This updated hazard assessment tool plus the associated instructions for its application constitute Part 1 of the BC Forest Safety Council Steep Slope Resource Package. It is intended for use along with responsibilities identified in Part 2 and safe work practices and procedures identified in Part 3 of the Steep Slope Resource Package OR equivalent actions and procedures identified in the user’s safety management program.
Part 1

Steep Slope Hazard Assessment Tool

Using the Steep Slope Hazard Assessment Tool

Who – As described by WorkSafeBC Regulation 26.16, the steep slope hazard assessment must be completed by a qualified person. WSBC OH&S Regulation Part 1 provides the following definition of a qualified person: “being knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof”. The Guideline related to Part 26.16 provides further description.

The qualified person collecting and recording site-specific attributes as inputs to the hazard assessment may not necessarily be the same person that designates required controls and builds the steep slope plan. For example, site information (slope, soils, hydrology, etc) could be collected at the planning / lay out stage by an experienced forester, and then communicated to a logging contractor qualified to use that information to build and implement an effective steep slope plan.

Where – As specified by WorkSafeBC OH&S Regulation 26.16, on all slopes over 35% or 40% where mechanical harvesting is planned and the manufacturer’s maximum slope operating stability limit is not known.

What – Complete the Steep Slope Hazard Assessment and develop a site-specific Steep Slope Plan.

When – Before harvesting operations commence. Assessing the area and developing a plan in advance of operations enables scheduling the right machines and operators, and affords time to revise the plan should that be necessary. See also Page 15 regarding changing environmental conditions.

How:
1. Complete the top part of Page 1 to identify the area / unit under the assessment and plan.
2. Have a copy of a map that shows block boundaries, roads, steep slope sites, plus other key features (e.g. the preliminary steep slope assessment map, current layout map, cutting permit map, etc.).
3. Field review (walk) the area planned for mechanical harvesting operations. Identify sites (see Site Identification and Mapping, below) with slopes / characteristics that may pose machine stability risks.
4. At each site and for each Machine Stability Factor, measure or evaluate site attributes.
5. In the “Comments” column record measurements (e.g. slope = 43%), and describe characteristics (well-drained gravelly sand, 5 cm duff) that support the risk rating and provide information useful in developing operational plans.
6. Based on site information, circle or shade-in the risk level rating for each Machine Stability Factor.
7. Consider State of Mind, Operator Competency and Duration of Exposure for operators that will conduct the work. Based on definitions below and text on page 15, determine a risk rating for each Factor.
8. Identify other site features and environmental factors that will influence machine stability (e.g. convex slopes, bluffs, gullies, benches, access or escape routes, etc.). Describe, and assign a risk rating.

9. Consider the following as each may confer operational limitations or hazards: soil disturbance and site degradation limits, Silviculture Prescription, retention objectives, riparian management, adjacent danger trees, upslope terrain stability or avalanche risk. If relevant, identify on page 1 and assign a risk rating.

10. Determine the Overall Machine Stability Risk Rating. Where three (3) or more of the 11 Machine Stability Factors are scored as Risk Level 3, the Overall Machine Stability Risk Rating is High, and additional controls (i.e. in addition to practices described in Parts 2 and 3 of Resource Package) are necessary to mitigate risks.

11. On Page 2, considering the Overall Machine Stability Risk Rating, planned harvest methods / equipment / operator options, prescribe necessary additional controls. This will often include several of the measures identified by a check box. Describe other specific measures in the appropriate lined areas of page 2.

12. If the risk to mechanical operations cannot be adequately controlled, designate and map area as “No Go”. Develop an alternate harvest plan or amend boundaries to exclude (e.g. designate as WTP).

13. Where measures adequate to ensure machine stability are designated, develop a clear, concise Steep Slope Plan map that identifies the location of steep slope sites. Attach it to the completed Steep Slope Plan and/or to the overall logging plan for that unit.

What else – Discuss and communicate the plan at the pre-work and tailgate meetings.

Definitions & Notes
Below are notes explaining hazard assessment criteria and providing direction on how to use the steep slope hazard assessment tool and develop the associated steep slope plan.

Site or Sub-Area – See Site Identification below; for blocks where attribute variability requires more than one steep slope hazard assessment and more than one steep slope plan. Use the Site and Sub-Area box to identify those areas, and the corresponding label on the steep slope plan map.

Slope – Steepness or gradient of the site as measured using a clinometer, typically expressed as a percentage.

Slope Length – For the site or sub-area being assessed, the slope distance from the bottom of the site to the top. Where significant benches (less than 25%) exist between steeper sections and provide an operational advantage, the slope length may be described as the average distance between benches.

