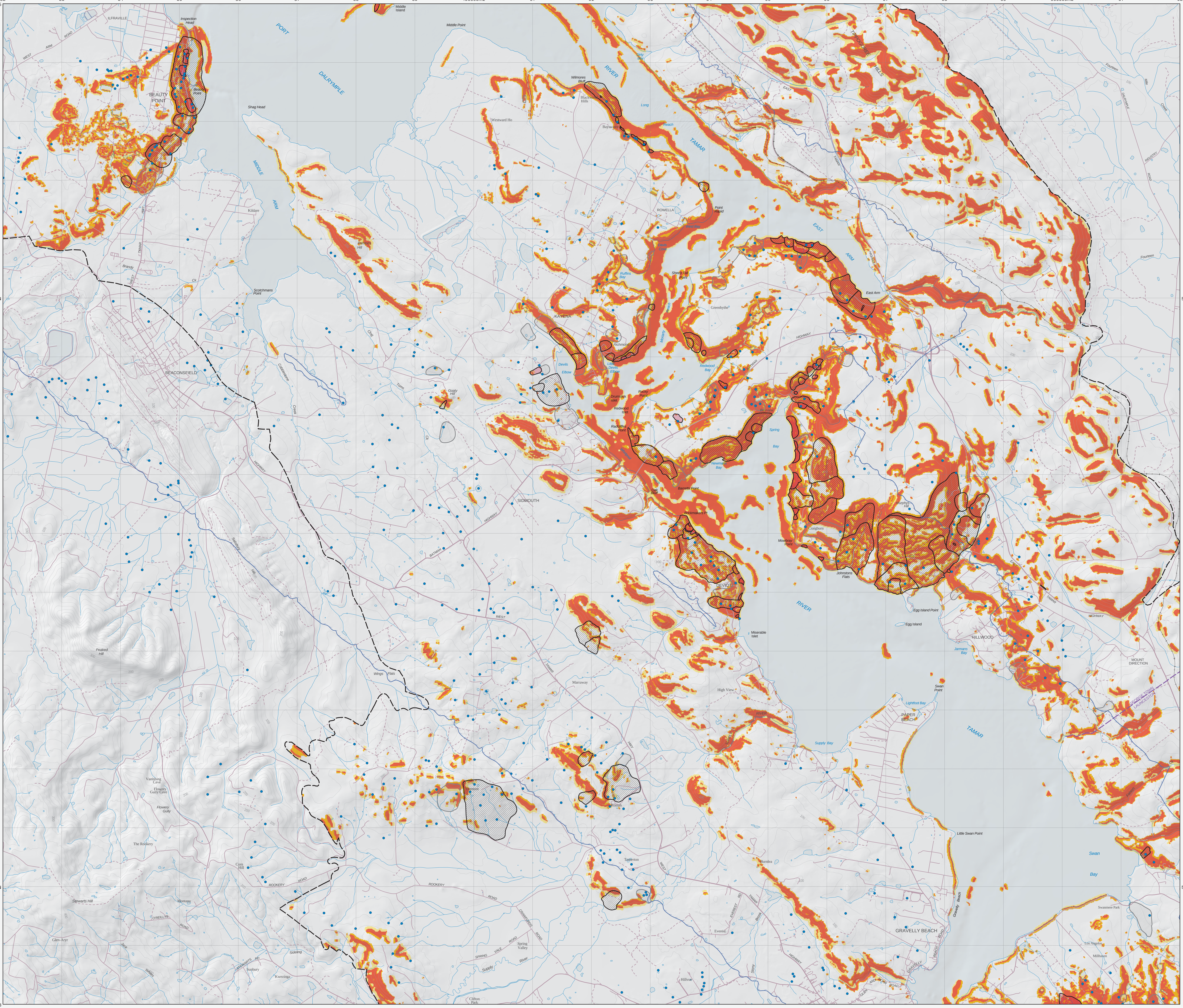
Department of Infrastructure Energy and Resources
MINERAL RESOURCES TASMANIA

TASMANIAN LANDSLIDE MAP SERIES

DEVIOT - SLIDE SUSCEPTIBILITY

MAP 5



Scale: 1:25 000

0 500 1000 1500 2000 2500m

GDA94 - MGA Zone 55. Contour Interval 20 metres.

