

DEBRIS FLOODS

Floods that move large amounts of soil, rocks, and trees

Debris floods can be triggered by heavy rain, rain-on-snow events, and upstream hazards (debris flows, dam breaches)

Debris floods are more likely to occur after periods of prolonged rain or snowmelt, or in years following forest fires

Houses near mountain creeks are at greatest risk



Debris floods can occur over a long period of time (days) and can have several surges (pulses)



Debris floods can burst their banks and flood houses far from the channel



Debris floods can erode banks and undermine building foundations



Debris floods can sweep away or bury cars



Debris floods can destroy roads and bridges



PROTECT YOURSELF FROM DEBRIS FLOODS

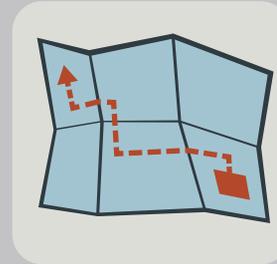
BEFORE

Stay informed



Keep updated with weather advisories, such as heavy rainfall warnings. Consult your local hazard map to learn where the flood hazard zones are located.

Prepare and plan



Prepare an emergency kit for your home, vehicle, and workplace. Know your local flood evacuation routes and emergency shelter locations.

Know the signs



Look/listen for an abrupt increase or decrease in water flow, unusually muddy water, and the sound of cracking trees and rolling boulders.

Protect your property



Store valuables in high places or water-tight containers. Consider flood-proofing measures, such as elevating the first floor, flood walls, erosion protection, sump pumps, etc.

DURING

DECISION: Evacuate



If it is safe to do so, take the flood evacuation route or go to higher ground. If you are able, shut off your gas/electricity and help others evacuate.

DECISION: Shelter



If you are unable or it is unsafe to evacuate, seek shelter on high ground. Avoid basements.

Build sandbag dikes



Sandbag dikes can prevent or lessen damage from overland flooding. Do not attempt to build if you are required to evacuate.

DO NOT go near the bank



Debris floods can quickly erode and undermine banks. If you are near the bank, you put yourself at risk of falling in and being swept away.

DO NOT cross bridges



Debris floods can erode bridge piers and cause bridges to collapse. Bridges affected by debris flooding must be avoided.

DO NOT cross flood waters



Moving water as little as 30 cm deep can quickly sweep you away. Do not attempt to drive or walk through water or debris.

AFTER

Obey road closures



Do not enter areas that are closed-off. There may be emergency repair efforts underway or flooded areas unsafe to the public.

Return only when safe



Do not return home until authorities say it is safe and they have cleared your home of structural, electrical, or other hazards.

Help each other



Floods are stressful and traumatic events. Offer and accept help if you are able. Communities are more resilient when they work together.

Clean up



If your home was flooded, dispose of mouldy items, open doors and windows, and scrub all washable surfaces with a household bleach solution.

NOTES

BGC Engineering Inc. (BGC) prepared this infographic with artwork by Sophia Zubrycky. This infographic depicts some measures that may help to lower but not eliminate certain kinds of risk associated with debris floods. Simply following the measures shown in this infographic does not make it safe to occupy areas at risk of debris floods. Even if the measures shown in this infographic are taken, debris floods may still cause serious personal injury (including death) or property damage. BGC provides no guarantee or warranty of any kind related to the information in this infographic. Persons and entities using or relying on this infographic do so at their own risk. BGC will not be responsible or liable for any loss or damage including any personal injury, death, or property damage that any person or entity may suffer or sustain as a result of the information in this document, or any use of or reliance on this document.

Information on flood preparedness is from PreparedBC's Flood Preparedness Guide.

Photo references:

[Top right] Wildfire. Photo: Shutterstock.

[Top left] Debris flood in Canmore, AB. Photo: THE CANADIAN PRESS/Jonathan Hayward.

[Middle right] Flood damaged homes along Cougar Creek in Canmore, AB. Photo: THE CANADIAN PRESS/Jeff McIntosh.

[Bottom left] Car swept away by debris on the Coquihalla Highway, Hope, BC. Photo: THE CANADIAN PRESS/Jonathan Hayward.

[Bottom right] Bridge damages from debris flood on Hwy. 1, Lytton, BC. Photo: TranBC.

DEBRIS FLOWS

A fast, flowing landslide comprised of mud, rocks, trees, and water

Debris flows are triggered by heavy bursts of rain or rain-on-snow events



Debris flows are more likely to occur after periods of prolonged rain or snowmelt, or in years following forest fires

Houses at the base of steep slopes with mountain creeks are at greatest risk



Debris flows begin in mountain creeks and grow in size as they travel down slope, usually in surges (pulses)

Debris can bury or destroy houses



Debris can flow faster than the fastest human can run

Debris can suddenly jump out of the channel

Debris can impact houses far from the channel



Debris can sweep away or crush cars



PROTECT YOURSELF FROM

DEBRIS FLOWS

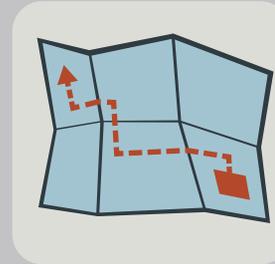
BEFORE

Stay informed



Keep updated with weather advisories, such as heavy rainfall warnings. Consult your local hazard map to learn where the slope hazard zones are located.

