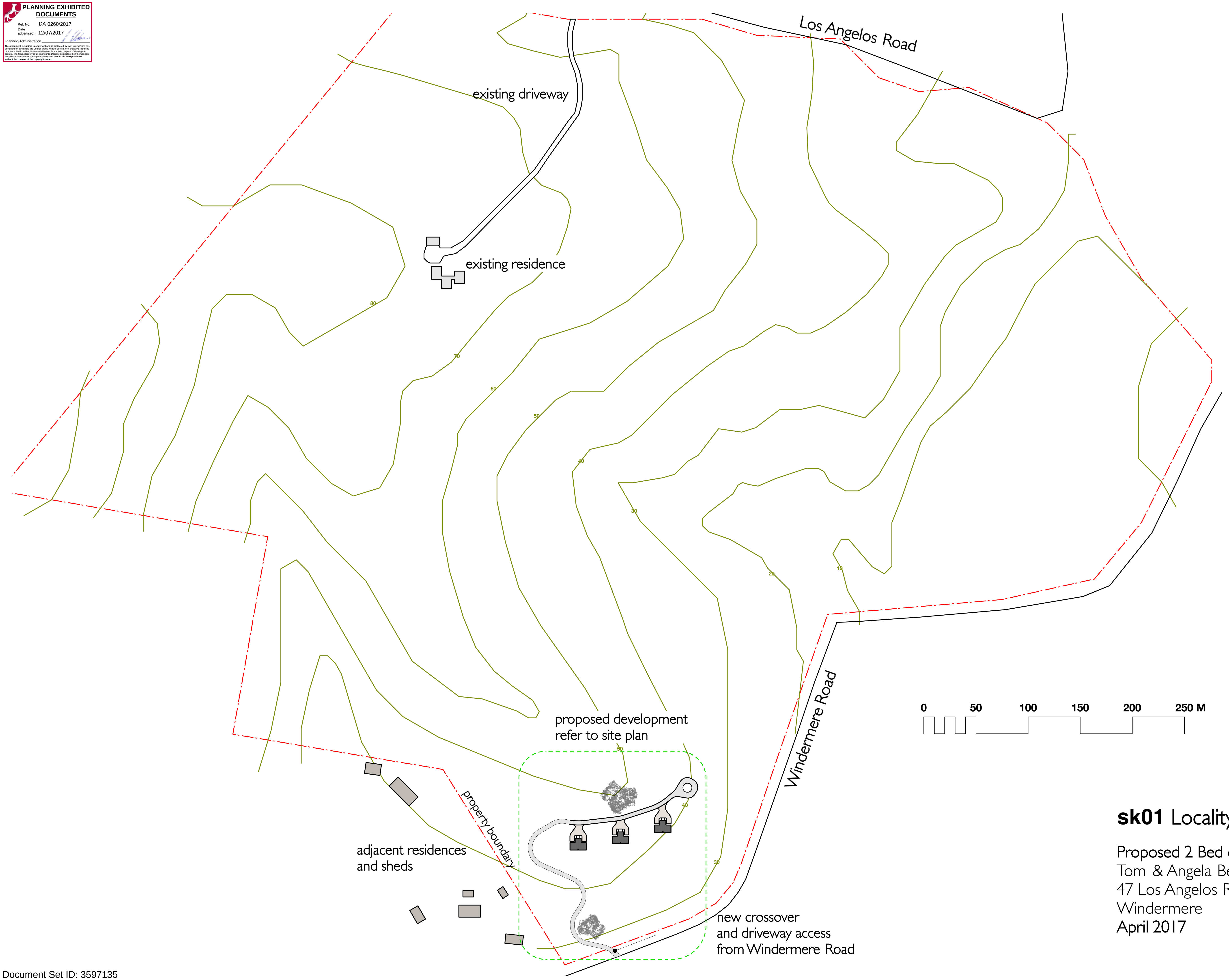
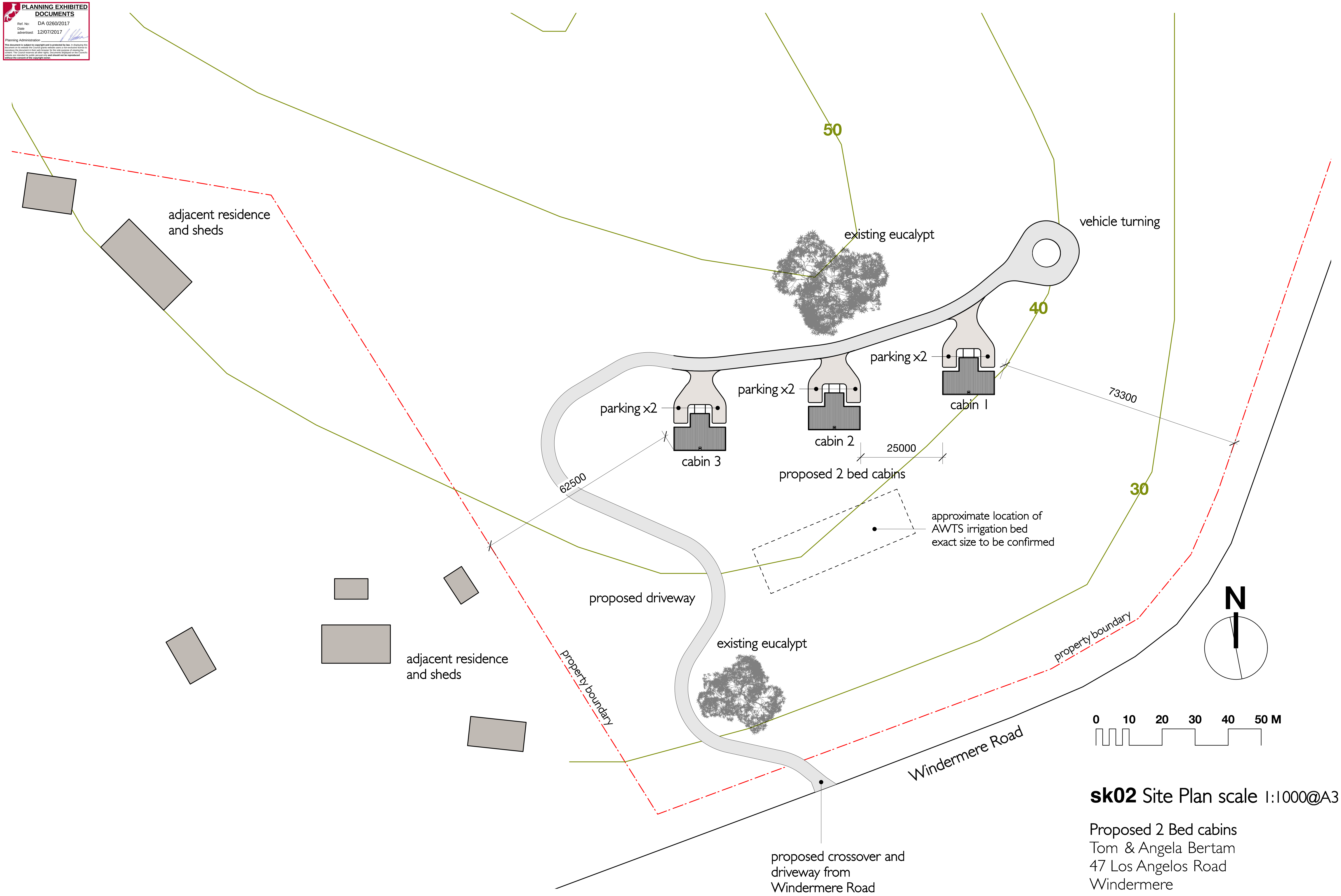


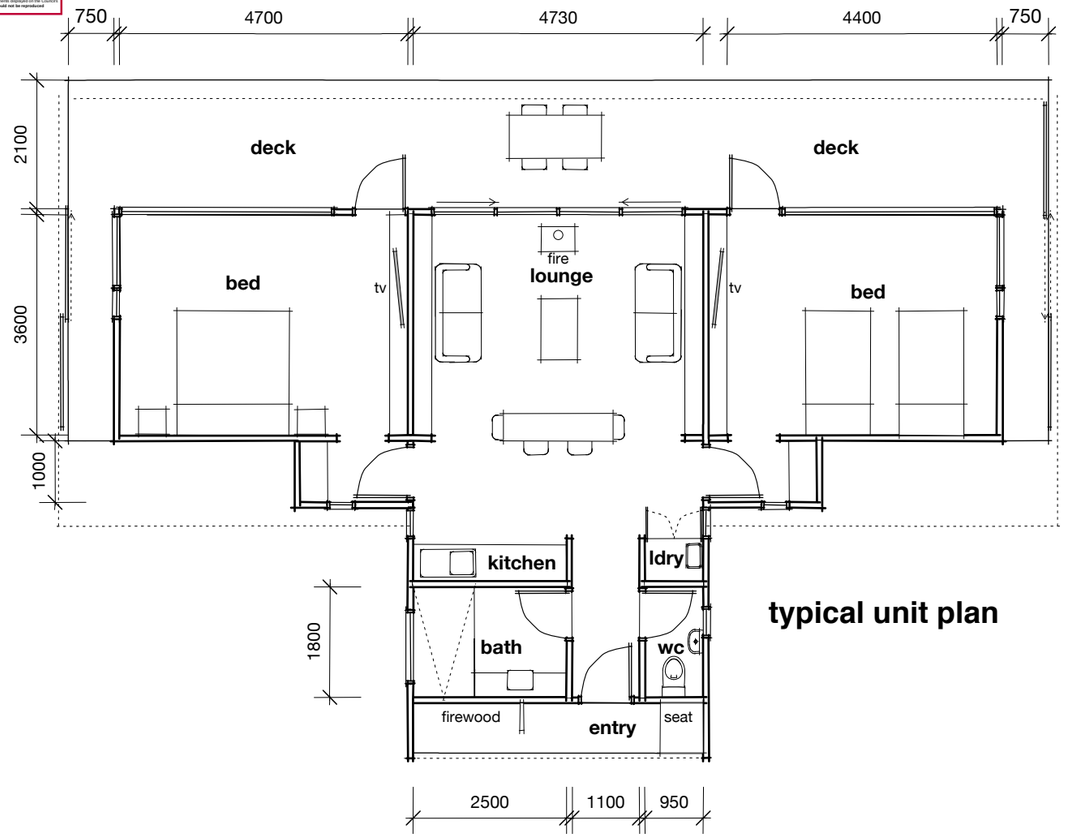
sk01 Locality Plan

Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere
April 2017

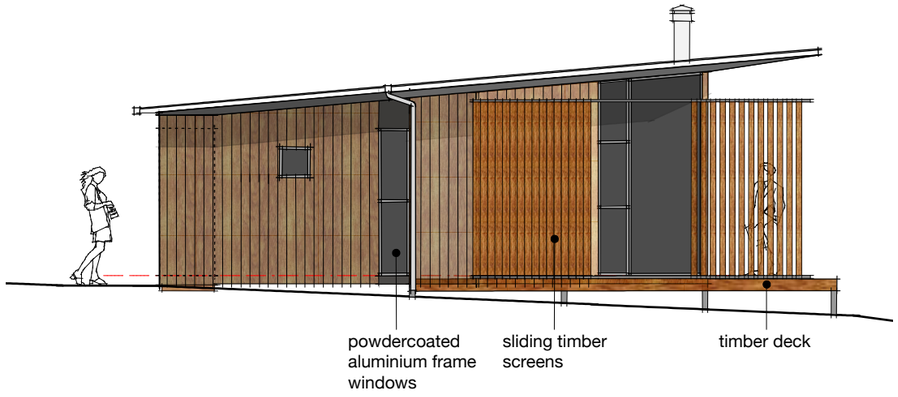


sk02 Site Plan scale 1:1000@A3

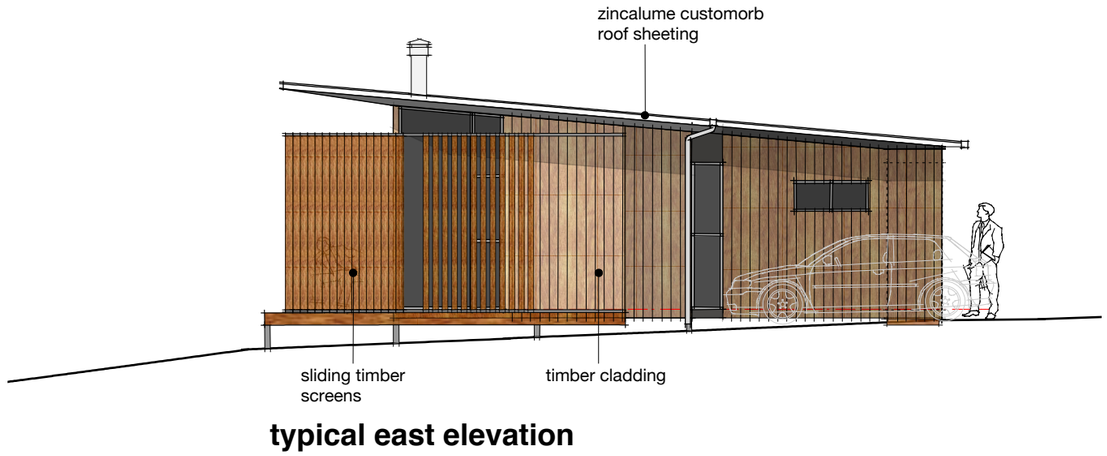
Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere
April 2017



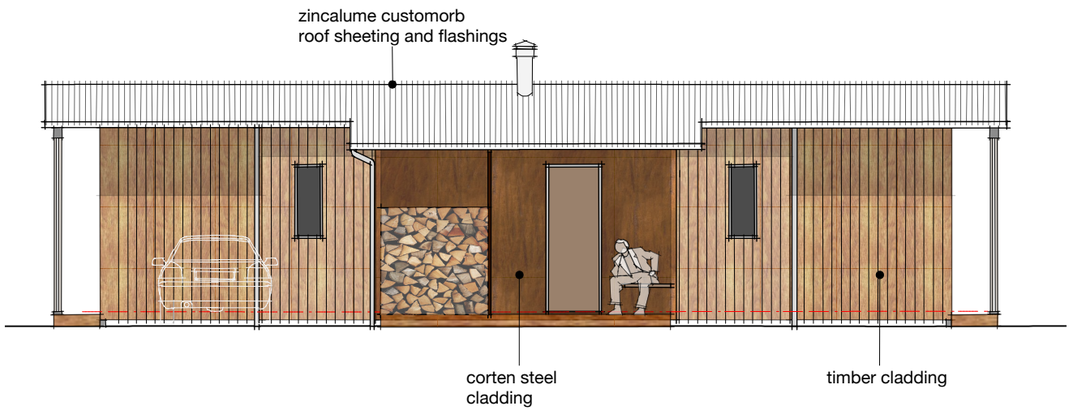
typical unit plan



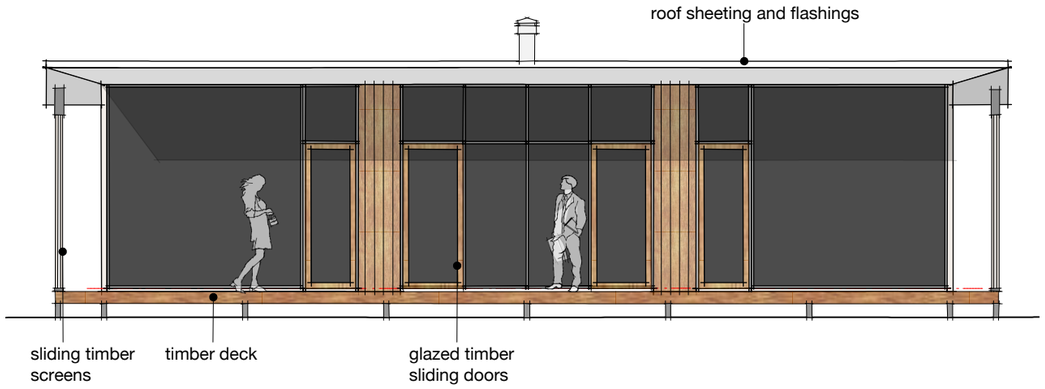
typical west elevation



typical east elevation



typical north elevation



typical south elevation

sk03 Plan / Elevations

Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere
April 2017

05/06/2017

Dear Launceston City Council,

RE: development application for self-contained accommodation, 729-739 John Lees Drive, Dilston

We request permission to build 3 x two bedroom self-contained cabins and access road, for the purpose of visitor accommodation on our land at 729-739 John Lees Drive, Dilston.

