potential sediment delivery ratings are higher for polygons near permanent streams. For interpretation purposes, streams are classified as “major” or “minor”. Minor streams are ephemeral streams that may

not contain water in the drier summer months, and flow in direct response to local precipitation and snowmelt. Major streams are defined as follows:

- All streams with permanent flow that are clearly visible on an air photograph and have a substantial catchment basin that likely have continuous flow.
- Lakes, ponds, and standing water.

3. Proximity and “connection” of the polygon to the nearest stream. Polygons near streams are generally given higher sediment delivery ratings, unless terrain exists between the polygon and the stream where sediment may deposit. The latter is referred to as the “connection” of the polygon to the nearest stream.

Table 4. Guidelines for Assessing Potential Sediment Delivery (MoF 1999)

Class	No stream channel in or adjacent to polygon	Minor stream channel in or adjacent to polygon	Major stream channel in or adjacent to polygon
Very Low (**vl**)	gentle to steep slope		
Low (**l**)		gentle slope	
Moderate (**m**)		moderate slope	gentle slope
High (**h**)		steep slope	moderate slope
Very High (**vh**)			steep slope

1.3. Terrain Stability Field Assessments

A TSFA is an on-site assessment of the potential impact of timber harvesting, road construction, or the construction of excavated or bladed trails on terrain stability (MoF 1999). TSFA’s are carried out by terrain stability specialists who are qualified registered professionals (QRPs). TSFA’s are triggered by Terrain Stability Mapping (TSM), and are required where the construction activities are planned for slopes mapped as moderate to high likelihood of landslide initiation following road construction (Class IV or V). TSFA’s focus on areas where slopes will be modified by road construction and require relatively more intense examination of the ground conditions. The proposed road design drawings should be reviewed in the field during the TSFA’s. A proposed road design in Class IV or V terrain, must address, among other requirements, measures to maintain slope stability within the road prism.

For example, given the clearing and road construction, an area mapped at TSIL C as Class IV (Moderate likelihood of landslide initiation) may be judged after a TSFA to have a low likelihood of instability. This is because although terrain characteristics meet the criteria for Class IV, carefully located roads on small areas of gentler terrain were recommended to create a low likelihood of post-construction instability. This does not mean the detailed TSM was incorrect but rather more detailed information helped refine the initial assessment. Similarly, a change in the road design during construction could increase or decrease the likelihood of instability as initially judged in a TSFA. For example, a proposed road alignment across an area mapped as Class IV (Moderate likelihood) could be judged to have a “moderate likelihood of instability" with regard to a conventional cut and fill road construction technique, or a low likelihood of instability following incorporation of site-specific engineering prescriptions (adapted from Ryder 2002).

Examples of prescriptions include (adapted from MoF 1999):

- road relocation, or a decision not to build;
- cut and fill slope angles for short and long term stability (i.e. for both worker’s and road users safety);
- location and design of spoil or waste areas and end haul areas;
- drainage control or installation of subsurface drainage;
- methods to cross gullies and fish streams;
- road modification, maintenance, and deactivation strategies;
- road sections that will require field review and/or supervision by a QRP during construction; and,
- road construction techniques such as:
    - for single season use of the road, 1/2 bench construction with no end haul, followed by full pullback of road fill after harvesting;
    - over steepened fills for single-season use of the road;
    - use of wood for fill support for short-term roads;
    - over steepened cuts with modified drainage control to manage minor sloughing;
    - 3/4 bench construction with end haul and replacement of finer material with coarse rock fill;
    - full bench construction with 100% end haul and water management following harvesting;
    - designed retaining wall structures to support cut or fill slopes; and,
    - designed fills that incorporate special requirements for compaction of the fill or reinforcement of the fill with geosynthetics.

2.0 PROJECT SCOPE AND METHODOLOGY

2.1. Project Scope

This report is limited to the proposed access roads listed in Table 1. Chainages for the Treaty Creek, North Treaty Lower, North Treaty Upper, Tunnel Adit and Tunnel Adit Spur access roads refer to the May 17, 2012 design (McElhanney 2012a). Chainages for the North Treaty Cut off Ditch refer to an updated (road length reduced by 0.3 km) design received July 6, 2012 (McElhanney 2012b).

2.2. Methodology

The proposed methodology is outlined below and is in general conformance with:

- Requirements detailed in the B.C. Government's Forest Practices Code Mapping and Terrain Stability Guidebook (MoF 1999) and Forest Road Engineering Guidebook (MoF 2002);
- APEGBC Guidelines for Professional Services in the Forest Sector - Terrain Stability Assessments (APEGBC 2010);
- Worksafe BC regulations for road cutslope stability; and,
- Generally accepted geotechnical practices in the B.C. forest industry.

The methodology for determining which road sections require ground-based TSFA is shown in Figure 2. This methodology involved an office and helicopter assessment to help identify which road sections required a ground assessment. The methodology for these two tasks is described below.

2.2.1. Office Assessments

Office study consisted of a three-step process to refine a list of road sections and cross sections requiring TSFA:

1. Review of high resolution orthophotographs in Google Earth, and terrain stability maps (BGC 2012).
2. Assess risk to downslope fisheries resources.
3. Review plan and profile drawings (McElhanney 2012c).
4. Identify road cross sections with anomalous cut and fill heights from McElhanney (2012d).

The first step consisted of careful review of Google Earth imagery and terrain stability maps (BGC 2012). The purpose of this review was to gain insight into the accuracy and limitations of the mapping such as understanding the terrain variability and texture of the soils within the Class IV and V polygons.

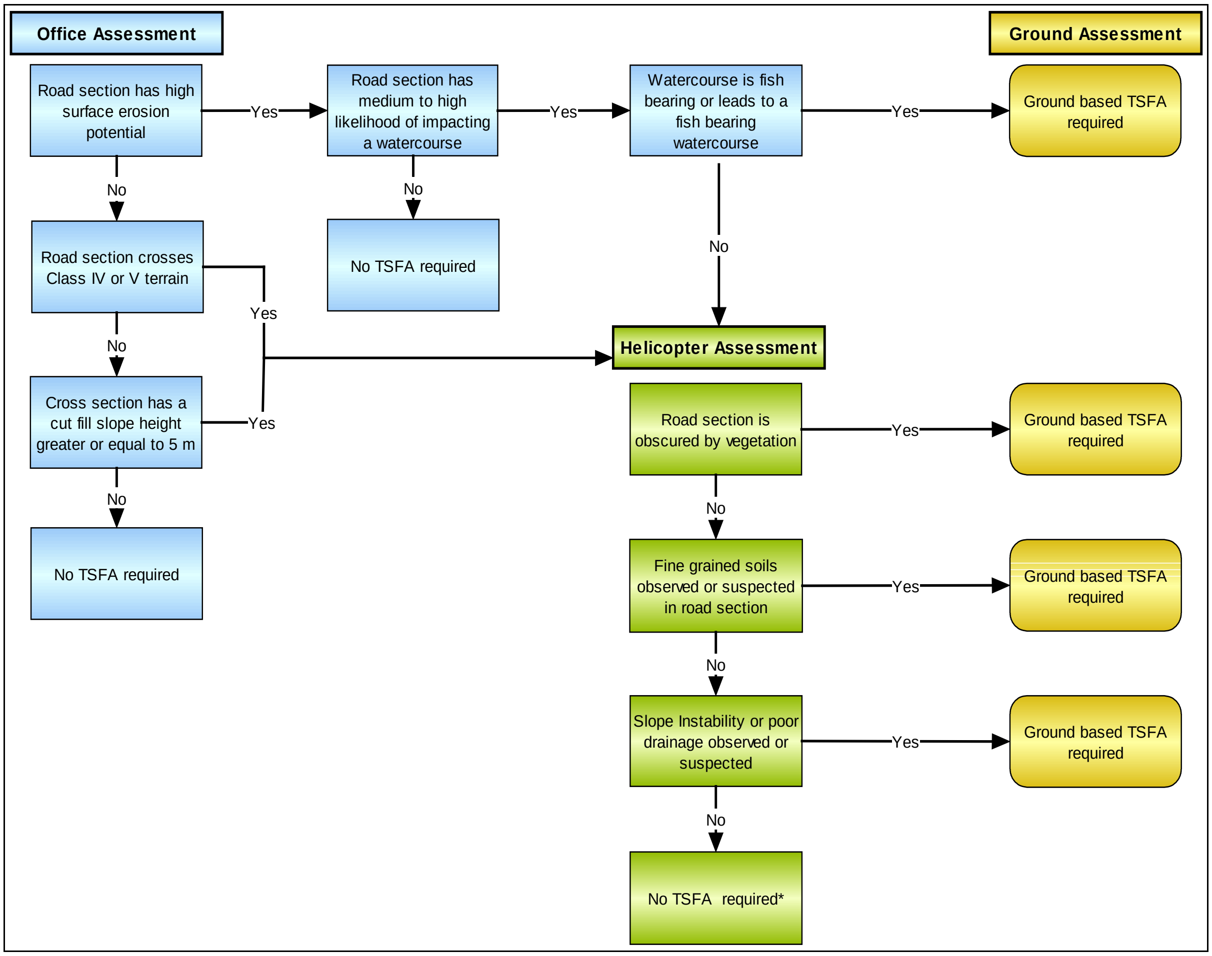

Figure 2. Flow Chart Describing Logic for Selecting Road Sections for Ground Based TSFA

Secondly, surface erosion potential of polygons was reviewed in Google Earth and TRIM topographic data was used to subjectively estimate the potential landslide runout and the risk to downslope streams, rivers, small lakes and swampy areas.

Finally, every proposed road section provided by McElhanney (2012d), regardless of Terrain Stability Class, was reviewed in the office. Cross sections were flagged for TSFA if the cross section called for a cut or fill slope height in soil ≥ 5 m.

Figure 3 and Figure 4 are examples of typical road sections flagged, and not flagged for TSFA, respectively. The road section in Figure 3 (Treaty Creek Km 26+400) is a 15.3 m cut and 11.5 m fill on a moderate to steep slope. Figure 4 (Treaty Creek Km 3+600) is a less than 5 m fill section on a flat slope.

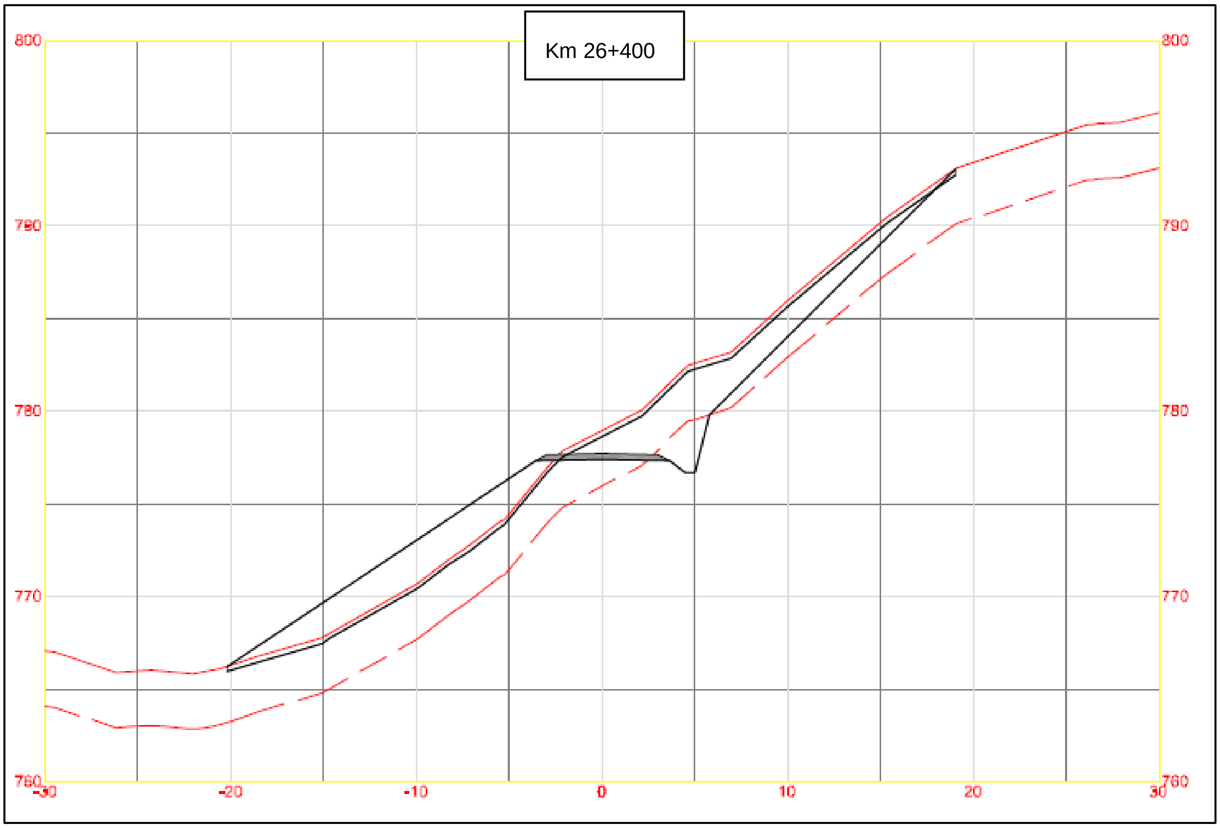

Figure 3. Example of Proposed Road Section that was Flagged for Field Review

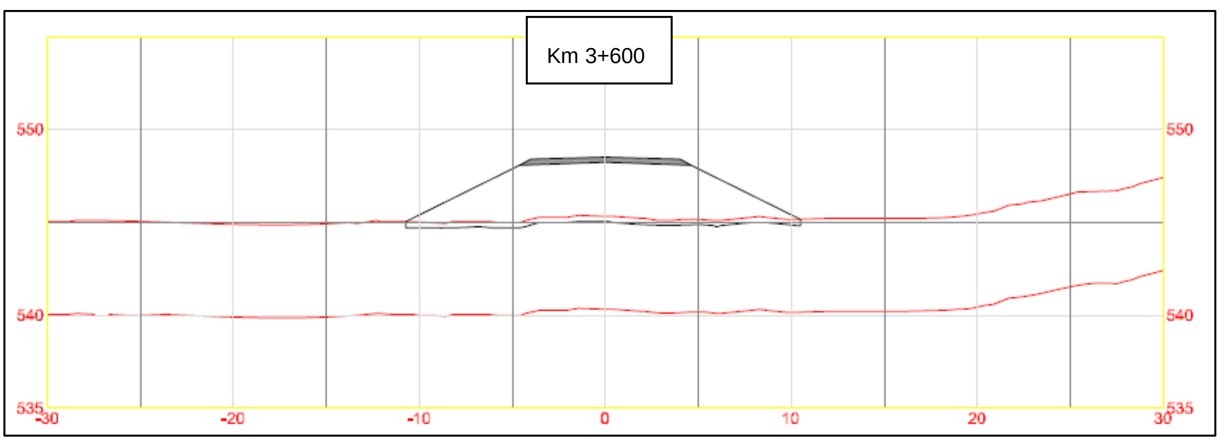

Figure 4. Example of Proposed Road Section that was not Flagged for Field Review

2.2.2. Helicopter Assessments

Helicopter and ground-based field assessments were carried out by Ms. Sarah Kimball, E.I.T., G.I.T. and Mr. Philip LeSueur, E.I.T. of BGC between June 26th and July 1st, 2012. Mr. Sam Fougere, P.Geo., of BGC participated in the assessments between June 30th and July 1st, 2012. No snow was on the ground along the proposed Treaty Creek access roads during the field assessments. There was approximately 1 m to 2 m of patchy snow cover on upper road sections of the North Treaty group of roads. Large (>10 m), isolated lenses of colluvium-covered snow and ice were present at the end of the proposed tunnel adit road (approximately Km 2.4 to Km 2.9) and at the tunnel adit spur road.

To start, all road sections and cross sections identified in the office assessment were reviewed during a “low and slow” helicopter reconnaissance to help confirm soil type, drainage, and potential to impact downstream watercourses. Road sections and cross sections;

- crossing soil,
- crossing poorly drained areas,
- containing evidence of slope instability,
- with potential to impact a downslope watercourse, and/or
- obscured by vegetation,

were selected for ground-based TSFA. The road sections observed crossing blocky talus or bedrock were assigned a lower priority for ground-based TSFA because blocky talus was not, in relative terms, expected to be a significant terrain stability issue. Additionally, rock cuts are common throughout this road alignment and remedial methods such as scaling and rock bolting will be implemented during construction as directed by an onsite QRP.

2.2.3. Ground Assessments

Ground assessments required helicopter set-outs and walking the P-line (preliminary centerline) along the identified road sections. Several road sections were not accessible on the ground due to unsafe helicopter landing areas, difficult access to the road section, thick brush, or required long (>2 km) foot traverses to reach the road section. However, the following was noted during the ground assessments to help assess the current stability of the slope and assess how the slope will perform during and after road construction:

- P-line chainage on the field flagging and GPS location.
- Slope gradients and shape.
- Soil drainage, texture, and thickness.
- Presence/absence of rock.
- Vegetation type and condition (deformation, tilting, etc.).
- Presence/absence of favourable terrain for road re-alignment, road fill support, or water discharge.
- Geomorphology down slope of the road cut to help assess the likelihood of eroded soil reaching a watercourse.
- Road sections that will require more detailed investigations and/or supervision by a QRP during construction.

Information on the subsurface soil, groundwater and bedrock conditions were gathered from gully side walls, bedrock outcrops and root balls of fallen trees. No subsurface information from mechanical test pits or drill holes was obtained.

Stability of cut and fill soil slopes in steep terrain is closely linked to the depth of soils over bedrock and gradation of the soil. TSFA work is based on the surface assessment of materials and natural exposures, so this assessment is subject to change as bedrock and soil is exposed and re-assessed during construction supervision by a QRP.

3.0 RESULTS

Prescriptions for the Treaty Creek, North Treaty Upper, North Treaty Lower, Tunnel Adit and Tunnel Adit Spur access roads are summarized relative to the May 17, 2012 (McElhanney 2012a) P-Line chainage in Appendix A. Prescriptions for the Cut-off Ditch access road are summarized relative to the July 6, 2012 (McElhanney 2012b) P-Line chainage, and can also be found in Appendix A.

Table 5 summarizes the types of prescriptions proposed for this road alignment. Photographs of select road sections are provided in Appendix B. For further reference, maps showing the terrain stability polygons, soil type, surface erosion potential, and GPS waypoints of BGC's ground traverse and the proposed road alignments are provided in Appendix C. These prescriptions assume that the preliminary cut and fill slope design angles listed in Table 6 were used in the road design (McElhanney 2012a and 2012b).

Table 5. Summary of Geotechnical Prescriptions Proposed in this Report

Stream Crossings	
A	Cross watercourse with a bridge (or other method) as recommended by a qualified Bridge Engineer. Culverts sized by McElhanney for minor streams and consider french drains for seepage in soil fill slopes as directed by a QRP during construction.
Rock Fall Potential	
B	Consider an oversized ditch in rock fall hazard zones as directed by a QRP ahead of construction. Also consider scaling and spot bolting as directed by an onsite QRP during construction.
Avoid Large Fill Slopes	
C	Consider adjusting the road alignment to eliminate large fill sections by constructing full-bench cut slopes and end-haul all construction material, or consider adjusting the road alignment to avoid long thin fill sections (i.e. sliver fills). Also, consider adjustment of the road centerline up to 5 m into the slope to reduce fill heights (i.e. large fill only sections at Km 17+720 to Km 17+800 on Treaty Creek Access Road).
Snow/Ice Removal	
D	Confirm depth of snow/ice cover for period when construction is proposed. Remove snow/ice before fill placement in accordance with applicable environmental guidelines.
Debris Flows and Channel Avulsion	
E	Consider site specific geotechnical review of debris flow crossing structures and surface soil erosion control techniques and sediment control techniques in advance of construction.
> 10 m High Soil or Bedrock Cut	
F	Consider site specific geotechnical review of >10 m high soil and rock cuts by a QRP in advance of construction. Confirm cut slope angle, surface water management design plans and refine rock fall protection and slope stabilization following tree felling and site clearing.
> 10 m High Fills or GRS Walls	
G	Consider site specific geotechnical review of fill footprint foundations conditions, fill slope angles, or proposed Geosynthetic Reinforced Soil (GRS) wall foundation conditions and design by a QRP in advance of construction.
Potential Sediment Delivery	
H	Site specific surface water management plans recommended for road construction adjacent to any major streams.
Geotechnical Review Ahead of Road Construction	
I	Consider site specific geotechnical field review ahead of road construction at this location.
No Prescription Required	
J	No prescription required at this time.

Table 6. Preliminary Road Cut and Fill Slope Design Angles by McElhanney

	Slope H:V	Slope Angle
Soil Cuts	1.5H:1V	34°
Combination Soil and Bedrock Cuts, Talus	1.5H:1V	34°
Bedrock Cuts (Solid Rock)	0.25H:1V	76°
Bedrock Cuts (Rippable Rock)	0.5H:1V	63°
Angle of Repose for Rock and Soil Fill Slopes	1.4H:1V	36°
Combination Soil and Bedrock (Rippable) Fills, Talus	2H:1V	27°
Granular Fill	1.5H:1V	34°
Dumped Angular Rock Fill	1.25H:1V	39°
Placed Angular Rock Fill	1H:1V	45°

3.1. Road Sections Requiring Detailed Design in Advance of Construction

In addition to these prescriptions, BGC recommends that road sections meeting the following screening criteria undergo detailed design and construction planning well before (several months) any construction commences:

- Rock cuts greater than 20 m height.
- Rock cuts traversing slopes greater than 50°.
- Soil cuts traversing slopes greater than 34°.
- Fill slopes greater than 20 m height.

The design and planning is required to ensure slope stability is maintained during and after construction in the most economical manner with the least environmental impact.

3.2. Rock Slope Stabilization

Stability of rock slopes is largely dependent on the number, frequency, orientation and conditions of discontinuities (joints, faults) in the rock mass. For cuts greater than 10 m in height, or where adverse geologic structure is suspected, we recommend that rock cut slope design and support provisions be refined by a QRP in advance of the road heading. The primary purpose of this work is to minimize the potential for cut slope failures that could disrupt the road construction schedule. In addition, BGC recommends that geotechnical review and detailed engineering design of rock cuts greater than 20 m high and soil or rock cuts traversing slopes greater than 50° be conducted well before (several months) any road construction commences.

The proposed road alignment crosses a significant length of rock cut slopes greater than 5 m high. Not all of these slopes could be reviewed in the field during the TSFA mainly due to the challenging access conditions. BGC's review of the road design cross-sections indicates that, in most cases, rock slopes with potential rock fall sources will be excavated during road construction and the potential problems may be removed. The face of the cuts should be scaled concurrently with construction, and a QRP should inspect the scaling and make a determination during construction as to whether additional slope stabilization measures are required. These stabilization measures primarily consist of spot bolting of potential planar or wedge failure blocks with 25 mm diameter, tensioned, resin grouted, galvanized rock bolts in various lengths, up to a maximum of 6 m. Additional slope stabilization measures may include localized trim drilling and blasting.

Measures to protect the road or vehicles may include wider/deeper ditches, engineered walls, and mesh/nets draped over the rock face. Controlled blasting techniques may be required during rock excavation of the final cut slope face to avoid excessive disturbance in areas where potential planar and wedge failures have been identified.

3.3. Road Construction Supervision

Despite the development of a sound road design and the implementation of geotechnical prescriptions for minimizing slope instability and soil erosion, the best designs will not be effective unless the design concepts and prescriptions are effectively communicated to, and understood by, machinery operators and blasting contractors. BGC recommends that full-time supervision of machine operators and blasting contractors by personnel who understand road design principals in order to maximize the benefits of this road design and set of prescriptions.

Again, BGC recommends that regular geotechnical review of rock cuts greater than 10 m high be conducted in advance of road construction to confirm cut slope design and stabilization recommendations. BGC also recommends geotechnical review and design of rock cuts greater than 20 m high and soil or rock cuts traversing slopes greater than 50° be conducted well before (several months) any road construction commences.

This report is limited to cut and fill slope stability and soil erosion susceptibility considerations for the proposed access roads. It is a premise of this report that best practices for road construction, road surface water runoff control, and natural surface water cross drainage provisions will be adopted, and that these requirements are being designed by others. In particular, it is assumed that natural surface water cross drainage will be designed, constructed, and maintained as appropriate to limit erosion, and that road cross slope and ditch gradients will be designed, constructed, and maintained to limit and control road runoff and potential road and ditch erosion, preventing road runoff into fill slopes. It is a premise of this assessment that a QRP will oversee and be responsible for the as-constructed road designs.

4.0 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.
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APPENDIX A
TABULATED RESULTS OF THE TERRAIN STABILITY FIELD ASSESSMENTS

KSM Project - Treaty Creek Access Road (May 17, 2012 alignment - McElhanney, 2012a)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (°)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
5.29	5.62	0.33			Helicopter	1113	Cv.Rsk	Rock and Colluvium	IV	M				w					J	
7.99	8.15	0.16	122-123	P6290137-P6290138	Ground	1132	Cv/Rsk	Rock and Colluvium	IV	M	LP	LS	Very Low	w			22/22	Colluvium/Rock	J	
8.40	8.48	0.08			Helicopter	1132	Cv/Rsk	Rock and Colluvium	IV	M				w					J	
8.63	10.02	1.39			Helicopter	1132	Cv/Rsk	Rock and Colluvium	IV	M				w					F	Geotechnical review of >10 m high cuts from Km 9+160 to 9+200 and Km 9+340 to 9+840.
13.40	13.74	0.34	20-21,142-144	-	Ground	1121	Cv/Rks	Rock and Colluvium	IV	M	LP	LS	Very Low	w-r			32/30	Colluvium	J	
16.06	16.10	0.04			Helicopter	401	Cv//Rs-V	Colluvium and Rock	IV	H				w					F, H	Geotechnical review of >10m high cuts between Km 16+080 and Km 16+100 (full bench cuts proposed in design).
17.36	17.43	0.07	48	P6260092-P6260093	Ground	1068	Cv/Rks	Rock and Colluvium	IV	M	MP	LS	Low	w			34/33	Colluvium	F	Geotechnical review of >10m high cut Km 17+400 to Km 17+420.
18.32	18.68	0.36	53-56	P6260098	Ground	1067	Cv/Rsk	Rock and Colluvium	IV	M	MP	LS	Low	w			25/25	Colluvium/Swampy	F, G	Geotechnical review of >10m high cuts at Km 18+320, Km 18+500 to Km 18+660 and >10m fill at Km 18+320.
25.42	26.59	1.17	2-4, 7-15	P6270007-P6270017, 005	Ground	1059	Cv.Rsk	Rock and Colluvium	IV	M	MP	LS	Low	w-r			34/35	Colluvium/Rock	B, F, G	BGC (2012b) identified rockfall hazard below a bench from Km 25.8 to 26.3, field review: approximately 150 to 200 m up slope from road alignment. Base of talus slope at GPS ID 015: up slope angle= 26o, down slope ange = 23o. Likely shallower depth to bedrock (est.<2-3m based on bedrock 8 m u/s of alignment between 26.32-26.38), adjust cut on section? Very steep at Km 26+190: GRS wall (see section Km 26+200). Bedrock face at Km 26+200 (not >10m but still might need QRP to review?). Geotechnical review of >10m high cut at Km 25+540 to 25+700, Km 25+940 to 26+040,Km 26+340 to 26+460 and >10m fill at Km 26+400 to 26+460.
Sites Below Not Assessed As Per TSFA Methodology - Some Sites Assessed To Confirm Ground Conditions																				
0.00	0.50	0.50				1074	Cf	Colluvial	I	L				m-i						
0.50	0.59	0.08				1076	FAp	Fluvial	I	L				i						
0.59	0.77	0.18				1086	Ft	Fluvial	I	L				w-m						
0.77	3.61	2.84				1091	Mbu	Till	I	L				m-w						
3.61	3.89	0.27				1088	Mb/Ov|Mb	Till and Organic	I	L				m-i						
3.89	5.29	1.41				1115	Ff-Ua	Fluvial	II	M				m-i	Ua	flooding			E	BGC (2012b) identified potential for debris floods crossing the road at Km 4+500 and channel avulsions along the debris-flow fan from Km 3+890 to 5+290. The design proposes two bridges at Km 4+650 (18 m long) and Km 700 (21 m long).
5.62	6.43	0.81				1122	Cb	Colluvium	III	L				m					F	Geotechnical review of >10 m high cut in soil at Km 5+760. Consider moving centerline 1 m out of slope.
6.43	7.53	1.09				1127	Cb	Colluvium	I	L				m-i						
7.53	7.65	0.12				1128	Ov|Fp	Organic	I	L				i						
7.65	7.70	0.05				1131	Mw	Till	III	M										
7.70	7.78	0.08				1128	Ov|Fp	Organic	I	L				i						
7.78	7.83	0.06	121	P6290136	Ground	1131	Mw	Till	III	M	LP	MS	Low					Colluvium		
7.83	7.99	0.15	122	-	Ground	1128	Ov|Fp	Organic	I	L	LP	LS	Very Low	i			35/-	Colluvium/Rock		
8.15	8.40	0.25	123-125	-	Ground	1128	Ov|Fp	Organic	I	L	LP	LS	Very Low	i				Colluvium/Rock		
8.48	8.63	0.15				1128	Ov|Fp	Organic	I	L				i						
10.02	10.59	0.57				1125	Mv.Cvb	Colluvium and Till	III	M				w-m					F	Geotechnical review of >10m high cut in soil at Km 10+280. Consider moving centerline out of slope ~5 m.
10.59	10.80	0.21				1129	Mw|Ru	Till	III	L				m						
10.80	13.40	2.60				1125	Mv.Cvb	Colluvium and Till	III	M				w-m					F	Geotechnical review of >10 m high cuts at Km 10+900 to Km 10+960.
13.74	14.03	0.29				416	Cv	Colluvium	III	M				w					F, G	Geotechnical review of >10m high fills from 13+740 to 13+820 and >10m high cut at Km 13+960.
14.03	14.29	0.26	141, 22	-	Ground	421	Cf-Ua	Colluvial	II	M	MP	MS	Moderate	m	Ua	flooding	12/17	Colluvium	E, F, G	BGC (2012b) identified fan at Km 14+300 subject to debris flows and flooding between approximately Km 14+030 to Km 14+290. Debris flow fan apex ~100m upslope (21m bridge proposed in design).Geotechnical review of >10m fill at Km 14+260 and >10m cut at Km 14+280.
14.29	14.45	0.16				416	Cv	Colluvium	III	M				w					F	Geotechnical review of >10m cut at Km 14+300.
14.45	16.06	1.61				414	Cvb	Colluvium	III	M				w-m					F, G	Geotechnical review of >10m high cuts at Km 15+680 to Km 15+700, Km 16+000 to Km 16+020, and >10m fill at Km 15+820.
16.10	16.20	0.10				417	Cf-Ua	Colluvium	II	M				m	Ua	flooding			E	BGC (2012b) identified debris-flow fan between Km 16+100 to 16+200. Two (24 m long) bridges proposed in design. Consider armoring to protect the road section in between the proposed bridges.
16.20	16.38	0.19				409	Cv	Colluvium	II	M				w					G	Geotechnical review of >10m fill at Km 16+260.
16.38	17.36	0.98	32-47	P6260076-P6260091	Ground	407	Cvb	Colluvium	III	M	MP-HP	LS	Moderate	w			<15-33/<15-33	Colluvium/Rock	F, G	Slope angle increases (>20°) between from GPS ID 37 to 47 (Km 17). Geotechnical review of cuts >10m high at Km 16+680 to 16+760, Km 17+140 to 17+340. Geotechnical review of >10m fill at Km 16+800, Km 16+880, Km 17+060, Km 17+100, and Km 17+200.
17.43	18.32	0.89	49-52, 157, 32	P6260094-P6260097, P7010157-P7010158	Ground	407	Cvb	Colluvium	III	M	MP-HP	LS	Moderate	w			20/22	Colluvium/Swampy	C, F, G	Geotechnical review of >10m high cuts at Km 17+420 to Km 17+520, and >10m high fills at Km 17+700 to Km 17+980 and Km 18+260. Consider moving centerline 5 m into the slope to reduce fill heights at Km 17+720 to Km 17+800.
18.68	19.57	0.89	57	_	Ground	407	Cvb	Colluvium	III	M	MP-HP	LS	Moderate	w			20/20	Colluvium/Swampy	F, G	Geotechnical review of >10m high cuts at Km 18+740, Km 19+160, Km 19+200 to 19+240, Km 19+400 and >10 m fills at Km 18+800 to 18+820.
19.57	21.51	1.95				1066	Cbc	Colluvium	III	L				m					F, G	Geotechnical review of >10m high cuts at Km 19+600 to Km 19+640, Km 20+020 to 20+040, Km 20+960 and >10m fill at Km 20+980.
21.51	21.93	0.42				1073	Cb.Mb	Colluvium and Till	II	L				m						
21.93	23.94	2.00				1066	Cbc	Colluvium	III	L				m					F, G	Geotechnical review of >10m high cuts at Km 22+980 to Km 23+120, Km 23+480 to 23+500 and >10m fills at 23+180 to 23+200.
23.94	24.43	0.49				1134	Cvb	Colluvium	II	M				w-m					F	Geotechnical review of >10m high cuts at Km 24+000 to Km 24+180.
24.43	25.42	0.99	16-18	P6270022-P6270024	Ground	1060	Cc	Colluvium	III	M	MP	LS	Low	m			26/23	Colluvium	E, F, G	Historic debris flow channel at GPS ID 17 (crossing road) also identified BGC (2012b) identified historic debris flow channels at Km 25.3 (not mapped as crossing road). Design proposed 1800 mm culvert - consider adding and additional culvert and cross drain. Geotechnical review of >10m high cuts at Km 24+480 to 24+500, Km 24+760 to Km 24+860 and >10m fill at Km 25+280.
26.59	28.40	1.80	5-6	P6270001-P6270006	Ground	1041	Cc-Rd	Colluvium	III	M	MP	MS	Moderate	m	Rd	debris flow	15/14	Colluvium	E, G	Field traverse to Km 26+700 only, observed multiple abandoned channels 5-6 m wide and 3-4 m high, no visible bedrock. BGC (2012b) identified debris flow path at Km 26+800, and multiple debris flow channels (not crossing the proposed road alignment) between Km 27+500 and Km 28+500. Double culvert (2000 mm) is proposed in design at Km 26+675. Geotechnical review of >10m fill at Km 26+600 to Km 26+740.
28.40	29.23	0.83				1031	Cvb-Rd	Colluvium	III	M				m	Rd	debris flow			E	BGC (2012b) identified debris flow paths at Km 28+800. Design proposes 1000 mm culverts at Km 28+760 and Km 28+840.
29.23	30.59	1.36				273	Raks/Mw	Rock and Till	II	L				w					F, G	Geotechnical review of >10m cuts at Km 29+480 to Km 29+520 and >10m fill at Km 29+320 and Km 29+540.
30.59	30.76	0.16				272	Fj/Mb	Fluvial and Till	II	L				m						
30.76	30.81	0.05				273	Raks/Mw	Rock and Till	II	L				w						

