February 12, 2019

Porcupine Wood Products Ltd.
Box 850
Salmo, BC
V0G 1Z0

Attn. Mike Kit

RE: TERRAIN STABILITY ASSESSMENT
BALFOUR FACE, CP 409, BLOCKS 7, 8 and 9

INTRODUCTION

At the request of Mr. Mike Kit, RPF of Porcupine Wood Products Ltd. (PWP), Perdue Geotechnical Services Ltd. (PGS) conducted a geotechnical assessment for the proposed timber harvesting within the Balfour Face operating area, Cutting Permit (CP) 409, Blocks 7, 8 and 9. The assessment was completed by Mr. Chris Perdue, P.Geo., Eng.L., of PGS on September 17 and 19, 2018. In addition, a series of cursory field reviews across the Balfour Face development area were conducted in April and May 2018.

The purpose of the assessment was to review the terrain within each of the proposed harvest areas and provide recommendations to minimize the potential for landslide initiation following timber harvesting within or above potentially hazardous terrain.

SITE LOCATION

The proposed CP 409 development area is located along the northwestern side of the Kootenay Lake valley, approximately 28 km northeast of Nelson, BC (see Figure 1). The study area is located in the Kokanee Range of the Selkirk Mountains within the Columbia Mountain System and is centered on UTM coordinates 501624E / 5499373N. The area is found on NTS map sheet 82F.066 in the Selkirk Forest District.

BACKGROUND INFORMATION

Terrain Stability Mapping and Previous Reporting

Detailed terrain stability mapping for the proposed development area was provided by PWP. Terrain Survey Intensity Level (TSIL) B mapping was completed by Kutenai Nature Investigations Ltd. and summarized in a report entitled *"Terrain and Soil Inventory, West Arm Demonstration Forest (WADF)"*, April 1997. The terrain hazard polygons are shown on Figure 2.

Bedrock Geology

Geological mapping of the study area, as illustrated by the Geological Survey of Canada (GSC) Map 1090A Nelson, west half (H.W. Little, 1960), Department of Energy, Mines and Resources Open File 1195 Nelson, west half (1971) and GSC Map 1864A Kootenay Lake (J.E. Ressor, 1996) shows that the proposed development is underlain by coarse-grained, igneous bedrock of the Nelson batholith across mid to upper valley slopes and finer-grained meta-sedimentary and sedimentary bedrock of the Milford

Group (argillite, phyllite and limestone) across lower valley slopes. Field observations identified igneous bedrock underlying the proposed development.

Biogeoclimatic Mapping

According to biogeoclimatic mapping completed for the area (Nelson 82F map sheet), the proposed CP 410 development is situated within the Dry Warm Interior Cedar-Hemlock biogeoclimatic subzone (ICHdw). The area is considered to be within a moist climate region.

Resource Values

The following resources are considered potential elements at risk associated with the proposed development:

- Private land and several residences are situated a considerable distance downslope of the proposed development;
- Highway 31 is situated both downslope and downstream of the proposed development;
- According to the on-line database provided by the iMapBC website, several licensed Points of Diversion (PODs) for domestic use exist on Queens Creek, Wyanndotte Creek, Rhymeley Creek and Mountainside Creek below the proposed development;
- The Nelson Hydro (30L) power line is situated a considerable distance downslope of the proposed development.

OBSERVATIONS

A field assessment was completed for each of the proposed harvest areas discussed herein on foot within the proposed harvest boundaries and adjacent slopes. A vehicle traverse along the existing roads was completed as well as a brief assessment of previously harvested cut blocks to assess the impact to the terrain following timber harvesting and road construction.

Block 7

Block 7 is an elongated and irregular-shaped harvest area situated on the northwestern side of the Kootenay Lake valley. It encompasses the mid valley slopes and is partially bound by existing cut blocks and the existing Balfour Face Road. Primary access will be provided by the existing Balfour Face Road.

According to previous terrain mapping, the lower majority of the block encompasses terrain rated as Terrain Stability Class (TSC) I, II and III terrain, while the upper remainder and a small inclusion along the lower boundary are rated TSC IV. At the request of PWP, a geotechnical assessment was completed for the entire block. It is understood the proposed cut block will be harvested as a clear cut with reserves, while utilizing ground-based harvesting equipment. A site plan of Block 7 is shown in Figure 3.

Block 7 is characterized by slightly irregular and broken terrain that is primarily governed by the underlying igneous bedrock. Slopes generally do not exceed 30% with localized, steeper gradients measuring up to 50%. Surficial soils observed along existing cut bank exposures, tree churns and shallow test pits consist predominantly of well-drained, mantled deposits of silty sand till and lesser accumulations of sandy silty rubbly colluvium.