Access to the accommodation would be via Windermere road. Access shown on site plan and in the attached Traffic Management Report.

The first stage of the development would be two cabins, containing 2 bedrooms, kitchenette, bathroom and laundry with the additional third cabin built as required based on booking demand.

In regard to **Business Operations**, the business would be maintained and run by us. We are both experienced in running a business, and given Tom is a builder/farmer, he also has skills to maintain the accommodation and landscape. Initially we will also clean the accommodation, however are open to engaging a cleaner if the demand is too high with our other work commitments. Dry cleaning of linen will be sourced locally. Equipment used to maintain the site/dwellings would be whipper snipper, ride on lawn mower and vacuum cleaner.

Accommodation is positioned to minimise noise from neighbouring properties and to ensure the style and experience of the accommodation stays true to the serenity of the natural surroundings. Materials used will also be of natural looking appearance to ensure the dwellings blend with surrounds. We will request additional rubbish service from Launceston City Council for onsite rubbish disposal for each cabin.

Floor plan for accommodation is detailed on attached site plan

Landscaping would be minimal, ensuring the accommodation blends in with the natural environment.

Car parking will consist of 2 car spaces for each cabin with a turning circle located to the east of the third cabin. Access road will be constructed as detailed in the attached Traffic Management Report.

Signage would be required in our paddocks on the corner of John Lees Drive and Windermere Road, Los Angelos Road and John Lees drive and also Windermere Road. Signs to be no more than 3.0mtr in width and 2.0mtr in height and positioned near the fence line ensuring traffic view is not obstructed. Sign on Windermere Rd to be incorporated into entrance to accommodation. Sign to be illuminated at night with low level lighting for guest access. (Photos of proposed sign positions attached)

Check in and out would be via the internet and phone, with no on site reception. Guests would be provided with breakfast items, including bread maker, cereal, tea/coffee and milk. The entrance to the accommodation would be gated, with guests to obtain a pin code for access prior to check in. The

accommodation would be open all year, with standard check in and out times of 10am and 2pm. We intend to promote local businesses (such as the local café and wineries) to ensure guests make the most of their time in the area.

Our hope for this project is to diversify the farm by generating another income without limiting the existing productivity of the land. We enjoy the rural aspect of our lifestyle. We appreciate that our neighbours do too, and are not proposing a large structure or development for this reason. We know our proposal won't impact the locality, as it won't be highly visible, significantly increase traffic, be noisy or create a significant amount of onsite waste for disposal. Our intention is to create an experience where guests too can enjoy the serenity and river views within this rural setting.

Regards,

Tom and Ange Bertram

P: 0407317893

A: 47 Los Angelos Rd. Swan Bay TAS 7252

E: tfb_contracting@bigpond.com

AGRICULTURAL REPORT

47 Los Angelos Road, Swan Bay

March 2017

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

Macquarie Franklin Head Office
112 Wright Street | East Devonport | Tasmania | 7310
Phone: 03 6427 5300 | Fax: 03 6427 0876 | Email: info@macfrank.com.au
Web: www.macquariefranklin.com.au

Report author: Dr Lee Peterson

An appropriate citation for this report is: Macquarie Franklin, *March 2017, Agricultural Report: 47 Los Angelos Road, Swan Bay, TAS*

Document status: Final

Date	Status /Issue number	Authorised by	Transmission method
31/3/2017	Final	L Peterson	Email

This report has been prepared in accordance with the scope of services described in the contract or agreement between Macquarie Franklin and the Client. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and Macquarie Franklin accepts no responsibility for its use by other parties.

Contents

Executive Summary

This report examines the land capability and classification of property Id. No. 3231971 title reference 165889/1, 47 Los Angelos Road, Swan Bay and the suitability in respect to development of tourism accommodation on the property.

Land classification on the property is generally Class 6 and Class 5 in the area of the proposed development. The soils in the area of the proposed development are sandy loam over sandstone that is not suitable for cropping or horticulture. The more suitable soil type are in the region of the property that is not proposed for development.

The accommodation buildings are planned to be developed on the Class 5 area, retaining all of the Class 4 land for the current agricultural activity.

The climate of the region combined with the topography is suitable for a range of temperate crops and agricultural enterprises, however the size of the property severely limits any agricultural activity as there is insufficient scale to economically produce either livestock or horticultural enterprise as a stand alone enterprise. However, the proposed development will not result in a significant loss of agricultural land and not impact on the current agricultural activity of livestock production on a small scale.

1 Introduction

This report, prepared by Dr Lee Peterson, Principal Consultant, Macquarie Franklin, has been prepared to provide an expert agricultural assessment of the proposed development of 47 Los Angelos Road, Swan Bay.

This report reviews the current agricultural usage of the present land title and the surrounding region in relation to the Land Capability and Land Classification. This includes soils, aspect, topography, water resource, and impact in relation to agricultural potential.

2 Qualifications and Experience

Dr Lee Peterson is an agricultural science graduate from the University of Tasmania with 30 years of experience in primary industry production, research and consulting. Dr Peterson has worked with a variety of farming enterprises throughout Tasmania. A detailed outline of experience and qualifications is attached in Appendix A.

3 Location and Proposal

The property proposed for development, 47 Los Angelos Road, Swan Bay PID 3231971 title reference 165889/1. The property is transected by Los Angelos Road, and this report deals only with the section to the north of Los Angelos Road. The southern section is predominantly low lying marsh that floods regularly and has minimal agricultural potential. The northern sections is predominantly improved pasture.

The property is bordered by agricultural land on the west and roads to the north, west and south of the area in consideration.

The proposal is to develop tourist accommodation buildings on the south west section of the property, Appendix B.

4 Land Classification

Land capability of the property was assessed according to the Tasmanian Land Capability Classification System (Grose, 1999). Land is ranked according to its ability to sustain a range of agricultural activities without degradation of the land resource. Class 1 land is the best land and Class 7 land is the poorest. A wide range of limitations are considered and the most significant limitation determines its final classification, or ranking. Limitations in relation to soils include stoniness, topsoil depth, drainage and erosion hazard. Limitations to topography include slope and associated erosion hazard. Limitations relating to climate include low rainfall and frost.

A full explanation of the Land Capability System is available in the *DPIPWE Tasmanian Land Capability Handbook*.

The classification system assumes an average standard of land management and that production will be sustainable if the land is managed according to the guidelines of its Class. The system does not take into account the economics of production, distance from markets, social or political factors, all of which can change over time.

Class 4 land is described as follows:

> *Land primarily suitable for grazing but which may be used for occasional cropping. Severe limitations restrict the length of cropping phase and/or severely restrict the range of crops that could be grown. Major conservation treatments and/or careful management is required to minimize degradation.*
>
> *Cropping rotations should be restricted to one to two years out of ten in a rotation with pasture or equivalent, during 'normal' years to avoid damage to the soil resource. In some areas longer cropping phases may be possible but the versatility of the land is very limited.*

Class 5 land is described as follows:

> *Land with slight to moderate limitations to pastoral use but which is unsuitable for cropping, although some areas on easier slopes may be cultivated for pasture establishment or renewal and occasional fodder crops may be possible. The effects of limitations on the grazing potential may be reduced by applying appropriate soil conservation measures and land management practices.*

Class 6 land is described as follows:

> *Land marginally suitable for grazing because of severe limitations. This land has low productivity, high risk of erosion, low natural fertility or other limitations that severely restrict agricultural use.*

A more detailed, site specific assessment of land classification of the property proposed for development was undertaken by the author on 9th March 2017.

The attached map (Appendix C) illustrates the extent of each land capability class within the property.

Land classification on the property is predominantly Class 6 with 2 areas of Class 4s. The remainder is Class 5s and this is the region proposed for development.

Table 1 provides a detailed description of each land capability class.

Table 1: Land Capability Summary

Land Capability Class[1]	Area (ha)	Limitation	Soil Description	Cropping Suitability Rating [2]	Land Use Types [3]	Cropping Frequency [4]
4s	18.3	Soil Structure	Sandy/clay loam on permeable clay with some stone inclusions. Moderate fertility. Moderate sloping land (0-12%).	Low to moderate	DP, IP, DS	Annual
5s	6.7	Soil structure	Sandy loam on impermeable clay. Low fertility, prone to mass movement. (3-10%)	Low	DP	Annual
6	37.8	Topography	Shallow clay loams on dolerite with areas of exposed rock. Moderate to high slopes, mainly with remnant vegetation	Unsuitable	NA	None

[1] *Land Capability Class*

Land capability was assessed according to the Tasmanian Land Capability Classification System (Grose, 1999). Land is ranked according to its ability to sustain a range of agricultural activities without degradation of the land resource. Class 1 land is the best land and Class 7 land is the poorest. A wide range of limitations are considered and the most significant limitation determines its final classification, or ranking. The classification system assumes an average standard of land management and that production will be sustainable if the land is managed according to the guidelines of its Class. The system does not take into account the economics of production, distance from markets, social or political factors, all of which can change over time.

[2] *Cropping Suitability Rating*

- *High - Soils with no or only slight limitations to use. Can support a wide range of intensive cropping and grazing activities. Cropping can occur almost continuously with only occasional pasture breaks.*
- *Moderate - Soils with moderate limitations to use. Conservation practices and sound management are needed to overcome limitations. Regular short-term pasture breaks are also required.*
- *Low - Soils suited to occasional cropping through severe limitations. Major conservation treatments and/or careful management required to minimise degradation.*
- *Very low - Very limited cropping with long pasture breaks (greater than 8 years).*
- *Unsuitable - No cropping should be undertaken.*

[3] *Land Use Types*

- *DP (Dryland pasture)*
- *IP (Irrigated pasture)*
- *DS (Dryland surface cropping; i.e. cereals and poppies)*
- *ISD (Irrigated surface cropping – dry harvest; i.e. cereals, poppies, carrot seed and grass seed)*
- *ISW (Irrigated surface cropping – wet harvest; i.e. peas, beans and broccoli)*
- *IRC (Irrigated root cropping; i.e. potatoes and carrots)*
- *H (Horticulture; i.e. grapes, olives and fruit)*
- *F (Forestry)*

[4] Cropping Frequency is given as an approximate range only. It assumes that best practices are being implemented in relation to soil management, sustainable crop rotations undertaken, and that seasonal and long term climatic conditions are favourable for cropping activities. Best practice soil management includes cultivation at an appropriate soil moisture level so as to maintain soil structure, management of cropping residues to assist in maintaining soil structure, and implementation of the most appropriate cultivation techniques. The lower range pertains to a more intensive cropping rotation (i.e. typically including irrigated root cropping) and/or less favourable seasonal/growing conditions. The upper range pertains to non-intensive cropping rotations (i.e. cereals and poppies) and/or more favourable seasonal/growing conditions (see Appendix 1). Cropping frequency does not include irrigated pasture which can be irrigated annually.

5 Soils

Two main soil types are present on the property. The majority of the property is a medium grey-brown clay loam on dolerite, known as a Dermosol. These soils are generally moderate to low fertility, moderately impermeable and prone to water logging in poorly drained areas. The major limitation is care when cultivation, if soils too wet they will crust and prove difficult for any seed germination. These soils are only moderately suited to cropping and best left as pasture.

The second soil type is almost a raw sand over impermeable clay. The topsoil is highly permeable but highly prone to aeolian movement if cultivated. These soils are not suited to cropping and best left as pasture.

The geology is predominantly dolerite, and transitions to sandstone in the southern area and is therefore not considered highly sodic or nor is there any acid sulphate soils present.

6 Climate

The climate of the region is described by Noble (1992) as mild to cool maritime climate which is favourable for agricultural production. This maritime influence decreases with distance inland from the coast, and with increasing altitude.

The main agriculturally significant climate changes that occur at the properties distance inland are increasing rainfall and frost events. The nearby weather station at the Low Head (091293) has a long-term average rainfall of 689mm which is moderate and relatively evenly spread.

However the frost frequency and timing is critical for any flowering crops.

Table 2	August	September	October
Number of days below 2 degrees (deemed frost risk)	0.4	0.1	0

Table 2 indicates the average number of days where temperatures drop below 2 degrees Celsius. This is deemed high risk for most temperate flowering crops such as vines and cherries. Whilst the actual site is a little further inland it can be seen that the region is relatively frost free and suitable for a range of horticulture.

Large rainfall events and heat spikes have significantly damaged agricultural production in other regions of Australia in recent years, this region is moderately prone to such events but deemed a low risk.

7 Waterways, Native Vegetation and Threatened Species

All of 47 Los Angelos Road, Swan Bay has been developed either for improved pasture or cleared for grazing in the past leaving minimal habitat for threatened species. This has been the case for many decades.

There are no significant direct or indirect impacts anticipated from the development as proposed.

In fact due to requirements for the proposed tourism accommodation on the property it is likely to be more intensively managed which will help minimise the establishment of any potential noxious weeds in the future.

8 Existing Infrastructure

There is currently existing infrastructure on the property for livestock management including recently constructed fencing and water troughs.

9 Water Resources

There are no dams or waterholes on the property of any significance.

The property is not within an irrigation district and no irrigation resource is available other than potentially off peak purchase agreement with Tas Water. This would require on site storage for summer crop demand. No present storage is available and sites for storage are limited.

10 Current Agricultural Activities

Historically the property would have originally been part of a larger grazing enterprise adjacent to the east. As a small area, it has low livestock holding capacity.

The following Table 3 contains margins generated by Macquarie Franklin for DPIPWE in 2013 for extensive activities in the northern midlands area of Tasmania. The highest margin enterprise (store lambs) would be expected to return a total of only $12,650 per annum, before wages and overheads (rates, interest on investment in land and livestock etc).

Table 3 : Enterprise	Gross Margin ($/ha)	Total Gross Margin ($/ha)
Beef Breeding (stores)	100	2,300
Beef Breeding (19-21mths)	295	6,785
Beef Trading	390	8,970
Store Lambs (3mths)	550	12,650
Wool Sheep	440	10,120

Note. Margins contain no allowance for labour or other business overheads.

The above livestock margins are still insufficient to cover essential overheads of rates, interest, depreciation and would only partially contribute to overhead and labour costs of any livestock enterprise.

Similarly cropping gross margins do not provide an economic return and in most case, the area available to crop is insufficient to attract a contract for supply.

No irrigation water is available therefore intensive horticultural crops cannot be undertaken.

11 Weeds and pests

Weeds present are typical of the region. The main weeds present are typical pasture weeds of the region that are easily controlled given the correct management.

12 Erosion

The soils types and low slopes provide risk of soil mass movement either by wind or water action.

13 Fire Management

Fire risk is low in all areas. The predominant ground cover is pasture species.

14 Launceston Interim Planning Scheme 2013

Section 26.1 of the Scheme outlines the purpose of the Rural Resource zone.

Scheme	Response
26.1.1 To provide for the sustainable use or development of resources for agriculture, aquaculture, forestry, mining and other primary industries, including opportunities for resource processing.	The assessment above reveals that the lot has no potential to support a fully commercial agricultural activity in its own right.
26.1.2 To provide for other use or development that does not constrain or conflict with resource development uses.	The proposed tourism accommodation is within a low productivity section of the property and does not conflict with resource development uses for the zone.
26.1.3 To provide for economic development that is compatible with primary industry, environmental and landscape values.	The proposed development is compatible with and utilises the current primary enterprise and landscape values as part of the development.
26.1.4 To provide for tourism-related use and development where the sustainable development of rural resources will not be compromised.	The proposed development is a tourism enterprise that enhances the rural resource.