Terrain Classification – Where a Terrain Stability Field Assessment (TSFA) is necessary (as required by regulation or as site characteristics incur due diligence responsibilities), it should be completed by the site owner and the report provided to the qualified assessor and contractor. Where mechanical operations are planned, the TSFA should address the harvest plan (e.g. include skid trail strategy) and
provide information on operational limitations (e.g. NO GO areas). The assessor must consider relevant recommendations of a completed TSFA.

The table below provides general guidance for the assessor / planner.

<table>
<thead>
<tr>
<th>Terrain Stability Classification</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV, V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Level for Steep Slopes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>No Go</td>
</tr>
</tbody>
</table>

**Instability Indicators** – Where a TSFA has not been completed, consider slope instability potential. Instability indicators include landslide scars; exposed soils or notably younger vegetation; pistol-buttoed or jack-strawed trees; fractured rock formations; seeps or springs at the toe of the slope; shallow, wet organic soils or wet site vegetation (e.g. devil’s club) on slopes >40%.

**Ground Roughness** – Includes boulders, rocky outcrops, gullies, hummocks, depressions and other physical features that impact machine stability.

**Soils** – Mineral soils underlying surface organic matter, evaluated to determine its ability to provide machine traction. Soil information can be directly collected via a soil pit, and by observing root balls of windthrown trees or recent road cuts, or as indicated in the Silviculture Prescription.

**Soil Depth** – Measured as the average distance from top of the mineral soil (i.e. not including organic matter) to bedrock or hardpan layer as would restrict machine stability and traction.

**Note re Snow:** In winter, where conditions are such that soils and soil depth are no longer relevant to machine stability (i.e. frozen ground, or machine is always walking on snow), it is appropriate to score Soil and Soil Depth as N/A. The assessor then needs to measure and evaluate impacts of snow depth and snow conditions (i.e. a risk rating for each one). Assessors will consider overall snow depth, depth of recent accumulations, snow consistency (e.g. firm or sugary), ice, freeze / thaw cycles, etc. Use the Soils and Soil Depth rows to provide criteria and scores, add comments.

**Pre-Existing Debris** – Windthrow, downed woody debris and stumps considered as obstacles with respect to how they would impact the ability of operators to effectively maneuver around (or over).

**Understory** – Saplings, shrubs and other low vegetation, considered with respect to the operator’s ability to see the ground, and how it would impact machine stability / maneuverability.

**State of Mind** – The operator’s particular mood or mental state that influences their attitude, behavior and performance. Favorable factors include positive attitude; being alert; mind on task; well-rested, well-fed and hydrated; understands risks / hazards; clear on plan and how to implement successfully. Troublesome factors include distractions, fatigue, impairment, complacency, and not sure of plan and how to complete successfully.

**Operator Competency** – The skills and abilities as determined by the combination of relevant observed / recorded experience, knowledge and training. Consider their experience operating a specific machine on sites with similar characteristics and in timber of similar size and quality, and the degree of success they have demonstrated in those conditions. Also consider their ability to read and understand maps and plans, communicate with supervisor and workers on site, self-trigger on changing conditions / hazards, etc.
Duration of Exposure – The length of time an operator will be working on a specific steep slope area; shift length, frequency of scheduled breaks, number of continuous shift days operating on steep sites, etc. The extent to which duration impacts each operator varies with their skills, experience and state of mind, as well as dynamic conditions (e.g. weather). For example, an operator working on the 7th consecutive day of 10-hour shifts that have few breaks and consistently poor weather is at far greater risk of error than if they were on the 3rd day of their schedule that has 8-hour shifts, regular breaks and favorable weather. See also page 15 of the Steep Slope Resource Package.

Worker Isolation – Should a machine upset or roll-over occur, the time that would be required for first aid assistance to reach the operator. Consider that in some situations mechanical assistance (e.g. another machine to right the upset machine before the door can be opened) may be necessary before first aid can be given.

Environmental Factors – Those weather conditions that impact machine stability, traction, operator visibility and fatigue, and operational difficulty. These include high winds, heavy rain or snow, extreme temperatures (more than 25°C or less than -30°C), fog, rapidly changing weather, etc.

Timber – Timber quality factors (e.g. decay, root rots, stem rots, broken tops, excessive limbs, etc.) have implications for operational difficulty, stem breakage, resulting in greater debris accumulations and increased difficulty working with or around debris. Assessors can also use this section to describe a general timber hazard.

NO GO area – An area or situation in which mechanical operations will not be undertaken as machine stability cannot be assured.

Building the Steep Slope Plan
One (1) completed assessment form can be used to build a plan that includes all machines to be used on a given site (noting that there may be more than one site in a given harvest unit). Recognizing that the operational plan implicitly includes other safe work procedures (e.g. as described in parts 2 and 3 of the Resource Package), the planner builds a plan by designating specific machinery, operators and additional controls on Page 2.