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (°)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
30.81	31.33	0.52				272	Fj/Mb	Fluvial and Till	II	L				m						
31.33	31.59	0.25				273	Raks/Mw	Rock and Till	II	L				w						
31.59	33.01	1.43				255	Mw	Till	II	M				w					F, G	Geotechnical review of >10m cuts at Km 32+300 to 32+320, Km 32+820 to 32+960 and >10m fill at Km 32+100 to 32+200.
33.01	33.02	0.00				247	Mwb|Rum	Rock and Till	II	L				m						

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

* * Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

KSM Project - Proposed North Treaty Lower Access Road (May 17, 2012 alignment - McElhanney, 2012a)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential: Proximity (*)	Sediment Source Potential: Sediment Source Potential (**)	Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (˚)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
0.86	1.00	0.14			Helicopter	402	Cvb	Colluvium	IV	M				m						
1.00	1.09	0.09			Helicopter	401	Cv//Rs-V	Colluvium and Rock	IV	H				w					C, G, H	Geotechnical review of >10m fill at Km 1+000. Consider moving centreline ~5 m into slope.
1.09	1.16	0.07			Helicopter	402	Cvb	Colluvium	IV	M				m					F	Geotechnical review of >10m cut at Km 1+100 to 1+120.
1.16	1.32	0.16			Helicopter	401	Cv//Rs-V	Colluvium and Rock	IV	H				w					F, G, H	Geotechnical review of >10m fill at Km 1+220.
1.32	1.39	0.07			Helicopter	402	Cvb	Colluvium	IV	M				m						
1.39	1.78	0.39			Helicopter	401	Cv//Rs-V	Colluvium and Rock	IV	H				w					H	
1.78	2.44	0.66			Helicopter	402	Cvb	Colluvium	IV	M				m						
2.44	2.50	0.06			Helicopter	401	Cv//Rs-V	Colluvium and Rock	IV	H				w					H	
2.50	3.09	0.59			Helicopter	402	Cvb	Colluvium	IV	M				m						
5.92	7.21	1.29	88-95	935-945	Ground	380	Mb-V	Till	IV	H	HP	LS	Moderate	m			19/17	Till/Rock	A, F, G, H	Bridge required at Km 7+157 (GPS ID 88), 7+180 and 7+200 (GPS ID 87). Culverts and drainage control measures as required (e.g. culvert at Km 6+850). Geotechnical review of >10 m high cuts at Km 6+620, Km 6+920 and >10 m fills at Km 7+180 to 7+200.
7.21	8.64	1.43	71-87	P6280047-P6280059, 006-007	Ground	377	Mw.Cv	Colluvium and Till	IV	M	HP	LS	Moderate	m-i			30/28	Rock/Till/Colluvium	A, C, F, G, H, I	Partial snow cover, snowmelt drainage, pistol butt trees and fallen debris within, and adjacent to, a shallow landslide scarp. This area around GPS ID 80 to be reassessed once snow cover has melted. A GRS wall is proposed through this section - consider a full bench cut option as part of a geotechnical field review. Consider crossing structures and other drainage management (e.g. culverts at GPS ID 74,76) through this polygon. Full bench cut recommended from Km 7+440 to 7+540 and Km 8+000 to 8+040 for >20 m sliver fills. Geotechnical review of >10m high cuts at Km 7+220 to Km 7+280, Km 7+460 to Km 7+480, Km 7+720,
8.64	8.92	0.28	68-70	P6280034-P6280046	Ground	372	Mk.Cv-V	Colluvium and Till	IV	H	HP	LS	Moderate	m-w			25-35/26-45	Till/Colluvium	A, F, G, H, I	Pistol butt trees near GPS ID 68. Bridge required for 20-30 m wide channel at GPS ID 68 (Km 8+800). Re-assess scarp at GPS ID 69 prior to construction once snow cover has melted. Geotechnical review of >10 m high cuts at Km 8+900 to 8+920 and >10 m fills at Km 8+700, and Km 8+780 to 8+860 (modification of design to remove these fill slopes is recommended).
8.92	9.88	0.96	66-67	P6280031-P6280033	Ground & Helicopter	318	Cv/Mw-Fu	Colluvium and Till	IV	H	MP	LS	Low	m-i			32/32	Colluvium/Rock	F, H	Undulating terrain, estimated depth to bedrock is approximately 1-2 m. Geotechnical review of >10 m high cuts at Km 8+940 to 9+140, Km 9+280 to 9+440, Km 9+560 to 9+600, Km 9+760 to 9+840.
Sites Below Not Assessed As Per TSFA Methodology - Some Sites Assessed To Confirm Ground Conditions																				
0.00	0.41	0.41				407	Cvb	Colluvium	III	M				w					C, F, G	Geotechnical review of >10 m cut at Km 0+220 and >10 m fill at Km 0+360 and Km 0+400.
0.41	0.86	0.44				409	Cv	Colluvium	II	M				w					C	Geotechnical review of >10 m fill Km 0+640 and Km 0+660. Consider moving centreline ~5 m into slope.
3.09	5.92	2.83	96	P6280069-P6280070	Ground & Helicopter	383	Cvb	Colluvium	III	M	MP	LS	Low	m-i			13/16	Colluvium	F, G	Ground traverse to Km 5+800 only. Poor drainage, moss, fallen tree debris. Fine sand, some fines, some gravel, moderately graded soil exposed in fallen tree roots. Geotechnical review of >10 m high cuts at Km 3+240 to 3+260, Km 5+480 to 5+580 and >10 m fills at Km 3+260 to 3+320, Km 5+500 to 5+560.
9.88	10.07	0.18				346	Mka	Till	III	H				m					A, G, H	Bridge required at Km 9+950. Geotechnical review of >10 m high fills from Km 9+940 to 10+040.
10.07	10.92	0.85				315	Mb	Till	III	M				m-i					F	Geotechnical review of >10 m high cuts from Km 10+100 to 10+180.
10.92	11.67	0.75				195	Mw|Rm/Rm	Rock and Till	II	L				w-m						

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

** Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

KSM Project - Proposed North Treaty Upper Access Road (May 17, 2012 alignment - McElhanney, 2012a)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (˚)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
3.18	3.65	0.46			Helicopter	385	Cv-V	Colluvium	IV	H				m					F, G, H	Geotechnical review of >10 m high cuts at Km 3+240, Km 3+340 to 3+420, Km 3+540 to 3+640 and >10 m high fills at Km 3+240, Km 3+460, Km 3+520.
5.60	5.66	0.06			Helicopter	380	Mb-V	Till	IV	H				m					H	
5.77	6.83	1.06			Helicopter	380	Mb-V	Till	IV	H				m					H	
0.25	0.59	0.34	154-155	P7010155-P7010156	Ground	1068	Cv/Rks	Rock and Colluvium	IV	M	MP	LS	Low	w			26/26-36	Colluvium	C, H	Forested area, >50 year old vertical trees, minor pistol butting in young trees. Full bench cut recommended from GPS ID 31 for 50 m up chain (Km 0+270 to Km 0+320). Geotechnical review of >10 m high cut from Km 0+260 to 0+380, Km 0+440, Km 0+560.
1.24	3.17	1.93	034-041, 162-167	P7010159-P7010169, DSC_8351-DSC_8353	Ground	402	Cvb	Colluvium	IV	M	MP	LS	Low	m			30/30	Colluvium/Rock	A, C, E, F, G, H, I	Consider culverts (e.g. from Km 1+400 to 1+600). GPS ID 035: small slump 10-15 m wide and 15-20 m long - potential for small magnitude debris flow. Avoid sliver fill slope at GPS ID 036 by adjusting alignment into the slope. GPS ID 038: shallow slides in colluvium downslope, likely an avalanche chute. Geotechnical review of rock face at GPS ID 168 and 42. Geotechnical review of cuts >10 m from Km 1+460 to 3+160 and >10 m high fills from Km 1+760 to 3+160.
6.83	7.07	0.24			Helicopter	379	Mwb	Till	IV	M				m					J	
7.07	8.00	0.93	77-80	P6280052-P6280054	Ground	377	Mw.Cv	Colluvium and Till	IV	M	HP	LS	Moderate	m-i			29/28	Colluvium/Till/Swampy	A, F, G, H, I	Partial snow cover, unconfined snowmelt drainage, pistol butt trees and fallen debris. Crossing structures and drainage management required. Re-assess small scarp at GPS ID 80 re-assess when snow has melted. Geotechnical review of >10 m high cuts from Km 7+220 to 7+940 and >10 m high fills at Km 7+380, Km 7+440 to 7+460, Km 7+640, Km 7+800.
0.73	1.08	0.35	27, 152-153	P7010147-P7010154	Ground	406	Cv.Rs	Colluvium and Rock	IV	L	LP	LS	Very Low	w-r			37/39	Colluvium/Rock	C, F	Vertical trees, dry. Sandstone and siltstone, persistent joint trending to SE and subvertical at GPS ID 28. Full bench cut recommended at GPS ID 26. Geotechnical review of >10m high cuts from Km 0+860 to 1+080.
Sites Below Not Assessed As Per TSFA Methodology - Some Sites Assessed To Confirm Ground Conditions																				
0.00	0.25	0.25	156	-	Ground	407	Cvb	Colluvium	III	M	LP	LS	Very Low	w			20/20	Colluvium	F	Established forest, coarse colluvium up to 500 mm diameter. Geotechnical review of >10 m high cuts from Km 0+040 to 0+080.
0.59	0.73	0.14	29	-	Ground	407	Cvb	Colluvium	III	M	MP	LS	Low	w			-	Colluvium/Rock	F, G	Geotechnical review of >10 m high cuts from Km 0+600 to 0+720 and >10m fills at Km 0+720.
1.08	1.24	0.16	151, 33	-	Ground	409	Cv	Colluvium	II	M	LP	LS	Very Low	w			26/26	Colluvium/Swampy	F	Forested slope, vertical trees, >50 years, some seepage, no bedrock observed. Geotechnical review of >10 m high cuts from Km 1+160 to 1+180.
3.17	3.18	0.01				386	Cv.Mw	Colluvium and Till	III	M				m-i					F	Geotechnical review of >10 m high cuts at Km 3+180.
3.65	3.81	0.17				384	Mw//Rk	Rock and Till	III	M				w					F, G	Geotechnical review of >10 m high cuts from Km 3+660 to 3+680, Km 3+760 and >10 m fills at Km 3+740.
3.81	3.84	0.03				383	Cvb	Colluvium	III	M				m-i					F	Geotechnical review of >10 m high cut at Km 3+840.
3.84	5.48	1.64				384	Mw//Rk	Rock and Till	III	M				w					C, F, G	Consider adjusting alignment into slope to eliminate sliver fills. Geotechnical review of >10 m high cuts from Km 3+860 to 5+040 and >10 m fills at Km 3+960 to 5+320.
5.48	5.60	0.12				381	Mwb	Till	III	M				m-i						
5.66	5.77	0.10				381	Mwb	Till	III	M				m-i						

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

** Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

KSM Project - Cut-off Ditch Access Road (July 6, 2012 alignment - McElhanney, 2012b)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (°)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
0.00	0.23	0.23	-	-	Helicopter	380	Mb-V	Till	IV	H				m					H	
2.44	2.78	0.35	-	-	Helicopter	385	Cv-V	Colluvium	IV	H				m					H	
3.55	3.80	0.25	-	-	Helicopter	402	Cvb	Colluvium	IV	M				m					F	Geotechnical review of >10 m high cuts from Km 3+560 to 3+800.
Sites Below Not Assessed As Per TSFA Methodology - Some Sites Assessed To Confirm Ground Conditions																				
0.23	0.52	0.30				381	Mwb	Till	III	M				m-i					F	Geotechnical review of >10 m high cuts from Km 0+460 to Km 0+520.
0.52	2.44	1.91				384	Mw//Rk	Rock and Till	III	M				w					F, G	Geotechnical review of >10 m high cuts from Km 0+760 to 2+400 and >10 m high fills at Km 1+580 and Km 2+080.
2.78	3.55	0.76				386	Cv.Mw	Colluvium and Till	III	M				m-i					F, G	Geotechnical review of >10 m high cuts from Km 2+840 to 3+500 and >10 m high fills from Km 2+940 to Km 2+980.

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

** Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

KSM Project - Tunnel Adit Access Road (May 17, 2012 alignment - McElhanney, 2012a)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (˚)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
0.65	1.52	0.87	113-116	P6290119-P6290126	Ground	1158	Mv.Rsk-V	Till and Rock	IV	H	HP	LS	Moderate	w	Rb	Rockfall	39/28	Till/Rock/Colluvium	B, F, H	Observed rockfall during field traverse. Geotechnical review of >10 m high cut from Km 1+260 to 1+460.
1.52	2.14	0.62	107-112	898-892	Ground	1151	Ms-VR"sd	Till	V	VH	HP	MS	High	w	R"sd	Debris flow	26-34/22-32	Till/Rock	B, E, H	BGC (2012b) identified Debris Flows or Debris Avalanches and Rockfall potential between Km 1+520 to 2+140.
2.91	2.92	0.01	-	-	Helicopter	1172	Rs-R"b	Rock	V	L				r	R"b	Rockfall			B, H	BGC (2012b) identified rockfall potential between Km 2+910 to Km 2+920.
Sites Below Not Assessed As Per TSFA Methodology - Some Sites Assessed To Confirm Ground Conditions																				
0.00	0.21	0.21				255	Mw	Till	II	M				w						
0.21	0.65	0.44	117-118	P6290127-P6290132	Ground	1145	Mv/Rk	Till and Rock	III	M	MP	MS	Moderate	w			22-31/17-37	Till/Rock	A, F	Culverts required at GPS ID 117 and 118. Geotechnical review of cut >10m high at Km 0+420.
2.14	2.91	0.77	104-106	P6290091-P6290100	Ground	1169	Cb.Mk-Rsd	Till and Colluvium	III	H	HP	HS	Very High	w	R"sd	Debris flow	33/20	Till/Colluvium/Ice	B, D, F, H	BGC (2012b) identified potential for Debris Flows or Debris Avalanches and Rock fall between Km 2+140 to Km 2+910. Active gullying and sloughing observed. Ice lenses on road alignment from Km 2+420 to Km 2+500 and Km 2+670 to Km 2+920 (observed by McElhanney field crew). Geotechnical review of >10 m high cuts at Km 2+240 and Km 2+600.

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

* * Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

KSM Project - Tunnel Adit Spur Access Road (May 17, 2012 alignment - McElhanney, 2012a)

P-Line From (km)	P-Line To (km)	Length (km)	GPS ID	TSFA Photo Number	Inspection Type	Polygon Number	Terrain Symbol	Surficial Material	Stability Class	Potential Sediment Delivery (Geohazards)	Sediment Source Potential		Potential Sediment Delivery (TSFA)	Drainage Class	Geohazards	Geohazard Type	Upslope/ Downslope Angle (˚)	Terrain/Soils/Stability Observations	Geotechnical Prescription	Comment
											Proximity (*)	Sediment Source Potential (**)								
0.00	0.14	0.14	108-109	P6290111	Ground	1151	Ms-VR"sd	Till	V	VH	HP	MS	High	w	R"sd	Debris flow	26/22	Till/Rock	B, D, E, H	BGC (2012b) identified Debris Flow or Debris Avalanche and Rock fall potential between Km 0+000 to 0+650.
0.14	0.65	0.50	101-103	P6290085-P6290090	Ground	1169	Cb.Mk-Rsd	Till and Colluvium	III	H	HP	HS	Very High	w	R"sd	Debris flow	25/23	Colluvium/Till/Rock	B, E, F, G, H	Upslope angle taken to base of steeper slope. Geotechnical review of >10m high cut and > 10 m high fill at Km 0+500.

* Field assessment of sediment proximity potential
High Proximity (HP): 0 - 25 m from a stream or water body
Moderate Proximity (MP): 25 - 50 m from a stream or water body
Low Proximity (LP): >50 m from a stream or water body

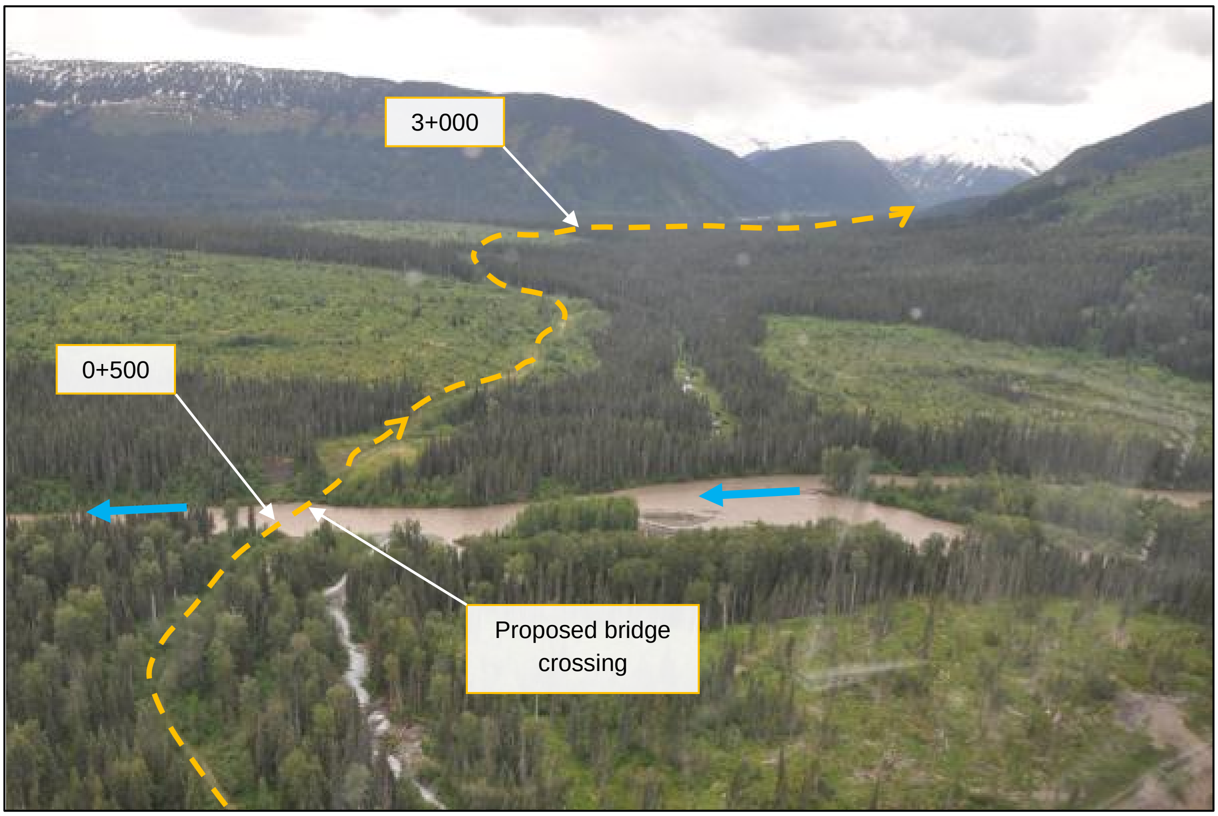
** Field assessment of sediment source potential
Low Sediment Source Potential (LS): Rock, coarse colluvium or gravels
Moderate Sediment Source Potential (MS): Till or fine colluvium or gravels
High Sediment Source Potential (HS): Fine soils

*** Field assessment of Potential Sediment Delivery

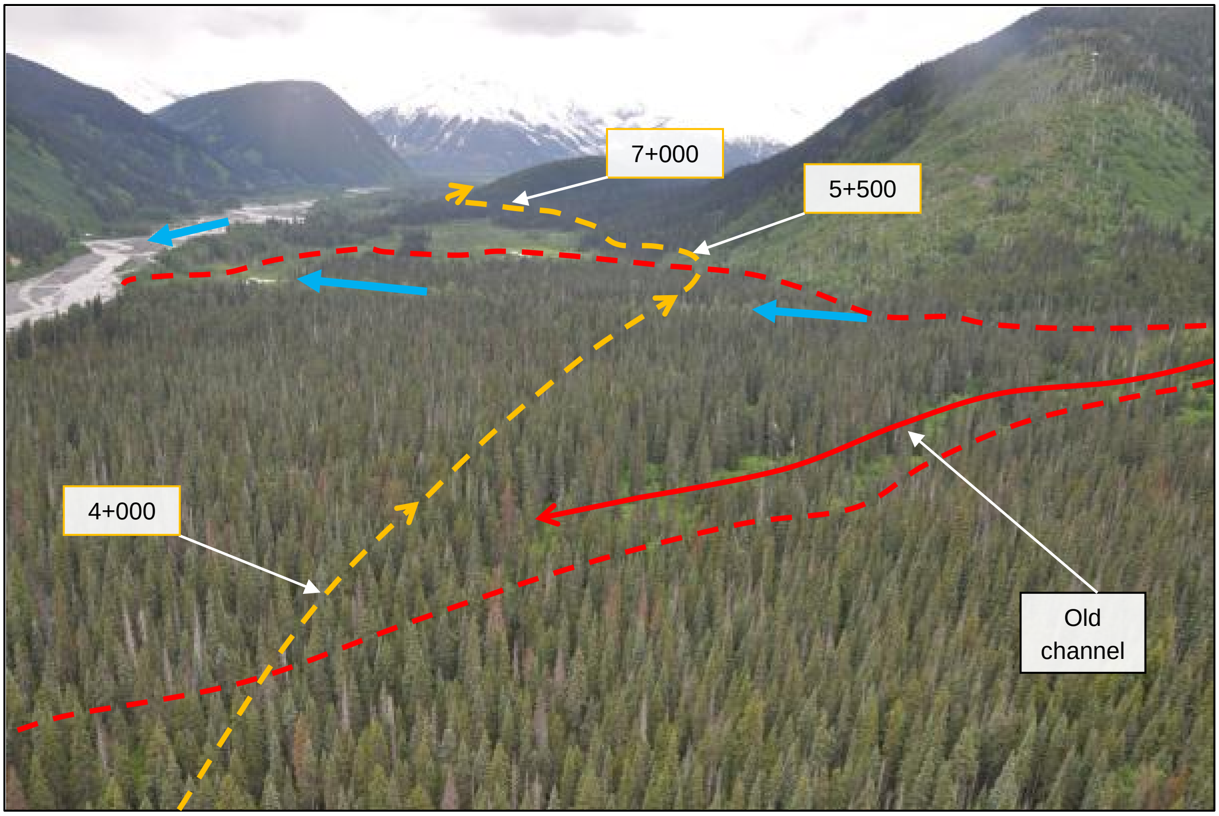
	Sediment Source Potential		
Proximity	High (HS)	Moderate (MS)	Low (LS)
High (HP)	Very High	High	Moderate
Moderate (MP)	High	Moderate	Low
Low (LP)	Moderate	Low	Very Low

APPENDIX B
PHOTOGRAPHS OF SELECT ROAD SECTIONS

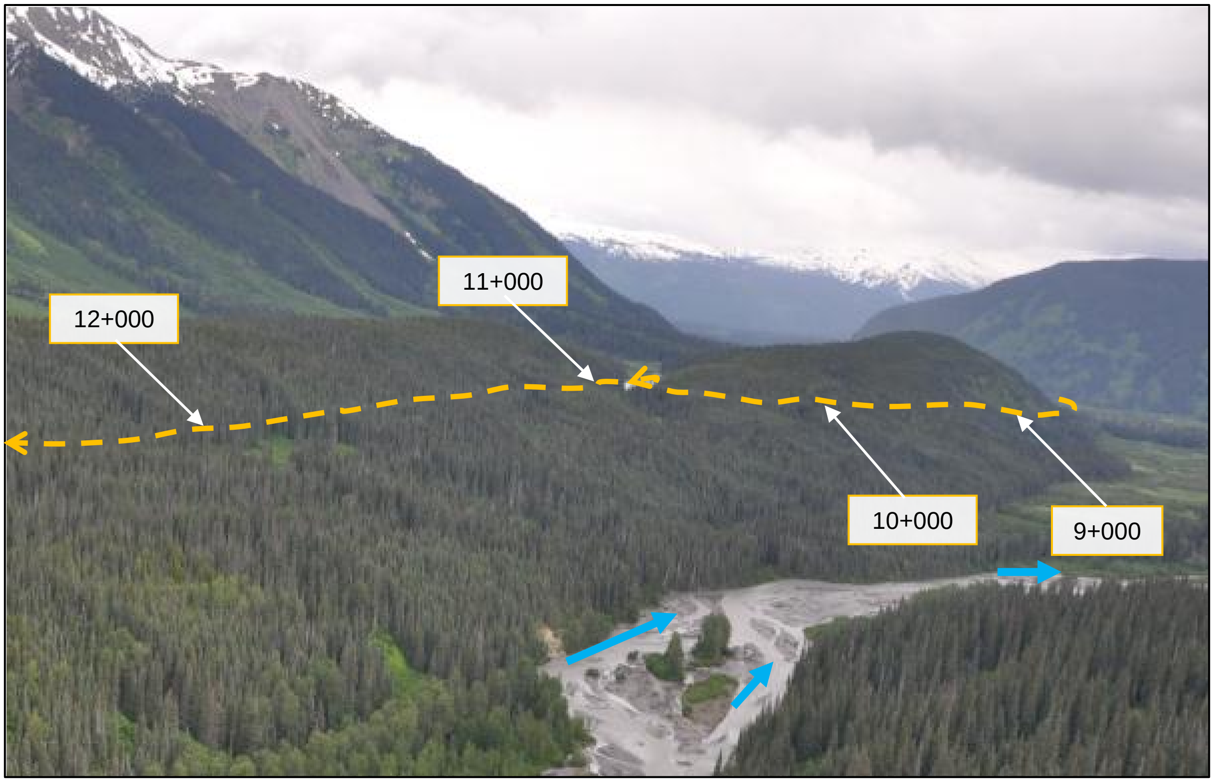
In the following site photographs "upchain" is looking in direction of increasing chainage towards the end of the access road (from KM 0 towards the road end) while "downchain" is looking in the direction of decreasing chainage towards the start of the access road (from the road end direction towards KM 0). The direction of ascending road kilometer posts is labeled with a dashed arrow for the proposed access roads in the follow colors: Treaty Creek (orange), North Treaty Lower (yellow), North Treaty Upper (green), North Treaty Cutoff Ditch (blue), Tunnel Adit (red), and Tunnel Adit Spur (purple). The term left and right creek or river bank refers to the left and right creek/river banks, respectively, when one looks in direction of the creek/river flow.



