NORTH VANCOUVER DISTRICT

Creek Hazards

Mountain creeks move large volumes of debris because they generally react quickly to rain and snow melt, have gulleys and narrow flood plains, and erode rather than deposit material.

They channel water and debris from their side hills. They can be clogged by debris that makes a dam which holds back water. Small dams like that generally disintegrate quickly and release the water.

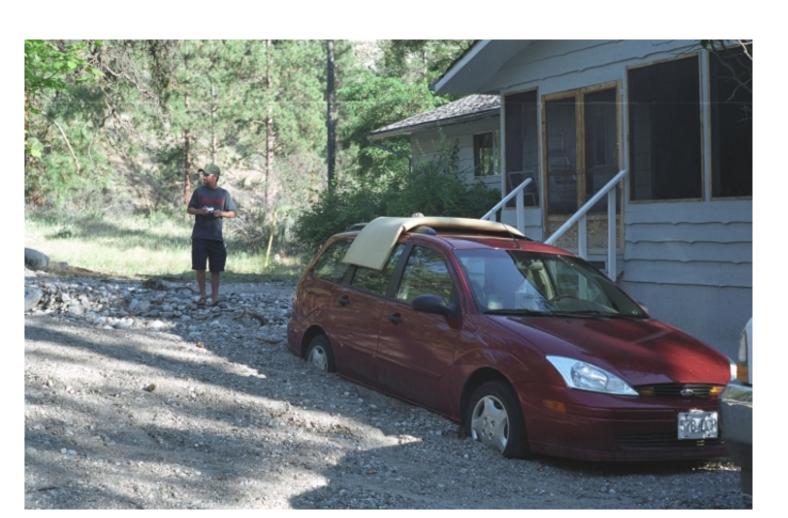
Increased storm events due to changing climate cause more frequent flooding. Preventative measures to avoid flood and debris flow damage used in the past may not apply to the near future.

Low gradient sections of creek are

susceptible to overbank flow forming

a wide flood plain.

water



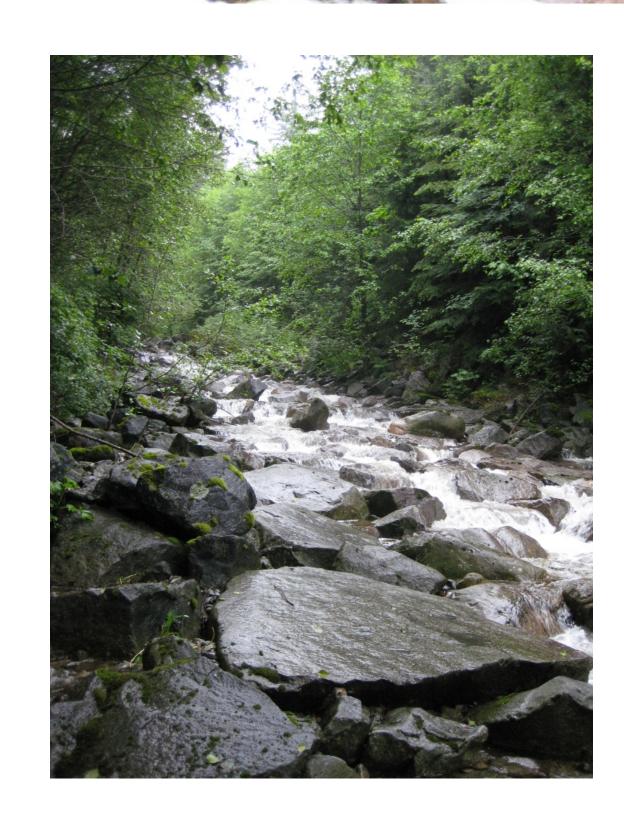
In the path of a debris flood overflow channel. The debris is dumped out of the water as it encounters obstacles and slows it flow.(C. Struik)



Debris flows triggered where the logging road concentrated runoff.

Contributing Factors

Moderately steep mountain stream over bedrock showing typical large boulders and blocks. Such material can be destructive when moved during intense floods.



Heavy rains and rapidly melting snow pack are the primary causes of creek hazards

Poorly engineered roadways can focus runoff and trigger landslides.

unconsolidated sediment and soil

Bedrock Incised narrow gulley

Debris flows can form dams that can back up creek water, catastrophically collapse and create debris floods.

compatible uses

e.g. golf course

Debris floods consist of a slurry of 10 to 25 % debris in flood waters.

Incised narrow gulleys at steep sections of the creek can concentrate debris and cause extensive rapid erosion during high runoff or debris floods.

Floodplain

breached dyke

Flood level

Normal river channel GSC, R. Turner

Living with a flood

Controls on Creek Conditions: Slope, Geology, Weather

Slope

The steeper the slope, the faster the water flows. Large volumes of fast-moving water can move large debris.

The shallower the slope the more the water spreads out, potentially creating wide flood plains.

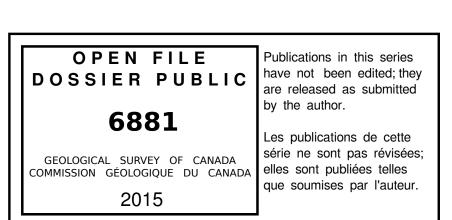
The instability increases as the slope steepens.

Geology

Loose sediment and soil can be easily eroded by fast creeks. On steep slopes the creek will form steep gulleys through loose material. Erosion is increased during floods.

Bedrock can form steep walled canyons where creeks are steep and fast flowing. Canyons and gulleys channelize the flow.

(http://geoscan.nrcan.gc.ca/).



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Flood-proofed structure

Weather and Stream Flow: January 2004 to January 2005 Legend Mean temperature (°C) Total precipitation (mm) Snow on ground (cm) Stream discharge (cfs) Daily weather data: Vancouver International Airport Daily discharge data: Seymour River (Station 08GA030) (Source: Environment Canada)

Graph shows weather conditions that led up to the January 2005 Berkley landslide in the District of North Vancouver, BC. In coastal BC, heavy rains are typical in fall and winter. Rain on snow can make the situation worse. Intense rainfall on saturated sediment causes increased groundwater flow and surface runoff. Floods are common in the fall (intense rain) and early summer (melting snow).



Britannia Beach flood of September 1991. Example of a typical mountain stream flood at the stream's delta.

L.C. Struik