Clause 26.3.1 of the Scheme outlines the use standards

Objective:

(a) protect the long term productive capacity of prime agricultural land by minimising conversion of the land to non-agricultural uses or uses not dependent on the soil as a growth medium, unless an overriding benefit to the region can be demonstrated;
(b) minimise the conversion of non-prime agricultural land to a non- primary industry uses;
(c) ensure that non-primary industry uses are located appropriate to the zone;
(d) discourage non-primary industry uses that can be reasonably located on land zoned for that purpose;
(e) provide for uses that are co-located with a dwelling and are of similar intensity to a home-based business;
(f) provide for tourism uses to enhance the experience and promotion of touring routes and natural and cultural features;
(g) locate uses so that they do not unreasonably confine or restrain the operation of primary industry uses; and
(h) provide for uses that are suitable in the locality and do not create an unreasonable adverse impact on existing uses or local infrastructure

Acceptable Solution	Performance Criteria
A1 If for permitted or no permit required uses.	P1 Uses (except for a single dwelling) are established at a location and at an intensity that is appropriate in the zone, having regard to: (a) the nature of the use, including:

	(i) the scale and extent of the use; (ii) the utilisation of existing buildings and infrastructure; (iii) the number of employees; (iv) the customer visitation and deliveries; (v) the hours of operation; (vi) the nature of any emissions; (vii) external storage of goods, materials or waste; and (b) the area of the site proposed to be used, including: (i) the existing use and development; (ii) the surrounding use and development; (iii) its capacity for productive agricultural use; (iv) the topography of the site; (v) current irrigation practices and the potential for irrigation; (vi) the effect, if any, of the loss of the site on the continuing or potential agricultural use of the site and the surrounding area; and (c) the potential to confine or constrain adjoining primary industry uses; (d) the location being reasonably required for operational efficiency; (e) the need to locate on the site; (f) the capacity of the local road network to accommodate the traffic generated by the use; and (g) the capability of the site to accommodate all aspects of the use.
Response 1. Objectives – is not applicable as there is no prime land involved. The proposed development retains the existing Class 4 agricultural use of the land. The proposed tourism accommodation supports both uses. The proposed development will not confine or restrain any neighbouring primary industry activities or impose any unreasonable adverse impact on local infrastructure and there are no current or potential irrigation practices. 2. P1 – is satisfied as the proposal is compliant.	

A2 If for permitted or no permit required uses.	P2.1 Use of prime agricultural land for Utilities, Extractive industry and controlled environment agriculture not dependent on the soil as a growth medium must be minimised, having regard to: (a) the area of land converted; (b) impacts on surrounding agricultural use; and (c) the location being reasonably required for operational efficiency; or P2.2 Use of prime agricultural land for uses other than Utilities, Extractive industry or controlled environment agriculture not dependent on the soil as a growth medium

	uses, must demonstrate a significant benefit to the northern region having regard to the economic, social and environmental costs and benefits of the proposed use.
Response 1. P2.1 and P2.2 – not applicable in this case.	

Clause 26.3.2 of the Scheme outlines the use standards for dwellings.

Objective: To ensure that dwellings are: (a) directly associated with and a subservient part of a Resource development use; or (b) located on land with limited primary industry uses potential; and (c) located where they do not constrain surrounding agricultural uses; and (d) accessible by vehicles for residential purposes and emergency services.	
Acceptable Solution	**Performance Criteria**
A1 If for the alteration, extension or replacement of existing dwellings.	P1.1 A dwelling may be constructed where it is directly associated with and a subservient part of a Resource development use, having regard to: (a) the scale of the use; (b) the complexity of the use; (c) the operational requirements of the use; (d) the requirement for the occupier of the dwelling to attend to the use; and (e) the proximity of the dwelling to the use; or P1.2 A dwelling may be constructed where the site is practically incapable of supporting an agricultural use or being included with other land for agricultural or other primary industry uses, having regard to: (a) limitations created by any existing use or development surrounding the site; (b) the topography of the site; (c) the capacity of the land for primary industry uses; and (d) a report from a suitably qualified person.
A2 New dwellings must be located on lots that have frontage with access to a road maintained by a road authority.	P2 New dwellings must have suitable access to a road, having regard to: (a) whether the access is by right-of-carriageway or other formal legal arrangements; (b) the number of users of the access; (c) the length of the access; (d) the suitability of the access for use by the occupants of the dwelling; (e) the suitability of the access for emergency services vehicles; (f) the topography of the site; (g) the construction and maintenance of the access; and (h) the construction, maintenance and usage of the road.

Response
1. Objectives – the proposed tourism accommodation are for short term accommodation and not permanent residences and is located on Class 5 land. 2. A1 – The proposed development is not an alteration, extension or replacement of existing dwellings. 3. A2 – the lot has frontage directly onto Windamere Road.

15 PAL Policy

Background

An assessment of land capability is required to ensure that the proposed development does not conflict with the principles outlined in State Policy on the Protection of Agricultural Land 2009 (PAL Policy). The purpose of the PAL Policy is to conserve and protect agricultural land so that it remains available for the sustainable development of agriculture, recognising the particular importance of prime agricultural land.

Principles

The PAL Policy is guided by 11 Principles. These Principles are discussed in detail below. Note that no one Principle should be read in isolation from the others to imply a particular action or cause and that generally the Principles are to be implemented through the planning scheme as it states in the PAL Policy.

Principle	Response
1. Principle 1: Agricultural land is a valuable resource and its use for the sustainable development of agriculture should not be unreasonably confined or restrained by non-agricultural use or development.	The lot has no prospect of supporting any level of commercial agriculture of an extensive nature due to insufficient scale and resources.
2. Principle 2: Use or development of prime agricultural land should not result in unnecessary conversion to non-agricultural use or agricultural use not dependent on the soil as the growth medium.	This is not applicable in this case. No prime agricultural land present
3. Principle 3: Use or development, other than residential, of prime agricultural land that is directly associated with, and a subservient part of, an agricultural use of that land is consistent with this Policy.	This is not applicable in this case. No prime agricultural land present
4. Principle 4: The development of utilities, extractive industries and controlled environment agriculture on prime agricultural land may be allowed, having regard to criteria, including the following: a. minimising the amount of land alienated;	This is not applicable in this case.

	Principle	Response
	b. minimising negative impacts on the surrounding environment; and c. ensuring the particular location is reasonably required for operational efficiency.	
5.	Principle 5: Residential use of agricultural land is consistent with this Policy where it is required as part of an agricultural use or where it does not unreasonably convert agricultural land and does not confine or restrain agricultural use on or in the vicinity of that land.	The lot has no prospect of supporting any level of commercial agriculture of an extensive nature due to insufficient scale and resources and therefore the development does not unreasonably convert agricultural land
6.	Principle 6: Proposals of significant benefit to a region that may cause prime agricultural land to be converted to non-agricultural use or agricultural use not dependent on the soil as a growth medium, and which are not covered by Principles 3, 4 or 5, will need to demonstrate significant benefits to the region based on an assessment of the social, environmental and economic costs and benefits.	This is not applicable in this case.
7.	Principle 7: The protection of non-prime agricultural land from conversion to non-agricultural use will be determined through consideration of the local and regional significance of that land for agricultural use.	Non-prime agricultural land has sufficient scale to warrant agricultural activity, albeit non commercial
8.	Principle 8: Provision must be made for the appropriate protection of agricultural land within irrigation districts proclaimed under Part 9 of the Water Management Act 1999 and may be made for the protection of other areas that may benefit from broad-scale irrigation development.	The subject lot is not within the boundary of the of any irrigation scheme either current or proposed by Tasmanian Irrigation.
9.	Principle 9: Planning schemes must not prohibit or require a discretionary permit for an agricultural use on land zoned for rural purposes where that use depends on the soil as the growth medium, except as prescribed in Principles 10 and 11.	This is not applicable in this case.
10.	Principle 10: New plantation forestry must not be established on prime agricultural land unless a planning scheme reviewed in accordance with this Policy provides otherwise. Planning scheme provisions must take into account the operational practicalities of plantation management, the size of the areas of prime agricultural land, their location in relation to areas of non-prime agricultural land and existing	This is not applicable in this case.

	Principle	Response
	plantation forestry, and any comprehensive management plans for the land.	
11.	Principle 11: Planning schemes may require a discretionary permit for plantation forestry where it is necessary to protect, maintain and develop existing agricultural uses that are the recognised fundamental and critical components of the economy of the entire municipal area, and are essential to maintaining that economy's sustainability.	This is not applicable in this case.

16 References

Grose C.J. (1999) Land Capability Handbook: Guidelines for the Classification of Agricultural Land in Tasmania. 2nd Edition, DPIWE, Tasmania

Noble K.E. (1992) Land Capability Survey of Tasmania. Tamar Report, Land Capability Study, DPIWE, Tasmania

17 Declaration

I declare that I have made all the enquiries which I consider desirable or appropriate, and no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Dr Lee Peterson B. Agri. Sci (Hons), ISHS, MAICD, CPag, PhD
Principal Consultant
Macquarie Franklin Pty Ltd
March 2017

18 Appendices

Appendix A: Profile Dr Lee Peterson

Appendix B: Proposed development

Appendix C: Property location image and land capability assessment

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

Lee Peterson

Position:

Principal Consultant

Qualifications:

B Ag Sc (Hons) University of Tasmania

PhD (Ag Science) Horticultural Research Group University of Tasmania

Professional Associations:

Certified Practicing Agriculturalist (CPAg)

Company Directors Graduate Diploma 2007

Member of the International Society of Horticultural Science

Contact Details:

M: 0418 141 762

E: lpeterson@macfrank.com.au

www.macquariefranklin.com.au

Tech 4, Unit 2 Technopark Innovation Drive

Dowsing Point TAS 7010

Introduction

Dr Lee Peterson is an agricultural professional with extensive expertise in many aspects of agricultural production gained over a period of 30 years in industry, consulting and research. Lee has considerable experience in the areas of new crop development, horticultural production systems, plant extracts and waste stream management in agricultural.

Professional Experience

2011 – present: Principal Consultant Macquarie Franklin

2005-2011:	Executive Director – Agribusiness Agricultural Resource Management (AGRM Pty Ltd)
2000- 2004:	Agricultural Resource Management Group
1998- 1999:	Serve-Ag Senior Project Agronomist
1996-1997:	Private agricultural consultancy and contract research provider
1993- 1995:	General Manager of Essential Oils of Tasmania
1989- 1993:	Production Manager of Essential Oils of Tasmania
1985- 1989:	Post-Graduate at the University of Tasmania
1984- 1985:	Agricultural Officer with the Tasmanian Department of Agriculture, Pasture and Field Crops Branch

Recent Projects

- Technical advisor to Houston's Farm roles include production system development, variety assessment, market research, crop scheduling, pesticide strategies, IPM program and representation of the company in respect to technical issues such as biosecurity and IPM
- Tasmanian contractor for the CSIRO land use and management information system estimating changes in soil carbon from changes in land use, an Australian Greenhouse Organisation project
- Project manager for the agricultural component of 8 wastewater reuse developments including Tasmania's two largest schemes, Brighton and Clarence.
- Agricultural advisor to United Utilities bid to develop effluent reuse for Ballarat North waste water treatment plant.
- Independent advisor and author to the "Environmental Guidelines for Recycled Water Use in Tasmania, 2002".

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

Lee Peterson

Areas of Expertise

- New crop development including essential oils, culinary herbs, medicinals and leafy vegetables
- Design of innovative harvest systems for new crops
- Waste water and effluent reuse
- Agricultural research and development
- Sustainable agricultural system design and implementation
- Environmental monitoring
- Plant physiology
- Land capability assessment
- Group training
- Agribusiness and financial management
- Socio and economic impact assessment

Macquarie Franklin Expertise

- Economic studies
- Business and farm management
- Feasibility studies
- State and regional development
- Irrigation and water development
- Land capability and mapping
- Natural resource management
- Training and extension
- Technical agricultural

- Development of annual soil monitoring programs for Clarence, Brighton and Collinsvale reuse schemes.
- Project Manager for the land capability assessment for the Meander Dam Development Proposal
- Agricultural potential study for the Jordan Dam Feasibility Study
- Review of the Australian Lavender industry for RIRDC
- Partner in the largest Boronia plantation development ever undertaken
- Project manager for Rekuna Pty Ltd, a Panax ginseng production company supported by an AusIndustry Commercial Ready Grant
- Climatic and resource suitability assessment for salad vegetable production on Australia's east coast, including risk assessment
- Technical advisor to Raspberry Fresh, out of season glasshouse raspberry production company
- Study tour and technical review of latest developments in hydroponic production of salad vegetables, Canada, Belgium, Holland and Italy
- Project manager for field services operation establishment for Tasmanian Poppy Enterprises
- Technical advisor to South Pacific Oils, essential oil production and extraction company, Vanuatu – Sandalwood production and research
- Technical resource to Southern Water for the coordinate and manage Tasmania's largest agricultural recycled water irrigation scheme, the Clarence Recycled Water (CRW)
- Technical advisor to Heydon Park Olives, Talmalmo, Victoria
- Production system economic assessment and inputs for TIDB feasibility studies – Musselrow, Great Forester and South East irrigation scheme developments
- Land capability assessments for numerous properties to support agricultural development, subdivision of non-agricultural land and expert witness reporting for legal representation
- Review of Industrial Hemp as a commercial cropping opportunity in Tasmania
- Review of pyrethrum industry strategic plan and industry development officer program
- Economic and socio analysis of the impact of blueberry rust incursion to the Tasmanian blueberry industry
- Site assessment, property liaison and development of Irrigation and Ground Water Management Plans for effluent management of Tassal hatchery expansion at Ranelagh and waste processing plant at Triabunna including representation to EPA

Los Angelos Road

existing driveway

existing residence

80

70

60

50

40

30

20

10

proposed driveway

Windermere Road

proposed development
refer to site plan

90

40

30

property boundary

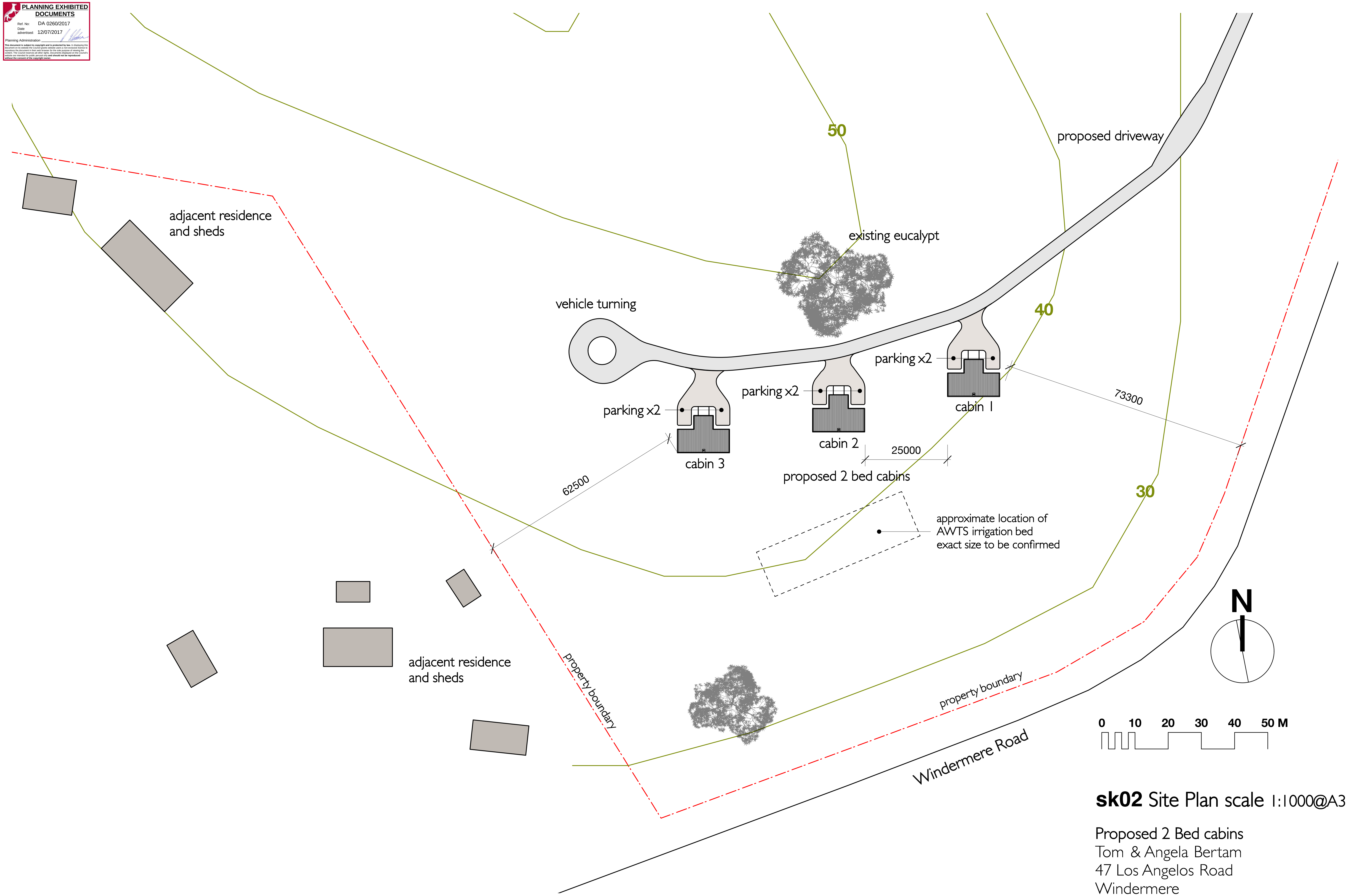
adjacent residences
and sheds

N

0 50 100 150 200 250 M

sk01 Locality Plan

Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere



sk02 Site Plan scale 1:1000@A3

Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere

MACQUARIE FRANKLIN

Land Capability Assessment

Bertram Proposed Development

N

0 50 100
metres

1 : 4,000 @ A3

Print Date: 3rd April 2017

Datum: GDA94 (MGA, Zone 55)
Created by: Mick Lehman
Reference: LP_3Bert

GDA

LEGEND

Property Boundary
Highway
Road
Contour (10m)
Land Capability Class

LC Class	Area (ha)
Class 4s	18.3
Class 5s	6.7
Class 6	37.8

Macquarie Franklin
112 Wright Street
East Devonport Tas 7310
Ph: (03) 6427 5300
www.macquariefranklin.com.au

Base data from theLIST © State of Tasmania. Google orthophoto image dated January 2016.

