

Living with Slopes

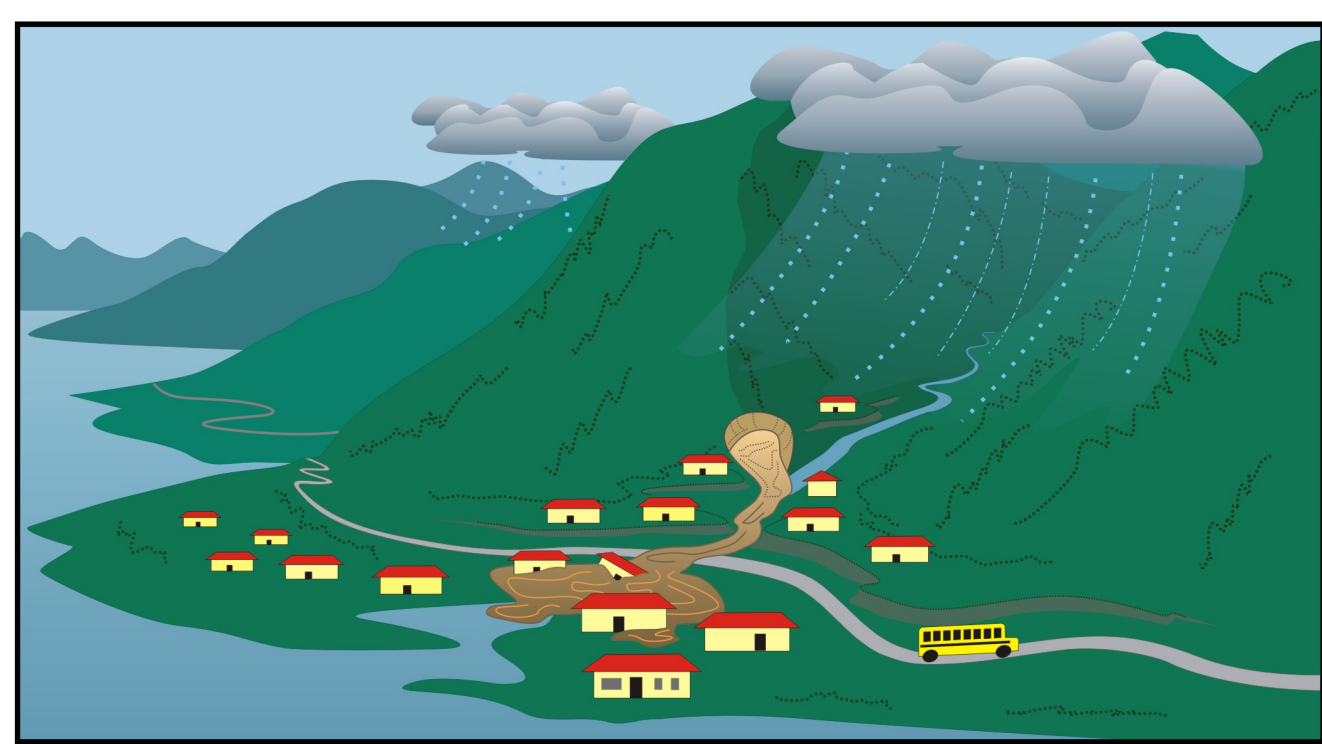