A review of Light Detection and Ranging imagery (LiDAR, provided by PWP), in combination with Google Earth imagery (2003, 2009 and 2016) and field observations, identified a remnant (inactive) colluvial deposition feature, associated with the Rhymeley Creek drainage feature, bisecting the west-central area of Block 7 and encompassing the southwestern corner of the block. Rhymeley Creek is confined within an incised, bedrock-controlled gully within the proposed harvest area boundaries and encompassed by a narrow Wildlife Tree Retention Area (WTRA) along its length. The relic feature is inferred to represent historic mass wasting during the deglaciation process along the Kootenay Lake valley (more than 10,000 years ago).

Mountainside Creek bisects the northeastern area of the block within an incised, bedrock-controlled draw that is encompassed by a broader WTRA. A remnant, colluvial deposition feature was not readily identified along its length.

Wyanndotte Creek originates as groundwater emergence within the northwestern area of Block 7, at approximately 1070 m elevation. Continuous surface flow bisects the southwestern area of the block within a broadly confined channel amongst the undulating and hummocky terrain. An incised draw extends upslope of the emergence zone with no indication of seasonal surface flow. The drainage feature approximately defines the western flank of the relic colluvial deposition feature, and may represent a former channel of Rhymeley Creek. Earlier field observations in April and May 2018 identified no surface flow along Wyanndotte Creek at the uppermost Balfour Face Road crossing, nor upstream thereof.

An active, 2-inch diameter surface waterline was encountered within the incised draw, upslope of the Wyanndotte Creek emergence zone. An open, pressure-reducing box was identified along its length at approximately 1080 m elevation with a 1.5-inch diameter, surface waterline continuing further downslope within and in close proximity to the Wyanndotte Creek channel. A lower, pressure-reducing box was identified at approximately 1010 m elevation, 15 m west of the creek channel.

A series of light groundwater emergences were encountered to the southwest of the Wyanndotte Creek emergence zone. Mackay Creek also originates as groundwater emergence, approximately 200 m southwest of the southwest boundary of Block 7. All of the aforementioned emergences occur along a near-linear bearing (55 / 235 degrees) that is inferred to represent groundwater migration along a dominant bedrock joint plane.

Light groundwater emergence was observed within the southern corner of the block along with a broad area of multiple emergences to the southwest, within the adjacent, existing cut block. A small stream also extends along the southwestern boundary within an incised draw. Surface flow originates as groundwater emergence above Block 7 and merges with Wyanndotte Creek below the block.

No evidence of recent slope instability was identified within the proposed harvest area or immediate adjacent terrain during the field review.

Block 8

Block 8 is an elongated and approximate rectangular-shaped harvest area situated on the northwestern side of the Kootenay Lake valley. It encompasses the mid valley slopes and is partially bound by an existing cut block and the existing Balfour Face Road along its southwestern corner and southeastern boundary, respectively. Primary access will be provided by the existing Balfour Face Road and recently constructed Spur 7 and Spur 8 alignments.

According to previous terrain mapping, the majority of the block is rated as TSC IV with a small inclusion along the central-northeastern boundary rated as TSC V. The remainder of the block is rated TSC I and III. At the request of PWP, a geotechnical assessment was completed for the entire block. It is understood the proposed cut block will be harvested as a clear cut with reserves, while utilizing both ground-based and cable-based harvesting equipment. A site plan of Block 8 is shown in Figure 4.

Block 8 is characterized by variable terrain. The lower (southeastern) approximate two-thirds is irregular and broken that is predominantly governed by the near surface, underlying bedrock. By comparison, the upper (northwestern) remainder is more uniform with slight irregularities. Slopes throughout the block typically range from 20% to 45% with limited steeper slopes measuring up to 60%.

Soils consist predominantly of well-drained, mantled deposits of sandy silt till and lesser accumulations of silty rubbly residual soils derived from the underlying bedrock weathering in-situ. Discontinuous, overlying deposits of glaciofluvial silty sand and gravel were identified within the northeastern area of the block. Infrequent exposures of igneous bedrock were encountered, typically in association with steeper slopes.

Overall, site conditions throughout Block 8 are considered primarily dry. Mountainside Creek is a seasonal watercourse that bisects the block along a variably-incised drainage feature. Localized moist sites were identified in close proximity to Mountainside Creek and within the northern corner of the block, which transitions to moist site conditions approximately 40 m south of Falling Corner (FC) 11.