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

PROJECT NOTE

To:	Tom Bertram	**From:**	Lee Peterson
Date:	Monday, 19 June 2017	**Pages:**	1 of 4
Project Code:	3Bertram	**Note Ref:**	
Re:	Development Application DA260/2017	**CC:**	Richard Jamieson

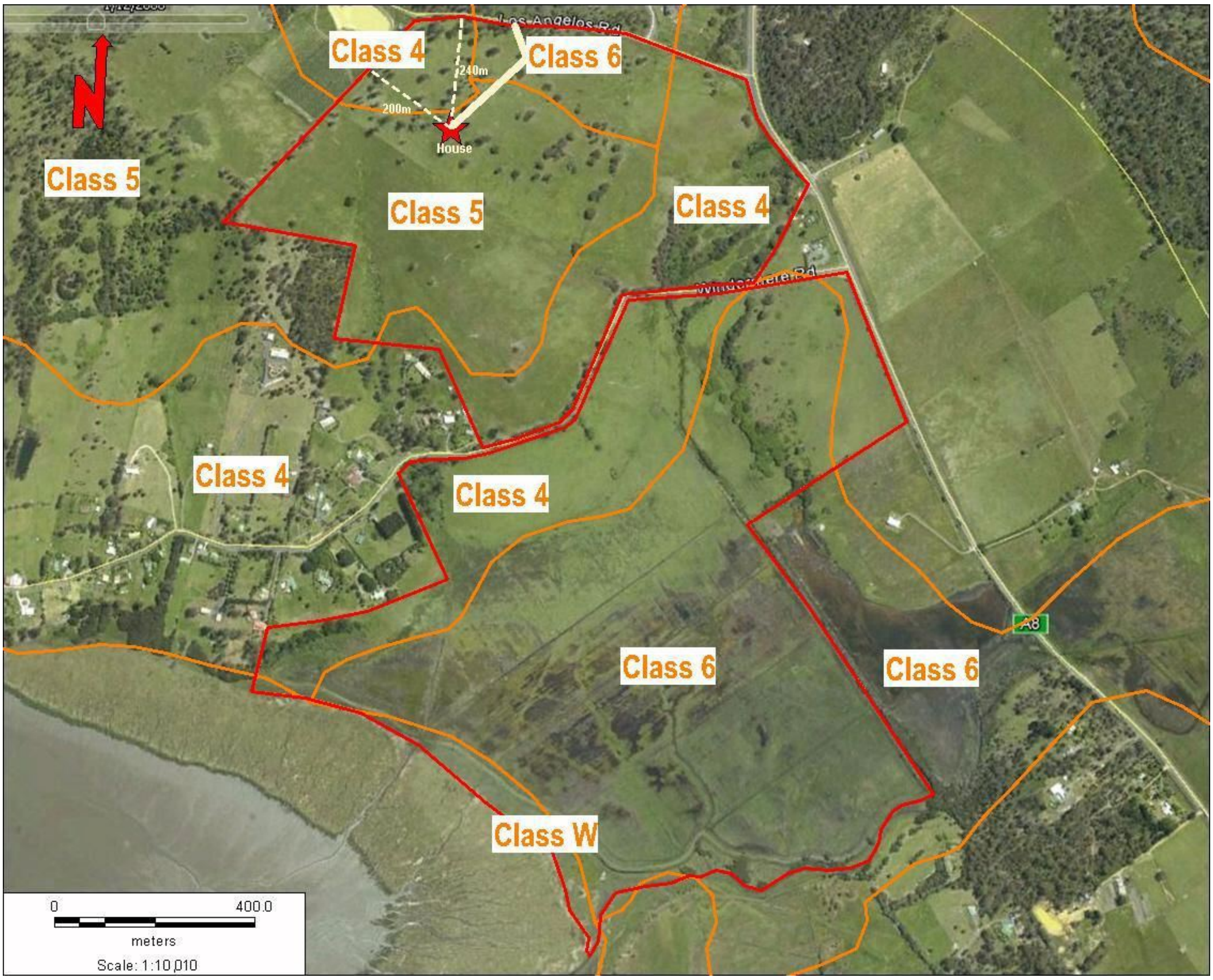
☐ *Urgent* ☐ *Review* ☐ *Comment* ☐ *Reply*

Re Development Application - Further Information Request - DA0260/2017 - Agricultural reports

1. Agricultural Land Capability discrepancy

The Macquarie Franklin report of 2014 referred to the DIPWE Land Classification as undertaken in the 1992 Land Capability Survey of Tasmania, Tamar Report. This mapping of land capability and subsequent land classification was undertaken at a scale of 1:100,000 and is not site specific data at a very course scale, insufficient to detect the actual soil boundaries or detailed topography and as such is only an indication of land capability at a regional level. The 2014 report author, John Maynard, reviewed the land capability at a whole property level based on the DIPWE data and reproduced at the same resolution, 1:100,000. Whilst the image title states at 1:25,000, this is clearly not the case as almost the same data as the DIPWE 1:100,000 information is represented. The author stated “after a brief inspection”.

Therefore the 2014 agricultural report was reliant on the DIPWE Land Classification data set as available on www.thelist.tas.gov.au



2014 mapping at 1:100,000 scale of both property titles

For the 2017 agricultural report and more detailed site specific soil survey was undertaken of the proposed development site and the immediate surrounds. This consisted of spade samples of the soils and detailed mapping of the topography at a scale of 1:4,000. Included was mapping of the vegetation and the slopes using an inclinometer as part of the land capability requirements and subsequent classification. The previous agricultural report relied on 10 metre contour data only.

In addition, since 2014 more detailed imagery data is also available that assists with assessment of land capability. Land form, rock outcrops and vegetation variances are more easily identified than in 2014.

The 2017 detailed site inspection focused and more detailed image highlight the areas of Class 4 land that are potential agricultural areas so that areas only suitable for grazing or with more severe limitations could be identified. The resulting high resolution land classification can be seen to be much more aligned with the imagery that was presented in the 2014 report.

Base data from theLIST © State of Tasmania. Google orthophoto image dated January 2016.

MACQUARIE FRANKLIN

Land Capability Assessment

Bertram Proposed Development

N

0 50 100
metres

1 : 4,000 @ A3

Print Date: 3rd April 2017

Datum: GDA94 (MGA, Zone 55)

Created by: Mick Lehman

Reference: LP_3Bert

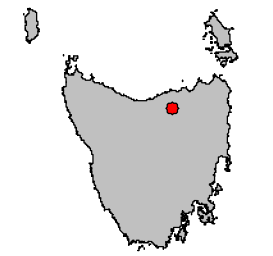
GDA

LEGEND

- Property Boundary
- Highway
- Road
- Contour (10m)
- Land Capability Class

LC Class	Area (ha)
Class 4s	18.3
Class 5s	6.7
Class 6	37.8

Macquarie Franklin
112 Wright Street
East Devonport Tas 7310
Ph : (03) 6427 5300
www.macquariefranklin.com.au



2. Zone Purpose statements

26.1.1.1 To provide for the sustainable use or development of resources for agriculture, aquaculture, forestry, mining and other primary industries, including opportunities for resource processing.

The property is not suitable for aquaculture as there is insufficient access to water resource for an aquaculture activities including a hatchery. The property does not have sufficient scale for forestry activities. The soils are not suitable for viticulture and the slopes are complex such that intensive fruit production would not be possible. And again, there is insufficient water resource for such intensive horticultural development which would also limit value adding opportunities and processing. The proximity of residential dwellings, major roadways dictates attenuation zones for most of the property that would prohibit an enterprise such as poultry or an abattoir. These constraints are already in place and the proposed development does not further impact on them

26.1.1.2 To provide for other use or development that does not constrain or conflict with resource development uses.

The property is currently livestock grazing production. The proposed development does not impact or constrain the continuation of this enterprise.

26.1.1.3 To provide for uses that add value to primary industries.

The proposed development does not impact any further than the current restraints on potential to value add to primary industry. The development of a tourism accommodation business has the potential to enhance and provide an opportunity to showcase the properties agricultural activities as well as those in the region.

26.1.1.4 To provide for uses that support or service rural communities.

The provision of accommodation within the region will provide opportunity for regional employment as well as promote the regional agricultural production.

MACQUARIE FRANKLIN

Consultants for business, agriculture and environment

PROJECT NOTE

To:	Tom Bertram	**From:**	Lee Peterson
Date:	Tuesday, 4 July 2017	**Pages:**	1 of 3
Project Code:	3Bertram	**Note Ref:**	Query 2
Re:	Development Application DA260/2017	**CC:**	Brian White

☐ *Urgent* ☐ *Review* ☐ *Comment* ☐ *Reply*

Re Development Application - Further Information Request - DA0260/2017 Clause 26.3.1

Clarification was sort in regard to:

Clause 26.3.1 (P1)(b)

Please provide a full assessment against (b). It is especially unclear whether the loss of the agricultural land for the proposal will have an effect on the continuing potential agricultural use of the site (balance) and the surrounding area.

Clause 26.3.1 (P1)(c)

Please discuss the likelihood of the proposal confining or constraining adjoining primary industry uses (including those not relating to agriculture).

Objective:

(a) protect the long term productive capacity of prime agricultural land by minimising conversion of the land to non-agricultural uses or uses not dependent on the soil as a growth medium, unless an overriding benefit to the region can be demonstrated;
(b) minimise the conversion of non-prime agricultural land to a non- primary industry uses;
(c) ensure that non-primary industry uses are located appropriate to the zone;
(d) discourage non-primary industry uses that can be reasonably located on land zoned for that purpose;
(e) provide for uses that are co-located with a dwelling and are of similar intensity to a home-based business;

(f) provide for tourism uses to enhance the experience and promotion of touring routes and natural and cultural features;
(g) locate uses so that they do not unreasonably confine or restrain the operation of primary industry uses; and
(h) provide for uses that are suitable in the locality and do not create an unreasonable adverse impact on existing uses or local infrastructure

Acceptable Solution	Performance Criteria
A1 If for permitted or no permit required uses.	P1 Uses (except for a single dwelling) are established at a location and at an intensity that is appropriate in the zone, having regard to: (b) the area of the site proposed to be used, including: (i) the existing use and development; (ii) the surrounding use and development; (iii) its capacity for productive agricultural use; (iv) the topography of the site; (v) current irrigation practices and the potential for irrigation; (vi) the effect, if any, of the loss of the site on the continuing or potential agricultural use of the site and the surrounding area; and (c) the potential to confine or constrain adjoining primary industry uses; (d) the location being reasonably required for operational efficiency; (e) the need to locate on the site; (f) the capacity of the local road network to accommodate the traffic generated by the use; and (g) the capability of the site to accommodate all aspects of the use.

Response

(b) (i) The existing use of the property is dryland pasture for grazing, the proposed development while have no impact on the pasture or grazing potential of the remainder of the property. The proposed site for the development is Class 5s land with low fertility sandy soils that have low pasture productivity.

(ii) The adjacent properties to the west of the proposed development are zoned rural resource but they are small blocks consisting of Class 5 and 6 land that have no current agricultural activity nor significant agricultural potential and will not be impacted by the development. To the south of the development is Class 6 land on the property then

Windermere Road. To the north and east is agricultural land on the property that is Class 4 that will not be impacted.

(iii) The proposed site for the development is Class 5s land with low fertility sandy soils that have low pasture productivity and not suitable for horticulture.

(iv) The topography of the proposed development is gentle slope with both surface drainage and permeable soil type providing ground drainage.

(v) The proposed site is not within an irrigation district, no current irrigation practices are undertaken as no irrigation resource is available. There is minimal potential for a suitable dam site for collection of surface water run off to provide for irrigation in the future.

(vi) The proposed development will not impact on the current agricultural activity, the development site represents only 1% of the total property and is not on any of the Class 4 productive land present.

(c) The proposed development will not confine or restrain any adjoining primary industry. The only current and possible agricultural activity is 700 metres to the north of the development and over a hill such that it is not visible to any adjoining primary industry.

(d) The location is not prime agricultural land but is highly suitable for a tourism accommodation site

(e) The site is some of the lowest agricultural productive land on the property but is ideally suited in respect to aspect and access for tourism accommodation

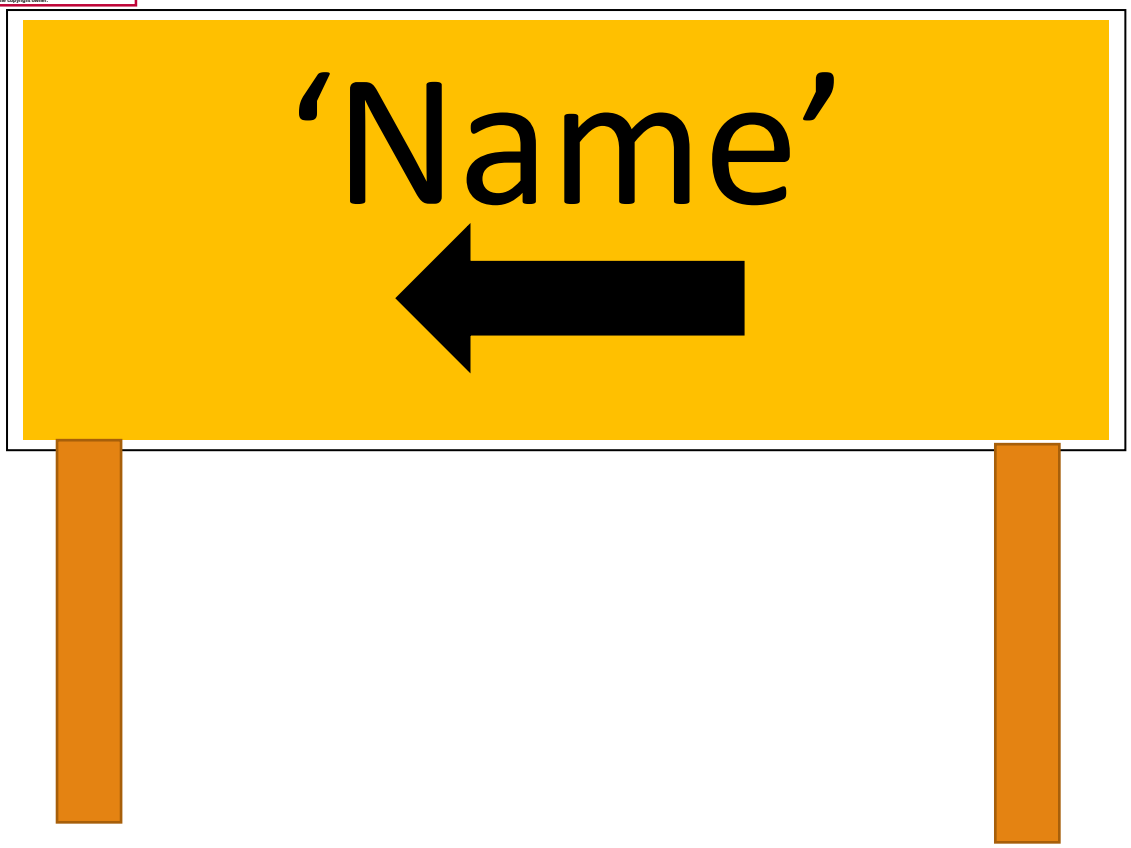
(f) Cannot respond

(g) The site has suitable topography, access, drainage, aspect for the proposed development and integrates with current agricultural activities with no impact on current activities