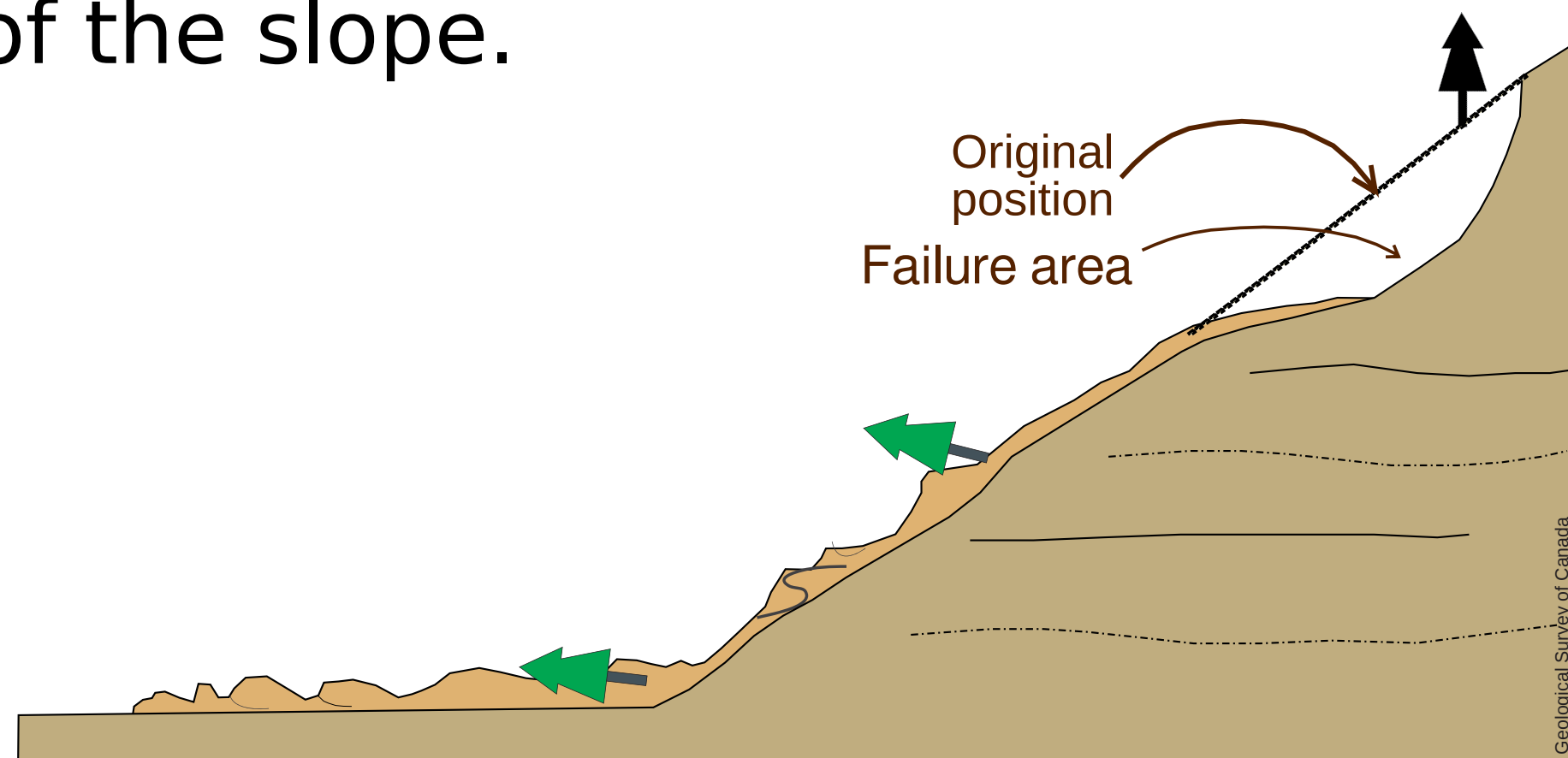