Practically, it is advantageous to use the one-form approach to ensure consistency of communications. Involving all operators in the initial pre-work, and when updates or amendments are required, ensures accurate and consistent plan communication. Assessors/planners need to be aware that because there may be significant time between phases (e.g. bunching occurs 2 months before skidding), it is necessary to re-evaluate sites to determine if changed conditions now require an updated harvest plan.

Site Identification and Mapping
This hazard assessment process is intended to be used to identify site-specific characteristics that impact machine stability, and to enable development and delivery of safe work results across a harvest unit. In order to determine the size of the area to which an individual hazard assessment applies, the qualified assessor will consider the variability of site attributes across the harvest unit, and the magnitude of hazards each confers. Below is guidance for consideration.
For purposes of steep slope logging, a “site” can be described as an area having similar site characteristics (e.g. slope, soils, timber, roughness, etc) such that it has one Overall Machine Stability Risk Rating and such that the associated plan identifies one set of operational controls to assure machine stability. Where additional actions or more stringent controls must be applied to assure machine stability, a different site exists and a separate plan must be developed.

Within a single harvest unit, it may be possible to group sites that are physically separate but have the same characteristics and risk rating. The assessor can complete one hazard assessment form and develop a plan that describes the common set of controls that will be implemented in all of those sites. In all cases, but particularly when separate sites are grouped, clear, consistent identification on maps is critical. Sites with the same set of controls must be colored the same on the map; sites that require different controls must be labeled differently.

For example, a block might have a general slope of 31%, but at 4 sites within the block, there are rocky outcrops and associated sideslopes of 46%. Provided these sites are clearly identified on the steep slope plan map, and provided the plan for each of those 4 sites is the same (e.g. tilt-cab buncher run by John, 527 track skidder operated by Stan, etc.), one hazard assessment and one steep slope plan can be applied to all 4 sites.

Conversely, if the west half of Block 767 (call it Site A) has uneven slopes of 38%, poorly-drained soils and heavy windthrow while the east half of Block 767 (Site B) has 53% slopes over well-drained soils and an open understory, the qualified person will likely determine that machine stability can only be assured if two different sets of controls are applied. The assessor will complete 2 hazard assessments to facilitate 2 steep slope plans.

Spatially, a site should usually be larger than 8 metres (or 1 ½ track lengths) before it requires a distinct assessment / plan. The rationale for this is as follows.

- Mobile equipment can be operated to maneuver around obstacles and small steep slope areas, and can therefore avoid spatially brief hazards.
- Mechanical harvesting equipment is equipped with a boom or blade that can be moved to assist in machine stability. For example, a feller-buncher boom typically can be extended 8 to 10 metres, and used as additional support while the machine traverses steep / uneven ground.
- Machines with booms, line skidders and grapple skidders with extendable grapples can be effectively extended, reaching in to access trees, and thereby avoiding the need to travel across brief steep areas.
- It is difficult to map very small areas without contributing clutter that detracts from the rest of the map. However, where hazards occur in a very small area, such “points” should be identified in the field and on the map, and necessary controls added to the harvest plan.

**Note:** For some applications, it may not be possible to employ the advantages of reaching-in or micro-site avoidance. For example, some silviculture treatments require 100% coverage to achieve objectives. A disc-trenching steep slope plan must consider machine stability for all steep pitches within the treatment area, and potentially identify NO GO zones even though the block was logged using standard mechanical methods.
## Steep Slope Hazard Assessment Tool
### Hazard Identification and Assessment