sk01 Locality Plan

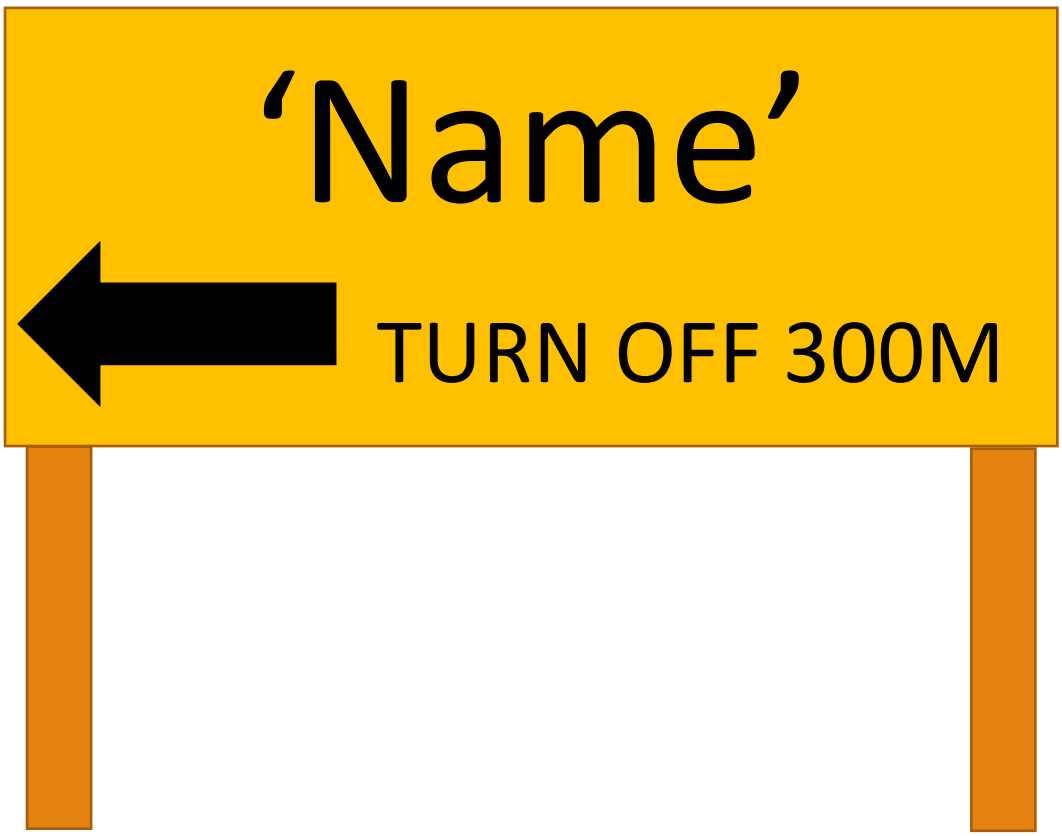
Proposed 2 Bed cabins
Tom & Angela Bertam
47 Los Angelos Road
Windermere
April 2017

GROUND BASE SIGNS (TO DIRECT GUESTS)



Sign 1 - corner of Windermere Road & John Lees Drive

- 2.5m Wide x 1.5m High plus 1.5m posts (sign 3m in total height)
- Double sided
- Name and arrow only. Name to be determined, laser cut into steel, with the arrow (pointing to Windermere road, indicating to turn)
- Made from Corten Steel (rusted steel, brown in appearance) steel RHS posts



Sign 2 - corner of Los Angelos Road & John Lees Drive

- 2.5m Wide x 1.5m High, plus 1.5m High posts (sign 3m in total height)
- Name and arrow only. Name to be determined, laser cut into steel, with the arrow (pointing down John Lees Drive, showing guests to keep driving to turn off at Windermere Rd).
- Made from Corten Steel (rusted steel, brown in appearance) steel RHS posts

ENTRY SIGNAGE

Sign 3 – entry

- 2.5m Wide x 1.5m High
- To be incorporated/fastened into entrance of accommodation
- Name only. Name to be determined, laser cut into steel
- Made from Corten Steel (rusted steel, brown in appearance)
- Solar light behind the steel to ensure dimly light at night.

TFB Contracting Pty Ltd

47 Los Angelos Road, Windermere

Traffic Impact Statement

June 2017

Table of contents

Table index

Figure index

1. Introduction

1.1 Background

GHD were engaged by TFB Contracting Pty Ltd to prepare a Traffic Impact Statement for proposed visitor accommodation at 47 Los Angelos Road, Windermere.

1.2 Purpose of this report

The purpose of this report is to assess the suitability of the proposed access point with regard to road safety as per the following preliminary advice from Council's Infrastructure Department:

> *"There is a reasonably steep bank to deal with and the access is outside the 50 km/h zone but within the 70 km/h zone. I think they will need to get someone to assess the sight distance and determine the best location and actually specify that on the plan with a dimension and any recommendations for batter works or vegetation removal. Given that we are talking about this being visitor accommodation I think it introduces a higher level of risk as people will not be familiar with the access so ensuring it is as safe as possible needs to be the priority."*

1.3 Scope and limitations

This report has been prepared by GHD for TFB Contracting Pty Ltd and may only be used and relied on by TFB Contracting Pty Ltd for the purpose agreed between GHD and the TFB Contracting Pty Ltd as set out in this report.

GHD otherwise disclaims responsibility to any person other than TFB Contracting Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by TFB Contracting Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4 Referenced Materials

The following documents and materials were referred to in this report:

- *Launceston Interim Planning Scheme 2015* (the Planning Scheme)
- Australian Standard AS/NZS 2890.1, *Parking facilities – Part 1: Off-street car parking,* 2004
- *Guide to Road Design – Part 4A: Unsignalised and signalised intersections,* Austroads 2010

2. Proposal

2.1 Subject Site

The site is located at 47 Los Angelos Road, Windermere (Title Reference 165889/1). It is bordered by Los Angelos Road, John Lees Drive (formerly East Tamar Highway) and Windermere Road. The site is presented in Figure 1.

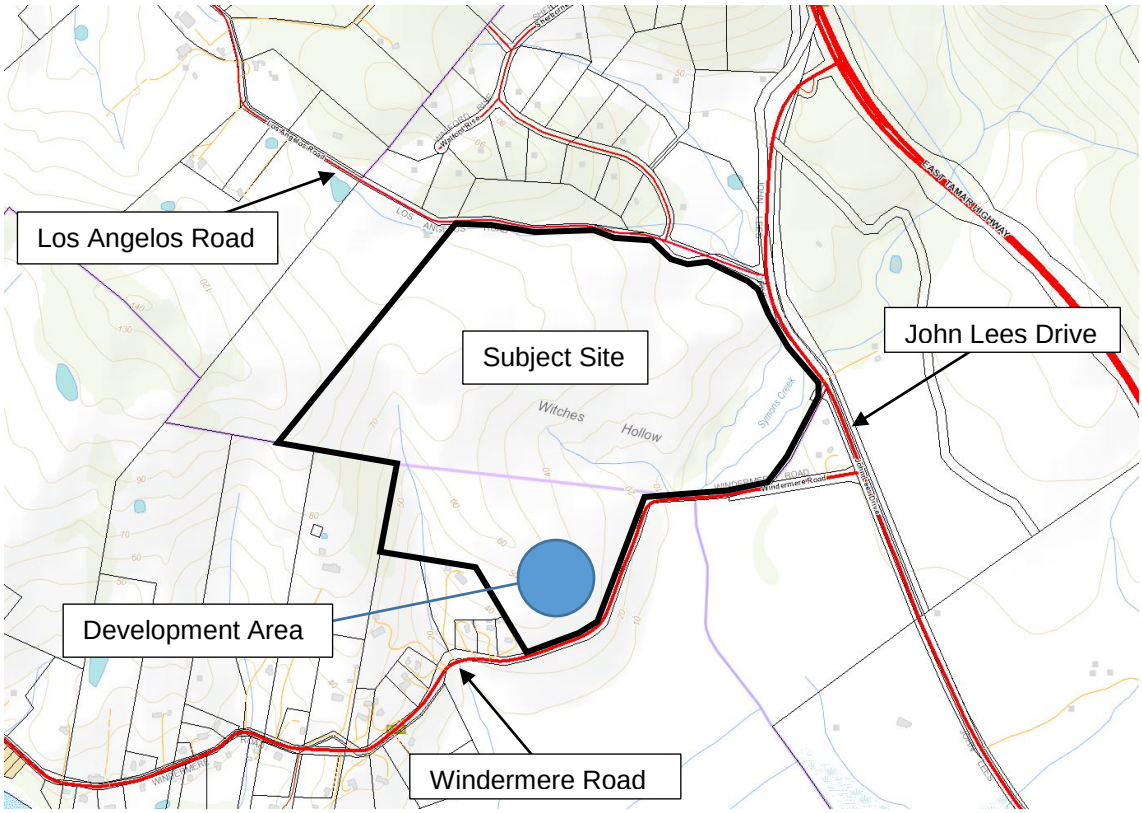


Figure 1 Subject Site Location

Base image obtained from TheLIST © State of Tasmania

The development area is located towards the southern tip of the site on Windermere Road.

2.1.1 Frontage Road

The frontage road for the proposed development is Windermere Road, a minor collector road providing access to the rural residential areas of Windermere. The posted speed limit is 70 km/h along the site frontage with the 50 km/h zone located approximately 90 metres west of the site boundary.

The horizontal alignment of Windermere Road is winding with several tight corners located near the subject site. The road also has a relatively steep uphill gradient travelling both eastbound and westbound towards the site development area.

There is a steep embankment on the northern side of Windermere Road near site due to the topography of the land. The edge of the road is moderately vegetated with a number of bushes and large trees located within the road reserve and just inside the property boundary.

The view along Windermere Road from the proposed site access point is presented in Figure 2 and Figure 3.

Figure 2 Windermere Road – Looking West

Figure 3 Windermere Road – Looking East

2.2 Proposed Development

The proposed development is for three new 2-bedroom cabins to be developed on the subject site within the development area identified in Figure 1. A site plan is provided in Figure 4.

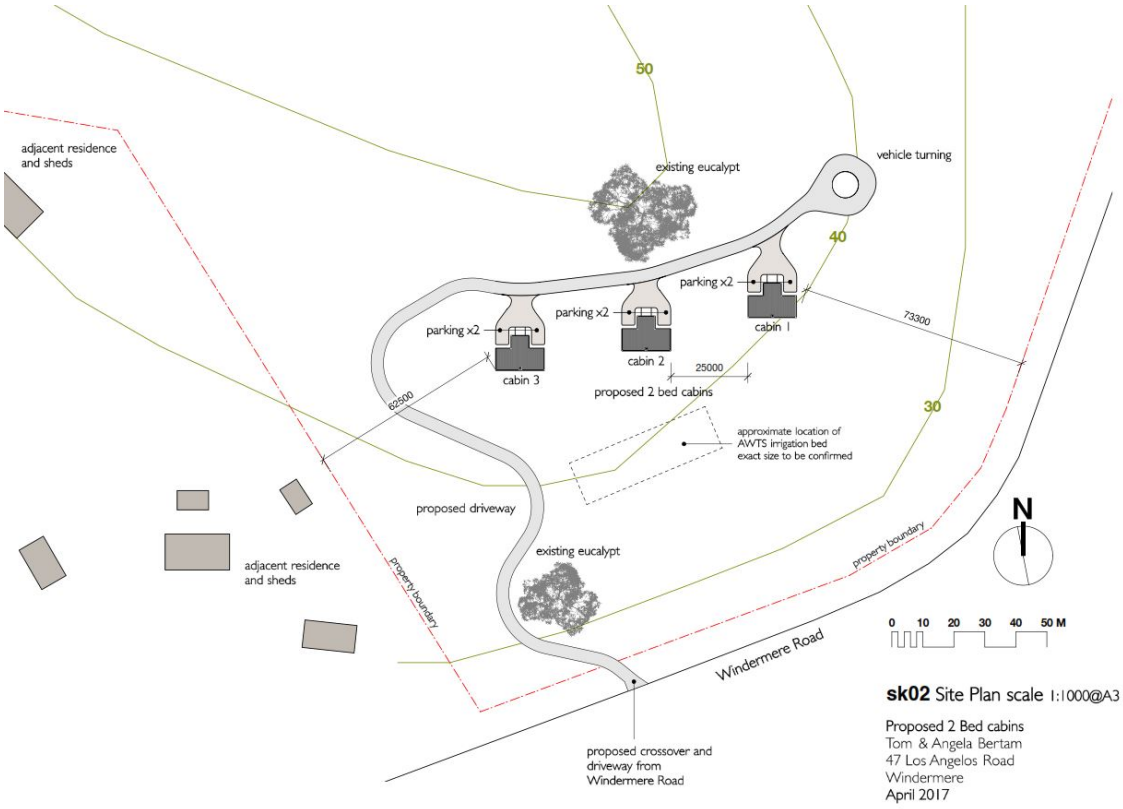


Figure 4 Proposed Development Site Plan

The development includes the following key features:

- Three, 2-bedroom cabins
- Six car parking spaces
- Average driveway gradient approximately 7.5% (~1:13)
- Maximum driveway gradient approximately 18% (~1:5.6)
- Vehicle turning circle

Site access will be via Windermere Road at the location indicated in Figure 4.

2.3 Traffic Generation

The proposed development is for three cabins to be used for visitor accommodation, each providing on-site car parking. If all three cabins are in use simultaneously, the expected average traffic generation is around 3 trips per unit per day, with a peak volume of 0.4 trips per unit per hour. Therefore, the proposed development is anticipated to generate up to a total of 9 vehicle trips per day, peaking at around 1-2 vehicle movements per hour.

This complies with the acceptable solution, Clause E4.5.1-A2 of the Planning Scheme, which states that: *"The annual average daily traffic (AADT) of vehicle movements, to and from a site, using an existing access or junction, in an area subject to a speed limit of more than 60km/h, must not increase by more than 10% or 10 vehicle movements per day, whichever is greater."*

3. Traffic Impact Statement

3.1 Site Access

3.1.1 Access Location

Clause E4.6.2-A1 of the Planning Scheme requires the following: *"No new access or junction to roads in an area subject to a speed limit of more than 60km/h."* Since the proposed development will include a new access on Windermere Road within the 70 km/h zone, the proposed development relies on performance criteria:

> *"For roads in an area subject to a speed limit of more than 60km/h, accesses and junctions must be safe and not unreasonably impact on the efficiency of the road."*

The proposed development will generate up to around 1-2 vehicle movements per hour during the peak periods, which is considered a negligible increase in traffic volumes. Therefore, no unreasonable impacts on traffic efficiency on Windermere Road or surrounding roads are anticipated.

The primary safety considerations are related to the conspicuity of the access and the available sight distance. These factors are discussed in Section 3.2 of this report. Subject to the recommendations of this report, the proposed site access is considered safe and will not unreasonably impact on the efficiency of the road in compliance with Clause E4.6.2-P1.

3.1.2 Driveway Grade

Clause E6.6.1-A1 of the Planning Scheme requires the following: *"All parking, access ways, manoeuvring and circulation spaces must … have a gradient of 10% or less."* In this case, the proposed development will require a driveway with a maximum gradient of up to 18% and relies on performance criteria:

> *"All parking, access ways, manoeuvring and circulation spaces must be readily identifiable and constructed to ensure that they are useable in all weather conditions."*

It is considered that the nature of the use, for visitor accommodation rather than high turnover public parking, warrants a relaxed standard for driveway gradient. Furthermore, the topography of the land is very steep and restriction to a 10% maximum gradient would result in a very long, winding driveway at considerable cost to the developer.

Following the construction period, the access would typically be used by light vehicles only resulting in a low probability of dust and/or debris being tracked onto the public road.

Australian Standard AS2890.1 states that for circulation roadways with ramps longer than 20 metres, the maximum gradient is 1 in 5 (or 20%). The proposed driveway gradient of up to 18% complies with the requirements of AS2890.1 and is considered to comply with Clause E6.6.1-P1.