Downslope Terrain (Queens Creek Gully)

The northeastern boundary discontinuously extends along a distinct, convex slope break, between FCs 08 and 11, that defines the Queens Creek gully. Slopes are relatively uniform below this boundary section, typically measuring 60% to 110%. Soils consist of well-drained, shallow accumulations of sandy silty rubbly colluvium and lesser residual deposits of sandy silt till amongst occasional exposures of igneous bedrock.

Slopes are less steep below the northern corner of Block 8 (north of FC 11), measuring 50% to 65% with evidence of historic slope instability and wetter site conditions. The headwall of an historic landslide was encountered immediately north of FC 11 and below the proposed harvest boundary. The dimensions of initiation zone measured 12 m wide, 25 m long and 2 m deep (on average). Evidence of seasonal groundwater emergence was observed within the head scarp region, which is presumed to be a primary contributing factor of slope instability. The age of the failure is estimated to be 100 to 150 years old, and may correlate with the most recent wildfire activity to affect the area.

A relic (inactive) detached mass was identified approximately 150 m below the northern limit of the block, across the lower sidewall of the Queens Creek gully. The dimensions of the initiation zone measured 40 m wide, 40 m long and more than 4 m deep. Slopes adjacent to the initiation zone measured 55% to 60%. The detached mass appears to have traveled 40 m to 50 m (slope distance) and terminated approximately 50 m above Queens Creek. Slopes below the residual deposition mass measured 90% to 110%. Site conditions are considered moist, although no indication of seasonal groundwater emergence was observed at the time of the field review. The relic feature predates the existing stand of timber and is presumed to have occurred several hundred or thousands of years ago. The cause of instability was not conclusively determined.

No evidence of recent slope instability was identified within the proposed harvest area or the immediate adjacent terrain during the field review.

Block 9

Block 9 is an elongated and approximate rectangular-shaped harvest area situated on the northwestern side of the Kootenay Lake valley. It encompasses the mid valley slopes and is partially bound by an existing cut block and the existing Balfour Face Road along its southwestern corner and southeastern boundary, respectively. Primary access will be provided by the existing Balfour Face Road and recently constructed Spur 7 alignment.

According to previous terrain mapping, the entire block is encompassed by terrain rated as TSC IV. At the request of PWP, a geotechnical assessment was completed for the entire block. It is understood the proposed cut block will be harvested as a clear cut with reserves, while utilizing ground-based harvesting equipment. A site plan of Block 9 is shown in Figure 3.

Block 9 is characterized by relatively uniform terrain with slight irregularities and an overall concave slope configuration. Slopes generally range from 25% to 40% across the lower (southeastern) area of the block and gradually increase up to 60% across the upper (northwestern) remainder. Soils observed along existing (recently excavated) cut bank exposures consist of well-drained, mantled deposits of silty sand till and lesser, discontinuous accumulations of sandy silty rubbly colluvium.

Rhymeley Creek flows along (outside) the northeastern harvest boundary within a variably-incised draw. The northeastern area of the block encompasses the upper extent of the relic, colluvial deposition mass associated with Rhymeley Creek, as described in the preceding Block 7 observations. Sitkum Consulting Ltd. (SCL)[1] described an historic, southwestern diversion of Rhymeley Creek into the Wyanndotte Creek draw at 1200 m elevation. Recent field observations by PGS identified the diversion at the apex of the remnant colluvial feature, approximately 35 m upslope of the northern corner of Block 9. The rudimentary diversion appears to have been hand-excavated to provide surface flow to an abandoned (non-functioning) 2-inch diameter waterline intake. The empty waterline extends downslope along the Wyandotte Creek drainage feature.

The Rhymeley Creek channel has been recently impacted by snow avalanching within the last five (5) years. Avalanche debris from the most recent event terminated approximately 40 m below the recently built Spur 7 alignment (1160 m elevation), consisting of broken timber and limited angular rock fragments. The debris was notably void of mineral soil, differentiating it from a typical debris slide event. Recent avalanche activity appears to have rendered the above-mentioned, rudimentary drainage diversion incapable of easily directing surface flow outside the Rhymeley Creek channel.

SCL (2007) described evidence of avalanching within the Rhymeley Creek gully with run out potential down to 1200 m elevation, closely correlating with the recent event. A review of Google Earth imagery (2016), identified a large residual snow cornice within the upper, southwestern headwall region of Rhymeley Creek, along the northeastern edge of BCTS Pre Block 14-60 (harvested in 2007). Prevailing winds are from the southwest and the size and frequency of avalanching is expected to remain higher than pre-harvest levels until sufficient tree height has re-established along the southwestern headwall region of Rhymeley Creek.