Prepare and plan



Prepare an emergency kit for your home, vehicle, and workplace. Plan a safe evacuation route and muster point. Know which rooms are safest if you have to shelter in place.

Know the signs



Look/listen for an abrupt increase or decrease in water flow, unusually muddy water, shaking ground, and a loud roar (sounds like a train or helicopter).

Safe home design



Put high occupancy rooms like bedrooms on the top floor and on the downhill side (away from slopes).

DURING

DECISION: evacuate



If you believe your life to be in imminent danger and you see a clear path to safety, evacuate. Get away and to higher ground as fast as you can.

DECISION: shelter



If it is unsafe to evacuate, shelter up and away. Climb to the top floor or on the roof. Shelter on the downhill side, away from the slope. Avoid basements.

Climb on top of furniture



Get on top of a bed or counter to avoid being swept away or buried. Do not hide behind or underneath heavy furniture as they can crush or pin you down.

Shelter in a closet



If you cannot escape vertically, small rooms like closets can offer additional protection from collapse if your home is buried.

DO NOT exit out of curiosity



Seek shelter instead of investigating the situation. Only go outside if you have to evacuate.

DO NOT cross flood waters



Moving water as little as 30 cm deep can quickly sweep you away. Do not attempt to drive or walk through water or debris.

AFTER

Assume more will come



Debris flows come in surges (pulses) and can continue for days. Subsequent pulses may be more severe than the previous.

Make noise if buried



Shout or tap on something so search and rescue can locate you faster.

If safe, help neighbours



Help evacuate your neighbours when it's safe to do so, and offer assistance to search and rescue personnel.

Obey closures



Evacuation orders and road closures must be taken seriously. Only return when local authorities declare it safe to do so.

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Information on life loss risk reduction in case of debris flow impact is informed by Pollock, W., and Wartman, J. (2020) Human Vulnerability to Landslides. GeoHealth, 4, e2020GH000287. <https://doi.org/10.1029/2020GH000287>.

Photo references:

- [Top right] Wildfire. Photo: Shutterstock.
- [Middle left] Debris flow at Cataline Creek, BC. Photo: BGC.
- [Middle right] Debris flow at Willox Creek, BC. Photo: BGC.
- [Bottom left] Debris flow in the Austrian Alps. Photo: Shutterstock.
- [Bottom right] Car swept away by debris on the Coquihalla Highway, Hope, BC. Photo: THE CANADIAN PRESS/Jonathan Hayward.

LANDSLIDES

Movements of earth, rocks, trees, and debris down a slope

Landslides can be triggered by rain, snowmelt, or earthquakes



Landslides are more likely to occur after periods of prolonged rain and snowmelt, or in years following forest fires

Landslides can be triggered by human-made land changes, such as roads, fill placement, or excavations



Landslides can occur with little warning

Landslides can bury or destroy houses



Houses on or near hillsides are at greatest risk



Landslides can reach speeds faster than cars



Landslides can impact areas far from their source

Landslides can sweep away or crush cars



PROTECT YOURSELF FROM

LAND- SLIDES

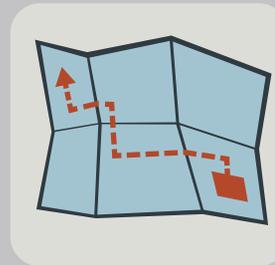
BEFORE

Stay informed



Keep updated with evacuation alerts, road closures, and weather advisories, such as heavy rainfall warnings.

Prepare and plan



Prepare an emergency kit for your home, vehicle, and workplace. Plan a safe evacuation route and muster point. Know which rooms are safest if you have to shelter in place.

Know the signs



Look/listen for fallen debris, moving and cracking trees, shaking ground, and a loud roar (sounds like a train or helicopter).

Safe home design



Put high occupancy rooms like bedrooms on the top floor and on the downhill side (away from slopes).

DURING

DECISION: evacuate



If you believe your life to be in imminent danger and you see a clear path to safety, evacuate. Get away and to higher ground as fast as you can.

DECISION: shelter



If it is unsafe to evacuate, shelter up and away. Climb to the top floor or on the roof. Shelter on the downhill side, away from the slope. Avoid basements.

Shelter in a closet



If you cannot escape vertically, small rooms like closets can offer additional protection from collapse if your home is buried.

