# 2D and 3D Analysis of the Peak Hill landslide

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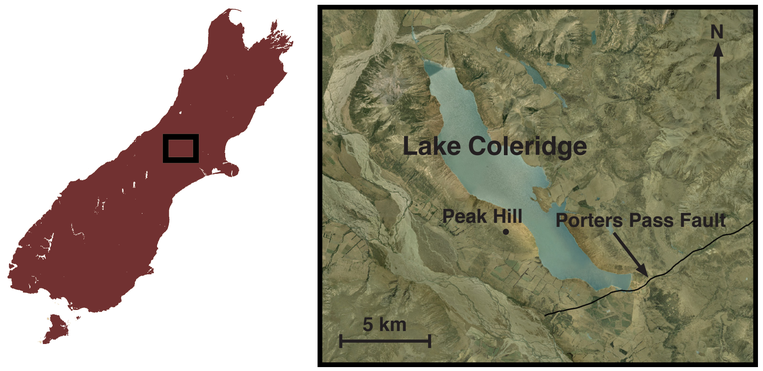
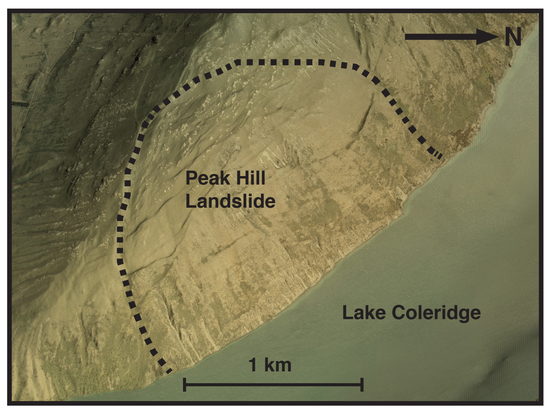
## Introduction and Objectives

This project sets out to find the advantages and disadvantages of using three dimensional slope stability analysis, while using the Peak Hill landslide as an example. The aims of the project are to:

- Produce 3D model of the Peak Hill landslide.
- Perform limit equilibrium analysis of the landslide on the 3D model and 2D sections.
- Understand the conditions required to initiate movement.
- Draw conclusions about the value of 3D failure modeling.




## Acknowledgments

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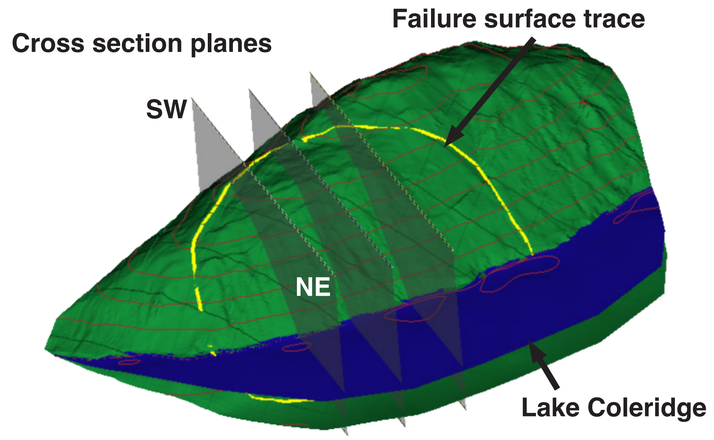
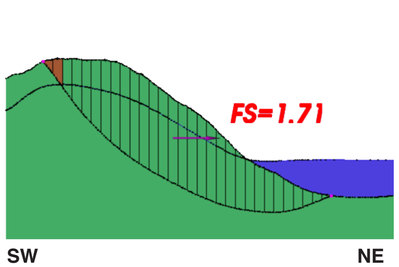
## Analysis

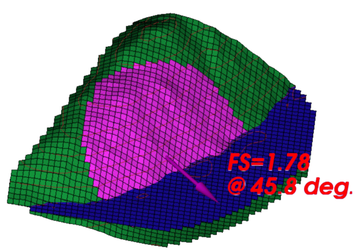
- TSLOPE software was used to analyse the slope in both 2D and 3D.
- 2D sections were positioned in the centre and to either side of the landslide, parallel to the direction of sliding found in 3D analysis.




## Results

- Factors of safety (FS) were consistently slightly higher in 3D analysis, compared to the central 2D section.
- The outside 2D sections gave higher factors of safety than both the central 2D section and the 3D analyses.




**Effect of groundwater**

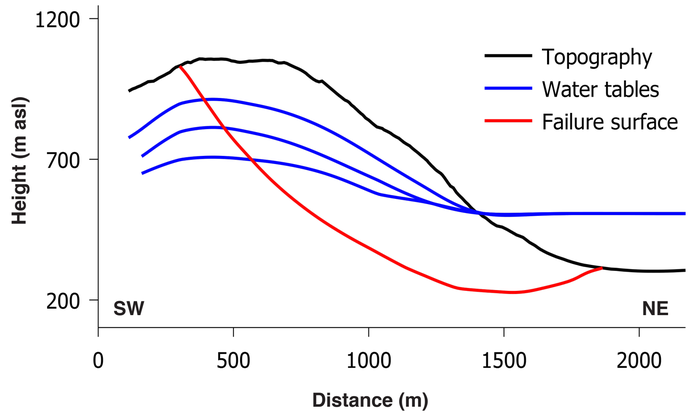
| Groundwater surface | Factor of Safety |
|---|---|
| Low | 1.93 |
| Middle | 1.89 |
| High | 1.78 |
| Saturated | 1.61 |

**Effect of seismic loading**

| Seismic load | Factor of Safety |
|---|---|
| 50 year | 1.73 |
| 150 year | 1.62 |
| 475 year | 1.52 |
| 1000 year | 1.36 |

## Methods

- Several possible water tables were used in the analysis.
- The failure surface was estimated using structural data from the scarp.
- Seismic forces were set to model 50, 150, 475 and 1000 year earthquake scenarios, based on the GNS Science National Seismic Hazard Model.




## Conclusions

### 2D vs 3D slope stability analysis

- Results of 2D analysis are conservative compared to 3D analysis only when the 2D section is through the deepest (least stable) part of the landslide.
- Sections should be parallel to the direction of movement, which must be estimated or found using 3D analysis, otherwise stability will be exaggerated.
- 3D analysis is much more reliable, if good data is available.

### Stability of the Peak Hill Landslide

- The Peak Hill landslide was found to be stable under normal conditions.
- Under both high pore pressures and high seismic loads the factor of safety suggested the landslide was stable.
- Movement of the landslide will only occur under saturdated conditions with a seismic force greater than a 1 in 1000 year event.