Debris flow at Lions Bay, BC, 1983

Flowing Debris

A dangerous type of landslide in coastal British Columbia is the debris flow.

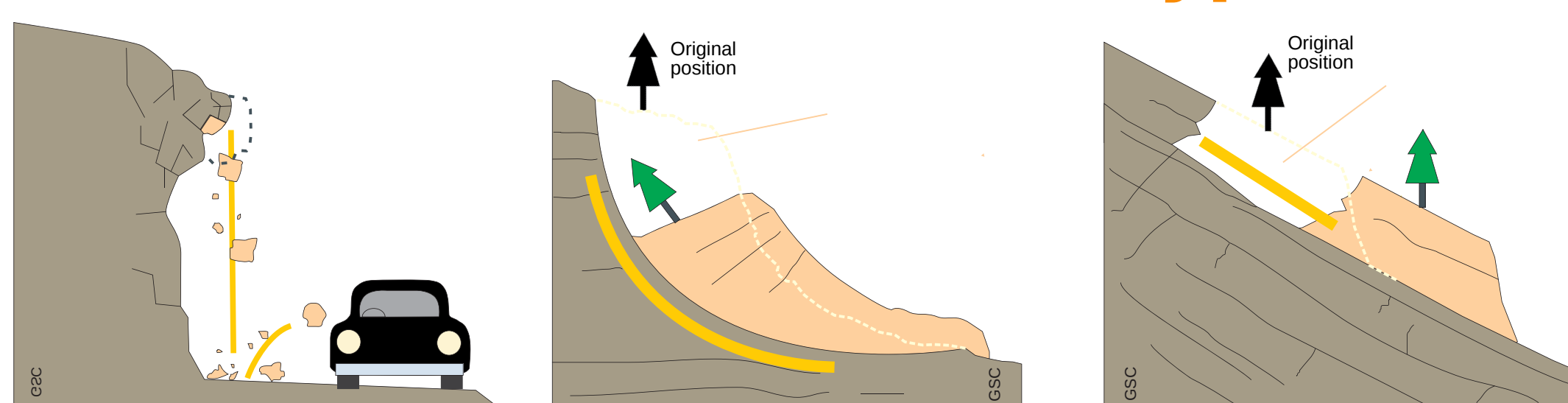
Sudden rapid flow can impact human life and property above the failure, along its path and at the bottom of the slope. The greatest threat is to the buildings and people at the base of the slope.



Debris flows usually occur in saturated loose sediment on steep slopes. Part of the slope becomes loose and begins to move downslope. The moving mass disintegrates or liquefies and flows, hence the informal name - mudslide or mudflow.

As the mass moves downslope, it gathers additional sediment and debris, including trees and other material in its path. At the bottom of the slope the material spreads out in a fan-shape, burying the original surface.

Other Local Landslide Types



A **rock fall** is the detachment and free fall of rock from a very steep slope. Rock falls are particularly hazardous along roadways.

A **slide** is the downward movement of a mass along a plane of weakness (failure plane). It moves relatively intact and can disintegrate as it travels. It can occur in bedrock or loose sediment.

Living with the slope

Property owners are responsible for maintaining their property and reducing risk where possible. Property owners are encouraged to be good stewards of the slope by following these guidelines:

Divert water around and away from unstable slopes in a controlled manner. Avoid ponding near slopes.

Contain flow by capturing roof and pavement drainage in lined gutters. Design your property and landscaping to shed water away from steep slopes.

Discharge concentrated water toward city storm drains, street gutters or rocky stream beds.

