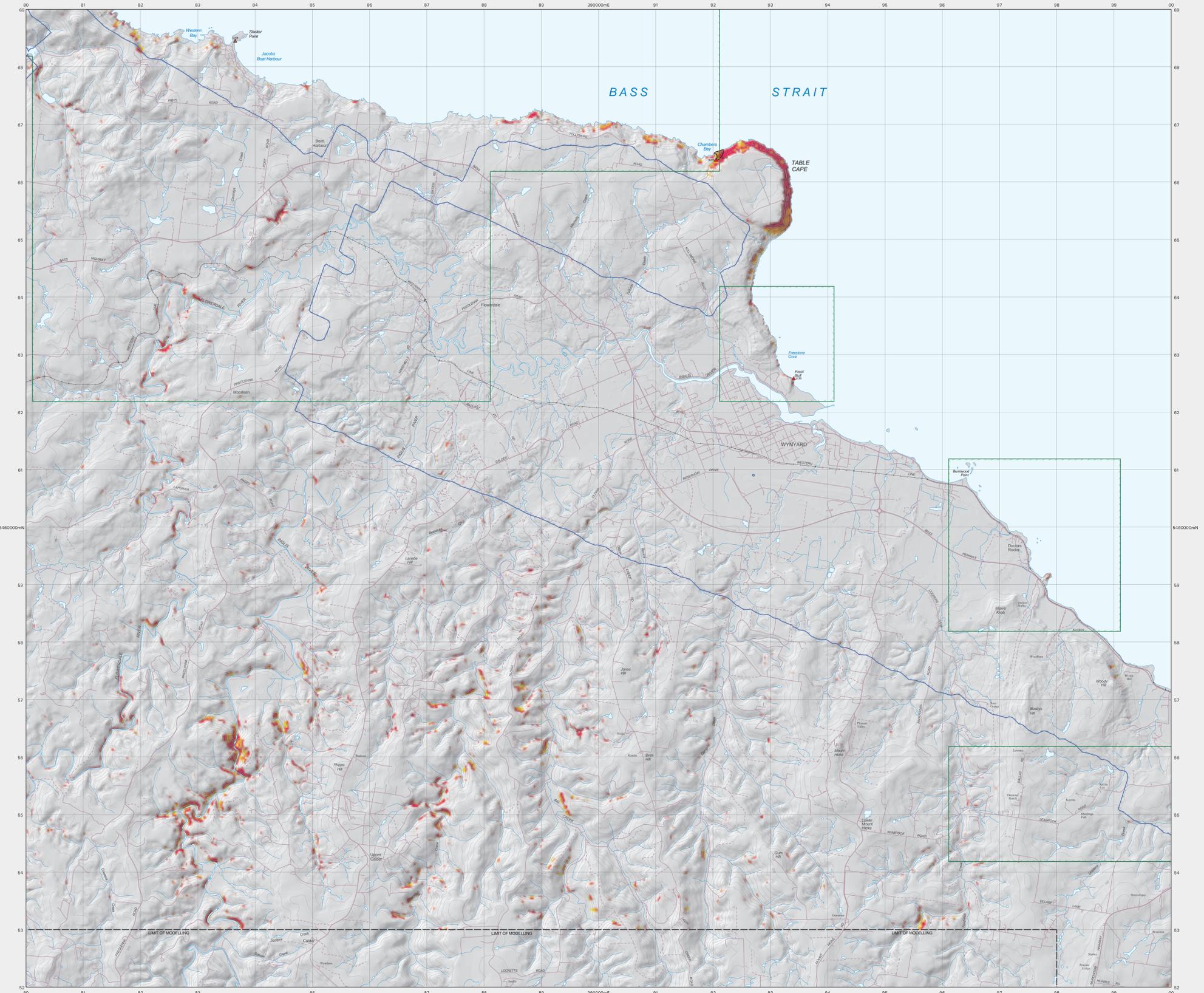


TASMANIAN LANDSLIDE MAP SERIES
WYNYARD – ROCKFALL SUSCEPTIBILITY
MAP 4



Landslide Hazard Series

Background, Aim and Purpose
This map is one of a set of thematic maps addressing regional landslide susceptibility and hazard for urban areas and surrounds in Tasmania. The project is undertaken by Mineral Resources Tasmania in partnership with Local Government and sponsored by the Natural Disaster Mitigation Programme (involving Federal and State contributions). Large tracts of land throughout Tasmania are subject to slope instability and over 60 houses have been destroyed by landslides since the 1950s with many more significantly damaged. While only minimal loss of life has occurred such events are highly traumatic to those directly affected and the financial cost to individuals and the State runs into many millions of dollars. Recent disasters such as the Thredbo Landslide in New South Wales, serve to remind us of the potential for loss of life even from relatively small landslides. In addition, landslide damage can be avoided where ground conditions are properly understood before construction proceeds and, in already developed areas, this understanding can be used to mitigate the hazard through various measures.