Landslide Map 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 75 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, organisations and the State runs into many millions of dollars. Recent disasters such as the Thredbo Landslide in New South Wales, serve to remind society of the potential for loss of life even from relatively small landslides. Fortunately, landslide damage can be avoided when 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. Refer to the document "Tasmanian Landslide Map Series: User Guide and Technical Methodology" (see Further Information). The methodology has evolved since the earlier maps were published, in part due to the Australian Geomechanics Society publishing guidelines for landslide zoning (AGS 2007a,b) - 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 (the landslide inventory).
- Analysis of the processes that control each landslide type.
- Computer assisted modelling that simulates each of 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 read and understand the purpose and limitations.

The following caveats shall apply to the maps.

- 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 (or flag) to the need for specific assessment in potential hazard areas.
- Planning decisions should not be made 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 limit could lead to inaccurate 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.
- Areas where no susceptibility or hazard is shown 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 performance of cut and filled slopes have not been specifically considered in map production and their scale is such that they often cannot be resolved on the maps. The presence of such slopes should always be considered in site specific assessments.

Slide Susceptibility

The landslides and their susceptibility zones shown on this map apply to several styles of landslides: both slides and flows; but excludes rockfall which is discussed on a separate map sheet. They include both deep- seated and shallow features. Deep- seated landslide features describe failures along shear surfaces that extend well below any surficial soil horizons into deeply weathered regolith and/or underlying geological units. The depth of these features is thought to usually exceed 5m although often this is only an estimate with little direct field evidence. Landslides in this region mainly consist of the following types: rotational and translational soil slides, soil slides that are transitional into soil flows, and less commonly rock slides or block slides. Shallow failures usually involve movement of surficial deposits and include translational slides and flows. Almost all of the landslides features shown on the map would be classed as large (>1000m³). The definition of these and other terms in this discussion are defined by the Australian Geomechanics Society Landslide Risk Management Guidelines (AGS 2007a).

Some of the existing landslide features have evidence of recent (European era) movement, the remainder are undated. The significant record of damage to properties, roads and other structures to date (as recorded in the MRT landslide database) indicate that the landslides considered are expected to move in the Extremely Slow to Slow range and present a credible hazard to be addressed.

The susceptibility modelling explicitly excludes deep- seated spread- type landslides that are difficult to model without identifying unreasonably large areas. Such features are expected to be either dormant or extremely- slow moving and present only minor hazard to structures. This map supersedes earlier mapping by MRT, including the pre 2001 Tamar Valley - Advisory Landslide Zoning and the Launceston map by Mazengarb (2006) where it overlaps with the current map. Some of the susceptibility areas identified are already developed or are under development pressure.

Geomorphological analysis of the various forms of landslides suggests that many have occurred under natural conditions although the effects of human activities, such as deforestation and developments can also be important contributing factors to landslide movement. The presence of landslides is strongly controlled by the geological materials involved, the local topography (particularly slope), and a range of geomorphic processes.

Landscapes underlain by Launceston Group sediments, contain about 80% of the landslides in the study area. Of the remaining geological units, landslides are much less common in part because they reside in more mature landscapes although some are clearly more resistant to mass- wasting.

Dolerite: There are only two deep- seated landslides in Jurassic dolerite, one of which is a new discovery north of the Batman Bridge where the dolerite appears to have deep weathering zones along joints and faults. Unfortunately weathering grade has not been mapped in a consistent manner making it difficult to use this as a predictor of susceptibility over the whole area.
Colluvium: Several landslides have been discovered within the colluvial deposits that occur on the flanks of Jurassic dolerite and Cenozoic basalt capped hills. While these deposits may have different physical properties they have not been consistently mapped over the study area. The stability of these units is significantly influenced by local groundwater conditions and the physical properties of the underlying geological materials.
Parmeener Supergroup: A small number of landslides are recognised within this unit and on overlying surficial units.