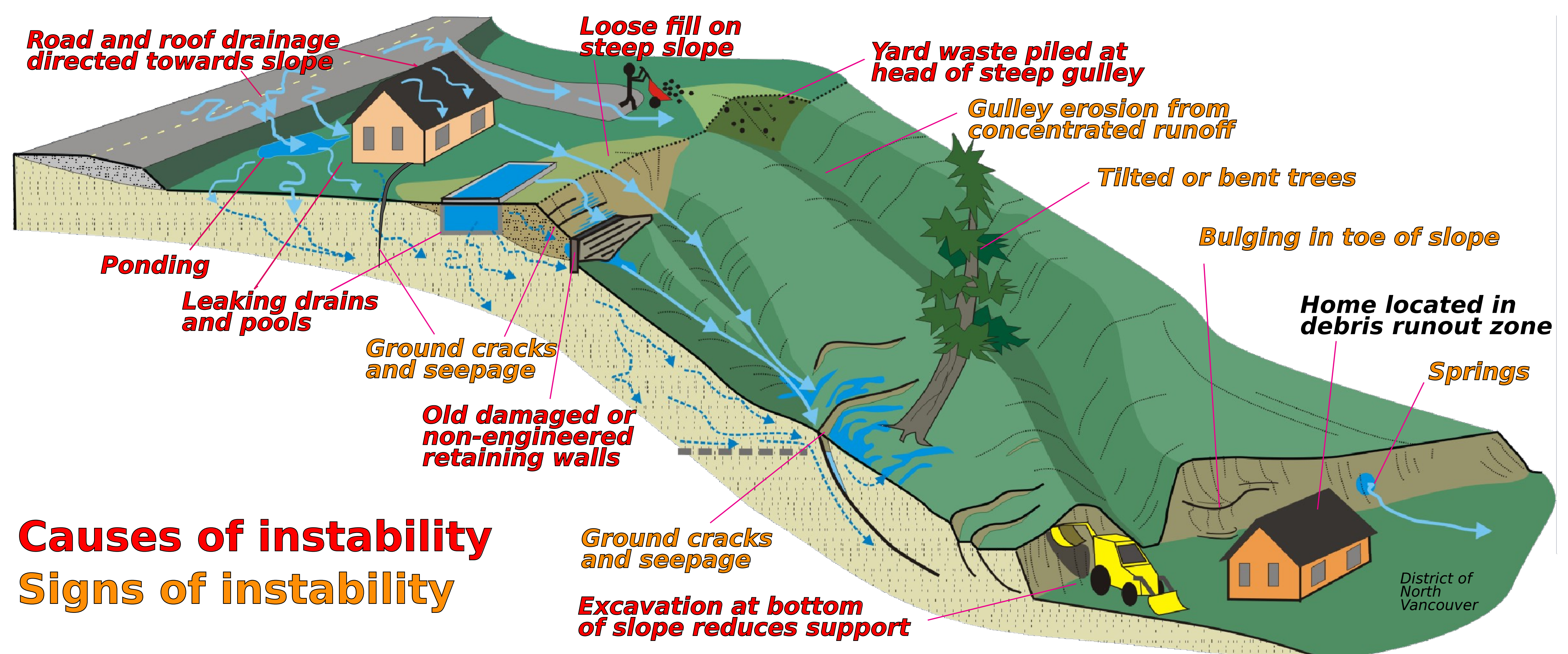
Avoid placing fill, including yard clippings, excavated material, sand and soil at the crests of steep slopes or along pre-existing drainage channels.

Do not undercut the bottoms of steep slopes without engineered reinforcement.

Locate landscaping structures as far as reasonably practicable from steep slopes or channel discharge points.

Check and repair leaks in plumbing irrigation pipes, drains, gutters, downspouts, and swimming pools.

Check for deformed structures like cracks in foundations or pavement, sticking doors and windows, tilted floors, sagging decks, failing retaining walls, tilted power poles. Retain a qualified engineer or contact the



Causes of instability Signs of instability

Why landslides? Slope, Geology, Weather

Slope Conditions

All slopes can be unstable. Slope incline / topography and the presence and condition of retaining structures and other engineered works are contributing factors.