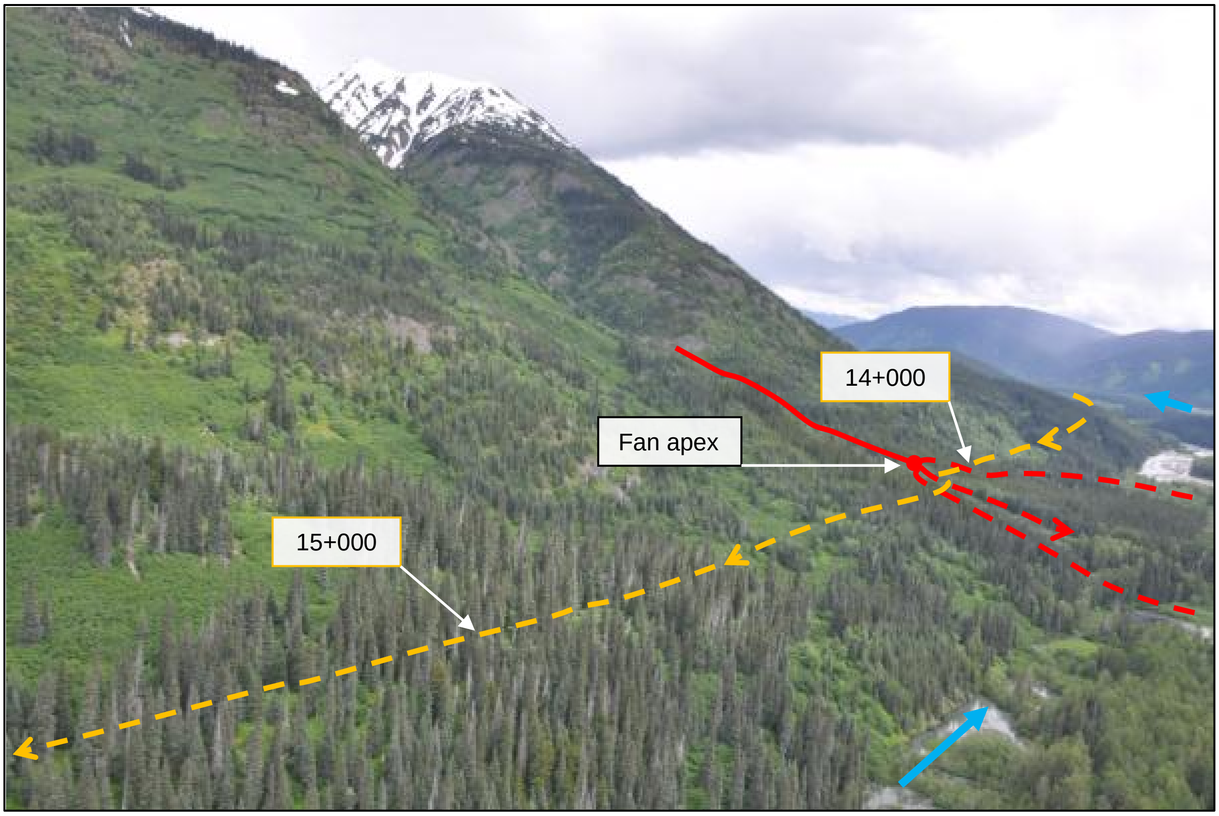
Photograph 1 Treaty Creek Access Road – Looking upchain (southwest) from Highway 37 with the proposed Bell-Irving River bridge crossing in the foreground.



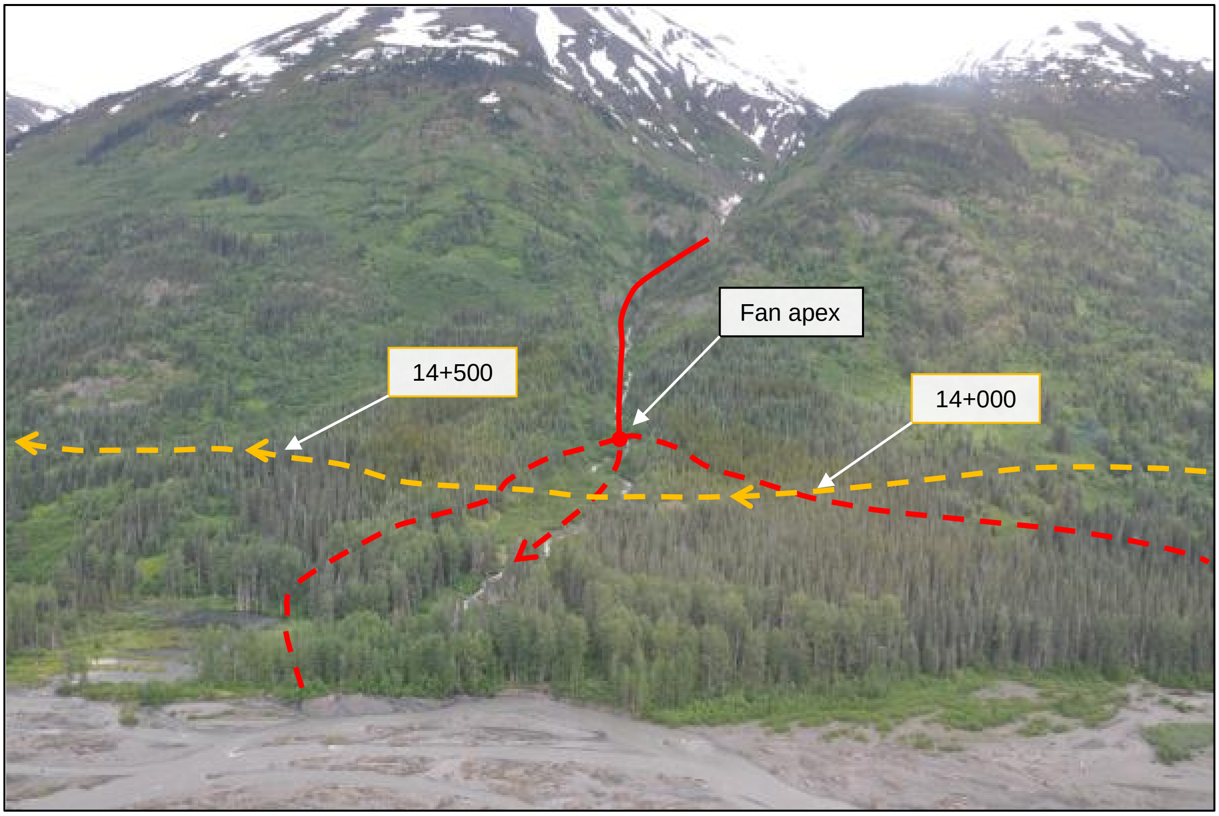
Photograph 2 **Treaty Creek Access Road – Looking upchain (west) along the northern bank of Treaty Creek towards Km 7+000. The proposed road crosses a debris-flow fan (red dashed lines) subject to channel avulsion between approximately Km 3+900 and Km 5+300. An old fluvial channel with recently established vegetation (<5 years old) is marked with a red arrow.**



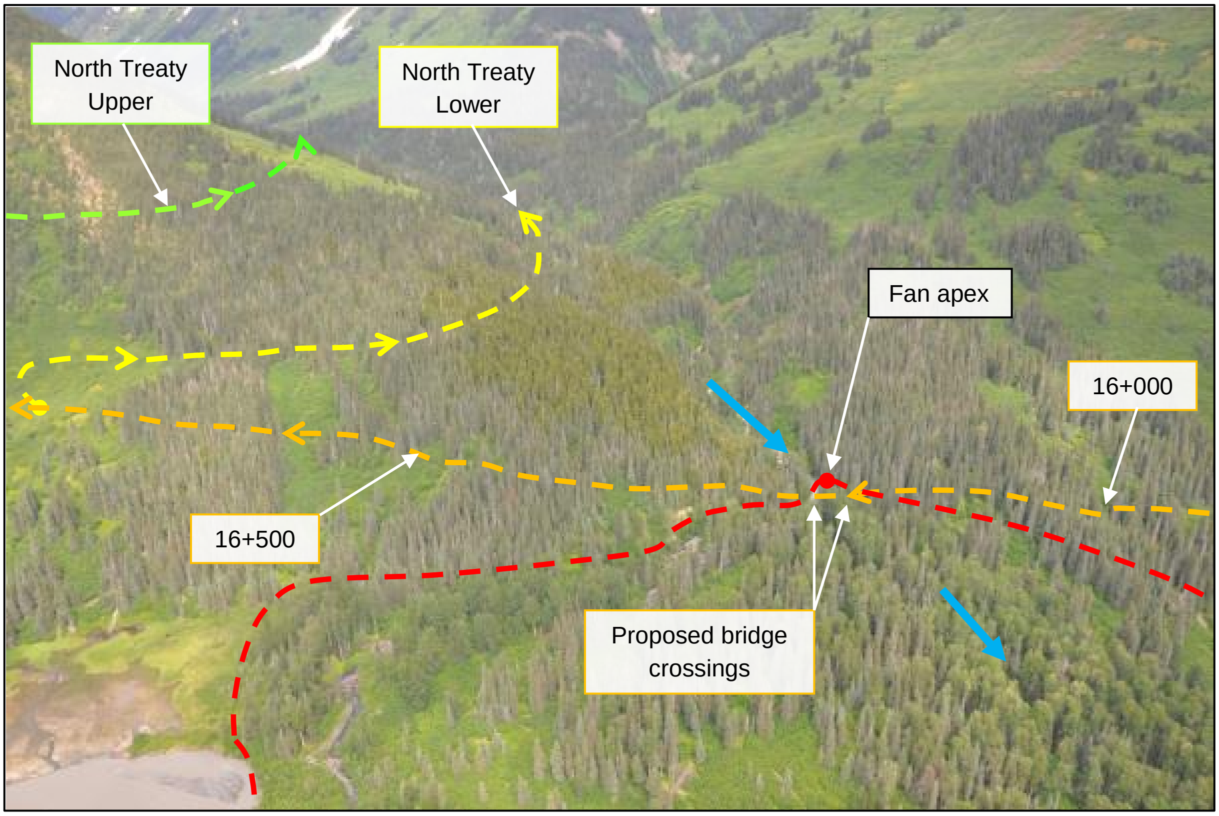
Photograph 3 **Treaty Creek Access Road – Looking downchain (east) towards Km 9+000 and Km 12+000 from above the Treaty Creek river bed.**



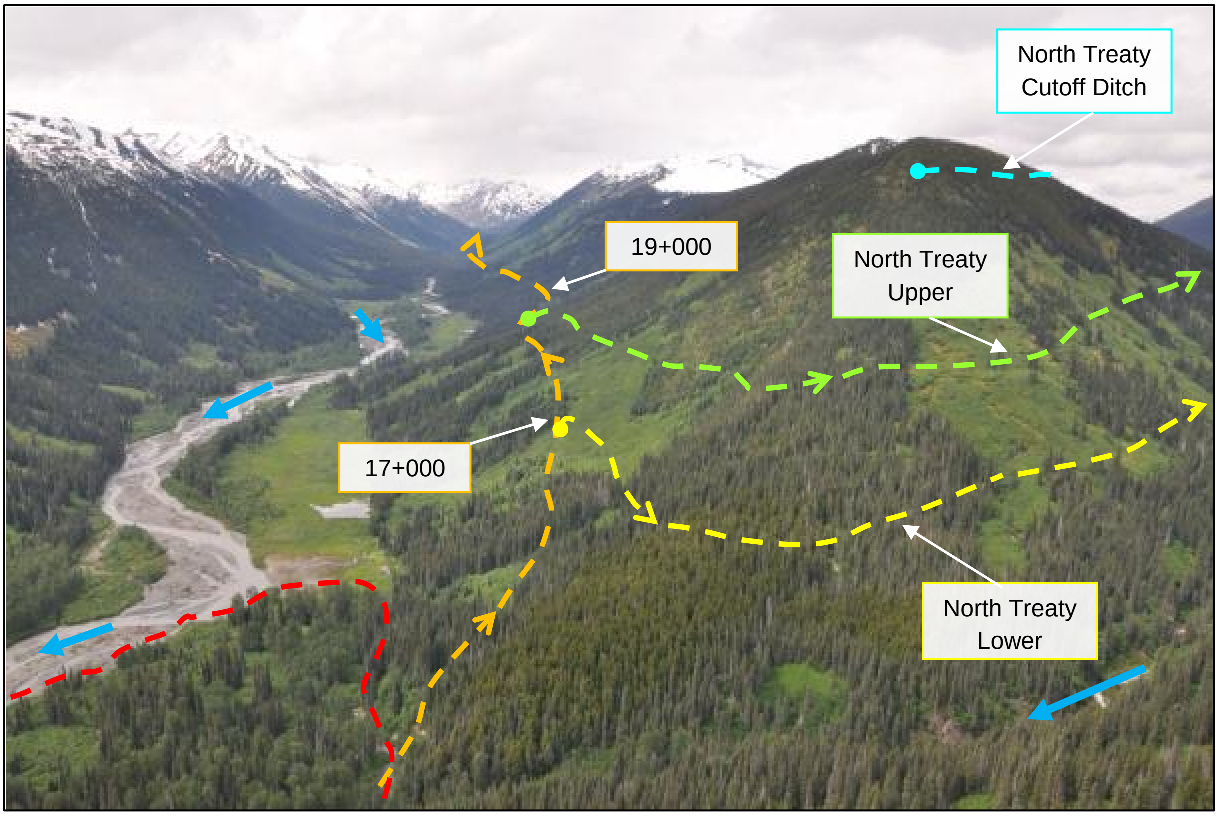
Photograph 4 **Treaty Creek Access Road – Looking downchain (east) from Treaty Creek towards Km 12+000 to Km 15+000. The proposed road crosses a colluvial fan (dashed red lines) subject to debris flows, flooding and channel avulsions between about Km 14+030 and Km 14+300 (BGC 2012).**



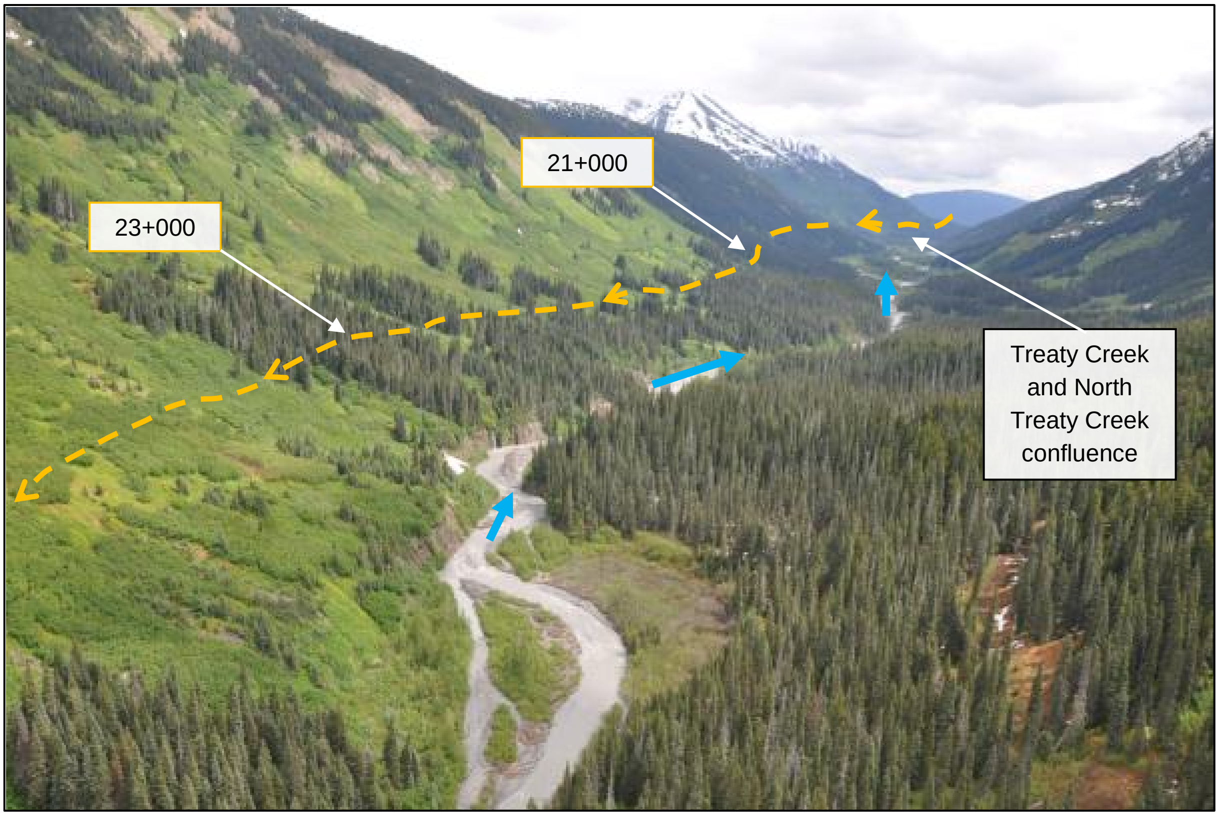
Photograph 5 **Treaty Creek Access Road – Looking north from Treaty Creek towards a debris-flow fan (dashed red lines) subject to debris flows that cross the road between about Km 14+030 and Km 14+300 (BGC 2012).**



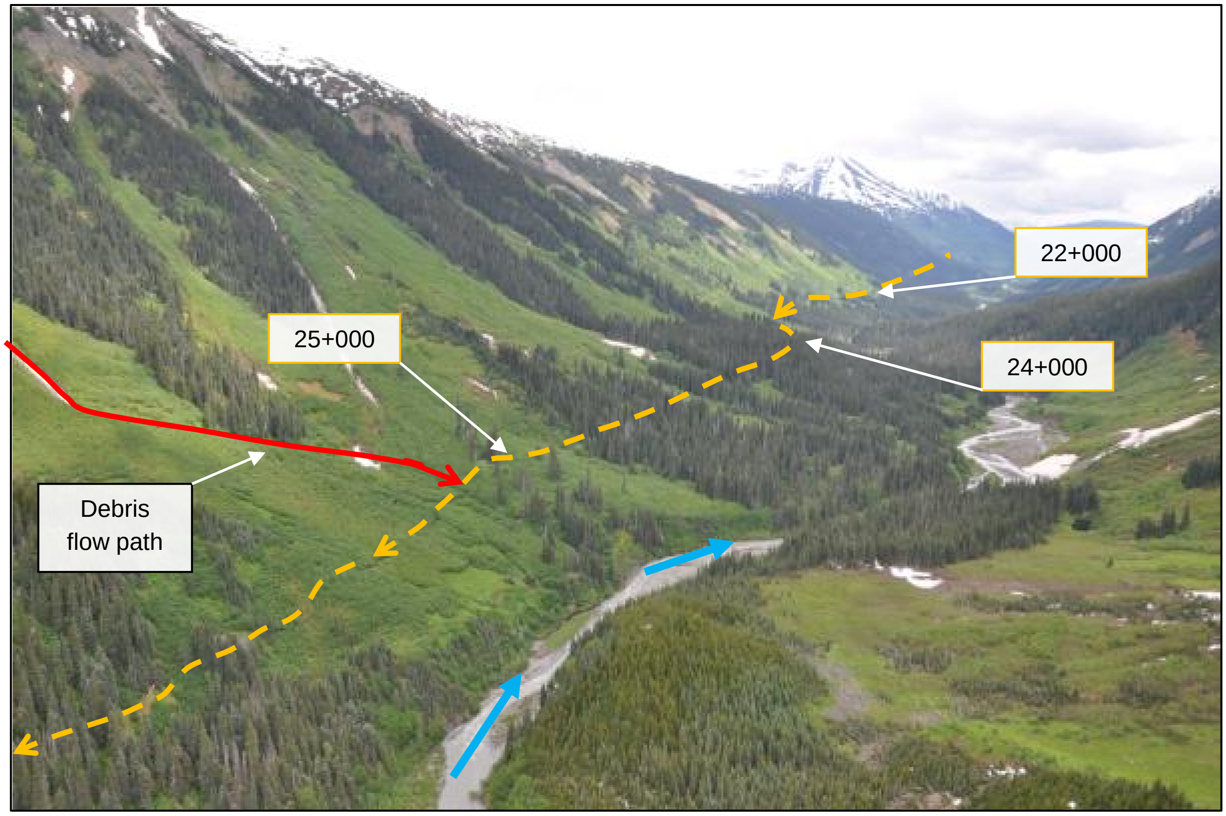
Photograph 6 **Treaty Creek Access Road – Looking north from Treaty Creek towards the North Treaty Creek bridge crossings at Km 16+076 to Km 16+100 and Km 16+124 to Km 16+148. A debris-flow fan (dashed red line) crosses the road alignment between Km 16+100 and Km 16+200.**



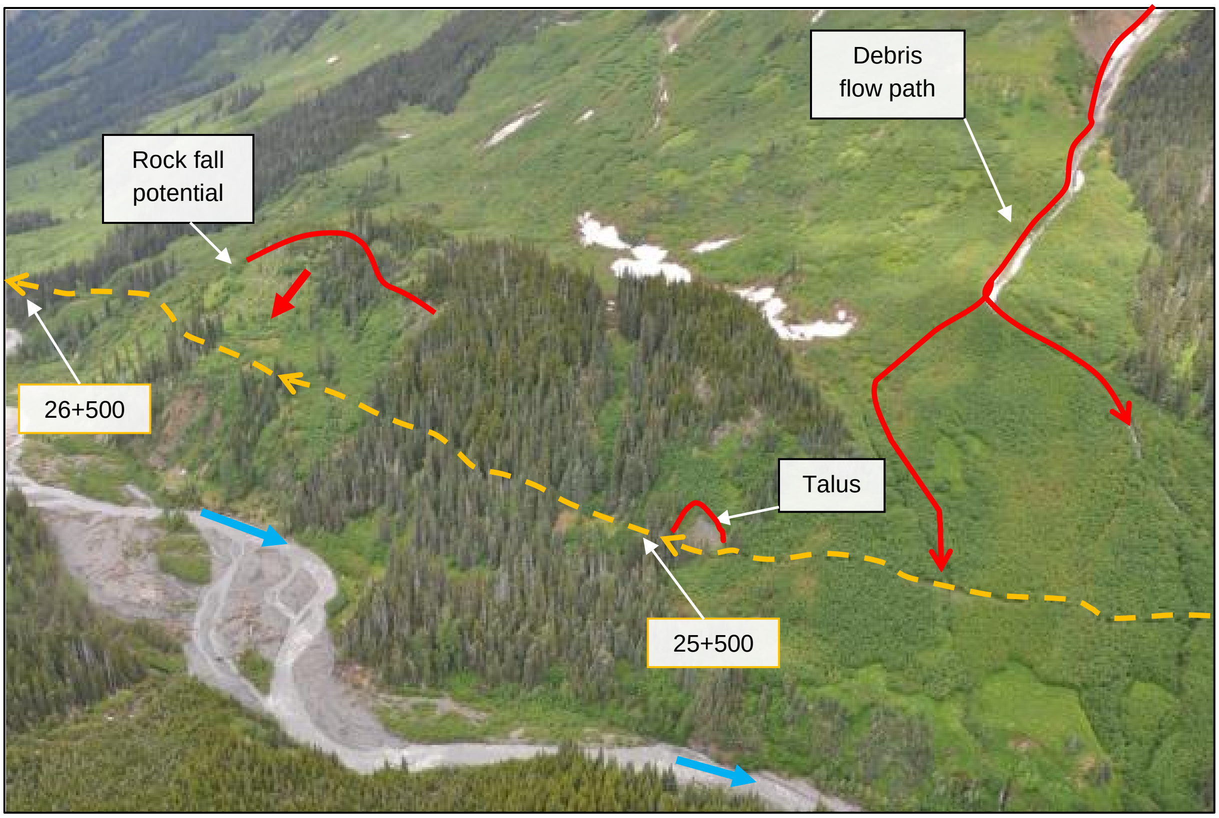
Photograph 7 **Treaty Creek Access Road – Looking upchain (west) from the confluence of Treaty Creek and North Treaty Creek.**



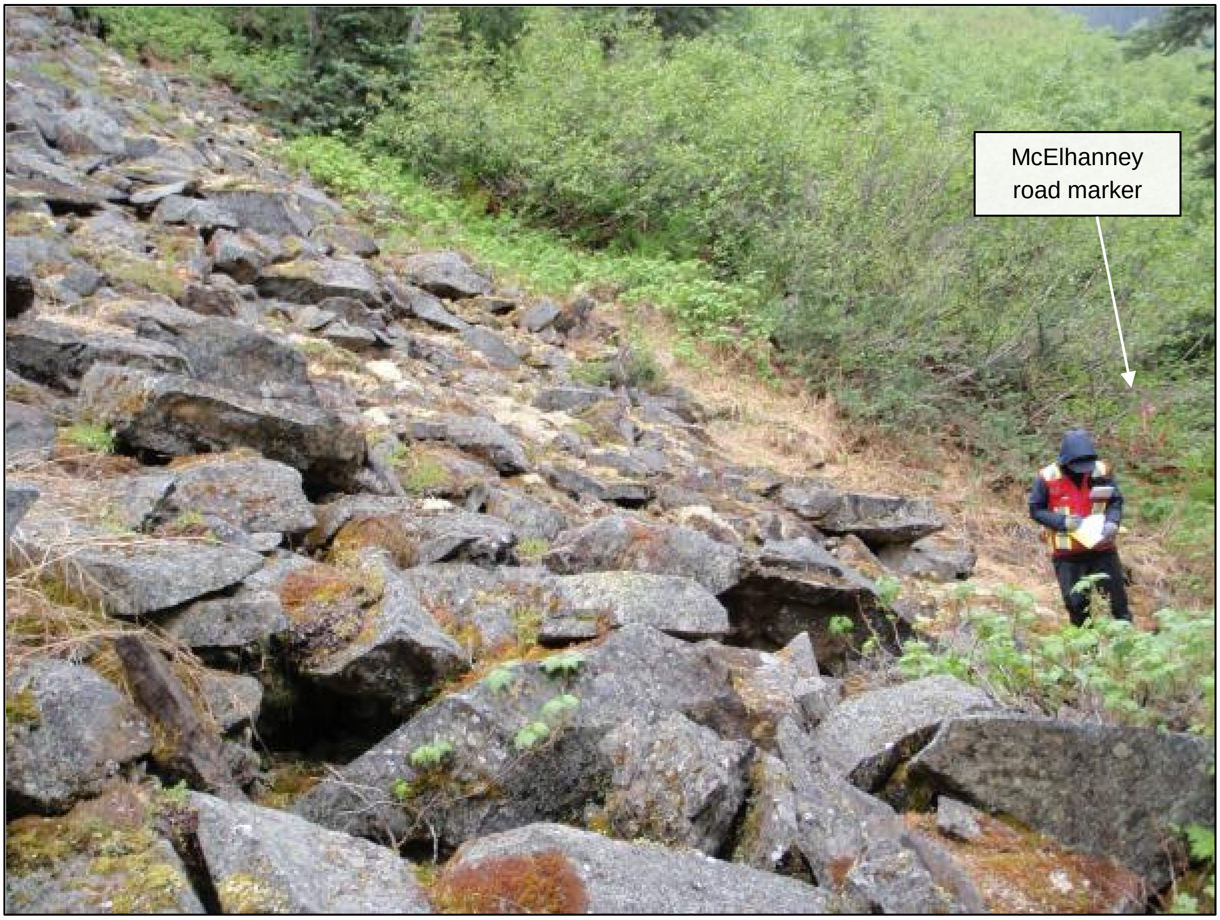
Photograph 8 **Treaty Creek Access Road – Looking downchain (east) from Treaty Creek towards Km 21+000.**



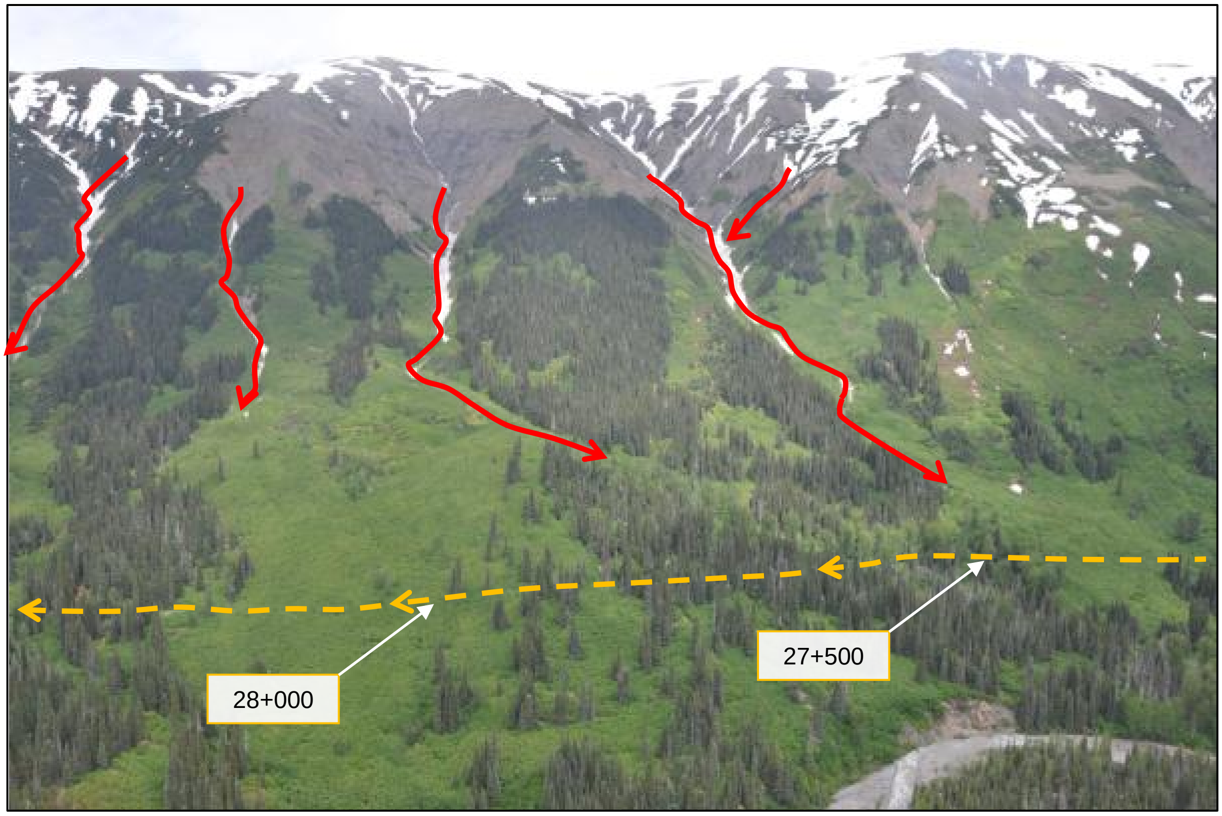
Photograph 9 **Treaty Creek Access Road – Looking downchain (east) from Treaty Creek towards Km 22+000. A debris flow path crosses the Treaty Creek Access Road at approximately Km 25+300.**