Shelter in your vehicle



If you cannot drive away safely, shelter in your vehicle. Your vehicle may provide some protection from a landslide impact.

DO NOT exit out of curiosity



Seek shelter instead of investigating the situation. Only go outside if you have to evacuate.

DO NOT cross debris



Crossing fallen debris is very dangerous since more debris could come down. Take a route away from the slope and debris.

AFTER

Assume more will come



Debris may continue to slide since the slopes are unstable. Subsequent landslides may be more severe than the previous.

Make noise if buried



Shout or tap on something so search and rescue can locate you faster.

If safe, help neighbours



Help evacuate your neighbours when it's safe to do so, and offer assistance to search and rescue personnel.

Obey closures



Evacuation orders and road closures must be taken seriously. Only return when local authorities declare it safe to do so.

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Photo references:
[Top right] Wildfire. Photo: Shutterstock.
[Middle right] House buried by Johnsons Landing landslide, BC. Photo: CBC. Available from: <https://www.cbc.ca/news/canada/british-columbia/johnsons-landing-evacuation-order-lifted-2-years-after-fatal-landslide-1.2723388>
[Bottom left] Landsliding in Petropolis, Brazil. Photo: AP Photo/Silvia Izquierdo.
[Bottom right] Car swept away by debris on the Coquihalla Highway, Hope, BC. Photo: THE CANADIAN PRESS/Jonathan Hayward.