### Machine Stability Factor

<table>
<thead>
<tr>
<th>Machine Stability Factor</th>
<th>Risk Level 1</th>
<th>Risk Level 2</th>
<th>Risk Level 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOPE &amp; SLOPE LENGTH, TRACKED MACHINES</td>
<td>40 to 50% and Slope Length &lt;50 metres</td>
<td>40 to 50% and Slope Length &gt;50 metres</td>
<td>&gt;50% and Slope Length &gt;10 metres</td>
<td></td>
</tr>
<tr>
<td>SLOPE &amp; SLOPE LENGTH, WHEELED MACHINES</td>
<td>35 to 45% and Slope Length &lt;50m</td>
<td>35 to 45% and Slope Length &gt;50m</td>
<td>&gt; 45% and Slope Length &gt;10m</td>
<td></td>
</tr>
<tr>
<td>TERRAIN STABILITY / CLASSIFICATION</td>
<td>No Instability Indicators and slopes &lt;50%</td>
<td>Instability Indicators and slopes &lt;50%</td>
<td>Slopes &gt;50%</td>
<td></td>
</tr>
<tr>
<td>GROUND ROUGHNESS: BOULDERS, OUTCROPS, HUMMOCKS, DEPRESSIONS</td>
<td>&lt;30% of steep slope area covered by roughness features</td>
<td>30 to 50% of area covered by roughness features</td>
<td>&gt;50% of steep slope area covered by roughness features</td>
<td></td>
</tr>
<tr>
<td>SOILS</td>
<td>Well-drained (e.g. gravel, coarse sand)</td>
<td>Mod. well-drained (fine sand, silt); indicators of sub-surface flows</td>
<td>Poorly-drained or saturated (silt, clay), high water table</td>
<td></td>
</tr>
<tr>
<td>SOIL DEPTH</td>
<td>&gt;30 cm to bedrock</td>
<td>15 to 30 cm to bedrock</td>
<td>Thin soils (less than 15 cm), or bedrock exposures</td>
<td></td>
</tr>
<tr>
<td>PRE-EXISTING AND POST-HARVEST DEBRIS</td>
<td>Open understory, no windthrow</td>
<td>Moderate downed timber, understory, stumps &lt;30cm</td>
<td>Heavy downed timber, understory, stumps &gt;30cm</td>
<td></td>
</tr>
<tr>
<td>HUMAN FACTORS: STATE OF MIND</td>
<td>Consider operator focus, alertness, understanding of plan and how to implement, confidence, stress level, physical and mental workplace distractions, well-fed and well rested; AVOID complacency, fatigue, rushing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATOR COMPETENCY</td>
<td>Does the operator have adequate training and experience to complete this work? Has the operator demonstrated successful operations using this machine on sites with similar attributes and timber?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DURATION OF EXPOSURE</td>
<td>How long will the operator be working on a specific steep site? Also consider shift length, # of scheduled breaks, # of consecutive shift days, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORKER ISOLATION - TIME FOR ASSISTANCE TO REACH OPERATOR</td>
<td>&lt; 15 minutes</td>
<td>15 to 30 minutes</td>
<td>&gt; 30 minutes</td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENTAL FACTORS (E.G. WIND, HEAVY SNOW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER SITE FEATURES / CONSTRAINTS (E.G. DANGER TREES, BENCHES, RETENTION STRATEGY, ETC.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIMBER HEIGHT (AVG.):</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AVERAGE STEM DIAMETER:</td>
<td></td>
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<tr>
<td>MAXIMUM STEM DIAMETER:</td>
<td></td>
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</tbody>
</table>

### Overall Machine Stability Risk Rating:
3 or More “Risk Level 3” Ratings Results In “No Go” Unless Additional Measures Are Taken (See Page 2).

### Qualified Assessor:

Signature:
# Steep Slope Hazard Assessment Tool
## Practices and Controls to Eliminate or Mitigate Hazards

<table>
<thead>
<tr>
<th>Cutting Permit:</th>
<th>Block:</th>
<th>Site or Sub-Area:</th>
</tr>
</thead>
</table>

### Designated NO GO for Mechanical Operations
Identify Designated Machines / Name Designated Operators:

#### Indicate those Mechanical Features Prescribed to Ensure Machine Stability
- [ ] Non-Tilting Cab
- [ ] Tilting Cab
- [ ] Zero Tail Swing Design
- [ ] Extended Tracks
- [ ] Telescoping Boom

#### Picks / Grousers (describe height & spacing):
- [ ] Non-swivel Head
- [ ] Rotating Head
- [ ] Intermittent Saw
- [ ] Hot Saw
- [ ] Shave Stumps, As Required

### Head Cutting Capacity (Diameter):
- [ ] Non-swivel Head
- [ ] Rotating Head
- [ ] Intermittent Saw
- [ ] Hot Saw
- [ ] Shave Stumps, As Required

#### Tree / Weight Handling Capacity:
- [ ] Chains on 4 Wheels
- [ ] Flotation Tires
- [ ] Swing Grapple
- [ ] Other Devices:

### Mechanical Features to Ensure Stability
- [ ] Approach Steep Slopes From Below Benches
- [ ] Operations During Daylight Hours Only
- [ ] Utilize Existing Benches
- [ ] Up trail, safe turn-around, Direct down-slope Skid
- [ ] Construct & Use Machine Trails (identify on map)

#### Communications Process (e.g. 2-way radio, cell, etc.)
- [ ] Man-check Frequency (who, how often)

#### Poor Weather Shut-down Conditions (describe)
- [ ] Available Assistance (machine, operator)

### Site-Specific Requirements & Notes

<table>
<thead>
<tr>
<th>Date:</th>
<th>Signature:</th>
<th>Date:</th>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### Qualified Person Building Plan:
- [ ] I have reviewed the associated Steep Slope Hazard Assessment and verify its accuracy.

**Attach Copy of Hazard Assessment to Steep Slope Plan Map**