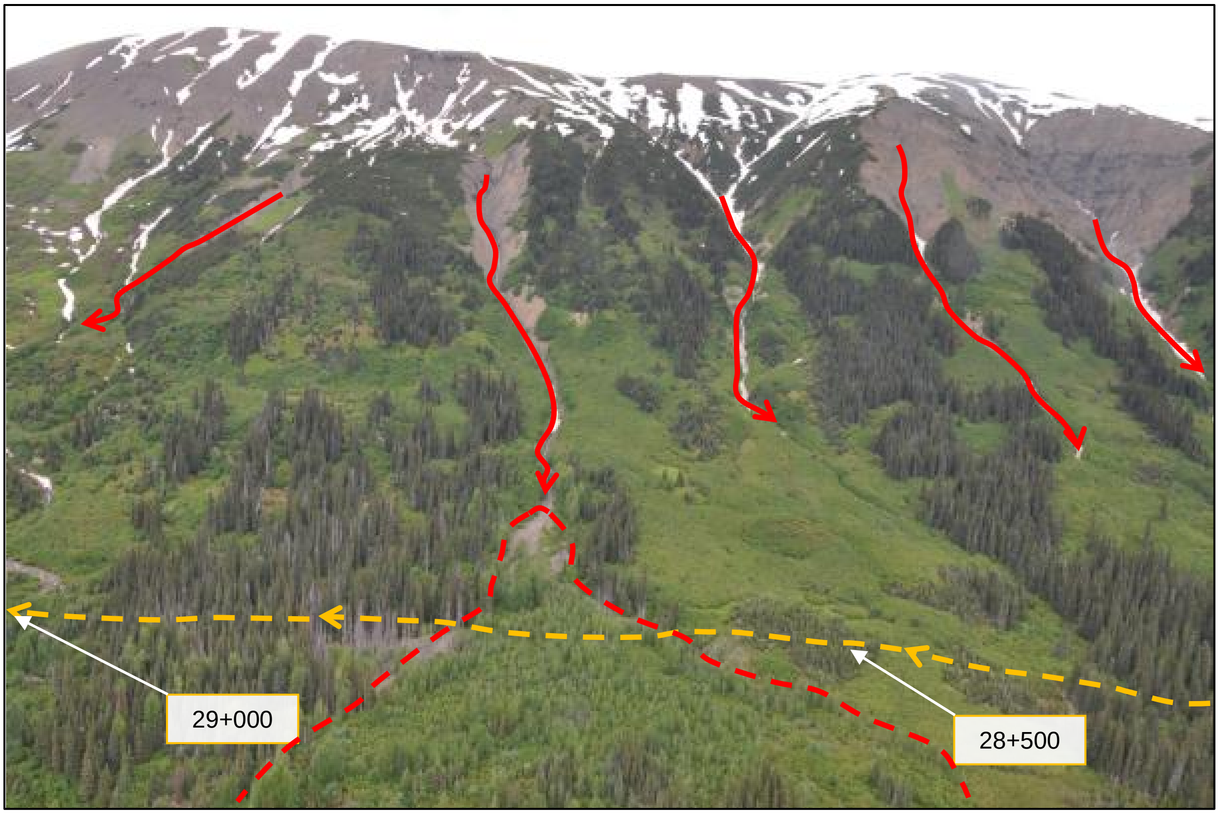
Photograph 10 **Treaty Creek Access Road – Looking upchain (north-northwest) from Treaty Creek towards Km 26+500. At Km 25+450, the road traverses along the base of a talus slope. Rock fall potential identified between Km 25+800 to Km 26+300 from rock bluffs located approximately 150 m to 250 m upslope.**



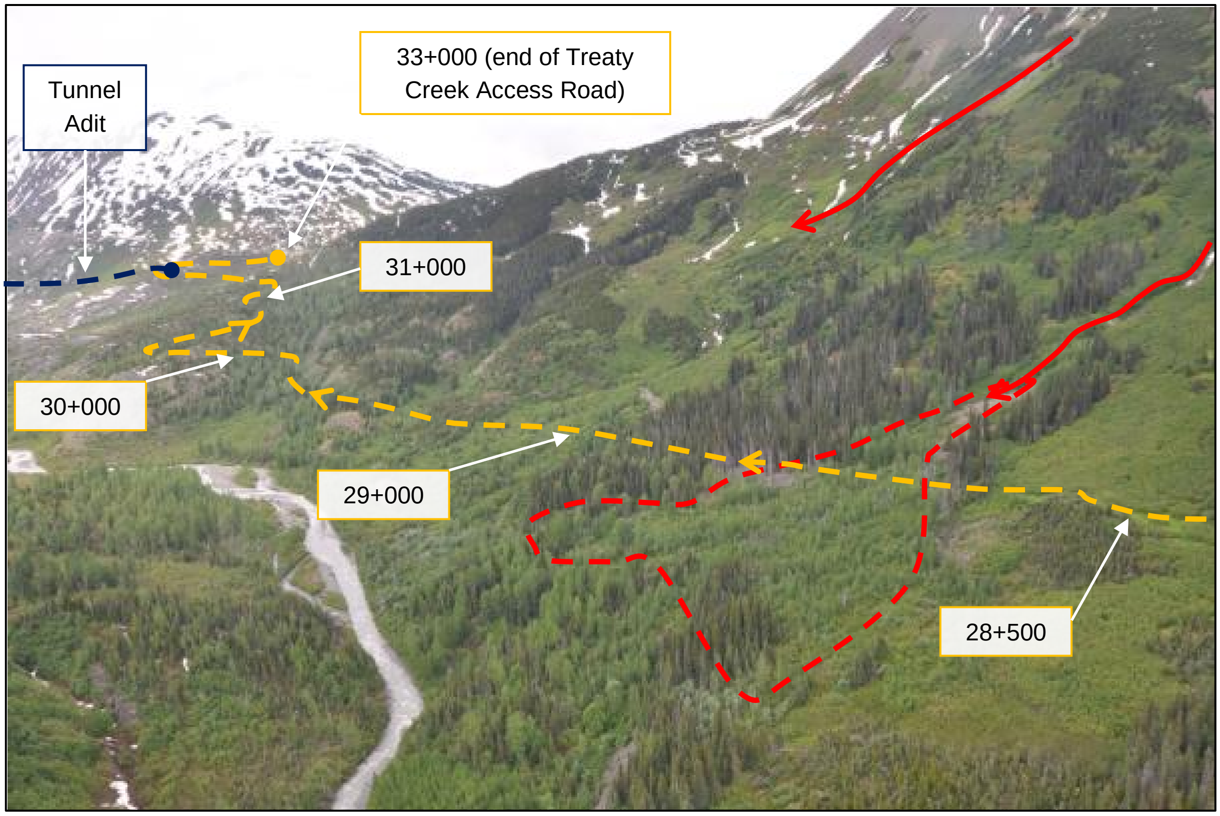
Photograph 11 **Treaty Creek Access Road – Looking downchain (east) towards Km 25+420 where the road traverses below a talus slope. Moss covered angular boulders between 1 m and 2 m diameter.**



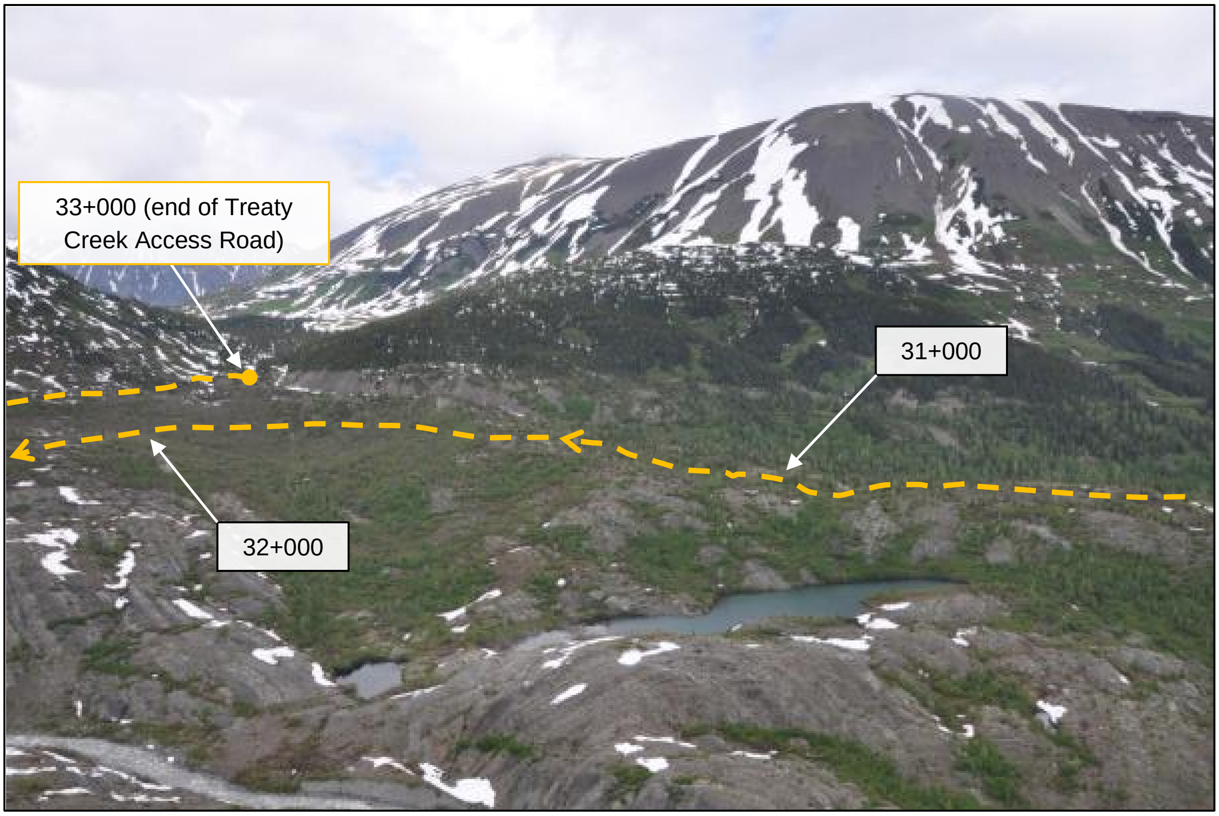
Photograph 12 **Treaty Creek Access Road – Looking north from Treaty Creek towards Km 28+500 to Km 29+000 where the road travels below several debris flow paths (marked in red).**



Photograph 13 **Treaty Creek Access Road – Looking north from Treaty Creek towards Km 28+500 to Km 29+000 where the road travels below several debris flow paths (marked in red). The proposed road crosses a debris-flow fan (dashed red line) between Km 28+600 and Km 28+800.**



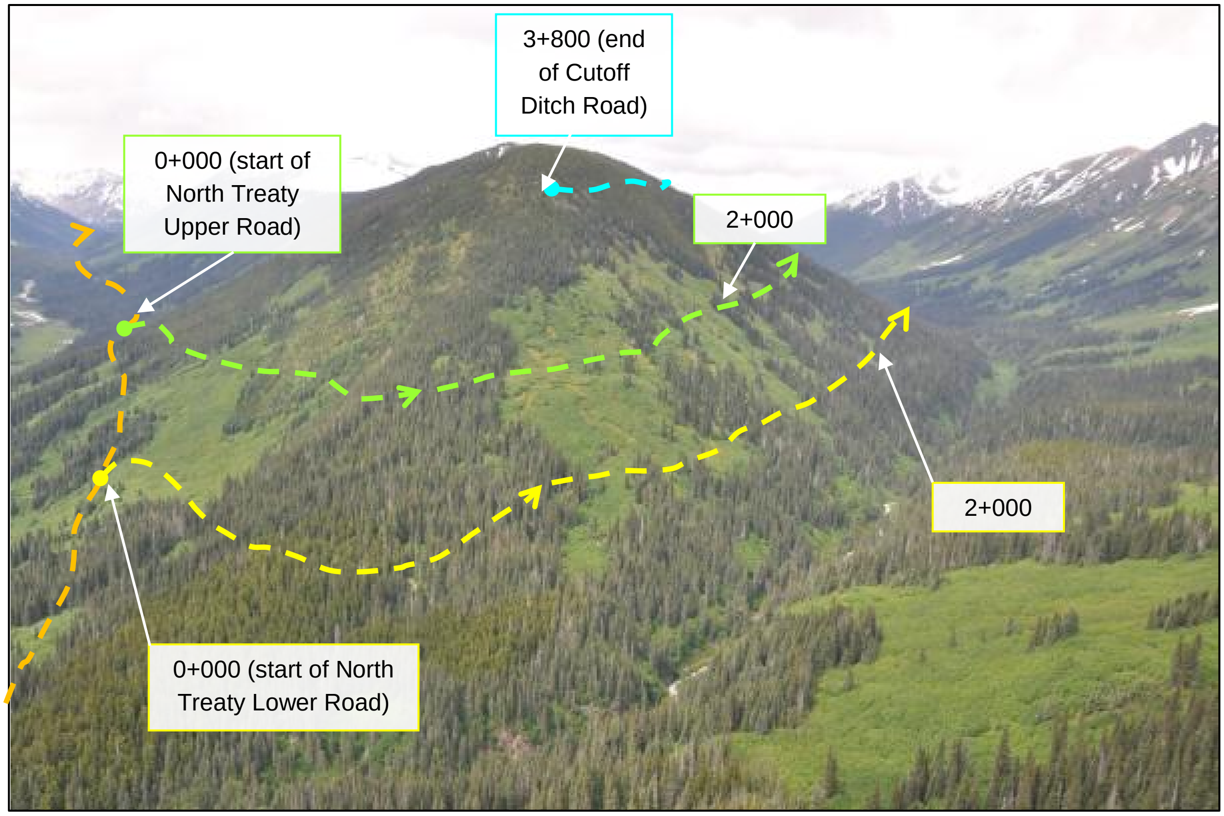
Photograph 14 **Treaty Creek Access Road – Looking upchain (north-northwest) from Treaty Creek towards the end of the Treaty Creek main access road at Km 33+000. The proposed road crosses a debris-flow fan (dashed red line) between Km 28+600 and Km 28+800.**



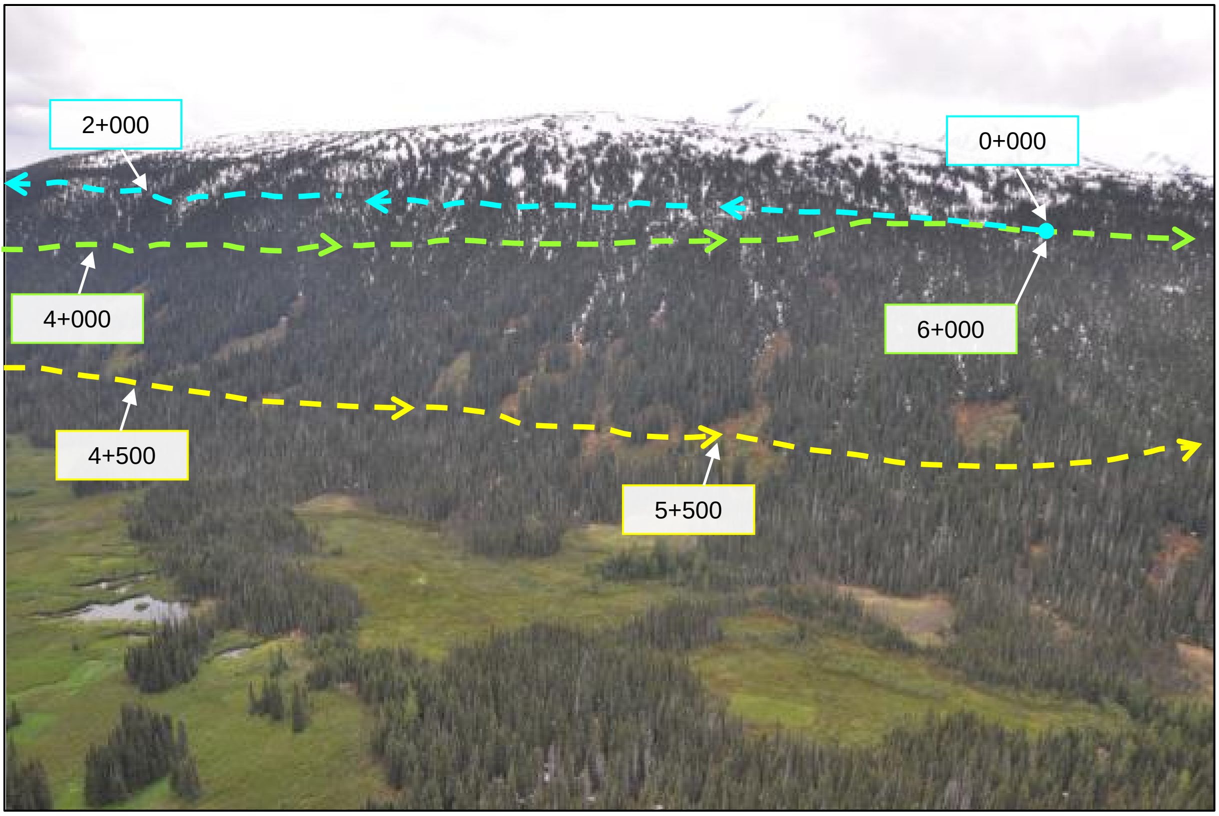
Photograph 15 **Treaty Creek Access Road – Looking upchain (north-northwest) from Treaty Creek towards the end of the Treaty Creek main access road at Km 33+000.**

Photograph 16 **Treaty Creek Access Road – Looking upslope (north) from Km 26+000 towards an exposed rock bluff with rock fall potential approximately 150 m to 200 m upslope from road alignment. The slope angle to the base of the rock scarp is 33 degrees. Vegetation is dense and well established (>20 years old) suggesting the slope is less active.**

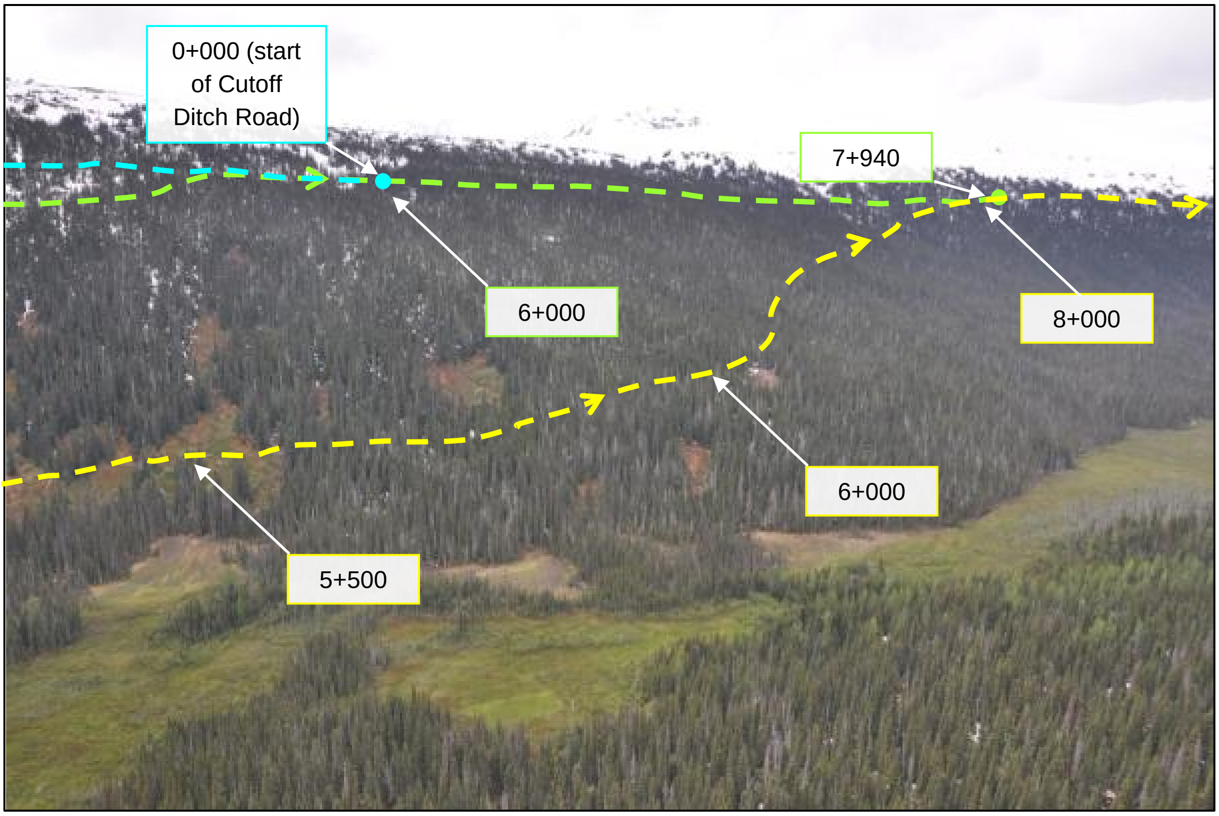
Photograph 17 **Treaty Creek Access Road – Looking downchain (east) from left river bank approximately 7 m upslope of Km 26+200 towards an exposure of slightly weathered (W2), weak to medium strong (R2 to R3), sandstone and siltstone.**



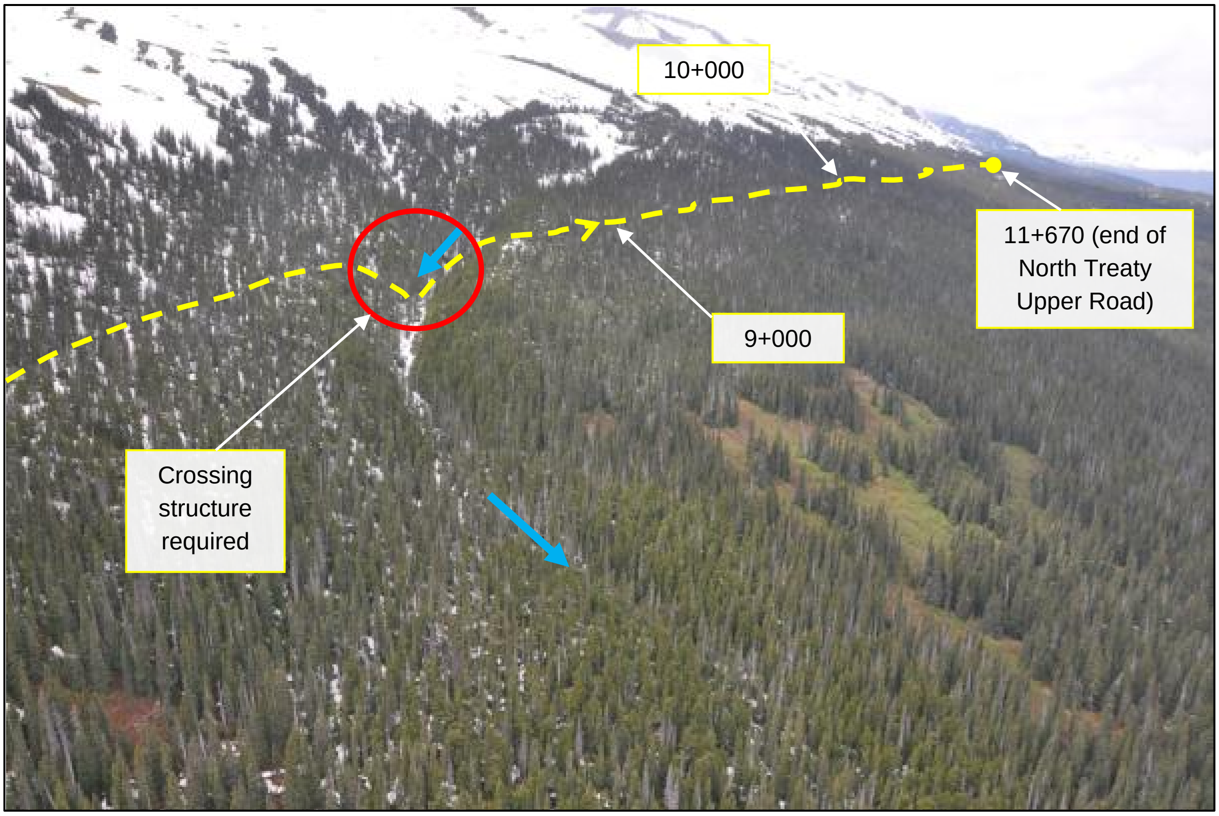
Photograph 18 North Treaty Lower (yellow), North Treaty Upper (green) and Cutoff Ditch Access Roads (blue) – Looking upchain (northwest) from the confluence of Treaty Creek and North Treaty Creek.



Photograph 19 North Treaty Lower, North Treaty Upper and Cutoff Ditch Access Roads – Looking southwest from North Treaty Creek.



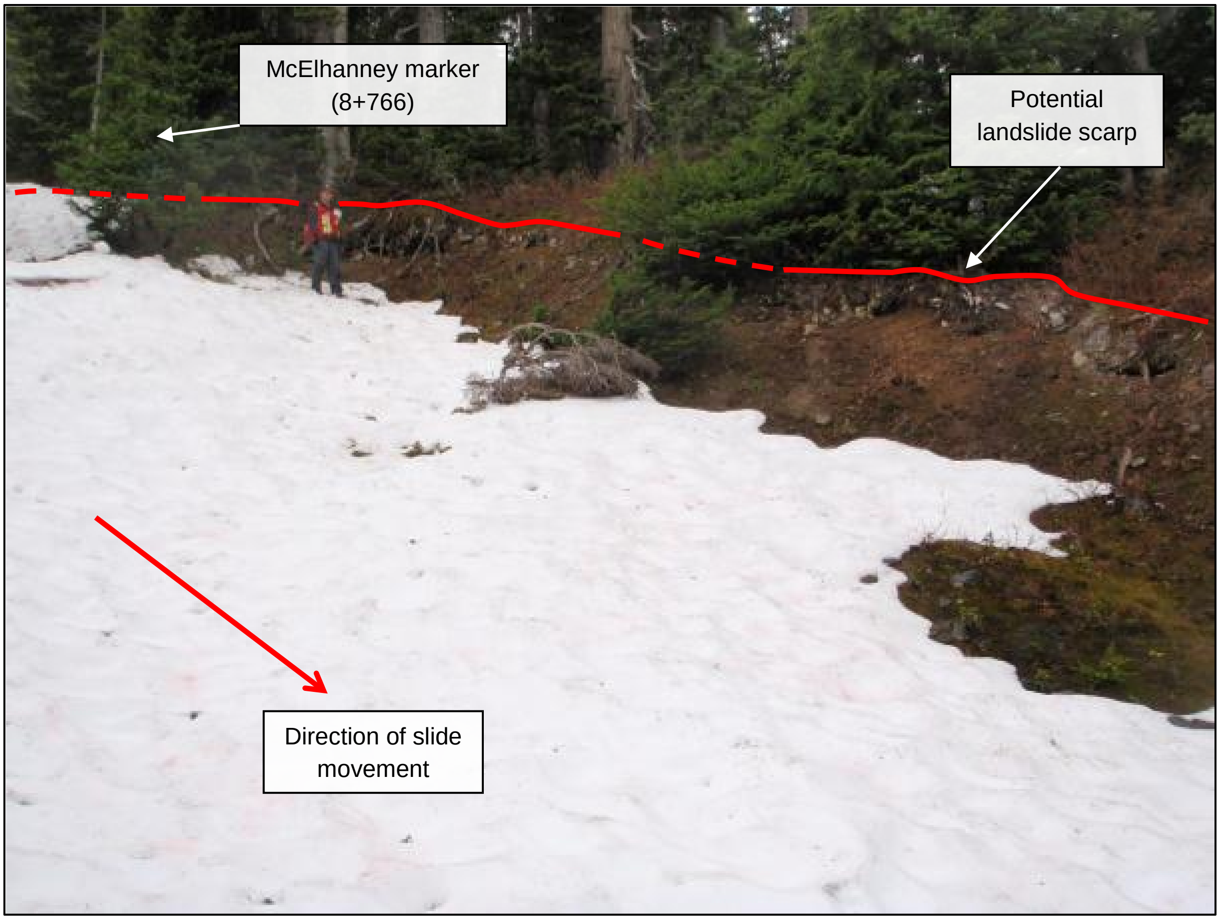
Photograph 20 **North Treaty Lower, North Treaty Upper and Cutoff Ditch Access Roads – Looking southwest from North Treaty Creek towards the proposed tailings management facility (foreground).**



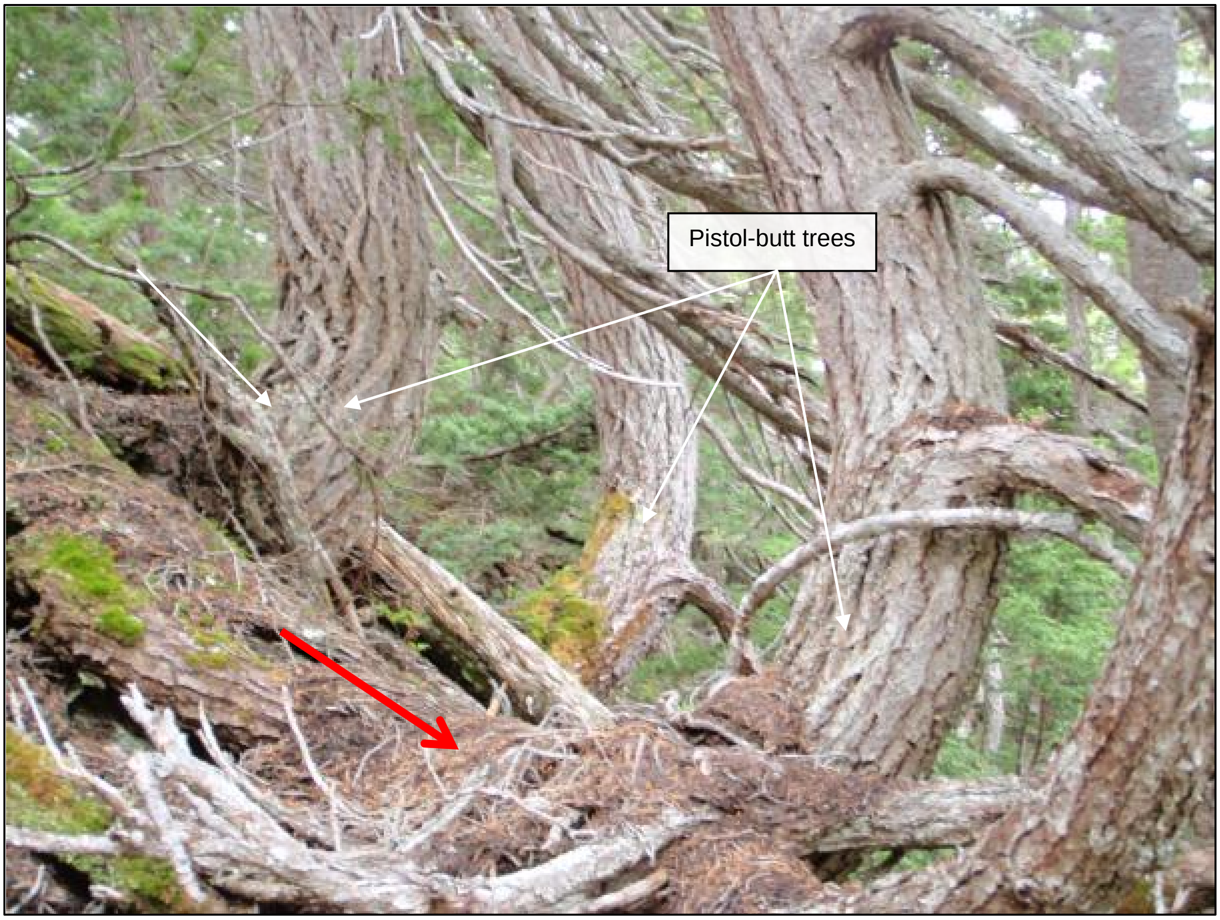
**Photograph 21	North Treaty Creek Lower Access Road – Looking upchain (northwest) towards Km 11+670.**

Photograph 22 **North Treaty Upper Access Road – Looking upslope (south-southeast) from the left bank towards Km 1+480 at small landslide scarp (drawn in red) on the right bank of the creek. The small slump is 10 m to 15 m wide, 15 m to 20 m long on the slopes of a snowmelt channel. Soil is comprised of loose to compact sand (~50%) and gravels (~30%) with fines (~10-20%).**

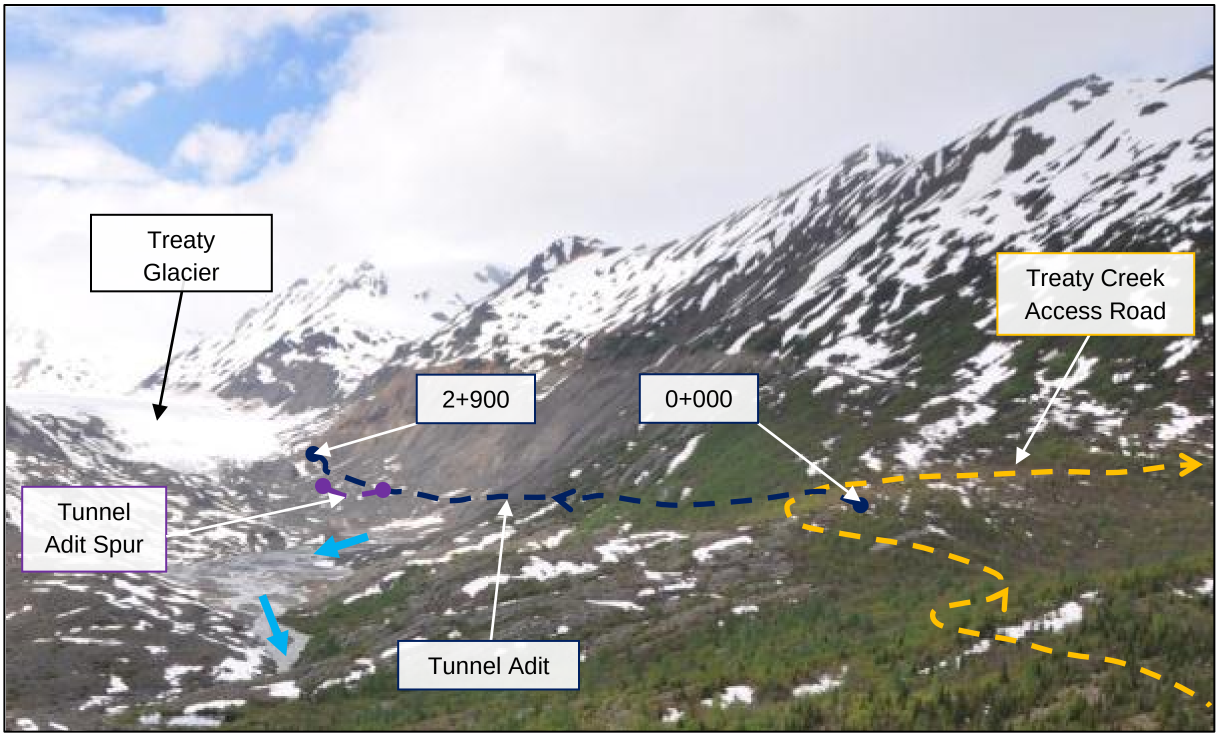
Photograph 23 North Treaty Upper Access Road – Looking upslope approximately 15 m from Km 2+400 of the North Treaty Upper access road towards a bedrock exposure. The bedrock is a slightly weathered (W2), medium strong (R3) sandstone with a highly persistent joint set that strikes sub parallel to the proposed road centerline (dip/dip direction is 44/043 degrees with joint persistence >18 m).