3.1.3 Driveway Design

It is recommended that the driveway be designed with an absolute minimum width of 3.0 metres with the following exceptions, to comply with the requirements of Clause E6.6.2-A1.1:

- A minimum width of 4.5 metres for the first 7 metres from edge of Windermere Road
- Passing bays with minimum width of 5.0 metres at minimum 30 metre intervals

3.2 Sight Distance Assessment

Clause E4.6.4-A1 of the Planning Scheme states that: *"Sight distances at … an access or junction must comply with the Safe Intersection Sight Distance shown in Table E4.6.4."* An extract from Table E4.6.4 of the Planning Scheme is provided below in Table 1.

Table 1 Safe Intersection Sight Distance

Vehicle Speed km/h	Safe Intersection Sight Distance (S.I.S.D) in metres, for speed limit of:	
	60 km/h or less	Greater than 60 km/h
50	80	90
60	105	115
70	130	140
80	165	175

The access is located approximately mid-way along the straight section on Windermere Road such that the available sight distance is as follows:

- Eastbound 90 m (subject to batter works – refer to Figure 6 and Figure 7)
- Westbound 120 m

The available sight distance is presented in Figure 5.

Figure 5 Sight Distance Assessment

Base imagery obtained from TheLIST © State of Tasmania

The sight distance does not comply with Planning Scheme requirements for a frontage road speed of 70 km/h and therefore relies on performance criteria.

While the posted speed limit along the site frontage is 70 km/h, it is likely that actual vehicle speeds will be less than this, particularly in the eastbound direction, due to the horizontal and vertical alignment of Windermere Road and the presence of the 50 km/h zone located a short distance west of the site boundary.

Vehicle speeds have been estimated as follows:

- Eastbound
  - The sight distance point for eastbound vehicles is located only a short distance to the east of the 50 km/h speed zone. The expected speed of vehicles travelling eastbound is therefore likely to be between 50 and 55 km/h as they accelerate from the 50 km/h zone uphill towards the site access point.
- Westbound
  - There are several geometrical constraints on Windermere Road east of the proposed access point which would influence vehicle speeds including a one-lane bridge, a tight corner with an advisory speed of 35 km/h, a relatively steep uphill gradient with narrow road width, and a final corner with radius approximately 120 metres to the sight distance point.
  - The expected speed of vehicles travelling westbound is likely to be between 60 and 65 km/h as they round the final corner due to limited opportunities to accelerate to the 70 km/h speed limit upstream of the site access. Note that westbound truck speeds would be significantly lower (likely less than 50 km/h) due to the uphill gradient and horizontal alignment.

The Austroads publication, *Guide to Road Design – Part 4A: Unsignalised and signalised intersections,* 2010, provides Safe Intersection Sight Distance (SISD) requirements for accesses and junctions using the Extended Design Domain (EDD). Use of the Extended Design Domain is considered appropriate in this case due to the constrained existing geometric environment, and the generally low use of the junction (less than 10 movements per day).

The sight distance is assessed under the Extended Design Domain in Table 2. Note that the appropriate parameters for observation and reaction times are as follows:

- Observation time of 1.5 seconds for T-intersections on single carriageway roads that have a traffic volume < 4,000 veh/d; and
- Reaction time of 1.5 seconds due to road geometry including consistently tight alignments on Windermere Road (eastbound and westbound) and the low speed, built-up area to the west of the subject site.

Table 2 Sight Distance Assessment

	Eastbound	Westbound
Estimated Vehicle Speed		
Car	50-55 km/h	60-65 km/h
Truck	~50 km/h	< 50 km/h
Available Sight Distance	90 m (subject to batter works)	120 m
EDD SISD Requirement		
Car	72 m	91 m
Truck	76 m	76 m
Complies	✓	✓

Based on the above, there is considered sufficient sight distance at the proposed access point on Windermere Road to comply with Austroads guidelines under the Extended Design Domain, subject to batter works west of the junction. In order to ensure that sufficient sight distance is maintained, it is recommended that works be undertaken at the access point to improve the conspicuity of the access and mitigate any potential risks associated with use of the Extended Design Domain including the following:

- Batter works to create a sight triangle having minimum dimensions of 5x40 metres on the west side of the access as demonstrated in Figure 6.
  - *Note that this should not require the relocation of the existing stay pole located adjacent to the property boundary, or modification of the existing rock batter shown in* Figure 7*.*
- Removal of low-lying vegetation along the edge of the road reserve for a distance of 40 metres either side of the access point; and
- Signage provided on Windermere Road at the proposed access point to identify the proposed development and access location.

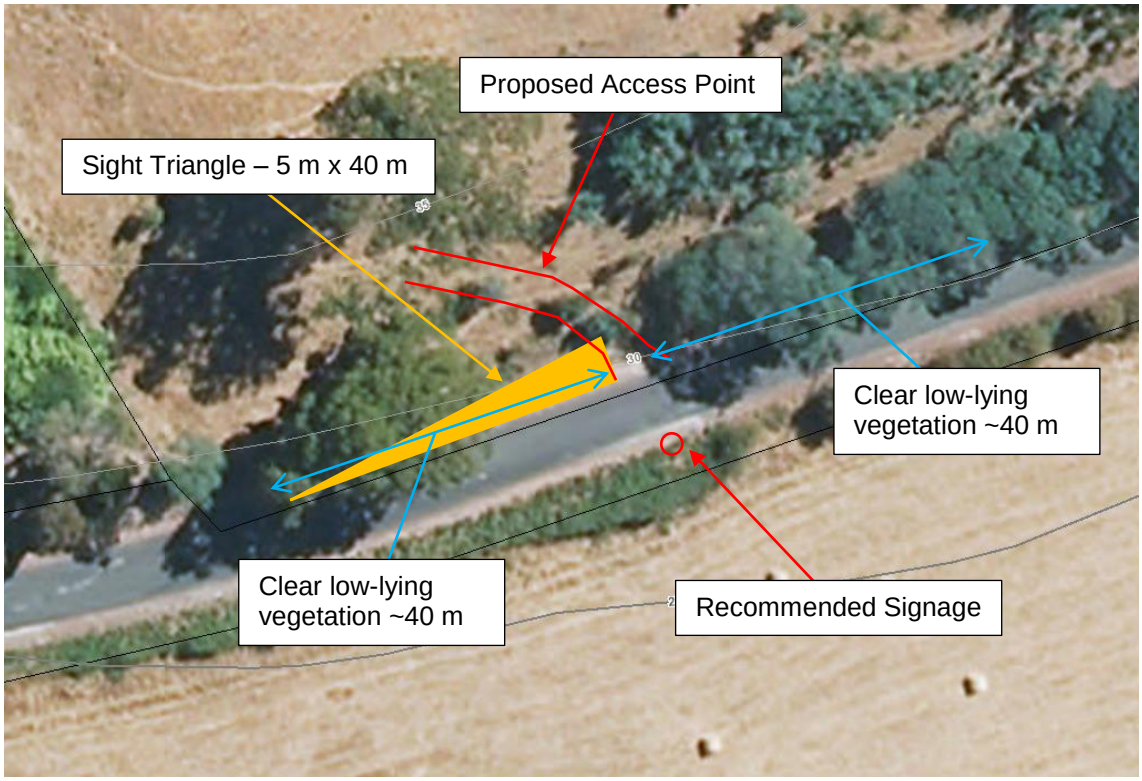


Figure 6 Recommended Access Works

Base imagery obtained from TheLIST © State of Tasmania

Subject to the above recommendations, the proposed development is considered to comply with performance criteria of Clause E4.6.4-P1.

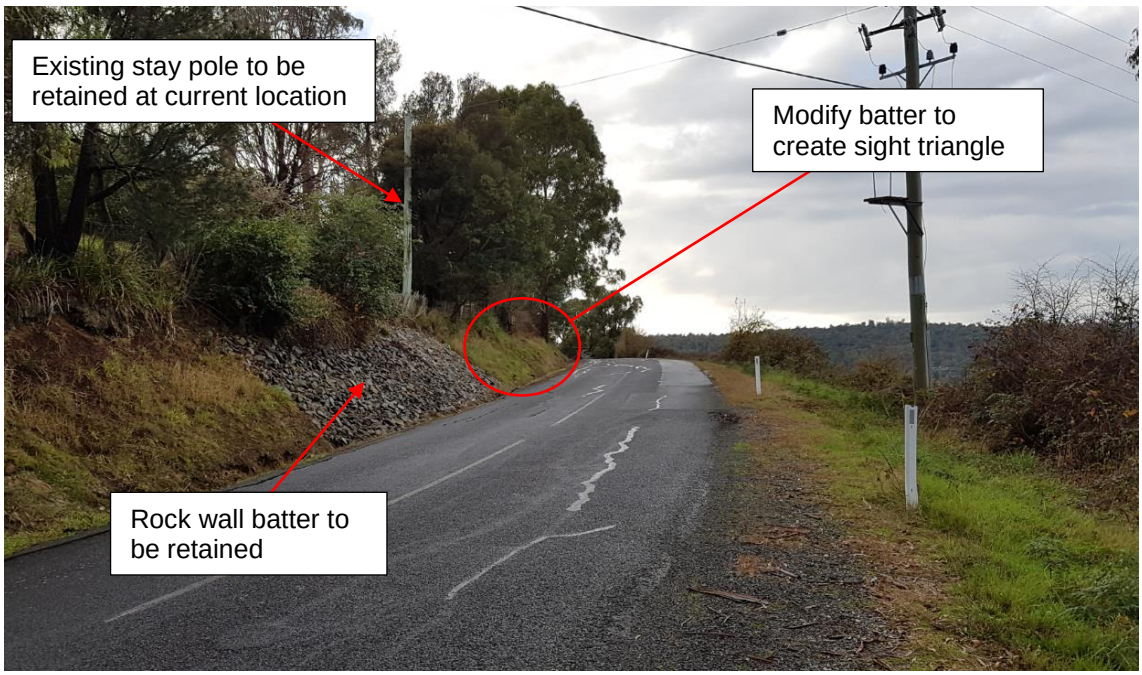


Figure 7 Recommended Batter Works

4. Conclusions

This report has investigated the proposed access point on Windermere Road for three new, 2-bedroom accommodation cabins, to be developed at 47 Los Angelos Road. The development is supported on traffic and road safety grounds subject to the following recommendations:

- Driveway dimensions to comply with the requirements of Clause E6.6.2-A1.1 including:
  - Minimum width of 3.0 metres nominal
  - Minimum width of 4.5 metres for the first 7 metres from edge of Windermere Road
  - Passing bays with minimum width of 5.0 metres at 30 metre intervals
- Batter works to create a sight triangle having minimum dimensions of 5x40 metres on the west side of the access as demonstrated in Figure 6.
- Removal of low-lying vegetation along the edge of the road reserve for a distance of 40 metres either side of the access point; and
- Signage provided on Windermere Road at the proposed access point to identify the proposed development and access location.

GHD

23 Paterson Street
T: 61 3 6332 5500 F: 61 3 6332 5555 E: lstmail@ghd.com

3218480-85845/https://projects.ghd.com/oc/Tasmania/47losangelosroadtis/Delivery/Documents/3218480-REP_47_los_angelos_rd_tis.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M. Petrusma	T. Bickerstaff		T. Bickerstaff		1/6/17

www.ghd.com

LANDSLIDE RISK ASSESSMENT
PROPOSED CABINS
47 LOS ANGELOS ROAD, SWAN BAY

Prepared for: **TFB Contracting**

Date: 5 June 2017

Document Reference: TG17078/1 - 01report

Tasman Geotechnics Pty Ltd ABN 96 130 022 589
Level 1, 10 Goodman Court
PO Box 4026, Invermay TAS 7248
M 0427 810 534 T 6332 3750
E wayne@tasmangeotechnics.com.au

Contents

Version	Date	Prepared by	Reviewed by	Distribution
Original	5 June 2017	Frank Huisman	Dr Wayne Griffioen	Electronic

1 INTRODUCTION

Tasman Geotechnics was commissioned by TFB Contracting to carry out a Landslide Risk Assessment for a proposed development at 47 Los Angelos Road, Swan Bay (title reference 165889/1).

The development is to consist of three cabins located in the southern part of the farm property.

The assessment is required as part of the Planning Application process as the development is mapped within a "Medium" hazard band on the Landslide Planning Map V2 – Hazard Bands overlay on The LIST.

Our scope of work consisted of:

- Carrying out a site walkover to note geomorphological features associated with landslide activity;
- Drilling of three boreholes (BH1 to BH3) to determine subsurface conditions;
- Performing a Landslide Risk Assessment.

The assessment is consistent with the Landslide Risk Assessment guidelines published by the Australian Geomechanics Society (2007).

2 BACKGROUND INFORMATION

2.1 Regional Setting

The farm, Witches Hollow, is about 65 Ha and is located on the eastern flank of the Tamar Valley, with the Windermere Road at the base (between 10-30m AHD). The site elevation varies from 10 to 80m AHD. The general slopes at the site are typically 7-10°.

The three units are proposed at about 40-50m AHD.

2.2 Geology

Except for a small part in the northern section of the site (mapped as Jurassic dolerite), the Mineral Resources Tasmania, Digital Geological Atlas, 1:25,000 Series, shows the site to be mapped as Tertiary aged sediments described as *"Dominantly non-marine sequences of gravel, sand, silt, clay and regolith."* An extract of the MRT map is presented on Figure 1.

2.3 Landslide Mapping

The most recent landslide maps of the area published by MRT are the *"Tasmanian Landslide Map Series"* published in 2013. The *"Deviot – Landslide Inventory"* and *"Windermere – Slide Susceptibility"* maps are relevant to our study area.

The Inventory map shows the cabins to be located on the flank of a large scale soil slide of unknown activity: landslide ID 1023. The slide is 300m wide by 500m long. Several other landslides are identified west, east and south of the site.

The Slide Susceptibility map divides the land into susceptibility zones for first time failure. These zones are mapped based on statistical analysis of landslides of slope geometry and geological material, and are mapped as possible source, regression and runout areas associated with potential landslide movement. For Tertiary sediments, threshold values of source, regression and runout areas are 7°, 7° and 8° respectively.

The Slide Susceptibility map shows the eastern cabin is mapped on potential source area. The middle cabin is located on a regression area, while the western cabin is not mapped on source, regression or runout areas. Two middle and western cabins are located on a large landslide.

An extract of the MRT Slide Susceptibility map is presented on Figure 1.

3 FIELD INVESTIGATION

The fieldwork was carried out on 10 April 2017 by a Geo-environmental Engineer and a Geo-technician from Tasman Geotechnics. The fieldwork involved a site walkover and mapping of features relevant to a landslide investigation. Slope angles were measured using a hand held inclinometer and photographs were taken of the site. Three boreholes (BH1 to BH3) were drilled to 4m below ground level, using a 4WD mounted auger rig.

The borehole logs are presented in Appendix A and the borehole locations are shown on Figure 2.

Particle size distribution and Atterberg limits of 3 soil samples were determined by Tasman Geotechnics. The results are presented in Section 4.3.

4 RESULTS

4.1 Surface Conditions

The farm is located within a rural area. The hill slopes have been dissected by several creeks. The proposed units are located on a northwest to southeast trending ridge separating two such creeks.

The south-west facing slope of the ridge has a relatively steep slope (around 13°) near the crest, flattening to around 7° near the cabins and adjoining property. On the east side of the ridge, the ground slopes are about 7°.

Cobbles and boulders are exposed at the surface near the proposed cabins.

The site is mainly vegetated with grasses and weeds, with isolated trees growing across the site. The steep slope above the proposed cabins showed some small sandy patches. These are interpreted to be hollows created by cows.

4.2 Subsurface Conditions

The boreholes encountered the following soil profile:

- SILTY SAND topsoil, with some fine grained gravel to 0.2 – 0.5m below ground level, overlying
- SANDY CLAY (BH1 and BH2) or SILTY CLAY (BH3) to at least 4.0m below ground level.

4.3 Laboratory Results

Tasman Geotechnics conducted laboratory testing on soil samples taken from the site to identify the physical properties of the soil. The results have been summarised in Table 1.

Sample	Gravel (%)	Sand (%)	Fines (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
BH1, 1.0-1.2m	0	53	47	49	17	32	13
BH2, 2.0-2.2m	1	55	44	42	17	25	9
BH3, 3.0-3.2m	17	31	52	51	19	32	13

Thus, from the laboratory results, the soil is a sandy clay or clayey sand.. The clay is medium to high plasticity (CL-CH).