An active Point of Diversion (POD) was identified along Rhymeley Creek, approximately 75 m downstream of Spur 7, approximately 1155 m elevation. A 2-inch diameter surface waterline leads to the

[1] Sitkum Consulting Ltd. 2007. *Addendum to Terrain Stability Field Assessment (TSA) and Soil Erosion Field Assessment (SEFA), Balfour Face Block 14-60, Laird Creek, BC (DRAFT)*, prepared for BC Timber Sales, Kootenay Business Area, Kootenay Lake Field Team.

southwest and passes through Balfour Face Road at the Wyandotte Creek crossing. At the time of the assessment, the waterline was decoupled from its fittings at two locations. As a result, the waterline was discharging onto the crest of the southwestern sidewall of the Rhymeley Creek draw. The eastern corner of the block, encompassing the active surface waterline and area adjacent to the POD, has been designated a WTRA.

Site conditions throughout the block are considered dry to moist. Several groundwater emergences were observed along the lower limit of the block, immediately upslope of Balfour Face Road.

Strong groundwater emergence was encountered within the northwestern area of Block 9, along the southwestern flank of a relic (inactive) detached mass. The dimensions of the initiation zone were visually estimated to be 30 m wide, 30 m long and 4 m deep (on average). Total travel distance of the detached mass measured approximately 40 m (slope length). Slopes adjacent to the initiation zone measured 60%, and 40% adjacent to the toe of the feature. The cause of instability is inferred to be directly related to the emergence of groundwater, which is localized to the western flank of the feature. The mass wasting event predates the existing stand of timber and is presumed to be several thousands of years old.

No evidence of recent slope instability was identified within the proposed harvest area or the immediate adjacent terrain during the field review.

GEOTECHNICAL ASSESSMENT

The following discussion details the likelihood of a specific hazardous landslide initiating as a result of the proposed timber harvesting. A hazardous landslide is considered the *landslide of significance*, which is the smallest landslide that could adversely affect an element at risk. The likelihood of a landslide occurring is rated qualitatively as Very Low, Low, Moderate, High and Very High with respect to the proposed harvesting method for each block. The ratings are based primarily on the presence or absence of existing slope instability related to timber harvesting, hydrologic conditions and the professional judgment and experience of the author.

A partial risk analysis will be completed only for blocks encompassing terrain rated as having a Moderate to Very High likelihood of landslide initiation as a result of the proposed timber harvesting, or where the proposed development is expected to adversely affect the stability of the adjacent terrain. *Appendix A* defines the ratings used herein and details the methodology used to complete a partial risk analysis.

Northern Corner of Block 8

Based on the results of the assessment, the northern corner of Block 8 is rated as **Moderate**. Due to the presence of moist site conditions and historic, seepage-induced mass wasting immediately below the proposed harvest area, timber harvesting will increase seasonal groundwater levels and increase the likelihood of further slope instability. The potentially hazardous area of Block 8 measures approximately 4.4 hectares (ha) in size and is defined as the area north of a linear line connecting Falling Corners 11 and 17, as illustrated on Figure 4. The hazard rating for this area of the block and the potential downslope / downstream effects were conveyed to Mr. Mike Kit (pers. comm., September 17, 2018).

A landslide originating within or below the northern area of Block 8 would directly impact Queens Creek and expected to initiate a debris torrent along the creek channel. According to LiDAR-derived contour mapping and field observations, channel gradients along Queens Creek (downslope of the northern area

of Block 8) measure an average of 35% for approximately 1,950 m (stream length) to Highway 31. VanDine (1996)[2] concluded that transportation and erosion of channelized debris torrent occurs on slopes greater than 27% (15°), and deposition of material typically occurs once the gradient decreases below 18% (10°). Channel gradients along Queens Creek are considerably greater than the documented transportation and deposition angles for debris torrents and debris flows.

Potential resources at risk from a debris torrent include multiple licensed water intakes, Highway 31, and a private, residential building on the Queens Creek alluvial fan, immediately below the highway. The spatial effect of a debris torrent along Queens Creek on each of the aforementioned resources is **High**.

Using the partial risk matrix in Appendix A (Table 3), the resultant partial risk associated with timber harvesting the northern area of Block 8 is rated as **High**.