Susceptibility classes have been defined in a simplistic manner by identifying source areas, above nominated slope thresholds for the various geological units mapped. These threshold values ultimately rely on professional judgement based on field observations (our own and from previous reports), desktop analysis of landscape models and consideration of laboratory measurements of material properties. Details of the modelling methodology is contained with the dataset which is slightly modified from Mazengarb and Stevenson (2010) and attempts to satisfy the AGS (2007a,b) guidelines as much as reasonably possible. The confidence in the susceptibility modelling is highest for the Launceston Group sediments because of the richness of the available data. For the other units, where there is much less data, the values chosen are largely based on consistency with other mapping areas as indicated.

Setback (regression) and runout values are assigned to allow the modelling method to identify the uphill and downhill extent respectively to which a potential failure could occur. An inset cartoon provides an explanation of the modelling principle. In addition, a distance limiter (50m) prevents unreasonably long zones being created. The final output incorporates various smoothing methods to ensure that a clean cartographic output has been produced to assist translation of these susceptibility features into planning tools.

The inputs to the susceptibility modelling are the landslide mapping contained in landslide inventory, digital terrain models (DTMs) and simplified geological maps. The geology input has been adapted from the 1:25 000 Geological Map of Tasmania series with modifications to honour recent mapping by the authors as well as dividing the units into thematic layers (bedrock, surficial deposits, weathered bedrock, artificial deposits and landslides). Many of the geological units have been simplified by amalgamating them into classes of similar properties.

The following table lists the modelling parameters employed in identifying susceptibility zones (all angles are in degrees). Where units overlie each other the lowest value has been used.

Geological Unit	Source slope angle[4]	Regression angle[4] (β)	Runout angle[4] (α)
Colluvium[1]	19	19	12
Launceston Group sediments	7	7	8
Launceston Group conglomerate	12	12	12
Cenozoic basalt[2]	10	14	12
Jurassic dolerite	15	89	12
Extremely weathered Jurassic dolerite[3]	12	89	12
Upper Parmeener Group[2]	16	16	12
Lower Parmeener Group[2]	16	16	12

[1]Colluvial deposits modelled after southern Tasmania mountain debris flow parameters
[2]Modelled after NW Coast Susceptibility mapping 2010
[3]Modelled after Launceston Susceptibility mapping 2006
[4]All values in degrees

Conclusions

This map identifies significant areas that may be susceptible to landslide movement of some form and based on available damage records there is a credible hazard to be addressed. This map identifies both past landslides that are potentially susceptible to reactivation and areas that are susceptible to first time failure. The susceptibility areas in general are not necessarily unstable in their present condition, but it cannot be assumed that they are suitable for development without some form of geotechnical investigation - such as that outlined in the Practice Note Guidelines for Landslide Risk Management (AGS 2007c,d). The risk of destruction of property, injury or loss of life should be estimated on a site by site basis within the identified landslides and landslide susceptible areas. While there is insufficient information to calculate likelihoods, the map can be used to support planning decisions, emergency management and for general community information.

References

AGS 2007a. Guideline for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. Australian Geomechanics, 42: 13- 36.

AGS 2007b. Commentary on Guideline for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. Australian Geomechanics, 42: 37- 58.

AGS 2007c: Practice note guidelines for landslide risk management, Australian Geomechanics, 42(1): 63- 1 14.

AGS 2007d: Commentary on practice note guidelines for landslide risk management, Australian Geomechanics, 42(1): 115- 158.

Mazengarb, C. 2006: Launceston, map 5 - potential landslide hazard. Tasmanian Landslide Hazard Series (1:25 000), Mineral Resources Tasmania.

Mazengarb, C.; Stevenson, M.D. 2010. Tasmanian Landslide Map Series: user guide and technical methodology. Tasmanian Geological Survey Record 2010/01. Mineral Resources Tasmania. 44p.

Further Information

IMPORTANT: This map should be used in conjunction with an understanding of the information contained within the document "Tasmanian Landslide Map Series: User Guide and Technical Methodology" by Mazengarb & Stevenson 2010 (see above)

This document, and other information on this map series or Tasmanian landslides in general can be obtained from the MRT web site at www.mrt.tas.gov.au or by contacting the agency directly. Copies of the map images (PDF format) are freely available from the MRT website. GIS layers developed by MRT and shown on the map are supplied to each Council in the area and are available for purchase at a minimal cost of supply.