5 LANDSLIDE RISK ASSESSMENT

5.1 General

Risk assessment and management principles applied to slopes can be interpreted as answering the following questions;

- What might happen? (HAZARD IDENTIFICATION).
- How likely is it? (LIKELIHOOD).
- What damage or injury might result? (CONSEQUENCE).
- How important is it? (RISK EVALUATION).
- What can be done about it? (RISK TREATMENT).

The risk is a combination of the likelihood and the consequences for the hazard in question. Thus both likelihood and consequences are taken into account when evaluating a risk and deciding whether treatment is required.

The qualitative likelihood, consequence and risk terms used in this report for risk to property are given in Appendix B and are based on the Landslide Risk Management Guidelines, published by Australian Geomechanics Society (AGS, 2007). The risk terms are defined by a matrix that brings together different combinations of likelihood and consequence. Risk matrices help to communicate the results of risk assessment, rank risks, set priorities and develop transparent approaches to decision making.

5.2 Potential Hazards

Based on the site observations, borehole data and available information discussed in the sections above, the following landslide hazards are identified for the site:

Reactivation of (regional) landslide. Based on the historical information and MRT mapping, two of the cabins are located on a large landslide of unknown activity. The failure mechanism of the slide is unknown, but probably occurred due to regionally high groundwater levels or geologically active earth. Re-activation of this landslide could occur due to elevated groundwater levels at a regional scale (eg impeded groundwater drainage or increased surface infiltration) possibly combined with extensive excavation/erosion at the toe to disturb the existing equilibrium.

The likelihood for reactivation of the existing landslide under current climatic conditions is assessed to be Rare.

Medium scale translational landslide (up to about 3m deep). Such landslides can occur where slopes are locally steep, or have been steepened by earthworks (cut or fill) and would involve up to 1,000 m^3 of soil. Medium scale landslides may also occur due to localized soil erosion (eg from poor control of surface runoff) and locally elevated groundwater levels (eg, seepage water collected in fill embankment).

There is presently no evidence of soil erosion or high groundwater levels at the location of the proposed cabins. Therefore, by minimising the depth and extent excavations on the property, the likelihood of a medium scale slide under current climatic conditions, is assessed to be Unlikely.

The identification of the potential hazards considers both the site and nearby properties, and is necessary to address stability issues that may negatively impact upon the site and influence the risk to property.

5.3 Risk to Property

The following table summarizes the risk to property of the landslide events in relation to the proposed development, **assuming limitations in Section 6 are incorporated.**

Table 2. Landslide risk profiles

Scenario	Likelihood	Consequence	Risk Profile
Re-activation of (regional) landslide	Rare	Medium: there could be some damage to the units	Low
Medium scale translational slide	Unlikely	Medium: there could be some damage to the units	Low

The assessment shows that the proposed development presents a Low level of risk, **provided the limitations listed in Section 6 are incorporated in the design.**

6 DISCUSSION & RECOMMENDATIONS

6.1 Limitations on Development

In order to ensure the proposed development does not change the risk profile above Very Low for the site, it is recommended that the following limitations be enforced:

- Structures should be of a light weight construction, articulated and flexible.
- Default site classification (to AS2870) for the site is Class P, as the site is mapped within a "Medium" hazard band. Notwithstanding, the soil classification is Class H1, with a characteristic surface movement (Ys) of 45mm. Recommendations for footing design are provided in Section 6.2.
- Permanent cut slopes in natural soil should be designed at 18° (1V:3H) or flatter, and be no more than 1m (vertical).
- Any permanent excavations greater than 1m below natural ground level should be supported by an engineer-designed retaining wall. Retaining walls should be designed to withstand at-rest earth pressures (K_o = 1-sinϕ). A friction angle of 30° should be assumed for the sandy clay. Allowance should also be made for sloping backfill and provision of drainage behind the wall.
- Fill at the site should be limited to no more than 1m above the current ground level, unless approved by a Geotechnical Engineer. Fill should be compacted and fill batters should be battered to be no steeper than 1V:3H, or retained with an engineer designed retaining system.
- Stormwater from roofs and paved areas should be diverted away from the cabins and wastewater disposal area.
- Disposal of wastewater via an AWTS and irrigation system is appropriate for the site.
- Where possible, vegetation should be maintained on the slopes to prevent erosion of surface soils. As a minimum, vegetation should comprise grass. If trees are planted on the slope, then the site should be managed such that when the trees reach maturity and are removed, they are replaced with new (young) trees.
- Maintenance of surface runoff, vegetation, retaining structures and other measures described above are the responsibility of the site owner.
- Good hillside construction practices should be followed. A copy of Some Guidelines for Hillside Construction are presented in Appendix C.

6.2 Footings

An allowable bearing pressure of 100 kPa is available for edge beams, strip and pad footings founded on the sandy clay or clayey sand encountered from 0.2m below ground level.

If the bore piers are proposed, we recommend they are founded at least 1.5m in the natural soil. Bored piers founded at least 1.5m below ground level may be proportioned for an allowable end bearing pressure of 300kPa. The base of bored piers should be inspected to ensure they are clean and free of loose soil prior to pouring concrete.

The site classification presented above assumes that the current natural drainage and infiltration conditions at the site will not be markedly affected by the proposed site development work. Care should therefore be taken to ensure that surface water is not permitted to collect adjacent to the structure and that significant changes to seasonal soil moisture equilibria do not develop as a result of service trench construction or tree root action.

Attention is drawn to Appendix B of AS 2870 and CSIRO Building Technical File BTF18 “Foundation Maintenance and Footing Performance: A Homeowner’s Guide” as a guide to maintenance requirement for the proposed structure.

Although the borehole data indicates that site conditions are relatively uniform, variations in soil conditions may occur in areas of the site not specifically covered by the field investigation. The base of all footing or beam excavations should therefore be inspected to ensure that the founding medium meets the requirements discussed above.

6.3 Wind Classification

The wind classification for the site is as follows:

N2 (AS 4055 - 2012)

Based on region, terrain, shielding and topography as follows:

Region	Terrain category	Topography	Shielding
A	TC2	T1	NS

Important information about your report

These notes are provided to help you understand the limitations of your report.

Project Scope

Your report has been developed on the basis of your unique project specific requirements as understood by Tasman Geotechnics at the time, and applies only to the site investigated. Tasman Geotechnics should be consulted if there are subsequent changes to the proposed project, to assess how the changes impact on the report's recommendations.

Subsurface Conditions

Subsurface conditions are created by natural processes and the activity of man.

A site assessment identifies subsurface conditions at discreet locations. Actual conditions at other locations may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time.

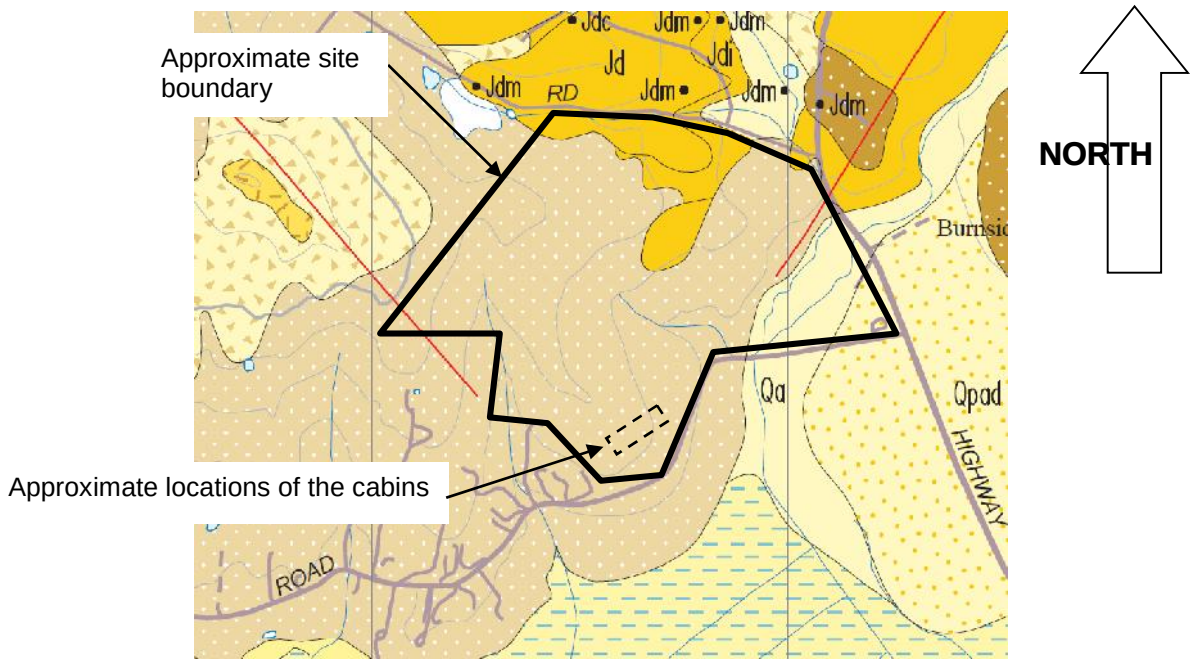
Nothing can be done to change the conditions that exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, the services of Tasman Geotechnics should be retained throughout the project, to identify variable conditions, conduct additional investigation or tests if required and recommend solutions to problems encountered on site.

Advice and Recommendations

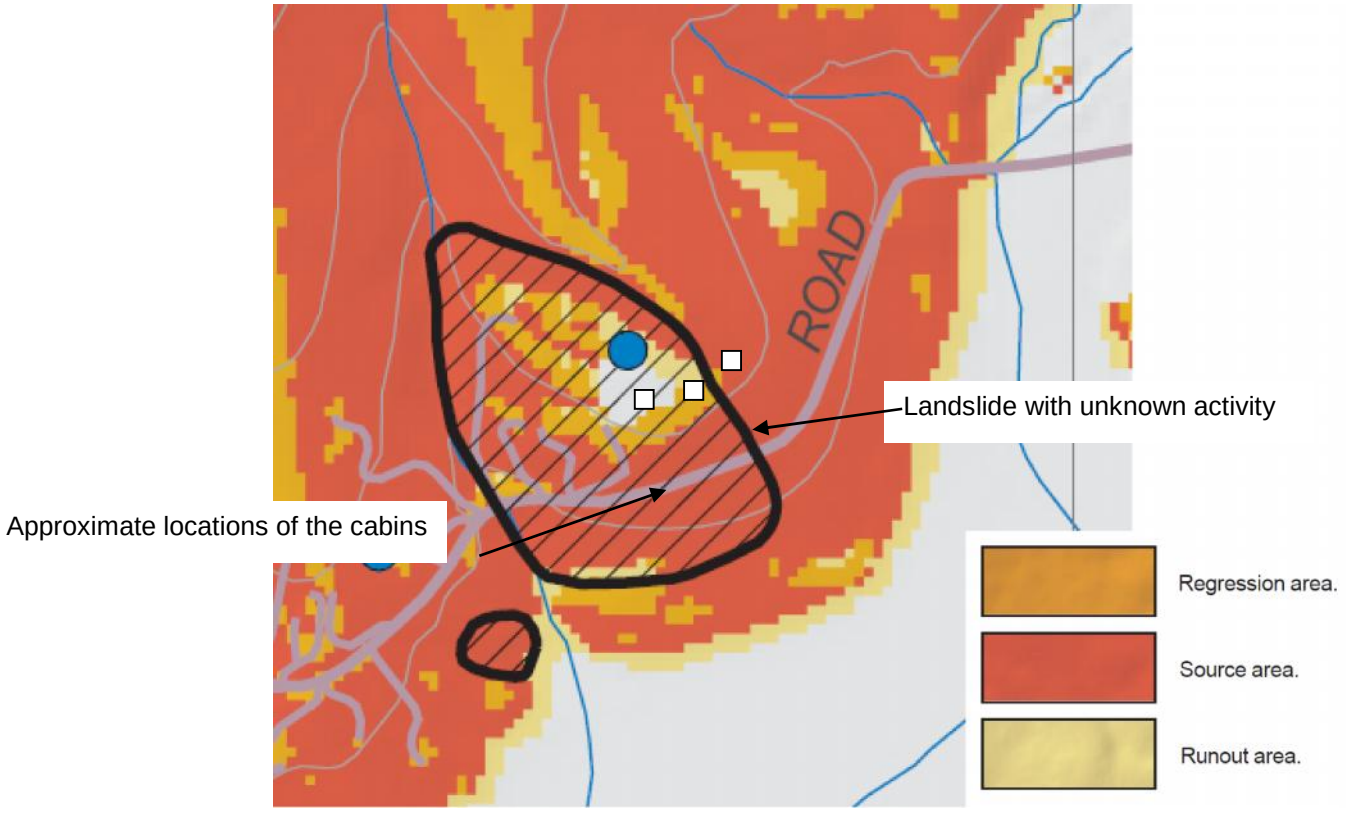
Your report contains advice or recommendations which are based on observations, measurements, calculations and professional interpretation, all of which have a level of uncertainty attached.

The recommendations are based on the assumption that subsurface conditions encountered at the discreet locations are indicative of an area. This can not be substantiated until implementation of the project has commenced. Tasman Geotechnics is familiar with the background information and should be consulted to assess whether or not the report's recommendations are valid, or whether changes should be considered.

The report as a whole presents the findings of the site assessment, and the report should not be copied in part or altered in any way.

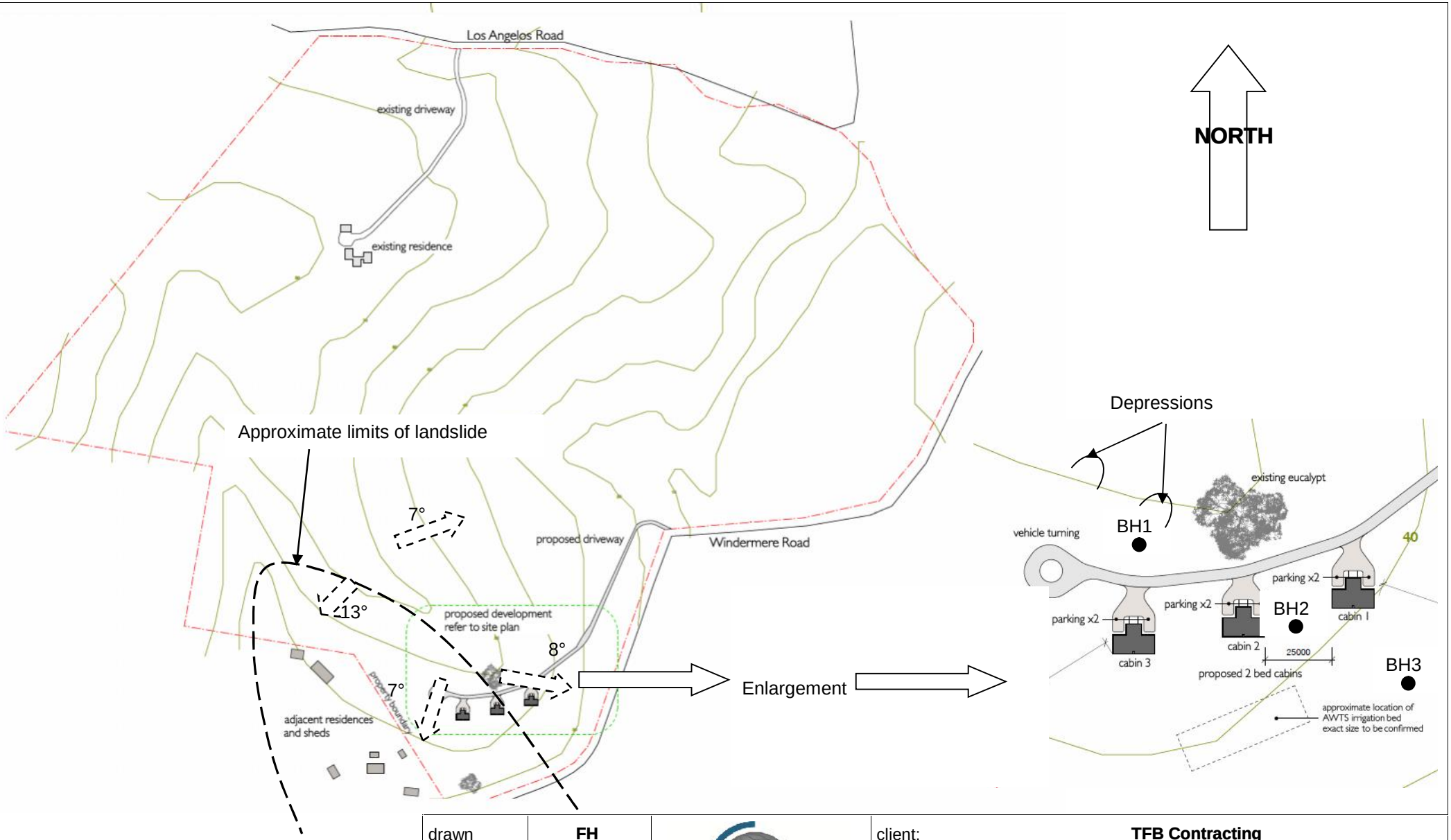


Extract of MRT Geology Map



Extract of MRT landslide Susceptibility Map

drawn	**FH**	TASMAN geotechnics	client:	**TFB Contracting**
approved	**WG**		project:	**Landslide Assessment, 47 Los Angelos Road, Swan Bay**
date	**19/04/2017**			
scale	**NTS**		title:	**MRT Map Extracts**
original size	**A4**		project no: **TG17078/1 – 01report**	figure no: **FIGURE 1**



drawn	**FH**
approved	**WG**
date	**19/04/2017**
scale	**NTS**
original size	**A4**

TASMAN geotechnics

client:	**TFB Contracting**
project:	**Landslide Risk Assessment, 47 Los Angelos Road, Swan Bay**
title:	**Site Layout and Borehole Locations**
project no: **TG17078/1 – 01report**	figure no: **FIGURE 2**

Appendix A

Engineering Borehole Logs

SOIL DESCRIPTION EXPLANATION SHEET

TASMAN geotechnics

Soils are described in accordance with the Unified Soil Classification System (USCS), as shown in the following table.