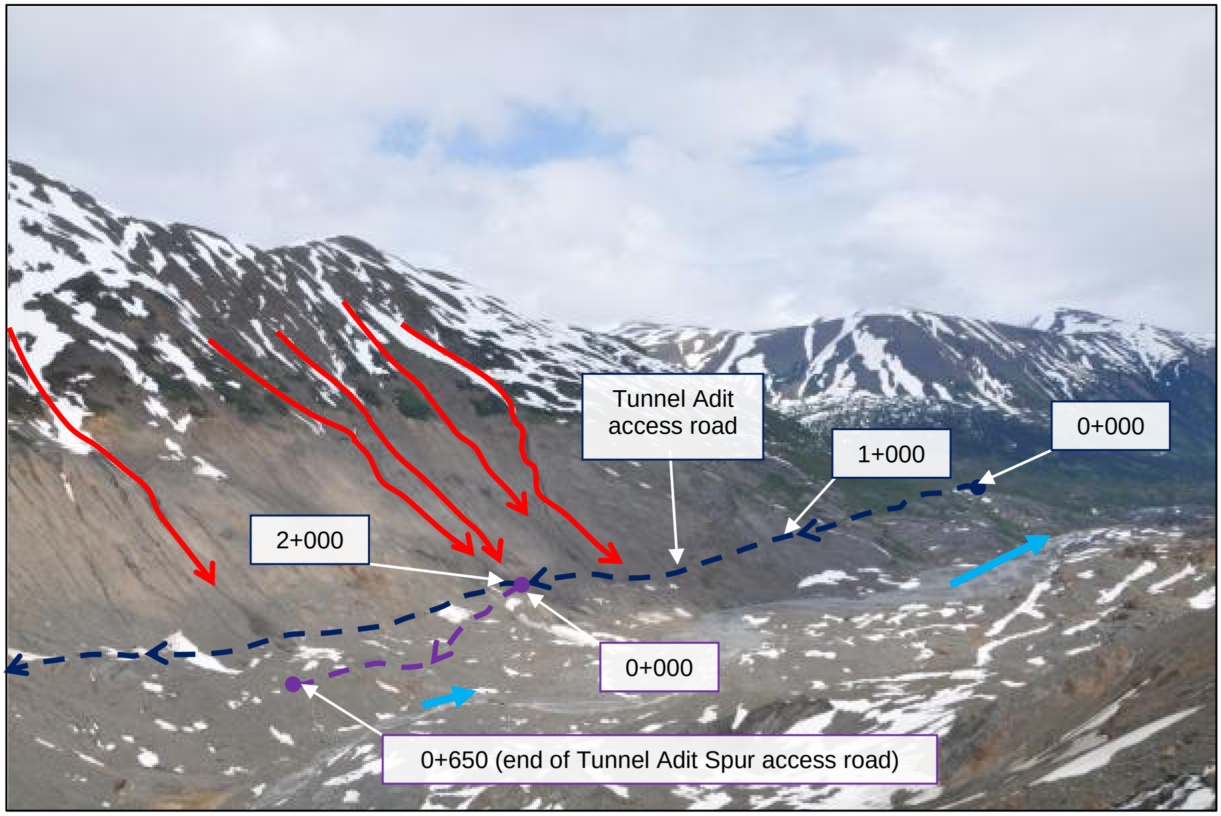
Photograph 24 **North Treaty Lower Access Road – Looking upslope (southwest) at a potential landslide scarp from approximately 20 m downslope of Km 8+766 on North Treaty Lower access road. Potential scarp is approximately 20 m wide, snow cover and lack of trees extends >80 m downslope.**



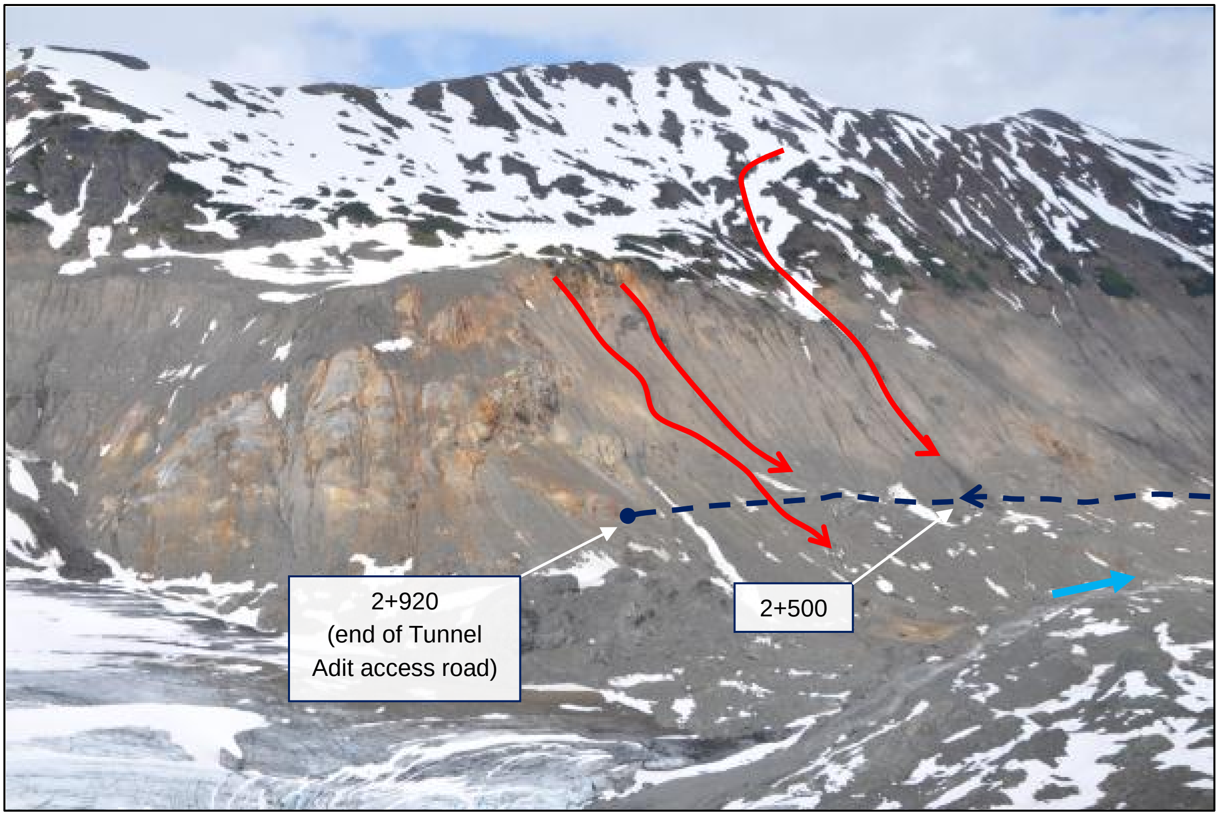
Photograph 25 **North Treaty Lower Access Road – Looking cross slope (north) from Km 8+880 of the North Treaty Lower access road at pistol-butt trees on a steep slope (downslope angle - 45^{o}). Red arrow illustrates the direction of soil creep towards the stream downslope.**



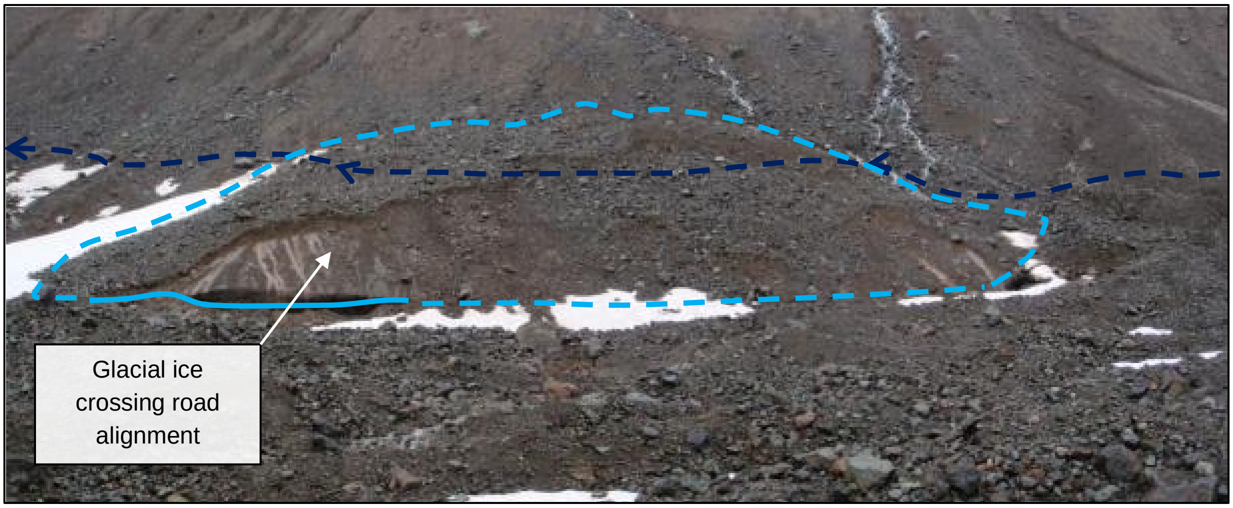
Photograph 26 **Tunnel Adit and Tunnel Adit Spur Access Roads – Looking downchain (southwest) from Treaty Creek access road towards the Tunnel Adit and Tunnel Adit Spur access roads.**



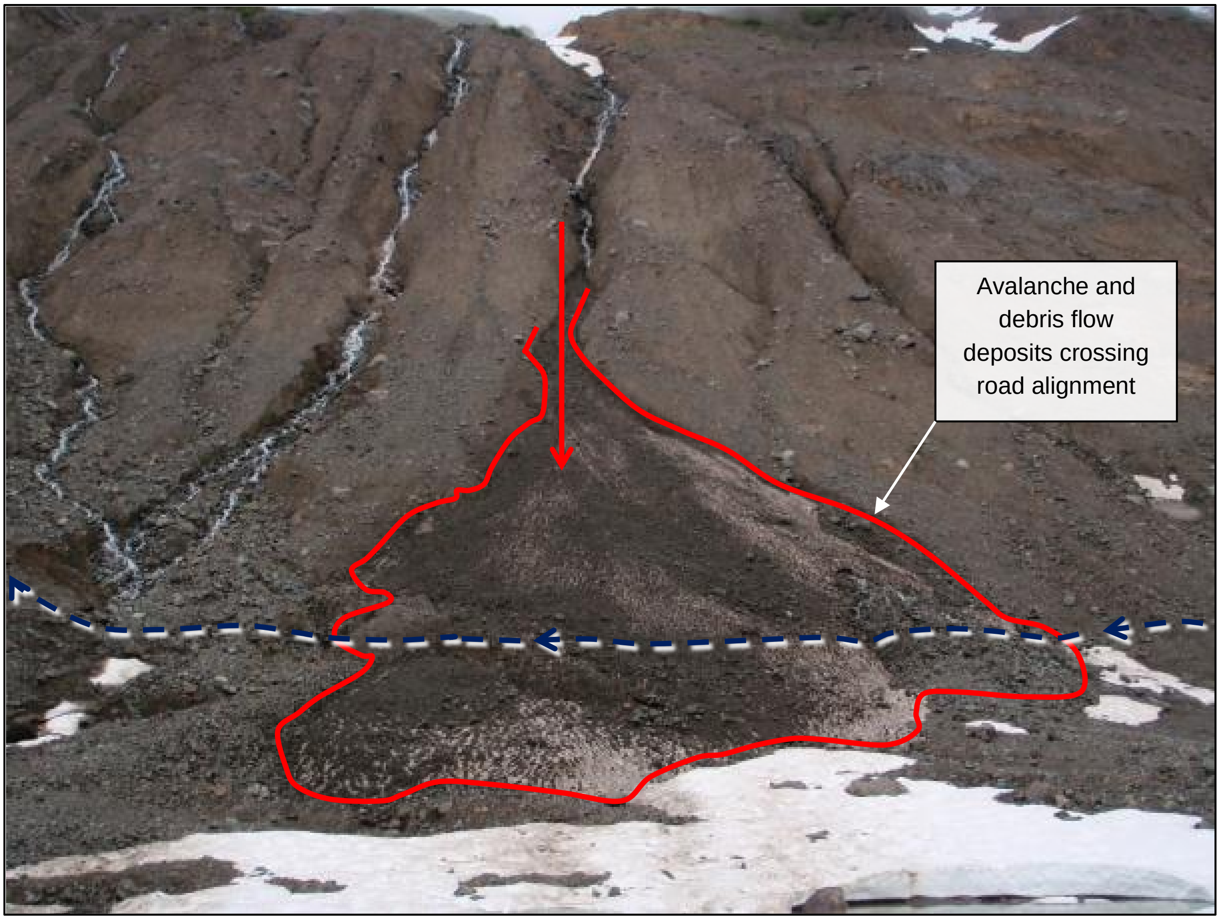
Photograph 27 **Tunnel Adit and Tunnel Adit Spur Access Roads – Looking upchain (northeast) towards Km 0+000. Debris-flow paths identified in the BGC (2012) geohazards report are illustrated by the red arrows.**



Photograph 28 **Tunnel Adit and Tunnel Adit Spur Access Roads – Looking northwest at the Tunnel Adit access road towards the end of the road at Km 2+920. Debris-flow paths identified in the BGC (2012) geohazards report are illustrated by the red arrows.**



Photograph 29 **Tunnel Adit and Tunnel Adit Spur Access Roads – Looking upslope (northwest) at glacial ice (~80 m long and 25 m to 30 m tall) which crosses the alignment between Km 2+420 and Km 2+500.**



Photograph 30 **Tunnel Adit and Tunnel Adit Spur Access Roads – Looking upslope (northwest) at avalanche and debris flow deposits which cross the alignment between Km 2+400 and Km 2+600.**

Photograph 31 **Tunnel Adit & Tunnel Adit Spur Access Roads – Looking upslope (north) from the Tunnel Adit at Km 2+200 towards rock fall hazards upslope (boulders up to 3 m diameter).**

APPENDIX C
ROAD MAPS

The following sets of road maps show the road sections, terrain stability mapping polygons, type of field survey, GPS waypoint numbers, and surficial material observations from the TSFA. A legend explaining the terrain stability mapping polygon labels is provided at the beginning of the drawing set.

Road maps along the proposed Treaty Creek access road are shown in Drawings TC-01 to TC-18. Road maps for the North Treaty group of roads (Lower, Upper and Cut-off Ditch) are shown in Drawings NT-01 to NT-06. Drawings TA-01 and TA-02 show the road maps for the proposed Tunnel Adit and Tunnel Adit Spur access roads.

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LEGEND

- STUDY BOUNDARY
- GPS WAYPOINT
- ACCESS ROAD

SURFICIAL MATERIAL

- COLLUVIUM
- COLLUVIUM/ROCK
- COLLUVIUM/SWAMPY
- COLLUVIUM/TILL
- TILL/ROCK
- ICE
- HELICOPTER SURVEY
- GROUND SURVEY
- DEBRIS FLOW (Rd, Rsd)
- DEBRIS AVALANCHE (Rs)
- ROCKFALL (Rb)
- SLOPE SAGGING (Fm)
- ROCK AVALANCHE (Rr)
- ROCK SLUMP (Rm)
- ROCKFALL AND DEBRIS FLOW OR AVALANCHE (Rbd, Rbs)

- LANDSLIDE PATH
- LANDSLIDE SCARP
- SACKUNG

STABILITY CLASS

- IV
- V
- CREEK
- 100 M CONTOUR
- 20 M CONTOUR
- TERRAIN POLYGON

R" RAPID LANDSLIDE (INITIATION ZONE)
R RAPID LANDSLIDE (RUNOUT ZONE)
F" SLOW LANDSLIDE (INITIATION ZONE)
F SLOW LANDSLIDE (RUNOUT ZONE)

NOTES:

1. THIS MAP SHOULD BE READ WITH THE ACCOMPANYING REPORT.
2. SMALL MAGNITUDE GEOHAZARDS EXIST (E.G. LOCALIZED ROCKFALL) THAT WERE TOO SMALL TO MAP.
3. ARROWED LANDSLIDE PATHS SHOW GENERAL SLIDE TRAJECTORIES. THEY DO NOT SHOW HAZARD EXTENTS. PATH ARROWS EXTEND INTO THE GENERAL RUNOUT ZONE BUT DO NOT REPRESENT THE MAXIMUM RUNOUT LIMIT.
4. LANDSLIDE HAZARD EXENTS ARE SHOWN BY SHADED POLYGONS. THEY SHOW EXISTING LANDSLIDE HAZARD INITIATION ZONE AND RUNOUT AREAS. POLYGON BOUNDARIES SHOULD BE REGARDED AS TRANSITIONS, NOT SHARP BOUNDARIES.
5. RUNOUT ZONES OF POTENTIAL LARGE LANDSLIDES (E.G. ROCK AVALANCHES) ARE NOT SHOWN ON THE MAP. WHERE EXISTING, THESE ARE DESCRIBED AS RISK SCENARIOS IN THE TEXT.
6. THIS MAP IS A SNAPSHOT IN TIME. CHANGES IN LAND USE (E.G. DEVELOPMENT, GLACIAL RETREAT) MAY WARRANT RE-DRAWING OF CERTAIN AREAS.
7. ROAD ALIGNMENTS FOR THE PROPOSED TREATY CREEK, NORTH TREATY LOWER, NORTH TREATY UPPER, TUNNEL ADIT AND TUNNEL ADIT SPUR ACCESS ROADS FROM MCELHANNEY (MAY 17, 2012). ROAD ALIGNMENT FOR THE PROPOSED CUT-OFF DITCH ACCESS ROAD FROM MCELHANNEY (JULY 6, 2012).

POLYGON LABELS

Polygon number	123
Terrain symbol	Cv/Rs – R"b
Drainage class	w
Terrain stability class	V
Surface erosion potential	M

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	a	Channel Avulsion		

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.

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PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: LEGEND

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013		A

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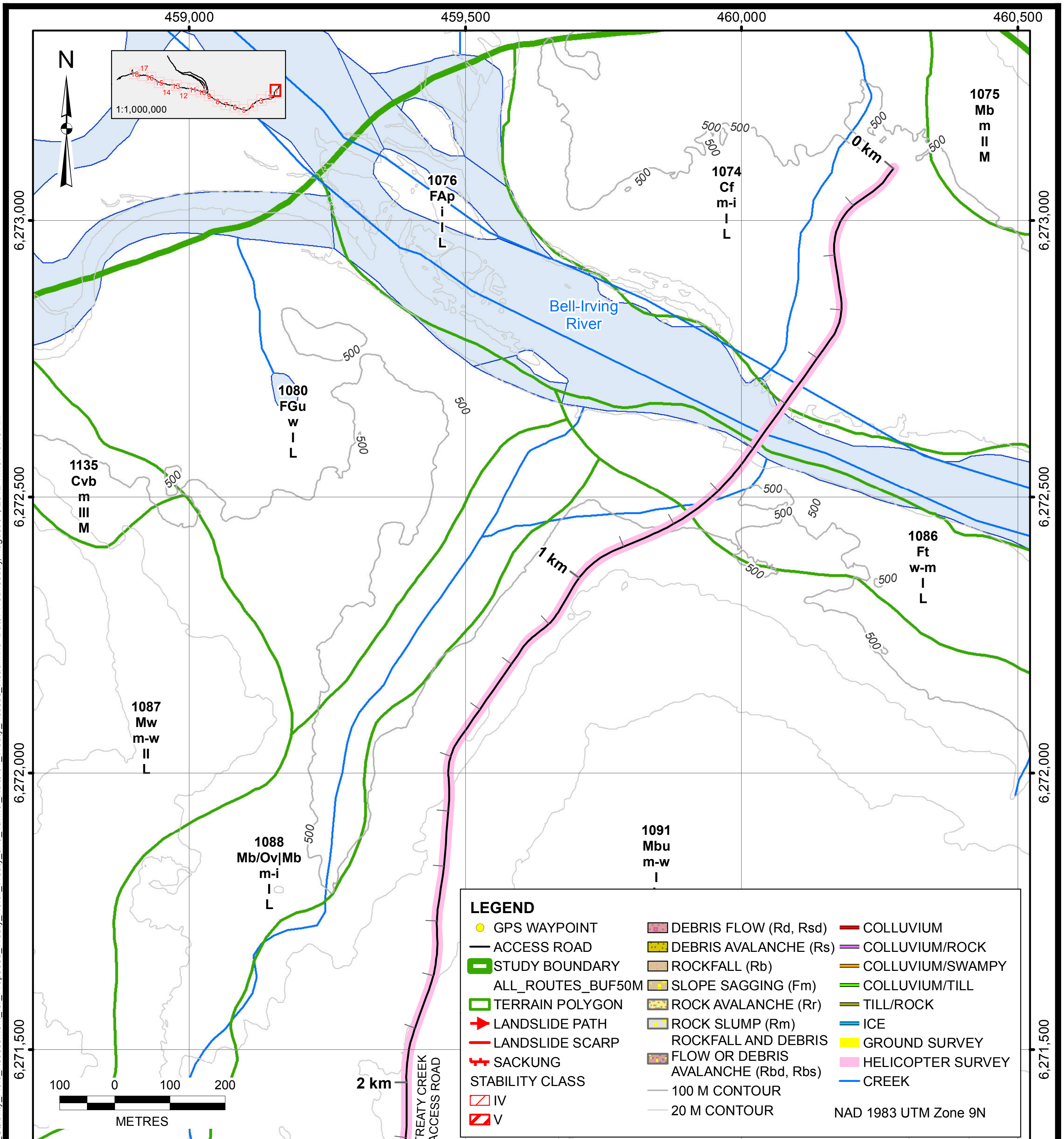

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PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 1 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
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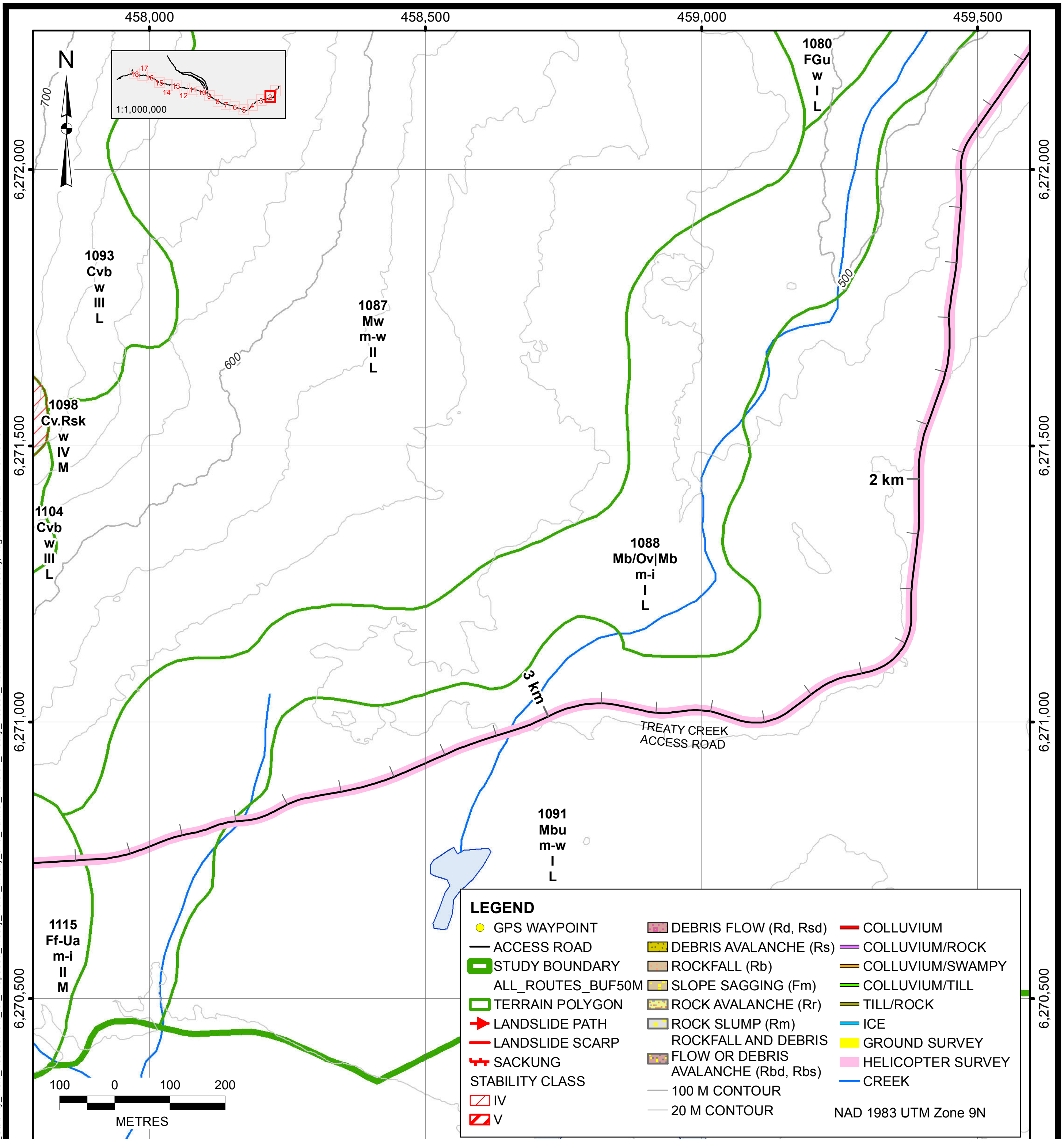

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PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 2 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 02	A

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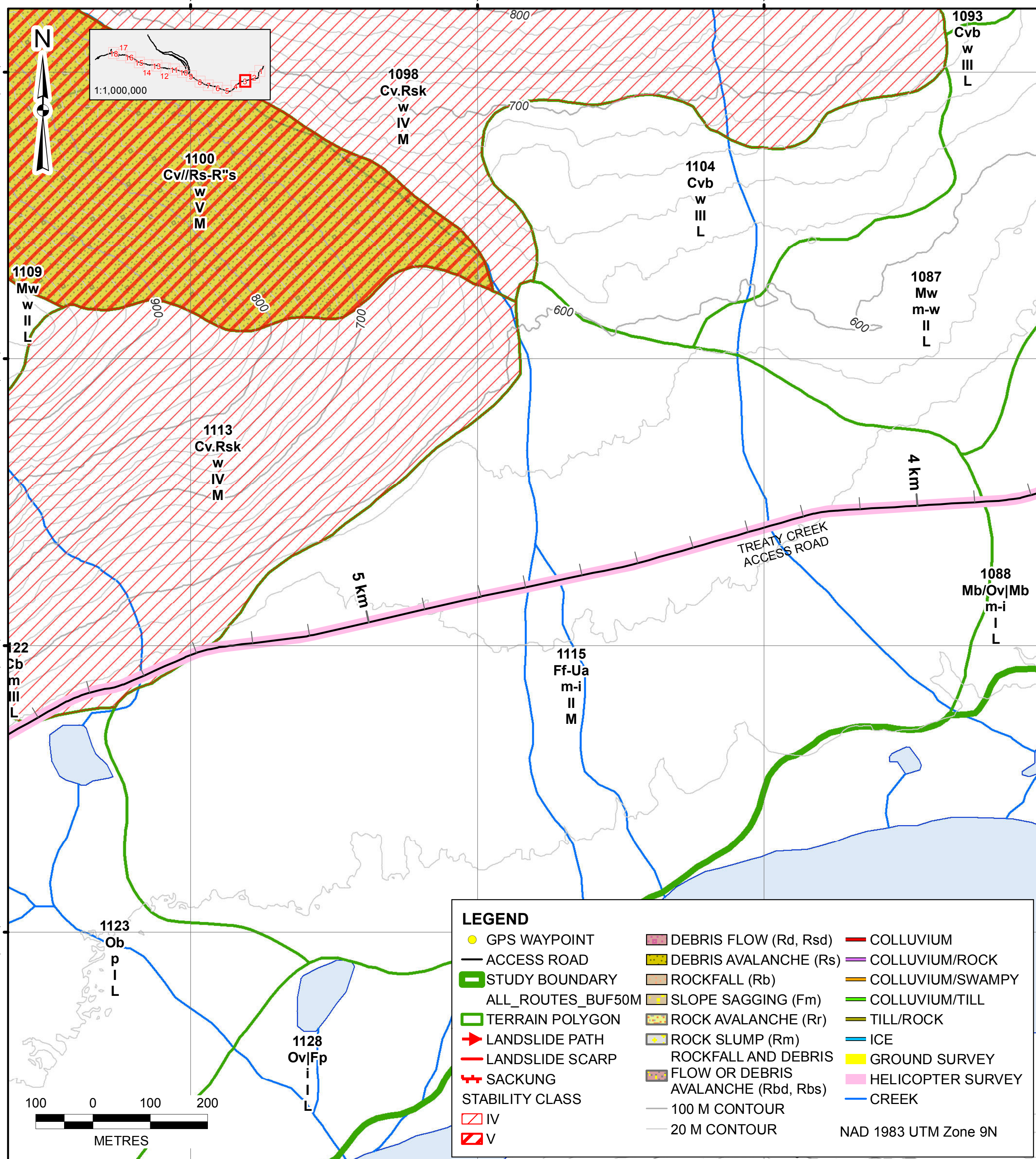

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PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 3 OF 18

CLIENT: SEABRIDGE GOLD INC.