Remaining Area of Block 8 and Blocks 7 and 9

Provided the general recommendations in the subsequent section (below) are followed, the likelihood of landslide initiation as a result of the proposed timber harvesting throughout the remaining area of Block 8 and the entire areas of Blocks 7 and 9 is rated as Low. The following factors were considered in determining the hazard rating:

- Hillslope hydrology appears to be predominantly governed by the underlying, highly-fractured igneous bedrock and subject to surface influences beyond the topographically-defined upslope catchment area above each block;
- The predominantly gentle to moderate-sloping terrain and steeper, bedrock-controlled slopes throughout the proposed forest development area are generally not considered conducive to mass wasting following timber harvesting;
- Evidence of relic (inactive) mass wasting along the upper (northwestern) boundary of Block 9 is not considered to be an indication of the potential for slope instability following timber harvesting.

Road construction practices and drainage control measures along access routes within and downslope of the proposed harvest areas (including seasonal surface drainage control measures during periods of non-operational use) will have the greatest influence on surface / sub-surface watercourses and slope stability.

Provided all natural watercourses are appropriately managed and maintained, the proposed timber harvesting is not expected to have a significant adverse effect on hillslope hydrology or slope stability.

[2] VanDine, D.F. 1996. *Debris flow control structures for forest engineering*. Research Branch, Ministry of Forests, Victoria, BC. Working Paper 22/1996.

RECOMMENDATIONS

Block 8

The northern, 4.4 ha area of Block 8 has been identified as having a Moderate likelihood of post-harvest landslide initiation. The proposed harvest area should be amended to exclude this area of the block.

General Recommendations

The following general recommendations for all season operations are intended to reduce the effects of timber harvesting:

1. Ground skidding and cable yarding across natural drainage paths and surface watercourses should be avoided. If this cannot be avoided, harvesting should be conducted during the drier months of the year, on a compressed snowpack, or effort made to ensure timber is skidded / yarded butt-first to minimize potential ground disturbance within such drainage features;
2. Timber harvesting should not be conducted under excessively wet site conditions, such as during spring snow melt or periods of heavy and prolonged rainfall;
3. A post-harvest inspection should be completed to ensure all natural drainage patterns have been maintained. Logging debris should be removed from the wetted perimeter of all watercourses and subtle drainage features to ensure an accumulation of coarse woody debris or site degradation from logging operations does not result in a drainage diversion. These measures include ensuring the drainage network (i.e. culverts and ditch lines) along permanent roads remain functional, as intended;
4. All temporary access trails may be built using debris-supported fill slopes to reduce cut bank excavation and the potential for groundwater interception. Appropriate drainage control measures must be implemented to ensure all natural drainage paths are maintained. All trails must be fully rehabilitated concurrently with completion of the proposed timber harvesting. If harvesting is to be conducted during winter months, trails should be seasonally deactivated prior to the freshet by out sloping where practical and installing cross ditches to maintain natural drainage patterns.

CLOSURE

This report has been prepared for the exclusive use of the Porcupine Wood Products Ltd. and their authorized representatives. The methods used herein are in accordance with generally accepted geological and geotechnical principles and practice. Site conditions are based on surface observations, shallow test pits and exposed soils. Deep, sub-surface exploration techniques were not used unless otherwise noted. Recipients of this report should be aware that sub-surface variability is inherent, as a function of natural geomorphic processes.

Any use of this report by a third party, or any reliance on or decisions to be made based on it are the responsibility of such third parties. Perdue Geotechnical Services Ltd. accepts no responsibility for damages incurred by any third party as a result of decisions made or actions based on this report. No other warranty is made, either expressed or implied.

Please contact the undersigned to resolve any questions or concerns regarding the foregoing information.

Regards,
PERDUE GEOTECHNICAL SERVICES LTD.

ORIGINAL SIGNED

Christopher G. Perdue, P.Geo., Eng.L.
Engineering Geologist

Attachments: Appendix A – Partial Risk Analysis
Figure 1 – Key Map (1:250,000 scale)
Figure 2 – CP 409, Development Overview Map (1:10,000 scale)
Figure 3 - CP 409, Blocks 7 and 9 Site Plan Map (1:5,000 scale)
Figure 4 - CP 409, Block 8 Site Plan Map (1:5,000 scale)

APPENDIX A

Partial Risk Analysis

Partial Risk, P(HA), is defined as the product of the probability of a specific hazardous landslide occurring and the probability of that landslide reaching or adversely affecting the site occupied by a specific element. Partial risk is mathematically expressed as:

$$P(HA) = P(H) \times P(S:H) \times P(T:S)$$

P(H) is the probability (or likelihood) of occurrence of a specific hazardous landslide. P(S:H) is the spatial probability relating the potential of a landslide to reach or adversely affect the site occupied by a considered element. P(T:S) is the temporal probability of a mobile element to be at the affected site at the time the event occurs. Static elements, such as a bridge, road or a building for example, have a quantitative (numerical) value of 1 because it is certain that the element will be at the affected site when the event occurs. Under these circumstances and unless otherwise noted, the partial risk equation can be simplified and expressed as:

$$P(HA) = P(H) \times P(S:H)$$

The components of the partial risk analysis will be expressed qualitatively. Table 1 defines the likelihoods of a landslide occurring as a result of the proposed timber harvesting methods.