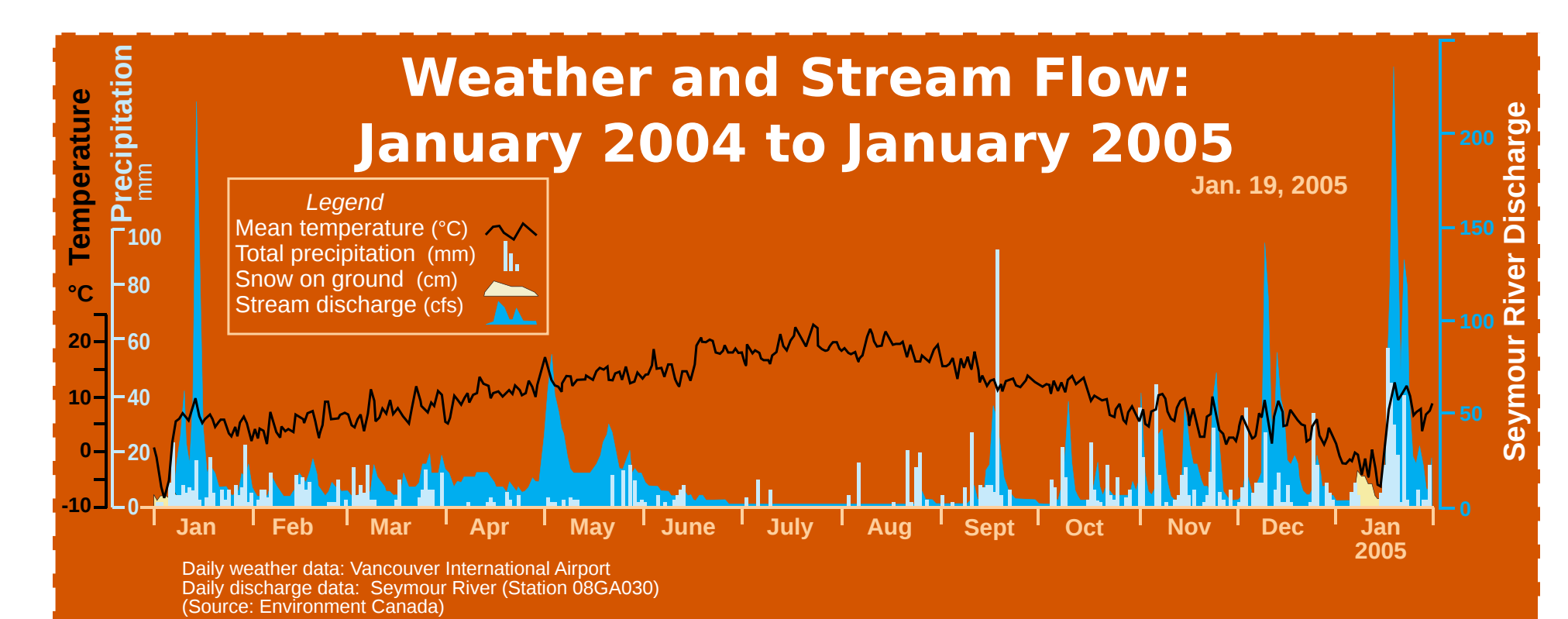
Unstable slopes along river valleys that are deeply incised and mantled by loose sediments, and rock faces along road cuts are as susceptible to landslides as mountain sides.

Geological Conditions

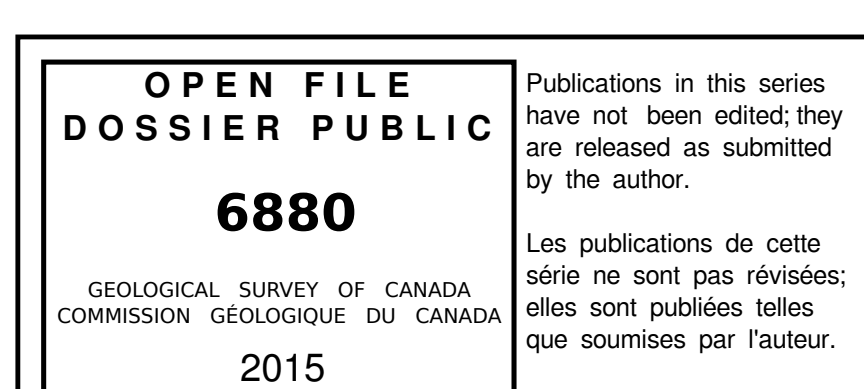
The instability of slopes increases as its material weakens.

Examples of weak materials are highly fractured bedrock and saturated unconsolidated sediments.

Weather Conditions



Graph shows weather conditions that led up to the January 2005 Berkley landslide in the District of North Vancouver, BC. Prolonged intense rainfall saturates the ground, weakens unconsolidated sediment or fill, and can trigger debris flows of that weak material. In coastal BC, such 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.



Recommended citation
Struik, L.C. (comp.), 2015. Living with slopes; Geological Survey of Canada, Open File 6880, 1 poster. doi:10.4095/295686

Acknowledgements: This poster is an abridged version of one produced by Dr. J.M. Aysworth, Geological Survey of Canada, and Fiona Dercole, District of North Vancouver.

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