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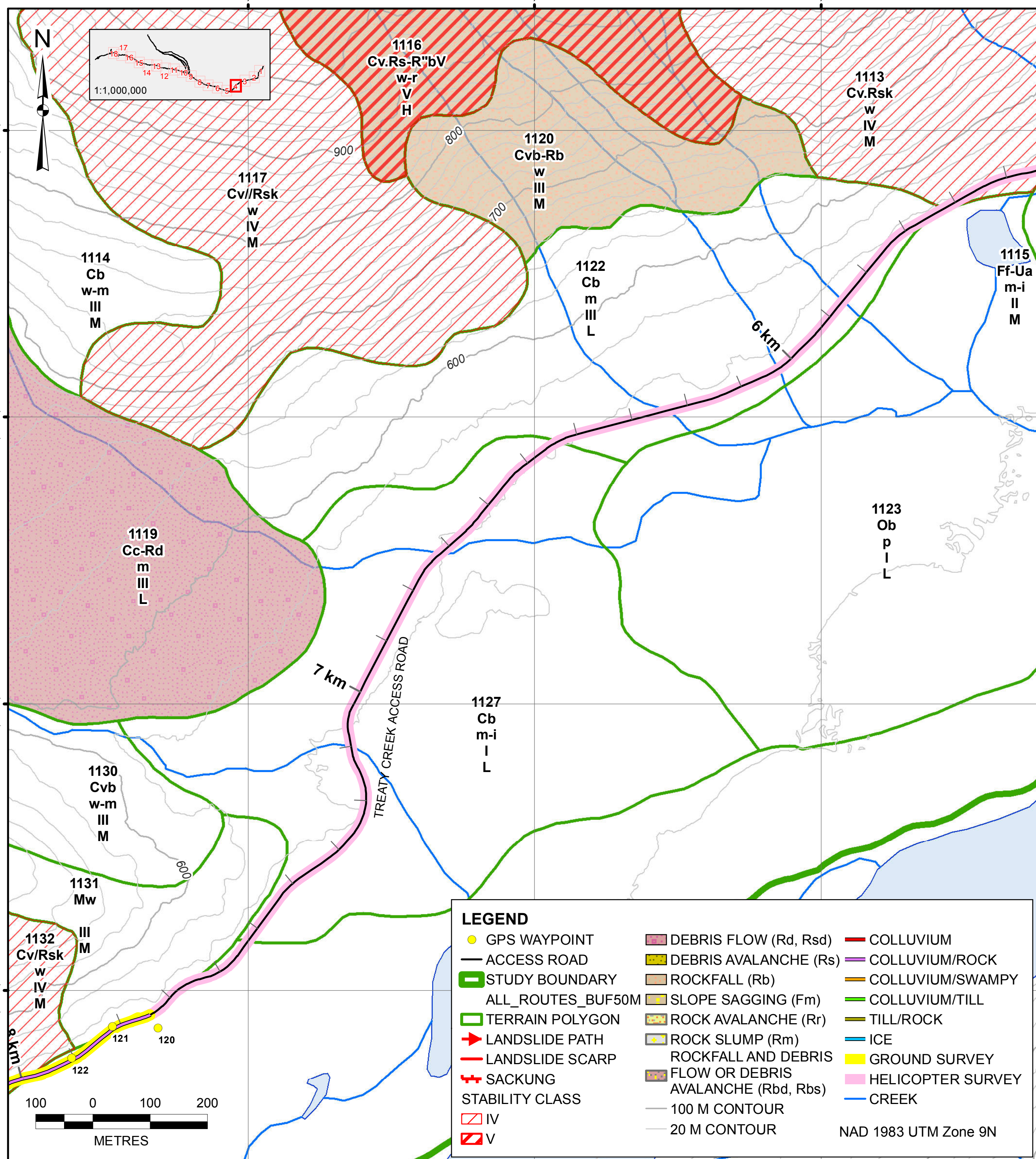

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PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 4 OF 18

CLIENT: SEABRIDGE GOLD INC.

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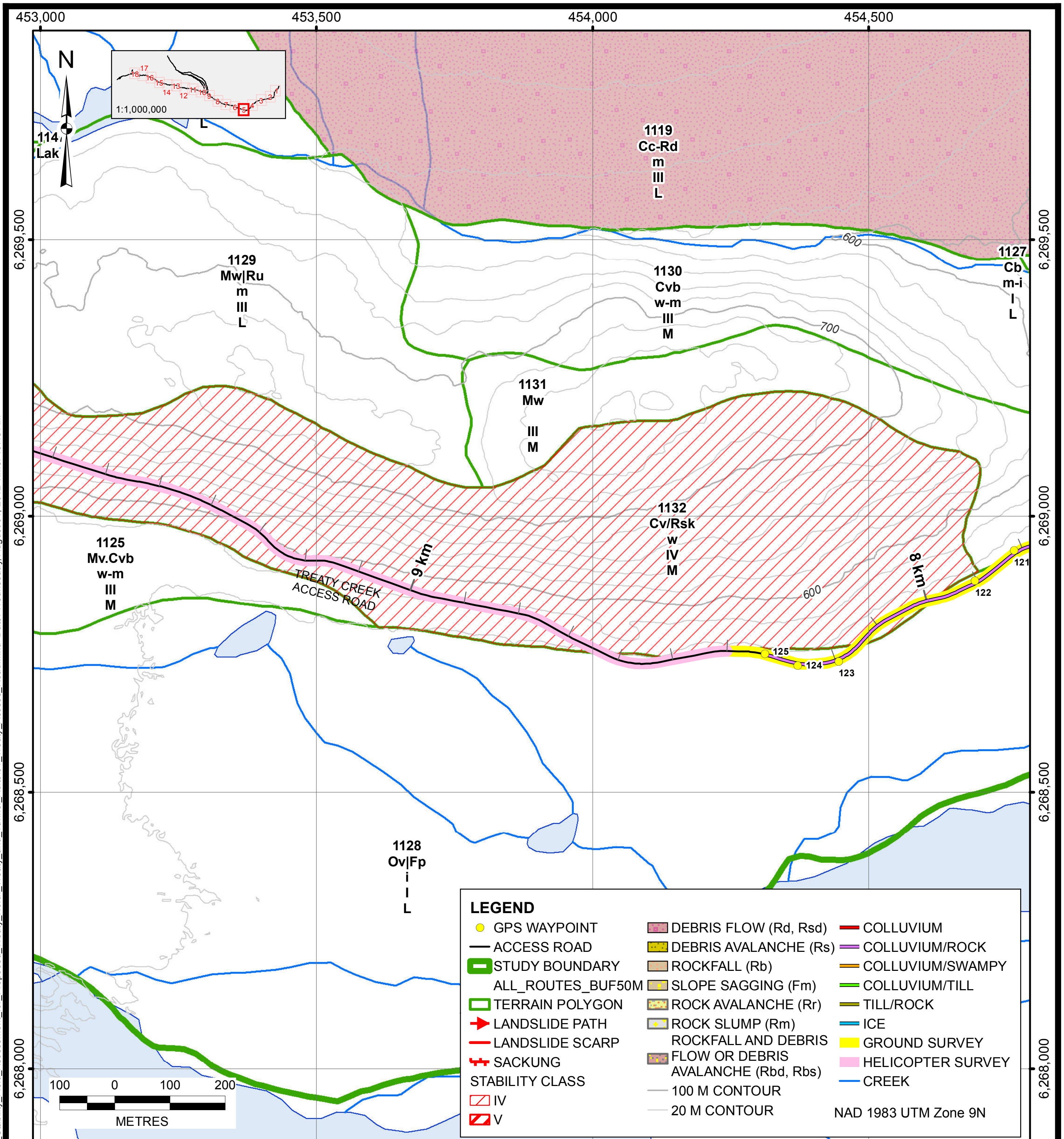

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TITLE: TREATY CREEK ACCESS ROAD

MAP 5 OF 18

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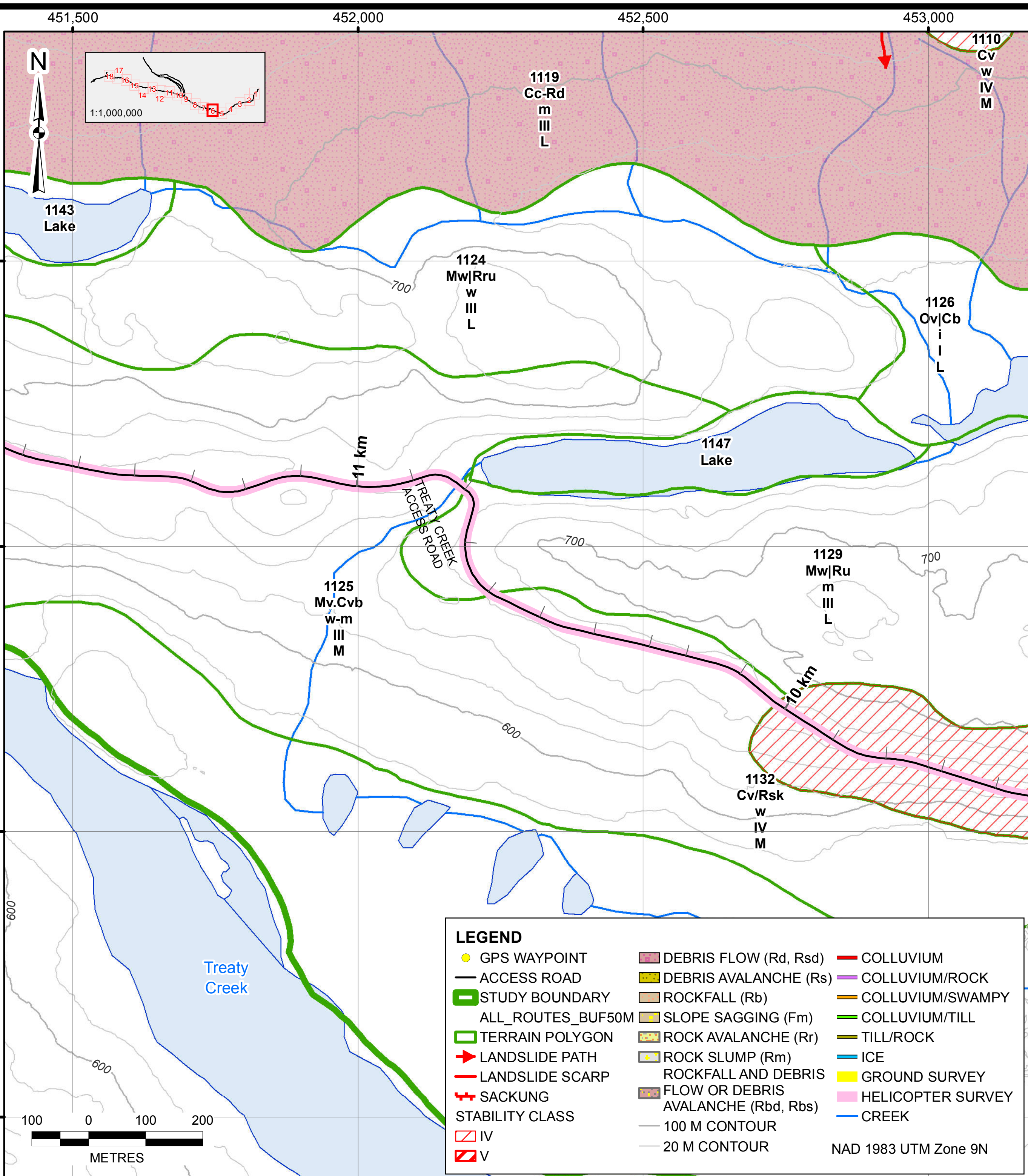

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TITLE: TREATY CREEK ACCESS ROAD
MAP 6 OF 18

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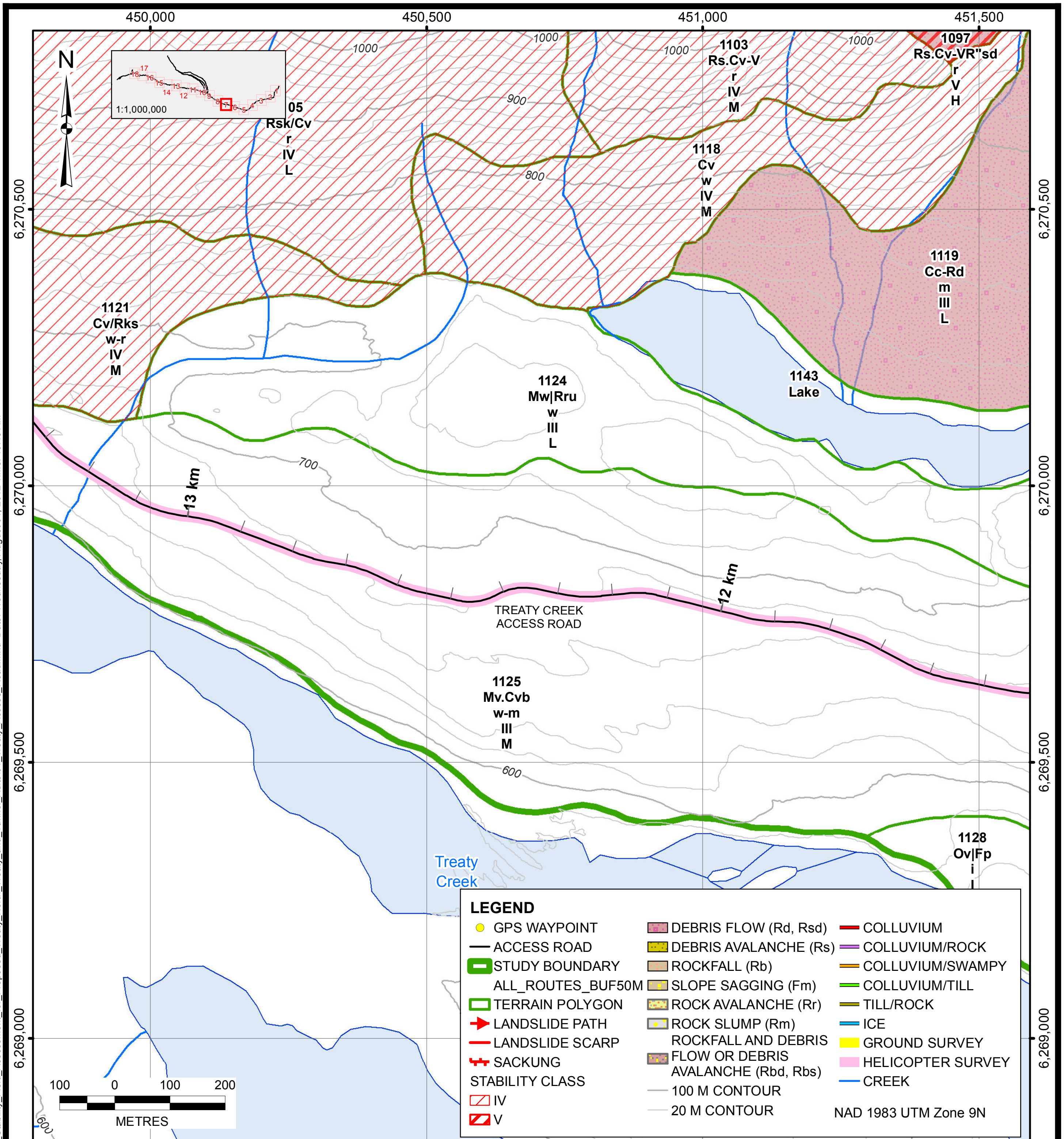

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TITLE: TREATY CREEK ACCESS ROAD

MAP 7 OF 18

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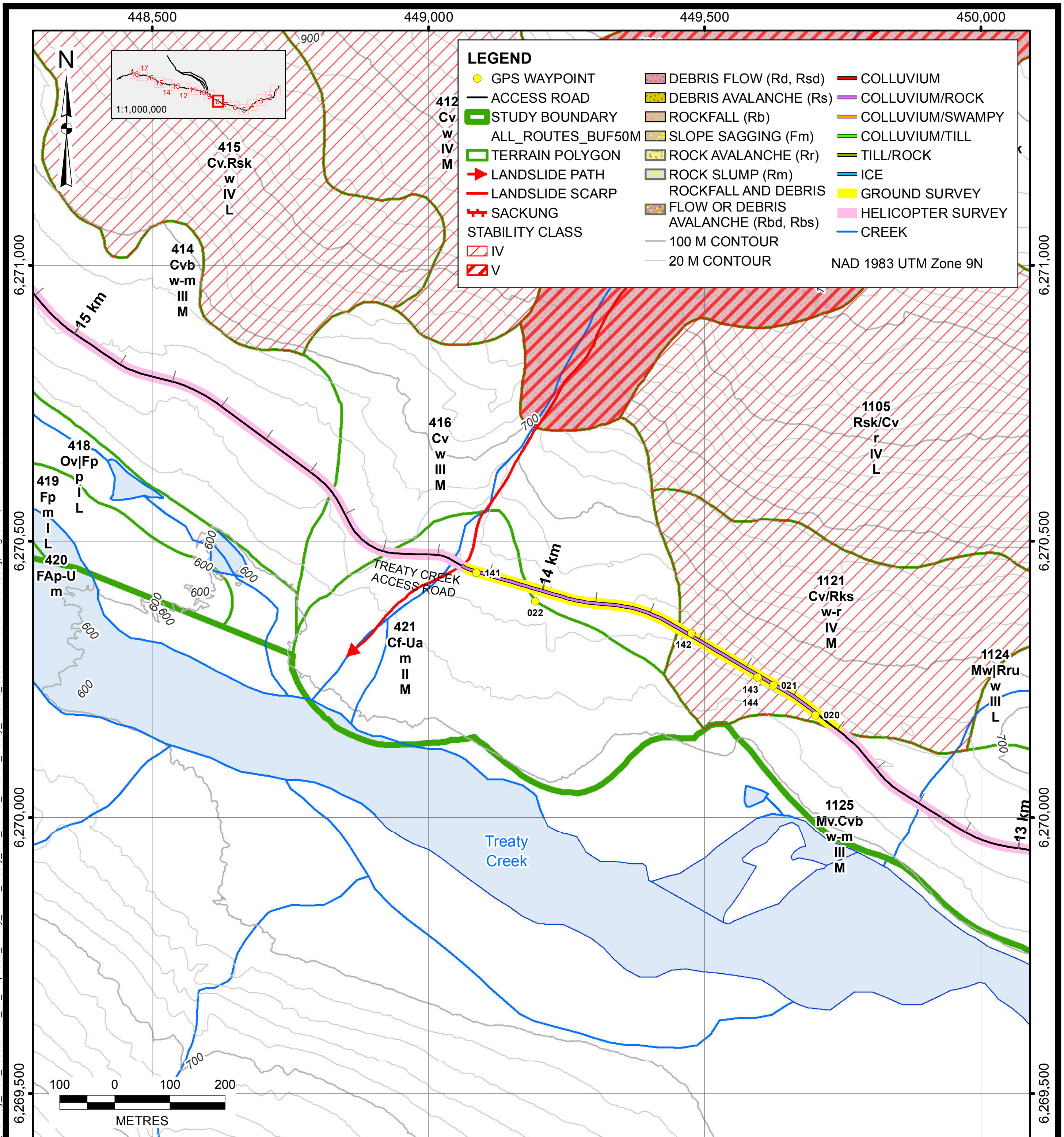

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MAP 8 OF 18

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0638-013	TC - 08	A

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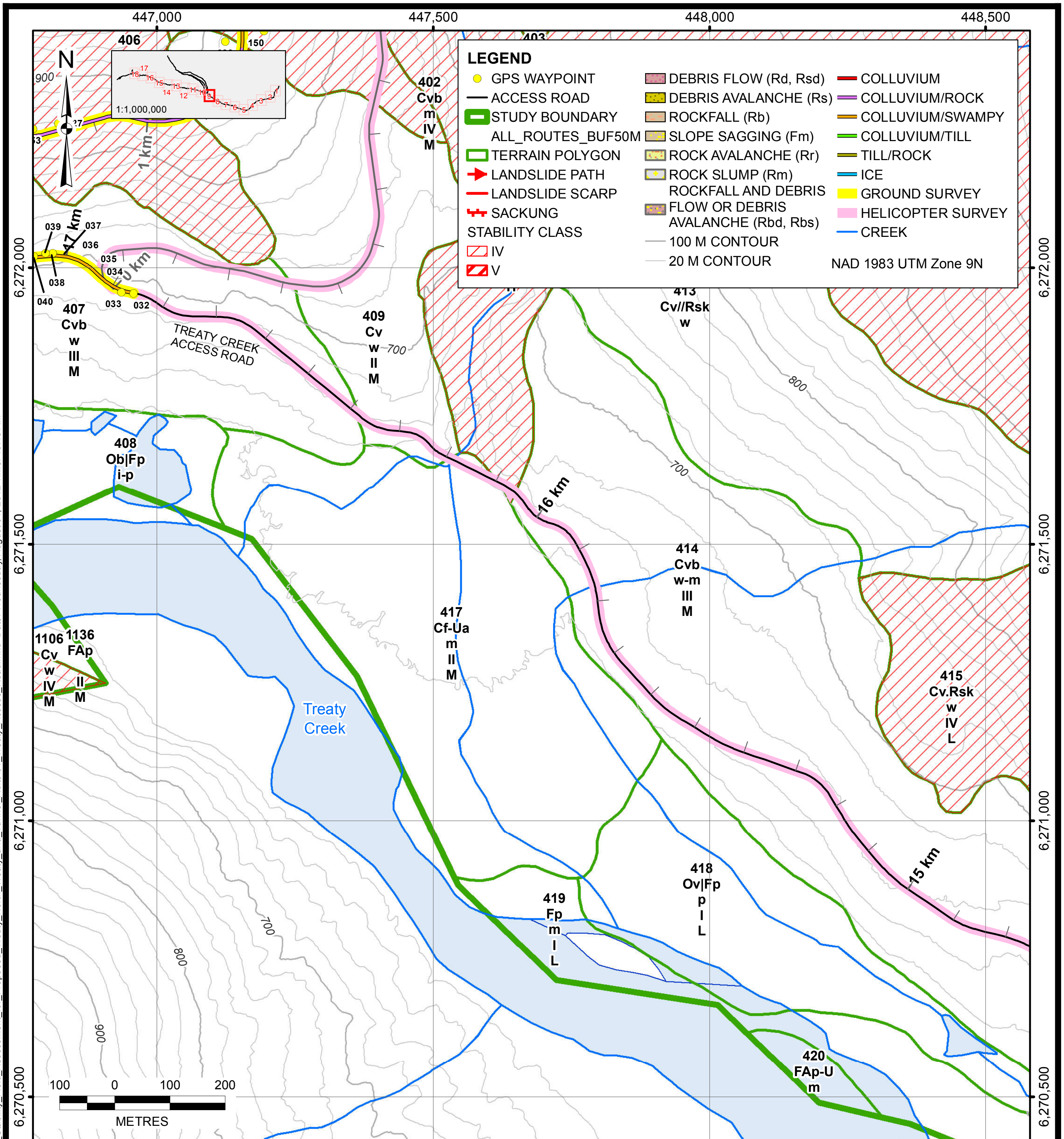
DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT:
TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

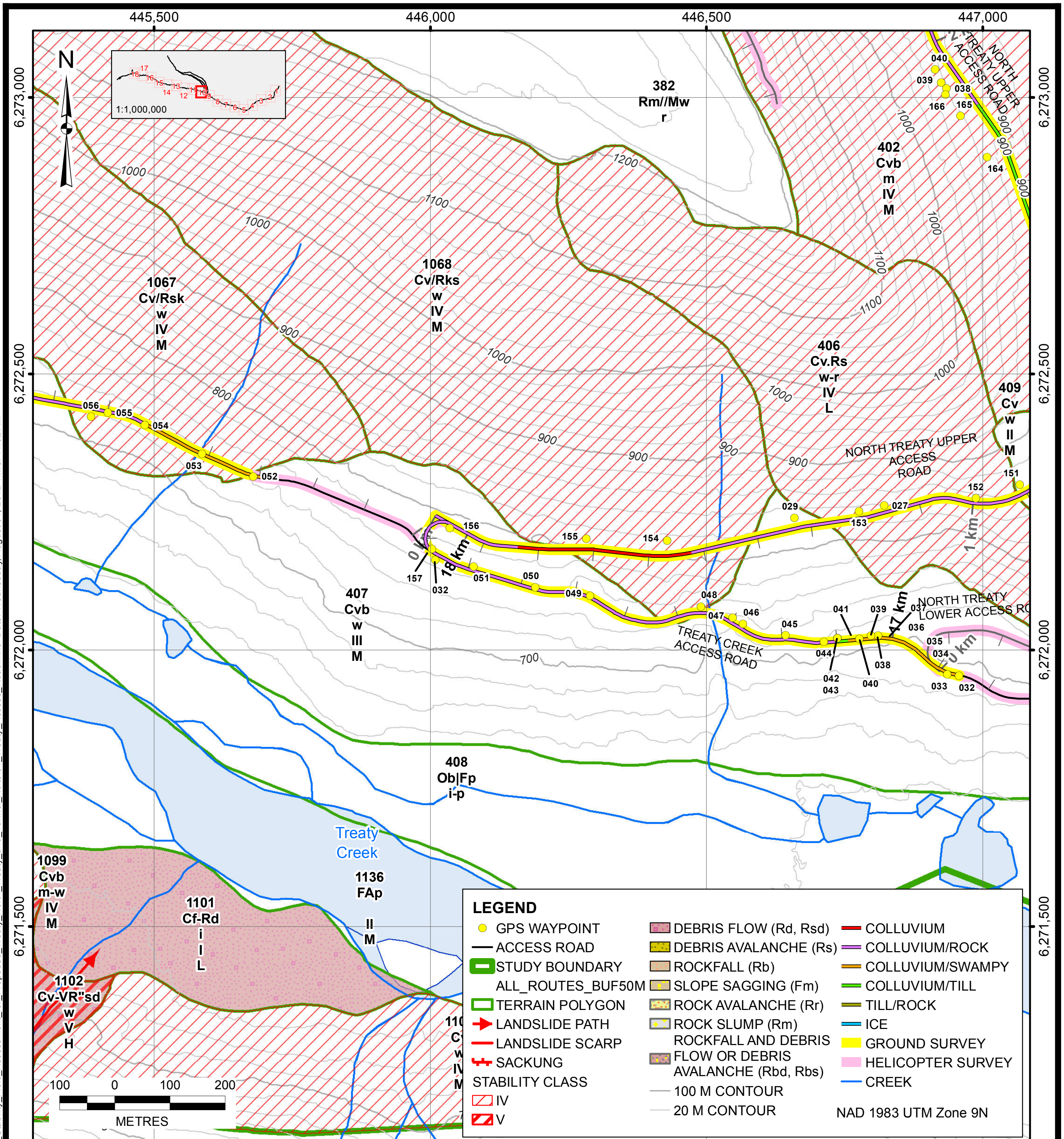
TITLE:
TREATY CREEK ACCESS ROAD

MAP 9 OF 18

CLIENT:
SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 09	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 10 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 10	A

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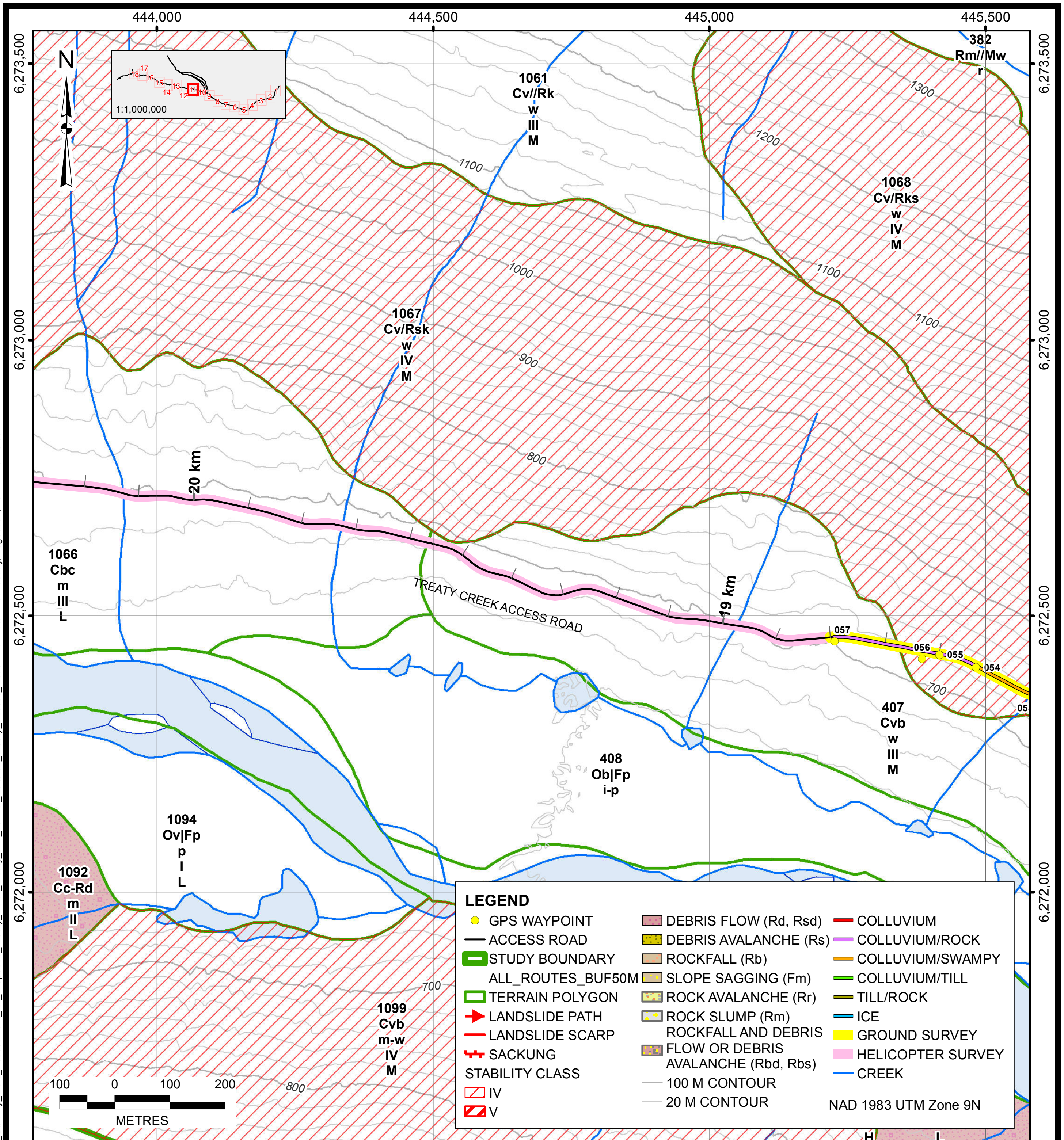