ROCKFALLS & ROCKSLIDES

Pieces of rock falling, bouncing, or rolling down a slope

Large masses of rock detaching, sliding, and breaking apart down a slope

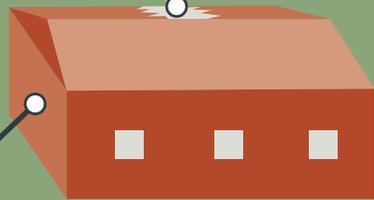


Rocks can easily break through walls and roofs



Rockslides can easily destroy roads, railways, and buildings

Houses at the base of steep slopes are at greatest risk



Events occur mostly during heavy rain, freeze/thaw cycles, or earthquakes

Rocks can reach speeds faster than cars



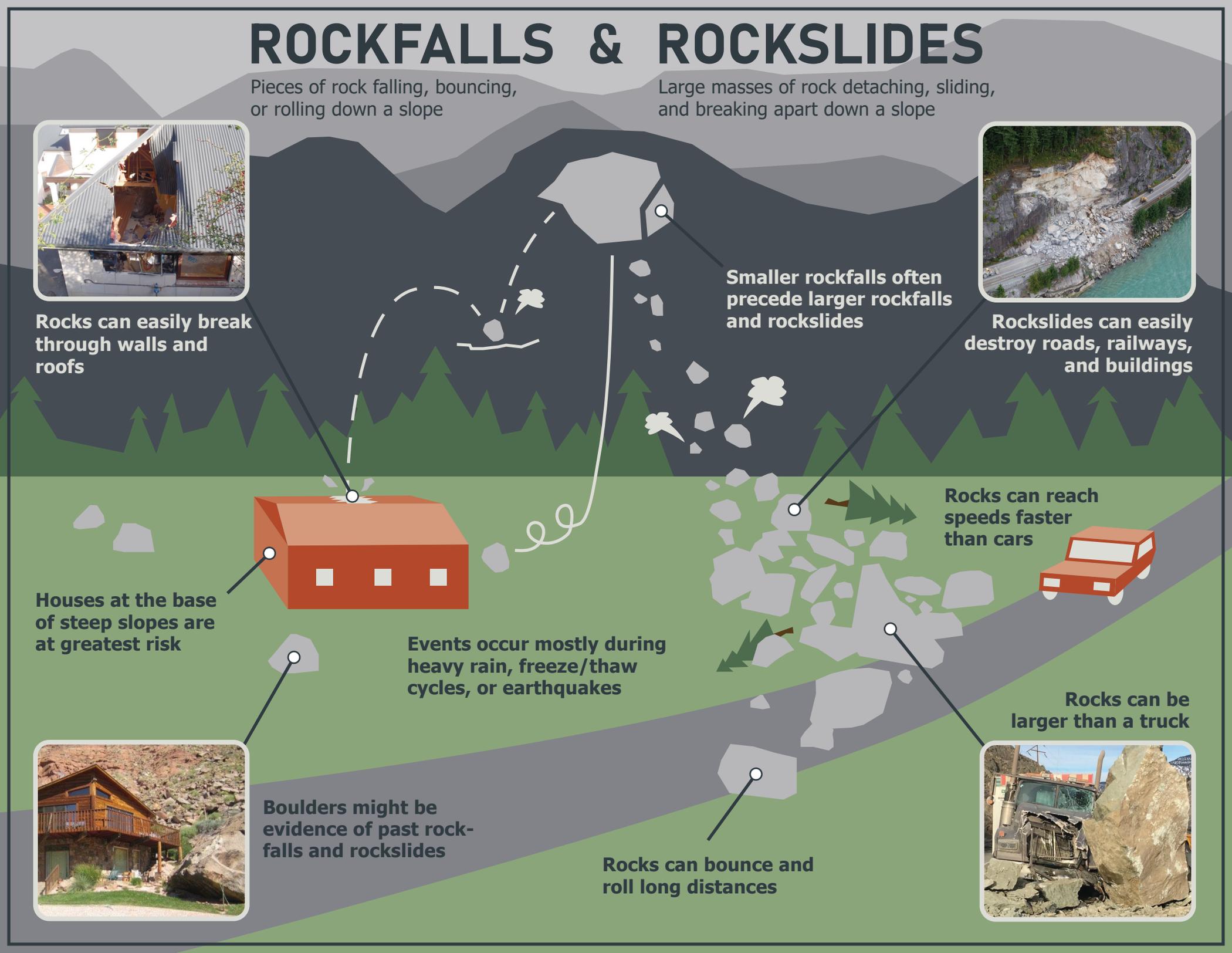
Rocks can be larger than a truck



Boulders might be evidence of past rock-falls and rockslides



Rocks can bounce and roll long distances



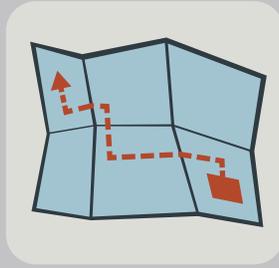
BEFORE

Stay informed



Keep updated with weather advisories, such as heavy rainfall warnings and repeated cycles of freeze/thaw.

Prepare and plan



Prepare an emergency kit for your home, vehicle, and workplace. Plan a safe evacuation route and muster point. Know which rooms are safest if you have to shelter in place.

Know the signs



Look/listen for loud cracking, clouds of dust, and shaking ground (like an earthquake). Smaller rockfalls often come before larger ones.

Know the hazard zones



Consult your local hazard map to learn where the slope hazard zones are located.

Limit exposure



Limit time spent in the slope hazard zones. Do not park beneath steep slopes or rock cuts.

Safe home design



Put high occupancy rooms like bedrooms on the top floor and on the downhill side (away from slopes).

DURING

DECISION: evacuate



If you believe your life to be in imminent danger and you see a clear path to safety, evacuate. Get away from the slope as fast as you can.

DECISION: shelter



If it is unsafe to evacuate, shelter in a room on the downhill side of your house, preferably on the top floor.

DO NOT cross rock path



Crossing fallen debris is very dangerous since more rocks will likely fall here. Take a route away from the slope and debris.

DO NOT stay to watch



Rocks can bounce irregularly and roll long distances. Get away from the slope instead of watching or filming them.

PROTECT YOURSELF FROM ROCKFALLS & ROCKSLIDES

AFTER

Assume more will fall



Rocks may continue to come down because the slope is unstable.

Notify authorities



Report any rockfalls and rockslides (big or small) to local authorities.

If safe, help neighbours



Help evacuate your neighbours when it's safe to do so, and offer assistance to search and rescue personnel.

Obey closures



Evacuation orders and road closures must be taken seriously. Only return when local authorities declare it safe to do so.

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BGC Engineering Inc. (BGC) prepared this infographic with artwork by Sophia Zubrycky. This infographic depicts some measures that may help to lower but not eliminate certain kinds of risk associated with rockfalls and rockslides. Simply following the measures shown in this infographic does not make it safe to occupy areas at risk of rockfalls and rockslides. Even if the measures shown in this infographic are taken, rockfalls and rockslides may still cause serious personal injury (including death) or property damage. BGC provides no guarantee or warranty of any kind related to the information in this infographic. Persons and entities using or relying on this infographic do so at their own risk. BGC will not be responsible or liable for any loss or damage including any personal injury, death, or property damage that any person or entity may suffer or sustain as a result of the information in this document, or any use of or reliance on this document.

Photo references:
[Top left] Rockfall damage from Christchurch, New Zealand earthquake. Photo: Julian Thomson.
[Top right] Rockslide blocking Sea-to-Sky highway near Porteau Cove, BC. Photo: THE CANADIAN PRESS/Jonathan Hayward.
[Bottom left] Site of rockfall tragedy in Rockville, Utah. Photo: Daily Mail U.K. Available from: <https://www.dailymail.co.uk/news/article-2523067/Boulder-size-elephant-crushes-entire-house-instantly-kills-inhabitants-Utah-landslide.html>
[Bottom right] Semi-truck smashed by boulder east of Spences Bridge, BC. Photo: Matt Ruscheinski. Available from: <https://www.cbc.ca/news/canada/british-columbia/trans-canda-highway-rock-slide-semi-boulder-1.4502567>