Table 1 - Landslide Occurrence

Likelihood of Occurrence, P(H)	Qualitative Definition
Very High	Landslide initiation is imminent or highly likely to occur shortly after timber harvesting or road construction has been completed. Evidence of naturally occurring instability identified within the proposed development area within the past 15 years. Evidence of development-related instability adjacent to the proposed development area with similar terrain characteristics and timber harvesting/road construction practices.
High	Landslide initiation as a result of the proposed timber harvesting or road construction is probable unless site conditions are significantly better than assumed. Subtle evidence of naturally occurring instability may be present.
Moderate	Landslide initiation is not likely to occur following the proposed timber harvesting or road construction, but considered possible if one or more the assumed site conditions are significantly altered as a result of the proposed development.
Low	Landslide initiation following timber harvesting or road construction is considered unlikely, although is possible under exceptional circumstances (i.e. an extreme or anomalous hydrological event).
Very Low	Remote possibility of a landslide initiating as a result of the proposed timber harvesting or road construction.

Table 2 provides the qualitative definition of the potential spatial effect of a specific hazardous landslide to reach or otherwise affect a site occupied by an element.

Table 2 - Spatial Effect

Potential Effect, P(S:H)	Qualitative Definition
High	Landslide will reach or directly affect the considered element at risk (e.g. private or public infrastructure, high-value fish habitat or consumptive water source).
Moderate	Landslide will marginally affect the considered element. Possible termination within 200 m of the site. Secondary transport of sediment and/or small woody debris may affect the element.
Low	Landslide is unlikely to reach or affect the considered element. The terrain above the site is capable of intercepting or dissipating slide debris and the potential secondary affects.

Table 3 is an example of a linear partial risk matrix that illustrates the relationship between the potential landslide occurrence and its estimated spatial effect to an element.

Table 3 - Partial Risk Matrix

Partial Risk, P(HA)		Spatial Effect, P(S:H)		
		High	**Moderate**	**Low**
Landslide Occurrence, P(H)	**Very High**	Very High	Very High	High
	High	Very High	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Very Low
	Very Low	Low	Very Low	Very Low