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SCALE:	1:10,000	DESIGNED:	SK
DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

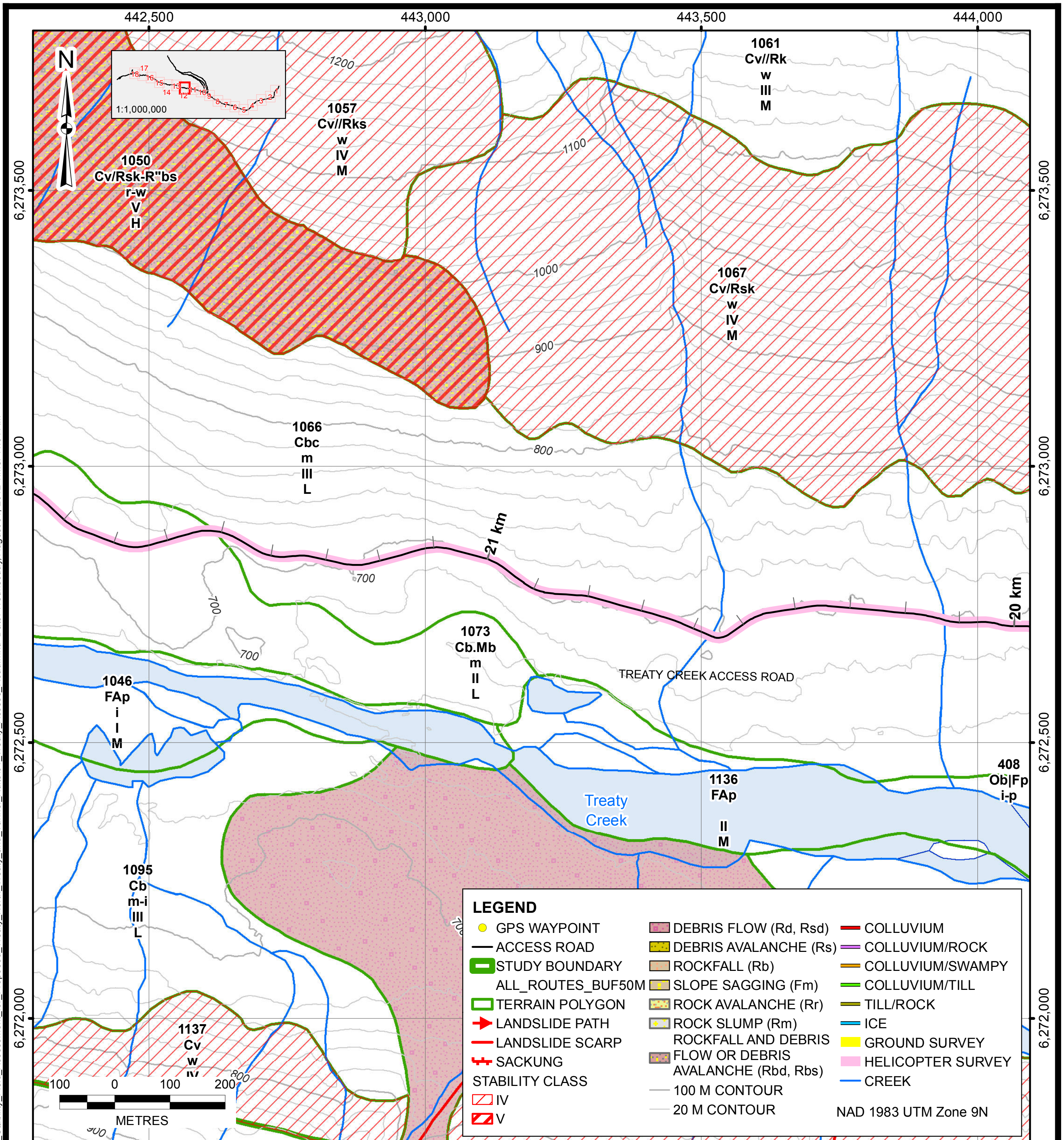
TITLE: TREATY CREEK ACCESS ROAD

MAP 11 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.: 0638-013	DWG No.: TC - 11	REV.: A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 12 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 12	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012

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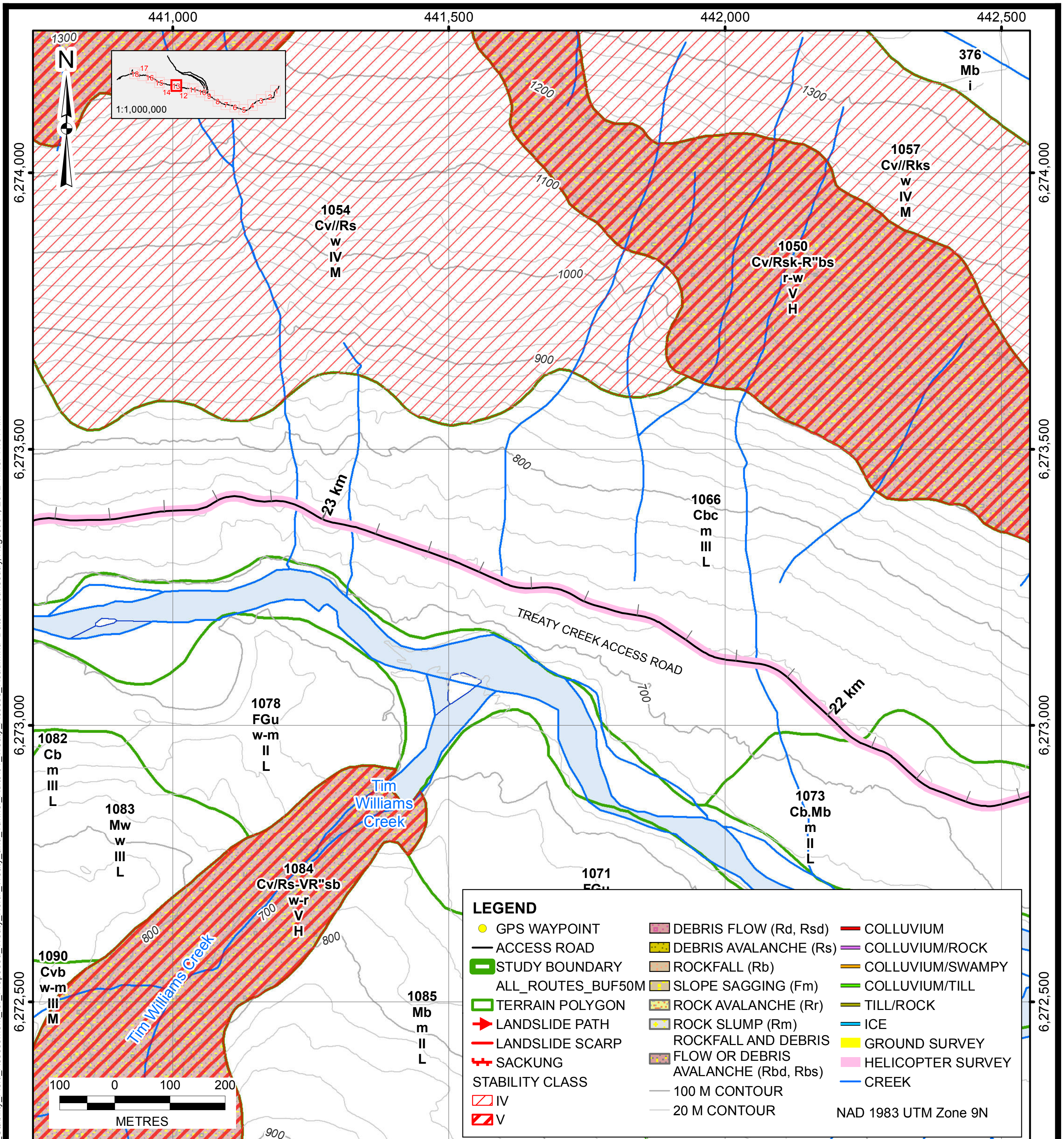

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SCALE:	1:10,000	DESIGNED:	SK
DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

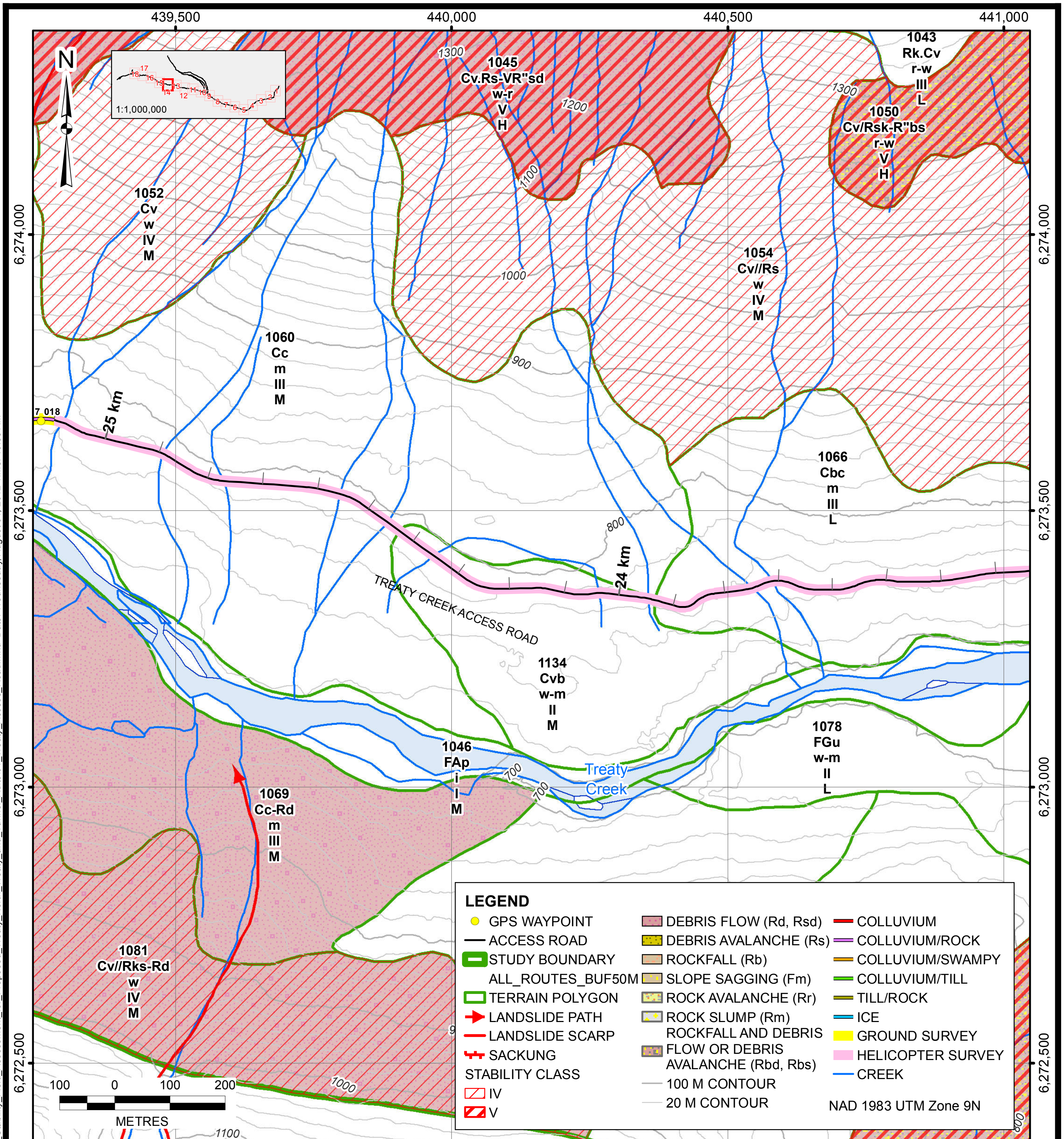
TITLE: TREATY CREEK ACCESS ROAD

MAP 13 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 13	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

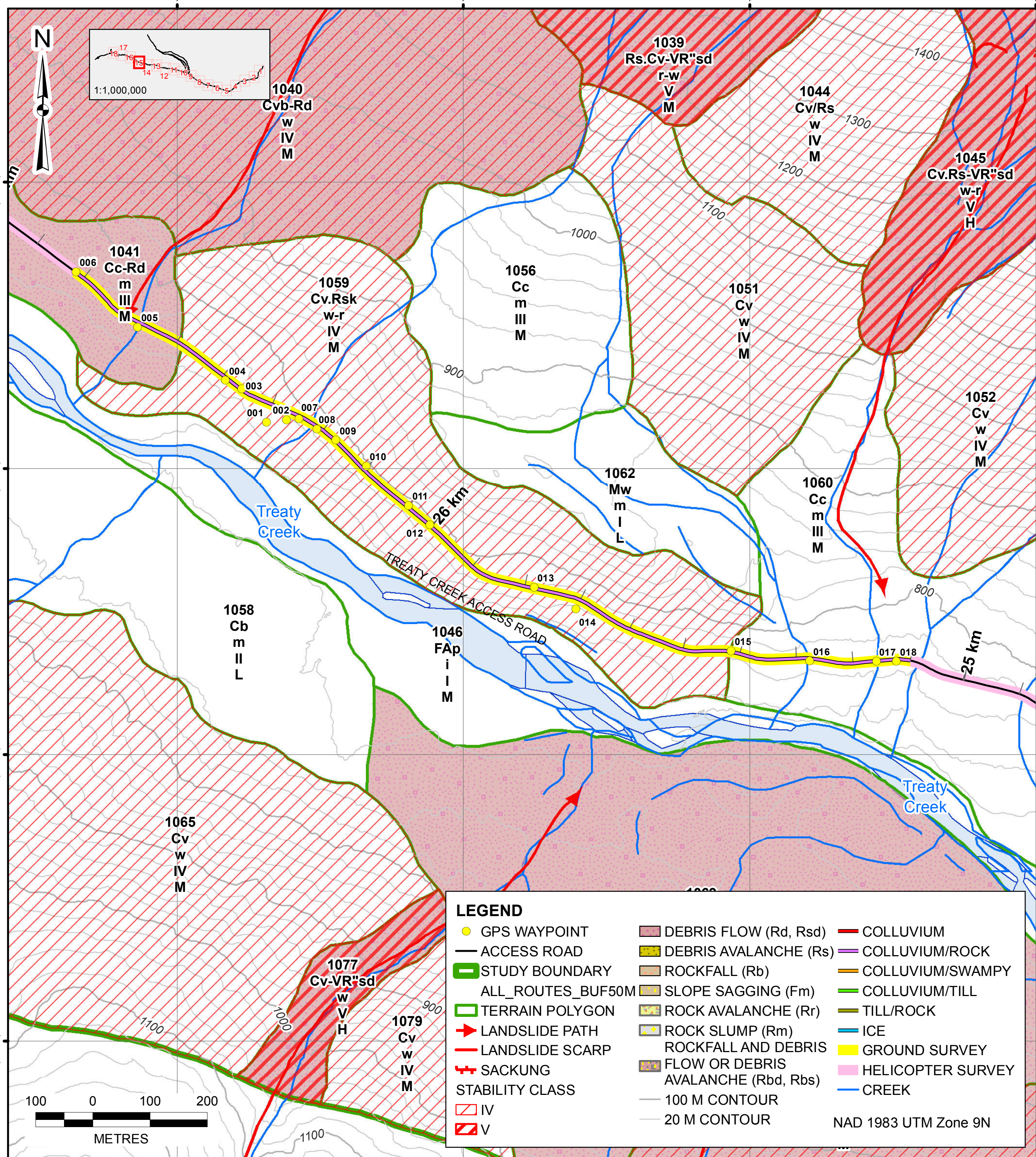
PROJECT:
TERRAIN STABILITY FIELD ASSESSMENT
OF THE PROPOSED TREATY CREEK, NORTH TREATY
AND TUNNEL ADIT ACCESS ROADS

TITLE:
TREATY CREEK ACCESS ROAD
MAP 14 OF 18

CLIENT:
SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 14	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 15 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 15	A

X:\Projects\0638\013\Workspace\20120705_REPORT_Terrain_Stability_Field_Assessment_for_Proposed_Treaty_North_Treaty_and_Tunnel_Adits\01_Treaty_Access_Road.mxd Date: Wednesday, August 01, 2012 Time: 10:58 AM

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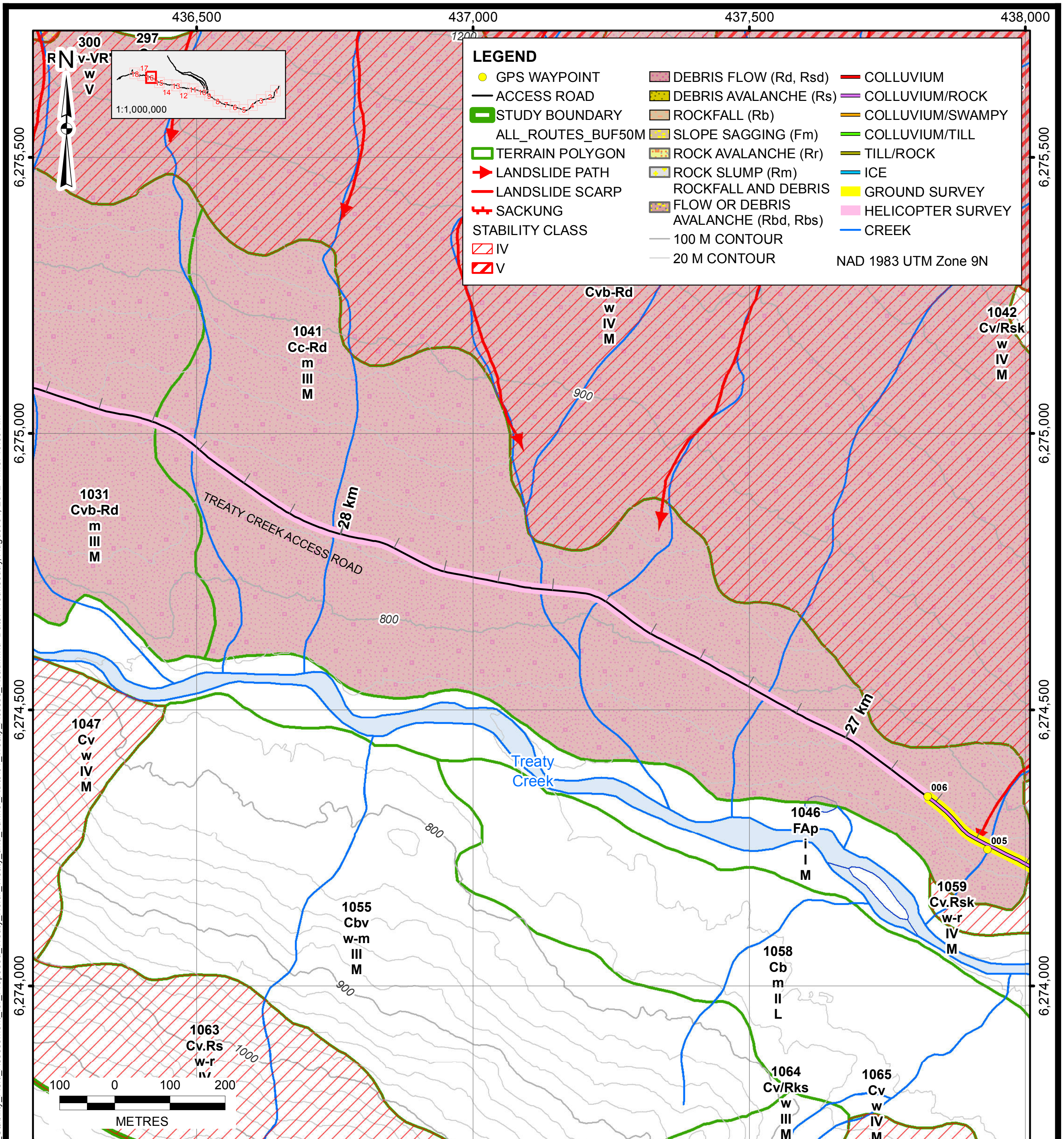

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SCALE:	1:10,000	DESIGNED:	SK
DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

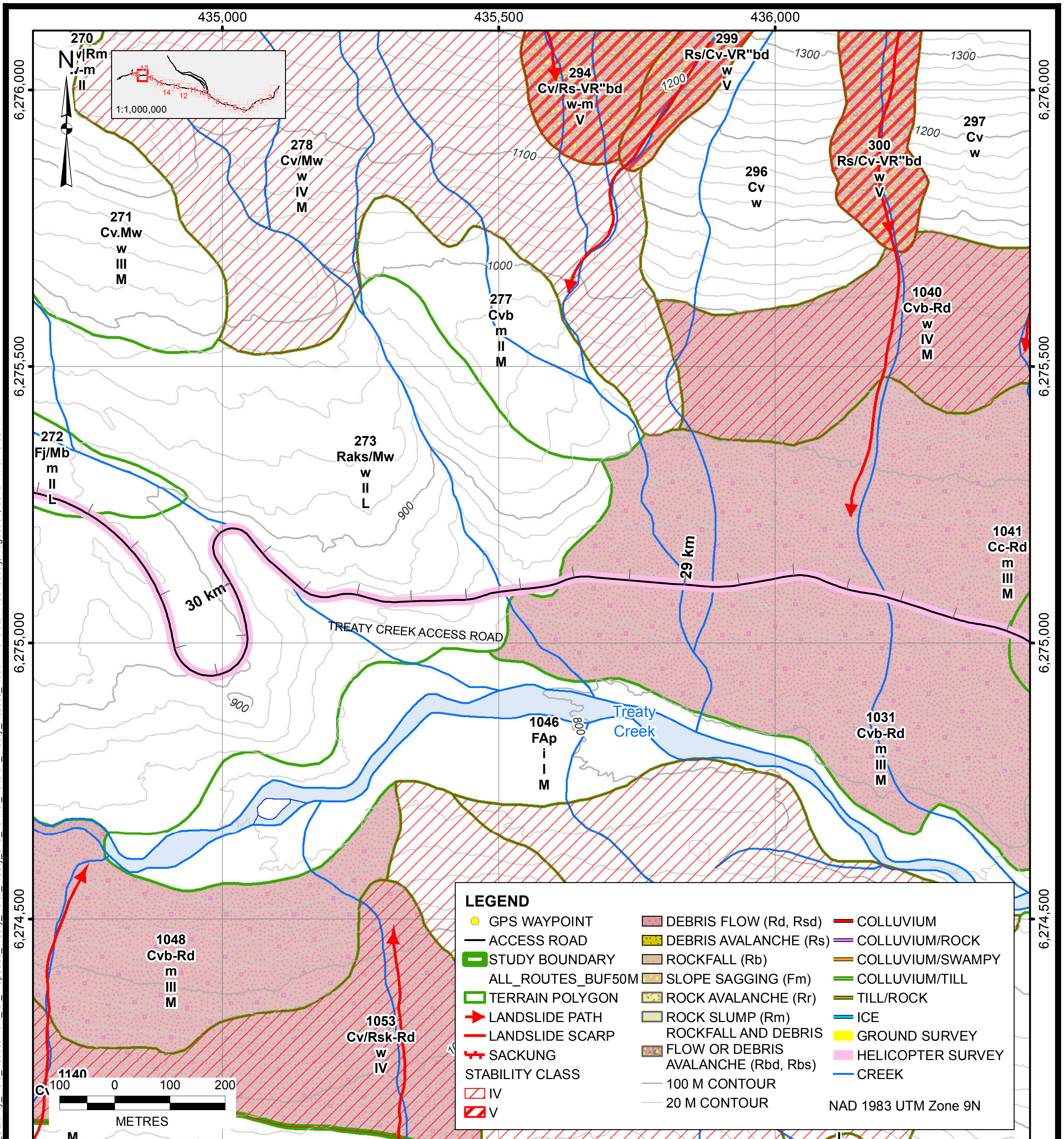
TITLE: TREATY CREEK ACCESS ROAD

MAP 16 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 16	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

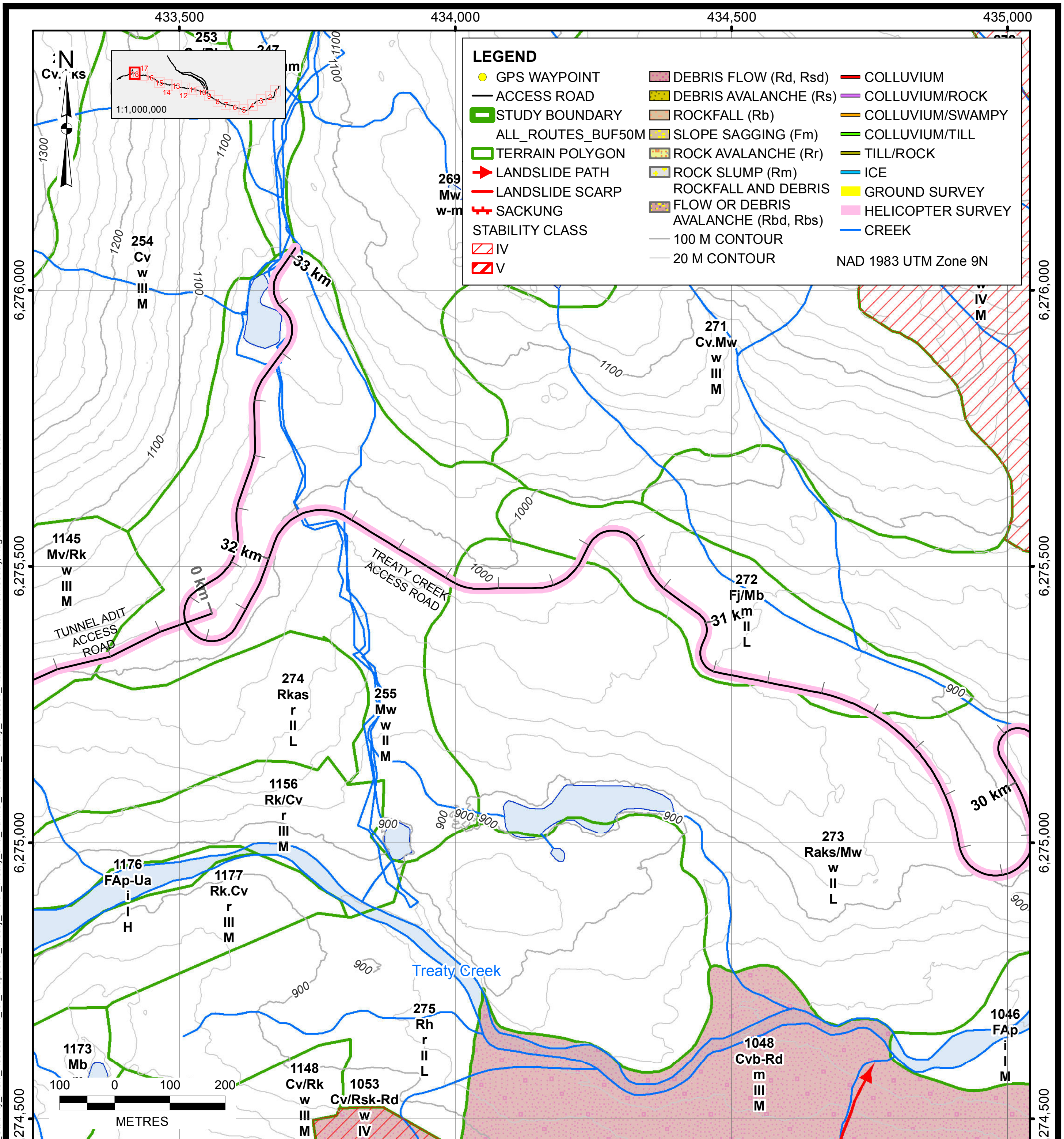
TITLE: TREATY CREEK ACCESS ROAD

MAP 17 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 17	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TREATY CREEK ACCESS ROAD

MAP 18 OF 18

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TC - 18	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012

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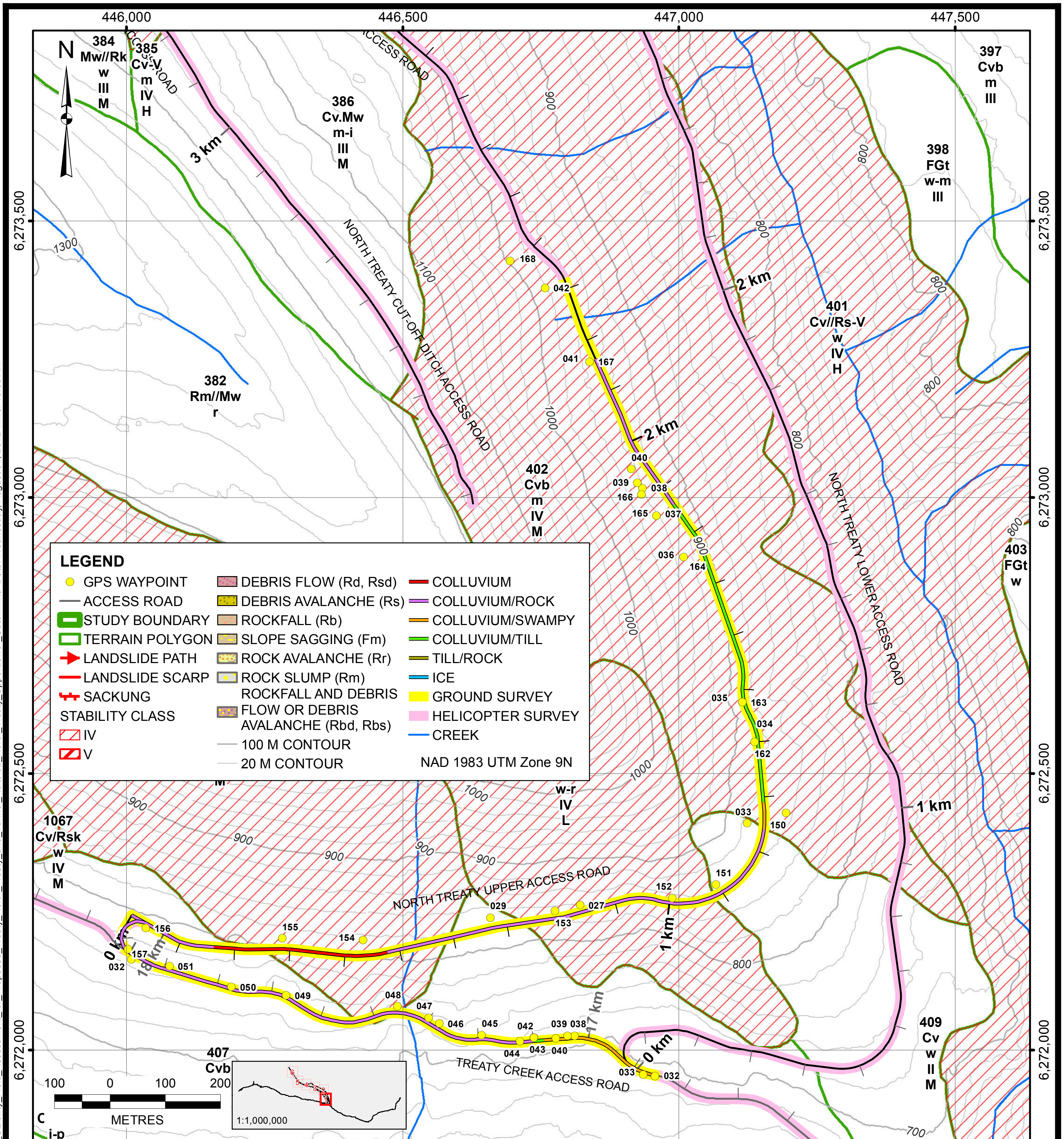

