

# Landslide Risk and Management

In areas affected by June 2021 Storms



The thousands of trees that fell in the June 2021 storms caused extensive damage to homes, roads, drains and the land across the Mount Dandenong (Corhanwarrabul) region.

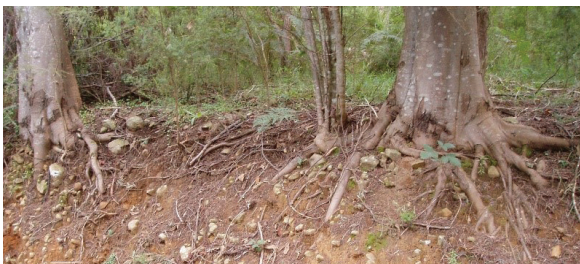
Many of the areas affected by the storm are also prone to landslide. In some cases, the uprooting of trees and damage to retaining walls may have increased or introduced new risks from landslide. To help protect residents and property from landslide, Yarra Ranges Council uses a planning control called an Erosion Management Overlay (EMO). This means that special measures need to be undertaken when rebuilding your property as the land you live on is steep and/or prone to landslides. These measures aim to keep you and your property safe.

## What Landslides Risks?

Mount Dandenong is underlain by a rock called rhyodacite which formed through volcanic activity around 370 million years ago.

In its unaltered state, rhyodacite is a very high strength rock and resistant to erosion. The high strength of this rock is the reason Mount Dandenong is a mountain, with the softer rocks around it having eroded down at a faster rate over millions of years leaving Mount Dandenong higher than its surrounds.

However, the rhyodacite undergoes a process called chemical weathering whereby over time and exposure to the atmosphere the minerals comprising the rock transform to red-brown clay which overlies the rock. Within these red-brown clays are remnant rock or 'corestones' - rounded boulders of rhyodacite embedded within the clay.



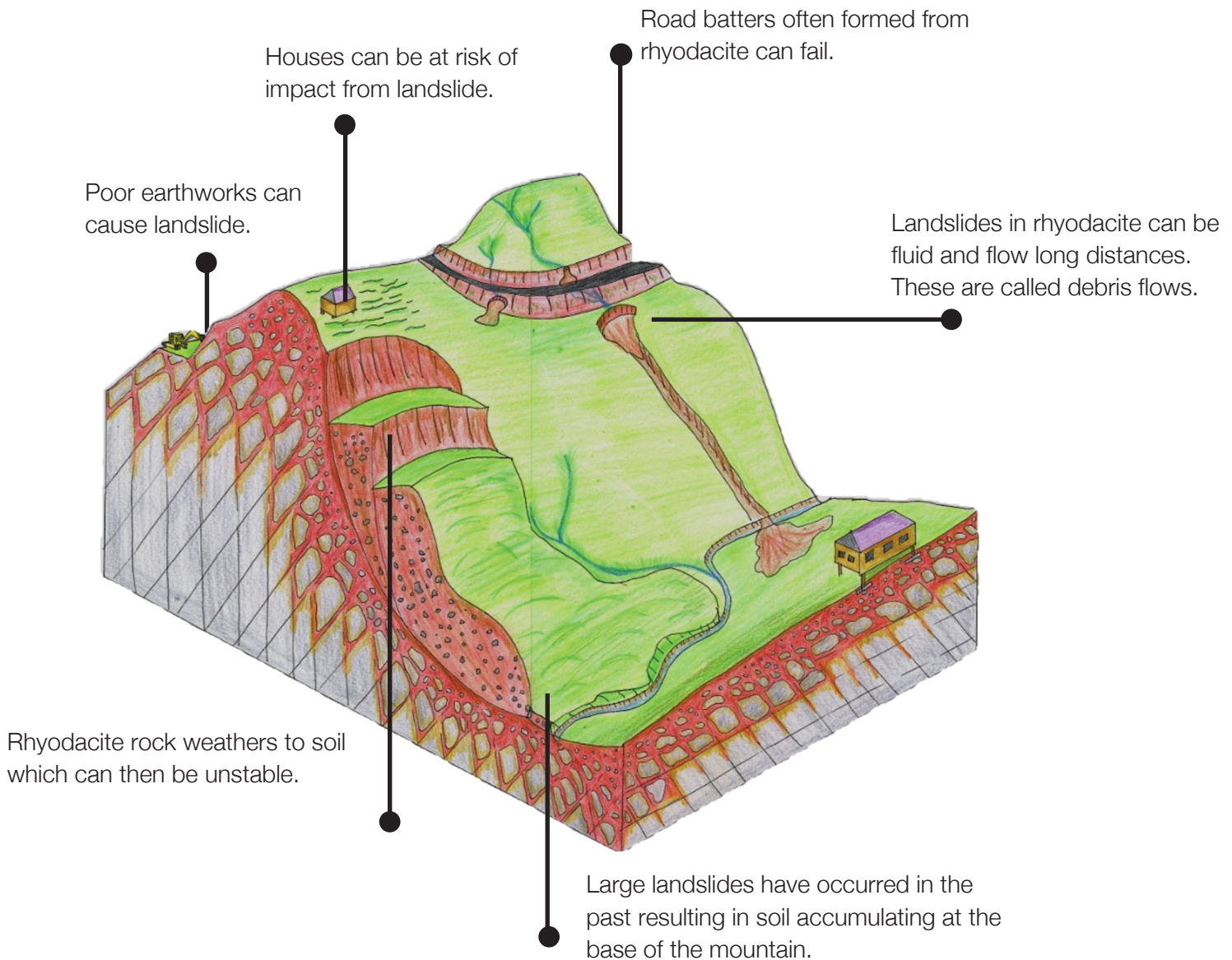
Residual rhyodacite exposed in a road cutting. The soil in this image has weathered from rhyodacite rock and at some stage been transported by a landslide.