Method
A methodology has been specially developed for this map series and is used for other areas of Tasmania. It can be downloaded from the MRT website although minor changes in approach have been made since the first map series was published. Furthermore, the Australian Geospatial Society have published guidelines for landslide zoning (AGS 2007a) and changes have been made to conform to these as much as possible.

The methodology used is based on:
- Recording observations of land instability in and surrounding the study area in the field.
- Analysis of the processes that control each landslide type.
- Correlation of landslide locations with the landslide processes to predict areas that could be affected by future landslides.

Caveats for Use
The information provided is in the public domain and anyone is free to use it provided they refer and acknowledge the purpose and limitations.

The following caveats apply to this map:
- The hazards identified are based on imperfect knowledge of ground conditions and models to represent our current understanding of the landslide process. As this knowledge improves our perception of the hazard and the depiction on the map may also change.
- These maps can be used as a guide (flag) to the need for specific assessment in potential hazard areas.
- Hazard assessments should not be based solely on the basis of the zones delineated on the map.
- The scale limitations of the data should be considered at all times as exceeding this scale could lead to incorrect decisions about the hazard.
- Site specific assessment of landslide hazard and risk should be undertaken by suitably qualified and experienced practitioners in the fields of engineering, geology and geotechnical engineering.
- Practitioners undertaking site specific assessments should read the map text and associated documents to obtain a thorough understanding of the methodology and limitations of the maps.
- The frequency of landslides or hazards to slopes can still have issues with slope instability.
- Anthropogenic influence on slopes cannot be predicted and the occurrence of slope instability resulting from the influence of human actions is specifically excluded from these maps.
- The identification and presence of cut and filled slopes have not been specifically considered in map production and their status is such that they often cannot be resolved on the maps.
- The velocity and size of boulders involved in rockfall is expected to vary from place to place and should be considered in site specific investigations. This includes the consequences for persons. Structures could also receive significant damage from typical sized boulders of basal or debris.

Rockfall Hazards

The rockfall susceptibility zones shown on this map apply to two types of landslide process, rockfall (mass wasting) and toppling. A rockfall is defined as the independent movement of rock or soil fragments through heaving, bouncing, rolling and sliding. They are usually sourced from cliffs or steep slopes and are a direct moving type of landslide. As long as the velocity and direction of the rockfall and properties of the displaced mass allow. For the purposes of the map they are modelled together and for convenience generally referred to as rockfall. It is possible that a third process may be involved in some cases - rock or debris avalanches that describe the movement of a large number of boulders in a single event but this has not been witnessed in the region and is difficult to prove from available geological evidence.

From a geomorphic perspective the major areas that are susceptible to rockfall occur in the Northwest Coast area and are mostly confined to modern coastal cliffs, some steep, sharp hills of rockfall in the landscape database, which is partly a reflection of the limited areas in which the process can occur but also because these fields are more poorly preserved in the landscape, not generally visible on aerial photographs and often not reported.

The process of rockfall modelling consists of predicting source areas and runoff paths. The methodology is explained more fully in Mather (2006) but has been necessary to modify some aspects to suit local conditions and to satisfy the AGS (2007a) guidelines for Landslide Risk Management. Source areas were determined by estimating slopes greater than or equal to 42 degrees. The choice of angle is based on the angle of repose for common soils derived in published literature (e.g. Caino 1983) and from unpublished field observations in Tasmania. It is recognized that rockfall may occur on slopes less than this value but this is considered to be generally of lower probability. A digital elevation model was constructed from which the source areas were determined. It is important to note that the reliability of the source prediction is variable because the digital elevation model from which the source is derived is based on a combination of disparate datasets of varying resolution and quality.

Runoff paths were modelled from each source cell, travelling in the direction of maximum slope as determined by the DEM. This is a variable but simple method that represents the most likely path of boulders (or debris) travelling downhill. In reality the actual path of material may deviate from this to some degree. The extent of each path was defined using the travel angle method with two values, 34 and 30 degrees, representing decreasing probability respectively (see conceptual diagram). These values are based on field studies of debris talus fan slope angles in Tasmania. For rockfalls occurring in weaker rock units, the travel angle values may, in many instances, be too low and thus overestimate the hazard.