FIELD IDENTIFICATION

					DRY STRENGTH	DILATANCY	TOUGHNESS
COARSE GRAINED SOILS	more than 50% of material less than 63mm is larger than 0.075mm	GRAVELS	GW	Well graded gravels and gravel-sand mixtures, little or no fines			
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines			
		GRAVELLY SOILS	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines			
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines			
		SANDS	SW	Well graded sands and gravelly sands, little or no fines			
			SP	Poorly graded sands and gravelly sands, little or no fines			
		SANDY SOILS	SM	Silty sand, sand-silt mixtures, non-plastic fines			
			SC	Clayey sands, sand-clay mixtures, plastic fines			
FINE GRAINED SOILS	more than 50% of material less than 63mm is less than 0.075mm	SILT & CLAY, liquid limit less than 50%	ML	Inorganic silts, very fine sands or clayey fine sands	None to low	Quick to slow	None
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays and silty clays	Medium to high	None to very slow	Medium
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low
		SILT & CLAY, liquid limit greater than	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts	Low to medium	Slow to none	Low to medium
			CH	Inorganic clays of high plasticity, fat clays	High	None	High
			OH	Organic clays of medium to high plasticity	Medium to high	None to very slow	Low to medium
PEAT			Pt	Peat muck and other highly organic soils			

Particle size descriptive terms

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63mm to 200mm
Gravel	coarse	20mm to 63mm
	medium	6mm to 20mm
	fine	2.36mm to 6mm
Sand	coarse	600µm to 2.36mm
	medium	200µm to 600µm
	fine	75µm to 200µm

Consistency of cohesive soils

Term		Undrained strength	Field guide
Very soft	VS	<12kPa	A finger can be pushed well into soil with little effort
Soft	S	12 - 25kPa	Easily penetrated several cm by fist
Firm	F	25 - 50kPa	Soil can be indented about 5mm by thumb
Stiff	St	50-100kPa	Surface can be indented but not penetrated by thumb
Very stiff	VSt	100-200kPa	Surface can be marked but not indented by thumb
Hard	H	>200kPa	Indented with difficulty by thumb nail
Friable	Fb	-	Crumbles or powders when scraped by thumb nail

Moisture Condition

Dry (D)	Looks and feels dry. Cohesive soils are hard, friable or powdery. Granular soils run freely through fingers.
Moist (M)	Soil feels cool, darkened in colour. Cohesive soils are usually weakened by moisture presence, granular soils tend to cohere.
Wet (W)	As for moist soils, but free water forms on hands when sample is handled

Cohesive soils can also be described relative to their plastic limit, ie: <Wp, =Wp, >Wp

The plastic limit is defined as the minimum water content at which the soil can be rolled into a thread 3mm thick.

Density of granular soils

Term	Density index
Very loose	<35%
Loose	15 to 35%
medium dense	35 to 65%
Dense	65 to 85%
Very dense	>85%

Minor Components

Term	Proportions	Observed properties
Trace of	Coarse grained: <5% Fine grained: <15%	Presence just detectable by feel or eye. Soil properties little or no different to general properties of primary component.
With some	Coarse grained: 5-12% Fine grained: 15-30%	Presence easily detected by feel or eye. Soil properties little different to general properties of primary component.

Document Set ID: 3597135
Version: 1, Version Date: 10/08/2017

ENGINEERING BOREHOLE LOG

Borehole no. BH1

Sheet no. 1 of 1
Job no. TG17078/1

Client : TFB Contracting
Project : Landslide Risk Assessment
Location : 47 Los Angelos Road, Swan Bay

TASMAN geotechnics

Date : 10/04/2017
Logged By : FH

Drill model : Rockmaster, 4WD Mounted **Slope :** deg **RL Surface :**
Hole diameter : 120mm **Bearing :** deg **Datum :**

Method	Penetration 1	2	3	4	Notes Samples Tests	Water		Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
									SM	SILTY SAND, fine grained, yellow with a trace of fine grained round gravel	M	Md	
									CH	SANDY CLAY, orange, high plasticity fines	M	FB/VSt	
							0.50						
							1.00						
					D								
							1.50					St	
Auger							2.00					S-F	
					D								
							2.50						
							3.00						
					D								
							3.50						
					D		4.00			Terminated at 4.0m. Still going.			

ENGINEERING BOREHOLE LOG

Borehole no. BH2

Sheet no. 1 of 1
Job no. TG17078/1

Client : TFB Contracting
Project : Landslide Risk Assessment
Location : 47 Los Angelos Road, Swan Bay

TASMAN geotechnics

Date : 10/04/2017
Logged By : FH

Drill model : Rockmaster, 4WD Mounted **Slope :** deg **RL Surface :**
Hole diameter : 120mm **Bearing :** deg **Datum :**

Method	Penetration 1	2	3	4	Notes Samples Tests	Water		Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
Auger							0.50		SM	SILTY SAND, fine grained, grey/yellow with some gravel	M	Md	
							1.00		CL	SANDY CLAY, low-medium plasticity, orange	M	Fb	
					D								
							1.50			high plasticity, trace of sand		St-VSt	
							2.00			SANDY CLAY, medium plasticity, orange		F-St	
					D								
							2.50						
							3.00					VSt	
					D								
							3.50			orange/grey		H	
					D		4.00			Terminated at 4.0m. Still going.			

ENGINEERING BOREHOLE LOG

Borehole no. BH3

Sheet no. 1 of 1
Job no. TG17078/1

Client : TFB Contracting
Project : Landslide Risk Assessment
Location : 47 Los Angelos Road, Swan Bay

TASMAN geotechnics

Date : 10/04/2017
Logged By : FH

Drill model : Rockmaster, 4WD Mounted **Slope :** deg **RL Surface :**
Hole diameter : 120mm **Bearing :** deg **Datum :**

Method	Penetration 1	2	3	4	Notes Samples Tests	Water		Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
Auger									SM	SILTY SAND, fine grained, grown/grey	M	Md	
									CH	SILTY CLAY, high plasticity, orange	M	H/Fb	
							0.50						
							1.00						
					D								
							1.50						
							2.00					St-VSt	
					D								
							2.50		GC	CLAYEY GRAVEL, fine grained round gravel and fine to medium grained sand in clayey matrix		St-VSt	
							3.00						
					D								
							3.50		CH	CLAY, high plasticity, orange/grey		H	
					D		4.00			Terminated at 4.0m. Still going.			

Appendix B

Landslide Risk Matrix

Terminology for use in Assessing Risk to Property

These notes are provided to help you understand concepts and terms used in Landslide Risk Assessment and are based on the "Practice Note Guidelines for Landslide Risk Management 2007" published in *Australian Geomechanics* Vol 42, No 1, 2007.

Likelihood Terms

The qualitative likelihood terms have been related to a nominal design life of 50 years. The assessment of likelihood involves judgment based on the knowledge and experience of the assessor. Different assessors may make different judgments.

Approximate Annual Probability	Implied indicative Recurrence Interval	Description	Descriptor	Level
10^{-1}	10 years	The event is expected to occur over the design life	Almost Certain	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life	Likely	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life	Possible	C
10^{-4}	10,000 years	The event might occur under very adverse conditions over the design life	Unlikely	D
10^{-5}	100,000 years	The event is conceivable but only under exceptional circumstances over the design life	Rare	E
10^{-6}	1,000,000 years	The event is inconceivable or fanciful for the design life	Barely Credible	F

Qualitative Measures of Consequence to Property

Indicative Cost of Damage	Description	Descriptor	Level
200%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequential damage.	Catastrophic	1
60%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequential damage	Major	2
20%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequential damage.	Medium	3
5%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works	Minor	4
0.5%	Little damage.	Insignificant	5

The assessment of consequences involves judgment based on the knowledge and experience of the assessor. The relative consequence terms are value judgments related to how the potential consequences may be perceived by those affected by the risk. Explicit descriptions of potential consequences will help the stakeholders understand the consequences and arrive at their judgment.

Qualitative Risk Analysis Matrix – Risk to Property

Likelihood		Consequences to Property				
	Approximate annual probability	1: Catastrophic	2: Major	3: Medium	4: Minor	5: Insignificant
A: Almost Certain	10^{-1}	VH	VH	VH	H	L
B: Likely	10^{-2}	VH	VH	H	M	L
C: Possible	10^{-3}	VH	H	M	M	VL
D: Unlikely	10^{-4}	H	M	L	L	VL
E: Rare	10^{-5}	M	L	L	VL	VL
F: Barely credible	10^{-6}	L	VL	VL	VL	VL

NOTES:

1. The risk associated with Insignificant consequences, however likely, is defined as Low or Very Low

2. The main purpose of a risk matrix is to help rank risks and set priorities and help the decision making process.

Response to Risk

In general, it is the responsibility of the client and/or regulatory and/or others who may be affected to decide whether to accept or treat the risk. The risk assessor and/or other advisers may assist by making risk comparisons, discussing treatment options, explaining the risk management process, advising how others have reacted to risk in similar situations and making recommendations. Attitudes to risk vary widely and risk evaluation often involves considering more than just property damage (eg environmental effects, public reaction, business confidence etc).

The following is a guide to typical responses to assessed risk.

Risk Level		Example Implications
VH	Very High	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than the value of the property.
H	High	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	Moderate	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	Low	Usually accepted by regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	Very Low	Acceptable. Manage by normal slope maintenance procedures

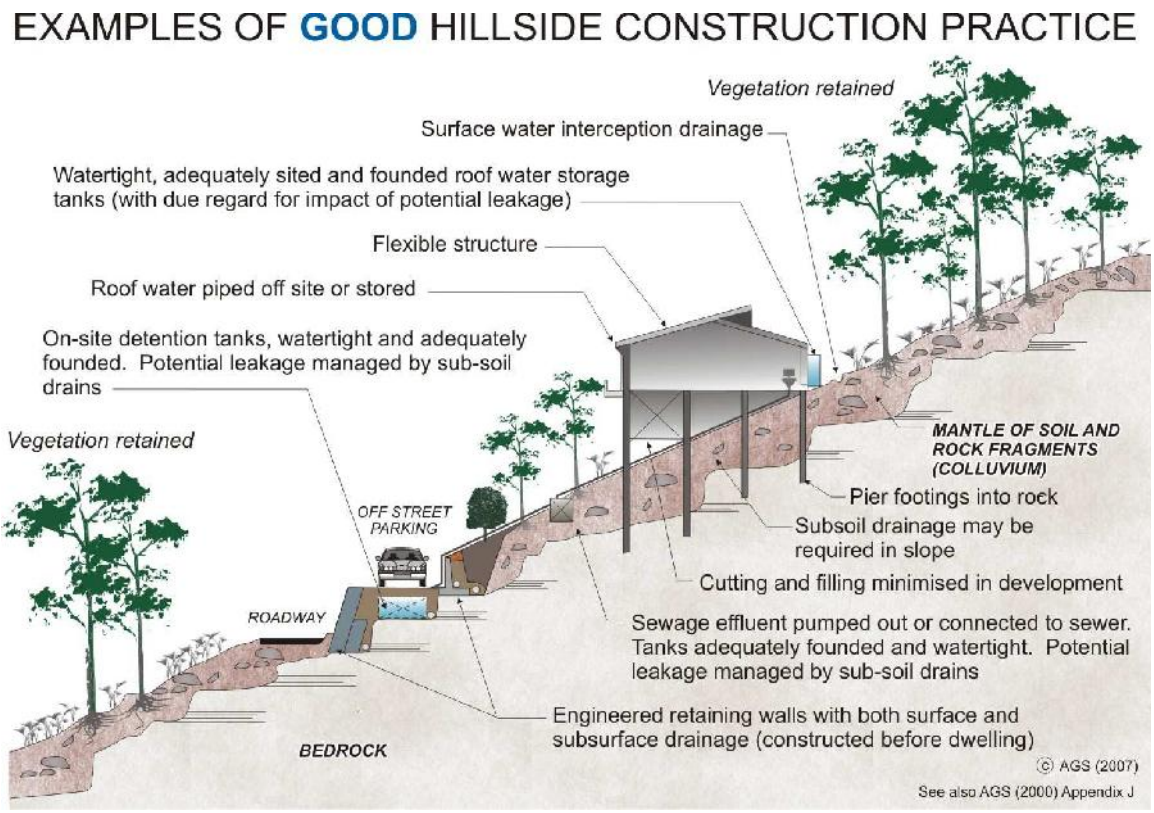
Appendix C

Guidelines to Hillside Construction

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.



WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

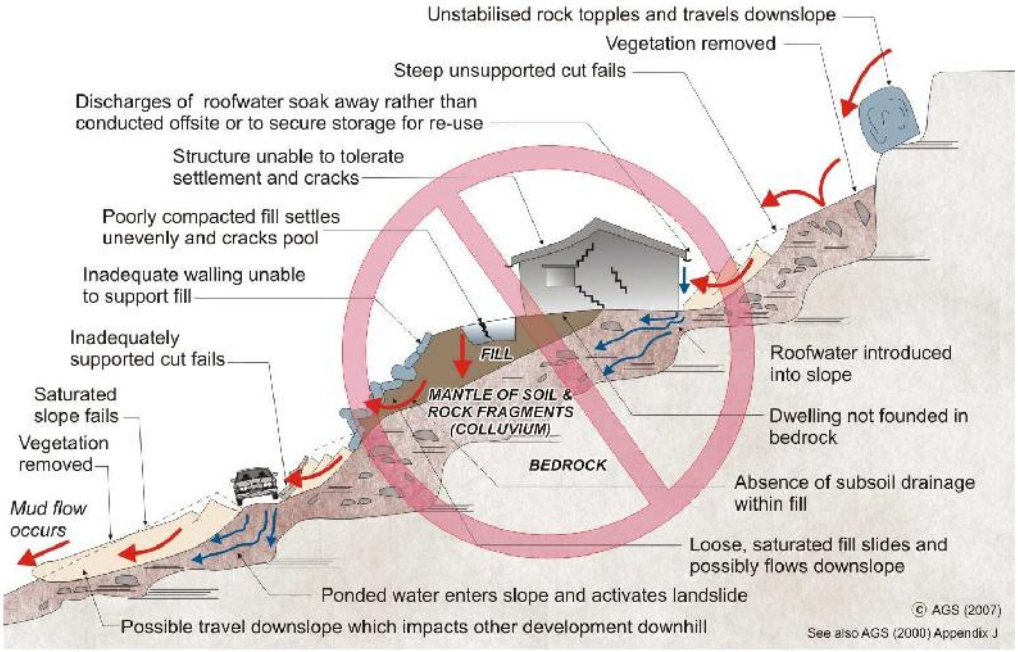
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.