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD MAP 1 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 01	A

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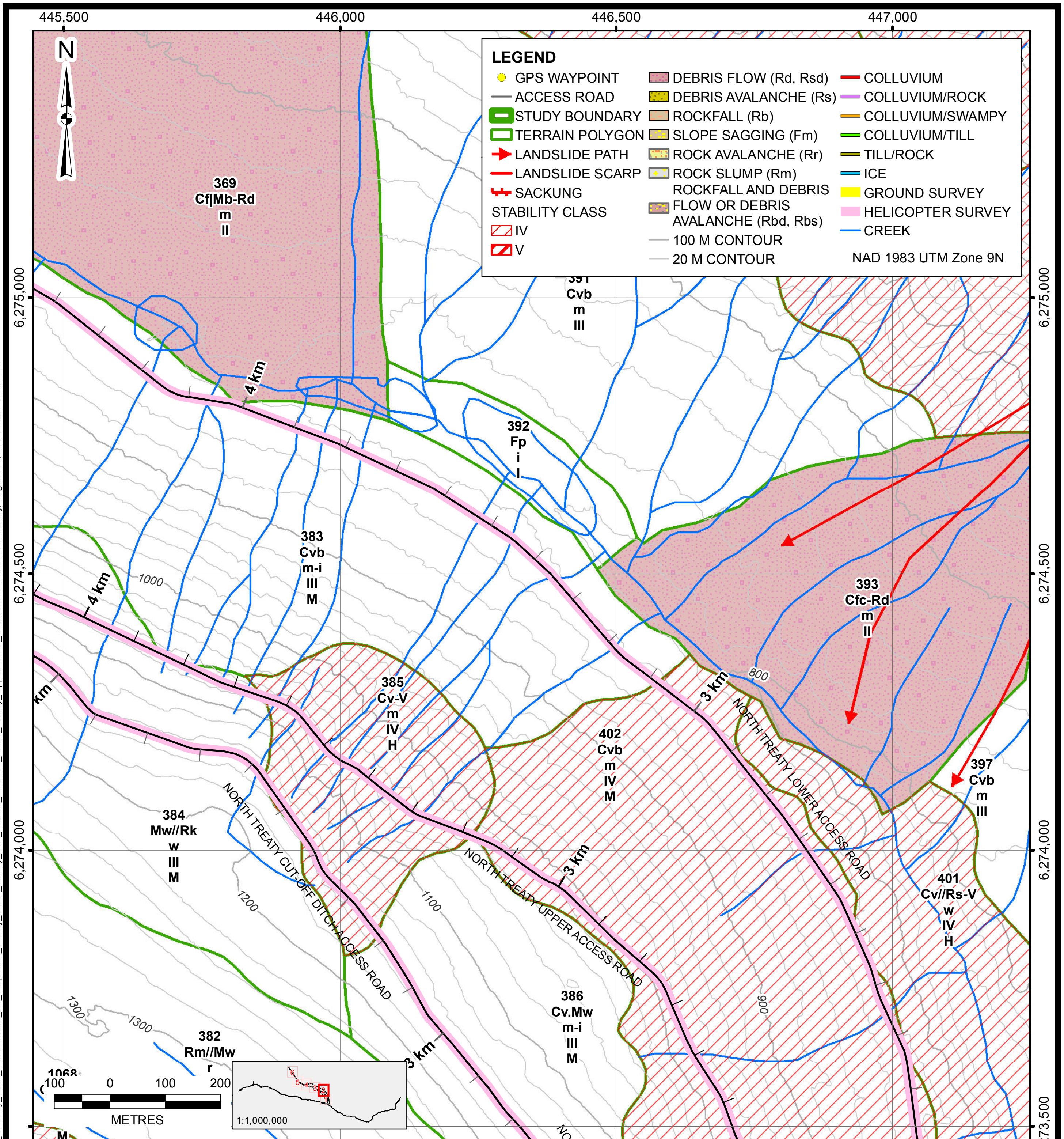

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SCALE:	1:10,000	DESIGNED:	SK
DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

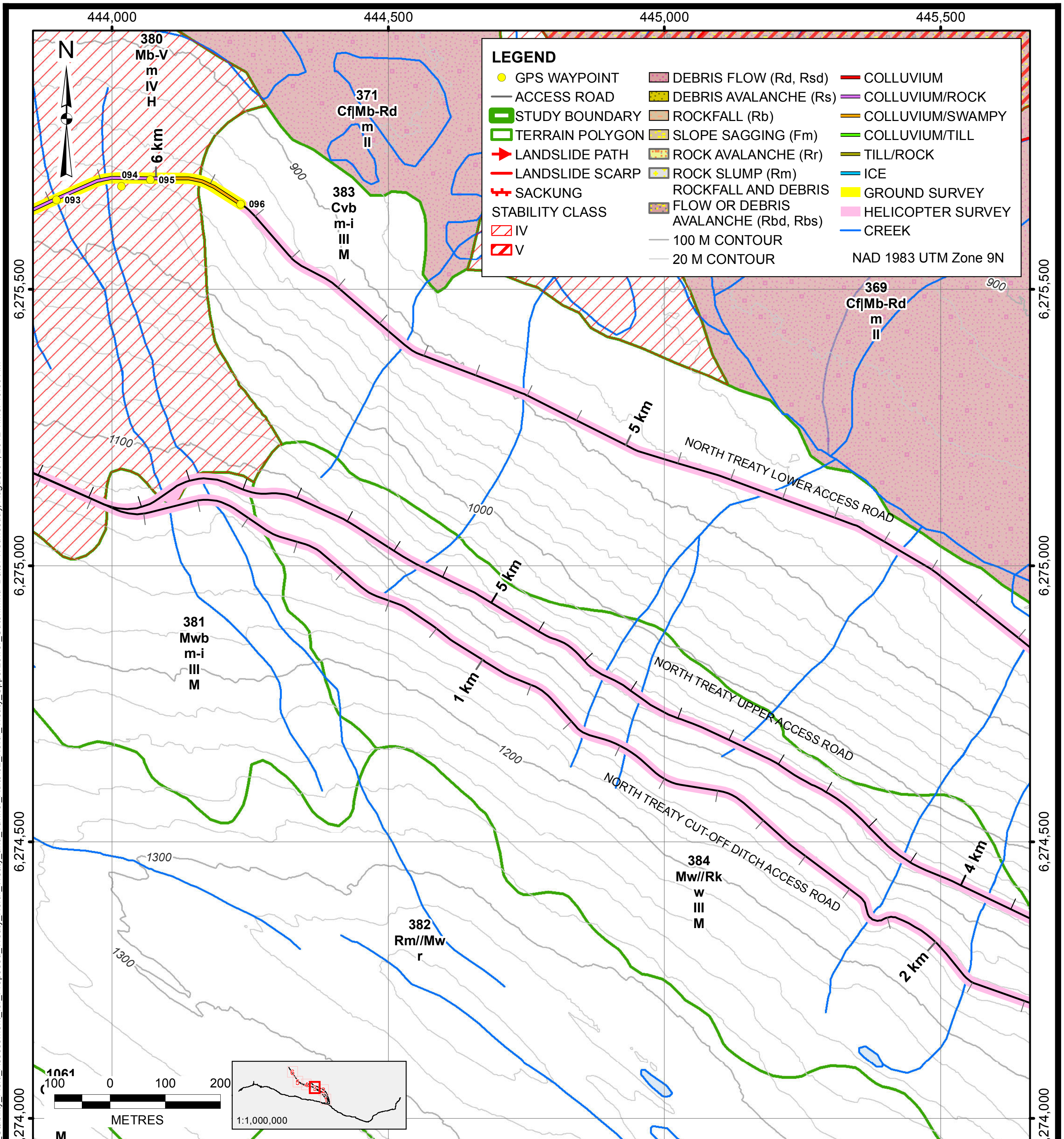
PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD
MAP 2 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 02	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD MAP 3 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 03	A

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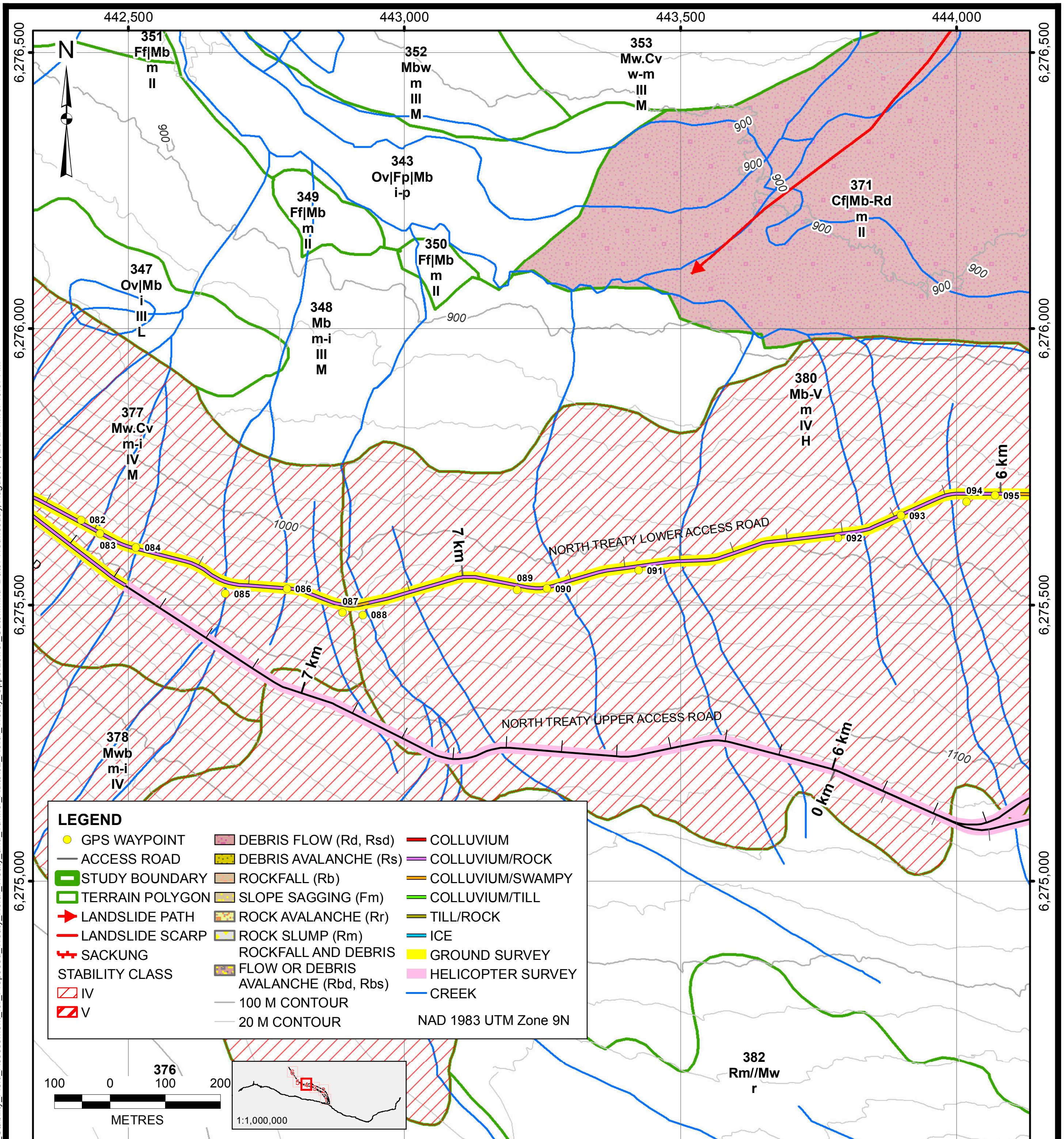

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD
MAP 4 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 04	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012

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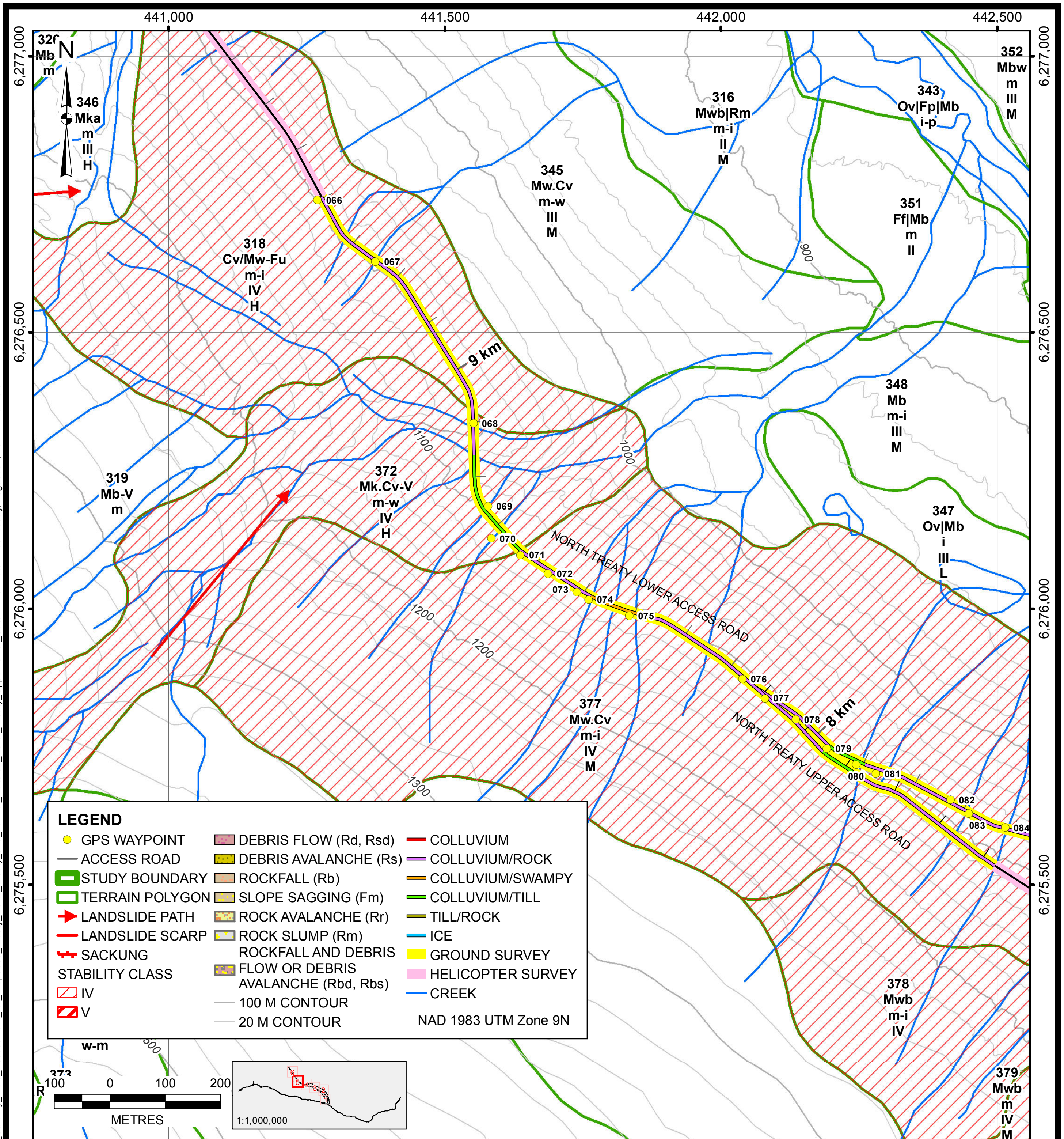

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DATE:	AUG 2012	CHECKED:	SF
DRAWN:	LL	APPROVED:	SF

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD MAP 5 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 05	A

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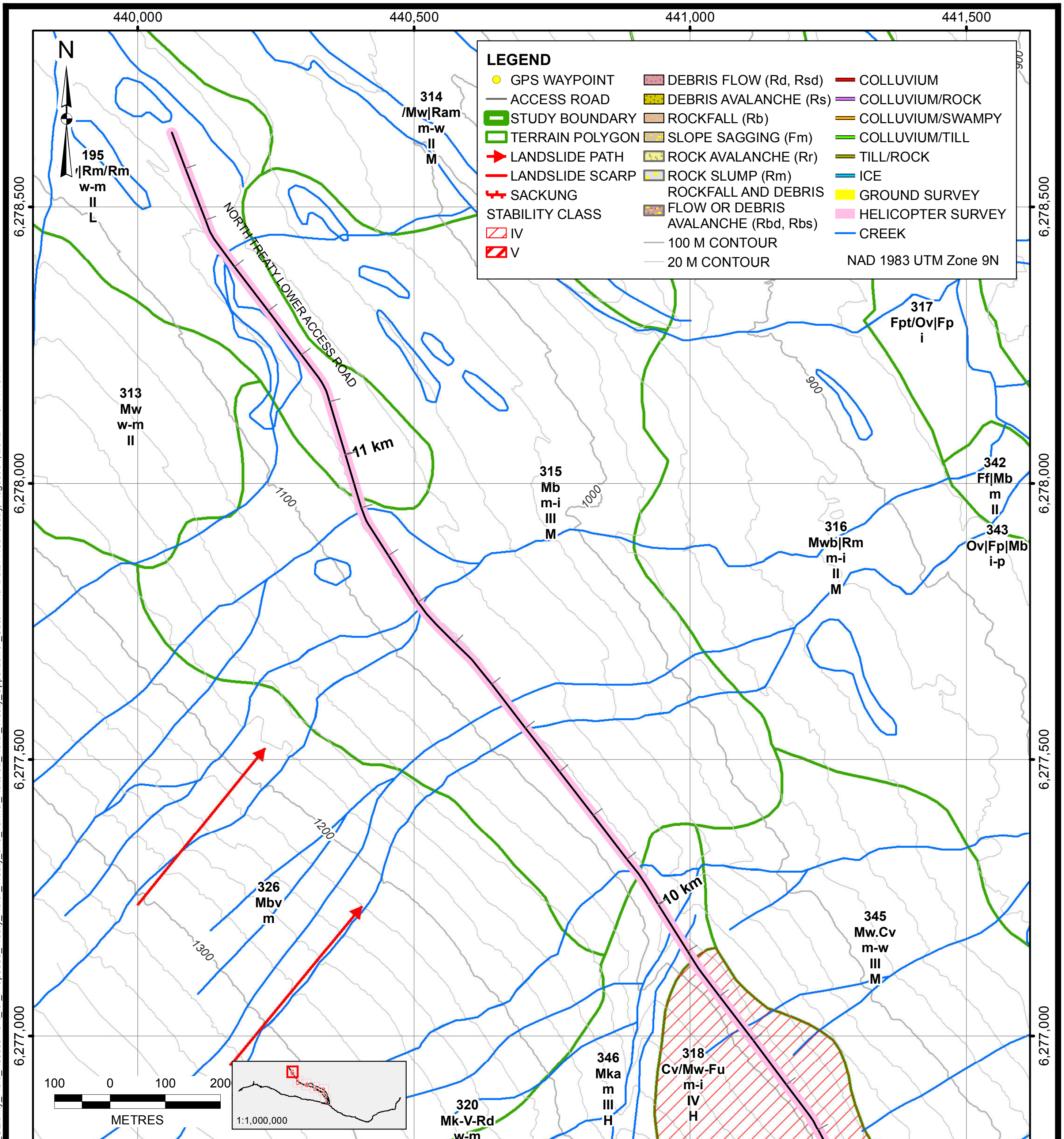

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: NORTH TREATY UPPER AND LOWER ACCESS ROADS AND CUT-OFF DITCH ACCESS ROAD
MAP 6 OF 6

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	NT - 06	A

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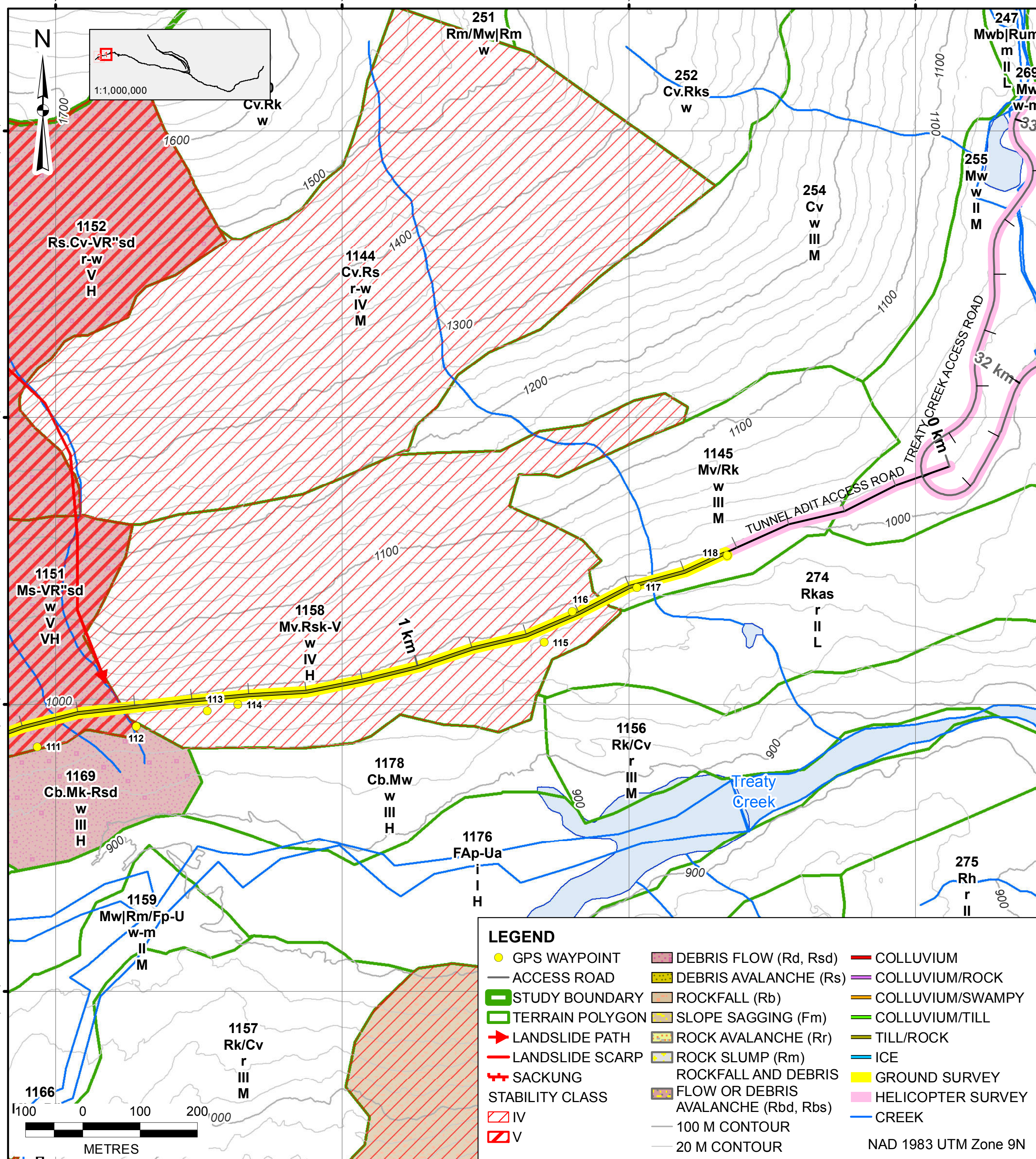

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

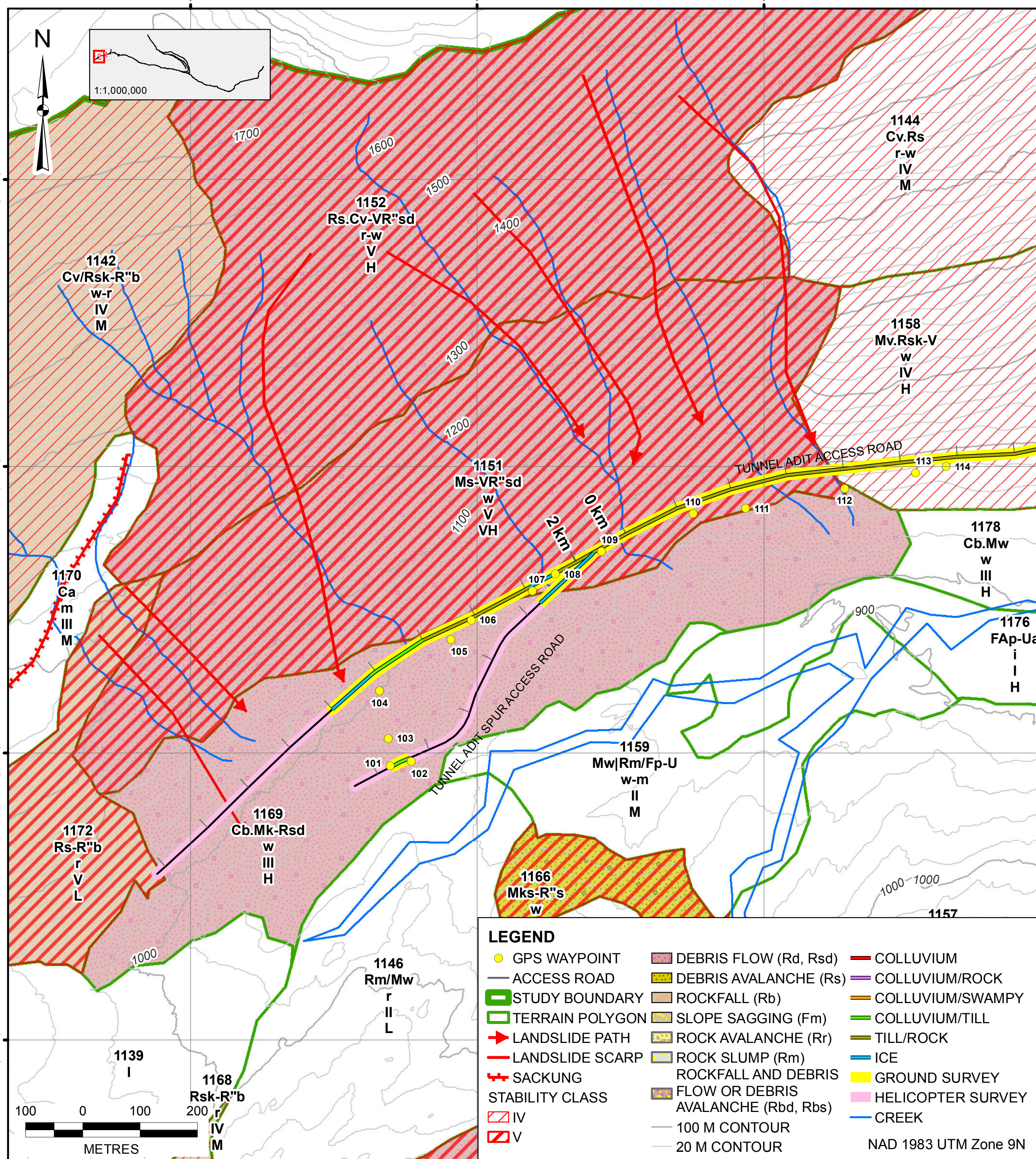
TITLE: TUNNEL ADIT ACCESS ROAD

MAP 1 OF 2

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TA - 01	A

DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012



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AN APPLIED EARTH SCIENCES COMPANY

PROJECT: TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS

TITLE: TUNNEL ADIT AND TUNNEL ADIT SPUR ACCESS ROAD
MAP 2 OF 2

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-013	TA - 02	A

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DWG TO BE READ WITH BGC REPORT TITLED "TERRAIN STABILITY FIELD ASSESSMENT OF THE PROPOSED TREATY CREEK, NORTH TREATY AND TUNNEL ADIT ACCESS ROADS" DATED AUGUST 2012

APPENDIX D
LIST OF >20 m ROCK CUTS AND FILL SLOPES

Table D-1. List of Road Sections with Cuts >20 m High

Road Segment	Chainage
Treaty Creek	9+520
	17+160
	17+240
North Treaty Lower	5+540
North Treaty Upper	4+340
	4+900
Cut-off Ditch	1+200
	1+800
	3+800

Notes:

1. Treaty Creek, North Treaty Upper, North Treaty Lower, Tunnel Adit and Tunnel Adit Spur access road chainages are relative to the May 17, 2012 (McElhanney 2012a).
2. Cut off Ditch access road chainages are relative to the July 6, 2012 design (McElhanney 2012b).
3. Sections provided by McElhanney (2012d) do not cover certain portions of the road (i.e. at the end of road segments or near bridges) so there may be additional road segments with cut and fill heights >20 m not listed in the table above.

Table D-2. List of Road Sections with Fill Slopes >20 m High

Road Segment	Chainage
Treaty Creek	17+960
North Treaty Lower	1+000
	7+180 to 7+200 (bridge)
	8+040 (sliver fill)
	8+780 to 8+840 (bridge)
	9+960 to 10+040 (bridge)
North Treaty Upper	1+800 to 1+940 (sliver fills)
	2+260 (sliver fill)
	2+320 (sliver fill)
	4+920 (sliver fill)
	5+180 (sliver fill)

Notes:

1. Treaty Creek, North Treaty Upper, North Treaty Lower, Tunnel Adit and Tunnel Adit Spur access road chainages are relative to the May 17, 2012 (McElhanney 2012a).
2. Cut-off Ditch access road chainages are relative to the July 6, 2012 design (McElhanney 2012b).
3. Sections provided by McElhanney (2012d) do not cover certain portions of the road (i.e. at the end of road segments or near bridges) so there may be additional road segments with cut and fill heights >20 m not listed in the table above.
4. Bridges are anticipated to replace the >20 m high fill slopes on the North Treaty Lower access road.
5. Sliver fills should be avoided through either a full bench cut or adjusting the alignment into the slope (as per geotechnical prescription “C”).