Summary information from the MRT landslide database and map images from the Tasmanian Landslide Map Series can be viewed with the MRT online web map viewer (choose Map: Landslide).

Susceptibility Zones for First Time Failure

- Regression area.
- Source area.
- Runout area.

Regression area: An area up- slope of a source area that could fail following a landslide movement (a.k.a retrogression or set- back area).

Source area: An area of hillside with the potential to form a slope failure, identified largely on the basis of slope angle and geology.

Runout area: An area down- slope of a source area where the moving earth, debris or rock can potentially travel.

Susceptibility Zones for Landslide Reactivation

- Landslide, recent or active.
- Landslide, activity unknown.
- Possible landslide, activity unknown.

Data Sources

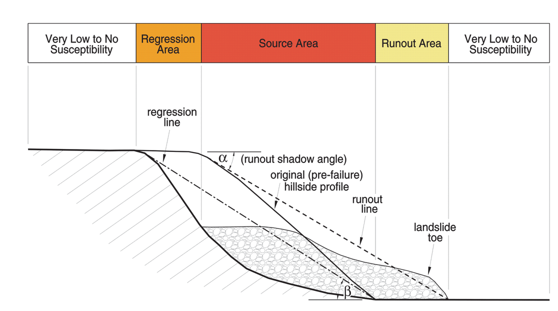
The sources for the digital elevation model (DEM) used in the susceptibility modelling are shown as follows:

- Boundary between Airborne Laser Scanning (survey centred on the Tamar Valley) and 1:5 000 / 1:25 000 topographic contours - for DEM derivatives.

Miscellaneous

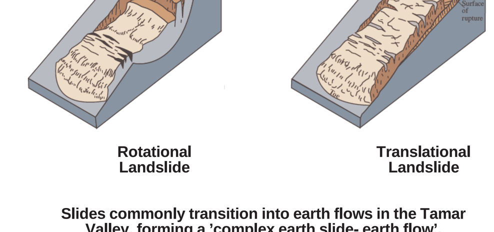
- Limit of modelling.
- Municipality boundary.
- Spring or seep - which have a known association with landslides in many cases.

Conceptual Diagram Illustrating Slide- Susceptibility Modelling Techniques



Hillside showing pre- failure and post failure profiles. Runout and regression lines for a hypothetical landslide are defined with their relationship to the modelled susceptibility zones for the pre- failure landscape.

Examples of Landslides Depicted on the Map



Rotational Landslide

Translational Landslide

Slides commonly transition into earth flows in the Tamar Valley, forming a 'complex earth slide- earth flow'.

(Source: United States Geological Survey fact sheet 2004- 3072)

Citation:

Mazengarb, C. 2013: Deviot, map 5 - Slide Susceptibility. Tasmanian Landslide Map Series. Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

Acknowledgements:

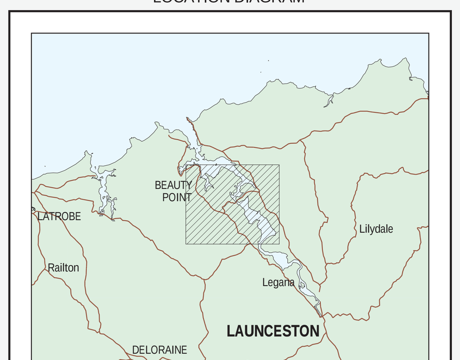
Contributions to the map from M. Stevenson, R. Blake, J. Bowerman and A. Mayne.

Base data from the Land Information System of Tasmania (LIST), Copyright State of Tasmania.

Sources for digital terrain model: airborne laser data derived from Climate Futures for Tasmania LiDAR dataset (2008), available from the LIST. Bathymetry derived from data supplied by SeaMap Tasmania (Institute of Marine and Antarctic Studies, 2009), and TasPorts Corporation, including the Tamar River Hydrographic Survey (2009).

Map produced by the Geoscience Information Branch of Mineral Resources Tasmania using GIS software.

LOCATION DIAGRAM



LANDSLIDE MAP SERIES

Data correct & plotfile generated: 12-MAR-2014

WARNING: INKS ARE LIGHT SENSITIVE