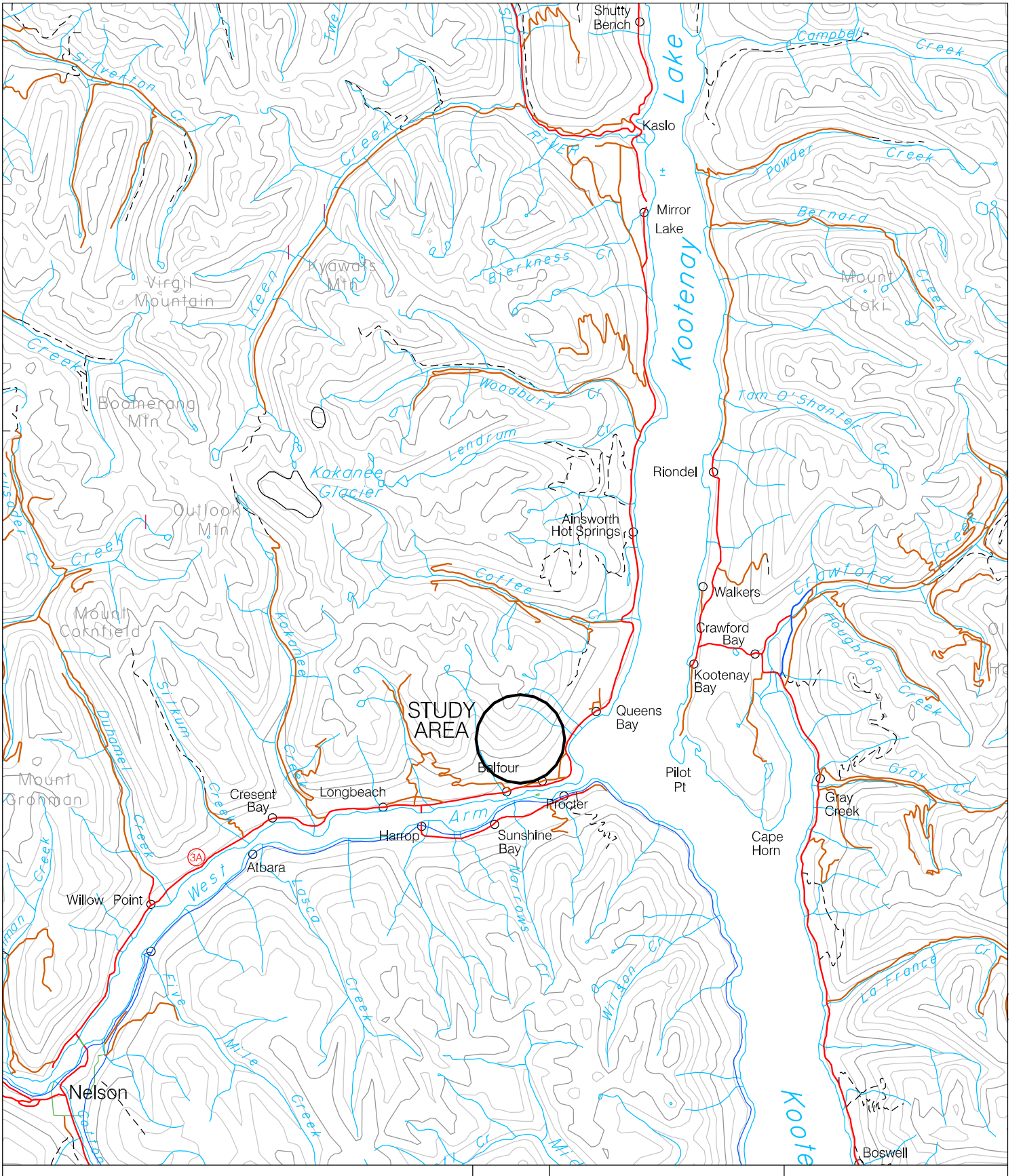
For the purposes of this report, partial risk does not include the vulnerability of the element(s) at risk, and therefore, is not considered a completed estimate of risk. Partial risk is usually the preferred analysis method when insufficient information is known about the vulnerability of the element(s). The vulnerability of certain elements is best provided by professionals with a specific knowledge of the element(s) at risk.

Forest Resource Managers with a greater knowledge of the vulnerability of an element can determine the specific risk of an element by multiplying the assigned vulnerability rating with the partial risk value.

References

BC Ministry of Forests (2002). Forest Road Engineering Guidebook. Forest Practices Code of British Columbia. BC Ministry of Forests, Victoria, BC.

Wise, M.P., G.D. Moore and D.F. VanDine (2004). Landslide Risk Case Studies in Forest Development Planning and Operations. BC Ministry of Forests, Research Branch, Victoria, BC. Land Management Handbook No. 56.



PORCUPINE WOOD PRODUCTS LTD.

LOCATION MAP

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Scale: 1:250,000
Date: FEBRUARY 2019
Drawn by: CP

Adapted from: 82F Nelson

Figure 1

PERDUE
GEOTECHNICAL SERVICES

CP 409 BLOCK 8

CP 409 BLOCK 9

CP 409 BLOCK 7

CP 410 BLOCK 11

CP 410 BLOCK 13

CP 410 BLOCK 10

CP 410 BLOCK 12

SPUR 8

SPUR 7

SPUR 6

SPUR 4

SPUR 2

SPUR 1

BRANCH 2

Queens Creek

Wynnmotte Creek

Mackay Creek

Mountainside Creek

Rhymeley Creek

Hoiseldon Creek

Kootenay Lake

BALFOUR FACE ROAD

BAY ROAD

QUEENS

HIGHWAY 31

NELSON HYDRO 30L POWER LINE

1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600

PORCUPINE WOOD PRODUCTS LTD.

Mapsheet:	82F066	CP:	409
Chart Area:	Balfour Face	Scale:	1:10,000
UTM:	501665E 5499438N	Figure:	2

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OVERVIEW MAP

PERDUE GEOTECHNICAL SERVICES

PORCUPINE WOOD PRODUCTS LTD.