The clay soils or 'residual soils' have a much lower strength than rock, and when on steep slopes are prone to landslide.

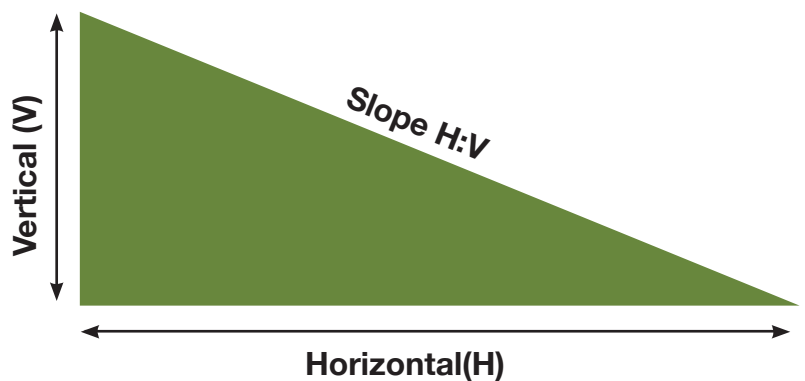
Mount Dandenong has a long history of landslides, with the first documented landslides occurring in the 1860's and geological evidence indicating that the soils of Mount Dandenong have been affected by landslides for hundreds of thousands of years.

Landslides in the Mount Dandenong area are a natural geological process.

# Examples of landslide hazards that can occur in the rhyodacite of Mount Dandenong



## Slope angle measurement



The terrain in Mount Dandenong indicates no slopes steeper than about 2 Horizontal : 1 Vertical (or about 28° measured from the horizontal). This is about the steepest slopes that the residual soils of the Mount Dandenong area can maintain long term stability.

There are no gorges or cliffs in the Mount Dandenong area and with the exception of recently formed slopes like creek banks and earthworks, and occasional slopes underlain by shallow rock, there are no natural slopes steeper than these angles.

Whilst the natural slopes of the Mount Dandenong area formed over millions of years, European occupation has impacted the natural balance over a very short time.

Through vegetation clearance, earthworks which steepen the slopes to greater than the natural stable angle and changes to the natural flow of water over the surface, humans have modified, and in many cases, increased the susceptibility of slopes to landslide.

## What Factors Lead to Landslide

Factors that cause landslide can be divided into Preparatory and Causative factors.

Preparatory factors describe the conditions that make a slope susceptible to landslide and include:

- the steepness of the slope
- lack of vegetation cover
- the thickness and type of soil
- earthworks
- poor drainage.

Causative factors are those that actually trigger the landslide and could include:

- heavy or prolonged rainfall and flooding
- earthquake.

We can't do much about Causative factors, so good planning and development in landslide prone areas seeks to address the Preparatory factors.

This ensures that development does not adversely increase the susceptibility to landslide, therefore Yarra Ranges Council has EMO planning controls. In principle, the more we can preserve the natural landform, vegetation and drainage, the less susceptible the slopes will be to landslide.

## Am I at Risk?

The EMO covers all areas within the Yarra Ranges which have been identified as having some susceptibility to landslide. However, within the Mount Dandenong area, there are some areas that are more susceptible than others. The following table indicates what attributes typically give a slope lower or higher susceptibility.

### Your level of landslide susceptibility

	Lower Susceptibility	Higher Susceptibility
Slope angle	Less than 3H:1V	More than 3H:1V
Landslide	No known past landslides or geological evidence for past landslides.	Known past landslide activity or evidence for past landslide activity.
Vegetation	Well vegetated.	Sparse or no vegetation.
Drainage	Near natural drainage or well designed and engineered stormwater drainage system directed to a legal point of discharge.	Natural surface drainage interrupted, redirected and concentrated. Uncontrolled run off and infiltration.
Earthworks	Unsupported earthworks less than 1 m high with slope batters of less than 2H:1V.	Unsupported earthworks higher than 1 m or steeper than 2H:1V Poorly supported (e.g. non-engineered or dilapidated retaining walls).

In some cases, storm damage may have increased susceptibility to landslide, for example by damaging retaining walls or effectively creating excavations by uprooting trees.

If any of the higher susceptibility attributes apply to your site, you and your home could be at an unacceptable risk from landslide and you should implement measures to reduce your risk.

## Planning requirements for EMO

For most new developments within an EMO, a suitably qualified geotechnical engineer must assess the landslide risks applicable and advise you on measures to manage those risks. This is intended to keep you and your house safe from landslide.

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If Council reviews your circumstances and concludes that you do need geotechnical advice you will need a geotechnical assessment and seek recommendations for risk mitigation from a suitably qualified geotechnical engineer or engineering geologist.

Following the

- your site has a higher susceptibility to landslide (as described in the above table)
- new water tanks, pools or spas constructed at ground level with greater than 4,500 litre capacity
- new earthworks deeper or higher than 600 mm
- changes to the location, footprint or habitable space of buildings and outbuildings
- vegetation removal.

The geotechnical engineer will prepare a report which you will need to submit to Council with your planning application. The geotechnical engineer or engineering geologist should also provide you with a geotechnical declaration form on which the engineer will declare they have assessed and advised you of your landslide risk. Council may require that you implement the geotechnical recommendations as a condition of your planning permit.

## Further Information

- Yarra Ranges Council Recovery Rebuilding Team 9294 6594
- Information about landslides and good hillside construction practice - [www.australiangeomechanics.org/](http://www.australiangeomechanics.org/)
- Provisions of the Erosion Management Overlay: [www.planning.vic.gov.au](http://www.planning.vic.gov.au)