Relative or quantitative susceptibility descriptions of Very Low, Moderate and High are defined in the AGS (2007a) guidelines were not adopted because of insufficient field evidence in the study area. Instead the guidelines show an alternative approach, although not necessarily satisfactory or appropriate for the purpose. The three zones on the map (susceptible area and the two hazard zones) can be considered as susceptible to rockfall. Areas outside these zones are considered not susceptible with the proviso that because the modelling is not perfect there may be special cases where rockfall could occur.
This map identifies a number of locations (less than 0.05% of the study area) that could be affected by rockfall events. The main rockfall areas are associated with steep cliffs and rockfall failure of basal along the coastal cliffs. They may also occur on other natural rock units such as steep gorges and isolated rocky outcrops. Rockfalls may also occur on artificial slopes such as quarry faces and road cuttings that are spread throughout the study area.
The velocity and size of boulders involved in rockfall is expected to vary from place to place and should be considered in site specific investigations. This includes the consequences for persons. Structures could also receive significant damage from typical sized boulders of basal or debris.
The frequency of rockfall events in the study area is difficult to quantify and needs further work for site specific instances.
Maritime, ocean waves, foot washing and human activities are all potential triggers for these events. Seismic (earthquake) is another potential trigger, but is based on a purely unobserved in Tasmania.

Conclusions

The rockfall susceptibility map identifies small areas of land within the modelled boundaries that may experience this hazard. Most of these areas are in remote and sparsely populated regions where exposure of structures and persons is minimal. While a few recent (European era) rockfall records are known, there is insufficient information to calculate likelihood. Adequate records of incidents, quality of an assessment that may provide a rockfall of the landscape and properties of the displaced mass allow. For the purposes of the map they are modelled together and for convenience generally referred to as rockfall. It is possible that a third process may be involved in some cases - rock or debris avalanches that describe the movement of a large number of boulders in a single event but this has not been witnessed in the region and is difficult to prove from available geological evidence.

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Susceptibility Zones



Rockfall Features



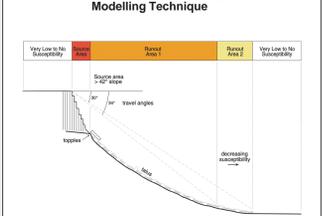
Data Sources

- 1 - Airborne Laser Scanning
- 2 - 1:5,000 topographic contour
- 3 - 1:25,000 topographic contours

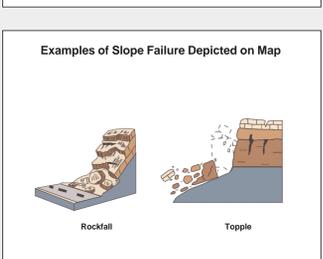
Conceptual Relationships for the Depiction of Rockfalls and Susceptibility in Plan View



Conceptual Diagram Illustrating Rockfall Modelling Technique



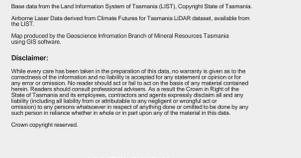
Examples of Slope Failure Depicted on Map



Scale: 1:25,000
0 500 1000 1500 2000 2500m
GDA94 - MGA Zone 55, Contour Interval 20 metres

Citation:
Mather, C. 2011. Map 4: Wynyard - Rockfall Susceptibility. Tasmania Landslide Map Series, Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.
Acknowledgements:
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Basis data from the Land Information System of Tasmania (LIS). Copyright State of Tasmania.
Map produced by the Geospatial Information Branch of Mineral Resources Tasmania using GIS software.
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LOCATION DIAGRAM



LANDSLIDE MAP SERIES

Map 1: Hobart
Map 2: Burnie
Map 3: Launceston
Map 4: Wynyard
Map 5: Devonport
Map 6: Ulverston
Map 7: Queenstown
Map 8: St Helens
Map 9: Strahan
Map 10: Port Sorell
Map 11: Freycinet
Map 12: Montserrat
Map 13: Maitland
Map 14: Wynyard
Map 15: Burnie
Map 16: Launceston
Map 17: Devonport
Map 18: Ulverston
Map 19: Queenstown
Map 20: St Helens
Map 21: Strahan
Map 22: Port Sorell
Map 23: Freycinet
Map 24: Montserrat
Map 25: Maitland