CP 409 BLOCK 7 AND BLOCK 9

LOCATION: BALFOUR FACE
MAPSHEET/OPENING NO: 82F.066
UTM ZONE: 11 501625E 5499640N NAD: 83

LEGEND

- CUTBLOCK BOUNDARY
- PAVED ROAD
- SECONDARY ROAD
- EXISTING ROAD
- PROPOSED PERMANENT ROAD
- PROPOSED TEMPORARY TRAIL
- EXISTING TRAIL
- CONTOURS
- PIPELINE
- TRANSMISSION LINE
- RAILROAD
- FALLING CORNER
- BLOWDOWN
- SLOPE
- LANDING
- EXISTING CULVERT
- PROPOSED CULVERT
- BRIDGE
- ROCK OUTCROP
- DRAW
- GULLY
- SLOPE BREAK
- RIDGE LINE
- WATER LICENCE INTAKE
- STREAM
- NCD
- LAKE
- SEEPAGE – EMERGENCE
- SWAMP
- LANDSLIDE
- SMALL SLOPE FAILURES
- AVALANCHE PATH
- WILDLIFE TREE RETENTION AREA
- EXISTING BLOCKS

N

5m CONTOUR INTERVAL DERIVED FROM LIDAR DATA PROVIDED BY PWP.

0 Meters 250
Scale: 1:5,000

FL: A30171	MAP REF: 82F066
DISTRICT: SELKIRK	PROJECT: 18006-002
DATE: FEBRUARY 2019	
DRAWN: TRIPWIRE	
CHECKED: CP	
SITE PLAN	FIGURE: 3

PERDUE GEOTECHNICAL SERVICES

CP 409 BLOCK 8
CP 409 BLOCK 9
CP 409 BLOCK 7
CP 410 BLOCK 11
CP 410 BLOCK 10
CP 410 BLOCK 12
CP 410 BLOCK 13
Rhymeley Creek
Haseldean Creek
Wyandotte Creek
Mackay Creek
Mountainside Creek
SPUR 1
SPUR 4
SPUR 6
SPUR 7
SPUR 8
BRANCH 2
BALFOUR FACE ROAD
HISTORIC DIVERSON AT APEX OF RELIC COLLUVIAL DEPOSITION
ABANDONED POD
ACTIVE POD
DECOUPLED 2" WATERLINE
RELIC (INACTIVE) DETACHED MASS
ABANDONED WATERLINE
PRESSURE REDUCTION BOX 2" TO 1.5" DIAMETER WATERLINE
PRESSURE REDUCTION BOX
EMERGENCE
SEASONAL WET AREA

PORCUPINE WOOD PRODUCTS LTD.

CP 409 BLOCK 8

LOCATION: BALFOUR FACE	
MAPSHEET/OPENING NO: 82F.066	
UTM ZONE: 11 501625E 5499640N	NAD: 83

LEGEND

- CUTBLOCK BOUNDARY
- PAVED ROAD
- SECONDARY ROAD
- EXISTING ROAD
- PROPOSED PERMANENT ROAD
- PROPOSED TEMPORARY TRAIL
- EXISTING TRAIL
- CONTOURS
- PIPELINE
- TRANSMISSION LINE
- RAILROAD
- FALLING CORNER
- BLOWDOWN
- SLOPE
- LANDING
- EXISTING CULVERT
- PROPOSED CULVERT
- BRIDGE
- ROCK OUTCROP
- DRAW
- GULLY
- SLOPE BREAK
- RIDGE LINE
- WATER LICENCE INTAKE
- STREAM
- NCD
- LAKE
- SEEPAGE – EMERGENCE
- SWAMP
- LANDSLIDE
- HISTORIC LANDSLIDE
- SMALL SLOPE FAILURES
- AVALANCHE PATH
- WILDLIFE TREE RETENTION AREA
- EXISTING BLOCKS

N

5m CONTOUR INTERVAL DERIVED FROM LIDAR DATA PROVIDED BY PWP.

0 Meters 250

Scale: 1:5,000

FL:	A30171	MAP REF:	82F066
DISTRICT:	SELKIRK	PROJECT:	18006-002
DATE:	FEBRUARY 2019		
DRAWN:	TRIPWIRE		
CHECKED:	CP		
SITE PLAN		FIGURE:	4

PERDUE GEOTECHNICAL SERVICES

RELIC (INACTIVE) DETACHED MASS

MODERATE HAZARD

HISTORIC LANDSLIDE

FC 17

FC 11

FC 08

Mountainside Creek

Queens Creek

Rhymeley Creek

CP 409 BLOCK 8

CP 409 BLOCK 9

CP 409 BLOCK 7

SPUR 7

SPUR 8

BALFOUR FACE ROAD